2025

GEORGIA WATER RESOURCES CONFERENCE

MARCH 25-26, 2025

GEORGIA CENTER FOR CONTINUING EDUCATION
ATHENS, GA

River Basin Center
UNIVERSITY OF GEORGIA

Table of Contents

HISTORY OF THE GWRC

The Georgia Water Resources Conference has been held biennially since May 1989. The inaugural conference included 76 oral presentations and 9 posters. Attendance has steadily grown, and this year's conference boasts 17 special sessions, 123 presentations, and 67 posters.

The idea for the first Georgia Water Resources Conference originated from discussions of Dr. Robert Pierce, Alec Little, and Kathy Hatcher, and stemmed from an initial statewide water conference led by Dr. Ram Arora (GSU) in 1984. The steering committee for that first conference was composed of Jeffrey Armbruster (USGS), Kathy Hatcher (UGA), Vernon Henry (GSU), Jim Kundell (UGA), Alec Little (UGA), Bob Pierce (USGS), Harold Reheis (GA EPD), and Bernd Kahn (Georgia Tech-GWRI).

The Georgia Water Resources Institute has been the core sponsor of the conference since that first year, and remains an essential source of support for the meeting. This year we have 30 additional sponsors, which has allowed us to keep registration fees affordable, especially for students.

Since its inception, the goal of the Georgia Water Resources Conference has been to provide an open forum for the discussion of current water policies, research, projects, and water management in Georgia. The conference features presentations and posters related to water policies, legislation, research, ongoing studies, technical innovations, issues and concerns, current situation and trends, new approaches, management programs, data and information, education, public participation, institutional and financial arrangements, history, culture, future needs and solutions, and other topics.

SCHEDULE AT-A-GLANCE

TUESDAY, MARCH 25

8:00 - 8:45	Check-in and Coffee, *Hill Atrium*					
8:45 - 9:00	Welcome, *Mahler Hall*					
9:00 - 10:15	Concurrent Morning Sessions					
	1.1 Flood Resilience Panel *Room Q*	1.2 GA FIT/Flint HCP Panel *Mahler Hall*	1.3 Local Wetlands Protection Panel *Room K/L*	1.4 Aquatic Microbial Ecology I *Room R*	1.5 Experiential Education *Room V/W*	1.6 Surface Hydrology *Room Y/Z*
9:00	Moderator: Brian Bledsoe Panelists: Matt Chambers, Rhett Jackson	Moderator: Kristin Rowles Panelists: Gordon Rogers, Cathy Marion, Matt Rowe, Anna Truszczynski	Moderator: Steffney Thompson Panelists: Molly Bogle, Carol Myers Flaute, Bill Sapp	Charles Bond (Chair)	Téa Autry	Shivani Chougule
9:15				Andrielle Kemajou	Damian Elmore	Robert Sobczak
9:30				Ethan Rutledge	Elizabeth Sudduth	Cole Myers
9:45				Jacqueline Pavlovsky	Félix Santiago-Collazo	~~Alexander Miele~~
10:00				Jingjing Li	Aslia Aslan	
10:15 - 10:45	Morning Break, *Hill Atrium*					
10:45 - 12:00	Plenary: Katherine Zitsch, *Mahler Hall*					
12:00 - 1:15	Lunch, *Magnolia Ballroom*					
1:15 - 3:00	Concurrent Afternoon Sessions					
	2.1 Flood Modeling *Room Q*	2.2 Mussel Conservation *Mahler Hall*	2.3 Georgia Wetlands Post-Sackett *Room K/L*	2.4.1 Aquatic Microbial Ecology II *Room R*	2.5.1 Targeted Solutions for Trash Traps Panel *Room V/W*	2.6 Coastal Carbon *Room Y/Z*
1:15	Orlando Viloria	Steve Golladay	Steve Brantley (Co-chair)	Lydia McGregor Bravo	Moderator: Ashley Desenti Panelists: Amy Doneff, Jordan Yu, Ramsey Cook	
1:30	Rohan Mohanty	Julian Spergel	Nick Marzolf (Co-chair)	Marilee Hoyle		Clark Alexander
1:45	Matt Bilskie	Carla Atkinson	Lora Smith	Stephanie Vaughn		Nikki Zhang
2:00	Lina Caro	Garrett Hopper	Suranjana Chattergee	*Discussion*		John Carroll
				2.4.2 Wastewater *Room R*	2.5.2 Chattahoochee Updates *Room V/W*	
2:15	Luciana Iannone-Tarcha	Eric Walther	Katy Perkins	Troy Keller	Becca Risser	Katie Hill (Chair)
2:30	Ralf Ludwig	~~Jess Jones~~	Jeffrey Riley	Courtney Scott	Jess Sterling	*Discussion*
2:45	~~John Schmidt~~	Irene Sanchez	Zoe Porter	Krista Capps (Chair)	Chris Manganiello (Chair)	
		Wendell Haag				
3:00 - 3:30	Afternoon Break, *Hill Atrium*			USGS Field Technique Demonstration, *Lumpkin Plaza*		
3:30 - 4:30	Poster Session, *Pecan Tree Galleria*					
5:00	Nutter & Associates Social at Creature Comforts (Shuttle transportation from Georgia Center available)					

WEDNESDAY, MARCH 26

7:30-8:45	Check-in and Coffee, Hill Atrium					
8:45 - 10:00	Concurrent Morning Sessions I					
	3.1 Substance in Resilience *Room Q*	3.2 Aquatic Connectivity *Room K/L*	3.3 Culvert Failure *Room V/W*	3.4 Contaminants *Room Y/Z*	3.5 Water Quality *Room R*	3.6 Agriculture & Coastal Water Management *Mahler Hall*
8:45	Charles van Rees (Chair)	Jake Duhe	Michael Wild	Gary Hawkins (Chair)		Zachary Gordon
9:00	Matt Chambers	Matt Carroll	Sudhanshu Panda (Chair)	Katy Smith	Brent Aulenbach	Swaty Kajaria
9:15	Alysha Helmrich	Daniel Wyatt	Sydney McDaniel	Ian Brunetz	Michael Marshall (Chair)	Lusi Xie (Chair)
9:30	Cydney Seigerman	Brett Albanese	Casey Helton	Nikki Jones	Mariam Rezai	Husayn El Sharif
9:45	*Discussion*	Ben Emanuel (Chair)		Rosemary Thomas	Jackie Encinas	Kuhelika Ghosh
10:00 - 10:30	Morning Break, *Hill Atrium*					
10:30 - 12:00	Concurrent Morning Sessions II					
	4.1 Water Forecasting (*Canceled)*	4.2 Aquatic Biota & Connectivity *Room K/L*	4.3 DOD Installation Resilience *Room V/W*	4.4 Urban Water Collaboration *Room Y/Z*	4.5 Nutrients, Carbon, & Algal Blooms *Room R*	4.6 Groundwater *Mahler Hall*
10:30	~~Taiye Sangoyomi~~	Chelsea Smith (Chair)	Brian Bledsoe (Chair)	Denzell Cross	Stephen Plont (Chair)	Brent Aulenbach
10:45	~~John Schmidt~~	Jamie Rogers	Matt Bilskie	Sarah Ledford	Zacharie Loveless	Noah Slade (Chair)
11:00	~~Haley Stuckey~~	Kelsey Wilbanks	Will Mattison	Therese Kelly	Annie Blalock	~~James Landmeyer~~
11:15	~~Haley Stuckey~~	Taylor Faherty	*Discussion*	*Discussion*	Dalton Tryba	Dustin Doyle
11:30	~~Taiye Sangonomi~~	Amy Brown			Husayn El Sharif	Dustin Doyle
11:45	~~*Discussion*~~	Jake Duhe			Anna Impellitteri	Sudhanshu Panda
12-1:15	Lunch, Magnolia Ballroom					
1:15 - 2:45	Concurrent Afternoon Sessions					
	5.1 Water Planning & Management *Room Q*	5.2 Aquatic Biota & Restoration *Room K/L*	5.3.1 Urban Green Infrastructure *Room Y/Z*	5.4 LID at Fort Benning Panel *Room V/W*	5.5 Phosphorus and Algae *Room R*	5.6 Coastal & Coastal Plain Groundwater *Mahler Hall*
1:15		Lauren Morris	Rhett Jackson (Chair)	Moderator: ~~Matt Shudtz~~, Daniel Wyatt Panelists: Jon Calabria, Alfie Vick, Rachel Dingley, Matt Gauldin, ~~Brent Widener~~	Tasnuva Farnaz	Gerard Gonthier
1:30	Martin Wunderly	Taylor Michael	Rebecca Abney		Iffat Tasnim	Bradley Harken
1:45	Andrea White	Jonathan Lopez	Haley Selsor		Fatima Iqbal	James Reichard
2:00	Laura Rack (Chair)	Paul Braun	*Discussion*		Rocio Perez	Jaivime Evaristo (Chair)
			5.3.2 High Density Stream Surveys *Room Y/Z*			
2:15	Lida Chen	Phillip Bumpers	Brett Connell		*Discussion*	Gregory Cherry
2:30	Celine Benoit	Charles van Rees	Brett Connell			Christine Voudy
2:45 - 3:15	Afternoon Break, *Hill Atrium*					
3:15 - 3:20	Georgia Power Waters for Georgia Winners, *Mahler Hall*					
3:20 - 4:30	Plenary: Anna George, *Mahler Hall*					
4:30 - 4:40	Closing Remarks, Adjourn					
5:00	Social at Odum School of Ecology Courtyard					

CONFERENCE SPONSORS

EXHIBITORS

Corblu
In-Situ
The Jones Center at Ichauway
Georgia Soil and Water Conservation Society
Kleinschmidt
Nutter and Associates
Frontier Precision

YSI/Xylem
Upper Oconee Watershed Network
The Nature Conservancy Georgia
Trutta Solutions
Resource Environmental Solutions
U.S. Geological Survey
Georgia Water Planning & Policy Center

COMMITTEES AND VOLUNTEERS

CONFERENCE CHAIR

Sechindra Vallury, River Basin Center & Odum School of Ecology

TECHNICAL COMMITTEE

Seth Wenger, River Basin Center & Odum School of Ecology
Shannon Caldwell, UGA Terry College of Business
James Deemy, College of Coastal Georgia
Sarah Buckleitner, UGA Institute for Resilient Infrastructure Systems
Duncan Elkins, UGA Warnell School of Forestry and Natural Resources
Will Pruitt, Kleinschmidt

STEERING COMMITTEE

Katherine Atteberry, ARC/Metro Water Planning District
Daniel Calhoun, US Geological Survey
Meagan Taylor, Albany State University
Ben Emanuel, American Rivers
Jennifer Flowers, Georgia Association of Water Professionals
Aris Georgakakos, Georgia Institute of Technology
Nick Marzolf, The Jones Center at Ichauway
Cody Hale, Nutter and Associates
Erin Lincoln, TetraTech
Chris Manganiello, Chattahoochee Riverkeeper
Doug Oetter, Georgia College and State University
Jenny Pahl, Corblu Ecology Group
Luke Pangle, Georgia State University
Jim Renner, Chemours
Mark Risse, UGA Marine Extension & Georgia SeaGrant
Eric Somerville, USEPA
Jill Stachura, Brown and Caldwell
Elizabeth Sudduth, Georgia Gwinnett College
Anna Truszczynski, Department of Natural Resources
Lori Visone, CDM Smith
Paula Marcinek, The Nature Conservancy

COMMUNICATIONS

Olivia Allen, UGA Institute for Resilient Infrastructure Systems
Beth Gavrilles, UGA Odum School of Ecology

VOLUNTEERS

Alvee Bin Hannan; Alyssa Quan; Annie Blalock; Arwen Coy; Aurora Fowler; Christine Majeni; Emily Chalfin; Haley Hubert; Kati Tanner; Katie Schroeder; Kuhelika Ghosh; Laura Rack; Luciana Iannone Tarcha; Mackenzi Hallmark; Margaret Hart; Maria Laura Siqueira Batista; Marilee Hoyle; Michaela Collins; Natalia Vargas López; Olajide Oladipo; Oyindamola Oseni; Pramod Hegde; Susan Paudel; Tracy Chukwuma

ABOUT THE RIVER BASIN CENTER

The River Basin Center (RBC) connects freshwater science to management and policy. Although affiliated with the Odum School of Ecology, it is known for an interdisciplinary approach—its affiliates are drawn from units across the University of Georgia. River Basin Center faculty, staff and students work on aquatic management issues around the globe, but the center maintains an emphasis on the southeastern U.S.

The RBC's mission is to produce and disseminate the knowledge and tools for sustainable management of aquatic resources and ecosystems through applied scientific and policy research, and by training the next generation of managers and researchers. The RBC works in three broad areas: (a) conservation ecology of aquatic ecosystems; (b) applied research on aquatic system stressors and development of appropriate management tools; (c) policy development and outreach.

KEYNOTE SPEAKERS

KATHERINE ZITSCH

Water Policy Advisor,
Georgia Water Planning
& Policy Center

Katherine Zitsch is a strategic water policy leader driving resilient solutions for Georgia's Water Future. Katherine joined the Georgia Water Planning and Policy Center in 2024, working in partnership with the Metro Atlanta Chamber to develop forward-thinking strategies for a resilient water future. She is a collaborative leader, building cross-sector partnerships with others in business, government, and philanthropy. Katherine is skilled at implementing holistic solutions that consider interconnected systems (energy, water, agriculture, forestry). Prior to joining the Center, Katherine served as the Deputy COO of the Atlanta Regional Commission and has over 25 years of experience in water resources planning and policy. Katherine is President of the National Water Supply Alliance, providing national policy direction to elevate water supply at U.S. Army Corps of Engineers reservoirs.

M.S. Environmental Systems Engineering, Clemson University
B.S. Civil Engineering, Clemson University

Tuesday, March 25 11:00 — 12:00
Mahler Hall

ANNA GEORGE

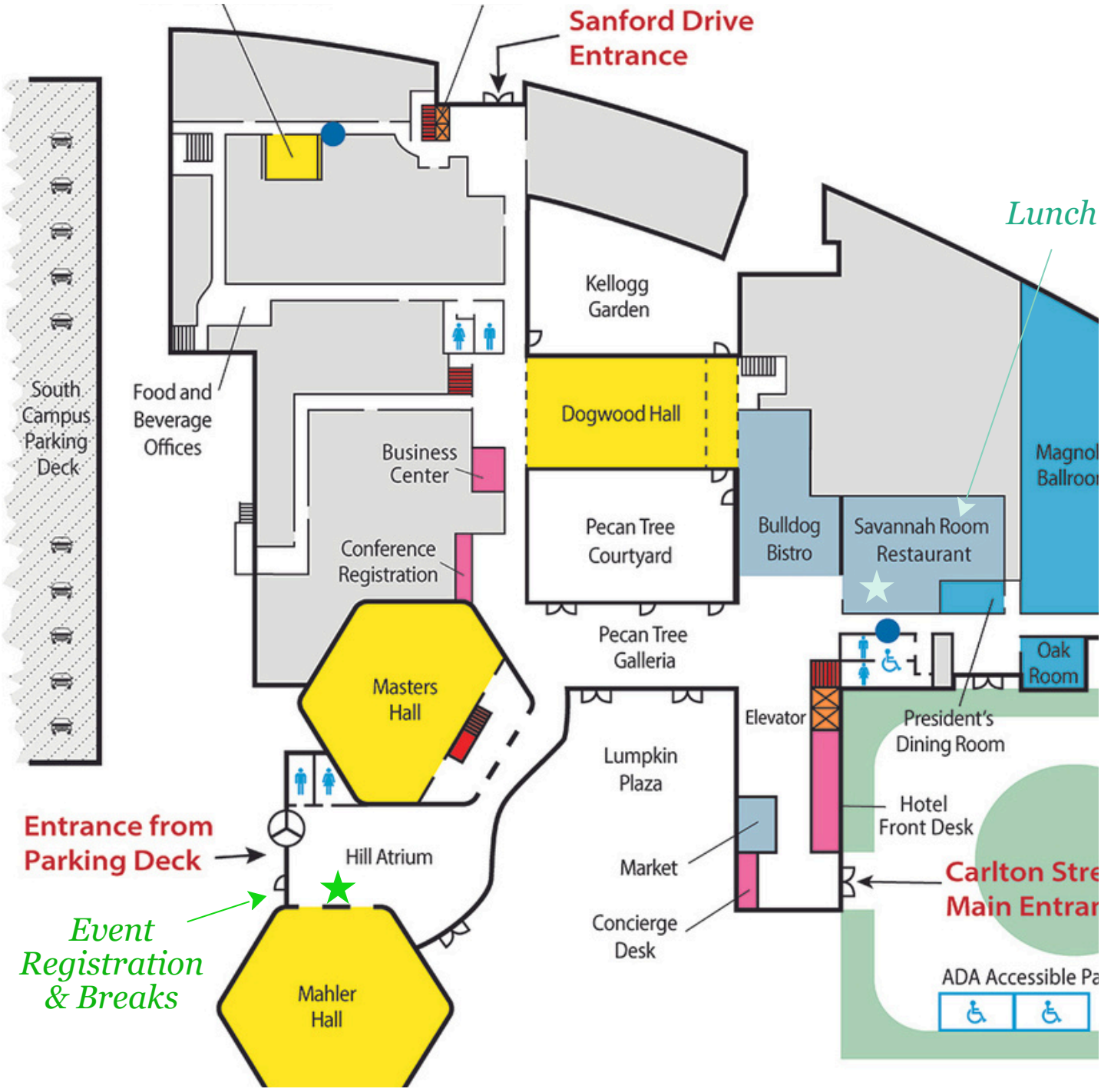
Vice President of Conservation Science and Education, Tennessee Aquarium

Dr. Anna George, Vice President of Conservation Science and Education at the Tennessee Aquarium, was lucky to discover her love for water early in life, on a 7th grade field trip to the Dauphin Island Sea Lab in Alabama. From that point on, her goal was to get underwater to hang out with fish as often as possible. During her undergraduate and graduate coursework in biology, she worked in both freshwater and marine systems to study the conservation, ecology, and evolution of fishes. Since joining the Aquarium in 2006, she has led research and education initiatives in biodiversity studies, species reintroduction, and habitat restoration to help conserve the incredible animals that live in the rivers and streams of the southeastern United States. Her enthusiasm for teaching everyone – scientists and non-scientists alike – about these river animals reflects her passion for protecting our own backyard. Anna has taught at Franklin & Marshall College, Mountain Lake Biological Station, the University of the South, and the University of Tennessee at Chattanooga. She has served on the Advisory Council for Gray's Reef National Marine Sanctuary and the Board of Directors for Crabtree Farms.

Ph.D. Biology, Saint Louis University
Graduate coursework in Biology, University of Alabama
B.A. Biology University of Virginia

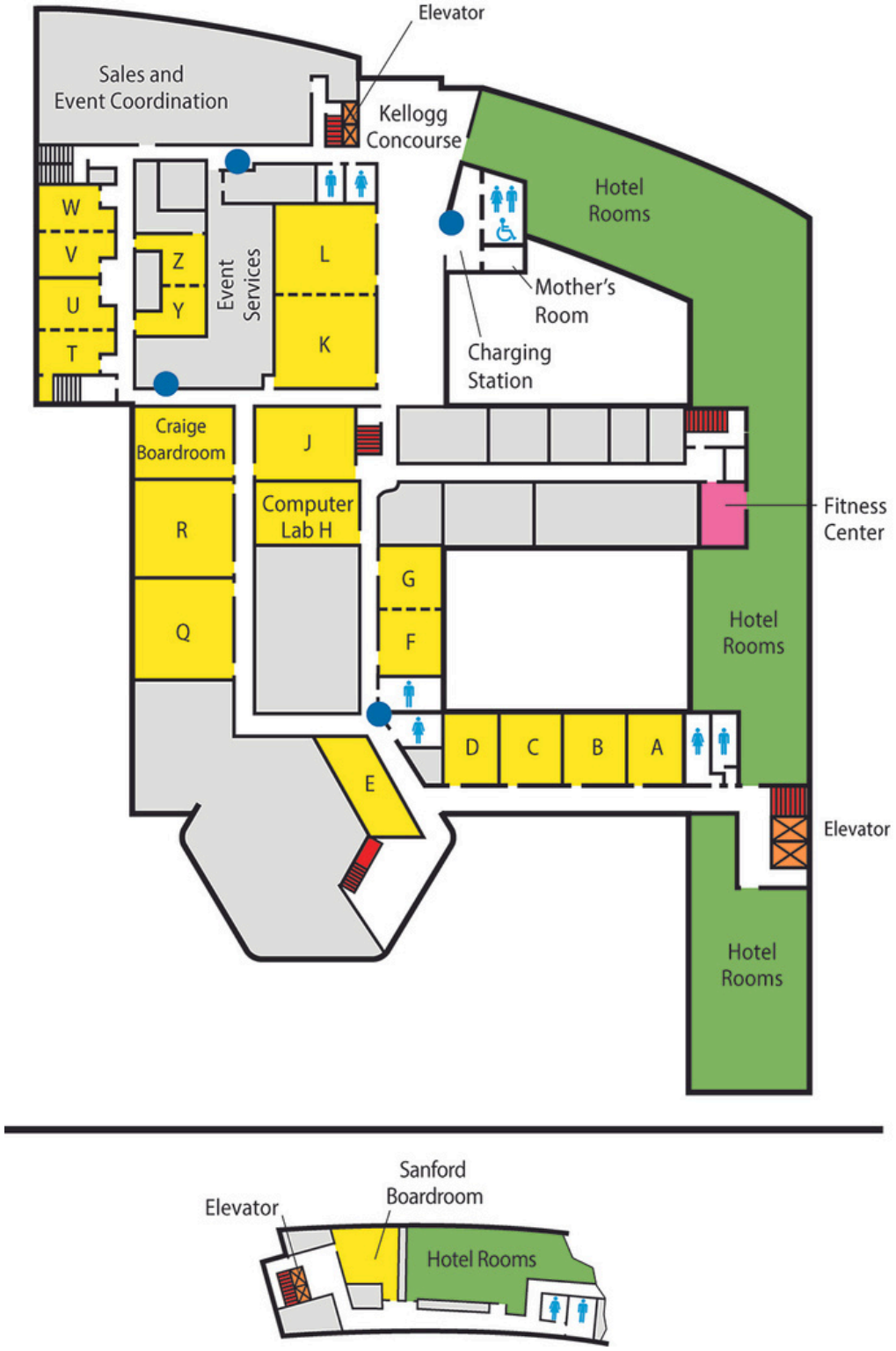
Wednesday, March 26 3:20 — 4:30
Mahler Hall

VENUE MAP



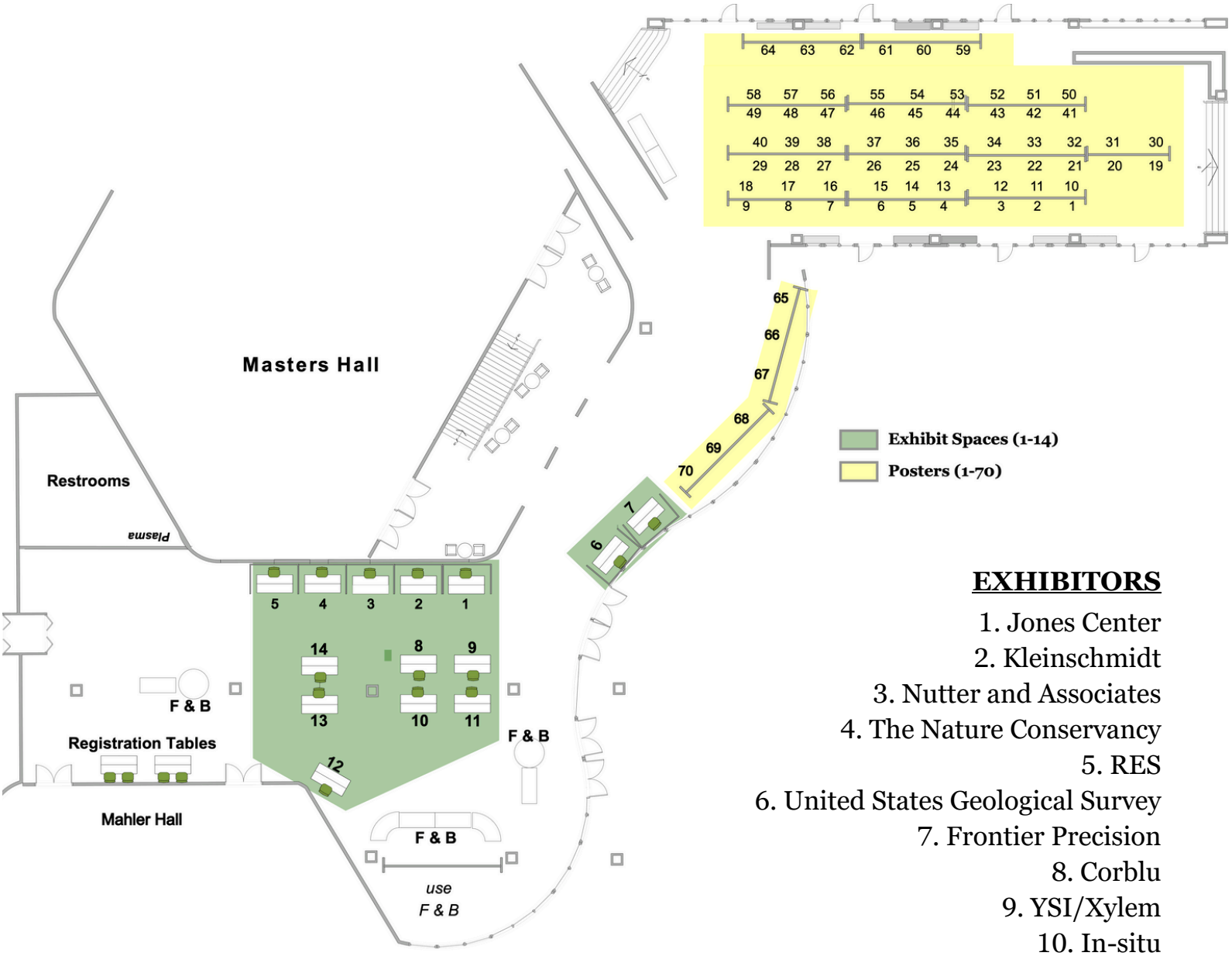
Georgia Center first floor

VENUE MAP



Georgia Center second floor

VENUE MAP



EXHIBITORS

1. Jones Center
2. Kleinschmidt
3. Nutter and Associates
4. The Nature Conservancy
5. RES
6. United States Geological Survey
7. Frontier Precision
8. Corblu
9. YSI/Xylem
10. In-situ
11. Upper Oconee Watershed Network
12. Trutta Solutions
13. Georgia Soil and Water Conservation Society
14. Georgia Water Planning and Policy Center

Georgia Center first floor

VISITOR INFORMATION

Parking Information

Parking for the conference is available in the South Deck Parking Lot, 100 W Green St., for $10 a day. The deck is immediately adjacent to the conference center (see first floor map). For registrants lodging at the Georgia Center, parking is included with your stay.

Shuttles

A limited shuttle service will be available for conference attendees from the conference site to the Creature Comforts Social. Outbound service will run from 4:30 to 6:30 PM. Three shuttles will be in operation, each with a capacity of 12 passengers per trip. While multiple trips are planned, seating is limited, so we encourage attendees to walk downtown or to arrange alternative transportation. Attendees can board the shuttle at the Carlton Street circle entrance of the GA Center (see first floor map).

FOOD

In addition to lunch, refreshments will be provided at our morning and afternoon breaks. If you would like a full breakfast before registration and programming begins, check out the Bulldog Bistro (see first floor map), which opens at 7:00 a.m.

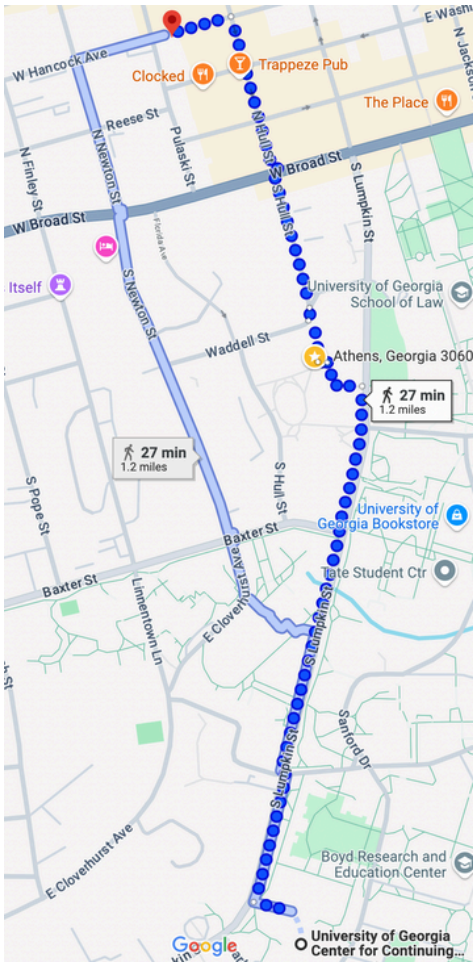
Attendees are encouraged to make their own arrangements for dinner downtown after the social. Shuttle service will not be provided back to the Georgia Center, but various ride share options are available.

The registration desk will be staffed at all times. If you lose your way or have questions, head back to Hill Atrium and find a student volunteer there. All volunteers are identifiable by a **green** sticker on their name tag!

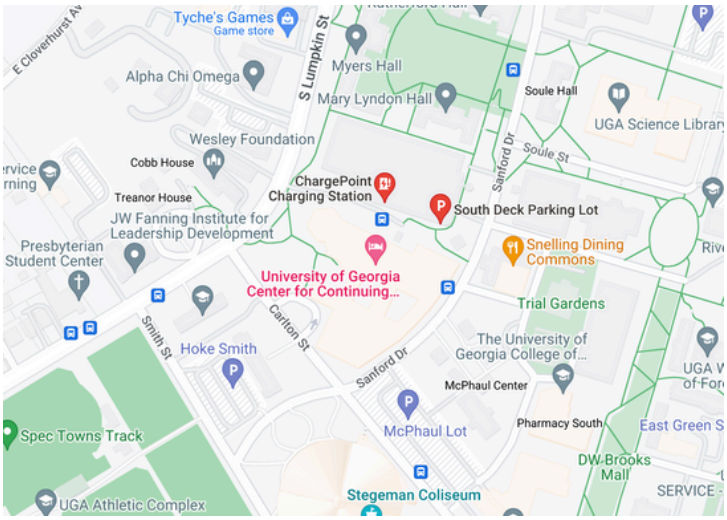
Socials

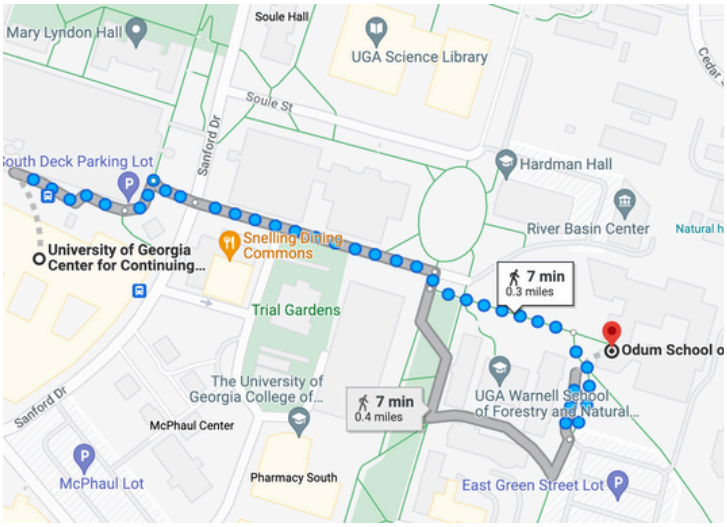
Social events will be held at 5:00pm on both days of the Conference. On Tuesday, 3/25, Nutter & Associates will sponsor a social at the Creature Comforts Taproom in Downtown Athens.

On Wednesday, 3/26, a social hour will be held at the Odum School of Ecology, a short walk from the Conference space.



Creature Comforts Brewing, 271 W Hancock Ave, Athens, GA 30601. See above for directions. Limited shuttle space will be available (see previous page for more information).





Odum School of Ecology, 140 E Green St, Athens, GA 30602. See map for walking directions from the conference center to the school. Parking is not enforced in lot S07 after 5 p.m. if you prefer to drive.

REMINDER To participate in the Creature Comforts Social, head to the taproom and show Kristy Teems of Nutter and Associates your conference name tag to receive a drink ticket. Kristy will be wearing a conference name tag with a green sticker!

PRESENTATIONS OVERVIEW

DAY ONE MORNING SESSIONS

Tues. March 25, 9:00 - 10:15am

1.1 Flood Resilience Panel

Room Q

Moderator: Brian Bledsoe, *University of Georgia Institute for Resilient Infrastructure Systems*

Panelists: Brian Bledsoe, Matt Chambers, *University of Georgia,* Rhett Jackson, *University of Georgia*

1.2 Georgia FIT: Securing Water for Mussels and Farmers in the Flint River Basin

Mahler Hall

Moderator: Kristin Rowles, *Albany State Univeristy Georgia Water Planning and Policy Center*

Panelists: Gordon Rogers, *Flint Riverkeeper*, Cathy Marion, *U.S. Fish and Wildlife Service*, Matt Rowe, *Georgia Department of Natural Resources,* Ania Truszczynski, *Georgia Environmental Protection Division*

1.3 Local Governments and Wetlands Protection Panel

Room K/L

Moderator: Steffney Thompson, U*niversity of Georgia School of Law*

Panelists: Molly Bogle, *City of Madison*, Carol Myers Flaute, *Northeast Georgia Regional Commission*, Bill Sapp, *Southern Environmental Law Center*

1.4 Aquatic Microbial Ecology I

Room R

Microbial communities across a non-perennial stream continuum in an Alabama Piedmont forest, Charles Bond, *University of Mississippi*

Seasonal Variation in Microbial Activity in an Intermittent Stream of the Southeastern United States, Andrielle Kemajou, *University of Mississippi*

Characterizing the microbial community structure across time and light conditions on wood veneers submerged in a freshwater pond, Ethan Rutledge, *University of Southern Mississippi*

Influences of Salinity on Long- and Short-term Patterns in Microbial Extracellular Enzyme Activity Along the Mississippi Gulf Coast, Jacqueline Pavlovsky, *University of Mississippi*

The Influence of Nutrient Availability on Non-nitrogen-fixing and Nitrogen-fixing Cyanobacteria and Microcystin production in Large Rivers, Jingjing Li, *Tennessee Technological University*

1.5 Experiential Education

Room V/W

Course-based Undergraduate Research Experiences (CUREs) as the Foundation of a Major, Téa Autry, *College of Coastal Georgia*

Estimated Hydrological Impact of the Proposed Mining of Trail Ridge, Damian Elmore, *College of Coastal Georgia*

Experiential learning with INVURTS to help students enrich their ecological understanding and build skills, Elizabeth Sudduth, *Georgia Gwinnett College*

Forming a Resilient Civil and Environmental Engineering Workforce Through Various Learning Opportunities at the Local, National, and International Levels, Felix Santiago-Collazo, *University of Georgia College of Engineering*

Community-Engaged Research in Coastal Georgia, Asli Aslan, *Georgia Southern University*

1.6 Surface Hydrology

Room Y/Z

Trends of Climate Extremes in the Southeast U.S., Shivani Chougule, *Georgia Institute of Technology*

Role and Applications of the USGS Hydrologic Monitoring Network in Georgia, Robert Sobczak, *U.S. Geological Survey*

Towards a LSPIV system for flow measurement of ungaged streams, Cole Myers, *Kennesaw State University*

Streamflow Dynamics in a southern US Water Tower: A Multi-Method Analysis Connecting Land Cover, Precipitation, and Topography in the Southern Appalachians, Alexander Miele, *Louisiana State University*

DAY ONE AFTERNOON SESSIONS

Tues. March 25, 1:15 - 3:00pm

2.1 Flood Modeling

Room Q

Island-Scale Hydrologic and Hydraulic Modeling Framework for Caribbean Islands, Orlando Viloria, *University of Georgia*

Georgia Flood Potential Modeling and Mapping using GeoAI for Proactive Management Decision Support, Rohan Mohanty, *North Oconee High School*

Real-time Forecasting of Georgia Coastal Flooding, *Matt Bilskie, University of Georgia*

Compound flood modeling for coastal military installations and surrounding communities, Lina Caro, *University of Georgia*

Assessing lake contribution to compound flood water levels in complex estuarine systems, Luciana Iannone-Tarcha, *University of Georgia*

Assessing the impacts of climate change and natural variability on hydrological extreme events over North America and Europe, Ralf Ludwig, *Ludwig-Maximilians-University of Munich*

Development and Operational Use of Ensemble Hydrologic Models at Southeast River Forecast Center, John Schmidt, *National Oceanic and Atmospheric Administration*

2.2 Mussel Conservation

Mahler Hall

Critical Field Data Essential for Developing Mussel Conservation Strategies, Steve Golladay, *Georgia Water Planning and Policy Center & Jones Center at Ichauway*

Lower Flint River Basin Habitat Conservation Plan: Inundation Models of Low-Flow in HEC-RAS, Julian Spergel, *Georgia Environmental Protection Division*

Environmental gradients drive convergence in life history strategies among disparate but linked taxonomic groups, Carla Atkinson, *University of Alabama*

Size-dependent extinction risk in freshwater mussels, Garrett Hopper, *Louisiana State University*

Using population dynamics models for freshwater mussel conservation, Eric Walther, *University of Georgia*

Hatcheries maintain high genetic variation but show shifts in genetic structure of progenies of five endangered riffleshell species (Epioblasma) (Bivalvia: Unionidae) of the eastern United States, Jess Jones, *U.S. Fish and Wildlife Service*

Integrating Publicly Available Datasets to Improve Conservation Practices for One of the Most Imperiled Taxonomic Groups on the Planet, Irene Sanchez-Gonzalez, *University of Georgia*

An Overview of Mussel Conservation in the Southeast, Wendell Haag

2.3 Georgia Wetlands Post-Sackett

Room K/L

Understanding and conserving ecosystem services from geographically isolated wetlands in Georgia, Steven Brantley, *Jones Center at Ichauway*

Spatiotemporal variability of isolated wetland hydroperiod across a managed landscape, Nick Marzolf, *Jones Center at Ichauway*

Ecosystem services of isolated wetlands in longleaf pine forests: amphibian diversity, Lora Smith, *Jones Center at Ichauway*

Modeling sedimentation and hydrology of geographically isolated wetlands with partial and fully agricultural catchments, Suranjana Chattergee, *Auburn University*

Characterizing Water Budgets in Isolated Wetlands, Katy Perkins, *Jones Center at Ichauway & Auburn University*

Predicting Wetting and Drying Dynamics of Depressional Wetlands to Determine Habitat Suitability for Amphibian Species, Jeffrey Riley, *U.S. Geological Survey*

Seasonal variability in nutrient and greenhouse gas cycling in surface and shallow groundwater within restored agricultural floodplain wetlands, Zoe Porter, *Tennessee Technological University*

2.4.1 Aquatic Microbial Ecology II

Room R

Phosphorus Uptake and Storage by Aquatic Hyphomycete Fungi, Lydia McGregor Bravo, *University of Alabama*

Investigating the Impact of Environmental Conditions on Metal-Microbe Dynamics in Wetlands, Marilee Hoyle, *University of Georgia*

Diversity of nearshore bacterial communities along the Mississippi Gulf Coast, Stephanie Vaughn, *University of Mississippi*

2.4.2 Wastewater

Room R

Carbon Dioxide Infusions Improve Wastewater Treatment by Filamentous Algae, Troy Keller, *Columbus State University*

Septic Wastewater Effluent Impacts on Urban Soil Biogeochemistry and Tree Condition, Courtney Scott, *University of Georgia*

Sociodemographic Disparities and Precipitation Impacts in Patterns of Wastewater Infrastructure Failure in Atlanta, GA, Krista Capps, *University of Georgia*

2.5.1 Targeted Solutions for Trash Reduction: Prioritizing Community Need with Watershed-Wide Trash Traps Panel

Room V/W

Moderator: Ashley Desensi, *Chattahoochee Riverkeeper*

Panelists: Amy Doneff, *Arcadis*, Jordan Yu, *Chattahoochee Riverkeeper*, Ramsey Cook, *Arcadis*

2.5.2 Chattahoochee Updates

Room V/W

Nutrient pollution in Chattahoochee River watershed reservoirs – implications for monitoring and management, Becca Risser, *Chattachoochee Riverkeeper*

The role of volunteer water quality monitoring in finding failing wastewater treatment plants: Case studies from the Chattahoochee watershed, Jess Sterling, *Chattachoochee Riverkeeper*

Data Centers in the Chattahoochee River Basin, Chris Manganiello, *Chattachoochee Riverkeeper*

2.6 Coastal Carbon

Room Y/Z

Salt Marshes of Georgia: Potential for long-term persistence and carbon sequestration, Clark Alexander, *University of Georgia*

Spatial patterns in wetlands soil carbon stocks across the Georgia coast, Nikki Zhang, *University of Georgia*

Oyster Reef Restoration and Changes to Shoreline Morphology and Salt Marsh Area: Potential for Blue Carbon?, John Carroll, *Georgia Southern University*

Coastal Blue Carbon: U.S. Offset Markets and Methodologies and State-Level Initiatives, Katie Hill, *University of Georgia*

DAY 2 MORNING SESSIONS I

Weds. March 26, 8:45 - 10:00am

3.1 Substance in Resilience

Room Q

Evaluating the Conservation Benefits of Large-scale Floodplain Restorations: The Biodiversity Science of Levee Setbacks, Charles van Rees, *University of Georgia*

Innovations in Benefit Quantification Methods to Support Federal Investment in Levee Setbacks, Matt Chambers, *University of Georgia*

Proactive Resilience Plan for Qatar's Physical Infrastructure, Alysha Helmrich, *University of Georgia*

Incorporating the Multiple Dimensions of Equity into Water Infrastructure Projects, Cydney Seigerman, *University of Georgia*

3.2 Aquatic Connectivity

Room K/L

Lessons learned from a very rapid instream barrier assessment effort in a data-deficient watershed in southwestern Georgia, Jake Duhe, *Louisiana State University*

Changing the Culture of Culvert Design at GDOT, Matt Carroll, *Georgia Department of Transportation*

Aquatic Connectivity and Resilient Infrastructure Investment at Fort Moore, Georgia, Daniel Wyatt, *University of Georgia*

State Wildlife Action Plan Update, Brett Albanese, *Georgia Department of Natural Resources*

What's New in Aquatic Connectivity, Dam Removal, Culvert Replacement and More in Georgia, Ben Emanuel, *American Rivers*

3.3 Culvert Failure

Room V/W

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Watershed Debris Flow Assessment Emphasis, Michael Wild, *University of North Georgia*

GeoAI Aided Geospatial Models Design for Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR, Sudhanshu Panda, *University of North Georgia*

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Stream Bank Erosion Vulnerability Modeling Approach, Sydney McDaniel, *University of North Georgia*

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Modified-RUSLE Modeling Assessment Emphasis, Casey Helton, *University of North Georgia*

3.4 Contaminants

Room Y/Z

PFAS Research and Outreach, Gary Hawkins, *University of Georgia*

Building a Regional Network to Study the Influence of Climate Change on Contaminants of Emerging Concern, Katy Smith, *University of Georgia*

Acute Impacts of Microplastics on Corbicula fluminea Respiration, Ian Brunetz, *University of Georgia*

Are you what you eat? A tale of mercury trophic transfer in a low-level contaminated stream, Nikki Jones, *Oak Ridge National Laboratory*

Leading the Way in Oil Spill Cleanup: Polyetherimide Electrospun Mats, Rosemary Thomas, *Indian Institute of Technology Delhi*

3.5 Water Quality
Room R

Patterns and Trends in Streamwater Constituent Loads from 15 Watersheds in DeKalb County, Georgia, 2012-2022, Brent Aulenbach, *U.S. Geological Survey*

Canary in a shoal mine: An interdisciplinary approach to river ecosystem monitoring using water-associated stable and radiogenic isotopes in Northeast Georgia, Michael Marshall, *University of Georgia*

Watershed Modeling with QSWAT to Determine the Causes of Sudden Temperature Drop at Two Fish Hatcheries in Chattahoochee River, Mariam Rezai, *University of North Georgia*

Leveraging US EPA's Restoration and Protection Screening Tool to Prioritize Watersheds for Nonpoint Source Pollution Management in Georgia, Jackie Encinas, *Georgia Environmental Protection Division*

3.6 Agriculture & Coastal Water Management
Mahler Hall

Coastal Freshwater Health and Function Impacted by Surface Saltwater Intrusion, Sapelo Island, GA, Zachary Gordon, *Georgia Southern University*

Nature's Shield: Deciphering Mangroves' Influence on Property Value Dynamics in the Wake of Hurricane Irma, Swaty Kajaria, *University of Georgia*

Contract Design in Water Conservation Programs in Southwestern Georgia, Lusi Xie, *University of Georgia*

Sensitivity of crop yield and irrigation to climate variability and uncertainty, Husayn El Sharif, *Georgia Institute of Technology*

Groundwater Depletion as a Prisoner's Dilemma Problem: A Game-Theoretic Analysis of Incentive-based approach to Sustainable Groundwater Management, Kuhelika Ghosh, *University of Georgia*

DAY 2 MORNING SESSIONS II

Weds. March 26, 10:30am - 12:00pm

4.1 Water Forecasting
(Cancelled)

Flood Forecasting Case Studies of 2024 Tropical Season, Taiye Sangoyomi, *National Oceanic and Atmospheric Administration*

SERFC Role in Riverine Flood Forecasting in the Southeast, John Schmidt, *National Oceanic and Atmospheric Administration*

Evolving Southeast River Forecast Center's Delivery of Hydrologic Information, Haley Stuckey, *National Oceanic and Atmospheric Administration*

Implementation of Operational Flood Inundation Mapping in the Southeast, Haley Stuckey, *National Oceanic and Atmospheric Administration*

Coastal Compound Flood Model Development and Operational Forecast Application, Taiye Sangoyomi, *National Oceanic and Atmospheric Administration*

4.2 Aquatic Biota & Connectivity
Room K/L

DNA metabarcoding reveals spatiotemporal patterns of invertebrate diversity in a headwater stream, Chelsea Smith, *University of Alabama & Jones Center at Ichauway*

Spatiotemporal variability in hatch success of Shoal Bass and Largemouth Bass in the Apalachicola-Chattahoochee-Flint Basin, Jamie Rogers, *Jones Center at Ichauway*

Response of macroinvertebrate assemblages in lateral river habitats including floodplains, oxbow lakes and the main river channel during hydrological drought, Kelsey Wilbanks, *University of Georgia*

Preliminary genetic evidence of an Atlantic sturgeon spring spawning run in the Savannah River, Taylor Faherty, *University of Georgia*

Analysis of Minimum Flow Requirements for Gulf Sturgeon in the Suwannee River, Amy Brown, *Suwannee River Water Management District*

Stream fish assemblage dynamics during severe drought in a drought-prone watershed, Jake Duhe, *Louisiana State University*

4.3 DOD Installation Resilience

Room V/W

Brian Bledsoe, *University of Georgia*

Protecting Military Readiness with NBS in the Marine Corps Recruit Depot Parris Island, Matt Bilskie, *University of Georgia*

Resilient Installations: Military Readiness through Engineering with Nature® (EWN) Design, Will Mattison, *University of Georgia*

4.4 Urban Water Collaboration

Room Y/Z

Urban Water Challenges: Co-Developing Community-Centered Solutions in the CSAW Learning Ecosystem, Denzell Cross, *Georgia State University*

Interactions between hydrologic drivers, land cover, and population characteristics control E. coli in urban streams, Sarah Ledford, *Georgia State University*

The Politics of Escherichia Coli Pollution in the South River Watershed, Therese Kelly, *Georgia State University*

4.5 Nutrients, Carbon, & Algal Blooms

Room R

Seasonal and Flow Impacts on Dissolved and Particulate C:N:P Stoichiometry in a Small, Forested, Southeastern Stream, Stephen Plont, *University of Alabama*

Seasonal optical properties of DOM, POM, and BOM in a piedmont watershed in central Alabama, USA, Zacharie Loveless, *University of Alabama*

Long-term trends in nutrient concentrations in the Etowah and Conasauga Rivers: Monitoring two biodiverse rivers to support imperiled aquatic species, Annie Blalock, *University of Georgia*

Algal community shifts and cyanobacterial blooms in large rivers are more likely to occur at extreme light and temperature conditions, Dalton Tryba, *Tennessee Technological University*

Lake Chlorophyll-a Assessment Using Satellites, Husayn El Sharif, *Georgia Institute of Technology*

Application of an artificial intelligence program for monitoring cyanobacteria in northern Lake Sydney Lanier, Anna Impellitteri, *Emory University*

4.6 Groundwater

Mahler Hall

The Role of Hillslope Groundwater Recharge in Generating Stormflow in a Forested Headwater Catchment in the Piedmont, Georgia, Brent Aulenbach, *U.S. Geological Survey*

Reclaimed Limestone Quarries: An Alternative Groundwater Resource for Georgia's Future, Noah Slade, *Nutter and Associates, Inc.*

