Abstract #: 001

Title: **Protecting Water Resources Through Conservation Tillage**

Presenter: Andrew Price

Organization: USDA-ARS

Session: Poster Session

Conservation agriculture has been highly effective in reducing soil erosion, increasing water holding capacity, and minimizing surface water contamination. The adoption of herbicide resistant crops facilitated successful implementation of conservation agriculture practices throughout the Southeast due to the effective weed control achieved with these cropping systems; however, the continuation of conservation tillage practices is jeopardized with controlling problematic weeds in addition to development of herbicide resistant weed species including Palmer amaranth (Amaranthus palmeri). Along with maximizing environmental benefits achieved through conservation practices, including increased water infiltration and decreased runnoff, the possibility of long-term increases in soil organic matter and consequent carbon fixation, the utilization of high residue cover crops can also provide substantial weed suppression and aid weed control for problematic weeds which limited herbicide options are available. This collaborative project, funded partially through Cotton, Inc., was designed to help educate farmers throughout the southern United States about the benefits of high residue cover crops as well as effective strategies for incorporation into current production practices. In general, conservation tillage + currently recommended herbicide systems resulted in similar or less pigweed emergence compared to winter fallow systems at most locations. Integrated weed management programs incorporating heavy rye residues, currently recommended herbicides, and in some instances strategic inversion tillage, were most effective at controlling glyphosate-resistant Palmer amaranth and other weeds.

Abstract #: 003

Title: **History and Prospectus of the Alabama Dam Safety Program**

Presenter: Steve Newton

Organization: TTL, Inc.

Session: Water Law & Policy 2

Dams are utilized to better manage water resources for beneficial purposes including recreation, water supply, flood control and others. Dam owners need to assure that their dams are constructed, operated, and maintained in ways that preserve the dam's integrity and protect the public and downstream property. For many years, Alabama was the only state without a dam safety program. The 2022 American Society of Civil Engineers (ASCE) Alabama Section Infrastructure Report Card assigned a "?" grade for Alabama dams since Alabama had no dam safety program, not certain about the number of significant- or high-hazard potential dams in Alabama, and no idea about the total number of people that could be in harm's way by a catastrophic dam failure. The Alabama Section of ASCE initiated the formation of the Safe Dam Coalition Technical Committee to promote the need for an Alabama Dam Safety Program.

On June 7, 2023, Governor Kay Ivey signed the Alabama Dam Safety Law championed by State Senator Clyde Chambliss, PE. The Dam Safety Law passed both houses of the state legislature unanimously. The initial Alabama Dam Safety Program is voluntary, with an early goal to reduce overall dam-safety risks for unregulated significant- and high-hazard potential dams throughout the state. As stated by Senator Chambliss, "We're trying to be proactive instead of reactive, instead of after some catastrophe. We're trying to get ahead of it and do it now." Many dam-safety programs began with voluntary dam safety practices. The Alabama Dam Safety Act sets forth basic definitions and establishes minimum standards for participating owners. Minimum standards include the participating owner notification requirement to the local Emergency Management Agency (EMA), inspection frequency, requirement to involve qualified engineers in the inspections, design and rehabilitation of dams, and the requirement to prepare an Emergency Action Plan for significant and high hazard potential dams. This serves as a starting point for the continued development of the program. During the 2024 Alabama Legislative Session, the legislature unanimously passed, and Governor Ivey signed into law legislation that would allow state agencies to be participating owners. The presentation will discuss the past and continued participation of the Alabama Safe Dam Coalition Technical Committee. The presentation will also discuss a potential path forward for the Alabama Dam Safety Program, including sequential steps and timing derived from other successful state dam safety programs and the findings of the Alabama Dam Safety Pilot study.

Abstract #: 004

Title: **Managing Vegetation to Manage Erosion Control**

Presenter: Perry Oakes

Organization: Alabama Soil and Water Conservation Committee

Session: Stormwater 1

This presentation focuses on how to establish and maintain vegetation by making sure the plant roots have a quality environment. By timely and proper establishment of vegetation, erosion is reduced and therefore potential off-site sediment is reduced. The main principles of Erosion and Sediment Control to help minimize erosion and capture sediment from a construction site are covered. Properly establishing vegetation using the conventional seeding and mulching technique is covered in detail. Most construction sites have problem areas (lack of vegetation). The presenter covers many of the probable causes and identifies solutions for these problem areas. Once established, vegetation requires correct maintenance techniques. The presenter also covers The Alabama Erosion and Sediment Control Program and what it has to offer throughout the state in the form of technical materials and training.

Abstract #: 005 **Student**

Title: **Agricultural Soil and Water Conservation Practice Adoption and Disadoption**

Presenter: Emmanuel Okonkwo

Organization: Auburn University

Session: Lightning Talk - Research 1

Nonpoint source nutrient pollution from agriculture has been a crucial issue across the US. Detrimental effects of nonpoint source nutrient pollution include harmful algal blooms, increased drinking water costs, and the hypoxic zone in the Gulf of Mexico. Cover crops and no-till are two in-field conservation practices that have potential to reduce nitrogen and phosphorous pollution from agriculture. Another off-farm benefit from these practices is increased carbon sequestration, which has received increased attention with the emergence of carbon markets. In addition to the off-farm benefits, long-term use of cover crops and no-till can result in on-farm benefits such as reduced soil loss, increased soil organic matter, increased biodiversity, improved soil health, and enhanced water availability (Kaspar et al. 2011; Moore et al. 2014; Snapp et al. 2005). Despite the noted benefits of these two practices, adoption is low and disadoption has become an increasingly prevalent issue. Thus, this research uses 2022 Census of Agriculture data to summarize county-level adoption and disadoption of cover crops and no-till across Alabama and the US. We aim to provide insights on the impacts of conservation-practice disadoption that threaten environmental benefits.

Preliminary FindingsIn 2022, Alabama exceeded the national average, with 7.6% of its cropland in cover crops, ranking 18th among US states. However, Alabama experienced net disadoption at the state level from 2017 to 2022. Despite gaining 31,334 cover-crop acres from 2012-2017, Alabama lost 9,743 cover-crop acres from 2017-2022. This presents the challenges to sustaining cover-crop adoption in the state.Alabama had no-till on 28.1% of the state’s cropland, exceeding the national average and ranking 19th among US states. While no-till area increased by 62,859 acres statewide from 2017 to 2022, there was considerable disadoption across the state. Twenty-four of the state’s sixty-seven counties saw no-till acreage decline from 2017 to 2022, disadopting a combined 72,617 acres.ConclusionsFuture policy design could lead to more cost-effective conservation policies if a concerted effort were made to calibrate the optimal mix of adoption-promoting versus disadoption-abating conservation programs. Our hope is that this research will raise key issues and motivate future research that will inform the design of policies to foster sustained adoption of regenerative practices in agriculture. This presentation would generate discussion among researchers, policymakers, and environmentally minded individuals.

ReferencesSnapp, SS, Swinton, SM, Labarta, R, Mutch, D, Black, JR, Leep, R, Nyiraneza, J and O'Neil, K (2005) Evaluating cover crops for benefits, costs and performance within cropping system niches. Agronomy Journal 97, 322–332.U.S. Department of Agriculture. 2024. 2022 Census of Agriculture. Washington, DC: U.S. Department of Agriculture, National Agricultural Statistical Service

Abstract #: 006

Title: **Chaos into Clarity: Emerging Issues in Water Policy and Law**

Presenter: Bennett Bearden

Organization: Geological Survey of Alabama

Session: Water Law & Policy 1

In the 21st Century, freshwater supplies are drying up, sea levels are rising and borders are being altered due to climate change, resources are being strained due to explosive population growth, and political infighting is stressing diplomatic relations. In the wake of a world reshaped by a global pandemic in 2020, global water demand is expected to increase 55% between 2000 and 2050. For example, consumptive water use in Alabama was estimated to be 84 mgd for 2010 and is projected to increase to 240 mgd in 2040. Emerging and continuing issues in the current water policy spectrum include water wars, interstate groundwater issues, lack of water management plans, drought plan revisions, the WOTUS carousel, PFAS, AMR, resilience, Federal reserved and Native American water rights, and the coastal insurance crisis. Like international, national, state, and local politics, issues in water policy and law are seemingly becoming more chaotic. Policy resolution groups, including international, federal, state, and local governments, the private sector, stakeholders, and environmental organizations and NGOs, are working to clarify the chaos. What is needed are policy resolution groups and policies that produce long-term results. Current strategies across the globe and the Nation include reconvening legislative water policy committees, developing resiliency plans, developing functional legal regimes, reviewing water management and drought plans, funding federal, state, and local agencies, developing piecemeal legislation, and building policy working relationships instead of just making contact acquaintances. Better adaptation to the changing world and enhancing policy resilience calls for “deeper dive” policy analysis, continued basic surface water and groundwater resources research, sustainable solutions, and an accelerated transition from policy resolution to implementation of practical solutions.

Abstract #: 007

Title: **Modeling streamflow alteration in the Mobile River basin using the Cubist algorithm**

Presenter: Sabahattin Isik

Organization: USGS Lower Mississippi-Gulf Water Science Center

Session: Modeling & Water Mgmt. 3

The U.S. Geological Survey, in cooperation with the Gulf Ecosystem Restoration Council and the U.S. EPA, is investigating changes in the delivery of freshwater from the Gulf States to the Gulf of Mexico. In the United States and around the world, humans have significantly altered many streams, posing a noticeable threat to river ecosystems. Extensive research has been conducted to develop methods for quantifying these changes and understanding their impact on river ecosystems. This study presents the use of machine learning to predict measures of streamflow alteration in the Mobile River basin, Alabama. Daily streamflow models for 12-digit hydrologic unit code (HUC12) watersheds were utilized to calculate the index of hydrologic alteration estimated as the net change before and after alteration. Streamflow data modeled for 1236 HUC12 units in the Mobile Bay River basin was divided into pre-alteration (1980-89), transition (1990-99), and post-alteration (2000-2009) periods. Net change percentages were then used to forecast patterns and drivers of hydrologic alteration in the basin. Cubist, a machine learning algorithm employing rules and regression models, was used to predict net change values in four ranges: Full (exceedance probability 0 – 100), High (0 – 33%), Mean (33% - 67%), and Low (67% - 100%). Full net change percentages ranged from -36.2 to 85.2, with a mean of 3.1. High net change percentages had a slightly wider range, from -42.6 to 91.7, with an average of 5.7. Conversely, mean net change percentages showed a more negatively skewed distribution, with values ranging from -42.8 to 63.4, with a mean of -3.3. Low net change percentages had the widest range, from -48.0 to 121.3, with a mean of 0.6. Analysis of predictors by importance in each model revealed divergent relationships between watershed geomorphology, land cover, and hydrologic alteration in the basin. Following the creation of the predictor and response variable database, a random selection comprising 80 percent of the database was employed for model training, while the remaining 80 percent served as test data to assess each model's performance. Model effectiveness was assessed using metrics including Nash-Sutcliffe efficiency (NSE), root mean square error (RMSE), mean absolute error (MAE), and percent bias (PBIAS). NSE values ranged from 0.92 to 0.99 while PBIAS values were less than 0.02% for all ranges. The results of this research demonstrate the utility of machine learning and model trees in assessing hydrologic alteration. In addition, the cubist algorithm holds promise for addressing various complex water resource issues through data-driven approaches to the benefit of local, state, and federal resource managers.

Abstract #: 008 **Student**

Title: **Metagenomics analysis of the microbial diversity and quantitative co-relationship to the pharmaceutical and pesticide compounds in different seasons in Alabama River, Montgomery**

Presenter: Md Imam Ul Khabir

Organization: ALABAMA STATE UNIVERSITY

Session: Lightning Talk - Research 1

High water quality is essential for aquatic life and human beings. The microbial communities are the major component of the river ecosystem. However, the microbial communities of the river water ecosystems are susceptible to changing climatic factors and human activities, for instance, water pH, temperature, nutrient contents, and human activities such as boating and contamination. So, there is a need to understand the composition and diversity of water-inhabiting microbial communities in relation to water (i) chemical properties (nutrients, metals, pH), (ii) metabolome composition (secondary metabolites, organic contaminants and their microbial metabolites) and (iii) seasonal variations. First, we hypothesize that (i) the abundance of microbial taxa (e.g., from phylum to species level) will change with different seasons (spring, summer, fall, winter) in the Alabama River system. The turnover in microbial taxa or species will also lead to changes in the microbial community composition. These changes will be further translated to changes in microbial networks, which are based on their positive or negative interactions. Second, (ii) we also hypothesized that the seasonal variations in microbiome communities will be linked with water chemistry. Third, it is also hypothesized that microbial communities would show interactions with various metabolites across different sampling points. Using various state-of-art eco-statistical models we will determine the metabolite-microbe interactions as the function of seasonal climatic variations. To perform this research, we have sampled Alabama River from Montgomery at the downtown location, where it experiences most human pressure, for one year (very comprehensive sampling). The water samples (4 for each month, total: 48) were filtered through specific filters (20nm) to capture microbial biomass. The filtered water was used to measure the chemical properties (using analytical kits) and metabolomic profiles (using GC-MS). We extracted microbial DNA from water filters using DNeasy PowerWater Kit. We are amplifying bacterial 16S rRNA genes (V3–V4 regions) to profile microbial communities. Unless otherwise stated, I have four replicates for each month and a total of 48 samples for metagenomics, metabolomics and water chemistry analyses for performing statistical tests. This is one of the first comprehensive studies that will significantly advance our understanding of microbial communities and their associations with other important water properties in the context of seasonal variations and human population pressure. Moreover, this study will also provide valuable information about microbial species and interactions, which are important for the biogeochemical cycling of nutrients in the river ecosystem.

Abstract #: 009

Title: **Restoration of Klingle Creek in Washington DC**

Presenter: Ranbir Kang

Organization: Kennesaw State University

Session: Restoration 1

River restoration is an expensive social, political, and ecological undertaking with varying spatial scales of landscapes ranging from low order streams to high order streams. As a result, the success of river restoration varies from project to project. This study presents the application of a terrestrial LiDAR to analyze the restoration of Klingle Creek, Washington DC. Klingle Creek is a headwater stream of Rock Creek which drains the city of Washington. The stream was surveyed from the headwater to mouth using a terrestrial LiDAR before and after the restoration. These surveys included capturing both the point cloud and orthophotos of the full length of the stream valley. The raw data was registered as a continuous point cloud of the stream valley for both pre and post restoration surveys. The registered point clouds were then used to create transects at 5-meter intervals at the bankfull stage in the downstream direction. These transects were used to extract geomorphic data on the channel morphology. The channel morphology for per and post restoration was statistically compared ($\alpha = 0.05$) to determine the impact of restoration on the stream. These comparisons reveal a significant reduction in the width, depth and capacity of the channel. Such changes were not the intended objective of the Klingle Creek restoration. Therefore, the restored channel is anticipated to experience flooding and increased management challenges. This research offers a data rich high resolution terrestrial approach for reference data on local freshwater systems to better manage the local hydrology. At the same time, it also provides a technique to analyze the effects of river management practices at high spatial resolution. Keywords: Restoration, stream, urban, channel morphology

Abstract #: 010

Title: **Real Time Monitoring of Water Quality With an Autonomous Surface Vessel in a Coastal Estuary**

Presenter: Gray Turnage

Organization: Mississippi State University

Session: Water Quality 3

Ocean and coastal water quality monitoring has become more important in recent decades as onshore anthropogenic activities contribute more pollutants to surface water runoff that flows to offshore systems like the Gulf of Mexico (GOM). Many coastal and estuary systems are major sources of income and natural resources for human populations. The Mississippi Sound (MSS) is one such system in the Northern GOM that is bounded by the mainland coast of Mississippi to the north, Mobile Bay to the east, Lake Borgne (Louisiana) to the west, and a series of barrier islands (Cat, Ship, Horn, Petit Bois, and Dauphin Islands) to the south. The barrier islands present an obstacle to water exchange between the MSS and the GOM suggesting prolonged weather or anthropogenic events (i.e., hurricanes or spillway openings, respectively) can greatly impact the biota and reliant ecological processes of the MSS due to reduced water exchange with the GOM. Water quality of the MSS is dynamic and can change seasonally, thus, a baseline understanding of water quality and algal density across the MSS can aid resource managers by providing a better understanding of freshwater particulate and solute impacts to the MSS over time. Algae is typically measured via pigments like chlorophyll A (universal algal pigment), phycoerythrin (restricted to saltwater cyanobacteria), or phycocyanin (restricted to freshwater cyanobacteria) which can contribute to water turbidity and therefore affect plant and fish growth. Water quality (DO, CDOM, Temperature, Turbidity, pH, and Salinity) and algal metrics were characterized spatially in the MSS. A generalized linear model was used to detect differences among transects. In general, all metrics were significantly impacted by proximity to the mainland coast and proximity to major freshwater inputs. Algal metrics were correlated more strongly with turbidity, CDOM, pH, and salinity than temperature or dissolved oxygen suggesting that these four metrics may have more influence over algal density than the others. This work highlights the utility of ASV collected data as a viable option for stakeholder decision making purposes and suggests this technology can be effectively utilized to supplement (and possibly replace) existing monitoring techniques.

Abstract #: 011

Title: **Texas Well Owner Network - County Agent Training**

Presenter: Joel Pigg

Organization: Texas A&M AgriLife Extension

Session: Extension, Outreach & Partnerships 1

County Extension Agent are a vital part of the program process and success of the local programs; therefor they must be introduced to the water well screening process. This presentation gives an overview of our program and shows what will be expected from the agents in their local county. The two types of screening programs are explained to the extension agents and we also show the types of results that have been obtained from previous programs across the state of Texas. The high points of the educational presentations are also shared to show the impact this program can bring to the citizens in the local county.

Abstract #: 013

Title: **Exploring Enabling Environments to Address Water and Wastewater Equity Challenges in Alabama**

Presenter: Jillian Maxcy Brown

Organization: Auburn University

Session: Wastewater Systems Mgmt

Many Alabamians still live without reliable access to clean and running water or a functioning sewage treatment system. This is especially true in the Black Belt region where an estimated 30% of homes lack functioning waste sanitation services, according to a recent presentation from the Alabama Department of Environmental Management (ADEM). One viable solution for communities to improve access to clean water and wastewater sanitation is to apply for funding available through ADEM's State Revolving Fund (SRF) loan program, recently bolstered by an influx of funding through the Bipartisan Infrastructure Law and American Rescue Plan Act. However, applying for water infrastructure funding is a complicated process and can prove insurmountable for rural, small, or otherwise disadvantaged communities to access funding. This presentation will discuss (1) ongoing efforts to analyze SRF applicants and funding allocations, (2) recommendations to improve access to water funding mechanisms for communities in Alabama, and (3) the development of a water-related infrastructure funding resource repository to educate residents, legislators, and other stakeholders. We have developed a map of SRF applicants and funded projects across the state in order to evaluate the effectiveness of this funding mechanism in reaching communities across Alabama and identify communities that may need technical assistance to apply for this funding. We have also developed a suite of strategies and recommendations for both ADEM and the state legislature that advocate for improving this funding mechanism's ability to address water and wastewater equity challenges in Alabama. Lastly, we will share about the recently developed resource repository which contains educational materials for residents who are interested in learning more about these ongoing equity challenges, assistance accessing infrastructure funding, and approaches that will mobilize solutions to improve water and wastewater infrastructure in Alabama and across the U.S.

Abstract #: 015

Title: **The Little Lagoon Restoration Project: A Multi-Component Approach to Water Quality and Ecosystem Restoration**

Presenter: Carl Ferraro

Organization: Stantec Consulting Services Inc.

Session: Restoration 1

The City of Gulf Shores has been awarded $5.9M in RESTORE funding to work in partnership with ADCNR, Auburn University, the University of South Alabama, Dauphin Island Sea Lab, and Mississippi State University to implement programs that improve water quality, increase and enhance habitat area, and improve ecological productivity. The five-year project will have secondary beneficial impacts to the region including more resilient and sustainable infrastructure and increased recreational and ecotourism opportunities.Objectives of this project will include:•The construction of approximately 1000 feet of living shorelines and shoreline habitat.•Improvements to the hydrology of the existing canal system.•The connection of approximately 200 individual septic systems to city sewer.•The establishment of an oyster restoration program.•Marsh and seagrass bed restoration.•Hydrodynamic modeling of Little Lagoon.•Ecological research and long-term monitoring by university partnersThe project team will also work with local community groups including the Little Lagoon Preservation Society and Gulf Shores High School’s Sustainability Academy to develop opportunities for volunteer involvement, and public outreach/education.Specific project components include: •Shellfish Restoration Program - Auburn University•Septic to Sewer Conversion Program - City of Gulf Shores•Shoreline Restoration Program - Mississippi State University•Mo’s Landing Living Shoreline Demonstration Project - City of Gulf Shores•Hydrologic Connectivity Program - City of Gulf Shores•Hydrodynamic Modeling/Monitoring - University of South Alabama •Seagrass Restoration Program - Dauphin Island Sea LabStantec is assisting the City in the implementation of the Septic to Sewer Conversion Program, the Mo's Landing Living Shorelines Demonstration Project, and a Hydrological Connectivity Project. This presentation will highlight specific locations, goals and objectives of each of these three project components as well the planning and design process and current status of the projects.

Abstract #: 016

Title: **HYDROGEOLOGICAL INVESTIGATIONS TO DELINEATE THE RECHARGE AREA OF BOBCAT CAVE FOR THE PROTECTION OF ALABAMA CAVE SHRIMP ON REDSTONE ARSENAL, A U.S. ARMY FACILITY IN MADISON COUNTY, ALABAMA, USA**

Presenter: Gheorghe ML Ponta

Organization: Geological Survey of Alabama

Session: Groundwater

The Geological Survey of Alabama has conducted a groundwater monitoring study (water quality and water table elevation) to delineate the recharge area of Bobcat Cave, on and near Redstone Arsenal, for the protection of the Alabama Cave Shrimp, a federally listed endangered species. Current industrial development and expansion of urban areas around Redstone Arsenal may threaten suitable habitat for this species. In 2019 and 2020, LiDAR technology was used to inventory sinkholes and other karst features to determine if surface water/storm-water runoff or other potential contaminants introduced at or near these features could potentially influence waters in Bobcat Cave and the Alabama Cave Shrimp habitat. Groundwater flow direction, which is beneficial to the overall understanding of groundwater behavior in the study area, was determined by measuring water levels in 15 onsite and 2 offsite wells in the recharge area of the Bobcat Cave area. Pressure transducers that continuously recorded water level and temperature data were installed in Bobcat and Matthews Caves. Specific conductance data was also recorded in Bobcat and Matthews Caves. Comparison of seasonal water level fluctuations in Matthews and Bobcat Caves, the selected existing wells on the facility, and water surface elevations of Jaya Springs, Indian Creek, and Wheeler Lake/Tennessee River adjacent to the project area provide an understanding of groundwater movement. The water quality and discharge rates of surface water runoff were evaluated to directly quantify the water quality threats to the existing Alabama Cave Shrimp population. Trace metals, nutrients, and other commonly used indicators (conductivity, pH, concentrations of Na+, K+, Mg2+, Ca2+, Cl^{-}, $SO42^{-}$, and $HCO3^{-}$) were evaluated to determine the sources and potential contaminants of surface waters entering the groundwater system. Based on our findings, a new recharge area has been delineated for Bobcat Cave. At the current concentrations and rates of application, the recorded variations in water quality do not appear to influence the Alabama Cave Shrimp population. However, any change in land use in the recharge area that alters either water quality (constituent types or concentrations) or water quantity (groundwater levels contributing to base flow) has the potential to affect shrimp population stability.

Abstract #: 017

Title: **Improving Surface Water Quality in Texas Through Public Outreach and Education**

Presenter: Leanne Wiley

Organization: Texas A&M AgriLife Extension - Lone Star Healthy Streams

Session: Extension, Outreach & Partnerships 1

Nearly one-third of waterbodies in Texas do not meet the state water quality criteria, with the majority being impaired due to elevated E. coli bacteria concentrations. Animal agriculture and feral hogs are potentially significant sources of bacteria in Texas. With nearly 96% of the state privately owned, it is imperative to educate private landowners about the impacts of land management practices on water quality. The Lone Star Healthy Streams (LSHS) program offers Texas landowners a unique curriculum focusing on the best management practices of livestock and wildlife management to reduce E. coli bacteria in water bodies. This presentation will discuss the purpose of the LSHS course, its application in watershed management, and current and future outreach efforts to continue engaging the diverse landowners of Texas.

Abstract #: 018 **Student**

Title: **Alabama Water Affordability for Community Water Systems and Private Drinking Water Wells**

Presenter: Rebecca Etter

Organization: Auburn University

Session: Water Quantity

Drinking water affordability in high-income nations such as the United States is not well documented. The United Nations recognizes the right to water in their Sustainable Development Goal 6.1 which states that everyone should have access to safe and affordable drinking water, worldwide, by 2030. However, there is no clear quantification of the United States' progress toward this affordability goal. This research presents a case-study of Alabama's drinking water affordability including both centralized drinking water distribution systems and private drinking water wells. To the best of the authors' knowledge, this is the first affordability study in the U.S. to incorporate the costs for the 12-15% of U.S. residents who rely on private drinking water wells. Additional novelty is derived from the intentional inclusion of smaller utilities that serve rural or unincorporated communities which have often been neglected by broader-scale drinking water affordability studies in the U.S. The analysis is completed at the block group level which enables a more detailed analysis of affordability in rural communities. Data sources include drinking water rates from the University of North Carolina's Dashboard and private well costs from a survey of Alabama well drillers. Additionally, service area and population data is available from the Alabama Department of Environmental Management and provided from the Alabama Rural Water Association. Water affordability is defined in many ways; however, for this study, the EPA's definition of 2.5% of the median household income is used. Additionally, the number of households whose water is unaffordable is determined for each of the study's block groups. This study develops maps that compare the cost of drinking water access to block group median household income and annual household incomes across Alabama. These maps enable visual and quantitative assessments of the populations with affordability challenges and populations that are at risk of unaffordable water access as the cost of water continues to rise. The quantification of water affordability is the first step toward ensuring the human right of affordable and available water for everyone in Alabama.

Abstract #: 019 **Student**

Title: **Examining Oyster Production Resiliency in the Alabama and Mississippi Oyster Industries**

Presenter: Jillian Sower

Organization: Auburn University

Session: Extension, Outreach & Partnerships 1

The oyster industry has been culturally and economically important to the Gulf of Mexico (hereafter, the “Gulf”) since the mid-1800s. However, due to numerous natural and manmade disasters in recent decades, the natural oyster population, and therefore the wild harvest industry, has drastically declined. Recently, a new sector of the oyster industry, oyster aquaculture, has been established in the Gulf, but not without facing similar challenges to its wild harvest counterpart. In an effort to study whether the oyster industry as a socio-ecological system is resilient (e.g., capable of absorbing shocks and recovering), we interviewed or surveyed oyster stakeholders (n = 53) from Alabama and Mississippi about their perceptions of the current status of the industry. Our questions asked participants about the challenges they face, what changes they would like to see, and whether they see themselves remaining in the industry in the near future, among others. Nine different stakeholder groups were interviewed or surveyed, but we give special attention to wild harvesters and oyster farmers, the two stakeholder groups most likely to be adversely affected by the effects of natural and man-made disasters on oyster resources and production. For example, farmers cited equipment costs, seed availability, lack of insurance, and permitting time as major barriers to entry, or even continuing in the industry after disasters such as hurricanes and freshwater intrusions. Farmers expressed that they do not see themselves remaining in oyster aquaculture over the next 5-10 years due to these challenges. These results indicate that this oyster-based socio-ecological system is vulnerable to disasters. We provide recommendations on how the oyster industry can become more resilient and ensure that it persists in the future.

Abstract #: 020

Title: **Watershed Scale Groundwater-Surface Water Interactions in Alabama: Implications for Water Policy and Management Decisions**

Presenter: Gregory Guthrie

Organization: Geological Survey of Alabama

Session: Water Law & Policy 1

Water policy and management discussions focus on surface water systems and for the most part consider groundwater as an afterthought. Unfortunately, this thought process is universal and not limited to Alabama. The times are changing, and the conjunctive relationships between surface water and groundwater are becoming more common in water policy discussions. Surface water, groundwater, and precipitation are the principal components of the water cycle and collectively should be considered in any policy or management analyses, especially, in view of predicted regional climate models that forecast little change in the amount of precipitation but considerable changes in the way precipitation is delivered in the form of fewer higher intensity events. These types of events can potentially lead to increased overland flow to surface water systems that increase flooding risks as well as decrease recharge to shallow aquifers across the state. Both extremes can result in negative impacts to aquatic systems. Groundwater flow to surface systems is critical for maintaining ecological flows that support habitats, for supplying nutrients, and for providing a buffering effect on surface water temperatures throughout the year. In areas served by unconfined aquifers, groundwater depletion can be exacerbated by increased extractions during drought periods, which can contribute to diminished surface water flows and quality that can have deleterious effects on aquatic habitats. The Geological Survey of Alabama (GSA) works with a variety of federal and state partners, non-profit organizations, and stakeholders to examine the relationships between surface water and groundwater systems and the effects of these relationships on ecological flows to aquatic ecosystems. The conjunctive relationships between the two systems are highlighted in a new GSA publication entitled “Water in Alabama.” The report is a new edition to a discontinued series last published in 2002. The new volume presents groundwater, surface water, and climatic data at a HUC8 watershed level and is intended to provide federal, state, and local officials as well as stakeholders and policymakers with information that can be used to make science-based policy and management decisions on the state’s water resources.

Abstract #: 021 **Student**

Title: **Can longleaf pine restoration restore hydrology of geographically isolated wetlands?**

Presenter: Kathryn Perkins

Organization: Auburn University

Session: Poster Session

The southeastern coastal plain has experienced increasing water scarcity due to climate change, land-use intensification, and increasing human populations. Restoration of low-density longleaf pine savannas can reduce forest evapotranspiration (ET) and offers a way to reduce water scarcity in vulnerable watersheds. Seasonally inundated geographically isolated wetlands (GIWs) often occur within longleaf pine ecosystems and may also benefit from reduced forest ET. GIWs serve as critical habitat for rare and threatened species and provide important hydrologic benefits to watersheds, such as water storage and water filtration. However, these ecosystem services depend on wetland hydroperiod, the length of time a wetland is inundated, which is influenced by forest ET in the surrounding catchment. Our goal is to link forest structure and ET to wetland hydrology before and after longleaf restoration. We began monitoring climate and water levels in a single wetland in 2006. In late 2009, we restored the surrounding catchment with hardwood removal and fire reintroduction. Management interventions decreased catchment basal area by ~35%, increased hydroperiod by ~60 days, and decreased the amount of rainfall needed for hydroperiod initiation by >100 mm/year. In 2017, we installed rain gauges and water level recorders in several additional wetlands. Water balance data from those additional catchments are being used to parameterize local hydrologic models and estimate the effects of longleaf restoration for a wider variety of GIWs. Replication of our early results, coupled with process-based modeling, will allow us to build a general framework for how longleaf restoration and management affects wetland hydrology, and extend our findings to a broader geographical area. We hope these results will support forest management activities that consider both upland forest and wetland restoration and increase wetland catchment conservation by demonstrating the link between forest structure and wetland function.

Abstract #: 022 **Student**

Title: **Enhanced Sorption and Degradation of PFAS by Biochar-Enabled Advanced Reduction Process (ARP)**

Presenter: Ziteng Song

Organization: Auburn University

Session: Poster Session

Biochar, especially functionalized biochar, has recently emerged as a cost-effective and efficient sorbent to sorb per- and polyfluoroalkyl substances (PFAS) pollution in water. We developed a biochar-enabled advanced reduction process (ARP) for the enhanced sorption (by biochar) and reductive degradation of PFAS (by ARP) in water. The biochar (BC) was first functionalized by iron oxide (Fe3O4), zero valent iron (ZVI), and/or Chitosan (Chi) to obtain four biochars (i.e., BC, Fe3O4-BC, ZVI-Chi-BC, and Chi-BC) with modified physicochemical properties (e.g., specific surface area, pore structure, surface charge, and functional groups that are related to PFAS sorption). Batch sorption experimental results revealed that compared to unmodified BC, all modified biochars showed greater sorption efficiency and the Chi-BC performed the best for PFAS sorption in water. The Chi-BC was then selected to facilitate the reductive degradation of PFAS in water by ARP using UV-sulfite system. The addition of Chi-BC in the UV-sulfite ARP system significantly enhanced both degradation and defluorination of PFAS (e.g., up to ~100% sorption efficiency and ~85% defluorination efficiency of PFAS). Our research elucidates the synergistic effects of biochar and ARP in enhancing PFAS removal and defluorination, providing a new cost-effective strategy in combatting PFAS pollution in water.

Abstract #: 023 **Student**

Title: **Fate of Salmonella from Wastewater to Hydroponic Lettuce in a Pilot-Scale Treatment System**

Presenter: Wellington Arthur

Organization: Auburn University

Session: Wastewater Systems Mgmt

The objective of this study was to evaluate a pilot-scale wastewater treatment system's capacity in safely utilizing poultry processing wastewater (PPW) for hydroponic lettuce irrigation, with a focus on the fate of sudden Salmonella influx and their potential attachment or uptake into lettuce. The treatment system comprised of bioreactors inoculated with consortia of algae and nitrifying bacteria, clarifiers, membrane filters, UV disinfection, and hydroponic grow beds. Bioreactors were dosed with Salmonella at two concentrations: 3 and 5 log CFU/ml, daily. Water and lettuce samples were analyzed across three stages: pre-inoculation (days 0-10), inoculation (days 11-20), and post-inoculation (days 21-30). Water samples were serially diluted and plated for Salmonella enumeration. Lettuce samples were homogenized, suspended in buffered peptone water, enriched, plated, and presumptive colonies were confirmed. At the lower concentration (3 log CFU/ml), pre-inoculation samples showed no detection of Salmonella. During inoculation, direct plating yielded no Salmonella counts in water samples, but enrichment revealed its presence. UV disinfection eliminated Salmonella from water samples, with no detection in lettuce. There was no detection of Salmonella in both water and lettuce samples at the end of the recovery phase (Day 30). When challenged with higher Salmonella concentration (5 log CFU/ml), pre-inoculation samples showed no detection of Salmonella. By day 15 of inoculation, Salmonella counts in reactors, clarifiers, and filters were reduced to approximately 3 log CFU/mL. Although no Salmonella was detected via direct plating in UV effluents and holding tanks, enrichment methods indicated potential pathogen persistence or reactivation. By the end of the recovery phase, the system had restored to baseline pathogen levels, with no detection of Salmonella in UV effluents, grow beds, and lettuce samples. This study confirms the effectiveness of the treatment system in managing varying Salmonella loads, enhancing food safety, and contributing to sustainable agriculture practices.

Abstract #: 024 **Student**

Title: **Influences of Biochar on Soil Health in Row Crop Production Systems**

Presenter: Alexandra Lindsey

Organization: Auburn University

Session: Poster Session

The most common type of soil in Alabama is an Ultisol, which characteristically have low water holding capacity, are highly weathered, and have low organic matter. The introduction of biochar into these soils as a soil amendment has the potential to increase water holding capacity and other soil health parameters that would be beneficial to Alabama producers. Biochar is organic matter that undergoes pyrolysis resulting in a highly charged, very stable source of carbon, but it is an expensive soil amendment and there is more research required to learn how biochar will affect crop production in Ultisol soil types. An ongoing study was started at both the Wiregrass Research and Extension Center in Headland, Alabama and the Tennessee Valley Research and Extension Center in Belle Mina, Alabama to test the effects of different rates of biochar with and without cover crops on soil health in cotton production systems. Biochar rates of 0, 4.5, 9.0, and 17.9 Mg per hectare were applied in fall 2023 with and without cover crops in a randomized complete block design and replicated four times. Soil samples were collected for 0-5, 5-10, 10-15, 15-30, 30-60, and 60-90 cm depths in fall 2023 prior to initiation of the experiment and in spring 2024 after cover crop termination. Chemical soil health indicators measured were pH, Mehlich 1-extractable plant nutrients, soil organic carbon, inorganic nitrogen, total nitrogen, and permanganate oxidizable carbon. Physical soil health indicators measured were bulk density, volumetric water content, water holding capacity, and wet aggregate stability. Biological soil health indicators measured were microbial biomass carbon and soil respiration. Results will be discussed.

Abstract #: 025

Title: **Evaluating the National Water Model's Predictive Ability for Extreme Hydrological Events Across HUC-Level Watersheds in Alabama**

Presenter: Md Shahabul Alam

Organization: Alabama Water Institute

Session: Water Security & Risk

Hydrological models play a crucial role in guiding essential management actions concerning floods and droughts. While traditional hydrological model evaluation focuses on overall accuracy of predicted time series, they often fall short in providing a categorical assessment of the accuracy in predicting extreme events. Addressing this need, here we develop and integrate the Streamflow Extreme Event Dataset (SEED) tool, a Python-based model-agnostic model evaluation package within the Community Streamflow Evaluation System (CSES) for a more robust evaluation of modeled flood and drought events. Leveraging Log Pearson Type III (LP3) distribution, SEED supports evaluation of predicted extreme events of varying return intervals (2 – 100 years) for over 5000 USGS CONUS-wide monitoring stations. To showcase the utility of CSES and SEED, we investigate the performance of the National Water Model (NWM) v2.1 in predicting flood and drought events within Alabama's Tombigbee-Mobile, Alabama, Choctawhatchee-Escambia, and Middle Tennessee-Elk River Basins. Overall, this study underscores the importance of robust evaluation frameworks, such as CSES and SEED, in assessing the performance of hydrological models like NWM v2.1 in predicting extreme events. Moreover, it highlights the role of these tools in offering valuable insights to improve flood and drought mitigation strategies in Alabama and beyond.

Abstract #: 026

Title: **Evaluating Alternatives in 2D Hydraulic Model for Flood Reduction(Terrain Modification: A Decision Making Tool)**

Presenter: Binita Shrestha

Organization: Waggoner Engineering Inc.

