Abstract #: 003

Title: **Water Policy and Law in the “Anthropocene”: Changing With the Times**

Author(s): Bennett Bearden & Gregory Guthrie

Presenter: Bennett Bearden

Organization: Geological Survey of Alabama

Session: Water Law & Policy

Human activities in the “Anthropocene,” the so-called “age of man,” now substantially impact the entire planet, especially the water cycle, and subsequently, its water resources. While climate change has attracted the most legal, political, and public attention, water policy and law are now beginning to shift that focus. For example, human activities have caused fundamental changes in the composition of water pollutants (nonpoint source pollution (NPS) and perfluoroalkyl and polyfluoroalkyl substances (PFAS)), as well as adding to the problem of ocean acidification. Legal regimes and political systems will need to change in order to adapt to or mitigate these impacts. Water law and policy will not be exempt from these changes. Current issues in the water resources spectrum that portend adjustments in water policy and law include water use by artificial intelligence data centers, reservation of groundwater rights, climate change and its impact on water supply, drought, and flooding, ecosystem management and species retention, sea level rise, melting glaciers, transboundary water conflict, nonpoint source pollution, WOTUS, and PFAS, just to name a few. As the consequences of impairments to the natural water cycle affect the Nation and states, many adaptation or mitigation responses may require restricting or reallocating property rights, including water rights. In many ways, one of the central challenges for water law and policy in the next 100 years will be how to manage the many continuing, as well as any new and unforeseen, stresses. While the focus in the past has been primarily on legal doctrinal changes, it is likely that our future response to these pressures will ultimately be a political one. Doing nothing will increasingly not be an option as water policy and law that we currently depend on shifts in response to our actions.

Abstract #: 004

Title: **: Has No Dam Purpose! Making the Case for Ecological Restoration**

Author(s): Steve Newton

Presenter: Steve Newton

Organization: TTL, Inc.

Session: Restoration 2

Alabama remains the only state in the U.S. without a comprehensive, state-enabled Dam Safety Program, but progress is being made. It has been generally believed that Alabama has around 2,300 dams that meet the regulatory definition of dams but recent studies indicate that that number may actually exceed 5,000. Dams provide us with many useful benefits such as water storage for irrigation, municipal water supplies, and industrial use. However, dams can also impact river ecosystems by reducing or preventing fish passage, altering natural stream flows, trapping sediment (clay, silt, sand, and gravel), downstream changes to water temperature, downstream channel degradation, and upstream channel sedimentation. The current framework of the Alabama Dam Safety Program provides for the inspections of dams at least once every 4 years. With the increased emphasis on dam inspections, it will be obvious that dam improvements are needed to withstand natural hazards and need to be maintained to ensure safe operating conditions that avoid risks to downstream catastrophic flooding. Some common dam safety improvements that may be needed to manage liabilities for neglected dams are:- Implementation of Emergency Action Plans for high and significant hazard potential dams- Increase in emergency spillway discharge capacity to protect the embankment- Replace inlet and outlet structures, gates, and valves- Increase stability of concrete and masonry dams- Control seepage and piping potential in embankment dams- Improve erosion control in embankment damsDams that were historically used for water supply, irrigation, industrial operations, etc. may no longer be needed but the liability and costs related to owning the dams still exists. This presentation will summarize the benefits of removing dams including providing ecological restoration of the affected streams, creeks or rivers. Project formulation and funding strategies will be discussed.

Abstract #: 005

Title: **Paleohydrologic analyses reveals insights into longterm hydrologic volatility inthe French Broad River**

Author(s): Lisa Davis, Ray Lombardi, Glenn Tootle & Matthew Gage

Presenter: Lisa Davis

Organization: The University of Alabama

Session: Water Security & Risk

Longterm observations of large floods and droughts, especially within the sameriver basin, are limited, and this complicates understanding hydrologic volatility.Significant departures from typical flow conditions (hydrologic volatility) canendanger human lives, disrupt water supplies, and cause agricultural andbiodiversity losses. This study uses paleohydrologic methods to examine long-term changes in summer hydrologic drought and extreme floods in the FrenchBroad River (eastern Tennessee). We analyzed sediment from floodplains andreconstructed 24 major floods that occurred between 1732 C.E. to 2005 C.E. andcombined these data with USGS gage data that included the Hurricane Heleneflood. We identified drought periods by combining annual (1700-1920 C.E.),summer, low flow data reconstructed from tree rings (International Tree-RingData Bank) and monthly USGS gage data (1921-2020 C.E.). We determined annualexceedance probabilities (AEP) and recurrence intervals (RI) for both floods andlow flows using distribution fitting and Bayesian modelling software (USACE/RMC-BestFit). We compared the temporal variability of extreme floods and summerlow flows to observed and reconstructed El Niño Southern Oscillation and NorthAtlantic Oscillation teleconnection datasets.The biggest flood in the ~300-year record happened in 1791 (0.0025 AEP or ~400-yr RI), surpassing the 2024 Hurricane Helene flood (0.02 AEP or 50-yr RI). Extremefloods often coincided with landfalling hurricanes, however, and during timeswhen strong El Niño and negative North Atlantic Oscillation teleconnections cooccurred in the region. Since 1700, there have been 29 droughts, with longerdroughts before 1910. The worst low-flow season occurred in 1988, and droughtsafter 1910 were twice as severe as before. This period was characterized bydecades of positive North Atlantic Oscillation and less frequent strong El Niño.Over the entire record (~300 years) neither drought or large floods exhibited lonterm persistence, but specific decades did exhibit greater volatility or short-termpersistence of large floods or drought. These findings suggest the existence ofhydrologic volatility since the 1700s in the study region and that changes involatility occurs at decadal timescales driven by decadal-scale meteo-climatogicalprocesses (hurricanes and teleconnection interactions) that amplify the severityof floods and droughts.

Abstract #: 007

Title: **ARSNiC and InBOLD: Addressing Longitudinal Connectivity for Habitat and Humanity**

Author(s): Daniel West

Presenter: Daniel West

Organization: The University of Alabama

Session: Lightning Talk - Outreach & Extension

With over 132,000 miles of rivers and ranking first in the U.S. for multiple aquatic species, Alabama is undoubtedly a river state and an aquatic biodiversity hotspot. Longitudinal connectivity of these streams is necessary for the proper hydrological function of aquatic systems. However, watersheds are at risk due to anthropogenic alterations to longitudinal connectivity, primarily through malfunctioning stream-road crossings, low-head dams, or other in-stream barriers, which can have dire consequences to the hydrological landscape and surrounding communities. Impacts from these hydrological alterations can obstruct connectivity, thereby fragmenting habitat and cutting off spawning grounds needed for successful reproduction and adequate gene flow, as well as restricting aquatic organism movements during critical time periods. Erosion and deposition related to stream-road crossings, especially during high flow events, can degrade habitats through scouring, bank destabilization, and burying of primary habitats under excessive sediment. Other impacts include risks to transportation infrastructure from structure failure and collapsing roadways as well as increases in the frequency of flash flooding, either of which can leave communities isolated, disrupt daily lives, block main throughways for emergency services, and lead to increased costs for repair and/or replacement. To confront these issues, which will be exacerbated by climate change, the Alabama Rivers and Streams Network including Connectivity (ARSNiC) initiative was created to identify, assess, evaluate, and prioritize longitudinal connectivity projects on a statewide scale. ARSNiC is a multi-agency partnership performing assessments using multiple compounding methodologies ranging from evaluating sediment risk input from roadways, to assessing the structural influence on fluvial geomorphic responses, to identifying the ecological and social benefits of restoring longitudinal connectivity of streams. The success of ARSNiC in assisting restoration efforts through identifying and prioritizing crossing structure replacements, along with improving transportation corridors, has introduced interest in using a similar method to assess restoration feasibility of in-stream barriers and other low-head dams through the development of the InBOLD initiative. This initiative is designed to corroborate the National Inventory of Dams for Alabama and evaluate the feasibility of potential efforts for the betterment of surrounding communities. This new approach to longitudinal connectivity through ARSNiC and InBOLD provides potential opportunities for improving watershed connectivity and habitat availability for aquatic organisms, strengthening transportation infrastructure, and adding to the social feasibility through a statewide diverse partnership working for Alabama’s greatest resources – its waterways, and its citizens.

Abstract #: 008

Title: **Using Anthropogenic Biomarkers in Sediments to Assess Fossil Fuel and Fecal Pollution in Urban Estuaries**

Author(s): Yuehan Lu, Guoqiang Duan, Man Lu, Stephen Jones & Rona Donahoe

Presenter: Yuehan Lu

Organization: The University of Alabama

Session: Lightning Talk - Research 2

Anthropogenic biomarkers in estuarine sediments provide valuable insights into the sources and extent of human impacts on estuarine ecosystems. This study investigates the sources and spatial distributions of fossil fuel and fecal biomarkers (sterols) in surface sediments collected from Mobile Bay and adjoining eastern Mississippi Sound (MS), a vital ecosystem on the northern Gulf of Mexico. Fossil fuel biomarkers included αβ-hopanes (below quantification limit (BQL)–7.96 μg/g), C27+28+29 regular steranes (BQL–1.51 μg/g) and 16 PAHs (BQL–23.37 μg/g). Hopane and sterane concentrations were comparable to or exceeded those in other economically developed estuaries worldwide. Source diagnostic ratios and statistical analyses indicated that hopanes and steranes in southern Mobile Bay (SMB) and MS originated from offshore drilling platforms and oil spills, while those in NMB were mainly from onshore sources. All SMB and MS sites showed PAH concentrations below ecological risk thresholds Unlike PAHs in NMB primarily originating from coal combustion, PAHs in SMB and MS were mainly derived from liquid fossil fuel combustion. Fecal sterols (BQL to 0.52 μg/g) primarily originated from animal waste, with most sites showing low fecal contamination, except for two SMB sites with high human fecal contamination. Sediment absorptions and proximity to sources were primary factors controlling the spatial variations of anthropogenic OM. High fossil fuel biomarkers and fecal sterols concentrations in the southern part of Mobile Bay likely resulted from longer water residence times, promoting fine-grained sediment depositions and OM accumulation, while elevated PAHs concentrations in the NMB were probably influenced by proximity to the urban and industrial sources along the shore.

Abstract #: 010

Title: **Alabama Floodplain Assessment Project: An Assessment of Flood Risk at State-Owned Properties**

Author(s): Carl Ferraro

Presenter: Carl Ferraro

Organization: Stantec Consulting Services Inc.

Session: Coastal Issues 1

In accordance Executive Order No. 737, issued by Governor Kay Ivey on October 13, 2023, which requires that all existing state-owned properties be assessed to ensure compliance with the National Flood Insurance Program flood plain management criteria, the Alabama Department of Insurance (ADOI) has initiated the Alabama Floodplain Assessment Project. The goal of the Project is to determine the number and location of state-owned properties that contain structures (as defined in 44 C.F.R. § 59.1) that are located within a flood-prone areas, and then conduct an assessment and inspection of those structure to document compliance with the National Flood Insurance Program floodplain management criteria for flood-prone areas, for mudslide-prone areas, and for flood-related erosion-prone areas. ADOI has been retained Stantec to assist in implementation of the Project.During the initial phased of the Project, Stantec conducted a GIS-based analysis of all state-owned properties to determine which state-owned properties contain areas designated as floodplains, and which, if any, of the structures located on those properties are within the designated floodplain. The next phase consisted of Pilot Field Assessments of six (6) state-owned sites in Mobile and Baldwin Counties that contained structures within the floodplain. This was followed by Site Assessments at state-owned properties across the state.This presentation will summarize the project goals, our approach and methodology for each phase and a summary of project results to date. Next steps will also be highlighted.

Abstract #: 013

Title: **Extreme Makeover: Flood Risk**

Author(s): Jeff Zanotti

Presenter: Jeff Zanotti

Organization: WSP

Session: GIS

How FEMA conveys flood risk, and its digital flood insurance rate map regulatory products, is changing. While paper maps and their digital copies will still be available, they are being de-emphasized in favor of database driven products. The future of flooding risk information will be found as databases able to be displayed on viewers and dashboards. The rise of GIS savvy community officials and the need for on-the-fly data has helped bring a much-needed update to how FEMA approaches the communication of flood risk. There will surely be growing pains to the new changes, but a change was needed from some of the antiquated methods for public distribution of flood risk maps and products. There are pros and cons to this much needed transition. These policies have already been implemented within FEMA, but few Alabama communities have yet to be affected so far. This presentation will dive into what is changing, why it is changing, and when to expect these changes to impact stakeholders. We will go over how the maps themselves will change in appearance. We will discuss the database and how it is taking the central focus of the products now. The difference in review process will also be explained and how this new database driven mindset has improved the overall product. A side-by-side comparison will be made between the old standards and the new standards. We will also roll out the current projects in Alabama that are adhering to this new product specification.

Abstract #: 014

Title: **Fish sludge to energy, feed, and fertilizer**

Author(s): Qichen Wang, Al Dean Francisco, Caroline Morris & Brendan Higgins

Presenter: Qichen Wang

Organization: Auburn University

Session: Water Quality 1

Energy demand and environmental impacts in sludge disposal are NOT negligible in a closed aquacultural production system such as recirculating aquaculture systems (RAS) and biofloc systems. The sludge, which consists with undigested feed, fish feces, fish metabolites and tissues, and algae/bacteria, are rich in organics, nitrogen, and a variety of minerals. Direct discharge of fish sludge raises huge environmental concerns in both water and air pollutions. The objectives of this study are to show a promising approach to reclaim waste fish sludge back into renewable energy, animal feed, and hydroponics fertilizer solution via anaerobic digestion, aerobic detoxification, and phytoremediation. High quality biogas (70% methane and 30% carbon dioxide) and high nutrient containing digestion effluent were produced from the pilot scale fish sludge digesters. Digestion effluent (digestate) which averages more than 1.5 g L-1 of ammonium, are considered too toxic for direct fertilizing crops. Therefore, aerobic detoxification and phytoremediation was used to: 1. Produce algal biomass that can be used for fish feed; 2. Convert the toxic nutrients in the digestate to be more crop available.

Abstract #: 015 **Student**

Title: **Optimizing Microplastic Removal Using Carbon-Based Technology**

Author(s): Jianqiao Song

Presenter: Jianqiao Song

Organization: University of South Alabama

Session: Student Poster

Plastic pollution is a global issue that significantly impacts the environment and human health. According to a report by the PEW Charitable Trusts, around 11 million tons of plastic enter the oceans annually. These particles pose a threat to human health as they are ingested by marine life, move up the food chain, and ultimately re-enter the human body. While much of the water is treated at sewage treatment plants before being released into rivers and oceans, these plants are ineffective at removing microplastics. The objective of this project is to optimize MPs removal using carbon-based materials such as biochar and activated carbon. These materials are environmentally friendly, sourced from renewable resources, and stable in water, making them safe for use without introducing additional pollutants. Biochar and activated carbon are effective for adsorbing microplastics due to their high surface area and porous structure, which allows them to trap microplastic particles. Their surface chemistry, including various functional groups, enables strong interactions with different types of microplastics. This study compared four different materials: 1) sand (which served as a control), 2) raw biochar, 3) coconut fiber, and 4) iron-modified biochar (Fe-Biochar). Approximately one gram of adsorbent material was exposed to a solution containing 0.2 and 0.02 μm sized labeled polystyrene MPs at a concentration of 1 mg/L. Periodic samples were collected and analyzed for MP concentration using a fluorescence spectrophotometer. The results indicated that the Fe-Biochar had the best performance, with a MP removal efficiency of 99.99% within six hours. Biochar and coco fiber had an adsorption efficiency of 56% and 44%, respectively, in 24 hours, with sand showing only 29% removal efficiency after 72 hours. The results show that the negatively charged MP particles are highly attracted to Fe-Biochar media, leading to high removal.

Abstract #: 016

Title: **Structural Control of Groundwater/Surface Water Interactions and Imperiled Species Habitats, Alabama Foreland Fold and Thrust Belt**

Author(s): Gregory Guthrie, Nathaniel Sturm, Rebecca Bearden, Christopher Haynes & Tyler Poe

Presenter: Gregory Guthrie

Organization: Geological Survey of Alabama

Session: Aquatic Ecology

The Cahaba River is a free-flowing stream with headwaters in the foreland fold-thrust belt, terminating in the overlying East Gulf Coastal Plain. The Cahaba River basin, one of the most biodiverse watersheds in the United States, harbors many species of imperiled fishes, mussels, and snails. Two snail species endemic to springs in the basin, the Cockle Elimia (Elimia cochliaris) and the Princess Elimia (Elimia bellacrenata), are under review for listing under the Endangered Species Act. Groundwater/surface water interactions in springs provide a stable habitat for species that exhibit a narrow range of thermal tolerance. Springs in the basin are localized in the fold-thrust belt where Lower Cambrian through Pennsylvanian sedimentary rocks in the Helena thrust sheet structurally overlie Pennsylvanian sedimentary rocks in the southwest-plunging Cahaba synclinorium. Few springs occur in Upper Cretaceous clastic rocks of the coastal plain. Field studies revealed that springs in the Helena thrust sheet occur primarily in carbonate rocks along the trace of the Helena fault. The rocks are highly brecciated, promoting increased groundwater flow and karst development, resulting in numerous losing and gaining stream reaches. Springs in the coastal plain occur in areas overlying the subsurface trace of the Helena fault, suggesting that they may issue from fractured karstic rocks in the underlying thrust sheet. Springs in the footwall of the Helena thrust sheet are found along the axial trace of the Cahaba synclinorium that displays a well-developed orthogonal joint set with fractures oriented northeast to southwest, parallel to the axial trace, and northwest to southeast. Groundwater flow maps developed in the northern part of the basin reveal predominantly northeast- to southwest-directed flows parallel to structural strike. Clastic rocks in the synclinorium are not susceptible to karst development; however, springs are developed in areas of groundwater upwellings with high fracture concentrations in the keel of the structure. While the Cockle Elimia and Princess Elimia are currently only known from springs in carbonate rocks along the trace of the Helena fault, identification of additional spring habitats controlled by structural features may reveal new populations or areas suitable for species reintroduction.

Abstract #: 017

Title: **Geoscience Impacts on State Water Policy in Alabama**

Author(s): Gregory Guthrie & Bennett Bearden

Presenter: Gregory Guthrie

Organization: Geological Survey of Alabama

Session: Water Law & Policy

Now more than ever, geoscience topics are appearing in the national news. Critical minerals and their impact on national security and policy, high groundwater levels that influenced the historic flooding in North Carolina following heavy rains from Hurricane Helene, or conversely, depleted groundwater levels impacting water availability across the Midwest and Western states have all been center stage across the national news cycles. All of these reflect a reactive response to potential crises eventually addressed through development of local and national policies and legislation based in part on knowledge gleaned from geologic studies. In Alabama, drought has been a driving force for water policy issues. In 2012, following an extensive drought period from 2010 through 2012, the Alabama Water Agencies Working Group (AWAWG) was formed by the Governor's office with the goal of developing a statewide water management plan. Five state agencies, the Geological Survey of Alabama (GSA), the Department of Environmental Management, the Office of Water Resources (OWR), the Department of Conservation and Natural Resources, and the Alabama Department of Agriculture and Industry, along with private and public stakeholders, were tasked with completing this goal. The AWAWG identified several critical issues such as data collection, inter-basin transfers, in-stream flows, drought response, and many others that would potentially impact a state water management plan. The group produced several policy documents that were sent out for comments, with the foremost being that any management plan should be based on sound science. The AWAWG was disbanded in 2017, and although a management plan was not developed, there were two significant outcomes: (1) the State Legislature passed the Alabama Drought Planning and Response Act in 2014, which led to the development of the Alabama Drought Management Plan and attendant policy in 2018, updated on a five-year cycle; and (2) groundwater and surface water resource assessments were conducted and published by the OWR and GSA in 2017 and 2018. In addition, the State contracted with the U.S. Geological Survey to update low-flow characteristics at 210 continuous record gaging stations. Statewide assessments have continued and aid the State in water resources management and policy decision making.

Abstract #: 018 **Student**

Title: **Nutrient Dynamics in Broiler Litter: Impact of Storage Methods and Environmental Implications**

Author(s): Shruthi Koneti, Rishi Prasad, Debolina Chakraborty, Dexter Watts & Allen Torbert

Presenter: Shruthi Koneti

Organization: Auburn University

Session: Ag & Irrigation 2

The United States (US) broiler industry has witnessed a rapid expansion in the past few decades. Litter management and its disposal remain a major challenge. Broiler litter (BL) is a popular row crop soil amendment with a nutrient grade of 3-3-2. Approximately 13-26 million metric tons of BL is generated annually in the US. However, the timing of BL cleanout from the poultry house may not coincide with the field applications, 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 aimed to understand the changes in macro and micronutrient concentration (pH, total carbon (TC) and nitrogen (TN), mineral N, water-extractable phosphorous (WEP), total phosphorus (TP), total potassium (TK), total sulfur (TS), total calcium (TCa), Total Magnesium (TMg), total copper (TCu) and total Zinc (TZn)) from the BL during a 12-month period under three different storage conditions. Broiler litter heaps of 1.5 m in height and 3.65m in diameter were created and replicated three times at the E.V. Smith research station in Shorter, Alabama. The treatments were a) uncovered litter pile (U), b) Trap covered litter pile (T), and c) litter pile covered with a layer of soil (S). 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. Results suggest that there is a temporal trend in changes in nutrient concentrations with BL stored under T treatment effectively retaining higher concentrations of nutrients compared to U and S treatments. Total C and TN showed a decreasing trend among all the treatments with storage time. Water extractable P, TP, TK, TCa, TMg, TS, TZn, and TCu decreased in greater proportion in U and S, indicating losses due to leaching and runoff, compared to T treatment. After 12 months of storage, U treatment lost 66% TN, 45% TP, 54% TK, 28% TCa, 44% TMg, 46%TS, 34%TCu, 42%TZn of initial concentration and S treatment lost 59%TN, 41%TP, 40%TK, 33%TCa, 47%TMg, 45%TS, 38%TCu, 46%TZn of initial concentration. Covering BL with a 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 #: 019

Title: **A comparison of rain gauges and soil sensors at the South Alabama Mesonet.**

Author(s): Sytske Kimball & Austin Clark

Presenter: Sytske Kimball

Organization: University of South Alabama

Session: Water Quantity

Precise measurement of rainfall and soil moisture is essential for effective water resource management across a range of sectors. Rainfall totals, rainfall rates, and soil moisture content must be measured accurately to provide information for short-term decision-making like crop irrigation and issuing flash flood warnings and for long-term planning to mitigate phenomena like drought and forest fires. Accurately measuring rainfall and soil moisture is challenging given the shortcomings of the sensors themselves and the influence of variable environmental conditions. Given their importance, rain gauge measurements are continuously being improved by rain gauge design and the development of on-board 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. Problems encountered with in-situ soil sensors include errors in moisture estimation if the soil-type is not properly identified and poor contact between sensor and soil due to air gaps, disturbance, or improper orientation. In this study, the performance of various rain gauge and soil sensor types is compared at the South Alabama Mesonet station on the University of South Alabama campus. The rain gauges include 1) a Texas Electronic TE-525 tipping bucket rain gauge, 2) a Hydrological Services TB3 tipping bucket rain gauge with syphon to regulate water flow for improved performance during high-intensity rainfall events, 3) 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, and 4) a rain gauge integrated into the Meter ATMOS 41 Gen 2 all-in-one weather station, which uses two methods to measure rainfall: a tipping bucket and a drop counter. The site also includes two collection gauges: a CoCoRaHS gauge and a National Weather Service Standard Rain Gauge. Three types of soil sensors are installed at the campus station which each measure soil moisture and temperature at various depths: 1) four METER TEROS 12 sensors (10, 20, 50, 100 cm), 2) a METER TEROS 54 Profiling Sensor (15, 30, 45, and 60 cm), and 3) four Acclima TDR-315N sensors (10, 20, 50, 100 cm).

Abstract #: 021 **Student**

Title: **Impact of Agricultural Land Use on Sedimentation of Geographically Isolated Wetlands with Partial and Full Agricultural Catchments**

Author(s): Suranjana Chatterjee, Frances O'Donnell, Kathryn Perkins, Steven T. Brantley & Emma Marzolf

Presenter: Suranjana Chatterjee

Organization: Auburn University

Session: Lightning Talk - Research 1

Geographically isolated wetlands (GIWs) are waterbodies with no direct surface water connection to perennial rivers, streams, estuaries, or the ocean. They exchange materials and energy with surrounding ecosystems, contributing to landscape functions. This study investigated the spatial variability in the sediment runoff received by GIWs in southwest Georgia - a karstic region with abundant GIWs and intensive row crop agriculture. We studied two GIWs, one surrounded by an agriculturally dominated catchment and one surrounded by a mixed forested and agricultural catchment. Rain gauges, water level loggers, and sediment traps were installed in these wetlands. To determine the dry mass of sediment deposited per unit time, sediment traps were collected monthly. Results showed substantial variation in sedimentation rate between the two wetlands. To further investigate the mechanisms driving this variability, the Modified Universal Soil Loss Equation (MUSLE) was used to model sediment yield from each wetland catchment. MUSLE was applied to individual storm events using runoff volume, peak flow rate, soil erodibility factor, slope length and gradient factor, cover management factor, and erosion control practice factor as input variables to find sediment yield. We predicted runoff volume and peak runoff from precipitation data collected onsite for 12 months using the NRCS TR-55 method. The soil erodibility factor was determined from analysis of soil samples collected from the site. 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 were determined from Google Dynamic World Imagery monthly land cover. Uncalibrated model results for both wetlands showed similar temporal patterns of high and low values in comparison with the sediment trap data. For 2021, model results for the wetland with the agricultural catchment showed sedimentation rates of 1.11 g/cm2/year, whereas the sediment trap data showed 1.93 g/cm2/year. For the second wetland, which has a mixed catchment, the model result showed a sedimentation rate of 0.33 g/cm2/year, whereas the sediment trap data showed a sedimentation rate of 0.47 g/cm2/year. The model was calibrated using sediment trap data from 2021 and validated with data from 2022. The MUSLE model demonstrated better performance for the GIW with an agricultural catchment. Future research will explore NASA Surface Water Ocean Topography (SWOT) to understand the hydrology of the GIWs. The final output of this study aims to identify ways to improve the health and functionality of these GIWs. The goal is to enhance their ability to retain water and improve overall water quality, while minimizing any negative effects on nearby agricultural production.

Abstract #: 022

Title: **Air Related Community Engagement**

Author(s): Jennifer Barker

Presenter: Jennifer Barker

Organization: Alabama Department of Environmental Management

Session: Lightning Talk - Outreach & Extension

The Alabama Department of Environmental Management (ADEM) was awarded a grant from the Environmental Protection Agency (EPA) to develop and utilize a mobile education trailer to provide education and training related to the causes and effects of air pollution under the Clean Air Act, Section 103 (b)(3) in communities with prolific impacts due to COVID-19. Community members have been educated about air quality and ways to implement practices to help manage symptoms of medical conditions such as chronic lung disease and asthma. Through partnerships with the Alabama Department of Public Health, Health Services, Inc, and The Wellness Coalition, community members have gained knowledge on how to interpret air quality reports and utilize the air quality flag program to identify when air quality is worse, enabling them to take steps to minimize exposure to air pollution.

Abstract #: 023 **Student**

Title: **A post-processed NextGen framework reanalysis dataset**

Author(s): Savalan Naser Neisary, Md Shahabul Alam, Joshua Cunningham, James Halgren & Steven Burian

Presenter: Savalan Naser Neisary

Organization: The University of Alabama

Session: Modeling & Water Management

Accurate, high-resolution streamflow predictions are essential for effective water resources management and planning, particularly under extreme event conditions. While the Next Generation Water Resources Modeling Framework (NextGen), a modular, open-source successor to the National Water Model, can generate streamflow predictions across 2.7 million reaches across the Contiguous United States, it has limitations in predicting extreme events and regions with extensive water resources infrastructure. To address the limitations of NextGen, we developed a post-processing machine learning (PP-ML) framework using the Long Short-Term Memory algorithm to enhance NextGen's ability to capture dominant hydrological processes and account for water regulation effects from 1990 to 2020. The PP-ML model inputs included snow water equivalent, upstream reservoir capacity, AORC meteorological forecasts, and streamflow predictions from the Conceptual Functional Equivalent model, one of the hydrological models included in the NextGen framework. Our framework improved the Kling-Gupta Efficiency metric by up to 65% overall and 225% at stations downstream of reservoirs. This study highlights that ML-based post-processing can effectively correct hydrological model outputs to account for the impact of water regulation, without explicitly incorporating infrastructure rulesets.

Abstract #: 024 **Student**

Title: **Explainable Deep Learning Framework for Assessing Terrestrial Hydroclimate Impacts on Coastal River Discharge**

Author(s): Ajeeta Shrestha & Di Tian

Presenter: Ajeeta Shrestha

Organization: Auburn University

Session: Student Poster

Coastal river discharge plays a crucial role in regulating coastal water quality, ecosystem health, and community resilience in downstream coastal environments. However, understanding how terrestrial hydroclimate influences both historical and future river discharge remains limited, constrained by the coarse-resolution and biases in climate models and reanalysis products, limitations of process-based hydrological models, and black-box nature of many deep learning approaches. To address these challenges, we propose an explainable deep learning framework for assessing terrestrial hydroclimate impacts on coastal river discharge. Using Alabama and Tombigbee River basins as a testbed, we develop a hybrid model combining explainable convolutional neural networks (X-CNNs) and long-short term memory networks (LSTMs) to enable automatic extraction of both spatial and temporal features. The integrated X-CNN-LSTM model achieves Kling Gupta Efficiencies (KGE) of 0.827 for the Alabama River and 0.776 for the Tombigbee River, outperforming standalone X-CNN or LSTM models, and accurately reconstructs daily discharge records dating as far back as 1940. Comparison with existing flood reanalysis datasets and process-based hydrologic simulations demonstrates the superior performance of our approach for historical discharge reconstruction. Saliency-based interpretability analysis further identifies runoff and soil moisture as dominant predictors and reveals key geographic locations contributing to coastal discharge variability. We apply the model to future projections using multivariate, trend-preserving, deep learning–downscaled and bias-corrected CMIP6 climate data under SSP2-4.5 scenario. The results reveal a projected increase in the frequency of high and low flow events of shorter duration, along with a decline in minimum flows, highlighting emerging hydrological risks. These findings underscore the critical importance of deep learning for both spatial-temporal river discharge modeling and downscaling and bias-correction of GCMs to enable reliable, fine-scale climate impact assessments. Overall, the proposed explainable AI framework offers a robust and interpretable tool for fine-scale climate impact assessments, supporting adaptive water resources management and enhancing coastal resilience in a changing climate.

Abstract #: 025 **Student**

Title: **Investigating the Impacts of Calcium Additive to Drainage in Blackland Prairie Soil**

Author(s): Alistair Bebbington, Jillian Maxcy-Brown, Mike Perez, Thorsten Knappenberger & Yaniv Olshansky

Presenter: Alistair Bebbington

Organization: Auburn University

Session: Lightning Talk - Research 1

Approximately 35% of homes in Alabama's Black Belt rely on onsite wastewater treatment systems, but many of the soils in the Blackland Prairie region are rated as "Very Limited" by the U.S. Department of Agriculture for wastewater dispersal. This is due to the vertisol soil's high smectite content and low hydraulic conductivity. Wastewater high in sodium promotes dispersion of clay particles. This reduces the already limited hydraulic conductivity of these soils, severely hindering the performance of the system. This research explores the addition of calcium cations using gypsum to improve the permeability of the soil by facilitating flocculation. Testing planned for Summer 2025 will evaluate the conductivity performance of amended Blackland Prairie soil using calcium enriched water. We anticipate seeing an increase in hydraulic conductivity as the calcium ions replace the sodium ions. We also plan to determine the optimal concentration of calcium in the influent water so that it can be applied to real world septic tank systems in a cost-effective manner. The results of this research could potentially improve the performance and accessibility of affordable onsite wastewater treatment systems in the Black Belt region. This improvement could result in fewer system failures which will lower the operational costs and health hazards associated with underperforming systems.

Abstract #: 026

Title: **Quantifying the Contributions of Stochastic and Deterministic Factors in Streamflow Dynamics of United States Rivers**

Author(s): Krzysztof Raczynski, Kate Grala & John Cartwright

Presenter: Krzysztof Raczynski

Organization: Mississippi State University

Session: Water Quantity

This study employed an extensive array of nonlinear time-series methodologies on daily streamflow data from 3135 gauges across all fifty US states and Puerto Rico over a 1970–2023 period. Our objective was to quantify the stochastic and deterministic factors influencing flow variability over several temporal scales, ranging from weekly to annual intervals, while also identifying geographical patterns in regime dynamics of: minimal, average, and maximal streamflows.Long-range memory was characterized using rescaled-range and detrended fluctuation analyses, revealing Hurst exponents varying from 0.75 to 0.95, indicating persisting correlations across time scales. Multifractal detrended fluctuation analysis and generalized Hurst exponents were used to derive multifractal spectra: the width of these spectra was maximal for Qmax, moderate for Qmin, and minimal for Qavg, suggesting that extremes induce the most intricate scaling. Continuous wavelet transforms further validated fractal nature via power-law decrease of spectral energy relative to frequency. Recurrence quantification analysis was utilized to evaluate deterministic structures via metrics including recurrence rate, determinism, entropy, laminarity, and trapping time. RR remained consistently steady across regimes across all aggregations. An inverse relationship between entropy and determinism demonstrates a trade-off between order and randomness that varies with aggregation scale. Chaos detection via Lyapunov exponent revealed weakly positive exponents at all scales. Phase-space reconstruction and false nearest-neighbors analysis indicated that low embedding dimensions suffice to capture the core deterministic dynamics, which are embedded within background stochastic variability.Fuzzy clustering was used to evaluate spatial relationships among metrics. Three distinct regimes were identified: a high-persistence regime covering the western and central mainland, Alaska, and Puerto Rico, exhibiting higher H, low entropy, significant spectral energy, and strong multifractality; a transitional regime in the Great Plains and Appalachian areas, characterized by intermediate levels of persistence, multifractal complexity, and recurrence–entropy balance; and a near-stochastic regime in the northeastern and Gulf Coast regions, characterized by lowest H values, shallow multifractal spectra, and diminished deterministic signatures. The framework enhances understanding of streamflow dynamics through stochastic variability, long-range dependence, multifractality, and chaos. The results significantly impact modeling, water resource management, and infrastructure design. Integrating non-stationary and fractal characteristics into predictive models improves evaluations of flood and drought risks, while RQA and chaos measurements serve as predictors for regime shifts. Identifying spatial regimes aids in developing targeted strategies for water distribution and ecosystem conservation amid future stressors.

Abstract #: 029

Title: **Streamflow As a Stressor: Disentangling Hydrology and Water Quality Impacts to Characterize Flow-Ecology Relationships Across Two Southeastern Landscapes**

Author(s): Joshua Hubbell

Presenter: Joshua Hubbell

Organization: Geological Survey of Alabama

Session: Water Quantity

Discerning the independent effects of flow and water quality on the ecology of flowing waters is an overarching goal in water resource science and is needed to improve the efficacy of watershed management. However, the interrelatedness of these parameters and their subsequent alteration due to land use change has constrained efforts on this front. The objective of this study was to characterize flow-ecology relationships for benthic macroinvertebrate and fish assemblages that were unchanged by water quality impacts across two southeastern landscapes in the USA to help detect ecological change driven by flow alteration. Generalized linear latent models were used to identify taxa that were responsive to high or low flow metrics and water quality gradients. Bayesian hierarchical generalized additive models were then developed using these indicator taxa and three biological metrics to identify flow-specific relationships that were unaffected by water quality impacts. Three low flow-specific relationships were identified, illustrating how potential agricultural or urban impacts to hydrology reduced biological health of the stream. Importantly, flow-ecology relationships developed using indicator taxa in this study effectively captured hydrology-specific impacts while biological metrics typical of state monitoring and assessment programs did not. Therefore, developing flow-specific biological metrics is a critical step when establishing management strategies targeting flow alteration. Implementing standardized frameworks such as this one can limit contradictory findings and improve streamflow enhancement and restoration project efficacy. These low flow-specific relationships will enhance managers' capacity to develop environmental flow standards, monitor their success, and better understand urban and agricultural impacts on stream assemblages.