USGS and U.S. Navy Assess the Effectiveness of an Evapotranspiration Cover at a Former Landfill, Marine Corps Logistics Base Albany, Georgia, James Landmeyer, *U.S. Geological Survey (CANCELED)*

Analytics Software for the Natural Environment to Monitor Flooding, Water Quality, Stormwater, and more., Dustin Doyle, *Aquatic Informatics*

Protecting East Kootenays Groundwater with Centralized Quality Data Management, Dustin Doyle, *Aquatic Informatics*

Geomorphohydrologic Analyses for determining Soil Subsidence, Sinkhole Formation Vulnerability, and Groundwater Contamination Susceptibility with GeoAI-aided Model Design, Sudhanshu Panda, *University of North Georgia*

DAY 2 AFTERNOON SESSIONS

Weds. March 26, 1:15pm - 2:45pm

5.1 Water Planning & Management

Room Q

Promoting Water Conservation in Sustainable Landscaping with a Statewide Educational Program: Early Efforts and Room for Improvement, Martin Wunderly, *University of Georgia*

Georgia Freedom to Float and our longstanding Right of Passage, Andrea White, *Georgia Rivers*

Evaluating Options for Improving Drought Resilience of the Upper Flint River, Laura Rack, *University of Georgia*

A New Management Approach for Large Reservoir Systems, Lida Chen, *Georgia Institute of Technology*

Data Center Trends in Metro Atlanta, Celine Benoit, *Metropolitan North Georgia Water Planning District*

5.2 Aquatic Biota & Restoration

Room K/L

Unveiling seasonal dynamics of mussel assemblages on ecosystems using in situ experimental chambers, Lauren Morris, *University of Alabama*

Freshwater mussel functional traits shape mussel-mediated ecosystem metabolism and biogeochemical cycling, Taylor Michael, *University of Alabama*

Long-term declines in freshwater mussel aggregations decrease biogeochemical storage and recycling, Jonathan Lopez, *University of Alabama*

Using environmental DNA to bolster traditional macroinvertebrate sampling at stream restoration sites in Georgia, Paul Braun, *Resource Environmental Solutions, LLC*

Harnessing positive interactions: Testing nature-based restoration to achieve conservation outcomes in the Conasauga River, Phillip Bumpers, *University of Georgia*

Ecological Theory, Biodiversity, and the Resilience of Nature-based Approaches to Water Management, Charles van Rees, *University of Georgia*

5.3.1 Urban Green Infrastructure

Room Y/Z

An alternate approach to urban stream corridor restoration, Rhett Jackson, University of Georgia

The potential of biochar amendment in water-stressed urban tree vaults for stormwater quality and tree growth, Rebecca Abney, *University of Georgia*

Incorporating the Multiple Mapping Urban Flood Risk: Identifying Floodplain Communities and the Role of Greenways in Mitigating Risk of Equity into Water Infrastructure Projects, Haley Selsor, *University of Georgia*

5.3.2 High Definition Stream Surveys

Room Y/Z

High Definition Stream Survey (HDSS): Addressing Water Quality Challenges in the Hurricane Creek Watershed, Brett Connell, *Trutta Environmental Solutions*

Chattahoochee River High Definition Stream Survey (HDSS): Delivering Powerful Data for Water Resource Management, Brett Connell, *Trutta Environmental Solutions*

5.4 Advancing LID Implementation Through DOD-UGA Partnerships: A Case Study and Reality-Check on an Important Resilience Policy Panel

Room V/W

Moderator: *Daniel Wyatt, University of Georgia* ~~Matt Shudtz, *University of Georgia*~~

Panelists: Jon Calabria, *University of Georgia,* Alfie Vick, *University of Georgia,* Rachel Dingley, *University of Georgia,* Matt Gauldin, *University of Georgia* ~~Brent Widener, *U.S. Army, Fort Benning*~~

5.5 Organic Phosphorus and Algae

Room R

Understanding the role of recalcitrant organic phosphorus mineralization on phosphorus dynamics to regulate algal blooms in freshwaters, Tasnuva Farnaz, *Georgia Southern University*

Assessing the Contribution of Recalcitrant Organic Phosphorus to the Soluble Reactive Phosphorus Pool through Microbial Mineralization in Freshwaters., Iffat Tasnim, *Georgia Southern University*

Advancing surface water phosphorus monitoring through affordable sensor systems networks, Fatima Iqbal, *Georgia Southern University*

Phosphorous Removal from Aqueous Samples using Alginate-NADES beads, Rocio Perez, *Georgia Southern University*

5.6 Coastal and Coastal Plain Groundwater

Mahler Hall

Groundwater-level trends in the Floridan aquifer system, Georgia, 1985-2025, Gerard Gonthier, *U.S. Geological Survey*

Groundwater Modeling in the South Atlantic Coastal Plain: Updates, Advances, and Future Directions, Bradley Harken, *U.S. Geological Survey*

Exploring deep-seated structural controls on the groundwater system on St. Catherines Island, Georgia, James Reichard, *Georgia Southern University*

Revisiting Groundwater Flow and Recharge in the Upper Floridan Aquifer: Insights from Past and Present Tracer Studies, Jaivime Evaristo, *University of Georgia*

Saltwater Intrusion in the Floridan aquifer system near downtown Brunswick, Georgia, 2023, Gregory Cherry, *U.S. Geological Survey*

Assessing the Impact of Floridan Aquifer Withdrawals from Bryan and Bulloch Counties utilizing Georgia's Coastal Sound Science Initiative (CSSI) DYNSYSTEM Model., Christine Voudy, *Georgia Environmental Protection Division*

POSTERS

Tues. March 25, 3:30 - 4:30pm

Pecan Tree Galleria

Assessing Urban Stream Syndrome: Water Quality Analysis of Oglethorpe University's Streams, Alanys Elvir Bustillo, *Oglethorpe University*

Characterizing watershed biogeochemical "fingerprints" across a managed forested watershed in Alabama, USA, Sarah Kelley, *University of Alabama*

Detecting Change Along a Stream Reach Using Terrestrial Laser Scanning, Jonathan Lipscomb, *University of North Georgia*

Developing Regional Curves for Estimating Bankfull Geometry for Streams in Georgia, Jonathan Musser, *US Geological Survey (CANCELED)*

Dissolved oxygen dynamics of geographically isolated wetlands in southwest Georgia influenced by Hurricane Helene, Jewell Johnson, *Jones Center at Ichauway and University of Alabama*

Evaluation of wild pig wallows as a source for transmission of human and animal pathogens, Kevin Kosewick, *University of Georgia*

Examining the ecological role of giant salamanders, Amphiuma means and Siren lacertina, within seasonally inundated, isolated wetlands, Madeline Zickgraf, *Jones Center at Ichauway & University of Alabama*

Freshwater Mussels of Louisiana: A Field Guide, Franchesca Ruiz, *Louisiana State University*

Habitat Integrity and Macroinvertebrate Community Response to an Urban Stream Restoration in Augusta, GA, Henna Gavem, *Georgia Southern University*

Impact of Water Phosphate Content on Macroinvertebrate Biodiversity, Sage Christman, *College of Coastal Georgia*

Implications of Shell Aging and Response of a Listed Freshwater Mussel Species to Relaxed Drought Stresses in the Lower Flint River Basin, Christine Bahlinger, *Jones Center at Ichauway*

Land Use as a Driver of Biotic Composition and Ecosystem Function in Georgia Streams, Jane Jones, *Georgia Southern University*

Light and temperature as drivers of organismal metabolism in arctic spring-streams, Adam Hensley, *University of Alabama*

Macroinvertebrates as Indicators of Salinity Stress in Sapelo Island Wetlands, Hana Sato, *Georgia Southern University*

Methods for Assessing Culvert Impacts on Water Quality in Urban Streams, Mary Claire Streat, *Columbus State University*

Observations on freshwater mussel-habitat interactions in a tributary of the lower Flint River Basin during summer base flow, Jenna Jackson, *Jones Center at Ichauway*

Opportunities and challenges identified from developing a regional conservation strategy for freshwater mussels, Caitlin Sweeney, *Jones Center at Ichauway*

Physicochemical properties of three freshwater wetlands in Southeast, Georgia USA, Kristen Darley, *College of Coastal Georgia*

Predicting storm generated surface discharge in an ephemeral stream channel in a karst watershed, Carlie Blackburn, *Jones Center at Ichauway*

Seasonal activity patterns of eastern musk turtles (Sternotherus odoratus) in a geographically isolated wetland within a longleaf pine (Pinus palustris) forest, Ivy Bryan, *Jones Center at Ichauway*

Seasonal shifts in ecoenzymatic activity of primary producers in arctic spring-streams along a temperature gradient, Tori Hebert, *University of Alabama*

Soil recovery in wetlands after heavy mineral sand mining, Megan Aslinger, *University of Georgia*

Trends in Cyanobacteria Harmful Algal Blooms: A Remote Sensing Study of North Georgia Lakes, Isabella Florentino, *University of Georgia*

Variation in Carbon and Nitrogen Fixation Across Substrates in the South Fork Eel River, California, Augustine Sitati, *University of Alabama*

Variation in Excretion Rates and Stoichiometric Ratios of Freshwater Mussels in Bogue Chitto River, LA, Madison Kuczek, *Louisiana State University*

Woods to Water (W2W): Leveraging the unique biodiversity of the Southeastern USA for training in ecology and resource management, Carla L. Atkinson, *University of Alabama*

Assessing the Effectiveness of Streamside Management Zones on Aquatic System Integrity, Haley Vaglienti, *Georgia Southern University*

Evaluating Inlet Breach Effects: Coastal Monitoring and Beach Profiling on Cabretta Island, GA, Paige Spence, *College of Coastal Georgia*

Modeling Amphibian and Plant Community Responses to Wetland Restoration Techniques in Georgia, Jade Samples, *Jones Center at Ichauway & University of Georgia*

Shoreline Wonders: Navigating Mangroves with GIS, Swaty Kajaria, *University of Georgia*

A Case for Increased Consideration of Downstream Riverine Health ANalysis in Stormwater Management Regulation, John Montoya, *University of Georgia*

Abundance and Diversity of Macroinvertebrates along a Conductivity Gradient at Sea Palms West, St. Simons Island, GA, Reid Kroken, *College of Coastal Georgia*

Analysis of Bioretention Design Performance on Georgia's Coast Using DRAINMOD-Urban, Maria Laura Siqueira Batista, *University of Georgia*

Concentrations of Microplastics in Urban Stormwater and Expected Removal Rates Using Bioretention Cells, Callie McCord, *University of Georgia*

Evaluating the Efficacy of Urban Low Impact Development Strategies for Managing Stormwater Runoff and Water Quality under Future Climate Scenarios, Alvee Bin Hannan, *University of Georgia*

Exploring stream biofilm metabolism across a gradient of land management in a forested watershed of the gulf coastal plain, Alabama, USA, Khalil Williams, *Jones Center at Ichauway*

Exploring the utility of remote sensing in water management and freshwater mussel habitat conservation, *Amber Johnson, Jones Center at Ichauway*

Green Space Solutions and Stormwater Forecasting – A New Indicator to Manage Basin-Scale Urban Runoff Volume in Watersheds in Gwinnett County, Imani Vincent, *Georgia State University*

Integrating Infiltration-Based NBI in Coastal Areas for Sustainable Stormwater Management: Case Study of St. Mary's, Chukwuemeka Atuma, *University of Georgia*

Measuring the Impacts of Urbanization with Macroinvertebrate Communities in Metro Atlanta, Hana Sato, *Oglethorpe University*

Precision agriculture: Evaluating the use of electrical conductivity for predicting spatially heterogenous soil properties to delineate soil management zones, Johanna Nordwall, *University of Georgia*

Risk-Based Prioritization Framework for Multi-Objective Culvert Adaptation: Enhancing Stream Connectivity and Transportation Resilience, Alejandra Gomez, *University of Georgia*

Spatiotemporal drivers of organic matter and nutrient dynamics in an unmodified Southeastern U.S. Gulf Coastal Plain river, Matthew Lodato, *University of Alabama*

Stormwater Wetlands as a Nature-Based Solution for Stormwater and Carbon Management on Military Bases, Maliha Tabassum, *University of Georgia*

USGS Water-Resources Data – What And Where?, Debbie Gordon, *U.S. Geological Survey*

Water Quality Monitoring of a Small Semi-isolated Freshwater Wetland on Saint Simon's Island, Ollie Mercer, *College of Coastal Georgia*

Where did you come from, when did you go: when did you peak, stormwater flow? Hydrologic travel time distributions of storm flow in the Lower Flint River basin, Chloe Hall, *Jones Center at Ichauway*

A Baseline Assessment of the Springs of the Cahaba River Watershed: Development of a Spring Inventory, Nathaniel Sturm, *Geological Survey of Alabama*

Assessing patterns of subcatchment biogeochemical processes across the expanding and contracting South Sandy watershed in Central Alabama, U.S.A., Andrew Abagai Ali, *University of Alabama*

Enhancing Phytoremediation of Perchlorate and Nitrate in Biochar-Amended Bioreactors: Investigating the Role of Adsorption, Oyindamola Oseni, *University of Georgia*

Groundwater flow from Okefenokee Swamp through the Hawthorn Formation and Trail Ridge to the Floridan Aquifer and St Marys River, GA, Todd Rasmussen, *University of Georgia*

Investigating the Impact of the Hyundai Metaplant on the Upper Floridan Aquifer, Audra Werley, *College of Coastal Georgia*

Sustainable Approach for Boron Stabilization in Coal Combustion Wastewaters, Olajide Oladipo, *University of Georgia*

Assessment of Upper Floridan and Claiborne Aquifer Interactions with Surface Water During Historical Droughts in Southwest Georgia, USA, Rajesh Khatakho, *University of Georgia*

Hydrogeophysical Characterization of the Claiborne Aquifer using Electrical Resistivity Tomography and Borehole Geophysical Logging Techniques, Kwaku Asiedu, *University of Georgia*

Improving Smart Irrigation Apps to Reduce Stress Not Only for Crops, But Also Farmers, Troy Walts, *University of Georgia*

Investigating aquifer connectivity and transmissivity in southwest Georgia through the Groundwater App, Haley Hubert, *University of Georgia*

Investigating Co-occurrences Between Freshwater Mussels and Host-Fish Species in southern Oklahoma Rivers, Jennifer Haase, *Louisiana State University*

Modeling the Hydrostratigraphy of Aquifer Systems in Southwest Georgia, USA, Amy Laubenstein, *University of Georgia*

On the Relationship between Soil Moisture and Soil Respiration: Assessing Impacts of Various Land Management Practices in Herbaceous Dominated Ecosystems, Pramod Hegde, *University of Georgia*

Addressing Contaminants of Emerging Concern in the Southeast through Extension, Katy Smith, *University of Georgia & Georgia Sea Grant*

Dissolved Heavy Metal Concentrations in the Muscle Tissue of Bluegill (Lepomis macrochirus) in the Chattahoochee River Drainage, Columbus, Georgia, Collin Miller, *Columbus State University*

Expanding Bacterial Monitoring in Georgia Watersheds: Analyzing Non-E. coli Coliforms in Noonday Creek Using Biolog Gen III Microplates, Joseph Stuart, *Kennesaw State University*

Investigating spatial patterns of particulate water chemistry across a forested gulf coast watershed in central Alabama, USA, Dustin Benton, *University of Alabama & Jones Center at Ichauway*

Investigation into the probability of saltwater intrusion (SWI) into a micro-watershed on Saint Simons Island, GA, Michele Mixon, *College of Coastal Georgia*

Nutrient Removal by Microalgae from Pre-treated Municipal Wastewater, George Mensah, *Georgia State University*

Updated Delineation of Water Supply Watersheds in Georgia, Yao Huang, *Georgia Environmental Protection Division*

USGS and U.S. Navy Investigate Groundwater Contamination in the Upper Floridan Aquifer, Marine Corps Logistics Base Albany, Georgia, James Landmeyer, *U.S. Geological Survey (CANCELED)*

Using Real-Time qPCR methods for antimicrobial resistance gene quantification for application in wastewater-based epidemiology, Abbey Wilson, *University of Georgia*

ORAL PRESENTATION ABSTRACTS

UNIVERSITY OF GEORGIA
River Basin Center

ORAL PRESENTATION ABSTRACTS

The potential of biochar amendment in water-stressed urban tree vaults for stormwater quality and tree growth

Rebecca Abney[1], Alexis Martin[1], Courtney Scott[1], Daniel Markewitz[1]

[1]*University of Georgia*

Session 5.3.1 Urban Green Infrastructure

Trees in urban environments are often touted as a mechanism to mitigate the urban heat island effect, improve air quality, and improve aesthetics. However, trees in urban environments experience some of the most challenging soil environments – including compaction, contamination, heat stress, and water stress. Biochar is a popular soil amendment for improving soil hydrologic properties, increasing pH and fertility, and increasing soil carbon sequestration. We designed a series of experiments that examine the role of soil amendments to test the role of biochar application in tree vault soils to improve stormwater quality and tree growth. We found that in soils with extreme heat stress and under dry conditions, biochar was effective at improving tree growth, water quality, and water retention. We found that mixing biochar in homogenously and applying at the surface had the greatest impact on improving tree growth and survival, as well as had the least contribution of salts to the outflow stormwater. We also found that initial application of biochar resulted in a small and temporary increase in electrical conductivity of the outflow water, but not at a level of environmental concern. We found that in soils under highly saturated conditions, the addition of biochar increased water retention and decreased tree growth through the duration of our study. We found significantly decreased infiltration, and likely pore clogging, particularly at lower doses of biochar. We found no significant effects of low-dose biochar surface applications on outflow water quality throughout the duration of this study. It is important to note that biochar application did significantly increase water retention across both studies, which may be helpful for managing stormwater flows in urban soils. However, understanding soil and site conditions before application is critical for achieving the best outcomes for plants growing in biochar amended soils.

State Wildlife Action Plan Update

Brett Albanese[1]

[1]*Georgia Department of Natural Resources*

Session 3.2 Aquatic Connectivity

Georgia began a comprehensive revision of their State Wildlife Action Plan (SWAP) in October 2022. This process was led by species technical teams that identified Species of Greatest Conservation Need (SGCN) along with threats, habitat requirements and conservation actions for each SGCN. Technical teams recommended 243 freshwater SGCN for the updated SWAP, including fishes, crayfishes, mollusks, and other aquatic invertebrates and further prioritized them into four priority tiers: Highest, High, Moderate and Data Deficient. These data were then used to update Georgia's High

Priority Watershed dataset, which ranks HUC10 watersheds based upon the number and priority level of each SGCN present. Dams and water management/use was identified as a top threat to more than half of the freshwater SGCN, reflecting in part the impact of dams and culverts on the connectivity of SGCN populations and aquatic ecosystems overall. Accordingly, technical teams identified both general and specific conservation actions to assess and improve connectivity in high priority watersheds. Georgia's updated SWAP and associated tools on our SWAP data hub can be used to help prioritize and implement future projects to improve aquatic connectivity in the state.

Salt Marshes of Georgia: Potential for long-term persistence and carbon sequestration

Clark Alexander[1], Claudia Venherm[1], Jazlyn Beeck[1], Mike Robinson[1], Kyle Krezdorn[1]

[1]*University of Georgia Skidaway Institute of Oceanography*

Session 2.6 Coastal Carbon

Salt marshes, dominated by Spartina alterniflora, are ubiquitous features of back-barrier regions in Georgia. These extensive coastal habitats improve water quality, protect the uplands from erosion, function as nurseries for important fishery species, and are sites of preferential accumulation of fine-grained sediments, along with their associated contaminants and organic carbon. However, with sea level rise accelerating and sediment input decreasing from human activity, concerns have been raised about the long-term persistence of these habitats. Future loss of salt marshes and these marsh benefits, particularly sediment and carbon sequestration, would negatively affect water quality in estuarine and nearshore environments, while confounding efforts to address global climate change. The first step in assessing the impacts of these future changes is to determine the current state of the resource involved.

Community-Engaged Research in Coastal Georgia

Asli Aslan[1]

[1 Georgia] *Southern University Institute for Water and Health*

Session 1.5 Experiential Education

Watersheds at Coastal Georgia face significant changes related to population increase, aging water infrastructure, extreme weather, and increased risk of runoff. Lack of continuous data impacts the science-driven decision-making process. This paper aims to improve connections between environmental data collection efforts and those affected by hazardous conditions. By establishing a community-owned water quality lab in downtown Brunswick and training local leaders to collect water chemistry and bacterial data, the initiative enhances scientific literacy and public participation in water quality monitoring. Led by the Institute for Water and Health at Georgia Southern University in collaboration with Glynn County citizens, the program provides participants with training and certifications in water analysis from Georgia Adopt-A-Stream, the state's largest volunteer water quality monitoring organization. Key outcomes include water quality data contributions, participant

interviews, and a commitment to maintaining the community laboratory for long-term academia-public collaboration.

Environmental gradients drive convergence in life history strategies among disparate but linked taxonomic groups

Carla Atkinson[1], Alex Franzen[2], Garrett W. Hopper[3], Jonathan W. Lopez[1], Zachery D. Zbinden[4], Caryn C. Vaughn[2]

[1]University of Alabama [2]University of Oklahoma [3]Louisiana State University [4]University of Maryland Center for Environmental Science

Session 2.2 Mussel Conservation

Trait-based approaches can improve ecological understanding by linking fitness to the environment. The trilateral life history model is an expansion of r- and K-selection theory that reflects trade-offs between juvenile survival, fecundity, and generation time, and describes differential survival of species across environmental gradients. We used the trilateral life history model to generate and test hypotheses regarding community assembly dynamics and the validity of such a model in two disparate taxonomic groups, freshwater mussels and fish. Here we assess the distribution of mussel and fish life history strategies occupying 80 sites along the river continuum within the Ouachita Highlands (USA). We asked whether the distribution of disparate but co-occurring taxonomic groups is predicted by a similar life history strategy framework. As both mussel and fish assemblages should be structured by selective forces in an upstream to downstream trajectory, we expected fish and mussels to both converge on more species-rich assemblages with a greater proportion of equilibrium strategists (K-selected species) in larger, more stable downstream habitats. We found that both mussel and fish species richness and the proportion of equilibrium strategists in the assemblages increased with watershed area. Our study validates the use of the trilateral life history framework across disparate taxonomic groups and provides novel insights regarding species occurrence in both freshwater mussels and fish.

Patterns and Trends in Streamwater Constituent Loads from 15 Watersheds in DeKalb County, Georgia, 2012-2022

Brent Aulenbach[1], Joshua Henley[1]

[1]US Geological Survey South Atlantic Water Science Center

Session 3.5 Water Quality

The U.S. Geological Survey, in cooperation with DeKalb County Department of Watershed Management, established a long-term streamflow and water-quality monitoring program in 2012 for 15 suburban to urban watersheds in DeKalb County, Georgia. Annual loads and yields for 15 streamwater constituents were estimated for 2012–2022 using a regression model approach. The 15 constituents include biochemical and chemical oxygen demand (BOD and COD, respectively), suspended sediment (total suspended solids and suspended-sediment concentration), nutrients (total nitrogen, total nitrate plus nitrite, total phosphorus, dissolved phosphorus, and total organic carbon),

major cations (total calcium and magnesium), trace metals (total copper, lead, and zinc), and total dissolved solids (TDS). Annual sediment loads typically varied with annual streamflow, indicating transport-limited channels in which the streams cannot sufficiently transport incoming sediment. Watershed constituent yields were associated with land-surface imperviousness, which can increase surface water runoff and stormflow, and land use characteristics. Higher watershed BOD, COD, nutrient, trace metal, and TDS yields were associated with higher percentages of high density residential and commercial-industrial-institutional land uses and imperviousness. Higher sediment yields were typically associated with higher percentages of watershed imperviousness. Particularly low particulate-related constituent yields from the Stone Mountain Creek Watershed likely resulted from reservoirs that retained sediment. Trends in annual loads were identified in about one-quarter of the 225 watershed-constituent combinations with just over half of trends increasing. Overall, there were only a few consistent patterns in trends within individual watersheds or by constituent. This long-term monitoring program allows for assessment of water quality conditions and trends within these watersheds that can be used by water managers to protect and improve water quality.

The Role of Hillslope Groundwater Recharge in Generating Stormflow in a Forested Headwater Catchment in the Piedmont, Georgia

Brent Aulenbach[1], Jeffrey Riley[1]

[1]*US Geological Survey South Atlantic Water Science Center*

Session 4.6 Groundwater

Understanding stormflow generation is important for accurately predicting flooding and for managing water resources. Whereas the roles of near-stream surface and groundwater flows in stormflow generation have been extensively studied, any contributions from hillslope landscapes have often been largely inferred. Long-term observations at the Panola Mountain Research Watershed (PMRW), a 41-hectare, forested catchment, provided insights into the roles of groundwater recharge (GWR) on stormflow generation in the hilly Piedmont Province of the southeastern U.S. GWR was estimated from soil moisture dynamics from four soil profiles with varying landscape positions (steep hillslope, moderate hillslope, low-slope, and flat lowland). About half of PMRW stormflow originates from the 10-hectare southwestern (SW) sub-catchment, which contains a 3-hectare headwater granite outcrop. Streamflow generation in this sub-catchment is predominantly stormflow and initiation typically requires its riparian aquifer to be sufficiently filled and connected to the stream channel. This filled state is dependent upon recharge, which comes from about equal contributions of hillslope GWR and outcrop surface runoff annually. However, a much larger proportion of hillslope GWR occurs during the dormant season, such that connectivity and stormflow occurs most frequently in December–April.

Substantial amounts of profile GWR occurred during storms, particularly from the three hillslope profiles (30–37% of profile total GWR). Strong positive relationships were identified between storm GWR and stormflow, but only when streamflow occurred at the SW sub-catchment outlet (indicating connectivity). Steep hillslope profile storm GWR best explained the variance in stormflow at the PMRW outlet. The relationship for the stormflow from the SW sub-catchment, however, was somewhat stronger for throughfall when the sub-catchment was initially connected before the storm,

indicating the importance of outcrop surface runoff in this sub-catchment. These observations indicate that hillslope GWR replenishes groundwater storage necessary to generate a substantial stormflow response and may also contribute directly to stormflow.

Course-based Undergraduate Research Experiences (CUREs) as the Foundation of a Major

Téa Autry[1], James Deemy[1]

[1]*College of Coastal Georgia*

Session 1.5 Experiential Education

Undergraduate research experiences, particularly course-based undergraduate research experiences (CUREs), are recognized as high-impact practices that enhance student retention and progression. The Environmental Science major at the College of Coastal Georgia integrates CUREs across all curriculum levels, beginning with the design and implementation of group research projects in first-semester course, Introduction to Earth Systems. In upper-division courses students gain further hands-on experience such as water quality sampling in Aquatic Ecology, working with public datasets and programming with R in Oceanography, and soil coring in Soil Morphology, Classification, and Mapping. Small scale CUREs, such as research on Sapelo Island, complement immersive field courses like Wetland Ecology through learning field-based experimental design methods such as point-intercept vegetation surveys. Courses such as Environmental Communication and Coastal Geomorphology allow students to find community partners and conduct research that is beneficial to both parties. After students' experiences in CURE courses, nearly all students participate in internships and expand on their work through independent research. In this talk we highlight a variety of CUREs from across the curriculum through specific student experience and provide recommendations for implementation.

Data Center Trends in Metro Atlanta

Celine Benoit[1]

[1]*Metropolitan North Georgia Water Planning District*

Session 5.1 Water Planning & Management

The Metropolitan North Georgia Water Planning District (District) is working with local communities and utilities across the Atlanta region to provide education and insight about the potential impact data centers may have on resources like water and power, community development, and long-term planning.

Metro Atlanta has become a national hub for data centers and other AI-related infrastructure as demand for AI tools continues to increase. Depending on design, these facilities may require large amounts of water to keep equipment cool and maintain operations. There are various forms of technologies implemented to provide cooling to data centers given the extensive amount of heat

generated. The two prominent forms of cooling implemented by data centers air and liquid cooling, with liquid cooling becoming increasingly more prevalent. It is critical to recognize the tradeoffs between types of liquid cooling and how they influence the finite natural resources of Metro Atlanta now and into the future.

Understanding how data centers influence the region's water resources is imperative given the unique challenges posed to metro Atlanta. The region is almost completely dependent upon surface water, situated at the headwaters of several small river systems, and does experience periods of drought.

The District provides information to stakeholders on various planning strategies. These efforts include early engagement and coordination with local water utilities, discussions about water availability, and needs associated with future growth. Additionally, consideration must be given at a larger scale regarding system redundancy, emergency outages and droughts. Consideration of these variables helps our region maintain good stewardship of our shared water resources.

Brian Bledsoe[1]

[1]*University of Georgia College of Engineering*

Session 4.3 DOD Installation Resilience

Protecting Military Readiness with NBS in the Marine Corps Recruit Depot Parris Island

Matt Bilskie[1]

[1]*University of Georgia College of Engineering*

Session 4.3 DOD Installation Resilience

Marine Corps Recruit Depot Parris Island (MCRD-PI) is situated in Port Royal Sound, South Carolina, which is at the confluence of the Broad and Beaufort Rivers. Due to its coastal-facing location, MCRD-PI faces many coastal hazards, which are being exacerbated in magnitude and frequency due to a changing climate. These hazards include flooding, shoreline erosion, and sea level change, affecting the mission and readiness of MCRD-PI. These coastal hazards are causing shoreline erosion at critical locations. Landscape-scale interventions and projects that optimize ecosystem function are necessary to protect military readiness, training, and testing at MCRD-PI from ongoing and future coastal hazards. To protect military readiness and inform of hazard mitigation, this project will establish a baseline hazard assessment, which does not exist currently. This work will then support and demonstrate NBS to build coastal resilience, specifically for shoreline protection, flood mitigation, and habitat/restoration/improvement through field-based monitoring and data development, computational modeling, design development, and construction. The outputs of this effort will directly improve the resilience of MCRD-PI to coastal risks, support better-informed management strategies forMCRD-PI, and provide a framework for other installations to enhance resilience through the use of NBS.

Real-time Forecasting of Georgia Coastal Flooding

Matt Bilskie[1], Brett Jones[1]

[1]*University of Georgia College of Engineering*

Session 2.1 Flood Modeling

Storm surge from tropical cyclones can lead to overland flooding, resulting in loss of life and damage to homes, businesses, and critical infrastructure. Although coastal Georgia has largely been spared from direct hurricane landfalls, bypassing hurricanes and winter storms, such as cold front passages, can still significantly impact the region's coastal communities, including transportation routes, marine navigation, and port operations. Real-time modeling and dissemination of coastal water levels, including tides, storm surge, and waves, are crucial for emergency response, evacuation, and post-storm recovery efforts. Frequent, lower-impact [non-named] events can cause road closures and other infrastructure impacts, necessitating detailed flood information when federal data (e.g., National Hurricane System) is unavailable. This presentation will focus on the development of a new real-time coastal hazard modeling system for Georgia, highlighting the interactive website and end-users needs for data sharing and visualization. Future efforts will also concentrate on real-time forecasting of direct impacts on Georgia's barrier islands during storm events, including predictions of barrier island overwash and inundation.

Long-term trends in nutrient concentrations in the Etowah and Conasauga Rivers: Monitoring two biodiverse rivers to support imperiled aquatic species

Annie Blalock[1]

[1]*University of Georgia River Basin Center*

Session 4.5 Nutrients, Carbon, & Algal Blooms

The Etowah and Conasauaga Rivers are historic hotspots of aquatic biodiversity, including many imperiled fish and mussel species that have experienced population declines. Declines in water quality associated with land use change could be a factor in these declines. Since 1998, water quality monitoring has been conducted in the upper Etowah and Conasauga Rivers providing a valuable long-term dataset for analyzing trends in nutrients, turbidity, and conductivity. This monitoring program aims to assess water quality changes and their impacts on aquatic ecosystems and biota, focusing on nutrient enrichment and land use change. We summarized long-term trends in water quality of the Etowah and Conasauga Rivers over a 25-year monitoring period and the effects of influential environmental, geographic, and geologic factors. Changes in nutrient concentration (dissolved nitrate, phosphate, total nitrogen (N) and phosphorus (P)) were evaluated using mixed-effects linear regressions, incorporating additional predictor variables such as turbidity, discharge, specific conductivity, stream reach, and ecoregion. The long-term analysis of the Etowah revealed modest declines in concentrations of nitrate, phosphate, and TN. Total P showed a modest decline over the study period. Analyses of long-term water quality trends of the Conasauga are ongoing and preliminary results show similar trends in dissolved and total nutrient concentrations.

Overall, nutrient concentrations in the Etowah have been relatively stable over the duration of the monitoring program. However, while nitrate and SRP have shown declines, increasing TP concentrations raise concerns about the potential impact of legacy nutrient loading. Additionally, increased rates of suburbanization in the watershed could exacerbate these legacy effects and trends in TP concentrations. The absence of localized effects on nutrient trends in the Etowah points to the influence of watershed-scale processes in shaping water quality, and indicates that management efforts should similarly focus on addressing nutrient pollution at the whole-watershed scale.

Integrated Synoptic Surveys Using an Autonomous Underwater Vehicle (AUV) to monitor the Effects of Controlled Reservoir Releases on Water Quality in the Cape Fear River Basin, North Carolina by the U.S. Geological Survey (USGS) South Atlantic Water Science Center

Lee Bodkin[1]

[1]*U.S. Geological Survey*

CANCELED

The Cape Fear River Basin is a part of the joint nationwide Sustainable Rivers Program (SRP), which is managed by The Nature Conservancy (TNC) and the United States Army Corps of Engineers (USACE). The purpose of the SRP is to improve the health of rivers by analyzing how the USACE operates their infrastructure, including the release of water from dams. The SRP attempts to analyze the effects from dams and use reservoir operations to enhance and manage downstream ecosystems. The Cape Fear River has a complex human-ecological relationship and strategic controlled releases from B. Everett Jordan Dam by the USACE have the potential to influence fish and wildlife habitat, water quality and other natural resources downstream from Jordan Lake reservoir.

The USGS has used an EcoMapper Autonomous Underwater Vehicle (AUV) manufactured by Xylem Inc. equipped with various water-quality sensors, to obtain high-resolution data at several locations on the Cape Fear River to better understand the water-quality conditions before and after a strategic controlled release from B. Everett Jordan Dam. The AUV is a specialized instrument that can produce a nearly instantaneous image of water-quality conditions over a broad area, including subsurface conditions. The AUV is integrated with an assortment of water-quality sensors, an acoustic Doppler current profiler, Doppler velocity log (DVL), a single-beam echo sounder, a side-scan sonar, and an inertial navigation system (INS). The water-quality parameters collected at one second intervals; include water temperature, specific conductance, dissolved oxygen concentration, turbidity, chlorophyll-a and phycocyanin.

Microbial communities across a non-perennial stream continuum in an Alabama Piedmont forest

Charles Bond[1]

[1]*University of Southern Mississippi*

Session 1.4 Aquatic Microbial Ecology I

Roughly half of streams by length in Alabama, USA, and in the world are non-perennial, drying at some point in space and time. Non-perennial streams and their microbiomes are largely overlooked, despite their potential importance to downstream water quality. We surveyed microbial communities across a non-perennial stream continuum within a ~92-hectare upland piedmont forest watershed (humid subtropical climate) in Talladega National Forest, AL. Prokaryotic and fungal communities were characterized via 16S and ITS rDNA metabarcoding, respectively, in natural substrates (leaf litter, rock surfaces, and sediments) from 48 sites distributed across eight tributaries and a downstream mainstem. In all three substrates, relative abundances of methanogenic and denitrifying prokaryotes (determined via PICRUSt2) were each positively correlated with the probability of surface water presence (percent wet) in the anteceding 28-days (determined via in-stream sensors). Methanogen relative abundance in sediments and leaves was positively correlated with dissolved methane concentrations in overlying water. Richness of prokaryotic amplicon sequence variants (ASVs) in leaf litter and sediments increased downstream, possibly reflecting downstream accumulation of aquatic taxa. Fungi showed no such trends in ASV richness, possibly due to greater contributions of terrestrial fungi to diversity at drier sites upstream. At sites that experienced dry conditions within the anteceding 28-days, sediments had double the mean relative abundance of Basidiomycota (including soil saprotrophs and ectomycorrhizae), supporting the hypothesis that sediment drainage enables colonization by terrestrial soil fungi. In leaf litter, the relative abundances of several dominant aquatic hyphomycetes (Hymenoscyphus tetracladius, Anguillospora filiformis, and Alatospora acuminata) and aeroaquatic hyphomycetes (Pseudoclathrosphaerina sp.) increased with percent wet, implying water permanence favors aquatic decomposers. Despite intermittency and low Strahler order of the mainstem, aquatic decomposers and saxicolous freshwater lichens were among the dominant fungal taxa detected. These results provide a foundation for ongoing research examining temporal dynamics and functional responses to flow intermittency.

Understanding and conserving ecosystem services from geographically isolated wetlands in Georgia

Steven Brantley[1], Nick Marzolf[1], Lora Smith[1]

[1]*The Jones Center at Ichauway*

Session 2.3 Georgia Wetlands Post-Sackett

Geographically Isolated Wetlands, or GIWs, are often defined as wetlands that lack a consistent surface water connection to other surficial waters. Despite this apparent lack of surface connectivity, these wetlands provide ecosystem services that are often greatly out of proportion to their spatial extent, making them an important functional component of the broader landscape. At local scales, GIWs provide critical habitat for wildlife, including many threatened and endangered species, and they often display exceptionally high plant biodiversity. GIWs may also be hotspots for carbon storage, a global imperative in climate change mitigation. At regional scales, GIWs provide important water regulation services such as sediment and nutrient removal, improving the quality of water for groundwater recharge. GIWs may also serve an important function in water storage at the watershed scale, helping to buffer extremes from flooding or drought. Despite these benefits, geographically

isolated wetlands lack the legal protections that are in place for riverine and coastal wetlands. The goal of this presentation is to introduction GIWs of the Dougherty Plain, a region of southwestern Georgia with >11,000 individual wetlands, and provide relevant background to the rest of this special session. We will discuss GIWs through the lens of ecosystem services and nature-based solutions, introduce concepts of hydrology as a master variable to wetland function, and discuss how GIWs can benefit from various land management practices that affect wetland function. We will also touch on the need for more effective protection of GIWs at the state and federal levels, including the role of voluntary incentive programs in the post-Sackett vs. EPA world.

Using environmental DNA to bolster traditional macroinvertebrate sampling at stream restoration sites in Georgia

Paul Braun[1]

[1]*Resource Environmental Solutions, LLC*

Session 5.2 Aquatic Biota & Restoration

In stream mitigation, the sampling and analysis of macroinvertebrate communities is often used as a method for assessing the quality of aquatic habitat before and after restoration events take place. An overarching goal of mitigation is to improve the biology of restored streams. Through the life of a restoration project, baseline macroinvertebrate species diversity scores are expected to maintain or exceed baseline scores, which serve as performance standards in the project's banking instrument. Negative financial outcomes (withholding credits, regulatory delays) result from failing to meet macroinvertebrate performance standards. This pilot study examined the effectiveness of environmental DNA (eDNA) detection of macroinvertebrate taxa as a tool to augment traditional sampling techniques. Environmental DNA has been found to be effective at detecting cryptic or rare taxa that are often missed with physical sampling, additionally, metabarcoding techniques can be used to identify taxa that are damaged and unidentifiable in physical samples. Initial results at one sampling location found no Plecopteran detections with physical sampling or eDNA. Ephemeropteran taxa detections were higher using physical sampling compared to eDNA, and Trichopteran taxa detections were equivalent with eDNA sampling. Additional findings will help determine whether continuing to augment physical samples with eDNA sampling is useful.

Analysis of Minimum Flow Requirements for Gulf Sturgeon in the Suwannee River

Amy Brown[1], Sean King[1]

[1]*Suwannee River Water Management District*

Session 4.2 Aquatic Biota & Connectivity

The Suwannee River Water Management District is tasked with conducting environmental flow assessments to develop minimum flows and levels (MFLs) for priority waterbodies in Florida. These MFLs set the limit at which further surface and groundwater withdrawals would be significantly harmful to the water resources or ecology of the area. One component of the MFL evaluation for the

Suwannee River has been to examine flow requirements for the Gulf sturgeon. Gulf sturgeon are large anadromous fish that migrate from the Gulf of Mexico to spawning areas found in upstream river reaches along the Suwannee River in Florida. As the longest unregulated river in the southeastern United States, the Suwannee River currently exhibits the largest spawning migrations of Gulf sturgeon. The Suwannee River MFL assessment examined several aspects of how river flows affect Gulf sturgeon spawning success, including the water depths and water quality at spawning areas and the water depths over shoals that can limit passage to the spawning areas.

Acute Impacts of Microplastics on *Corbicula fluminea* Respiration

Ian Brunetz[1], Fabiola Lopez Avila[1], Irene Sánchez González[1], Krista Capps[1]

[1]*University of Georgia Odum School of Ecology*

Session 3.4 Contaminants

Corbicula fluminea is a ubiquitous invasive species often used as a surrogate for imperiled freshwater mussels in environmental studies. Similar to freshwater mussels, C. fluminea functions as a biosentinel due to its sensitivity to various toxins and pollutants. Despite documented research on C. fluminea's responses to common pollutants, the interaction between C. fluminea's metabolic rate and microplastics is unknown. This interaction is crucial to understand as microplastics are a common pollutant that has been found to induce potentially harmful inflammation in aquatic organisms. In this study, we used a closed-loop respirometer with varying concentrations of microplastics to test their effect to the respiration rate of C. fluminea. We hypothesized three outcomes: (1) exposure to microplastics would increase mass-corrected respiration rates, (2) this increase would intensify over time, and (3) larger individuals would exhibit less pronounced effects than smaller ones. To test these hypotheses, we collected 738 C. fluminea, measured their mass, and divided them into 20 tanks with 36 individuals each. The tanks were exposed to one of three microplastic concentrations (low, medium, high) or served as controls. Over 21 days, individuals from a range of microplastic concentrations were sampled every seven days. For each sampling event, six individuals per treatment were separated by size (large >15 mm, small <15 mm) and subjected to intermittent closed respirometry using a Q-Box AQUA Aquatic Respirometer. Key metrics included dissolved oxygen concentration and VO2 across multiple cycles. Our results showed no significant changes in mass-corrected respiration rates due to microplastic exposure, nor did these rates increase over the 21-day study period. There were no differences in response between larger and smaller individuals. Future studies should explore chronic exposure over extended timescales and investigate behavioral changes such as valve opening and closing to better understand the sublethal effects of microplastics on C. fluminea and other aquatic biosentinels.

Harnessing positive interactions: Testing nature-based restoration to achieve conservation outcomes in the Conasauga River

Phillip Bumpers[1], Matt Chambers[2], Brian Bledsoe[2], Bud Freeman[1], Mary Freeman[1], Seth Wenger[1]

[1]*University of Georgia River Basin Center* [2]*University of Georgia College of Engineering*

Session 5.2 Aquatic Biota & Restoration

The Conasauga River, once considered a refuge for imperiled aquatic species, has experienced major declines of mussel and fish species over the last 25 years. Much of the fish and mussel diversity rely on shoal habitat that was historically occupied by two foundational aquatic plant species, Justicia americana (American Water Willow), an emergent macrophyte that grows along shoal margins, and Podostemum ceratophyllum (Hornleaf Riverweed), a submerged macrophyte that grows on coarse substrate in swift current. Building on the theory of positive interactions, we are testing the role that Justicia and Podostemum play in shaping physical habitat, with the idea that restoration of aquatic plants may initiate a cascade that improves physical habitat and, ultimately, increases the abundance and richness of animal species. Specifically, we are quantifying hydrogeomorphic and biological responses to augmentation of shoal habitat with Justicia and Podostemum at two sites in the Conasauga River. We hypothesize that Justicia will create more complex habitat and a deeper thalweg by decreasing erosion potential of shoal margins which may facilitate the persistence of Podostemum and benthic fish, particularly during low-flow conditions. We are estimating changes in bed elevation, substrate, and velocity and abundance and richness of fish at two restoration sites and two control sites before and after planting during seasonally low-flow conditions. Our aim is to use low-cost, minimally invasive restoration techniques that incorporate ecological theory to exert a state change in shoal habitat that benefits multiple imperiled species.

Sociodemographic Disparities and Precipitation Impacts in Patters of Wastewater Infrastructure Failure in Atlanta, GA

Krista Capps[1], Crystal Pendergast[1], John Paul Schmidt[1]

[1]*University of Georgia Odum School of Ecology*

Session 2.4.2 Wastewater

Wastewater infrastructure failures are an increasing global issue under changing climate conditions. Identifying vulnerabilities in wastewater infrastructure is essential for sustainable urban planning and equitable management of water infrastructure. However, data on structural weaknesses in centralized wastewater systems remain limited. This study analyzed publicly available records to map sewage spill patterns over two decades in two counties in the Atlanta metropolitan area. A total of 11,053 spills were documented, with spill frequency positively correlated with precipitation, especially in areas with repeated spills, indicating that intensifying rainfall may exacerbate aging infrastructure's impact on human health and the environment. Using a geoadditive logistic regression model, we found spills were associated with block group land area, sewer length, and social vulnerability (as measured with a social vulnerability index), but not significantly with racial demographics or population size. Without data derived metrics to assess the distribution of failing infrastructure, efforts to support equitable water infrastructure management are inadequate. Our approach supports proactive planning efforts for equitable urban development under changing climate conditions by identifying temporal and spatial patterns in system vulnerabilities.

Compound flood modeling for coastal military installations and surrounding communities

Lina Caro[1]

[1]*University of Georgia College of Engineering*

Session 2.1 Flood Modeling

Recent research has demonstrated that the threat of compound flood events has risen across the United States (Wahl et al., 2015). Compound floods include different flood drivers, such as storm surges (hurricane and tropical cyclones), heavy rainfall, and river discharge. While computational modeling has improved, many unknowns remain regarding assessing compound floods and their cascading risks. A considerable concern for the U.S. is the lack of accurate and up-to-date flood maps and their risks for coastal US military installations (Kodack,2020). These installations are critical to national security and military missions, especially in areas where military installations are located in the coastal transition zone (Bilskie M, & Hagen S., 2018). Additionally, the area outside the installation still supports critical staff and infrastructure that the installation relies on for its continuous operation. Recent research has shown the need for compound flood modeling and the identification of its main drivers (Gori et al., 2024, Leijnse et al.,2023).

This research aims to assess compound flood risk, targeting military installations and their surrounding communities, including compound flood hazard, vulnerability, and exposure. The methodology includes a compound flood model using SFINCS (Super-Fast INundation of CoastS), with a case study simulation of Hurricane Dorian (2019) for the Fort Stewart military installation and surrounding communities, including Savannah, GA. After validating the model with observed data, simulations of various flood drivers (storm surge, rainfall, and fluvial discharge) are considered to determine flood hazards for various joint probabilities of events (on going work). The expected final result is an updated set of flood maps of annual exceedance probability flood events. The flood maps are then used in a GIS-based flood risk framework to establish vulnerability metrics at the census block scale that include social vulnerability and critical infrastructure, including roads and community facilities.

Oyster Reef Restoration and Changes to Shoreline Morphology and Salt Marsh Area: Potential for Blue Carbon?

John Carroll[1]

[1]*Georgia Southern University*

Session 2.6 Coastal Carbon

Eastern oysters, Crassostrea virginica, are a commercially important species that also play a critical role in creating habitat by forming large reef structures. Oyster reefs provide a variety of ecosystem services, including food production, habitat formation, improved water quality, and shoreline protection. One underexplored role of oyster reefs that has recently been examined is the role that oyster reefs might play in carbon sequestration along the coastline. Specifically reefs that fringe the salt marsh shoreline help stabilize sediments and have been shown to lead to carbon burial.

Therefore, local oyster restoration efforts may enhance blue carbon potential of Georgia's coastlines, particularly if they help create new marsh area. Drone aerial imagery flown before and after oyster restoration was taken for image analysis of changes in shoreline morphology and percent change in the vegetated salt marsh area. Three oyster reefs, ~31m2 each, were constructed in the South Newport River. In the year since construction, approximately 145m2 of new marsh have been created. While the surveys are ongoing, preliminary results suggest that oyster restoration may lead to an increase in carbon sequestering marsh habitats.

Changing the Culture of Culvert Design at GDOT

Matt Carroll[1]

[1]*Georgia Department of Transportation*

Session 3.2 Aquatic Connectivity

Conveyance of streams under roadways can be highly variable, ranging from small diameter pipes to multiple-span bridges. Proper design and construction of pipe and culvert crossings in perennial streams is critical in maintaining aquatic organism passage (AOP). Undersized culverts can lead to altered geomorphology downstream and impassable pools or perched outlets, while oversized culverts can result in low flows with insufficient depth for passage. The Georgia Department of Transportation (GDOT) is responsible for the operation and maintenance of over 50,000 lane miles of interstate and state routes throughout Georgia. With many culverts across Georgia nearing the end of their life expectancy, proper sizing for AOP, accommodations for terrestrial wildlife passage, and designing for climate resiliency are needed.