Session: Modeling & Water Mgmt. 2

Floods are a major environmental threat disrupting lives and societies. It necessitates robust and cost-effective approaches to flood analysis and mitigation. Cost of physical models, 3D models for scenario analysis or inaction against floods can be enormous. This study explores the potential of terrain modification tools within the open-source hydraulic modeling software, HEC-RAS as a method for evaluating structural flood reduction strategies in the City of Canton. Two-dimensional (2D) hydraulic modeling has become a popular and widely-used tool for flood studies. Utilizing a calibrated HEC-RAS model, the study assessed the effects of various terrain modification scenarios, including floodwall construction, culvert/bridge expansion, channel modification, and floodplain rejuvenation. By simulating a 100-year, 24-hour storm event and comparing results to a FEMA data benchmark, the study identified changes in water surface elevation and flood extent as a result of the alternatives. This analysis revealed terrain modifications capable of representing alternatives. The study identified some alternatives lowering flood levels by up to 3 feet, considerably decreasing the flooding extent as well as mitigating backwater effects of the main study stream on its tributary within the study area. These findings demonstrate how terrain modification tools, coupled with economic feasibility studies, can offer a valuable preliminary decision-making framework for flood mitigation. While terrain in the form of DEMs (Digital Elevation Models) provide valuable data, they have limitations in capturing complete natural terrain details. Thus the ability to manipulate terrain within hydraulic models represents a significant advancement for accurate simulation. In addition, this study highlights the potential of terrain modification tools in HEC-RAS as a cost-effective and flexible method for evaluating various structural flood reduction strategies. This approach allows communities to examine potential solutions, supporting informed decision-making towards a more resilient future in the face of flood threats. Policy makers can benefit from the preliminary decision making tool as a medium for risk assessment, mitigation option, cost benefit analysis, and awareness among the community members. Keywords: Numerical Modeling, 2D Hydraulic Modeling, Flood Mitigation, Alternative Analysis, Terrain Modification, Cost-effectiveness, Decision-Making Tool, Structural Mitigation Measures

Abstract #: 027 **Student**

Title: **Estimation of River Channel Shape Using Regression and Machine Learning Approaches**

Presenter: Riley McDermott

Organization: The University of Alabama

Session: Poster Session

Emerging datasets of riverine observations at large scale and fidelity are enabling the development of more robust estimates of river hydraulic characteristics. More specifically, the availability of a large dataset containing Acoustic Doppler Current Profiler (ADCP) measurements, the gold standard of underwater channel attribute measurements, offers pathways for developing new models of channel geometry and shape. Previous methods of modeling channel geometry were limited by dataset size and quality of channel dimension measurements. The new datasets, on the other hand, can be challenging to use due to their abundance of observations, unfiltered errors, and inclusion of observations during over-bank (flooding) conditions, which do not reflect channel dimensions. Cleaning the data in order to achieve robust channel geometry estimations is challenging. This project aims to develop a first-order channel shape estimation model based on these large CONUS-scale datasets. First, we develop a methodology for identifying and removing overbank observations in order to ensure that only within-channel measurements are used. We found that a derivative of a fitted polynomial regression on observed channel width and depth dimensions and discharge works well in identifying and removing near-bankfull observation points. A data-driven model of channel shape will be developed using the derived dataset. Multiple methods of reconstructing channel cross-sectional shape from observational data will be compared to observed channel cross-sections to identify the most accurate approach, which will be used in the development of continental channel shape models. These models aim to improve the quantification of channel geometric parameters with the goal of advancing the field of hydrologic modeling and improving the generation of flood inundation mapping (FIM).

Abstract #: 028 **Student**

Title: **An analysis of microbial source tracking metadata in coastal Alabama**

Presenter: Brianna Janssen

Organization: Dauphin Island Sea Lab

Session: Poster Session

Microbial source tracking (MST) is increasingly in demand to define water quality and associated seafood safety and public health risks. While MST-related data have been collected for decades, the data have not been collated and made readily available to define spatial and temporal or other research gaps, inform policy decisions, and ultimately protect natural resources and public health. To address these needs, we established a publicly accessible MST metadata clearinghouse (https://www.disl.edu/research/wastewaterfootprint/alabama-mst-metadata-clearinghouse/) for coastal Alabama to compile and share information about existing or in-progress MST and other monitoring-related datasets. Additionally, the clearinghouse provides a model for similar historical data collation in other coastal areas where microbial source tracking is of interest. The clearinghouse currently includes 30 metadata entries from a wide diversity of participating organizations and researchers, with an opportunity for those with relevant data to contribute through the website's questionnaire. We have organized the metadata into four major indicator categories: bacterial, viral, genetic, and chemical. Entries related to these indicators and their associated methodologies can be accessed using the clearinghouse, among other search parameters. With data dating back to 1953, the clearinghouse boasts an impressive timescale of indicators and methodologies within southern Alabama. A temporal analysis of the metadata found nutrients as the most consistently available indicator, with classical indicators such as e. coli and fecal coliforms rising to prominence after 1990 and newer indicators such as DNA markers and stable isotope analysis gaining traction in the mid-2000s. A preliminary spatiotemporal analysis of the metadata suggests an apparent shift in monitoring sites along Mobile Bay. Such analyses can hopefully help researchers identify data gaps to fill and assist practitioners in locating applicable data.

Abstract #: 029 **Student**

Title: **Flooding and Hydrology Issues on The Pinhoti and Chinnabee Silent Trail**

Presenter: Allie Field

Organization: Jacksonville State University

Session: GIS

This study aimed to identify flood-prone areas along the Pinhoti Trail and Chinnabee Silent Trail in the Talladega National Forest. Using the Hydrology Flood Index layer and analyzing several essential data layers, the research aimed to provide campers, hikers, nature enthusiasts, and trail maintenance teams with information about areas at a higher risk of flash flooding. The Hydrology Flood Index layer rates the risk of flooding on a scale of 1 to 4, with level 1 indicating a low risk of flooding and level 4 indicating an extremely high risk. The data layers for analyzing flood hazards for the Hydrology Flood Index Map include the Soil Survey Geographic Database (SSURGO), National Land Cover Dataset (NLCD), Slope, and Flow Accumulation. The study area includes three Pinhoti campsites and the entire length of the Chinnabee Silent Trail, where high-resolution images were taken after a flood occurred in 2014.

Abstract #: 032 **Student**

Title: **Performance Evaluation of Slash Mulch Berms as Sediment Control Practices**

Presenter: Brian Roche

Organization: Auburn University

Session: Stormwater 2

Sediment barriers are temporary practices installed downstream of disturbed areas and around the perimeter of construction projects to remove sediment from stormwater runoff, typically relying on sedimentation within impoundments formed behind the practice. Typical sediment barrier practices include silt fences, wattles, and straw bales; silt fences are the most used sediment barrier practices and contain plastics that are landfilled after use or can break down into microplastics when left on a construction project after completion. An under-evaluated sediment barrier practice is slash mulch berms, composed of shredded wood material commonly created during the process of clearing land on site, which is required to be landfilled if it cannot be used on-site. If slash mulch berms can be as effective in removing sediment from runoff from construction projects as an alternative to silt fence sediment barriers, less plastic and natural waste will be added to landfills while still protecting adjacent water bodies and natural areas from sediment. This research intends to evaluate the performance and applicability of slash mulch berms in sediment-laden sheet flow application on construction projects through large-scale performance testing. Various slash mulch berm installations, including Nebraska Department of Transportation standard and modified installations, were evaluated using a modified ASTM D7351 testing apparatus at the Auburn University – Stormwater Research Facility, which introduces flow and sediment equivalent to a 2-yr, 24-hr storm event for a selected region in the form of sheet flow that runs into a 20 ft (6.1 m) wide installed sediment barrier practice. Data collected during testing included sediment capture upstream and within the berms, water quality improvements in turbidity and total suspended solids (TSS), and the depth and length of impoundment formed upstream of the installation. Results of large-scale testing of a standard slash mulch berm installation, which was trapezoidal with a height of 3 ft (0.9 m) and a width of 6 ft (1.8 m), indicated high sediment capture; a total of 98.1% of introduced sediment was captured by the installation while facilitating a maximum impoundment depth upstream of 4 in. (10.2 cm). A compacted 1.5 ft by 3 ft (0.46 m by 0.91 m) modified slash mulch berm that used less material showed improved impoundment potential to 4.9 in (12.4 cm), increased overall sediment capture to 98.9%, and increased water quality treatment. Water quality samples downstream of slash mulch berm installations indicated a greater treatment potential for turbidity and TSS than silt fence and wattle sediment barrier tests under the same conditions. This research indicates that slash mulch berms can be effective as sediment barrier practices due to capturing more sediment and lowering turbidity more effectively than commonly used sediment barrier practices for treating sediment-laden sheet flow runoff from construction projects.

Abstract #: 033

Title: **Formation of Mineral Scale on Paper Evaporative Cooling Pads Using a Farm Well Water Source**

Presenter: Kelly Griggs

Organization: Auburn University

Session: Water Quality 1

Many poultry producers have trouble with mineral scale accumulating on evaporative pads when using a well water source. Mineral accumulation happens on pads when there is a supersaturation of minerals in the evaporative cooling system sump. As scale precipitates onto the paper, it restricts the pad flute openings of the evaporative cooling pads, thus restricting the overall airflow and lowers the heat removal from the birds inside the poultry house. Four portable evaporative cooling systems were used as test stands. All four systems evaporated a total of 7571 L (2000 gal) of water, equivalent to the amount of water evaporated for one summer flock on a per pad basis 4075 L/m pad (100 gal/ft pad). Water samples were collected every 76 L (20 gal) for the supply water and every 757 L (200 gal) for the sump water. Pads were dried and weighed to determine scale accumulation every 757 L (200 gal). Over a summer, water quality parameters important to scaling that are significantly different were alkalinity, calcium, carbon dioxide, conductivity, magnesium, and sodium (P<0.0001), along with pH (P=0.0003) across water consumption. The scaling rate for this well water source was 168 ± 8.4 g per 1000 L of water evaporated. This rate may be used to predict minimum scaling that would happen on the farm over a summer of use.

Abstract #: 034 **Student**

Title: **Understanding Fate and Flow of Nitrogen in Commercial Row Crops of Alabama**

Presenter: Arpita Sharma

Organization: Auburn University

Session: Water Quality 1

According to food economy experts, the food demand projections for 2050 are about 70% above 2014. This constantly growing demand for food puts much pressure on current agricultural practices and the environment. The success of the green revolution without nitrogenous fertilizers seems far from reality. Since the mid-1900s, nitrogen fertilizers have proved to be a blessing in saving the world from hunger, but the unfortunate fact associated with this fertilizer is its low recovery. According to recent trends, the global nitrogen recovery is approximately 48%, thus leading to losses of the rest of the fertilizer applied. These losses occur via various pathways like nitrate-nitrogen (NO3 N) leaching, ammonia (NH3) volatilization, surface runoff, and denitrification. Alabama boasts a diverse agriculture sector, representing more than a dozen different commodity areas, of which row crop agriculture is of utmost importance. Due to Alabama's rainfall pattern and its highly weathered – low OM soils, nitrogen loss is prevalent. Estimating nutrient balance following the systems approach is one of the most trusted ways to assess potential nutrient losses from agricultural systems. To quantify the ins and outs of nitrogen from agriculture fields, research was initiated in 2021 at a farmer's field (118 acres) in North Alabama to understand the nitrogen dynamics in a commercial row crop system. Based on historical yield data, the field was divided into low, medium, and high-yielding zones. The seasonal nitrogen inputs, outputs, and unaccounted nitrogen (nitrogen lost via different loss pathways) were quantified for corn, soybean, and wheat crops. The results revealed that significantly the highest losses were reported from wheat crops. Among different management zones, the Low yield zone reported significantly high unaccounted nitrogen losses. Further, it was observed that the deep soil cores showed the ammonium fraction of soil nitrogen to be less prone to fluctuations. Additionally, a consistent amount of soil mineral nitrogen was recovered before planting each cash crop. Establishing a nitrogen budget can help identify areas within a field that are rich or deficient in nitrogen or subjected to losses. This information may empower farmers to make informed decisions about nitrogen management, ultimately leading to better use of this crucial nutrient.

Abstract #: 035

Title: **Evaluation of the Effects of Synthetic and Natural Textile Fibers on Aquatic Bacteria, Algae, and Duckweed**

Presenter: Nhung Nguyen

Organization: Department of Applied Biology, Institute for Nanomaterials, Advanced Technology and Innovation Technical University of Liberec Bendlova 1409/7, Liberec 01, 460 01, Czech Republic

Session: Poster Session

Textile microfibers are the most abundant man-made particles found in aquatic environments. These microfibers, which are released from clothing, can come from either synthetic or natural fibers, each potentially having different biological effects. The funded project titled “Microplastics released from textiles in aquatic ecosystems: identification, characterization and effects assessment” and register number LUAUS23054 is part of the INTER-EXCELLENCE program between the Technical University of Liberec (Czechia) and Auburn University (USA). The experts in toxicity from the USA side mentor the studies of the impact of fibrous microplastics on aquatic organisms, cell lines and their risk assessment. The first study was to investigate the acute toxicity of common textile microfibers, both synthetic/semi-synthetic (kevlar, polyester, acrylonitrile) and natural (cotton), towards activated sludge bacteria, the green alga Raphidocelis subcapitata, and duckweed Lemna minor. The microfibers were well characterized before and after exposure, and the species were exposed to the microfibers at concentrations ranging from 0.1 to 100 mg/L. The concentration of growth inhibition was determined over a period of time using non-standard or standard OECD methods for each species, especially bacteria for 1 to 7 days, the alga for three days, and duckweed for seven days. The results revealed that natural microfibers were attractive to bacteria and enhanced bacterial growth. Furthermore, algal growth increased by 20% at a concentration of 0.2 mg/L. Interestingly, the natural cotton microfibers had a minor negative effect on the roots and leaves of Lemna minor of 100 mg/L. These results provide a better understanding of how natural and synthetic microfibers derived from textiles may affect aquatic organisms and influence ecotoxicity. The study continues to investigate other microfibers in the fish cell lines.

Abstract #: 039

Title: **How to Proactively Communicate about PFAS: Case Studies from Across the Country**

Presenter: Mike McGill

Organization: WaterPIO/PFASComms.com

Session: Emerging Contaminants

This presentation will provide attendees with the current PFAS landscape – including the impacts of the EPA's finalized MCLs, the Health Advisories that remain in place, and the UCMR 5 results being reported nationwide – to detail the successful public communication strategies water and wastewater utilities must use to proactively inform customers and key stakeholders about PFAS ahead of future discoveries.Combined with the EPA's proposed changes to the CCR rule, where utilities are being threatened with regulatory action if they describe their water safe as it meets state and federal standards, public water faces a crossroads as UCMR 5 data steadily rolls in from across the country. So far, the UCMR 5 reveals that ten to twenty thousand utilities could find themselves in would-be violation of the new PFAS MCLs and/or Hazard Index. While the EPA will say utilities have five years to comply with the MCLs and HI, angry customers, elected officials, and community leaders will want the PFAS removed ASAP. WaterPIO has helped hundreds of utilities deal with PFAS since 2016; we provided a proactive statement to utilities across the country prior the EPA's announcement of the MCLs and Hazard Index in April. We also helped reporters get the story right from the water utility perspective. Because of our assistance, we were quoted by the Associated Press, Politico, and several top environmental reporters.This presentation will run down common themes from our case studies to provide a clear and proactive path for utilities to take when it comes to PFAS public communications so they set up for success whenever chaos comes. And there will be chaos; we've already been dealing with it since the EPA's announcement.The finalized MCLs and Hazard Index will combine the EPA's health advisory levels (HAs) for PFOA & PFOS to create immense public pressure and a nearly untenable position for many water utilities, even for utilities where PFAS aren't even detected. That's because the remaining Health Advisory levels enable EVERY water provider across the country can be accused of having "unsafe" levels of PFAS in their water. Combining all these actions together, the EPA has set up the Water World for failure. Any discovery, especially one over the final MCL levels, will create PFAS panics all over the country just as PFAS discoveries are going to exponentially increase because of UCMR 5 testing. This presentation will outline the strategies to use for successful, proactive PFAS public communications, and how they are different from crisis communications after a UCMR 5-related discovery. Based on our work with hundreds of utilities prior to the release of the final MCLs, several primacy agencies, as well as the Association of State Drinking Water Administrators, we will detail what to say – and what not to say – when it comes to explaining PFAS to the press, public, and essential stakeholders.

Abstract #: 041 **Student**

Title: **Evaluating IRIS Films in Alabama Blackland Prairie Soils for Wetland Restoration**

Presenter: Kristen Cartee

Organization: Auburn University

Session: Poster Session

Wetlands are ecosystems that play a crucial role in maintaining biodiversity, water quality, flood regulation, and carbon storage while providing animal habitat. Since the mid-1700s, about half of the wetland area in the United States was drained. Since the 1980s, wetlands have been protected by federal law through the Clean Water Act. Some of the agricultural wetlands have been farmed since before federal protection took place. The United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) offers the Wetland Reserve Easement (WRE) program. WRE is a voluntary program that provides technical and financial assistance to private landowners to protect, restore, and enhance wetlands in exchange for retiring eligible land from agriculture. In Alabama, 36% of the wetland easements are in the Blackland Prairie Region, although the region covers less than 10% of Alabama.Farmed wetlands must be identified so that a farmer can apply to the WRE program. Part of the wetland determination is to detect hydric soils through their greyish color. However, the soils in the Blackland Prairie Region lack manganese and iron oxides, making it difficult for soil scientists to determine whether these soils are hydric. A lack of field indicators for hydric soils may falsely categorize a soil as non-hydric, affecting the restored wetland area and the easement's value. Indicators of Reduction in Soils (IRIS) devices are plastic films that are coated with iron (Fe) or manganese (Mn) oxides, and then they are installed into the soil for a 4-week period. Under anaerobic soil conditions, soil microbes reduce the Fe and Mn coatings from the IRIS devices. Coating removal indicates hydric conditions and confirms wetland soils. Hence, IRIS devices could be used in the smectitic soils of the Blackland Prairie Region to detect hydric soils. The objective of this project is to find out if IRIS devices can be used in the Blackland Prairie Region to confirm wetland soil conditions.With the help of NRCS soil scientists, I identified a field site in the Blackland Prairie Region that has problematic soils (soils without Fe and Mn parent materials). I produced Fe and Mn IRIS films, and then I installed them at the field site following the IRIS protocol. Every four weeks, films were removed and replaced with new ones. The films were washed, dried, and scanned to determine the percent coating removal via image analysis. IRIS film coating removal was evaluated following the IRIS protocol (removal of a 15 cm section of at least 30% of the coating within the top 30 cm of the soil). IRIS results from a transect (upland, transitional zone, wetland) together with physical and chemical soil properties will be presented.

Abstract #: 042 **Student**

Title: **Machine Learning Post-Processing Enhances NWM Accuracy by Over 30% in Watersheds with Extensive Water Infrastructure**

Presenter: Savalan Naser Neisary

Organization: The University of Alabama

Session: Modeling & Water Mgmt. 3

Drought management and effective water supply planning require accurate water prediction in arid western US. As a national-scale water prediction model, we explore the National Water Model (NWM) as a water resource management tool within the Great Salt Lake (GSL) water basin. Evaluation of NWM v2.1 retrospectively revealed a decrease in accuracy within the controlled basins, with the absence of extensive water resources infrastructure such as reservoirs, diversions, inter-basin water transfers, and water treatment plants likely impacting model skill. To address the limitations of the NWM for season-to-season water supply forecasting, we explored the XGBoost algorithm as a post-processor of the NWM flows - accounting for the impacts of water infrastructure on streamflow estimates without explicit rule-based representation. The ML model training framework used USGS streamflow observations from 1980 to 2020, corresponding NWM v2.1 predictions, upstream reservoir storage data, AORC precipitation and temperature forcings, catchment characteristics, and snowpack criteria. Preliminary results show a reduction in Mean Percentage Error (MPE) by up to 50%, a 20% decrease in Percent Bias (PBIAS), and a 33% improvement in Kling-Gupta Efficiency (KGE). The prototype model demonstrates ML algorithms can successfully account for the impacts of water resources infrastructures on naturalized streamflow estimates.

Abstract #: 043 **Student**

Title: **Exploring the Relationship Between Social Vulnerability and LULC Dynamics in Harris County, Texas**

Presenter: Annyca Tabassum

Organization: The University of Alabama

Session: Poster Session

Harris County, Texas has become more vulnerable to flooding due to a combination of factors including climate change, intense urban growth, and coastal proximity. Expanding urban development can potentially exacerbate the innate social vulnerability to flooding and thus result in increasing damage. The present study applies land use land cover (LULC) change detection and social vulnerability assessment to investigate the effects of urbanization in association with growing social vulnerability on flood risk in Harris County. We collect data from 2000 to 2020 from the US Census Bureau and apply the principal component analysis (PCA) method to construct the social vulnerability Index for each year (2000, 2010, and 2020). Meanwhile, to detect LULC changes, we apply the supervised classification method and machine learning techniques to analyze geospatial data over the same period from 2000 - 2020. Additionally, we employ hotspot and cluster analyses to formalize the observations of spatiotemporal changes. Finally, we investigate the correlation between changes in LULC and shifts in social vulnerability across Harris County. Through this analysis, we identify several hotspots where land cover has transitioned to urban land, coinciding with an increase in social vulnerability. By examining spatial patterns over an extended period, we can enhance our understanding of the dynamic spatiotemporal changes in both social vulnerability and the local environment. This study can provide valuable insights into the complex interplay among urbanization, social vulnerability, and flood risk. These insights can help policymakers, urban planners, and other practitioners to adopt effective mitigation strategies to reduce flood risk and enhance community resilience across the U.S. Gulf Coast region.

Abstract #: 044

Title: **Leveraging Geographic Information System tools to evaluate the impacts of the sea level rise on coastal forestry infrastructure**

Presenter: Kate Grala

Organization: Geosystems Research Institute, MSU

Session: GIS

The forest sector's supply chains and transportation networks in the Gulf of Mexico are frequently exposed to extreme weather events, including hurricanes, storm surge, high tide flooding, and sea level rise (SLR). However, the impact of intensified storm surge and rising sea levels on coastal forestry infrastructure, timber supply chains, and the overall supply of processed timber products in the region is not well understood. Decision-makers and forestry stakeholders in the northern Gulf of Mexico need to be able to evaluate the potential consequences of rising sea levels on coastal mills, and our study focuses on addressing these needs. This project utilized a Geographic Information System (GIS) to develop interactive tools and applications to identify vulnerable mill locations, analyze their transportation networks, and determine potential impacts on timber availability within their procurement zones. The analyses focused on mills situated within 25, 50, and 75 miles of the coastline of Alabama, Florida, Louisiana, Mississippi, and Texas. The study performed transportation network analyses to delineate the impacts on timber procurement zones around individual mills in relationship to the trucking transportation segments, their span, varying hauling distances and time, bridges, weight and speed limits, and the regional SLR scenarios as projected by the National Oceanic and Atmospheric Administration. The inaccessible road segments were incorporated as barriers and used to determine potential SLR impacts on coastal mills and the volumes of timber potentially available for procurement and/or salvage. The results will be disseminated via interactive online tools, such as interactive story maps and dashboards, that can be used by decision-makers to develop more effective strategies to mitigate negative SLR impacts on the forest sector in the coastal region. Examples of such strategies involve the planning of the most efficient timber hauling routes to reduce hauling costs and identifying more resilient locations for new coastal mills or wood-based bioenergy facilities. This presentation demonstrates the key steps of transportation network analyses utilizing easily accessible public coastal datasets. The presented geospatial analyses can be replicated for any other types of economy sectors and coastal infrastructure that can be represented as point locations. Our aim is to identify the most vulnerable coastal communities and provide them with tools to enhance their resilience to potential sea level rise threats.

Abstract #: 045 **Student**

Title: **Does Thin Layer Placement Lead to Replanting Living Shorelines?**

Presenter: Jannell Clampitt

Organization: Auburn University

Session: Coastal Issues 2

Coastal wetlands, recognized as highly productive ecosystems, play a vital role in safeguarding against erosion, sea level rise, and storm events, while performing nutrient removal, improving water quality, and serving as crucial habitats for fisheries. Human communities along coastlines rely on these services, yet the degradation of coastal areas poses risks to both these services and property. Particularly in the northern Gulf of Mexico, elevated rates of sea level rise, intensified storm events, and erosion are key contributors to substantial land loss. The objective of this research is to determine the optimal thin layer placement depth needed to maintain black needle rush (Juncus Roemerianus) vegetation survival in the northern Gulf of Mexico. A raised pool filled with brackish water was used to house 84 buckets filled with beneficial use dredged material from Mobile Bay. Each bucket had a 12 in. (30 cm) diameter and started with five, 2 in. (5 cm) Black Needle Rush (Juncus Roemerianus) plant plugs planted in a domino five pattern. This experiment was designed in two phases. Phase I was the first four months, where plants were given time to establish themselves. Phase II was where plants were subjected to sea level rise and various thin layer placement (TLP) depths. Phase I diurnal tidal heights ranged between 3 in. (7 cm) and 13 in. (33 cm) and increased to 11 in. (28 cm) and 21 in. (53 cm) during Phase II to imitate Gulf of Mexico tidal conditions. All buckets were constructed of a polypropylene fabric to allow for free-flowing water through the buckets and were filled with an average dredged soil depth of 13 in. (33 cm). TLP depths consisted of 6, 8 ,10, 12, and 14 in. (15, 20, 25, 30, 36 cm) where the control did not contain any additional sediment. Soil compaction, stem length, stem width, stem count, stem biomass, and root biomass samples have been monitored to track plant health over 9 months. Final data will be collected in mid-June that will complete research for this study. Building back coastlines that are being lost due to erosion or sea level rise can be expensive. Results of this study will provide guidance and understanding of steps needed to maintain vegetation establishment when existing living shoreline projects reach the end of their design life.

Abstract #: 046

Title: **Projects using Tied Concrete Block Mat along Shorelines**

Presenter: John Slupecki

Organization: Flexamat (Motz Enterprises, Inc.)

Session: Coastal Issues 1

I have been involved with using Tied Concrete Block Mat for 12 years in the Southeast. I have seen how invasive we have become to our shorelines and how we have created a demand for a enhanced vegetated solution. I want to share a couple projects to open up the conversation on out of the box solutions. There is more than one problem causing erosion along our shorelines.

Abstract #: 047

Title: **ARSNiC: This is a Good Thing!**

Presenter: Daniel West

Organization: Geological Survey of Alabama

Session: Restoration 2

The Southeastern U.S., specifically Alabama, is an aquatic biodiversity hotspot. However, many species are at risk from habitat fragmentation. Assessments confirming the ecological importance of providing aquatic organism passage (AOP) through road-stream crossings for aquatic species during some stages of life are needed to ensure robust communities and healthy populations. Longitudinal connectivity of stream reaches and channels is often necessary for species to access spawning grounds to allow opportunities for successful reproduction and adequate gene flow among populations. A common cause for stream reaches to become isolated is perched crossing structures (culverts), which can restrict the movements of aquatic organisms during critical time periods. Perched culverts result from erosion on the downstream side of the crossing related to hydrologic changes in the stream altered by the crossing structure. Increased erosion degrades habitat downstream through scouring, bank destabilization, and burying of primary habitat under excessive sediment, which can suffocate bottom dwelling species. Other threats related to increased erosion of crossing structures are issues related to transportation infrastructure. From structure failure to collapsing roadways, these events can leave communities completely isolated, disrupting daily lives, blocking main throughways for shipping and emergency services, and lead to increased costs for repair and/or replacement. In an effort to confront these issues, the Alabama Rivers and Streams Network including Connectivity (ARSNiC) team was created to identify, assess, evaluate, and prioritize longitudinal connectivity projects on a statewide scale. ARSNiC is a multi-agency partnership which performs assessments using multiple compounding methodologies from evaluating sediment risk input for roadways, to the structural influence on fluvial geomorphic responses, to the ecological and social benefits of these projects. Applying a step-up approach, the ARSNiC team is assisting in streamlining restoration efforts through identifying and prioritizing crossing structure replacements, along with improving transportation corridors. Utilizing this new approach focusing on longitudinal connectivity, ARSNiC provides potential opportunities for improving watershed connectivity and habitat availability for aquatic organisms, strengthening transportation infrastructure, as well as adding to the social feasibility through a statewide diverse partnership.

Abstract #: 048 **Student**

Title: **Investigating the impact of biochar application method on contaminant leaching in agricultural soils fertilized with poultry litter**

Presenter: Gurparshad Singh Brar

Organization: Auburn University

Session: Poster Session

Nutrient and metal loss from agricultural fields fertilized with animal manure leads to water quality issues. Effective management strategies can help to control the loss of contaminants from croplands. Our study evaluated the impact of different poultry litter application methods along with the use of biochar on the transport processes of phosphorus and metals. The investigation utilized the flow interruption technique to assess the leaching behavior of metals and phosphorus. Column-based rainfall simulation experiments were conducted on soil cores collected from pastures. Treatments were surface-applied poultry litter, subsurface-banded poultry litter, surface-applied poultry litter + biochar, subsurface-banded poultry litter + biochar, and control (no biochar and poultry litter). Results showed that the subsurface application of poultry litter helped reduce the concentration of orthophosphate (PO4–P) in the leachate. Further, preliminary results show that the addition of biochar helped to reduce the loss of metals such as iron and aluminum.

Abstract #: 049

Title: **Policy needs for the future of Alabama's agriculture-water nexus**

Presenter: Nicholas Magliocca

Organization: The University of Alabama Department of Geography and Environment

Session: Water Law & Policy Panel

Climate variations and change (e.g., increased temperature seasonality, more frequent and severe heat waves, and droughts) can have a major impact on Alabama's agriculture. Notably, many farmers in the state will experience these impacts disproportionately, such as historically excluded communities that have higher exposures, greater vulnerability, and less adaptive capacity. Transformation of our agri-food systems through inclusive, large-scale adoption of climate-resilient agriculture (CRA) practices has the potential to meaningfully reduce adverse climate change impacts. However, achieving widespread adoption of CRA practices, such as deficit irrigation, could also increase pressure on Alabama's surface water and groundwater resources. Moreover, most CRA practices have been developed for application in large-scale production, which limits the adoptable options for the more numerous group of small- and medium-scale producers. Achieving large-scale, transformative climate change adaptations in agriculture while mitigating further climate impacts and supporting sustainable and equitable rural livelihoods, is a grand challenge for society. A new project called 'Socio-Agroclimatology' seeks to increase adoption of CRA practices across the state. While incentives exist to promote the adoption of CRA practices, these are not accessible to all farmers in the state, and structural barriers persist for many that impede widespread CRA adoption and increasing the climate resilience of Alabama's agriculture. This panel will convene a group of researchers, legal scholars, farmer advocates, and farmers to discuss the policy needs for supporting CRA in Alabama in the future. Current policies and/or policy issues in Alabama that will be discussed include riparian water rights, the irrigation tax credit, and the role of 'impact grants' for supporting emerging food systems. The past or potential impacts of each of these policies and/or policy issues will be discussed in the context of farmers' livelihood security, equitable opportunities in farming, and the sustainability of the state's water resources while explicitly considering their feedback on climate. Panelists include Bennett Bearden (Geological Survey of Alabama), Emma Chapman Busby (School Yard Roots, Alabama Sustainable Agriculture Network), Olivia Cleveland (independent), Heather Elliott (University of Alabama Law School), Cindy Lowry (Alabama Rivers Alliance), Nicholas Magliocca (University of Alabama), Darrell McGuire (Deep South Food Alliance), Marie McGruder (McGruder Farms), and John Allen Nichols (Alabama Farmers Federation).

Abstract #: 050

Title: **Calibrating the APEX Model for Assessing Environmental Impacts of Agricultural Practices: A Case Study in Alabama**

Presenter: Anh Nguyen

Organization: Auburn University

Session: Lightning Talk - Research 1

The APEX model stands as a valuable tool for assessing edge-of-field water, nutrient, and sediment transport, thereby playing a crucial role in evaluating the environmental impacts of management practices. Calibration of the model with water quality data prior to simulating sediment and total nutrient loss is essential. This study aimed to calibrate the APEX model utilizing site-specific soil, weather, event flow, and water quality data, with the objective of determining its potential application as a tool to support practical decisions in agricultural management in Alabama. The study was conducted on a 120-acren field within the Town Creek Watershed of the Tennessee Valley Region, characterized by Decatur silty clay loam soil and row-crop production. Baseline information for setting up the APEX model included a 1-meter digital elevation map obtained from real-time kinematic global positioning systems (GPS) on farm vehicles, as well as climate, soil, water quality, and agricultural operations datasets. Runoff discharge and water quality datasets were collected from Edge of Field (EOF) monitoring stations installed at watershed outlets of the field. Onsite climate information for the field was referenced only for precipitation depths during the observed runoff events. Uncalibrated runs were performed using default values for various model parameters included in the ArcAPEX package. Calibration followed a sequential process, initially adjusting for runoff calibration, subsequently for crop yield, followed by sediment. Nutrient loss calibration was conducted solely after achieving satisfactory outcomes for the fundamental runoff and erosion processes that impact them. The calibration datasets covered the first two years (from 2021 to 2022) out of three of EOF data. Uncalibrated and calibrated APEX model predictions were compared against measured runoff and water quality data. Model performance was evaluated using metrics such as the Nash–Sutcliffe efficiency (NSE), coefficient of determination (R^2), and regression slope between simulated and measured annualized loads across all site years. Preliminary results demonstrating the potential of calibrated APEX models in informing environmental decision-making for sustain

Abstract #: 051

Title: **Restoring and Recovering Alabama's World Class Aquatic Biodiversity**

Presenter: Patrick O'Neil

Organization: Cawaco RC&D Council

Session: Restoration 2

A recent count of Alabama's aquatic megafauna (fishes, bivalve mollusks, snails, and crayfishes) totals around 820 species, more than the states of Mississippi, Tennessee, and Georgia. Around 310 (38%) are considered imperiled and classified as extinct, extirpated, endangered, threatened, or species of highest and high conservation concern in Alabama. Restoring and recovering Alabama's imperiled aquatic species is a daunting task that not any one agency, institution, or organization can solve alone. The Alabama Rivers and Streams Network (ARSN) is a group of agencies, industries, non-profits, individual landowners, academic institutions, and conservation organizations working together to implement "cooperative conservation" to improve water resource and habitat quality, educate the public about conservation benefits, and restore aquatic species to sustainable levels. The ARSN conservation model is built on the USEPA's nine elements approach for watershed management plans and the U.S. Fish and Wildlife Service's (USFWS) strategic habitat conservation approach for conserving wildlife populations and their habitats. The ARSN aquatic species conservation framework consists of eight essential elements: (1) private landowner importance, (2) emphasizing watershed restoration and water resource protection, (3) building cooperative and trusting relationships among participants, (4) identifying processes for habitat and species recovery, (5) working at a geographic scale that maximizes economic and human resources, (6) balancing individual goals while allowing science to guide recovery decisions, (7) finding common ground where organization priorities, funding, and conservation needs align, and (8) providing educational outreach opportunities for all. The amount of aquatic species conservation work by ARSN partners in the recent past is significant. From 2013-23, 40 species have been precluded from listing, six species have been delisted, and six species have been formally listed under the ESA. From 2010-22 the Alabama Aquatic Biodiversity Center transformed over 1,328,000 individual mussels, released over 110,984 mussels and 133,265 snails, and provided over 21,000 mussels for stocking and research purposes. Several large dams have been removed and over 5,400 stream-road crossing surveys have been completed. Between 1990-2021 ADEM sampled over 2,900 stations, collected 19,151 water samples, and measured 654,490 water quality parameters in priority watersheds. Over 1,000 biological assessment samples have been collected evaluating habitat and biological conditions in critical watersheds. With 60+ active ARSN participants, cooperative conservation is successfully proceeding in Alabama and contributing to the positive recovery trends of many imperiled aquatic species.

Abstract #: 052

Title: **Development of Effective Herbicides Mixtures to address Microcystis in Aquaculture Ponds**

Presenter: Andrew Barrick

Organization: Auburn University

Session: HABs & other Contaminants

It is well understood that water quality and eutrophication are major drivers of harmful algal blooms (HABs). Issues arising from nutrients loads, water circulation, and temperature also influence blooms of harmful algae, such as Microcystis which are the most common cyanobacteria in Alabama aquaculture ponds, which can be detrimental to cultured organisms and public food safety. Catfish producers commonly use copper sulfate, an EPA-approved algicide, to treat harmful algal blooms. While effective, repeated annual use of copper can accumulate in aquaculture ponds and potentially make the pond too hazardous for commercial production. Copper also has short-term effects on algal densities, leading to repeated doses to address HABs. Use of herbicides may be more effective in establishing long-term remediation of HABs. As herbicides have different mechanisms of action, using multiple herbicides simultaneously may be more effective in controlling Microcystis blooms. The efficacy of herbicides towards Microcystis however, is poorly characterized. The aim of the present study was to establish dose response profiles for Microcystis exposed to common herbicides and characterize effects on growth rates, chlorophyll concentrations, and chlorophyll/phycocyanin ratios (PC:CHL). Microcystis aeruginosa (UTEX 3037) was grown in house and dose response testing was conducted with 7 alternatives to copper (H2O2, Topramezone, Bispyribac Sodium, Triclopyr, Imazapyr, Diaquat Dibromide, Flumioazin, Fluridon). Effect concentrations (EC10, EC25, and EC50) were used to identify thresholds of ecotoxicity for chemicals independently. Diaquat dibromide was the most effect at inhibiting growth rates with an EC50 of 0.08 ± 0.01 mg/L and H2O2 was the second most effective method with an EC50 of 0.13 ± 0.04 mg/L. Of the endpoints, chlorophyll was more sensitive (EC50 0.06 ± 0.01 mg/L for Diaquat dibromide and an EC50 of 0.11 ± 0.02 mg/L for H2O2) for these compounds. Herbicides decreased the PC:CHL ratio (EC50 0.15 ± 0.05 mg/L for H2O2), indicating that either the chemicals inhibited phycocyanin production more than chlorophyll or that Microcystis altered its pigment ratios to promote light capture. Follow up research is in process to identify the efficacy of the herbicides to inhibit algal growth through binary and tertiary mixtures. Additional research will investigate long term efficacy of the mixture identified to be most successful.

Abstract #: 053 **Student**

Title: **Evaluating the tolerance of harmful algal blooms to copper sulfate pentahydrate**

Presenter: Ashley Hennessey

Organization: Auburn University

Session: HABs & other Contaminants

Harmful algal blooms can cause severe economic and ecological problems, including fish mortality and the production of toxins and off-flavor compounds. These blooms often require chemical treatments, such as copper sulfate pentahydrate (CuSO4·5H2O), to mitigate damaging effects. Given that waterbodies require repeated CuSO4·5H2O treatments to control blooms, we hypothesized that phytoplankton communities treated with CuSO4·5H2O develop tolerance to treatment, which could make blooms difficult to manage over time. To test this hypothesis, the toxic effects of CuSO4·5H2O were evaluated at a standard dose (1.37 mg/L CuSO4·5H2O; 0.348 mg/L Cu) and a low dose (0.69 mg/L CuSO4·5H2O; 0.174 mg/L Cu) relative to untreated control. Treatments were applied once to 1,000 L mesocosm enclosures installed in a productive aquaculture pond at the start of the experiment and monitored for 28 days using the lab-based pollution-induced community tolerance (PICT) methodology. This method measures photosynthetic efficiency across a broad range of 0.05 to 300 mg/L Cu concentrations in acute short-term bioassays. The results of the bioassay were applied to create half-maximal effective concentration (EC50) dose-response curves that can be utilized to determine tolerance to copper. Results from this experiment indicated that both doses of CuSO4·5H2O resulted in >99% removal of cyanobacteria in the first 7 days and reduced cyanobacteria by at least 70% throughout the experiment. In the first 3 days, communities in the standard dose and low dose treatments were 20x and 10x more tolerant, respectively. Tolerance peaked at 14 days after the treatments were applied and remained higher than the control throughout the experiment. These data suggest that a lower dose of copper sulfate is equally effective at treating harmful algal blooms dominated by cyanobacteria and that higher doses can lead to higher tolerance in the system, making blooms more difficult to treat in the future.

