

Abstract #: 001

Title: Quick Fire - Over 50 Erosion and Sediment Control Tips

Presenter: Perry Oakes

Organization: Alabama Soil and Water Conservation Committee

Session: Stormwater 1

Since becoming Alabama's Erosion and Sediment Control Program Coordinator for Alabama's Soil and Water Conservation Committee, Perry produces regular erosion and sediment control tips through an email blast. The tips are also contained on the Committee's Blog site, placed on several soil and water conservation districts Facebook pages, and copied onto LinkedIn by the Auburn University Stormwater Research Facility. Perry has received positive reaction to the tips and plans to continue the effort. Participants will be able to understand easy tips for the installation and maintenance of BMPs, how to find the old tips and connect with Perry for future Tips.

Abstract #: 002

Title: The Status of Wastewater Affordability for Households Connected to Sewer Systems and Households with Onsite Wastewater Treatment Systems in Alabama

Presenter: Jillian Maxcy Brown

Organization: The University of Alabama

Session: Wastewater Systems

Wastewater affordability has become a pressing concern in the U.S. as the cost of collecting and treating wastewater continues to rise rapidly and reports have revealed that millions of residents are currently experiencing a lack of access to proper wastewater management. The U.S. Environmental Protection Agency (EPA) has established household affordability metrics based on median household income (MHI) with 2.5% for the upper bound of water affordability for the national MHI and 2.0% of MHI for affordable combined sewer overflow controls. This study uses the water affordability threshold to give a conservative estimate of wastewater affordability in Alabama to reflect that combined sewers are not common in Alabama and many public utilities base their sewer rates on water consumption. Affordability discussions have typically focused on monthly billing, an approach that does not incorporate the 25% of households in the U.S. that are not connected to networked sewer systems. Such decentralized users are responsible for managing their wastewater with onsite wastewater treatment systems, including both the ongoing costs for maintaining the system as well as the associated capital cost of the system, the latter of which is typically “hidden” in mortgage or rent payments. While previous affordability studies have focused on capturing wastewater affordability at the national scale or through the use of indirect data and exclusion of households not connected to networked systems, to the best of our knowledge, this study will be the first to develop state-level wastewater affordability maps that account for both networked and onsite wastewater systems. This study develops wastewater affordability maps for Alabama based on EPA’s guidelines using data from the Alabama Department of Environmental Management (ADEM), local utilities, the Alabama Department of Public Health (ADPH), and the U.S. Census Bureau. This study also looks beyond the EPA’s use of MHI (50% of households have a lower income) and proposes the first robust alternative wastewater affordability metrics that account for income inequality.

Abstract #: 003

Title: Identification of Fecal Contamination in the Grand Bay National Estuarine Research Reserve

Presenter: Amanda Free

Organization: Mississippi State University Coastal Research and Extension Center

Session: Water Monitoring

The Grand Bay National Estuarine Research Reserve (GNDNERR) has chronically elevated fecal coliform counts; however, the source of the contamination is unknown. Due to the poor understanding of the local fecal pollution sources, this area has not been opened to shellfish harvesting since 2007. According to past sanitary surveys, there has been a history of malfunctioning residential septic systems and inadequate wastewater treatment in the upper watershed. Feral hogs and birds are also abundant in the estuary and could be a potential contributor to elevated fecal coliform levels in this area. The GNDNERR is located on the northern Gulf of Mexico coastline which is known to receive some of the highest annual precipitation totals in the United States. The intense rainfall can lead to a large fecal load from upland sources into the estuary. To better understand the temporal and spatial variation of fecal coliforms in the GNDNERR and inform oyster reef management, monthly sampling will take place over the course of a year at six sites within the main watershed of the GNDNERR and two sites upstream in the bayous. Having the two sites upstream will allow for a better understanding of how rainfall affects fecal contamination throughout the estuary. Quantitative polymerase chain reaction (qPCR) will be used for microbial source tracking to identify levels of potential fecal sources from humans, feral hogs, and birds within the estuary as well as the concentrations of enterococcus, a fecal indicator bacteria.