Regulations and guidance from the US Army Corps of Engineers and US Fish and Wildlife Service set a standard for proper culvert sizing to ensure AOP. From that foundation, GDOT is using collaboration with those and other agencies, participation and tools from the Southeast Aquatic Resources Partnership (SARP), research from the University of Georgia's River Basin Center, and development of an Aquatic Programmatic Agreement to build a new standard of best practices for integrating culverts into our natural landscape. Through continued partnerships, GDOT continues to explore new opportunities to reconnect our aquatic environments. This talk will provide an overview of GDOT's current practices, ongoing initiatives, and future opportunities related to AOP.

Modeling the service of city-scale distributed green stormwater infrastructure

Matt Chambers[1], Félix Santiago-Collazo[1], Rod Lammers[2], Brian Bledsoe[1]

[1]*University of Georgia Institute for Resilient Infrastructure Systems* [2]*Central Michigan University*

Session 1.1 Flood Resilience Panel

The science and practice of green stormwater infrastructure (GSWI) is rapidly advancing and numerous GSWI approaches have been demonstrated in urban communities around the world. Such approaches are often hydrologically localized without integration into city-scale stormwater

management systems or are tailored for a specific community and lack generality. As investment in GSWI increases, city managers need generalized approaches for quantifying the potential stormwater benefits of city-scale spatially distributed systems of GSWI. The purpose of this work is to provide such a method using numerical modeling and the curve number method as they are common tools of professional engineering practice in the USA. Our approach is demonstrated for an urban community of coastal Georgia, USA. We first numerically model the watershed's hydrology with a fully distributed rainfall runoff model that includes tidal influx and the service of the community's existing grey stormwater infrastructure. We then numerically model the hydrologic benefits of incremental land use conversions to GSWI in the buffers of public road rights-of-ways and residentials areas that are spatially distributed within the community. Our results suggest that hydrologic benefits increase non-linearly with incremental land use conversion. Benefits are first reported as city-wide net reductions in excess runoff generation (up to 36%). Then as reductions on the service demand of existing grey stormwater infrastructure (up to 50% reduction in average peak discharge through outfalls) and ultimately as reductions in the severity of nuisance flooding (up 28% reductions in average ponding depths on structures, roads, and storm drain inlets). This work supports future resilience planning by providing a generalized method that city managers may use to calculate how much city-scale investment in GSWI is required to achieve desired improvements in stormwater management.

Innovations in Benefit Quantification Methods to Support Federal Investment in Levee Setbacks

Matt Chambers[1], Dave Crane[1], Susana Ferreira[1], Craig Landry[1], Brock Woodson[1], Brian Bledsoe[1]

[1]University of Georgia Institute for Resilient Infrastructure Systems [2]U.S. Army Corps of Engineers

Session 3.1 Substance in Resilience

Levee setbacks are a promising nature-based solution for flood risk management. Their application in practice is currently limited by knowledge of their economic benefits and related risk quantification methods. This work addresses these uncertainties by assessing setbacks with two common pathways of levee investment in the United States. The first pathway is through the US Army Corps of Engineers (USACE) Civil Works process. The second pathway is a USACE disaster recovery program known as PL84-99. Both procedures use benefit-cost analysis to support investment decision-making, and both rely on numerical modeling to quantify flood risk. Flood risk benefits are quantified with modelled setbacks of the Missouri River, USA following USACE's benefit-cost analysis procedures and with amendments to address critical knowledge gaps. The results suggest that setbacks can greatly reduce the likelihood of structural failures and overtopping. They also suggest that setbacks of various sizes and land usages are economically defensible. The reported numerical modelling and risk quantification methods are general and may be useful in most levee civil works processes, beyond the USA context of this work.

Modeling sedimentation and hydrology of geographically isolated wetlands with partial and fully agricultural catchments

Suranjana Chattergee[1], Frances C. O'Donnell[1], Kathryn Perkins[1], Coleman J. Barrie[1], Steven T. Brantley[2], Matthew N. Waters[1]

[1]Auburn University [2]Jones Center at Ichauway

Session 2.3 Georgia Wetlands Post-Sackett

Geographically isolated wetlands (GIWs) are waterbodies with no direct surface water connection to perennial rivers, streams, estuaries, or the ocean. They exchange materials and energy with surrounding ecosystems, contributing to landscape functions. This study investigated the spatial variability in the sediment runoff received by GIWs in southwest Georgia - a karstic region with abundant GIWs and intensive row crop agriculture. We studied two GIWs, one surrounded by an agriculturally-dominated catchment and one surrounded by a mixed forested and agricultural catchment. Rain gauges, water level loggers, and sediment traps were installed in these wetlands. To determine the dry mass of sediment deposited per unit time, sediment traps were collected monthly. Results showed substantial variation in sedimentation rate between the two wetlands. To further investigate the mechanisms driving this variability, the Modified Universal Soil Loss Equation (MUSLE) was used to model sediment yield from each wetland catchment. MUSLE was applied to individual storm events using runoff volume, peak flow rate, soil erodibility factor, slope length and gradient factor, cover management factor, and erosion control practice factor as input variables to find sediment yield. Uncalibrated model results for both wetlands showed similar temporal patterns of high and low values in comparison with the sediment trap data. Model results for the wetland with the agricultural catchment showed sedimentation rates of 1.11 g/cm2/year, whereas the sediment trap data showed 1.93 g/cm2/year. For the second wetland, which has a mixed catchment, the model result showed a sedimentation rate of 0.33 g/cm2/year, whereas the sediment trap data showed a sedimentation rate of 0.47 g/cm2/year. Future research will calibrate and validate the model with sediment trap data and explore using NASA Surface Water Ocean Topography (SWOT) to understand the hydrology of the GIWs.

A New Management Approach for Large Reservoir Systems

Lida Chen[1], Aris Georgakakos[1]

[1]Georgia Institute of Technology Georgia Water Resources Institute

Session 5.1 Water Planning & Management

Reservoirs are critical infrastructure projects providing many socio-economic and environmental services including urban, agricultural, and industrial water supply; flood management; hydropower generation; navigation; recreation; and protection of aquatic environment and ecology. The water infrastructure of river basins typically includes several interacting reservoirs that must be managed as a system to realize full benefits. Reservoir management lends itself to optimization methods, but it becomes challenging for systems with more than two-three reservoirs. As a result, most reservoir systems in the U.S. and abroad are management based on heuristic approaches. This article presents a new optimization method (named State Form Dynamic Programming, SFDP), developed to optimize the management of large reservoir systems and facilitate the use of optimization techniques in professional practice.

The article highlights the SFDP attributes and comparative advantages relative to (1) several current state-of-the-science methods including Dynamic Programming (DP), Discrete Differential Dynamic Programming (DDDP), and Genetic Algorithms (GA) and (2) heuristic methods commonly used by the U.S. Army Corps of Engineers and other river basin agencies. These highlights are based on method applications and tests in two real-world river basins in the southeast US: the Apalachicola-Chattahoochee-Flint (ACF) and the Alabama-Coosa-Tallapoosa (ACT). These applications and tests validate SFDP's effectiveness and efficiency for large-scale systems, demonstrating its potential to enhance real-world reservoir management beyond heuristic approaches.

Saltwater Intrusion in the Floridan aquifer system near downtown Brunswick, Georgia, 2023

Gregory Cherry[1], Michael Hamrick[1]

[1]*U.S. Geological Survey South Atlantic Water Science Center*

Session 5.6 Coastal & Coastal Plain Groundwater

For more than 60 years, the U.S. Geological Survey has led a cooperative water program with the City of Brunswick, Georgia to assess the effect of groundwater development on saltwater intrusion within the Floridan aquifer system (FAS). In 1959, elevated levels of chloride concentration were detected in wells completed in the Upper Floridan aquifer (UFA) near the southern part of the city. By the early-1960s, a plume of groundwater with chloride concentrations exceeding 250 milligrams per liter had migrated northward toward two major industrial pumping centers. In 1978, data obtained from a 2,720-foot-deep test well, south of Brunswick, indicate the source of saltwater was located below the UFA in the Fernandina permeable zone (FPZ) of the Lower Floridan aquifer (LFA). During October 2023, water-levels were collected in 48 wells to map the potentiometric surface of the UFA in the Brunswick/Glynn County area. The constructed contours from the potentiometric-surface map of the UFA indicate primary groundwater-flow directions toward the major industrial pumping centers located in the downtown Brunswick area. Prior to development, groundwater-flow directions in the UFA were eastward toward the coast. During October 2023, chloride concentrations were also determined from 49 wells completed in the FAS. Both recent and long-term results from thirty of the wells sampled near the downtown Brunswick area indicate the shape of the chloride plume in the UFA has remained relatively stable over the past 25 years with maximum chloride concentrations exceeding 2,500 milligrams per liter. In addition, five real-time conductance monitoring wells located near the plume boundary serve to detect lateral movement of saltwater. Since the beginning of groundwater development in the area, pumping from the major well fields has altered local vertical hydraulic-head gradients and led to upward migration of saltwater from the FPZ of the LFA into the upper and lower water-bearing zones of the UFA.

Trends of Climate Extremes in the Southeast U.S.

Shivani Chougule[1], Husayn El Sharif[1], Aris Georgakakos[1]

[1]*Georgia Institute of Technology Georgia Water Resources Institute*

Session 1.6 Surface Hydrology

Understanding and quantifying trends of climate extremes (floods and droughts), both historical and projected, is critical for the management of water, energy, and land resources in the southeast US. In this study, we use the latest climate projections from 16 Global Circulation Models (GCMs) to assess the climate trends in the southeast US from the 1980s to the end-of-century. The climate projection sequences (precipitation, potential evapotranspiration, daily mean, maximum, and minimum air temperatures, and downwelling solar radiation) are corrected based on the Joint Variable Bias Correction with Historical Analog (JVBC-HA) approach (Georgakakos & El Sharif, 2024). The analysis focuses on the southeastern states of Florida, Alabama, Georgia, South Carolina, and North Carolina.

GCM projections for future periods show an overall increasing trend for average daily minimum, mean, and maximum temperatures for all 10 regions of the southeast US, with a few exceptions seen during the period 2078–2095. Precipitation trends are generally positive throughout 2024–2095, with most regions experiencing increases, though a few regions occasionally project negative trends, particularly from 2060–2095. Downwelling solar radiation shows consistent positive trends from 2024–2095. Lastly, most regions are projected to experience increasing precipitation deficits and more severe droughts. These findings have critical implications for many socio-economic and environmental sectors in the southeast US and highlight the need for management plans that increase the immunity and resilience of river basins against climate-induced disasters.

High Definition Stream Survey (HDSS): Addressing Water Quality Challenges in the Hurricane Creek Watershed

Brett Connell[1]

[1]*Trutta Environmental Solutions*

Session 5.3.2 High Density Stream Surveys

The High Definition Stream Survey (HDSS) is being used to address the complex water quality issues across the 250-mile Hurricane Creek watershed in central Alabama, an area historically impacted by pre-1977 coal mining operations. Funded through the Abandoned Mine Land Economic Reclamation (AMLER) Program, this project aims to prioritize streams most in need of reclamation by providing a continuous, high-resolution dataset that supports multiple water resource management objectives.

The HDSS methodology rapidly captures continuous, 1-meter resolution GIS data throughout the stream corridors in a single survey pass. By integrating GPS, video, depth, side-scan sonar, and water quality sensors, the approach creates a comprehensive baseline condition inventory. Each second of video is georeferenced to a specific GPS point, enabling precise identification, selection, and prioritization of stream segments.

This presentation will summarize the HDSS methodology and showcase fieldwork highlights from the Hurricane Creek project. The results illustrate how HDSS data can determine the most cost-effective mitigation locations, monitor post-restoration progress, map instream habitat, assess geomorphic

conditions, and identify infrastructure impacts. Additionally, HDSS provides an interactive "virtual tour" of the watershed, enhancing stakeholder collaboration and decision-making. The Hurricane Creek HDSS serves as a scalable model for addressing water resource challenges in historically impacted watersheds.

Chattahoochee River High Definition Stream Survey (HDSS): Delivering Powerful Data for Water Resource Management

Brett Connell[1]

[1]*Trutta Environmental Solutions*

Session 5.3.2 High Density Stream Surveys

The Chattahoochee River National Recreation Area (CRNRA) has challenges protecting the health of the river as a result of runoff from land development, wastewater overflow, and impacts from the regulated water discharges of Buford Dam. To improve river management, the National Park Service requested a High Definition Stream Survey (HDSS) to thoroughly document river corridor conditions on all 48 miles of the river associated with the CRNRA. A StreamView video for the entire stream, a database including GIS layers for the three parameters of depth, habitat type, and streambank condition, a recreational use suitability model, and a list of the 20 worst stream segments were provided. Additionally, the classification and development of GIS layers for the recreational use suitability model were included.

The High Definition Stream Survey (HDSS) approach was created to rapidly gather continuous, meter-resolution GIS data in a single pass for a broad range of stream corridor metrics by integrating GPS, video, depth, side scan sonar, and other sensors. Once the data are collected, the videos are combined into four simultaneous views of the river. Each second of video is linked to a specific GPS point which allows for the identification, selection, and prioritization of streambanks for restoration. The results can also be used to monitor restoration results, determine the extent and distribution of instream habitat, define the geomorphic condition for the stream, identify infrastructure impacts, and provide a powerful “virtual tour” experience.

Targeted Solutions for Trash Reduction: Prioritizing Community Need with Watershed-Wide Trash Traps

Ramsey Cook[1]

[1]*Arcadis*

Session 2.5.1 Targeted Solutions for Trash Traps Panel

Arcadis is an international environmental consulting company with the express purpose of improving quality of life. The Local Sparks program, which is funded by the Lovinklaan Foundation, a majority stakeholder in Arcadis, awards grants to teams of Arcadians who have identified a social impact project in their local community. This team of Arcadians, in partnership with Chattahoochee

Riverkeepers (CRK), applied to the program and received $40,000 over two years to support labor and expenses associated with the project. The project builds upon the methodology that CRK developed for their local assessment to create a series of user-friendly ArcGIS ModelBuilder tools that can be applied across the country to prioritize trash trap installation locations by HUC12 watershed and National Hydrography Dataset flowline. Using socioeconomic and environmental layers, the model prioritizes HUC12 watersheds based on indicators of both the trash quantity within the watershed and the level of environmental justice that could be achieved through trash trap installation. Flowlines are prioritized based on their mean annual flows and proximity to public spaces. The Local Sparks grant also funds trainings, hosted by CRK and Arcadis, on how to use the tools and funds the installation of one trash trap in the Chattahoochee River Basin and two in the Haw River Basin. This presentation will discuss the identification of funding and partners as well as the challenges associated with developing this nationally applicable model.

Urban Water Challenges: Co-Developing Community-Centered Solutions in the CSAW Learning Ecosystem

Denzell Cross[1], Sarah Ledford[1], Richard Milligan[1], Naurica Encarnacion[1]

[1]*Georgia State University Department of Geosciences*

Session 4.4 Urban Water Collaboration

As societal concerns related to climate and environmental justice gradually become more complex - spanning social, political, and economic contexts - there are increasing calls in geosciences for a more socially-engaged workforce trained in conducting societally-relevant research to influence policy and management. This objective can be most readily achieved by redefining geoscience training and education from a form based in disciplinary rigidity to one that is transdisciplinary, opening the door for meaningful public inclusion into the research process. The Community-Soil-Air-Water (CSAW) learning ecosystem at Georgia State University encompasses a cross-collaborative partnership among academic institutions, grassroot environmental organizations, and community leaders, and seeks to address issues of climate and environmental justice by integrating DEIA principles into geoscience graduate education. Based in Atlanta, Georgia, a battleground for environmental justice issues driven by historical racially-driven policies and decision-making, the CSAW learning ecosystem seeks to answer, “How can Geosciences learn from, contribute to, and find solutions with communities facing fundamental problems related to Earth systems?" Now in its second year of implementation, this presentation highlights the early successes of CSAW, emphasizing the role of inclusion through its integration of community partners to help co-develop research projects and ensure their alignment with community considerations. Additionally, we will address the ways in which inclusion principles, such as knowledge co-production and place-based research, are operationalized through the CSAW learning ecosystem. Ultimately, the CSAW partnership aims to contribute to the development of a geoscientist workforce uniquely equipped to address contemporary issues of climate and environmental justice and to transform geoscience training by prioritizing inclusive and societally-relevant research.

Targeted Solutions for Trash Reduction: Prioritizing Community Need with Watershed-Wide Trash Traps

Ashley Desensi[1]

[1]*Chattahoochee Riverkeeper*

Session 2.5.1 Targeted Solutions for Trash Traps Panel

Following an introduction to CRK's trash trap program, this talk will cover the creation of the first predictive model to prioritize trap placement. Using ArcGIS, environmental and demographic data were analyzed to rank subwatersheds in the Chattahoochee basin. The model revealed correlations between litter pollution, poverty, and minority populations, highlighting areas of greatest need. This data-driven approach set the stage for the partnership with Arcadis to create the newest model and associated guidebooks.

Targeted Solutions for Trash Reduction: Prioritizing Community Need with Watershed-Wide Trash Traps (StoryMaps Section)

Amy Doneff[1]

[1]*Arcadis*

Session 2.5.1 Targeted Solutions for Trash Traps Panel

As part of Arcadis' partnership with the Chattahoochee Riverkeepers, a "story" was crafted utilizing the innovative ArcGIS StoryMaps platform. This immersive experience serves as an interactive data visualization tool, portraying the narrative of Chattahoochee Riverkeepers' Trash-Free Chattahoochee campaign, delving into the background of CRK, historical insights, and data related to volunteer cleanups along the Chattahoochee River. The story is brought to life through dynamic interactive maps, graphs, and compelling visuals showcasing the outputs of the trash trap location prioritization model. This publicly available StoryMap aims to educate the public about the trash trap program and address the pressing trash epidemic. It also seeks to cultivate public interest and engagement in environmental conservation efforts. Spotlighting the critical role of the Chattahoochee River in the metro-Atlanta area as the source of drinking water for approximately 5 million individuals, the StoryMap emphasizes the impact of CRK's work towards a clean and trash-free Chattahoochee River. This presentation serves as a guided journey through the StoryMap, offering a detailed exploration of its contents and the process involved in its creation and publication.

Analytics Software for the Natural Environment to Monitor Flooding, Water Quality, Stormwater, and More

Dustin Doyle[1]

[1]*Aquatic Informatics*

Session 4.6 Groundwater

Amidst the challenges posed by the global pandemic, the water industry experienced a transformative shift in stakeholder engagement. Time, a critical resource for water professionals, became even more precious during lockdowns, prompting a swift transition to remote systems for communication, data collection, and reporting. This paradigm shift, though accompanied by initial challenges, led to a surge in cloud migrations among thousands of organizations.

Remote accessibility underscored the importance of robust support teams provided by top-tier solution providers. Global reach and remote training became standard, and frustration mounted for users encountering solutions lacking these essential options.

As the pandemic forced a transition to remote work, the accessibility of data followed suit. However, the newfound wealth of data raised questions about accuracy and actionable insights. Addressing data accuracy became a focal point, culminating in the adoption of water quality monitoring processes occurring every 6-8 weeks, lasting 2-3 days on average. This rigorous Quality Assurance/Quality Control (QA/QC) process played a pivotal role in the environmental water space, ensuring the accuracy and reliability of water data.

Recognizing the consequences of poor-quality data—potentially leading to erroneous conclusions and misguided decision-making—underscored the significance of QA/QC protocols. These protocols, essential for supporting regulatory decisions and guiding management practices, ensure consistent and accurate data collection and processing, minimizing errors and bias.

Beyond the technical aspects, QA/QC data contributes to enhanced transparency and accountability in water data collection and analysis. Organizations, by adhering to rigorous QA/QC protocols, demonstrate their commitment to producing high-quality data. This commitment, in turn, fosters public trust and credibility in the organizations responsible for managing environmental water.

With clean and reliable data in hand, the focus shifts to actionable outcomes. Data outputs, derived from advanced analytics and quality-assured information, drive significant improvements in water management and conservation efforts. Identifying pollution sources, highlighting areas requiring protection, and evaluating the effectiveness of management practices become paramount. Leveraging the power of data analysis empowers stakeholders to make informed choices, ensuring the health of aquatic ecosystems and the sustainability of water resources.

Protecting East Kootenays Groundwater with Centralized Quality Data Management

Dustin Doyle[1]

[1]*Aquatic Informatics*

Session 4.6 Groundwater

In the East Kootenays of British Columbia, Living Lakes Canada (LLC) is spearheading a groundwater monitoring initiative to safeguard vital underground water resources in the region's complex hydrogeological landscape. With a reliance on groundwater as a primary water source for many local communities, monitoring groundwater availability is essential for sustainable water management. Prior to LLC's program, groundwater monitoring efforts in the region were fragmented, with limited oversight and isolated data collection efforts.

LLC's innovative program has brought together local governments, municipalities, First Nations communities, and private well owners to create a robust groundwater monitoring network. Through an outreach campaign, the initiative has expanded from a provincial government priority list of six wells to a collaborative network of 35 wells. This expansion has been pivotal in filling historical data gaps and enabling long-term, continuous monitoring of groundwater levels.

Central to LLC's success is the implementation of modern data management software, which enables seamless data integration and sharing across multiple monitoring programs. By utilizing the Aquarius platform, LLC has streamlined data acquisition, processing, and modeling, allowing for efficient real-time data sharing and collaboration with other water organizations. The platform's intuitive tools for quality assurance, error detection, and data grading ensure data integrity, a key factor in securing additional funding and demonstrating the value of the program to stakeholders.

As the program continues to evolve, LLC is focused on expanding its monitoring network and incorporating additional layers of data, including weather and surface water monitoring, to enhance decision-making around water resource management. This data-driven approach plays a critical role in addressing the impacts of climate change on groundwater resources and supports informed community planning and resilience-building efforts.

This presentation will highlight LLC's groundbreaking work in the East Kootenays, demonstrating how centralized data management and collaboration can improve groundwater monitoring efforts in complex regions and provide a scalable model for future initiatives.

Lessons learned from a very rapid instream barrier assessment effort in a data-deficient watershed in southwestern Georgia

Jake Duhe[1], Garrett Hopper[1]

[1]*Louisiana State University*

Session 3.2 Aquatic Connectivity

In recent decades, intensive human development in the southeastern U.S. compounded by historic modifications to aquatic habitats has placed stress on the region's aquatic biota. Among these stressors, restrictions on aquatic organism dispersal via habitat fragmentation by instream barriers like road-stream crossings (RSCs) are known but have not been extensively studied in the region, underpinning the need for increased assessment efforts that identify potential barriers to aquatic organism passage (AOP). Limited funding, time, and personnel can challenge standardized rapid assessment protocols in large, data-deficient regions, impeding natural resource managers from identifying barriers for replacement or removal. Our goal was to use a standardized rapid assessment protocol developed by the Southeast Aquatics Resources Partnership (SARP) to collect descriptive data for RSCs in Ichawaynochaway Creek Watershed, Georgia. To evaluate the capacity of a resource and time limited RSC assessment team of two people, we randomly selected 20 RSCs located on third order and larger streams from each of the 10 subwatersheds and attempted to assess them following the SARP protocol over four days. We successfully assessed 121 of 136 RSCs that were identified by our randomization procedure, representing 9% of all unassessed RSCs in the watershed (n = 1084). Our assessments showed that 57.9% of assessed RSCs were bridges that did not impede AOP and

remaining RSCs (multiple culverts = 26.4%; inaccessible = 7.4%; single culvert = 5.0%; no crossing = 2.5%; other = 0.8%) imposed variable modifications to surrounding lotic habitats. Our work serves as a baseline for understanding barrier-related aquatic connectivity issues that will inform natural resource managers of high priority barriers in this biodiverse watershed. Given the large spatial coverage (~2940 km2), small crew, and restrictive timescale of our field assessments, we also discuss benefits and shortcomings in our sampling design to offer suggestions for future assessment efforts with similar resource availability.

Stream fish assemblage dynamics during severe drought in a drought-prone watershed

Jake Duhe[1], Garrett Hopper[1], Michael Kaller[1], William Kelso[1], Carla Atkinson[2]

[1]Louisiana State University [2]University of Alabama

Session 4.2 Aquatic Biota & Connectivity

Stream fish assemblages in the southeastern U.S. show adaptations to natural hydrological disturbances such as droughts. However, this region is projected to experience increasingly frequent and severe disturbances that may adversely affect stream fish assemblages, warranting rigorous testing of how hydrological disturbances influence stream fish dynamics. Here, we assessed spatiotemporal variation of stream fish assemblage responses to two multi-year severe droughts in the Ichawaynochaway Creek watershed, GA with an observational fish abundance dataset collected each summer and fall from 2011-2017. We used multivariate generalized linear models to pair species abundances with two hydrologic metrics describing seasonal and annual discharge patterns immediately preceding sampling and those relative to historical observations by streamflow gages (i.e., short- and long-term hydrologic processes). Average species richness varied spatially but was temporally stable at the watershed-scale. Hydrologic variation explained changes in abundance across numerically dominant species collectively but could not explain species-specific abundance patterns during post-hoc univariate tests, suggesting varied responses by species over space and time. We then classified each species into one of three life history strategies (equilibrium, periodic, opportunistic) to determine if observed assemblage dynamics conformed to predictions of life history theory. Most species occupied the opportunistic strategy, which tended to occur in higher densities than periodic and equilibrium strategists. Densities of each strategy differed over space and time, but changes in total strategist abundances at the watershed-scale were not explained by hydrologic patterns. Our findings suggest that stream fish assemblages in the southeastern U.S. are comprised of drought-tolerant fishes as species in our streams fluctuated with changing hydrological conditions but did not exhibit directionality. We also provide partial support for application of the life history framework to smaller spatial scales, but posit that other traits (e.g., thermal tolerance) may override life history theory predictions and thus should complement the framework when used to inform stream fish management actions in drought-prone areas.

Sensitivity of Crop Yield and Irrigation to Climate Variability and Uncertainty

Husayn El Sharif[1], Aris Georgakakos[1]

[1]*Georgia Institute of Technology Georgia Water Resources Institute*

Session 3.6 Agriculture & Coastal Water Management

Biophysical crop models coupled with meteorological data and climate projections can support better crop planting strategies, more efficient irrigation water use, and more resilient drought management responses to climate variability and uncertainty. In this study, bias-corrected and spatio-temporally downscaled climate projections are coupled with the Georgia Water Resources Institute (GWRI) Agricultural Decision Support Tool (Ag-DSS) to assess how climate conditions may impact crop yield and irrigation for corn, cotton, peanut, and soybean in the Apalachicola-Chattahoochee-Flint (ACF) River Basin over the coming decades.

In this study, the GWRI Ag-DSS tool is driven by present-day crop acreages as delineated by the USDA Cropland Data Layer and historical and projected daily climate from 16 bias-corrected global circulation models (GCMs) under two Shared Socioeconomic Pathway (SSP) scenarios – the SSP 245 and SSP 585 scenarios consistent with mild and aggressive greenhouse gas emissions respectively.

The key study findings include: 1) Both rainfed and irrigated corn and cotton yields may decrease by as much as nine percent by the end-of-century due to higher projected temperatures and relatively minor increases in regional precipitation; 2) Peanut and soybean yields are expected to increase up to 26 percent by the end-of-century; 3) Irrigation for cotton, peanut, and soybean is expected to increase up to 30 percent by the end-of-century, while corn irrigation remains fairly close to its current level. These findings highlight the need for adaptation plans aiming to increase the ACF agricultural resilience to climate variability and uncertainty, while maintaining the water service expectations for other socio-economic and environmental sectors.

Lake Chorophyll-a Assessment Using Satellites

Husayn El Sharif[1], Aris Georgakakos[1]

[1]*Georgia Institute of Technology Georgia Water Resources Institute*

Session 4.5 Nutrients, Carbon, & Algal Blooms

Traditional methods to identify and monitor algal blooms, such as in situ sampling and laboratory analysis, are labor intensive, costly, and infeasible over large spatial scales. Advances in satellite remote sensing provide a promising means to complement field monitoring and extrapolate in situ measurements. Algal blooms have distinct spectral characteristics relative to pure water (Shen et al., 2012), and satellite sensors, such as those aboard the ESA Copernicus Sentinel-2 satellites, are able to discern their reflectance signatures and quantitatively characterize their occurrence and intensity. In this study, parsimonious and robust relationships are developed linking Sentinel-2 multispectral satellite reflectance retrievals to field measurements of photic-zone Chlorophyll-a (Chl-a), a proxy indicator for algal blooms and water quality, over Lake Lanier. The satellite-based Chl-a assessment tool is hosted and run on the Google Earth Engine cloud-based computing platform, facilitating near real-time lake monitoring, regulatory, and management applications.

Assessments from year 2019 to present indicate that large regions of Lake Lanier exceed the Georgia Environmental Protection Division (GA EPD) regulatory standards for Chl-a, highlighting the

necessity for prompt and coordinated management actions to protect the lake's environmental and ecological health.

Estimated Hydrological Impact of the Proposed Mining of Trail Ridge

Damian Elmore[1], Robin McLachlan[1], James Deemy[1]

[1]*College of Coastal Georgia*

Session 1.5 Experiential Education

In southeast Georgia, Trail Ridge is a natural geologic formation that serves as a hydrologic barrier for the water within the Okefenokee National Wildlife Refuge. This is a fragile relationship, as there is only one barrier, and the Okefenokee has an average water table depth of 0.5 meters. The mining proposal by Twin Pines Minerals, LLC aims to create a moving open pit mine on the ridge with a depth of 50 feet. This would in turn drop the water table by 50 feet gradually moving across Trail Ridge over the span of 4 years. This project, which is a year-long undergraduate research study, aims to accurately model the hydrologic effects of the Twin Pines LLC mining of Trail Ridge. The model will use Visual MODFLOW Flex to create 3 dimensional surfaces of the hydrogeostratigraphy and simulate flow dynamics over time with estimated pumping well schedules and locations. This project is a continuation of work done in ArcGIS Pro using Darcy Flow geoprocessing tools. The estimated drawdown using the Theis Equation on the edge of the Okefenokee National Wildlife Refuge, was 0.18m after 4 years. The model built within Visual MODFLOW Flex will allow for the estimation of the impact caused by the mining on the integrity of the hydrology and ecology of Okefenokee National Wildlife Refuge. This project was also greatly beneficial as an educational experience. The iterative process of learning between programs such as ArcGIS Pro and Visual MODFLOW Flex guides early career scientists through experiential learning by trial and error while using industry-standard protocols with real-world impacts.

What's New in Aquatic Connectivity, Dam Removal, Culvert Replacement and More in Georgia

Ben Emanuel[1]

[1]*American Rivers*

Session 3.2 Aquatic Connectivity

Numerous aquatic and terrestrial organisms — humans included — depend on river and stream connectivity to survive and to thrive. Watersheds with high levels of fragmentation often have lower levels of species resilience to anthropogenic and environmental stressors, i.e. flooding, drought, flow alteration, and water quality impacts. These barriers also pose a threat to human health and safety, as many of them restrict flow and cause an increase in flooding during high rain events. Further, low-head dams present severe and ongoing safety hazards, while many aging culverts and dams of all types exacerbate hazards associated with flooding and weather extremes. The Georgia Aquatic Connectivity Team (GA-ACT) is the home for multidisciplinary research and cross-sector

collaboration to increase the pace and scale of efforts to improve river and stream connectivity throughout the state, with multiple benefits for communities and ecosystems. Currently, public and private partners are advancing a variety of projects in multiple areas of the state to improve river and stream condition and preserve aquatic biodiversity. The GA-ACT has organized a session during every GWRC for the past 8 years as an opportunity for current members to reconnect and work together on topics of interest, to invite new participants to learn about our work, and to get feedback and input from the science community members in attendance.

Leveraging US EPA's Restoration and Protection Screening Tool to Prioritize Watersheds for Nonpoint Source Pollution Management in Georgia

Jackie Encinas[1]

[1]*Georgia Environmental Protection Division Nonpoint Source Program*

Session 3.5 Water Quality

Nonpoint source pollution poses significant challenges to water quality management due to its diffuse nature and various contributing sources. Under Section 319 of the Clean Water Act, States are tasked with developing and implementing management programs to address nonpoint source pollution. The Georgia Environmental Protection Division (GAEPD) implements its Statewide Nonpoint Source Management Plan, which establishes specific long-term goals and short-term activities to mitigate nonpoint source pollution.

As part of the 2024 plan update, GAEPD revised its list of 319(h) Priority Watersheds using the U.S. Environmental Protection Agency's Restoration and Protection Screening Tool (RPS). This tool allows users to compare watersheds based on ecological, stressor, and social characteristics at the HUC12 scale, highlighting watersheds likely to respond positively to management efforts. Through this data-driven process, GAEPD identified 494 priority watersheds for targeted restoration and protection efforts. The RPS Tool can support strategic planning for nonpoint source management, including developing EPA Nine Element Watershed Management Plans and implementing GAEPD 319(h) grant-funded projects, increasing the potential for restoration and conservation success.

This presentation will detail the indicators and datasets GAEPD used to run the RPS Tool, as well as highlight how the results were transferred to ArcGIS to be available for future analysis and decision making by the agency.

Revisiting Groundwater Flow and Recharge in the Upper Floridan Aquifer: Insights from Past and Present Tracer Studies

Jaivime Evaristo[1], Todd Rasmussen[1]

[1]*University of Georgia Warnell School of Forestry and Natural Resources*

Session 5.6 Coastal & Coastal Plain Groundwater

The Upper Floridan aquifer in southeastern Georgia, USA is a complex interplay between regional and local groundwater flow systems. While previous tracer studies have inferred past climatic

conditions from groundwater signatures, questions remain regarding the relative contributions of local hydrologic processes versus broader climatic shifts in shaping these signals. Building on previous body of research, we revisit key research questions regarding groundwater movement and recharge histories in this system. We synthesize available tracer datasets supplemented with newly collected data. We aim to refine our understanding of hydro(geo)logic connectivity in this complex system. Our renewed investigation offers a pathway toward a more integrated understanding of groundwater evolution in the Upper Floridan aquifer. We highlight the need for continued research to further refine our outstanding of recharge sources and timing, as well as hydroclimatic and surface processes influences on surface water-groundwater connectivity.

Preliminary genetic evidence of an Atlantic sturgeon spring spawning run in the Savannah River

Taylor Faherty[1], Brian Shamblin[1], Adam Fox[1], Joseph Nolan[1]

[1]*University of Georgia*

Session 4.2 Aquatic Biota & Connectivity

Population-specific spatial ecology data are critical for contextualizing threats and assessing recovery for migratory species of conservation concern. Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) are endangered fish that spawn in their natal rivers but disperse to estuarine and marine environments. Genetic assignment tests using baseline population samples, often river run juveniles deemed too small to have dispersed from their natal rivers (<500 mm total length), can provide an efficient method for characterizing population of origin. Previous telemetry data suggested the presence of a spring spawning run in the Savannah River. We hypothesized that spring hatched individuals, too small to recruit to the sampling gear in their first summer, would exceed the conservative 500 mm cutoff in their second summer, thus allowing this population to go undetected genetically. We genotyped 81 fish captured via netting in the Savannah River from May to July 2024 at 12 microsatellite loci and performed assignment tests in GeneClass. More than half of the individuals could not be assigned or were assigned to spring spawning runs from other rivers. One opportunistically captured individual measured only 198 mm, too small to have dispersed from its natal river, but was nonetheless assigned with 0.96 probability to the Pee Dee spring run. Given this result, we choose this individual and 9 additional fish (600-675 mm total length) with assignments to other spring runs to represent a hypothetical Savannah spring spawning population in the genetic baseline. With this new baseline, these 15 fish previously unassigned or assigned to a spring run in a different river were assigned as Savannah spring run. These preliminary genetic data corroborate the telemetry data in suggesting the presence of a spring spawning run in the Savannah River. Additional genotyping is underway to expand the baseline and test additional markers for improved resolution of Georgia populations.

Understanding the role of recalcitrant organic phosphorus mineralization on phosphorus dynamics to regulate algal blooms in freshwaters

Tasnuva Farnaz[1]

[1]*Georgia Southern University*

Session 5.5 Phosphorus and Algae

In the last decades, considerable resources have been invested to decrease external phosphorus (P) loads to freshwaters, resulting in lower eutrophication levels in some cases. However, P loads reduction is not always concomitant with a decrease in harmful algal bloom. The objective of this study is to better understand the contribution of recalcitrant organic P forms to the total pool of OP that fuels algal blooms. Experimental results showed that under low OP levels, sediments subject to legacy P loadings released OP and organic-P under different environments. Under aerobic conditions, OP release was observed as concentrations gradually increased from 0.01 to 0.1 mg-P/L, suggesting that organic P mineralization, and not redox reactions, was the main contributor to OP release under aerobic conditions. In anoxic environments, OP concentrations increased to values higher than 0.1 mg-P/L when ORP levels gradually decreased to approximately 0 mv. As ORP further decreased, OP initially decreased to ~0.05 mg-P/L but suddenly increased to values higher than 0.1 mg-P/L. Changes in OP levels in anaerobic environments were at first the result of redox reactions and then the result of organic P mineralization under reduced environments after a decrease in OP concentrations. A significant release of OP resulted in algal growth, which further increased OP concentrations. Results from sediment P extractions further revealed that sediments contained high concentrations of recalcitrant organic P, suggesting a high potential for organic-P mineralization. Overall, results suggested that recalcitrant organic P forms are important sources for OP, mainly under initial low OP conditions.

On-demand low-flow frequency and mean annual flow statistics for streams in the Carolinas and Georgia

Toby Feaster[1]

[1]*U.S. Geological Survey*

CANCELED

In April 2022, the U.S. Geological Survey (USGS) began an investigation to update low-flow and mean annual flow statistics at approximately 900 USGS streamgages in Georgia, South Carolina, and North Carolina using daily mean flow data through March 31, 2022. A second phase of the investigation involves using a subset of those streamgages to develop regional regression equations that can be used to estimate these statistics at ungaged locations. Those equations will be served on demand using the USGS StreamStats application. StreamStats is a Web application that provides water-resource planners, managers, and engineers access to an assortment of spatial analytical tools for planning, management, and design purposes. The map-based interface can be used to delineate drainage areas at user-selected stream locations to get basin characteristics, estimates of flow statistics, and more, where functionality is available.

As part of the study, the USGS is computing 31 streamflow statistics such as the annual minimum 1- and 7-day average flows that are likely to occur once, on average, every 10 years (1Q10 and 7Q10, respectively), and mean annual flow. Such statistics are vitally important for the protection and management of both the water quality and water quantity of streams. As part of the regression

analysis, the USGS will compute 57 potential explanatory variables for each of the basins represented by the streamgages, such as drainage area, mean annual precipitation, impervious area, and percentage of EPA level III and IV ecoregions. This presentation will provide highlights and results from the investigation.

Groundwater Depletion as a Prisoner's Dilemma Problem: A Game-Theoretic Analysis of Incentive-based approach to Sustainable Groundwater Management

Kuhelika Ghosh[1]

[1]*University of Georgia*

Session 3.6 Agriculture & Coastal Water Management

Groundwater depletion poses a significant threat to agricultural sustainability, particularly in regions heavily reliant on irrigation. This study examines groundwater withdrawal for irrigation through the lens of game theory, framing it as a Prisoner's Dilemma, where individual farmers prioritize short-term gains at the expense of long-term resource availability. We develop a heterogeneous game-theoretic framework that incorporates differences in landholding size and well ownership, capturing how these factors influence extraction decisions. The model explicitly accounts for rising irrigation costs as groundwater levels decline, leading to strategic interactions that determine long-term water availability.

A key contribution of this study is the examination of how agents with different endowments -small and large farmers, as well as well owners and non-owners - make extraction decisions based on profit maximization. We analyze how these differences drive natural consolidation, where the ability to exploit groundwater increasingly shifts toward larger farmers with greater financial and technological capacity. This has critical implications for the viability of small-scale agriculture, as shrinking access to groundwater could push smallholders out of production.

Furthermore, as groundwater levels decline, the number of individuals extracting the resource naturally decreases, raising questions about the feasibility of collective action in resource governance. We explore how strategic behavior changes over time as the cost of extraction rises and access to the resource becomes increasingly concentrated. By modeling expected behavior under different policy scenarios—such as financial incentives, extraction limits, or water rights—we aim to identify pathways that balance individual profit motives with long-term sustainability.

We apply this framework to the case of groundwater irrigation in Punjab, India, focusing on its impact on the region's rice-wheat cultivation system. Additionally, we integrate Decision Support System for Agrotechnology Transfer (DSSAT) simulations to model yield losses under declining water availability, providing insights into the economic and food security consequences of unregulated extraction.

Critical Field Data Essential for Developing Mussel Conservation Strategies

Steve Golladay[1,2], Caitlyn Sweeney[2], Christine Bahlinger[2], Amber Johnson[2], Kristin Rowles[1], Mark Masters[1]

[1]*Georgia Water Planning and Policy Center* [2]*The Jones Center at Ichauway*

Session 2.2 Mussel Conservation

As part of a regional water conservation effort (see ga-fit.org), a Habitat Conservation Plan (HCP) is being developed for six species of freshwater mussels in the lower Flint River Basin (LFRB). The purpose of the HCP is to allow for water resource development while providing for the needs of aquatic biota and human activities. We are directly responsible for gathering data and conducting fieldwork in support of the HCP. As we began work in 2023, we encountered many challenges. Perhaps the greatest was the lack of information on the distribution and abundance of mussels in the basin. The LFRB has ~535 miles of critical habitat, and the last comprehensive survey was conducted in 2001. This was the beginning of an extended period of below normal rainfall including three multi-year droughts. We also discovered that historical collecting data often lacked essential details including area sampled, numbers of surveyors, time sampled, and habitat conditions, making comparisons difficult. As our work progressed, we developed a standardized survey approach that yields quantitative data while permitting the coverage of 'large' areas under good survey conditions. We gained an appreciation for how land-use within stream valleys varied across physiographic districts and influenced the quality of instream habitats. In the LFRB, growing season hydrology, particularly low flows, are critical in determining mussel survival. Most of the land in the LFRB is privately owned and managed for forestry, agriculture, and wildlife. Establishing long-term relationships with landowners has proved essential for understanding mussel distributions. This has required patience and outreach to gain their trust. Our experience has motivated us to organize this session. We hope to share what we have learned and learn from the experiences of others. Freshwater mussels are one of the most globally imperiled fauna. Their survival depends on the development of effective conservation practices.

Groundwater-level trends in the Floridan aquifer system, Georgia, 1985-2025

Gerard Gonthier[1], Debbie Warner Gordon[1]

[1]*U.S. Geological Survey*

Session 5.6 Coastal & Coastal Plain Groundwater

The Floridan aquifer system (FAS) is the principal aquifer in Georgia, producing more than half of all groundwater used in the state. The U.S. Geological Survey in cooperation with Georgia state and local agencies has monitored groundwater levels in the FAS for up to 70 years (https://ga.water.usgs.gov/infodata/gwconditions/). Water-level trends for a 40-year period, (1985 to 2025) were assessed from available daily mean water-level data from 42 wells open to the FAS. Water-level trends were also assessed for four 10-year periods. Trends were based on linear least squares. Slopes were considered statistically significant if the probability of the type I error is less than 0.01. The 10-year period with the most positive trends (increasing water levels) was 1985-1995, with a median water-level trend of 0.19 feet per year (ft/yr). The 10-year period with the most negative trends (declining water levels) coinciding with a major drought was 1995-2005, with a median water-level trend of -0.27 ft/yr. The 40-year period had a median water-level trend of -0.02 ft/yr. Wells with the most negative 40-year trends (less than -0.18 ft/yr) tend to be southeast of and near the down-dip limit of the Cretaceous aquifers. Wells with the most positive 40-year trends

(greater than 0.18 ft/yr) were in proximity to the cities of Valdosta, Brunswick, and Savannah. Select counties associated with declining groundwater levels mostly have long-term increasing groundwater use while counties with increasing groundwater levels primarily have long-term decreasing groundwater use (https://apps.usgs.gov/ga-water-use/). Trends based on linear least squares provide a succinct number of the water-level trend but do not provide information about how water levels are changing, which is often nonlinear. The type of short-term fluctuations (responses to precipitation events, pumping, and seasons) wasn't uniquely associated with long-term trends (increasing, decreasing, or no change in water levels), indicating that long-term trends are likely related to regional, and not local, water-budget conditions.

Coastal Freshwater Health and Function Impacted by Surface Saltwater Intrusion, Sapelo Island, GA

Zachary Gordon[1]

[1]*Georgia Southern University*

Session 3.6 Agriculture & Coastal Water Management

Saltwater intrusion is a global threat to coastal freshwater ecosystems linked to climate and anthropogenic change. Alterations to coastal landscapes can lead to saltwater intrusion events. Sapelo Island has an extensive history of landscape alteration for agriculture, but the movement of salt inland decreases growth. Intrusion events are expected to increase in frequency and magnitude due to rising sea levels and storms. Salinizing freshwater habitats are at risk for diversity loss, impacting humans relying on these habitats and a potential positive feedback effect on global warming through the loss of carbon sequestration. While species have varying tolerance levels to salt, many are incapable of migrating to other habitats, resulting in a higher chance of eventual extirpation or extinction. As saltwater is denser, this also puts more pressure on benthic organisms in intruded areas, like macroinvertebrates that higher trophic levels rely on for food. Previous studies show that saltwater intrusion negatively affects freshwater communities and the essential ecosystem process of decomposition. We hypothesized freshwater habitats exposed to an increasing gradient of salinity would exhibit reduced diversity and function (e.g., lower decomposition rates). We monitored hydrology, measured decomposition rates, and sampled benthic macroinvertebrate communities to assess potential impacts of saltwater intrusion in six sites. At the site with the highest salinity, preliminary data show levels higher than oceanic salinity on the benthos and lower salinity levels at the surface, indicative of halocline presence. This site had less diverse benthic macroinvertebrate communities, less crayfish abundance, an absence of amphibians, and presence of estuarine fishes. Preliminary decomposition data shows overall lower rates of decomposition (slope = 3.170×10^{-5}), with a higher rate in the freshwater reference site (slope = 3.403×10^{-5}). This study outlines problems associated with saltwater intrusion on freshwater habitats tied to anthropogenic impacts and data should help the management of imperiled habitats.

An Overview of Mussel Conservation in the Southeast

Wendell Haag

Session 2.2 Mussel Conservation

PFAS Research and Outreach

Gary L. Hawkins[1], Jack Huang[1], Ke Li[1], Ching-Hua Huang[2], Yongsheng Chen[2]

[1]University of Georgia [2]Georgia Institute of Technology

Session 3.4 Contaminants

Per- and Polyfluoroalkyl Substances (PFAS) has been in the news recently and scientist at the University of Georgia in collaboration with scientist at Georgia Tech have been working on improving techniques to remove PFAS from water and wastewater. They have also been providing outreach through many different methods to educate the public on what these chemicals are and what the research is showing. This presentation as part of the session will provide some information on the research being conducted and how the team is working to disseminate the information about what is being researched at UGA and GT and how they are providing information to the scientific community and citizens.

Groundwater Modeling in the South Atlantic Coastal Plain: Updates, Advances, and Future Directions

Bradley Harken[1], Andrew Hughes[1]

[1]U.S. Geological Survey

Session 5.6 Coastal & Coastal Plain Groundwater

The U. S. Geological Survey South Atlantic Water Science Center (USGS SAWSC), in cooperation with the South Carolina Department of Environmental Services (SCDES), is working to develop groundwater models to support SCDES planning efforts under the South Carolina State Water Planning Framework. As part of the modeling process, SAWSC is updating a previously developed regional scale Coastal Plain model and building basin scale inset models, which allow for localized parameter estimation while accounting for regional flow patterns simulated by the regional scale model. In addition to the parent-inset combined modeling paradigm, SAWSC is utilizing several methodological advancements in improving the regional scale and inset models. These include Bayesian parameter estimation, automated model development tools, model parallelization, and improved representation of the regional hydrostratigraphy. The purpose of this talk is to provide an overview of the project and highlight these advances in groundwater modeling technologies, their impact on water resources management, and future directions.

Proactive Resilience Plan for Qatar's Physical Infrastructure

Alysha Helmrich[1], Lynn Abdouni[1], Bjorn Birgisson[1]

[1]University of Georgia College of Engineering

Session 3.1 Substance in Resilience

Critical infrastructure systems must be managed to withstand extreme disturbances and adapt to increasingly complex environments (e.g., climate change, urbanization, emerging technologies, etc.). Systematic planning for national critical infrastructure resilience requires a robust process, numerous data inputs, and significant participation from relevant stakeholders. This study uses capabilities-based planning to inform decision-making for future investments in physical infrastructure and institutional processes in Qatar across three physical infrastructures: transportation, energy, and water (including potable, wastewater, and stormwater aspects). The proposed framework, prepared for the national government of Qatar and its ministries, prepares users for known and unknown risks in a complex environment and identifies the existing and missing capacities to address resilience for interconnected infrastructures across temporal phases of resilience, Qatar's national development plans, and social-ecological-technological system components. The framework was developed with researchers in the US and Qatar through an iterative process of document analysis, collaborative discussions, and validation with subject matter experts. The capabilities specifically address climate change with an emphasis on flood events, sea-level rise, extreme heat, and drought. The proposed framework demonstrates a process to navigate complexity while providing measurable target capabilities to assess the system's resilience.