Abstract #: 054

Title: **Marsh plant decomposition rates along a salinity gradient affected by litter bag mesh size**

Presenter: Adam Siders

Organization: The University of Alabama

Session: Lightning Talk - Research 2

Decomposition is an essential ecosystem process where leaf litter and other organic matter is mineralized by microbes and invertebrates. Decomposition studies in tidal marshes typically employ litter bags with mesh sizes < 2 mm. Operationally, this mesh size excludes large detritivorous invertebrates and associated predators and does not account for litter mass loss due to fragmentation. However, invertebrates may play an important role in decomposition and subsequent ecosystem functions in tidal marshes, as they do in non-tidal freshwater ecosystems. To begin to examine the role of invertebrates on decomposition, we conducted a decomposition study using both fine (<0.5 mm mesh opening) and coarse mesh (5 mm mesh opening) litter bags at three sites spanning a salinity gradient in Mobile Bay, AL. We deployed 10 fine and 10 coarse mesh litter bags containing litter from Typha latifolia in a freshwater marsh, Juncus roemerianus litter in a brackish marsh, and Spartina alterniflora litter in a salt marsh. These litter types corresponded to the dominant marsh plant at each location. An additional set of 10 fine and 10 coarse mesh litter bags containing Phragmites australis litter was deployed at each site, as this plant was found at all marsh sites. Half of the litter bags were harvested after 6 weeks and the remaining were harvested after 16 weeks. We hypothesized that litter decomposition rates would be higher in the coarse mesh bags relative to the fine mesh bags at all sites and harvests, regardless of plant litter type, due to invertebrate-mediated decomposition. We further hypothesized that P. australis decomposition rates would be highest in the freshwater marsh and decline as marsh salinity increased. In the freshwater marsh, P. australis litter decomposed more rapidly in coarse mesh than fine mesh litter bags, but the effect of litter bag mesh size on T. latiflolia decomposition depended on the harvest. In the brackish marsh, P. australis litter decomposed more rapidly in coarse mesh than fine mesh litter bags. In the salt marsh, P. australis litter decomposed more slowly in the coarse mesh than fine mesh bags, potentially due to increased moisture retention of fine mesh litter bags during low tides. Spartina alterniflora decomposition rates did not differ between fine and coarse mesh litter bags in the salt marsh. By allowing invertebrates to colonize litter and permitting loss of litter fragments from bags, the use of coarse mesh litter bags may accelerate marsh litter decomposition rates compared to fine mesh bags and may be more representative of litter decay rates. However, the extent to which this occurs may depend on litter type and site salinity. Because tidal marshes occur at the land-water interface and marsh expansion-retreat dynamics and persistence can be linked with organic matter decomposition, it is important to accurately measure decomposition rates to understand how methods, such as choice of mesh size, affects these rates.

Abstract #: 055 **Student**

Title: **Data-Driven Water Management: Leveraging Soil Moisture Sensors and Machine Learning**

Presenter: Vaibhav Shelar

Organization: Auburn University

Session: Poster Session

Understanding the soil moisture status of farmland is necessary not only to make decisions on irrigation application rates but also to help prevent runoff from farmland. Unprecedented amounts of runoff can lead to significant nutrient losses and cause water quality issues. However, monitoring runoff from agricultural farms often requires sophisticated monitoring equipment and is labor-intensive. Soil moisture sensors (SMS) are becoming popular to monitor soil moisture and recommend water needed during the growing season. These SMS can also be integrated with weather information to estimate runoff from agricultural fields contributing to more informed water management decisions. Machine learning algorithms can be deployed to analyze soil moisture fluctuations over time, enabling the estimation of potential runoff from precipitation or irrigation events that exceed soil water holding capacity. By leveraging these innovative tools, farmers and irrigation managers can efficiently monitor and manage runoff, reducing its adverse effects on water quality and ecosystems. The objective of this study was to employ various machine learning (ML) models, including Random Forest (RF), Support Vector Machine (SVM), Artificial Neural Network (ANN), Gradient Boosting Machine (GBM), and Gaussian Process Regression (GPR), to predict runoff from a commercial row crop farm in Alabama. The predictions used input variables such as daily rainfall, runoff, temperature, irrigation, evapotranspiration, soil moisture sensor readings, crop coefficient, and effective root zone depth of the crop. The data was divided into training and testing datasets in an 80:20 ratio. Edge-of-field monitoring stations installed at the outlets of two watersheds located on the farm were used to evaluate the runoff predictions from the models. The performance of the models was evaluated using metrics such as root mean square error (RMSE) and coefficient of determination (R2). Results will be presented.

Abstract #: 056

Title: **Effect of treating poultry litter with biochar and inorganic amendments on the potential release of phosphorus and heavy metals in soil: Relevance to water quality**

Presenter: Prasenjit Ray

Organization: Auburn University Department of Crop, Soil and Environmental Sciences

Session: Water Quality 1

Poultry litter typically contains high concentrations of phosphorus (P) and heavy metals particularly, zinc (Zn) and copper (Cu) due to the supplementation of poultry diets. The release and availability of these elements in soil due to land application of poultry litter have received considerable attention in view of perceived environmental concerns, primarily water pollution. Soils receiving surface application of poultry litter contribute to the loss of P and heavy metals in the runoff water, which consequently degrade the surface water quality. Developing appropriate strategies for reducing the concentrations of P and heavy metals in runoff water following land application of poultry litter has been a long-felt need. Reducing the solubility of released P and heavy metals from poultry litter and their immobilization in soil is considered as one of the important strategies for preventing the surface runoff of the pollutant elements. The present study aimed at reducing the availability of P, Zn and Cu in soil by treating poultry litter with organic and inorganic amendments. For this purpose, a laboratory incubation study was conducted using soils with two different textures. Poultry litter was mixed with pristine biochar, engineered biochar, alum, and ferrous sulfate at differential rates, and applied to the soils. Amended soils were kept for incubation at constant temperature and moisture content. It is hypothesized that treating poultry litter with biochar and inorganic amendments will reduce the solubility of P, Zn and Cu following application of litter in soil. To test the hypothesis, water extractable P, Zn and Cu contents were determined at 0, 7, 21 and 42 days during the incubation period. To unveil the mechanism of actions of the amendments in controlling the release and solubility of the elements of interest, pH and dissolve organic carbon content in the water extract were also determined. Findings of the study will be presented.

Abstract #: 057

Title: **Comparison of automated and manual rain gauge performance during heavy rainfall and high wind events.**

Presenter: Sytske Kimball

Organization: University of South Alabama

Session: Water Quantity

Accurately measuring rainfall is critical for water resource management. Both rainfall totals and rainfall rates must be measured to effectively provide information for short-term decision-making like crop irrigation and issuing flash flood warnings and long-term planning like drought, forest fires, and water resource preservation. Measuring rainfall is a difficult endeavor no matter how you do it. Satellite- and radar-based rainfall products provide a spatial distribution of rainfall, the rainfall amounts are estimated from remote sensing data using algorithms. These algorithms are developed and validated using rain gauge measurements. Rain gauges measure rainfall directly, but only provide point observations. As a result, rainfall measurements used for forecasting, decision-making, and other purposes often are a combination of remote sensing and ground-based observations. Given their importance, rain gauge measurements are continuously being improved by rain gauge design and the development of error correction algorithms based on numerical simulations and laboratory experiments. High rainfall rates and strong winds are the main factors affecting the accuracy of rain gauge measurements. Rain gauges with wider orifices perform better and tipping bucket rain gauges under-collect during heavy rainfall intensities. Traditional cylindrically shaped gauges perform poorly in high winds because raindrops miss the gauge opening. In this study, the performance of various rain gauge types is compared at the South Alabama Mesonet weather station on the University of South Alabama campus. Two standard automated tipping bucket rain gauges are located at every South Alabama Mesonet site: a Texas Electronic TE-525 tipping bucket rain gauge and a Hydrological Services TB3 tipping bucket rain gauge with syphon to regulate water flow for improved performance during high-intensity rainfall events. Three additional gauges are installed at the campus site: a manual CoCoRaHS gauge, a manual National Weather Service Standard Rain Gauge, and a Campbell Scientific RainVUE20 tipping bucket rain gauge with a microprocessor with a built-in algorithm to correct for rainfall intensity and an aerodynamic shape to reduce the amount of rain that is lost during high winds. With traditional cylindrical rain gauges, wind can reduce the rainfall catch by up to 20 percent. Before commencing the experiment, all gauges were leveled and calibrated. The manual gauges are read once a day. All gauges are inspected after each rainfall event and the tipping bucket water content is recorded. The standard tipping bucket gauges record rainfall measurements every minute, and the rainVUE gauge records measurements every 5 minutes. Gauges are cleaned regularly. The South Alabama Mesonet stations measure wind speed and direction at 2 and 10 m elevation. These measurements are used to determine if the performance of any of the gauges reduces as a function of wind speed during a rain event.

Abstract #: 058 **Student**

Title: **Phosphorus Recovery and Removal using Non-Woven Iron-Amended Geotextiles**

Presenter: Devyn Roh

Organization: University of South Alabama

Session: Water Quality 3

Phosphorus (P) is an important and non-renewable component of agriculture fertilizers. However, urban and agricultural stormwater P runoff poses a significant environmental challenge. The presence of excess P in surface waters leads to harmful algal blooms, which threatens aquatic wildlife and human health (Carpenter, 2008). The Environmental Protection Agency determined nutrient pollution as the nation's most universal, expensive, and difficult environmental problems (EPA, 2019). As far as recovering P that is being removed for beneficial reuse, there are no established methods in practice. Therefore, there is an essential need to develop P removal, recovery and reuse techniques for improved environmental sustainability. The focus of research is to develop an iron amended non-woven geotextile to remove adequate amounts of P from stormwater and to demonstrate controlled P recovery for beneficial reuse. The objective of this study is to establish crucial parameters such as P adsorption capacity, kinetics, P recovery conditions and reusability of this geotextile material. Fe-Geotex was produced with a roll of commercial non-woven polypropylene geotextile and using a chemical precipitation method. P adsorption kinetic experiments were conducted in replicate 50 mL centrifuge tubes at room temperature. The Fe-Geotex were initially weighed and placed in to centrifuge tubes containing 40 mL of simulated stormwater (0.01 M KCl) with 10 mg P/L at pH 6.5. Samples were collected periodically and analyzed for P concentration using the Ascorbic Acid Method (APHA, 2023). For P adsorption capacity, the Fe-Geotex's were placed in 15 mL centrifuge tubes containing 12 mL of stormwater solution at pH 6.5, with varying P concentrations ranging from 0 to 240 mg P/L. Samples were collected and analyzed for P concentration. P recovery from Fe-Geotex was tested using varying strengths of strong acid and base solutions at different temperatures. First, replicate Fe-Geotex's were exposed to P by placing them in beakers containing 300 mL of synthetic stormwater with 30 mg P/L. The beakers were gently mixed at 10 rpm for 20 days to allow for maximum P adsorption. After P adsorption, the Fe-Geotex samples with adsorbed P were washed, dried and weighed. Each dried Fe-Geotex was submerged in replicate 50 mL tubes containing 40 mL of strong acid and base solutions ranging in normality from (0.5 to 10 N). The tubes spun and sampled until no more P release was observed. The ability of the Fe-Geotex to adsorb and desorb P over multiple cycles were tested. Each cycle contains a P adsorption step followed by a P desorption step and iron amendment step as previously described. The P adsorption experiment demonstrated P removal within the first few hours. The rapid P adsorption capacity comparable to other iron based media. Fe-Geotex shows >90% release of adsorbed P with minimal or no damage to the material. The experiment is to be repeated to determine reusability.

Abstract #: 059

Title: **Addressing Pathogen Pollution through Youth-Focused Participatory Science**

Presenter: Mona Dominguez

Organization: Auburn University Water Resources Center

Session: Extension, Outreach & Partnerships 1

Since 2021, the 4-H Alabama Water Watch Program, which is part of the Auburn University Water Resources Center, has been piloting the project, Exploring and Mitigating Pathogen Pollution in Our Waters, which is funded by the NOAA Bays Watershed Education Training (B-WET) Program. Through the project, 4-H AWW has trained # educators Alabama and Mississippi to utilize the project created curriculum, Exploring Pathogen Pollution in Our Waters, to lead students in Meaningful Watershed Educational Experiences (MWEEs) focused on understanding, detecting, and mitigating pathogen pollution in local waters. To date, 17 educators from 16 schools in nine Alabama counties and Madison County, Mississippi have engaged more than 1,500 elementary, middle, and high school students in this project, which includes bacteriological monitoring bacteria of local waterbodies to detect fecal contamination. Participating schools have submitted over 60 data records to the AWW database. Participating students gain real-life experience with data collection, analysis, science communication, problem identification, and development of strategies to address water quality issues. Students learn about participatory science and the important role it can play in water quality monitoring, protection, and restoration. The project is effectively addressing the Gulf of Mexico Alliance's Education and Engagement Priority by increasing environmental literacy and encouraging watershed stewardship in the Gulf of Mexico Region. Furthermore, it contributes significantly to the goals of the Water Resources Priority, which include the use of science and technology to protect human, aquatic, and economic health in the Gulf Region. The goals of this presentation are to 1) provide a project overview that includes outcomes and findings, 2) highlight challenges and benefits of engaging school groups in local watershed management efforts, 3) encourage collaboration between conference participants and 4-H AWW, and 4) initiate a conversation surrounding how Alabama's water resource professionals can better guide and support high school students who have an interest in working in water related fields.

Abstract #: 060

Title: **Evaluating the Effectiveness of Fish Consumption Advisories Along Choccolocco Creek**

Presenter: John Schell

Organization: Energy & Environment LLC

Session: Water Law & Policy 2

The Alabama Department of Public Health (ADPH) has placed fish consumption advisories on Choccolocco Creek due to the presence of PCBs and mercury in fish tissue. These advisories are meant to inform individuals about exposure to PCBs and mercury through eating fish caught from the creek. The advisories identify specific locations, species, and the number of fish meals that may be consumed, if any.

The fish consumption advisories are an effective Institutional Control (IC) to reduce or prevent chemical exposure, and like other ICs, the degree of effectiveness can be tied to outreach and education activities. The current outreach and education efforts for the Choccolocco Creek fish consumption advisories include websites maintained by ADPH, the Coosa Riverkeeper (CRK), and EPA, and signage along the creek at public access locations. The current signage includes upgrades in sign quality and spatial coverage that were recently implemented by the CRK with funding support from the Choccolocco Creek Watershed Group.To assist in identifying additional outreach and education activities, an intercept creel survey was conducted along Choccolocco Creek from May to September 2023. The survey was developed as a collaborative effort between the CRK and Eastman. CRK staff conducted the field surveys over a span of 101 days. The goal was to collect data about angler demographics, fishing habits, knowledge of fish consumption advisories, and fish consumption habits.The results of the survey identified a small angler population for Choccolocco Creek. Of the angler population surveyed, most do not eat fish from Choccolocco Creek and are aware that ADPH has set fish consumption advisories for Choccolocco Creek, although many are not clear on the specifics. Among those surveyed who reported eating fish, the majority indicated they would follow or consider following the advisories if information about them was accessible. Most anglers were high school graduates and above and primarily English speaking. Anglers identified various ways to increase public awareness of fish consumption advisories such as increased signage at boating ramps, social media, and including with fish licenses.

The survey data are also being used to identify additional actions that could increase the effectiveness of the fish consumption advisories. The range of potential actions include further expansion of the signage program, radio/TV advertisements, posting of informational flyers with QR codes in local bait/tackle shops, including advisory information with the purchase of fishing licenses, and the use of smart phone apps.

Abstract #: 061 **Student**

Title: **Enhancing Water Quality Through Biochar: Evaluating Phosphorus Retention and Release Dynamics of Biochar**

Presenter: Temitope Popoola

Organization: Auburn University

Session: Poster Session

The global exploration of ways to tackle water, air pollution, and enhance public health and well-being has resulted in the development of different technologies and mitigation strategies. Biochar has gained attention in recent times as a promising solution for the remediation of water pollution caused by non-point sources. Biochar is derived from biomass or organic waste material through a process known as pyrolysis which involves heating the feedstock material to high temperatures without oxygen, resulting in a stable form of carbon. The quality of biochar depends on the feedstock material used (such as manure, pine, corn stalks) and combustion temperature. This study aims to examine phosphorous (P) retention and release potential in four biochar (pristine and engineered state) samples for possible use as soil amendment to manage P losses from non-point sources. Four different feedstocks with varying characteristics were used for this study. In addition, biochar was engineered by doping with iron. The pristine biochar samples were characterized, and a single point adsorption isotherm was determined. This was followed by seven successive P desorption cycles. The preliminary results showed that the water-soluble P (WSP) in the engineered biochar ranged from 0.35 – 0.41 mg/kg compared to the pristine biochar which had an average range of 0.9 – 23.74 mg/kg. The single point adsorption isotherm analysis showed that the engineered biochar had a higher P sorption capacity (about 724 – 742 mg/kg) than the pristine biochar (116 – 185 mg/kg). We hypothesize a slow release of P from the sequential desorption study for the engineered biochar compared to the pristine biochar material. Further findings will be presented at the meeting.

Abstract #: 062 **Student**

Title: **QUANTIFYING PHOSPHOROUS ADSORPTION MECHANISM OF MAGNESIUM-DOPED BIOCHAR FOR SLOW-RELEASE PHOSPHOROUS FERTILIZER**

Presenter: Vivian Usha

Organization: Auburn University

Session: Wastewater Systems Mgmt

Nutrient pollution from nitrogen and phosphorous is currently posing a great risk to water quality and aquatic ecosystems. Eutrophication, resulting from the excessive discharge of phosphorus and nitrogen into aquatic ecosystems, primarily through fertilizer leaching, and industrial and agricultural waste, stands as a pressing water quality challenge. In this regard, biochar has proven to be a viable solution capable of carbon sequestration, effective adsorption, and offering agricultural benefits simultaneously. It is crucial to note that slow-release fertilizers have been used in agriculture for a long time. They are coated with polymers or other harmful compounds for soil health and microorganisms. As a result, slow-release fertilizer with minimized hazardous components will improve soil health while also protecting water bodies. The goal of this study is to develop magnesium-doped biochar that can be used for phosphorous adsorption and quantification of its adsorption mechanism to enable the fine-tuning of its slow-release properties. The biochar samples were produced from chemically treated pine biomass using a tube furnace under a nitrogen environment for different temperature ranges of 450◦C, 550◦C, and 650◦C with residence time of two hours. The effect of temperature and chemical pre-treatment of pine biomass on biochar structural morphology, functional group, and adsorption efficiency was investigated. Significant impacts were observed on biochar properties with adsorption efficiency of over 70% for each temperature. Biochar samples will further be understudied for kinetic studies, adsorption mechanisms, and their quantification using modified Langmuir and intraparticle diffusion models.

Abstract #: 063 **Student**

Title: **A surrogate modeling approach for the enhancement of the NOAA operational Flood Inundation Mapping framework (OWP HAND-FIM)**

Presenter: Supath Dhital

Organization: The University of Alabama

Session: Poster Session

Reliable Flood Inundation Mapping (FIM) is a key component in flood forecasting and analysis framework. The selection of FIM prediction solvers is generally a tradeoff between computational and data costs and accuracy. Physically based (hydraulic) models are typically considered to be more accurate but computationally and data expensive, while low complexity terrain-based solvers offer efficiency and scalability at the expense of accuracy. The NOAA Office of Water Predictions (OWP) operational FIM framework is based on the Height Above Nearest Drainage (HAND) approach. In this study, a deep convolutional neural network (CNN) technique is explored to enhance the OWP HAND-FIM. CNN is trained in physics-based HEC-RAS simulations and a suite of other input features (digital elevation model, topographical wetness index, land use land cover, etc.). The results show a considerable improvement in FIM accuracy when using CNN compared to the original OWP HAND-FIM. The transferability of the model is tested in locations not used for the CNN training. The results show considerable enhancement in the OWP HAND-FIM when the CNN model is applied. This demonstrates that CNN holds a generalizing capability by capturing the spatial correlation between pixels. Introducing physics into the neural network and increasing the size and diversity of its training data is expected to further enhance the transferability and predicting capability of the model.

Abstract #: 064 **Student**

Title: **Runoff losses of phosphorus from different cropping systems in Alabama row crop farms**

Presenter: Anjan Bhatta

Organization: Auburn University

Session: Water Quality 1

Phosphorus (P) losses from agricultural lands is a major non-point source for water pollution, causing harmful algal blooms and eutrophication. Surface runoff is one of the predominant pathways for P loss and includes dissolved (associated with water) and particulate (associated with sediments) P forms. Although transport factors along with P sources are the dominating factors contributing to P losses, the ground cover by crop plays a significant role in reducing runoff, erosion, and P loss from the fields. Therefore, quantifying P losses under different crop cover at field scale becomes important for effective P management and planning to reduce environmental P losses. The objectives of this study were to identify the dominant forms of P losses in runoff under different crops and during the growing and non-growing seasons in Alabama farms. Two paired watersheds from North and South Alabama farms equipped with Edge-of-Field monitoring instruments were selected. The runoff samples were collected during natural rainfall from 2021 to 2023, and water samples were analyzed for dissolved reactive P (DRP), total particulate P (TPP), total P (TP), and total suspended sediments (TSS). The study showed that TP loadings from the North Alabama watershed (NAW) ranged from 0.01 to 3.00 kg/ha and for the South Alabama watershed (SAW) between 0.003 and 2.63 kg/ha under different crop scenarios. The higher TP losses from NAW during the fallow winter period in 2021 and winter wheat period in 2022 were 0.79 and 3.00 kg/ha, respectively. The dominant forms were particulate P (up to 65% of TP) during the fallow period and dissolved P (up to 78% of TP) during winter wheat in NAW. The higher dissolved P losses during winter wheat were driven by surface application of poultry litter before planting. In SAW the greater TP loss (up to 2.63 kg/ha) was observed during the winter period with cover crop in the year 2022. Although cover crops were present during the winter period, the greater P losses were due to higher frequency of rainfall and poor vegetative cover until early spring. The non-growing period (November to March) was found to be the most sensitive period for P losses for both North and South Alabama farms and indicated the need for early planting of winter cover to ensure enough vegetative cover and judicious application of manure to minimize runoff, erosion, and P losses.

Abstract #: 065 **Student**

Title: **Enhancing Tree-Ring Proxy-Based Streamflow Reconstructions Using Machine Learning Techniques**

Presenter: Mahsa Mirzakhani Nafchi

Organization: The University of Alabama

Session: Poster Session

Water resources and planning management decisions are generally based on observed historic records. Therefore, it is crucial to investigate historic streamflow for better water resources planning. Tree-ring-based proxies have been used to skillfully reconstruct streamflows with traditional regression techniques such as stepwise linear regression (SLR). Machine learning (ML) methods have the potential to improve streamflow reconstruction but have not been widely applied. The Tennessee River Valley is a vital water source in the Southeast United States for applications including energy production and flood planning. Given the recent and projected variability in precipitation impacting watersheds across the Southeast US, the optimal allocation of streamflow is an ongoing challenge in the Tennessee Valley. USGS streamflow data for the Tennessee River Valley was collected for 11 sites where average annual volumes were calculated for each gauge's period of record, ~1920 to 2005 AD, and broken into seasonal volumes. Extending this period of record and increasing information about past (paleo) drought and pluvial (wet) periods would assist in quantifying risk to water managers and planners. This study evaluates novel AI/ML methods against traditional regression-based methods of streamflow reconstructions. The random forest (RF) machine learning algorithm yielded significantly better performance than traditional SLR in reconstructing summer streamflow (June-September) in the Tennessee Valley. RF demonstrated a higher coefficient of determination (R^2) of 0.7 compared to SLR's R^2 of 0.467, and a lower root mean square error (RMSE) of 23.942 versus SLR's RMSE of 26.473 for the SF Holston gauge. These results highlight RF's superior ability to capture the complex dynamics of streamflow data, making it a more reliable and accurate method for reconstructing streamflow. The findings of this research exemplify machine learning as a viable and robust method of reconstructing streamflow using tree-ring-based proxies, which can be utilized by water resources managers such as the Tennessee Valley Authority (TVA) to aid in informed decision-making.

Abstract #: 066 **Student**

Title: **Frequency of Hydroclimatic Extremes Inferred from Intra-Annual Density Fluctuations in Longleaf Pine**

Presenter: Shelby Jordan

Organization: The University of Alabama

Session: Poster Session

Recent climate change has caused increases in the frequency and intensity of extreme hydroclimatic events, altering normal climate patterns. Paleoclimate proxies such as tree rings have been used in addition to instrumental data to further the understanding of past climate patterns. Intra-Annual Density Fluctuations (IADFs), which are wood density anomalies found in the earlywood and latewood of tree rings, are a newly studied phenomenon that can be formed because of climate changes. The aim of this study is to determine if IADFs in longleaf pine trees (Pinus palustris) are effective proxies of extreme hydroclimatic events in the southeastern United States. Ring width chronology and IADF data from five sites with longleaf pines in the southeastern United States will be statistically analyzed with instrumental hydroclimate data in order to determine the relationship between IADF frequency and extreme hydroclimatic events. Preliminary results suggest that there is a positive relationship between IADF frequency and extreme hydroclimatic events during the growing season. This study will eventually contribute to the understanding of historic hydroclimatic activity prior to instrumental records, which will help researchers understand past climate patterns, contextualize present changes in the climate, and plan for future climate change.

Abstract #: 067

Title: **Native Rivercane Restoration Efforts in Southeastern Watersheds: A Story of Resilience**

Presenter: Michael Fedoroff

Organization: The University of Alabama

Session: Restoration 2

Giant river cane (Arundinaria gigantea (Walter) Muhl.) is a bamboo native to the Southeastern United States (SE US) and historically served as the basis of vast canebrake habitats prominent in watersheds pre-dating European colonization. With the influx of settlers, these vast breaks were cleared and destroyed for grazing and agricultural purposes with little understanding of the potential negative impact on the watershed ecosystem. Currently, less than 1% of the native rivercane habitat has survived in the SE US, and there still exists a knowledge gap on the impacts to watersheds and aquatic ecology from its loss. Due to the known benefit of these ecosystem's in protecting native river systems, promoting biodiversity, providing wildlife habitat, and rapid accumulation of biomass, giant giver cane serves as an ideal system for development of ecosystem service-minded restorations. Furthermore, its contribution to the continued and sustained cultural traditions of southeastern Indigenous communities makes it a valuable resource for the cultural survival for underserved communities. This presentation will provide insight into current efforts to preserve, protect, and better understand these valuable ecosystems as a cultural keystone species in the watersheds of the Southeastern United States.

Abstract #: 068

Title: **Restoring Priority Marsh Habitat on Fowl River, Alabama**

Presenter: Jason Kudulis

Organization: Mobile Bay National Estuary Program

Session: Restoration 2

Degraded marsh spits, breaching shorelines, and disappearing islands along the intertidal region of Fowl River were prioritized by the community during development of the Fowl River Watershed Management Plan. Using a comprehensive marsh health and recovery study to guide restoration alternatives, a team of scientists and engineers have developed design plans to address identified stressors and project challenges including sediment starvation, saltwater intrusion, sea level rise, sensitive habitats, boat wakes, permitting, and cost. Using a phased and adaptive approach, the design solutions will incorporate thin-layer placement and structural wave attenuation. Thanks to continued support from the National Fish and Wildlife Foundation and the State of Alabama, construction will begin summer 2024.

Abstract #: 069

Title: **Automating streamflow-recession indexes in Alabama**

Presenter: Elena Crowley Ornelas

Organization: USGS Lower Mississippi-Gulf Water Science Center

Session: Water Monitoring

Streamflow-recession indices are helpful in understanding surface-water and groundwater interactions, ecological niches, and the susceptibility of alteration to the hydrologic regime from anthropogenic influences. To improve low-flow calculations, Bingham (1982) calculated the “geologic factor” or gfactor which reflects the impact of surficial geology to streamflow recession. Bingham selected ideal peak flows after isolated precipitation events at U.S. Geological Survey streamgages during a 20-year period and hand plotted streamflow recession curves. The number of days needed for the streamflow to decrease one log cycle for each recession curve was averaged to calculate the gfactor for the streamgage. Bingham (1982) further regionalized the gfactor using a combination of the calculated gfactor, geologic maps, and decades of experience as a hydrologist in Alabama. Since then, the gfactor has been used not only for low-flow calculations, but also for regulatory and ecological research purposes. Although proven to be helpful, the time intensive and subjective process for calculating and regionalizing the gfactor make it difficult to replicate Bingham’s methodology in other regions or to include more recent hydrologic data. In this study, an automated methodology for reproducing Bingham’s gfactor in Alabama using the R programming language is presented. This new methodology will make it possible to evaluate decadal impact of droughts, surface-water withdrawal, and connectivity between surface-water and groundwater as well as provide a basis for using machine-learning regionalization methods.

Abstract #: 070

Title: **Water consumption trends for modern commercial broilers grown to nine weeks**

Presenter: Carson Edge

Organization: Auburn University

Session: Water & Energy Management

Monitoring drinking water consumption is a daily routine for broiler (meat-type chicken) producers and can be a good indicator of flock health and performance. As with any livestock animal, providing plenty of drinking water is critical and should not be overlooked. In general, water consumption will increase as a broiler ages and any sudden dips or decreasing trend in water consumption can indicate an issue that should be addressed by the producer. Depending on farm size and broiler age, drinking water consumption can exceed a million liters in a year. While past studies have described water trends in commercial broilers and suggested drinking water needs have increased, there is a lack of information regarding these needs for today's commercial broilers, particularly for broilers grown to nine weeks (4.1 kg target weight). This study aimed to establish daily water consumption trends for today's broilers grown to nine weeks under commercial conditions. Two trials (Flock 1 and Flock 2) were conducted using straight-run, Ross 708, broiler chicks. A total of 2,160 chicks were randomly allocated to eight pens in a tunnel ventilated research house and reared according to current management practices. Daily water consumption varied between flocks where Flock 1 consumed 15,725 L/1,000 birds and Flock 2 consumed 13,657 L/1,000 birds over the nine-week growth period. As broiler genetics improve and management practices are updated, water consumption requirements for broilers should continue to be monitored in order to sustain a relevant body of work in understanding water needs for commercial broilers.

Abstract #: 071 **Student**

Title: **Providing Stormwater Education and Outreach to Underserved Communities**

Presenter: Paige Macdonald

Organization: Auburn University

Session: Extension, Outreach & Partnerships 2

This project aims to provide training and educational resources to stormwater professionals and community members residing in the Black Belt region of Alabama to improve water quality from construction runoff sources. This project additionally focuses on The Poarch Band of Creek Indians residing on the outside edge of the Black Belt region to provide training for their stormwater needs. This project includes hands-on training workshops and outreach resources such as instructional videos and infographics.This project seeks to fill the gap between researchers and practitioners through developing training specific to on-site needs. The service area includes 47 individual U.S. Census Bureau tracts in 17 counties within the Black Belt Region of Alabama. There has been a population migration out of the area due to a lack of opportunities. The populations in the service area are less than 2,500 and have median household incomes well below 80% of the State Nonmetropolitan Median Household Income. In addition to socioeconomic disadvantages within the service area, there are also environmental concerns. Alabama is highly vulnerable to erosion and is at high risk for construction stormwater pollution due to the heavy rainfall and erosive soils. The Black Belt region of Alabama had highly fertile soil that led to cotton production, and due to the heavy production of cotton, the topsoil is now depleted which compounds flooding and pooling effects. The project has a goal of developing trainings that target these specific needs through working with practitioners and utilizing successful implementations of technology transfer done in other parts of the country.

Abstract #: 072 **Student**

Title: **Crowded in High Flood Risk Zones: Assessing Flood Risk in Tampa Bay Using a Machine Learning Driven Approach**

Presenter: Hemal Dey

Organization: The University of Alabama

Session: Poster Session

In recent decades, floods have increasingly caused severe damage to both human life and infrastructure. Utilizing historical flood damage records, Machine Learning (ML) models can be applied to simulate future flood risk by identifying the critical non-linear relationships between flood damage location and flood risk factors. To explore this, Tampa Bay, FL is selected as a test site. The main goal of this study is to simulate the flood risk with the best ML model. Furthermore, this study aims to identify the dominant factors contributing to flood risk in the Tampa Bay region. This study adopts five ML models, including Decision Tree (DT), Support Vector Machine (SVM), Adaptive Boosting (AdaBoost), Extreme Gradient Boosting (XGBoost), Random Forest (RF). In this study, past flood damage data serves as the target variable and a total of 17 flood risk factors from physical and social dimensions serve as predictor variables for training and testing these ML models. According to the findings, both the RF and XGBoost model demonstrate similar and the highest accuracies across all evaluation metrics compared to the other ML models. The RF model classifies 2.23% of Tampa Bay as very high risk and 2.55% as high risk, while the XGBoost model indicates a very high risk in 3.77% and high risk in 1.09% of the area. Overall, 10.69% of the population lives in these risky areas, with 14.18% being Hispanic and 6.72% Black residents. This study also highlights elevation, distance from waterbodies, extreme precipitation, and population density as the dominant risk factors of flooding. To conclude, this study introduces an innovative approach of assessing flood risk by utilizing ML models that will guide future research on flood risk simulation. The results of this study will help local policy makers to formulate effective flood risk mitigation by revealing the dominant flood risk factors and elevated flood risk areas of Tampa Bay. A similar approach can be applied to assess flood risk along the entire U.S. Gulf Coast.

Abstract #: 073 **Student**

Title: **Engineered biochar to improve nitrogen use efficiency and decrease nitrous oxide emissions from the agriculture sector.**

Presenter: Pradip Adhikari

Organization: Auburn University

Session: Poster Session

The extensive use of nitrogen-based fertilizers and animal manure has led to soil health and environmental problems such as nitrous oxide (N2O) emissions, lower nitrogen use efficiency, and nitrate pollution in water resources. Biochar can be used to minimize nitrogen loss and maintain soil health and water quality. However, the efficacy of biochars for improving ecosystem benefits may vary according to their modification techniques. This study seeks to develop engineered biochar via physical and chemical methods to improve nitrogen use efficiency and decrease N2O emissions in agricultural fields. We hypothesize that biochar doped with iron (Fe) and magnesium (Mg) metals will help boost nitrogen use efficiency and reduce N2O emissions. Pine biomass was pyrolyzed at three temperatures (500ºC, 600ºC, and 700ºC) under a nitrogen environment with a residence time of one and a half hours to produce biochar. The biochar was then modified using Fe and Mg salts to produce metal-doped biochar. The yield of biochar varied from 32% to 24% respectively. The produced biochars will be characterized using various analytical instruments (elemental analysis, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), Scanning Electron Microscopy (SEM), and surface area analyzer) to understand the modified biochars' physical, chemical, and surface properties. Then, the modified biochars will be tested further for ammonium and nitrate adsorption-desorption kinetic studies to evaluate their potential as slow-release material. It is expected that the findings of this research will help to understand the mechanism of modified biochar surface functionality and structure on nitrogen capture and transformation to enhance nitrogen use efficiency.Keywords: nitrogen use efficiency, metal-doped biochar, Pyrolysis, Adsorption-desorption

Abstract #: 074

Title: **Should Alabama's water institutions be reorganized to implement a state water management plan?**

Presenter: Mary Wallace Pitts

Organization: The University of Alabama

Session: Water Law & Policy 1

The need for an integrated water policy in Alabama has long been acknowledged and although considerable progress has been made, much remains to be accomplished. This research, through analysis of the evolution of water resources management and State entity mandates with respect to water management, identifies the most appropriate institutional framework within which to implement the development of a state water policy. An appropriate framework is apparent when the concept of subsidiarity as an organizing principle for water policy is applied to the existing spatial patterns of the political, legal, and institutional structures in the State that are mandated and funded to manage water. This framework could operate within existing legal, institutional, and funding arrangements, but would necessitate some revisions to existing State agency spatial organization. Other alternatives discussed relate to the creation of a new State-level organization mandated and funded to oversee water resource management or merging functions and mandates of existing State agencies. These alternatives would require legislative reform, spatial reorganization, and additional funding sources. This article is intended to inform and initiate continued discussion amongst all interested parties so that consensus is reached and prioritized regarding the selection and initiation of an appropriate institutional framework for the State. Given that many other organizations are currently developing comprehensive water management plans and considering appropriate institutional arrangements findings herein can also inform decision-making in other jurisdictions.

Abstract #: 075

Title: **SipSafe Program: Findings from two years of lead testing in drinking water at schools and childcare facilities**

Presenter: Jason Barrett

Organization: Mississippi Water Resources Research Institute

Session: Extension, Outreach & Partnerships 2

Lead in drinking water has had heightened attention since the Flint Michigan crisis even though lead has been an issue for years. The EPA has passed the lead and copper rule that regulates and dictates testing for lead in drinking water systems but does not specifically address the most at-risk individuals which are youth under the age of six. This research and extension effort focuses on child care facilities with a goal of determining best practices to reduce and/or eliminate the expose of lead in drinking water by testing for lead at each faucet within each facility.Protecting children from lead exposure plays a critical role in ensuring they develop into healthy adults. Children under the age of 6 have shown slowed growth, learning disabilities and other physical and mental impairments after prolonged exposure to environmental lead. The SipSafe Program seeks to limit children's exposure to lead via drinking water by screening water in qualifying schools and childcare facilities across Mississippi, as well as offering remediation assistance and educational materials on the dangers of lead.Mississippi State University Extension with assistance from the Mississippi State Department of Health, Mississippi Department of Education, Mississippi State Chemical Laboratory, and other cooperating partners, SipSafe has developed into a program that:•Trains staff and operators at participating facilities how to protect their children from lead exposure.•Tests drinking water in participating facilities for lead and its sources.•Takes action to help facilities reduce the amount of lead in their drinking water and further raise state-wide awareness of lead exposure in children.Utilizing public water system water quality data and elevated blood lead level data, SipSafe initially identified 14 counties in Mississippi to focus its screening activities. It is anticipated that data collected from these counties will be beneficial in future school and childcare drinking water screening efforts. This presentation will display and discuss the findings from two years of testing approximately 155 childcare facilities in 45 different counties throughout Mississippi.

Abstract #: 076

Title: **Water Use in 2020 - Looking Back to 1970 Water Use Projections**

Presenter: Michael Harper

Organization: Alabama Office of Water Resources

Session: Water Quantity

In 1972, The Geological Survey of Alabama published “Use of Water in Alabama, 1970 with projections to 2020”. Accordingly, The Alabama Office of Water Resources is developing the “Estimated 2020 Water Use and Surface Water Availability in Alabama” report. This presentation will look back to the 1970 report focusing on the 2020 water use projections and highlight methodologies and procedures for data collection and analysis for all Water Use sectors. To conclude, a comparison of the results of the “Estimated 2020 Water Use and Surface Water Availability in Alabama” report to what was projected in 1970 for the year 2020, thus determining how accurate the projections were based on data collected at that time.

Abstract #: 077

Title: **ADEM WATER QUALITY MONITORING PROGRAMS: CURRENT STATUS**

Presenter: Fred Leslie

Organization: AL Dept of Environmental Management/Field Operations Division

Session: Water Monitoring

In 1974 the Alabama Water Improvement Commission, ADEM's predecessor, created the initial surface water quality monitoring program with a network of 51 ambient trend monitoring stations statewide. In 1997 ADEM developed the initial water quality monitoring strategy to focus and document the Department's surface water quality monitoring mission. The strategy was updated in 2005, with the 2003 EPA Elements of a State Water Monitoring and Assessment Program as the basic framework. The 2005 Strategy outlined quality assurance plans, data management, data analysis, reporting, program review, and overall resource needs. The ADEM 2005 Monitoring Strategy was a coordinated monitoring approach designed to characterize water quality, to identify impacts from a variety of sources, and to provide a systematic and integrated framework for gathering necessary information to support the ADEM decision-making processes. The Strategy was primarily comprised of four programs defined by waterbody type:•Rivers and Streams Monitoring Program (RSMP), wadeable rivers and streams;•Rivers and Reservoirs Monitoring Program (RRMP), nonwadeable rivers and reservoirs;•Coastal Waters Monitoring Program (CWMP), coastal waters; and,•Wetlands Monitoring Program (WMP), wetlands.The 2005 strategy was implemented on a 5-year rotation by river basin and incorporated a combination of targeted, probabilistic, and long-term monitoring stations to meet state monitoring goals and objectives. Original ambient trend monitoring network sites were reviewed and included in the programs by waterbody type, with the addition of other long-term sites as needed. This approach was continued in the 2012 Monitoring Strategy, providing statewide data from two full monitoring cycles. In 2014, 2019, and 2023, ADEM conducted comprehensive reviews of the Monitoring Strategy. The reviews were conducted by personnel from the Field Operations Division, Water Division, and Nonpoint Source Unit to ensure that the Strategy met overall monitoring objectives as well as §303(d) listing, TMDL, and non-point source program needs while maintaining consistency of monitoring as needed for long-term trend analysis. Progress made during the last 20 years and changes to program priorities within ADEM and EPA allow ADEM to now conduct monitoring on a 3-year rotation for most programs. This presentation will provide information on ADEM surface water quality monitoring programs and priorities in more detail. Data and report availability information will also be provided, as well as contacts for additional program information.