Abstract #: 030

Title: **Freshwater Restoration Across Alabama's Rural Landscape- Bolstering resiliency in a changing climate**

Author(s): Alana Reynolds

Presenter: Alana Reynolds

Organization: The Nature Conservancy

Session: Restoration 2

Alabama ranks number one in aquatic biodiversity in the United States- yet is also foremost in the number of imperiled species, rate of endemism, and species decline. The state's rural landscape is a tapestry interwoven with prime agricultural land and biodiverse freshwater ecosystems. Sedimentation from poor farming practices, upstream land use change, and increased storm intensity is the primary threat to stream health and freshwater biodiversity in the Southeast. It alters instream habitat, reduces primary production, disrupts food webs, and smothers sensitive species and their life history stages. Water quality is a key component of aquatic habitat health and the overall resilience of freshwater systems to adapt to variable conditions predicted under climate change scenarios. Reducing sediment and nutrient pollution in US streams and rivers is a key strategy for ensuring our freshwater systems are resilient to a changing climate. Recent data shows that freshwater systems which are unable to provide high quality habitat, free from excess nutrients and sedimentation, will not be able to support aquatic species as they attempt to adapt to a changing climate.

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 30 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 and farmers to install best management practices (BMPs) and streambank restoration projects to improve water quality and instream habitat in focal watersheds across the state. This holistic approach can be used anywhere to improve freshwater resiliency in the face of climate change, promote food security and reduce erosion on agricultural lands, protect critical aquatic habitat, and sustain water resources for generations to come.

Abstract #: 031 **Student**

Title: **Water Quality Assessment in Moore's Mill Creek Watershed: A comparative Modeling Approach**

Author(s): Ashmita Poudel, Michael Bragg & Jose G. Vasconcelos

Presenter: Ashmita Poudel

Organization: Auburn University

Session: Student Poster

The Moore's Mill Creek Watershed (MMC), located in Lee County, Alabama, is listed as an impaired waterbody under section 303 (d) of the Clean Water Act. Its impairment is linked to rapid urban development and the expansion of impervious surfaces in the Auburn-Opelika area, which has increased runoff velocity and erosion, transporting larger loads of sediment into the creek. Thus, understanding the sediment transport in this watershed is important from a water quality perspective. While In-situ sediment monitoring provides essential data for sediment management, its utility is often constrained due to costs and limited spatial coverage. An integrated hydrological and sediment transport modelling can be an important tool for sediment management as it can provide better spatial representation for the development of best management practices (BMPs) to mitigate such issues in a mixed land use watershed. However, there are uncertainties in selecting optimal modeling frameworks for sediment yield prediction. This study aims to evaluate two sediment modeling approaches within the US Army Corps HEC-HMS tool, traditional subbasin delineation and unstructured grid modeling, comparing their performance in predicting sediment concentration. Additionally, the results will be benchmarked against an existing SWMM 5 model developed for the same watershed as part of this ongoing research. Field data, including rainfall measurements from rain gauges and stage records from water loggers, have been collected to support model calibration and validation. A total suspended solids (TSS)-turbidity relationship has also been established using water samples from one MMC location. The study will show the extent to which the setup of an HEC-HMS model influences sediment predictions in mixed land use watersheds, thus guiding the choice of tools for the purpose. The findings will provide critical insights for identifying locations impacted by stormwater and thus informing BMPs to restore water quality in the MMC Watershed.

Abstract #: 032 **Student**

Title: **Engineered Media Removal of Nutrients**

Author(s): Grace Kerr, Michael Perez & Wesley Donald

Presenter: Grace Kerr

Organization: Auburn University

Session: Stormwater 2

Stormwater runoff containing nitrogen and phosphorus contributes to eutrophication in receiving surface waters. While naturally occurring, nutrient loading rates are increased by anthropogenic activities, such as urbanization, industrialization, agricultural activities, and wastewater treatment effluent. Eutrophication leads to agal blooms which can deoxygenate water bodies impacting the aquatic ecosystem. Stormwater control measures can be used to reduce nutrient loading and associated negative impacts. Stormwater control measures often function by promoting filtration, infiltration, and evapotranspiration. The purpose of this research is to analyze engineered media matrices commonly used within filtration and infiltration-based stormwater control measures to determine pollutant removal efficacy. This research is used laboratory column testing to inform future full-scale investigations on optimal media makeup. A variety of media configurations and materials including sand, iron-enhanced sand, biochar, and woodchips were investigated through this research. A total of 24 laboratory columns (6 inches in diameter by 36 inches in length) were constructed and filled with different media types. Each material was first analyzed to determine whether it contributed to nutrient leaching. Following this assessment, nutrient removal rates were quantified. Synthetic stormwater, introduced with a falling 1-ft water head, contained 5.55 mg/L ammonium sulfate ($(NH_4)_2SO_4$), and 0.6 mg/L potassium phosphate monobasic (KH_2PO_4). Columns were evaluated based on nutrient removal efficacy using standard nutrient detection methods. Removal of total phosphorus includes iron enhanced biochar A 70.7%, sand 62.3%, biochar -105.2% (produced TP), iron enhanced biochar B 73.6%, and iron enhanced sand 85.6%. Total nitrogen removal includes iron enhanced biochar A 65.6%, sand 7.9%, biochar 78.6%, iron enhanced biochar B -29.7% (produced TN), and iron enhanced sand 23.5%. Among the tested media, iron-enhanced biochar 1 demonstrated the highest TN and TP removal rates, making it the most effective option. Future work will focus on selecting the most promising media for application in full-scale stormwater biofiltration experiments to validate laboratory-scale findings and enhance real-world stormwater treatment strategies.

Abstract #: 033

Title: **A Shore Thing: Planning a Resilient Future for Mobile County's Coastline**

Author(s): Christian Miller

Presenter: Christian Miller

Organization: Mobile Bay National Estuary Program

Session: Coastal Issues 1

Mobile County's extensive coastline—from the bustling Port of Mobile south to Alabama Port and Heron Bay, and west along the Mississippi Sound through Coden, Bayou La Batre, and Grand Bay to the Mississippi state line—is a vital interface between land, water, and people. This region supports nationally significant estuarine habitats, critical infrastructure, working waterfronts, and vibrant coastal communities. However, it faces escalating threats from sea level rise, shoreline erosion, habitat loss, and intensified storms. The Mobile Bay National Estuary Program (MBNEP) is leading a transformative, countywide effort to develop a Comprehensive Shoreline Management Plan (SMP) to protect, stabilize, and restore this diverse and vulnerable coastal region.The plan addresses over 50 miles of shoreline, much of which has undergone significant degradation. Historic armoring, dredging, and land conversion have disrupted sediment dynamics and eliminated critical intertidal habitats. Today, more than 50% of the shoreline is armored, and recession rates in some areas exceed two feet per year. These impacts are intensified by tropical storms, wave energy, and salinity intrusion. The SMP offers a roadmap to enhance resilience through science-based, site-specific nature-based solutions (e.g., living shorelines, marsh sills, breakwaters) that restore natural function while protecting infrastructure and property.Key components include shoreline and habitat trend analysis, wave climate modeling, regulatory review, and stakeholder-driven prioritization of actions. The plan builds on previous watershed planning and restoration efforts and aligns with regional goals for biodiversity, water quality, and economic sustainability. A cornerstone of the initiative is the engagement of diverse stakeholders—including landowners, municipalities, agencies, and commercial operators—in co-creating and implementing solutions.An Interagency Working Group—including the U.S. Army Corps of Engineers, State of Alabama, Alabama State Port Authority, City of Mobile, Mobile County, and others—is coordinating with MBNEP to support shoreline management and explore beneficial use of dredged material from channel deepening projects to bolster defenses. MBNEP has also allocated Infrastructure Investment and Jobs Act funding to help jumpstart implementation with multiple groups of property owners along Mobile Bay's western shoreline.This initiative recognizes that piecemeal, property-by-property fixes are inadequate to meet the scale of the challenge. Instead, it advances a unified, landscape-scale approach to coastal stewardship that reflects the interconnectedness of ecological processes, infrastructure protection, and community resilience. The resulting plan will serve as a replicable model for regional shoreline management, positioning Mobile County at the forefront of nature-based coastal resilience along the Gulf.

Abstract #: 034

Title: **Spatial Optimization for Wastewater Infrastructure Planning in Lowndes County, Alabama**

Author(s): Mallory Jordan, Jillian Maxcy-Brown, Mark Barnett, Mark Elliott, Kevin White & Stephanie Rogers

Presenter: Mallory Jordan

Organization: Auburn University

Session: Professional Poster

The Black Belt region of Alabama has struggled with inadequate wastewater management and steps are being taken to create safe, effective infrastructure. The wastewater infrastructure crisis has been exacerbated by low population density, high rates of poverty, and sub-optimal geologic conditions. Low population density makes centralized wastewater infrastructure impractical for much of the region, and the clayey soils are not well suited for traditional onsite wastewater treatment systems. These local characteristics have left about 50% of the Black Belt population without affordable access to safe, effective wastewater management highlighting the need for a multi-faceted solution (planning, incorporation of decentralized infrastructure options, funding, management, regionalization of management, etc.). One challenge in addressing this problem is the difficulty in identify the optimal number, location, and type of wastewater treatment systems (centralized, cluster, or onsite) for a given area. Thus, the objective of this research was to utilize a spatial optimization model—the sustainable infrastructure network planning model (SNIP)—to determine the cost-effective layout of wastewater treatment infrastructure for Lowndes County, Alabama. The objective of the model, created by Eggimann et al. (2015), was to minimize the total wastewater system costs in Switzerland. The original model was modified to provide reasonable design and cost inputs for rural Alabama. Only three input datasets are required: buildings that require wastewater treatment, topography (i.e., a digital elevation model), and the street network (assumes sewer lines will follow the street network). We found that at cost-optimized conditions, about 50 percent of wastewater infrastructure should be centralized, but currently only about 24 percent of wastewater infrastructure is centralized in Lowndes County. These results show that centralized and decentralized clustered wastewater treatment systems offer more cost-effective solutions in certain areas compared to the predominantly used onsite wastewater treatment systems. The model produces geospatial data showing the location and capacity of wastewater treatment plants, sewer lines, and pumps. These map-based outputs are particularly valuable as they are interpretable to all stakeholders (e.g., community members, engineers, governing officials, and funders). Model outputs can guide household-level decision making on the optimal wastewater treatment technology (e.g., use an onsite wastewater treatment system, connect to a clustered system, or connect to a wastewater treatment plant). Ultimately, designing a wastewater infrastructure improvement plan requires considering the local social, environmental, political, and economic dynamics and this is an accessible planning tool for low-resource communities to develop reasonable wastewater infrastructure design options.Modified code for the SNIP model can be found at https://aub.ie/SNIP.

Abstract #: 035

Title: **ACFS Sponsored Drought Exercises**

Author(s): Bradford Moore

Presenter: Bradford Moore

Organization: Apalachicola, Chattahoochee, Flint Stakeholders

Session: Drought & Climate

ACF Stakeholders considers drought management a top priority and is committed to improving preparation, coordination, and comunication and sharing best practices. In April 2025, ACF Stakeholders hosted its third Drought Tabletop Exercise, designed to understand the decisions water resource managers and users make during drought and identify opportunities to improve drought response across the basin. This year's exercise focused on understanding the drought plans of Alabama, Florida, and Georgia and drought operations of the U.S. Army Corps of Engineers, and it included discussion of metrics that are useful in drought decision-making. Participants also explored opportunities to enhance coordination and communication throughout the basin during drought. Over fifty people took part in the exercise. They came from all three states in the basin and represented federal and state agencies, water utilities, agriculture, commercial fishing, energy companies, nongovernmental organizations, and other interests and stakeholders.

The daylong exercise presented participants with a simulated multi-year drought scenario. At four key discussion points, participants shared their observations on drought responses, management strategies, information sources, communication needs, and coordination efforts. They met in drought response teams to discuss state and federal agency decisions and stakeholder impacts. They also met in small, cross-functional, interstate groups to evaluate drought responses and assess the usefulness of various drought metrics.

The drought was designed by a team of hydrologic modelers, scientists, and a facilitator. They modeled streamflows and reservoir levels for a hypothetical drought spanning the years of 2028 to 2031. The scenario was based on real world conditions observed during past droughts and designed to prompt discussion not only about response to severe drought, but also about actions taken early in drought and when drought is ending. The exercise emphasized metrics used by the U.S. Army Corps of Engineers and state agencies in drought decision making. The team created data visualizations to illustrate drought conditions, including graphics derived from the ACF Drought Dashboard.

Abstract #: 036 **Student**

Title: **Investigating the Spatiotemporal Patterns of Annual Water Yield in Alabama Watersheds**

Author(s): Jan Joseph Dida & Stephanie Rogers

Presenter: Jan Joseph Dida

Organization: Auburn University

Session: GIS

Water yield refers to the total surface flow or maintenance of water by a landscape. It is an important ecosystem service that supports communities by providing water for irrigation, hydropower generation, and domestic use. Previous research has shown that water yield is influenced by a multitude of anthropogenic and biophysical factors, one critical one being land cover change. Some counties in Alabama have experienced rapid urbanization where forests have been converted to developed areas. We hypothesize that expanding developed areas have led to increased water yield in Alabama's watersheds. Thus, the goal of this study is to quantify Alabama's annual water yield from 1990 to 2020, to determine if yield is changing over time, where changes are occurring, and whether changes are related to land cover alteration. The Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model was used to estimate annual water yield across 8-digit Hydrologic Unit Code (HUC8) watersheds in Alabama. Inputs to the InVEST model include data layers for precipitation, evapotranspiration, land cover, root restricting layer depth, and plant available water content. A space time cube was generated in AcGIS Pro to analyze the patterns and trends of annual water yield. Results show that there are significant hot spots of water yield across Alabamian watersheds, specifically in northern watersheds near urban areas. Fluctuating hot spots were observed in developed areas, indicating that water yield is influenced not only by increasing precipitation but also by urbanization. Given the increasing precipitation and expanding developed areas, monitoring watersheds with rising water yield is essential to support sustainable land use planning and effectively capture the expected yield.

Abstract #: 037 **Student**

Title: **Decoding Problematic Wetland Soils of the Alabama Blackland Prairie Region**

Author(s): Jade Ulbrich, Thorsten Knappenberger & Yaniv Olshansky

Presenter: Jade Ulbrich

Organization: Auburn University

Session: Student Poster

Smectitic soils dominate portions of the central and western United States and the Blackland Prairie of Alabama and Mississippi. Their pronounced shrink–swell behavior, low-permeability structure, and parent material with chroma ≤ 2 coloration obscure common field indicators of saturation. Compounding this, many smectitic horizons contain little crystalline iron (Fe) or manganese (Mn); consequently, they seldom display the redox depletions or concentrations typically used to confirm hydric conditions. These traits make wetland delineation under the NRCS Wetland Reserve Easements (WRE) program especially difficult, risking misclassification of hydric soils and misestimation of easement value.This study develops laboratory and spectroscopic criteria to support field identification of hydric status in such problematic soils. Whole soil (< 2 mm) and clay fraction mineralogy were characterized by quantitative X ray diffraction using random powder and oriented mounts subjected to K , Mg , heat, and glycerol treatments. Rietveld refinement and pattern matching software will determine the abundance of smectite and associated phases that influence hydrologic behavior and color expression.To characterize trace Fe and Mn pools that govern redox feature development, a five step sequential extraction was applied: (1) deionized water (soluble), (2) sodium pyrophosphate (exchangeable + organically complexed), (3) ammonium oxalate (short range order), (4) dithionite–citrate–bicarbonate (crystalline oxides, hydroxides, oxyhydroxides), and (5) total digestion via microwave acid mixture. Partitioning these pools clarified the availability and mobility of Fe and Mn and identified thresholds below which traditional redox morphology fails.Finally, mid-infrared (MIR) diffuse reflectance spectra were collected for paired hydric and non-hydric pedons (from an upland location) with a Fourier transform IR spectrometer. Multivariate models trained on mineralogical and extraction data were evaluated for their ability to predict hydric status directly from MIR signatures, providing a rapid, cost-effective screening tool for conservation practitioners.Data for three locations with three sites (upland, problematic transition, wetland) will be presented.

Abstract #: 038

Title: **Water use trends, how water use has changed in Alabama since 2010.**

Author(s): Michael Harper & Mary Blackmon

Presenter: Michael Harper

Organization: ADECA Office of Water Resources

Session: Water Quantity

Since 2005, OWR has published a very detailed water withdrawal summary for the State of Alabama. Beginning with the 2017 Surface Water Assessment, OWR has included returns and overall net demands in these studies. This presentation will take a deep dive into eight specific categories of use (public supply, residential, irrigation, industrial, thermoelectric, livestock, mining, and aquaculture) as well as total water use and highlight the changes that have taken place since the 2017 Surface Water Assessment was published focusing on withdrawal, returns and overall net demands.

Abstract #: 039

Title: **NEON in Alabama's Aquatic Ecosystems: An Introduction to NEON and Demonstration of Data Applications**

Author(s): Nicole Conner & Stephanie Parker

Presenter: Nicole Conner

Organization: National Ecological Observatory Network (Battelle)

Session: Professional Poster

Alabama is home to six field sites within the National Ecological Observatory Network (NEON), which is a continental-scale observatory that collects long-term, open access ecological data. NEON data cover a range of subject areas within ecology, including organismal observations, biogeochemistry, hyperspectral imagery, and micrometeorology. Collection methods are standardized to ensure long-term comparability of patterns and processes spatially and temporally. Additionally, all samples and data collected by NEON are publicly available and can be accessed digitally through the NEON website. By providing free and open standardized data - along with samples, data analysis tools, tutorials, and educational resources - NEON is engaged in the global effort to expand the scope of science and make scientific data access easier for all. Alabama is in NEON's Domain 08: Ozarks Complex and has three colocated sets of terrestrial and aquatic field sites. Domain 08 (D08) is the only NEON Domain that has field sites featuring big rivers with large floodplain and delta areas. The aquatic sites in D08 include Mayfield Creek NEON (MAYF), Black Warrior River NEON (BLWA), and Lower Tombigbee River NEON (TOMB). These sites are situated along the same watershed system, creating a unique opportunity to study hydrology, nutrient transport, and biogeochemical cycling through a hydrologic gradient. These aquatic systems experience seasonal flooding, which may be prone to changes in frequency and duration over time. NEON data products enable researchers to explore ecological concerns and ecosystem changes such as these. To demonstrate an application of NEON data tutorials and analysis tools, we explore the relationship between continuous stream discharge and macroinvertebrate abundance at Mayfield Creek NEON (MAYF).

Abstract #: 040 **Student**

Title: **Evaluation of Floating Surface Skimmer Flowrates Though Experimental Testing**

Author(s): Caroline Harrison

Presenter: Caroline Harrison

Organization: Auburn University

Session: Stormwater 1

A floating surface skimmer is a device designed to regulate dewatering in a sediment basin. Compared to traditional dewatering mechanisms, skimmers decant from the top of the water column, allowing for greater capture of total suspended solids (TSS) within the basin. Engineers select skimmer size based on sediment basin dimensions and target retention times. The flowrate on some skimmers can be adjusted by modifying the orifice size. The objective of this research is to evaluate the discharge rates of eight J.W. Faircloth & Son, Inc. skimmers of varying sizes across different orifice openings. Flowrate data will be used to develop design guidance for engineers to apply when sizing skimmers. Experiment procedures followed an enhanced version of the ASTM Standard D8107 to enable greater apparatus depth and more comprehensive data collection. Testing was conducted in a 1,053 ft3 evaluation tank at the Auburn University-Stormwater Research Facility. The following skimmer sizes were assessed: 1.5 in, 2 in, 2.5 in, 3 in, 4 in, 5 in, 6 in, and 8 in. Each skimmer was paired with a properly sized barrel in length and diameter. In addition, each skimmer was evaluated across four orifice openings: 100%, 75%, 50%, and 25%. Each configuration was triplicated for a total of 96 experiments. A Solinst Levelogger® was used to continuously record water levels at 15 second intervals throughout testing. Collected data was used to model flow characteristics. Results indicate J.W. Faircloth & Son, Inc. skimmers can achieve flow rates ranging as high as 92,585 ft3/d to low as 981 ft3/d across all sizes. Flow rate models were used to develop an interactive and user-friendly skimmer sizing tool for designers to select and appropriately size skimmers. This research advances understanding of floating surface skimmer behavior, improving selection guidance, and resulting in enhanced overall sediment basin functionality.

Abstract #: 041 **Student**

Title: **Removal and Recovery of Phosphorus Using Modified Geotextiles**

Author(s): Aidan Bosman

Presenter: Aidan Bosman

Organization: Auburn University

Session: Stormwater 1

Nutrients, such as nitrogen and phosphorus are commonly found in stormwater runoff originating from both urban and rural areas. In excess, phosphorus can negatively impact aquatic environments through eutrophication, which leads to harmful algal blooms. Current stormwater control measures (SCMs) target the increased quantity of stormwater runoff from the growth of impervious areas by detaining/retaining runoff or promoting infiltration. However, these practices' ability to remove pollutants such as nutrients from runoff can vary and do not always prevent excess nitrogen and phosphorus from entering natural waterways. Geotextiles are commonly used within SCMs to provide separation and reduce the transport of suspended sediment. The objective of this research project is to evaluate enhanced geotextiles that are designed to capture phosphorus and allow for its recovery for reuse. Iron, which is known to be effective at adsorbing phosphorus, was dosed into nonwoven geotextiles. Three SCMs were chosen for evaluation: infiltration trenches, green roofs, and biofiltration cells. A lab-scale infiltration trench designed following guidelines from the Georgia Department of Transportation Drainage Manual, as well as green roof modules, were constructed to test with and without the modified geotextile. Simulated runoff was introduced containing 0.4 mg/L of phosphorus, the average concentration found in runoff according to the National Stormwater Quality Database (NSQD). This simulated runoff was used to determine the removal capacity of the geotextile based on the concentration of phosphorus remaining in the outflow. Flow was also introduced without phosphorus to determine the baseline removal or leaching of nutrients from each SCM. Following testing the modified geotextile was removed from each practice and treated to determine the possible recovery of phosphorus that was adsorbed onto the material. For the biofiltration tests various media were evaluated in columns in combination with geotextile to determine an effective combination for infiltration and nutrient removal. The media tested includes iron filings, glass beads, washed sand, topsoil, wood chips, and biochar. Since geotextiles primarily consist of plastics, other possible materials including wheat straw, pine wood chips, coconut coir, recycled carpet, and aspen excelsior are planned to be tested for their ability to be dosed with iron for possible sustainable and environmentally friendly alternatives. The results from testing for this project, planned to take place in December and January, will offer insight into potential simple modifications to typical SCMs that could help improve water quality in natural waterways and provide a possible new source of phosphorus, a heavily utilized resource in agriculture.

Abstract #: 042 **Student**

Title: **Global Sensitivity Analysis of Hydrodynamic Urban Flood Inundation Mapping and Modeling in a Coastal River Basin in the South United States**

Author(s): Reza Saleh Alipour, Junho Song, James Halgren & Steven Burian

Presenter: Reza Saleh Alipour

Organization: The University of Alabama

Session: Student Poster

Urban flood inundation mapping (FIM) is increasingly challenged by the need to accurately represent urban characteristics such as terrain elevation, building footprints, and land use/land cover (LU/LC). While advancements in datasets and FIM techniques have improved flood modeling, uncertainties remain about the impact of these factors on flood depth and extent. Reliable flood maps require high-quality digital elevation models (DEMs) and detailed urban features like impervious surfaces, vegetation, and buildings, which influence overland flow during flood events. This study aims to identify the critical urban factors that influence flood dynamics and provide insights for refining urban flood modeling and mapping. Using variogram-based global sensitivity analysis, we assess the sensitivity of the HEC-RAS 2D model to key configuration factors and parameters. The analysis includes simulations with varying DEM and mesh resolutions, as well as different land use/land cover categories within the Amite River Basin, Louisiana, USA. In the next steps, we will assess how building footprints and variations in LU/LC types and resolutions affect flood depth and extent by considering different scenarios that combine these datasets. Preliminary results from local sensitivity analysis indicate that flood depth and extent are significantly influenced by both LU/LC and DEM type. The findings of this study provide insight into urban terrain data needs for advancing the accuracy of urban flood mapping and modeling applications.

Abstract #: 043

Title: **Hydrogeological Monitoring of The Key Cave National Wildlife Refuge, Lauderdale County, Alabama**

Author(s): Gheorghe Ponta & Ann Arnold

Presenter: Gheorghe Ponta

Organization: Geological Survey of Alabama

Session: Water Monitoring

The Geological Survey of Alabama is conducting a groundwater monitoring study (water quality and water table elevation) to delineate the recharge area of Key Cave for the protection of the Alabama Cavefish (Speoplatyrhinus poulsoni), a federally listed endangered species. The cave also provides essential aquatic habitat for the Southern Cavefish (Typhlichthys subterraneus), the Alabama Cave Crayfish (Cambarus jonesi), and the undescribed Key Cave Shrimp. It is also a maternal site for the endangered gray bat (Myotis grisescens), as well as the following at-risk species: an undescribed cave shrimp, Alabama cave crayfish, and Phantom cave crayfish. The identification and protection of the groundwater recharge area for Key Cave is a critical component for long-term protection of water quantity and quality that provides habitat for these cave faunae. In 2016 and 2017, LiDAR technology was used to inventory sinkholes and other karst features to determine if potential contaminants contained in surface water/storm-water runoff that is introduced at or near these features could potentially influence waters in Key Cave and its 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 three wells in the potential recharge area of the Key Cave and its surroundings. A pressure transducer that continuously records water level, conductivity, and temperature data was installed in Key Cave. Comparison of seasonal water level fluctuations in Key Cave, selected wells in the study area, and water surface elevations of Pickwick Reservoir/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 fauna 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 these findings, a recharge area has been designated for Key Cave. In addition, the recorded variations in water quality do not appear to influence the cave fauna at current concentrations and rates of application. 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 fauna population stability.

Abstract #: 044 **Student**

Title: **Similar Habitats, Different Watersheds: Identifying Geomorphological Commonalities in Endangered Shoal Lily (Hymenocallis coronaria) Habitats**

Author(s): Sarah Tash, Stacey Blersch & Christopher Anderson

Presenter: Sarah Tash

Organization: Auburn University College of Forestry Wildlife and Environment

Session: Student Poster

The endangered and endemic shoal lily (Hymenocallis coronaria) is found in shoal habitats along the Fall Line of Alabama, Georgia, and South Carolina. This emergent macrophyte depends on moderate water levels to expose its inflorescence during a brief flowering window of late spring. Shoals in these areas exhibit wide variation in elevation as the Piedmont region transitions into the Coastal Plain, creating fractured riverbeds and diverse microhabitats. Stands of individuals occupy elevations that allow for moderate fluctuations in water surface levels, ensuring exposure during the critical flower period of May and June. Previous work on the Flint River, Georgia in 2023 demonstrated a significant relationship between stand elevations and the likelihood of future populations occurrence. In this study plants were more likely to inhabit shoal elevations where water level never exceeded 1.8 meters. This project investigates whether elevation and relative water depth is a key predictor of habitat suitability across other H. coronaria populations in different watersheds in its range. Model validation through replication will be completed in six additional river sites spanning all three states. Site selection incorporates a range of stream order habitats ensuring a wide variation of geomorphic and hydrologic conditions. Confirmation of this model across these habitats will provide a broader correlation between species presence and habitat elevation. Confirmation of this relationship can identify suitable locations for seedling establishment and eventual restoration of H. coronaria populations across all watersheds.

Abstract #: 045

Title: **A Survey of Public Perceptions and Attitudes About Water Issues in Texas**

Author(s): Joel Pigg

Presenter: Joel Pigg

Organization: Texas A&M AgriLife Extension

Session: Social Sciences/Human Dimensions

Texas continues to face challenges to ensure clean and adequate water supplies for the future of our growing population. The 2022 Texas State Water Plan projects the Texas state population to be over 51 million by 2070. That is an increase of 73% from the 2017 projection with approximately 50% of the growth occurring in metropolitan areas. Water demands will also be growing during this time but at a much lower rate; around 9 percent; from 17.8 million acre-feet to 19.2 million acre-feet per year. With the depletion of aquifers and the sedimentation of surface water reservoirs the existing water supplies are projected to decline by 18 percent during this time; from 16.8 million to 13.8 million acre-feet per year. Municipal demand is projected to increase during this time from 5.2 million acre-feet to 8.5 million acre-feet per year even with conservation strategy efforts and improved plumbing codes. Agriculture use is projected to decrease from 9.4 million acre-feet to 7.6 million acre-feet per year due to efficient irrigation systems and groundwater depletion. Droughts are a common occurrence for Texas and may be of a short duration or persist for several years. The impact of droughts is critical for most areas of Texas. Water is a natural resource that must be preserved and conserved to the best of our abilities for the State to thrive and survive for future generations. Water quality will also be a concern as the population grows. As “good” quality water that is easy to obtain is used and not replenished, municipalities will be forced to find alternate water supply sources and many of these will not be of the quality that the population expects. This quality issue will force treatment of the water supply to elevate drinking water standards, thus driving up the cost to the customer. A statewide survey has been developed to assess the perceptions and attitudes of Texas citizens on water resource issues. The survey was sent to 1,275 randomly selected Texas residents in August 2008; 419 surveys were completed and returned. In 2014, minor modifications were made to adapt better to Texas participants and the survey was re-issued. The study population for the previous versions of this survey has been adult residents of Texas, and this version will continue with the same target population as previous versions. The survey instrument has been slightly modified to more accurately reflect current trends. The difference between this version of the survey and the previous versions will be the distribution method. Previous versions have been hard copy versions that have been sent via conventional mail to possible respondents. This survey will be sent only utilizing Qualtrics online methods of distribution to a target audience of Texas residents that are over 18 years of age, with a gender of 48% male and 52% female, and be reflective of statewide population demographics. The data will include 500 completed surveys and take 10 minutes to complete.

Abstract #: 046 **Student**

Title: **Characterizing Water Budgets and Landscape Connectivity in Isolated Wetlands**

Author(s): Kathryn Perkins, Steven Brantley, Frances O'Donnell, Jeffery Cannon & Steve Golladay

Presenter: Kathryn Perkins

Organization: Auburn University/ The Jones Center at Ichauway

Session: Modeling & Water Management

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

Abstract #: 047

Title: **Rebuilding Alabama's Mississippi Sound One Project at a Time**

Author(s): Mary Kate Brown & Judy Haner

Presenter: Mary Kate Brown

Organization: The Nature Conservancy

Session: Restoration 2

The Nature Conservancy in Alabama (TNC) first made their mark in Mississippi Sound when they constructed three types of reefs along 1.5 miles of southeast Coffee Island in 2009 using NOAA American Recovery and Reinvestment Act funds. Now 15 years later, TNC is a permanent resident in this waterbody through its tireless efforts to implement projects to restore the shorelines, coastal habitats and watersheds, while solidifying relationships with the local communities who thrive on these waters and lands. From Coffee Island breakwater construction in 2010 to long-term monitoring across 10+ years to Lightning Point large-scale shoreline restoration in 2020, our efforts have remained steady in Mississippi Sound due to managing multiple relationships from Federal to State to local stakeholders and its ability to bridge gaps and find connections between diverse projects and leveraging our partners' plans and initiatives. This presentation will give a case example of working in a waterbody with multiple stakeholders and how to balance the needs and wants of each entity to sustain the health and quality of that waterbody and its habitats. The lessons learned from TNC's path and growth from the first project at Coffee Island to multiple interconnecting projects happening today, including Bayou La Batre stormwater mapping dashboard, Bayou La Batre Library bioretention pond, upcoming Coffee Island breakwater construction, and future engineering and design of nature-based solutions for Bayou Coden, will be shared with the audience. TNC will demonstrate the connection between each unique project that contribute to improving the resiliency of Mississippi Sound's habitats, animals and peoples through many generations and how these restoration and conservation efforts can be applied to other watersheds within our state and beyond.

Abstract #: 049

Title: **Is groundwater good for your heart?**

Author(s): Matthew Loop, Helen Moylan, Jieun Park & Ann Ojeda

Presenter: Matthew Loop

Organization: Auburn University

Session: Social Sciences/Human Dimensions

Background: Drinking water contaminated with lead or arsenic is associated with a higher risk for cardiovascular diseases. Drinking hard water, with higher concentrations of magnesium ions, has been associated with less risk for cardiovascular diseases. However, prior research has focused on municipal water supplies where the variability of contaminants and water hardness is small. Private well water is largely untreated, with a wider range of exposures to potential contaminants and water hardness. We conducted an ecological study of the relationship between the percentage of households reliant on private wells and cardiovascular disease mortality among Census block groups (CBGs) in Alabama, where almost one-third of households are reliant on private wells. Methods: We collected number of deaths in Alabama from 2016 - 2019 from the Alabama Department of Public Health for all CBGs and age groups (45 - 54, 55 - 64, 65 - 74, and 75+ years) where the primary cause of death was hypertensive heart disease, ischemic heart disease, stroke/cerebrovascular disease, or diabetes. We used a publicly available national database of the estimated percentage of households reliant on private wells by CBG. We fit Poisson regression models to estimate the association between mortality and the percentage of households reliant on private wells. We also estimated how much these rate ratios varied by physiographic region of the CBG, a proxy for groundwater quality (Alabama Valley and Ridge, Cumberland Plateau, East Gulf Coastal Plain, Highland Rim, and Piedmont Upland), and the percentage of residents who self-reported African American only race in the 2020 Census.

Results: We included 3,919 CBGs in Alabama. The median (1st quartile, 3rd quartile) percentage of households reliant on private wells was 6.5% (0%, 38.3%). The percentages of CBGs in each physiographic region were: East Gulf Coastal Plan (43%), Alabama Valley and Ridge (26%), Highland Rim (14%), Cumberland Plateau (12%), and Piedmont Upland (6.2%). The rate ratio (95% confidence interval; less than 1 indicates a protective association) for a 1-standard deviation higher percentage of households reliant on private wells was 0.85 (0.78 - 0.92) for hypertensive death, 1.01 (0.97 – 1.06) for ischemic death, 0.91 (0.86 – 0.96) for stroke/cerebrovascular death, and 0.90 (0.82 – 0.98) for diabetes death. The associations with hypertensive death and ischemic death were more protective in CBGs with high percentages of residents self-identifying as African American. Effect modification by physiographic region was inconclusive.Conclusions: Among Alabama CBGs from 2016 to 2019, a higher percentage of households reliant on private wells was associated with a 15% lower mortality rate from hypertensive death and a 10% lower mortality rate from stroke/cerebrovascular and diabetes death. The association with lower hypertensive mortality was stronger in CBGs with a higher percentage of African American residents.