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Modified-RUSLE Modeling Assessment Emphasis

Casey Helton[1], Sudhanshu Panda[1], Michael Wild[1], Sydney McDaniel[1], Peter Swanton[1], Devendra Amatya[2]

[1]University of North Georgia [2]U.S.D.A. Forest Service

Session 3.3 Culvert Failure

Major consequences on road/stream crossing drainage structures are siltation and scouring, particularly after extreme precipitation. The risk of forest structure failures is high with high-gradient topography that causes increased soil erosion, higher discharge, enhanced streambank erosion probability, and a heightened chance of debris flow to the structure mouth. Land cover, vegetation type, soil and geologic characteristics, slope, Precipitation-Intensity-Duration-Frequency (PIDF), average annual precipitation, temperature, solar radiation, and other climatic factors, and other hydro-geomorphologic factors play roles in the possible failure of these structures in climatic extreme conditions. The goal of this study is to develop a Morphological Vulnerability Assessment Decision Support System (MVADSS) to identify road/stream crossing drainage structures failure vulnerability risks using Modified-Revised Universal Soil Loss Equation (M-RUSLE) . The study is completed in a coastal experimental forest research (EFR) system at Santee watershed, a part of Francis Marian National Forest in South Carolina. GeoAI aided M-RUSLE geospatial model amounts to the eroded soil load coming to each structure, which applies a newly developed R-Factor using NOAA-published PIDF-I30 raster and NDVI-based C- and P-Factors. gSSURGO data analyzed to develop K-, L-, and S-Factors used in the upgraded M-RUSLE model. Spatial environmental rasters used in models were reclassified with their vulnerability probability scale/weight, developed through the Delphi method of weighted scale determination which is explained in detail in this study. Each model explained the structure failure risk on a scale of 1(Highest), 2 (High), 3(Moderate), 4 (Low), and 5(Lowest). Culvert

vulnerability was assessed with this modeling approach only. The results were field verified to confirm our automated geospatial modeling approach for stream/road crossing structures' vulnerability assessment. This study would provide proactive decision support to the USDA Forest Service or any other agencies responsible for safeguarding these structures.

Coastal Blue Carbon: U.S. Offset Markets and Methodologies and State-Level Initiatives

Katie Hill[1]

[1]*University of Georgia Carl Vinson Institute of Government*

Session 2.6 Coastal Carbon

As the world focuses efforts to mitigate global climate change, much attention is being paid to the ability of natural systems to remove significant amounts of carbon dioxide and other greenhouse gases from the atmosphere. In coastal areas, natural "blue carbon" systems have been heralded as a particularly powerful tool for climate change mitigation because they can remove and store more carbon than terrestrial systems such as forests, and possibly at longer time scales. Here the term "blue carbon" describes the three types of coastal blue carbon ecosystems that have been described as "actionable" for climate change mitigation: mangroves, tidal marsh, and seagrass. Much of the attention being paid to these systems has been spurred by the demand for carbon offsets. We will describe the current state of blue carbon offset markets in the U.S., available methodologies, and ongoing initiatives in other states.

Size-dependent extinction risk in freshwater mussels

Garrett Hopper[1], Carla Atkinson, Traci DuBose, Sean Keogh, John Pfeiffer, Jeffrey Lozier, Irene Sánchez González

[1]*Louisiana State University*

Session 2.2 Mussel Conservation

Body size is a critical axis of biodiversity and is an important factor influencing extinction risk. Whether small- or large-bodied organisms are more extinction prone has received mixed support in various ecological contexts. Slow demographic rates that prevent quick recovery from disturbance and human exploitation can place large-bodied species at greater extinction risk, whereas limited dispersal abilities and range sizes can underly increased extinction risks for small-bodied species. Freshwater mussels (order Unionoida) are a highly threatened group of generally long-lived, slow-growing, filter-feeding bivalves that exhibit interspecific variation in body size that is linked to demographic rates and can influence species' responses to human exploitation and habitat alterations, such as fragmentation by dams. Evaluating the relationship between body size and extinction risk could offer insight into the causes of mussel imperilment. Here, we used a species-level trait dataset for mussels of the USA to test if and how body-size and area of occupancy (AOO) were related to extinction risk. Because dispersal underlies the body size-extinction risk hypothesis and long-distance dispersal of mussels relies on the dispersal ability of a vertebrate hosts, typically fishes,

during the parasitic larval life phase, we also addressed how host-fish dispersal distances and the number of dams occurring in a species' AOO could relate to imperilment. Imperiled mussels were typically smaller and had narrower AOOs than non-imperiled mussels. Host-fish of non-imperiled mussel species had greater dispersal distances than those of imperiled mussel species, and the number of imperiled species increased where tall, large river dams (>12m dam height) were most frequent. As such, species with smaller bodies, which are often found in mussel diversity hotspots, and those with limited host dispersal are typically imperiled and thus could likely benefit from increased conservation attention, especially those species occupying rivers impounded by large dams.

Investigating the Impact of Environmental Conditions on Metal-Microbe Dynamics in Wetlands

Marilee Hoyle[1,2], Raven Bier[1,2]

[1]*University of Georgia Odum School of Ecology* [2]*Savannah River Ecology Laboratory*

Session 2.4.1 Aquatic Microbial Ecology II

Wetlands are vital aquatic habitats susceptible to metal contamination, leading to environmental degradation. Despite these adverse effects, uncertainties persist regarding the biological controls on metal bioavailability within wetland ecosystems. Wetlands harbor key microbial species that can facilitate the fate of these metals, reducing or enhancing their bioavailability and ecosystem impact. Environmental factors such as nutrients and light exposure are known to alter microbial processes and shift their community composition. However, there is significantly less knowledge of their impact on the metal - microbial interactions within a wetland. Understanding these controls can help conserve, restore, and manage the ecosystem. Here we investigate the following question: How do these environmental variables affect the capability of microbial communities to alter the fate of metals in wetlands? We conducted two experiments to investigate copper concentrations in a microcosm-based study at two South Carolina wetlands: one constructed and the other a natural depression. In one experiment we established a macronutrient gradient (nitrate and phosphate), and in the other, we manipulated their exposure to sunlight. After microbial communities acclimated, we spiked a set of microcosms with copper. In this presentation, I will share results that suggest a potential correlation between copper concentrations in the water column and the separate light and nutrient treatments. We hypothesize that macronutrient and light exposure will shift microbial community taxonomic and functional composition, indirectly influencing predominant reactions with metals in the environment. This research will enhance understanding of mitigating metal contamination in wetlands, helping to preserve their ecological integrity and ecosystem services.

Assessing lake contribution to compound flood water levels in complex estuarine systems

Luciana Iannone-Tarcha[1], Felix Santiago-Collazo[1], John Schmidt[2], Emma Collins[2]

[1]*University of Georgia* [2]*National Oceanic and Atmospheric Administration*

Session 2.1 Flood Modeling

Providing flood warnings is vital for decision-making and preparedness. A lack of or an inaccurate operating warning system can cause significant property and life losses during extreme weather events. Even with recent advances in numerical modeling, estuarine systems can still be challenging to model, mainly because they are susceptible to pluvial, fluvial, and coastal flood drivers that may happen at the same time or in close succession, i.e., Compound Flooding (CF). For example, the St. Johns River (Florida) is an extensive estuary with numerous large inline lakes (e.g., George, Monroe, and Harney) and a low-gradient bed, making it susceptible to CF at higher frequencies. The Sacramento Soil Moisture Catchment Model - currently used for forecasting purposes by the Southeast River Forecast Center (SERFC) - does not account for backwater effects caused by wind and tidal bores, affecting the forecast accuracy to several cities upstream of those lakes (e.g., Astor and Sanford). Thus, this project aims to analyze flood hydrodynamics in estuarine systems with large waterbodies during CF events. A combined one- and two-dimensional hydrodynamic model was developed for the St. Johns River based on a hybrid (empirical and physics-based) approach by coupling the Sacramento and HEC-RAS models and tested under Hurricane Nicole and Ian events of 2022. Various synthetic tropical cyclone simulations were performed to assess the contribution of each driver to CF, delineating flood hazard zones for the estuarine system and identifying the effects of large waterbodies under high-wind events on CF. As future work, the hydrodynamic model will be transitioned into operational forecast purposes, allowing the SERFC to generate timely and accurate predictions of CF water levels to warn and prepare estuarine communities for extreme events, enhancing the system's resilience and reducing losses.

Application of an artificial intelligence program for monitoring cyanobacteria in northern Lake Sydney Lanier

Anna Impellitteri[1], Abigail Kennedy[2], Claude-David Mbemba[2], Virgil Welch[2], Christopher Impellitteri[2]

[1]Emory University [2]The Water Tower Institute

Session 4.5 Nutrients, Carbon, & Algal Blooms

Lake Sydney Lanier (LSL) in North Georgia serves as a drinking water source for roughly 60-70 percent of the greater metropolitan Atlanta area. The lake also creates nearly $700M annually related to recreational activities. This presentation focuses on data collected from May to November 2024 from eight sites in and around Gainesville, GA. The sites were selected for their proximity to recreational areas. Samples were collected weekly for the time period with some water quality (WQ) measurements conducted in the field and others through laboratory analysis. Field measurements included pH, water temperature, dissolved oxygen, phycocyanin, and chlorophyll a. Laboratory measurements included nitrate, ortho-phosphate, total nitrogen, total phosphorous, turbidity, UV254, and cyanotoxin analyses by liquid chromatography/mass spectrometry and enzyme linked immunosorbent assays. A portable microscope (ioLight) was used for algal identification which connects to an artificial intelligence (AI) program (BloomOptix) through a mobile phone application. The AI program provided results in approximately 10 minutes and included identification, colony count estimates, and cell counts for primarily Microcystis sp. and Dolichospermum sp., among a few other cyanobacterial genera. Results will be presented for regression analyses on cell counts, cyanotoxin concentrations, and field/laboratory WQ measurements to identify relationships among the measured parameters. The results will be put into context with 20+ years of pooled historical data

for WQ measurements in the main channel of LSL and the importance of monitoring for cyanobacteria for drinking water and recreational exposure will be discussed.

Advancing surface water phosphorus monitoring through affordable sensor systems networks

Fatima Iqbal[1], Francisco Cubas Suazo[1], Lewis Stetson Rowles[1]

[1]*Georgia Southern University*

Session 5.5 Organic Phosphorus & Algae

Monitoring organic phosphorus (OP) dynamics in surface waters requires comprehensive water quality data, yet access to such monitoring capabilities remains limited in many communities. Building upon Aquatic Quality Watch Informed by Communities (AQWIC), an online platform designed to support low-cost water monitoring initiatives, this study evaluates the integration of oxidation-reduction potential (ORP) sensors with existing low-cost water quality monitoring systems to understand phosphorus cycling. The baseline AQWIC sensor system measures temperature, pH, turbidity, and conductivity and integrates an Arduino Uno microcontroller, respective sensors for measurement, a battery for power supply, and an SD card for data logging to enable continuous monitoring. The system was deployed at two distinct locations to evaluate its reliability under different environmental conditions. To ensure precision and consistency, the sensors were calibrated using standard solutions, and their performance was evaluated against conventional field measurements. Results showed that the temperature, pH, and TDS sensors produced reliable results comparable to standard sensors in both environments, whereas the turbidity sensor requires further improvement due to inaccuracies in its results. The integration of ORP sensors with these baseline parameters presents new opportunities for tracking sediment orthophosphate release and organic phosphorus mineralization, contributing to the understanding of organic phosphorus dynamics in surface waters. Additionally, these sensors may provide real-time insights into microbial activity and the degradation of organic compounds by monitoring real-time redox conditions. Early results from networked AQWIC systems present a novel strategy to understand OP concentration, transformation, and fate across interconnected water bodies. This real-time, cost-effective water quality monitoring system can empower resource limited communities to monitor their water quality, while contributing to a broader understanding of phosphorus cycling through distributed sensor networks.

An alternate approach to urban stream corridor restoration

Rhett Jackson[1] Seth Wenger[2]

[1]*University of Georgia Warnell School of Forestry and Natural Resources* [2]*University of Georgia Odum School of Ecology*

Session 5.3.1 Urban Green Infrastructure

We've been doing urban stream restoration all wrong.

Hatcheries maintain high genetic variation but show shifts in genetic structure of progenies of five endangered riffleshell species (Epioblasma) (Bivalvia: Unionidae) of the eastern United States

Jess Jones[1]

[1]*U.S. Fish and Wildlife Service*

Session 2.2 Mussel Conservation

We assessed genetic variation at mitochondrial DNA (mtDNA) and nuclear DNA microsatellites for progeny (i.e., juveniles produced at a hatchery) of five endangered Epioblasma species reared at three hatcheries in the eastern United States. The progeny of Epioblasma aureola , Epioblasma brevidens , Epioblasma obliquata and Epioblasma triquetra showed no loss of mtDNA haplotype diversity relative to broodstock (i.e., wild collected gravid females used to produce juveniles) and wildstock (i.e., individuals sampled in the wild to assess baseline genetic diversity), while progeny of Epioblasma capsaeformis showed no loss relative to broodstock but an ~50% loss relative to wildstock. At DNA microsatellites, mean expected heterozygosities (He) were maintained in wildstock, broodstock and progeny, with the lowest values observed in E. aureola and E. triquetra . Among progeny, values of He and allelic richness (A) at times exceeded those observed in the wildstock and broodstock. Hence, no loss of genetic variation at DNA microsatellites was observed in progeny among species. We documented multiple paternity in progeny of E. aureola , E. capsaeformis and E. obliquata and in part attribute their high H e and A to fertilization of broodstock females by multiple males in the wild. We observed significant divergence in FST and D values between progeny to wildstock and progeny to broodstock. Most pairwise comparisons for E. brevidens and E. capsaeformis were significantly diverged, and for E. obliquata , divergence was low but also significantly different, and only for E. aureola was it low and nonsignificant. Our results showed that population genetic structure can develop quickly between progeny and their progenitors in the first generation (F1) of offspring produced from a set of parents and that genetic diversity at mtDNA and nuclear DNA microsatellites was generally maintained in progeny of endangered Epioblasma species reared at three mussel hatcheries utilizing current propagation practices.

Are you what you eat? A tale of mercury trophic transfer in a low-level contaminated stream

Nikki Jones[1]

[1]*Oak Ridge National Laboratory*

Session 3.4 Contaminants

Mercury (especially as methylmercury [MeHg]) is one of the only metals known to biomagnify in aquatic food webs, leading to elevated concentrations of this toxicant in fish. However, because Hg is predominantly accumulated in fish via dietary rather than aqueous exposure, the link between aqueous Hg concentrations and concentrations in fish is not always straightforward. This is particularly confounding for remediation efforts at contaminated sites because although reducing

aqueous Hg concentrations may be achievable, concentrations in fish may not be affected if conditions favor Hg methylation in the environment. In this study, we characterized the Hg and MeHg concentrations throughout the food web in two streams in East Tennessee: Bear Creek, a stream that historically received low level inputs of Hg in its headwaters, and Hinds Creek, a reference site, to evaluate trophic transfer of these contaminants. Patterns of Hg and MeHg transfer throughout the food web in Bear Creek indicate that MeHg bioaccumulation is the primary driver of Hg accumulation. Mercury and methylmercury concentrations among invertebrates were highest in predators and omnivores, except for Chironomidae collected from BCK 9.9 whose concentration was higher than all other invertebrates and most fish collected for this study. Chironomids were the only invertebrate collected exclusively from sediment and thus the disproportional mercury concentration is likely due to the high concentration of HgT in sediment at BCK 9.9. In fish, HgT concentrations generally increased as trophic level increased, except for Tennessee snubnose darter which exhibited HgT concentrations similar to the highest trophic level fish at both Bear Creek sites, presumably due to its preferred diet of Chironomidae larvae. This study underscores the significant role of background mercury in facilitating mercury entry into aquatic food webs and results from this study will guide remedial and risk evaluation decisions when considering planned activities in the Bear Creek watershed.

Nature's Shield: Deciphering Mangroves' Influence on Property Value Dynamics in the Wake of Hurricane Irma

Swaty Kajaria[1]

[1]*University of Georgia*

Session 3.6 Agriculture & Coastal Water Management

Our paper leverages Hurricane Irma, one of the most intense and costly hurricanes that impacted the United States, as a quasi-random experiment to estimate the protective services mangroves provide, as reflected in housing market capitalization. The study employs a difference-in-differences (DID) framework to identify the effect of mangrove protection on coastal property values. The DID results suggest that mangrove forest in Lee County provided significant flood damage reduction and are associated with at least a 7.69 percent higher in property values compared to properties that are without mangroves. Our work contributes to the growing literature on the economic valuation of ecological services provided by mangroves and wetlands. Previous valuation studies have estimated the role of mangroves in natural hazard mitigation in India ((Das & Vincent, 2009), (Das & Crépin, 2013), Thailand (Barbier et al., 2008), and the USA (Sun & Carson, 2020), (Narayan et al., 2019). To the best of our knowledge, our paper is the first to employ the hedonic pricing method to estimate how protection provided by mangroves is capitalized in property prices in the hurricane prone coastal county.

Carbon Dioxide Infusions Improve Wastewater Treatment by Filamentous Algae

Troy Keller[1], Rupert Craggs[1]

[1]*Columbus State University* [2]*National Institute of Water and Atmospheric Research, New Zealand*

Session 2.4.2 Wastewater

The majority of wastewater treatment facilities in the US are not designed to remove nutrients. Because the discharge of nutrients can cause eutrophication, new low-cost tools are needed to reduce nutrients from wastewater effluent. Filamentous algae, grown in shallow wastewater floways, can serve in this role. Because of their elevated rates of photosynthesis, algae grown in these systems may become limited by the availability of dissolved inorganic carbon (DIC). This hypothesis was tested in 3 experiments conducted in New Zealand using 15-m long, 1-cm deep recirculating floways. Experiments compared algal growth and nutrient removal with and without the addition of carbon dioxide. Primary treated wastewater infused with carbon dioxide stimulated 30% more algal biomass. While floways enriched with DIC did not show improved nitrogen removal, they did have ~30% faster phosphorus removal. These experiments support the hypothesis that DIC availability can limit the effectiveness of filamentous algal treatment systems. Thus, we can solve two problems simultaneously, sequester carbon and remove phosphorus, by infusing wastewater algal treatment systems with waste gases rich in carbon dioxide.

The Politics of Escherichia Coli Pollution in the South River Watershed

Therese Kelly[1]

[1]*Georgia State University*

Session 4.4 Urban Water Collaboration

Escherichia coli (E.coli) threatens the public and ecological health of Georgia waterbodies like the South River, which reflects a legacy of sewage pollution that continues to impair its urban headwaters in Atlanta. The Georgia Environmental Protection Division (GA EPD) performs limited water quality monitoring and relies on point source detection to identify sewage spills, which overlooks sociopolitical factors that affect bacteria fate and transport. Further complicating the accurate assessment and mitigation of aquatic bacteria pollution are recent regulatory changes to the Georgia water quality standards. Georgia recently adopted the national E. coli standard more than 30 years after the Environmental Protection Agency first recommended the transition from the fecal coliform standard in 1986. GA EPD is currently utilizing a scientifically flawed strategy in its revisions to the Total Maximum Daily Load (TMDL) and National Pollution Discharge Elimination System (NPDES) programs that will permit direct conversions between fecal coliform and E. coli values. This strategy undermines the purpose of the E. coli standard to protect public health. My presentation will provide an overview of Georgia water quality policy situated within a critical geography framework to critique the impact of state regulation on the Upper South River watershed.

Seasonal Variation in Microbial Activity in an Intermittent Stream of the Southeastern United States

Andrielle Larissa Kemajou Tchamba[1], Charles Bond[2], Delaney Peterson[3], Michelle Wolford[3], Chelsea Smith[3], Erin Seybold[4], Stephen Plont[3], Colin Jackson[1]

[1]*University of Mississippi* [2]*University of Southern Mississippi* [3]*University of Alabama* [4]*University of Kansas*

Session 1.4 Aquatic Microbial Ecology I

Microbial processes in streams are influenced by changes in nutrient availability, organic matter, temperature, hydrology, and land use. To explore the drivers of microbial activity in intermittent streams, we examined the ability of streambed microbial communities to metabolize organic material in Shambley Creek, in the East Gulf Coastal Plain of Alabama. Water, biofilm, leaf litter, and sediment samples were collected over six seasons from March 2022 to January 2024. We measured the activity of microbial enzymes involved in organic carbon degradation (β-glucosidase, phenol oxidase, peroxidase), and organic phosphorus (phosphatase) and nitrogen (N-acetylglucosaminidase) mineralization. Microbial enzyme activity was consistently greater in leaf litter compared to other sample types, with activity ranging from 0-60.5 µmol substrate consumed/h/g. Season, sample type, and water availability were key factors influencing enzyme activity. Activities of phosphatase and N-acetylglucosaminidase were most affected by seasonality, with higher activity observed at wet sites during spring. These findings highlight significant seasonal variations in enzyme activity across sample types and the influence of wet and dry conditions on microbial processes in intermittent streams.

USGS and U.S. Navy Assess the Effectiveness of an Evapotranspiration Cover at a Former Landfill, Marine Corps Logistics Base Albany, Georgia

James Landmeyer[1]

[1]*U.S. Geological Survey*

Session 4.6 Groundwater

CANCELED

Volatile organic compounds and metals have been detected in groundwater at various locations at the Marine Corps Logistics Base (MCLB) Albany, Georgia. As a result, the MCLB was placed on the National Priorities List NPL in 1989 by the U.S. Environmental Protection Agency (EPA). To address groundwater contamination beneath a closed landfill, an evapotranspiration (ET) cover was planted in the early 2000's as part of a nationwide Alternative Cover Assessment Program lead by the EPA and others. The ET cover is designed to route infiltrated precipitation back into the atmosphere through trees. The goal is to decrease the migration of leachate into the Upper Floridan aquifer. During 2024, the USGS performed a pilot-scale assessment of the rate of water uptake by 10-year old pine trees at the site. Two heat-based tracer methods were used to measure transpiration (called "sap flow") on representative trees. Soil moisture probes and a precipitation gage were installed near the monitored trees. Sap-flow measurements and vertical soil-moisture profiles will be quantified temporally to estimate a water budget for the ET cover. These data will enable an evaluation of the effectiveness of the existing ET cover in decreasing recharge below the landfill. Moreover, an assessment will be undertaken to determine if other trees characterized by higher transpiration rates trees, such as hybrid poplars, could be planted in the future.

Interactions between hydrologic drivers, land cover, and population characteristics control E. coli in urban streams

Sarah Ledford[1], Richard Milligan[1], Zakia Riaz, Jessica Sterling[2], Michael Meyer[2], Jacqueline Echols[3]

[1]Georgia State University [2]Chattahoochee Riverkeeper [3]South River Watershed Alliance

Session 4.4 Urban Water Collaboration

Urban streams and rivers have chronic bacteria contamination in the United States, coming from multiple sources, following a variety of flowpaths to the waterway, and with differing downstream fates. However, bacteria from human sewage, estimated through measures of Escherichia coli, are the highest risk to human health. We analyzed four years of E. coli monitoring by community science groups to look for spatial and temporal drivers of E. coli densities in watersheds in Atlanta, GA, with a wide range of racial and economic diversity. These watersheds already have environmental injustices towards Black communities around flooding, soil contamination, and air quality, and our goal was to understand if this extended to E. coli. While there were minimal differences in E. coli between watersheds with different Black and white populations, individual sites could be identified as hot and cold spots of contamination. Storm events did increase E. coli at most sites, indicating a combination of runoff and sediment-sorbed E. coli explain about 50% of the variability in E. coli densities. Long-term median E. coli levels were not strongly correlated to land cover or socio-demographic characteristics of the contributing watershed, but E. coli variability was lower in less urbanized areas. Temporal and spatial distributions of E. coli are controlled by complex interactions between sources that vary across watersheds and hydrologic transport. While direct correlations to minority populations were not observed, the interactions between sewage as one environmental harm and the many others (air quality, soil quality, prison-industrial complex, etc.) present in minority and low-income urban communities emphasize the oversized burden environmental justice communities carry.

The Influence of Nutrient Availability on Non-nitrogen-fixing and Nitrogen-fixing Cyanobacteria and Microcystin production in Large Rivers

Jingjing Li[1]

[1]Tennessee Technological University

Session 1.4 Aquatic Microbial Ecology I

Cyanobacterial harmful algal blooms (cyanoHABs) in rivers are increasing in frequency worldwide, with this trend driven in large part by increasing nutrient loading into the watershed. Nitrogen (N) and phosphorus (P) dynamics are key factors regulating algal growth and composition in lakes, but it is not clear if these relationships transfer to flowing waters, and especially large rivers with complex and constantly changing hydrology, light, and nutrient regimes. This study investigated the effects of nutrient concentrations and stoichiometry on the dominant cyanobacteria in the Ohio River, near Huntington, WV. We conducted 40-day laboratory incubations of river water in the spring and summer of 2024 under varying N and P gradients and ratios to identify optimal nutrient conditions

that trigger cyanobacteria growth and toxin production. Low N:P ratios promoted the growth of N-fixing cyanobacteria, which significantly increased N input via N fixation. Additionally, N availability was a key driver of non-N-fixing cyanobacteria and microcystin synthesis, with higher N concentrations and ratios producing more non-N-fixing cyanobacteria and more toxin. These findings emphasize the critical role of N and P in shaping cyanoHABs dynamics and toxin production in river systems. This research provides essential insights into the nutrient-driven succession of dominant cyanobacteria, offering valuable data to refine predictive models and inform effective river management strategies to mitigate cyanoHABs in flowing waters.

Long-term declines in freshwater mussel aggregations decrease biogeochemical storage and recycling

Jonathan Lopez[1], Carla Atkinson[1], Caryn Vaughn[2,3]

[1]University of Alabama [2]University of Okalhoma [1]Oklahoma Biological Survey

Session 5.2 Aquatic Biota & Restoration

The causes and consequences of declining freshwater biodiversity and biomass (defaunation) depend on species traits that regulate which species are vulnerable to particular stressors and the ecosystem-level consequences of declines. Areas with high levels of freshwater species richness and endemism, such as the southeastern USA, are especially vulnerable. We used a >30-year long-term monitoring dataset and a trait-based framework to identify defaunation in multi-species freshwater mussel aggregations. Losses of mussel density were associated with biomass declines of 51–83%, and consequent losses of mussel-generated carbon and nutrient recycling and storage of 47–83%. Mussel aggregations became defaunated and lost function in rivers where drought conditions were more severe and/or frequent during the study. Unexpectedly, declines did not differ among thermal tolerance guilds—both thermally sensitive and thermally tolerant species declined in defaunated streams. Rather, the taxa driving the declines in density and ecosystem function were those with life history traits adapted for stable hydrologic conditions (low fecundity, long lifespans, late age at maturity). We suggest that the ecophysiological traits that impact individual survival may be more important in governing drought-induced defaunation at shorter time scales, while life history traits that govern population recovery may be more important at longer time scales. Given the significant role that river ecosystems play in global biogeochemical processes, freshwater defaunation may have major consequences if continued unchecked. These losses and their consequences may be especially significant in the southeastern USA, where freshwater biodiversity—and threats to that diversity—are high.

Seasonal optical properties of DOM, POM, and BOM in a piedmont watershed in central Alabama, USA

Zacharie Loveless[1], Aria Shogren[1], Stephen Plont[1], Chelsea Smith[1], Jonathan Benstead[1], Carla Atkinson[1]

[1]University of Alabama

Session 4.5 Nutrients, Carbon, & Algal Blooms

Stream OM is a heterogeneous mixture of material, but can be partitioned operationally into dissolved, suspended particulate, and benthic pools (DOM, SPOM, and BOM, respectively). While the availability and composition of OM affects carbon processing rates, temporal and spatial trends in these characteristics across different OM pools are rarely well resolved in river networks. To address this knowledge gap, we examined the seasonal and spatial patterns of OM availability and composition in a small, forested stream network: the Pendergrass Creek watershed within the Talladega National Forest in central Alabama, USA. Every three weeks from January 2024 through March 2025, we sampled OM pools at four nested sampling sites, from tributaries to the watershed mainstem. At each site, we quantified optical properties of each OM pool using excitation-emission matrices (EEMs) as a proxy of OM composition. In addition, we deployed a suite of high-frequency water quality sensors (YSI EXO2) and used high-frequency measurements of fluorescent DOM (fDOM) and turbidity to establish relationships between OM concentration, optical properties, and discharge. Our preliminary analyses revealed spatial variation in DOM, SPOM, and BOM composition, where the OM at the most upstream site tended to be more degraded and humic (Average HIX = 0.865), while OM at the downstream sites was less humic (Average HIX = 0.665). Concentrations of fDOM across sites followed seasonal trends, increasing during the leaf-off period and during periods of increased discharge. Our preliminary results indicate that the composition of DOM, SPOM, and BOM pools shifts across space and time, with implications for the fate of carbon in headwater stream networks and the need for future research to examine and consider multiple pools of OM in addition to DOM.

Assessing the impacts of climate change and natural variability on hydrological extreme events over North America and Europe

Ralf Ludwig[1], Magdalena Mittermeier[1], Andrea Boehnisch[1], Alexander Sasse[1], Henri Funk[1]

[1]*Ludwig-Maxilians-University of Munich*

Session 2.1 Flood Modeling

This study focuses on the effects of climate change on hydro-meteorological extreme events and their implications for water management on multiple scales, highlighting examples from Europe and North America. It employs High Performance Computing to dynamically downscale two single-model-initial-condition-large ensembles using the CRCM5 at 0.11° resolution for the time period 1951-2100. These unique single model ensembles are analyzed to better assess the influence of natural climate variability, land cover change and climatic change on the dynamics of hydrometeorological extreme events.

Hydrological assessment is performed using the process-based and spatially explicit hydrological model WaSiM in high temporal (3h) and spatial (500m) resolution. The simulations form the basis for in depth analysis of hydrological extreme events based on the inputs from the large climate model datasets. The specific data situation enables to establish new methods to assess climate change impacts on flood risk and water resources management by identifying patterns in the data which reveal preferential triggers of hydrological extreme events.

Hydrological application of this data set is exemplified for catchments in Bavaria, Germany, where hydrological modeling illustrates the capacity to better determine the return periods of hydrological extreme events (e.g. HF100) under conditions of climate change. The regionally specific and non-linear impact of natural climate variability and climate change on extreme stream flows for the investigated catchments is discussed.

Increases in flood frequency and intensity are described by significant changes in return periods, which, however, show interesting geographical patterns. It is further illustrated how the causes of flood extremes are changing and evermore dominated by previously unseen compound events.

Data Centers in the Chattahoochee River Basin

Chris Manganiello[1]

[1]*Chattahoochee Riverkeeper*

Session 2.5.2 Chattahoochee Updates

Over the last few months, public interest in data centers has grown considerably. These facilities have become more visible due to their increasing demands on our water resources and electric infrastructure, their growing physical size, and their community and environmental impacts.

Data centers are buildings filled with computer equipment to process internet traffic, facilitate cloud computing and artificial intelligence, and store increasingly massive amounts of digital data.

Among the major challenges, today's large data centers require massive amounts of energy and water for cooling systems to keep the computer equipment from overheating. However, we do not know with certainty how much because data center operators, and energy and water providers, are not required to report demand or usage. Land disturbance during the construction phase is also a concern.

Chattahoochee Riverkeeper (CRK) has been tracking data center development as communities organize to address construction and operation in Georgia, Virginia and other states. CRK has identified trade-offs, best management practices, and policy considerations to mitigate the impact of data center proliferation in the Chattahoochee River Basin and Georgia.

Canary in a shoal mine: An interdisciplinary approach to river ecosystem monitoring using water-associated stable and radiogenic isotopes in Northeast Georgia

Michael Marshall[1], Katie Reinberger[1], Alex Heri[1], Julie Cox[2], Erin Gallatin[1]

[1]*University of Georgia Center for Applied Isotope Studies* [2]*University of Georgia Department of Geology*

Session 3.5 Water Quality

Water quality and environmental monitoring programs in rivers typically involve only one or two scientific disciplines to assess changes through time. However, rivers represent the integration of

many processes occurring in basins including geologic (e.g. weathering), hydrologic (e.g. precipitation) and biologic (e.g. metabolism). We use an interdisciplinary approach to monitoring river systems that incorporates water-associated isotope ratios, including strontium (87Sr/86Sr), water-oxygen (18O/16O) and dissolved organic carbon (13C/12C, aka DO13C) concurrent with standard water quality metrics (temperature, dissolved oxygen, conductivity) using a multimeter in the Middle (MOR) and North (NOR) Oconee Rivers in Georgia monthly during 2024.

Preliminary 87Sr/86Sr ratios are higher in MOR than NOR possibly indicating slightly different source mineral composition. Because strontium isotope ratios should remain relatively constant, variation in those ratios between sampling sites and/or through time may be indicative of environmental changes distinct from normal background geological processes.

Water-oxygen isotopic compositions (18O/16O) range from -4.4 to -3.6‰, largely covarying with water temperature in both sites, with notable exceptions during mid-summer when river source water is dominated by precipitation. Water-18O/16O is also typically higher in NOR than MOR possibly due to differences in watershed area and/or relative contributions to flow by groundwater inputs.

DO13C is slightly higher on average in MOR (-27.9 ‰) than NOR (-28.1‰), with highest values occurring during the spring at both sites. DO13C reaches the lowest 13C/12C values in the summer, reflecting maximum watershed forest activity and the most labile carbon availability. DO13C gradually increases over the winter at both sites, likely indicating increasingly more refractory carbon compounds remaining.

The use of water-associated isotope ratios could help reveal watershed-scale patterns and processes that might otherwise go unnoticed. River isotopes could also provide an interdisciplinary framework for evaluating river ecosystem health with less effort compared to traditional methods such as biomonitoring, chemical sampling or hydrological surveys.

Spatiotemporal variability of isolated wetland hydroperiod across a managed landscape

Nick Marzolf[1]

[1]*The Jones Center at Ichauway*

Session 2.3 Georgia Wetlands Post-Sackett

Wetlands are important ecosystems that host a diverse array of functions and are crucial habitats for at-risk flora and fauna. Wetland structure and function are emergent properties of hydrology and defined by the hydroperiod, or the period where standing water is present. Variability in wetland hydroperiod is influenced by both local hydrology (rainfall and evapotranspiration) and large-scale climate patterns that influence the annual and multi-year availability of water. Here, we use hydrologic data collected from 33 marsh savannah and Cypress-gum swamp wetlands from the Jones Center at Ichauway to understand spatial and temporal variability in wetland hydroperiod across a managed landscape. Staff gauges in each wetland were installed near the deepest part of the wetland basin and monitored biweekly from 1994 – 2024. In each wetland for each year, we determined the duration of the hydroperiod from the onset of measurable water at the staff gauge to when water was

no longer present. We explored variability in hydroperiod duration and in the start and end dates of the hydroperiod across wetland type, and the spatial autocorrelation of hydroperiod across the site. Our results show the influence of wetland catchment-scale drivers and variation in drought intensity and frequency on wetland hydroperiod. Further, we found evidence for long-term changes in wetland hydroperiods and the effect of forest management on regional water budgets. Our results directly inform the conservation efforts for at-risk amphibians across the Southeast US that rely on longer hydroperiods and suggest new research directions for understanding the effects of hydroperiods on wetland function.

Resilient Installations: Military Readiness through Engineering with Nature® (EWN) Design

William Mattison[1], Zak Ruehman[1]

[1]*University of Georgia*

Session 4.3 DOD Installation Resilience

Military installations across the United States must maintain their ability to operate effectively and stay resilient in the face of changing conditions. Future precipitation scenarios and land use change can potentially jeopardize military operations and the readiness of the Nation's fighting force. Amplified rainfall intensity, coupled with altered landscapes, can negatively impact water resources and compromise existing infrastructure systems of installations through increased runoff, erosion of hillsides, streambank instability, and debris flow. Hurricane Helene serves as a recent and stark example of the need for resilient installations to mitigate severe impacts that can comprise our national security. Engineering with Nature (EWN) seeks to enhance the military mission by integrating conventional infrastructure with natural systems to produce sustainable and efficient engineering solutions. EWN design principles place an emphasis on non-stationary and multi-objective design utilizing in-depth hydrologic and hydraulic analyses, ecological processes, and innovative materials to achieve benefits such as flood mitigation, enhanced water quality, and ecological uplift. Fort Moore, an important training and power projection installation for the United States Army, has partnered with UGA's Institute for Resilient Infrastructure Systems to make EWN part of their approach to address these challenges. Multi-objective stream crossing structures (e.g., Shell Creek) and preliminary stream restoration designs (i.e., Laundry Creek) exemplify how Fort Moore is leveraging EWN to ensure operational readiness and support of its fighting force. The case study examples highlight how integration of nature infrastructure and nature-based solutions with traditional, grey infrastructure seeks to provide innovative techniques that meet military operation requirements and ensure long-term infrastructural resilience.

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Stream Bank Erosion Vulnerability Modeling Approach

Sydney McDaniel[1], Sudhanshu Panda[1], Michael Wild[1], Casey Helton[1], Peter Swanton[1], Devendra Amatya[2]

[1]*University of North Georgia* [2]*U.S.D.A Forest Service*

Session 3.3 Culvert Failure

Major consequences on road/stream crossing drainage structures are siltation and scouring, particularly after extreme precipitation. The risk of forest structure failures is high with high-gradient topography that causes increased soil erosion, higher discharge, enhanced streambank erosion probability, and a heightened chance of debris flow to the structure mouth. In coastal landscapes with flat topography, constant hurricane-induced debris flow to the structure mouth mounts the risk of its failure. Land cover, vegetation type, soil and geologic characteristics, slope, Precipitation-Intensity-Duration-Frequency (PIDF), average annual precipitation, temperature, solar radiation, and other climatic factors, and other hydro-geomorphologic factors play roles in the possible failure of these structures in climatic extreme conditions. The goal of this study is to develop a Morphological Vulnerability Assessment Decision Support System (MVADSS) to identify road/stream crossing drainage structures failure vulnerability risks an innovative streambank erosion spatial vulnerability assessment (SBEVA) geospatial modeling approach. The SBEVA model is developed using spatial data like land uses across the streambanks (100 feet), Lidar-based 1m DEM, 10 m gSSURGO data, and design flood discharges calculated using 100-yr 24-hr partial duration series PIDF developed using the local weather station data. Spatial environmental rasters used in models were reclassified with their vulnerability probability scale/weight, developed through the Delphi method of weighted scale determination which is explained in detail in this study. For each culvert watersheds, the streambank buffered pixels were summarized by summing up the model assigned scale values of 1(Highest), 2 (High), 3(Moderate), 4 (Low), and 5(Lowest). The Risk-scaled model provided the qualitative scale vulnerability results of each structure in the EFR system. The results were field verified to confirm our automated geospatial modeling approach for stream/road crossing structures' vulnerability assessment. This study would provide proactive decision support to the USDA Forest Service or any other agencies responsible for safeguarding these structures.

Phosphorus Uptake and Storage by Aquatic Hyphomycete Fungi

Lydia McGregor Bravol[1]

[1]*University of Alabama*

Session 2.4.1 Aquatic Microbial Ecology II

Leaf litter and its associated microorganisms play a key role in phosphorus (P) uptake in streams. However, the response of aquatic hyphomycete fungi, the dominant litter decomposers in forest streams, to elevated concentrations of dissolved P remains unclear. Whole-stream nutrient addition experiments at Coweeta Hydrologic Laboratory suggest that as the litter P content increases, fungal biomass also increases but at a slower rate, potentially indicating 'luxury' storage of P. To investigate this, we conducted short-term P-enrichment experiments to assess how dissolved P concentrations in the water column influence the biomass and P content of litter-associated fungi. Leaf litter of two species, fast-decomposing tulip poplar (Liriodendron tulipifera) and slow-decomposing white oak (Quercus alba), was incubated in a second-order stream and underwent short-term P enrichment at three stages of the decay process: early (day 50), middle (day 100), and late decay (day 150). Phosphorus additions were conducted at each decomposition stage by enriching stream water P

concentration to 200 ug/L for one-week. During each P addition, litter samples were collected after 0, 4, 8, 24, 72, and 168 hours after P enrichment started. Litter samples were analyzed for P content, fungal biomass (measured as ergosterol), and phosphatase activity. Fungal biomass did not increase proportionally with increased litter P content, suggesting either luxury storage of P or shifts in fungal community composition toward more P-rich taxa. To further explore this, nuclear magnetic resonance (NMR) is being used to identify P-containing compounds, particularly polyphosphate, the primary storage form of P in fungi. Additionally, ITS sequencing will detect potential shifts in community structure during each P addition.

Freshwater mussel functional traits shape mussel-mediated ecosystem metabolism and biogeochemical cycling

Michael Taylor[1], Lauren Morris[1], Matthew Lodato[1], Jonathan Lopez[1], Carla Atkinson[1]

[1]*University of Alabama*

Session 5.2 Aquatic Biota & Restoration

Freshwater unionid mussels play important roles in many key ecosystem functions (i.e., nutrient dynamics and ecosystem metabolism), however, their species-specific roles in these processes remain understudied. Freshwater mussels are imperiled across much of North America, and declines in mussel populations may result in cascading losses of mussel-mediated nutrient and organic matter provisioning. Given the high trait diversity among mussel species, shifts in the composition of mussel assemblages may alter mussel-mediated nutrient cycling rates and other processes. To understand the role of freshwater mussels on ecosystem function, we conducted in situ experiments in a stream with high mussel diversity in the southeastern USA. Using experimental chambers, we quantified how different mussel species and assemblages shape net N2 exchange, ecosystem respiration, net ecosystem production, and gross primary production. We paired these measured rates with mussel trait data to assess how species-specific traits drive mussel-mediated ecosystem processes. We expected that mussels would enhance N2 exchange by increasing organic matter content through releasing carbon-rich biodeposits; however, N2 exchange did not differ among species treatments, and no mussel traits were related to N2 exchange. Additionally, mussels enhanced ecosystem respiration and gross primary production rates while exerting minimal influence on net ecosystem production. Mussel traits including biomass and nutrient excretion rates were important factors in determining ecosystem respiration and gross primary production, which exemplifies the importance of trait differences in mussel-mediated ecosystem processes. This study highlights the complex roles freshwater mussels play in mediating biogeochemical processes in situ and emphasizes the importance of considering how biodiversity shapes ecosystem function. Understanding mussel-mediated ecosystem processes is crucial for conserving both mussel biodiversity and associated ecosystem services.

Streamflow Dynamics in a southern US Water Tower: A Multi-Method Analysis Connecting Land Cover, Precipitation, and Topography in the Southern Appalachians

Alexander Miele[1]

[1]*Louisiana State University*

Session 1.6 Surface Hydrology

Streamflow trend analyses provide water managers with a tool for planning and predictions. Using multiple methods, we analyzed streamflow trends from 1996 to 2022 for the Southern Appalachian (SA) region of the U.S. The forested uplands of the SA receive high amounts of precipitation and act as a "water tower" for the surrounding lowland area, both of which have experienced higher than average population growth. For USGS gages in the area with continuous streamflow measurements (168 total), we also evaluated precipitation trends with the same methods, and land cover change and complexity (LCCC) rates within the area upstream of the gage (or contributing area). Generalized linear models were then used to assess any linkages between landscape variables and precipitation trends, and streamflow trends. Our results show that all basins are experiencing streamflow trends in at least one metric, with the ITA method showing the most trends and the SMK method showing the least. We also found that many drainage areas are experiencing trends in their precipitation and change in their land cover and complexity. From our models, it is suggested that reforestation, urbanization, and wetland loss to agriculture are all associated with monthly minimum and maximums and seasonal variability trends, but precipitation is also positively linked. These streamflow metrics and precipitation trends point towards depleted high-flow magnitude, reduced annual variability of high flows, erratic flows, and urban influences.

Georgia Flood Potential Modeling and Mapping using GeoAI for Proactive Management Decision Support

Rohan Mohanty[1], Kashish Pankaj[2], Sourya Pattanaik[3], Sudhanshu Panda[4], Prahlad Jat[4]

[1]*North Oconee High School* [2]*Chattahoochee High School* [3]*Cambridge High School* [4]*University of North Georgia*

Session 2.1 Flood Modeling

Georgia, as an Atlantic coastal state, has experienced severe flooding over the past decade. Since 2018, Georgia has experienced extreme flood events, exceeding 200-year flood levels as frequently as 4-5 times per year. This underscores the urgent need for a robust flood potential geospatial model to support proactive management and reduce the severity of damage and resource loss from such geohazards. Therefore, this study aims to: 1) develop an automated geospatial model to assess flood potential across Georgia, identifying areas of vulnerability under worst-case flooding scenarios using geospatial data from 1990-2020, which includes weather data reflecting current climate change impacts, and 2) compare these results with data from 1971-2000, when the effects of climate change were less significant. For our analysis, we used 3-meter DEM elevation, 30-year average annual precipitation and maximum temperature data (1971-2000 and 1991-2020) from PRISM, NOAA's 200-year 24-hour Precipitation-Intensity-Duration-Frequency (PIDF) values, soil moisture data from NASA's SMAP and ECOSTRESS satellites, gSSURGO soil characteristics (including drainage, hydrologic group, available water capacity, and permeability), and 2021 NLCD land cover datasets. All geospatial datasets were analyzed for two temporal periods, and advanced data processing techniques were applied to generate flood potential rasters for each spatial input variable. Each input layer was reclassified on a flooding potential scale of 1-5, with 5 representing the highest vulnerability, based on

expert knowledge of the data and its flooding risk potential. A Delphi-based expert opinion process was used to assign weights to each layer, which were then combined using ArcGIS's Weighted Sum function to create Flood Potential Maps for both temporal periods. Jenks classification was employed to categorize flood risk into five levels: very low, low, moderate, high, and very high. The two temporal flood potential rasters were compared to assess the changes in flood vulnerability under current climate change conditions. Historical flood extent data were used to validate the model results. This automated model is highly replicable for other regions and allows for the integration of new datasets. The study's outcomes could provide valuable support to state authorities and FEMA, serving as a proactive tool for flood risk mitigation and management.

Unveiling Seasonal Dynamics of Mussel Assemblages on Ecosystems Using In Situ Experimental Chambers

Lauren Morris[1], Taylor Michael[1], Matthew Lodato[1], Jonathan Lopez[1], Carla Atkinson[1]

[1]*University of Alabama*

Session 5.2 Aquatic Biota & Restoration

Freshwater mussels (Bivalvia: Unionida) are filter-feeding animals that occur in dense, biodiverse aggregations, and are abundant in rivers in the southeastern United States. Mussel assemblages can influence stream ecosystem processes, though the magnitude of effect is dependent on species-specific traits, such as biomass and thermal tolerance, and environmental conditions, such as temperature. For example, mussels directly contribute to ecosystem respiration (ER) and translocate suspended organic particles from the water into the sediment via biofiltration. To evaluate how mussel-driven ecosystem impacts vary with seasonal temperature changes, we conducted field experiments using water-tight benthic chambers in the Sipsey River, Alabama, U.S.A. We predicted that: 1) mussel-driven algal clearance and ER rates would increase with greater mussel biomass and decrease with lower temperatures, and 2) thermally sensitive mussel species would have disproportionately greater effects on ecosystem processes at warmer temperatures. We selected four functionally distinct species that differ in thermal tolerances and life history strategies, including federally listed Pleurobema decisum. We quantified algal clearance rates and ER using light-dark incubations under contrasting temperature regimes (summer and fall). Preliminary results indicate that chambers containing larger-bodied species have higher clearance rates and a greater influence on ER than smaller-bodied species. Additionally, mussel clearance rates differed significantly across seasons, emphasizing the role of temperature in shaping mussel physiological processes. This research demonstrates the role of freshwater mussels in driving aquatic ecosystem functions like nutrient and suspended organic matter (e.g., algae) dynamics. It also advances methodologies for in-situ mussel research, expanding upon traditional laboratory-based studies of mussel ecophysiological processes. By deepening ecological understanding of these organisms under natural conditions, this work provides useful information to support conservation efforts for this imperiled group of organisms.

Towards a LSPIV system for flow measurement of ungaged streams

Cole Myers[1], Tien Yee[1], Da Hu[1]

[1]*Kennesaw State University*

Session 1.6 Surface Hydrology

Streamflow measurement is a critical component of hydraulic and hydrologic studies. Traditionally, streamflow data are obtained from USGS gaging stations. However, due to factors such as cost, maintenance, and practicality, many streams in Georgia remain ungaged. Large-Scale Particle Image Velocimetry (LSPIV) is an image processing technique with the potential to address this gap. This study aims to develop a cost-effective, on-site LSPIV system and compare its streamflow measurements to those from established USGS gaging stations. The hardware architecture of the proposed LSPIV system is presented, along with results from initial laboratory tests. The findings demonstrate the feasibility of using LSPIV for streamflow measurement, highlighting its potential as a valuable tool for ungaged sites and future water resource studies.