Abstract #: 078

Title: **PFAS - REAL WORLD CONSEQUENCES OF THE PENDING MCL**

Presenter: Bryan Pate

Organization: INSITE ENGINEERING LLC

Session: Emerging Contaminants

With EPA's announcement of the new PFAS MCL to become effective in 2029, there will be real world consequences for utility systems of all sizes. During this fast-paced session, Mr. Pate will tackle some of the hard questions that utilities will inevitably face from their customers and provide strategies and resources for communicating with those customers. He will also address EPA-identified "Best Available Technologies" as well as emerging technologies for removing PFAS from drinking water and discuss the associated operational costs. As a conclusion, Mr. Pate will discuss what's next in the PFAS world - including wastewater, biosolids, and landfill leachate.

Abstract #: 079

Title: **Freshwater Restoration Across Alabama's Rural Landscape**

Presenter: Alana Reynolds

Organization: The Nature Conservancy

Session: Restoration 1

Alabama ranks number one in aquatic biodiversity- yet is also foremost in the number of imperiled species, rate of endemism, and species decline. Sedimentation remains one of the primary threats in the Southeast to stream health and freshwater biodiversity. It alters instream habitat, reduces primary production, disrupts food webs, and smothers sensitive species and their life history stages. To address the ongoing threat of sedimentation in Alabama's streams, it is necessary to use a watershed-scale conservation approach across the rural landscape. Over the past 20 years, The Nature Conservancy (TNC) in Alabama, along with partners, has demonstrated how to develop and implement a successful watershed-scale restoration methodology for sediment abatement. TNC works with private landowners to install best management practices (BMPs) and streambank restoration projects to improve water quality and instream habitat in focal watersheds across the state.

Abstract #: 080

Title: **Spatially Referenced Models of Nitrogen and Phosphorus Loads in Streams in Mississippi**

Presenter: Emily Gain

Organization: U.S. Geological Survey

Session: Water Quality 2

The effective management of nutrient pollution in rivers and streams often requires not only a robust water-quality monitoring program, but also an understanding of the sources of nutrients and the factors that influence their delivery to water bodies across the landscape. Because it is only feasible to monitor a small percentage of streams, model-based approaches are often utilized for the management of unmonitored watersheds. SPARROW (SPAtially Referenced Regression On Watershed attributes), a hybrid statistical and process-based mass balance model, uses nonlinear least-squares regression to correlate water quality observations with sources and transport-related properties of the watershed. SPARROW models have often been used at regional and national scales, and across broad spatial, geographic, and climate scales. A large domain affords the inclusion of more calibration sites which allows for the inclusion of more explanatory variables in the final model. However, larger calibration domains may result in predictions that are biased for a particular subregion. Models calibrated for a specific state may offer state resource managers more accurate estimates of nutrient loads for the watersheds that they manage.In cooperation with the Mississippi Department of Environmental Quality (MDEQ), we used load estimates for 46 nitrogen calibration sites and 51 phosphorus calibration sites to develop 2018 base year nitrogen and phosphorus models for the state of Mississippi. These models provide source apportioned estimates of nitrogen and phosphorus loads, yields, and concentrations for all catchments within the state.

Abstract #: 081 **Student**

Title: **Using StoryMaps as a Tool for Science Communication: a Case Study with the Wyandotte Nation and Flood Risk Perception**

Presenter: Parker King

Organization: Alabama Water Institute

Session: Poster Session

Northeast Oklahoma has long endured significant water-related challenges, particularly flooding, exacerbated by colonization and misguided development. While the area is home to nine federally recognized tribes, this case study focuses on the Wyandotte Nation, who suffer some of the worst effects of this flooding. As part of a larger NOAA-funded project, examining tribal understanding of NOAA products and improving communication, this study evaluates the efficacy of ArcGIS StoryMaps as a science communication tool. ArcGIS StoryMaps are emerging as an ideal method for conveying scientific information to decision-makers and stakeholders alike. StoryMaps are incredibly accessible and can be disseminated to large, diverse audiences. They are also significantly more engaging than traditional methods, as they are interactive and incorporate a variety of media. Using a combination of images, videos, dynamic maps, and charts, information can be presented as a story, allowing for deep engagement with the content. This case study demonstrates the use of ArcGIS StoryMaps to scope flood risk issues from the Wyandotte perspective, aiming to communicate these challenges to a wider audience, including decision makers. By utilizing interactive and multimedia-rich StoryMaps, we aim to bridge communication gaps and facilitate a collaborative understanding of flood risks and challenges in communities that have historically faced barriers to accessing and understanding scientific information. The presentation will detail the process of creating these StoryMaps alongside tribal partners, improving data accessibility, and driving collaborative solutions through a comprehensive scoping process. Through this case study, we aim to provide insights into the benefits of using ArcGIS StoryMaps for collaborative science communication, particularly in the context of improving resilience against flooding for the Wyandotte Nation and other tribal communities.

Abstract #: 082 **Student**

Title: **Making Stormwater an Asset: How Auburn University is using multifunctional stormwater design to manage stormwater and build community**

Presenter: Emily Ward

Organization: Auburn University Water Resources Center

Session: Lightning Talk - Outreach

Managing stormwater is often a challenge for campuses and municipalities alike, but it can also be a landscape asset. Auburn University has demonstrated a commitment to using nature-based Low Impact Development (LID) strategies across campus to both mitigate nonpoint source pollution and better manage stormwater. However, these efforts are not always visible to the public. The AU Water Resources Center in partnership with Auburn University Facilities Management is working to create an interactive StoryMap using ArcGIS in effort to provide information and background on LID projects across the main campus to better engage and educate students, staff, and visitors. StoryMaps is a visual storytelling tool that combines a narrative with maps and images using ArcGIS. This StoryMap will include more than 10 different LID sites where Green Infrastructure (GI) is in place.Auburn University strives to be a leader in natural and engineered GI due to their confidence in these practices. Across campus, Auburn has successfully combined stormwater regulations and branding aesthetic with LID practices including rain gardens, bioswales, permeable pavement, and more. This multifunctional approach treats and protects stormwater quality and quantity, beautifies the campus through landscaping, and exemplifies Auburn’s efforts to incorporate green infrastructure into renovations and new construction.

Abstract #: 083

Title: **Water is Life: Community Conversations towards Protecting Alabama's Freshwater Resources**

Presenter: Kelsey Herndon

Organization: The University of Alabama in Huntsville

Session: Poster Session

Alabama the Beautiful is a state rich in freshwater resources, including more than 132,000 miles of rivers and streams and the greatest freshwater biodiversity in the country, including more species of turtles, crayfish, carnivorous plants, freshwater fish, snails, and mussels than any other state. While Alabama's neighboring states have tackled the legislative feat of a comprehensive water management plan, Alabama has yet to fully address the opportunities and challenges of such an exceptional resource. The U.S. State Department through the Citizen Diplomacy Action Fund (CDAF) provided funding to support Water is Life: Community Conversations towards Protecting Alabama's Freshwater Resources. This project, in partnership with the Alabama Rivers Alliance (ARA), engaged three broad audiences with a stake in Alabama's freshwater resources: state-level legislators, environmental NGOs, and local community members. With support from CDAF, ARA convened these stakeholder groups across four Alabama watersheds (Tennessee River, Black Warrior River, Cahaba River, and Tallapoosa River) to provide information on opportunities and threats unique to each region and to facilitate conversations aimed at moving towards improved management of Alabama's rivers and streams. In total, more than a hundred community members and representatives of water-focused environmental organizations from across the state were connected with three state representatives to not only build awareness of Alabama's freshwater resources, but also to better understand the complex processes of transforming these concerns into political action. As a result of this project, ARA will continue to develop resources to help educate legislators about Alabama's amazing water resources and what they can do to protect and preserve these resources. ARA will also continue creating opportunities for partner organizations and interest individuals to build relationships with elected officials at the state and local level.

Abstract #: 084

Title: **Impact of biochar on phosphate transport and deposition under varying pH, ionic strength, and biochar dosage**

Presenter: Rakesh Kumar

Organization: Auburn University

Session: Wastewater Systems Mgmt

Phosphorus is one of the essential nutrients required for plants; however, loss of phosphorus from agricultural areas results in water quality impairment. The objective of this research was to understand the effect of pine wood raw biochar and iron-modified biochar on phosphate transport and deposition under varying solutions, pH (5.5-10.5) and ionic strength (0-10 mM) at different phosphate-biochar dosages. The breakthrough curve (BTC) analysis of raw and iron-modified biochar showed maximum deposition at high ionic strength (IS). Besides, BTCs of phosphate (10-20 mg/L) transport at increased IS showed delayed elute and long tailing curves compared to BTCs of tracer. Further, phosphate transport in biochar-mediated saturated porous media was investigated at 10 and 20 mg/L phosphate, where maximum phosphate retardation (37%) was found at pH 6.7 ± 0.1 and 0 mM IS due to the availability of sufficient active sites for 10 mg/L phosphate using iron-modified pine wood biochar compared to raw biochar. The BTCs of phosphate transport analyzed at pH 6.7 ± 0.1 and 0-10 mM IS showed phosphate deposition of 37% and 40% in iron-modified pine wood biochar-mediated saturated porous media for 0 mM and 10 mM, respectively, compared to raw biochar-mediated saturated porous media. For raw biochar, maximum phosphate adsorption was observed at pH 5.5 ± 0.1, whereas at pH 6.7 ± 0.1 for iron-modified biochar for 10 mM IS, and thus, least adsorption was observed at pH of 10.5 ± 0.1 for both raw and ion-modified biochar. Phosphate retardation BTCs for raw and iron-modified biochar at 10 mM showed adsorption of 40% phosphate for biochar dosages of 100 and 200 mg/L. Besides, co-transport and deposition of biochar and phosphate, considering with and without ripening effect, were analyzed at pH 6.7 ± 0.1 and 10 mM for a biochar dose of 100 mg/L and phosphate of 10 mg/L. Phosphate retardation using biochar was observed due to electrostatic attraction at liquid-solid interfaces. Overall, modeling of transport and deposition of phosphate and biochar are significant to understanding fate, biochar-phosphate interactions, and remediation designs in saturated porous media.

Abstract #: 085

Title: **Communicating Science through Virtual Reality: An Exploration of Week's Bay National Estuarine Research Reserve (NERR)**

Presenter: Dixie Cartwright

Organization: Mississippi State University, Geosystems Research Institute

Session: Lightning Talk - Outreach

Team members with the Geospatial Education & Outreach (GEO) project at Mississippi State University's Geosystems Research Institute are developing a virtual-reality interactive learning experience for Alabama's Weeks Bay NERR. This VR experience will allow users to explore Weeks Bay NERR and its unique ecosystems from anywhere around the globe using a computer, tablet, or mobile device. Using 360° visuals and interactive pop-up windows, this VR experience will help users understand the critical role estuaries play, while also providing Weeks Bay NERR a unique way to engage users and stakeholders in sharing the reserve's mission of research and education. Through the estuary's virtual reality experience users will be able to view nature trails, wetlands, marshes, forests, and tour a pitcher plant bog. Because the virtual environment is being captured using a 360° LiDAR scanner, users will also be able to interact with the environment to raise water levels to simulate how inundation from sea level rise or storm surge may affect the reserve. Using this blend of education and technology, our goal is to create a platform for learning and engagement that resonates with people of all ages and backgrounds. Our hope is that this VR journey will provide an interactive and informative experience that fosters a deeper connection to the Week's Bay NERR and a greater understanding of the delicate balance between freshwater and saltwater environments. For this lightening talk, GEO Project team members will share portions of the VR experience with participants and give an overview of the process and software platforms they used to create the educational resource.

Abstract #: 088

Title: **Hot spots of water quality impairment discovered in coastal Alabama**

Presenter: Stephanie Rogers

Organization: Auburn University

Session: Poster Session

Managing surface water quality is a global challenge, and understanding spatial and temporal patterns of water quality is a key component to effective management. However, analysis of spatiotemporal patterns of impaired waters over broad areas is sparse due to disparate water quality data and variable water quality standards. In this study we have leveraged the 303(d) List of impaired waters to present a new perspective for investigating spatiotemporal water quality patterns in Alabama. Every two years, each state in the United States is required to assess its surface water quality and compile a list of impaired waterbodies, meaning waters that do not meet water quality standards for their designated usage – referred to as the 303(d) List. The purpose of the 303(d) List is to identify impaired waters so that corrective action can be taken to reduce pollutant loads and, ultimately, improve water quality. We created a space time cube in GIS to analyze and visualize spatiotemporal patterns of the impaired rivers added to the Alabama 303(d) Lists between 1996 to 2022. For this analysis, the percentage of river length impaired out of the total river length, and number of times each impairment cause was listed, were summarized within Alabama sub-basins (Hydrologic Unit Code 8) (n = 51). Trend and hot spot analyses were conducted on the river impairment and causes. We found an up trend in river impairment for eight sub-basins across the state and a downtrend in one sub-basin. Over half of the sub-basins with an up trend in impairment also had an up trend in the number of times ‘pathogens’ was listed as a cause of impairment. Additionally, coastal sub-basins were found to be hot spots of river impairment. Interestingly, there was a down trend in the number of times ‘nutrients’, ‘ammonia’, and ‘siltation’ were listed as a cause of impairment at the state and sub-basin scales of analysis. Altogether, these findings show the use of spatiotemporal pattern analysis of impaired waters and can indicate where, both spatially and by pollutant, management should prioritize water quality improvement efforts.

Abstract #: 089

Title: **How Random Are Extreme Streamflow Events?**

Presenter: Krzysztof Raczyński

Organization: Mississippi State University

Session: Water Quantity

Like most natural processes, river flows are characterized by variability over time, which affects regional water resources, associated water quality, and availability. While most natural and man-made systems are able to function well under a normal range in hydrologic conditions, the inherent variability includes the presence of extremes, such as floods or droughts. Extreme events are often considered “random” phenomena in that they cannot be accurately predicted using statistical measures; however, studies conducted on streamflow patterns indicate the presence of certain periodic dependencies affecting the repeatability of extreme occurrences. Factors influencing this behavior include the seasonality of precipitation, the onset and melting of snow cover, or long-term atmospheric circulation. This repeatability is gradually being recognized and partially adapted to the definition of extreme phenomena, like in the case of drought. The aim of this study is to quantitatively assess the extent to which streamflow variability depends on non-random processes manifesting at various scales. To address this objective, daily flow data from 3,135 US Geological Survey (USGS) stream gauges for the period 1970–2023, distributed across the United States, were utilized for analysis. Flows were aggregated into various temporal scales from weekly to annual, after which time series analysis methods such as the Hurst exponent, harmonic analysis, and seasonal and trend decomposition using Loess (STL) were applied to define patterns within the data. The results of this study show a high temporal dependency and spatial correlations within the data, indicating that extreme hydrologic events exhibit tangible non-random patterns associated with physical forcing mechanisms. For annual data, over 70% of all examined gauges exhibit pattern persistence, while on a monthly scale only about 8% show either no clear patterns or anti-persistence behavior. Long-term patterns suggest the presence of processes influencing repeatability from 2 to 7 years, while seasonal patterns exhibit high stability in all studied gauges. Harmonic analysis showed that on a monthly scale, 50 harmonic functions can explain over 80% of the variance, and with an increase in aggregation step, fewer functions are needed to reach high variance percentages (e.g., only eight functions are needed for the annual time series). Among the examined cases, low flows are characterized by a higher influence of recurring processes compared to high flows. Overall results show the existence of non-random and repeatable patterns within extreme hydrologic conditions, indicating a high potential to support long-term streamflow forecasting capabilities. Further work building on these identified patterns could lead to a significant enhancement of the accuracy and scope of predictive models, which in turn can support improved decision-making and water resource management.

Abstract #: 090

Title: **Efficacy of community-based workshops to increase community knowledge regarding WASH in rural West Central Alabama**

Presenter: Jasmine S Kennedy

Organization: UAB- University of Alabama at Birmingham

Session: Lightning Talk - Outreach

Background: Community education regarding water, sanitation and hygiene (WASH) has been identified as a major need by several stakeholders working on closing the water and sanitation access gap in underserved communities. In response, The UAB Sanitation Health Program partnered with The West Central Alabama Community Health Improvement League, regional community-based organizations, and AmeriCorps VISTAs to develop and deliver community-based workshops aimed at increasing peoples' knowledge regarding specific WASH concerns relevant to the Alabama Black Belt. Funding was provided by the Center for Disease and Control and Prevention Foundation.Method: Project community partners participated in developing education material by adapting material from global health WASH literature, environmental models explaining water sources, and methods of local advocacy to be relevant to a local audience. Community members were trained in conducting the workshop and then organizing and hosting the workshops in their respective communities. A 7-question test was used pre- and post-workshop to assess knowledge. In total 14 workshops were held across 4 counties in the Alabama Black Belt (Wilcox, Dallas, Perry and Sumter counties) between July 7, 2023, to December 12, 2023. Results: There were a total 116 workshop participants of which 99 completed a pre-test and 116 the post-test. All participants were African American, with 60% female. Pre- and post-scores were 22% / 53%: WASH definition, 25% / 72%: hand hygiene, 2% / 36%: sanitation options in the region, 5% / 16%: regional water source, 4% / 15%: health risk of sewage, 2% / 35% local assistance, 14% / 60%: advocacy calls to legislators.Discussion: Results from the pre-test demonstrate that baseline knowledge of WASH related health effects, source of household water, resources for household water assistance or methods of advocacy were lacking. Although scores improved on all questions on the post-test survey, the knowledge gained by topic area was not equal with the lowest scores achieved on knowledge regarding sources for drinking water and health effects of sewage exposure. The greatest post-test scores were achieved on easy to teach topics, such as the ideal time needed for hand washing, and the number of calls needed to the state legislator. These results suggest that community knowledge on WASH topics are lacking, community led education can be effective however attention is needed on how material is presented to optimize understanding and retention.

Abstract #: 091

Title: **The Alabama Stormwater Association: Entering a New Era**

Presenter: Scott Rogers

Organization: Alabama DOT

Session: Lightning Talk - Outreach

Since its formation in 2017, the Alabama Stormwater Association (ASA) has experienced remarkable successes in connecting water resources professionals and stakeholders in the pursuit of its mission to protect and restore the quality of Alabama's waters and various other resources. Most notably, ASA has facilitated multiple in-person and virtual seminars that have attracted large numbers of diverse participants as well as "table talks" that have allowed for comfortable conversations among professionals about stormwater-related issues specific to local areas. Also, ASA has developed a comprehensive contact list of Alabama water resources professionals numbering in the hundreds and has used the contact list to promote awareness of stormwater-related training and collaboration opportunities. Moreover, ASA focused its early activities on MS4 matters (i.e., urban stormwater management), serving an immediate need given that no other professional organization in Alabama was directly addressing MS4 matters at the time and that dozens of municipalities, counties, and other public entities had been issued new MS4 permits by ADEM and were seeking actionable guidance. ASA eventually began to broaden its scope and address water-related issues beyond MS4 matters.Many of the accomplishments to date were realized while ASA was operating as an informal organization (i.e., an "unincorporated nonprofit association"). ASA is proud of those accomplishments, but the ASA board of directors determined that, for the long-term sustainability of the organization, ASA would need to transform into a formal, incorporated organization while continuing the important and popular activities that created a foundation on which ASA can grow. In this talk, ASA's entrance into a "new era" is discussed. Attendees will understand that ASA needed to become incorporated in order to expand and continue its success, appreciate how ASA is balancing its established activities with its new ambitions, learn about ASA's new membership structure, see how ASA is improving connectivity and knowledge-sharing through its revamped Web site, and acknowledge that participation in ASA's new era will better situate them within the professional community and will provide them with tools to more effectively protect and restore waters in Alabama and elsewhere.

Abstract #: 092 **Student**

Title: **Stakeholder Coastal Hazard Communication and Decision Making in Mobile, AL**

Presenter: Evan Cass

Organization: The University of Alabama

Session: Coastal Issues 1

The Gulf Coast of the United States has been identified as a region with high vulnerability to coastal water-related hazards such as hurricanes and floods. It is vital that these hazards are adequately mitigated to limit damage to residents and infrastructure. Laypeople are limited in the resiliency and mitigation measures they can adopt, so organizations are responsible for large-scale projects. Individual stakeholders in various organizations differ in experiences and responsibilities, which can influence their perceptions of coastal hazards and their preferred actions. Understanding different approaches to mitigation adopted by stakeholders in an at-risk community can provide an idea as to the prioritized risk mitigation actions in coastal communities with hurricane and flood experience. In addition, this can inform mitigation strategies in other coastal communities without a history of coastal hazards or an established mitigation plan. Two focus groups were conducted with stakeholders associated with coastal hazard planning, mitigation, and recovery in Mobile, AL in the spring of 2023. These focus groups covered actions taken to address hazards by emergency managers, government officials, members of news media, and non-governmental organizations. In addition, individual stakeholder perceptions of flood and hurricane risks were considered. Transcripts of the focus groups were used for qualitative content and sentiment analysis to identify the flow of information and subsequent actions taken in the hazard mitigation process. These results were condensed into a decision-making framework for visualization and application of the major themes and influences on the flood hazard communication and mitigation process reported by stakeholders. Mobile stakeholders identified stakeholder communication, preparation, and management as the most salient factors contributing to municipal flood hazard mitigation actions. First, stakeholder communication emphasized effective flow of information between stakeholders and the public. This was accomplished by implementing plans within and between government and private entities. Second, stakeholder preparation involved assessment and development of local projects and plans in preparation for future flood hazards. These actions differed based on the role of individual stakeholders and organizations. Finally, stakeholder management involved monitoring and reacting to actions taken by members of the general public. They believed that public decisions and actions often hinder the effectiveness of preparation and mitigation of flood hazards because laypeople often make decisions regardless of recommendations made by government and experts. These findings provide a framework for government and private stakeholder actions and plans for an at-risk Gulf Coast community that can be referenced and expanded on for effective flood hazard mitigation elsewhere.

Abstract #: 093 **Student**

Title: **The Profitability of Alabama On-Farm Irrigation: Representative Farms Incorporating Scientific Models of Irrigation Yield Benefits**

Presenter: Pritam Mitra

Organization: Auburn University

Session: Agriculture & Irrigation

Many explanations exist about why adoption of irrigation in Alabama lags behind most states in the region—despite the availability of a tax credit and high-quality Extension information. Among various reasons, many Alabama farmers face challenges with groundwater availability, topographic challenges for irrigation equipment, and high energy costs. Some also perceive that rainfall is sufficient to meet crop needs. Rather than simply promote irrigation adoption, our project seeks to understand the underlying economics of irrigation adoption in Alabama. To this end, this presentation describes the first representative Alabama farm built to study irrigation profitability, i.e., a whole-farm analysis. This approach can be compared to alternate calculations of irrigation profitability, such as the current guidance from the Alabama Cooperative Extension System—guidance that shows only a subset of farmers can expect net profitability gain from adoption.The representative farm approach offers the advantage of capturing all of the fixed costs and revenues associated with running a typical farm, as opposed to an enterprise budget that offers a more-narrow perspective that focuses more on variable cost analysis. In other words, we build several multi-crop farms that represent large, full-time farm operations and calculate their profitability. This status quo condition reflects the whole-farm profits from dryland farming for 4-5 crops. We then compare this status quo to the same farm with various levels of irrigation adoption. The change from the status quo to the alternate irrigation scenarios allows us to estimate the change in profits. The profit change thus becomes a more complete analysis about whether farmers should adopt irrigation.Another innovation in this project is to use realistic irrigation yield changes for the 4-5 crops in a location-specific scientific crop model. Specifically, we use our team scientists' estimation of the distribution of yield changes from irrigation over 35 seasons of historical weather data as an input to our representative farm economic decision making. This approach offers more scientific realism than simple yield assumptions. Preliminary results suggest that irrigation when triggered by sensors is used less frequently than some might imagine, sensor management offers profitability advantages, and under some conditions irrigation adoption is not profitable.The presentation will focus on two representative farms built with location-specific scientific and economic data: Houston County and Limestone County. This is one part of a larger-team project, where the models and assumptions will be refined over several years. The ultimate goal is to offer location-specific profitability estimates about irrigation adoption to Alabama farmers.(To be presented following Dr Knappenberger's paper in the same session)

Abstract #: 095 **Student**

Title: **DESIGNING AND EVALUATING INFILTRATION SWALES FOR RETAINING AND INFILTRATING ROADWAY STORMWATER RUNOFF**

Presenter: Parker Austin

Organization: Auburn University

Session: Stormwater 2

Urbanization has led to a rise in impermeable surfaces such as roads, parking lots, and buildings, resulting in significant challenges related to stormwater management. The development of urban areas generates large volumes of stormwater runoff and high peak flow rates, which must be effectively controlled to mitigate the risks of flooding and streambank erosion. To address these issues, the adoption of Low Impact Development (LID) and Green Infrastructure (GI) practices are used to manage stormwater quantity and quality from runoff by using sustainable methods to ensure a natural and cost-effective project. These methods aim to promote various sustainable processes such as evapotranspiration, infiltration, filtration, and water reuse. Infiltration swales are one type of GI practice that is commonly used in Alabama to minimize surface discharge and offer the potential to provide substantial surface runoff reduction benefits. By emulating the pre-development hydrology of a project site, infiltration swales have the ability to replenish the local water table through the redirection of runoff back into the native soils. This is achieved through the implementation of an engineered media matrix, which effectively manages the infiltration of water while utilizing natural materials. Although infiltration swales are currently used in Alabama, there is variability in their performance, with some demonstrating success while others fall short of expectations. This presentation will showcase ongoing research being conducted at the Auburn University - Stormwater Research Facility, focusing on the large-scale evaluation and enhancement of the current infiltration swale design used by the Alabama Department of Transportation. This comprehensive research encompasses the construction of field-scale swales, conducting controlled infiltration experiments, and evaluating performance under both simulated rainfall events. The findings from this research will enable to identify various design options, enhance construction methods, and establish comprehensive maintenance plans for effective post-development management.

Abstract #: 096 **Student**

Title: **Impact of Dissolved Organic Matter on Perfluoroalkyl Interactions in Soils**

Presenter: Fatama Tuz Johura

Organization: Auburn University

Session: Poster Session

Perfluoroalkyl substances (PFAS) contamination is widespread in various environmental matrices, such as surface water, groundwater, drinking water, air, sediment, soil, and biota. Human exposure to PFAS can lead to adverse health effects, including neurotoxicity and genotoxicity. The fate and bioavailability of PFAS in soil are governed by adsorption and desorption on the soil's mineral and organic surfaces and retention in air-water interfaces. In agricultural land, PFAS contamination co-occurs with applying organic fertilizers, releasing elevated dissolved organic matter (DOM) concentrations. DOM can reduce adsorption through competing for competition on adsorption surface sites and forming soluble DOM-PFAS complexes. It can also enhance adsorption by activating surface sites and facilitating co-adsorption. Therefore, to develop efficient risk management and remediation plans, it is crucial to investigate the impact of DOM on the adsorption in soils. This study aims to (1) evaluate the different chemical and physical properties of DOM extracted from common organic amendments and (2) measure the impact of DOM on the adsorption and desorption kinetics of PFAS.We characterized DOM extracted from Biosolids, Evergreen compost and manure, Cattle manure, Swine manure, Poultry litter, aged and fresh, and Leonardite. The molecular structure and composition was determined using UV-vis absorbance, fluorescence excitation-emission matrices (EEM) coupled with Parallel Factor (PARAFAC) analysis, Fourier Transform Infrared (FTIR) spectroscopy, and dissolved organic carbon and nitrogen. Adsorption experiments were performed on a clayey and slightly acidic B horizon of a Gwinette (Kanhapludults) soil. An adsorption-desorption kinetic isotherm of six perfluorosulfonate and perfluorocarboxilate on Gwinnett soil was executed. In further experiment, added DOM in the PFAS-soil adsorption isotherm can give a clear picture of the PFAS-DOM-soil ternary complexes.

Abstract #: 097

Title: **Recent Changes to Web Retrievals of U.S. Geological Survey Discrete Water-Quality Data**

Presenter: Amy Gill

Organization: U.S. Geological Survey

Session: Lightning Talk - Research 2

Online delivery of U.S. Geological Survey (USGS) water data continues to undergo a series of updates intended to make USGS data more findable, accessible, interoperable, and reusable (FAIR) for all users. Several changes to USGS discrete water-quality sample data access have been completed or are in progress during 2024. These changes reduce reliance on prior knowledge of agency-specific codes, streamline the repeatability of specific searches in order to capture data additions and updates, and increase the possibility of integration of USGS datasets with data from other sources. Although USGS data have been available to the public for many years through the USGS National Water Information System (NWIS) and Water Data for the Nation (WDFN) web sites, data retrievals have often required data users to be familiar with USGS-specific coding systems to locate and filter the desired data. The Download discrete sample data webpage (https://waterdata.usgs.gov/download-samples/#dataProfile=site) is a new interface that uses online filtering tools with plain language and built-in search capabilities to identify data types and specific constituents of interest. The site serves as a query builder, allowing the user to specify or limit USGS monitoring locations, sample media, observed properties, and dates of interest. Requested data are rapidly downloaded to comma-delimited files and the user-built query is expressed as a URL, which can be copied and reused to share or repeat data searches.USGS discrete sample data was mapped to the Water Quality Exchange (WQX) 3.0 schema in xml format in spring 2024. The WQX 3.0 format harmonizes USGS data descriptors with data from other agencies, facilitating retrievals from the Water Quality Portal (WQP) for multi-agency data. New and historical USGS data are available through a beta version of the WQP until the rollout of the new WQP planned for late summer/early fall 2024. News and explanations of these and other upcoming changes to USGS water data dissemination services are available through the Water Data for the Nation blog (https://waterdata.usgs.gov/blog/), the WQP webpages (https://www.waterqualitydata.us/), and the dataRetrieval repository on Github (https://github.com/DOI-USGS/dataRetrieval).

Abstract #: 098 **Student**

Title: **Relative Sensitivity of Cyanobacteria to Copper**

Presenter: Md Sayem Ahmed

Organization: Auburn University

Session: HABs & other Contaminants

Copper (Cu) is commonly used in aquaculture ponds to control cyanobacterial blooms. In Alabama, copper is often used when blooms become evident and there is not a strong understanding of how to use dosing to mitigate bloom development. To improve management plans to address harmful algal blooms, I carried out a number of studies characterizing the effects of copper on cyanobacterial species that are commonly found in Alabama catfish ponds. Three cyanobacteria: Microcystis, Anabaena, and Oscillatoria were isolated from a local catfish pond and culturing methods were developed. All three species were exposed to copper using a dose-response format ranging from 0-200 µg/L to identify decreases in cell density, impacts on growth rates, chlorophyll concentrations, and the phycocyanin: chlorophyll ratio. As these algal strains are grown in aquaculture ponds which have consistent copper exposure, Microcystis were compared to a lab strain (UTEX 3037). The results demonstrated that Cu affected biological performance of the algal species. Using chlorophyll-a concentrations to determine Cu toxicity, the 96-h EC50 values were 15.7, 19.8, 21.4, and 12.0 µg/L Cu for UTEX 3037, Microcystis, Anabaena, and Oscillatoria, respectively. Based on the results of cell density measurements, the 96-h EC50 values for UTEX 3037 and Microcystis were 15.6 and 19.9 µg/L Cu, respectively. These EC50 values indicate that both measurement endpoints gave consistent results. Among the algal species, Oscillatoria appeared to be the most sensitive to Cu. These results highlight the need for species-specific knowledge of how different species react to Cu pollution in order to effectively manage aquatic environments. The development of focused mitigation methods will be greatly impacted by the resolution of dose-response connections between Cu exposure and cyanobacterial populations as well as the validation of chlorophyll concentrations as a proxy for algal density. To formulate effective management methods that mitigate detrimental impacts of Cu contamination on cyanobacterial communities, more studies are necessary to fully understand the underlying processes regulating the observed responses.Keywords: copper toxicity, harmful algal bloom, Microcystis, Oscillatoria, Anabaena

Abstract #: 099 **Student**

Title: **Seasonal Characterization of Private Groundwater Well Vulnerability to Indicator Bacteria**

Presenter: Connor Howard

Organization: Miles College

Session: Poster Session

As a primary freshwater resource, groundwater plays a crucial role to secure drinking water. Within the Black Belt Region of Alabama, groundwater is the source of most residents' water, either from private wells or as the source for distribution systems. However, wells and groundwater sources can be potentially contaminated by fecal coliform bacteria traveling with infiltrating water during increased rainfall and flooding events. Fecal coliform bacteria can survive for extended periods in the groundwater, maintaining the risk of waterborne diseases and impacting the overall quality of the water supply. Therefore, understanding the impact of rainfall in association with probable microbial risk in groundwater sources will contribute toward best management practices to safeguard the health and safety of Black Belt residents. Using culture-based enumeration screens, the study objective was to i) determine seasonal trends in thermotolerant fecal coliform bacteria and ii) determine the impact of prolonged wet and dry periods on detection of indicator bacteria. The University of Alabama Tanglewood Biological Station served as the representative study site to establish a proof of concept for detecting and identifying indicator bacteria present in shallow groundwater wells located within a riparian floodplain, above the floodplain, and wetland surface water vulnerable to nearby sources of anthropogenic contamination (i.e. residential septic tank, farm). Results suggest detection of thermotolerant FC varied seasonally and spatially. Among well sites, thermotolerant FC were detected more frequently at the well located above the floodplain. Although, FC were consistently detected throughout the collection period (June 2023- April 2024) in wetland surface water samples, the riparian well had nominal detection of FC. Future work involves identifying the probable source of indicator bacteria detected in culture-based assays.

Abstract #: 100 **Student**

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

Presenter: Suranjana Chatterjee

Organization: Auburn University

Session: Modeling & Water Mgmt. 1

Geographically isolated wetlands (GIWs) are wetlands 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 such as nutrient and sediment retention and biogeochemical transformations. This study investigated the spatial and temporal variability in the mediation of nutrients and sediment runoff received by GIWs in southwest Georgia - a karstic region with abundant GIWs and intensive irrigated row crop agriculture. The area of interest for this study consists of two GIWs, one of which is surrounded by an active agriculturally dominated catchment where the other is surrounded by a mixed catchment. Rain gauges, water level loggers, and sediment traps were installed in these wetlands and water samples were collected monthly for water quality analysis. Sediment traps were collected monthly to find the dry mass of sediment deposited per unit time. 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 is a simple model 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. We predicted runoff volume and peak runoff from precipitation data collected onsite for 12 months using the NRCS TR-55 method. Other model parameters were determined from soil textural analysis and analysis of a NEON 10-m Digital Elevation Model using the ArcHydro extension for ArcGIS Pro. Cover management and erosion control practice factors and site-specific curve numbers were determined from onsite observation. Curve numbers were calibrated to the change in wetland water level for 23 significant rain events, which we converted to changes in volume using a mathematical relationship between water depth, surface area, and volume. We calibrated the parameters in the MUSLE model to the results from the sediment trap data. Uncalibrated model results for both of the wetlands showed similar temporal pattern of high and low values in comparison with the sediment trap data collected onsite. Model result 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, model result showed the sedimentation rate of 0.33 g/cm2/year whereas the sediment trap data showed sedimentation rate of 0.47 g/cm2/year. Future research will refine the calibrated model and validate it with data from the next 12 months. The final output of this study aims to identify ways to improve the health and functionality of these GIWs.

Abstract #: 101 **Student**

Title: **A Process-Based Approach to Model Pesticide Dynamics in Non-Floodplain Wetlands**

Presenter: Cristiano Feitosa

Organization: Auburn University

Session: Poster Session

Pesticides, although essential for increased crop yields in agricultural fields and control of weeds and pests in lawns, can pose a significant environmental challenge once they enter the waterbodies, therefore affecting ecological health and the safety of water for human consumption. Proper management and removal of pesticides from waterbodies is essential to maintain safe levels in freshwaters. Wetlands are among the natural solutions to mitigate pesticide pollution problem. Wetlands receiving pesticide-contaminated water act as sinks and transformers of contaminants , reducing the concentration of chemicals before they are released into the environment. Understanding the dominant processes behind the fate of pesticides in wetlands is essential for modeling, design improvement, and removal efficiency of constructed wetlands. The fate of pesticides in wetlands is the result of a combination of transport and transformation processes occurring simultaneously, these processes depend on the environmental variables such as temperature and precipitation; on the wetland biological diversity characteristics such as vegetation community; on the chemical characteristics of the studied pesticide compound; and in the project characteristics of the wetland: the type of constructed wetland (e.g., subsurface horizontal flow, free floating, surface flow), hydraulic loading and retention time. In this research, we present a conceptual framework for a process-based approach to model the dynamics of pesticides in non-floodplain wetlands. The model takes into account the characteristics of the wetland, the transformation process in which changes in the chemical composition of pesticides occur (biotransformation, hydrolysis, oxidation, reduction, volatilization) and the transport process characterized by the movement of compounds between the different compartments of the wetland: settling, resuspension, runoff, atmospheric deposition, diffusion and burial.

Abstract #: 102

Title: **Seasonal Characterization of Private Groundwater Well Vulnerability to Microbial Contamination and Probable Sources**

Presenter: Nikaela Flournoy

Organization: Miles College

Session: Groundwater

As a primary freshwater resource, groundwater plays a crucial role to secure drinking water. Within the Black Belt Region of Alabama, groundwater is a source of most residents' water, either from private wells or as the source for distribution system. Ordinary activities (industry, agriculture, residential) are anthropogenic sources of contamination which contribute to chronic (i.e. long-term) or pulse (periodic) disturbance that may enhance groundwater vulnerability to waterbourne microbial pathogens, impairing groundwater quality during recharge or recovery. In addition, extended drought periods and increased rainfall events associated with a changing climate may increase the likelihood of microbial pathogens infiltrating private groundwater wells. The University of Alabama Tanglewood Biological Station served as the representative study site to establish a proof of concept for identifying probable sources of indicator bacteria present in shallow groundwater wells located within a riparian floodplain, above the floodplain, and wetland surface water susceptible to nearby sources of anthropogenic contamination (i.e. residential septic tank, farm). The objective of this study was to i) determine seasonal patterns of cultivable thermotolerant fecal coliforms, ii) compare and contrast microbial diversity of indicator bacteria among sampled wells, and iii) determine the impact of prolonged wet and dry periods on probable source of indicator bacteria. This project serves as an opportunity to provide key insights into non-point sources contributing to indicator bacteria measured total maximum daily load (TMDL) and environmental drivers which dictate their prevalence in groundwater.

Abstract #: 103 **Student**

Title: **Cultivation-Independent and Dependent Assessment of indicator Bacteria in Shellfish Growing Waters**

Presenter: Monique Speigner

Organization: Miles College

Session: Poster Session

Impaired water quality in coastal watersheds, exacerbated by urbanization, land use changes, climate shifts, and extreme weather events, remains a significant concern. In Alabama, efforts have shown progress in safeguarding coastal watersheds. However, challenges persist, as highlighted by elevated levels of fecal coliforms in West Fowl River Watershed which may impact human health and the local economy. Still in its early stages of project initiation, represented data reflects a high-throughput means of detecting known thermotolerant strains of fecal coliforms (FC; Escherichia coli, and Enterococci) using IDEXX. IDEXX results were also compared against traditional culture-based enumeration protocols typically used for water testing. Through fieldwork and molecular assays this research will advance undergraduate research training experiences at Miles College. By involving students and faculty in this initiative, the project not only enhances research skills but also fosters partnerships for informed decision-making among stakeholders and regulators in coastal watershed management. The outcomes of this study may offer insights into water quality indices and improved monitoring practices, crucial for sustaining the health of coastal environments and communities.