Abstract #: 050

Title: **"The Alabama Climate Observing Network: Connecting Data, Tools, and Users"**

Author(s): Michael Solomon

Presenter: Michael Solomon

Organization: The University of Alabama in Huntsville

Session: Lightning Talk - Outreach & Extension

Effective monitoring of weather, climate, and soil moisture is essential for informed decision-making in agriculture, forestry, emergency response, and drought assessment. In Alabama, several independent environmental monitoring networks currently collect these observations, but they operate separate databases, interfaces, and data access protocols—creating barriers to data sharing and integration.The Alabama Climate Observation Network (ACON) seeks to overcome these challenges by consolidating the state's dispersed environmental monitoring datasets into a unified, standardized platform. ACON has two primary goals: (1) to harmonize existing data sources using consistent variable naming and measurement units, and (2) to develop an interactive dashboard for data visualization, query, and download. This dashboard is being initially designed with specific end users in mind—such as the National Weather Service, Alabama Forestry Commission, and the Alabama State Climate Office—but will also be publicly available to ensure broad accessibility.The ACON system is built on a PostgreSQL backend with a Django-based frontend dashboard. Both components are containerized and deployed within a secure, scalable pod on a University of Alabama in Huntsville (UAH) server. By streamlining access to real-time and historical environmental data, ACON enhances statewide capabilities for proactive and science-informed decision-making.

Abstract #: 051

Title: **Investigating model reliability: A twofold evaluation of the National Water Model using time series and extreme events**

Author(s): Md Shahabul Alam, Savalan Neisary, Briton Tebbey, Sifan Koriche & Steven Burian

Presenter: Md Shahabul Alam

Organization: The University of Alabama

Session: Modeling & Water Management

Accurate prediction of streamflow under both extreme flood and drought conditions is critical for water resource management and hazard mitigation. Traditional model evaluation often relies on long-term time series metrics that summarizes performance across a wide range of hydrologic conditions, but this evaluation approach can overlook critical performance during extreme events. In this study, we present a twofold evaluation of the National Water Model (NWM) version 3.0 by comparing its reliability using conventional time series analysis and event-based assessment focused on extremes. We apply typical performance metrics, such as Nash-Sutcliffe Efficiency (NSE) and Kling-Gupta Efficiency (KGE), over retrospective simulations across the South Atlantic Gulf region to characterize the model skill. In doing this, we extract flood and drought events from the USGS streamflow records using a Python tool called Streamflow Extreme Event Dataset Developer (SEED) and evaluate model performance during these critical periods using another Python tool known as Community Streamflow Evaluation System (CSES). Our preliminary findings show that while the NWM generally performs well across full time series, the performance significantly declines during extreme events, especially in capturing flood peak timing and drought severity. These results highlight the importance of event-based evaluation to complement conventional approaches. This dual evaluation framework offers a more comprehensive understanding of the NWM's capabilities and limitations, providing insights to improve operational forecasting and leading to further model improvements.

Abstract #: 053

Title: **Lessons Learned from the 2023 Southeast Fall Drought**

Author(s): Brianne Minton, Lee Ellenburg, Rob Junod & Elliot Wickham

Presenter: Brianne Minton

Organization: Alabama Office of the State Climatologist

Session: Drought & Climate

Despite being a water-rich region, the Southeast is no stranger to drought. Its highly variable hydrologic cycle can shift rapidly between wet and dry conditions, leading to fluctuating drought patterns that are difficult to monitor and even harder to predict. And because the region's ecosystems have adapted to expect abundant annual rainfall, even short-term deficits can quickly lead to drying conditions. The fall 2023 drought offered a chance to examine regional challenges in drought monitoring, highlight initiatives already working to address those challenges, and explore opportunities to improve the Southeast's resiliency to future droughts.The 2023 drought—beginning in late summer and worsening into the fall—brought widespread impacts to livestock, pastures, and wildfire activity. It highlighted persistent challenges in drought monitoring, including limited observational data, difficulty capturing fast-evolving conditions, and the need for sensitive, effective communication around a topic that carries both emotional and economic weight. The drought also highlighted several ways that the Southeast is already addressing these challenges. The Southeast Drought Early Warning System (DEWS) provides a collaborative platform for knowledge sharing, while strong cross-state communication and coordination networks improve regional response. States across the Southeast are also leading innovative practices and programs that strengthen local drought resilience and address many of these challenges.The drought also underscored clear opportunities to build on this progress: integrating short-term drought indicators, strengthening relationships with sectors that can offer timely impact data, encouraging citizen-driven reporting to reflect diverse experiences, and expanding shared tools like webinars, communication kits, and lessons learned. The insights gained from the 2023 drought emphasize the importance of continued investment in collaborative, regionally tailored drought strategies. This presentation will provide a high-level overview of these lessons learned from the 2023 drought across the Southeast.

Abstract #: 054

Title: **An Interactive Geospatial Portal for Climate and Natural Resource Data in Alabama**

Author(s): Krel Haynes & Lee Ellenburg

Presenter: Krel Haynes

Organization: The University of Alabama in Huntsville

Session: Professional Poster

The Alabama Office of the State Climatologist (AOSC) supports science-based decision-making by providing weather, climate, and natural resource data to public agencies, private stakeholders, and the broader community. Over the past five years, AOSC has partnered with the Auburn University Water Resources Center and the USDA Natural Resources Conservation Service (NRCS) on a statewide initiative to advance sustainable irrigation through watershed planning. This collaboration has produced a rich geospatial database encompassing soils, digital elevation models, hydrologic and climate data, cultural features, and demographic information.To enhance accessibility and usability of these datasets, we are developing an interactive ESRI-based dashboard. This tool allows users to explore spatial layers, visualize overlap among datasets, and query key attributes relevant to natural resource planning and water management. Future updates will include the ability to download hosted datasets directly from the platform. This presentation showcases the design and functionality of the dashboard, emphasizing its potential to support applied research, planning, and stakeholder engagement across Alabama.

Abstract #: 055 **Student**

Title: **Water and Wastewater Based Planning for Workforce and Economic Development in Rural Alabama Black Belt**

Author(s): Barsha Pudasaini & Usam Pudasaini

Presenter: Barsha Pudasaini

Organization: University of South Alabama

Session: Student Poster

The rural Alabama Black Belt has been plagued by the vicious cycle of undeveloped public infrastructure, lower tax base, and rampant poverty for decades on end. Deliberate intervention projects have been launched, operated, and terminated, but the socio-economic status of the residents and the economic development of the 17 counties have remained unchanged. With basically a clean slate to work with, the unique soil and socio-economic dynamics of the region present an opportunity to develop a wastewater-based circular economy, where industries are developed, the workforce is planned, and policy intervention is spearheaded to have a direct impact on the region's economy. This region, to be represented by a few model cities, will have these pilot-level projects launched, in direct association with the public school system, to create a workforce of the future concentrating on the needs of the industries that are to be attracted, complementing water treatment, plumbing, wastewater treatment, treatment plant operations, and the re-use of treated wastewater.The project will primarily focus on community development or selected cities in the Alabama Black Belt, focusing on business attraction, eventually business retention, and workforce development based on the concentrated effort to establish appropriate water and wastewater infrastructure. The workforce planning for this industry is going to focus on collaboration between the Alabama Rural Water Association and the Alabama Department of Environmental Management via their apprentice programs for Operators. This also calls for cross-collaboration between the Alabama Community College Systems and higher education institutions for developing the training programs, materials, and managing the cross-platform communication, targeting jobs like plumbers, wastewater treatment plant operators, septic tank installers, among others. To best fit the needs of the region, to plan for these jobs, primary and secondary data will be analyzed. Primary data are to be collected using surveys and focus group discussions to collect the opinions of experts in the field of water and wastewater infrastructure, economic developers, and other experts as needed. The secondary data will be sourced from published results by the US Census Bureau, the American Community Survey, the US Department of Labor, and other federal agencies. The poster will present how the circular economy can be built in these Alabama Black Belt counties based on water and wastewater infrastructure, how jobs can be created, and how economic development activities will be stimulated in one of the poorest counties in Alabama.

Abstract #: 056

Title: **The State of Alabama's Estuaries and Coast: An update on the health of our coastal ecosystems and communities**

Author(s): Blair Morrison, Victoria Scriven, Tim Thibaut, Kristin Jenkins & Roberta Swann

Presenter: Blair Morrison

Organization: Mobile Bay National Estuary Program

Session: Water Quality 2

The Mobile Bay watershed is the fourth largest river basin by volume in the United States; as such, the Bay serves as a dynamic transition zone where freshwater rivers mix with the tidal salt water of the Gulf of Mexico. The Mobile Bay National Estuary Program (MBNEP) is charged with promoting the wise stewardship of the water quality and ecological integrity of this estuary of national significance. As a part of this mission, the MBNEP is tasked with generating periodic 'State of the Bay' reports to provide a comprehensive assessment of the environmental health of Alabama's coast, focusing on Mobile Bay and the surrounding landscape. Since the last stand-alone report in 2008, the Program has been integrating years of research and new data to share. In a collaborative approach that included literature reviews, data requests, an interactive workshop, and an open comment period, the new State of Alabama's Estuaries and Coast report features work from numerous MBNEP management conference members, state and federal agencies, environmental consulting partners, and the NOAA RESTORE-funded Decadal Study team. The scope of the State of Alabama's Estuaries and Coast includes the vast network of uplands, wetlands and waterways that characterize lower Alabama. The document aims to illustrate the connections between - and contributions of - local tidal watersheds, Mobile Bay, and the broader Mobile Bay watershed. Program priorities and data analysis focus on critical elements such as water quality, land use change, community and environmental resilience, habitat health and diversity, fish and wildlife populations, heritage and culture, and access. Stressors on the coastal environment are highlighted, underlining the importance of community involvement and education in fostering sustainable stewardship of natural resources. In addition to status and trends in ecosystem health, the report also brings attention to local research, restoration, and conservation efforts that improve our understanding of coastal ecosystems and work to preserve our coastal way of life. This presentation will cover highlights of the report, provide opportunities for digital downloads, and detail the next steps in sharing this information with our coastal communities and partners.

Abstract #: 057

Title: **Mechanistic Insights into Phosphate Removal by Hybrid Anion Exchange Resins: Advancing Sustainable Nutrient Recovery from Wastewater**

Author(s): Neha Sharma, Edward Apraku, Hannah Holmes & William Tarpeh

Presenter: Neha Sharma

Organization: Auburn University/Currently a postdoctoral scholar at Stanford University

Session: Water Quality 1

Excessive phosphorus discharges from wastewater and agricultural runoff disrupt aquatic ecosystems, contributing to environmental issues like eutrophication. Transforming liquid waste streams into sources of valuable phosphate products can mitigate this problem while reducing dependence on phosphate rock mining for fertilizers. Hybrid anion exchange (HAIX) resins, incorporating ferric oxide nanoparticles (FeOnp), exhibit high phosphate binding affinity under neutral pH, enabling efficient removal even at low concentrations (3 mg P/L). While previous studies have assessed HAIX's phosphate removal efficacy, limited resin characterization has hindered quantitative modeling of its dual active sites: quaternary ammonium groups and FeOnp sites. To bridge this gap, we combined aqueous-phase analysis with advanced X-ray techniques to elucidate the mechanisms driving selective phosphate removal.This study explores the phosphate-binding behavior of HAIX in the presence of competing anions within ideal and complex wastewater systems including real anaerobic membrane bioreactor (MBR) effluent. Two HAIX resin types were compared to examine the role of ammonium groups in phosphate adsorption: a strong-base, quaternary-ammonium-functionalized resin (SBA) and a weak-base, tertiary-ammonium (WBA) variant. Batch adsorption experiments demonstrated over 60% phosphate removal efficiency for both resins in simulated and real MBR effluent. Micro-X-ray fluorescence (XRF) imaging revealed a uniform distribution of FeO nanoparticles (FeOnp) within SBA, while WBA exhibited heterogeneous Fe distribution concentrated near the resin bead periphery. Uniform distribution of FeOnp sites in SBA inhibited adsorption of competing anions and organic moieties, enhancing selective phosphate removal. Pixel-by-pixel quantification of XRF maps determined the phosphate adsorption capacity of HAIX, aligning within ±20% of the values obtained from aqueous phase analysis. Phosphorus K-edge X-ray absorption spectroscopy combined with linear combination fitting depicted phosphorus adsorption primarily onto FeOnp sites at low concentrations, with increased adsorption onto quaternary ammonium groups at higher phosphorus levels. These advanced synchrotron techniques overcome the limitations of conventional methods (e.g., scanning electron microscopy) by probing the adsorbent surface at the molecular level, enabling detailed identification of elemental speciation and distribution. This comprehensive understanding of phosphate adsorption mechanisms onto HAIX informs resin optimization for its cost-effective recovery from wastewater. Our findings support the scalable implementation of HAIX within circular nutrient economies, promoting sustainable wastewater management and environmental conservation.

Abstract #: 058

Title: **AQUACULTURE EDUCATION: A THREE-PRONGED APPROACH**

Author(s): David Cline

Presenter: David Cline

Organization: Alabama Cooperative Extension System

Session: Aquatic Ecology

Aquaculture is among the fastest growing segments of agriculture worldwide, yet it is still surrounded by misconceptions, myths and lack of understanding. Our job as Extension educators is to find ways to build aquaculture literacy, aid existing and potential practitioners and help train the next generation of aquaculture scientists. Using a multimodal, three-pronged approach allows us to reach teachers and students, producers and researchers, and the public, locally and around the world.

Prong 1 - Using a train the trainer approach with teachers has a multiplying effect. Each teacher has the potential to educate more than 200 students per year. Through our Aquaculture and Aquaponics 101 workshops we have trained more than 700 teachers using hands-on experiences and group learning activities. In addition, Auburn University offers summer camp experiences for 15–18-year-old students. These camps include five days of intense fun and firsthand activities blended into a creative learning experience that provides the broadest possible exposure to natural resource careers with an emphasis on aquaculture, fisheries, and aquatic ecology.

Prong 2 – Webinars provide professional development opportunities for farmers, researchers, students and educators. Thus far, in 2024, the United States Aquaculture Society webinar committee in partnership with WAS, the National Aquaculture Association (NAA) and the Alabama Cooperative Extension System have offered 4 learning opportunities for more than 2,000 people from 62 countries.

Prong 3 – The US Aquaculture Society and the ACES Aquaculture Education and More YouTube channels provide on-demand education for a worldwide audience. These channels have garnered more than 1.25 million views and provided over 65,000 hours of education for people around the globe. It is our hope that this three-pronged approach can be duplicated by many other entities to help raise aquaculture awareness.

Abstract #: 059 **Student**

Title: **Co-Producing Resilience: Rethinking Frameworks for Equitable Climate Planning**

Author(s): Emma Lowe, Wanyun Shao & Simone Simone Domingue

Presenter: Emma Lowe

Organization: The University of Alabama

Session: Coastal Issues 1

The US Gulf Coast region is highly vulnerable to coastal hazards such as hurricanes and floods. Facing increasing risks posed by these hazards, coastal communities should adopt effective hazards mitigation plans. In practice, many communities are unprepared for the increased risks. It is thus critical to examine the current state of planning in these communities. Situated in one vulnerable community: Mobile Bay, Alabama; this study conducts an in-depth document-based analysis of local and regional plans pertaining to hazards mitigation. In particular, the document analysis includes land use plans, hazard mitigation strategies, infrastructure investment reports, and development policies. These documents are systematically coded to help identify institutional patterns of equity omission, utilitarian planning logics, and disinvestment in marginalized communities. The analysis of these documents reveals how planning practices have historically overlooked and intensified the vulnerabilities of underserved populations facing water-related hazards. The document analysis serves as a foundational component of a broader research project aimed at addressing climate adaptation inequities in water-rich but socioeconomically vulnerable regions. The project applies a co-production framework that integrates community knowledge into hydroclimatic modeling and adaptation planning. Insights from the coded materials inform the development of regional vulnerability indices, flood modeling tools, and community-informed adaptation scenariosThis research contributes to the literature on environmental justice, infrastructure governance, and participatory planning by demonstrating the value of qualitative document analysis in shaping interdisciplinary approaches to climate resilience.

Abstract #: 060

Title: **Advancing Irrigation and Watershed Planning in Alabama: Updates from Ongoing Projects**

Author(s): Thorsten Knappenberger, Lee Ellenburg & William Batchelor

Presenter: Thorsten Knappenberger

Organization: Auburn University

Session: Ag & Irrigation 1

Several ongoing projects across Alabama are aimed at better understanding how irrigation can be expanded in the state by empowering farmers to make informed decisions that reduce drought-related losses while also protecting water resources. This talk provides updates and highlights progress from three major efforts: the Alabama Irrigation Initiative, the USDA-NRCS Watershed Planning for Irrigation project, and Auburn University's long-term irrigation trials.The Alabama Irrigation Initiative integrates agronomic and economic data to provide profitability information at the farm level. Using soil and weather data on a 5km (~3mile) grid, the project simulates crop yield for irrigated and non-irrigated corn, soybeans, peanuts, wheat, and cotton. Now in its second year, the project continues to refine and expand these simulations.The Watershed Planning for Irrigation project, funded by USDA-NRCS, focuses on creating watershed plans and assessing the environmental impacts of irrigation and expanding access to federal cost-share programs. Approved watershed plans -- completed for the Middle Tennessee River Valley, Middle Alabama, and the Upper Choctawhatchee and Pea watersheds -- make farmers in those areas eligible for federal matching funds to support irrigation infrastructure. With the Pickwick Lake and Bear plan recently completed, planning is underway for the Upper Alabama watershed. In support of these efforts, Auburn University continues to evaluate crop variety performance under irrigated and rainfed conditions at several locations across Alabama, including the Tennessee Valley, Sand Mountain, EV Smith, Prattville, Gulf Coast, and Wiregrass Research and Extension Centers. Ongoing trials for corn, cotton, and peanuts help quantify irrigation's yield benefits across Alabama's diverse soils and climates.To support broader access and transparency, results and background information of the Alabama Irrigation Initiative and the Watershed Planning for Irrigation project are now accessible online. The website compiles decades of irrigation research in Alabama, along with current data and conditions. It serves as a comprehensive resource for the general public, farmers, researchers, and decision-makers.

Abstract #: 061

Title: **Rooted in Culture and Code: Advancing Rivercane Restoration Through Genomic Research and Tribal Leadership**

Author(s): Michael Fedoroff & Michael McKain

Presenter: Michael Fedoroff

Organization: The University of Alabama CONSERVE

Session: Special Session 3 - CONSERVE 1

Native rivercane (Arundinaria gigantea) is a cultural keystone species critical to the heritage, ecological stewardship, and economies of many Southeastern Tribal Nations, including the Choctaw Nation of Oklahoma, Jena Band of Choctaw, Poarch Band of Creek Indians, and Eastern Band of Cherokee Indians. Despite increasing efforts to protect and restore canebrakes, progress has been hindered by the lack of propagation protocols and access to genetically and ecologically appropriate planting stock. Through funding from the National Fish and Wildlife Foundation's America the Beautiful Ecosystem Restoration Initiative, this project—led by the University of Alabama CONSERVE Research Group—supports large-scale restoration by developing regionally appropriate rivercane seed stock and establishing demonstration sites in partnership with Tribal governments. The initiative spans 12 Southeastern states (NC, SC, MS, LA, OK, AR, KY, VA, TN, AL, WV, GA), with propagation centered in Tuscaloosa, Alabama and field sites located on Tribal and regional lands. By embedding staff within Tribal offices and co-producing restoration protocols, the project strengthens Indigenous-led conservation capacity while aligning with at least nine State Wildlife Action Plans that identify canebrakes as key habitats for species of greatest conservation need (SGCNs). Using large-scale genomics, the overall genetic diversity of hundreds of populations of rivercane will be assessed and linked to key morphological and physiological characteristics to optimize the selection process for plants in diverse restoration and conservation projects. This work advances a scalable, culturally grounded strategy to restore a vital species across ecocultural landscapes of the Southeastern U.S.

Abstract #: 062

Title: **Coupled modeling of diverse adaptation behaviors and land-atmosphere interactions to identify transformative adaptation pathways in agri-food systems**

Author(s): Nicholas Magliocca, Lee Ellenburg, David Haliczer, Andrew White & Mukesh Kumar

Presenter: Nicholas Magliocca

Organization: The University of Alabama

Session: Ag & Irrigation 1

Transformations of current agri-food systems (AFS) are necessary and inevitable. While the number and diversity of existing community-based/engaged initiatives aimed at scaling-up local AFS innovations is inspiring, they tend to be narrowly focused and/or operate in isolation from one another. Increasingly extreme seasonal hazards (i.e., droughts, floods) pose challenges that cannot be overcome by any single intervention in AFS 'leverage points' – or places in complex systems where small interventions can lead to large changes. Rather, 'chains' of interacting leverage points that synergistically intervene in socioeconomic, cultural, and biophysical systems are needed to catalyze scalable, transformative adaptation. Understanding how such transformative pathways might emerge requires advances in systems modeling tools, and specifically the integration of behaviorally rich models of adaptation decision-making into large-scale Earth system models. Research dynamically coupling agent-based models (ABMs) of diverse adaptation behaviors with large-scale crop and atmospheric circulation models is nascent, yet essential for identifying synergistic leverage point interventions across socioeconomic, cultural, and biophysical domains. This study presents two advances. First, an ABM with behaviorally diverse farmer decision-making was used to investigate factors explaining adaptation deficits in response to droughts. Second, the ABM was coupled with a proof-of-concept crop and land surface-atmosphere modeling framework to investigate the effects of farming practices on local and regional atmospheric conditions. Preliminary simulations using a high-resolution, gridded crop simulation models show that irrigation modifies soil moisture patterns across different crop types and soils and had the potential to reduce nitrogen export. Comparisons with WRF simulations underscore the importance of crop-specific irrigation dynamics and resolution-sensitive feedbacks. Further, initial results showed that adaptation deficits among farmers were driven by behavioral diversity rather than initial capital differences, and land-atmosphere feedbacks modified by irrigation adoption can moderate some of the impacts of adaptation deficits among the most disadvantaged. The integration of ABM-generated irrigation adoption scenarios into the coupled DSSAT–WRF system is now underway, enabling the project to evaluate how spatial patterns of adoption influence regional hydroclimate.

Abstract #: 063 **Student**

Title: **Evaluating Nitrogen Losses under the Precipitation Variability in the Winter Wheat using the DSSAT-CERES-Wheat Model**

Author(s): Vaibhav Shelar, Rishi Prasad, Anh Nguyen, Brenda Ortiz & William Batchelor

Presenter: Vaibhav Shelar

Organization: Auburn University

Session: Lightning Talk - Research 1

Nutrient pollution is a significant environmental concern today. Nitrogen (N) losses related to agriculture are the primary contributors to the contamination of surface water bodies and groundwater, resulting in serious human health and environmental risks. Therefore, it is crucial to examine N losses in row crop systems, especially in winter wheat, which receives an average of 917 mm of rainfall during its growing season (October to May) in Alabama. The complexities of the N cycle make it difficult to estimate N losses through leaching, volatilization, and denitrification, necessitating costly and advanced instrumentation. It is hypothesized that winter rains lead to substantial N losses. To test the hypothesis, a study was carried out on a commercial farm in Lawrence County, North Alabama, over two growing seasons of winter wheat (2022-23 & 2023-24). Based on several years of yield monitoring data, the farm was delineated into two management zones: high-yielding (HYZ) and low-yielding zones (LYZ). The objectives of this study were: 1) classifying the water years using historical precipitation data with the Standardized Precipitation Index (SPI), and 2) simulating N losses in winter wheat in water years classified by the SPI index utilizing the DSSAT-CERES- Wheat model (v.4.8.2.). Historical precipitation data from 1993-2024 (32 years) for the winter wheat growing season from October to May was analyzed to calculate the SPI index. Based on the Z-score computed in the SPI index, the water years were categorized into wet (1175 ± 107 mm), normal (906 ± 88 mm), and drought (693 ± 72 mm) years. Out of 31 growing seasons, there were 4 wet years, 5 drought years, and 22 normal years. The DSSAT model was calibrated and validated using data collected during the 2022-23 and 2023-24 growing seasons, respectively. The calibrated model was employed to simulate nitrogen losses from both HYZ and LYZ utilizing historical weather data. The results of the study indicated that leaching was the primary N loss pathway, followed by denitrification. Nitrogen leaching losses were significantly higher in wet years (HYZ- 66 ± 4.7 kg/ha & LYZ- 95.4 ± 4.7 kg/ha) compared to normal (HYZ- 50 ± 2 kg/ha & LYZ- 73.4 ± 2 kg/ha) and drought (HYZ- 38.2 ± 4.2 kg/ha & LYZ- 61.1 ± 4.2 kg/ha) years for both HYZ and LYZ. Volatilization and denitrification losses showed no significant differences; however, denitrification losses in LYZ during wet years had high variability (0.12 kg/ha). In wet years, both management zones experienced considerably higher total N losses (HYZ- 68.1 ± 4.9 kg/ha & LYZ- 98.1 ± 4.9 kg/ha) due to winter rain.

Abstract #: 064 **Student**

Title: **'We only hear because you know somebody who knows about it': Role of Social Networks in Irrigation Adoption in Alabama**

Author(s): Ruchie Pathak & Nicholas Magliocca

Presenter: Ruchie Pathak

Organization: The University of Alabama

Session: Special Session 4 - CONSERVE 2

Alabama's increasing seasonality, shorter growing seasons, recurring droughts, and large irrigation adoption deficit pose daunting challenges, particularly for small-scale producers practicing rain-fed agriculture. Irrigation, a common climate change adaptation around the world, can help reduce the risk of climate extremes and enhance yields even in areas that receive adequate annual rainfall. Existing studies have explored the factors that affect the adoption of irrigation by farmers within the state, including farmer characteristics, attitudes, farm size, surface water availability, soil suitability, and access to information. This study examines the role played by social networks in the diffusion and adoption of irrigation by small-scale farmers in the state. Social networks can enhance farmers' adaptive capacity and affect their willingness to innovate. These interpersonal connections and interactions facilitate the exchange of information about new technologies and their effectiveness, thus influencing farmers' decision-making regarding the adoption of a technology. It is through their network ties that farmers also get access to various resources, such as informational, financial, and artifactual (e.g., equipment or technology), which, in turn, helps them support their farming operations. Using primary data collected through in-depth, personal interviews with thirty-five farmers and applying a social network analysis approach, this study recognizes the different actors that are part of smallholder farmers' social networks and the various resources they mobilize through these connections. Results reveal that farmers who have not adopted irrigation tend to have smaller networks with fewer connections than those planning to adopt irrigation, whose networks include many irrigators, thus highlighting the crucial role social networks play in information dissemination. Furthermore, the spatial patterns of irrigation adoption show dispersion among irrigators as compared to the spatial clustering observed among non-irrigators. Additionally, the study explores the role of farmers' values and motivations in shaping their network associations and decision-making, thus influencing irrigation adoption. An improved understanding of such agrarian social networks is crucial to help ensure farmer learning and the dissemination of critical adaptation and mitigation strategies.

Abstract #: 065 **Student**

Title: **From Alabama to Oklahoma: Bridging Culture and Environmental Science Through Mixed Method Storytelling**

Author(s): Ekaterina Menkina & Parker King

Presenter: Ekaterina Menkina

Organization: Alabama Water Institute

Session: Special Session 3 - CONSERVE 1

At a time of growing environmental and water challenges, science should become more engaging, relatable, and culturally grounded to society. This presentation explores how mixed method storytelling, spanning case studies from cultural keystone species restoration in Alabama to Indigenous water planning in Oklahoma, can directly inform and enhance water and environmental science research and communication. We share an in-depth look at our science storytelling approach—which blends anthropology, GIS, and digital media to make complex data more accessible and impactful. Through participatory interviews, drone footage, and spatial mapping, we craft narratives that center community voices and promote deeper public understanding of critical water issues. Visual documentation of change, especially in areas like landscape management, helps communicate problems and co-develop solutions. We also reflect on key lessons and challenges, including ethical storytelling and the risks of oversimplifying complex topics.

Abstract #: 067 **Student**

Title: **Predicting Subterranean Drought and Ecological Risk using Hydrologic Indicators**

Author(s): Shaelyn Deal & Lee Ellenburg

Presenter: Shaelyn Deal

Organization: The University of Alabama in Huntsville

Session: Drought & Climate

Drought poses a critical threat to karst ecosystems, where hydrological shifts can rapidly impact sensitive subterranean habitats. This study combines ecological, hydrological, and geostatistical analysis to evaluate drought impacts on cave systems in northern Alabama. We used PRISM precipitation data to compute SPI at 28-day and 60-day scales, integrating these with soil moisture and groundwater metrics to assess relationships with cave water levels. Principal Component Analysis, Random Forest, and Mutual Information identified key predictors, while contingency tables evaluated categorical agreement with USDM and SMVI drought classifications. We also reviewed seasonal vulnerability of obligate cave species, including Tennessee Cave Salamanders and the Southern Cave Crayfish, to contextualize hydrological findings ecologically. Results underscore the value of multi-week drought indicators and highlight mismatches between surface drought signals and subsurface responses. This work advances understanding of drought in karst environments and informs conservation planning for drought-sensitive cave fauna.

Abstract #: 068

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

Author(s): Nicholas Magliocca

Presenter: Nicholas Magliocca

Organization: The University of Alabama

Session: Special Session 1 - Water Law & Policy Panel

Extreme hydrological hazards (e.g., increased precipitation intensity, 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 resilient agriculture (RA) practices has the potential to meaningfully reduce impacts form hydrological hazards. However, achieving widespread adoption of RA practices, such as deficit irrigation, could also increase pressure on Alabama's surface water and groundwater resources. Moreover, most RA 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. While incentives exist to promote the adoption of RA practices, these are not accessible to all farmers in the state, and structural barriers persist for many that impede widespread RA adoption and increasing the resilience of Alabama's agriculture. Achieving large-scale, transformative adaptations in agriculture while mitigating further hazard impacts and supporting sustainable and equitable rural livelihoods, is a grand challenge for society. This panel will build on the success of a panel session convened on this topic by the 'Socio-Agroclimatology' project at the ALWRC 2024 and provide updates from on-going research efforts to contribute to the development of an evidence-based water management plan for the state. This panel will reconvene a group of researchers, legal scholars, farmer advocates, and farmers to discuss the policy needs for supporting RA in Alabama in the future. Current policies and/or policy issues in Alabama that will be discussed include expanding irrigation access to all farmers and the potential benefits of and strategies for implementing a surface water accounting framework. 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. Panelists include Bennett Bearden (Geological Survey of Alabama), Lee Ellenburg (The University of Alabama in Huntsville), Heather Elliot (The University of Alabama Law School), Cindy Lowry (Alabama Rivers Alliance), Darrell McGuire (Deep South Food Alliance), Marie McGruder (McGruder Farms), Preston Roberts (Alabama Farmers Federation).

Abstract #: 069 **Student**

Title: **Does Land Tenure Affect Adoption of Cover Crops and No-till?**

Author(s): Emmanuel Okonkwo, Wendiam Sawadgo & Alejandro Plastina

Presenter: Emmanuel Okonkwo

Organization: Auburn University

Session: Ag & Irrigation 2

Nonpoint source nutrient pollution from agriculture is an important issue in the U.S., contributing to harmful algal blooms, increased water treatment costs, and the hypoxic zone in the Gulf of Mexico. Cover crops and no-till practices are effective in-field conservation practices that mitigate nitrogen and phosphorus runoff, improve water quality, enhance carbon sequestration, reduce erosion, and improve soil health. With nearly 40 percent of U.S. farmland being rented, understanding how land tenure affects conservation practice adoption is essential, particularly as agriculture faces increasing weather variability and demands for sustainability. This study examines the relationship between land tenure and the adoption of cover crops and no-till, across the 48 contiguous U.S. states using county-level data from 2012 to 2022. Using a fixed-effect model, we find that a 1 percentage-point increase in a county's share of rented farmland corresponds to a 0.763 percentage point decrease in the share of land in cover crops and a 0.571 percentage point decrease for no-till. Larger farms generally show lower adoption rates of both practices, although the interaction between farm size and rented land suggests that larger rented farms may have resources to overcome adoption barriers. Regional variation shows that tenant-landowner relationships and social capital may mitigate land tenure insecurity. Our findings suggest that flexible lease agreements, conservation incentives for landlords, and tenant-landowner workshops could enhance conservation adoption, especially in regions facing high land tenure insecurity. This study shows the importance of region-specific strategies to address disparities in conservation adoption, to improve water quality. This research is expected to generate discussion among researchers, policymakers, and agricultural stakeholders.

Abstract #: 070 **Student**

Title: **Characterization of Risks from Decentralized Water and Wastewater Infrastructure: A Multifaceted Approach**

Author(s): Rebecca G. Etter, Jillian Maxcy-Brown, Mark O. Barnett & Jeffrey LaMondia

Presenter: Rebecca Etter

Organization: Auburn University

Session: Lightning Talk - Research 2

Many households rely on decentralized water and wastewater treatment such as private wells and septic systems. When private wells and septic systems are located within the same area, septic effluent intrusion can impact private well water safety. Additionally, private well and septic system users bear a substantial financial burden, as they are solely responsible for the installation, maintenance, and upkeep of their decentralized water and wastewater infrastructure systems. This study analyzes these risks using geographic information systems (GIS). GIS was used to leverage existing public data to create a state specific, multifaceted analysis methodology to determine areas where drinking water wells and septic systems exceed affordability and safety benchmarks. Data sources include the United States Census, well water testing results, and the Social Vulnerability Index. To determine areas of increased affordability concerns, several affordability metrics were applied, at the block group level. The conventional method was used to represent water and wastewater costs as a percentage of household income. Additionally, the hours worked at minimum wage method was used to represent costs as the number of hours worked at minimum wage required for their repayment. For safety and water quality determinations, maximum contaminant levels, maximum contaminant level goals, and treatment techniques were extended from their current regulatory roles in centralized utilities and applied to private well water contamination. These regulations were used to compare private well contaminant levels to quality benchmarks currently employed centralized water infrastructure. Additionally, these regulations were used to generate risk rankings to determine the most threatened counties. Communities within the resulting high-risk areas have inequitably distributed risks from both water contamination and water access costs. These communities require expedited assistance tailored to their specific needs. Literature supports tailoring mitigation and assistance measures which has been shown to greatly increases their effectiveness when compared to a generic approach. Therefore, a focus on smaller scale, community-level interventions may be more appropriate than a national or state-wide disbursal of funds, in some cases. The goal of this study is to develop a multifaceted methodology to identify these at-risk communities, as well as a discussion of how to leverage existing data to better characterize the risks of our communities from failing private drinking water wells and septic systems. The methodologies presented herein can be adjusted for varying spatial scales to better characterize these communities' risks from affordability, social justice, and contamination concerns.

Abstract #: 071

Title: **Improving the Management of Evaporative Cooling Systems**

Author(s): Kelly Griggs, Jeremiah Davis, Jesse Campbell & Joseph Purswell

Presenter: Kelly Griggs

Organization: Auburn University

Session: Lightning Talk - Outreach & Extension

In the commercial poultry industry, evaporative cooling systems are used during the summer to help keep birds in poultry houses at comfortable temperatures. Well water is often used to supply the evaporative cooling system, and the quality of water is highly variable. In this study, one well water source and one municipal water source were used to clean minimally scaled (685 g/m2) and heavily scaled (10,914 g/m2) evaporative pads. Each set of pads was cleaned four times with well water and four times with municipal water. The heavily scaled pads were sourced from a farm location in southeast Alabama, where the well water was collected. A 30% phosphoric acid cleaner was selected for all eight cleanings. Over eight cleaning events, a total of 687 g (roughly 54%) and 1020 g (roughly 5%) of scale was removed for the minimally scaled and heavily scaled pads, respectively. This study highlights the importance for producers to proactively manage scale formation on evaporative cooling pads through more frequent cleaning events beginning when pads are new. Waiting until pads are heavily scaled before addressing the scale build-up creates a scenario that becomes difficult to improve.