GeoAI Aided Geospatial Models Design for Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR

Sudhanshu Panda[1], Michael Wild[1], Casey Helton[1], Sydney McDaniel[1], Peter Swanton[1], Devendra Amatya[2]

[1]*University of North Georgia* [2]*U.S.D.A. Forest Service*

Session 3.3 Culvert Failure

The risk of forest structure failures is high with high-gradient topography that causes increased soil erosion, higher discharge, enhanced streambank erosion probability, and a heightened chance of debris flow to the structure mouth. The goal of this study is to develop a Morphological Vulnerability Assessment Decision Support System (MVADSS) to identify road/stream crossing drainage structures failure vulnerability risks combining four geospatial vulnerability risks assessment models – i) Design Discharge with Modified CN (DDM-CN), ii) Modified-Revised Universal Soil Loss Equation (M-RUSLE), iii) streambank erosion spatial vulnerability assessment (SBEVA), and iv) Hydro-geomorphologic characteristics supported Watershed Debris-Flow Assessment (WDFA). The study is completed in a coastal experimental forest research (EFR) system at Santee watershed, a part of Francis Marian National Forest in South Carolina. The DDM-CN automated geospatial model uses the recently developed modified CN algorithm to calculate pixel-based runoff from individual watersheds that exited at each culvert. The M-RUSLE geospatial model amounts to the eroded soil coming to each structure, which applies a newly developed R-Factor using NOAA-published PIDF-I30 raster and NDVI-based C- and P-Factors. The SBEVA model is developed using spatial data like land uses across the streambanks (100 feet), Lidar-based 1m DEM, 10 m gSSURGO data, and design flood discharges calculated using 100-yr 24-hr partial duration series PIDF developed using the local weather station data. The WDFA model is majorly emphasized in this study that is developed through an innovative approach of using pixel-based tree/shrub speciation, rock type, and rock depth spatial variation information obtained from Geology vector, watershed dryness index (WDI) along with other parameters used in other models. Spatial environmental rasters used in models were reclassified with their vulnerability probability scale/weight, developed through the Delphi method of weighted scale

determination which is explained in detail in this study. Each model explained the structure failure risk on a scale of 1(Highest), 2 (High), 3(Moderate), 4 (Low), and 5(Lowest). These four Risk-scaled models were combined to provide the qualitative scale vulnerability results of each structure in the EFR system. The results were field verified to provide proactive decision support to the USDA Forest Service or any other agencies responsible for safeguarding these structures.

Geomorphohydrologic Analyses for determining Soil Subsidence, Sinkhole Formation Vulnerability, and Groundwater Contamination Susceptibility with GeoAI-aided Model Design

Sudhanshu Panda[1], Armaan Rath[2], Shuvam Rath[3], Eva Rout[2], Sonu Anubhav[4]

[1]University of North Georgia [2]Denmark High School [3]Lambert High School [4]South Forsyth High School

Session 4.6 Groundwater

Aquifer in the southeast USA is covered by limestone/dolomite carbonate rock that dissolves in contaminated water at a faster rate and leads to increased risk of sinkholes formation. Soil subsidence in coastal areas is a global phenomenon even it is in the terrestrial landscapes, such as Claiborne aquifer spatial areas in Georgia. The goal of this study was to develop three automated geospatial models to determine i) spatial locations with high-risk potential for sinkholes, ii) spatial locations highly affected by soil subsidence, and iii) groundwater contamination spatial susceptibility and integrate these models to find the spatial risk associated with the loss of groundwater in the Claiborne aquifer. Geology, soil, land-use, aquifer, groundwater depth, road, fault line, elevation, precipitation, and evapotranspiration data produced nine sinkhole vulnerability layers: subsidence or surface change, average aquifer well depth, groundwater vulnerability (DRASTIC), groundwater travel time, road density, aquifer-media, geology type, slope, and land-use types. Each layer was reclassified and assigned a value from 1-9 (Lowest – Highest vulnerability risk) using the Delphi Method of Weight Assignment, according to its sinkhole vulnerability. The weighted layers were analyzed interpretively producing a Sinkholes Vulnerability Raster. The 10m DEM recorded/created with the Shuttle Radar Topography Mission (SRTM) data (~2000) and latest LiDAR based DEM (2016) comparison model provided the spatial soil subsidence vulnerability. DRASTIC model provided the spatial vulnerability risk regarding groundwater contamination that help enhanced the process of Karst dissolving to create sinkholes formation risks.. These three models were integrated to determine most vulnerable spatial location in the Claiborne aquifer area of Georgia with respect to diminishing groundwater table. The result was correlated with urban landscapes to explain the severity of the issue. This study would support the managers to take pro-active measures to safeguard lives and resources and help in preventing geohazards.

Influences of Salinity on Long- and Short-term Patterns in Microbial Extracellular Enzyme Activity Along the Mississippi Gulf Coast

Jacqueline Pavlovsky[1], Stephanie Vaughn[1], Jordan Heiman[1], Andrielle Larissa Kemajou Tchamba[1], Colin Jackson[1]

[1]*University of Mississippi*

Session 1.4 Aquatic Microbial Ecology I

Microorganisms play critical roles in biogeochemical cycling, largely through the activity of extracellular enzymes. While the involvement of these enzymes in organic matter degradation is well-known, how microbial enzyme activity fluctuates over different timescales is uncertain, especially in near-shore coastal environments. Using artificial substrates, day-to-day, week-to-week, and month-to-month variation in the activity of phosphatase and beta-glucosidase was examined at five sites along the Mississippi Gulf Coast and related to changes in salinity. Enzyme activity varied over each timescale, with phosphatase showing greater variability at scales of day-to-day and week-to-week, while beta-glucosidase showed greater variability from month-to-month. Both enzymes varied across sites during the week-to-week and month-to-month timescales, while neither varied significantly during the day-to-day timescale. Over shorter timescales, higher salinity was correlated with an increase in phosphatase activity, but over the month-to-month time scale, salinity was negatively correlated with phosphatase activity, potentially because of broader salinity ranges and a longer time scale. Similarly, beta-glucosidase was positively correlated with salinity over the week-to-week timescale and negatively correlated over a longer timescale. These findings suggest that the nearshore aquatic microbial community is impacted by and responds to both long- and short-term changes in salinity, which could be attributed to shifting tides or fluctuations in freshwater input. These findings also showcase the sensitivity of the nearshore microbial community, and fluctuations in the activity of extracellular enzymes could result in significant changes to rates of biogeochemical cycling in coastline waters of the Gulf of Mexico.

Phosphorous Removal from Aqueous Samples using Alginate-NADES beads

Rocio Perez[1]

[1]*Georgia Southern University*

Session 5.5 Phosphorus and Algae

The increasing demand for sustainable phosphorus recovery strategies is critical for addressing global phosphorus depletion and water pollution concerns. This study explores the development and optimization of alginate-natural deep eutectic solvent (NADES) beads for the efficient recovery of phosphorus from aqueous solutions. Alginate, a naturally occurring biopolymer, was combined with choline chloride-based NADES to fabricate alginate-NADES beads, leveraging their high adsorption capacity and environmentally friendly properties. The beads were characterized using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and Brunauer-Emmett-Teller (BET) surface analysis to assess their structural and chemical properties.

The results demonstrated that the optimized alginate-NADES beads effectively captured and retained phosphorus, significantly reducing its concentration in aqueous solutions. The incorporation of NADES enhanced the interaction between the beads and phosphate ions, improving adsorption efficiency and recyclability.

This study highlights the potential of alginate-NADES beads as an environmentally friendly and efficient material for phosphorus removal and recycling. Their biodegradable nature and effectiveness provide a viable alternative to conventional phosphorus recovery techniques. This research contributes to the advancement of green chemistry and environmental sustainability, offering an innovative approach to phosphorus management that aligns with circular economy principles and water resource conservation.

Characterizing Water Budgets in Isolated Wetlands

Katy Perkins[1,2]

[1]*The Jones Center at Ichauway* [2]*Auburn University*

Session 2.3 Georgia Wetlands Post-Sackett

The southeastern coastal plain has experienced increasing water scarcity due to drought, climate and land-use change, and increasing populations. Geographically isolated wetlands (GIWs), a frequent component of coastal plain ecosystems, provide valuable ecosystem services such as wildlife habitat, water storage, and water filtration. Although these wetlands are also vulnerable to water scarcity, they have generally been excluded from regulatory protections. Because of their small size and lack of continuous connectivity to other water bodies, GIW hydrologic factors like hydroperiod, depth, and volume are highly dependent on ecosystem processes in surrounding landscapes. Our goal was to link GIW hydrology to landscape variables such as forest structure and local geomorphology. Results from an earlier study showed that hardwood removal and reintroduction of prescribed fire increased hydroperiod by ~60 days and decreased the amount of rainfall needed for hydroperiod initiation. In 2017, we installed rain gages and water level recorders in several additional wetlands. These data, combined with new bathymetric maps to convert water depth to surface area and volume, allowed the calculation of recession rates. Preliminary results indicated that wetland recession is consistently higher than can be accounted for via evapotranspiration rates alone, suggesting water losses to surrounding soil or groundwater. These data are being used to parameterize local hydrologic models and estimate the effects of catchment restoration for a wider variety of GIWs. Understanding both the magnitude and driving landscape factors of these additional losses will aid in informing land management decisions in the catchment area of these GIWs. We hope these results will support both upland and wetland restoration and protection by demonstrating the link between forest structure, geomorphology, lateral flow of water through soils, and wetland function.

Seasonal and Flow Impacts on Dissolved and Particulate C:N:P Stoichiometry in a Small, Forested, Southeastern Stream

Steven Plont[1], Chelsea Smith[1], Arial Shogren[1], Michelle Wolford[1], Kaci Zarek[2], Shannon Speir[3], Delaney Peterson[1], Carla Atkinson[1]

[1]*University of Alabama Department of Biological Sciences* [2]*Cornell University Department of Biological Sciences* [3]*University of Arkansas Department of Crop, Soil, and Environmental Sciences*

Session 4.5 Nutrients, Carbon, & Algal Blooms

Climate change is anticipated to alter surface water connectivity in the Southeast, altering carbon (C), nitrogen (N), and phosphorus (P) dynamics in headwater streams. However, we have limited understanding as to how seasonality and flow may differentially influence dissolved and particulate C:N:P stoichiometry across headwater streams. Thus, we assessed dissolved and particulate C and nutrient dynamics across a non-perennial, headwater stream network in Alabama, USA. On five occasions over 2022, we measured streamflow and collected samples for dissolved organic C (DOC), dissolved inorganic N (DIN), and soluble reactive P (SRP), as well as particulate C, N, and P (as seston) and total suspended solids (TSS) from seven sites throughout the network. Each sample site was outfitted with stilling wells to measure water level throughout the study period. From this water level data, we estimated site-specific antecedent conditions as the number of high flow days (nHF) in the month prior to each sampling campaign at each site. Stoichiometric ratios were more variable across seasons and among sites within a seasonal sampling campaign for dissolved C, N, and P compared to particulate fractions. In contrast, particulate C, N, and P displayed similar patterns to changes in streamflow, suggesting that dissolved constituents were transported separately, while particulate constituents were transported together. Flow, antecedent conditions, and seasonal drivers differentially impacted stoichiometric fluxes: 1) DOC had a positive correlation with streamflow, 2) DIN and SRP were positively correlated with average daily temperature, and 3) all constituents had a negative correlation with nHF. Critically, our study shows that the stoichiometric balance of C, N, and P is dynamic, even in small, headwater streams, and links between flow, season, antecedent conditions, and export will likely depend on the resource form and demand.

Seasonal Variability in Nutrient and Greenhouse Gas Cycling in Surface and Shallow Groundwater Within Restored Agriculture Floodplain Wetlands

Zoe Porter[1], Justin Murdock[1]

[1]*Tennessee Technological University*

Session 2.3 Georgia Wetlands Post-Sackett

Intensification of agriculture within the lower Mississippi River Basin (LMRB) has dramatically altered wetland environments and expanded inorganic fertilizer use, resulting in excess nutrients being transported across the landscape and downstream to the Gulf of Mexico. A major goal of the USDA Wetlands Reserve Program (WRP), now the Wetland Reserve Enhancement Partnership (WREP), is the restoration of wetland ecosystem services; however, the environmental conditions that optimize nutrient retention and minimize greenhouse gas fluxes are poorly understood. The goal of this study is to identify tradeoffs in these ecosystem services in restored agricultural wetlands due to different hydrologic and vegetation restoration practices. We are studying WRP/WREP easements in western Tennessee to identify the environmental conditions that control these biogeochemical transfer pathways and determine the environmental conditions and restoration practices that optimize nutrient and greenhouse gas flux rates. Here we present initial data investigating seasonal variation in nutrient and greenhouse gas flux rates in restored easements and discuss potential tradeoffs in services. This work will inform how future restorations could be optimized to ensure the long-term functional success of federal restoration programs in the face of a changing climate.

Evaluating Options for Improving Drought Resilience of the Upper Flint River

Laura Rack[1,2], Mary Freeman[1,2], Ben Emanuel[3], Rhett Jackson[4], Seth Wenger[1,2]

[1]University of Georgia Odum School of Ecology [2]University of Georgia River Basin Center [3]American Rivers [4]University of Georgia Warnell School of Forestry and Natural Resources

Session 5.1 Water Planning & Management

The upper Flint River is an important water source for multiple uses, including water supply for municipalities south of Atlanta, recreation, and supporting diverse aquatic ecosystems. Five droughts since the late 1990's highlighted the potential vulnerability of the river system to severe drought. Municipal water utilities and others as part of the Upper Flint River Working Group, have worked to ensure water security. Working in collaboration with the Upper Flint Regional Water Planning Council and Upper Flint River Working Group, through a seed grant funded by a Georgia Environmental Protection Division, we explored alternative management actions for low-flow and drought resilience in the upper Flint River. We developed three scenarios for evaluation in the Flint Basin Environment Assessment Model (BEAM). In the first scenario we estimated the impact of increased stormwater infiltration. In the second, we simulated additional water storage in a retired quarry near the top of the basin to supplement river flows and in the third we simulated using a higher minimum flow and shifting the timing of water withdrawals from the river. Finally, we combined the stormwater infiltration, quarry storage, and modified operations scenarios to explore the collective impacts of all management actions. We found that the only way to meaningfully enhance river flow during drought events was to change low-flow operations by raising the minimum flow for withdrawal level during the summer and early fall. However, these altered low-flow operations resulted in the lowest reservoir storage levels, which is of concern for water utilities. The combined scenarios showed that the impact on reservoir storage was partially offset by releases from the repurposed quarry. Thus, the combination of actions has the best potential to improve riverine ecological conditions while maintaining adequate water supplies for human needs.

Exploring deep-seated structural controls on the groundwater system on St. Catherines Island, Georgia

James Reichard[1], R. Kelly Vance[1], Jacque Kelly[1], Brian Meyer[1]

[1]Georgia State University

Session 5.6 Coastal & Coastal Plain Groundwater

A long-term field investigation on a barrier island along the Georgia coast has revealed structural controls on groundwater flow, in both the surficial aquifer and underlying Floridan System. Hydraulic head and chemistry data strongly suggest that groundwater moves upwards through the Floridan System along near-vertical faults and or solution collapse features. In addition, head and chemistry data show that unusually large tides cause episodic saltwater intrusion events within the surficial aquifer at discrete locations. Ground-penetrating radar and electrical resistivity profiles near the sites of saltwater intrusion indicate the presence of shallow fractures, faults and sag (collapse) structures.

We hypothesize that the structural controls are related to movement along deep-seated basement faults associated with Mesozoic rifting and opening of the Atlantic. Recurrent movement has allowed faulting to propagate upwards through the coastal plain, creating permeable pathways for the vertical and lateral movement of groundwater. To test our hypothesis, we are gathering additional hydrogeologic and geophysical data at a new field site on the island. Here, there is evidence of solution collapse features and relic drainage from past artesian spring flow. Because the new site follows the strike of a mapped fault at the original site, we proposed that both field sites fall along the same near-vertical fault. We also suspect that this fault is an extension of a previously mapped, deep-seated fault at Brunswick, Georgia, which has been shown to be associated with up-coning and vertical saltwater intrusion in the Floridan Aquifer. Since Mesozoic faults are deeply buried and generally have little surface expression, we believe they are more common than previously thought and likely play an important role in the vertical movement of groundwater beneath the coastal plain.

Watershed Modeling with QSWAT to Determine the Causes of Sudden Temperature Drop at Two Fish Hatcheries in Chattahoochee River

Mariam Rezai[1], Aarush Kate[2], Sudhanshu Panda[1], Rahul Mohanty[3], Prahlad Jat[1]

[1]University of North Georgia [2]Cambridge High School [3]North Oconee High School

Session 3.5 Water Quality

Two fish hatcheries below the lake Sidney Lanier Dam are experiencing hatchling loss due to cold water temperatures during winter. According to Georgia Fish and Wildlife Department, Georgia Department of Natural Resources, and Army Corps of Engineer, it is very unusual lately. A sudden drop of few degrees Celsius water temperature is the cause of the hatchling's death. We hypothesize that ammonia (NH4) spurt in the water is developing sudden water temperature drop lately. We Have used QSWAT (QSWAT | SWAT | Soil & Water Assessment Tool (tamu.edu)) hydrologic model to delineate the watersheds for the two hatchery locations along with for the USGS gauging stations in-between them from the Lake Sidney Lanier Dam to Morgan falls dam. A detailed watershed modeling was completed with QSWAT using the SSURGO soil data, 10m DEM, and 2021 NLCD land cover rasters with the default weather database associated with the SWAT model. Other watershed management parameters were set as default because SWAT has a perfect spatial database to rely on the watershed water quality and quantity modeling analyses. The model was simulated for 2010-2030 and the result being validated with the 2012-2024 USGS gauging station real-time data. Thus, ammonia load to the two hatchery locations were ascertained to confirm that higher than the prescribed load of ammonia proving our hypotheses that the ammonia creating drop in water temperatures. We propose to authorities to reduce ammonia load to Chattahoochee River. The SWAT model also provided detailed watershed characteristics with relation to water quality and water quantity information of present and for future for prudent watershed management decision support. Our study pinpointed to the chicken liter mismanagement in the watershed area is the cause of sudden spurt of Ammonia in the waterbodies.

Predicting Wetting and Drying Dynamics of Depressional Wetlands to Determine Habitat Suitability for Amphibian Species

Jeffrey Riley[1], Mark Roth[1], Ryan Burner[2]

[1]U.S. Geological Survey South Atlantic Water Science Center [2]U.S. Geological Survey Upper Midwest Environmental Science Center

Session 2.3 Georgia Wetlands Post-Sackett

Small depressional wetlands (<1 hectare) are numerous across many landscapes and provide critical habitat for amphibians and many other species. Hydrologic permanence (i.e., hydroperiod) determines the suitability of a wetland for certain species and is an important factor in source-sink carbon dynamics. Those tasked with managing land and species are often forced to make decisions on how to prioritize protection of critical habitat without sufficient information on hydrologic permanence of small wetlands. Unlike the robust streamflow gaging network in the United States, wetland hydrologic data are scarce. Furthermore, models that can predict wetland hydrologic dynamics without detailed field data do not exist, and small depressional wetlands, especially those that are forested, are rarely captured in remotely sensed imagery. Therefore, additional data and tools are needed to better understand hydrological dynamics and protect these critical but understudied habitats.

In this study we present results from a data driven modeling approach for predicting temporal inundation dynamics in small depressional wetlands. Specifically, we used a random forest classifier with predictors derived from broad scale spatial datasets which allows the modeling approach to be easily replicated in other areas. The key predictors in the model describe topographic characteristics of the wetlands and climatic water deficits. We relied on two datasets that include daily wetland water level for 80 wetlands spanning 5 – 10 years in the Southeast and Upper Midwest of the United States for model training and validation. Water level measurements were converted to presence/absence of water to allow the incorporation of multiple data types (e.g., sensors, citizen observations, leaf off aerial imagery, etc.) and facilitate a robust model evaluation scheme. Models demonstrated good predictive performance with a mean balanced accuracy of 84% when compared to validation data. Efforts are now underway to test model performance in wetlands well outside of the training domain.

Nutrient pollution in Chattahoochee River watershed reservoirs – implications for monitoring and management

Becca Risser[1]

[1]Chattahoochee Riverkeeper

Session 2.5.2 Chattahoochee Updates

Excess nutrient pollution and resulting algae growth represents a major challenge in the management of reservoirs in Georgia and throughout the Southeast. The Chattahoochee River Watershed has three major reservoirs with state water quality standards for nutrients – Lake Lanier, West Point Lake and Walter F. George. Each has different watershed sizes, trophic conditions, and regulatory histories. Chattahoochee Riverkeeper has been monitoring chlorophyll a levels during the growing season in

Lake Lanier since 2010 and in WPL since 2014. Lake Lanier was placed on the 303(d) list as impaired for chlorophyll a in 2006 and a Total Maximum Daily Load (TMDL) Plan has been implemented in the watershed for 8 years. Considering recent water quality violations in West Point Lake and Walter F. George, we review the impacts of the Lake Lanier TMDL. Comparing the physical characteristics and pollution sources of these reservoirs may provide insights into considerations for future TMDLs.

Spatiotemporal variability in hatch success of Shoal Bass and Largemouth Bass in the Apalachicola-Chattahoochee-Flint Basin

Jamie Rogers[1], Amy Cottrell[2], Shannon Brewer[3], Stephen Golladay[1]

[1]The Jones Center at Ichauway [2]ICF [3]U.S. Geological Survey Alabama Cooperative Research Unit, Auburn University

Session 4.2 Aquatic Biota & Connectivity

For riverine fishes, spawning and subsequent survival of newly hatched offspring can be the most challenging period of their life cycle. Understanding factors contributing to survival, termed recruitment, is essential for conservation and management of fish species. Surprisingly, little is known about the reproductive requirements of many riverine species, including black basses (genus Micropterus). This is unfortunate because black bass provide numerous benefits including vibrant recreational fisheries, increasing river productivity through foraging, and act as umbrella species for river conservation efforts. Our study objective was to determine factors related to hatch success of endemic Shoal Bass M. cataractae and native Largemouth Bass, M. nigricans in the Apalachicola-Chattahoochee-Flint Basin. We used a hurdle model framework to analyze the hatch success of these species from different parts of the basin over seven years. Largemouth Bass hatch success was negatively related to water temperature but positively related to increasing discharge. Shoal Bass hatch success was negatively related to discharge variability and was greater during relatively stable flows on the descending limb of the hydrograph. Largemouth Bass typically hatched earlier and had a more protracted hatch duration than Shoal Bass. It appears that hydropeaking flows in regulated portions of the basin may alter hatch success of both species, particularly Shoal Bass. Our results indicate important species-specific relationships that influence successful hatching and underscore the importance of maintaining components of a natural flow regime. If the goal is to promote recruitment in these populations, then modifying of dam operations and managing angler exploitation during important spawning times may be important strategies to promote successful recruitment.

Georgia FIT: Securing Water for Mussels and Farmers in the Flint River Basin

Kristin Rowles[1], Anna Truszczynski[2], Matt Rowe[3], Cathy Marion[4], Gordon Rogers[5]

[1]Albany State University Georgia Water Planning and Policy Center [2]Georgia Environmental Protection Division [3]Georgia Department of Natural Resources [4]U.S. Fish and Wildlife Service [5]Flint Riverkeeper

Session 1.2 Georgia FIT/Flint HCP Panel

This moderated panel presentation will describe the Georgia Flow Incentive Trust's (GA-FIT) development and implementation of a basinwide aquatic conservation and water resource management project in the Lower Flint River Basin. The GA-FIT Drought SWAP program is providing farmers with alternative water sources for use during drought to support flows and improved conditions in aquatic habitat for freshwater mussels. GA-FIT partners, including the Georgia Water Planning and Policy Center and the Georgia Environmental Protection Division, are working with regional stakeholders to develop a Habitat Conservation Plan (HCP) for federally listed freshwater mussels.

An HCP is a tool provided for under the Endangered Species Act that accommodates economic development where it might cause limited and unintentional take of listed species. The Flint Region HCP specifies conservation measures that will avoid, minimize, and mitigate impacts to the listed species. The HCP will guide long-term commitments to conservation and water security in the region.

The panel discussion will describe the HCP and how it will transform water use management in the Flint River Basin. It will highlight successes and discuss challenges. The discussion will address project activities including mussel surveys, hydrologic modeling, well installation, farmer recruitment, stakeholder engagement, and policy implications. The discussion will place GA-FIT's efforts in the context of the past few decades of water resources management in the Flint River Basin.

Panelists will represent the broad scope of project partners, supporters, and stakeholders, including representatives of the Georgia Environmental Protection Division, the Georgia Department of Natural Resources, the U.S. Fish and Wildlife Service, the GA-FIT Advisory Board, and the Flint Riverkeeper. The panel will be moderated by a representative of Albany State University's Georgia Water Planning and Policy Center, which is a coordinating partner in this project. The panel presentation will include short presentations by the panelists (5-10 minutes) to be followed by a moderated discussion. The panel discussion will include opportunities for audience engagement with the panel.

Characterizing the microbial community structure across time and light conditions on wood veneers submerged in a freshwater pond

Ethan Rutledge[1]

[1]*University of Southern Mississippi*

Session 1.4 Aquatic Microbial Ecology I

Microorganisms play key roles in the cycling of nutrients and energy in freshwater ecosystems, including as photoautotrophs (algae and cyanobacteria) and decomposers (fungi and heterotrophic bacteria). The breakdown of recalcitrant substrates, such as lignocellulose, by decomposers can be altered by the availability of labile carbon from microbial photoautotrophs, with labile carbon subsidies either accelerating decomposition (positive priming) or slowing decomposition (negative priming). In a previous experiment, negative priming effects were detected in Quercus rubra wood veneers that were incubated in either shaded (dark) or unshaded (light) pond mesocosms for up to 263 days, where wood veneers had higher decomposition rates in the dark despite higher fungal productivity in the light treatments. In this follow-up study, we sampled DNA from those wood veneers to characterize changes in fungal and bacterial communities over time and between

treatments via ITS and 16S rDNA metabarcoding, respectively. Amplicon sequence variants (ASVs) were identified using DADA2 in R, and the metabolic potential of bacteria was predicted using PICRUSt2. PERMANOVA results indicated that microbial community composition (Jaccard dissimilarity of ASV counts between samples) differed significantly between both light and dark treatments and over time. However, light and dark treatments did not affect alpha diversity (ASV richness or evenness) of fungi or bacteria communities. As expected, Cyanobacteria (and metabolic pathways associated with photosynthesis) were significantly enriched in the light treatment. Predicted relative abundance of metabolic pathways related to the degradation of cellulose and pectin monomers (mannans, D-galacturonate) were higher in the dark, consistent with higher wood decomposition rates in the dark. Fungal ASV richness decreased over time independently of treatment, suggesting loss of early successional species as resources are depleted. Ongoing analysis of these data will investigate potential interactions and associations between specific photoautotrophic and decomposer taxa.

Integrating Publicly Available Datasets to Improve Conservation Practices for One of the Most Imperiled Taxonomic Groups on the Planet

Irene Sanchez Gonzalez[1], Seth Wenger[1], Ian Brunetz[2], Krista Capps[1]

[1]*University of Georgia* [2]*University of Alabama*

Session 2.2 Mussel Conservation

Freshwater systems, though covering a small portion of Earth's surface, host a remarkable diversity of species, yet over a third of freshwater animals are endangered or threatened. The conservation of these systems requires holistic approaches that account for complex species interactions. Freshwater mussels and fish are examples of interdependent groups, with mussels relying on fish to complete their life cycles. Despite the critical influence fish-mussel interactions have on mussel propagation and conservation, many conservation initiatives fail to account for the full complexity of host-mussel relationships, often prioritizing physiological compatibility over ecological suitability. Typically, host identification is conducted in laboratory trials, where glochidia from adult female mussels are exposed to potential host fish. This study employs publicly available datasets to examine co-occurrence patterns between mussels and their host fish across the Southeastern U.S., revealing significant gaps in our understanding of these relationships, particularly for vulnerable mussel species. Among the 229 mussel taxa assessed; 25 species exhibited less than 80% habitat overlap with their known hosts. Of these, 52% are classified as vulnerable, imperiled, or critically imperiled. Our analysis also identified two watersheds lacking any mussel species with identified hosts and a 100 containing at least one mussel species without confirmed hosts. Our findings emphasize the need for more refined host identification and species distribution into conservation strategies. We propose a decision framework that prioritizes host-mussel co-occurrence as a key factor in identifying potential hosts for species of conservation concern. Ultimately, a deeper understanding and conservation of biotic interactions, such as mussel-host relationships, are crucial for preserving the resilience of freshwater ecosystems and the diverse species they sustain.

Coastal Compound Flood Model Development and Operational Forecast Application

Taiya Sangoyomi[1]

[1]*Southeast River Forecast Center, National Weather Service*

Session 4.1 Water Forecasting

The Southeast River Forecast Center provides river flood forecasts in seven states in the Southeastern USA including Florida, Georgia, Alabama, Mississippi, South Carolina, North Carolina and Virginia. To do this, a rainfall-runoff model (Sacramento Soil Moisture Accounting Model or SAC-SMA) coupled with a hydrologic routing model are used to forecast flows, which are then translated to river level forecasts using a flow rating curve. This approach works well for freshwater inland river flooding, but not so for river flooding in coastal areas for two main reasons. The first reason is because the hydrologic routing model and flow rating curves cannot adequately handle the unsteady flows associated with coastal areas, while the second reason is due to compound flooding. Compound flooding occurs as a result of freshwater flows, abnormally high tides, storm surge and wind.

The SERFC approach to flood forecasting at these coastal areas is to couple the SAC-SMA model with a hydraulic model (HEC-RAS) that can handle the unsteady flows, and then incorporate storm surge and abnormally high tides through the downstream boundary conditions that are specified for the HEC-RAS model. The downstream boundary conditions are derived from the Surge and Tide Operational Forecast System (STOFS) and the Probabilistic Storm Surge (P-Surge) model.

This modeling approach has been successfully implemented and used for operational flood forecasting at several coastal locations within the SERFC area including in Florida (Alafia River), South Carolina (Waccamaw River) and Virginia/North Carolina (Blackwater/Chowan River). A case example of one of these will be presented.

Flood Forecasting Case Studies of 2024 Tropical Season

Taiya Sangoyomi[1]

[1]*Southeast River Forecast Center, National Weather Service*

Session 4.1 Water Forecasting

The 2024 Atlantic hurricane season was a very active one producing 18 named storms, 11 hurricanes, and 5 major hurricanes, with three of the major hurricanes affecting the Southeast River Forecast Center (SERFC) coverage area. These were Hurricane Debby (August), Hurricane Helene (September), and Hurricane Milton (October). These storms affected Florida, Georgia, South Carolina and North Carolina, bringing large precipitation amounts and causing severe flooding that resulted in loss of life and property damage.

The SERFC provided deterministic (single value) and probabilistic (ensemble) river forecasts prior to, during and after these storm events. A retrospective examination of these forecasts is provided as well as some of the more extreme flooding impacts.

Forming a Resilient Civil and Environmental Engineering Workforce Through Various Learning Opportunities at the Local, National, and International Levels

Felix Santiago-Collazo[1]

[1]*University of Georgia*

Session 1.5 Experiential Education

Civil and Environmental engineering is a multidisciplinary field that involves designing, building, and maintaining the infrastructure people use daily. This includes several challenges (e.g., infrastructure design to flood forecasting) and landscapes from inland river systems to vast coastal floodplains. However, this field is moving towards "greener" solutions amid climate change rather than focusing on the outdated "grey" approach. This change of design perspective is challenging to teach, and different strategies must be pursued so students can be better prepared to address such challenges. Thus, this presentation highlights two learning opportunities—service and experiential—that the University of Georgia's College of Engineering provides. These initiatives have made a positive impact on the local Georgia community, as well as neighboring states like the Carolinas, Florida, and Tennessee, and various international communities, including São Paulo, San Juan, and Great Abaco. Through these programs, participants gain cultural enrichment and valuable local knowledge. In our experiential program in engineering capstone design, our senior undergraduate students are presented with a "real-life" design challenge where they analyze an existing problem and find a suitable solution that services the community. Additionally, the Institute for Resilient Infrastructure System's faculty offers two new courses that serve as experiential learning opportunities for graduate water resources engineering students by focusing on natural-based solutions as the future endeavor to combat climate change impacts. Lastly, this presentation highlights strategies for principal investigators to include these learning opportunities in research proposals to produce competitive applications. Faculty aim to equip civil and environmental engineering students with a variety of learning experiences beyond the classroom. By doing so, they encourage students to adopt diverse perspectives when addressing design.

Development and Operational Use of Ensemble Hydrologic Models at Southeast River Forecast Center

John Schmidt[1]

[1]*National Oceanic and Atmospheric Administration, National Weather Service, Southeast River Forecast Center*

Session 2.1 Flood Modeling

The National Weather Service's (NWS) Southeast River Forecast Center (SERFC) maintains real-time hydrologic models to support the production of river level and water volume forecasts. Historically, these forecasts have been of a deterministic nature with a forecast time horizon of 5-7 days. Over the past 3 decades, the SERFC has leveraged the current antecedent states of its operational models to produce longer duration, probabilistic forecasts by applying a suite of different precipitation and temperature forecasts to its models.

In the 1990s and early 2000s, the NWS's Ensemble Streamflow Prediction (ESP) was implemented applying more of a climatological approach to describing future streamflow probabilities. In the late 2000s, raw precipitation and temperature ensemble members from the North American Ensemble Forecasting System (NAEFS) and the Global Ensemble Forecast System (GEFS), comprised of ensemble model runs from the NWS's National Centers for Environmental Prediction (NCEP) and the Canadian Meteorological Centre (CMC), began to be utilized in a program named the Meteorological Model Ensemble Forecast System (MMEFS). In the mid-2010s, a regional effort resulted in the application of the NWS Weather Prediction Center's Probabilistic Quantitative Precipitation Forecasts (PQPF) as a forcing dataset to produce probabilistic streamflow outputs. In 2021, SERFC completed its implementation of the Hydrologic Ensemble Forecasting System (HEFS), a bias-corrected, probabilistic streamflow simulation available across the entirety of the United States. Each of these methodologies has specific forecast horizons, assumptions, and visualizations. The assumptions, details, examples, and applications of each of these techniques will be presented.

SERFC Role in Riverine Flood Forecasting in the Southeast

John Schmidt[1]

[1]*National Oceanic and Atmospheric Administration, National Weather Service, Southeast River Forecast Center*

Session 4.1 Water Forecasting

The Southeast River Forecast Center (SERFC), located in Peachtree City, Georgia, is a branch of the National Weather Service with a staff of 15 hydrologists, civil engineers, meteorologists, and geographers. The center is responsible for the production of river forecasts for all rivers that drain into the Atlantic Ocean along the coasts of North Carolina, South Carolina, Georgia, and Florida, as well as the rivers that drain into the Gulf of Mexico from Mobile Bay to the southernmost tip of Florida -- an area of almost 270,000 square miles. To accomplish this mission, SERFC develops, maintains, and operates hydrologic and hydraulic models and produces real-time precipitation forcing data that drive the forecast process. SERFC forecasts and data are used by a wide range of federal, state, and local partners as well as the general public for daily, flood, and water resource decision making. This presentation will provide an overview of SERFC's flood forecasting process as well highlight key applications of SERFC's operational information.

Septic Wastewater Effluent Impacts on Urban Soil Biogeochemistry and Tree Condition

Courtney Scott[1]

[1]*University of Georgia*

Session 2.4.2 Wastewater

In the United States, on-site wastewater treatment or septic systems are used in approximately 25% of residences. These systems utilize soil biogeochemical processes to filter carbon, nitrogen, and phosphorus from wastewater effluent. This process can result in the addition of nutrients, organic

matter, contaminants, and water into leach field soil. Many city ordinances stipulate trees should not be planted within 50 feet of these systems; however, many trees can be found inhabiting septic leach fields. Little is known about how the shifting soil biogeochemistry and hydrology in leach fields can impact soil and tree health. The goals of this study were to (1) investigate the impact of septic effluent on soil chemical and physical properties and (2) assess tree responses to different soil conditions. To evaluate septic leach field tree and soil conditions, we established paired plots within and outside of septic leach fields at 9 residences in Athens-Clarke County, Georgia. In each of these plots we have collected soils and installed lysimeters. Soils were analyzed for nutrient content, soil organic matter quantity and quality, as well as other chemical and physical properties. Soil leachate was analyzed for nutrient composition. Tree growth, history, and condition were assessed using diameter at breast height, height, crown condition, species identification, mechanical injury, and infestation/infection rates. Preliminary data suggests that soil pH and bulk density were similar between leach field and non-leach field plots in the same residence. However, nutrient analysis of the leachate indicates higher concentrations of nitrate within the leach field soils and at sites with newer septic systems. We expect the results of this project to inform management practices that will improve urban soil quality and tree health.

Incorporating the Multiple Dimensions of Equity into Water Infrastructure Projects

Cydney Seigerman[1]

[1]*University of Georgia*

Session 3.1 Substance in Resilience

Amidst direct attacks on efforts to promote equity and environmental sustainability by the Trump administration, effectively incorporating equity into water resource infrastructure (WRI) projects remains essential. Unequal distribution of risks and benefits and top-down approaches associated with traditional hydrological infrastructure undermine the present and future wellbeing of local communities throughout the United States. While project managers may be willing to incorporate equity considerations, there is little guidance on how this may be done. In this presentation, I present a framework developed through the collaboration between anthropologists and US Army Corps engineers to address the multiple dimensions of equity in WRI projects. I then highlight "bright spots" that can serve as examples for future infrastructure projects and discuss how nature-based solutions can serve to promote socioecological equity in water infrastructure. By examining how to operationalize equity at the WRI project level, this presentation emphasizes the importance of everyday decisions, respectful engagement, and sets of values at the project level to advance equity, notwithstanding (the lack of) overarching policies and standard procedures at the national level.

Incorporating the Multiple Mapping Urban Flood Risk: Identifying Floodplain Communities and the Role of Greenways in Mitigating Risk of Equity into Water Infrastructure Projects

Haley Selsor[1]

[1]*University of Georgia*

Session 5.3.1 Urban Green Infrastructure

Flooding is among the most frequent and expensive natural disasters in the United States, and in urban areas, expanding development in tandem with climate change is increasing flood risk for concurrently growing urban populations. To understand the impacts of a changing hydrologic regime on flood exposure, we conduct hydraulic modeling with Monte Carlo simulations to produce probabilistic floodplain maps (PFM). The PFMs depict the distribution of flood risk rather than producing a single, deterministic boundary. The inundation from the PFM will be compared to the National Flood Insurance Program's Special Flood Hazard Area (SFHA) and be used to estimate the number of people at-risk and explore the demographics of who resides in the urban floodplain. Comparing the PFM predictions to the SFHA can reveal where flood risk is being under-communicated and potential impacts to households at-risk yet unaware. Flood management on urban rivers typically focuses on the 1% annual exceedance probability (AEP) event, and such management approaches coupled with green infrastructure, which is more efficacious for smaller, higher frequency events, can build overall urban flood resilience by considering the full range of flood frequencies.

Advancing LID Implementation Through DOD-UGA Partnerships — A Case Study and Reality-Check on an Important Resilience Policy

~~Matthew Shudtz~~[1], Daniel Wyatt[1], Alfie Vick[2], Jon Calabria[2], Rachel Dingley[2], Brent Widener[3], Matt Gauldin[2]

[1]*University of Georgia Carl Vinson Institute of Government* [2]*University of Georgia College of Environment + Design* [2]*U.S. Army, Fort Moore*

Session 5.4 LID at Fort Benning

As the Department of Defense invests in climate resilience, improvements to handle stormwater runoff will be a significant point of focus. An interdisciplinary team from UGA will share their experiences addressing this challenge in partnership with staff at Fort Moore. Fort Moore's airfield abuts Laundry Creek, which has changed in ways that threaten the airfield's operability as a result of development in the watershed and increased storm intensity. A stream restoration proposal created by the UGA team will protect the military mission, but the analysis they conducted in support of the design highlights the need to reduce stormwater flows across the watershed. Faculty from UGA are now working across departments and with support from students to identify opportunities for implementing Low Impact Development (LID) practices at sites around Fort Moore. Examples will be presented by the panel. Our panel will then explore the implications of this case study for the broader DOD enterprise, which could deliver major benefits across the country and serve as inspiration for other infrastructure planners and asset managers in state and local governments or large private entities. The underlying problem of too much impervious surface is not unique to Fort Moore, and is part of the reason why Congress passed Section 438 of the Energy Independence and Security Act of 2007, requiring the use of "site planning, design, construction, and maintenance strategies … to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology" of all

Federal facilities. Panelists will present a summary of this and other legal or regulatory requirements, as well as insights about how they are implemented in practice.

Reclaimed Limestone Quarries: An Alternative Groundwater Resource for Georgia's Future

Noah Slade[1]

[1]*Nutter and Associates, Inc.*

Session 4.6 Groundwater

Obtaining reliable water resources in the southeastern United States is becoming more difficult as competition for groundwater and surface water sources increases. Abandoned quarries fed by groundwater offer potential raw water resources without the complications associated with the development of traditional surface water sources like rivers and reservoirs, especially when completed into water-bearing units like limestone or other productive fractured rock aquifers. This study evaluates potential groundwater yields, water quality, and water storage of three flooded limestone quarries in Bartow County, Georgia. The quarries were pumped for 30-day periods at rates of 1,500 to 3,000 gallons per minute, while precipitation, evaporation, groundwater levels, pond drawdown, and pond outflows were monitored onsite. A three-dimensional bathymetric model of each quarry pond was generated in GIS from sounding measurements prior to pumping and used to calculate pond volumes and surface areas at each drawdown level. The monitoring and bathymetric data were incorporated into a mass balance model to estimate groundwater yields, which ranged from 0.5 to 1.5 million gallons per day. Higher yields generally occurred in larger basins, after heavy rainfall, and with increased pond drawdown. Water quality sampling conducted before and after the pumping tests indicated the quarry water is generally high quality and will meet drinking water standards with minimal treatment. Numerous other quarries in Georgia offer potential for raw water sources, but site-specific geologic and hydrologic limitations should be accounted for. Quarries with limited groundwater recharge may still be favorable for storage of other raw water sources.

DNA metabarcoding reveals spatiotemporal patterns of invertebrate diversity in a headwater stream

Chelsea Smith[1,2], Daniel Allen[3], Jonathan Benstead[2], Michelle Busch[4], Stephen Plont[2], Carla Atkinson[2]

[1]*The Jones Center at Ichauway* [2]*University of Alabama* [3]*Pennsylvania State University* [4]*University of Kansas*

Session 4.2 Aquatic Biota & Connectivity

The dendritic structure of stream networks makes them unique ecosystems in which to examine species diversity within ecological communities. Headwater stream networks are ubiquitous and make disproportionate contributions to biodiversity and ecosystem function. We used DNA metabarcoding to examine invertebrate diversity patterns across varying spatiotemporal scales within a small (1 km2), forested headwater catchment in Alabama, USA, from October 2021 to January 2023.

DNA metabarcoding allowed for the quantification of taxa present at the genus or species level across different sampling approaches. Specifically, we examined how diversity varies across time and space, what drives beta diversity, and how temporal diversity compared across sites. We sampled at the stream outlet every 3 weeks (temporal; 2021-2023), seasonally (March, June, August, January 2022-2023) at seven sites across the network (spatiotemporal), and during a synoptic sampling event (spatial) covering 27 sites (June 2022). Spatial sampling captured the greatest overall diversity (154 taxa), followed by spatiotemporal (109), and temporal (42) sampling. Richness and local contributions of richness to beta diversity decreased with distance from the outlet in the spatial sampling; however, two sites near a beaver pond in the watershed had the highest taxa richness, reinforcing the importance of spatial habitat diversity as a driver of species richness in stream networks. Rare taxa tended to occur in smaller tributaries, which generally had lower diversity. Comparing diversity across sites before and after a hydrologic contraction event revealed that more upstream sites lost fewer taxa after contraction compared to those near the outlet, likely due to the loss of more perennial flow-adapted taxa farther downstream that never established in upstream sites. By considering spatial and temporal variation simultaneously, our study provides insights into the patterns and processes that drive species richness in headwater stream networks.

Building a Regional Network to Study the Influence of Climate Change on Contaminants of Emerging Concern

Katy Smith[1]

[1]*University of Georgia*

Session 3.4 Contaminants

Sea Grant programs in the southeast have teamed up to address contaminants of emerging concern (CECs) through the project, “Building a Regional Network to Study the Influence of Climate Change on Contaminants of Emerging Concern.” In the project, South Carolina Sea Grant Consortium, Marine Extension and Georgia Sea Grant, and the National Sea Grant Law Center (NSGLC) are supporting research, extension, and outreach activities aimed at better understanding the impacts of CECs in the region. The NSGLC conducted a legal scan to evaluate how each state – South Carolina, Georgia, and Florida – is responding through policy regarding CECs. In addition, the regional team is facilitating development of a regional CEC network through which researchers, extension specialists, educators, and policymakers can identify those working in specific CEC areas and connect as needed. UGA Water Resources Specialist, Katy Smith, will join the panel to share project insights and future directions and needs from the extension perspective.

Ecosystem services of isolated wetlands in longleaf pine forests: amphibian diversity

Lora Smith[1], Jade Samples[2], Jennfier Howze[1], John Maerz[2]

[1]*The Jones Center at Ichauway* [2]*University of Georgia Warnell School of Forestry and Natural Resources*

Session 2.3 Georgia Wetlands Post-Sackett

Geographically isolated wetlands (GIWs) are often recognized for their importance in supporting biodiversity. This is particularly true for amphibians in wetlands embedded within native terrestrial systems such as longleaf pine (Pinus palustris) forests, where >30 species of amphibians can occur. More than a third of these species breed exclusively in GIWs including two federally-listed species (reticulated flatwoods salamander, Ambystoma bishopi; frosted flatwoods salamander, A. cingulatum), one species under review for federal listing (gopher frog, Rana capito), and a state-listed threatened species (striped newt, Notophthalmus perstriatus). Their larvae rely on aquatic systems, whereas juveniles and adults spend the non-breeding season in adjacent upland habitats. These species, like other amphibians that breed in GIWs, generally have a long life span, high reproductive potential, and some degree of plasticity in larval development as adaptations for cycles of wetland filling and drying. However, reproductive success is dependent on minimum thresholds of hydroperiod length. Additionally, extended hydroperiods may increase annual reproductive output of species with facultative paedomorphosis. Therefore, management of wetlands and the surrounding forests to increase wetland hydroperiod is critical to support amphibian diversity.

Role and Applications of the USGS Hydrologic Monitoring Network in Georgia

Robert Sobczak[1]

[1]*U.S. Geological Survey*

Session 1.6 Surface Hydrology

The U.S. Geological Survey's (USGS) hydrologic monitoring program delivers critical data that supports water resource management, tracks hydrologic trends, and informs decision-making with accuracy and reliability. Often viewed as a single, unified national network, the USGS monitoring is a collection of smaller networks funded by federal, state, and local partners.

The USGS monitoring network in Georgia exemplifies this model. Financially supported by over 80 cooperators, Georgia's USGS network includes more than 300 streamflow and precipitation sites, 150 water quality sites, 175 groundwater sites and approximately 100 locations for collecting storm tide measurements. The network covers every basin, aquifer, and major waterway in Georgia, providing continuous real-time data, with historical records that span decades. Additionally, there are 23 streamgages that have been in operation for over a century.

The partnership between the USGS and its cooperators assist in site specific monitoring objectives while also providing information for local and regional water resource management. The USGS ensures that all data meet nationally consistent and rigorous scientific standards. These data is integrated into a central database and applied to advanced tools and applications, including the USGS National Water Information System (NWIS) Web, USGS Water Data for the Nation, USGS National Water Dashboard, USGS Flood Event Viewer, USGS StreamStats, and National Weather Service flood forecasts. This robust network supports a wide range of applications, such as tracking long-term hydrologic trends, conducting time-of-travel assessments, analyzing flood frequencies, designing infrastructure, evaluating water supply availability, meeting regulatory standards, assessing drought impacts, and preparing water year summaries.

Lower Flint River Basin Habitat Conservation Plan: Inundation Models of Low-Flow in HEC-RAS

Julian Spergel[1], Stephen Golladay[2]

[1]*Georgia Environmental Protection Division* [2]*The Jones Center at Ichauway*

Session 2.2 Mussel Conservation

As part of the Lower Flint Region Habitat Conservation Plan (LFRB HCP), GAEPD developed HEC-RAS river models using field mapping of bathymetry provided by the Jones Center for nine stream representative reaches in the Flint River Basin. In this presentation, we describe the field data collection, model formation, and model processing steps within this inter-agency conservation plan to mitigate 'take', i.e. environmental harm, by future agricultural water usage. The LFRB HCP selected nine stream locations where protected freshwater mussels live, near to USGS river gages: Chicksawatchee Creek, Chokee Creek, Kinchafoonee Creek, Muckalee Creek, two locations on Ichawaynochaway Creek, two locations on Spring Creek, and one location on Flint River.

Our nine models are based on the bathymetry and river discharge data collected by the field work of the Jones Center. We use an Acoustic Doppler Current Profiler to record both stream velocity and water depths within a section of stream. We use a combination of our field team's continuous depth sensor and staff gage readings and USGS river gage data for water height and river discharge readings. The stream bathymetry is mapped by extrapolating the water depth data points with Inverse Distance Weighting (IDW), then adding the resultant raster to the stream's concurrent water surface elevation.

HEC-RAS models are constructed using these bathymetry maps, then calibrated from discharge-water height observations. These calibrated models can then be used to calculate the rating curve and map the spatial distribution of inundation, or instream habitat, as discharge is decreased. GAEPD uses these HEC-RAS models to estimate available instream habitat at low flows of specific magnitude in each representative stream reach, calculating the water depth, spatial coverage, connectivity, and duration of instream habitat under each flow scenario. Estimates of impacts to instream habitats inform and confirm the habitat surrogate approach to take estimation.