Abstract #: 104

Title: **Long-term trends in streamflow, water quality, climate, and land-use trajectories across the Mobile Bay watershed-AL**

Presenter: Latif Kalin

Organization: Auburn University

Session: Modeling & Water Mgmt. 1

Long-term water quantity and quality trends are influenced by climate change (CC) and land-use/cover change (LUCC), posing significant challenges to food security, ecosystem health, and socioeconomic development. Understanding the magnitude and drivers of these trends is crucial for developing effective mitigation and adaptation strategies. This study analyzed the long-term trends in streamflow, water quality concentrations, vegetation growth, evapotranspiration (ET), rainfall, mean air temperature, land use/cover, and fertilizer application rates across the Mobile Bay watershed-USA (MBW). Using the Mann-Kendall test, we identified a consistent decreasing trend in average annual streamflow for 60 out of the 82 monitoring stations analyzed across the MBW. Water quality trends were analyzed at 30 monitoring stations and results varied: nitrate, organic nitrogen, and organic carbon concentrations increased, while phosphate, ammonium, and sediment concentrations decreased. From 1980 to 2020, LUCC analysis revealed increased urbanization, grasslands, pasturelands, and wetlands, along with decreased agricultural and forested areas. Concurrently, average annual rainfall and air temperature showed increasing trends. From 2000 to 2020, leaf area index (LAI), and ET consistently increased. Our findings suggest that the rising ET, most likely driven by increasing LAI and/or air temperature, exceeded the rise in rainfall, resulting in decreased streamflow. Additionally, we found a strong correlation between urbanization and rising nitrate concentrations, and between reduced agricultural areas and decreasing sediment concentrations. Our study provides important insights on the impacts of climate and land-use changes on water resources and may offer valuable information to support sustainable watershed management and ecosystem health across the Mobile Bay watershed area.

Abstract #: 105 **Student**

Title: **Evaluation of ALDOT Erosion Control Practices Using Rainfall Simulation on Various Soil Types and Slope Gradients**

Presenter: Jack Cater

Organization: Auburn University

Session: Stormwater 2

Construction sites rely on erosion control practices to protect bare slopes and prevent soil loss. This study used large scale rainfall simulators to evaluate various erosion control methods used by the Alabama Department of Transportation (ALDOT) on construction sites. The study included the construction of 12 rainfall simulators at the Auburn University – Stormwater Research Facility (AU-SRF) using three different soil types (i.e., clay, sand, and loam) and two slope configurations (e.g. 3:1 and 4:1). All testing and data collection is in accordance with ASTM D6459-19, the standard test method for testing Rolled Erosion Control Products (RECP) performance in protecting hillslopes from rainfall-induced erosion. This ASTM method is a full-scale performance assessment of the amount of soil lost on a slope in a storm with varying intensity. Some key aspects in this standard include calibration of equipment, preparation of test plot, documentation of RECP to be tested, installation of RECP, performance of test, collection of runoff and associated sediment yield, analysis of the resultant data, and reporting. In accordance with ASTM D6459-15, the rainfall simulators simulated a storm of varying 20-minute increments of 2 in./hr (5.08 cm/hr), 4 in./hr (10.16 cm/hr), and 6 in./hr (15.24 cm/hr). The simulator achieved a natural raindrop size and distribution according to calibration techniques outlined in the standard. Runoff volume and sediment concentration samples were recorded throughout the test. The total sediment lost during the test was collected and recorded for each rainfall intensity interval. Testing for this project began by conducting bare soil tests to analyze the amount of sediment lost without the use of erosion control methods. A total of nine bare soil tests on the 4:1 test plots have been performed to date with an average total soil loss of 1,977 lbs, 236.17 lbs, and 114.2 lbs for sand, loam, and clay respectively. The average k-factor for each soil type is calculated to be 0.37 (sand), 0.043 (loam), and 0.013 (clay). Nine crimped straw tests have been performed on the 4:1 plots with an average total soil loss of 44.31 lbs, 6.74 lbs, and 17.13 lbs for sand, loam, and clay respectively. Crimped straw testing indicated substantial soil loss reduction with average C-factor values of 0.021, 0.047, and 0.193 for sand, loam, and clay applications respectively. AU-SRF will continue to test a variety of erosion control products and practices (e.g., hydraulic mulches, straw cover, erosion control blankets, etc.) to fulfill final project objectives.

Abstract #: 106 **Student**

Title: **Forested Wetland Community Composition Across a Tidal Gradient in the Mobile-Tensaw River Delta**

Presenter: Andrew Balder

Organization: Auburn University

Session: Coastal Issues 2

Tidal freshwater forested wetlands (TFFWs) typically occur at the interface between river dominated non-tidal forests and downstream brackish marshes. Due to their unique position, these systems are affected by both riverine and estuarine factors, notably saltwater intrusion events coupled with low river flows. With increasing sea level rise, there is concern that upriver tidal influence will increase and impact existing TFFWs. The Mobile-Tensaw River Delta, one of the largest river deltas in the United States, features a vast wetland system that has been understudied. In 2023, we surveyed 47 400-m2 forest plots in the TFFWs of the Mobile-Tensaw delta across a tidal gradient, documenting the composition, abundance, and diameter of all canopy trees in each plot. Multivariate hierarchical clustering identified six distinct canopy communities ($p = 0.001$): 1) Mixed Forest, 2) Swamp Tupelo and Bald Cypress, 3) Mixed Tupelo and Bald Cypress, 4) Water Tupelo and Early Successional Forest, 5) Swamp Tupelo, and 6) Water Tupelo and Bald Cypress. Environmental factors, such as river distance ($p = 0.001$) and elevation ($p = 0.019$), showed significant correlations with forest-type community composition. Two communities (Mixed Forest and Swamp Tupelo) were located at the downstream (i.e., most tidal) extent of the Tensaw and Mobile/Bayou Sara (a tributary) Rivers, respectively and exhibited lower basal area (1.7-31.2 m^2/ha), species diversity (H’ 0.35-1.55), and canopy coverage (~<20%) compared to those in the upper reach. Our results suggest a strong influence of tidal and hydrological dynamics on forest structure and composition and highlight the potential for increasing saltwater intrusion to affect the lower reaches of the Mobile-Tensaw Delta.

Abstract #: 107

Title: **“Water” We Talkin’ About? – Facilitating Effective Science Communication for Alabama’s Water Resources**

Presenter: Rebecca Bearden

Organization: Geological Survey of Alabama

Session: Water Law & Policy 1

From influencing appropriations allocations to driving new policy initiatives, effective science communication by water researchers is paramount to ensuring that policymakers are prepared to make the most informed decisions possible regarding water resource management. While hydrologists, geologists, biologists, geographers, and engineers may consider themselves adept at advancing their disciplines within each of their respective fields, many lack the tools necessary to effectively communicate their research to legislators in a manner that results in increased understanding of the importance of water research at the local, state, and national level. To address this need in Alabama, the Geological Survey of Alabama has partnered with the University of Alabama Department of Geography and the American Geophysical Union (AGU) to host a series of hands-on workshops to train undergraduate and graduate students and early career professionals to be more effective water research advocates. As an extension of AGU’s Voices for Science and Local Science Partners programs, the workshops feature in-person meetings with staff members from Alabama’s senate and congressional offices as well as sessions geared toward crafting clear and concise one-page summaries that convey complex scientific information in a legislator-friendly format. While the current training takes place on the University of Alabama campus and features a beginner level introduction to communicating science, researching legislators, and executing legislative staffer meetings, plans are in place to offer trainings at other universities, agencies, and private sector venues and tailor advanced content for those interested in pursuing water policy initiatives.

Abstract #: 109 **Student**

Title: **Relative Sensitivity of Alabama Endemic Snail Species to Nickel exposure**

Presenter: Sean Parham

Organization: Auburn University

Session: HABs & other Contaminants

Snails are effective bioindicators due to their prolific distribution, high level of endemism, and capacity to accumulate contaminants. Freshwater snails have unique ecological niches which are imperiled by land-use change and the introduction of hazardous chemicals. To assess how environmental alterations affect gastropods, lab-based studies are needed to characterize the toxicity of specific stressors. This can help guide policy decisions and remediation efforts. The aim of this research was to characterize acute toxicity of nickel (Ni) towards endemic snails (Somatogyrous georgianus (Walker,1904); Elimia cahawbensis (I. Lea, 1961); Elimia spp.) and measure the bioaccumulation of Ni and mineral elements including calcium, magnesium, potassium, and sodium. Snails were exposed to six concentrations (25-800 µg/L) of Ni for 96h. Additionally, a local species of least concern, Physella acuta (Draparnaud, 1805), was exposed to nickel concentrations (125-2000 µg/L) for comparison to the endemic species. Among the studied snail species, E. cahawbensis was the most sensitive to Ni with the lowest lethal concentration (LC) where 50% of the organisms died at 88.88 µg/L Ni. The LC50 for Somatogyrous georgianus was 167.78 µg/L Ni. Elimia spp.'s LC50 was 393.13 µg/L Ni. The LC50 for Physella acuta was 436.56 µg/L Ni. Except for Elimia spp., mortality of the other two endemic snail species corresponded to the whole-body uptake of Ni. Ni exposure also influenced sodium and calcium uptake for Elimia spp.. All three endemic species are potential candidate species for characterizing localized effects of human activities, and this study provides a first step in characterizing how snails would be affected by environmental alterations. More research is needed to further characterize potential effects of other human stressors on these endemic snail species. Additionally, research into subindividual responses and routes of exposure can further elucidate variations in species sensitivity.

Abstract #: 110 **Student**

Title: **A Southeastern US Regional Flash Drought Review and Agriculture Impact Assessment**

Presenter: Shaelyn Deal

Organization: The University of Alabama in Huntsville

Session: Poster Session

The Southeast US (SE) has experienced several drought episodes since 2000 and is particularly susceptible to rapid onset of short-term droughts (flash droughts). In the SE, the surface-based hydrologic cycle is accelerated relative to other regions due to consumptive vegetation and generally poor water-holding soils. The impacts may be widespread and often bring catastrophic consequences for a variety of sectors, most acutely, agriculture. There is a need to better characterize flash droughts in the SE with specific focus on the onset, timing, duration, and impacts. Here we present an assessment of flash drought events across the southeast providing a spatial and temporal review of rapid onset drought metrics across the SE using regionally derived datasets to compare characteristics such as timing, antecedent conditions, impacts, and amelioration. This study utilizes the Lawn and Garden Moisture Index (LGI), the Evaporative Stress Index (ESI), and the Soil Moisture Volatility Index (SMVI) (via modeled and in situ data) in comparison with the United States Drought Monitor (USDM). Results include flash drought occurrence and vulnerability by season and county across the SE and will provide insights on how these events translate to agricultural risks in the region.

Abstract #: 111 **Student**

Title: **Shift of Stakeholder Perception Through Knowledge Co-Development in Mobile Bay, Alabama**

Presenter: Fatema Tuz Johra Nourin

Organization: The University of Alabama Department of Geography and Environment

Session: Water Security & Risk

Knowledge co-production is a participatory process that brings together scientists and other community stakeholders to interact for addressing a complex challenge collectively. The project "Assessing Nature-Based Solutions (NBS) to Mitigate Flood Impacts and Enhance Resilience" is conducted in Mobile Bay, Alabama, through community engagement workshops soliciting stakeholder input by knowledge co-production. This project organizes an introductory workshop on 17 April 2023, followed by a virtual meeting about modelling updates and another in-person workshop on 23 May 2023. The workshops were held to engage the stakeholders closely with the research team to understand the project goals, objectives, timeline, and the stakeholder's role in shaping the project outputs. Meanwhile, through the all-day-long dialogue between the research team and the stakeholders, the scientists became informed about the intimate local knowledge. Throughout these workshops, broader knowledge co-production took place to create informed stakeholders and an informed research team. Furthermore, this research attempts to observe shift in risk perceptions about compound flood risk and understanding of NBS in Mobile Bay through the knowledge co-production process in the workshops. The workshops are designed to introduce concepts about compound flood and NBS and get stakeholder input about the design return period and desired NBS as flood mitigation strategy at specific locations in the Mobile Bay area. Dialogues are held between the research team and the local stakeholders about existing projects and potential locations where successful NBS could be implemented to mitigate compound flood risk. The information flow between the research team and community stakeholders about the compound flood, risk, and mitigation is traced through a fuzzy cognitive mental model. Policymakers, scientists, and planners can adopt this process of knowledge co-production for community engagement for effective risk communication and appropriate risk mitigation strategies.

Abstract #: 112 **Student**

Title: **Assessment of microplastics abundance and distribution in the Alabama River System**

Presenter: Safeerul Islam Hashmi

Organization: Auburn University

Session: Emerging Contaminants

Rapid increase in plastic pollution has received increased attention since the past decade. Plastics find their way to enter the aquatic ecosystem and remain there for hundreds of years. Fragmentation of plastics occurs with time that converts them into micro-sized fragments and fibers called microplastics (MPs). Studying the abundance, distribution, and transportation of microplastics in water systems is necessary for evaluating potential risk and impacts of MPs in the natural ecosystem. A significant number of studies have been carried out in different countries to assess the presence of microplastics in river waters and sediments. However, limited studies on the microplastics pollution in river systems of the US have been conducted. This study is designed to evaluate the abundance and temporal and spatial distributions of MPs in the Alabama River. Five sites from the upstream to lower stream of the river were selected for sampling and 4 seasons (summer, fall, winter and spring) were assessed for MPs in the surface, middle column, and bottom column of Alabama River water. In addition to MP abundance, various physical (e.g., size, shape, density) and chemical properties (e.g., type of polymer) of MPs were characterized. Microplastics with different types, sizes, and colors were found in the Alabama River water. Among the five sites, MP abundance was highest in Montgomery site and summer season (454 particles/L) and lowest in Dixie Landing site and summer season (76 particles/L). These MP concentrations are comparable to the MP concentrations that have been reported for some polluted rivers in the world. Except for Mobile site, the highest MPs abundance was found in surface water as compared to water in the middle or bottom water column. Black and white microplastics were found to be the dominant colors and PET, PE, and PP were the dominant polymer types. This study is important and will serve as a benchmark for microplastics' presence in the Alabama River water that can be used for evaluating potential risk and impact of MPs in the ecosystem of the Alabama River. Keywords: Microplastic abundance, microplastic distribution, microplastic prevalent, Alabama River

Abstract #: 113

Title: **The Trials and Tribulations of BoCEPhUS: Troubleshooting and Maintenance of an Outdoor Autonomous Water Quality Sampler**

Presenter: Blair Morrison

Organization: Mobile Bay National Estuary Program

Session: Water Monitoring

Autonomous samplers are the way of the future; they provide scheduling flexibility, cost savings, and access to remote places. They can also be quite a handful. In 2023, staff of the Mobile Bay National Estuary Program (MBNEP) built a portable autonomous water quality sampling system to augment the restoration monitoring efforts conducted by the organization. Nicknamed BoCEPhUS - Box of Cool Electronics Phor Understanding Sediments – the system passively collects in-stream turbidity data, which triggers the active autonomous collection of water samples at certain thresholds. After being taken back to the lab, water samples are filtered, with resultant filters dried and weighed to determine total suspended solids (TSS). The pairing of turbidity readings and TSS allows a calibration curve to be generated for a body of water, which estimates how much sediment is transported by the waterway at certain turbidities. To ensure data comparability with existing monitoring protocols, the SedEvent system methodology was co-opted from procedures utilized by the Alabama Department of Environmental Management (ADEM) to determine 303(d) Impaired Waterbody listings and de-listings. BoCEPhUS was first deployed during April 2023 to collect post-construction data on a restoration site within the Fish River watershed in Baldwin County. From there, the system has been deployed at an additional site in Baldwin County within the Magnolia River watershed to collect pre-restoration sediment baselines. As of May 24th, 2024, BoCEPhUS has captured nearly 20,000 turbidity readings and collected 174 samples at the site, profiling 12 rain events. Many of these rain events occurred overnight when conditions were unsafe for a traditional field crew to sample.Over the course of a year in the field, MBNEP staff have had to adapt aspects of the monitoring plan due to an array of obstacles and unforeseen circumstances. Despite the challenges, BoCEPhUS still presents significant cost savings over in-person water quality monitoring contractors and collects high-resolution baseline data for sensitive waterways before and after restoration activities occur. This presentation will cover details of the methodology and mechanics, as well as tips, tricks, and things to consider in planning for autonomous sampling systems.

Abstract #: 114 **Student**

Title: **Utilizing SWAT+ for Comprehensive Water Quality Analysis in Alabama**

Presenter: Alexandria Cox

Organization: The University of Alabama in Huntsville

Session: Water Quality 3

Water quality assessments are critical in protecting aquatic ecosystems in Alabama. Understanding baseline water quality allows for the planning around potentially competing uses such as irrigation. Additionally, understanding potential water quality impacts allows for a more comprehensive assessment of our streams regulating ecosystem services. However, the persistent challenge of insufficient data limits our ability to formulate comprehensive water quality monitoring strategies. To help address this, a watershed calibrated instance of the Soil and Water Assessment Tool Plus (SWAT+), an advanced modeling framework that offers a better method for monitoring water quality in regions with limited data accessibility, is applied to estimate.By utilizing Digital Elevation Model (DEM) data, CropScape land use data, gSSURGO soils data, North American Land Data Assimilation System (NLDAS) for weather, and Analysis Of Record for Calibration (AORC) for precipitation data for the Pine Barren watershed (located in Middle Alabama), SWAT+ is able to construct Hydrologic Response Units (HRUs). These HRUs represent areas with similar physical characteristics, and by combining land cover, land use, and soil type, HRUs can be used to estimate runoff and pollutant loading from defined land areas at a planning level.Our project aims to improve methods for analyzing water quality within the context of ecosystem services. A key objective of our research is to identify the limitations and challenges associated with data scarcity in water quality analysis. Preliminary applications of SWAT+ in the Pine Barren watershed provides confidence that this modeling framework will offer a more accurate understanding of water quality, potentially applicable across Alabama's ecosystems. This will pave the way for more effective and sustainable water management practices.

Abstract #: 115 **Student**

Title: **Does covering broiler litter in open field minimize nutrient losses and reduce environmental concerns?**

Presenter: Shruthi Koneti

Organization: Auburn University

Session: Poster Session

Broiler litter (BL) is a popular row crop soil amendment with a nutrient grade of 3-3-2. Approximately 12.6 million metric tons of chicken litter is generated annually by the poultry birds produced in the United States. However, the timing of BL cleanout from poultry house may not coincide with the optimal periods for field application, necessitating the storage of BL for varying durations. The storage of BL poses significant environmental and agronomic challenges. One primary concern is the potential for nutrient runoff and leaching during precipitation events, which can degrade water quality in nearby water bodies. This study focused on quantifying the changes in nutrient concentration (total carbon (C) and nitrogen (N), mineral N, organic carbon, water-soluble phosphorous (WSP), total phosphorus (TP), total potassium (TK), pH, and ash content) from the BL during a 12-month period under three different storage conditions. Broiler litter heaps of 3.5 feet in height were created and replicated three times at the E.V Smith research station in Shorter, Alabama. The treatments were a) uncovered stockpile, b) covered stockpile (covered with tarpaulin), and c) stockpile covered with a layer of soil. Nutrient concentrations were tracked on a monthly basis by using a multipoint sampling technique where homogenous BL samples were collected from the pile and thoroughly mixed to represent the entire pile. We hypothesize that the type of storage method will alter the nutrient concentration of BL. Preliminary results suggest that there is a temporal trend in changes in nutrient concentrations with BL stored under tarp effectively retaining higher concentrations of nutrients compared to uncovered and soil-covered treatments. Total C and TN showed a decreasing trend among all the treatments with storage time. Water soluble P decreased in greater proportion in uncovered and soil covered treatments indicating losses due to leaching and runoff, compared to tarp covered treatment. Nitrate concentration in all the treatments increased with a greater increase in tarp treatment indicating mineralization of organic N. Covering BL with tarp can be adopted as a best management practice to reduce nutrient losses and minimize environmental concerns due to BL storage in open fields.

Abstract #: 116

Title: **An improved operational HAND FIM framework for Ungauged regions across Contiguous United States**

Presenter: Anupal Baruah

Organization: The University of Alabama

Session: Poster Session

The increasing threats of global flood risk require rapid and accurate high-resolution flood modelling strategies on a large scale. National Oceanic and Atmospheric Administration-Office of Water Prediction's (NOAA-OWP) Height above the nearest Drainage (HAND)-Flood Inundation Mapping (FIM) is a low fidelity approach. It utilizes the 3DEP 10m elevation product together with the National Water Model retrospective streamflow data to generate fluvial flood maps at HUC-8 scale across the contiguous United States. The current HAND FIM4.4 framework employs the NHD_Plus V2.1 Medium resolution (MR) reach-averaged channel hydrofabrics. It works in conjunction with Manning's equation to produce binary inundation raster achieved by converting streamflow into stage values (in meters) through synthetic rating curves (SRC). However, the uncertainty in Manning's roughness coefficient brings a valid equation about the accuracy of the SRCs while generating the inundation maps on a large scale. Presently, the established methodology includes the derivation of adjustment factors using the gauged USGS rating curve and spatial inundation maps at the Advanced Hydrological Prediction sites (AHPS) to calibrate the SRCs. However, due to a lack of observational stage-discharge data and surface roughness information, it is quite difficult to extend the present framework in ungauged regions .In this work, we have compared three machine learning (ML) regression models including a random forest regression, extreme Gradient boosting and an ensemble model to predict the SRC adjustment factors for ~2.7 million stream networks of NHD_plus. The results indicate that out of the different ML models, we found that ensemble model is the best predictor, with an R2 of 0.87. The adjusted SRCs are then utilized to generate the flood maps for Hurricane Mathew in October, 2016 in the Neuse River, North Carolina and synthetic flood events at 100 and 500 year return period flow for two HUC8s. The performance of the predicted flood maps before and after the SRC adjustments is evaluated with the remotely sensed maps and FEMA -base level engineering (BLE) flood maps available. Out of different indicators, we found that SRC adjustments improve the critical success index (CSI) and probability of detection (POD), F1 score and Mathews correlation coefficient (MCC) but we also found an increase in the false alarm rate (FAR). On the other hand, we found a sufficient improvement in POD while evaluating the model with the FEMA BLE maps in urban areas for synthetic flood events.

Abstract #: 117

Title: **PFAS Sample Cross-contamination Caused by Sampling?**

Presenter: Lindsay Boone

Organization: Pace Labs

Session: Emerging Contaminants

PFAS are prevalent in numerous items used when taking samples for laboratory testing. This, coupled with the fact that laboratories calibrate instruments to detect PFAS in the single digit ppt range, has led to a great deal of concern about the potential for cross-contamination of samples caused by sampling. Numerous PFAS sampling SOPs call for significant measures not required when sampling for other contaminants, as well as more field QC samples. Is all this concern warranted? During this presentation attendees will learn about the incidence of cross-contamination that occurred in 2023 over a six-month period in water samples taken from around the country. The data set is comprised of over 14,000 drinking water analytical results. Practices taken to mitigate cross-contamination will also be discussed.

Abstract #: 118 **Student**

Title: **Determining habitat requirements for restoration of the threatened spider shoal lily (Hymenocallis coronaria)**

Presenter: Sarah Tash

Organization: Auburn University

Session: Lightning Talk - Research 2

Many emergent macrophytes in river systems occupy a narrow habitat for optimal survival. Each plant adapts to a unique set of conditions that dictates its ecological niche. Spider shoal lilies (Hymenocallis coronaria) is an emergent macrophyte found in fragmented and limited populations with populations in rivers located along the Fall Line of the southern states of Alabama, Georgia, and South Carolina. In these states, the geomorphology of riverbeds provides a shallow and swift-flowing environment. However, anthropogenic alterations along river waterways have fundamentally altered the seasonal flow and variability, which has impacted H. coronaria populations in its already decreasing numbers. To better understand the habitat requirements of this species, elevation and relative water surface levels of the H. coronaria populations in the Flint River were measured in 2023. These measures were used to establish baseline data and detect a possible correlation between water levels and plant presence. We found a significant correlation between relative water depth of the river and the presence and absence of H. coronaria. As relative depth increased the probability of the presence of H. coronaria decreased which demonstrated a link between water surface level and emergent macrophyte presence. Determining the characteristics of river geomorphology, discharge, and prevalent water surface levels will aid in the assessment and study of future populations of this endangered plant while also guiding restoration efforts. Further, this information will be used to evaluate other populations through several upcoming collaborative restoration projects across Alabama, Georgia and South Carolina.

Abstract #: 119 **Student**

Title: **The chemical and microbial impacts of well water quality in response to flooding and purging following a major hurricane**

Presenter: Alisha Webb

Organization: The University of Alabama

Session: Poster Session

Floods present major public health risks to drinking water resources and private drinking water systems are most vulnerable to the impacts of flooding, but there is a lack of understanding of the physical, chemical, and biological mechanisms that cause contamination when a well is flooded. Therefore, this study aims to characterize well water quality following a major flood event and subsequent purging of the wells. The objectives of this study are to examine the relationship between flood status and (1) culturable bacterial count, (2) relative abundance of dominant phyla, and (3) inorganic concentrations, as a function of purge volume, depth and geology. We sampled 8 monitoring wells affected by Hurricane Matthew in Chesapeake, VA in 2016, where some areas experienced greater than 1 meter of precipitation over the course of 2 days. Wells were screened in three aquifers: the local surficial aquifer, Yorktown-Eastover Aquifer, and Potomac Aquifer, with maximum depths of ~ 7, 33, and 558 meters, respectively. Four wells were inundated with flood water, and five wells were purged. Water quality sampling occurred in two phases: stagnant column samples were taken at specified depths, and purging samples were taken in increments of 0.25 or 0.5 well casing volumes discharged. Culturable bacteria were quantified using BART tests (acid producing bacteria, sulfate reducing bacteria, and iron reducing bacteria), and the IDEXX Colilert 2000 method (total coliform). Dominant phyla were profiled using 16S rRNA gene amplicon sequencing and inorganics were measured using the IC and the ICP-MS methods. Flooded wells display lower maximum bacterial colony forming units of sulfate reducing bacteria (flooded: 1,000; non-flooded: 10,000), and greater counts of acid producing bacteria (flooded: 100,000; non-flooded: 10,000) and total coliforms (flooded: 100; non-flooded: 10) than non-flooded wells. Purging yielded overall decrease in sulfate reducing bacteria and total coliforms, and opposing trends from the acid producing bacteria. Shallow wells show a greater abundance of Nitrospirae (35%) and Acidobacteria (20%), while the deeper wells contain a notable abundance of Firmicutes (60%). Spirochaetes abundances were the best fit phyla to indicate flood status. Purging reduced Spirochaetes in only one well (P3), and all deep wells had less Firmicutes after purging 1 casing volume. NMDS ordination reveals microbial community structure at the genus level show significant correlations with ionic composition (p < 0.001, r2 > 0.3) and ANOSIM results indicate that microbial community is significantly influenced by aquifer type (R = 0.5186, p = 0.001) and flooding status (R = 0.2512, p = 0.002). This research highlights the complex, dynamic nature of chemical and microbial water quality in private water management systems, as well as the potential complications in analysis and remediation due to variation in depth and geology.

Abstract #: 120 **Student**

Title: **Machine Learning for Salinity Prediction in a Deltaic Ecosystem: A Case Study of the Mobile-Tensaw Delta**

Presenter: Thomas Kavoo

Organization: Auburn University

Session: Coastal Issues 1

Tidal freshwater forested wetland ecosystems are transitional ecosystems located along the upper tidal zone of estuarine landscapes. They commonly occur in river deltas that have low salinity levels (usually < 0.5 ppt) but are occasionally exposed to high salinity levels. To evaluate risks from sea level rise and forecast the future health of these ecosystems, we need to understand the hydrology and salinity regime. Field measurements and other monitoring data were used to analyze the hydrology and salinity of the lower Mobile Tensaw Delta in Alabama, USA. Nine gaging stations were installed at approximately equal intervals along a tidal gradient to monitor and capture salinity and water levels at the river-forest interface. These datasets were used to develop a long-term salinity record (2000 – 2023) for each monitoring station based on deep neural networks model. Key inputs to the model include river discharge, windspeed and direction, bay salinity, and Bay water levels among others. Based on the long-term salinity models, mean daily salinity ranged from 0.97 ppt to 1.31 ppt for stations closest to the Bay and away from the two river (Mobile and Tensaw) channels and from 0.25 ppt to 0.70 ppt for stations further upriver and closer to the two river channels. The salinity prediction models demonstrated robust performance across all monitoring stations. The absolute bias is generally less than 5% and root mean squared error about 0.07 ppt. The Nash–Sutcliffe efficiency and correlation coefficients values are close to 1. Stations further from the two river channels exhibited significant salinity variability and dispersion (range > 10 ppt). On the other hand, stations closer to the two main river channels and further from the bay displayed less dispersion and lower salinity concentrations (range < 6 ppt). In these locations, freshwater input tends to suppress salinity levels. However, saline water from the bay and greater tidal connectivity increases salinity at sites further from the river channels and closer to the bay. Within the delta, stations upriver and closer to the two river channels are less likely to exceed 2 ppt (less than 10% exceedance probability) while stations downriver and further from the two river channels show a 20% probability to exceed the 2 ppt salinity threshold. However, there is less than 10% chance that the salinity levels within the study area will exceed the 5 ppt threshold. This study demonstrates the feasibility of deep learning models to provide long-term and real-time estimates of salinity within a deltaic ecosystem which provides an opportunity to assess climate change impacts, including river flow and sea level rises, on these environments to inform management, restoration, and monitoring efforts.

Abstract #: 121 **Student**

Title: **Investigating in Water Biochemistry and Microbial Diversity by Molecular Sequencing and LC/MS at different locations of Alabama River in Warm Weather**

Presenter: Jannatul Ferdous Jhumur

Organization: ALABAMA STATE UNIVERSITY

Session: Poster Session

Biological ecosystems play an important role in providing water and food to society, in addition to supporting a highly diverse aquatic life. River ecosystems are subjected to several anthropogenic activities particularly during summer times because of increased human activities, such as boating, rafting, nutrient and agro-chemical inputs. These activities may alter water chemistry and river microbial communities. So we hypothesize that the composition of microbial communities and water chemistry are correlated with each other in the summer season. So our main goal is to investigate the relationship between (i) microbial communities and chemical compounds in the summer season. To perform this research, we have sampled the Alabama River from Montgomery at different locations. Then, we filtered the water samples using the filter machine (AIR CADET, Model: 420-190100FK) equipped with Whattman Nylon membrane filters (0.2µm Diameter). After filtration, we kept this filter paper in the -20oC freezer until DNA extraction. Meanwhile, the filtered water was used for analyzing chemical properties and metabolome. To extract microbial DNA from the filter, we used the Qiagen (DNeasy Power water kit) Kit. We are amplifying the bacterial 16S rRNA genes (V3–V4 regions) using standard primers at the sequencing facility. The amplification and sequencing of 16S rRNA genes will be done at the University of Minnesota Genomic Center. We will analyze the sequenced data using the standard ecological pipeline named “Quantitative Insights into Microbial Ecology 2”. Then, we will perform quantitative analysis (LC-MS) to determine chemical compounds (pharmaceutical and pesticide) in the water. Our metabolome analysis has described the presence of several contaminants in the water belonging to pharmaceutical and pesticide compounds. Our data suggest that human activities are negatively impacting river water, and the presence of these compounds will show dramatic associations with the aquatic microbial communities. Keywords: River ecosystem, river metabolome, river water chemistry, microbial communities, microbial networks, environmental pollution

Abstract #: 122

Title: **The Beginnings of a Unified Alabama Mesonet**

Presenter: Michael Solomon

Organization: The University of Alabama in Huntsville

Session: Poster Session

Many branches of environmental science rely on the ability to access, visualize, and apply data from various observation platforms. In Alabama, there is a need for a coordinated, representative network of weather and soil moisture observations across the state for consistent and improved monitoring, analysis, and prediction. Though several observational networks or mesonets exist across the state, access is independent, each with its own data service, formats, and accessibility. However, combining these networks provides a robust coverage across the state and enables new dataflows for decision-making. Our goal is to develop a “network of networks” with sensors and observations that, for the most part, already exist and combining them into a Unified Alabama Mesonet. The desired outcome is to provide robust hydrometeorological coverage over the state of Alabama in a single database. We aim to accomplish this by relying on the instrument networks already in place such as: the South Alabama Mesonet (USA), Auburn Mesonet (AU), and the AL-USRCRN (State Climate). In addition, two Federally maintained networks, the NOAA USCRN and USDA SCAN will provide 21 additional observation points within the state. We also have a network of Low-Cost soil moisture sensors deployed across the state to supplement the previously mentioned networks. Combined (96+ total stations), the unified mesonet will provide robust coverage over the state in a single database with a user-friendly online dashboard. Testing of various methods of data handling will be evaluated, including using a customized online interface and application programmatic interfaces (API). All resulting databases and access platforms will be open source, hosted, and maintained at the State Climate Office (SCO). The data will also be submitted to a limited Quality Control (QC) process that will flag possible erroneous values for further analysis. This project also intends to investigate techniques to display the data in a cohesive manner that will enable data viewing, such as customized base data layers, time series, and spatial statistics over areas of interest (i.e., analysis-ready data). The database and visual products will aid organizations responsible for making decisions regarding fire risk, controlled burns, flood concerns, drought, and more. Here we present the beginnings of the Unified Alabama Mesonet and welcome feedback and input from the research and decision-making communities across Alabama.

Abstract #: 123

Title: **2D Base Level Engineering Pilot Study: Cahaba Watershed**

Presenter: Jeff Zanotti

Organization: WSP Environment & Infrastructure Inc.

Session: Modeling & Water Mgmt. 2

Alabama's riverine models for FEMA's floodplain mapping programs, Risk MAP and Base Level Engineering (BLE) initiative, are almost exclusively performed as 1D models currently. These 1D models flow along a channel in one direction for easy-to-follow reaches, but the new push from FEMA is to start going towards a 2D model which instead handles water flowing over an entire area while incorporating flow in multiple directions. The new philosophy is backed by the knowledge that water does flow from all directions (not just one) in a flood event, and it would be best to consider this to get the most accurate floodplains. The Cahaba Watershed has been chosen as pilot study to attempt this approach at such a scope for BLE studies going forward. This presentation will highlight the benefits and challenges that occur with this change from 1D to 2D as well as give specific examples of how this type of modeling changes how a typical floodplain will look in the future. The goals of this study are also clearly laid out with considerations to hydrology and hydraulics. The concept of potential issues with outreach for the affected communities is also addressed.

Abstract #: 124

Title: **Prioritizing Decisions for Water Resource Management using High Definition Stream Survey (HDSS): Hurricane Creek, Alabama.**

Presenter: Brett Connell

Organization: Trutta Environmental Solutions

Session: Water Monitoring

In collaboration with Cawaco RC&D and the Geologic Society of Alabama (GSA), the Hurricane Creek High Definition Stream Survey (HDSS) is being used to address the complex water quality challenges facing the entire watershed. The Abandoned Mine Land Economic Reclamation (AMLER) Program uses fees paid by present-day coal mining companies to reclaim coal mines abandoned before 1977. Located in central Alabama, Hurricane Creek has a long history of coal mining and many ongoing water quality issues due to the historical mining operations. In an effort to prioritize which individual streams in the Hurricane Creek Watershed are in greatest need of reclamation, a HDSS will provide a continuous meter resolution data set that can be used for multiple water resource issues. This presentation will provide a summary of HDSS along with highlights from completed field work and assessment. The 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 water quality sensors, water resource managers now have a continuous baseline condition inventory that reaches as far upstream and downstream from a project as needed. With each second of video linked to a specific GPS point, you are now able to identify, select, and prioritize areas of the river for multiple different water resource issues. The results can be used to determine the most economical location and methods for mitigation, 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.

Abstract #: 125

Title: **Irrigation in Alabama: A 20-Year Look**

Presenter: Krel Haynes

Organization: The University of Alabama in Huntsville

Session: Poster Session

As interest in irrigation grows and coverage is expanded, detailed information about these systems and their locations is critical. Official USDA irrigation reports are often only reported at the County or State level. The Center Pivot Survey is a project to address this lack of specific irrigation data in the state. Spatial crop models designed to estimate irrigation demand and pass this to water availability studies require such specific data. The Center Pivot Survey uses the National Agricultural Imagery Program (NAIP) data to manually identify (visual interpretation) those areas in Alabama that have been added to the state's irrigated acreage each year the data is available (every two years since 2006) . The visual interpretation process involves a human analyst inspecting an aerial photograph or digital image for irrigated areas and then manually digitizing polygons around those sites. This method is more accurate than digital classification for densely vegetated landscapes but requires more time and labor. While center pivot systems are not the only irrigation method, it is the most common when working with commodity row crops such as corn, cotton and soybeans. As irrigation coverage expands, it is also important to detail which crops it is being used on. This data would allow for better estimates to be made for crop yield models, and to the effects irrigation has on which crops are being farmed. This study will look at the expansion of irrigation in Alabama and the changes in the irrigated crops over a ~20 year period from 2006 to 2023.

Abstract #: 126

Title: **Assessing Aquatic Ecosystem Risks: Investigating Spatiotemporal Dynamics of Climatic Variables on Microbial Fecal Bacteria and Sources Using Novel RatMt Marker**

Presenter: Ronell Bridgemohan

Organization: BRIDGEMOHAN PROPERTY MANAGEMENT LLC

Session: Lightning Talk - Research 1

As anthropogenic pressures and climatic variability intensify, understanding their impact on water quality in subtropical, mixed-use coastal catchments becomes crucial. This study thoroughly examines the Pensacola Bay System, serving as a model for such ecosystems. In 2022, 600 water samples from 50 geographically diverse aquatic sites were collected. Cutting-edge analytical techniques were employed, including IDEXX Colilert-18 and Enterolert-18 assays for enumerating Fecal Indicator Bacteria (FIB), ion chromatography for nutrient profiling, and quantitative Polymerase Chain Reaction (qPCR) for Microbial Source Tracking (MST).Complex interactions between microbial burdens, physicochemical variables, and anthropogenic influences were elucidated using statistical analyses such as correlation analysis, multiple linear regression, and general linear modeling. FIB concentrations showed significant correlations with spatio-temporal parameters, including precipitation, temperature, and turbidity. The HF183 Bacteroides marker confirmed substantial human effluent contamination at 37.12 percent of the sites. Minimal traces of ruminant and avian excrement were found, while canine feces contamination was prevalent in 15 locations.Additionally, the LipL32 gene was used as a qPCR marker to detect Leptospira interrogans, found in 12 high-FIB sites across various land covers and aquatic ecosystems. A novel mitochondrial marker identified rodent feces contamination in 46 sites, particularly in recreational areas. Statistical models were developed to correlate land-use patterns with water quality, providing invaluable insights for data-driven land-use and watershed management policies.This study underscores the critical importance of robust surveillance mechanisms, the synergistic use of multiple fecal indicator bacteria, and the utility of qPCR for precise source tracing. The findings offer stakeholders a comprehensive understanding of the dynamic variables influencing water quality and public health in subtropical mixed-use catchments. The research provides essential data to inform land-use and watershed management policies, emphasizing the need for ongoing monitoring and the integration of advanced analytical techniques in environmental assessments.