Abstract #: 004

Student

Title: Using Social Science to Manage Human-Wildlife Conflict of Bottlenose Dolphins in the Gulf of Mexico

Presenter: Hannah Henry

Organization: Auburn University

Session: Coastal Issues 1

Bottlenose dolphins are among the most widely recognized and charismatic flagship species for marine mammals and ocean conservation, particularly in the Gulf of Mexico, often reflecting the health of coastal ecosystems and other species. Cetacean-based tourism is also an exponentially growing industry worldwide, generating US \$2.1 billion in 119 countries and employing over 16,500 people according to the most recent published estimate. It is the greatest economic activity on the globe that is solely reliant on cetaceans. However, bottlenose dolphins and other cetaceans continually face wide and diverse threats to their survival, especially through increased human-wildlife conflict as coastal populations continue to grow. Due to regional norms and a hypothesized lack of knowledge or understanding of wildlife laws and regulations, the pursuit of dolphins using watercraft and illegal feeding are rooted in coastal communities and are highly prevalent in states surrounding the Gulf of Mexico. These activities are in violation of the Marine Mammal Protection Act, where harassment is defined as any act of pursuit with the potential to disturb a marine mammal in the wild by disrupting behavioral patterns. The focus of this research is to assess the public's perceptions, knowledge of wildlife laws and regulations, and willingness to change behavior for coastal wildlife conservation. Bottlenose dolphin conservation requires lessening cases of harassment and supporting sustainable tourism operations. To better understand stakeholder perceptions, we are deploying a large-scale survey to key wildlife stakeholders to characterize different perceptions of coastal tourists and wildlife tour operators. These surveys document the awareness that coastal tourists and wildlife tour operators have toward the behavior and ecology of bottlenose dolphins, as well as associated wildlife laws, regulations, and threats. Preliminary results show that social science can reduce human-wildlife conflict through education programs on voluntary behavior changes, primarily through better-informed education efforts by state and federal fish and wildlife agencies. This research will be the first of its kind, determining where coastal tourists and wildlife tour operators get their information, and how willing they are to alter behaviors that may lead to protecting dolphins for the next generation. As cetacean-based tourism activities continue to grow in scale and popularity worldwide, it is critical that the development and execution of these operations follow policies set by regulatory bodies to support the sustainable use of shared ocean resources, including our wildlife.

Abstract #: 005

Title: Match Made in "Heaven": Auburn University and Alabama Water Watch

Presenter: Michael Freeman

Organization: Auburn University Risk Management and Safety

Session: Water Monitoring

This presentation will highlight the contractual partnership between Auburn University Risk Management and Safety and Alabama Water Watch in helping Auburn University manage water quality within the Parkerson Mill Creek watershed; a 303D listed watershed for pathogens. The presentation will also present insight on how that partnership helps to influence positive outcomes within the watershed to include: stormwater management, water quality and data collection, infrastructure improvements, illicit discharge detection and the everchanging streambed conditions. It will also present how this interaction can be useful for other MS4's in maintaining their permit responsibilities. In closing, this presentation will highlight Auburn Universities work as an MS4 and showcase some future work being done to improve water quality along the Parkerson Mill Creek Watershed.

Abstract #: 006

Title: Alabama Coastal Comprehensive Plan Website Presentation

Presenter: Ashley Forwood

Organization: U.S. Army Corps of Engineers

Session: Coastal Issues 2

The Alabama Coastal Comprehensive Plan (ACCP) is a proactive and stakeholder-driven planning tool commissioned by the State of Alabama's Department of Conservation and Natural Resources and developed by the Mobile District U.S. Army Corps of Engineers. The ACCP planning process was designed to facilitate a greater understanding of the dynamic social, environmental, and economic landscapes that comprise the Coastal Alabama community. The State and its partners are working with stakeholders to determine where opportunities exist to make impactful improvements across multiple community sectors in support of our Coastal Alabama values. Objectives include developing a high-level planning tool for the State of Alabama that: Identifies the public's social, economic, and environmental visions for Mobile and Baldwin Counties. Highlights existing plans and strategies that support those visions and promote resilience across the coastal communities.