The role of volunteer water quality monitoring in finding failing wastewater treatment plants: Case studies from the Chattahoochee watershed

Jessica Sterling[1]

[1]*Chattahoochee Riverkeeper*

Session 2.5.2 Chattahoochee Updates

Chattahoochee Riverkeeper (CRK) has developed a successful volunteer water monitoring program to monitor over 200 sites in the Chattahoochee River and its tributaries for E.coli bacteria. Over the past 14 years, the Neighborhood Water Watch program has demonstrated repeated success in identifying failures in the sewer collection system. In 2023 and 2024, however, data generated by this program helped Chattahoochee Riverkeeper identify four wastewater treatment plants that were unknowingly

violating their NPDES permits, highlighting key failures of the Clean Water Act. CRK is using multiple strategies to prevent the Chattahoochee from violating water quality standards due to plant failures and protect downstream river users from the public health threats of partially treated wastewater. CRK's strategies include increased monitoring of wastewater outfalls throughout the watershed, pressure on local governments and state environmental agencies, and Clean Water Act litigation. The Chattahoochee River and its mainstem reservoirs are at risk for violating water quality standards due to high nutrient loads in wastewater effluent from failing treatment plants, and opportunities for safe river recreation are at risk due to bacterial contamination. Despite three decades' worth of improvement in water quality in the Chattahoochee, recent and emergent pollution problems represent threats to this progress.

Evolving Southeast River Forecast Center's Delivery of Hydrologic Information

Haley Stuckey[1]

[1]*National Weather Service, Southeast River Forecast Center*

Session 4.1 Water Forecasting

The Southeast River Forecast Center (SERFC) has a strong legacy of working closely with partners to deliver targeted hydrologic information that spans back decades. That partner support continues to this day, though its delivery is constantly evolving. This evolution has come in several forms, including standardization of briefing creation, allowing for quicker production and a more consistent look with the rest of the National Weather Service. Though the SERFC is a regional office, hydrologic information is still able to reach the local-level decision makers through the help of the local Weather Forecast Office (WFO). An effort was made to develop tools for the WFOs we serve to make that process easier and more consistent. Targeted decision support and close collaboration with partners has always been a part of the SERFC operating model, but in recent history that support is beginning to become more formalized. All of these tools have historically been used across social media platforms, the SERFC website, and distributed through emails, but recent efforts have been made to be more intentional and targeted with these dissemination methods. SERFC social media in particular is currently undergoing changes to be more deliberate with messaging and engagement. Looking to the future, SERFC's delivery of decision support services will continue to evolve and adapt, particularly as NWS flood inundation mapping is rolled out across the country. This will make the huge leap from taking information from a standard hydrograph at a point location and expressing impacts based on a gage height, to putting that hydrologic information on a map and allowing for the visualization of flood extent and potential impacts. While probabilistic information has been a part of SERFC decision support for some time now in the form of ensemble river predictions, it is expected to become more widely ingrained as it becomes further incorporated into NWS operations, which will give partners uncertainty information and help them make better decisions based on their own level of risk tolerance. A timeline of SERFC decision support services, centered around recent developments and future plans, will be the focus of this presentation.

Implementation of Operational Flood Inundation Mapping in the Southeast

Haley Stuckey[1]

[1]*National Weather Service, Southeast River Forecast Center*

Session 4.1 Water Forecasting

Flood Inundation Mapping, or FIM, is a service introduced by the National Weather Service (NWS) that intends to provide more robust and actionable river flooding information to partners and decision makers. This service is meant to "put water on a map" by taking model and River Forecast Center forecast data and using that to create a visualization of flood extent and any potential impacts. NWS FIM has been publicly unveiled in stages across the country over the past couple of years, and will become publicly available across the entire nation in the fall of 2026.

In preparation for this service's introduction in the Southeast, the Southeast River Forecast Center first developed training plans and materials to familiarize staff with this new tool and learn to provide meaningful interpretation. The SERFC then constructed a plan for how to effectively incorporate FIM into operations, detailing things such as what time will be dedicated, how resources and staff would be allocated to it, and how operational procedures would adapt to different magnitudes of flooding events. During the floods of the 2023 and 2024 hurricane seasons, this concept of operations was able to be implemented, and the lessons learned will be used to further refine and adapt operating procedures in order to incorporate this new service, while continuing to be effective in delivering existing products and services. This presentation will specifically focus on the strategies and experiences of the SERFC during planning and implementation of FIM.

Experiential learning with INVURTS to help students enrich their ecological understanding and build skills

Elizabeth Sudduth[1]

[1]*Georgia Gwinnett College*

Session 1.5 Experiential Education

Aquatic macroinvertebrates are an excellent community for use in classes and outreach with undergraduates (and younger students!) because sampling and basic identification are not too challenging for most students and connections are easily made to important ecological concepts like bioindicators, community biodiversity indices, and correlation with long-term datasets. In classes over the years, I have frequently had students complete stand-alone projects where they sampled 2 or more streams and compared the communities to test their own hypotheses based on their site observations. More recently, this has expanded into the Ecological Research as Education Network (EREN) project Investigations with NEON: Variability of macroinvertebrates versus Urban and Rural Temperature dynamics in Streams (INVURTS). The overarching goal of this project is to test hypotheses about the relationship between temperature variability and macroinvertebrate biodiversity at the macrosystem level, across different biomes and levels of human impact. Students all over the country are using standardized methods allowing them to test their own hypotheses by comparing their data to locally collected long-term temperature data, to data from other students across the county, and to data from the National Ecological Observatory Network (NEON), sites that

are much less impacted than those most students will ever sample themselves. The large temperature datasets help students begin to learn the big data analysis skills that are commonly needed in environmental careers today. Students also help collect samples for eDNA analysis, which in the future will provide additional connections as students will see similarities and differences between manual and eDNA macroinvertebrate community samples. I will show a few examples of class and individual student work using our data here in Georgia to demonstrate the possibilities of a large-scale experiential learning project for student learning at different levels and perhaps spark some attendee interest in joining our project in the future. https://erenweb.org/active-projects/invurts/

Assessing the Contribution of Recalcitrant Organic Phosphorus to the Soluble Reactive Phosphorus Pool through Microbial Mineralization in Freshwaters

Iffat Tasnim[1], Tasnuva Farnaz[1], Francisco Cubas[1]

[1]*Georgia Southern University*

Session 5.5 Phosphorus and Algae

Organophosphorus, such as inositol phosphate (IP), may serve as a source of orthophosphate (OP) in freshwater. In the absence of OP, competent aquatic microorganisms start producing specialized enzymes to acquire growth-sustaining OP from organic-P forms. The contribution from recalcitrant organic-P to the OP pool has been overlooked due to the lack of tools capable of accurately measuring OP production from organic-P. The objective of this study was to quantify OP production from IP, a surrogate form of recalcitrant organic-P, to assess the contribution of recalcitrant P forms to the total OP pool that fuels algal blooms in streams draining agricultural and suburban watersheds. This study also sheds light on the presence of different forms of phosphorus in freshwater sediments along with IP. Experimental results showed that IP was found in sediment samples collected in downstream areas of agricultural fields and forest land. IP levels ranged between 2 and 5% of the total organic-P extracted, emphasizing the presence and availability of recalcitrant P in freshwater systems. At the same time, no significant levels of IP were found in sediment samples receiving water from a wastewater treatment plant. A fluorescence probe serving as a substrate analog for phytic acid (myo-inositol hexakis phosphate) was used to measure the enzymatic activity required for IP mineralization to quantify OP production from IP accurately. Results from microcosm experiments showed that IP mineralization was possible in the absence of OP under different environmental conditions (i.e., aerobic vs. anaerobic). IP mineralization rates were higher in anaerobic and reduced environments than in aerobic environments. Although IP abundance and IP mineralization rates were relatively low, the results highlighted the importance of considering recalcitrant organic-P as a viable source of SRP in freshwater systems.

Leading the Way in Oil Spill Cleanup: Polyetherimide Electrospun Mats

Rosemary Thomas[1]

[1]*Indian Institute of Technology Delhi*

Session 3.4 Contaminants

The 'blue tapestry of our planet',ie, the deep sea oceans offers fascinating insights into the world of exploratory science which makes us feel as if we are merely a tiny speck in this diverse universe.Oil drilling in the profound depths,driven primarily by economic gain, have garnered tremendous downfalls to ecological system that are already grappling against adverse conditions such as extreme alkalinity, poor sunlight and intense pressure.The debacle caused under the guise of 'ecorent' dichotomises the views of industrialists and ecologists apart similar to the scrambled pieces of an unsolved jigsaw puzzle.One of the most lamented environmental catastrophes in the world such as the Deepwater Horizon oil spill in the Gulf of Mexico, in 2010, have grabbed media attention worldwide.Technocrats have crafted numerous ways to tackle oil spill cleanup by use of chemical dispersants, skimmers, sorbents ,etc, out of which, sorbent materials exhibiting high sorption capacities, selective wettability and excellent reusability checks all boxes and proves to be the most facile technique so far.Though exhibiting high oil sorption capacity, commercial sorbents like PP,PS,cellulose,etc hit the buffers at high temperatures.In this study, the fabricated Polyetherimide based electrospun fibres sparks a difference in fibre cross-sectional morphology with varying solvents such as Dichloroethane and N-Methyl Pyrrolidone due to a stark contrast in their boiling points inflicting upon morphological change from dumbbell shaped to circular shaped cross-section.Upon scrutiny, dumbbell shaped fibres showcases better surface area,highly aligned inter fibre channels, resulting in higher capillary pressure, all contributing to more oil sorption capacity than it's circular counterpart.These membranes upon crosslinking using Ethylenediamine(EDA) withstands temperatures as high as 150C and display an oil sorption capacity of 25.4 ±1.5 g/g of engine oil within one hour.Alongside these attributes,it also demonstrates lower BOD and COD levels within permissible limits, a feature scantly researched in the context of electrospun mats.

Local Governments and Wetlands Protection

Steffney Thompson[1], Molly Bogle[2], Carol Myers Flaute[3], Bill Sapp[4]

[1]University of Georgia [2]City of Madison [3]Northeast Georgia Regional Commission [4]Southern Environmental Law Center

Session 1.3 Local Governments and Wetlands Protection Panel

Wetlands offer critical benefits for water quality and flood mitigation, while also providing essential habitat for plants and animals. The Supreme Court's Sackett v. EPA decision (2023) reduced federal wetlands protection by narrowing the criteria for which wetlands are considered regulated waters of the U.S. This session will explore implications of the decision on federal wetlands protection regulations, describe state requirements, and introduce regulatory and non-regulatory options for how local governments can address the gap in protection created by Sackett to manage and protect local wetlands.

Panelists:

Molly Bogle, Asst. Planning Director, City of Madison. Bogle guides short- and long-range planning efforts as well as program and policy implementation for the City of Madison. She will provide examples of how small rural communities can leverage limited local dollars with a variety of state and

federal resources to acquire and protect sensitive natural resources for perpetual conservation and passive recreation purposes while also encouraging sustainable development in specific areas through a local transfer of development rights program.

Carol Myers Flaute, Senior Community Planner, Northeast Georgia Regional Commission. Myers assists local governments in twelve counties with plan development and implementation. Her previous work at the Nebraska Department of Resources focused on regional integrated water management planning and interstate water compacts. During the session, she will provide a broad overview of actions local governments can take to protect the wetlands within their jurisdiction, including both voluntary and regulatory options.

Bill Sapp, Attorney. Sapp is a senior attorney with the Southern Environmental Law Center where he works on wetlands and coastal issues.

Steffney Thompson, Assistant Clinical Professor, the University of Georgia School of Law. The US Supreme Court case, Sackett v. EPA, altered the definition of wetlands protected by the Clean Water Act sec. 404 program, greatly reducing the scope of the CWA. 24 states, including Georgia, do not have independent wetland protection requirements or permitting programs. The CWA does not prevent state and local wetlands protection. Georgia has a number of laws that provide some protection to certain wetlands from certain activities (Coastal Marshland Protection Act, Erosion and Sedimentation Act, River Corridor Act). Local governments retain the ability to protect wetlands in order to advance legitimate health, safety, and general welfare goals.

Algal community shifts and cyanobacterial blooms in large rivers are more likely to occur at extreme light and temperature conditions

Dalton Tryba[1], Justin Murdock[1]

[1]*Tennessee Technological University*

Session 4.5 Nutrients, Carbon, & Algal Blooms

Harmful algal blooms (HABs) in large rivers are increasing, posing a risk to drinking water, recreation, and ecological stability. Our knowledge of how light and temperature alter community compositions and promote HABs in large rivers lags behind that of lakes, as flowing water can create a more complex environment with continuously changing resource availability. This study examined the effects of light intensity and temperature on algal community composition shifts and maximum cyanobacterial bloom potential in the Cumberland River near Gainesboro, TN and the Ohio River near Huntington, WV. The algae were incubated for 14 to 35 days across light gradients of 20 to 1,100 µmol m-2 s-1 and temperature gradients of 10 to 38 °C. In the Ohio River, the cyanobacterium Microcystis sp. dominated in light above 750 µmol quanta m-2 s-1 and temperatures above 27 °C. For both rivers, the cyanobacterium Dolichospermum sp. dominated below 150 µmol quanta m-2 s-1 and 18 °C. Communities were mostly diatom and green algae-dominated in between these values. The highest cyanobacteria growth in both rivers occurred above 750 µmol quanta m-2 s-1 and 28 °C or below 50 µmol quanta m-2 s-1 and 25 °C. These results suggest eukaryotic algae may be better competitors for resources and inhibit HABs when light and temperature are not at extreme values. Additionally, the similar community response to light and temperature between rivers provides some

evidence that the observed trends may hold across large rivers, which is important to developing universal protocols for large river HAB management.

Evaluating the Conservation Benefits of Large-scale Floodplain Restorations: The Biodiversity Science of Levee Setbacks

Charles van Rees[1,2], Rabindra Parajuli[1], Matt Chambers[3], Seth Wenger[1,2], David Crane[4], Deepak Mishra[5], Mark Dixon[6]

[1]University of Georgia Odum School of Ecology [2]University of Georgia River Basin Center [3]University of Georgia College of Engineering [4]U.S. Army Corps of Engineers Omaha District [5]University of Georgia Department of Geography [6]University of South Dakota

Session 3.1 Substance in Resilience

Levee setbacks are quickly becoming a flagship nature-based solution (NbS) to managing flood risk due to their multiple co-benefits beyond flood management, including nutrient reduction, and groundwater infiltration, and space for recreation. From an ecological perspective, these levee realignments, undertaken by infrastructure agencies like the U.S. Army Corps of Engineers (USACE), are large-scale, high-budget floodplain restorations. However, their conservation benefits are poorly understood. Here, we describe an ongoing, NASA-funded effort leveraging remote sensing, hydrological modeling, artificial intelligence, automated recording units, and field biology to quantify and predict the conservation benefits of levee setback projects along the Lower Missouri River. As one of the USA's largest rivers, this flood-prone system once had a complex, braided channel with diverse floodplain and oxbow habitats, but this was lost to extensive levee buildup in favor of agricultural development and channelization for commercial navigation. As flood regimes change, these levee systems are increasingly failure-prone, prompting tens of millions of dollars of investment in flood control. In the last decade, this has led to several setbacks, including one recently approved South of Omaha, Nebraska. By quantifying habitat cover and the species composition of bird, bat, anuran, and woody plant communities in existing floodplains and setbacks, we are training linked ecological models to predict habitat creation and species conservation benefits from planned and future levee setbacks. This collaborative work will allow USACE and other organizations to account for biodiversity in large-scale water management infrastructure decisions.

Ecological Theory, Biodiversity, and the Resilience of Nature-based Approaches to Water Management

Charles van Rees[1,2]

[1]University of Georgia Odum School of Ecology [2]University of Georgia River Basin Center

Session 5.2 Aquatic Biota & Restoration

Nature-based Solutions (NbS) like Natural Infrastructure (NI) leverage restored, managed, or artificial ecosystems to achieve societal goals like sustainable development and climate adaptation through ecosystem services. According to proponents, two of the major advantages of these

approaches over conventional engineering solutions are (1) their environmental sustainability, including the potential to promote wildlife conservation, and (2) their self-repairing properties and resilience to disturbances. Both of these advantages may ultimately be underpinned by the ability of nature-based features to support viable ecological communities, or local biodiversity. Ecological theory suggests that biodiversity can enhance the delivery of multiple ecosystem services, and increase the resilience of ecological systems to perturbations. In this talk, I suggest that research on the biodiversity of NbS and its relationship to ecosystem function and resilience is of critical importance to advancing resilient infrastructure and ecosystem-based adaptation strategies.

Diversity of nearshore bacterial communities along the Mississippi Gulf Coast

Stephanie Vaughn[1], Jacqueline Pavlovsky[1], Colin Jackson[1]

[1]*University of Mississippi*

Session 2.4.1 Aquatic Microbial Ecology II

Understanding how bacterial communities vary spatially and temporally could aid in assessing ecosystem health along the Gulf Coast. To investigate seasonal and spatial patterns in bacterial community structure, water and sand samples were collected from 10 sites along the Mississippi Gulf Coast over the course of a year. 16S rRNA gene sequencing revealed that the coastal bacterial community differed between water and sand, by location, and by month of collection. Spatial patterns were more pronounced than temporal patterns, with sand and water communities influenced more by distance between sample sites than month of collection. Water bacterial community composition was driven by pH, salinity, and temperature, while sand bacterial communities were influenced primarily by temperature. Bacterial species richness and diversity were higher in sand than water, with both varying by site and month. Relative abundances of major bacterial phyla also differed between water and sand, location, and collection month, although members of the Bacteroidetes, Gammaproteobacteria, and Alphaproteobacteria were predominant across samples. Cyanobacteria accounted for a greater proportion of the seawater bacterial community than that of sand, and proportions of Cyanobacteria were positively correlated with water temperature. These findings reveal the dynamic nature of nearshore bacterial communities along the Mississippi Gulf Coast, potentially offering insights for coastal ecosystem management across seasons.

Assessing the Impact of Floridan Aquifer Withdrawals from Bryan and Bulloch Counties utilizing Georgia's Coastal Sound Science Initiative (CSSI) DYNSYSTEM Model.

Christine Voudy[1], Wei Zeng[1], Xinjun Zhu[1], Feng Jiang[1]

[1]*Georgia Environmental Protection Division, Watershed Protection Branch*

Session 5.6 Coastal & Coastal Plain Groundwater

The CSSI model is a 14-layer finite element model with a model domain that includes the entire Georgia coastline and portions of Florida and South Carolina. The CSSI model is Georgia's primary tool for assessing Floridan Aquifer withdrawals along Georgia's coast.

In October 2024, Georgia Environmental Protection Division issued two groundwater withdrawal permits to Bryan and Bulloch Counties for wells located in Bulloch County to withdraw an aggregated 6.625 million gallons per day (mgd) from the Floridan Aquifer. This presentation will provide background and specifics on the CSSI model, summarize the simulation results of the 6.625 mgd withdrawal on the Floridan aquifer in Coastal Georgia, detail how EPD reviewed and presented the simulated local and regional impacts to interested stakeholders.

Using population dynamics models for freshwater mussel conservation

Eric Walther[1,2], Matt Rowe[3], Mary Freeman[1,2], Seth Wenger[1,2]

[1]University of Georgia River Basin Center [2]University of Georgia Odum School of Ecology [3]Georgia Department of Natural Resources

Session 2.2 Mussel Conservation

Understanding how freshwater mussel populations respond to different environmental and biotic conditions is critical for conservation panning. Mark-recapture data, commonly collected in long-term monitoring programs, can be used to parameterize population dynamic models that estimate key population values and rates such as annual survival, recruitment, and abundance. In this talk, I will discuss how long-term mark-recapture-recovery data can be used to estimate freshwater mussel population parameters and common challenges encountered during model development. A proposed analysis of data collected by the Georgia Department of Natural Resources as part of a long-term monitoring program of five stream reaches in the Lower Flint River Basin will be used to demonstrate the modeling framework. Monitoring surveys have been conducted at the five stream reaches (n = 14 – 19 surveys) between 2005 and 2024, during which 24 species and 19,026 individuals were tagged among stream reaches. However, the number of species (4 – 16) and the number of tagged individuals of a given species (1 – 2,057) varied within and among stream reaches. Mark-recapture-recovery models are hierarchical models comprised of an observation process represented by the capture history of the tagged individuals and a state process represented by the latent states of all potential individuals in the population. This is a flexible modeling framework which can share information about parameters among species that, individually, have an insufficient number of tagged individuals to parameterize a single-species models. Additionally biological and environmental covariates (e.g., discharge, stream temperature) can be incorporated into the model structure to predict how population demographics respond to a range of conditions. Borrowing population dynamic information from better-studied populations can help researchers and conservation practitioners develop hypotheses for other data-limited mussel populations that are of conservation concern.

Georgia Freedom to Float and our longstanding Right of Passage

Andrea White[1]

[1]*Georgia Rivers*

Session 5.1 Water Planning & Management

River recreation advocates are supporting public policy solutions to support our longstanding Right of Passage in Georgia. recent legislative proposals have put these rights at risks and similarly endangered the prospects for many river recreation oriented small businesses. Learn the current status of legislative activity related to river recreation and our Right of Passage at this session.

Georgia rivers and streams have been used for centuries for trade, transportation, passage, and navigation for goods and people, serving as the original "public highways" by which early inhabitants traversed the state and from which our communities developed. Over the decades different interests have influenced our use of waterways and required balancing of competing interests. While in the 18th and early 19th centuries the rivers and streams of the state were used as an essential mode of transportation, modern day uses tend to favor recreation. Since the 1960s, the recreational value and significance of the state's rivers and streams has been increasingly recognized and the use of such waterways for recreational activities, such as paddling, canoeing, kayaking, rafting, tubing, and floating, more widespread. Today, we are faced with mounting pressure which seeks to greatly abridge or foreclose the public right to use the state's waterways for recreation.

Unfortunately, discussions on the issue often mistakenly invoke concepts of navigability unrelated to passage or pit private property interests against public use rights in a way that is not productive, instills fear, and mischaracterizes the law.

The modern-day phrase "if you can float it, you can boat it," is ground in well-established law and legal principles upon which colonial Georgia, this State, and this country were founded. At the time of statehood, the concept was better known as the "right of common passage" and shows up in the form of a navigational servitude – an easement - allowing for public passage on those waterways susceptible of use as a common highway for man or goods or both. In other words, the public right of common passage exists on all waterways capable of supporting passage.

Under Georgia law, the public right of common passage continues to exist today as a servitude in the nature of an easement upon all streams which are susceptible of use as common highways for man or goods or both, including on waterways that may not necessarily be deemed "navigable" as defined by Georgia law O.C.G.A. 44-8-5 and although the beds of which may be privately owned.

Response of macroinvertebrate assemblages in lateral river habitats including floodplains, oxbow lakes and the main river channel during hydrological drought

Kelsey Wilbanks[1]

[1]*University of Georgia*

Session 4.2 Aquatic Biota & Connectivity

Rivers corridors are interspersed with a mosaic of lateral habitats that include floodplains, oxbow lakes and the main river channel. We aimed to explore the ecological response of aquatic macroinvertebrates in lateral river habitats during drought. We hypothesized that during high

hydrological connectivity, macroinvertebrate assemblages would be homogenous, but as drying progressed, assemblages would become heterogenous with increasing dissimilarity. Invertebrate assemblages (n = 113) were sampled during a seasonal drought period (early (n = 45), mid (n = 30) and late (n = 38) drought) in three habitats (floodplains, oxbow lakes, and main river channel). Community response showed differences in habitats during early (Psuedo-$F_{2,44} = 9.4$, $p < 0.01$), mid (Psuedo-$F_{2,29} = 12.0$, $p < 0.01$) and late drought stages (Psuedo-$F_{2,37} = 9.9$, $p < 0.01$). We also found that pairwise comparison of habitats showed relatively unchanging levels of similarity (SIMPER) during the study period, with oxbow lakes and river channels ranging from 19% to 23% similarity, oxbow lakes and floodplains ranging from 14% to 36% similarity and floodplains and the river channel ranging from 6% to 18% similarity. Our results indicated a mixture of heterogenous and homogenous community assemblage within the river corridor, where habitats were unique, but there was a small degree of overlap due to spatial association. Additionally, drying did not dramatically affect assemblages within habitats, with the floodplains being the only habitat affected by drying, as it was eliminated during late drought stage. This has implications for river management, since landscape heterogeneity is crucial for maintaining biodiversity, providing refugia and conserving species.

Culvert Failure Vulnerability Assessment Using Hydro-Geomorphologic and Climatic Data Analyses of Coastal Santee EFR: A Watershed Debris Flow Assessment Emphasis

Michael Wild[1], Sudhanshu Panda[1], Casey Helton[1], Sydney McDaniel[1], Peter Swanton[1], Devendra Amatya[2]

[1]University of North Georgia [2]U.S.D.A Forest Service

Session 3.3 Culvert Failure

The risk of forest structure failures is high with high-gradient topography that causes increased soil erosion, higher discharge, enhanced streambank erosion probability, and a heightened chance of debris flow to the structure mouth. In coastal landscapes with flat topography, constant hurricane-induced debris flow to the structure mouth mounts the risk of its failure. The goal of this study is to develop a Morphological Vulnerability Assessment Decision Support System (MVADSS) to identify road/stream crossing drainage structures failure vulnerability risks using Hydro-geomorphologic characteristics supported Watershed Debris-Flow Assessment (WDFA). The study is completed in a coastal experimental forest research (EFR) system at Santee watershed, a part of Francis Marian National Forest in South Carolina. GeoAI aided WDFA model is developed through an innovative approach of using pixel-based tree/shrub speciation, rock type, and rock depth spatial variation information obtained from Geology vector, several soil characteristics including an important one, i.e., spatial soil depth (gSSURGO) data, slope data (LiDAR-based DEM), and the designed runoff (DDM-CN model) along with a new spatial watershed characteristics, watershed dryness index (WDI) that determines the soil and vegetation spatial dryness index to determine if the vegetation and soil could easily broke to giving way for more debris. Ultra-high resolution NAIP imagery was classified using the GeoAI-supported Object-Oriented Image Analysis (OBIA) segmentation algorithm with a designed ruleset. Each vegetation type has the unique ability to open up debris on a spatial basis. Spatial environmental rasters used in models were reclassified with their vulnerability probability scale/weight, developed through the Delphi method of weighted scale

determination which is explained in detail in this study. Each model explained the structure failure risk on a scale of 1(Highest), 2 (High), 3(Moderate), 4 (Low), and 5(Lowest). These four Risk-scaled models were combined to provide the qualitative scale vulnerability results of each structure in the EFR system. The results were field verified to confirm our automated geospatial modeling approach for stream/road crossing structures' vulnerability assessment. This study would provide proactive decision support to the USDA Forest Service or any other agencies responsible for safeguarding these structures.

Promoting Water Conservation in Sustainable Landscaping with a Statewide Educational Program: Early Efforts and Room for Improvement

Martin Wunderly[1], Heather Kolich[1], Jessica Warren[1]

[1]*University of Georgia Cooperative Extension*

Session 5.1 Water Planning & Management

UGA Cooperative Extension Service is positioned to promote various natural resource education topics and best practices across the state. A sustainable landscaping certification program was developed by UGA Extension to address natural resource conservation on private property in Georgia. Water conservation topics make up three of the ten sustainable landscaping education components in the UGA Extension Georgia Green Landscape Stewards program. The program was introduced in 2021 and has been slow to gain attention in the Extension organization. Program participant interactions and sustainable landscaping choices have been analyzed, along with factors affecting UGA Extension personnel implementation of the program. This information provides insight into future development of the Georgia Green Landscape Stewards program, for its' success and longevity, and for promoting water conservation practices.

Contract Design in Water Aquatic Connectivity and Resilient Infrastructure Investment at Fort Moore, Georgia Programs in Southwestern Georgia

Daniel Wyatt[1], Brent Widener[2], Jay Shelton[3], Alex Lamle[4]

[1]*University of Georgia Carl Vinson Institute of Government* [2]*U.S. Army Fort Moore, Department of Public Works* [3]*University of Georgia Warnell School of Forestry and Natural Resources* [4]*U.S. Fish and Wildlife Service Southeast Conservation Adaptation Strategy*

Session 3.2 Aquatic Connectivity

The capacity to do aquatic connectivity work in the Southeast has increased significantly in recent years. This is in no small part due to the efforts of the Southeast Aquatic Resources Partnership (SARP) in establishing Aquatic Connectivity Teams (ACTs) in each state. Now with many examples of individual projects throughout the region, ACTs are looking to restore and reconnect lands and waters at a larger scale. Members of the Georgia Aquatic Connectivity Team (GA-ACT) have recently partnered with the University of Georgia Defense Community Resilience Program (UGA-DCRP), a

multi-disciplinary collaborative network working directly with military installations and their surrounding communities.

Fort Moore encompasses 183,000 acres along the Georgia Fall Line, including 33 miles of streams, 5,596 acres of wetlands, 24 impoundments (314 total acres). In addition, the base maintains 1,936 miles of roads, resulting in an untold number of culverts and other types of crossings. The plant and animal diversity remains quite high, including 66 species known to occur on the installation which are state and/or federally protected. Base natural resources managers must regularly coordinate with training personnel, as well as with other units on the installation, to maintain natural resources and ensure environmental compliance while conducting training activities.

The GA-ACT is currently working with UGA-DCRP personnel to identify areas of alignment with respect to ecological objectives that strengthen military and community resilience. Resultant examples of specific connectivity projects will be presented. These examples include barrier removal, culvert replacement and stream realignment projects that are designed with a multi-objective watershed approach that considers upstream contributing areas as well as downstream impacts. We will discuss a framework for landscape-scale resource management for multiple objectives including aquatic organism passage, flood-risk vulnerability, erosion, and sediment control resulting from resilient infrastructure investment.

Contract Design in Water Conservation Programs in Southwestern Georgia

Lusi Xie[1]

[1]*University of Georgia*

Session 3.6 Agriculture & Coastal Water Management

Over-extracting freshwater for irrigation reduces streamflow, disrupts aquatic ecosystems, and threatens habitats for endangered species. Water buyback programs compensate farmers for voluntarily reducing irrigation water use to preserve in-stream flows for environmental benefits. While these programs, such as the one under the Flint River Drought Protection Act, have seen significant investments, few studies have assessed their cost-effectiveness by considering the influence of farmers' preferences and willingness-to-accept (WTA) on contract design. Moreover, despite a range of U.S. state and federal conservation programs, most notably the Conservation Reserve Enhancement Program (CREP), aiming to address the negative externalities of irrigation water withdrawals, farmers' interest in these programs has been minimal, partly due to program payment levels and attributes.

This paper aims to elicit farmers' preferences and compensation requirements for water buyback contracts to conserve water for endangered species during uncertain droughts in the Flint-Chattahoochee Basins, as a continuation of the Georgia Flow Incentive Trust auction. We conduct an online survey with landowners who make operation decisions to understand their preferences on contract attributes and elicit corresponding WTA.

In the survey, three contract attributes are considered to strike a balance between program flexibility, program feasibility, and drought uncertainty. Key contract attributes include irrigation suspension

types (i.e., no water use, limited use, or conditional suspension during drought), contract durations (ranging from one year to permanent), and a signing bonus for conserving surface water. The survey collects additional data on farm operations, farmers' demographics, and risk and time preferences. Invitations will be sent to 2,500 eligible landowners, with data analyzed using discrete choice models to estimate coefficients and WTA in both present and future values. Increased streamflow from irrigation reductions will be calculated using water meter data and production details for enrolled fields, enabling a comparison of the cost-effectiveness of multi-year contracts. The data collection is ongoing with preliminary results expected in March.

This research contributes to the design of water buyback programs by incorporating farmers' preferences. Insights from this study will support the development of contracts that balance program flexibility, feasibility, and environmental objectives under climate uncertainty.

Targeted Solutions for Trash Reduction: Prioritizing Community Need with Watershed-Wide Trash Traps

Jordan Yu[1]

[1]*Chattahoochee Riverkeeper*

Session 2.5.1 Targeted Solutions for Trash Traps Panel

The Chattahoochee River is vital to the people and wildlife in the southeast United States. However, collective access to this crucial regional resource is being threatened. The volume of litter and garbage in our waterways has become a crisis and plastic waste is now a dominant form of freshwater pollution. Established in 1994, Atlanta-based environmental non-profit Chattahoochee Riverkeeper (CRK) employs a variety of strategies to protect and preserve the Chattahoochee River Basin. They include water monitoring, education, research, advocacy, and legal action.

To address trash pollution, CRK has traditionally relied on volunteers to walk, wade, or paddle through waterways to collect refuse. These cleanups, including CRK's annual "Sweep The Hooch" event, have removed 2 million pounds of trash over the last 30 years. Though CRK fostered a robust volunteer cleanup program, we were limited in our ability to continuously collect litter conveyed by small tributaries. New technology was needed to collect additional trash with fewer volunteers.

To meet these needs, CRK employed trash traps – in-stream litter collection devices designed to passively catch floating garbage from stormwater runoff. These devices use booms to guide trash into a collection area where it can be captured and emptied after a rainstorm. In 2019, CRK launched a pilot project deploying two traps in Atlanta's Proctor Creek. Since then, our In-stream Litter Collection Program has grown to collect thousands of pounds of trash each year. The program has now trapped over 15,000 pounds of floating garbage, over 20% of which has been recycled. Today, CRK operates 14 traps in five Georgia counties, with plans to expand into more impaired waterways throughout the basin.

Trash traps pose a unique challenge – locating suitable installation sites. A waterway's physical characteristics, trash load, and personnel access are key factors impacting a trap's viability. Trap placement determines cleanout logistics, equipment and labor needs, and trap effectiveness. Soon

after the program began, CRK identified a need to automate the process of determining potential sites. In 2021, CRK began developing an ArcGIS tool to locate potential trash trap sites throughout the Chattahoochee River Basin. The model incorporates land use, topographic, hydrologic, and demographic data to grade the relative potential of trap sites. Tailored to CRK's mission, this "Trash Trap Location Prioritization Model" can be updated as new data becomes available.

Spatial patterns in wetlands soil carbon stocks across the Georgia coast

Nikki Zhang[1]

[1]*University of Georgia*

Session 2.6 Coastal Carbon

Coastal wetlands play a vital role in carbon sequestration, yet the factors influencing variation in soil carbon stocks across marshes are not fully understood. Our goals are to characterize the distribution of soil carbon stocks across Georgia's coast and assess potential factors contributing to spatial variability. We compiled a database from published data, archived samples, and new collections from under-sampled areas that include spatial coordinates, soil properties, and organic carbon, among other factors. With this dataset of 205 sediment cores, we calculated carbon stocks for three soil horizons: rhizosphere (0–30 cm), below rhizosphere (30–100 cm), and deep (>100 cm). Carbon stocks vary across estuaries, vegetation types, and marsh land cover (freshwater, brackish, and salt marshes). Preliminary analyses show that freshwater marshes contain the highest carbon stocks, while salt marshes contain the lowest. Among estuaries, Doboy Sound has the highest carbon stock in the rhizosphere within salt marshes. Soil δ13C signatures and carbon: nitrogen ratios reveal that Georgia's salt marshes receive a mix of terrestrial and salt marsh organic carbon and are strongly influenced by both freshwater and in-situ plant inputs. Notably, under-sampled areas, such as freshwater and brackish marshes, require additional data for more robust analyses. For the next steps, we plan to collect additional sediment cores from under-sampled areas, particularly brackish and freshwater marshes, integrate additional factors such as total suspended solids, and perform more comprehensive analyses on the contribution of various drivers to carbon stock variability.

POSTER ABSTRACTS

POSTER ABSTRACTS

Assessing patterns of subcatchment biogeochemical processes across the expanding and contracting South Sandy watershed in Central Alabama, U.S.A.

Ali Andrew Abagai[1], Arial Shogren[1]

[1]*University of Alabama Department of Biology*

Nested subcatchments often exhibit diverse geology, land cover, topography, and hydrology and may contribute disproportionately to the carbon (C) and nutrient exports observed at the watershed outlet. However, how subcatchment carbon and nutrient contributions change as the river network expands and contracts is unknown in the Coastal Plain landscape. We addressed this gap by intensively sampling spatially-distributed water chemistry in 20 nested subcatchments across the forested South Sandy watershed (~125 km2) in the Coastal Plain landscape of Alabama, USA. We use these monthly watershed-wide sampling campaigns to assess the spatial scale and persistence of C, [N]itrogen, and [P]hosphorus fluxes. We found that small subcatchments (4-14km2) strongly influenced C, N, and P exports, highlighting an array of localized sourcing and processing in dynamic headwaters. Additionally, we found that C was exported conservatively, while N (as nitrate, NO3-) and P (as phosphate, PO43-) were generally produced across the watershed. Also, N concentrations were more stable than C and P during the sampling period (r2 > 0.50), indicating that sampling the exact locations may result in a similarly spatial distribution of nitrate concentration within the South Sandy watershed. Understanding solute export in the South Sandy watershed is crucial for identifying subcatchments representing water-scale behavior. These sub-watersheds can serve as key references for more effective scaling of biogeochemical dynamics in Coastal Plain rivers.

Hydrogeophysical Characterization of the Claiborne Aquifer using Electrical Resistivity Tomography and Borehole Geophysical Logging Techniques

Kwaku Asiedu[1], Amy Laubenstein, Adam Milewski, Charlotte Garing

[1]*University of Georgia Department of Geology, GA-FIT*

Surface water resources in southwest Georgia are vital for sustaining human populations, wildlife, and ecosystems. The agriculture economy of Georgia, which includes all food and fiber production in the state, is worth more than $12.2 billion. Three of the state's top ten commodities in terms of value; cotton, peanuts, and lumber, are produced in southwest Georgia and use the largest share of water from the Flint River Basin. However, the region faces challenges related to the sustainability of surface water during drought, exacerbated by increasing agricultural activities and water demand for irrigation. This puts surface water at risk, a critical natural resource in southwest Georgia. To address these concerns, there is a growing need to explore alternative water sources, including groundwater from deep aquifers such as the Claiborne Aquifer.

This study focused on the hydrogeophysical investigation of the Claiborne Aquifer in Southwest Georgia using well-logging techniques. Different well logs were analyzed to determine the petrophysical and hydraulic properties of the Claiborne Aquifer such as lithology, aquifer geometry

and porosity. These logs included the gamma ray, electrical resistivity, sonic, fluid resistivity, caliper, and spontaneous potential logs. The well log interpretations were supplemented with data from drill cuttings when available. Analyses from these logs shows that the Claiborne Aquifer is predominantly made up of materials such as sands, limestones, clay and silts with varying porosity and aquifer geometry across the wells logged. By characterizing the petrophysical and hydraulic properties of the aquifer, we aimed to evaluate its potential to supplement or serve as an alternative source of groundwater for farmers in the region. The research is part of the large effort by the Georgia Flow Incentive Trust (GA-FIT) aimed at drawing upon the importance of managing both groundwater and surface water sustainably to ensure a reliable water supply for farmers in southwest Georgia during drought periods while safeguarding the local ecosystem.

By presenting the results of this hydrogeophysical investigation, this study contributes to ongoing efforts aimed at promoting water resource sustainability in Southwest Georgia, with implications for agricultural practices and ecosystem conservation in the region.

Soil recovery in wetlands after heavy mineral sand mining

Megan Aslinger[1]

[1]*University of Georgia*

Wetlands, and The Okefenokee Swamp in particular, provide a multitude of ecological services to our state. The Okefenokee is notably undisturbed and has retained its natural hydrology. The Okefenokee is also the largest blackwater wetland in North America. The carbon that makes the swamp water black also makes the soils carbon rich. The swamp, given its abundant water and carbon, creates anoxic (i.e., low oxygen) conditions in the soil that reduces decomposition and acts to stabilize carbon in place. However, this landscape has belowground stores of heavy minerals (most notably Titanium and Zirconium) and is subsequently mined for said minerals. In this study I am investigating changes in soil carbon and chemical attributes in reclaimed wetlands relative to unmined reference wetlands. Overall, mining next to the Okeefenokee is very controversial because of the conservation status, size, and special nature of this swamp in addition to its vast carbon stores (Okefenokee Protection Alliance, n.d.).

My primary comparison is between reference wetlands and wetlands that were initially reclaimed 3 years ago (referred to as 3-year-old Reclaimed). I also have one reclaimed wetland, the Lulaton site, which is 15 years old, and which I use to extrapolate through time. Lulaton is referred to in the results as Old Reclaimed. The objective of this study is to determine if soil conditions have been restored by comparing chemical data—soil pH, carbon/nitrogen percent, and Mehlich extractions, of Reference and Reclaimed sites. Additionally, I tested for evidence of spodic horizon formation processes (often called podzolization) in a column study using fresh mine tailings.

Woods to Water (W2W): Leveraging the Unique Biodiversity of the Southeastern USA for Training in Ecology and Resource Management

Carla L. Atkinson[1], Arial J. Shogren[1], Heidi Benstead[1], Jeffrey B. Cannon[2], Rachel E. McGuire[2], Guy Faunaught[3], Beth Fugate[3], Christie Staudhammer[1]

[1]University of Alabama [2]The Jones Center at Ichauway [3]National Ecological Observatory Network (NEON)

The Southeastern US (SEUS) is a global biodiversity hotspot boasting >1500 species of vascular plants and 79% of freshwater fish and 91% of the mussel species in the US. Undergraduate students in the SEUS interested in ecology and conservation have unique opportunities to learn about aquatic and terrestrial biodiversity in this globally recognized region. Yet, opportunities for experience-based learning about SEUS ecosystems may be limited for many students as a result of 1) the lack of accessible public lands (>90% of land in the SEUS is private); 2) limited physical infrastructure to teach ecosystem-scale research; and 3) insufficient field and classroom training opportunities, including working with Big Data. The Woods to Water (W2W) project will address these challenges by training post baccalaureates in ecological field techniques and data sciences that link water availability to carbon and nutrient fluxes among ecosystems focused on the forests and streams of the SEUS. Our W2W program aims to increase expertise in field ecology by providing an immersive experience leveraging training with NSF's National Ecological Observatory Network sites in the SEUS (Domains 3 and 8), research scientists at The Jones Center at Ichauway, and ongoing NSF projects at The University of Alabama. W2W will provide the opportunity for participants to transition into ecological fields, which will enhance the strength of the US scientific workforce and support the growing need to understand ecosystems in the face of a changing world.

Integrating Infiltration-Based NBI in Coastal Areas for Sustainable Stormwater Management: Case Study of St. Mary's

Chukwuemeka Atuma[1]

[1]University of Georgia

Coastal floodplain systems are experiencing heightened flood risks attributable to climate change, urbanization, and deficiencies in conventional infrastructure (CI). Current coastal infrastructure frequently lacks the flexibility and environmental advantages to manage elevated water tables, storm surges, and severe precipitation events. This study examines the efficacy of infiltration-based nature-based infrastructure (NBI) strategies, specifically Green Infrastructure (GI) and Hybrid Infrastructure (HI), in improving flood resistance. The emphasis is on St. Mary's, Georgia, a low-lying coastal city susceptible to tidal flooding and storm surges, where sandy soils and shallow groundwater intensify flood threats.

This study utilizes StormWise™ hydrological modeling to evaluate baseline, green infrastructure-enhanced, hybrid, and conventional infrastructure-only scenarios under different storm intensities and tidal effects. The methodologies encompass evaluating essential performance measures like peak flow reduction, infiltration rates, flood extent, and groundwater recharge. Sensitivity analyses will examine the impact of key parameters such as soil permeability, rainfall intensity, and vegetation coverage on system performance.

Anticipated outcomes indicate that green infrastructure and hybrid systems can enhance water infiltration, postpone peak runoff, and augment ecological co-benefits relative to conventional

infrastructure alone. Hybrid systems are expected to reconcile green infrastructure's environmental benefits with traditional infrastructure's dependability, offering a scalable and adaptable option for flood management.

This work addresses a significant knowledge deficiency by measuring the hydrological and ecological advantages of Nature-Based Interventions (NBI) in coastal environments and emphasizing the trade-offs linked to adopting hybrid strategies. These findings will inform sustainable flood management measures and influence long-term urban design for flood-prone coastal areas.

Implications of Shell Aging and Response of a Listed Freshwater Mussel Species to Relaxed Drought Stresses in the Lower Flint River Basin

Christine Bahlinger[1], Caitlyn Sweeney[1], Amber Johnson[1], Stephen Plont[2]

[1]The Jones Center at Ichauway [2]Albany State University Georgia Water Planning and Policy Center

There are at least 25 species of freshwater mussels native to the Lower Flint River Basin (LFRB) in Southwestern Georgia. The Shinyrayed Pocketbook, Hamiota subangulata, was listed as federally endangered in 1998 due to declines throughout their historic range. Between 1999 and 2012, the LFRB experienced three multi-year droughts characterized by extreme low flows during the growing season (May – September). During droughts, extensive segments of once perennial streams dried completely, whereas segments that stayed wet had extended periods of low velocity and isolated pools with hypoxic conditions. Shinyrayed Pocketbooks are highly vulnerable to low dissolved oxygen and predation; populations declined catastrophically during these droughts. After a decade of reduced growing season water scarcity in the basin, in 2023 evidence of recovery of Shinyrayed Pocketbook populations was observed in surveys of historic mussel sites. Multiple size classes of individuals were observed in stream segments where the species was presumed to be extirpated. Two other federally listed species in the LFRB tributaries, Medionidus penicillatus and Pleurobema pyriforme, have not shown a rapid recovery, likely a reflection of differences in life history strategy among mussel groups. Little is known about the life histories of the LFRB's mussel species. Learning more about their life histories (e.g., age, recruitment, growth) can support more informed conservation actions. We are exploring shell aging to determine life spans, characteristics of recruitment years, and perhaps growth rates for both common and rare mussel species in the LFRB. Different mussel species have different strategies for survival, and filling knowledge gaps about their lifespans can help inform management practices and expectations for recovery. The dense network of USGS stream flow stations, extensive climatic information, long term record of mussel sampling, and availability of recently dead shells make the LFRB well suited to this type of study.

Investigating spatial patterns of particulate water chemistry across a forested gulf coast watershed in central Alabama, USA.

Dustin Benton[1,2], Arial Shogren[2], Andrew Ali[2], Jamie L. Rogers[1], Chloe Hall[1], Nick Marzolf[1]

[1]The Jones Center at Ichauway [2]University of Alabama

Stream networks are hierarchical ecosystems, where nested sub-catchments within the larger watershed may have unique vegetation, soil, and topographic characteristics. However, how these landscape characteristics uniquely affect water quality across space and time remains an open question in the understudied southeastern United States. To fill this knowledge gap, this study aimed to determine how different landscape characteristics influence stream particulate chemistry across twenty nested sub-catchments within the South Sandy Watershed, which drains the Oakmulgee Ranger District of the Talladega National Forest in central Alabama. This district of the Talladega National Forest is the largest remaining portion of the longleaf pine ecosystem in Alabama. Yet, multiple extreme storms and lumber harvesting operations have disrupted the natural structure of this forest, and the hydrologic network therein. From June through November 2024, we collected monthly surface water samples at all twenty stream sites. We estimated several water quality characteristics, turbidity (NTU), total suspended solids (mg/L), and seston ash-free dry mass (mg/L). Our preliminary findings show a moderate positive correlation between turbidity and seston ash-free dry mass. Particulate chemistry was sensitive to flow conditions, where more arid conditions in August and October led to lower concentrations throughout the watershed. When streamflow returned, total suspended solids increased, most likely due to the relationship of autumn rains causing an increase in sediment transport. Our findings suggest that understanding the spatiotemporal characteristics influencing water quality will help promote freshwater stream function across this watershed.

Predicting storm generated surface discharge in an ephemeral stream channel in a karst watershed

Carlie Blackburn[1]

[1]*The Jones Center at Ichauway*

Ephemeral stream channels and intermittent flowpaths between wetlands can make up a large portion of a river basin network that is not well represented in typical hydrologic models. On the Dougherty Plain, a karstic region in southwestern Georgia, episodic storm runoff-driven flows are observed in response to intense storms and can connect geographically isolated wetlands to nearby perennial waters. These “fill-and-spill" connections occur as overland flow through poorly defined channels and support the movement of materials, energy, and organisms. However, these events are difficult to predict, and the fluxes of water, nutrients, and organisms are difficult to monitor. Our objective was to use a network of sensors, along with site surveys, to predict these events and quantify variations in discharge and water yield along one of these flowpaths. The site was located at the Jones Center at Ichauway in Baker County GA. In 2017, we deployed a series of water-level recorders and rain gages along the flowpath to monitor precipitation inputs and stage. Field campaigns surveyed channel dimensions and watershed area was delineated using lidar data from NEON (National Ecological Observatory Network). We quantified peak flow velocity, discharge, and water yield during five discreet flow events that occurred from 2018 to 2021, with the highest flow recorded in December 2018. Preliminary results show a peak discharge as high as 31.2 cfs during that event. Further work will produce a predictive model of stage/discharge based on precipitation and soil moisture. These results will improve our understanding of the mechanisms of flow initiation and allow better planning

for future monitoring campaigns that will help us quantify exchanges between wetlands and other water bodies.