Abstract #: 072 **Student**

Title: **Improving Silt Traps: Full-Scale Performance Evaluation Under Regional Conditions**

Author(s): Lillian Krueger

Presenter: Lillian Krueger

Organization: Auburn University

Session: Stormwater 2

Sediment is a pervasive and persistent issue in waterbodies around the world. This research study was conducted to address and improve upon the current roadside stormwater management and the downstream water quality results. The practice evaluated was the silt trap. Under specific regional conditions, calculated through Geographic Information Systems (GIS) models, the Modified Universal Soil Loss Equation (MUSLE), and the AutoCAD Civil 3D Hydrographs application, the performance was assessed through a series of rigorous full-scale tests. A standard silt trap resembled an excavated sump, one foot deep, six feet wide across the bottom, at a recommended 2:1 length-to-width ratio. Other sediment control practices such as wattles, silt fences, slash mulch berms, and earthen berms were used in conjunction with the silt trap. Each experiment aimed to discover a more feasible and effective installation (MFE-I) of the silt trap. After three longevity tests simulating the 2-year 24-hour storm event of the region, the impoundment length, dewatering time, water storage volume, sediment capture weight, and water quality values were recorded for comparison. The cost, installation effort, and required maintenance were also factored into the decision for the MFE-I. Results showed that the MFE-I achieved a 21 % improvement in sediment retention, a nearly 90 % improvement in downstream total suspended solids (TSS), and a 29 % improvement in downstream turbidity compared to the standard configuration. The MFE-I exhibited extended impoundment and retained water longer to facilitate sediment settling found lacking in the control practice. These findings suggest that a silt trap paired with a wired-backed silt fence with a cut-out weir could be a viable application for roadside stormwater management and water quality preservation.

Abstract #: 073 **Student**

Title: **How are oyster farmers and harvesters responding to climate change?**

Author(s): Jillian Sower, Kristen Krumhardt, Christopher Anderson, Russell Grice & James Stoeckel

Presenter: Chris Anderson

Organization: Auburn University College of Forestry, Wildlife and Environment

Session: Extension, Outreach & Partnerships 2

Short, narrative-style climate scenarios are used to communicate plausible ecological futures in an accessible way to stakeholders from a wide range of educational and cultural backgrounds. Scenarios are generated using environmental models such as the Large Ensemble Community Project and focus on different environmental factors and how they may change over time. Models for this project focused on processes key for eastern oyster (Crassostrea virginica) survival, a species sensitive to climate change impacts. Factors include net primary productivity, pH, salinity regimes, and temperature in the Mississippi Sound and Mobile Bay over the next three decades. Results predicted higher salinities and water temperature and lower net primary productivity and pH, indicating stressful conditions for oysters. Climate scenarios depicting these conditions using scientific illustrations were distributed to oyster farmers and oyster harvesters from Alabama and Mississippi to communicate future impacts. Scenarios were accompanied by a 10-question survey to gauge what resources and techniques participants have to respond to environmental change, as well as how these possible responses can or will change with expanding climate impacts. Results can help identify the accessibility of known strategies and uncover novel strategies, which in turn could inform future policy and management strategies.

Abstract #: 074

Title: **A case study of a commercial broiler farm in Cullman County, Alabama utilizing a rainwater harvesting system to offset rising water costs.**

Author(s): Carson Edge, Jeremiah Davis, Jesse Campbell, Eugene Simpson & Joseph Purswell

Presenter: Carson Edge

Organization: Auburn University

Session: Extension, Outreach & Partnerships 2

It is important for broiler producers to have access to sufficient water supplies as it is a critical nutrient for the health and wellbeing of broilers (meat-type chickens). Currently, the only water sources available to broiler producers are well water and municipal water. In areas of broiler production that rely on well water, producers can experience issues with low-yield or poor water quality which can cause damage to equipment and become expensive to treat. Producers who have access to municipal water can have a more reliable water source, however in some areas of the U.S. water rates have increased. This has been the experience for broiler producers in Cullman County, Alabama, where the county water department announced customers would see increased water rates beginning in 2015. In anticipation of increased rates, a rainwater harvesting (RWH) system was constructed in 2016 on a four-house commercial broiler farm in Cullman County to evaluate the systems performance and help offset rising water costs. The RWH system captures rainfall from all four roof areas via gutters and downcomers. Captured water is gravity fed to a 100,000-gal flexible storage bladder through a system of aboveground and underground piping. Prior to entering the storage bladder, vortex prefilters provide a first flush and filtration of debris larger than 280 µm. When water is required, it is pumped from the storage bladder to a system control room where water is filtered through a bag filter, disinfected using UV light, and then pumped to the houses. When storage is insufficient, the producer can switch to municipal water. While the producer has observed a reduction in their monthly water bill, the system did not include an effective way of measuring rainwater use (RWU) and municipal water use (MWU). Therefore, the purpose of this study was to quantify daily farm RWU and MWU to better understanding the overall performance of the RWH system. Two wireless ultrasonic meters were used to capture daily farm RWU and MWU from Jan. 13, 2024 to Jan. 3, 2025. Six flocks were grown during the test period with an average flock age of 45 d. Total water usage (TWU) for the entire farm per flock ranged between 265,660 and 421,000 gal. Over the entire 12-month test period, the farm consumed 1,919,903 gal of water where RWU accounted for 55% of TWU while MWU accounted for 45% of TWU. RWU tended to be greater compared to MWU in the cooler weather months when the primary source of consumption was from broiler drinking water. During warmer months, increases in daily water use were observed due to the use of evaporative cooling systems to maintain in house temperatures. Combined with a lack of rainfall, MWU tended to be greater than RWU during the warmer months. Based on the water rates during the test period (average of $15.86 per 1,000 gal) the producer saved $16,715. Had the producer only had access to MWU they would have paid $30,224 for their water.

Abstract #: 075 **Student**

Title: **Improving Drought and Soil Moisture Monitoring in Alabama**

Author(s): Dylan Schmidt, Brianna Boles & W. Lee Ellenburg

Presenter: Dylan Schmidt

Organization: The University of Alabama in Huntsville

Session: Student Poster

The Alabama State Climate Office maintains a network of over thirty soil moisture monitoring stations statewide. Together with partner agencies such as NRCS, NOAA, and Auburn University, these observations offer a valuable and increasingly comprehensive view of soil moisture conditions in Alabama. However, raw soil moisture data becomes far more meaningful when linked to plant-available water (PAW) — the portion of soil moisture that plants can use. To do this effectively, precise characterization of soil properties is crucial. Understanding PAW is critical for drought monitoring, agricultural decision-making, and improving the accuracy of hydrological and land surface models. This study evaluates multiple methods for estimating PAW using different levels of input data and across diverse Alabama soil types. We compare the use of pedotransfer functions (e.g., the Rosetta model) under two conditions: one using basic inputs (soil texture only) and the other using more detailed inputs (including bulk density and organic matter). We also explore an empirical approach that derives field capacity and wilting point thresholds from in situ soil moisture observations at different depths. By applying these methods across diverse soil profiles, we assess how PAW estimates respond to differences in data availability and soil properties.

Abstract #: 076

Title: **Empowering Women in Natural Resources: Insights from the Bennett Trust Land Stewardship Program**

Author(s): Leanne Wiley & Larry Redmon

Presenter: Leanne Wiley

Organization: Texas A&M AgriLife Extension

Session: Extension, Outreach & Partnerships 2

Women are playing an increasingly prominent role in natural resource management, with more women now serving as owners, operators, and professionals than in previous decades. This shift highlights the importance of addressing their distinct learning preferences, which often emphasize collaboration, holistic decision-making, and long-term sustainability. The Bennett Trust Land Stewardship program, offered through Texas A&M AgriLife Extension, focuses on conservation education with an emphasis on land and water management. Recognizing the rising number of women in agriculture, the program provides both a traditional co-ed workshop and a women-only workshop each year. This presentation will explore the structure and impact of both workshop formats, emphasizing the importance of understanding diverse management strategies, leadership styles, and the unique contributions of male and female producers. Supporting these differences is key to empowering women in agriculture and fostering sustainable growth for future generations.

Abstract #: 077

Title: **Understanding Bats: Benefits and Regulatory Review for Development Projects**

Author(s): Nick Sharp

Presenter: Nick Sharp

Organization: TTL, Inc.

Session: Lightning Talk - Outreach & Extension

Bats have recently become a focal point for regulators, environmental professionals, and businesses alike, largely due to the spread of White-Nose Syndrome, a devastating fungal disease that has decimated bat populations across North America since 2006. The impact of this disease has been so severe that bat species, including the Northern long-eared bat (Myotis septentrionalis) and the Tricolored bat (Perimyotis subflavus), have been listed as endangered or proposed endangered by the U.S. Fish and Wildlife Service. But why should we care about bat populations? What does this mean for businesses or clients if a bat species is endangered? Bats are often misunderstood, yet they play an essential and beneficial role in ecosystems worldwide, providing vital services such as insect control, pollination, and seed dispersal. This presentation explores the ecological importance of endangered bats, specifically in Alabama, and their significance within the context of construction and development.Additionally, the presentation will discuss the implications of Alabama’s endangered bat species on project planning and execution, emphasizing the need for compliance with conservation measures set forth by the U.S. Fish and Wildlife Service.

Abstract #: 078 **Student**

Title: **Spatial Patterns of Power and Water in Alabama's Food System**

Author(s): Sydney Turpin & Nicholas Magliocca

Presenter: Sydney Turpin

Organization: The University of Alabama

Session: Special Session 4 - CONSERVE 2

Power in agri-food systems strongly shapes who produces food, who profits from it, and who controls access to essential natural resources such as land and water. In Alabama, smaller-scale producers often face barriers to competing with highly commercialized food value chains. These barriers can extend beyond markets and include unequal access to water resources. This study explores the spatial relationships among food value chain structure, power distribution, and water access in Alabama, focusing on indicators such as riparian access and irrigation infrastructure. To assess power within the food system, the farm share of the food dollar (FSFD) is calculated for each county. Derived from farm sales and food consumption data, FSFD reflects how many cents of each consumer food dollar are returned to producers. This offers insight into the distribution of economic power across the food value chain. By connecting food system structure to landscape-level water access, this exploratory spatial analysis aims to reveal how patterns of economic power in agri-food networks align with resource inequities. Findings are expected to inform future research concerning food value chain distribution, the challenges faced by small-scale producers, and the connections between food and water systems in underserved regions.

Abstract #: 079

Title: **Performance Implications of Erosion Controls on Different Soil Types**

Author(s): Wesley Donald, Jack Cater & Michael Perez

Presenter: Wesley Donald

Organization: Auburn University

Session: Stormwater 2

Construction sites rely on many different erosion control practices to protect bare slopes and prevent soil loss. Published data from observational tests or 3rd-party testing determines performance expectations that designers may use when developing construction management best management practices plans (CBMPPs). This study evaluated common erosion control practices using large scale rainfall simulators to evaluate various erosion control methods using 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 hill slopes from rainfall-induced erosion. Erosion control practices including straw mulch and erosion control blankets were tested to determine soil loss mitigation performance. Using the Revised Universal Soil Loss Equation (RUSLE) to determine the appropriate cover factors (C-factor) for these practices demonstrated that products and practices appear to have different C-factors for each soil type, contradictory to the nature of what the RUSLE equation is thought by the industry to provide. The test parameters and results of this research are discussed. Considerations on C-factor applications are also discussed regarding how site soil characteristics may affect expected erosion control performance that designers may need to consider when developing CBMPPs.

Abstract #: 081

Title: **These Chips are Making Me Thirsty: Data Center Water Use in Alabama**

Author(s): Charles Miller

Presenter: Charles Miller

Organization: Alabama Rivers Alliance

Session: Water Law & Policy

As AI and cryptocurrency drive demand for computing power, Alabama and the Southeast have become a target for data center developers. This is partially due to our abundant water resources. This presentation will examine water use by data centers, including both direct (e.g., cooling) and indirect (e.g., from thermoelectric power generation) uses. It will also examine possible legal and policy issues that may present obstacles to data center development in Alabama, and examine alternative water policy frameworks (e.g., regulated riparianism, often referred to as a "water plan") that can balance and manage competing uses of water more effectively than Alabama's current water laws.

Abstract #: 082 **Student**

Title: **Understanding the nutrient dynamics of reservoirs and their implications for downstream water quality across the Southeast United States**

Author(s): Mumtahina Rahnuma & Nitin Singh

Presenter: Mumtahina Rahnuma

Organization: Auburn University

Session: Student Poster

In the past few decades, we have built thousands of reservoirs across the Southeast United States to meet our demands for energy, food, and water. While these reservoirs provide a range of ecosystem services, they also serve as “instream reactors” and alter water quality along the river network. Hence, to better manage these reservoirs and sustain the services they provide, there remains a need to advance our understanding of hydrological and biogeochemical processes that govern these managed aquatic ecosystems. However, to date, it remains unclear how the source vs. sink behavior of reservoirs varies in space and time across the Southeast United States and what such behavior may mean for the water quality downstream. To address this knowledge gap, we studied the fluxes of key water quality parameters, total phosphorus, total suspended solids, total nitrogen, stream temperature, and Dissolved Oxygen upstream and downstream of several dozen reservoirs. To fill in data gaps in nutrient concentrations, we utilized concentration-discharge relationships to simulate concentrations for the missing period for each analyte and the monitoring station. Further, we used a mass balance approach and time series of nutrient fluxes to quantify whether the reservoir is a sink or source for each analyte and reservoir. Lastly, we relate this source vs. sink behavior with the eutrophic status downstream of the reservoir. We hypothesize that source vs sink behavior may vary with each analyte, land use of the contributing watersheds, and local reservoir controls (e.g., residence time). This study will highlight the underlying mechanisms that drive nutrient processing in reservoirs and their implications for water quality downstream. The findings will contribute to better management of reservoirs and water quality across the Southeast United States.

Abstract #: 083

Title: **Assessing the Capacity of Local Officials in Alabama to Plan for Climate-Resilient Water Infrastructure and Management**

Author(s): Spencer Goidel, Paul Harris, Megan Heim-La Frombois, John Morris & Jose Vasconcelos

Presenter: John Morris & Spencer Goidel

Organization: Auburn University

Session: Social Sciences/Human Dimensions

This interdisciplinary research examines water infrastructure and management in Alabama (US) and the impact of severe weather events on those systems and communities' capacities. Using a multi-disciplinary approach to climate resiliency and using Alabama as a case study, this research builds an inventory of knowledge to assist policy makers, city planners, infrastructure engineers, scientists, economists, and citizen stakeholder groups in decision making around climate resilient infrastructure. Data were collected through a web-based survey of city managers, planners, public works officials, and other public officials, as well as members of professional trade organizations, such as the Alabama Stormwater Association, the Water Environment Federation Alabama Chapter, the Alabama Chapter of the American Public Works Association, and Alabama's Water Environment Association. As a result of the survey, an inventory of severe weather events, their frequency and severity, and their impact on water-related infrastructure across the state of Alabama has been created. Degrees of engagement with local citizen groups or other local stakeholders; governance issues, including governmental collaboration and assistance/funding; and the role that severe weather events play in decision making about water infrastructure are also examined. Perceptions about preparedness, planning, knowledge, and resources are gauged. Barriers and challenges, as well as best practices for creating more resilient communities, were also identified by practitioners and public workers. Follow-up interviews with local officials around the state reinforced these themes, and provided specific examples of barriers, challenges, and successes. The goal of this research's findings is to assist in local decision making around resilient water infrastructure, and to help communities prepare for the effects of severe weather on their water infrastructure.

Abstract #: 084 **Student**

Title: **Assessing Social Vulnerability and Land Use Change Interactions Across the Gulf Coast: A Multi-Temporal Analysis in Alabama, Louisiana, and Mississippi**

Author(s): Annyca Tabassum & Dr. Wanyun Shao

Presenter: Annyca Tabassum

Organization: The University of Alabama

Session: Social Sciences/Human Dimensions

Understanding the relationship between social vulnerability and land use/land cover (LULC) change is vital for developing effective flood risk mitigation strategies, particularly in coastal regions facing increased environmental stress due to coastal proximity, high flood frequency, rapid urban growth. This study investigates how changes in the Social Vulnerability Index (SoVI) correspond with LULC transformations across communities in three Gulf Coast states—Mississippi (Hinds, Rankin), Louisiana (Lafayette, Vermilion, St. Martin, Iberia Parishes), and Alabama (Mobile, Baldwin Counties). We use a multi-temporal analysis approach, integrating demographic and socioeconomic data from the U.S. Census and American Community Survey to calculate SoVI at five-year intervals between 2005 and 2023. LULC classifications are derived from the National Land Cover Database (NLCD) for the corresponding years to detect changes in urban areas, impervious surfaces, wetlands, and forest cover over time. Principal Component Analysis (PCA) is used to generate SoVI scores, while spatial analysis and change detection techniques in GIS quantify LULC trends. By doing a comparative study between land use changes and social vulnerability together, we aim to find patterns showing how development affects community vulnerability over time. This cross- state, multi-temporal analysis will highlight critical zones where environmental changes influence social vulnerability. That will help to assess the risk and inform for a better of regional flood mitigation and resilience planning.

Abstract #: 086

Title: **Integrated Assessments of Social, Infrastructural, and Environmental Vulnerabilities in Mobile Bay, Alabama**

Author(s): Wanyun Shao, Md. Munjurul Haque, Hemal Dey & Fatema Nourin

Presenter: Wanyun Shao

Organization: The University of Alabama

Session: Special Session 5 - RESTORE

This presentation synthesizes findings from four complementary studies that collectively assess the evolving vulnerability landscape of Mobile Bay, Alabama—a region increasingly exposed to flood hazards and a suite of environmental stressors. The first study employed spatial analysis to examine the relationship between land use and land cover (LULC) changes and social vulnerability changes from 2000 to 2020. Results revealed distinct hotspots where conversion to developed land coincided with heightened social vulnerability, raising concerns about concentrated risk exposure. The second study engaged local stakeholders to integrate experiential knowledge into flood vulnerability mapping, resulting in a more contextually grounded representation of flood risk that supports informed planning and response. The third study developed a spatial database of critical infrastructure, applying suitability analysis to identify optimal locations for emergency shelters to enhance disaster preparedness and response efficiency. The final study utilized GIS, remote sensing, and machine learning techniques to detect and analyze shoreline changes over the past two decades, revealing patterns of erosion and accretion that inform long-term coastal management. These studies altogether demonstrate the value of integrated, data-driven, and participatory approaches for assessing and managing multifaceted vulnerabilities in coastal communities.

Abstract #: 087 **Student**

Title: **Quantifying Wetland Changes in the MTA Delta Using Deep Learning and Remote Sensing Approaches**

Author(s): Md Mozahidul Islam, Chris Anderson, Shufen Pan & Zutao Ouyang

Presenter: Md Mozahidul Islam

Organization: Auburn University

Session: Special Session 5 - RESTORE

Coastal wetlands are vital for sustaining biodiversity, regulating hydrological processes, and supporting adjacent ecosystems. However, they are vulnerable to anthropogenic and natural disturbances and require comprehensive monitoring to understand their spatial-temporal dynamics. This study focuses on the Mobile-Tensaw-Apalachee (MTA) Delta in Alabama, a largely freshwater tidal wetland system crucial for ecological integrity, serving as a biodiversity hotspot. To evaluate wetland dynamics from 2019 to 2024 in MTA, we utilized deep learning and remote sensing technologies to map wetland extents at high spatial resolution (10 m). Addressing the limitations of relying solely on optical satellite imagery, we integrated atmospherically corrected Sentinel-2 optical annual composite images with monthly median Sentinel-1 SAR data within Google Earth Engine for wetland classification. Ground-truth data for training and accuracy assessment are sourced from geo-tagged photographs, Mobile Bay National Estuary Program (MBNEP) points, citizen science contributions, national land cover datasets (C-CAP, CDL, NLCD), and visual observations based on the highest zoom level in Google Earth Pro. In total, 9367 ground truth data were collected. Eight land cover classes were classified using a deep learning classification model, which included five wetland classes (Forested Wetlands, Marsh, Unconsolidated Shore, Upland Forest, and Open Water) and three non-wetland classes. Two approaches were employed: pixel-based models (Random Forest, 1D-CNN, ResNet, DenseNet), as well as localized image chips for deep learning models (U-Net with ResNet-34, DeepLabv3, and a self-supervised HF: ResNet50_Sentinel2_ALL_DINO). Among these models, those based on image masking achieved an accuracy of 96–97%, validated against independent ground data. The study indicates that approximately 0.02% (1,402 ha) of Forested Wetlands and 4% of marshes were lost during this period, while Unconsolidated Shore and Open Water increased by 11% and 1%, respectively. Change detection identified marshes as the most conversion-prone class, with riverbeds and mixed forests in headwater zones shifting toward upland types, predominantly driven by quasi-natural processes. These findings underscore the importance of high-resolution, temporally consistent wetland mapping for effective environmental management and policy planning.

Abstract #: 088

Title: **Groundwater Level Trends Across Alabama's Groundwater Provinces: Information from the 2024 Water Year**

Author(s): Kyle Olsen & Gregory Guthrie

Presenter: Kyle Olsen

Organization: Geological Survey of Alabama

Session: Water Monitoring

Information on the state's groundwater conditions is an important component of drought monitoring and water resource planning. The Geological Survey of Alabama (GSA) Groundwater Assessment Program operates a statewide, real-time groundwater monitoring network that supports long-term water resource assessment across all major aquifers in the state. This network comprises 41 wells containing transducers that measure pressure and temperature data, which are recorded every two hours and transmitted to GSA servers twice daily across a cellular network. Three of the transducers installed in coastal wells also record specific conductance. Data from 21 real-time wells are served to the USGS National Groundwater Monitoring Network once a week. The network wells are strategically distributed across Alabama's five groundwater provinces—Highland Rim, Cumberland Plateau, Valley and Ridge, Piedmont Upland, and East Gulf Coastal Plain—continuously capturing groundwater conditions in the state's most significant aquifer systems. This presentation reviews the general trend of groundwater levels (e.g., stable, declining, recovering) from real-time wells in each major province and major aquifers over the 2024 water year and compares these data to statistical averages reflecting each well's period of record. The wells are grouped by groundwater province and aquifer unit using WaterSTAR and GIS-based aquifer mapping. Data from the real-time monitoring program provides critical context for drought response, aquifer sustainability, and water resource planning. It also serves a broader public function—delivering accessible, location-specific data to state agencies, local governments, consultants, regulators, and private citizens. By formalizing the structure of this analysis and producing consistent annual updates, the GSA Groundwater Assessment Program aims to provide a transparent and useful accounting of groundwater conditions across Alabama on a yearly basis.

Abstract #: 089

Title: **Advancing Hydrologic Modeling through Community-Driven Development: The NextGen Framework**

Author(s): Arpita Patel, James Halgren, Steven Burian, Zach Wills & Jordan Laser

Presenter: Arpita Patel

Organization: The University of Alabama

Session: Lightning Talk - Research 2

The NextGen Water Resources Modeling Framework (NextGen) represents a significant advancement in hydrologic modeling. This study introduces the "Community NextGen" initiative, a collaborative effort by the University of Alabama and Lynker, aimed at fostering open innovation and accelerating the framework's development. Our project focuses on four key areas: (1) establishing a CIROH Community Fork of NextGen to promote open governance and community-driven development; (2) developing NextGen In A Box (NGIAB) and DataStream, a deployable laboratory workbench for experimenting with localized configurations; (3) utilizing robust model evaluation functionality; and (4) implementing comprehensive testing and continuous integration/delivery pipelines. These efforts aim to facilitate efficient research-to-operations and operations-to-research transitions, ultimately enhancing our ability to model and predict water resources at various scales. By fostering a collaborative ecosystem around NextGen, we seek to harness the collective expertise of the hydrologic community, driving innovation and improving the framework's applicability to diverse water management challenges. This study will focus on the strategies for community engagement, including the development of standards and guidelines, and share insights from case studies utilizing NGIAB, DataStream as an experimental platform, and demonstrating the potential for accelerating the integration of research insights into NOAA operational forecasting.

Abstract #: 090 **Student**

Title: **Assessing Infrastructure Vulnerability and Evacuation Routes to Flooding Using Spatial Database Management: A Case Study of Mobile City, Alabama**

Author(s): Md Munjurul Haque, Wanyun Shao, Supath Dhital & Dapeng Li

Presenter: Md Munjurul Haque

Organization: The University of Alabama

Session: Special Session 5 - RESTORE

Flooding is a growing global threat, with both the frequency of flooding and the extent of flood-related damage increasing significantly over the past three decades. Coastal communities such as Mobile City are facing escalating risks, particularly as critical infrastructure, including roads, hospitals, schools, and public buildings become increasingly vulnerable to floods. This study aims to assess infrastructure vulnerability and identify effective evacuation routes using Spatial Database Management Systems (SDBMS) in Mobile City. The use of SDBMS allows for the integration, management and analysis of diverse geospatial datasets through spatial queries, the identification of vulnerable infrastructure and the computation of optimal evacuation paths. Publicly available datasets are utilized, including the FEMA flood hazard layer and OpenStreetMap infrastructure data, to identify critical infrastructure located within 100-year flood zones. By incorporating census block data, the study estimates the number of people that are exposed within these vulnerable areas. To facilitate safe evacuation, spatial queries are used to determine the shortest routes from exposed locations to existing emergency shelters. In cases where existing shelters are not located nearby, a suitability analysis is conducted to identify alternative potential shelter sites. This analysis considers multiple criteria, including elevation, distance from FEMA flood zones, land use/land cover (LULC), population density, proximity to roads and service points, and slope. The goal is to propose nearby, high-suitability locations for emergency shelters to improve evacuation efficiency. The methodology developed in this study is generalizable and can be scaled for application in other geographic regions. The findings are expected to support policymakers and urban planners in enhancing flood risk mitigation and emergency preparedness strategies.

Abstract #: 091 **Student**

Title: **Sediment Dynamics and Coastal Resilience: Investigating Geomorphic Changes on Dauphin Island, AL from 2015-2023**

Author(s): Lauren Talkington, Lana Narine & Stephanie Shepherd

Presenter: Lauren Talkington

Organization: Auburn University Department of Geosciences

Session: Student Poster

Dauphin Island, AL is found off the coast of southern Mobile County, Alabama, and experiences dynamic and rapid geomorphological changes. Among them, such changes include periodic attachment and collapse of peninsulas, overwash from storm surge, and anthropogenic factors. In this study, we investigated sediment volume changes across Dauphin Island, AL from 2015 to 2023 through two hurricane events Nate (2017) and Sally (2020), both of which caused significant geomorphic changes to the island's morphology. We implemented an image classification workflow using the supervised maximum likelihood technique to determine land cover changes following each event. Using high-resolution (5 m) orthorectified and radiometrically corrected imagery from RapidEye and PlanetScope satellites, acquired in 2015, 2018, and 2023, we delineated seven land cover categories (Developed, Wetland, Barren, Vegetated, Unvegetated Barrier Flat, Water, and Sandy Water) based on field-based observations and field visits to Dauphin Island. We first split the island into two regions; the undeveloped west end and the developed east end, resulting in a total of six land cover classifications. Using the classified images, a land cover change analysis was completed for each region, from 2015-2018, 2018-2023, and 2015-2023. We targeted regions that illustrated a land cover change with a difference of DEM calculation to compute the sediment volume change of the most affected regions from 2015-2023. We found that the regions that aligned with the most significant change from the Difference of DEM calculations aligned with class changes of sandy water to barren, sandy water to developed, and developed to barren. From the DEM calculations, we found four regions of significant increase in sediment volume: Sanchez Spit, Pelican Peninsula, Katrina Cut and the far West end. These regions experienced volume changes of 77,496.34, 189,922.56, 190,552.36, and 162,793.68, cubic meters, respectively.This illustrates the regions of the island that are affected by beach remediation projects, as well as the regions that are still affected by natural barrier island geomorphic processes. The results of this work provide a roadmap to guide future research on Dauphin Island as well as other Gulf Coast barrier islands, particularly, the continued push to gain a better understanding of how these islands respond to natural and human disturbances.

Abstract #: 092 **Student**

Title: **Modeling Spatiotemporal Salinity Dynamics Within the Mobile-Tensaw River Delta Using Machine Learning**

Author(s): Thomas Kavoo, Andrew Balder, Latif Kalin, Christopher J. Anderson & Sanjiv Kumar

Presenter: Thomas Kavoo

Organization: Auburn University

Session: Student Poster

Tidal freshwater forested wetlands (TFFWs) are ecologically significant yet highly vulnerable to salinity intrusion driven by sea level rise and changing hydrological regimes. This study investigates salinity dynamics within the Mobile-Tensaw River Delta (MTRD), one of the largest and the most ecologically significant deltas within the United States. We utilize high frequency data collected from nine monitoring stations distributed within the delta, along with other environmental variables including river discharge, tidal levels, ocean salinity and wind for the period 2022 to 2024. The study employs advanced machine learning techniques designed for complex environmental phenomenon. We develop and evaluate five Deep Learning (DL) models to predict salinity at 24 hours lead time using ten predictors. The DL models architecture included traditional temporal models (such as LSTM and GRU) and newer residual network (ResNET) inspired designs (residual LSTM/GRU) with capabilities to capture deeper and wider relationships within environmental variables. All the models demonstrate a strong predictive accuracy (NSE 0.91 to 0.98, RMSE 0.07 to 0.38 PSU, and pBias ±5%) across all nine stations where average salinity varies from 0.17 to 1.26 PSU. The ResNET model designs were more robust and efficient, especially generalizing to unseen locations. The salinity exceedance analysis reveals clear spatial and seasonal patterns of salinity dynamics within the delta. Stations near Mobile Bay and further away from freshwater inflow show prolonged periods of high levels of salinity, often lasting two months or longer from later summer through fall (August to October). Upstream stations and closer to freshwater inflows do not show regular patterns of exceeding critical salinity thresholds. In addition, we also assess salinity drivers to evaluate which environmental factors drive salinity predictions. The results show that ocean salinity (24%), tidal regimes (16%), and river discharge (12%) are primary factors driving salinity dynamics. This study demonstrates the utility of machine learning techniques to predict salinity dynamics within the TFFW ecosystems. Understanding when and where critical salinity thresholds are exceeded will inform adaptive management, restoration planning, and monitoring strategies to improve wetland resilience under increasing frequency and intensity of environmental stressors.

Abstract #: 093

Title: **Novel Approaches to Understanding the Hydrology of Geographically Isolated Wetlands**

Author(s): Frances O'Donnell, Suranjana Chatterjee, Kathryn Perkins, Steven Brantley & John Beck

Presenter: Frances O'Donnell

Organization: Auburn University

Session: Lightning Talk - Research 1

Geographically isolated wetlands (GIWs) are wetlands with no direct surface water connection to other water bodies. They influence watershed-scale hydrologic processes but have generally been excluded from regulatory protections and monitoring. We work with a network of instrumented GIWs in southwest Georgia that represent a diversity of wetland size, wetland vegetation, and catchment land cover. This talk will provide an overview of three interrelated research projects that seek to improve understanding of the hydrology of GIWs. First, many hydrologic analyses of GIWs depend on knowing the relationship between wetland water depth, surface area, and storage volume. While simple geometric functions exist to describe this relationship, we found that a function based on a detailed wetland bathymetry produces substantially different results. We developed a new method for using low-cost castable depth finders to characterize GIW bathymetry and validated it with ground-based LIDAR. Second, the timing and duration of GIW inundation influences the ecosystem services provided, but it is unclear how this varies across wetlands due to variation in upland land cover and local geomorphology. We quantified water balance components in a subset of study GIWs from 2017 to the present. Results indicated that wetland recession is consistently higher than can be accounted for via evapotranspiration rates alone, suggesting water losses to surrounding soil or a perched water table. Understanding both the magnitude and driving landscape factors of these additional losses can aid in informing land management decisions in the catchment area of these GIWs. Finally, we are comparing field measurements of GIW water level and inundated area to water surface elevation and water area data from the NASA Surface Water and Ocean Topography (SWOT) satellite. Our objective is to determine if the raster and pixel cloud products from SWOT can be used to monitor and quantify water storage in GIWs over large scales.

Abstract #: 094 **Student**

Title: **Detection of shoreline changes in Mobile Bay**

Author(s): Fatema Tuz Johra Nourin & Dr. Wanyun Shao

Presenter: Fatema Tuz Johra Nourin

Organization: Department of Geography and the Environment, University of Alabama

Session: Student Poster

Shorelines are crucial for coastal communities since they provide buffers for storms and critical habitats for many species of flora and fauna. With the increase of coastal populations, the societal impact of shoreline change will rise. Accordingly, understanding the patterns of past and present shoreline positions is essential to managing coastal hazards for communities. Both natural and human activities can alter shorelines, where observing the past and present positions can reveal some patterns of the changes. Various tools and techniques, including GIS and remote sensing techniques, have been traditionally utilized in recent years to monitor coastal erosion and coastline changes. Recently, the rise of machine learning has introduced a new frontier, offering the ability to automate large-scale shoreline extraction. In this study, CoastSat, an open-source software toolkit written in Python built on the cloud computing platform Google Earth Engine (GEE), is used to detect shoreline positions and analyze the change rate for the past twenty years. The CoastSat toolkit utilizes the GEE platform- 1. to retrieve Landsat and Sentinel-2 images and 2. to pre-process the retrieved images. In the processed images, the Modified Normalized Difference Water Index (MNDWI) is used for land-water border segmentation. This shoreline detection technique can detect and map the position of the shoreline with a spatial resolution of nearly 10 meters. The observation of past and present shoreline positions can further support the development of predictive models to forecast coastal ecosystem responses to environmental stressors.

Abstract #: 095 **Student**

Title: **Forest Ecology and Productivity of the Lower Mobile Tensaw River Delta**

Author(s): Andrew Balder & Christopher Anderson

Presenter: Andrew Balder

Organization: Auburn University

Session: Coastal Issues 2

Coastal wetlands, particularly tidal freshwater forested wetlands (TFFWs), are among the most vulnerable ecosystems to climate change. They face direct impacts from global sea level rise and extreme weather events, compounded by indirect anthropogenic disturbances like urban development and hydrologic alterations. We investigated the ecological responses of TFFWs to tidal influence and salinity intrusion within the Mobile-Tensaw River Delta (MTRD), an internationally significant deltaic region along the northern Gulf of Mexico. This work is intended to serve as a baseline for current forest conditions and an initial indication of resilience within the study area. This study consisted of vegetation surveys (n = 47) conducted in forested wetland stands across a tidal gradient. Results revealed five distinct canopy communities that corresponded with river distance to Mobile Bay and plot elevation. Multivariate analyses highlighted a strong response of tidal influence on forest composition and structure, indicating community-level sensitivity to estuarine influences. Forested areas located near Mobile Bay exhibited lower basal area, species richness, higher shrub stem density, and a higher proportion of visually stressed canopy trees. To assess species-level responses, over 50 Taxodium distichum (bald cypress) trees were monitored over two growing seasons using low-cost dendrometer bands and continuous hydrologic measurements. Results showed that flooding was the best predictor of tree basal growth as well as low salinity floods promoted basal growth across the tidal gradient. In addition, during the monitoring period, a major saltwater intrusion event following Hurricane Francene in September 2024 was documented near the end of the study. Although this event was near the end of the growing season, it further emphasized the vulnerability of these forests to extreme climatic events. Together, these findings demonstrate how tidal conditions influence forest structure, composition, and productivity in TFFWs. This research underscores the importance of site-specific monitoring to inform adaptive management and conservation strategies in the face of accelerating climate change. As sea levels continue to rise and saltwater intrusion events become more frequent and intense, understanding the nuanced responses of coastal forest communities will be critical for land managers looking to predict ecosystem trajectories and mitigate coastal forest loss.