Identifies areas vulnerable to sea level change and coastal storms and characterizes the resilience of the area (i.e., the ability to prepare and plan for, absorb, recover from, and successfully adapt to adverse events). Identifies opportunities to further develop the resilience of the region.

Abstract #: 007

Title: Evaluating the efficacy of recycled glass sand as a soil substrate for Gulf Coast marsh plants in restoration projects

Presenter: Ansley Levine

Organization: Mississippi State University

Session: Lightning Talk - Research

Natural and anthropogenic factors are driving shoreline changes along the Gulf Coast, threatening coastal habitats and populations that rely upon them. To mitigate these impacts, a wide range of coastal restoration projects have been implemented, with many of them including sand and soil fill to help combat sea level rise and serve as structural habitat for replenishing plant and wildlife. However, sand and soil fill is becoming increasingly expensive and difficult to source and transport. A proposed method to help increase the accessibility and cost-effectiveness of sand and soil fill is by using recycled glass that is crushed into sand-sized particles as a source material. This solution can simultaneously eliminate landfill waste and provide locally-sourced fill material for coastal restoration projects. However, ecological testing is still needed to confirm the efficacy of using recycled glass sand instead of traditional fill material. Therefore, I am conducting a mesocosm experiment to evaluate the ability of black needlerush (*Juncus roemerianus*), a dominant marsh plant along the northeastern Gulf Coast, and saltmeadow hay (*Spartina patens*), a common upland marsh plant, to grow in recycled glass sand. I will compare various metrics of growth such as plant height, biomass, colonization, and rooting depth among different sediment treatments (glass, mixture, natural) to assess the tradeoffs of glass sand use in marsh restoration. Completion of this research could help inform the design of future coastal restoration projects and support more cost-effective and sustainable restoration efforts along the northern Gulf of Mexico.

Abstract #: 008

Student

Title: Angler Conflict with Coastal Wildlife on the Alabama Coast: Protecting Sea Turtles with Greater Awareness

Presenter: TiAnna Olivas

Organization: Auburn University College of Forestry, Wildlife, and Environment

Session: Coastal Issues 1

The Gulf of Mexico beaches supports three sea turtle species throughout various life stages: the loggerhead, Kemp's ridley, and the green sea turtle. Alabama beaches serve as one of the key nesting habitats for these species. Sea turtles play vital roles in the coastal ecosystem's health, such as helping keep seagrass beds healthy and being a key component of coastal and marine food webs. Of the seven sea turtle species, six are listed in the Endangered Species Act. Some of the threats that sea turtles face includes coastal development, pollution, bycatch (unintentional catch), and human-wildlife conflict. For this research, we are partnering with the Alabama Department of Conservation and Natural Resources (ADCNR) to better understand the human-wildlife conflict between sea turtles and recreational fishermen, commercial fishermen, and charter/head boatmen. The scope of this project encompasses the cities surrounding Mobile Bay, ones with high tourist traffic and fishing-based communities. Surveys and interviews will be used to assess the different perceptions these stakeholders have toward sea turtles while documenting their local knowledge of different wildlife laws and their willingness to change their behavior. Flyers advertising the coastal tourist survey and the commercial fishery survey will be distributed to local businesses and various access points to the coast such as piers and fishing docks. Paper surveys will also be available to participants. Currently, data is being collected from both surveys. Next steps include planning additional fieldwork in new areas surrounding Mobile Bay, conducting interviews with commercial fishermen, charter boat, and head boat employees, and statistical data analysis. The end goal is to provide information to ADCNR that will help with designing educational materials intended to reduce human activities and habits that harm sea turtles along Alabama's beaches and waters.