Seasonal activity patterns of eastern musk turtles (Sternotherus odoratus) in a geographically isolated wetland within a longleaf pine (Pinus palustris) forest

Ivy Bryan[1]

[1]*The Jones Center at Ichauway*

Geographically isolated wetlands embedded within longleaf pine (Pinus palustris) forests support a diversity of amphibian and reptile species. Eastern musk turtles (Sternotherus odoratus) are one of 10 species of freshwater turtles found within these seasonally inundated systems. Although eastern musk turtles use a variety of aquatic habitats across the eastern United States, little is known about wetland use in longleaf pine forests. From January through August 2024, we used baited crayfish traps at trap stations spaced 10 meters apart along three transects within an isolated cypress-gum swamp at the Jones Center at Ichauway in Baker County, Georgia. We measured water depth (cm) and water temperature (°C) at each trap station. Upon capture, we collected carapace length (mm) and mass (g) measurements, identified age and sex classes, and notched scutes to assign a cohort mark. We captured 46 eastern musk turtles (28 males, 10 females, and 8 juveniles), including 7 recaptures, over 1079 trap-nights. Eastern musk turtle activity (captures) peaked in May, but we found no significant relationship between captures and water depth or water temperature. Because eastern musk turtles spend most of their life tied to aquatic habitats, it is important to understand the role that seasonal wetlands play for this species within longleaf pine systems.

Impact of Water Phosphate Content on Macroinvertebrate Biodiversity

Sage Christman[1], Kimberly Takagi[1]

[1]*College of Coastal Georgia*

Aquatic environments must have proper hydrology, hydric soils, and hydrophytic vegetation to be considered wetlands. A surprising location of freshwater wetlands are golf course ponds like those at Sea Palms West on St. Simon's Island, GA. This study investigates the relationships between the water phosphate concentrations and macroinvertebrates of the area's southernmost pond. The macroinvertebrate biodiversity indices not only provide insight into the macroinvertebrate population dynamics but also indicate the pond's overall health and its ability to support a large biodiversity of species. Weekly water quality testing was completed on Thursdays from September 12th, 2024, to November 21st, 2024, with two dates missed due to hurricanes. During this period, five macroinvertebrate surveys were conducted by sweeping the bottom of the sampling area with a D-net. The calculated Shannon and Simpson's indices showed low to moderate macroinvertebrate biodiversity, indicating the presence of a few dominant species. Biodiversity indices indicated moderate macroinvertebrate biodiversity for this pond. Additionally, water phosphate concentrations were not correlated with macroinvertebrate biodiversity, indicating an alternative mechanic behind biodiversity in the area. Overall, the biodiversity indices and phosphate values are appropriate for

aquatic species like dragonflies to complete a full life cycle. To further this research, additional data could be collected from areas where water enters this pond. This would allow additional insight into how ponds provide wetland ecosystem services such as processing organic matter and water filtration in areas with high residential input.

Physicochemical properties of three freshwater wetlands in Southeast, Georgia USA

Kristen Darley[1], James Deemy[1]

[1]*College of Coastal Georgia*

Water quality in freshwater wetlands is a product of biological, chemical, and physical components. The objective of this project was to compare physicochemical water quality (ammonia, nitrate, nitrate, nitrite, phosphate, turbidity, pH, specific conductance, temperature, and dissolved oxygen) and extant vegetation at three freshwater wetlands. Our focal wetlands occurred along a proximity gradient from coastal to inland (embedded on a coastal barrier island to bordering the Okefenokee). The three different freshwater wetland areas were surveyed and compared between the months of July and November. Each site was tested multiple times per month, in five different, consistent sampling locations. Each area also had plant samples taken for identification. Physicochemical water quality was compared among sites with boxplots and ANOVA. Results indicate that there were differences in multiple aspects of physicochemical water quality among sites which are expected due to the geographic settings of each site. Vegetation at each site might also drive differences in water quality due to differences in organic matter deposition and variation in plant senescence patterns.

Assessing Urban Stream Syndrome: Water Quality Analysis of Oglethorpe University's Streams

Alanys Elvir Bustillo[1]

[1]*Oglethorpe University Stream Team*

The Urban Stream Syndrome describes the characteristic ecological degradation common in urban streams (streams with more than 10% total imperviousness in their watershed). Oglethorpe University is an urban campus in Metro Atlanta with multiple streams, including Ogle Creek and Petey's Creek (29.4% and 43.5% total imperviousness, respectively). Consequently, it is predicted that Oglethorpe's streams will have high conductivity, pH, and temperature and low dissolved oxygen compared with natural streams. Chemical testing for both streams was performed according to the Georgia Adopt-a-Stream methods. Conductivity and temperature were tested with a conductivity meter, pH was tested using a colorimetric assay, and dissolved oxygen (DO) was tested through a Winkler titration. Based on the chemical testing performed on both streams between 2023 and 2024, it was found that the maximum water temperature was 25.8 C° for Ogle Creek and 24.0 C° for Petey Creek, both lower than the maximum state standard of 32.2 C°. The minimum DO was found to be 3.4 ppm for Ogle Creek and 3.8 ppm for Petey Creek, slightly below the minimum state standard which is 4 ppm. The pH for both streams ranged between 6 and 7, both within the state standard of 6 and 8.5. Minimum conductivity was 120.0 µS/cm for Ogle Creek and 108.4 µS/cm for Petey Creek. While there

is no state standard for conductivity, prior studies suggest that conductivity over 100 µS/cm may be harmful to aquatic life. Although the Oglethorpe streams are mostly within Georgia's standards, the conductivity levels may indicate the presence of pollutants that impair biota in these streams. Further research must be conducted to determine the cause of the high conductivity.

Trends in Cyanobacteria Harmful Algal Blooms: A Remote Sensing Study of North Georgia Lakes

Isabella Fiorentino[1]

[1]*University of Georgia*

Cyanobacteria Harmful Algal Blooms (cyanoHABs), a diverse group of photosynthetic microorganisms, play a key role in aquatic ecosystems as primary producers. However, cyanoHABs are also notorious for producing toxins known as cyanotoxins, which can pose serious threats to aquatic life and human health when present in high concentrations. For instance, in January 2021, an incident at Bull Sluice Lake underscored these concerns when a dog died after exposure to water suspected of being contaminated by a cyanobacterial bloom. Similarly, nine separate blue-green algae blooms were seen on Lake Lanier in 2020 with one confirmed to contain the cyanotoxin microcystin. As incidents like these become more frequent due to anthropogenic global warming, real time monitoring of cyanoHABs has become paramount. However, the current scientific literature to do so is very recent. This paper provides a comprehensive overview of a remote sensing and in-situ ground truthing method used to monitor cyanoHAB formation in North Georgia freshwater lakes. In providing a comprehensive overview, this method uses USGS Gage Station historical data and twelve monthly field trips to develop the temporal and spatial distribution of cyanoHABs within Bull Sluice Lake and Lake Lanier. These distributions are then used to analyze satellite imagery in a Google Earth Engine dashboard with the ultimate goal of helping state and local agencies better monitor cyanoHABs and protect the surrounding public and wildlife.

Habitat Integrity and Macroinvertebrate Community Response to an Urban Stream Restoration in Augusta, GA

Henna Gavem[1], Hazel Quarterman[1], Raymond P. Kidder II[1], Rachael Gonzalez[2], Oscar Flite[3], Checo Colon-Gaud[1]

[1]*Georgia Southern University* [2]*Phinizy Center for Water Sciences* [3]*Augusta Engineering and Environmental Services Department*

Urbanized watersheds are often at odds with a variety of anthropogenic pressures including land use change, channelization, lowered water availability, and increases in sediment and nutrient runoff. These stresses, in turn, negatively impact the biotic integrity of aquatic habitats. Rocky Creek, a low-order urban stream in Augusta, Georgia underwent a stream improvement effort in Winter 2023 which consisted of the planting of native riparian vegetation and the installation of instream features such as riffle enhancements and bank stabilization. These physical alterations were selected to minimize sediment deposition and increase viable habitat for aquatic biota. In late 2018, prior to the

restoration effort, the habitat integrity of Rocky Creek was examined utilizing the GAEPD Rapid Bioassessment Protocol. This multimetric assessment approach takes into account the physical stream characteristics as well as organisms present in the habitat. The main organisms of interest are aquatic macroinvertebrates; groups such as immature insects, crustaceans, worms, and bivalves. These organisms are an essential biotic component in streams as they break down organic material, cycle nutrients, and support larger organisms as a prey source. As a group, aquatic macroinvertebrates have been widely used for biological monitoring because of their taxonomic diversity, ubiquity in aquatic environments, short life cycles, ease of capture, and, most importantly, range of tolerance to environmental stressors. In late 2024, we returned to the study site for post-restoration sampling. Our data, coupled with the pre-restoration assessment, will allow us to understand the efficacy of the restoration efforts in Rocky Creek. Ensuring the health and function of stream habitats in urban settings is crucial as populations grow and cities spread. This study aims to better understand the biotic impacts of urban stream restoration and to inform future management decisions.

Risk-Based Prioritization Framework for Multi-Objective Culvert Adaptation: Enhancing Stream Connectivity and Transportation Resilience

Alejandra Gomez[1]

[1]*University of Georgia*

River and stream connectivity is essential for maintaining ecological resilience and mitigating the impacts of anthropogenic stressors such as flow alteration, habitat fragmentation, and flooding. However, aging and undersized culverts obstruct stream ecosystem connectivity, degrade stream function, and increase flood risks. This research presents a Risk-Based Prioritization Framework to systematically assess culvert replacement needs by integrating hydrologic, ecological, and socio-economic considerations.

The framework combines hydrologic modeling, culvert capacity assessment, and ecological connectivity analysis to evaluate the vulnerability of stream crossings under climate change scenarios. By incorporating the analysis of land use change effect over design discharge, the study identifies priority sites where culvert adaptation would yield the greatest benefits for aquatic species movement, transportation resilience, and flood risk mitigation. Additionally, a cost-benefit analysis assesses the economic implications of maintaining a business-as-usual approach versus implementing nature-based solutions for culvert design. This includes evaluating insurance cost trends associated with flood risks and quantifying wildlife-vehicle collision costs in areas where stream crossings disrupt ecological corridors.

A statewide assessment is conducted to identify opportunities for implementing transportation resilience planning while addressing safety concerns and enhancing stream ecosystem connectivity. Results highlight critical locations where culvert retrofits or replacements can reduce infrastructure vulnerability while improving aquatic habitat continuity. This research advances a multi-objective approach to infrastructure adaptation, demonstrating how proactive culvert management can serve as a climate resilience strategy that benefits both human communities and biodiversity.

USGS Water-Resources Data – What And Where?

Debbie Gordon[1]

[1]*U.S. Geological Survey*

Part of the U.S. Geological Survey's (USGS) mission is to provide reliable scientific information to describe and explain science about natural hazards, natural resources, ecosystems and environmental health, and the effects of climate and land-use change. The USGS mission can be found at https://www.usgs.gov/about/about-us/who-we-are. This poster will present some of the data collected by the USGS and where to find it. Data presented will include water-monitoring networks and studies (https://www.usgs.gov/centers/sawsc), groundwater conditions of Georgia (https://ga.water.usgs.gov/infodata/gwconditions/index.php), Georgia water use (https://www.usgs.gov/centers/sawsc/science/water-use-georgia and https://apps.usgs.gov/ga-water-use/), and Chattahoochee BacteriALERT (https://www.usgs.gov/centers/sawsc/science/chattahoochee-river-georgia-bacterialert). The USGS Natural Hazards website (https://www.usgs.gov/science/science-explorer/natural-hazards) provides information and alerts on hazards including earthquakes, volcanoes, floods, and more. The USGS National Water Dashboard provides real-time data on streamflow, water levels, water quality, and precipitation (https://dashboard.waterdata.usgs.gov/app/nwd/en/). The newly released National Water Availability Assessment is the first of its kind and provides insights on where there is a potential imbalance between water supply and demand in the United States. The report, key findings, and the associated data companion are available at https://www.usgs.gov/special-topics/integrated-water-availability-assessments. The USGS Water Science School has information and resources about water for teachers and students (https://www.usgs.gov/special-topics/water-science-school). All USGS publications can be found in the USGS Publications Warehouse (https://pubs.er.usgs.gov/).

Investigating Co-occurrences Between Freshwater Mussels and Host-Fish Species in southern Oklahoma Rivers

Jennifer Haase[1], Caryn Vaughn[2], Garrett Hopper[1]

[1]*Louisiana State University* [2]*University of Oklahoma*

Freshwater mussels (Order: Unionoida) and fishes are two imperiled taxa that make up an important part of global freshwater biodiversity. Mussels exhibit a complex life cycle that can contribute to their imperilment. Mussels parasitize a host-fish during their larval stage to reach maturity, making fish and mussels coevolved taxa, thus mussel diversity and distribution often correspond to that of fishes. The Host-Habitat Continuum Concept (HCC) seeks to explain mussel distribution by combining life history theory, host-fish distributions, and stream ecological gradients. The HCC predicts increases in fish and mussel richness, shifts in life history strategy composition as habitat area, complexity, and stability increase with stream size; here, we used watershed area at each site as a proxy for stream size. We used observational data on fish and mussel assemblages collected from seven mussel bed reaches in southeastern Oklahoma during 2015-2016. We combined these datasets with published

mussel and host-fish relationships and mussel life history traits to evaluate if the HCC explains mussel and host-fish distributions in southeastern Oklahoma. We found weak support for the HCC as fish and mussel richness, but not densities, increased with watershed area. Centrarchids (sunfishes) and leuciscids (minnows) were the most abundant fishes among sites, and equilibrium life history strategies and luring host infestation strategies dominated mussel assemblages. Additionally, proportional abundances of fish families, mussel life history strategies, and infestation strategies did not change longitudinally as expected. There was a high degree of host partitioning among coexisting mussels, but we found no relationship between known host-fish occurrences and mussel occurrences. The complex nature of freshwater systems and biological interactions among species likely influenced our ability to detect strong associations. Strong host-fish partitioning among mussels at sites distributed along a stream size gradient indicates that management aimed at protecting the interaction between fish and mussels could benefit these coevolved taxa.

Where did you come from, when did you go: when did you peak, stormwater flow? Hydrologic travel time distributions of storm flow in the Lower Flint River basin

Chloe Hall[1], Jamie Rogers[1], Stephen Golladay[1], Nicholas Marzolf[1]

[1]*The Jones Center at Ichauway*

Travel time estimates of flowing ecosystems are essential for hydraulic modeling. However, they are challenging to estimate due to labor-intensive field protocols and the dangers of surveying during high flows. Using USGS stream gage data from across the Ichawaynochaway Creek watershed, a tributary of the Lower Flint River Basin in southwestern Georgia, we aimed to predict travel times across a 15-kilometer stream reach using continuous data from 1995–2025. Using a paired gage approach, we identified peaks in discharge above a threshold at upstream and downstream sites to calculate travel time. We use a LOESS smoothing model to describe travel time duration across storm flows, resulting in predictions for flows ranging from 0–400 m3/s. Our model revealed increased travel times at higher discharges—a counterintuitive pattern likely driven by overbank flow storage, influenced by the creek's geomorphology and floodplain connectivity. Travel times ranged from 4–9 hours below 85 m3/s and 10–17 hours at higher flows. Further, we used flow duration curves to identify periods of overbank flooding and isolate its effects. Flow duration curves identified breakpoints suggesting stream flow reached bankfull conditions around 2250 m3/s at both sites. Our approach reduces the need for field surveys during high-flow events, relies on available data, and can be applied between any adjacent pair of stream gages. Understanding the factors affecting travel times across flow conditions will support future research by providing critical insight for interpreting stream productivity, nutrient cycling, and ecosystem function.

Evaluating the Efficacy of Urban Low Impact Development Strategies for Managing Stormwater Runoff and Water Quality under Future Climate Scenarios

Alvee Bin Hannan[1], Whitney Pagan[1]

[1]*University of Georgia*

Non-point source pollution from urban areas leads to stormwater runoff carrying excess nutrients, sediment, and other pollutants into waterways, causing degradation of water quality in many watersheds. The Chesapeake Bay Watershed is an important example, as decades of urbanization have contributed to degraded water quality, prompting the U.S. Environmental Protection Agency (EPA) to establish the most extensive Total Maximum Daily Load (TMDL) in its history. As climate change intensifies storm events and urbanization expands impervious surfaces, innovative stormwater management strategies are needed to mitigate these impacts.

This study focuses on Conewago Creek, a rapidly urbanizing HUC-12 watershed in the Susquehanna River Basin, the largest tributary to the Chesapeake Bay, to assess the effectiveness of urban Low Impact Development (LID) strategies in improving water quality. While numerous site-scale studies have demonstrated the efficacy of these practices in reducing runoff and controlling water quality, the study of their watershed-scale impacts is complex, particularly in the context of climate change. We use the Soil and Water Assessment Tool (SWAT) to evaluate the performance of such LID practices (rain gardens, bioretention cells, and permeable pavements) in reducing stormwater runoff, sediment transport, and nutrient loading under future climate scenarios.

Preliminary results indicate that LID strategies can help reduce peak runoff and pollutant loads in urbanized areas, with rain gardens and permeable pavements demonstrating high efficiency in mitigating sediment transport. However, the effectiveness of LIDs is influenced by climate variability, with more frequent and intense storm events limiting their capacity to manage peak flows.

This research provides actionable insights into LID performance under future scenarios and highlights the role of nature-based urban stormwater solutions in addressing water quality challenges and supporting sustainable watershed management. The further goal of the study is to scale up to the entire Susquehanna River Basin, where an integrated urban-agricultural management approach will be assessed. This will serve as a model for understanding and managing water quality in integrated landscapes that balance the needs of agriculture, urban development, and ecosystem health.

Seasonal shifts in ecoenzymatic activity of primary producers in arctic spring-streams along a temperature gradient

Tori Hebert[1], Adam Hensley[1], Carla Atkinson[1], Jonathan Benstead[1], Alex Huryn[1]

[1]*University of Alabama*

Light levels and temperature are strongly correlated in most ecosystems (i.e., highest during summer and lowest in winter). Because of this near-ubiquitous correlation, it is difficult to isolate the individual effects of light and temperature on ecosystem processes under natural conditions. Arctic spring-streams provide an exception due to their relatively stable water temperatures combined with extreme annual light fluctuations, which effectively uncouples their annual light and temperature regimes. We collected samples of primary producers (i.e., aquatic bryophytes and biofilms) semi-monthly from five spring-streams that vary in source temperature from ~1 to 13°C. We measured the activity of carbon (C), nitrogen (N), and phosphorus (P) eco-enzymes for each producer to assess their nutrient limitation and demand. While there were no strong temperature effects, both bryophytes and biofilms showed seasonal patterns for all three enzymes, with the highest activity

occurring in summer and lowest in winter. Strong limitation (as indicated by the inverse of enzyme activity rates and nutrient content) by P was indicated for both bryophytes and biofilms, whereas only biofilms showed N limitation. At the whole-stream scale, bryophytes produce more C- and P-processing enzymes, as a function of their high biomass, but biofilms produce more N-processing enzymes, indicating a greater relative importance in ecosystem-level N cycling. By comparing the enzyme activity of the two major primary producers found in arctic spring-streams, we made progress toward disentangling their relative contributions to ecosystem-level processes (e.g. nutrient cycling) to better understand light and temperature as drivers of ecosystem processes.

On the Relationship between Soil Moisture and Soil Respiration: Assessing Impacts of Various Land Management Practices in Herbaceous Dominated Ecosystems

Pramod Hegde[1]

[1]*University of Georgia*

One of the largest fluxes of carbon from the terrestrial ecosystem to the atmosphere is soil respiration. It is mechanistically controlled by the movement of air within the soil and the presence of microorganisms. Both these factors are directly dependent on the dynamics of moisture and temperature in the soil. Consequently, the relationship between respiration and soil moisture is important in predicting carbon dioxide emissions from soil and their subsequent effects on climate change. Moisture dynamics are influenced by soil pore structure and soil hydraulic properties. In this study, we aim to evaluate and quantify the relationship between soil moisture and soil respiration for variably structured soils. We collected soils from four treatments: 1) nitrogen-phosphorus- potassium (NPK) enriched soils, 2) tilled soils, 3) their combination, and 4) a control. We quantified the structure of the soils using the pore size distribution. This was determined by fitting a Durner dual-porosity model to the soil hydraulic properties of the soils that were measured using the evaporation and dewpoint methods. Soil respiration was measured for 3-6 days following a precipitation event, using an automatic gas analyzer. Multiple linear mixed models were fitted based on pre-hoc hypothesis, and the best performing model was selected based on the lowest AICc. Initial results indicate that although tilled soils have greater moisture following precipitation, they dry quicker than undisturbed samples. This can be attributed to the increased macroporosity observed in disturbed soils. Results from the multi-model inference suggest that water-filled pore volume in pores sized < 0.6 μm and 1-3 μm play a significant role in explaining soil respiration dynamics. This study provides critical insights into the relationship between changing moisture dynamics due to climate change and soil pore structure. Understanding the connection is essential for informing and directing land management practices.

Light and temperature as drivers of organismal metabolism in arctic spring-streams

Adam Hensley[1], Tori Hebert[1], Carla Atkinson[1], Jonathan Benstead[1], Alex Huryn[1]

[1]*University of Alabama*

Arctic spring-streams experience extreme seasonal fluctuations in light but maintain relatively constant water temperatures. As ecosystem productivity and metabolism are closely linked to light availability and temperature, the decoupling of these two drivers in arctic spring-streams provides an opportunity to assess their individual effects on the energetics of consumers. We measured respiration rates of Dolly Varden char (Salvelinus malma) from five spring-streams in arctic Alaska, USA, that lie along a temperature gradient from ~1 to 13°C. Char were sampled five times (n = 4 per stream per date) during August and November 2023, and February, June, and August 2024. Respiration rates were measured sequentially at five temperatures along our study site gradient (3.0, 5.5, 8.0, 10.5, 13.0°C). Specimens were then sacrificed and frozen for subsequent estimates of body mass, lipid content, energy density, and tissue δ13C and δ15N. Preliminary data show that mass-corrected respiration rates of cold-adapted S. malma were higher (0.6 – 2.3 mg O2/h) than those of warm-adapted individuals (0.2 – 1.6 mg O2/h) when measured at 3 and 5.5°C during all seasons. When measured at their native temperatures, however, respiration rates of S. malma from all streams were lower during winter (November and February) than during summer. Ongoing work includes body tissue analyses to assess potential physiological responses (i.e., starvation) to differences in temperature and light regimes across seasons.

Updated Delineation of Water Supply Watersheds in Georgia

Yao Huang[1], Wei Zeng[1], Feng Jiang[1]

[1]*Georgia Environmental Protection Division*

It is required under OCGA 12-2-8 that "Local governments shall submit for approval by the department a watershed protection plan which shall include watershed protection standards and procedures." Here, "department" means Department of Natural Resources, Environmental Protection Division, or EPD. The statute has been promulgated into Georgia Regulation 391-3-16, which sets the minimum criteria for protecting large and small water supply watersheds. EPD, through its water withdrawal permitting authority, implements the statute and regulation. It is important for EPD to clearly identify and delineate water supply watersheds across the state as references to the regulated community.

The following case studies illustrate some approaches of watershed delineation. The Savannah Industrial & Domestic Water system Surface Water Withdrawal Permit, 051-0115-01, authorizes surface water withdrawals from Abercorn Creek, a tidal tributary of the Savannah River, for industrial and municipal use. Abercorn Creek's unique looped flow path creates a circular hydraulic connection to the Savannah River, underscoring the interdependence of the river and its tributaries. The associated water supply watershed was delineated using HUC10 boundaries and intake location data, emphasizing the need for resource management strategies that align with natural hydrologic systems. A second permit, Permit 121-0191-06, allows Augusta-Richmond County to withdraw water from Augusta Canal. As an engineered subsystem entirely reliant on the river, the Canal's water supply watershed was defined by the boundary of the Augusta Canal-Savannah River Basin and the intake site. Additional permits govern surface water withdrawals from springs, where watershed areas are classified as having no contributory drainage area due to the absence of visible upstream channels. Collectively, water supply watershed delineation serves as a critical framework for protecting water resources, reconciling ecological integrity with sustainable development, and addressing challenges

such as pollution and climate impacts. By integrating scientific rigor, policy frameworks, and community engagement, this approach fosters long-term water security while honoring the complexity of natural systems.

Investigating aquifer connectivity and transmissivity in southwest Georgia through the Groundwater App

Haley Hubert[1], Adam Milewski[1], Todd Rasmussen[2]

[1]University of Georgia Department of Geology [2]University of Georgia Professor Emeritus

This study aims to contribute to the ongoing efforts of the GA-FIT project to fill critical gaps in the understanding of groundwater flow and aquifer connectivity in Georgia. The demand for freshwater in southwest Georgia exacerbates concerns over the volume that can be sustainably withdrawn from the Upper Floridan Aquifer (UFA). Thus, identifying locations where connectivity between the principal aquifers of southwest Georgia exists has become an important area of research. Though previous studies have provided insights into aquifer connectivity in Georgia's southwest Coastal Plain, the extent of connectivity and transmissivity between the Claiborne and UFA systems remain uncertain. This study assesses transmissivity values in the Claiborne aquifer at well sites where its recharge zone overlaps with that of the UFA. This study analyzes aquifer properties to achieve research objectives and determines Claiborne transmissivity using Theis and Cooper-Jacobs solutions for drawdown analysis. The Groundwater App is used as a computational tool that corrects groundwater heads to help solve these equations efficiently. Preliminary results from pump tests conducted in Claiborne wells reveal variability in transmissivity: ~76.6 ft2/day at Monitoring Well CA1 (Early County), ~4,404 ft2/day at Production Well SW1 (Lee County), and ~17,616 ft2/day at Production Well SW20 (Terrell County). These results suggest connectivity may be site-dependent, with higher transmissivity observed in areas where the Claiborne may exchange water with adjacent aquifers. This method enhances the measurement and understanding of the hydraulic characteristics of the Coastal Plain aquifer systems. Hydrologic parameters can be quantified using the Groundwater App, and drawdown responses from existing monitoring wells can be compared. In future research, the empirical connections between aquifer systems can be analyzed. This research advances science and society by validating the groundwater app as an accurate tool for estimating transmissivity while providing real-time data to support sustainable groundwater management in response to Georgia's growing frequency of droughts.

Observations on freshwater mussel-habitat interactions in a tributary of the lower Flint River Basin during summer base flow

Jenna Jackson[1,2]

[1]The Jones Center at Ichauway [2]University of Alabama NSF RaMP Woods-2-Water

Development of a Habitat Conservation Plan (HCP) in the lower Flint River Basin (LFRB) has revealed notable data absences pertaining to the relationship between freshwater mussel species and their small-scale environment (microhabitat). In this study, we conducted mussel surveys and

collected sediment cores at 1-meter-long stream transects to investigate sediment characteristics (texture, bulk density, and FPOM) relative to mussel species distribution pattern (zonation) at low flow conditions. We conducted the study at Spring Creek near Colquitt, Georgia, because of the diversity and abundance of freshwater mussels, as well as differing sediment textures across the stream bed. Historic drought events from 1999-2012 caused significant declines in species abundance and diversity. Decreasing water scarcity during the growing season beginning in 2013 and subsequent survey efforts in 2023-2024 showed mussel species recovery at Spring Creek. Preliminary data have shown that species such as Leaunio lienosus and Toxolasma paulum preferred stream banks characterized by fine sediments and higher organic matter concentrations. Stream channel areas with coarser sediments and less organic matter were preferred by species such as Pleurobema pyriforme and Hamiota subangulata, both federally listed. Elliptio pullata/fumata, a common species, showed no habitat preference. At summer base flow conditions, zonation patterns were retained after bank preferring species had moved downslope. This study, while limited in scope, adds important information about mussel-habitat interactions during base flows. Understanding the responses of common and listed species to growing season low flows and changing sediment characteristics is pertinent for evaluating management strategies under the HCP to promote mussel population recovery in the LFRB.

Abundance, Characteristics and Variation of Microplastics in Different Freshwater Fish Species

Shumya Jannat[1]

[1]*Georgia State University*

Microplastic contamination in fish species is an emerging environmental concern due to the proliferation of plastic pollution in the environment. This study investigated the abundance, characteristics, and variation of MPs in different commercial freshwater fish species from Bangladesh. This country generates a considerable amount of plastic waste annually, with a significant portion remaining uncollected. Forty-eight fishes from eighteen taxa spanning different feeding zones were collected to observe the difference in MPs ingestion rate among various feeding habitats. MPs were found in the gastrointestinal tracts of 73.3% of all examined fish samples, which is relatively higher than previously reported studies in other regions. The abundance of MPs was highest in Mystus vittatus among all the fish species. Microscopic analyses revealed that MPs were predominantly fibers in shape and transparent in color. Fourier Transform Infrared (FTIR) analysis showed that the polymers found in fish GIT were high-density polyethylene, polypropylene-polyethylene copolymer, and ethylene vinyl acetate. The results indicate that demersal fishes presented a higher amount of MPs than benthopelagic and pelagic fishes, suggesting that the ingestion of plastics in fish may be related to their feeding habitat. However, differences in body weight and length of the fishes were not found to influence the MPs ingestion. These findings will help raise awareness about the freshwater fishes and feeding zones that are more contaminated with MPs.

Exploring the utility of remote sensing in water management and freshwater mussel habitat conservation

Amber Johnson[1], Caitlyn Sweeney[1], Christine Bahlinger[1], Stephen Golladay[1,2]

[1]The Jones Center at Ichauway [2]Albany State University Georgia Water Planning and Policy Center

Stresses associated with water insecurity push aquatic species populations towards collapse. A Habitat Conservation Plan (HCP) is under development to guide water management strategies and provide water security for freshwater mussel habitat throughout the Lower Flint River Basin (LFRB). The LFRB is home to five listed mussel species, with one more proposed for listing. Mussels serve as important indicators of stream health and are foundational in stream food webs. Unfortunately, many species are highly susceptible to low-flow conditions. Our freshwater mussel conservation team has established nine reaches throughout the LFRB as representative habitats for listed freshwater mussel species. Understanding habitat conditions under varying flows is necessary for developing conservation actions that provide water security for mussels and other aquatic biota, while still meeting human water demands. We are applying several remote sensing techniques to digitally reconstruct these reaches and their adjacent stream valleys. By integrating hydrologic models and conservation scenarios, we aim to use these outputs to predict the availability and quality of aquatic habitat if drought were to occur under potential water management strategies. The remote sensing methods being evaluated for this study include terrestrial LiDAR and Unmanned Aerial Vehicles (UAVs). One of our goals is to compare the capabilities and practicality of these modern geospatial approaches for mapping and modeling instream habitats. However, each technique presents its unique challenges. For example, while terrestrial LiDAR produces high-resolution three-dimensional point clouds of each reach, it is expensive and cannot penetrate water surfaces. In contrast, we are able to generate low cost, high-resolution orthomosaics using an UAV, but classification is often impeded by tree canopies and water clarity, resulting in very little, if any, usable data. We intend to compare both methods at each of our nine research sites in order to determine the most effective method of predicting the effects of conservation scenarios on inundated habitat necessary for supporting freshwater mussel populations under varying flow conditions.

Dissolved oxygen dynamics of geographically isolated wetlands in southwest Georgia influenced by Hurricane Helene

Jewell Johnson[1,2]

[1]University of Alabama NSF RaMP Woods-2-Water [2]The Jones Center at Ichauway

Geographically isolated wetlands (GIWs) are common across the karst depressional landscape of the Dougherty Plain, southwest Georgia. GIWs are dynamic systems that include marshes, savannahs and swamps. Despite their small size relative to the surrounding landscape, GIWs provide many ecosystem services and are biogeochemical hotspots. Patterns of dissolved oxygen (DO) concentrations in inundated conditions inform biological activity, biogeochemical cycling, and greenhouse gas production. Understanding how DO changes at varying temporal scales (e.g., daily and seasonally), and different water levels can help inform habitat quality and ecosystem production. Additionally, changes in DO during and after storm events can inform ecosystem oxygen demand and system recovery. Our study objective was to 1) understand how DO patterns vary across temporal scales and hydroperiods of GIWs and 2) determine how these are influenced by storm events. We collected continuous DO, climate, and precipitation data from four wetlands (two marsh savannahs

and two Cypress swamps) at The Jones Center at Ichauway from July to November 2024. This period included Hurricane Helene, a 101-mm storm event across the Dougherty Plain between September 24 – 26th 2024. During the storm, we observed increased DO across all GIWs. Our results show greater diel DO variability in the marsh GIWs compared to the Cypress swamps. Knowledge of the influence that storm events have on wetland biogeochemistry is necessary for the agencies making informed decisions about greenhouse gas emissions and land management.

Land Use as a Driver of Biotic Composition and Ecosystem Function in Georgia Streams

Jane Jones[1], Raymond Kidder II[1], Haley Vaglienti[1], J. Checo Colón-Gaud[1]

[1]*Georgia Southern University*

Differences in land use across large, watershed-wide spatial scales is known to ultimately influence the abiotic and biotic dynamics of aquatic habitats within a given landscape. The conversion of natural landcover to agricultural, industrial, or urban use represents a significant stressor that can increase sediment runoff, flow rates, and nutrient levels in aquatic habitats. These impacts shift biotic assemblages within affected stream habitats, favoring more tolerant species and leading to a predicted decrease in holistic ecosystem function. Our study, a constituent regional component of a larger international research effort, aimed to compare the aquatic macroinvertebrate community and detrital processing rate of streams surrounded by different land cover classes. Sites nested within watersheds dominated by Urban, Forestry/Pine Plantation, Natural Forest, and Agriculture or Pasture land use classifications were assessed using a standard leaf-pack methodology. By introducing and subsequently retrieving known amounts of detrital material from a given stream, we were able to quantify the rate of decomposition in each land cover category. As a process, detrital decomposition is a holistic indicator of overall ecosystem function as it is driven by a combination of fungi, bacteria, and aquatic macroinvertebrates. Further, the deployment of leaf packs presents a passive method for aquatic macroinvertebrate collection. Macroinvertebrates are a commonly-used bioindicator taxa due to their taxonomic diversity, ubiquity in aquatic ecosystems, and range of tolerance to environmental stressors. We compared macroinvertebrate communities across land cover types to assess the overall influence of land use on aquatic macroinvertebrate assemblages. Results from this study will contribute to a global effort aimed at better understanding the effects of shifting global land use patterns on the health and function of aquatic habitats.

Shoreline Wonders: Navigating Mangroves with GIS

Swaty Kajaria[1]

[1]*University of Georgia*

Mangrove forests provide numerous ecological services, including coastal protection, habitat for marine species, and carbon sequestration. Despite their immense economic value, these services are often overlooked in decision-making processes. One reason being that the historic data on the extent of mangrove cover is not readily available. This paper aims to develop a method to map the extent of

mangroves from 1984 to 2020 for the coastal state of Florida. The data generated from this study will be used for economic analysis to estimate the value people place on mangroves and how this value is capitalized in the property market. I use Google Earth Engine (GEE) to extract Landsat imagery for each year for the last 37 years (1994-2020). Following image extraction, I utilized elevation data to mask out higher elevation areas, as mangroves typically thrive in regions with lower coastal elevations. I then calculate different vegetation indices using the Landsat band values, namely Normalized Difference Vegetation Index (NDVI), the Normalized Difference Mangrove Index (NDMI), the Modified Normalized Difference Water Index (MNDWI), and the Simple Ratio (SR) to our existing independent variables. These indices provide critical information about vegetation density, water content, and moisture levels, respectively, which are essential for mangroves mapping.

Characterizing Watershed Biogeochemical "Fingerprints" Across a Managed Forested Watershed in Alabama, USA

Sarah Kelley[1]

[1]*University of Alabama*

Non-perennial streams comprise more than half of global stream length, and these streams extend and contract seasonally and during storm events. Recent work indicates that these tributaries can act as biogeochemical hotspots and may have disproportionate influence on biogeochemical fluxes across the terrestrial-aquatic nexus. Despite these advances, our understanding of the complex, often interconnected, mechanisms by which stream chemistry responds to changing hydrologic conditions remains understudied in the southeastern United States. To explore the biogeochemical "fingerprint" across a representative watershed of the Gulf coastal plain, we conducted monthly spatially-intensive sampling to explore the impacts of stream size (as area km2) on nutrient concentrations of [C]arbon, [N]itrogen, and [P]hosphorus in 2024-2025. During each sampling event, we collected surface water samples across twenty sites nested within the South Sandy Watershed (125 km2), which flows within the Talladega National Forest in central AL. We found that C (as dissolved organic carbon, DOC) and ammonium (NH4+) concentrations increased as site area increased, while phosphate (PO43-) and nitrate (NO3-) concentrations generally decreased as site area increased. Our preliminary results suggest that as subcatchment area increases, larger subcatchments act as integrators of upstream processes, being potential sources of DOC and NH4+ and potential sinks of PO43- and NO3- across the South Sandy watershed. Further, our results suggest that frequency, timing, and duration of network expansion and contraction are particularly important for characterizing C, N, and P distributions. Understanding the impact of steam network conditions on nutrient concentration helps us understand the transport and processing of C, N, and P in dynamic headwaters.

Assessment of Upper Floridan and Claiborne Aquifer Interactions with Surface Water During Historical Droughts in Southwest Georgia, USA

Rajesh Khatakho[1], David E. Stooksbury[1], Ernest W. Tollner[1], Adam Milewski[2], Nandita Gaur[3], Ritesh Marki[4]

[1]*University of Georgia School of Environmental, Civil, Agricultural & Mechanical Engineering* [2]*University of Georgia Department of Geology* [3]*University of Georgia Department of Crop and Soil Sciences* [4]*University of Maryland College of Agriculture and Natural Resources*

Excessive water withdrawal from the Upper Floridan Aquifer (UFA) in the lower Apalachicola-Chattahoochee-Flint (ACF) River Basin has led to the depletion of groundwater levels and a decline in baseflow to the streams in the river basin. In addition, recurring extreme drought in the region due to climate change has exacerbated the water resources issue. The Claiborne aquifer (CA) that underlies the UFA may serve as an alternative water source to supplement the increasing water demand in the region, especially during drought periods. However, the spatiotemporal investigation of the hydrological response of the CA to increasing use for irrigation remains unexplored. In this study, we evaluated the hydrological interaction of Surface Water (SW) with UFA and CA, especially under the 2010-2012 and 2016 drought periods, by employing the numerical MODFLOW model. Furthermore, the standardized groundwater (GW) index was also assessed as a potential metric for groundwater resource management in the lower ACF River Basin. Analysis revealed that the interaction of UFA and CA with SW is inconsistent due to variations in thickness and the hydraulic parameters of the aquifers, Upper Semi-Confining Unit (USCU), Lisbon Semi-Confining Unit (LSCU). Interaction of aquifers with SW was governed by the outcrop area of the UFA, CA, thickness of the USCU, LSCU, and sensitive recharge areas such as Instream Karst and Northern regions where the UFA and CA respectively has a lower thickness and is close to the land surface. This study provides valuable insights into water availability, groundwater levels, recharge potential and rates, and groundwater droughts, which are crucial for water resources planning and management.

Evaluation of wild pig wallows as a source for transmission of human and animal pathogens

Kevin Kosewick[1]

[1]*University of Georgia Department of Environmental Health Science*

Feral pigs are an invasive species known to carry at least 30 viral and bacterial pathogens that can impact humans, livestock, and wildlife. They engage in destructive rooting and wallowing behavior, costing hundreds of millions annually for agriculture industries and negatively impacting wildlife and plants of conservation concern. Wallowing disturbs soil and forms pools of standing water used by wildlife for several reasons. Wallows present unique opportunities for pathogens to proliferate and colonize wildlife that interact with them. Because feral pigs can carry diseases that could devastate many sectors of the nation's livestock and agriculture industries, it is essential to monitor their disease status.

We investigated the presence of zoonotic pathogens Salmonella spp., Leptospira spp., and shiga-toxin producing Escherichia coli and the concentrations of fecal coliform bacteria in feral pig wallow water across three sites in the Georgia and South Carolina over one year. Cultured isolates of Salmonella were obtained at all sites (3/3) and in 29% (10/34) individual samples. Fecal coliform bacteria were detected in 85.7% of samples with a mean of 99,265 CFU/100 ml (ranging from 0 to 2,520,000 CFU/100 ml, with turbid waters having high levels).

This project is ongoing and will help determine fecal contamination and pathogen levels within wallows. This work may help identify additional knowledge gaps, the results of which would inform the management of wild pigs and pathogens of importance to livestock, wildlife, and human health.

Abundance and Diversity of Macroinvertebrates along a Conductivity Gradient at Sea Palms West, St. Simons Island, GA

Reid Kroken[1], Kimberly Takagi[1]

[1]*College of Coastal Georgia*

Freshwater ponds provide ecological functions including aquatic habitat, biogeochemical cycling, and hydrologic storage. Aquatic macroinvertebrates can function as bioindicators for ecosystem health and are important to aquatic food webs. This study was based in the Sea Palms West (SPW) residential community, on St. Simons Island, GA, where a golf course was converted to a greenspace. Water features occur along a gradient of exposure to nearby marsh flooding during high tides and storm surges. Our objective was to 1) determine if there was a relationship between macroinvertebrate diversity / abundance and conductivity; and 2) compare macroinvertebrate abundance and diversity across ponds. Conductivity was measured with a YSI ProQuatro Model 10 and macroinvertebrate data was collected with standard D-Nets. Macroinvertebrate diversity was calculated using Shannon Diversity index. No relationship existed between macroinvertebrate abundance / diversity and conductivity. Next steps are to compare diversity across ponds using ANOVA.

Variation in Excretion Rates and Stoichiometric Ratios of Freshwater Mussels in Bogue Chitto River, LA

Madison Kuczek[1]

[1]*Louisiana State University School of Renewable Natural Resources*

Animal-driven nutrient cycling processes are crucial for regulating natural nutrient dynamics and are influenced by ambient water chemistry and species-specific traits such as body size. Freshwater mussels (Order Unionoida) are a diverse, largely threatened group of sedentary, filter-feeding bivalves that predominantly occur in dense multispecies aggregations and can create hotspots of biogeochemical activity. Although occurring within the same feeding guild, different species retain distinct soft-tissue stoichiometric ratios that lead to differences in the rates and ratios of nutrients released as excretion. Thus, quantifying interspecific differences in nutrient excretion rates and stoichiometric ratios can reveal how differences in mussel assemblage composition affect nutrient dynamics at the ecosystem level. Our objective was to test whether body size and species identity influence excretion rates and ratios of nitrogen (N) and phosphorus (P) for freshwater mussels in the Bogue Chitto River, LA. We expected that per capita nutrient excretion rates (μmol/h) would increase with body size, as predicted by the metabolic theory of ecology, and that species identity would influence N:P ratios given phylogenetic constraints on stoichiometric traits. We quantified N and P excretion rates for 128 individuals representing 11 mussel species. As expected, N and P excretion rates increased with body size. We also found that mass specific excretion rates and N:P ratios varied

significantly among species, supporting previous work demonstrating that mussel occupy distinct stoichiometric niches. Future work will combine soft tissue nutrient concentrations and stoichiometric ratios with data on mussel assemblage structure to quantify assemblage level nutrient cycling and storage capabilities. Our study informs biodiversity conservation by highlighting the functional role of different freshwater mussel species in nutrient cycling.

USGS and U.S. Navy Investigate Groundwater Contamination in the Upper Floridan Aquifer, Marine Corps Logistics Base Albany, Georgia

James Landmeyer[1]

[1]*U.S. Geological Survey*

CANCELED

Volatile organic compounds and metals have been detected in groundwater at various locations of the Marine Corps Logistics Base (MCLB) Albany, Georgia. The MCLB was placed on the National Priorities List by the U.S. Environmental Protection Agency in 1989. Since then, numerous studies have been done to understand the sources, fate, and transport of contaminants, such as carbon tetrachloride, in the Upper Floridan aquifer. These studies have been complicated at MCLB Albany by the presumed karst conditions in the regionally extensive Upper Floridan aquifer, the proximity to population centers in Albany, and the fact that the Flint River receives recharge from the Upper Floridan aquifer. To facilitate hydrogeologic characterization at the MCLB, borehole geophysical data on four monitoring wells in the Upper Floridan aquifer were collected during 2020 by U.S. Navy contractors. Three additional wells were then installed to address data gaps, and these wells were logged by the USGS during 2024. Logging comprised traditional logs, such as gamma, and novel logs, such as nuclear magnetic (NMR). The presentation will showcase the site characteristics, groundwater flow, and how the NMR logs were used to estimate hydraulic conductivity of the Upper Floridan aquifer and overlying sediments. The ultimate goal of this work is to understand the sources, fate, and transport pathways for contaminants detected in groundwater.

Modeling the Hydrostratigraphy of Aquifer Systems in Southwest Georgia, USA

Amy Laubenstein[1], Adam Milewski[1], Kwaku Asiedu[1], Charlotte Garing[1]

[1]*University of Georgia Department of Geology*

Southwest Georgia is susceptible to extreme weather events. In scenarios of drought, surface water and groundwater resources become greatly limited within the region. This presents a substantial threat to irrigation strategies and public supply. Alternative water resources must be characterized to evaluate their effectiveness during drought conditions. The Georgia Flow Incentive Trust (GA-FIT) facilitates the Drought Source Water Alternatives Program (Drought SWAP), which provides production wells that access deeper aquifers in southwest Georgia to be utilized for irrigation systems during severe drought events. Hydrogeological characterization is crucial to identifying suitable areas for pumping without depleting the remaining surface water supply and the Upper Floridan aquifer, the principal groundwater source. However, it is possible to deplete from the Upper Floridan without

pumping it directly through hydraulic leakage between other aquifer systems. Previous studies have identified potential leakage in specific counties through data analysis of groundwater levels. A full extent of the subsurface hydrogeology of southwest Georgia using hydrostratigraphic correlations and 3D modeling can identify locations of hydraulic connectivity between aquifers. In this display of surfaces created from GA-FIT and historical well data, there is thinning of the confining unit between the Claiborne and Upper Floridan aquifer, displaying fewer than 10 meters thick in some areas. The data analysis of groundwater levels in the Claiborne aquifer that suggested potential connectivity to surficial systems was not easily detectable through modeling efforts. Hydrogeological characterization using other data applications such as lithological analysis, pumping tests, and groundwater level monitoring must be utilized to confirm these as non-suitable areas to drill deeper aquifer wells.

Detecting Change Along a Stream Reach Using Terrestrial Laser Scanning

Jonathan Lipscomb[1], Samuel Bixier[1], Alex Brunson[1], Sydney McDaniel[1], Jacob Bateman McDonald[1]

[1]*University of North Georgia*

Terrestrial laser scanning (TLS) provides a high-resolution method for assessing geomorphic changes within stream reaches over time. In this study, we utilized a Trimble SX10 terrestrial laser scanner to monitor changes on a reach of Balus Creek behind the University of North Georgia's Gainesville Campus. The scanner was set up on four benchmarks (two on river left and two on river right) to optimize line-of- sight coverage. Initial scans of the reach were conducted in February 2024 with the second set of (contemporary) scans being collected in January 2025. The point clouds produced by the scans were processed using Trimble Business Center (TBC), which performed an initial classification of the data. To ensure accuracy, the classification was manually refined to extract ground points while removing vegetation and large wood. To determine the influence manual classification/cleaning of the point clouds might have on the ability to detect change, four researchers cleaned the contemporary point clouds, while one (senior) researcher processed the point cloud from 2024. Ground classified points were exported from TBC and turned into digital elevation models (DEMs) using ArcGIS Pro. The 2024 DEM was subtracted from the contemporary (2025) DEMs to identify regions of erosion (negative values) and deposition (positive values), revealing areas of geomorphic change. Additionally, the study highlights the importance of rigorous point cloud classification, as misclassified data can introduce uncertainties in change detection analyses. Our findings demonstrate the effectiveness of TLS in detecting coarse- as well as fine-scale topographic changes within dynamic fluvial environments. Furthermore, we emphasize the necessity of standardized classification methods to minimize uncertainty in multi-temporal analyses. This research provides valuable insights for fluvial geomorphologists and restoration practitioners aiming to monitor and quantify landscape changes with high precision.

Spatiotemporal drivers of organic matter and nutrient dynamics in an unmodified Southeastern U.S. Gulf Coastal Plain river.

Matthew Lodato[1], Nathan Jones[1], Stephen Plont[1], Arial Shogren[1], Carla Atkinson[1]

[1]*University of Alabama*

Floodplain-derived resources play a vital role in sustaining aquatic life in low-gradient rivers. The availability of both particulate and dissolved resources is strongly influenced by floodplain geomorphology and river-floodplain connectivity. However, river-floodplain connectivity has been suppressed in many riverine ecosystems, hindering our understanding of how it shapes resource dynamics. Here, we aimed to (1) evaluate spatiotemporal drivers of variability in particulate organic matter (POM), dissolved organic carbon (DOC), and dissolved nutrients, specifically nitrogen (N) and phosphorus (P); and (2) determine the relative contributions of material across sites along a longitudinal gradient within the watershed on DOC, N, and P. Our study took place in the Sipsey River, Alabama, U.S.A., an undammed fifth-order alluvial river system with a large swamp complex in its floodplain along our study reach. For two years (February 2021 - February 2023), we collected monthly particulate organic matter (POM), DOC, and dissolved nutrient samples from nine sites across the watershed. We found that sampling year, season, site, and discharge drove variations in POM, DOC, and dissolved nutrient concentrations. To estimate how site-specific contributions of DOC, N, and P changed over time and space, we calculated subcatchment leverage values for each of our sampling sites, representing a distributed mass balance across the watershed. The leverage analysis revealed that the floodplain-swamp complex acted as a persistent net source of DOC to the river, which contains the widest portions of the floodplain and relatively low elevation. Conversely, net nitrogen (NH_4^+ and NO_3^-) uptake increased notably as the river flowed through this swamp complex. Sites upstream of the swamp acted as net P sources, with conditions switching to favor net P uptake upon entering the swamp. Our findings highlight the importance of spatiotemporal controls on POM, DOC, and dissolved nutrient variability underscoring the role of floodplain-swamp complexes in modulating resource availability in low gradient river ecosystems.