Abstract #: 096

Title: **UTILIZING GIS FOR DYNAMIC STORMWATER UTILITY FEE MANAGEMENT**

Author(s): Tanya Gallagher

Presenter: Tanya Gallagher

Organization: Jacobs

Session: GIS

Stormwater management is a critical aspect of urban infrastructure, necessitating accurate and equitable billing mechanisms to fund necessary services. Traditional methods of calculating stormwater utility fees often rely on static data and infrequent updates, leading to inefficiencies and potential inequities. Advancements in Geographic Information Systems (GIS), high-resolution aerial imagery, and scripting technologies offer municipalities and utilities the tools to modernize and streamline stormwater fee assessments.Jacobs has partnered with municipalities such as the City of Fayetteville, Arkansas and the City of Macon, Georgia to update and streamline the stormwater utility fee process. High-resolution aerial imagery along with drone technology, provides detailed and up-to-date visual data essential for accurately identifying impervious surfaces ensuring that billing reflects the current state of impervious surfaces. Utilizing GIS to integrate impervious area imagery, utility information, and parcel data enables municipalities to automate the delineation of impervious surfaces and their association with specific properties. This integration facilitates efficient stormwater fee calculation and the identification of discrepancies or changes in land use that may affect billing. Implementing systems that allow for real-time or near-real-time updates ensures that stormwater utility fees reflect the most current data. This dynamic approach enables municipalities to promptly address changes such as new construction, demolition, or alterations to properties, thereby maintaining the accuracy and fairness of fee assessments.

Abstract #: 097 **Student**

Title: **Understanding how different Gulf killifish (Fundulus grandis) populations respond to osmotic stress**

Author(s): Antrelle Clark, Christopher Anderson & Moisés Bernal

Presenter: Antrelle Clark

Organization: Auburn University

Session: Aquatic Ecology

Coastal urbanization has increased exponentially in recent decades, affecting numerous abiotic factors in the process. The intensity of these abiotic changes can change based on the severity of human interventions, and some areas are experiencing greater environmental fluctuations than others. For example, urbanized coastal zones experience quick changes in salinity during rainfalls, leading to unusually fast osmotic fluctuations. The Gulf killifish, Fundulus grandis, is known for its wide tolerance to a broad range of salinities, and it is the only species consistently found in both urbanized and natural sites. With this in mind, this project aims to evaluate how plasticity and adaptation have enabled the killifish to thrive in diverse osmotic environments. Samples were collected from a low-urbanized area (Long Bayou, AL), and an urbanized area, (Weakley Bayou, FL). A reciprocal transplant experiment was conducted, where both populations experienced their home conditions and the opposing conditions for the duration of a tidal cycle (~7 hours). The RNAseq analyses 112 differentially expressed genes (DEGs) between low- and high-urbanized sites, with 31% of variance being explained by treatment and 13% by origin of population. The high-urbanized population showed 20 times more DEGs than the low-urbanized population, suggesting differences in plasticity among them. Analyses from single nucleotide polymorphisms of coding regions suggest part of the responses are also associated with genetic sequences, potentially related with osmotic adaptation. This study indicates how changes in urbanization at small spatial scales can lead to different profiles of plasticity and adaptation in coastal marine species.

Abstract #: 098 **Student**

Title: **Simulating Velocity Over a Large Lock and Dam Using 3D Hydrodynamic Modeling**

Author(s): Indronil Sarkar, Anna Linhoss, Russell Wright & Dennis Devries

Presenter: Indronil Sarkar

Organization: Auburn University

Session: Student Poster

Ensuring successful fish migration is crucial for maintaining aquatic ecosystem health. However, the Claiborne Lock and Dam on the Alabama River pose obstacles to fish movement, necessitating innovative design solutions. In this study, EFDC+ hydrodynamic modeling was used to simulate velocity and flow profiles. Bathymetry data was integrated into the model. The upstream and downstream sections were assigned two different boundary conditions: flow for upstream and water surface elevation for downstream. The model accounts for three types of hydraulic structures: a broad-crested weir, six sluice gates, and a navigational lock. The model was tested by comparing modeled velocity with measured velocity taken from an Acoustic Doppler Current Profiler (ADCP) for a specific flow condition in March 2025. Velocity data was collected at five cross-sections downstream of Claiborne Lock and Dam, and the simulated profiles were numerically and graphically compared to observed data for each section. Among all these five cross-sections, the closest cross-section from hydraulic structure maximum and minimum velocities were 1.41 m/s and 0.09 m/s respectively. For the farthest cross-section, the maximum and minimum velocities were 0.79 m/s and 0.07 m/s respectively. The middle section of river channel experienced higher velocity than the velocities close to the riverbank for most of the data cross-sections. The current direction varied significantly from the most upstream data cross-section to the downstream data cross-section. The cross-sections closest to the hydraulic structures experienced the most variation in current direction. The current direction at the cross sections furthest from the hydraulic structures didn’t change significantly. With satisfactory calibration and validation results, the project will expand to assess fish passage suitability. These findings offer practical insights for enhancing fish passage and mitigating ecological impacts of existing infrastructure.

Abstract #: 099 **Student**

Title: **Hydrodynamic Modeling of Wind-Induced Flood Risk in a Critical Coastal Transportation Link**

Author(s): Ali Maleki & Anna Linhoss

Presenter: Ali Maleki

Organization: Auburn University

Session: Student Poster

This study examines the impact of wind on storm surge-induced water level fluctuations in Mobile Bay, with a particular focus on Battleship Parkway (aka the Causeway). The Causeway is a vital transportation link that is prone to flooding during extreme weather events. A hydrodynamic model of Mobile Bay is developed, validated, and then used to simulate the impacts of wind on water level. The model is validated by comparing modeled results of water surface elevation to measured values of water level at three monitoring sites. Model performance is evaluated using statistical metrics such as R^2, RMSE, and NSE. The model is then run with varying wind speeds and directions to understand the influence of wind on water surface elevation. The findings identify critical wind directions and speeds that generate the highest water levels along the Causeway and cause flooding. This work provides key insights into wind-driven coastal flooding and supports future planning for resilient infrastructure in vulnerable coastal zones.

Abstract #: 100 **Student**

Title: **Adapting GSSHA for Coastal Flood Modeling: Capturing Tidal Impacts on Roadway Vulnerability**

Author(s): Bruno Sousa, Luiz Morgado & Jose Vasconcelos

Presenter: Luiz Morgado

Organization: Auburn University

Session: Coastal Issues 2

Coastal roads are increasingly vulnerable to flooding and high groundwater levels, driven by sea-level rise and more frequent extreme rainfall events. In low-lying areas, traditional drainage systems lose effectiveness, leading to chronic saturation and infrastructure degradation. While distributed hydrologic models like GSSHA offer potential for detailed analysis, they are rarely applied in coastal settings without defined drainage networks and with complex interactions between surface and subsurface flows. This study evaluates the performance of GSSHA for simulating runoff, flooding, and groundwater dynamics along Alabama State Route 180 (AL-180), a flood-prone corridor in the Fort Morgan Peninsula, AL.Two modeling scales were tested: a broad-scale model of the entire peninsula at 30-meter resolution, and a detailed 3-meter cell resolution model of a high-risk site near Mobile Bay. The high-resolution model was run using two land cover inputs: the National Land Cover Database (NLCD) and Geographic Object-Based Image Analysis (GeOBIA) using the National Agriculture Imagery Program (NAIP) imagery. The inclusion of evapotranspiration and groundwater processes was tested, as well as different discretization strategies.Results show that incorporating subsurface processes reduces simulated flood extent compared to simpler models, which exhibited a lower mass conservation error. Flood predictions aligned well with field observations. On the western side of the peninsula, standing water that was observed during field visits matched model predictions, validating the model's potential in representing coastal hydrodynamics. The eastern side displayed increased flooding close to and over the roadway, highlighting risks to evacuation routes emphasizing the importance of considering localized hydrological behavior in infrastructure planning for flood-prone areas. Additionally, GeOBIA-based classification improved hydrologic accuracy by reducing runoff overestimation and better representing surface roughness. This study demonstrates that specific adaptations can improve the representation of complex hydrologic behavior in coastal settings lacking traditional drainage networks.

Abstract #: 101 **Student**

Title: **Improving Rock Check Dam Installations through Full-Scale Testing**

Author(s): Brian Roche

Presenter: Brian Roche

Organization: Auburn University

Session: Stormwater 1

Channels on construction projects are prone to erosion before stabilization due to high flow velocities during stormwater runoff events. To protect channels from erosion, ditch check (or check dam) practices, such as wattles or rock check dams, are typically installed to reduce flow velocity by facilitating impoundment. Properly spacing ditch checks requires the lowest point on the top of the downstream installation to be at the same elevation as the toe of the installation immediately upstream to protect the entire channel; however, if installations do not fully impound due to high flow-through rates, segments of the channel can be subject to high-velocity erosive flows. Impoundment being unable to reach the top of installations is especially seen in rock check dams, which most Department of Transportation (DOT) standards stipulate as rock placed in a channel with no additional improvements to increase impoundment. Despite large sums of money spent on installing, maintaining, and removing rock check dams on construction projects, little research has been conducted to improve the impoundment potential of rock check dams. This research evaluated various configurations of rock check dams for hydraulic performance, including the Iowa DOT standard installation and modifications, to improve the protection provided to unlined channels by rock check dam installations. To determine performance, installations were subjected to commonly experienced conditions in channels on Iowa highway construction projects in a channel at the Auburn University – Stormwater Research facility. Flow velocity and depth measurements were taken during testing at regular spacing; the length of the impoundment with slower-moving subcritical flows where erosion would not occur was also measured. A total of eight rock check dam configurations were tested, including the Iowa DOT standard and modifications, including modifying the rock gradation, the removal of an excavation beneath the installation, adding geotextile overlay, and dewatering holes in the overlay to prevent excessive dewatering periods. The standard installation only had an average impoundment of approximately 6 ft (1.8 m), leaving large portions of the channel unprotected. The highest performing installation, with a smaller rock gradation, a geotextile overlay with dewatering holes, a reduced width, and no excavation beneath, improved impoundment to 58 ft (17.7 m) while also reducing material cost from approximately $673 to $304 compared to the standard. Sediment-laden performance evaluations also indicated that adding a geotextile overlay to rock check dam installations improved sediment capture by 63% and reduced turbidity of flow moving through the installation.

Abstract #: 102 **Student**

Title: **A method to resolve spatial mismatches in geospatial exposure modeling**

Author(s): Helen Moylan, Matthew Loop & Ann Ojeda

Presenter: Helen Moylan

Organization: Auburn University

Session: Lightning Talk - Research 2

The limited availability of private well data constrains the extent to which health outcomes can be linked to drinking water quality. For example, there is no state or federal database that collects information about private well location, use, or water quality. Similarly, routine health assessments do not include information about water supply or quality. To overcome these issues in data availability, an ecological study design is appropriate so that relationships between private well use and outcomes can be assessed at the aggregate population level. Consequently, spatial units of analysis must be defined and reasonably scaled to characterize the study population. Locations of private well users are modeled at the US Census Block Group (CBG) scale (600-3,000 people). However, physiographic regions serve as delineations for hydrogeologic factors governing well water quality and are defined by the geologic conditions—as well as earth system processes (e.g., erosion, climate)—that shape the landscape. Linking CBGs to the boundaries of these physiographic regions is complicated because physiographic regions do not follow the same boundaries as administrative census units. To overcome this obstacle, I assigned each Alabama CBG (n = 3,924) to one of the five physiographic regions (Piedmont Upland, Alabama Valley and Ridge, Highland Rim, Cumberland Plateau, and East Gulf Coastal Plain) using two spatial join match methods in ArcGIS Pro: “Completely Within” and “Have Their Center In.” The “Within” match method assigned 90.4% of the CBGs to a physiographic region and the “Centered” match method assigned 100% of CBGs to a physiographic region. The “Centered” method yielded greater CBG sample sizes within each physiographic region, but for health outcomes analysis it is important to recognize that 9.6% of CBGs straddled physiographic region delineations. Based on the “Centered” match method, the median percent well use was 26.6% for the Piedmont Upland, 23.6% for the Cumberland Plateau, 11.5% for the East Gulf Coastal Plain, 0.2% for the Highland Rim, and 0.0% for the Alabama Valley and Ridge. Median percent well use for the “Within” method was 31.3% for the Piedmont Upland, 17.6% for the Cumberland Plateau, 10.6% for the East Gulf Coastal Plain, 0.0% for the Highland Rim, 0.0% for the Alabama Valley and Ridge, and 32.2% of CBGs were not assigned to a physiographic region. These results show that the “Within” method introduces sampling bias as CBGs with low well use are excluded from the Piedmont Upland and CBGs with high well use are excluded from the Cumberland Plateau. This study is important because it presents methods for resolving the spatial mismatch between population-level data like the CBG and hydrogeologic scales like physiographic regions, creating a geospatial exposure variable that can be assessed for potential health implications.

Abstract #: 103 **Student**

Title: **Groundwater Drought Monitoring Across the CONUS: Insights from Data Assimilation and Land Surface Modeling**

Author(s): Parnian Ghaneei & Hamid Moradkhani

Presenter: Parnian Ghaneei

Organization: The University of Alabama

Session: Student Poster

Groundwater helps sustain surface water resources through its contribution as baseflow and mitigates the effects of drought. However, reduced fluxes in the water exchanged between surface water and groundwater can accelerate drought conditions. Recently, both physically-based and data-driven models have been used to study groundwater drought. While data-driven models deliver accurate outcomes in some cases, the complexity inherent in subsurface hydrological processes necessitates physically-based models such as land surface models (LSMs) that account for water and energy exchanges. This involves considering a broad spectrum of factors, notably groundwater recharge and discharge, which are themselves affected by other factors. However, LSMs often carry structural and parameterization uncertainties that limit their reliability in analyzing subsurface processes under variable climatic and anthropogenic conditions. In this study, we use an advanced data assimilation method to generate accurate daily groundwater drought maps across the Contiguous United States. The proposed procedure accounts for the indirect effects of climate and vegetation on groundwater storage by assimilating various observation data into LSM. The results reveal the emergence of distinct and persistent dry patterns in recent years across the CONUS, identifying the severe groundwater drought conditions that notably impacted large regions of CONUS. Results show the migration of wet conditions predominantly towards the eastern regions, resulting in an intensified east-west contrast. Specifically, large regions in the Deep South displayed extremely wet conditions. The dominance and stability of these patterns indicate a weakening of the natural hydroclimatic mechanisms that typically facilitate recovery. Our findings highlight the need to reassess groundwater resilience strategies, especially as the results show that droughts intensify and persist across large regions. The spatial coherence and seasonal persistence of extreme drought patterns observed in this study suggest that conventional recovery assumptions may no longer hold under current hydroclimatic trends.

Abstract #: 104 **Student**

Title: **Long-Term Analysis Reveals Hidden Patterns in Drought Variability and Characteristics**

Author(s): Ehsan Foroumandi & Hamid Moradkhani

Presenter: Ehsan Foroumandi

Organization: The University of Alabama

Session: Student Poster

The past few decades have witnessed an unprecedented surge in hydrologic extremes, from devastating floods and prolonged droughts to record-breaking heatwaves and temperature anomalies. While the scientific community has established a link between these intensifying disasters and anthropogenic activities, our understanding of their historical context remains incomplete. Understanding long-term drought patterns is crucial for predicting future extreme scenarios and developing effective water management strategies. This study provides 500-year analysis of the Contiguous United States (CONUS) drought patterns that reveals evolution of complex spatiotemporal dynamics during the past five centuries. By statistical analysis of tree-ring data, we uncover the high hydroclimatic instability of the regions across the 100th meridian. During this period, the Eastern CONUS, particularly along the Mississippi River corridor, exhibits a significant wetting trend, although without frequent extremes. Our analysis demonstrates that while the duration of droughts has remained relatively stable over the CONUS, there is a statistically significant decreasing trend in drought-affected areas, primarily influenced by increased moisture in Eastern CONUS. The Great Plains consistently show the highest variability in both drought and wet durations across all periods. In contrast, our analysis identifies Deep South states among those with the highest frequencies of normal conditions over the 500-year period, respectively. Additionally, our analysis, informed by machine learning models, reveals no evidence that drought patterns have become increasingly regionally distinct over time. Our results suggest that future drought risk assessments should consider the potential for shifts in the spatial organization of drought patterns. The Western CONUS strategies focusing on water conservation, enhancement of water use efficiency, and sustainable management of agricultural practices are imperative. Conversely, the Eastern and Southern CONUS may need to prepare for challenges associated with increased precipitation, such as more flood risks and associated water quality issues.

Abstract #: 106

Title: **From Data to Design: Leveraging the Research of Water Resource Managers to Inform the Work of Landscape Architecture Along the Gulf Coast**

Author(s): Helena Starnes, Rob Holmes, Maria Elena Vanegas Perez, Emily Dolatowski & Marilyn Reish

Presenter: Rob Holmes & Helena Starnes

Organization: Auburn University

Session: Water Security & Risk

The term landscape architecture would suggest that the purview of the discipline is solidly oriented towards the land. But what of the water? In recent years, a growing number of landscape architects have turned their eyes towards the mounting challenges faced by coastal communities beset by issues like coastal storm risk, water quality deterioration, habitat loss, and sea level rise. This shift in practice requires the discipline to acquire new knowledge and develop new strategies. Fortunately, coastal landscapes are often rich with knowledge. Decades of existing and on-going work by water resource managers, researchers, and advocates can provide a foundation to directly inform landscape architectural design work that addresses coastal challenges. While this design work may be small at times, it is often large — matching the scope of coastal challenges and the level of intervention that may be needed to adequately respond. This is the scale of the Four Coasts Project, under which a team of landscape architects and coastal engineers worked with the US Army Corps of Engineers' Engineering With Nature program and partner districts around the United States to bolster their implementation of site-appropriate, nature-based infrastructure. Several of these concepts were explored in Perdido Bay, Mobile Bay, and Grand Bay, providing USACE with concepts that align with the efforts, strategies, and priorities of local organizations. These proposals build on the work of local organizations such as the Dauphin Island Sea Lab and the Pensacola & Perdido Bays Estuary Program, as well as national institutions like USGS and NOAA. This research is synthesized with the traditional strengths of landscape architecture, including form-based design, aesthetics, consideration of sociocultural context, and promotion of human relationships with the environment. The result is a series of design concepts that explore new opportunities for the creation or expansion of habitats such as seagrass beds and oyster reefs — all calibrated to respond to existing conditions, adapt to future change, and facilitate meaningful human interaction with the bay.

Abstract #: 107

Title: **Coastal Commitment: Building a Stronger Volunteer Network for Alabama's Waterways**

Author(s): Mona Dominguez, Regan Smart & Carolina Ruiz

Presenter: Mona Dominguez

Organization: Auburn University Water Resources Center -AL Water Watch

Session: Extension, Outreach & Partnerships 1

This presentation will highlight outcomes and ongoing initiatives of AWW monitoring of waters in Coastal Alabama that have been bolstered by the Mobile Bay National Estuary Program's investment in and support of the program. Specifically, it will outline a recent initiative launched by the organizations that aims to increase the number of volunteer monitors in Mobile and Baldwin counties, better support existing water monitors to continue data collection, and to increase community knowledge about water quality trends. We will describe the specific activities we have implemented to accomplish project objectives 1) Coordinate Coastal Water Monitoring Trainings 2)Develop Monitoring Materials Management System to Distribute to 100 Coastal Monitor 3)Facilitate Quarterly Communication Among Coastal Water Monitoring Partners 4)Lead Volunteer Recruitment of 30 New Monitors and Maintain Retention Rate of 25% 5) Provide Volunteers with Feedback about their Water Data. We will share project outputs and outcomes including a brief overview of the data collected by coastal AWW groups during the past three decades. We will share examples of how AWW monitors have used their data to identify water problems and other trends using their data. This project serves as an example of a successful regional partnership aimed at supporting community-based water science and stewardship.

Abstract #: 108 **Student**

Title: **Phosphorus Removal and Recovery from Stormwater via Iron-Biochar Augmented Geotextiles**

Author(s): Jean-Pierre le Roux, Devyn Roh & Kaushik Venkiteshwaran

Presenter: Jean Pierre le Roux

Organization: University of South Alabama

Session: Stormwater 1

Phosphorus is a vital, nonrenewable resource that is required for survival for all living things. However, excessive use of phosphorus (P) in fertilizers leads to excess phosphorus in stormwater runoff, causing eutrophication and dead zones, threatening ecosystems and human health. Therefore, there is a crucial need for effective means of removing and recovering P from stormwater runoff. There are several green infrastructure methods currently used (rain gardens, bioswales, etc), but these focus on stormwater management rather than P removal. There is also no means for P recovery. The objective of this research was to develop an augmented geotextile capable of P removal and recovery. This kind of geotextile would provide an effective method for the increase in capability of stormwater management systems. In the study, a chemical precipitation method was used in an 8L system to add iron to nonwoven geotextiles. The geotextiles were washed, dried, and analyzed for P adsorption. These augmented geotextiles (FeGeotex) demonstrated an adsorption capacity of 5.5 mg P/g of geotextile. After adsorption, the ability of the geotextile to release P and be reused was tested using HCl and NaOH solutions. Both desorption solutions demonstrated approximately 80% P release. The adsorption/desorption process was repeated using the same fabrics for a total of three cycles, demonstrating the FeGeotex's reusability. In order to test large-scale application and feasibility of the chemical precipitation method for iron attachment to geotextiles, a 150L reactor system was designed and built. This system was successfully used to create large amounts of FeGeotex (~30 sq ft) which will be subjected to field testing at a later date. In a separate experiment, biochar was added to non-woven geotextile pouches in varying amounts by weight, allowing for a larger surface area for iron attachment. Using the chemical precipitation method, iron was attached to the biochar geotextiles, creating an iron-biochar augmented system (Fe-BC-Geotex). The Fe-BC-Geotex was then washed, dried, and analyzed for P adsorption. The iron amending experiment demonstrated that biochar provides a greater surface area for the attachment of iron. The 50% Fe-BC-Geotex (50% biochar by weight) demonstrated the highest iron capacity of 432±53.8 mg-Fe/g-Fe-BC-Geotex, whereas, the with no biochar (0% biochar by weight) demonstrated the lowest iron capacity (58±7.8 mg-Fe/g-Fe-BC-Geotex). The P adsorption experiment, however, demonstrated that the Fe-Geotex with no biochar had the highest P adsorption capacity of 10.2±0.48 mg-P/g-Fe-BC-Geotex, whereas, the 50% Fe-BC-Geotex had the lowest P adsorption capacity (5.6±0.21 mg-P/g-Fe-BC-Geotex). From this research, it can be concluded that biochar does increase the available surface area for iron attachment, but this does not translate to higher P adsorption capacity.

Abstract #: 109

Title: **Lower Alabama River Fish Passage: Policy and Implementation**

Author(s): Jason Throneberry

Presenter: Jason Throneberry

Organization: The Nature Conservancy

Session: Restoration 2

Watershed integrity and resiliency to climate change is paramount for The Nature Conservancy in Alabama. Alabama is the most aquatically biodiverse state in North America. The Mobile River Basin drains more than 32,000 square miles in Alabama, equating to 63% of the total land area; all of which flows through the three hundred square mile Mobile-Tensaw Delta and into the Gulf of Mexico at Mobile Bay. Within this vast watershed, the Alabama River is one of the most biodiverse ecosystems in North America and connects the Gulf of Mexico to the Appalachian Mountains. Many species supported by these rich waters are migratory, including several federally protected species. Species migrate either from the Gulf of Mexico upstream into the Alabama River and its tributaries or are locally migrant within the river and tributaries. The Cahaba River, with its headwaters in the Appalachian foothills, boasts the most aquatic biodiversity in the Alabama River system and is critical for aquatic species and their life history and ecological needs.Since dam construction on the Alabama River, a historic and ecologically important migratory corridor has been disconnected. Many species rely on this migration corridor for life history requirements. Recent studies have yielded that past efforts were not successful, despite decades of effort. In response to species decline and recognition of critical timelines for species survival, The Nature Conservancy and the U.S. Army Corps of Engineers have completed a Feasibility Study for fish passage at these sites. Fish passage implementation at these structures would ecologically reconnect approximately 6,000 river miles from the Gulf of Mexico to Appalachian Mountains. With this reconnected migratory corridor, and given the monumental aquatic biodiversity of this system, this will be the most ecologically significant river restoration in North America.Upon completion of the Feasibility Study, the need for policy changes within USACE were highlighted by TNC governmental relations staff. The current non-federal sponsorship agreement includes three conditions that hinder non-federal sponsorship (i.e., indemnification clause, unlimited cost overrun, and operation and maintenance). TNC is currently working with USACE and other partners to work through these much-needed policy amendments, which in turn could change the paradigm for USACE non-federal sponsors and project implementation. Fish passage restoration, coupled with watershed restoration and policy changes at the USACE headquarters level could lead to far reaching benefits to our states' aquatic resources. This comprehensive approach to watershed restoration is critical for sustainability and resiliency of our most diverse freshwater ecosystems.

Abstract #: 110 **Student**

Title: **Evaluating the Impact of Biochar Rates for Reducing Greenhouse Gas Emissions in Cotton Fertilized with Manure and Commercial Fertilizer**

Author(s): Maryam Saeed, Debolina Chakraborty, Rishi Prasad, Audrey Gamble & Allen Torbert

Presenter: Maryam Saeed

Organization: Auburn University

Session: Student Poster

The ongoing increase in the prices of commercial fertilizers has led farmers to look for alternative nutrient sources, such as manure. At the same time, the question about the effect of fertilizer and manure application on greenhouse gas (CO2, N2O, CH4) emissions has been a concern. The agricultural sector of the United States contributes to global warming by emitting 10-12% of the total anthropogenic greenhouse gas (GHG) emissions. Biochar, a carbon-rich substance and product of the controlled pyrolysis process, is gaining attention as an eco-friendly solution because of its high specific surface area and adsorption capacity. However, there is a knowledge gap in identifying the optimal biochar application rate and method for mitigating GHG emissions from SE US soils. We hypothesized that higher rates of biochar will reduce GHG emissions from agricultural soil. This study aimed at evaluating the potential of the combined application of biochar, broiler litter (BL), and urea fertilizer on the mitigation of GHG emissions from cotton production systems in the SE US. An experiment was conducted at Wiregrass Research Station, Alabama, using four rates of biochar (0, 4.4, 8.9, and 17.9 Mg/ha), with nitrogen fertilizer (135 kg/ha) and BL (4.4 Mg/ha) in a randomized complete block design with four replicates. All the treatments were applied one week prior to planting cotton. Nitrogen (N) fertilizer was applied in two splits using urea. GHG samples were collected biweekly using static chambers and analyzed using gas chromatography. First-year results indicate that the application of a higher rate of biochar (17.9 Mg/ha) with BL reduces GHG emissions from the soil. However, we observed a significant decrease in the emissions of GHG when low rates of biochar (4.4 Mg/ha) were applied with fertilizer. Such findings indicate that biochar application at variable rates has differential effects on GHG emissions when applied with varying sources of nutrients. The information generated in the present study can help develop management strategies for sustainable cotton production by reducing GHG emissions from soil.

Abstract #: 111

Title: **Exploring the Potential of Transdisciplinary Research for Community-Oriented Conservation: the CONSERVE Future Ecologies Research Portfolio**

Author(s): Michael McKain & Michael Fedoroff

Presenter: Michael McKain

Organization: The University of Alabama

Session: Special Session 4 - CONSERVE 2

The CONSERVE research group is a multidisciplinary team focused on addressing issues of biodiversity and watershed management using targeted solutions relevant to land managing agencies, private industry, and communities. The CONSERVE Future Ecologies research portfolio is centered around integration of large-scale genomics projects with diverse ways of thinking to identify and resolve problems of environmental, ecological, and cultural concern. Here, we discuss three developing projects that leverage the expertise of CONSERVE affiliates to successfully incorporate ecological restoration goals, address needs of water and energy security, and promote better integration of communities with the natural environment. We further explore these projects in the overall landscape of the Future Ecologies research portfolio highlighting our goals and planned milestones for the next three years and openly invite inquiries for future collaborations.

Abstract #: 114 **Student**

Title: **Manure Application in Conventional Tillage**

Author(s): Chhabi Raj, Debolina Chakraborty, Dexter Watts, Tibor Horvath & Rishi Prasad

Presenter: Chhabi Raj

Organization: Auburn University

Session: Ag & Irrigation 2

Manure improves the soil's physical, biological, and chemical properties as well as provides nutrients to crops. Additionally, soil properties vary among types of tillage systems which in turn affect nutrients and sediment losses. We hypothesize that runoff volume, sediment, and nutrient concentrations of nitrogen (N) and phosphorus (P) in runoff water will differ between manure application rate on conventionally tilled soil during a rainfall event. In this study, we compared the impact of application rate of broiler litter (BL) and swine liquid manure (SLM) on runoff volume, sediment, N, and P losses using a rainfall simulator and three consecutive 0.025 m rainfall events. Surface soil (0.15 m, Decatur soil series) was collected from North Alabama and packed in runoff boxes (0.55 × 0.30 × 0.06 m3). Manure was surface-applied to the soil at rates ranging from 62, 124, 186, and 249 kg ha-1 for BL and 5, 9, 14, and 18 kg ha-1 for SLM, respectively. Rainfall events took place 7, 14, and 21 days after manure application. Results indicated that loss of nitrate-N (NO3-N), dissolved reactive P (DRP), and dissolved organic P (DOP) was significantly more for application rates 249 kg P ha-1 in case of BL and 18 kg P ha-1 for SLM with respect control treatment. The total suspended solids (TSS) loss was lower (500 kg ha-1) in control compared to BL (600-600 kg ha-1) and SLM (1500-1600 kg ha-1) treatments. An increase in M3P and WSP following post-rainfall simulation for higher P application rates indicates caution should be taken for considering the manure application rate to prevent environmental risks from nutrient loss during runoff events.

Abstract #: 115

Title: **The relative profitability of adopting irrigation on Alabama corn farms: Preliminary results from an economic simulation**

Author(s): Joshua Duke, Adam Rabinowitz, William Batchelor, Thorsten Knappenberger, Lee Ellenburg & Vikalp Mishra

Presenter: Adam Rabinowitz

Organization: Auburn University

Session: Ag & Irrigation 1

This presentation reports research and related Extension efforts on the economic conditions under which irrigation is likely to be most profitable for Alabama farmers. The economic analysis combines scientific data generated by DSSAT simulations on the yield advantage from adopting irrigation in Alabama, USDA-NASS and other data on the costs of adopting irrigation, and an original projection of future prices for row crops. This presentation highlights work on a single row crop (corn) in select regions of Alabama. Using stakeholder and expert feedback to preliminary work on this topic, which was presented in various settings and at this conference last year, the team revised our model simulations. New data on irrigation installation costs were collected. In present form, the agronomic-economic model represents Alabama's agricultural landscape into four regions with one modeled field in each region—North Alabama, Black Belt, Southwest Alabama, and Southeast Alabama. The final analysis will thus offer information on diverse Alabama agricultural locations. For each location, 10,000 simulations predict the range of likely profits from adopting irrigation with a diesel-powered generator or electric power. Due to well-known uncertainty in agricultural production and difficult-to-predict variability in the farm economy, multiple simulations aim to replicate many potential real-world outcomes. Some of the individual scenarios may be profitable, while others may be unprofitable. The simulation average profitability provides one perspective on the expected profitability for farm fields in given location-soil combinations. However, we also present the percentage of positive profitability simulations—i.e., how likely is it that a given farm field will earn a profit over the life of a new irrigation system? Because these results vary by location and soil type, the results ought to be useful to a large variety of Alabama farmers. These research results and Extension evidence are being presented in preliminary form for further stakeholder reactions so that an improved model can be built and then incorporated into an on-line "irrigation audit" that will be available for individual Alabama farmers to use to make their own, individualized profitability predictions.

Abstract #: 116

Title: **“Water” We Doing?—A Stakeholder Friendly Approach to Communicating Water Research**

Author(s): Rebecca Bearden, Gregory Guthrie & Bennett Bearden

Presenter: Rebecca Bearden

Organization: Geological Survey of Alabama

Session: Water Law & Policy

From commerce to conservation, water resources have been a driving force behind Alabama’s formation as a state and subsequent leadership in economic growth, agricultural production, and recreation. Home to more than 133,000 miles of rivers and streams, the state hosts abundant surface water and groundwater resources that not only meet the most basic needs of Alabama’s citizens but also offer tremendous potential for Alabama’s future growth and development, if managed responsibly. The first step to achieving effective stewardship is through a more thorough understanding of Alabama’s surface water and groundwater as a conjunctive resource influenced by both natural system features and processes and anthropogenic stressors. Unfortunately, interpretations of these often-complex systems are geared toward scientific audiences, leaving non-scientific policy makers devoid of the tools necessary to make informed water management decisions. To address this need, researchers at the Geological Survey of Alabama are employing a different approach to communicate the current conditions of the state’s water resources. The approach utilizes a watershed-based framework allowing water resource information to be viewed through a regional lens, one in which local climate, geology, and land use are linked to watershed characteristics and resulting water availability. This approach results in a comprehensive state report that contains summary information needed for the subsequent creation of one-page watershed fact sheets, with each explaining multidisciplinary water research in a stakeholder friendly format and highlighting the unique state of water resources in that watershed. This format can be used to inform stakeholders and policymakers about the current state of Alabama’s water resources, providing them with information that can be applied to address areas of greatest need and define cost-efficient regional management strategies. Additionally, this approach will provide policymakers with the framework necessary to spearhead new policy initiatives for water resource management, positioning Alabama for continued economic, agricultural, and recreational growth.

Abstract #: 117 **Student**

Title: **Efficacy of Biochar Variants and Application Rates in Phosphorus Runoff Mitigation Under Low and High Simulated Rainfall Events**

Author(s): Temitope O. Popoola, Debolina Chakraborty & Rishi Prasad

Presenter: Temitope Popoola

Organization: Auburn University

Session: Water Quality 1

Biochar has emerged as a highly effective adsorbent material with significant potential for mitigating environmental phosphorus (P) losses during runoff events. The enhanced P sorption capacity of biochar is attributed to its intrinsic properties, which include its porous structure, high surface area, and surface functional groups. This study evaluates the efficacy of untreated and treated (synthesized by iron (Fe)-doping and washing with deionized water: DI-washed) pinewood-derived biochar variants in reducing P runoff and soil loss under varying rainfall conditions and application rates. Biochar variants and soil samples were characterized using XRD, SEM, and FTIR to assess their crystallinity, surface structure, and chemical functionalities, respectively. Other physicochemical properties were also analyzed. Initial water extractable P (WEP) analysis, which acts as a surrogate of P loss from biochar during a runoff event, was conducted for the biochar variants to determine their efficiency. The rainfall experiments were conducted on simulator pans. Three biochar variants (untreated, Fe-doped, and DI-washed) were applied at varying rates (0, 4.48, and 8.97 Mg ha-1) to agricultural rock phosphate fertilized soil in the simulator pans. The soil and biochar mix were subjected to simulated rainfall events at low and high intensities with two-week intervals between rainfall events for a period of ninety days. The runoff and infiltration samples were collected to assess runoff volume, total suspended sediment (TSS) loss and dissolved reactive P (DRP). The physicochemical characterization of the biochar variants showed that the Fe-doped and DI-washed biochar variants might be an alternative sorbent material compared to the untreated biochar. This is corroborated by the presence of the surface and crystalline structure, and functional groups that support P retention on the biochar. The WEP showed a potential P loss of 27 mg kg-1 from the untreated biochar, 0.04 mg kg-1 from the Fe-doped and 6 mg kg-1 from the DI-washed variant. We hypothesize that the Fe-doped and DI-washed biochar would retain P in the soil for a longer period with varying rainfall intensity. This study aims to contribute to the development of sustainable nutrient management practices that reduce nonpoint source pollution, protect water quality, and support resilient agricultural systems. Further findings will be presented at the meeting.