Abstract #: 009

Student

Title: Wetland Accretion Rate Model of Ecosystem Resilience (WARMER) and Its Application to Coastal Transportation Infrastructure

Presenter: John Anderson Jr

Organization: Auburn University

Session: Lightning Talk - Research

Alabama State Route 180 located in Gulf Shores is a vital coastal roadway impacted by severe storms, high groundwater tables and future sea level rise (SLR). The area surrounding AL-180 supports a wide variety of ecological habitats for natural and nature-based features (NNBF). This project focuses on the effects of SLR on surface transportation infrastructure and the ability of NNBF to mitigate those effects. NNBF, such as living shorelines, combine ecological with conventional designs and can be expected to change substantially over their lifespan through natural processes. NNBF are also responsive to hydrologic conditions such as inundation, groundwater fluctuations, and wave action. To inform modeling of NNBF scenarios, we applied the Wetland Accretion Rate Model of Ecosystem Resilience (WARMER) to vegetated areas of proposed NNBF designs. WARMER predicts changes in marsh surface elevation relative to mean sea level using a 1-D model to capture the critical marsh accretion processes. We parameterized WARMER using marsh sediment core data collected by previous studies in Bon Secour Bay paired with NOAA predictions for SLR in the northern Gulf Coast region. Based on *Juncus roemerianus* decomposition rate of $-0.254/\text{yr}$, total volume per unit area of matter accumulated in the 1st, 2nd, and 3rd+ years is $1.026\text{cm}/\text{yr}$, $1.059\text{cm}/\text{yr}$, and $1.112\text{cm}/\text{yr}$ respectfully. Under the low and intermediate-low SLR scenarios, the accretion processes will continue to outpace SLR over the next 150 years. Marsh surface elevation begins to decrease under intermediate or intermediate-high scenarios, predicting complete inundation after 141 years using the high scenario. Future work on this project will apply new simulations of coastal hydrologic dynamics under a changing climate as model inputs, allowing us to understand how the function of NNBF will evolve as part of a dynamic system.

Abstract #: 010

Student

Title: Effect of Pipe Replacement on Environmental Impacts of Water Distribution Systems

Presenter: Jonathan Clayton

Organization: The University of Alabama

Session: Infrastructure

Pipe replacement and maintenance is a critical operational decision that water distribution systems (WDSs) must make to manage costs, revenues, and water loss. WDSs often delay pipe replacement due to high immediate costs (e.g., the Great Replacement in U.S. WDSs) but overlook resulting long-term environmental consequences. This study is first to examine a real-world WDS in Alabama, USA, using a novel workflow integrating GIS mapping, hydraulic modeling, breakage prediction, and life cycle analysis (LCA) to evaluate environmental impacts and water loss of five replacement schedules (25-, 50-, 75-, 100-, and 150-year intervals). The results indicated 150-year replacement yielded the least impacts for all categories, with global warming impacts less than half those of 25-year replacement, despite tripling water loss. The results were robust to uncertainties in many parameters such as pipe size, transport, and demand. Using the statistical leak model reported by the Gatineau, Québec WDS reversed the results, with 25-year replacement having the least impact and results being highly sensitive to the parameters. Overall, the findings assert the importance of considering the tradeoff between environmental impacts and water loss when designing pipe replacement frequency for WDSs. The workflow developed is transferrable to other WDSs to quantify realistic, WDS-specific impacts.

Abstract #: 011

Title: The First Shall Be Last: Native American Water Rights and Future Water Policy

Presenter: Bennett Bearden

Organization: Geological Survey of Alabama

Session: Water Law & Policy

Comprehensive state water management plans and policies should account for the use and protection from natural and anthropogenic stresses for all waters of the state, both now and in the future. But how can the state accomplish this task if it does not control the water? This question is pertinent when considering federally controlled surface water and groundwater on federally recognized Native American reservations.