Abstract #: 127

Title: **Calibrated WRF-Hydro implementation for Irrigation Potential in Alabama**

Presenter: Vikalp Mishra

Organization: The University of Alabama in Huntsville

Session: Agriculture & Irrigation

Accurate accounting of water resources is essential to sustainably expand irrigation water use across Alabama. Despite relatively consistent annual precipitation (4-5 in/month), streamflow in Alabama follows a distinct seasonal pattern with fall flows often reaching critical levels, at less than 1/3 of their annual mean flows. This is due to the voraciously consumptive vegetation and the generally poor water-holding soils. These low flow conditions can occur when irrigation water is most in demand. Streamflow conditions can represent compounded impacts of multiple hydrological processes, land use, climate etc. However, streamflow monitoring gages are sparse and may fail to represent a distant un-gauged stream. Therefore, a robust water resource assessment solely based on gages can be challenging in Alabama. The aim of this project is to setup a regionally calibrated instance of the WRF-Hydro model for water availability assessments. The WRF-Hydro is one of the most widely used modeling system that allows a full coupling of a numerical weather model with distributed land surface and hydrological routing model to simulate streamflow conditions in addition to other land and hydrological components. The model is updated to include several new features to better represent regional hydrological dynamics by implementing a rule-curve based reservoir routing module for managed streams. Furthermore, to account for anthropogenic consumptive water use, the HUC-12 level dynamic water withdrawals were also implemented into the model. The model is calibrated specifically for low flows using a Dynamically Dimensioned Search (DDS) algorithm. Several physical parameters from the land surface and hydrologic routing models are calibrated to optimally match with the USGS stream gage observations. The streamflow estimates from the WRF-Hydro are used to determine sustainable irrigation water use potential at the HUC-12 level using the Irrigation Potential Analysis (IPA). This presentation will provide an overview of the modeling set-up and demonstrate the combined application of the WRF-Hydro and the IPA to plan for sustainable irrigation expansion in the state.

Abstract #: 128

Title: **Novel Time-Integrated Quantification of Sediment-Associated Fecal Indicator Bacteria in Rural Alabama Creek with Straight Pipes**

Presenter: Emily Elliott

Organization: The University of Alabama

Session: Water Quality 3

In the Alabama Black Belt, widespread rural poverty, limited access to sewer, and shrink-swell clays preclude the use of conventional septic systems, leading to both failing septic systems and the discharge of raw sewage from homes through “straight pipes.” The degree to which fecal microbes are associated with the suspended sediment load has important implications for contamination transport. Current state guidelines require periodic grab sampling to monitor for surface water fecal contamination. While technically simple, grab samples alone are inadequate to monitor enteric pathogens in a body of water due to the highly variable nature of microbes in surface water. We present the novel use of the bi-directional time-integrated sediment mass samplers (TIMS) as an accurate and efficient technology for capturing and monitoring fecal indicator organisms and the suspended sediment load. Made of PVC, the TIMS devices are low-cost, easy to use, and much more effective than grab sampling, especially during periods of high precipitation. While these devices have been utilized for sediment capture in both fluvial and estuarine settings, this is the first use of the bi-directional TIMS to characterize fecal microbes, associated with sediment and in the water column. Applied in three locations, one adjacent and one downstream of known straight pipe use and a control site upstream, the TIMS devices captured significantly more E. coli as compared to grab sampling. This effect was greater following initial flush precipitation events, which involve heavy rain after a dry period. In the water column, TIMS samples were able to capture the initial flush, yielding an average of 111 times (>2-log10) more E. coli than grab sampling. Additionally, the attachment of fecal indicator bacteria to sediment was evaluated using a novel, simple two-step centrifugation-based isolation method. Results show that the simplified isolation method was most effective at an incubation temperature of 35 °C, which yielded an average of 38.7% sediment-associated E. coli across the sampling sites.The results of this study indicate the most critical time to sample surface water for fecal contamination is during initial flush events, which paves the way for improved surface water monitoring guidelines and better risk management. These novel methods have proven effective in allowing us to monitor the quality of in-situ derived surface water samples over time, providing a deeper understanding of sediment-microbial association and the role that precipitation and fine-grained particles have on the fate and transport of fecal pathogens. We are donating TIMS devices and working with partners to facilitate implementation of affordable, time-integrated surface water sampling in other Alabama watersheds.

Abstract #: 129 **Student**

Title: **Drought Impacts on Cogongrass Spread in Alabama**

Presenter: Rebecca De Fazio

Organization: The University of Alabama in Huntsville

Session: Lightning Talk - Research 2

The rapid spread of Cogongrass (Imperata cylindrica) throughout the southern United States has resulted in a surge of wildfires and negative environmental impacts. This study focuses on the proliferation of Cogongrass in Alabama, investigating the ecological and environmental factors that are influencing its expansion across the state. Key variables being analyzed include critical drought periods, precipitation and temperature changes, soil conditions and profiles, and wildfire occurrences. The methodology involves identifying optimal fertility conditions and soil profiles for areas that are or may experience high Cogongrass presence, assessing fire risk based on climate factors such as historical and projected precipitation, temperature, and drought patterns, and tracing species trajectory patterns under minimal mitigation efforts. A trajectory model is developed to predict seed dispersal patterns through the implementation of hydrological variables (streams and rivers), human activity (roads and pathways), and other primary methods of transport. Advanced technologies and software such as Python, ArcGIS Pro, satellite imagery, and official state databases are utilized to perform and support the analysis. This research aims to provide a comprehensive understanding of Cogongrass distribution in order to develop informed management strategies and efficiently mitigate its spread in Alabama. The methodological framework and preliminary results of this study will be presented.

Abstract #: 130

Title: **What is a flood: Quantitatively defining discrete flood events in forested wetlands**

Presenter: Elaine Rice

Organization: The University of Alabama

Session: Poster Session

Wetlands play an important role in biogeochemical processing in forested watersheds. During discrete flood events, Wetlands act as biogeochemical control points and alter the downstream delivery of dissolved organic matter and other nutrients. Therefore, characterizing the properties and frequency of flood events is an important step in understanding biogeochemical processes in forested watersheds. However, characterizing discrete flood events in forested wetlands is difficult due to the hydrologic complexity and heterogeneity of these systems. In this study we aim to quantitatively define flood events within our study wetlands based on the duration, magnitude, timing, and rate of change of inundation events. We conducted the study at the J. Nicolene Tanglewood Biological station located in western Alabama's Coastal Plain physiographic region. Across the site, we identified nine wetlands that varied from hillslope-connected to floodplain-connected wetlands. We quantify inundation regimes using continuous wetland and upland water level. Observations show that rate-of-change of inundation is greatest in hillslope-connected wetlands whereas the magnitude and duration of inundation during flood events is greatest in floodplain-connected wetlands. Our initial results highlight that variation in the inundation regime drives differences in anoxia, organic matter delivery, and nitrogen processing pathways indicating that our wetlands act as "activated" control points; and that as wetlands transition from hillslope to floodplain connected wetlands, they transition from export to retention dominated systems. Furthermore, because flood events are not uniform, they may require distinct definitions to address variation in the mode of inundation in wetlands with different connectivity. Continued analysis will inform efforts to understand relationships between hydrologic connectivity, and biogeochemical cycling and export at wetland and watershed scales.

Abstract #: 131 **Student**

Title: **Onsite Wastewater Treatment System Inventory: A Step Towards a National Database**

Presenter: Mallory Jordan

Organization: Auburn University

Session: Poster Session

Recently, onsite wastewater treatment systems (OWTSs) have gained attention as a potential nonpoint source of water pollution, and an increase in resources has been directed to evaluating and improving OWTSs at federal, state, and local scales. However, there are minimal publicly available OWTS spatial data which limits the ability to evaluate these systems. If data are available, locating and acquiring OWTS data can be an arduous task as data are maintained by disparate entities. We lack a consolidated national inventory of OWTS data at the state and local scales. Thus, here we created an inventory of OWTS data to inform the development of a national OWTS data repository. For this inventory, we identified (1) where OWTS data are available and (2) the attributes of available data. The search for OWTS data was an iterative process conducted at the state and local scale–if a statewide database did not exist. OWTS data were evaluated based on several categories including permitting agency information, data availability, and data characteristics and format. We found that 38% (19/50) of states published statewide OWTS permit data, and data varied from webmaps with land parcel scale (i.e., address) locations of systems to tables with county scale estimates of the number of systems. Of the states with available data, 32% (6/19) have publicly available land parcel scale spatial data. This inventory will aid in identifying data gaps and provide a centralized resource to acquire currently available OWTS data. Ultimately, OWTS data are imperative for effective water management in terms of knowing the location of these potential pollution sources and evaluating their relationship to environmental conditions.

Abstract #: 132 **Student**

Title: **Stakeholder responses to the 2023 marine heat wave in Florida Keys National Marine Sanctuary: implications for coral conservation and crisis management**

Presenter: Gretchen Luchauer

Organization: Auburn University

Session: Water Security & Risk

Florida Keys National Marine Sanctuary (FKNMS) experienced its most severe marine heat wave in 2023. Excessive temperatures lasting from June 2023 to October 2023 resulted in the first-ever mass evacuation of corals to inshore labs and deeper nursery sites in FKNMS. Many evacuated corals are outplanted coral for the Mission Iconic Reef project, which plans to restore FKNMS coral reefs after decades of reef losses. When responding to the 2023 FKNMS marine heat wave, managers and organizations had to collaborate and adapt schedules to rescue corals and monitor the heat wave. However, few studies can capture stakeholder emergency responses during events. In this study, we show FKNMS stakeholder responses to the 2023 marine heat wave during the heat wave from August 2023 to October 2023. We interviewed 31 FKNMS stakeholders who work in management and conservation. Findings show that FKNMS responded rapidly to the 2023 marine heat wave, with many groups shifting schedules to reduce coral losses. Most conservation groups were experiencing negative impacts from the marine heat wave, with corals and fish dying, increased human-wildlife conflict among sea turtles, and decreased body mass in birds and dolphins. Climate grief was a universal experience, but stakeholder responses varied based on their job position and location in FKNMS. Responses show the tolls of responding to long-term emergency events on managers. Most respondents worked more, felt an increasing sense of loss and mourning of FKNMS coral reefs, and experienced a loss of co-workers and volunteers who could no longer work in FKNMS management and conservation. Understanding management responses to ongoing emergency events will become increasingly important as more managers and organizations experience climate change crises. Building personal resilience in staff and volunteers will become critical to maintaining management and conservation efforts in climate-vulnerable ecosystems.

Abstract #: 133

Title: **Retrofitting Stormwater Infrastructure on a Small Commercial Site in Urban Birmingham: A Case Study.**

Presenter: Ben Wegleitner

Organization: The Nature Conservancy

Session: Stormwater 2

Stormwater retrofitting where infrastructure is either undersized or nonexistent is essential to reducing pollutant loading, flooding, erosion issues in urban watersheds. However, urban sites pose several challenges to retrofitting, including availability of space, soil conditions, and zoning or regulatory constraints. The Nature Conservancy's redevelopment of a historic building in downtown Birmingham provides a case study of the challenges, results, and additional opportunities that come from an urban stormwater retrofit. Reduced imperviousness of the site, rainwater harvesting, and bioretention were effective in reducing runoff volumes and pollutant loading from the 1-acre commercial property. Using nature-based and structural and non-structural stormwater controls, The Nature Conservancy's redevelopment project provides a roadmap to other retrofits to improve water quality in the Village Creek watershed.

Abstract #: 134 **Student**

Title: **Investigating Hydrological Connectivity as a Framework to Characterize Small Wetland Inundation Regimes and Their Impacts on Downstream Waters**

Presenter: Jasmine Morejon

Organization: The University of Alabama

Session: Poster Session

Wetlands provide important physical, biological, and chemical functions to downstream waters, such as enhancing watershed nitrate removal due to fluctuating inundation. Hydrological connectivity, the water mediated transfer of materials, energy, and organisms, can be used as a framework to evaluate wetland inundation regimes and their impact on downstream waters. Intergrading continuous water level data with nutrient measurements can allow us to quantify and characterize small wetland functions during episodic storm events. In this study, we investigate small headwater wetlands across a gradient of hydrological connectivity (i.e., hillslope-, riparian-, or floodplain- connected wetland) and explore wetland inundation dynamics. This research is conducted at the J. Nicolene Tanglewood Biological Station, a forested watershed located in West Central Alabama. Tanglewood is a representative of the Upper Coastal Plain environments across the southeastern United States and contains floodplain connected wetlands (surface water connected wetlands), hillslope connected wetlands (groundwater connected wetlands), and riparian/intermediate wetlands. We monitored nine of the wetlands based on their connectivity class, where we installed monitoring piezometers at each wetland and its nearby upland. HOBO pressure transducers were installed in each piezometer to record water levels to observe the inundation regimes during each storm event. At a wetland scale, we will be tackling how wetland type impacts inundation dynamics by quantifying hysteresis between wetland and upland water levels during each storm event. Our results show that at an event scale the floodplain connected wetlands' upland and wetland water levels displayed a positive counterclockwise-clockwise (figure eight) hysteresis (surface water forcing). In contrast, our hillslope connected wetlands' upland and wetland water levels displayed a positive counterclockwise hysteresis (groundwater forcing hysteresis). These results show the initial water level response time to storm events, which influences the hydrological connectivity of wetlands, varies with each wetland type.

Abstract #: 135 **Student**

Title: **Hydrologic Regime Impacts to Nitrogen Removal and Retention in Forested Wetlands**

Presenter: Lidia Molina Serpas

Organization: The University of Alabama

Session: Water Quality 2

Wetlands have a critical role in reactive nitrogen (N) transport within watersheds which affects watershed export. Denitrification and dissimilatory nitrate reduction to ammonium (DNRA) are two key pathways that influence reactive N export. Wetland biogeochemical functions are influenced by wetland hydrologic regimes, which are characterized by the timing, duration, and magnitude of surface water flow. However, land use and climate change are altering wetland hydrologic regimes, and it is unclear how shifts in soil wetting and drying patterns will impact N wetland transformations, and ultimately, watershed N export. In this study, we evaluated hydrologic regime impacts on competing microbial dissimilatory nitrate reduction pathways that result in the permanent removal (denitrification) or temporary retention (DNRA) of N. We quantified hydrologic regime (i.e., water level) and nitrate reduction potential rates across 9 forested wetlands along gradients of groundwater dominated to surface water dominated wetlands (i.e., hillslope, riparian, floodplain). To evaluate impacts to potential denitrification and DNRA processes, we used the isotope pairing technique on sediment slurries to measure rates bimonthly for one year (i.e., 6 times). We measured surface water nitrate and ammonium concentrations, soil organic carbon, total carbon, and total N content to determine environmental drivers of variation in nitrate reduction potential rates. Our initial results indicate that seasonal changes in nitrate reduction potential differed between wetland types. During the dry season, floodplain wetlands had higher potential denitrification and DNRA rates compared to hillslope and riparian-connected wetland types. During the wet season, floodplain wetlands had the lowest potential denitrification rates and highest DNRA rates when compared to the other wetlands. The highest nitrate reduction rates coincided with higher dissolved inorganic N availability and organic matter content, suggesting that hydrologic regimes indirectly affect nitrate reduction rate by regulating substrate availability.

Abstract #: 136

Title: **Turning the Corner: Improving the Resiliency of the Jackson, MS Water System**

Presenter: Mia Welch

Organization: Jacobs

Session: Water Security & Risk

In late August 2022, extreme rainfall and flooding upstream of the Ross Barnett Reservoir caused high turbidity spikes in the raw water supplied to the O.B. Curtis WTP that could not be adequately addressed with the condition of chemical feed systems and removal capabilities of unit processes (e.g., coagulation, flocculation, sedimentation) at that time. As a result, the treatment process experienced complete failure and the City was without safe drinking water for almost two weeks. President Joe Biden issued a 90-day emergency disaster declaration and both State and Federal response was initiated to address the failures at the O.B. Curtis WTP and stabilize the system.Following the emergency declaration in December 2022, the Department of Justice (DOJ) issued a Stipulated Order, negotiated between the City and the U.S. Environmental Protection Agency (EPA), that placed the operation, maintenance, management, and control of the City of Jackson's water assets under an interim third-party manager (ITPM), who then established a Mississippi corporation (JXN Water) to conduct the business of the ITPM. The Stipulated Order contained 13 Priority Projects that the EPA identified as critical efforts to be undertaken by the ITPM to restore successful operation of the Jackson water system. These projects extended beyond addressing just the O.B. Curtis WTP and included elements to improve the J.H. Fewell WTP, wells, tanks, booster stations, and distribution system.

At the direction of the ITPM, Jacobs was engaged to provide operations and maintenance services as well as consulting and construction management services to facilitate recovery of the treatment plants and associated systems. Multiple assessment efforts to determine the required improvements for restoring functionality and providing resiliency to the system were undertaken, which included not just capital efforts, but also efforts to address the human resources required to sustain a resilient system. The Jackson water system has now turned a corner, and while recovery is ongoing, the consistency of water service and quality of the water received by customers is greatly improved. This presentation will outline the streamlined and rapid deployment of the systems and processes required to assess the facility asset condition, risk, and capacity as well as the enhancements to plant management approaches and operational processes. Crucial issues relevant to water infrastructure management today will be discussed, with the intent of providing a deeper understanding of the complexities of water infrastructure management, as well as practical tools and strategies to address the challenges of an ever-changing world.

Abstract #: 137

Title: **Process-based Modeling of Stream Corridor Hydrologic Fluxes to Investigate the Impacts of Hydrogeomorphology**

Presenter: Ashleigh Kirker

Organization: The University of Alabama

Session: Modeling & Water Mgmt. 3

Stream corridors control the movement of water and solutes to downstream water bodies, and their function is, at least in part, driven by the lateral movement of materials between riparian zones and stream channels. Because stream corridors have variable hydrogeomorphology, lateral connectivity between riparian areas, subsurface waters, and stream channels vary in space and time. To investigate the influence of hydrogeomorphology on lateral connectivity, we defined study areas in the form of hydrogeomorphic features. Hydrogeomorphic features extend for 10s or 100s of meters along the stream corridor and vary in width, bank height, and channel slope. We identified three hydrogeomorphic features across the Shambley Creek watershed in Greene County, AL: wetland-stream complexes, incised stream corridors, and intact riparian corridors, These hydrogeomorphic features (wetland, incised, and intact) have been observed in other Southeastern Coastal Plain sites. In this study, our objectives were to i) quantify the impacts of hydrogeomorphology on riparian water storage, ii) investigate the influence of incision on intermittent drying, and iii) evaluate watershed-scale patterns of flow generation in watersheds with varying hydrogeomorphology. We used long-term streamflow data from a paired watershed study to construct and validate a process-based model (Advanced Terrestrial Simulator, ATS). We subsetted the model domain into hydrogeomorphic features, which we defined as lengths of stream corridors (including the channel and its riparian zone) with a continuous morphology (wetland, incised, or intact) for at least 40 meters longitudinally, and used ATS to output hydrologic fluxes from each hydrogeomorphic feature. Headwater streams in the Southeastern Coastal Plain are frequently intermittent and increasingly dry, so we focused on simulating flows and water table depths seasonally and compared the dry season (July-September) to the wet season (February-April). We found that in the dry season, while wetland-stream complexes and developed riparian corridors tended to lose water from the surface to the subsurface, incised corridors tended to have persistent dry season flow (gaining). Although incised corridors are more likely to gain water from the subsurface, they also have an overall lower water table and more rapid streamflow recession. Streams with incised corridors are likely to export more materials downstream, as they have limited capacity for storage (low water table) and dry out infrequently (longitudinal connectivity). In contrast, intact riparian corridors or wetland stream complexes store water for longer periods, allowing for more extensive biogeochemical processing before materials are flushed downstream. Our research implies that classifying stream corridors by their hydrogeomorphology can provide insight into riparian function, water table depth, and likelihood of drying.

Abstract #: 138

Title: **FEMA Flood Risk Outreach in Alabama**

Presenter: Kelley Rich

Organization: WSP Environment & Infrastructure Inc.

Session: Extension, Outreach & Partnerships 2

As FEMA Flood Risk products become available for communities in Alabama, it is important that community members be able to utilize these products. Since these products must adhere to federal standards, guidelines, and specifications, the functionality of the GIS datasets produced as part of the FEMA Flood Risk Program is not always straightforward. Consultants, in partnership with the Alabama Department of Economic and Community Affair's Office of Water Resources (OWR), are the technical producers of these GIS datasets and are in a unique position to help communities with understanding what information is included in the Flood Risk Products and how to apply these products to each community's unique needs. Personnel from WSP partner with colleagues from various institutions across Alabama to provide end-users of FEMA Flood Risk Products with trainings and outreach activities geared towards using the digital GIS datasets produced as part of the FEMA Flood Risk program. This presentation will detail outreach activities WSP and OWR provide to Alabama communities, including GIS tools classes, FEMA Flood Risk Product trainings, guest lectures at universities in the State, and FEMA "Open House" events, highlighting the importance of our partnerships with institutions in Alabama to ensure success in communicating flood risk.

Abstract #: 139 **Student**

Title: **Analyzing Land Use Change in Coastal Alabama: A Two-Decade Perspective**

Presenter: William Rich

Organization: Auburn University

Session: Poster Session

Land use change is a dynamic process that significantly impacts both natural ecosystems and human societies. In the context of the coastal region of Alabama there must be a balance between urban development and environmental conservation, therefore understanding land use changes in this region is crucial. This research project aims to analyze land use (lu) and land cover (lc) data over a 20-year period (2001-2021) using the National Land Cover Database (NLCD) products for Mobile and Baldwin counties. By investigating key drivers, assessing ecosystem impacts, and considering socio-economic factors, we seek to inform sustainable land management practices. Coastal Alabama is characterized by diverse and delicate ecosystems including wetlands, forests, and estuaries. Each of these potentially face impacts from ongoing lu transformations. Urbanization, agricultural expansion, and other human activities intersect with natural processes which can affect both ecological health and community well-being. The project focuses on the trends and drivers of change, hotspots of lu change, and ecosystem service implications. We examined how the lu patterns have evolved over the past two decades by comparing NLCD data from 2001-2021 and identifying shifts in land cover categories. Key drivers such as population growth, infrastructure development, and land policy were explored given that it was assumed urbanization and agricultural expansion were likely contributors. Using geographic information systems (GIS), spatial patterns of lu change were analyzed to identify hotspots of change. These “hotspots” are areas of continued or intense transformation over time. Urban sprawl is often associated with areas of medium to high intensity developed land and is often threatening to the surrounding environment. Changes in lu directly impact ecosystem services provided by wetlands for instance. Increased runoff due to urbanization can lead to an increased rate of streambank erosion and threaten water quality which are detrimental to wetland and coastal habitats. By utilizing raster data files from the NLCD for the past two decades we were able to compare and determine the percent increase or decrease of lu categories over time at a fine spatial resolution. This process revealed trends in the conversions, for instance determining when forests are decreasing what are they being converted to. GIS tools were used to map areas of change and identify hotspots, for instance urban areas expanding into natural habitats are highlighted.We have determined that forested land is seeing a decline with deciduous and mixed forest categories having decreased by at least 20% in the study area. However, urban areas have grown with medium and high intensity developed lands having increased by over 40%. Understanding and monitoring lu change in coastal Alabama is extremely important as we consider future developments and the impacts they can have over time.

Abstract #: 140

Title: **The Well Aware Dashboard: Translating Research to Resources**

Presenter: Ann Ojeda

Organization: Auburn University

Session: Lightning Talk - Outreach

Groundwater is a critical water resource, particularly for private well users that rely on groundwater exclusively for household needs. Private well stewardship is an individual responsibility, meaning that well users act as their own water utility and are responsible to ensure safe and sustainable drinking water supplies for the household through appropriate management decisions like water quality testing and treatment. Because private well use is largely a “private property issue,” there can be a disconnect between issues that arise for an individual well user and larger scale issues that are shared across regions or aquifers. The goal of the Well Aware Dashboard was to develop an interactive mapping platform that combines water quality data, geographic information, and predictive models to help guide well users and resource managers in well stewardship. The Well Aware Dashboard was developed through collaborations between technical experts, community engagement professionals, and private well users. Researchers worked with private well users to test well water. In addition to communicating directly with well users about their water, the data was compiled and combined with other publicly available datasets to predict water quality at larger scales. Each dataset includes a short description of its relevance to private well users. Users can select to view and interact will datasets independently or simultaneously as a first-step in decision-making. Additionally, a series of community workshops were held to listen to private well user needs. The Well Aware Dashboard is a response to make data more accessible and transparent to all stakeholders so that users can identify areas with potential water quality problems. As a free public product, the Well Aware Dashboard can also be used to support educational programming, informing outreach and engagement efforts, and grant writing.

Abstract #: 141

Title: **Implementing National Weather Service Flood Inundation Mapping in Alabama**

Presenter: Michael Garrison

Organization: NOAA/NWS/WFO-BMX

Session: Modeling & Water Mgmt. 2

The NOAA National Weather Service (NWS) has a mission to provide weather, water and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy. Emergency management, floodplain managers, and other partners across the nation have expressed a critical need for the provision of more detailed flood forecasts and for event-driven flood inundation mapping (FIM) as a high value source of actionable information to prepare, mitigate, and respond to flood impacts. In response, the NWS National Water Center, in coordination with River Forecast Centers (RFC) and Weather Forecast Offices (WFO) and Federal and academic partners, has developed high-resolution inundation modeling capabilities providing geo-referenced visualizations of forecast flooding extent at the continental scale. This capability uses synthetic or USGS rating curves to estimate river stage from the forecast streamflow, and applies the Height Above Nearest Drainage (HAND) method to produce a map showing forecast inundation extents. The NWS FIM methods deploy a model agnostic approach to map the inundation with 10-meter horizontal resolution for rivers and streams in the National Hydrography Dataset network. The inundation extent determination uses forecast streamflow from the National Water Model (NWM) and from NWS River Forecast Centers (RFCs).Over the past year, the National Weather Service has been preparing internally and externally across the state of Alabama for the operational rollout of real-time FIM services on or around October 1, 2024. FIM services will include an hourly updated analysis FIM and 5-day forecast FIM driven by the official NWS RFC and NWM streamflow predictions. This presentation will cover these preparations, an overview of FIM and forecast techniques, and some example cases.

Abstract #: 142 **Student**

Title: **Using hydrogeomorphic features to quantify structural and functional hydrologic connectivity in a Coastal Plain headwater stream**

Presenter: Delaney Peterson

Organization: The University of Alabama

Session: Water Quality 2

Headwater streams comprise the majority of global river miles, and hydrologic processes occurring in these upstream networks affect the chemical, physical, and biological functions of downstream aquatic ecosystems. However, we still do not have a clear understanding of the dominant spatial scales that drive hydrologic processes and connectivity, particularly in Coastal Plain landscapes. We address this gap by characterizing hydrologic connectivity across scales in a small, forested watershed in the Upper Coastal Plain of Alabama. We collected data across three key spatial scales: the watershed-scale, the hydrogeomorphic feature-scale, and the hillslope scale. Within this watershed, we characterized stream network variability using seasonal stream network surveys, in addition to using a network of groundwater and surface water monitoring wells to characterize stream hydrologic state and water table variability across the calendar year of 2021. Additionally, we used an Electrical Resistivity Tomography (ERT) survey to characterize subsurface structure. Our data suggests that operationalizing the river corridor into structurally-based hydrogeomorphic features (here, incised channels, intact river corridors, and wetland stream complexes) provides a lens for understanding the dynamics of groundwater-surface water interactions within a watershed. Our results show that each hydrogeomorphic feature has a significant and consistent hydrologic state, with incised channels gaining water from the river corridor, intact riparian zones losing water to the river corridor, and wetland-stream complexes reflecting a state of near equilibrium between gain and loss. Subsurface structure observed with the ERT survey and soil characterizations indicate potentially discontinuous perched flowpaths, with perched saturation occurring heterogeneously throughout both space and time. All together, these results suggest that studying watersheds across a hierarchy of scales can provide insight into the dynamics of connectivity, and that hydrogeomorphic features can provide a key intermediate scale for the integration of streamflow generation across the river corridor.

Abstract #: 143

Title: **Low-Cost Sensor Suite for Monitoring Nitrogen Remediation in Riparian Zones**

Presenter: Robert Dean

Organization: Auburn University, ECE Dept.

Session: Extension, Outreach & Partnerships 2

Nitrogen (N) pollution, whether from nitrates or nitrites, entering watersheds is a serious problem with deleterious results such as eutrophication, cancer, birth defects, and methemoglobinemia. Agriculture is a primary source of N pollution, and in New Zealand, agriculture is the number one industry, where there are many times more sheep and cattle than people. The dairy industry in New Zealand is centered in the Waikato region. Over 90% of streams in intensively farmed catchments of the Waikato region have moderate or high levels of N. In addition, 40% of shallow ground water in the Hamilton Basin of the Waikato region is unsuitable for drinking because of high N content. High N content can be attributed to fertilizer application for pasture and crops, and to stock effluent from grazing. Riparian planting is a method often used to help limit the amount of chemicals and nutrients reaching a waterway, aiming to improve water quality. Monitoring the efficacy of this approach is paramount to its success, however currently the effectiveness of the planting is both spatially and temporally sparsely measured, if at all, as methods of assessment are expensive or time consuming. Riparian planted zones have a high level of spatial heterogeneity including variables from soil type to planting used. Variation between sparse point measurements taken at different locations can render measurements meaningless as changes caused by differences in measurement location are indistinguishable from temporal changes of interest. Long-term deployed sensors have the potential to address this challenge, but require deployed testing to validate their performance.To solve this issue, researchers from Auburn University (USA) and the University of Waikato (New Zealand) collaborated to develop a low-cost sensor suite to monitor N remediation efforts in riparian zones. The sensor suite uses low-cost printed circuit board sensor technology developed at Auburn University to realize an inexpensive (under $5 USD per unit) sensing platform that measures temperature, electrical conductivity, and moisture content of the soil. The sensor suite provides an indirect measurement of N concentration in the soil. For this application, it is assumed that the only salts entering or leaving the environment around the sensor are nitrates/nitrites. In that case, the calibrated electrical conductivity reading yields a soil ion content reading proportional to the nitrate/nitrite ion concentration. The other sensor readings are used to calibrate the electrical conductivity sensor readings. The goal achieved here is not the absolute measurement of soil N level, but rather an accurate measurement of the change in soil N levels in order to monitor the efficacy of plant based remediation efforts. The long-term results of this ongoing project will be used to select optimal plants and plant spacing for N remediation in riparian zones. This presentation covers the developed sensor suite and its use.

Abstract #: 144

Title: **Preparing and Validating National Weather Service Flood Inundation Maps for Alabama**

Presenter: Nicole Rockwell

Organization: NOAA/NWS/SERFC

Session: Lightning Talk - Research 2

Flood Inundation Maps (FIM) are being developed by the National Weather Service (NWS), putting “water on the map” to help with flood-related preparedness and response. A phased rollout of the public release of FIM for different portions of the country began in 2023 and will continue through 2026, when 100% of the country’s population will be served by dynamic, forecast FIM. Operational, public-facing FIMs will be available for the state of Alabama by the end of September, 2024. To assess accuracy and help build confidence in these new resources, forecasters are evaluating FIM by comparing the maps to historical flood observations, existing floodplain maps, and other flood models. Issues are being highlighted and addressed in advance of the public release of these maps. This short talk will give a brief overview of the validation process that NWS Weather Forecast Offices (WFOs) and River Forecast Centers (RFCs) are going through ahead of the rollout.

Abstract #: 145 **Student**

Title: **How does extreme rainfall events influence surface runoff from Alabama cropping systems?**

Presenter: Rajveer Singh

Organization: Auburn University

Session: Poster Session

With rise in global surface temperatures, the frequency of extreme rainfall events is increasing. To understand climate change adaptation of current management systems, the effects of extreme rainfall events on surface runoff quantity and quality remains to be determined. A rainfall simulation experiment was conducted on intact soil blocks collected from fields that had been under no-till, conventional tillage, and pasture systems. Two one-acre-inch rainfalls were applied 24-hr apart to simulate the intensity of a 10 and 25-yr rainfall in a 5 min duration. No runoff was observed under pastureland except for 25-yr rainfall event applied 24 h following first simulation. Higher runoff occurred under till vs. no-till field independent of the rainfall event and simulation. However, nutrient (dissolved reactive P, particulate P, nitrate N, and ammonium N) yields were generally lower in till system due to less buildup of nutrients at the soil surface. Complete results from the study will be presented.

Abstract #: 146

Title: **An Overview of the National Weather Service Dynamic Flood Inundation Mapping Methodology**

Presenter: Haley Stuckey

Organization: NOAA/NWS/SERFC

Session: Poster Session

In response to partner requests for more robust, actionable information with respect to river flood forecasts, the National Weather Service (NWS) has developed the capability to provide Flood Inundation Maps (FIM) based on forecast streamflow from the National Water Model (NWM) and from NWS River Forecast Centers (RFCs). This poster will describe the Height Above Nearest Drainage (HAND) method of flood inundation mapping which derives flood extents based on synthetic or USGS rating curves to estimate river stage from the forecast streamflow. This method is model agnostic and allows for the application of varying streamflow forecasts. The suite of operational FIMs based on varying streamflows will also be presented along with sample visualizations that will be available across the state of Alabama on or around October 1, 2024.

Abstract #: 147

Title: **Enhancing Resilience in Coastal Alabama with the Bipartisan Infrastructure Law**

Presenter: Christian Miller

Organization: Mobile Bay National Estuary Program

Session: Coastal Issues 2

On November 6, 2021, Congress passed the Infrastructure Investment and Jobs Act (known as the Bipartisan Infrastructure Law -- BIL), a significant investment in the nation's infrastructure and resilience. The BIL specifically identifies the National Estuary Programs (NEPs) as key partners for implementation and, therefore, provides additional funding to these programs. Funding through the BIL provides a historic investment to the NEP. The BIL provides an additional $26.4 million, or $909,800 per year for the next five years, to the NEPs beginning in fiscal year 2022 through fiscal year 2026. The BIL funding is available to the NEPs until fully expended. As with annual appropriations distributed to NEPs to implement Section 320 of the Clean Water Act, the funds distributed under the BIL must implement a management conference and EPA-approved Comprehensive Conservation and Management Plan (CCMP) and annual workplan specifically developed for BIL funds. The workplan for the expenditure of BIL funds shall focus on these priorities:1) Accelerate and more extensively implement CCMPs 2) Ensure that benefits reach disadvantaged communities3) Build the adaptive capacity of ecosystems and communities 4) Leverage additional resources Through the BIL, the Mobile Bay National Estuary Program (MBNEP) has an unprecedented opportunity to reinforce the wise stewardship of Alabama's estuarine and coastal natural resources, while making communities more resilient to the impacts of climate change. The Mobile Bay NEP will implement priorities identified in the CCMP for Alabama's Estuaries and Coast 2019-2023, with a focus on transforming how we monitor environmental conditions (Estuary Status and Trends); how we manage coastal Alabama shorelines (Ecosystem Restoration and Protection); and how we build the environmental management capacity of local governments to serve disadvantaged communities who are marginalized, underserved, and overburdened by pollution (Technical Assistance and Capacity Building). This strategy for the use of BIL funds includes:● Expanded environmental monitoring in Mobile and Baldwin counties to better understand and address pollutant loading and contamination.● Improved and better-coordinated shoreline management to strengthen the resilience of our first line of defense against rising seas and more intense and frequent storms resulting from climate change; and ● Installation of green infrastructure in underserved areas to counter chronic flooding and other stormwater management challenges facing disadvantaged communities.

Abstract #: 148

Title: **Dredging is a Messy Business: Managing Water Quality During Implementation**

Presenter: Alan Fowler

Organization: Geosyntec

Session: Restoration 1

Dredging sediment to improve waterway areas dates back several millennia. Dredging is typically conducted to provide a better environment, and dredging-related improvements include a wide range of objectives. Examples include creating or improving waterways, constructing waterfront infrastructure, environmental cleanup, and habitat restoration. Irrespective of the objective, removing sediment from the bed of a waterway is disruptive and can impact water quality. The water quality impacts can occur where the dredging is conducted and in downstream areas, both during and after dredging. These impacts can include sediment suspended in the water column where contaminants of concern (COCs) attached to the sediment particles can desorb into surface water, or the particulates can migrate downstream and settle on the sediment bed. Other dredging-related impacts include increasing COC concentrations for biota that inhabit or forage in affected areas. For example, a common observation following dredging conducted as part of cleaning-up contaminated sediment sites is an increase in fish tissue COC concentrations. In some cases, the increase in COC concentrations can reverse an ongoing declining trend in fish tissue concentrations due to ongoing natural recovery and take a decade or more to return to predredge concentrations.Examples shown in the presentation will illustrate how COC concentrations in fish tissue increased following two infrastructure projects located in the footprint of the Anniston PCB Site in northcentral Alabama. The first project included dredging PCB-containing sediment by a Federal agency to create pits in portions of Choccolocco Creek to alleviate flooding. The second project involved the placement of PCB-containing soils in Snow Creek near its confluence with Choccolocco Creek by a quasi-municipal organization. The soils were placed in Snow Creek as part of a temporary creek crossing and were subsequently removed under regulatory direction. Both projects appear to have been implemented with limited or no environmental controls or best management practices (BMPs) and ultimately resulted in reversing the declining trends in fish tissue COC concentrations.The presentation will describe approaches to minimize impacts to water quality during dredging, including different types of dredging equipment, other support equipment, and BMPs. Representative supports include isolation enclosures, turbidity barriers, surface water flow deflectors, BMPs, and real-time monitoring devices. The presentation will discuss an integrated adaptive site management approach to link monitoring results with ongoing dredging activities to minimize water quality impacts while maintaining dredge productivity.The presentation will also discuss the needed balance between the amount of dredging that is conducted as part of an environmental cleanup project and preserving valuable aquatic habitat such that the cure does not become worse than the ailment.

Abstract #: 149

Title: **Evaluation of the long-term feasibility of natural and nature-based features to reduce flooding of a coastal roadway**

Presenter: Frances O'Donnell

Organization: Auburn University

Session: Poster Session

Natural and nature-based features (NNBF) are human-made landscape components that mimic natural features. In coastal areas, NNBF that replicate features such as dunes, marshes, and oyster reefs can provide numerous ecosystem services including a reduction of flood risk. However, these ecological elements are expected to change substantially over their lifespan through natural processes, making it necessary to understand their long-term trajectory in the context of increasing climate stresses. We investigate these issues at sites on Fort Morgan Road (SR-180) on Alabama's Gulf Coast, which is a vital coastal roadway impacted by severe storms, high groundwater table, and future sea-level rise (SLR). The area surrounding SR-180 supports a variety of ecological habitats for NNBF. We developed two feasible and site-specific NNBF designs. One is based on a marsh habitat ribbon located on the bay side of the peninsula, while the other involves the construction of large offshore marsh islands. The elevation of these marsh components is dynamic, as ecosystem accretion processes interact with SLR. To project the future elevation of the wetland NNBF components, we applied the Wetland Accretion Rate Model for Ecosystem Resilience (WARMER) to these areas. WARMER predicts changes in marsh surface elevation relative to mean sea-level (MSL) through a cohort tracking method to capture critical marsh accretion processes. We parameterized WARMER using marsh sediment cores collected by previous studies in Bon Secour Bay paired with NOAA predictions for SLR in the northern Gulf Coast. Four coastal salt marsh vegetation species were analyzed in WARMER to predict their effectiveness when incorporated into NNBF design. Mean annual accretion rates computed by WARMER during the 150-year simulation were 14. mm/yr for C. mariscus, 13 mm/yr for J. roemerianus, 12 mm/yr for S. patens, and 14 mm/yr for T. domingensis. Under low and intermediate-low SLR scenarios, the NNBF increases elevations for all marsh species. With intermediate SLR, only T. domingensis remains above sea level throughout the simulation. Under the intermediate-high and high scenarios, the NNBF will become inundated within 22 years and 11 years, respectfully, for all species. We are currently conducting sensitivity analyses to determine potential variability in these estimates. Marsh surface elevations from WARMER will be used in the ongoing NOAA ESLR project as inputs for hydrologic and hydrodynamic modeling of Fort Morgan Peninsula. WARMER will also be used to predict how NNBF will evolve as part of a dynamic system while informing the better design of NNBF to improve coastal transportation infrastructure resilience.