Abstract #: 118

Title: **Elba Hydroelectric Dam Removal Project on the Pea River: Biomonitoring and Outreach Efforts**

Author(s): Brian Helms, Jonathan Miller, Lisa Harris & Kaelyn Fogelman

Presenter: Brian Helms

Organization: Troy University

Session: Restoration 1

Dam removal presents a unique opportunity to improve or restore river connectivity, enhance habitat quality, and improve ecological integrity, while also posing challenges related to community engagement, historical preservation, and effective monitoring. The Pea River, home to a rich diversity of aquatic species including Gulf Sturgeon, Alabama Shad, and imperiled mussel species, is the site of a multi-agency collaborative effort to remove the Elba Hydroelectric Dam. The Elba Dam (constructed 1911-1914) is the oldest known example of a concrete hydroelectric dam in Alabama and allowed for the electrification of much of the Wiregrass, opening the way for the industrial and commercial development of this region. Presently, the dam is inoperable and in disrepair following a 2015 flood, thus has become a human hazard and financial liability. Troy University is supporting the removal effort through pre- and post-removal biological assessments and promoting education and outreach initiatives. Our work focuses on evaluating the effects of dam removal on macroinvertebrate and mussel populations and associated habitat pre-and post- dam removal, while also engaging local schools and communities to promote understanding and support for the project. Biological assessments will include targeted mussel surveys, macroinvertebrate sampling, and habitat characterization along an ~8km reach above and below the existing Elba Dam 1y before dam removal and at annual warm-season sampling efforts after dam removal. Outreach efforts will include mentoring local secondary school teachers and student leaders to implement aquatic-based environmental projects in their respective schools and/or communities. This presentation will highlight the ecological goals of the project and proposed strategies for effective science communication, education and outreach, and community building activities. By sharing our objectives, we aim to foster discussion, solicit expertise, and build partnerships to enhance the success of this project and ensure that our efforts serve as a model for future watershed restoration efforts.

Abstract #: 120 **Student**

Title: **Effect of Broiler Litter Application Rate on Phosphorus, Nitrogen, and Sediment Loss from 4 Consecutive One Acre-Inch Rainfall Events**

Author(s): Carson Archie, Rishi Prasad , Shruthi Koneti , Debolina Chakraborty & Tibor Horvath

Presenter: Carson Archie

Organization: Auburn University Biological Resources Laboratory

Session: Lightning Talk - Research 1

The Poultry industry comprises the largest part of Alabama's agricultural sector and currently produces over 1 billion broiler chickens and 2 million tons of broiler litter (BL) annually. While BL can act as an inexpensive fertilizer for row crops, the low nitrogen concentration leads farmers to apply for nitrogen (N) crop requirements instead of phosphorus. Excess phosphorus (P) buildup can lead to P losses in rainfall events following application of BL. Phosphorus is the primary limiting nutrient for algae and cyanobacteria growth in freshwater ecosystems. Understanding the agricultural management of BL that affects P runoff and leachate losses is necessary to protect Alabama's waterways. In this 1-acre-inch artificial rainfall study, we assessed the effect of five P application rates applied using BL on soils having three distinct Mehlich-1 P levels designated as very low, medium, and very high for Alabama's P-Index. Surface Marvyn loamy sand (0-0.06 m) was collected and packed into trays (0.55 x 0.30 x 0.06 m3). BL was surface applied to soil at equivalent rates of 25, 50, 75, and 100 kg ha-1. Rainfall events took place on day 7, 14, 21, and 28 after litter application. Runoff and leachate samples were collected and analyzed for P, N, and total suspended sediments (TSS). Results comparing P, N, and TSS loss loads between five P application rates and three soil P levels will be presented.

Abstract #: 121

Title: **An Overview of FEMA Flood Risk Products Available for Communities in Alabama**

Author(s): Kelley Rich

Presenter: Kelley Rich

Organization: WSP USA Inc.

Session: Restoration 1

When the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) program was implemented a decade ago as the successor to the Flood Map Modernization program, FEMA expanded their flood risk-related deliverables to include a set of non-regulatory Flood Risk Products (FRP) produced in conjunction with the regulatory Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) for the purpose of increasing awareness and engaging communities regarding flood risk. The FRP dataset includes the Flood Risk Database (FRD), Flood Risk Map (FRM), and Flood Risk Report (FRR) and is an enhanced dataset that serves as a companion to the regulatory Risk MAP products, consisting of information used and created during the development of the regulatory FIRM and FIS products. In this presentation we will explore the more frequently utilized FRP elements, including Changes Since Last FIRM (changes to floodplain designation since the previous effective products were created), flood depth and water surface elevation grids for all modeled flood events, information about structures located within the floodplain as defined in the regulatory products (including estimated financial loss due to flood for all modeled flood events), and Areas of Mitigation Interest (e.g. at-risk community facilities, past claims hotspots, stream flow constrictions). As FEMA and their mapping partners began receiving feedback on the utility of the FRP dataset from FRP users, FEMA revised the FRP production guidelines to streamline the product development process, resulting in some FRP elements being eliminated, combined, or renamed. Here we will clarify the revisions FEMA specified in their FRP guidance updates since production of these datasets initiated, and we will demonstrate where FRP data can be found and downloaded online. FRP datasets are not yet available to all communities within Alabama, as not all areas in the state have been restudied since FRP production began, so this presentation also serves to define the areas in Alabama that currently have FRP datasets available and areas for which these datasets are currently in production or are currently queued for production.

Abstract #: 122

Title: **Evaluating Cover Crops Impact on Runoff and Nutrient Loss in South Alabama Row-Crop Systems**

Author(s): Anh Nguyen, Rishi Prasad, Arpita Sharma & Audrey Gamble

Presenter: Anh Nguyen

Organization: Auburn University

Session: Water Monitoring

In the challenging agricultural environment of South Alabama, where intense rainfall and erosion present significant risks, cover crops offer a crucial strategy for enhancing soil health and minimizing environmental impacts. This three-year study used Edge-of-Field monitoring to evaluate cover crop effectiveness in limiting runoff and nutrient loss in a paired watershed in Geneva County. The study site included two adjacent watersheds, WS1 (1.87 ha) and WS2 (2.10 ha), characterized by differing slopes and cultivated with row crops and winter cover crops. Runoff volume, sediment loss, and nutrient concentrations, including ammonium nitrogen (NH_4^+-N), nitrate nitrogen (NO_3^--N), dissolved reactive phosphorus (DRP), and total phosphorus (TP), were compared between WS1 and WS2. Baseline data collection during the 2021 cover crop (Nov 2021 – Apr 2022) with both WS1 and WS2 followed the same cover crop practice. However, due to its steeper topography, WS2 exhibited substantially greater runoff and nutrient losses than WS1. Specifically, WS2 recorded 83.9 mm of runoff compared to just 4.1 mm in WS1. As a result, WS2 experienced much higher losses of DRP (0.56 kg/ha vs. 0.03 kg/ha), TSS (1087.14 kg/ha vs. 43.58 kg/ha), TP (1.63 kg/ha vs. 0.079 kg/ha), NH_4-N (0.54 kg/ha vs. 0.012 kg/ha), and NO_3-N (0.79 kg/ha vs. 0.03 kg/ha). In 2022 (Nov 2022 – Apr 2023), WS2 adopted Auburn University's mixed cover crop system, while WS1 maintained farmer-managed practices. This change narrowed watershed differences, with WS1 showing a higher runoff (196.8 mm) than WS2 (143.2 mm), reversing the baseline trend. Although nutrient and sediment losses in WS2 remained slightly higher, the magnitude of the difference was considerably reduced. DRP loads were 1.48 kg/ha for WS2 and 1.07 kg/ha for WS1; TSS loads were 816.08 kg/ha for WS2 vs. 503.35 kg/ha for WS1; and TP loads were 2.97 kg/ha for WS2 vs. 2.63 kg/ha for WS1. These results suggest that the enhanced cover crop management in WS2 contributed to more effective runoff control and helped narrow the disparity in nutrient losses between the two sites. However, during the 2023 – 2024 season, WS2 experienced higher early-season (Nov 2023 – Feb 2024) runoff, 176.7 mm compared to 83.4 mm in WS1, due to delayed cover crop growth, which left the soil more exposed to rainfall. Sentinel-2 NDVI imagery confirmed light vegetation at WS2 during Nov 2023 – Feb 2024 (NDVI < 0.28), correlating with elevated erosion and nutrient loss. Although March growth (NDVI > 0.50) improved hydrologic regulation, early termination limited sustained benefits. These results highlight the conservation benefits of cover crops, particularly in reducing sediment and phosphorus loss. However, their effectiveness depends on timely planting, establishment, and termination. Improved, site-specific management is essential to enhance sustainability and nutrient management in South Alabama's high-rainfall-runoff agricultural systems.

Abstract #: 123 **Student**

Title: **Game Changer: How AI is Transforming Flood Resilience Education**

Author(s): Hudson Markin & Qiuhua (Lisa) Duan

Presenter: Hudson Markin

Organization: The University of Alabama

Session: Lightning Talk - Research 2

Flood resilience education is critical for the young generation's preparedness against natural disasters; however, traditional methods often fail to engage learners effectively. The integration of Artificial Intelligence (AI) into gamified education and serious games can enhance flood resilience awareness and decision-making skills. By leveraging adaptive learning algorithms and dynamic scenario generation, these tools personalize challenges based on user interactions, simulating real-world flood risks and mitigation strategies. This review synthesizes advances in three key areas: 1) AI-driven gamification for adaptive learning, 2) Serious games for disaster preparedness, 3) Intelligent scoring systems that evaluate competency beyond traditional metrics.First, we examine how machine learning (ML) and natural language processing (NLP) enable dynamic game adaptations, such as adjusting flood risk simulations via reinforcement learning. Next, we analyze serious games for flood resilience, highlighting AI's role in generating realistic disaster scenarios to foster decision-making under uncertainty. Finally, we explore AI-powered scoring systems that use stealth assessment, predictive analytics, and explainable AI (XAI) to provide granular feedback, transforming games into robust assessment tools. Research shows that AI-enhanced gamification improves knowledge retention by 20–35% compared to conventional methods, while adaptive scoring systems boost both learner motivation and instructor insights. Challenges remain in algorithmic fairness, scalability, and pedagogical validation. We conclude with a framework for future work, emphasizing human-AI collaboration to design immersive, equitable, and empirically validated educational games for flood resilience.

Abstract #: 125

Title: **The Water-R2O NSF Research Traineeship: Leveraging Experiential Learning to Translate Operational Hydrology Research into Practice**

Author(s): Steve Burian, Hannah Holcomb, James Halgren, Karri Holley & Abby Davies

Presenter: Abby Davies

Organization: The University of Alabama

Session: Extension, Outreach & Partnerships 1

This presentation will introduce insights, ideas, recommendations, and opportunities for collaboration based on the design and two years of delivery of the Water Research to Operations (Water-R2O) National Science Foundation Research Traineeship (NRT) graduate program at The University of Alabama (UA). The Water-R2O NRT uses multiple integrated experiential learning elements to prepare graduate students at UA for careers in operational hydrology. To kick off the one-year program, students are immersed in a 3-day operational hydrology study tour in the southeast United States. During the study tour, students visit water management infrastructure (e.g., dams), hydrologic forecasting businesses, government hydrologic forecasting centers, and the Tennessee Valley Authority (TVA), which introduce students to the spectrum of research to operations and applications in the field of operational hydrology. A regular weekly seminar connects the students to practitioners in the operational hydrology field and offers professional development strengthening student skills in interdisciplinary research, communication, and project management. As part of the Hydrologic Forecasting Praxis Lab course in the spring semester, students complete a team project inspired by an operational hydrology user. Culminating the Water-R2O NRT program is a required experiential learning element. Students may complete the operational hydrology education abroad program, one of the summer research experience programs offered by the Cooperative Institute for Research to Operations in Hydrology (CIROH), or an internship. Students completing the course requirements and the experiential learning element are granted the Operational Hydrology Graduate Certificate. This presentation will highlight the Water-R2O program, instructor insights, student reflections, and evaluation data.

Abstract #: 126 **Student**

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

Author(s): Megan Sharpe, Barry Fagan & Michael Perez

Presenter: Grace Kerr

Organization: Auburn University / Fagan Consulting

Session: Student Poster

Construction, operation, and maintenance of roadways generate pollutants such as sediment, heavy metals, and nutrients, pollutants which the USEPA identifies as the most widespread in impeding the beneficial uses of the Nation's rivers and streams. Despite decades of regulatory action, over half of our nation's assessed waterways are listed as impaired or threatened by urban non-point source runoff. Increased urban runoff pollution coupled with aging systems earned Stormwater infrastructure a letter grade of "D" on the 2021 American Society of Civil Engineers Infrastructure Report Card. Therefore, a need exists to develop enhanced stormwater management practices that are easy to employ and maintain while minimizing pollutant concerns.Through a Small Business Innovation Research (SBIR) contract with the US DOT, Fagan Consulting, in partnership with Auburn University, is developing a self-contained, portable stormwater 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. 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. 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. Data collected from preliminary testing shows over a 70% reduction in TSS, iron, copper, and lead. Similarly, these results yielded over a 60% decrease in cadmium and phosphate. Further, spectrophotometer testing was conducted to assess the amount of dissolved aluminum (Al^{3+} ions) that would be released using the electric floc generator, under the same testing conditions. Results from the spectrophotometer testing showed 0.22 mg/L of dissolved aluminum was found in the effluent of our samples. Since there is no specific guidance for stream protection from aluminum, these values were compared to the National Secondary Drinking Water Regulations, which recommend a maximum of 0.20 mg/L in drinking water. Additionally, certified EPA toxicity testing has confirmed that the device's effluent is safe for aquatic life, including sensitive species. Research and development will continue to fully refine and optimize the floc generator.

Abstract #: 127

Title: **Enhancing Estuarine Education and Outreach Through Immersive Story Mapping: A Case Study of Weeks Bay National Estuarine Research Reserve**

Author(s): Dixie Cartwright, John Cartwright, Flavia Xavier & Claire Babineaux

Presenter: Dixie Cartwright

Organization: Mississippi State University, Geosystems Research Institute

Session: Extension, Outreach & Partnerships 1

Estuarine environments, where freshwater and saltwater converge, are among the most productive ecosystems on Earth. They provide critical habitats for diverse species, support commercial fisheries, and offer natural protection against storms and flooding. Despite their importance, estuaries often remain underappreciated by the public due to limited access and awareness. Traditional outreach methods, such as site visits and workshops, are effective but can be constrained by logistical and geographic barriers.To address these challenges, we propose the development of an immersive story map centered on the Weeks Bay National Estuarine Research Reserve (NERR) in Alabama. Established in 1986, Weeks Bay NERR encompasses over 6,000 acres of tidal and forested wetlands, including unique habitats like pitcher plant bogs and submerged aquatic vegetation. The reserve serves as a living laboratory for research, education, and stewardship, making it an ideal case study for innovative outreach approaches.Outdoor AlabamaThe story map will integrate 360-degree videos, interactive maps, and multimedia content to create a virtual experience that brings the estuarine environment to life for remote audiences. By simulating on-site experiences, users can explore the reserve's diverse habitats, learn about ongoing research, and understand the ecological significance of estuaries. This approach aims to enhance scientific literacy, foster a sense of connection to coastal environments, and inspire pro-environmental attitudes.Our project builds upon existing research indicating that immersive technologies can increase engagement and knowledge retention in environmental education contexts. By focusing on Weeks Bay NERR, we aim to develop a scalable model that can be adapted for other reserves within the National Estuarine Research Reserve System. The story map will serve as both an educational tool and a platform for public outreach, expanding the reach and impact of estuarine conservation efforts.In this presentation, we will outline the design and implementation of the story map, discuss preliminary findings on its effectiveness in enhancing public engagement, and explore its potential applications for broader environmental education initiatives. By leveraging immersive technology, we seek to bridge the gap between estuarine ecosystems and the communities they support, promoting informed stewardship and long-term sustainability.

Abstract #: 128 **Student**

Title: **Use of Bioindicators to Characterize Blackwater Wetland Reference Sites in Alabama**

Author(s): Barrie Sullivan, Kathryn Schabron, Tyler McNeese, Owen Marvin & Brian Helms

Presenter: Barrie Sullivan

Organization: Troy University

Session: Student Poster

Wetlands provide 40% of global ecosystem services despite covering just 1.5% of Earth's surface. However, wetlands are disproportionately threatened by human development, pollution, and climate change, with Alabama's wetlands being particularly impacted. Alabama is home to a variety of wetland types, each harboring unique flora and fauna. Particularly unique are blackwater wetlands. These wetlands are typically floodplain swamps associated with blackwater systems, waters originating below the fall line containing heavy amounts of tannins, iron, and organic matter, with a low pH. The Alabama Department of Environmental Management (ADEM) is responsible for monitoring surface waters, including wetlands, yet full incorporation of wetland monitoring has been difficult. To assist in these efforts, we are establishing baseline reference conditions of water chemistry, flora, and fauna in blackwater wetlands and their receiving streams in southwest Alabama. Five blackwater systems will be compared to five alluvial and five spring-run wetland systems common in the area as points of comparison. Systems will be chosen based on AL Natural Heritage Program database information and scores from the Wetland Ecological Integrity Assessment developed by the Natural Heritage Network, resulting in 30 sites overall (15 wetlands, 15 receiving streams). For each site, we will use standard protocols at the appropriate season and hydroperiod to quantify water quality and physiochemistry, vegetation composition, macroinvertebrate assemblages, fish assemblages, herpetofaunal composition, and avian assemblages. GIS layers and maps will be created as an interactive tool for community-based environmental protection and public outreach. The sampling at selected sites is anticipated to begin spring 2025. Results from this effort will provide water quality and biotic composition to characterize reference condition of blackwater systems, quantify relationships in conditions between wetlands and receiving streams, and ultimately assist ADEM in establishing standard wetland monitoring protocols across Alabama.

Abstract #: 129 **Student**

Title: **Assessing the Pollution Potential of Onsite Wastewater Treatment Systems in Coastal Mississippi and Alabama Counties Under Sea Level Rise**

Author(s): Katie Bendall, Ann Ojeda & Stephanie Rogers

Presenter: Katie Bendall

Organization: Auburn University

Session: Student Poster

Approximately 40 percent of Mississippi (MS) and Alabama (AL) residents are dependent on onsite wastewater treatment systems (OWTSs). Although these systems are reliable when properly maintained and installed, the effects of sea level rise threaten their functionality. Poorly and excessively draining soils, surface flooding, and groundwater rise impact the ability of OWTSs to effectively filter pollutants from wastewater. Because OWTSs are buried underground, these failures typically go undetected. Thus, coastal communities reliant on OWTSs may be left vulnerable to unknown concentrations of pollutants caused by system failure. We use a GIS-based multi-criteria decision analysis (MCDA) to characterize the likelihood of pollution caused by system failure across the coastal counties of MS and AL. Informed by previous studies and U.S. EPA guidelines, five criteria were chosen based on their impact on OWTS efficacy. Criteria include flooding frequency, depth to groundwater table, soil drainage class, soil hydrologic group, and OWTS density. Using ArcGIS Pro 3.3, each criterion was reclassified on a scale of one to five, where one represents a low pollution potential and five represents a high pollution potential. Then, criteria were weighted against each other using the analytical hierarchy process (AHP), where higher weights were assigned to criteria that are more likely to cause pollution from OWTSs and vice versa. Data were then aggregated in ArcGIS Pro, producing the final model in raster format, which assigns a rank of five to highest and one to lowest pollution potential. We discovered that as much as 11.5% of the total study area was characterized as high-moderate (≥3.5) to high (≥4) pollution potential as an effect of OWTS failure. This research contributes to an increasing number of studies focusing on the impacts of sea-level rise on coastal OWTSs and provides important insights for policymakers, stakeholders, and community members in developing targeted decision-making strategies regarding OWTS usage.

Abstract #: 130

Title: **Mapping Ecological Zones Using Terrain-Derived Environmental Models Across the Cumberland Plateau and Cumberland Mountains**

Author(s): Steven Simon, M'Kayla Motley, Dwayne Estes & Gregory Guthrie

Presenter: M'Kayla Motley

Organization: Geological Survey of Alabama

Session: Professional Poster

Remote sensing has long supported the mapping of forest, wetland, and grassland communities, though traditional classification using moderate-resolution imagery often yields inconsistent results. High-resolution remote sensing and terrain-based modeling offer new opportunities to improve resource management, conservation, and ecological restoration. Ecological Zones (EZ) provide a spatially explicit framework for predicting potential vegetation distributions based on environmental factors such as moisture, temperature, soil fertility, solar radiation, and disturbance. Developed in the Southern Appalachian Mountains, EZs are based on detailed field descriptions of plant communities modeled with digital terrain derivatives. While conceptually similar to Biophysical Settings, EZs offer finer spatial resolution and more vegetation specificity. This study refines Ecological Zone models across the Cumberland Plateau, adjacent mountain regions, and neighboring low-relief ecoregions. The objectives were to improve model accuracy, identify key environmental drivers, and evaluate scalability for ecological planning. A multi-stage approach was used, beginning with field data from 1,916 vegetation plots. High-resolution LiDAR-derived digital terrain models (DTMs) provided 23 environmental variables, which were input into MAXENT models to predict suitable conditions for each EZ. These predictions were then refined using expert review, post-processing filters, and ecotone analysis. Top predictors included distance to cliffs, sandstone-conglomerate and shale geology, and elevation-dependent precipitation patterns. Slope, solar radiation, and the Terrain Shape Index proved especially effective in distinguishing moist, concave coves from dry, convex ridges. Limestone geology consistently predicted calcareous woodlands and mesophytic forest types. While curvature metrics contributed minimally to model fit, they were valuable for refining boundaries in transitional zones. Interactions among elevation, slope position, and solar exposure revealed complex but interpretable physiographic patterns. Model accuracy was highest in areas with distinct topographic or geologic features. EZs offer a robust tool for characterizing landscape heterogeneity, especially in fire-adapted systems where vegetation patterns are shaped by disturbance and terrain. Post-modeling enhancements, including ecotone adjustments and fine-resolution terrain inputs, improved both realism and accuracy. Validation with field reference plots supported the reliability of outputs for use in operational ecological mapping. This approach has been applied across multiple Appalachian ecoregions and extended into the Atlantic Coastal Plain and Piedmont, confirming its applicability across diverse landscapes.This work delivers a spatially detailed understanding of ecological diversity on the Cumberland Plateau and provides a scalable framework to support conservation, restoration, and land management efforts.

Abstract #: 131 **Student**

Title: **Connecting Streambed Groundwater Quality to Failing Septic Systems in Coastal Alabama**

Author(s): Megan Jones, Katie Bendall, Stephanie Rogers & Ann Ojeda

Presenter: Megan Jones

Organization: Auburn University Department of Geosciences

Session: Student Poster

Onsite wastewater treatment systems (OWTSs) are potential sources of surface and groundwater contamination. OWTSs are popular in rural communities that do not access municipal wastewater treatment, and many Alabama residents rely on OWTSs to treat their wastewater. OWTSs require optimal conditions to function without failure, which include ideal system conditions, consistent maintenance practices, and proper soil and site characteristics. However, it's likely that those conditions are not always met, particularly in coastal Alabama. High densities of OWTSs, frequent surface flooding, restrictive or highly permeable soil types, or shallow depths to groundwater, can cause these systems to fail. Additionally, limited OWTSs data availability makes large scale observations about water quality conditions difficult. Pollution potential modeling is one solution to identifying waterways that are most at risk of contamination from failing OWTSs. In this study, we analyze baseflow shallow streambed groundwater samples for multiple wastewater tracers to evaluate the performance of an OWTSs pollution potential model in coastal Alabama. This study intends to assess the relationship between modeled pollution potential and acquired water quality data using artificial sweeteners (acesulfame-K and sucralose) as chemical source tracers (CSTs) and total coliforms, E. coli, and human-specific marker Phocaeicola dorei (HF183) as microbial source tracers (MSTs). We expect that as pollution potential increases, so will the measured concentrations of these CSTs and MSTs. We also expect that pollution potential modeling used with ground-truth data will perform better than individual variables that predict risk of OWTS failure. Results may validate the effectiveness of pollution potential modeling or encourage reevaluation of the weighting scheme that is used to develop the pollution potential model.

Abstract #: 132

Title: **Concentrating Nature-Based Solutions to Stormwater for Ecosystem Benefits**

Author(s): Ben Wegleitner

Presenter: Ben Wegleitner

Organization: The Nature Conservancy

Session: Lightning Talk - Outreach & Extension

In the face of intensifying rainfall events, nature-based solutions for stormwater and floodplain management is an essential strategy for protecting urban communities from catastrophic flooding, excess pollutant loading, and erosion issues. Erosion from these storms is also filling in the aquatic habitats of Threatened and Endangered (T&E) species in some of the state's most biodiverse river systems. The Nature Conservancy has partnered with the City of Springville and U.S. Fish and Wildlife Services to design and implement nature-based solutions in its Youth Sports Complex to lessen the impacts of recreational development on Trispot Darters in the Big Canoe Creek watershed near Springville (AL). This project overview will briefly demonstrate the nature-based solutions, activities, and stormwater best management practices that have been completed and any underway or planned activities for further protection of Left Prong Little Canoe Creek. Activities include perched culvert replacement to remove instream barriers to aquatic species movement, riparian buffer revegetation, instream habitat restoration, grass swales and ditches, natural checkdams for erosion control, and others. Engagement with City leaders about these sites began in 2022, and projects have been ongoing since.

Abstract #: 133 **Student**

Title: **Flushing Down Stream – Assessing the association between fecal load from failing septic systems and straight pipes into local waterways and precipitation driven runoff in the Alabama Black Belt**

Author(s): Harley Tandy, Emily Elliott, Mark Elliott, Corinne Baroni & Todd Hester

Presenter: Harley Tandy

Organization: The University of Alabama

Session: Student Poster

In the Alabama Black Belt, 68% of homes have centralized sewer, while the other 32% are required to have onsite wastewater treatment systems (e.g., septic systems). This part of the state is characterized by shrink-swell clay soil, which becomes essentially impermeable when wet, causing hydraulic failure of conventional septic systems. Alternative engineered onsite wastewater systems are too expensive for most rural Black Belt residents. When conventional systems fail, they turn to “straight piping” or the release of untreated sewage directly into the environment. Both straight-piping and hydraulic failure of septic systems result in sewage accumulating on the ground surface; additionally, the shrink-swell clay prevents infiltration of the sewage and the associated fecal indicator bacteria (FIB). Therefore, we hypothesize that FIB and fecal pathogens that accumulate on the ground surface during dry periods will run off and be “flushed” into local surface water bodies during each substantial precipitation event. This study utilizes two years of consistent time-integrated samples to analyze the levels of FIB, in both the water column and attached to fine-grained sediment, in Big Prairie Creek, adjacent to the town of Newbern, Alabama. This study addresses the effect of precipitation, especially following dry spells, on the concentration of FIB in Big Prairie Creek. The presence of fecal indicator bacteria (FIB), such as Escherichia coli (E. coli) serves as markers for potential pathogenic contamination. While rainfall’s impact on FIB in Big Prairie Creek during flush events has been studied, a thorough evaluation of the effect of dry periods before high precipitation events requires further investigation. This study evaluates FIB levels during flush events in wet and dry conditions to determine if precipitation in the previous 14 days affects FIB levels during a flush event. The results are expected to show a positive correlation between FIB levels and dry periods preceding flush events.

Abstract #: 134 **Student**

Title: **Coastal Flood Risk Assessment of Wastewater Treatment Facilities in the Great Egg Harbor Watershed**

Author(s): Rumman Mowla Chowdhury, Kauser Jahan & Julia Thorton

Presenter: Rumman Mowla Chowdhury

Organization: Rowan University

Session: Student Poster

This study evaluates the flood vulnerability of wastewater treatment facilities in the Atlantic coastal zone of the Great Egg Harbor River watershed, New Jersey, and examines potential impacts on surrounding communities. Located in exposed shoreline areas of Atlantic City, Ocean City, and Seven Mile Beach/Middle, these facilities serve multiple municipalities across Atlantic and Cape May Counties and are vital to public health and environmental protection. The assessment quantifies escalating risks driven by tidal fluctuations, storm surges, and intense rainfall, all intensified by the region's complex nearshore hydrology.The analysis used advanced methods, including FEMA flood zone verification, confirming that all three facilities lie within the 1% Annual Chance Flood Hazard zone. A 2D unsteady flow model simulated compound flooding by integrating rain-on-grid precipitation, river discharge, and tidal dynamics. SLOSH model projections from NJ Flood Mapper indicate that Category 4 hurricanes could inundate all facilities under up to 9 feet of water, potentially leading to total system failure. Frequency distribution analysis of extreme rainfall events predicted over 6 feet of inundation during a 50-year storm. Additionally, future precipitation projections from climate models (GFDL-ESM4.1, CESM2, HadGEM3-GC31) incorporated into HEC-RAS modeling suggest that climate change will significantly increase both the frequency and severity of flooding in the region.The findings reveal that infrastructure disruptions disproportionately affect vulnerable coastal communities, where limited resources amplify recovery challenges. Integrating hydrological modeling with historical data and climate projections provides a powerful tool for proactive vulnerability assessment, supporting informed adaptation strategies and resource prioritization to safeguard critical facilities in this high-risk coastal environment.

Abstract #: 136

Title: **Reconstructing Historical Streamflow: Reanalysis via Strong Data Assimilation**

Author(s): James Halgren, Jonathan Frame, Quinn Lee, Sonam Lama & Andres Ramirez Molina

Presenter: James Halgren

Organization: Alabama Water Institute

Session: Modeling & Water Management

Our research, sponsored by the Cooperative Institute for Research to Operations in Hydrology (CIROH), seeks to create a streamflow reanalysis dataset for ungaged locations across the domain of the current and future generations of the NOAA National Water Model (NWM). Because of the cost of installation and maintenance, there are fewer stream gages than would be optimal for hydrological model verification and calibration. With this scarcity, researchers generally lack insight into the hydrologic behavior of many smaller ungaged watersheds. Runoff reconstruction studies aim to bridge this gap by estimating historical streamflow, which can be used to evaluate model performance. Traditionally, machine learning and statistical reconstruction methods have been applied independently. When information about basin parameters and meteorological forcings are provided during training for diverse watersheds, a machine learning (ML) model can effectively provide predictions of hydrologic behavior in ungaged basins that are dissimilar to the basins used in training (Kratzert et al., 2019). Frame et al. (2025) showed that ML models trained on USGS gage data can be used for prediction across continental domains. Out-of-basin data can also improve hydrological model performance because of the spatial autocorrelation between streamflow in different river reaches, even crossing watershed boundaries. The correlation can be due to similar forcing meteorology or other spatially correlated factors. Moreover, the correlation may be associated with topological connections as with Fisher et al. (2020), who showed that by propagating USGS gage observations backwards and forwards to ungaged upstream and downstream locations using a physical routing model, they were able to generate reliable streamflow estimates despite having only a small number of in situ gages.

We have prototyped a combined approach utilizing both ML and out-of-basin assimilation techniques, which demonstrates improved accuracy compared to either method alone. Further, we have expanded upon this prototype, working towards applying the combined methodology to generate a reconstructed runoff dataset for Alabama. Extending the early experiments using synthetic meteorological and gage data, we are examining real watershed networks and preparing candidate model approaches. The Alabama dataset will provide a template for expanding the analysis to larger domains and will support CIROH’s education and outreach initiatives, as well as CIROH’s research to operations pathway.

Abstract #: 137

Title: **Integrating Community Revitalization and Watershed Health: Leveraging Clean Water Act Section 319(h) Funding to Mitigate Urban Nonpoint Source Pollution in Athens, Alabama**

Author(s): Cody Watson

Presenter: Cody Watson

Organization: Alabama Department of Environmental Management

Session: Extension, Outreach & Partnerships 1

Urban nonpoint source (NPS) pollution continues to pose a significant challenge as communities across the United States experience increasing urbanization and revitalization. Expanding impervious surfaces reduce stormwater infiltration and storage capacity within watersheds, often leading to the degradation of historically valued water resources. Addressing these impacts requires a multi-level, collaborative approach that integrates municipal planning, stakeholder engagement, and strategic funding mechanisms.This presentation highlights a case study from Athens, Alabama, where Athens Main Street, in partnership with the City of Athens and multiple state, federal, and private entities, implemented a comprehensive revitalization project targeting both economic development and watershed health. With over $800,000 in leveraged funding, including support from Alabama's Section 319(h) nonpoint source pollution control program, the project enhanced the Athens Farmers Market through both structural improvements and the implementation of best management practices (BMPs) designed to reduce stormwater runoff into Town Creek, a tributary of the impaired Swan Creek watershed.Many cities and towns in Alabama see their downtown areas as the foundation of their community. Athens, Alabama, is Alabama's second oldest town and is one example of citizens' commitment to ensuring downtown areas continue to thrive. As urban expansion has occurred, the city has continued to make efforts to enhance its historical sites through economic development, conservation initiatives, and preserving history. The Athens Farmers Market, built in 1986, is one of many areas of historical importance to its citizens. In 2022, Athens Main Street launched a comprehensive renovation of the Athens Farmers Market. BMPs included the installation low impact development practices such as porous pavers and pervious asphalt to replace legacy impervious surfaces, thereby increasing on-site infiltration and reducing pollutant loads. Section 319(h) funding supported the design and installation of these BMPs, enabling other project funds to be redirected toward complementary urban revitalization efforts. The success of this project illustrates how Section 319(h) funding can serve as a catalyst for integrative planning, blending water quality objectives with community development goals.This session will explore the project's technical implementation, stakeholder engagement process, and funding strategy from the perspective of a Section 319 grant coordinator. It will highlight key challenges encountered during design and construction, strategies for successful community buy-in, and the long-term impacts of this initiative—such as the development of Sunrise Park and broader city efforts to incorporate LID principles into future planning.

Abstract #: 138

Title: **Hydrologic and Hydraulic Modeling of a Robust Gully System to Support a Blend of Natural and Traditional Stabilization**

Author(s): Katie Fox & Benhur Asefaw

Presenter: Benhur Asefaw & Katie Fox

Organization: Geosyntec Consulting

Session: Restoration 1

The Pugh Gully Sedimentation and Erosion Control Project in Santa Rosa County, Florida, targets a deeply incised and actively eroding gully system contributing excessive sediment to downstream water bodies, including the Blackwater River and ultimately the Gulf of America. To inform sustainable stabilization and design, Geosyntec Consultants conducted a comprehensive hydrologic and hydraulic (H&H) evaluation involving field surveys, bankfull assessments, pressure transducer installations, and high-resolution drone-based LiDAR mapping. The 2D HEC-RAS model assessed baseline erosion potential by analyzing flow depth, velocity, shear stress, and stream power across geomorphometrically variable cross-sections. The model also provided quantitative insights into sediment transport under various storm scenarios. These baseline results will serve as the foundation for future modeling of proposed design conditions. Once sediment and erosion control measures are finalized, comparative simulations will quantify anticipated reductions in erosive forces and sediment yield. The project explores a hybrid restoration approach integrating Natural Channel Design principles with analytical modeling tools to improve watershed resilience while minimizing costs and long-term maintenance burdens associated with traditional hardening methods. This modeling approach enables targeted intervention and strengthens watershed resilience. The case study underscores the complexities of unstable gully systems and illustrates how modeling can guide nature-based solutions in challenging geomorphic contexts.

Abstract #: 139

Title: **Cradle to Early Grave: Reaching No Further Action at the Robertsdale Elementary School ADEM Tank Trust Fund Site**

Author(s): Kendall Rich

Presenter: Kendall Rich

Organization: WSP USA Inc.