In *Winters v. U.S.*, the Supreme Court of the United States (SCOTUS) declared that water was included as part of the land within Native American reservations. The “Winters doctrine” is now applied to tribes across the arid Western states. When the federal government reserves land for federal use, it impliedly reserves a quantity and quality of water sufficient to fulfill the purposes of the reservation. The doctrine is often referred to as one of necessity, based on two key factors: (1) the hydrology and climate of a reservation, and (2) the water law of the state where the reservation is located. In the West, these two factors create a presumption of necessity. Winters rights have several distinctive characteristics. First, the rights are considered as having been established as of the date the federal government created the reservation involved. This means that tribal rights are nearly always senior to rights of other current users of water according to the principle of Western “prior appropriation.” Second, although the scope of these rights is sometimes quantified as the amount of water necessary to support the “practically irrigable acreage” (PIA) on a reservation, the rights, once quantified, can be used for non-agricultural purposes. Third, the rights involve the future needs of a reservation, not just its present needs. Fourth, the rights cannot be forfeited by non-use, unlike the appropriative rights held under Western state law. Over a century after *Winters*, the Ninth Circuit Court of Appeals decision in *Agua Caliente Band of Cahuilla Indians v. Coachella Valley Water District* marked the first time a federal appellate court extended the Winters doctrine to include groundwater. But what about the riparian East? No court has recognized Winters rights for any Eastern reservation, although tribes have attempted to assert those rights in two cases, *Seminole Tribe of Indians v. Florida* and *Mattaponi Indian Tribe v. Commonwealth*, both ending in settlement agreements. Indeed, in the East abundant water resources give rise to a presumption against necessity, but future population growth, development, climate change, and inherent uncertainty portend a future where tribes may satisfy the Winters necessity requirement. Native American tribal reserved rights to water are as viable in the East as in the West and should be addressed in future Eastern U.S. water policy.

Abstract #: 012

Title: ARSNiC: An Update on Prioritizing Aquatic Organism Passage and Infrastructure in Alabama

Presenter: Daniel West

Organization: Geological Survey of Alabama

Session: ARSNiC

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

Abstract #: 013

Student

Title: Assessing Tidal Extant of the Mobile-Tensaw-Apalachee River Delta's Forested Wetlands Through Vegetative Indicators

Presenter: Andrew Balder

Organization: Auburn University College of Forestry, Wildlife and Environment

Session: Poster Session

Tidal Freshwater Forested Wetlands (TFFWs) are understudied yet ecologically significant ecosystems that provide flood buffering/stormwater protection, filtering, and removing/recycling pollutants. TFFWs are coastal forested wetlands at the interface between terrestrial and marine systems characterized by low salinities of ~0.5 parts per thousand (ppt) and distinct regionalized halophytic vegetation along the tidal gradient. However, due to their proximity to marine waters, these systems are at risk of degradation from climate change-induced sea level rise. This study will target efforts on shrub and canopy-level communities' response to tidal influence throughout the TFFWs of the Mobile-Tensaw-Apalachee (MTA) River Delta, Alabama's largest continuous wetland. Water stations composed of in-situ pressure loggers (n=9) have been placed along the tidal gradient, on each river to eliminate any bias, beside riverine inlets to quantify the tidal extent. Where each station is consistently measuring water level, temperature, and salinity concentration. In addition to the water instruments, circular 400 m² forest surveys (n=47) will be conducted along the study reaches, examining vegetation assemblage across the stratification. A sub-series of sites (n=27) will be placed perpendicular to the water stations to directly examine the relationship between the water pressure loggers and the vegetation assemblage, then additional; sites (n=20) will be established to fully represent the entirety of the MTA River Delta, varying in degrees of placement upstream/downstream, inland/adjacent to the rivers, microtopography, and non-tidal. After completing the vegetation surveys, the species assemblages will form distinct tidal communities across the hydrologic regime, enabling indicator species to be calculated through multi-variate statistical analysis. The preliminary hypothesis is that the absence of the *Sabal minor* (dwarf palm) in the shrub level will indicate lowered tidal influence. This work will ultimately aid in determining the MTA River Delta's TFFWs resiliency in response to regional sea level rise.