Abstract #: 150

Title: **Alabama 811:A Means to Protect Human Health, the Environment, and Water Quality**

Presenter: Delaney Beier

Organization: Bradley Arant Boult Cummings LLP

Session: Water Law & Policy 2

Institutional controls (ICs) are legal or administrative actions that minimize the potential for human exposure to contamination and protect remedy integrity in various media. ICs include informational devices (e.g., fish consumption advisories) and governmental controls. Alabama 811 is a governmental control codified in Alabama Code § 37-15-10.1 as the Alabama Underground Damage Prevention Authority. The Alabama 811 program includes the 811 One-Call Notification System, which processes notifications of proposed excavation activities made by callers and notifies member underground facility owners to mark their facilities prior to the excavation activities. In short, Alabama 811 can be an IC for contaminated sites to confirm that intrusive activities do not endanger human health or the environment. A representative example is the Alabama Department of Transportation (ALDOT) Coliseum Boulevard Plume (the CBP) in Montgomery, Alabama that includes a shallow groundwater plume contaminated with trichlorethylene (TCE). Shallow groundwater remediation is ongoing and access to and use of shallow groundwater is restricted because of TCE concentrations. The IC program for the CBP includes a range of devices and controls, including Alabama 811. ALDOT works with Alabama 811, such that ALDOT is notified when activities (e.g., utility work) may result in contact with groundwater in the CBP so that performance of these activities is protective of human health and the environment. A second representative example is the Anniston PCB Site in Anniston, Alabama that includes over 7,000 acres of floodplain areas surrounding more than 40 miles of Choccolocco Creek and Snow Creek that flow through multiple municipalities and unincorporated areas. Long-term management of PCB-containing residuals is important to maintaining remedy protectiveness. Historical intrusive activities conducted along Choccolocco Creek in the absence of 811 have risked human health and the environment. This includes the unregulated placement of PCB-containing soils in Snow Creek by a quasi-municipal organization as part of an infrastructure expansion project. As a result, PCB concentrations in fish tissue were increased. Similar impacts to fish tissue PCB concentrations occurred when a Federal agency removed PCB-containing sediment from Choccolocco Creek and placed it on land next to the creek. In both cases, the party supporting management of PCB residuals was not contacted prior to the construction work being implemented. To avoid these situations from recurring, an information plan to manage PCB residuals was established with the concurrence of the U.S. Environmental Protection Agency, and the final details for including Alabama 811 as a formal IC for the Anniston PCB Site are under development. Once finalized, the 811 One-Call Notification System will be part of the final remedies at the Anniston PCB Site and will provide long-term protection of human health and the environment.

Abstract #: 151

Title: **Hard Work Pays Off: Leveraging Grant Funding and Sweat Equity to Improve Stormwater Quality and Restore Riparian Stream Buffers at a Wastewater Treatment Facility**

Presenter: Dusty Kimbrow

Organization: The City of Auburn

Session: Stormwater 1

Pathogen impairments in waterbodies across the United States are on the rise. In Alabama alone, 87% of streams on the 2024 303(d) List cite pathogens as the cause of the impairment. The City of Auburn secured a National Fish and Wildlife Foundation (NFWF) grant through matching funds to improve water quality by reducing pathogen concentrations in stormwater runoff at the H.C. Morgan Water Pollution Control Facility. Primarily using in-house labor, this project restored over 2 acres of riparian stream buffer by planting 800 native trees and shrubs, installed 850 feet of flexible concrete matting to protect facility infrastructure, and installed 3 bioretention cells at the facility's stormwater outfalls to treat runoff. Initial data results suggest that E. coli concentrations in stormwater runoff are being reduced upwards of 90% by the bioretention cells. This presentation will provide details on the grant process, matching contributions, lessons learned, and results of water quality data collection. Hopefully other municipalities and stormwater professionals will be able to implement a similar approach at their own facilities and help reduce pathogens and other contaminants in their local water resources.

Abstract #: 152 **Student**

Title: **Effect of Biochar and Poultry Litter Application on Greenhouse Gas Emissions, Nutrient Dynamics, Yield and Yield Parameters of Cotton and Peanut Rotation**

Presenter: Maryam Saeed

Organization: Auburn University

Session: Poster Session

The United States produces 10.3 million metric tons of poultry litter every year. Uric acid and ammonium in poultry litter are good sources of nitrogen (N) for crop production but the microbial decomposition of uric acid and ammonium causes 20-50% of N loss in the form of Ammonia and nitrous oxides. On the contrary, use of commercial fertilizer especially urea to supply N for crop production has increased by 46% since 2013. The use of fertilizers in agriculture releases approximately 80% of nitrous oxides and 70% of ammonia emissions into the atmosphere. In addition to increase in the greenhouse gases, fertilizers are also responsible for soil acidification, nutrient runoff, and eutrophication. We hypothesize that the application of biochar in soil will help retain more nutrients, reduce the emissions of greenhouse gases, and improve the soil health. The porous structure of biochar will also adsorb nitrate and methane by electrostatic force of attraction due to its high surface area and greater cation and anion exchange capacity. Moreover, polar and hydrophilic traits of the biochar will adsorb carbon dioxides by van der Waals forces between the gas molecules of CO2 and biochar. This research aimed to evaluate the potential of biochar application to reduce the emission of greenhouse gas in the cotton field when fertilized with poultry litter (PL) and urea. Poultry Litter was collected from the local farm in Alabama and applied in the field at 2-ton acre-1 one week prior to planting. Urea was also applied at the same N rate and time as PL. Static chambers were installed in 36 plots and the emissions of GHG were recorded biweekly. The gas samples were analyzed through a Gas chromatography. Soil samples were also collected from each plot from 0-15 cm depth to correlate the soil nitrate and ammonium concentrations to the GHG emission rate. This study will help us to understand the effectiveness of biochar to reduce GHG emissions from poultry litter and fertilizers. Results will be presented in the meeting.

Abstract #: 153 **Student**

Title: **Cost Effective and Efficient Technique for Removing PFOSA and PFOS in Water**

Presenter: Steven Mai

Organization: Auburn University

Session: Lightning Talk - Research 2

PFAS (Per- and Polyfluoroalkyl Substances), also known as the forever chemicals, are synthetic chemicals with multiple fluorine atoms attached to an alkyl chain. A PFAS molecule's carbon-fluorine bond is incredibly strong which makes it resistant to natural degradation and can explain how it is persistent in the environment. PFAS molecules are resistant to heat, oil, water, and grease which makes PFAS an attractive material to have in many manufactured goods such as food packaging, non-stick pans, flame retardant, waterproof clothing, and many more. However, due to their widespread usage and persistence, PFAS contamination is becoming a big issue as it has been found in water resources and soil. PFAS has also been detected in human blood through dietary intake, water consumption, exposure to personal care products and cosmetics, inhalation of dust, and indoor air exposure. PFAS contamination in humans has been linked to thyroid disease, increased cholesterol levels, liver damage, kidney cancer, and testicular cancer in humans. The focus of this research will be on learning more about PFOSA and PFOS and how to remove it efficiently. This experiment will include biochar sorption and UV driven degradation on two PFAS compounds; Perfluorooctanesulfonimide (PFOSA) and Perfluorooctanesulfonic acid (PFOS). Sorption of PFAS involves the use of biochar. Biochar is the process of pyrolysis on biomass to form biochar. The biochar absorbs the PFAS in the water, through electrostatic and hydrophobic properties, and holds it in a concentrated area. This experiment will use Douglas Fir biochar pyrolyzed at 900 degrees Celsius and Poplar biochar pyrolyzed at 900 degrees Celsius. There will be a 0.5mM cetyltrimethylammonium bromide (CTAB) modification to both Poplar and Douglas Fir biochars. Chitosan modified biochar for Poplar and Douglas Fir biochar will be used too. These tests will be performed under different pH conditions of 5, 7, and 9. After the experiment, the samples will be analyzed to see how much PFAS remains and that will reveal the removal eff next step of removal is degradation. In this portion, the biochar will be coated with sulfite which produces free radicals, or hydrated electrons, and will degrade the PFAS into more organic molecules, such as carbon and fluorine, when it encounters U.V light. For this process, test tubes containing the sulfite coated biochar, water, a known amount of the PFAS, and sodium chloride will be placed in a photochemical reactor. After the experiment, the samples will be analyzed to see how much fluorine ions are left and that will reveal degradation efficiency. This research will provide directions for the best and most efficient way to remove PFOSA and PFOS. It is important to note that these samples are not reflective of real-world environments as water is more complex with the addition of organic matter, different chemical and physical conditions, biodiversity, etc.

Abstract #: 154

Title: **Protecting Water Quality with Channel Migration Zone Analysis**

Presenter: Alan Fowler (Thomas Loper)

Organization: Geosyntec

Session: Water Quality 2

The remedial design (RD) for the Choccolocco Creek portion of the Anniston PCB Site (the Site) will include a Channel Migration Zone (CMZ) analysis. The technique will be used to develop a resilient source control design for creek banks with PCB residuals. The technical approach for CMZ was developed by the Washington State Department of Ecology and presented in A Framework for Delineating Channel Migration Zones (Rapp and Abbe 2003) and has been used to evaluate creek bank management and restoration options for multiple waterways in the Pacific Northwest.The CMZ approach is based on geomorphological principles where creek channels move over time and the results of a CMZ evaluation will be used to proactively protect critical habitat, infrastructure, and water quality. The CMZ analysis will be conducted as part of the RD for the Choccolocco Creek portion of the Site and include a combination of desktop modeling and field investigations. The results of evaluation will be used to identify locations where the creek channel may migrate laterally in the future under a range of flow conditions including potential changes in surface water flow conditions based on climate change considerations. The CMZ results will also be used to identify creek bank areas where cleanup actions are not presently required but movement of the creek channel could necessitate future cleanup actions and prevent PCB-residuals from impacting water quality.The CMZ analysis begins with a desktop exercise of mapping the channel's location over time to develop the historical migration zone (HMZ). This process is typically conducted using historical aerial photographs to identify trends in channel movement. The aerial photographs can be supplemented with in-field survey measurements, the placement and monitoring of erosion pins, and/or a series of light detection and ranging surveys taken over time. Following the HMZ evaluation, a field mapping exercise will be conducted to document in-creek, creek bank, and riparian buffer zone conditions.The final step in the CMZ process is identifying the avulsion hazard zone (AHZ) where the channel could migrate to secondary or relic channels, swales, or other areas outside of the HMZ. This evaluation step is important to the RD because channel movement to an AHZ could put a creek bank area at risk that was previously not of concern based on the HMZ. Additional components of the process include long-term monitoring with an adaptive site management feedback-loop. These efforts will ensure that vulnerable areas are closely monitored and additional actions, if needed, can be implemented to prevent PCB-residuals from entering the creek and thus maintain the effectiveness of the creek bank source control remedy.

Abstract #: 155 **Student**

Title: **A Comprehensive Database of Carbon Fluxes in U.S. Wetlands**

Presenter: Ana Flavia Brancalion Costa

Organization: Auburn University

Session: Poster Session

Wetlands are temporarily or permanently inundated lands well known for the multiple ecosystem services that they provide. They are also recognized for the high concentration of carbon in their soil, demonstrating their significant potential for carbon sequestration. Conversely, wetlands can be one of the largest emitters of greenhouse gases (GHG) into the atmosphere. Although drivers of these processes have been identified over the decades, the actual contribution of wetlands to GHG emissions and the global carbon budget is not fully understood. In this study, we compile and preprocess a comprehensive and detailed database of CO2 and CH4 emissions and carbon storage using Net Ecosystem Exchange (NEE), Gross Primary Production (GPP), and Ecosystem Respiration (RECO) measurements for the United States. The database includes 54 individual datasets encompassing approximately 314 sites. Data were collected using gas chambers and Eddy Covariance Towers, capturing a wide array of seasonal processes at the monthly temporal scale. Environmental and hydrometeorological variables (e.g., vapor pressure deficit, water table depth, air and soil temperature, atmospheric pressure, soil moisture, organic matter, pH, salinity, NDVI, and precipitation) were also collected at the wetland sites to analyze the drivers and ultimately extrapolate carbon emissions and sequestration to wetlands where carbon flux data are not available. Preliminary exploratory analyses showed that temperature is one of the primary drivers of these processes. High temperatures are not only associated with increased CO2 and CH4 emissions but also with increased carbon storage, highlighting an opposing behavior depending on the emission/sequestration characteristics of the wetland. Further, the biome location of the wetland was shown to better explain the patterns of carbon processes than the wetland type, corroborating our previous findings. The exploratory analysis will be expanded to include more robust meta-analyses correlating carbon fluxes with hydrometeorological and environmental drivers. Data-driven models (e.g., neural networks, random forest, decision trees) will be developed to predict wetland carbon fluxes in select areas representative of the contiguous US and Alaska.

Abstract #: 156

Title: **Alabama the River State**

Presenter: Donna Matthews

Organization: Alabama the River State

Session: Lightning Talk - Research 1

A rebranding of Alabama as Alabama the River State opens numerous avenues for the future of Alabama. The foundational influences of our waterways on the history and development of the state are underappreciated and underacknowledged.This poster proposal outlines a way forward, led by the Alabama Legislature; to adopt a new state identity based on the realization that our history (early settlements), our growth (development of the waterways) and our future are integrally entwined with the branches, creeks, swamps, wetlands and rivers of our state.

Abstract #: 157

Title: **The Hybrid Approach: Leveraging Big Data and Simulation to Better Manage Water and Energy**

Presenter: Matt Deavenport

Organization: Jacobs

Session: Water & Energy Management

Water utilities are facing pressures to do more with less while still providing a cost-effective reliable service to their customers. These challenges underscore the critical role played by operators in ensuring the continuous and efficient operation of water treatment systems. As experienced operators approach retirement, the imperative to better inform, train and equip a new generation of operators becomes increasingly urgent to maintain the reliability and efficiency of these lifeline systems that serve our communities. Water utilities also generate a lot of data. However, making practical use of even a fraction of those data is a well-known challenge, especially for frontline operations and maintenance staff who do not spend their days at a computer screen but out running their plants. Opportunities to better manage water and energy can be categorized into three buckets of a water system:•Physical system Improvements. Examples include replacing equipment such as pumps or blowers that is better designed for the facility conditions to reduce operational costs.•Automation Improvements: Updating, refining, adding automated control strategies that better control the physical equipment of the physical system. This may include better management of pump transitions to ensure energy efficiency.•Operations Improvements: Utilizing data collected to better inform operators. This could be to develop a machine learning model that predicts a chemical flow setpoint. It could also be the use of an operator training simulation that enables operators to better train staff for standard operations as well as emergency events. This presentation will be useful to water utility owners and operators who are interested in ways to improve their own use of existing data to improve plant performance, support their O&M staff, and reduce costs. Four key points will be presented and discussed:1.Start with solving a real issue – going digital sounds modern but is a lot of wasted effort unless there is a clear objective. 2.Your existing data is good enough to get started – there is a perception that only “big data” in perfect condition is useful, but we will show this is not the case and you can start where you are at. 3.Data science is only the beginning. We will discuss a project where data science techniques are being combined with mechanistic treatment simulation models to create a hybrid approach more powerful than either alone.4.Preparing Operators and providing an offline ‘flight -simulator’ that allows engineers and operators alike to explore what-if scenarios such as shut-downs, extreme events, and be prepared for changes to a facility.

Abstract #: 158

Title: **Calcium-modified biochar for efficient removal of aqueous phosphate ions**

Presenter: Nitesh Kasera

Organization: Auburn University

Session: Water & Energy Management

Eutrophication of water bodies is a serious global environmental concern. Achieving the permissible limits of phosphate concentration in water bodies is one of the crucial goals of sustainable surface water management. Biochar-based adsorbents could be a potential solution to develop next-generation wastewater treatment technologies. In this work, we modified switchgrass-derived biochar with sustainable calcium sources such as oyster shells (~36% Ca), eggshells (~38% Ca), and spent industry gypsum (~23% Ca) to study the phosphate adsorption from water systems. The calcium sources were mixed with the switchgrass at 1:1, followed by ball-milling at 500 rpm for 4 hours. The ball-milled biomass and biomass calcium mixture were then pyrolyzed at 800 degrees C for 2 hours to prepare pristine and calcium-modified biochars. It is hypothesized that the positive charge from calcium will aid in removing the negative phosphate ions from water. The physicochemical properties of the prepared biochar samples will be characterized using various analytical techniques. These techniques include ultimate and proximate analysis, inductively coupled plasma mass spectroscopy (ICP-MS), pH, pH at the point of zero charge, infrared spectroscopy, scanning electron microscopy (SEM), BET specific surface area, and X-ray photoelectron spectroscopy. Batch adsorption of phosphate ions will be performed using the prepared biochars. The adsorption equilibrium will be studied using Langmuir, Freundlich, and Sips isotherms. Reaction-based (pseudo-first order, pseudo-second order, intraparticle, and Elovich diffusion) and mass transfer-based (internal and external) kinetics of the adsorption process will be studied. A comparative analysis of the different sources of calcium will be performed based on their structure-activity relationship. This research's findings are expected to help understand the mechanistic aspects of the phosphate adsorption process using engineered biochar-based adsorbents.

Abstract #: 160

Title: **Alabama Envirothon: Program Growth and Participation Opportunities**

Presenter: Courtney Curenton Baker

Organization: Alabama Association of Conservation Districts

Session: Lightning Talk - Outreach

The Alabama Envirothon, coordinated by the Alabama Association of Conservation Districts in cooperation with multiple partner organizations, is an environmental and natural resource conservation problem-solving, teambuilding and leadership experience for high school students. It incorporates classroom training and hands-on outdoor field experiences to focus learning in the areas of aquatics, forestry, soils, wildlife, and an annually chosen current environmental issue, which for 2024 is, “Renewable Energy for a Sustainable Future”.During this three-day event, teams of students from throughout Alabama receive training from industry professionals, take written exams, and develop a full plan for solving a comprehensive complex problem, and present their plan to a panel of judges. The complex problem is developed at the state level, using information and expertise from environmental professionals working throughout Alabama. The state-level winning team advances to compete at the international level in the NCF-Envirothon, hosted by New York in 2024.In the 2022-2023 competition year, the Alabama Envirothon was able to conduct two regional programs in addition to its state level competition and more than tripled its student participation. In the 2023-2024 competition year, the program experienced sweeping growth with 6 regional training events, and a 200+ person statewide competition-again doubling previous its previous participation.This presentation will provide an update on the continued growth and future plans of the Alabama Envirothon Program and provide information on how interested professionals can get involved with the program.

Abstract #: 161

Title: **Leveraging Marine Heatwaves for Improved Rapid Intensification Prediction in the North Atlantic Basin**

Presenter: Soheil Radfar

Organization: The University of Alabama

Session: Coastal Issues 2

Tropical cyclones (TCs) pose a significant threat to coastal communities in the North Atlantic basin. According to NOAA, there have been 62 billion-dollar TCs in the US history since 1980, causing A total economic loss of $1405B and 6897 deaths. These losses and fatalities may be exacerbated if the TCs experience rapid intensification prior to landfall (at least a 30-knot increase in maximum sustained wind speed in less than 24 hours). Predicting the RI phase of TCs remains a pivotal forecasting challenge due to its profound impact on storm severity. It is well known that the warming climate may worsen the catastrophic events due to elevated sea surface temperatures (SSTs) and loading the atmosphere with more moisture. In recent decades, these impacts have become more apparent as prolonged periods of anomalously high SSTs, known as marine heatwave (MHW), have become more frequent. MHWs have been linked to increased cyclone intensity of the costliest historical TCs (e.g., Katrina 2005, Michael 2018, Ida 2021, and Ian 2022) and can provide valuable insights into RI dynamics. This study investigates the potential of using MHW metrics for improved RI prediction in the North Atlantic. We develop a machine learning model for predicting RI events that integrates oceanic and atmospheric variables associated with MHWs. For this purpose, we detect MHW and RI events between 1981 and 2023. We then identify MHW events that have close spatial and temporal relationships to historical TCs in the North Atlantic. The results show that incorporating MHW characteristics such as duration, intensity and spatial extent improves the model's predictive ability by accounting for the potential influence of these oceanic thermal anomalies on cyclone intensification. The results demonstrate up to 30% improvements in the RI prediction accuracy of intense TCs compared to the operational models. The proposed approach showcases the value of integrating MHW characteristics into RI forecasting systems. This research not only enhances our understanding of the predictors of RI but also serves as a crucial step towards more reliable and actionable RI forecasts. Better RI forecasts can facilitate more effective decision-making and resource allocation, ultimately contributing to better preparedness and resilience against the impacts of severe TCs.

Abstract #: 162 **Student**

Title: **Enhancing Urban Flood Modeling Efficiency Using Machine Learning-based Surrogate Models**

Presenter: Fatemeh Rezaei Aderyani

Organization: The University of Alabama

Session: Poster Session

The persistent and extensive risk of urban flooding is heightened by rapid urbanization and the consequences of climate change. Addressing this challenge necessitates a comprehensive understanding of urban flood features. The Stormwater Management Model (SWMM) is commonly used for the simulation of hydrologic and hydraulic processes within urban drainage systems. The study specifically emphasizes the use of the Random Forest (RF), a machine learning (ML) algorithm, as an alternative to the SWMM model for predicting manhole surcharge parameters (Hours Flooded, Maximum Rate, and Total Flood Volume) in the metropolitan of Houston. To enhance prediction accuracy and manage spatial autocorrelation within the urban drainage system of Houston, clustering methodology is employed. The study highlights the computational efficiency and accuracy of RF models in predicting critical surcharge parameters during both synthetic and real rainfall events. It is essential to note that the synthetic events are generated based on historical rainfall time series data, providing a robust foundation for training the ML model. The significant reduction in computational time, when compared to traditional models, underscores the potential of ML-based surrogate models for real-time hydrological modeling tasks. This accelerated computational speed not only improves the overall efficiency of modeling processes but also positions ML-based surrogate models as valuable tools for prompt decision-making in the context of urban flood management and emergency response planning.

Abstract #: 163 **Student**

Title: **Assessing the Vulnerability of Coastal Roadways to Flood Hazards: A Case Study of the Mobile Causeway in South Alabama**

Presenter: Faezeh Maghsoodifar

Organization: The University of Alabama Center for Complex Hydrosystems Research

Session: Poster Session

Coastal roadways, such as the Mobile Causeway in southern Alabama; play a critical role in facilitating transportation, connecting communities, and supporting economic activity in coastal regions. To maintain critical connectivity and community resilience during flood hazards, such as storm surges, high tides, and heavy rainfall, these coastal roads must remain serviceable. To assess the impact of hurricane-induced water level changes on the causeway, advanced geospatial tools and a high-fidelity hydrodynamic model were used. Hydrodynamic data from Hurricane Ida (2021) and historical causeway closure data (ALDOT dataset) are used to develop a geoprocessing script to improve the utility of spatial data for environmental event analysis. By reading a NetCDF file, the script will extract relevant spatial data points based on the duration of the user target. Afterwards, the points are then converted into a user-defined coordinate system and exported as shapefiles. The method provides a streamlined way to convert complex hydrodynamic data into a geospatial data format that can be analyzed and visualized. It is particularly useful for researchers and practitioners who require efficient data transformation solutions for environmental and coastal engineering applications. The output is used to identify water level thresholds associated with four closure states: low, medium, high, and closed. The results are used to delineate critical hotspot segments and a color-coded inundation depth and closure map is created. This method effectively reduces the complexity typical of multi-platform analyses. For stakeholders, planners, and decision-makers, the outputs provide valuable insights into the causeway's resilience, assisting them in developing effective disaster response plans. This study provides insights into potential traffic disruptions for risk management and provides insights into the serviceability of the Mobile Causeway under flooding hazards.

Abstract #: 164

Title: **Remedy Selection Process and the Selected Targeted Method for Remediation at the Robertsdale Elementary School ADEM Tank Trust Fund Site**

Presenter: Kendall Rich

Organization: WSP Environment & Infrastructure Inc.

Session: Groundwater

Robertsdale Elementary School was constructed at its current location in Baldwin County, Alabama, USA during the early 2000s, and as part of the school facility, a new refueling station was planned at the site for their school bus fleet. A previous bus-refueling station near the same location included one 1000-gallon underground storage tank (UST) for unleaded fuel and one 3,000-gallon aboveground storage tank (AST) for diesel fuel. Removal of the UST in 2009 revealed gasoline-contaminated soil and groundwater, and the site was subsequently enrolled in the Alabama Department of Environmental Management (ADEM) Underground and Aboveground Storage Tank Trust Fund program to fund reimbursement of costs for removal and remediation of contaminated soil and groundwater associated with the discovered release of fuel. Preliminary and secondary investigations were conducted in 2013 and 2014, respectively, and an Alabama Risk Based Corrective Action evaluation was performed in 2016 to characterize potential exposure pathways and to determine appropriate remediation goals. A corrective action plan (CAP) for groundwater remediation including include in-situ chemical oxidation (ISCO) with high-vacuum extraction (HVE) implemented at the site in early 2022. ISCO with HVE demonstrated the potential for successfully meeting cleanup goals by reducing gasoline-related constituents of concern (COCs) in localized zones where ISCO reagents were in contact with COCs in the subsurface. However, the full extent of the contaminant source area was not in direct contact with ISCO materials, and as a result, COCs persisted above corrective action limits in in groundwater during quarterly groundwater monitoring events in 2022 and 2023. A high-resolution site characterization (HRSC) study was then conducted to better characterize the location, nature, and extent of COCs in groundwater, and the resulting three-dimensional subsurface model of the site and its subsurface contaminants provided data needed for development of an amended, targeted CAP. Three separate concepts for a targeted remediation approach were evaluated as potential amended CAP methodologies, and variables including site access; structural integrity of the site; and efficiency, duration, and cost of implementation were considered. This presentation will provide a brief description of the ADEM Tank Trust Fund program, a detailed description of the Robertsdale Elementary School Tank Trust Fund site, and an explanation of the targeted remediation method chosen from the remedy selection evaluation that will soon be implemented for targeted, precise, and efficient remediation of groundwater at this sensitive locale in Baldwin County, Alabama.

Abstract #: 165

Title: **The GEO Project: Building Geospatial Capacity with Education and Outreach**

Presenter: John Cartwright

Organization: Mississippi State University

Session: Lightning Talk - Outreach

The Geospatial Education and Outreach (GEO) Project is a collaborative effort of the Geosystem Research Institute, Northern Gulf Institute, and the Mississippi State University Extension Service. Established in 2006, the GEO Project is dedicated to building geospatial capacity across Mississippi and the northern Gulf Coast. This is achieved through the strategic utilization of geospatial data acquisition and application and GIS training across multiple disciplines. The interdisciplinary approach within the GEO Project promotes an innovative geospatial support system for education, outreach, and application. The foundation of the project is built upon educational workshops and trainings focused on integrating geospatial concepts and tools with hands on training to solve real-world problems. Outreach efforts are focused on building partnerships with government agencies at the local, state, and federal level. Application efforts are building a suite of geospatial analysis and visualization tools to examine complex data interactions, visualize the effects of sea level rise and inundation, and characterize vulnerability. Through these efforts the GEO Project is providing resources that are addressing societal challenges related to climate change by advancing knowledge in the geospatial field by promoting geospatial literacy, fostering innovation, and empowering informed decisions in a spatial interconnected world from local to regional scales.

Abstract #: 166 **Student**

Title: **Distribution and Establishment Status of the Invasive Zebra Mussel (Dreissena polymorpha) in Alabama Reservoirs**

Presenter: Liz Farley

Organization: Samford University

Session: Poster Session

The zebra mussel (Dreissena polymorpha) has been ranked among the world's worst invasive species. Adults settle on hard substrate and pose substantial threats not only to power and water infrastructure (by clogging pipes, increasing corrosion rates, etc.), but also to biodiversity of native taxa (through competition for limited resources and settling on native mussels). D. polymorpha was originally detected in the Great Lakes during the 1980s and has since become established in many states across the US. Though the species was first observed in Alabama in the 1990s and occurrences have been noted in at least 5 HUCs, limited sampling for D. polymorpha has been conducted in our state. Because of this, a zebra mussel working group (composed of members of the Alabama Department of Natural Resources, USACE, and various other individuals) has been established to address the invasion of Alabama waters through monitoring, education, etc. This specific project aims to compile and summarize existing occurrence data from multiple agencies and individuals and to sample reservoirs for zebra mussel veligers (planktonic larval stage) and other zooplankton to verify where established, reproducing, populations exist and investigate potential impacts on zooplankton communities.Existing occurrence data is primarily in the form of observations recorded in the USGS Nonindigenous Aquatic Species Database and brick surveys. Veliger and zooplankton sampling began this May in Pickwick, Wilson, Wheeler, Guntersville, Smith, Bankhead, and Holt reservoirs (additional reservoirs will be added) and sites will be revisited in August to increase probability of detection in reservoirs with established populations. Veliger and zooplankton samples were taken from two sites at each reservoir, one mid-reservoir and one at a frequently used boat ramp. Available occurrence (adult and veliger) data is summarized in this poster, and zooplankton analysis is currently underway.

Abstract #: 167

Title: **Enhancing Community Resilience Through GIS Integration: Applications in Coastal and General Community Planning**

Presenter: Claire Babineaux

Organization: MSU GEO Project

Session: Lightning Talk - Outreach

Geographic Information Systems (GIS) are essential in developing resilient communities by supporting informed decision-making through detailed spatial analysis, risk assessment, and land-use planning. Coastal communities face significant threats from climate change, including rising sea levels, increased storm frequency, and flooding. These challenges require advanced planning and adaptive strategies to ensure sustainable development and safety.GIS technology plays a crucial role in identifying high-risk areas and developing resilient housing solutions, making it a powerful tool for both coastal and general community planning. By integrating complex environmental variables, demographic data, and localized factors, GIS enables communities to create tailored resilience strategies that promote sustainable and adaptive development.Beyond coastal applications, GIS is invaluable for managing population growth, urban development, and environmental sustainability in all communities. By incorporating GIS into planning processes, communities can better anticipate risks, allocate resources efficiently, and foster resilience against a variety of challenges. This integrated approach demonstrates the critical role of GIS in building resilient, adaptable, and thriving communities. This presentation will highlight the transformative impact of GIS in community planning, using the Geospatial Education and Outreach (GEO) Project's work in Foley, Alabama, as a case study. The GEO Project collaborated with local stakeholders and utilized GIS to conduct a resilient housing risk assessment to assist in developing adaptive strategies for climate-related challenges. This interactive approach ensured that resilience strategies are community-specific and inclusive.

Abstract #: 168

Title: **A High-Resolution Multi-Source Global Precipitation Product**

Presenter: Keyhan Gavahi

Organization: The University of Alabama

Session: Modeling & Water Mgmt. 2

Accurate quantification of precipitation (QPE) is of utmost importance for a wide range of applications, including flood forecasting, drought monitoring, and land surface modeling. However, there exists diverse uncertainty among in situ precipitation datasets, remote sensing-based estimations, and reanalysis products. Many models have been developed to merge these estimations from different sources, aiming to enhance QPE accuracy. However, most of these attempts focus primarily on spatial or temporal correlations between remote sensing and gauge data separately, which limits their ability to fully capture the underlying spatiotemporal dependencies that could lead to better precipitation estimations. In this study, we have introduced a comprehensive framework capable of simultaneously merging and downscaling multiple user-defined precipitation products using rain gauge observations as reference values. To achieve this, we designed an innovative deep learning-based convolutional neural network architecture, referred to as the precipitation data fusion network (PDFN). The PDFN incorporates several layers of 3D-CNN and ConvLSTM, allowing us to exploit the spatial and temporal patterns of precipitation effectively. The framework, built using Amazon Web Services (AWS), automates pre-processing of remote sensing and in-situ data, execution of computationally expensive deep learning models, and visualization of the final precipitation product. The system is designed to run automatically to produce high-resolution precipitation estimation over CONUS on a daily basis.

Abstract #: 170 **Student**

Title: **Identifying water quality problem source areas in small coastal watersheds: The challenge of attribution**

Presenter: David Hensley

Organization: University of the Virgin Islands

Session: Lightning Talk - Research 1

Coastal water quality is a concern worldwide and can have major economic effects when coastal economies depend on good water quality. In small, nearshore watersheds, however, although water quality may be regularly impaired, it can prove difficult to determine the ultimate source of pollutants within the nearshore watershed. Though stream mouths and stormwater outfalls are reasonable starting points in small watersheds, particularly those of ephemeral stream networks, this is not always a reliable indicator of short-term changes in water quality indicators. By way of example, the Salt River Bay watershed of St. Croix, U.S. Virgin Islands, does have a relatively important stream channel network that culminates at the head of Sugar Bay, located within the larger Salt River Bay. However, water quality issues are at times observed within the bay that are not clearly associated with known discharge events from the stream, despite monitoring efforts. Other potential pollutant sources, like immediate local runoff from adjacent roadways, leaky septic systems from coastal homes and businesses, or wastewater from vessel moorings, may play a significant role in small coastal embayments' overall water quality picture. Although ephemeral stream networks in coastal watersheds may occasionally play a critical role in coastal water quality, such as after flash flooding events, this case study highlights the importance, especially in small watersheds, of considered more localized sources of water pollution as well. For example, following major runoff in October 2022, there was no detected change in salinity from ambient marine conditions near the mouth of the main stream channel of Salt River Bay, but after the rain events of April 2024, a clear gradient of salinity proceeding from 4.7 to 33.9 ppt was observed. This accords with data from a nearby stream gauge close to the point of discharge to the bay, which demonstrates that, even when major rain falls, streamflow may not take place in the near the mouth, but the water quality effects of other, possibly localized runoff or wastewater leakage, may still be observed. This highlights the need to look in nearshore areas as well as larger stream catchments to identify the potential source of water pollution in coastal waters.

Abstract #: 171

Title: **Identifying and Mapping Potential Sediment Abatement Priorities of the Southern Appalachians**

Presenter: Georgia Pearson

Organization: The Nature Conservancy

Session: GIS

This spatial analysis was conducted to identify and map potential agricultural sources of sediment to high priority rivers in The Nature Conservancy's Southern Appalachians project area, and to prioritize those sources for possible implementation of abatement projects. Our analysis combined both publicly available and proprietary spatial data for the region that allowed us to take into consideration the following factors: Is the sediment source within critical floodplain zones or does it lie in less critical upland areas? What is the percent contribution of the catchment (within which the sediment source is located) to the overall flow volume of the downstream priority river segment? How far away, in instream travel time, is the sediment source from the associated downstream priority river segment? How much do the other detrimental environmental factors of impervious surface and mining also potentially effect priority rivers, using the same spatial measures? This approach not only allowed us to identify the major agricultural sediment contributors to the watershed flowing into priority rivers, but also allowed us to differentiate between the level of impact of each major agricultural sediment contributors within each watershed and across the entire project area. Our results were mapped at 10-meter raster resolution, giving us the ability to produce a detailed "heat map" of the potential agricultural sediment sources throughout the Southern Appalachians. These results will be overlayed with parcel ownership information to identify prospective landowner partners in sediment abatement projects. These results have also been aggregated to the 8- and 12-digit Hydrologic Unit Code (HUC) to identify and prioritize watershed-scale working areas.

Abstract #: 172 **Student**

Title: **Investigating the Impacts of Land Use on Soil Biogeochemistry in Headwater Wetlands in Baldwin County, Alabama**

Presenter: Brianna Travis

Organization: Auburn University

Session: Poster Session

Has the biogeochemistry of soils in headwater wetlands been altered due to surrounding land uses, such as agricultural and urban development? As the Gulf coast continues to develop, it has been shown that land use can increase stormwater runoff, reduce baseflow conditions, and lower water levels in receiving wetlands. We are investigating the tendency for land use to make headwater wetland soils less anaerobic by using IRIS (Indicator of Reduction in Soils) tubes at nine sites in Baldwin County, Alabama. For each wetland sampling event, five IRIS tubes are coated with a layer of manganese-based paint and five with iron-based paint, and then inserted into the soil 50 cm deep. After three weeks, the loss of manganese and iron paint from the IRIS tubes is measured and used as an indication of anaerobic soils conditions. By quantifying the amount and depth of loss, we will assess the tendency for wetland soils to sustain anaerobic conditions which is expected in reference wetlands. These results will help assess the potential hydrologic impacts that are related to surrounding land use. In wetlands with less impact from these developments, we expect more consistent anaerobic conditions. These conditions should cause a significant loss of these elements into solutions and, in turn, a high percent loss of IRIS tube paint. Periodic sampling of wetlands is conducted seasonally for one year (i.e., winter 2024). Initial IRIS tube measures indicated mixed results between wetlands and land uses, however year-long trends will be examined at the end of the one-year study. This project will enable us to examine 1) if the headwater wetland soils show signs of alteration and impacted conditions compared to reference conditions and 2) the seasonal changes in these headwater wetlands. We are expecting to see greater variability in IRIS tube results at wetland sites affected by agricultural and urban land use.

Abstract #: 173 **Student**

Title: **Navigating Trends, Advancements, and Challenges in Climate-Smart Agriculture: An Umbrella Review**

Presenter: Ruchie Pathak

Organization: The University of Alabama

Session: Lightning Talk - Research 2

Climate-smart agriculture (CSA) can help maintain the economic, environmental, and social sustainability of farming operations. The interest in these practices has become widespread nationally, especially with the U.S. Department of Agriculture investing more than $3 billion in agricultural projects under the “Partnerships for Climate-Smart Commodities” funding program introduced in 2022. Around the world, too, a plethora of research exists on CSA practices and their adoption by farmers since the introduction of this approach back in 2010. Nevertheless, confusion persists around what CSA is actually about or has to offer as there is a lack of a formal conceptual framework or set of tools to guide the implementation process. Even the meaning of CSA seems to differ with geographic context as it is sometimes interpreted as precision agriculture or used interchangeably with highly complementary approaches, such as sustainable intensification and conservation agriculture. Moreover, there is no consensus on the kind of technologies or practices that should or should not be considered climate-smart. Furthermore, a lack of research documenting CSA experiences from developed countries has also been noted due to a predominant focus on only transforming smallholder agriculture in less developed and developing countries. After a decade since its origin, the prevalent discourse around CSA still relies on the scientific and technical dimensions, when it should extend beyond specific practices to include the enabling environment needed for it— types of partnerships, supporting policies and institutions as well as funding mechanisms for scaling up. Given the rapid development that CSA has witnessed, an umbrella review of existing systematic reviews and meta-analyses from around the world will be quite informative and useful. Since the existing reviews focus either on the expansion of CSA within a particular region or country, a specific dimension (e.g., climate mitigation), or a specific technology or method, this study summarizes and synthesizes information from multiple such reviews to offer a comprehensive overview of CSA- the recent advancements, existing challenges, and the gaps that remain.