Session: Water Monitoring

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 constructed 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. During construction of the new fueling station in 2009, the UST was removed, revealing gasoline-contaminated soil and groundwater. The site was enrolled in the Alabama Department of Environmental Management (ADEM) Tank Trust Fund program to fund reimbursement of costs for removal and remediation of contaminated soil and groundwater associated with the fuel release. Preliminary and secondary investigations were conducted in 2013 and 2014, respectively, and an Alabama Risk Based Corrective Action (ARBCA) evaluation was performed in 2016 to characterize potential exposure pathways and to establish site-specific Groundwater Resource Protection (GRP) target concentrations for constituents of concern (COCs). A corrective action plan (CAP) for groundwater remediation including in-situ chemical oxidation (ISCO) with high-vacuum extraction (HVE) was implemented at the site in early 2022. ISCO with HVE demonstrated the potential for successfully meeting cleanup goals by reducing COC concentrations in localized zones where ISCO reagents were in contact with COCs in the subsurface. However, concentrations persisted above GRP target levels during subsequent groundwater monitoring events. A high-resolution site characterization (HRSC) study was then conducted to better characterize the location, nature, and extent of COCs in groundwater, and a three-dimensional Conceptual Site Model of the site and its subsurface contaminants was developed. ADEM then requested an amended CAP to further reduce COC concentrations in groundwater. The selected remedy included ISCO injections at various depths on approximate 10-foot grid, directly targeting contaminant zones characterized in the HRSC study. However, as quarterly monitoring continued, downward trends of benzene and toluene in groundwater continued. Even though benzene continued to significantly exceed site-specific GRP target concentrations, ADEM required that all groundwater wells associated with the site be abandoned for site closure and will ultimately issue a letter of No Further Action for the Robertsdale Elementary School site. This presentation will provide a brief description of the ADEM Tank Trust Fund program and the cleanup history of the Robertsdale Elementary School Tank Trust Fund site, with a focus on the data-driven rationale for ADEM’s decision to close the site, including evaluations of statistical trends of COC concentrations over time and evaluation of potential receptor pathways for remaining COCs in groundwater.

Abstract #: 140

Title: **Democratizing Data: A Low-cost, Real-time Monitoring Network for AL: Phase One Implementation of a Water Monitoring Strategy**

Author(s): Melissa Partyka, Ronald Bond, Edward Atwill & Nigel Temple

Presenter: Ronald Bond

Organization: University of California, Davis

Session: Lightning Talk - Research 2

This lightning talk will present an overview of the methodologies we will employ during our fine-scale three-year water quality study of the Mobile Bay near-shore environments scheduled to begin Fall of 2025. Focusing on traditional and innovative approaches, the study aims to assess spatial and temporal variations in microbial indicators such as E. coli, fecal coliforms and enterococci coupled with high density real-time physicochemical parameters. Sampling strategies included high-frequency water collection across multiple sites (including watershed transects), supported by in situ sensors and real time land use and meteorological data collection. This talk highlights key methodological considerations—including site selection, sampling frequency—and discusses how these approaches support data-driven decision-making for estuarine health and public safety in coastal Alabama.

Abstract #: 141

Title: **An Integrated Hydrologic Atlas of Opportunity and Risk for Enhanced Water Resource Management in Alabama**

Author(s): Sifan A Koriche, Nimisha Wasankar, Steven Burian, Wanyun Shao & Annyca Tabassum

Presenter: Sifan A Koriche

Organization: The University of Alabama

Session: Lightning Talk - Research 1

Alabama is characterized by a rich diversity of ecosystems and varied socio-economic landscapes, each presenting a unique combination of hydrologic opportunities (e.g., water supply, ecosystem services, and agricultural potential) and dynamic hydrologic risks (e.g., evolving flood and drought patterns, and water quality degradation). Water resource assessment within the state of Alabama would benefit from a spatially explicit framework that consistently and comprehensively integrates both the full spectrum of hydrologic opportunities and risks. A framework could provide a comprehensive understanding of Alabama's complete water resource picture, enhancing the ability for researchers, engineers, planners, and policymakers to holistically evaluate trade-offs, prioritize investments, and implement equitable strategies for sustainable water management and infrastructure resilience. With an integrated "atlas" mapping these combined opportunity-risk metrics across diverse contexts, Alabama would have a crucial tool for optimizing water use, safeguarding communities, and ensuring the long-term health of its varied aquatic and terrestrial environments. This research introduces the initial efforts to create an integrated water resource assessment framework by compiling extensive geospatial, hydro-climatic, infrastructure, and socio-economic datasets pertinent to Alabama. A study applying the information quantifies diverse indicators representing hydrologic risks (e.g., flood and drought exposure), hydrologic opportunities (e.g., water availability, ecosystem service values), and social vulnerability. These multifaceted metrics are integrated through a novel framework to develop a spatially explicit atlas presenting composite hydrologic opportunity-risk profiles across the state. The resulting integrated hydrologic atlas offers a critical decision-support tool for Alabama, enhanced with capabilities for scenario analysis, enabling enhanced strategic planning for sustainable water resource management, targeted infrastructure investment, and equitable community resilience in the face of evolving environmental conditions.

Abstract #: 142

Title: **What we know about sea-level rise and storms in Alabama from the geologic record**

Author(s): Rebecca Totten & Davin Wallace

Presenter: Rebecca Totten

Organization: The University of Alabama

Session: Special Session 3 - CONSERVE 1

Accurate predictions of floods and sea-level impacts are critical to developing resiliency for coastal communities of Alabama. Predictions are based on short-term records from instrumental data that may not capture the highest magnitude of extreme events, however. Here we aim to improve predictive capability by extending records of environmental change with long sediment archives in Mobile Bay and Weeks Bay, Alabama. In 2018, The University of Alabama and The University of Southern Mississippi collected 9-m and 6-m sediment cores from each bay. Laser particle size, elemental concentrations from X-Ray Fluorescence, stable isotopes of carbon and nitrogen from organic matter, and diatom assemblages were analyzed in the layered sediment of each core, which together tell a holistic story of environmental change over the past 9,000 years. We carbon-dated shells and measured Cesium-137, produced by atomic bomb testing in the 1960's. Peaks in sand indicate flood and/or hurricane events, which we have calibrated with recent streamflow and hurricane records. Elemental composition, especially of titanium, potassium, and zirconium, record terrestrial run-off variability. Stable carbon and nitrogen isotopes indicate terrestrial vs. aquatic nutrient sources, while diatoms record productivity in the water column. Modern Mobile Bay formed during a period of extreme sea-level rise ca. 8,200 years ago. A ca. 3,000-year period of reduced marine influence followed—until 5,000 years ago, when storm activity increased. Modern Weeks Bay formed 7,800 years ago and became a freshwater estuary by 2,000 years ago. We found that there are more prevalent diatom blooms in recent decades—since Weeks Bay became a NOAA National Estuarine Research Reserve—than in the past 3,000 years, suggesting that nutrient management upstream may also be a concern. Ongoing research will compare storm frequency and salinity change with sea-level rise rates and climate variability of the past 9,000 years.

Abstract #: 143

Title: **Addressing microbiological impediments to oyster growing through cooperative monitoring and transparent communication**

Author(s): Melissa Partyka, Ronald Bond & Robert Atwill

Presenter: Melissa Partyka

Organization: Auburn University

Session: Water Quality 2

Coastal Alabama receives an average of 64 inches of rain annually; excessive rainfall episodes lead to elevated river stage, periodic wastewater sewage discharge exceedances, and regular accidental sanitary sewer overflows. Further, pressure from climate change and increased urbanization contribute to both increased rainfall intensity coupled by elevated storm runoff. This combination of climate, weather, and infrastructure failures result in recurring periods of degraded microbial water quality, potentially impacting human health, seafood safety, and economic wellbeing of the oyster industry following protracted closures. Microbial water quality data currently collected by the both the Alabama Department of Environmental Management (ADEM) and the Alabama Department of Public Health (ADPH) are limited in both spatial and temporal extent, limiting the ability of researchers, oyster growers, and regulators themselves to make informed management decisions about point and non-point sources of microbial pollution in Alabama's coastal surface waters. Through support provided by the National Ocean and Atmospheric Administration through the Saltonstall-Kennedy Grant Program, we built an oyster-grower supported microbial monitoring program aimed at increasing the amount of near-shore, shallow water (<2 m), ambient water quality data within Alabama's oyster growing waters. Participating oyster growers (n=6) were trained to collect water samples aseptically in addition to measuring ambient physicochemical parameters from their respective oyster farms (n=9). Data collected by the growers were used to complement and supplement bi-monthly field sampling efforts of our research team (farm-independent sites = 34) for a total of 565 samples over the two-year study. Project results have helped determine locations and conditions that continue to contribute to degraded water quality while educating oyster growers about current water quality regulations and ways that climate, weather, and infrastructure impact water quality and their businesses. Additionally, data collected during the study are being used in conversations with ADPH to help guide future management decisions and improve guidance for growers on regulatory compliance.This project aims to strengthen and improve Alabama coastal management using adaptive approaches while sharing coastal knowledge with impacted communities. In this presentation we will share the outcomes of the water quality sampling efforts as they relate to spatiotemporal variability and timing of regulatory closures. Additionally, we will discuss methods we employed to increase stakeholder communication with regulatory authorities, improve risk communication related to regulations and seafood safety, and expand available environmental data related to a burgeoning but heavily regulated industry.

Abstract #: 144 **Student**

Title: **Water and Wastewater Education and Outreach Impacts in the Rural Alabama Black Belt**

Author(s): Lacey Christian, Rachel Chai & Kevin White

Presenter: Rachel Chai

Organization: University of South Alabama

Session: Lightning Talk - Outreach & Extension

According to the 2025 American Society of Civil Engineers Report, 1 in 5 United States residents (66 million) use onsite wastewater treatment, with many of these onsite and cluster wastewater treatment systems in rural communities. Based on a Delta Regional Authority study of 11 central Alabama counties (with significant overlap of the 17 Alabama Black Belt counties), approximately 50% of residents in these counties would require decentralized onsite or clustered wastewater treatment systems. Even with widespread use or need for these systems, there is a knowledge gap for not only residents but also industry leaders and elected officials. Among the general public, there is a lack of understanding of what can and can not be flushed, the maintenance needs for their household systems, water conservation, and the health and environmental impacts of straight pipe usage. For regulators and industry professionals, there is a lack of training materials on the usage and maintenance of varying types of decentralized onsite and cluster systems, as well as the importance of investing in appropriate wastewater infrastructure solutions (environmental, community health, and economic impacts). With these circumstances in mind, the Consortium for Alabama Rural Water and Wastewater Management developed the goals of helping the community of the Alabama Black Belt by (1) helping them gain a basic understanding water and wastewater usage (i.e. septic care, water conservation), (2) understanding of health and environmental impacts of unlawful discharges (i.e. problems with straight pipes), (3) influencing elected officials to invest in wastewater infrastructure for the community, (4) increasing the awareness of decentralized onsite/cluster wastewater treatment types, and (5) workforce development in the water/wastewater industry by educating K-12 students. To achieve these goals, the consortium has been developing and implementing education and outreach materials: videos, brochures, posters, PowerPoints, activity sheets, and lesson plans covering topics including environmental and health impacts of untreated wastewater, water and wastewater treatment, decentralized technologies, household septic care, and more. Implementation of these materials have been used at the K-12 level at events such as STEM workshops like Go Explore Math and Science (GEMS), Sawyerville Summer Camp in Hale County, Amelia Love Johnson Elementary School (in partnership with Black Belt Women Rising), and community outreach for the Rural Wastewater Demonstration Project in Newbern, AL (in partnership with Auburn Rural Studios). Materials are currently being made in partnership with Moonshot Missions to encourage workforce development (for water and wastewater operators) in local high schools. Additional video resources are available on our YouTube channel. Resource materials are available for use on the consortium website.

Abstract #: 145

Title: **Opportunities to Integrate Satellite Remote Sensing into Turbidity Monitoring in Alabama**

Author(s): Meryl Kruskopf & Kelsey Herndon

Presenter: Kelsey Herndon & Meryl Kruskopf

Organization: The University of Alabama in Huntsville

Session: Professional Poster

Alabama contains 129,700 miles of river and more than 490,472 acres of ponds, lakes and reservoirs. As a water rich state, monitoring water quality is a major effort. Water quality in Alabama is a major issue, with 40% of river and stream miles not supporting designated uses and over 80% of reservoirs being impaired due to sediment. Broad-scale satellite-based monitoring can help resource-limited state agencies and non-profit organizations identify pollutant sources and target areas for intervention. While some turbidity monitoring data from in-situ observations exists, these point based samples are limited in their ability to characterize spatial and temporal patterns. Publicly available satellite data like the European Space Agency's Sentinel-2 Multispectral Imager and NASA's Landsat 9 Operational Land Imager have the ability to monitor turbidity using green, red and near-infrared spectral signatures. Other complementary datasets such as satellite derived precipitation products such as the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) can potentially help characterize climatological drivers of turbidity. This presentation highlights methods for turbidity monitoring and outlines the overall opportunities for applying these methods in Alabama.

Abstract #: 146

Title: **Understanding Phenology of Invasive Aquatic Plants to Inform Management Initiatives in the United States**

Author(s): Gray Turnage, Ryan Wersal & John Madsen

Presenter: Gray Turnage

Organization: Mississippi State University

Session: Aquatic Ecology

Invasive aquatic plants are an increasing global problem that have limited management strategies when contrasted with terrestrial invasive plants. The most effective plant management strategies for invasive species are those that maximize stress on target species when internal energy reserves are low (i.e., weak points in the plant life cycle). Understanding the phenology of invasive aquatic plants can help resource managers time management initiatives to maximize stressors during weak periods of target species. Phenology is the study of the seasonal timing of critical life stages in plants in response to environmental cues (e.g., temperature or photoperiod), whereby the allocation of biomass and other resources, such as carbohydrates, are fundamental aspects during these life stages. Oftentimes, aquatic plants exhibit cyclical seasonal growth patterns that allow researchers to identify periods of low plant energy reserves (i.e., weak points in the life cycle) that can be exploited for management activities that maximize stress on the target species (e.g., mechanical, chemical, or biological control methods). Biomass data was collected over two years for invasive aquatic plant species in the United States (curlyleaf pondweed [Potamogeton crispus] and parrotsfeather [Myriophyllum aquaticum]) and correlated to environmental parameters (air temperature and photoperiod) to predict natural weak points in plant phenology. Starch, which is a component of carbohydrate reserves, was also quantified in parrotfeather tissues to further validate predictions of weak points the plant life cycle. Spring and late-fall were identified as weak points of curlyleaf pondweed phenology, based on biomass allocation, and therefore suitable times to implement management strategies to maximize stress. Late summer was identified as the weakest phenological point in the parrotfeather life-cycle based on biomass allocation and starch content suggesting management should coincide with this period to maximize stress on this species. Phenological data are necessary when developing management strategies to better manage invasive species and potentially selectively reduce target species when growing as part of a mixed plant stand. However, not all management strategies are appropriate for use during all plant life stages as desirable species may be present during some stages of the target species life-cycle. Therefore, target plant phenology and the presence of non-target species should be considered prior to initiating management activities as each may influence selection of appropriate management techniques that simultaneously target to weak points of the invasive species life cycle while minimizing impacts to non-target species.

Abstract #: 147 **Student**

Title: **PFAS Transport in Soil Columns: Impact of Dissolved Organic Matter**

Author(s): Ziteng Song, Thorsten Knappenberger & Yaniv Olshansky

Presenter: Ziteng Song

Organization: Auburn University

Session: Water Security & Risk

Poly and perfluoroalkyl substances (PFAS) are environmentally persistent pollutants that have raised increasing concern due to their widespread occurrence and human and environmental health risks. In agricultural systems, the application of organic amendments, such as biosolids and composts, can introduce both PFAS and elevated levels of dissolved organic matter (DOM), which may alter the environmental fate and transport of these contaminants. However, the complex interactions among PFAS, DOM, and soil constituents remain insufficiently understood.This study examines how DOM derived from common organic amendments affects PFAS sorption and transport in soil. Saturated column experiments were conducted with soil collected from a B horizon of an Ultisols (Gwinnett). Breakthrough curves of six PFAS solution (PFBS, PFHxS, PFOS, PFHpA, PFOA, PFNA) indicated compound-specific behavior, with short-chain PFAS (e.g., PFBS) exhibiting earlier breakthrough and reduced retention, while long-chain compounds (e.g., PFOS, PFNA) demonstrated greater retardation. These results are consistent with known differences in hydrophobicity and functional group chemistry among PFAS. We plan to conduct additional column experiments incorporating DOM solutions extracted from a range of organic amendments, including municipal biosolids, composted poultry litter, cattle manure, plant-based compost, and commercial humic acid. These DOM types span a broad spectrum of molecular characteristics, such as aromaticity, protein-like content, and molecular weight distributions. The upcoming experiments aim to evaluate how these properties influence PFAS mobility under saturated flow conditions. It is anticipated that DOM rich in proteinaceous or aromatic components may enhance PFAS solubility or facilitate the formation of DOM–PFAS complexes, potentially altering transport dynamics through competitive sorption or reduced soil affinity.DOM is characterized by extraction from diverse amendments, including municipal biosolids, composted manures, plant-based compost, and commercial humic substances. DOM samples were analyzed using UV-Vis absorbance (SUVA254, E2:E3, E4:E6), excitation-emission matrix fluorescence coupled with PARAFAC, FTIR spectroscopy, and size exclusion chromatography. These techniques provide molecular-level descriptors such as aromaticity, proteinaceous content, and molecular weight distributions, which are hypothesized to influence PFAS binding affinity and mobility. Initial batch sorption data suggest that DOM with greater aromatic or protein-like characteristics may enhance PFAS sorption, but further column studies are required to confirm these effects under dynamic flow conditions.

Abstract #: 148 **Student**

Title: **Evaluating the Potential of Commercial and Modified Biochar to Mitigate Phosphorus Loss in No-Till Agricultural Systems with Cover Crops**

Author(s): Gibi Thomas , Debolina Chakraborty, Rishi Prasad, Prasenjit Ray & Sushil Adhikari

Presenter: Gibi Thomas

Organization: Auburn University

Session: Lightning Talk - Research 1

The Southeastern US experiences a considerable amount of precipitation during winter months, which contributes to phosphorus (P) loss from its highly weathered and erodible soils. This loss is a significant concern to the surface water system, promoting algal blooms and the formation of dead zones. Hence, farmers adopt cover crops to improve soil health and reduce soil erosion. Cover crops have several agronomic and environmental benefits, such as nutrient cycling, reduced soil compaction, increased soil structure and aggregation, and improved soil microbial activity. However, in no-till soil, cover crops can be a P source by re-releasing the bioavailable P during the decomposition process. Biochar has gained attention for its potential to retain nutrients and protect water quality. However, the limited functional groups in raw biochar restrict its ability to adsorb nutrients effectively. Research has shown that modifying biochar with metal oxides can significantly enhance its P retention. This study investigates the impact of cover crop termination on environmental P loss in no-till soils and evaluates the effectiveness of commercial and modified biochar in reducing P runoff. Commercial biochar, derived from pine wood chips pyrolyzed at 500 °C, was modified using 1 M $FeCl_3 \cdot 6H_2O$. Soil samples were collected from no-till fields in Alabama (0–3 inch depth) and packed into 0.16 m² trays. Cereal rye (Secale cereale) was sown at 90 lbs/acre and terminated after 90 days, with residues left on the surface to decompose. Simulated rainfall equivalent to one acre-inch was applied during cover crop decomposition at an interval of one-month. Runoff and leachate samples were analyzed for P species (dissolved reactive P, particulate P, and total P). Preliminary data on P loading rates from cover crop decomposition with the use of commercial and modified biochar will be presented.

Abstract #: 149

Title: **Investment Costs for Center Pivot Adoption in Alabama**

Author(s): Aaron Wells, Roshell Rosales Aguilar, Adam Rabinowitz & Brenda Ortiz

Presenter: Roshell Rosales Aguilar

Organization: Alabama Cooperative Extension System

Session: Professional Poster

There can be a lot of variation in agricultural production, and this can be especially noticed when installing a center pivot irrigation system. The benefits of irrigation are primarily to mitigate the risks and uncertainty associated with producing a rainfed crop. Mitigating drought risk and providing a more consistent annual yield can be a valuable risk management strategy for row-crop farmers. However, funding a new center pivot is a significant and long-term investment, therefore it needs to be given plenty of financial planning. Different locations may also mean different access to water, which in turn means different costs. This research investigates the investment necessary to install the components of a center pivot irrigation system in Alabama.

The specifics of an irrigation system depend on the farm location, field size, available water, and access to electricity. We illustrate through a series of scenarios the costs based on specific assumptions associated with adopting a center pivot irrigation system. Some of the current costs associated with installing irrigation equipment are the following. The irrigation system will be about $100/ft of the pivot. In the case of a 1,295 ft pivot, that will cost $129,500 to install. A well can cost between $55,000 - $170,000 depending on how deep it needs to be drilled and the potential success of finding water once drilled. These costs are based off of 2024 – 2025 numbers. To know the true costs of installing irrigation equipment, one needs to also clarify whether there is surface water readily available, location of the well, and access to three-phase electricity. With respect to electrical access, there are three types of options to consider. The most straightforward option is to already have three-phase access. In the case of single-phase access, there would need to be a conversion to three-phase. Alternatively, if there is no electricity at the field then a line will have to be drawn in from a distance. In some cases, it would be more cost effective to buy a diesel engine. In our scenarios we consider these different electricity options compared to a diesel alternative.

Abstract #: 151 **Student**

Title: **Are Cover Crops a Potential Risk to Water Quality?**

Author(s): Gibi Thomas, Debolina Chakraborty & Rishi Prasad

Presenter: Gibi Thomas

Organization: Auburn University

Session: Student Poster

Mitigating non-point source pollution from agricultural fields remains a major challenge in the US. The Southeastern US soil is highly weathered, easily erodible, and poor in water and nutrient holding capacity. Therefore, farmers in this region have turned to conservation agriculture and often use cover crops during the fallow period. They are widely adopted due to their agronomical and environmental benefits and have been successfully demonstrated to control erosion and sediment transport, improve soil physical and chemical properties and promote nutrient cycling. However, cover crops on decomposition are known to release bioavailable P, leading to its potential loss, thereby compounding the risk to water quality. This challenge is further intensified by extreme rainfall events during the winter months. Given these constraints, our study seeks to address a critical knowledge gap regarding the influence of cover crops on environmental P loss during rainfall events. Specifically, the objective is to evaluate how the decomposition of cover crop residues affects the environmental P loss under simulated rainfall conditions. This study was conducted in a controlled greenhouse environment using soil samples collected from a no-till system. The samples were placed in rainfall simulation pans measuring 0.16 m^2. Two cover crop species—hairy vetch (Vicia villosa) and cereal rye (Secale cereale)—were planted at seeding rates of 40 and 90 lbs/acre, respectively. Cover crops were terminated 90 days after planting, with the residues left on the soil surface to decompose. Rainfall simulations were performed monthly over a three-month period following termination. Runoff samples collected during these simulations were analyzed for P species (dissolved reactive P, particulate P, and total P). The findings from this study will be presented.

Abstract #: 152 **Student**

Title: **Developing Time Integrated Technology to Detect Cryptosporidium in Waterways**

Author(s): Sean McKinney, Jillian Maxcy-Brown, Frances O'Donnell, Chengming Wang & Ann Ojeda

Presenter: Sean McKinney

Organization: Auburn University

Session: Student Poster

In Alabama, 247 of the 548 impaired waterways are listed due to high concentrations of pathogens and bacteria, indicating fecal contamination that poses health risks to individuals exposed to these waters. One of the most significant pathogens affecting humans and animals is Cryptosporidium. Cryptosporidium causes the illness cryptosporidiosis which has contributed to over 200,000 child deaths per year worldwide. Research has found that Cryptosporidium oocysts attach to naturally occurring biofilms in surface water, similar to how they attach to the intestinal lining. Current methods for assessing surface water quality use instantaneous sampling techniques which limits the ability of the data to accurately represent the natural variances in water quality over time. This presentation will discuss the development and implementation of a novel time-integrated sampling device that could more accurately quantify the present levels of Cryptosporidium in surface water. In preliminary work, we designed a biofilm-based sampling device that can capture Cryptosporidium in surface waters, with successfully capturing up to 8 oocysts in one sampling period. In this presentation, we will showcase our recent work to improve the implementation of the sampling device through exploring different material surfaces for hosting the biofilm and analyzing water quality parameters that may affect rates of oocysts attachment to biofilm. The device will be placed in Parkerson Mills Creek at locations downstream of known animal waste runoff and at depths based on a historic streamflow analysis. We will be using PCR to analyze the biofilm samples and use this data to predict where the Cryptosporidium oocysts originated from, whether that be human or nonhuman sources. We anticipate that by testing different surfaces to grow biofilm, we can find a material best fit for this new device while balancing both effective capture of Cryptosporidium oocysts and sampling cost. We will use this information to further develop the device, with future testing planned to evaluate the effectiveness of the device compared to traditional filtration tests. We anticipate that future testing will show the developed device is more effective and inexpensive compared to filtration testing. We hope this project will lead to a multi-year and multi-project collaborative effort to provide water managers with an improved low-cost method of evaluating water sources for the presence of Cryptosporidium.

Abstract #: 154 **Student**

Title: **Dissolved Organic Matter Affects PFAS Fate in the Soil-Water Continuum**

Author(s): Soleil Sklencar, Rance Hood, Thorsten Knappenberger & Yaniv Olshansky

Presenter: Soleil Sklencar

Organization: Auburn University

Session: Student Poster

Per- and Polyfluoroalkyl substances (PFAS) are a group of synthetic surfactants used ubiquitously in consumer and household products. Due to their persistence and toxicity, PFAS threaten environmental and public health. PFAS contamination in agricultural soils occurs due to the use of contaminated organic amendments, such as biosolids, and irrigation water. This process also increases the levels of dissolved organic matter (DOM). Interactions with DOM influences the mobility of PFAS within the soil profile, their uptake by plants, and their leaching into groundwater. However, a significant knowledge gap remains regarding PFAS-DOM interactions, particularly under varying environmental conditions such as pH, ions, and DOM composition, which hinders accurate prediction of PFAS behavior and transport in soil-water systems. To gain a mechanistic understanding of PFAS-DOM interactions, this study investigates the complexation of PFAS with varied fluoroalkyl chain lengths including three perfluorosulfonates, perfluoroctane sulfonate (PFOS, C8), perfluorobutane sulfonic acid (PFBS, C4), and perflurohexane sulfonate (PFHxS, C6), and three perfluorocarboxylates, perfluorooctanoic acid (PFOA, C8), perfluorononaoic acid (PFNA, C9), and perfluoroheptanoic acid (PFHpA, C6). DOM is extracted from various sources including biosolids, manures, composts, and natural organic matter capturing DOM with a range of plant- and animal- inputs. DOM from natural sources and mature composts have more stable humic substances, while fresh composts have labile dissolved compounds such as proteins and fatty acids. DOM is extracted with ultrapure water followed by filtration through 0.45 um membrane, and dialysis against NaCl or CaCl2 solutions at pH 3-9. Fluorescence excitation-emission matrix (EEM) spectroscopy and UV-VIS absorbance spectroscopy are used to identify chemical properties of DOM. Fluorescence quenching of DOM fluorophores is measured by mixing each DOM with PFAS at concentration of 1-5,000 ug L-1.Initial results identified three fluorophores in DOM: terrestrial-humic like, anthropogenic humic-like, and protein-like. DOM-perfluorooctanoate sulfonate interactions are dominated by protein-like moieties of biosolids-derived DOM at natural pH levels. Ongoing work explores suites of multiple PFAS-DOM interactions at various solution chemistry conditions, including pH, ionic strength, and composition advancing the mechanistic understanding of PFAS-DOM interactions and their effect on PFAS fate in the soil-water continuum.

Abstract #: 155

Title: **The status of phosphorus in Alabama soil: What's in the horizon?**

Author(s): Rishi Prasad, Anjan Bhatta, Debolina Chakraborty, Allen Torbert & Dexter Watts

Presenter: Rishi Prasad

Organization: Auburn University

Session: Water Quality 1

Poultry production in Alabama is spread across 49 counties, with primary concentrations in the northern and southeastern regions of Alabama. The industry generates approximately 1.5 million tons of poultry litter annually, containing 45,000 tons of phosphorus (P2O5). Poultry litter is bulky, creating economic limitations for transportation beyond the 80-mile radius. This limitation promotes the usage of litter in agricultural lands that are in proximity to poultry operations. Annual application of poultry litter on agricultural lands leads to phosphorus build-up in the soil to levels beyond the phosphorus storage capacity of the soil. This is primarily because of the low removal of phosphorus in grains or harvested products. The accumulated phosphorus, often known as ‘Legacy Phosphorus’, poses a long-term threat to the water quality of freshwater bodies. We evaluated the State’s P-index, currently being recommended by the NRCS under the 590 standard, to determine its efficacy in the P loss risk assessment. Sensitivity analysis with and without the weighted factors showed larger, albeit inconsistent, variability, pointing to the need for further validation of weightage factors used in the Alabama P-index. Three sites in Alabama were further evaluated using Edge-of-Field runoff data. Results showed that the relationships between annual dissolved reactive P (DRP), total particulate P (TPP), and total P (TP) loads with the Alabama P-index scores were weakly correlated. The poor alignment of P-index scores with actual P loadings indicated directional inaccuracies for P loss risk assessment and the need to improve the tool to protect the water quality of Alabama freshwater bodies.

Abstract #: 156

Title: **Characterization and quantification of organic matter and pyrogenic carbon in coastal forest soils subjected to fire prescription and wind damage**

Author(s): Sushant Bhandari, Heather Alexander, Sushil Adhikari, Basanta Shrestha & Yaniv Olshansky

Presenter: Sushant Bhandari

Organization: Auburn University

Session: Professional Poster

Coastal forests in the southeastern U.S. are key carbon sinks, historically maintained by low-intensity prescribed burns. However, altered fire regimes due to land-use change and suppression, combined with hurricane disturbances, have reshaped fuel loads and carbon dynamics. This study investigates how prescribed fire influences soil organic matter (SOM) and pyrogenic carbon (PyC) formation in wind-damaged coastal forests. PyC, a stable byproduct of incomplete combustion, resists decomposition and may enhance long-term carbon storage. Its production depends on fire severity, fuel load and type, and oxygen availability. We studied two sites that were impacted by hurricane damage prior to fire prescription. Weeks Bay National Estuarine Research Reserve in Alabama, a mature (~60–80 years) coastal slash pine (Pinus elliottii) forest, and Perdido River Preserve in Florida, a younger (~20 years) longleaf pine (Pinus palustris) stand. At both sites, surface soils (0–5 cm) were sampled before fire prescription, immediately after, and one year post fire. In Weeks Bay additional sample was collected one month post-fire. We measured the molecular changes in SOM and PyC using Fourier-transform infrared (FTIR) spectroscopy and the Benzene Poly Carboxylic Acid (BPCA) biomarker analysis. BPCAs serve as molecular markers of PyC, with highly condensed forms such as benzene hexacarboxylic acid (B6CA) and benzene pentacarboxylic acid (B5CA) indicating greater aromatic stability and formation under higher combustion temperatures. These compounds reflect the thermal maturity and long-term persistence of fire-derived carbon in soils. We quantified total carbon and nitrogen using elemental analysis. Fire severity did not correlate with a change in SOM content; however, a transient increase in BPCAs following fire was seen, rising from 1,020 mg-C/kg prefire to 3,700 mg-C/kg postfire, particularly in low carboxylate compounds, indicating the presence of small and relatively mobile PyC. The proportion of low carboxylate groups increased from 33.5% of the total BPCA prefire to 47.6% of the total BPCA postfire. FTIR results will be used further to investigate the molecular change in SOM and PyC.

Abstract #: 157

Title: **Functional Assessment and Mapping of Headwater Slope Wetlands in Coastal Alabama**

Author(s): Christopher Anderson & Kurtis Fisher

Presenter: Christopher Anderson

Organization: Auburn University

Session: Special Session 5 - RESTORE

Headwater slope wetlands are a ubiquitous forested wetland type located at the headwaters of coastal streams in Alabama and the southeastern U.S. Coastal Plain. There is concern that land use change may reduce the capacity for these wetlands to provide important services and functions (e.g., habitat, water quality improvement, and flood attenuation). We review past and recent work including an assessment of 74 headwater wetlands across coastal Alabama (i.e., Mobile and Baldwin County). These wetlands were assessed for important functional attributes (forest structure, soils, and hydrology) represented by various ecological measures. These data were compared to LULC data (i.e., % forest, urban and agriculture) from each wetland's catchment over a range of surrounding landscapes typical of the Alabama coast. Functional assessments were conducted based on methodologies detailed in a Hydrogeomorphic Approach (HGM) previously developed for these wetlands. Significant relationships between wetland shrub cover and agricultural and urban land use suggests these land uses may increase mid-story densities including invasive species. Urban land use was additionally related to increased herbaceous understory coverage and soil dewatering, as well as reductions in soil organic matter content and hydric soil conditions.

Headwater wetlands can be difficult to discern on maps because of their tendency to transition gradually into uplands on the landscape. As part of our study, we evaluated the Wetland Intrinsic Potential (WIP) tool and its use of multi-scale topographic indices, hydrologic proxies, and random forest procedures that assist with detection of 'cryptic' wetlands. Using the Bushy Creek – Dyas Creek watershed, near Bay Minette, Alabama, an initial model was trained and validated on a spatial subset of the watershed to predict headwater wetland presence, absence, and extent. The model was then applied to the remaining extent of the watershed. Overall accuracy for the secondary validation dataset was 92.3%, with wetland omission and commission errors of 14.0% and 4.5%, respectively. Our statistical analyses indicated WIP reliably discerned wetlands from uplands. As development continues rapidly in the coastal counties of Alabama, understanding the potential impacts and capabilities to detect and map these important wetlands is encouraged to sustain the services they provide society in Alabama and along the Gulf coast.

Abstract #: 158

Title: **Adapting CIROH's Research to Benefit Water Resources Management in Alabama**

Author(s): Steve Burian, Matt Womble & Sagy Cohen

Presenter: Steve Burian

Organization: The University of Alabama

Session: Water Security & Risk

The Cooperative Institute for Research to Operations in Hydrology (CIROH) at the University of Alabama launched its first round of research projects in 2022. Those projects are now nearing completion. Three additional sets of projects have been started each year since CIROH's founding on April 6, 2022. At this time, CIROH is supporting 133 active research and education projects. As CIROH's research portfolio matures and pathways emerge for research to operations and applications across the country, CIROH's researchers at the University of Alabama are aiming to strengthen partnerships and increase research impact in Alabama. CIROH's research portfolio includes a significant number of projects with potential benefits for Alabama in the areas of flood forecasting, drought monitoring, hydrologic analysis, water infrastructure operations, hydropower, and sediment and water quality management. There is also great potential to leverage CIROH's higher education and training programs to connect hundreds of graduate and undergraduate students annually to water resources applications in Alabama. This presentation will provide a summary overview of CIROH's projects, describe the potential benefits in Alabama, and describe potential paths forward for partnerships and to enhance the benefits for water applications in Alabama from CIROH's national and international research and education activities.