Abstract #: 015

Title: Effects of impoundments on selected flood-frequency and daily mean streamflow characteristics in Georgia, South Carolina, and North Carolina

Presenter: Toby Feaster

Organization: U.S. Geological Survey

Session: Water Quantity

The U.S. Geological Survey (USGS) has a long history of working cooperatively with the Georgia, South Carolina, and North Carolina Departments of Transportation developing methods for estimating the magnitude and frequency of floods for rural and urban basins that have minimal to no regulation or tidal influence. The USGS is currently working with the DOTs in GA, SC, and NC to update flood-frequency statistics for rural streams at gaged and ungaged locations. As part of that study, flood-frequency statistics were computed at 72 regulated streamgages across the three States. In a companion study with the SCDOT, the USGS is assessing the effects of impoundments on flood-frequency characteristics by comparing annual exceedance probability (AEP) streamflows from pre- and post-regulated (before and after impoundment) periods at 18 USGS long-term streamgages (30 or more years of record). For an assessment of how differences in such statistics can be influenced by period of record and hydrologic conditions captured in those records, which could be considered as natural variability, AEP streamflows at an additional 18 long-term USGS streamgages that represent unregulated conditions in those three states were computed and compared for the first and last half of those records. A subset of the 72 regulated streamgages that are located predominately above the Fall Line, also have been used to develop regional regression equations that can be used to estimate flood-frequency statistics at ungaged regulated locations in GA, SC, and NC. This presentation will provide an overview of the results of this cooperative investigation.

Abstract #: 016

Title: NEON in Alabama: Aquatic Data and Resources to Understand Changing Ecosystems

Presenter: Matt Koerner

Organization: National Ecological Observatory Network (Battelle)

Session: Poster Session

The National Ecological Observatory Network (NEON) is a continental-scale observation facility that collects long-term, open access ecological data to better understand how ecosystems are changing across the United States. NEON will provide 30 years of data from 81 terrestrial and aquatic field sites, including 24 wadeable streams, seven lakes, and three non-wadeable rivers. NEON data cover a range of subject areas within ecology, including organismal observations, biogeochemistry, hyperspectral imagery, and micrometeorology. NEON's freshwater data assesses chemical, biological, and morphological conditions of streams and lakes, such as surface and groundwater quality, population dynamics, and hydrologic processes. 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 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. NEON has six field sites in Alabama, three terrestrial and three aquatic. These field sites are essential to continuing the most extensive ecological data collection and monitoring program in the United States. A vast array of scientists from various disciplines within ecology have conducted research using NEON data and samples from NEON field sites in Alabama. Many of these studies use NEON data to investigate questions that contribute to our understanding of how climate change is altering aquatic ecosystems in the United States. This poster will provide an introduction to NEON as well as the resources available for accessing and working with NEON data for your research, curriculum, or land management. It will also showcase published research studies that use NEON aquatic data and samples from Alabama field sites to demonstrate how NEON science can be an integral co-benefit of protecting and preserving Alabaman aquatic wildlife and natural communities. Lastly, it will highlight NEON's Assignable Assets program, which makes available components of NEON's infrastructure to outside researchers and community members to support their research or other activities.