Abstract #: 174 **Student**

Title: **ArcGIS Online Portal for ALDOT Landslide Monitoring**

Presenter: Abraham Alvarez

Organization: Auburn University

Session: Lightning Talk - Research 2

Landslide events in the proximity of roads and urban areas are common occurrences in the state of Alabama. Due to the potential damage to the transportation infrastructure, safety concerns, and significant traffic disruptions, the Alabama Department of Transportation (ALDOT) has been in charge of deploying instrumentation to monitor soil behavior changes and further provide project repairs in the affected areas. The data collected from ALDOT has been used for several years to understand how certain factors have an influence in soil failure. High-intensity rainfall and high soil moisture readings have been related to the potential of triggering slope stability disruptions, soil stress increases, and strength reduction of the soil. Our previous work successfully applied several methods to identify landslide thresholds based on rainfall and soil moisture values in Alabama. However, an online tool based on these current data and threshold identification methods is not available which will assist to reduce the impact of landslides on infrastructure. This project aims to develop an accessible online portal made with ArcGIS-online for ALDOT officials to monitor their instrumentation in the state of Alabama with multiple feature layers available. The dashboard for this portal will be able to update the displacements per instrumentation site once new data is collected from ALDOT officials. Additionally, it will include a real-time feature for changes in precipitation, soil moisture, and normalized soil moisture while having stationary layers for geology, and slope. Normalized soil moisture will be developed by using the average soil moisture of the period 2015-2021 with the current soil moisture value. Moreover, it will show the relation between the identified landslide triggering thresholds with landslide and non-landslide events and it is expected to have a warning feature for potential risk based on the value reached for soil moisture and precipitation. Identifying potential landslide events using this tool can help ALDOT officials to plan preventative maintenance of roads and avoid road closures.

Abstract #: 175 **Student**

Title: **Bayesian Hydrologic Data Assimilation inside the Next Generation Water Resource Modeling Framework (NextGen)**

Presenter: Ehsan Foroumandi

Organization: The University of Alabama

Session: Modeling & Water Mgmt. 1

Hydrological modeling holds great significance in hydrology as it provides essential information for effective water resources and emergency management during hydroclimatic disasters. To overcome the operational limitations of the current National Water Model (NWM), the Next Generation Water Resource Modeling Framework (NextGen) has been developed. A key shortcoming of the current NWM is the lack of an ensemble data assimilation (DA) method, a gap that NextGen also shares. The accuracy of hydrological simulation and forecasting heavily relies on the initial condition of the model, which can be affected by various sources of uncertainty, stemming from forcing data, state variables, and parameters, as well as the model structural uncertainty. Therefore, there is a growing need to apply DA at the forecasting level to quantify the uncertainty of the modeling procedure. This study designs a DA module incorporating two DA filters: the Ensemble Kalman Filter (EnKF), and the particle filter (PF) for NextGen to improve the accuracy of the hydrological models in the forecasting phase. The efficiency of the developed module is evaluated by assimilating streamflow observations at USGS gauges into the Conceptual Functional Equivalent (CFE) model, which was recently designed to be a simplified version of the NWM with a compatible functionality.

Abstract #: 176

Title: **Innovative Perspectives on Water: Enhancing Accessibility through the Auburn Water Resources Center and BraveHeart Center for Place and Purpose Partnership**

Presenter: Carolina Ruiz

Organization: Auburn University Water Resources Center

Session: Lightning Talk - Outreach

Over the past year, the Auburn University Water Resources Center (AUWRC) has collaborated with BraveHeart Center for Place and Purpose (BCPP), to provide opportunities for young adults with moderate-severe disabilities to participate in watershed stewardship. BCPP is a collaborative community program within the Auburn University Social Work Program in the College of Liberal Arts and First Presbyterian Church of Auburn. Braveheart is a comprehensive, dynamic post-high school health and wellness program that supports and enhances cognitive, social-emotional, life and vocational skills through community participation and outreach. A core part of the AUWRC's mission is "Bringing People to Science and Science to People" through the empowerment of private citizens to become active stewards of water resources. This partnership is mutually beneficial because the AUWRC helps BCPP meet its program goals of 1) improving quality of life for participants, 2) providing job skill development and outreach opportunities, and 3) utilizing photo voice to encourage disability awareness and acceptance. BCPP assists AUWRC programs with administrative support by putting together training materials and documenting water pollution issues on the Auburn University campus. The AUWRC has helped BraveHeart incorporate watershed stewardship into their regular activities, and facilitates additional programming with the young adults, such as stream clean-ups, demonstrating the Enviroscape (interactive watershed model), and water-related art projects to be shared with the Auburn community. These activities have introduced the topic of non-point source pollution to the young adults, which led to them to being aware of pollution and documenting through photography projects on campus. This presentation will provide an overview of the variety of activities the Auburn University Water Resources Center and BraveHeart have collaborated on, highlighting the importance of inclusion in watershed stewardship and emphasizing the benefits this partnership.

Abstract #: 179 **Student**

Title: **A Daily Baseflow Dataset for Hydrological Modeling and Analysis Across the CONUS**

Presenter: Parnian Ghaneei

Organization: The University of Alabama

Session: Groundwater

High-quality baseflow data is essential for improving water resources modeling and management since groundwater plays an important role in streamflow and ecosystem sustainability. Baseflow, the portion of streamflow contributed by groundwater, aids in representing the complex relationship between groundwater and surface water. It serves as the primary source of runoff recharge during dry periods, making it vital for accurate hydrological modeling. This research aims to predict baseflow by proposing a deep learning-based framework. The framework includes the integration of a deep learning regression model and a neural clustering algorithm to improve the prediction accuracy in both gauged and ungauged basins. Given the scarcity of accessible daily long-term baseflow data, our goal is to create a comprehensive dataset across the contiguous United States (CONUS). This dataset will be an invaluable resource for environmental scientists and water resource engineers, setting a new benchmark for future studies on groundwater and surface water interactions.

Abstract #: 180

Title: **Water: The Game Changer**

Presenter: Caryl Orr

Organization: Earth Resource Systems LLC

Session: Water & Energy Management

What do public water supply, personal water consumption, industrial water use, data centers, bit coin mining, hydraulic fracturing for oil and gas, traditional mining all have in common? WATERHow is the use of digital and robotics applications changing how water is allocated now and in the future? What companies are investing and applying these applications and technologies?How are energy and engineering companies harnessing water for various uses? In Alabama, how is our water currently used? What state and local agencies keep track of water usage? Which federal agencies gather water data in Alabama and how are they using this data?

This talk will examine the flow of investments, infrastructure, agencies and companies harnessing water for their unique end products and usages.

Abstract #: 181 **Student**

Title: **Navigating Nature-Based Solutions in Mitigating Compound Flood Risks Through Knowledge Co-development Process: A Collaborative Study on Mobile Bay**

Presenter: Md Munjurul Haque

Organization: The University of Alabama

Session: Poster Session

Nature-based solutions (NBS) are increasingly considered a sustainable approach to mitigating compound flood risk, offering a unique strategy to address multiple flood factors, including storm surges, sea-level rise, massive rainfall, and riverine floods. However, effective knowledge production is not straightforward in a collaborative project as diverse groups are involved. In this study, we attempt to navigate the existing and potential NBS projects in Mobile Bay, AL, through a participatory approach. The research team, including hydrological modelers, biologists, and social scientists, works closely with coastal practitioners to identify NBS projects that may mitigate the risk of compound flooding in the area. We adopted a participatory GIS mapping and discussion approach to understand the experiences and needs of coastal practitioners regarding compound flooding. Meeting attendees interacted with printed maps and GIS maps to share their thoughts about past NBS projects and their potential to mitigate compound flooding. These were later converted into spatial data for this investigation. Building on findings from prior workshops in 2023 that assessed stakeholders' perceptions of NBS and compound flooding, we again conducted in-depth discussions with the same workshop participants to understand and prioritize success metrics for existing NBSs in the 2024 workshop. The in-depth discussions with the community partners were noted carefully and later converted into qualitative data for this study to achieve our research question. This study advocates for knowledge co-development through collaboration between scientists and community partners in effective flood risk mitigation. The research approach adopted by this study can be applied to understand perceptions regarding NBS projects implemented in other coastal cities along the U.S. Gulf Coast to enhance community resilience to flooding.

Abstract #: 182

Title: **The Effect of Grid Resolution on Hydrodynamic Modeling: A Case for Coarser Resolution Grids**

Presenter: Anna Linhoss

Organization: Auburn University

Session: Coastal Issues 1

Understanding the dynamics of water surface elevation and salinity in estuaries is vital for the effective management of coastal water resources, ecology, and infrastructure. Hydrodynamic models are especially useful for simulating water in coastal systems because they explicitly represent flow in space and time and can represent the back-and-forth flow of tidal systems. An important step in hydrodynamic modeling that lacks formal guidance is determining grid resolution. Fine resolution grids provide a better representation of bathymetry and allow for the detailed simulation of hydrodynamic processes; however finer resolution grids also have increased computational requirements. In this study, we evaluate the impact of grid resolution on the accuracy of a hydrodynamic model of Biscayne Bay, Florida. Five grids with varying spatial resolutions were developed, tested, and compared. Results show a clear trend where water surface simulations improved with increasing grid resolution. On average R2 values improved by 18% between the fine and course and fine grid simulations. Surprisingly, results of modeled salinity did not improve with increasing and grid resolution. The findings suggest that factors beyond grid resolution may be at play in determining model accuracy for salinity.

Abstract #: 183 **Student**

Title: **A Probabilistic Machine Learning Framework for Daily Extreme Events Forecasting**

Presenter: Ali Sattari

Organization: The University of Alabama

Session: Poster Session

AbstractForecasting daily extreme events is crucial, particularly amidst the escalating severity of tropical storms and hurricanes in the East and Gulf coasts of the United States. The intensity of these hydrometeorological events, exacerbated by climate variability and change, has resulted in catastrophic floodings, posing significant risks to public safety and infrastructure. In response to the shortcomings associated with the deterministic rainfall-runoff models, specifically to account for uncertainties, we develop a probabilistic framework to enhance the accuracy and reliability of streamflow forecasting during extreme events. The core of our framework is a Monte Carlo-based deep learning model based on Long Short-Term Memory. The probabilistic LSTM model incorporates inputs from the Conceptual Functional Equivalent (CFE) model, enhancing the probabilistic framework with an understanding of physical hydrological processes. We employed the wavelet transform in our probabilistic framework to decompose observed discharge data, effectively breaking down the data into its constituent components to identify trends and de-noise data. The model efficacy is tested across twenty-four basins in Southeast Texas, with a particular focus on the extreme conditions during Hurricane Harvey event. The results show that the proposed model outperforms the basic LSTM model by 44%, 43%, 9%, and 22% in NSE, KGE, PCC, and RMSE, respectively. This validation demonstrates the model's robustness and applicability in real-world scenarios and underscores its potential as an effective tool for decision-makers in planning and risk management during extreme hydrological events. Keywords: Probabilistic Forecasting, CFE, Uncertainty Quantification, Extreme Event, Data Decomposition

Abstract #: 184 **Student**

Title: **Understanding different factors for the runoff control of infiltration swales along roadways**

Presenter: Yuting Ji

Organization: Auburn University

Session: Stormwater 1

Urbanization and roadway construction increase impervious surfaces and result in an increase in the amount and peak of surface runoff. Low-impact development (LID) has been introduced for stormwater management to reduce surface runoff. LID can be an effective measure to protect pre-development hydrological functions of drainage areas. The infiltration swale along Alabama roadways is one type of LID practice that functions as bio-retention cells or bioswales. These bioswales comprise three layers: surface, soil, and storage layer, each performing a distinct function in reducing stormwater runoff. The soil layer contains an engineered medium. Using the EPA's Storm Water Management Model (SWMM), we comprehensively analyzed the control parameters/factors affecting the surface runoff and infiltration rates of infiltration swales. This is because SWMM can simulate and report the depth change of surface ponding water, soil moisture content, and permeability of each layer. The findings aim to elucidate the relationship between the infiltration swale design and the control parameters, enhancing our understanding of runoff mitigation. The detailed analysis provides a comprehensive understanding of how different parameters contribute to the bioswale's ability to retain/infiltrate rainwater, thereby reducing surface runoff. These factors include such as the surface berm height, the thickness of each layer, the soil layer's porosity and hydraulic conductivity, and the seepage rate of the native soil. By systematically and rationally changing these parameters and factors in three layers, the detailed time series of the modeling variables helps us understand their effect on the overall infiltration rate. The simulation results indicate that the soil layer's hydraulic conductivity and the seepage rate of the native soil are the two most critical and important factors that control the runoff reduction of infiltration swales. This study's findings have practical implications, highlighting the effects of soil characteristics and layer parameters on the rainwater retention capacity of bioretention cells and infiltration swales along roadways.

Abstract #: 185 **Student**

Title: **Sensitivity of Flood Inundation Mapping to DEM Type, Resolution and Urban Features in the Amite River Basin**

Presenter: Reza Saleh Alipour

Organization: The University of Alabama

Session: Poster Session

Urban flooding is a prevalent natural disaster worldwide, influenced by various factors. These factors include the resolution of the Digital Elevation Model (DEM), urban characteristics, initial conditions of river systems, etc. DEMs play a crucial role in the accuracy of flood inundation modeling. Coarser-resolution DEMs may not accurately represent small-scale features, while finer-resolution DEMs can have computational complexities. Moreover, the composition of land use within urban areas, encompassing impervious surfaces such as roads and buildings, vegetation, and water bodies, significantly influences water flow during a flood event, with the height and type of buildings in urban areas further contributing to the impact on floodwater dynamics. This study employs the HEC-RAS model to generate flood inundation maps under various scenarios, including 3, 10, and 30-meter resolution of DEM, and several different elevation sources, including the Digital Terrain Model (DTM), Digital Surface Model (DSM), and Digital Building Model (DBM) within the Amite River Basin. We conduct a sensitivity analysis by performing multiple simulations across various scenarios, evaluating the results based on flood depth and flood extent. This process helps to pinpoint the critical factors influencing mapped flood inundation extent. We expect the results to enhance the understanding of flood dynamics, assist in refining flood risk assessment and mitigation strategies, and enable us to identify vulnerabilities while developing more effective flood management measures.

Abstract #: 186

Title: **Unearthing the Past: A Comprehensive Study of Natural and Anthropogenic Changes at an Archaeological Site Through Hydrogeologic Connectivity Utilizing GIS, Mehlich II Phosphorus Extractant, and pH**

Presenter: Dana Herren

Organization: Jacksonville State University

Session: GIS

This study aims to understand the complex relationship between human activities, environmental factors, and hydrogeological connections. It involves a detailed investigation of soil phosphorus and pH levels. To determine soil phosphorus levels, the Mehlich II extraction method was used, which identified phosphorus variations. Cutting-edge techniques such as GIS for analyzing and visualizing geographical data, LiDAR for high-resolution mapping, and multispectral imagery were essential to the research. GIS interpolation tools were used to generate phosphorus and pH maps. These high-resolution datasets reveal complex patterns that can be combined with other archaeological evidence, providing valuable insights for further investigation while utilizing a less invasive technique before exposing bare soils through excavation units. The research investigates how temporal changes in land cover and land uses impact soil health and water quality, as well as the significance of the site's geographic location. The Bains Gap village site is located on the west bank of Choccolocco Creek and is surrounded by mountainous terrain, dense forests, and natural springs. The Cobb family has a deep-rooted connection to the land that spans nearly a century. They have utilized the land for both agricultural and livestock purposes. This particular site carries immense historical importance, as it was inhabited by Native Americans from the Transitional Paleo-Indian period all the way through to the middle Mississippian era. Notably, the discovery of a palisaded wall and stockade trenches parallel to Choccolocco Creek strongly suggests the existence of a palisaded village at Bains Gap. Further excavations have revealed that the trenches lead to adjacent springheads on the property, adding to the historical significance of the site. This study highlights the ongoing importance of analyzing soil chemistry to identify previous human activities. However, using Mehlich II as an extractant in soil testing may lead to some uncertainty, especially in acidic soils where phosphorus could be bound to iron or aluminum. Based on my findings, the most promising area for further investigation seems to be near the north spring head, where cores 1, 4, 5, and 6 show the highest values, even with acidic soils. Additionally, low phosphorus levels near the stockades may indicate erosion from where water once flowed from the springhead through the large stockade. Additionally, I observed that excavation units correspond to changes in phosphorus levels. The cores collected near the creek also suggest that erosion may be causing phosphorus depletion. The conservation of our natural heritage is of utmost significance, and riparian vegetation zones play a crucial role in safeguarding our environment. These zones, located along waterways, offer protection against soil erosion and the loss of cultural artifacts and act as a natural filter, preventing the contamination of water bodies.

Abstract #: 187 **Student**

Title: **Stormwater Recharged: Innovating with Electrical Flocculation**

Presenter: Megan Armstrong

Organization: Auburn University

Session: Stormwater 1

Through a Small Business Innovation Research (SBIR) contract with the US DOT, Fagan Consulting LLC, in partnership with Auburn University, is developing a self-contained, portable treatment device. The device employs electrical flocculation technology to meet desired water quality goals. This innovative device, similar to electrocoagulation systems in water and wastewater treatment, harnesses electrical current to induce the formation of flocs from suspended contaminants, thereby enhancing settling and removal efficiencies. This process achieves the effectiveness of chemical flocculation without the use of chemical compounds.Further, the “electrical floc generator” operates effectively using 12 volts of power. Its design allows for versatile applications – it can be a standalone, battery-powered unit for mobility or be integrated into a fixed location with an external power source. Additionally, the scalability of the device enables it to handle larger flows and pollutant loads effectively, making it a valuable tool for stormwater management practices. This flexibility makes it an ideal solution for a variety of settings, from construction sites to post-construction environments. Significant findings from the assessment of the electrical floc generator's capabilities show its effectiveness in treating a diverse array of pollutants, encompassing total suspended solids (TSS), nutrients, heavy metals, and beyond. This finding proves the device's versatility and efficacy in addressing a broad spectrum of environmental contaminants. A comprehensive overview of electrical flocculation technology in stormwater treatment will be presented, detailing the development of a commercially viable electrical floc generator. This presentation aims to bridge the gap between innovative research and practical applications in stormwater management. It will highlight the technological advancements and explore this device's potential implications and applications for enhancing environmental sustainability and pollution control. The focus will be on explaining the general concept of electrical flocculation and its role in advancing stormwater treatment technologies.

Abstract #: 188

Title: **The Development of Watershed Plans To Guide a Sustainable Expansion of Irrigation Water Use in Alabama**

Presenter: Adam Newby

Organization: Auburn University Water Resources Center

Session: Agriculture & Irrigation

The Alabama Soil and Water Conservation Committee is the sponsor of a Watershed Protection and Flood Prevention (WFPO) Program project to protect water, land, and natural resources by assisting farmers with the development and installation of efficient irrigation systems.

Abstract #: 189 **Student**

Title: **Comparative Analysis of Flood Inundation Models for the Neuse River, North Carolina: Evaluating Accuracy Across Different Land Use/Land Cover Types.**

Presenter: Parvaneh Nikrou

Organization: The University of Alabama

Session: Poster Session

Flood inundation mapping (FIM) plays a crucial role in comprehending and mitigating the impacts of flooding in riverine environments. This study presents a comprehensive flood inundation modeling analysis for the Neuse River in North Carolina, focusing on the 2016 flood triggered by Hurricane Matthew. The assessment of flood inundation extent predictions is conducted using hydrodynamic and topography-based models, including HEC-RAS, LISFLOOD-FP, OWP HAND-FIM, TRITON and AutoRoute. To ensure accuracy, extensive calibration and validation of the hydrodynamic models are performed, utilizing various sources of Manning's Roughness coefficients. To assess the strengths and weaknesses of each model in different types of areas, an analysis is conducted using remote sensing data as a benchmark. The findings demonstrate that hydrodynamic models are capable of accurate predictions of flooding extent, with the HAND-FIM and AutoRoute models offering significantly lower computational costs, making them a promising tool for efficient flood inundation mapping.

Abstract #: 190

Title: **Realistic Irrigation Yield Effects: Insights from Variety Trials and Crop Modeling in Alabama**

Presenter: Thorsten Knappenberger

Organization: Auburn University

Session: Agriculture & Irrigation

Crop irrigation is an agricultural water management method to mitigate drought and increase crop yield. The percentage of irrigated agricultural land in Alabama is significantly lower than in neighboring states. Soils, climate, and irrigation water sources vary among the states in the Southeastern US and explain some of the variation of irrigated land between Alabama and surrounding states. Growers also hesitate to invest in irrigation systems as the expected yield and return on investment are not clear to them. Alabama generally receives enough precipitation to grow a variety of row crops. However, rainfall during the growing season is driven by local thunderstorms and droughts, which can develop quickly if rainfall does not occur frequently. This project aims to provide realistic irrigation yield effects for different row crops grown in different regions of Alabama.Auburn University evaluates crop varieties at several outlying units across the state. Some of these variety trials are grown under irrigation as well. For the past ten years, we evaluated rainfed and irrigated variety trials of corn, cotton, and peanuts grown at the Tennessee Valley, Sand Mountain, EV Smith, Prattville, Gulf Coast, and Wiregrass Research and Extension Centers. The Alabama Cooperative Extension Service has estimated irrigation costs at $170-$210 per acre. The median irrigation income increase for corn was 134 $/ac in Prattville, 94 $/ac in the Tennessee Valley, 26 $/ac at Gulf Coast, and −83 $/ac in the Blackbelt.Additionally, we used the DSSAT crop model with 35 years of weather data to simulate irrigation yield effects for corn, soybeans, peanut, cotton, and wheat grown at a location in Limestone and Houston counties. This data complements the variety trial data and captures more climate variability by including 35 years of weather.The 35-year average simulated irrigation yield effect of corn was 15.4 and 14.9 bu/ac in Houston and Limestone Counties, respectively, leading to an income increase of about $45/ac, significantly lower than the estimated irrigation costs ($170-$210/ac). For soybeans, the 35-year average irrigation yield effect was 21.7 and 20.7 bu/ac in Houston and Limestone Counties, respectively, leading to an income increase of about $200/ac, which would break even with the estimated irrigation costs ($170-$210/ac). More variety trials and modeled irrigation yield effects data will be presented together with an approach to model crop yield on a ~4 km grid (gridMET data), emphasizing extracting the right soil resources for a 16 km^2 area based on SSURGO data.

Abstract #: 191

Title: **Maturation, Complementarity, and Compounding in the Water Use Body of Knowledge: National and Local interplay in Models, Data, and Expertise**

Presenter: Vincent White

Organization: U.S. Geological Survey

Session: Modeling & Water Mgmt. 3

This presentation will trace the evolution of the United States Geological Survey's (USGS) approach to quantifying water use from state-based, county-level, 5-year estimates to nationally consistent models by water-use sector. Models are in construction for the livestock, aquaculture, mining, and self-supplied domestic water-use sectors and have been completed for agricultural irrigation, public supply, and thermoelectric power use sectors. Adjacent to these national models are smaller regional models and water use data modernization efforts which seek to compile reported, site-specific water use data to make water use data more available to USGS models and the general public. These efforts are greatly improving the USGS capacity to serve water use data to the nation and reflects an expansion in focus on the water use component of the water budget that has emerged in broader scientific and management communities in the last decade. It also is a result of recommendations from the National Academy of Sciences (NAS) to develop robust water accounting systems with analysis of uncertainty and distinctions between consumptive and non-consumptive use. Additionally, the NAS has recommended that USGS collaborate with other agencies and relevant organizations in the categorization and standardization of formats for water use. As these data and models are deployed across the United States, unique opportunities emerge for leveraging these national efforts to benefit smaller study areas such as counties, regions, states, watersheds, etc. Federal and non-federal agencies, non-profit organizations, academia, private entities, and other stakeholders are encouraged to take advantage of these federally funded initiatives to the benefit of these smaller study areas. This presentation will be application focused with links to products and datasets which may benefit the attendees of the Alabama Water Resources Conference. Because these are primarily nationally focused and developed models, more locally focused professionals and stakeholders have an opportunity to bring their unique knowledge sets, methods, and perspectives to bear in a manner which may improve the national approach or develop hybridized approaches which marry the national models and datasets with the more localized methods and data.

Abstract #: 192

Title: **Systematic Evaluation of Flood Inundation Area with NOAA OWP HAND FIM**

Presenter: Dipsikha Devi

Organization: The University of Alabama

Session: Poster Session

Flood risk assessment has gained significance due to the rapid increase in the frequency of flood events. Accurate flood risk assessment requires reliable flood inundation mapping. Various methodologies can be employed to generate flood inundation maps, including physics-based models, data-driven models, terrain models, and remote sensing applications. Uncertainties in flood inundation models largely depend on the type of input datasets, topography, etc. This study demonstrates the effectiveness of NOAA's Height Above Nearest Distance (HAND), a low-fidelity terrain model. The framework uses the NHD_Plus V2.1 Medium resolution (MR) reach averaged channel hydrofabrics in conjunction with Manning's equation to create the binary inundation raster by translating the NWM retrospective streamflow information to stage through synthetic rating curves (SRC). In this work, we performed the landuse analysis of the flood inundation models, including HAND (with SRC adjustment) and HAND (without SRC adjustment). We developed for Hurricane Matthew, which occurred on October 10, 2016, on the Neuse River in North Carolina. For the LULC, Sentinel 2 of 10 m resolution was utilized in the analysis. The LULC maps were extracted from the flood maps generated by each model. A comparative analysis of the HAND FIM with SRC adjustment reveals the significant rate of change of landcover with an increase of 11.78% in built-up areas followed by a decrease of 9.6% in forest cover. This investigation also highlights the adjustment of SRC in HAND FIM and its impact on landuse and flood extent.Keywords: Flood inundation mapping, HAND, landuse landcover, HEC RAS, Sentinel 2

Abstract #: 193 **Student**

Title: **Bankfull and Mean-flow Channel Geometry Estimation through a Hybrid Multi-Regression and Machine Learning Algorithms across the CONtiguous United States (CONUS)**

Presenter: Reihaneh Zarrabi

Organization: The University of Alabama

Session: Poster Session

Widely adopted models for estimating channel geometry attributes rely on simplistic power-law (hydraulic geometry) equations. This study presents a new generation of channel geometry models based on a hybrid approach combining traditional statistical methods (Multi-Linear Regression (MLR)) and advanced tree-based Machine Learning (ML) algorithms (Random Forest Regression (RFR) and eXtreme Gradient Boosting Regression (XGBR)), utilizing novel datasets. To achieve this, a new preprocessing method was applied to refine an extensive observational dataset, namely the HYDRoacoustic dataset supporting Surface Water Oceanographic Topography (HYDRoSWOT). This process improved data quality and identified observations representing bankfull and mean-flow conditions. A compiled dataset, combining the preprocessed dataset with datasets containing additional catchment attributes like the National Hydrography Dataset Plus (NHDplusv2.1), was then used to train a suite of models to predict channel width and depth under bankfull and mean-flow conditions. The analysis shows that tree-based ML algorithms outperform traditional statistical methods in accuracy and handling the data but face limitations in prediction capabilities for streams with characteristics outside the training range. Consequently, a hybrid method was selected, combining XGBR for streams within the dataset range and MLR for those outside it. Two tiers of models were developed for each attribute using discharges derived from distinct sources (HYDRoSWOT and NHDPlusV2.1, respectively), where the second tier of models offers applicability across approximately 2.6 million streams within NHDplusv2.1. Comprehensive independent evaluations are conducted to assess the capability of the developed models in providing stream/reach-averaged (rather than at-a-station) predictions for locations outside the training and testing datasets.

Abstract #: 194 **Student**

Title: **A Novel Neural Network-Based Algorithm for Selecting the Most Accurate FIM Model for Desired Area**

Presenter: Sadra Seyvani

Organization: The University of Alabama

Session: Poster Session

The accuracy of flood mapping using hydrodynamic and topography-based models varies depending on the topographical and geomorphological conditions. The variations in topographical and geomorphological parameters in different regions lead to discrepancies in the accuracy of hydrodynamic and topography-based models. Hence, it is crucial to compare the outputs of various hydrodynamic and topography-based models with benchmark data to ensure precise flood mapping and select the most suitable model for a specific area. However, this approach faces two challenges:•Running all hydrodynamic and topography-based models and comparing them with benchmark data is computationally intensive and time-consuming.•Benchmark data may be unavailable for certain periods and areas, complicating the comparison process.In this study, we introduce an innovative approach leveraging deep learning to determine the most accurate hydrodynamic or topography-based model based solely on the topographical and geomorphological characteristics of a desired region. Using the neural network developed in this research, the agreement percentage between HEC-RAS, LISTFLOOD-FP, and the HAND models with remote sensing benchmark data can be estimated with a low time and memory complexity and it enables selecting the most accurate model without having models' results or benchmark data, relying only on DEM, NDVI, slope, aspect, curvature, permanent water bodies, flowlines, land cover, and soil type data.This neural network utilizes a multi-layer perceptron architecture and is trained with the flood of October 2016 data in North Carolina state.

Abstract #: 195 **Student**

Title: **Potentiality of Biochar Entrained Porous Concrete to Improve Pollutant Removal from Stormwater**

Presenter: Rodela Tasnim

Organization: Auburn University

Session: Poster Session

Stormwater runoff is a major environmental hazard because it enters aquatic habitats and introduces contaminants including nutrients, heavy metals, and organic compounds, which degrades water quality and damages ecosystems. This study investigates how biochar-entrained porous concrete may be used as a novel way to improve the removal of pollutants from stormwater runoff. A filtering media that can both physically and chemically capture pollutants was created by integrating biochar, which is well-known for its large surface area and adsorption powers, into porous concrete. Biochar was collected from Biosystems Engineering Research Laboratory, its characteristics were characterized, and different percentage of biochar as the replacement of cement were mixed with concrete. Tests on the biochar-entrained porous concrete samples' permeability, structural stability, and efficacy in removing pollutants were conducted. The results showed that adding biochar considerably improved the concrete's capacity to extract nutrients and heavy metals from rainwater while preserving its high infiltration rates and mechanical strength. Since different forms of biochar have distinct capacity for removing pollutants, future study should explore how the features of biochar vary depending on its chemical properties. Furthermore, experimenting with various replacement percentages of biochar in concrete may provide information on how well it removes pollutants. The results of this study highlight the potential of biochar-entrained porous concrete as a viable and efficient stormwater management technique; more research is advised for thorough analyses and optimization.Keywords: Stormwater, heavy metals, organic compounds, biochar, porous concrete

Abstract #: 196

Title: **The Puzzle of Irrigation Water Management: Evaluating and demonstrating to Alabama farmers technologies that will increase water use efficiency.**

Presenter: Brenda Ortiz

Organization: Auburn University

Session: Modeling & Water Mgmt. 1

Irrigation is currently being considered by many farmers as a crop yield risk mitigation strategy. However, the use of technology-based Irrigation Best Management Practices (BMPs) could contribute to strengthening productivity and environmental sustainability. Irrigation BMPs such as sensor-based (soil and crop), irrigation scheduling, deficit irrigation, and variable rate irrigation (VRI) are currently being evaluated and demonstrated to farmers and consultants across Alabama. Studies are being conducted at Auburn University experiment stations and farmers' fields located in south, central, and north Alabama (AL). This presentation will highlight and provide results of the use of soil sensors and canopy temperature (infrared thermal sensors, drone, and satellite-based imagery) to determine when and how much to irrigate, use of satellite-based imagery to assess crop evapotranspiration differences within crop fields which can be used for the application of variable rate irrigation. Crop growth simulation modeling and on-farm experimentation are also being used to evaluate the impact of deficit irrigation, therefore preliminary results of those studies will be presented. Because research is not complete without appropriate strategies for farmers' engagement, knowledge sharing, and skills development, results of innovative extension strategies to promote best irrigation management practices will be shared.

Abstract #: 197 **Student**

Title: **Evaluating the use of the ECOSSTRESS NASA product for estimation of within-field Crop Evapotranspiration variability on Alabama Fields**

Presenter: Lorena Rodriguez

Organization: Auburn University

Session: Lightning Talk - Research 2

Increasing resilience in agriculture will require not only the adoption of new agronomic practices but also the use of technology to precisely manage natural resources and adjust crop management to minimize the risk of adverse weather-related conditions. Although the adoption of irrigation is increasing in Alabama, the use of technology to assess daily crop evapotranspiration (ET) will increase water use efficiency (WUE) and therefore increase crop yields. New satellite-based products to assess ET could increase WUE and also favor the adoption of technologies such as variable rate irrigation (VRI). This study focuses on the evaluation of improved ECOSSTRESS ET products on various farmers' fields located in South and Central Alabama. The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) mission of NASA allows the assessment of canopy temperature and therefore, assessment of crop water use and how plants respond to stress. Recently published studies have improved the 30-meter daily ECOSTRESS ET product using weather data from Eddy Covariance towers across the USA and machine learning algorithms. This improved product will be evaluated on peanut and soybean fields which have been instrumented with soil sensors. Data of leaf area index, crop biomass, daily volumetric water content, and stomatal conductance will be collected at multiple locations within these fields and used in the evaluation of the ECOSTRESS ET. We expect to establish the methodology for evaluation of this product on farmers' fields of Alabama and to identify the potential for this product for irrigation water management.

Abstract #: 198 **Student**

Title: **Evaluation of the Canopy Water Stress Index as a Tool for Irrigation scheduling on Peanut fields in Alabama**

Presenter: Bram Parbi

Organization: Auburn University

Session: Lightning Talk - Research 1

In precision agriculture, precise monitoring of crop water stress is crucial for optimizing water use, increasing crop yield, and promoting environmental sustainability. Achieving high water use efficiency in peanut production is key to producing high-quality crop. This study investigates the efficiency of infrared thermal sensors for estimation of the crop water stress index (CWSI) in a peanut irrigation study. Furthermore, this research explores the use of the CWSI as a decision tool for timing irrigation. A peanut farm in Geneva county Alabama was used as the site for this study. The evaluation of the CSWI will be done on a deficit irrigation study which included three treatments: a control treatment that represents non-limiting water 100%, and two levels of deficit irrigation (66% and 33% deficit from plant available water). These three irrigation levels were implemented using a center pivot irrigation system with capabilities of variable rate speed control and the treatments were replicated three times. On each treatment/replication, ground-based infrared temperature sensors were installed and data collected in real time was used for CWSI estimation. Volumetric water content sensors were installed on each irrigation treatment/replication and the data was used to schedule irrigation and determine the different depletion levels. To determine variations in crop temperatures that indicated water stress levels, thermal data were collected at regular intervals throughout the irrigation period. Ground truthing was done through the measurement of soil moisture and crop physiological parameters, especially stomatal conductance and chlorophyll content. We expect that the results of the study show the sensitivity of the CWSI to various irrigation levels and its feasibility as an irrigation scheduling tool.

Abstract #: 199 **Student**

Title: **Evaluating the impact of growth-stage-based deficit irrigation on corn using crop growth simulation modeling**

Presenter: Jhoan Velasco

Organization: Auburn University

Session: Lightning Talk - Research 1

In Alabama, as in many regions of the southeastern states, flash droughts and rising temperatures present significant challenges to the sustainability of agricultural systems. Specifically maize, a crop with a high water demand, faces production risks due to these adverse conditions. The study explores the optimum irrigation scheduling strategies on maize (Zea mays L.) in the reproductive growth stages through the evaluation of the impact of three irrigation treatments, defined by Maximum Allowed Depletion (MAD) thresholds (30%, 50%, 70%), where yield, total biomass, and water productivity were evaluated. This evaluation was run for 20 years (2000–2020) using the Decision Support System for Agrotechnology Transfer (DSSAT) seasonal analysis tool. The CERES-Maize model included in the DSSAT system was calibrated and validated using extensive crop and soil moisture data collected from a 16.3 hectares maize field in Samson, Alabama. Model calibration utilized data from the 2019 and 2022 growing seasons collected on two different soil types, sandy clay loam soil – management zone 1; and sandy soil -management zone 4. Model evaluation was conducted using data from the 2018 season. The field was planted with the Dyna-Gro 57VP51 corn hybrid selected for its regional suitability and growth characteristics. A sub-routine in DSSAT that allows establishing specific treatments by growth stage was used to evaluate the impact of the three different deficit irrigation levels from the start of the reproductive period until physiological maturity, and the simulations were run on the two management zones (MZ). Results indicated that as the level of water deficit increased, the corn yield and biomass decreased and this impact was exacerbated in dry years. Management zone 1 showed a higher water use efficiency as compared to management zone 4. The results from this study showed that the CERES- Maize model in DSSAT, particularly the routine where users can impose treatment by growth stage, is a promising irrigation research and extension tool. Concepts developed in the present study can be adapted to effectively manage irrigation scheduling during the maize reproductive period in sandy and sandy clay loam soils of South Alabama.

Abstract #: 200

Title: **Retelling the Story of Moores Mill Creek**

Presenter: Laura Cooley

Organization: Auburn University Water Resources Center

Session: Lightning Talk - Outreach

The past fifty years have seen unprecedented change and development in many urban areas. The increased stormwater volume entering rivers and streams has subsequently posed various stormwater and non-point source pollutant challenges and has led to the degradation of various surface waters across the United States. Many in urban areas now ask: Where should we begin in addressing the improvements needed in our waterways today? The Moores Mill Creek Watershed Project is watershed improvement effort led by The Auburn University Water Resources Center and the Auburn University (AU) Department of Civil Engineering. Project partners are working with the City of Auburn, the City of Opelika and various local and regional partners in the Auburn-Opelika area to make improvements in land use around a local urban stream, Moores Mill Creek, that could ultimately help improve water quality. The project, which started in late 2023, is funded in part by a Clean Water Act 319(h) grant from the Alabama Department of Environmental Management Nonpoint Source Unit. The Auburn University Department of Civil and Environmental Engineering team is also developing a Storm Water Management Model (SWMM) using water data from the watershed to predict how changes to land use in the future will impact stormwater's flow and volume. The SWMM can then help predict which stormwater best management practices can work well, and where to place them to have the most impact. The model will help guide where future water quality funding can be best used. In addition to updating the original 2008 watershed plan, the AU team and the Friends of Moores Mill Creek (a group of local stakeholders) will conduct education and outreach initiatives to engage the community in understanding the local waterways and learning how to prevent pollution. This project structure can serve as an example for other small watersheds wishing to socially organize around water quality improvement and long term planning.

Abstract #: 201 **Student**

Title: **Evaluating The Effects of Groundwater on Water Quality Modeling in the Moore's Mill Creek Watershed Using PCSWMM**

Presenter: Michael Bragg

Organization: Auburn University

Session: Lightning Talk - Research 1

Water quality models can provide useful predictions about the flow of pollutants through a watershed. They can help develop plans and control methods for mitigating those pollutants entering the environment. Total suspended solids (TSS) are one such pollutant that can adversely affect the health of waterways. The Moore's Mill Creek (MMC) Watershed, located in Lee County in east Alabama, has experienced rapid development since the previous watershed management plan in 2008. This has caused a large amount of sediment to wash off into MMC, and thus it has been classified as an impaired stream under section 303(d) of the Clean Water Act. An ongoing project updating the watershed management plan is built on previous research for the upper reaches of MMC which was calibrated using PCSWMM. The model was improved to include parameters for groundwater-surface water interactions assuming a uniform SWMM aquifer object to improve the description of hydrograph's recession. It has since been expanded to include the entirety of the MMC watershed for the purposes of modeling water quality. Data was collected at several points along the creek for water depth and rainfall. Parameters for groundwater were calibrated to best fit the hydrograph recession curves. A comparison will be drawn between two versions of the model that do and do not account for groundwater interactions. It will be determined how significant groundwater interactions are to SWMM predictions of surface water quality over an area larger than previous research. Additional data will be collected pertaining to stream velocity, flow rate, and turbidity to continue calibrating the full watershed model representation of surface water flow hydrographs and TSS pollutographs.