Concentrations of Microplastics in Urban Stormwater and Expected Removal Rates Using Bioretention Cells

Callie McCord[1]

[1]*University of Georgia College of Engineering*

Microplastics, small plastic particles that are not seen by the naked eye, pose a serious health concern to our terrestrial and aquatic ecosystems. Stormwater runoff is a major carrier of microplastics because large amounts of runoff come from densely populated areas due to higher levels of impervious surfaces. These hot spots typically contain larger amounts of plastic pollution and also debris from car traffic, which over time is broken down into smaller pieces from human interactions and weathering. Bioretention cells are retrofitted swales in the ground that naturally slow down water and allow it to infiltrate the soil through natural plant materials. This type of green infrastructure could serve as a natural filter of microplastics in stormwater runoff. Currently the information on microplastics is fairly inconclusive due to limited monitoring efforts and difficulty in microplastics identification. Through my research, I will address the following research questions- What are typical concentrations of microplastics in stormwater? At what rate do bioretention cells filter microplastics from stormwater? Where do bioretention cells retain microplastics, i.e. primarily in the inlet or distributed throughout the surface area? The research methodology follows a study by the National Geographic “Sea to Source: Ganges” river expedition which sampled water for microplastics using ISCO autosamplers. These samples were then processed in a lab using TSS filtration, and examined by

microscope for microplastic concentration. We will use similar methodology to test water samples from two bioretention cells in Gwinnett and Clarke county, Georgia.We expect that bioretention cells will filter microplastics from the stormwater with high removal rates with the largest retention near the inlet. This research is critical to understand the extent of microplastic pollution via stormwater and a method of removal through a common stormwater management practice.

Nutrient Removal by Microalgae from Pre-treated Municipal Wastewater

Georgia Mensah[1]

[1]*Georgia State University*

Conventional wastewater treatment methods are constrained by high energy consumption, operation costs, and poor nutrient recovery. Phosphorus is an essential element for all living organisms after nitrogen, but it is a finite and a non-renewable resource, largely derived from phosphate rock. With P reserves dwindling and population growth increasing, it is imperative to find sustainable ways to recover and recycle phosphorus. Microalgae-based wastewater treatment provides a promising solution to recover essential nutrients while mitigating eutrophication caused by excessive nutrient levels in surface waters. This study evaluates the efficiency of Chlorella vulgaris in utilizing nitrogen and phosphorus nutrients for growth and biomass production in municipal wastewater. The algae was cultured in pre-treated municipal wastewater for 7 days using different dosages. The effectiveness of chemical flocculants in microalgal biomass harvesting were also investigated. Sodium hydroxide (NaOH), potassium hydroxide (KOH), calcium hydroxide (Ca(OH2), ferrous sulphate ($FeSO_4$), potassium sulphate (K_2SO_4) and calcium carbonate ($CaCO_3$) were employed in different dosages to harvest microalgal biomass by sedimentation over time. Results showed that C. vulgaris grew without any inhibitory effect in the wastewater samples and efficiently removed N and P at 88% and 95% respectively. This growth was also detected by an observed increase in pH, and the nutrient removal was proven by a measured decrease in electrical conductivity values. Surprisingly, lower dosages of Chlorella vulgaris displayed a higher increase in biomass density compared to higher dosages despite both ending at similar biomass density levels. Our investigation on algae flocculation indicated that calcium hydroxide was the most effective flocculant after both 5 and 60 minutes. However, all low dosages of the flocculants in our modelling experiments were found to be insufficient to improve the normal settling rate of algal biomass. The application of Ca(OH)2 as a flocculant appears to be a promising option due to its safe use and relatively low cost.

Water Quality Monitoring of a Small Semi-isolated Freshwater Wetland on Saint Simon's Island

Ollie Mercer[1], James Deemy[1]

[1]*College of Coastal Georgia*

Freshwater wetlands are important ecological features with various influences, such as underground water sources, vegetation, and anthropogenic activities. These features provide multiple ecosystem services, including storm and flood buffering, habitat protections, cultural benefits, water purification

and supply, and many others. Our objectives were to: 1) quantify baseline water quality parameters at weekly intervals, 2) quantify spatial variation in water quality based on weekly sampling of two transects across the wetland and in regular sampling intervals around the wetland, and 3) quantify changes in the water quality parameters prior to vegetation leaf out and post-leaf out. The focal wetland for this project was a semi-isolated, freshwater, forested wetland at Oglethorpe Point Elementary School's campus located on Saint Simon's Island, Georgia. Physicochemical parameters (dissolved oxygen, pH, specific conductivity, temperature, turbidity) were measured with a YSI Proquatro multi-probe and a LaMotte turbidimeter. Nutrient parameters (NH4, NO2, NO3, PO4) were measured with a LaMotte colorimeter. Preliminary physicochemical and nutrient data indicate that the wetland is well mixed.

Dissolved Heavy Metal Concentrations in the Muscle Tissue of Bluegill (Lepomis macrochirus) in the Chattahoochee River Drainage, Columbus, Georgia

Collin Miller[1], Michael Newbrey, Samuel Abegaz

[1]*Columbus State University*

An initial examination of Bluegill in Weracoba and Roaring Branch Creeks have shorter lifespans and higher red blood cell counts than Bluegill in Lindsey Creek in the Columbus, GA area. Using dissolved water metal data provided by Chattahoochee Riverkeeper, we suspect that age truncation of this species in these creeks could be due to chronically high levels of the metals copper and lead in Weracoba Creek. High levels of manganese in Roaring Branch creek could also be contributing to poorer health in Bluegill. We sampled 20 Bluegill from each of four localities, Roaring Branch, Lindsey, and Weracoba Creeks, as well as Lake Oliver. Fish muscle tissue was collected, lyophilized, and digested prior to analysis. We used ICP-MS to detect trace elements at the parts per trillion level and major elements at the parts per million level. We expect data to show significantly higher levels of heavy metals in fish from Weracoba and Roaring Branch Creeks as compared to Lindsey Creek. Additionally, we expect Weracoba Creek to have the highest concentrations of metals, while Lindsey Creek is expected to have the lowest concentrations.

Investigation into the probability of saltwater intrusion (SWI) into a micro-watershed on Saint Simons Island, Ga

Michele Mixon[1], Kimberly Takagi[1]

[1]*College of Coastal Georgia*

Increases in annual average temperatures have facilitated melting in polar ice regions, leading to a rise in ocean levels. This phenomenon poses a substantial risk to our coastlines, with barrier islands being particularly vulnerable to sea level rise given their low elevation. Freshwater sources on barrier islands rely on a freshwater lens (FL), a bubble of freshwater above the denser salt groundwater. The FL is fed by precipitation absorbed by the soil and protects the surrounding freshwater wetland vegetation from inundation with saltwater, which could be toxic. Highly developed barrier islands may experience less perception absorption due to the increase in impervious surfaces. Our initial

observation of a micro-watershed on Saint Simons Island, Ga (SSI) indicated the presence of two invertebrate species that are unlikely to coexist. C. fragilis, the acorn barnacle, requires inundation by salt water, while D. longispina, the water flea, is an obligate freshwater species recently discovered to have adaptive salt tolerance. The objective of this study was to investigate the possibility of saltwater intrusion (SWI) into the watershed. This study utilized current and historical satellite imagery coupled with in situ observations and water quality analyses collected between 2020 and 2024 to assess the micro-watershed. Invertebrate surveys indicated a large population of D. longispina and recruitment and survival of C. fragilis. Conductivity and TDS were utilized to infer salinity levels for consistency with testing in previous years. Our data indicates it is likely this micro-watershed is becoming inundated with salt water from the adjacent marsh due to a decrease in the freshwater lens. This SWI is consistent with the lack of D. longispina in previous invertebrate surveys as it would take several generations for the population to adapt and recover. Additional ground water monitoring should be completed to determine the impact and severity of SWI.

A Case for Increased Consideration of Downstream Riverine Health Analysis in Stormwater Management Regulation

John Montoya[1]

[1]*University of Georgia*

Flood prevention and maintaining water quality standards are incredibly important tasks. Without stormwater management, watersheds would experience massive increases in peak flows and sediment transport that would quickly alter river morphology and in turn the surrounding area. Current standards and regulatory requirements ensure that development will not have an adverse impact on the site itself by returning peak flows to pre-development conditions. However, the same cannot be said about stream conditions downstream of the site. This study focuses on the intersection of stormwater management and downstream riverine health analysis. A StormWise model was developed to represent an area of new development at the Savannah River Site (SRS) and develop an understanding of the runoff quantity and timing of the site. We expect the StormWise model to show how the conventional stormwater infrastructure, while maintaining peak flows to pre-development conditions, is creating harmful conditions for the downstream reaches. Several detention ponds at the same site can cause an unintended new peak in flows when all the water that has been detained by each pond is released at similar time periods. Furthermore, detention ponds reduce the sediment transport of the watershed, which compounds with unexpectedly high flows to create erosive conditions. Left unattended, this could lead to head cuts traveling upstream and affecting the SRS development and large amounts of sediment being transported downstream and damaging even more of the river system and the surrounding ecosystems. A River Evolution Model (REM) was also developed to understand how stormwater flows predicted by StormWise due to the site development would affect stream erosion downstream. The REM model is expected to show that the current conditions upstream are causing massive incision and channel degradation. Through the research conducted at the SRS, we hope to better define the relationship between stormwater management and downstream riverine health in order to support updating stormwater management regulations.

Developing Regional Curves for Estimating Bankfull Geometry for Streams in Georgia

Jonathan Musser[1]

[1]*U.S. Geological Survey*

Stream channel morphology may be altered by human activities that modify runoff characteristics, such as urban development or agriculture. These alterations can increase suspended sediment and lead to unstable streambanks. To address these impacts, scientists and engineers have begun to apply the principles of natural channel design to the construction and restoration of stream channels. Natural channel design, or "stream restoration" involves rebuilding a channel with the appropriate dimensions and slope, so that it can pass the water and sediment loads supplied to it without aggrading or degrading. Stream channels designed to approximate natural stable conditions are more likely to remain in equilibrium over time and therefore reduce erosion and sedimentation and provide suitable aquatic habitat. An important component of this design and restoration are regional curves, or mathematical relations, developed to estimate the bankfull geometry for a stream location. The U.S. Geological Survey (USGS) StreamStats Web application, which is available at https://streamstats.usgs.gov/ss/, estimates the bankfull geometry (area, depth, and width) for a selected location on a stream using regression equations based on the upstream drainage area. However, only 12 locations in Georgia were used to develop the regional curves relating bankfull area, depth, and width to drainage area for the 5 Physiographic Regions in Georgia: Appalachian Plateaus, Blue Ridge, Coastal Plain, Piedmont, and Ridge and Valley. Of those locations, 6 were in the Piedmont Physiographic Region and the other 6 locations were in the Coastal Plain Physiographic Region. No locations in Georgia were used for the remaining three Physiographic Regions in Georgia. Thus, current estimates produced by StreamStats may not be accurate for the entire state of Georgia. In cooperation with Georgia Department of Transportation, the USGS undertook extensive field surveys to develop regional curves relating bankfull area, depth, and width to drainage area for each of the 6 EPA Level III Ecoregions in Georgia: Blue Ridge, Piedmont, Ridge and Valley, Southeastern Plains, Southern Coastal Plain, and Southwestern Appalachians to update the regional equations in the StreamStats application. Measurements of bankfull geometry were surveyed at 114 stream locations in and near Georgia, ranging in size from 0.47 to 272 square miles. The updated equations will improve the accuracy of bankfull characteristics across the state and facilitate their use in stream restorations and other hydrologic investigations.

Precision agriculture: Evaluating the use of electrical conductivity for predicting spatially heterogenous soil properties to delineate soil management zones

Johanna Nordwall[1], Matthew Thibodeaux[1], Nandita Gaur[1]

[1]*University of Georgia*

Precision agriculture (PA) practices, such as variable irrigation, often rely on the knowledge of spatially and temporally varying soil properties. Ground conductivity meters like the EM38 (Geonics Limited, N L5T 1C6, Canada) allow for quick and cost-effective mapping of apparent soil electrical conductivity (ECa), which has been used to estimate heterogeneity in soil properties across a landscape. However, associating variability in ECa to specific properties can be challenging due to the large number of factors impacting it. Hence, while ECa is commonly used to create management

zones for PA, it is unclear what these zones represent in terms of spatial soil properties. The goal of this study is to determine whether the EM38 can be reliably used for predicting soil moisture (SM) and other soil properties to delineate PA management zones using these predictions. The study site is a cornfield located within a floodplain at Iron Horse Plant Sciences Farm, in the Southern Piedmont region of the US. We measured ECa at 0.375 meter and 0.75 meter depths using the EM38 across the field for up to five days following irrigation during the Summer in 2024. Data were collected both before and after harvest to represent vegetated and unvegetated conditions. Concurrently, soil was also collected from the top 15 cm to measure gravimetric SM at 34 locations within the field. Additionally, we collected 6 cm deep soil cores at the end of the study and measured total soil carbon (TSC) and nitrogen (TSN), field capacity (FC), wilting point, porosity, texture, and bulk density (BD). The relationships between soil properties under various constraints were analyzed using principal component analysis (PCA) and Pearson's correlation coefficients. Our results showed that the relationship between the measured variables varied for vegetated and unvegetated conditions. The PCA analysis showed that ECa (0.75 m) was significantly and strongly correlated with BD in unvegetated soil but had no correlation with SM. In fact, contrary to other studies, we found a significant yet weak negative Pearson correlation (r=-0.27) between soil moisture and the 0.375 m readings. Dynamic SM, however, consistently correlated with FC, which is a more static property of soil. We also found that TSC and TSN were strongly correlated with each other but only weakly correlated with both SM and ECa. Our results show that the PA zones created using EM38 could represent variability in BD and consequently help in generating spatially distributed soil hydraulic parameters using pedotransfer functions.

Sustainable Approach for Boron Stabilization in Coal Combustion Wastewaters

Olajide Oladipo[1], Oyindamola Oseni[1], Valentine Nzengung[1]

[1]*University of Georgia Department of Geology*

This research focuses on removing and stabilizing boron from various coal combustion waste products, including coal ash leachate (CAL) and flue gas desulfurization (FGD) wastewater. The objective is to mitigate boron toxicity's environmental and health risks and prevent its leaching into groundwater. We have developed a cost-effective and efficient treatment approach tailored to achieve this in these waste streams.

The treatment approach utilizes optimum doses of aluminum, calcium, sulfate, and pH to rapidly remove boron from CAL by precipitation and coprecipitation. Steel slag and recycled aluminum cans provide low-cost sources of aluminum and calcium. Experimental results indicate that calcium and aluminum play a crucial role in boron removal, facilitating the formation of stable boron-containing minerals. By adjusting the process within a pH range of 10 to 12, X-ray diffraction (XRD) analysis confirms the formation of stable boron compounds, including ettringite, inyoite, ameghinite ($Na_2B_5O_6(OH)_4 \cdot 3H_2O$), borcarite ($Ca_4MgB_4O_6(OH)_6 \cdot H_2O$), garrelsite ($CaB_2O_4(OH)_2 \cdot 3H_2O$), jarandolite ($CaB_3O_4(OH)_3 \cdot H_2O$), and olshanskyite ($Ca_3B_4(OH)_{18}$).

Further characterization of the residual solids using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and X-ray photoelectron spectroscopy (XPS) is ongoing to understand the chemical interactions and removal mechanisms better.

In addition to precipitation-based removal, bone biochar has emerged as a promising sorption medium for boron. Column experiments conducted thus far involve pre-treating wastewater with $Ca(OH)_2$ before passing it through alternate bone biochar and aluminum powder column layers.

This method has proven highly effective, achieving up to 95% boron reduction in CAL and FGD wastewater. These findings provide a mechanistic understanding of boron removal from water and stabilization. The innovative and cost-effective treatment process being developed presents a low-cost solution for the coal power industry to treat the many billions of gallons of CAL and seawater desalination for use in agriculture.

Enhancing Phytoremediation of Perchlorate and Nitrate in Biochar-Amended Bioreactors: Investigating the Role of Adsorption

Oyindamola Oseni[1], Olajide Oladipo[1], Valentine Nzengung[1]

[1]*University of Georgia*

Phytoremediation has shown significant potential as an environmentally sustainable, efficient, and cost-effective approach for perchlorate degradation in groundwater. However, its effectiveness is often hindered by the presence of nitrate, a common co-contaminant that competes as a terminal electron acceptor. At elevated concentrations, nitrate can delay perchlorate reduction and lead to unintended phytoaccumulation in plant tissues. To overcome these limitations, we are investigating an enhanced phytoremediation system utilizing biochar-amended, willow-planted bioreactors to stimulate microbial activity in the root zone. This approach aims to facilitate the simultaneous rhizodegradation of perchlorate and nitrate while minimizing perchlorate accumulation in plant tissues. Preliminary results from planted sand-biochar bioreactors containing willow trees indicate perchlorate reduction; however, the dominant degradation mechanism remains unclear. This study investigates the contribution of adsorption in removing perchlorate from willow-planted biochar bioreactors.

Batch adsorption experiments were conducted to determine if adsorption contributes to perchlorate removal using biochar samples from a willow-planted bioreactor and the raw biochar. Before use, the biochar was rinsed with deionized water and oven-dried at 105°C for 3 hours. The same mass of biochar (2 g) and volume of water (40 mL) was dosed with either perchlorate only, nitrate, or a combination of perchlorate and nitrate in duplicate. The prepared batch sorption samples were placed on a rotary shaker and equilibrated at 3.3 rpm. Samples were collected at 6, 12, 24, 30, and 36 hours and analyzed using ion chromatography to quantify perchlorate and nitrate loading onto the biochars.

This presentation will elucidate the relative contribution of adsorption and biodegradation during phytoremediation of perchlorate in plant root zones amended with biochar. By determining adsorption's role in perchlorate and nitrate removal, these findings provide valuable insights into enhancing phytoremediation with biochar.

Groundwater flow from Okefenokee Swamp through the Hawthorn Formation and Trail Ridge to the Floridan Aquifer and St Marys River, GA

Todd Rasmussen[1]

[1]*University of Georgia*

Groundwater flow in the vicinity of Okefenokee Swamp is poorly constrained due to a lack of water level and quality monitoring in the Swamp, the underlying Hawthorn Formation and Floridan Aquifer, and the adjacent Trail Ridge and St Marys River. This contribution introduces a suite of conceptual models that describe possible flow and transport behavior for the region. Rather than tessellating the poorly defined spatial variation in aquifer hydraulic parameters, heterogeneities are characterized using the horizontal-to-vertical anisotropy ratio, which is a measure of the directional variation of permeability that is commonly used in layered geologic media. The Complex Variable Boundary Element Method is used to construct two-dimensional flownets that portray the complex potential (equipotentials and streamlines) along a West-to-East transect from Okefenokee Swamp, through Trail Ridge, to the St Marys River, and beyond, as well as a vertical transect from the surface through the Hawthorn Formation to the underlying Floridan Aquifer. This approach allows for understanding relative flow contributions from the swamp through the Hawthorn Formation and Trail Ridge to the underlying Floridan Aquifer and St. Marys River.

Freshwater Mussels of Louisiana: A Field Guide

Franchesca Ruiz[1], Garrett Hopper[1]

[1]*Louisiana State University*

Freshwater mussels (Order Unionida) are important animals that provide valuable ecosystem services for both people and the environment. Due to a multitude of factors such as habitat modifications and habitat destruction related to human population growth many mussel populations are declining throughout the United States increasing the need for public awareness. Louisiana is home to 65 mussel species, but most residents are not aware of their presence, importance, or state of imperilment. We addressed this by creating a field guide to the freshwater mussels of Louisiana. Our goals include providing a resource for accurate freshwater mussel field identification, increasing public and scientific awareness of these animals, providing information about their importance to ecosystem health, and promoting a conservation ethic for freshwater mussels in the state. We collated data for species accounts from freshwater mussel textbooks, peer-reviewed research papers, and government reports. We photographed shells of native species housed in the mollusk collection at Louisiana State University-Shreveport's Museum of Life Sciences and the Mississippi Museum of Natural Science. Each species account contains a photograph, detailed physical description of the shell, habitat, host fishes, state and federal conservation status, and any additional information that may aid in identification. In addition to an account for each native freshwater mussel species, there are brief accounts for two species of common invasive bivalves and general information about mussel ecology, ecosystem services, the life cycle, and a glossary of malacological terms. This field guide will introduce Louisiana's residents to the diversity of freshwater mussels in the state and assist scientists studying Louisiana's freshwater mussels, in the hope of moving toward a future where mussels are appreciated and protected.

Modeling Amphibian and Plant Community Responses to Wetland Restoration Techniques in Georgia

Jade Samples[1,2]

[1]*The Jones Center at Ichauway* [2]*University of Georgia*

Conservationists rely heavily on habitat restoration as a foundational management tool to counteract declines of threatened and endangered species. Effective restoration requires a multifaceted approach, including adaptive management, which integrates monitoring, evaluation, and feedback. The Coastal Plain of the United States has experienced widespread loss and degradation of geographically isolated wetlands (GIWs) primarily due to fire suppression and the resulting encroachment of hardwood vegetation. These wetlands are crucial to a suite of endemic amphibian species' that rely on them for reproduction like the State-threatened Gopher frog (Rana capito). Thus, there is high conservation value to restoring GIWs to enhance regional biodiversity. However, there is limited information on the effectiveness of restoring these wetlands for wildlife such as amphibians. In this study, we are conducting acoustic for calling anurans and dipnet surveys to detect larval and adult anurans and salamanders at four field sites in southern Georgia, including more than 30 wetlands across a gradient of condition from reference wetlands representing historic conditions to unrestored and restored wetlands with varying degrees of hardwood removal and prescribed fire. Vegetation surveys will characterize pre- and post-restoration conditions using a belt-transect method. Amphibian and plant monitoring data will be analyzed using an integrated Bayesian hierarchical community occupancy model in R, originally developed for forest buffer management, and modified for this project. We predict that restored wetlands will exhibit higher amphibian and plant species richness than non-restored wetlands. Wetlands treated with both mechanical hardwood removal and prescribed fire are expected to show the least hardwood regeneration and the largest change in amphibian and plant community composition. The results from this study are expected to inform future wetland restoration management in the southeast, providing quantitative insights into amphibian-plant community interactions within an adaptive management framework that targets key plant species and rare amphibian taxa.

Measuring the Impacts of Urbanization with Macroinvertebrate Communities in Metro Atlanta

Hana Sato[1]

[1]*Oglethorpe University*

In countless studies across the primary literature, macroinvertebrate community composition has been successfully used as a bioindicator of ecosystem health across a variety of freshwater systems, including streams. Macroinvertebrate communities are commonly impacted by the effects of urbanization, such as habitat degradation and negative impacts of stormwater runoff (e.g., increased pollution and nutrient inputs). Our study aimed to better understand how urbanization impacts stream health on the campus of Oglethorpe University in Atlanta, Georgia, by using macroinvertebrates as bioindicators. Prior studies using the Georgia Adopt-A-Stream chemical and

bacterial testing protocols to monitor the water quality indicate that Oglethorpe's streams are within state standards for these parameters. Consequently, we expected to see a macroinvertebrate community composition with more somewhat tolerant taxa and fewer tolerant taxa. Using the Georgia Adopt-A-Stream macroinvertebrate sampling protocol in our two stream sites, we found that macroinvertebrate composition is not consistent with our water quality. We found more tolerant taxa and few somewhat tolerant taxa, suggesting that there may not be suitable or sufficient habitat present in the streams to support more individuals. Tolerant macroinvertebrate communities may be due to few suitable habitats for macroinvertebrates, and habitat surveys could more accurately reflect the community we observed at our sites. Our study establishes a baseline of the local macroinvertebrate community for our campus streams. In the future, we will be able to use this baseline to help identify the stressors that are leading to low macroinvertebrate communities which will in turn help us to mitigate them.

Analysis of Bioretention Design Performance on Georgia's Coast Using DRAINMOD-Urban

Maria Laura Siqueira Batista[1], Whitney Pagan[1]

[1]*University of Georgia*

Climate change and urbanization present significant challenges for stormwater management in coastal regions. To address these issues, green infrastructure has been increasingly adopted, with bioretention systems playing a key role in managing runoff and improving water quality. This study evaluates how design modifications, such as varying media depth, underdrain configurations, and groundwater levels, impact the performance of these systems using DRAINMOD-Urban.

Changes in these design parameters are critical for addressing challenges specific to coastal environments, where high water tables can limit retention capacity. For instance, increasing media depth can enhance water storage and pollutant removal, while strategic underdrain configurations can improve drainage efficiency under fluctuating groundwater conditions. Evaluating the depth to groundwater is essential in these regions, as it directly influences the bioretention system's ability to manage runoff and maintain sufficient retention capacity.

To improve modeling efficiency, pedotransfer functions (PTFs) were utilized to estimate critical soil hydraulic properties, such as saturated hydraulic conductivity (Ksat) and soil-water retention characteristics. This method helps overcome the challenges of obtaining detailed soil measurements, simplifying the input process for DRAINMOD-Urban simulations. The model will be calibrated based on water level measurements and validated using field data, including rainfall and soil characteristics.

Performance assessment in this study will extend beyond runoff reduction alone. Additional metrics, such as peak flow attenuation, and system resilience under varying precipitation intensities, will be evaluated using DRAINMOD-Urban. These comprehensive performance indicators provide a holistic understanding of bioretention efficacy and resilience in coastal environments .

The study provides valuable insights into optimizing bioretention designs for Georgia's coastal regions, emphasizing the need for tailored stormwater management strategies to mitigate climate

change impacts. The findings offer practical guidance for enhancing the resilience and effectiveness of green infrastructure solutions.

Variation in Carbon and Nitrogen Fixation Across Substrates in the South Fork Eel River, California

Augustine Sitati[1], Michael Zampini[2], Michael Wulf[2], Saeed Kariunga[2], Frank Akamagwuna[1], Jane C. Marks[2], Mary E. Power[3], Steve Thomas[1]

[1]University of Alabama Department of Biological Sciences [2]Northern Arizona University Department of Biological Sciences and Center for Ecosystem Science and Society [3]University of California, Berkeley Department of Integrative Biology

Streams consist of a mosaic of microhabitats that differentially influence the activity of autotrophic and heterotrophic organisms. As a result, these microhabitats are expected to differ in their areal rates of carbon (C) and nitrogen (N) fixation. In this study, we used isotopic tracers (13C and 15N) to measure substrate-specific C- and N-fixation rates in four primary producer patches: Cladophora glomerata mats with their associated epiphyte assemblages, benthic filamentous turfs, epilithic algae, and moss along ~100m stream reach in the South Fork Eel River. We also quantified the biomass of each substrate patch, estimated their percent cover using aerial drone imagery and used quantitative polymerase chain reaction and next generation sequencing to determine taxonomic composition and relative abundance. The substrate-specific measurements were scaled to reach estimates using mean rates and percent cover and compared to reach-scale estimates of gross primary production derived from diel records of dissolved oxygen. Analysis of drone imagery indicates that the total reach area was 400.5 m-2 of which Cladophora mats, turfs, epilithon and moss covered 7%, 15%, 69%, and 9% of the reach, respectively. Similarly, patch-specific areal standing stocks were 56.1, 236.3, 223.2, and 170.0 gDM m-2 for Cladophora mats, turfs, epilithon and moss. Isotope analyses and sequencing are ongoing; thus, few conclusions can be drawn at present. However, prior research has shown that mass-specific N- and C-fixation rates associated with Cladophora (highly epiphytized by Epithemia and its N-fixing symbiont) are high and we expect these patches to dominate reach-scale activity. We anticipate that our results will provide new insights into how substrate heterogeneity drives biogeochemical variation across the stream bed and show how Epithemia and its N-fixing endosymbiont drive stream productivity compared to the other autotrophic components of the stream.

Addressing Contaminants of Emerging Concern in the Southeast through Extension

Katy Smith[1]

[1]University of Georgia Marine Extension and Georgia Sea Grant

Several Sea Grant programs in the southeast have teamed up to address contaminants of emerging concern (CECs) through the project, “Building a Regional Network to Study the Influence of Climate Change on Contaminants of Emerging Concern.” In the project, South Carolina Sea Grant Consortium, Marine Extension and Georgia Sea Grant, and the National Sea Grant Law Center

(NSGLC) are supporting research, extension, and outreach activities aimed at better understanding the impacts of CECs in the southeast region. The poster will highlight project accomplishments and future directions, including policy insights from a legal scan conducted by the NSGLC; an overview of the research projects supported by the program to address emerging contaminants in the environment, food resources, wastewater, and organisms; and the development of a regional network to facilitate connecting researchers, extension specialists, educators, and policymakers working to address CEC issues in the southeastern region. Future activities will include the development of communication and outreach products for diverse audiences, as well as a Summer 2025 webinar series highlighting the research projects supported by the program.

Evaluating Inlet Breach Effects: Coastal Monitoring and Beach Profiling on Cabretta Island, GA

Paige Spence[1]

[1]*College of Coastal Georgia*

Northern Cabretta Beach, part of the Sapelo Island complex in Georgia, has experienced erosion (~12,600 m^2/year) for at least seventy years, followed by a shift to accretion (~3,000 m^2/year) following Hurricane Irma in 2017, when an inlet breach through the adjacent Blackbeard Island redirected water flow. The primary cause of previous erosion was the migrating inlet due to north-to-south longshore transport. To analyze these changes, satellite imagery (1985-2024) from Google Earth Pro and Copernicus Browser were analyzed to estimate rates of erosion and accretion, supplemented by land surveys to assess beach scarp presence and stability. After the breach an accretion rate of 0.0024 km2/yr was calculated. An error analysis was conducted to compare measurements made from satellite imagery to those from the field, which were found to not be significantly different. Following the 2017 inlet breach, northern Cabretta Beach has entered an accretionary phase within its expected inlet breaching cycle, the cycle is expected to persist for at least 60 years. To monitor impacts of the breach, field measurements were conducted of beach elevation in March, October, and November of 2024, revealing steeper winter profiles due to higher wave energy, but no persistent erosional structures such as scarps. Additionally, the dunes increased in height and the vegetation became denser and more expansive, indicating a stable accretionary beach. These elevation surveys allow for the assessment of accretion rates and the tracking of seasonal variations in the beach profile and should be continued into the future.

Methods for Assessing Culvert Impacts on Water Quality in Urban Streams

Mary Claire Streat[1]

[1]*Columbus State University*

Urbanized watersheds typically have streams with elevated pollutant concentrations, altered discharge, lowered biodiversity, and human-made structures (e.g., culverts, bridges, and dams). Culverts, large pipes, are widely used in urban environments to transport rivers below human infrastructure.There is strong evidence that culverts cause downstream erosion and fragment

populations of aquatic organisms such as fish, crayfish, and salamanders. While it is recognized that culverts have decreased light availability and limited natural substrates, there are few studies detailing how culverts impact water quality. To address this gap in the literature, we propose to use water quality sensors to characterize how culverts influence water quality parameters, such as turbidity, dissolved oxygen, pH, and temperature. By understanding how culverts influence urban stream water quality, we can identify potential mechanisms by which culverts impact biodiversity in streams. Results of this study could be used to help justify culvert removal or redesign.

Expanding Bacterial Monitoring in Georgia Watersheds: Analyzing Non-E. coli Coliforms in Noonday Creek Using Biolog Gen III Microplates

Joseph Stuart[1], Nathan Halperin[1], Kimmie Burlamaqui[1], Shelby Symons[1], Ramya Rajagopalan[2]

[1]Kennesaw State University College of Science and Math [2]Kennesaw State University Department of Molecular and Cellular Biology

We are conducting bacterial monitoring of the State of Georgia's waterways as a part of the Georgia Adopt-A-Stream initiative. Our goal is to enhance monitoring efforts and raise public awareness about nonpoint source pollution and water quality issues. Specifically, we are investigating fecal coliform contamination in Noonday Creek, Kennesaw, Georgia, over a five-month period beginning in November 2024.

Coliforms such as Escherichia coli are indicators of fecal pollution and thus widely used to monitor water quality and point contamination. The current volunteer-run assays specifically monitor the presence or absence of E.coli in water bodies. However, while the absence of E. coli suggests lower immediate health risks, the presence of other coliforms remains a concern, signaling potential fecal contamination, thus warranting further investigation.

Our study investigates the occurrence and distribution of non-E. coli coliforms in the Noonday Creek watershed in order to determine the benefits incorporating total coliform counts into statewide volunteer bacteria testing. One ml of the water sample is added in triplicate to a petrifilm of specialized bacterial growth medium that is selective for coliform bacteria. After incubation at 35°C overnight, bacterial colony forming units are counted. Colonies are categorized into E. coli and general coliforms. Candidate colonies are then streaked for isolation and presumptively identified using Biolog Gen III Microplates. This 96-well assay system identifies bacterial species based on metabolic activity and biochemical characteristics, such as the ability to utilize various carbon sources and other substrates.

By expanding bacterial monitoring beyond E. coli, this study provides valuable insights into water quality and contamination patterns. Our findings support the integration of total coliform counts into statewide volunteer bacteria testing, a modification that requires no additional materials and could enhance water quality assessment efforts.

A Baseline Assessment of the Springs of the Cahaba River Watershed: Development of a Spring Inventory

Nathaniel Sturm[1], Rebecca Bearden[1]

[1]*Geological Survey of Alabama*

The Cahaba River is a primary tributary of the Alabama River in the Mobile River basin in Alabama. It is the longest free-flowing river in the state and is known to have the greatest stream fish diversity of any similarly sized river in the country. It also has one of the most diverse mussel and snail faunas remaining in North America. While the fish and mussel faunas of flowing streams in the Cahaba River watershed are better known, there has never been a comprehensive assessment of the watershed's springs or their respective faunas. Springs are unique habitats where groundwater-surface water interactions provide relatively stable temperatures throughout the year. Several snail species inhabit springs, such as the Cockle Elimia (Elimia cochliaris) and the Princess Elimia (Elimia bellacrenata), which are endemic to the Cahaba watershed and currently under review for listing under the Endangered Species Act. The Geological Survey of Alabama (GSA) has been tasked with developing a baseline assessment of the springs in the Cahaba River watershed through creation of a spring inventory. While the Cockle Elimia and Princess Elimia are currently only known from a limited number of springs, identification of additional spring habitats may reveal new populations or areas suitable for species reintroduction. To accomplish this task, GSA personnel has implemented multiple methods for locating and identifying springs, including compiling information from topographic maps, agency reports, and various geographic databases, interviewing local landowners and stakeholders, utilizing LIDAR and digital elevation models (DEM) to identify potential spring pools, and conducting field surveys with thermal cameras. Potential spring sites on the initial inventory list were then subject to ground truthing efforts to confirm the presence of a spring and assess habitat characteristics, quality, threats, and snail presence. To date, 96 potential springs sites have undergone initial assessment, of those 96 sites, 22 require additional assessment, 24 did not contain a spring, and 50 springs were verified. Field survey efforts will continue through the summer of 2025, but the spring inventory list will likely continue to grow as new information becomes available. It is intended that the resulting spring inventory will provide a valuable tool to researchers and responsible resource stewards to inform future sampling, restoration, and reintroduction opportunities.

Opportunities and challenges identified from developing a regional conservation strategy for freshwater mussels

Caitlin Sweeney[1], Amber Johnson[1], Christine Bahlinger[1], Steve Golladay[1]

[1]*The Jones Center at Ichauway*

A Habitat Conservation Plan (HCP) is in development for federally listed freshwater mussels in the Lower Flint River Basin (LFRB) of Georgia. The objective of the HCP is to maintain adequate stream flow in the basin to minimize the take of listed species while providing for irrigation water usage that maintains agricultural productivity in a changing climate. When work began on the HCP, a basin-wide mussel survey of the LFRB tributaries had not occurred since 2001. As the field team working on the HCP, we have been responsible for data collection that documents the current distribution of our listed species and assesses the change in distribution over time. Using extensive surveys during field seasons of 2023 and 2024 and having some historical data, we have established considerations and critical needs that support conservation actions in our region and provide an

example for the larger southeastern United States. Long term data, including surveys and stream flow records, are critical for documenting population changes and for understanding the drivers of these changes. Other priorities for assessing long-term changes include considering the effects of physiography on water availability across a larger region and developing life history information, such as lifespan, habitat requirements, reproductive strategies, and host fishes. Since most of the southeastern US is private land, establishing relationships with landowners and understanding their management objectives is critical for conservation success. We have also identified opportunities, such as the use of standardized surveys and the benefit of working with landowners to establish survey sites away from highway crossings and other areas of chronic disturbance. This poster will put these considerations in the context of our work and support our special session "Identifying Critical Field Data Essential for Developing Mussel Conservation Strategies in the Southeastern US."

Stormwater Wetlands as a Nature-Based Solution for Stormwater and Carbon Management on Military Bases

Maliha Tabassum[1], Whitney Pagan[1]

[1]*University of Georgia*

As climate change accelerates, military bases face increased pressure to enhance resiliency while achieving carbon neutrality. Stormwater wetlands have the ability to manage stormwater while supporting ecosystem productivity and sequestering carbon. This research explores the potential of stormwater wetlands to serve as multi-benefit devices, particularly for military bases to achieve net-zero greenhouse gas (GHG) emissions under Department of Defense (DoD) climate strategies. Seasonally inundated wetlands, such as wet meadows are hypothesized to maximize carbon sequestration while minimizing the methane emissions which is a major concern of permanent wetlands. A literature review and modeling framework will serve as the foundation for identifying the optimal design of the proposed wetland. Subsequently, a model of the wetland will be developed. To evaluate wetland performance, the model will be simulated and measured key metrics, including nutrient removal efficiency (e.g., percentage reduction of Total Nitrogen and Total Phosphorus), sediment removal efficiency (e.g., percentage reduction of Total Suspended Solids), organic carbon storage capacity (e.g., carbon sequestration rate in soils and vegetation), and biodiversity indices (e.g., species richness and diversity). Based on the modeling result, a pilot wetland will be constructed to validate the model performance and assess field performance. This study will guide the design criteria of stormwater wetlands into military base infrastructure to enhance ecosystem services, reduce carbon footprints, and increase resilience against climate change.

Assessing the Effectiveness of Streamside Management Zones on Aquatic System Integrity

Haley Vaglienti[1]

[1]*Georgia Southern University*

Harvesting trees, including creating or maintaining roads, causes physical alterations that can increase sediment and nutrients delivered to streams, which may negatively affect aquatic organisms, including plants, fish, and macroinvertebrates (i.e., immature insects, crustaceans, mollusks, etc.). However, forestry best management practices (BMPs), including riparian buffers (i.e., Streamside Management Zones (SMZ)) greatly reduce or eliminate sediment delivery to streams. Additionally, SMZs also regulate stream temperature, stream flow, and nutrient levels. However, knowledge gaps remain in understanding the effectiveness of SMZs in protecting aquatic organisms. We evaluated the ecological integrity of streams by conducting physical assessments and analyzing aquatic macroinvertebrate communities at 24 SMZ sites within the Piedmont and Coastal Plain ecoregions in Georgia. We compared our results to reference sites drawn from a database that matches the study's protocol and ecoregion to assess SMZs' effectiveness in conserving streams' ecological integrity. Our project will help inform forest managers of SMZ effectiveness in limiting ecological effects of timber harvesting on stream ecosystems and identify potential shortcomings of this standard forestry practice.

Green Space Solutions and Stormwater Forecasting – A New Indicator to Manage Basin-Scale Urban Runoff Volume in Watersheds in Gwinnett County

Imani Vincent[1]

[1]*Georgia State University*

Multiple lines of evidence reveal that urbanization in Gwinnett County, Georgia, has led to increased impervious surfaces and exacerbated stormwater runoff issues, threatening water quality, streambank stability, and infrastructure (Gwinnett County 2045 Unified Plan). In response, the Stormwater Forecast—a water quantity-based indicator developed by the Metropolitan North Georgia Water Planning District in 2022— used to support watershed managers by estimating runoff volumes from developed areas was implemented. The Stormwater Forecast does not account for existing stormwater measures already implemented, presenting a gap in understanding (Atteberry 2022). Through a geospatial, hotspot and gap analysis of stormwater runoff volumes using ArcGIS, this research will provide a deeper understanding of the stormwater challenges in major watersheds in Gwinnett County. More specifically, this research seeks to discover: (1) How do forecasted runoff volumes compare in areas with and without existing green spaces? (2) What role do green spaces play in mitigating runoff in the Upper Chattahoochee, Upper Oconee, and Upper Ocmulgee river basins? (3) Map stormwater runoff and streambank erosion hotspots, while focusing on the potential relationship between areas with runoff volumes and insufficient green space capacity with data collected from aerial imagery. GIS is utilized to represent the visualization of the Stormwater Forecast data to bring awareness to hot spots and target solutions in the areas of highest need. The proposed research also seeks to expand our understanding and highlight the Stormwater Forecast scripting tool to assess stormwater runoff volumes in an effort to explore how vegetation such as green spaces as stormwater control measures can address stormwater challenges.

Improving Smart Irrigation Apps to Reduce Stress Not Only for Crops, But Also Farmers

Troy Walts[1]

[1]*University of Georgia*

The Smart Irrigation App was developed by UGA Extension to provide farmers with a tool to help them know how much irrigation is needed for their crops to improve water-use efficiency. While this tool is useful for irrigation guidelines, it does not provide information on the water available in irrigation ponds. This project is designed to provide farmers with a functional device to calculate the current water storage in their ponds. The Pond Capacity Tracker will find if they have enough water present to meet the irrigation recommended by the Smart Irrigation apps. Farmers will not need to overfill their ponds if they know how much water is needed for irrigation practices, increasing water efficiency practices.

The extension to the Smart Irrigation app will be developed by finding preliminary data from an irrigation pond in Tifton, Georgia, and through listening sessions with farmers to get their feedback. The preliminary data for the app will be gathered through the use of soil moisture sensors, rain gauges, and water level loggers. The pond will be modeled in ARC GIS to analyze the change in the water table for the pond. This data will help create a model that predicts pond water levels based on water demand, enabling farmers to manage irrigation more efficiently and with confidence.

The Pond Capacity Tracker Module will enhance farmer's ability to follow recommended irrigation practices. Farmers will be able to monitor the current water storage in their ponds with more ease. This tool, when paired with the Smart Irrigation App will improve the average water efficiency on farms without sacrificing crop productivity. The importance of this tool will only increase with the looming threat of climate change and as water resources become more scarce.

Investigating the Impact of the Hyundai Metaplant on the Upper Floridan Aquifer

Audra Werley[1], Damian Elmore[1], Reid Kroken[1], James Deemy[1]

[1]*College of Coastal Georgia*

The Hyundai Motor Group Metaplant America (HGMA), an electric vehicle and battery manufacturing facility in Ellabell, GA, spans approximately 3,000 acres and is permitted to pump up to 6.6 million gallons of water per day from the Upper Floridan Aquifer over the next 25 years. Our objective was to assess the potential impacts of this groundwater withdrawal on river baseflow and regional water table elevations. Data on river height, groundwater levels, and transmissivity values were sourced from the USGS database. Focal river systems included the Altamaha, Savannah, Ogeechee, Ohoopee, and Canoochee Rivers. Using R, QGIS, and Excel, we analyzed river stage, discharge, and groundwater depth, incorporating transmissivity and storage coefficients to calculate drawdown at five-year intervals over 25 years. Results indicate a maximum drawdown between 5.60–15.04 m, suggesting significant impacts on groundwater availability for anthropogenic uses (e.g., agriculture) and ecological functions (e.g., stream baseflow).

Exploring stream biofilm metabolism across a gradient of land management in a forested watershed of the gulf coastal plain, Alabama, USA.

Khalil Williams[1]

[1]*The Jones Center at Ichauway*

Biofilms are an important component of freshwater ecosystems that perform important ecological functions. With this project, we assessed the influence of natural (stream temperature, forest type) and anthropogenic (forest management) factors on stream biofilm function across the South Sandy watershed, a forested headwater stream network in central Alabama, U.S.A. To this end, we selected five sites distributed throughout the South Sandy watershed (SST02, SST03, SST05, SST07, and SST17) that represented a gradient of management intensity. At each site, we deployed standardized ceramic tiles and cellulose sponges for ~4 weeks to accrue biofilms on these substrates. We co-located the substrate deployments with a water temperature logger (HOBO). After their instream incubation, we collected the substrates and conducted light-dark bottle incubations to estimate rates of biofilm metabolism as gross primary production (GPP) and community respiration (CR). We found that stream temperature was a strong control on biofilm metabolism across sites; furthermore, we found that sites with higher stream temperatures had higher average rates of GPP than cooler streams. In addition, in the most actively managed site, SST17, we found the highest stream temperatures and the highest rates of CR. Overall, our study demonstrates that stream biofilm function in a gulf coastal plain stream is influenced by a variety of factors, with implications for management and ecosystem resilience.

Using Real-Time qPCR methods for antimicrobial resistance gene quantification for application in wastewater-based epidemiology

Abbey Wilson[1]

[1]*University of Georgia*

Antimicrobials have played an important role in the treatment of diseases and infections for many years. However, their overuse in human and veterinary treatment, as well as in the agricultural industry has given rise to the spread and evolution of antimicrobial resistance (AMR) within bacterial species. The passing of non-metabolized antimicrobials and AMR bacteria within the gut through stool results in antimicrobials being present in wastewater, creating selection for AMR bacteria and transfer of AMR genes between bacteria in the environment. Because wastewater is such a hotspot for AMR genes and their transfer, gathering relative concentration data from wastewater DNA extracts using real-time qPCR can allow us to better understand 1) the role that wastewater has in the evolution of AMR in human populations, 2) how AMR gene concentrations are cycling within the Athens-Clarke County population, and 3) the potential risk for contamination to waters receiving wastewater discharge. In this study, we validated real-time qPCR duplex assays to detect and quantify important AMR genes ermB, tetB, blaKPC, blaSHV, bla-CTX-M-1, qnrS, MCR-1, blaNDM-1, blaOXA-48, and blaNDM-7 in wastewater influent samples collected from the North Oconee Wastewater Treatment Plant. DNA was extracted from an archive of weekly samples from 2020-2024 before analysis was done using the validated qPCR assays. Initial analysis of samples collected between July and September of 2021and 2022 showed that ermB was highly consistent across the time series (100% detection rate with an average between 1 x 1016 to 1 x 1017 copies per mL). Whereas blaCTX-M-1 had the lowest concentrations across the samples, with an average of 1 x 1013 copies per

mL in 2021. Analysis is ongoing to complete the full time series, but results to date suggest that wastewater influent is a robust platform for detecting trends in AMR distribution across a community and can be used to support public health efforts to understand potential emergence of antimicrobial resistance. This work also informs our understanding on contamination risk to surface waters that may be contaminated by faulty sewer lines in the Athens-Clarke County area.

Examining the ecological role of giant salamanders, Amphiuma means and Siren lacertina, within seasonally inundated, isolated wetlands.

Madeline Zickgraf[1,2]

[1]*University of Alabama* [2]*The Jones Center at Ichauway*

Isolated wetlands in the southeastern U.S. provide ecosystem services including water storage, biodiversity support, and nutrient storage and export via emerging biotic taxa. In these often-fishless wetlands, two large aquatic salamanders, Amphiuma means (two-toed amphiuma) and Siren lacertina (greater siren), can be abundant. As both predators and prey, A. means and S. lacertina likely exert influence on wetland community structure. Despite this potential influence, little is known about the ecology of A. means and S. lacertina in isolated wetlands. To estimate abundance and biomass of these two species, we established a mark-recapture study in an isolated wetland at the Jones Center at Ichauway in Baker County, Georgia. Salamanders were captured using baited crayfish traps set along transects spanning the wetland basin to determine abundance relative to water depth for a total of 1079 trap nights (January to August 2024). We took morphological measurements and weighed all captured A. means and S. lacertina. All salamanders were individually marked with Passive-Integrated Transponders and released to allow future estimates of density and abundance using capture-mark-recapture methods. Preliminary results indicate that A. means and S. lacertina capture rates were highest in July. A. means captures were highest at water depths from 0.2-0.4 m and S. lacertina captures were highest from 0.4-0.5 m; capture numbers varied significantly for both species across the water depth gradient in our study wetland (Chi-square, $n = 197$, $p < 0.01$). Future work includes replicating this study to capture variation among wetlands. Additionally, movement patterns and home range sizes of salamanders will be examined using radiotelemetry. Finally, diet partitioning and trophic position of A. means and S. lacertina will be examined using stable isotope analysis. With this work, we hope to further define the ecological role and activity of A. means and S. lacertina within southeastern isolated wetlands.