Abstract #: 159 **Student**

Title: **Assessing Private Well Vulnerability to Flood Risk in Mobile and Baldwin Counties Using Remote Sensing and Climate Projections**

Author(s): Abraham Alvarez & Frances O'Donnell

Presenter: Abraham Alvarez

Organization: Auburn University

Session: Stormwater 2

Flooding is a significant concern for private well owners in coastal Alabama counties, where heavy rainfall events affect water quality by increasing the probability of groundwater contamination. This study integrates remote sensing, hydrologic modeling, and climate projections to assess flood exposure and private well vulnerability across the region. Previous research has demonstrated that flood events that inundate the well head of private wells lead to microbiological contamination. Therefore, we analyzed the frequency of flood inundation across the study area under current and future climate conditions.This analysis used TR-55 precipitation frequency data and ArcGIS-based hydrologic simulations, to establish the return period of storms that would inundate wells across the study area under current climate conditions. The ArcGIS-based simulations were validated through analysis of three large flood events affecting Baldwin and Mobile counties. Synthetic Aperture Radar (SAR) data from the Sentinel-1 satellite was analyzed using Google Earth Engine (GEE) and ArcGIS Pro 3.4.0, Vertical/Horizontal VH backscatter were processed using the difference method to detect initial flood areas based on pre-flood and post-flood SAR images. By detecting decreases in backscatter, water-covered areas are identified. The Log-Ratio Method was also used to enhance flood signals, and the European Commission's Joint Centre (JRC) Occurrence dataset was used to identify permanent water-covered areas. rainfall depth for each of the three events was determined from DAYMET data, and the precise storm duration was inferred through radar data analysis. These historical estimates serve as a baseline for assessing the impact of climate change on storm recurrence. Through this analysis, we mapped areas where well heads would be flooded under a typical large storm, equal to 138 mm over 6 hours.To project future storm behavior, a Generalized Extreme Value (GEV) analysis was applied to 25 years of annual maxima data from MACA downscaled climate projections (CCSM4, RCP4.5). The GEV model suggests that under future climate conditions, a storm of 138 mm over 6 hours would occur approximately every 4.96 years—indicating an increased frequency compared to the historical 5.52-year return period. Further analysis using the RCP8.5 scenario and GFDL-ESM2G model is planned to examine worst-case outcomes. By integrating multi-source data and modeling techniques, this project provides a framework for understanding how flood risk and private well vulnerability may evolve under changing climate conditions in Alabama.

Abstract #: 160

Title: **Measured Retreat - Using a multi-proxy approach to contextualize long-term back-barrier erosion and eco-geomorphic response to sea-level rise, storms and anthropogenic influence in coastal Alabama**

Author(s): Emily Elliott, Lexie Thornton & Joshua Bregy

Presenter: Emily Elliott & Lexie Thornton

Organization: The University of Alabama

Session: Coastal Issues 2

Barrier island erosion and retreat due to sea-level rise, severe storms and anthropogenic influence threaten coastal stability, infrastructure and access along coastal zones globally. The northern Gulf coast is no exception, with the acute impact well documented along the northern Gulf coast from Florida through Texas. While research on barrier island retreat (transgression) has focused mainly on the redistribution of sediment along the ocean front shoreline in response to rising sea-level and storms, multiple studies have shown that back-barrier erosion can have an equal or greater impact on overall coastal degradation, leading to overall barrier island narrowing. This underscores the need to elucidate the mechanisms and extent of back-barrier sediment removal, while also better understanding the role coastal ecology plays in overall shoreline stability. Along many back-barrier estuarine shorelines, vegetation loss due to saltwater intrusion often precedes rapid coastal retreat, yet the timing of these processes is not well characterized. Erosion research along coastal barrier islands are currently primarily conducted through low-resolution, long-term (i.e., centennial to millennial) records or high-resolution, short-term (i.e., multi-decadal) monitoring and remote sensing studies. In preliminary work, a combination of remote sensing data (i.e., LiDAR, aerial photography, geo-rectified maps) has been used to identify areas with high rates of back-barrier erosion along Morgan Peninsula, AL and Dauphin Island, AL. Both have experienced high rates of erosion over the last century, with shoreline protective measures, including living shorelines and hardened protective structures, added in recent years. In this research we plan to identify timing of saltwater intrusion through tree-ring studies, specifically focusing on growth suppression and tree death, elucidating the ecogeomorphic feedback that is present between tree-death and coastal erosion. This combination of sedimentological and dendrochronological techniques taken along the back-barrier will make it possible to accurately reconstruct multi-century records of the past shoreline position at annual to decadal resolution, ground truthing remote sensing data and extending the record of coastal retreat beyond the instrumental period. This will also allow us to determine the role of storms and sea-level rise on the rate of retreat observed along the back-barrier environment. The goal of this research is to provide an assessment of the impact ecology plays along back-barrier shorelines, allowing for the characterization of barrier island vulnerability and prioritization of natural shoreline protection techniques. This research will also provide context for long-term rates of barrier island erosion and narrowing, while also allowing for an assessment of the role storms, sea-level rise and anthropogenic influence on overall barrier island geomorphology through time.

Abstract #: 161

Title: **Developing a Statewide Flood Inundation Mapping and Communication Platform for Alabama**

Author(s): Junho Song, Abby Davies, Annyca Tabassum, Brodie Alexander & James Halgren

Presenter: Junho Song

Organization: Alabama Water Institute

Session: Professional Poster

Flood risk and risk communication remain critical challenges, particularly in states such as Alabama where a comprehensive and publicly accessible flood inundation mapping (FIM) tool is limited. The lack of resources increases community vulnerability, lowers public awareness of disaster risk, and limits the ability to effectively prepare for and respond to flood events. To address this urgent need, this study integrates innovative modeling techniques, enhanced topographic data, and community engagement to develop a robust and accessible FIM communication platform for the state. As the first phase in developing a water risk information platform for the states, we incorporated over 100,000 culvert location collected across Alabama into the preprocessing of digital elevation models (DEMs), enabling more realistic hydrologic representations. Comparative analyses between DEMs with and without culvert data confirmed an improvement in the accuracy of flood extent and depth. Using the enhanced DEMs along with FLDPLN (Floodplain) model to perform precise flood inundation mapping at the individual watershed scale, while also utilizing the FastPLN model to rapidly generate flood extent maps for the entire state of Alabama. In particular, the FastPLN model demonstrated high computational efficiency, making it highly suitable for rapid disaster assessment and scenario-based planning over large areas. To further improve flood information delivery and promote equity, we integrated the Social Vulnerability Index (SoVI) into a GIS-based dashboard to visualize socially vulnerable regions. The inclusion of SoVI aim to support equitable resource allocation during disaster response and provide a scientific foundation for strengthening community resilience. Overall, the results of this study are expected to deliver a practical, scalable, and scientifically robust framework for FIM in Alabama serving not only as a tool for technological innovation but also as a means of enhancing communication, participation, and public awareness around flood risk at the community level.

Abstract #: 162 **Student**

Title: **Modeling Submarine Groundwater Discharge and Contaminant Pathways in a Rapidly Developing Coastal Region: A Case Study of Baldwin County, Alabama**

Author(s): Maryam Daneshvar, Natasha T. Dimova, Prabhakar Clement, Alex Beebe & Stephen Anderson

Presenter: Maryam Daneshvar

Organization: The University of Alabama

Session: Coastal Issues 1

Submarine groundwater discharge (SGD) is an important but often overlooked source of nutrients, trace metals, and contaminants from land to the ocean, potentially impacting coastal water quality. Excessive SGD-driven nutrient input can cause eutrophication, harmful algal blooms, and habitat degradation. This study examines SGD along the coast in Baldwin County, Alabama, a region with rapid development, agriculture, and sensitive estuarine environments. Previous smaller-scale modeling work by Ellis (2013) focused on the coastal aquifers of Gulf Shores, Alabama, indicated seasonal variability. To understand the larger scale seasonal variability, we expanded the research area, incorporating diverse land uses and environmental factors. This expanded scope provides a broader understanding of SGD dynamics and groundwater sustainability in a significant coastal region. The primary objectives of the study are to: (1) quantify the fresh SGD entering the coastal zone, and (2) assess the transport of potential contaminants such as heavy metals, nutrients and others. To achieve these goals, a three-dimensional groundwater flow model was developed using the Groundwater Modeling System (GMS), employing MODFLOW to simulate saturated subsurface flow. The model integrates hydrogeologic and hydrologic data from 24 observation wells and 70 production wells, representing confined and unconfined aquifers. The model domain is discretized into 102,165 cells, each with a horizontal resolution of 170 × 170 meters. Vertically, it is divided into five layers: the first two layers are each approximately 30 meters thick, the third layer is 65 meters, the fourth layer is 125 meters, and the fifth and deepest layer is 250 meters. Recharge was estimated using regional climatological data, assuming 10-20 % of annual precipitation contributes to aquifer recharge. Detailed data on aquifer geometry, hydraulic conductivity, well pumping rates, and boundary conditions were incorporated to ensure a realistic simulation of groundwater dynamics, and the model was calibrated using historical groundwater level measurements. After dividing the seepage face into 19 subsections along the coast, our preliminary data show that SGD in the area varies between 2.0 and 2.2 cm/day. These findings will help to identify areas of high SGD fluxes and potential contaminant pathways and improve understanding of freshwater-saline water interactions.

Abstract #: 163

Title: **Woods, Water, and Wildlife: Education & Outreach Opportunities with The Jones Center at Ichauway**

Author(s): Rachel McGuire

Presenter: Rachel McGuire

Organization: The Jones Center at Ichauway

Session: Lightning Talk - Outreach & Extension

The Jones Center at Ichauway provides a unique combination of place, people, and processes to better understand, demonstrate, and promote effective management of natural resources through research, conservation, and education. We are a private, nonprofit organization situated on 29,000 acres that is dedicated to researching, managing, and instructing on the longleaf pine ecosystem and its associated wildlife and aquatic habitats. Our target audiences are University students (undergraduates and graduates) and natural resource professionals (researchers, practitioners, landowners, policy makers, and educators). We have co-advised nearly 180 graduate students with 20 partnering universities since 1993. Our Education and Outreach division has instructed and co-developed numerous University short courses on ecological problem solving, vector ecology, wetlands, prescribed fire, longleaf pine ecology, and more. In the summer of 2025, we reignited our historic Environmental Education Research Academy (EERA), an intensive professional development program for formal and informal educators that covers terrestrial and aquatic ecology with strong ties to Project WET, Project WILD, and Project Learning Tree. Although the 2025 EERA was intended for 7th-12th grade science teachers in SW Georgia, future offerings will expand in geographic range. In this session, we'll share more information about our recent and upcoming education and outreach opportunities for University students, researchers, and natural resources professionals.

Abstract #: 165

Title:

Alabama Envirothon: Engaging the Next Generation in Environmental Stewardship

Author(s): Courtney Curenton Baker

Presenter: Courtney Curenton Baker

Organization: Alabama Association of Conservation Districts

Session: Lightning Talk - Outreach & Extension

The Alabama Envirothon, coordinated by the Alabama Association of Conservation Districts in partnership with numerous organizations, offers a dynamic environmental and natural resource conservation experience for high school students. This program emphasizes problem-solving, teambuilding, and leadership through a combination of classroom instruction and hands-on, outdoor field activities.Students explore five core topics: aquatics, forestry, soils, wildlife, and a current environmental issue, which for the 2025 competition year is "Roots and Resiliency: Fostering Forest Stewardship in a Canopy of Change.”Over the course of a three-day event, student teams participate in:-Expert-led training sessions,-Written examinations, and-The development and presentation of a comprehensive plan to address a complex environmental problem.The winning team from the state competition earns the opportunity to represent Alabama at the NCF-Envirothon, an international-level competition.Since 2022, the Alabama Envirothon has significantly expanded and been able to offer many regional training opportunities to participants and more than tripled student engagement.This year, the Alabama Envirothon will establish training resource committees—dedicated groups of professionals in each of the core subject areas. These committees will support the program by:-Assisting with the development of training resources,-Contributing to the creation and review of testing materials,This presentation will:-Provide an update on the continued growth and future direction of the Alabama Envirothon,-Encourage water resource and other natural resource professionals to share expertise and materials that may be used in student training and development of the 2025 complex issue,-Offer information on how interested professionals can get involved with the program and its new training resource committees.

Abstract #: 166

Title: **GeoCoast Tools**

Author(s): John van der Zwaag, John Cartwright & Andrew Nagel

Presenter: John van der Zwaag

Organization: Mississippi State University

Session: GIS

The threat of flooding along the Gulf Coast from natural disasters is a constant concern for the millions of residents living in the coastal areas. Hurricanes, such as Hurricane Katrina and Hurricane Laura, have resulted in billions of dollars worth of damage while causing numerous fatalities. GeoCoast Tools is a suite of applications to educate users about the threat of flooding and to assist decision makers in evaluating the impact of inundation to critical infrastructure, transportation, and residents. The tools include GeoCoast3D, GeoPanorama, and GeoInundation. GeoCoast3D, a 3D mapping application, visualizes the effects of flooding on buildings, terrain, and roads. Several inundation models are provided including NOAA flood data and a hindcast surge model of 2005's Hurricane Katrina. Widgets such as routing and service area allow users to analyze the effects of inundation on critical infrastructure and transportation. GeoPanorama and GeoInundation compliment GeoCoast3D by highlighting specific locations along the Gulf Coast in realistic virtual reality and 3D environments. GeoPanorama combines 360° panoramic imagery with LiDAR to create an interactive, immersive visualization of flooding. GeoInundation provides a bird's-eye view of realistic 3D models generated from satellite and ground-based imagery and aerial LiDAR. Both GeoPanorama and GeoInundation can be accessed as standalone web-based applications to highlight specific areas of interest such as the Mississippi High Water Marks or the Weeks Bay National Estuarine Research Preserve. They can also be accessed as widgets within GeoCoast3D to provide additional visualizations of the impact of flooding.

Abstract #: 168

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

Author(s): Lee Ellenburg & Shaelyn Deal

Presenter: Lee Ellenburg

Organization: The University of Alabama in Huntsville

Session: Drought & Climate

The Southeast US (SE) is particularly vulnerable to flash droughts—rapidly developing, short-term droughts—due to consumptive vegetation and poor water retention in soils. These events can have significant impacts, especially on agriculture. This study evaluates flash droughts in the SE, focusing on their onset, duration, and impacts using metrics such as the Lawn and Garden Moisture Index (LGI), Evaporative Stress Index (ESI), and Soil Moisture Variability Index (SMVI), alongside the U.S. Drought Monitor (USDM). A key insight from this study is the importance of flash drought timing in relation to critical agricultural growth stages. Flash droughts that coincide with crucial growth phases can sharply reduce crop yields, as crops are particularly sensitive to moisture deficits during these periods. Here we identify not only the risk but also the vulnerability of crops to flash droughts, highlighting how the timing of these events can exacerbate agricultural impacts in the region. This assessment underscores the need to better understand how the timing of flash droughts influences agricultural outcomes across the region.

Abstract #: 169 **Student**

Title: **Urban Drainage Capacity Assessment under Compound Coastal Flooding in Mobile, Alabama**

Author(s): Michael Lewis, Hamed Moftakhari & Soheil Radfar

Presenter: Michael Lewis

Organization: The University of Alabama

Session: Lightning Talk - Research 2

Compound flooding (CF) occurs when multiple flood drivers driven by concurrent and mutually reinforcing factors, such as heavy rainfall, high tides, storm surges, and river discharge, lead to potentially more severe flooding than any single driver alone would cause. CF is characterized by multidimensionality, nonlinear interactions between flood hazard drivers, and potential non-stationarity in their characteristics. Our previous research in South Alabama identified these characteristics and demonstrated how sea-level rise (SLR) further amplifies these risks by increasing still water levels and exacerbating CF events.This study investigates the impacts of SLR on Mobile, Alabama's urban stormwater drainage system, using the Environmental Protection Agency's Storm Water Management Model (SWMM). We hypothesize that SLR exacerbates backwater effects (BWE), where elevated downstream water levels impede runoff drainage, intensifying upstream flooding. The ten most extreme precipitation events between January 2020–August 2024 are modeled in alignment with available validation data from the City of Mobile. Hurricane Zeta (October 2020) is then modeled with and without SLR, using boundary conditions. Model results indicate that the system is susceptible to CF and BWE, exacerbated by SLR. We complement the modeling with a statistical analysis that quantifies joint risks from extreme rainfall and coastal flooding under current and future sea levels. Findings from this integrated modeling and statistical analysis can inform flood resilience policies by pinpointing current and anticipated flooding hotspots due to backwater effects and highlighting critical gaps in existing flood management strategies.

Abstract #: 170 **Student**

Title: **A Novel Approach for Nitrate Removal and Recovery from Wastewater Using Pseudomonas Nitrate Binding Proteins**

Author(s): Daniel Servos, Nidhi Purav, Kaushik Venkiteshwaran & Sinéad Ní Chadhain

Presenter: Daniel Servos

Organization: University of South Alabama

Session: Lightning Talk - Research 1

Excess nitrate in wastewater effluent is a persistent problem for our waterways and aquatic ecosystems. This nitrate intensifies hypoxic deadzones and strengthens algal blooms. Many current methods, such as biological wastewater treatment systems, do an effective job at removing nitrate. However, these systems require a lot of space and do not allow for the recovery of nitrate. Other technologies, such as ion exchange systems, can remove nitrate and offer a way to recover it for reuse. However, these systems often struggle to fully remove nitrate, as they aren't specific enough or have high enough affinities to function at low concentrations of nitrate. Additionally, the process used to clean and reuse these ion exchange resins typically involve concentrated brine solutions, which end up mixing with the nitrate and make it harder to separate and recover. A promising new approach involves using proteins found in bacteria that naturally bind to specific compounds. These proteins, known as substrate-binding proteins, can offer high selectivity and affinity. This makes it easy to remove specific target compounds from water. Past research has shown success with phosphate-binding proteins, which were able to successfully absorb phosphate and could then be washed and reused several times without losing their effectiveness.

In this study, we explored NrtA, which is a substrate binding protein used by bacteria to take up nitrate. Previous research on NrtA from cyanobacteria showed that it binds to nitrate with a higher affinity compared to many commercial ion exchange resins. Additionally, it was shown to work when in the presence of common competitive anions, such as sulfates and chlorides which often interfere with these resins. For our research, we focused on NrtA proteins from Pseudomonas bacteria because these bacteria are known as textbook denitrifiers, which makes them a good source for finding these nitrate-binding proteins. The goal of this research was to find a new way to remove and recover nitrate even at low concentrations, as well as expand upon the previous work focused on using protein-based removal methods for dissolved contaminates.

Abstract #: 171

Title: **Understanding Basic Wastewater Math and Permit Parameters**

Author(s): Jason Barrett

Presenter: Jason Barrett

Organization: Mississippi Water Resources Research Institute

Session: Water Quality 2

The Environmental Protection Agency (EPA) and the Mississippi Department of Environmental Quality (MDEQ) work together to monitor compliance with the CleanWater Act and Mississippi Code, which regulate permitted wastewater systems. The goal of this presentation is to define the measured and treated parameters of a municipal wastewater system and explain why treatment and management are important. The Clean Water Act (CWA) of 1972 created a basic model for regulating discharges of pollutants into the waters of the United States, measuring the quality of surface water, and developing water quality standards. Through the National Pollutant Discharge Elimination System (NPDES) program, EPA regulates wastewater management through a series of parameters. These regulations are applicable to industrial facilities and municipalities that discharge from point sources to surface waters. When water is used by citizens in a typical residential setting, it becomes contaminated with pollutants and is commonly referred to as domestic wastewater. Pollutants in domestic wastewater must be removed to protect the environment and human health. Permitted wastewater systems must provide proper operation of wastewater treatment facilities to ensure the treatment and removal of pollutants. Budgeting and having a quality maintenance program are imperative for a facility's successful operation. To avoid costly equipment breakdowns, wastewater systems should establish an efficient preventive maintenance schedule. A quality operation and maintenance program for the wastewater system is able to identify breakdown issues before they occur, further equipment life, reduce the overall costs to citizens, and address the professional development of system managers and operators. There are additional factors that determine the effluent limitations and monitoring requirements for any permit, but the majority of NPDES permits contain similar parameters that must be met.

Abstract #: 173

Title: **Co-transport and Retention of Arsenic and Pine Wood Biochar in Saturated Porous Media: Fate and Interaction Mechanisms under Solution Chemistry and Practical Feasibility**

Author(s): Rakesh Kumar, Jasmeet Lamba, Sushil Adhikari, Nitesh Kasera & Allen Torbert

Presenter: Rakesh Kumar

Organization: Auburn University

Session: Water Quality 2

Geogenic arsenic (As) contamination in groundwater causes serious health and environmental concerns. Anthropogenic actions also contaminate natural ecosystems, including groundwater aquifer systems, with As severely impacting human health and ecosystems. Considering practical feasibility and sustainable water management, this research work aims to determine the adsorptive properties of pine wood raw biochar (PWBC) and engineered iron-modified biochar (Fe-PWBC) in As(V) removal. Co-transport and deposition of As(V) with PWBC and Fe-PWBC were investigated in saturated columns, and experimental data were modeled using HYDRUS-1D to determine effective As removal in the managed aquifer recharge technique. Sand-packed saturated columns lead to high As(V) deposition at an ionic strength (IS) of 0 mM, whereas an IS of 10 mM mobilizes As(V) at pH 6.7 ± 0.1. Considering co-transport, the adsorptive behavior of PWBC and Fe-PWBC were analyzed for 5–10 mg/L As(V) under varying pH (5.5 ± 0.1 to 10.5 ± 0.1), IS (0–10 mM), As(V) concentrations (5–10 mg/L), and biochar dosages (50–100 mg/L). Significantly, increased biochar deposition was observed with increased IS due to aggregation and ionic effects, and Fe-PWBC showed higher potential As(V) adsorption compared to PWBC. Understanding the fate and remediation of As in saturated porous media is crucial for developing effective remediation techniques. Overall, Fe-PWBC acts as a better carrier for As(V) in saturated porous media and facilitates adsorption onto its active sites than PWBC during co-transport and deposition governed by solution chemistry. Lastly, this work concludes with implications of biochar use in aquifer recharging and biochar-sand-packed fitting in hand pumps for groundwater recharge and safe drinking water supply.

Abstract #: 174 **Student**

Title: **Influence of Biochar Types on Poultry Litter Based Phosphorus and Nitrate Immobilization in Saturated Soils**

Author(s): Atiqur Rahman, Rakesh Kumar, Gurparshad Singh Brar, Jasmeet Lamba & Sushil Adhikari

Presenter: Atiqur Rahman

Organization: Auburn University

Session: Ag & Irrigation 1

Excessive nutrient loss from agricultural landscapes via surface runoff and leaching to waterbodies can result in eutrophication and contribute to water quality impairment. Therefore, innovative strategies need to be developed that can prevent the off-site transport of nutrients. This study aims to investigate the immobilization of nutrients leached from extracted poultry litter (PL) solution using biochar (carbon-rich material produced from the thermochemical conversion of feedstocks or waste biomass in the absence of oxygen) through saturated porous media. The specific objectives include: (1) to assess the dose-response relationship between the biochar doses and PL and the extent of nutrient immobilization, (2) to evaluate the influence of different biochar types on nutrient immobilization, and (3) to investigate the impact of different pH levels on nutrients immobilization and determine if certain pH levels enhance or inhibit the process. The treatments include (i) Raw biochar with different application rates (5% and 10% of total weight of the sand) + different pH (5, 7, and 10), (ii) Mg-modified biochar with different application rates (5% and 10% of total weight of the sand) + different pH (5, 7, and 10), (iii) Fe-modified biochar with different application rates (5% and 10% of total weight of the sand) + different pH (5, 7, and 10), and (iv) control. In this experiment, biochar and sand mixtures are being used as a saturated porous medium in a glass column, and extracted PL solution is transported from the bottom to the top of the column using a peristaltic pump. Analyzing different combinations of biochar dose, biochar type, and pH levels will help understand the interaction of nutrients with biochar in the soil and contribute to the sustainability of poultry and the agricultural industry.

Abstract #: 175

Title: **Assessing Irrigated Acreage Response to Drought Severity and Water Availability in Alabama**

Author(s): Tej Gautam & Osagie Idehen

Presenter: Tej Gautam

Organization: Tuskegee University

Session: Ag & Irrigation 2

Abstract:Irrigation water is a crucial input for achieving higher crop productivity. Over the years, corn, cotton, and soybean producers in most southeastern U.S. states have increasingly turned to irrigation to reduce the yield uncertainty caused by frequent droughts during the growing season. However, Alabama stands out with a surprisingly small fraction of irrigated farmland, despite having abundant water resources available for irrigation. This contrast highlights a unique challenge or opportunity in the state's agricultural practices compared to its regional counterparts. This study focuses on how producers in traditionally rain-fed agricultural systems in Alabama adopt irrigation in response to drought events. It also examines how small farm holders and socially disadvantaged producers respond to these challenges, exploring their adoption of irrigation as a coping strategy to mitigate the effects of drought and enhance resilience in agricultural production. For this study, we use county level Census of Agricultural data from 1978 to 2022 paired with weather data from NOAA and the U.S. Drought Monitor to estimate how drought severity and water availability affect the timing of irrigated acreage expansion. For empirical analysis, we apply a survival model to estimate how factors such as drought severity, farm size, and water availability influence the expansion of irrigation over time. The findings of this study will support policy-making efforts to enhance the climate resilience of agriculture by promoting irrigation expansion while ensuring the sustainable use of available water resources in the state of Alabama.

Abstract #: 176

Title: **The Waters We Share – Charting Coastal Alabama's Next Comprehensive Conservation Management Plan**

Author(s): Jason Kudulis

Presenter: Jason Kudulis

Organization: Mobile Bay National Estuary Program

Session: Extension, Outreach & Partnerships 2

Each National Estuary Program is charged with developing and implementing a Comprehensive Conservation and Management Plan (CCMP). The development of the Mobile Bay National Estuary Program's (MBNEP) third CCMP marks a milestone in the program's thirty-year history of continuing to support local priorities to ensure the quality and ecological integrity of Alabama's estuarine waters. This plan is the culmination of extensive input over the last year from the Management Conference—a diverse body of stakeholders including federal, state, and local agencies, industry and business, resource managers, academia, and community groups—ensuring that it reflects a broad range of perspectives and priorities. The Waters We Share: A CCMP for Alabama's Estuaries and Coast 2025-2035 will retain use of a watershed-based approach to guide coastal management and is structured around three pillars: Sediment, Waste, and Growth. Core to each pillar, four action areas remain: Ecosystem Status and Trends; Ecosystem Restoration and Protection, Technical Assistance and Capacity Development, and Education and Public Involvement. This presentation will highlight key elements of the 18-month development process, provide an overview of current issues and priorities, and share what the new CCMP action plans include.

Abstract #: 177

Title: **Power in Partnerships: Linking Research, Extension, and Communities to Support Well Water Users**

Author(s): Jessica Curl, Erin Ling, Joel Pigg & Jason Barrett

Presenter: Jessica Curl, Joel Pigg, Erin Ling, & Jason Barrett

Organization: Auburn University Water Resources Center

Session: Special Session 2 - Well Water Panel

Private wells are not federally regulated, leaving the estimated 45 million people who rely on these systems for household water vulnerable to health and nuisance contaminants including bacteria and lead. Several states have utilized the Cooperative Extension network to facilitate testing, education, and research programs to better understand water quality problems and possible solutions associated with private systems. This panel highlights how strategic partnerships across state lines, agencies, and disciplines can support well owners through collaborative outreach, resource sharing, and science-based programming. Panelists will share experiences from statewide well water initiatives that bring together Extension professionals, university researchers, public health officials, rural water associations, nonprofit organizations, groundwater conservation districts and state agencies, that demonstrate how partnerships strengthen and expand the reach of well water programming and leverage expertise across disciplines. Panelists will also explore how Extension systems and land-grant universities can serve as connectors, bridging research and outreach, and linking state agencies with local communities. Case studies will demonstrate how advertising private well programs in ways that resonate with different audiences (e.g., health-focused, agricultural, family-centered) can expand participation and engagement. By sharing practical examples, challenges, and lessons learned, this session aims to inspire new collaborations and offer a replicable model for other regions. This panel will offer ideas for building stronger networks that empower private well users and protect public health.

Abstract #: 178

Title: **Unraveling the Diet of the Dominant Shredding Caddisfly in Southeast Watersheds Using Shotgun Metagenomics: A Better Approach to Understanding Stream Food-web Dynamics**

Author(s): Kyle Breault, Michael McKain & Jonathan Benstead

Presenter: Kyle Breault

Organization: The University of Alabama

Session: Special Session 4 - CONSERVE 2

Aquatic biologists frequently assess macroinvertebrate diets to inform energetics, secondary production, and trophic ecology studies. Dietary information is typically obtained via stable-isotope analysis or by identifying gut-contents under a microscope. However, neither technique provides high-resolution data. The diets of shredding insects can rarely be resolved beyond vascular plant tissue, while the nutritionally important fungal component is often under-sampled or ignored. Using shotgun metagenomics to understand detritivore trophic ecology could provide a faster and more taxonomically robust way to evaluate detritus-based food webs. Shotgun sequencing allows researchers to sample the environment without prior knowledge about what is there, while detecting rare diet components. Pycnopsyche, a common genus of shredding caddisfly found in forest streams in the eastern U.S.A., relies on litter and associated fungi for its energetic requirements. We are collecting Pycnopsyche larvae from a developing cohort (second- to fifth-instar) in a single headwater stream at the Coweeta Hydrologic Laboratory, North Carolina, U.S.A. DNA from the caddisfly guts and stream leaf litter is being extracted and sent for whole-genome shotgun sequencing. We will compile chloroplast genomes from our litter species, along with fungal mitochondrial genomes from GenBank and fungal nuclear genomes from the JGI MycoCosm repository. Developing a database for our genomes and mapping our shotgun reads will identify the litter and fungi species—or at least genera—found in caddisfly guts and their relative abundance compared to samples taken from the surrounding environment. Our study tests the potential of shotgun metagenomics to inform stream trophic dynamics with far higher resolution than that possible using traditional techniques.

Abstract #: 179

Title: **Real-Time Microplastic Detection: Developing a Low-Cost, Portable Sensor for Water Monitoring in Coastal Alabama and Mississippi**

Author(s): Anthony Vedral, Mark Cheng, Shaowu Bao, Pu-Xian Gao, Adam Skarke, Ebenezer Nyadjro & Michael Fedoroff

Presenter: Anthony Vedral

Organization: The University of Alabama CONSERVE

Session: Special Session 3 - CONSERVE 1

Microplastics pose growing risks to aquatic ecosystems, human health, and industry, yet current detection methods remain labor-intensive and slow. This project, led by the University of Alabama, with support from the NOAA Marine Debris Program and the National Sea Grant Program, seeks to introduce a novel, low-cost, portable sensor designed to detect and characterize microplastics in real-time directly from water sources in Alabama. The prototype integrates filtration and separation technology, Raman spectroscopy for polymer identification, and machine learning-enabled imaging for physical characterization and concentration analysis. By drastically reducing analysis time and increasing field accessibility, this sensor offers transformative potential for research, monitoring, and small-scale remediation. A collaborative Research-to-Application Team—comprising academic institutions, Sea Grant programs, industry partners, municipalities, and outreach groups—guides development to ensure practical use-case alignment.

Abstract #: 180

Title: **Explainable Video Vision Transformer for Tackling Accuracy and Sparsity in Remotely Sensed Precipitation Observations**

Author(s): Fang Wang & Di Tian

Presenter: Fang Wang

Organization: Auburn University

Session: Professional Poster

High-resolution, long-term gridded precipitation datasets are essential for climate monitoring, disaster response, and environmental modeling. However, existing datasets often suffer from inconsistencies and biases, especially in regions with sparse in situ observations. Here we introduce TransPrecip, a novel deep learning model framework based on a video vision transformer architecture that generates 4-km, hourly precipitation estimates by learning from sequences of spatial inputs from multiple sources. Leveraging self-attention mechanisms, TransPrecip captures contextual and long-range dependencies to produce accurate, spatially continuous precipitation fields. A sliding time window approach is used to construct spatial-patch input and single-point output pairs, with gauge observations serving as targets for model training, validation, and testing. Input data include: Stage IV radar precipitation estimates, digital elevation data, CPC merged infrared brightness temperature, the satellite-based IMERG V07 precipitation product, and meteorological variables from the reanalysis-based CONUS404 dataset. To enhance transparency, we apply SHapley Additive exPlanations (SHAP) to quantify each variable's contribution to the model's precipitation estimations. Model performance is assessed over the Appalachian Mountains, with a focus on both general accuracy and extreme event representation. Results show that TransPrecip substantially improves hourly precipitation accuracy compared to the current Stage IV radar precipitation product. Via transfer learning, the model generalizes well to other mountainous regions across the contiguous United States. By analyzing estimation-observation mismatches and incorporating auxiliary information, TransPrecip effectively corrects biases in radar and satellite precipitation products, even in areas with sparse in situ observations. This work presents a scalable approach for producing globally consistent, high-resolution, hourly precipitation estimates, opening new opportunities for long-term precipitation monitoring and supporting more accurate climate-related monitoring, modeling, and decision-making.

Abstract #: 181

Title: **Perfluorooctane Sulfonic Acid (PFOS) Removal by Delaminated Titanium Carbide MXene: Impact of MXene Surface Chemistry on Adsorption Mechanisms and Removal Efficiency**

Author(s): Milad Esfahani

Presenter: Milad Esfahani

Organization: The University of Alabama

Session: Professional Poster

Titanium carbide (MXene) is characterized by its unique surface chemistry, featuring various functional groups such as =O, -OH, and -F. These groups make MXene a tunable material capable of interacting with a wide range of compounds, including hazardous substances such as per- and polyfluoroalkyl substances (PFAS). The selective removal of PFAS from aqueous media remains challenging due to their low concentrations (~50 ppb) and limited reactivity with most current adsorbents. Modifying the surface chemistry of MXene holds excellent potential for improving the adsorption of PFAS. However, the precise relationship between MXene surface chemistry and PFAS adsorption remains largely unexplored. Furthermore, the tunable surface of MXene provides a platform to investigate the impact of emerging fluorophilic interactions in addition to the well-studied hydrophobic interactions. In this work, two distinct MXene variants were synthesized to assess their effectiveness in removing perfluorooctane sulfonic acid (PFOS) from water. The first variant, referred to F-MXene, was synthesized using hydrofluoric acid (HF) and predominantly featured a surface terminated with high fluorine content. The second variant, OMXene, was synthesized through a mild delamination method and had a higher oxygen-to-fluorine ratio. The adsorption performance of these two MXenes was evaluated under varying pH levels (4.5 and 10), PFAS concentrations (50 ppb and 2 ppm), and contact times (1h, 3h, 5h, and 24 h). The results showed that at an initial PFOS concentration of 50 ppb, F-MXene and O-MXene achieved almost similar adsorption efficiencies of 92.6 ± 7.9% and 88.5 ± 5.6%, respectively. However, at a higher PFOS concentration of 2 ppm, F-MXene outperformed O-MXene, achieving an adsorption efficiency of 69.8 ± 15%, while O-MXene showed a much lower efficiency of 27.6 ± 15%. This result indicates the contribution of fluorine–fluorine interactions to PFOS adsorption, particularly at higher PFOS concentrations, where the number of available adsorption sites on MXene becomes limited. Similarly, kinetic studies further demonstrated the superior performance of F-MXene, which reached adsorption equilibrium within 5 hours, significantly faster than O-MXene, which required 24 hours.

Abstract #: 183

Title: **It's All About the Roots**

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Vegetative cover is the main preventive tool for erosion control. Vegetative cover intercepts the powerful effect that a raindrop has when striking the ground surface. Raindrops that strike a bare ground surface dislodges soil particles and starts the erosion process with what is referred to as Splash Erosion. However, we sometime overlook the role roots of the plant play in vegetative establishment, maintenance, and long-term sustainability. The soil in which the plant is to grow and thrive must be understood. A good soil test, proper pH of the soil, elimination of compaction in the root zone, and proper introduction of soil additives are some of the items that must be considered. Roots of the plant and the above ground vegetation must be in equilibrium as one detrimental to the other causes the plant to decline. Any deficiencies found in the soil and root medium must be dealt with prior to vegetative establishment. The type of vegetation must be properly selected for the location, and the seed or plant must be introduced at the proper time of the year. However, even with the best vegetative measures, problem areas can still occur. These problem areas must be understood and corrective actions taken to ensure a complete stand of vegetation. And finally, proper maintenance of vegetation must occur to ensure long-term vegetation sustainability. Improper maintenance can lead to decline of the vegetation and bare soil (splash erosion). Fertilization, mowing frequency and mowing height play significant roles in vegetation management. Native vegetation is now being preferred in many situations and requires special care.