Abstract #: 017

Title: ASSESSMENT OF IMPROVED HOST MODEL FOR ANALYSIS OF HYDROLOGIC DROUGHT

Presenter: Krzysztof Raczynski

Organization: Mississippi State University

Session: Drought & Climate 1

Drought is an extreme hydrologic phenomenon that is difficult to predict due to its anomalous occurrence and wide range of drivers. However, since it is a prolonged process, it can be estimated based on its temporal aspect. While meteorological conditions such as precipitation or evaporation rate may affect the intensity of droughts, they are generally considered short-term or seasonal factors. On the other hand, long-term patterns in water circulation and underground runoff affect the overall availability of water in a region and its susceptibility to dry conditions. This two-stage process has formed the foundation for developing the Harmonic Oscillator Seasonal-Trend (HOST) model framework. Initially, the HOST model showed good fit to data over the Southeastern US (SEUS), with an average accuracy of drought occurrence prediction around 70% (60% for validation set); however, the initial version of the model had three limitations: (1) the inability to consider drought magnitude distribution, (2) the inability to reflect varying temporal periods between droughts, and (3) the inability to predict changes in drought intensity beyond simple linear estimation. This work presents an improved version of the HOST model that addresses these issues and discusses its performance. The study utilized data from the National Water Model (NWM) retrospective dataset v.2.1 for the period of Feb. 1979–Dec. 2020, with 80% of the data used for training purposes and 20% for validation. The study area consists of NWM nodes within the Mobile River basin (SEUS). Droughts are identified using an objective threshold and aggregated on monthly scales. The temporal changes are evaluated by a set of superimposed harmonic functions with a subset of modified functions with changing parameters, calculated from decomposed time series representing drought parameters: occurrence, magnitude, and minimal flows. The final model is a product of waveform synthesis for submodels built for short- and long-term patterns. The initial results show improvement in the model performance relative to earlier versions, with a Kling-Gupta efficiency (kge) of around 0.75 for the long-term component and 0.5 for short-term changes (all parameters). Approximately 75% of minimal flow models showed improved results (kge > -0.41) for the validation dataset, with 81% of nodes having an accuracy higher than 50% for the occurrence model. In general, occurrence models showed a better fit to the data than magnitude-based models. Spatially, the results show a similar pattern relative to previous versions of the model, with reoccurrence periods shortening in the northern parts of the catchment and prolonging in the south. On average, long-term models reach a period of 20 years in the south and around 5–10 years in the north, while short-term models indicate about 1–5 year changes. □

Abstract #: 018

Student

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

Presenter: Corinne Baroni

Organization: The University of Alabama

Session: Water Quality 3

In the AL Black Belt, widespread rural poverty, limited sewer access and shrink-swell clay soils lead to failing septic systems and discharge of raw sewage from homes through “straight pipes.” Sewage pools until it flushes with sediment into local waterways. Roughly 60% of fecal microbes in surface water following storms attach to suspended sediment. An accurate and efficient method to capture and monitor suspended sediment and determine the microbial association is critical to understand the impact precipitation has on sustained fate and transport of fecal pathogens within waterways. Most surface water sampling for fecal contamination involves grab sampling. While technically simple, this does not adequately capture highly variable microbial surface water quality so it cannot fully evaluate potential human health risk from enteric waterborne pathogens. Incorporating time-integrated sampling methods used in sedimentology into pathogen capture results in more representative, significantly higher numbers of fecal microbes than grab samples. The novel time-integrated methodologies for capturing suspended sediment and associated microbial load have been applied to three sites along Big Prairie Creek in Newbern, AL since 2021. Time-integrated mass sediment (TIMS) samplers, which are easy-to-install PVC devices, were placed at locations upstream, adjacent and downstream of known straight piping. Sediment was analyzed for particle size distribution and organic content (loss-on-ignition). Fecal indicator bacteria attachment to sediment was evaluated using vortex and centrifugation-based methodology. *E. coli*, thermotolerant coliforms and total coliforms were analyzed using the IDEXX Colilert media and Quanti-Tray 2000 system. Results show increased proportionate fine particle load following precipitation due to fine vertisol-clay soils runoff. Both the concentration of fecal indicator bacteria and the proportion of sediment-associated *E. coli* and coliform bacteria increased following rain events as bacteria partitioned to increased cumulative surface area. Most regulatory surface water sampling in AL and other states does not require continual monitoring and is often measured during low precipitation periods. More robust data from the TIMS sampler enables deeper understanding of surface water conditions and therefore better management. TIMS are low cost alternatives to conventional time-integrated methods, reflecting our efforts to enable affordable time-integrated approaches to quantify pathogens in rural streams, differentiate sediment-associated fecal microbes, assess the potential of in-situ natural and engineered surfaces to capture significant portions of pathogens that current conventional approaches lack and provide water managers with improved methods to evaluate the safety drinking and recreational water sources. A new clustered decentralized wastewater system is being installed in Newbern; the TIMS will monitor its surface water quality impact.

Abstract #: 019

Title: Long term outdoor algal production on undiluted anaerobic digestate in the southeastern US

Presenter: Qichen Wang

Organization: Auburn University

Session: Wastewater Systems

Integrating primary production processes into pre-existing waste treatment systems has the potential to serve as a cost-effective solution for managing excess nutrient runoff originating from point pollution sources, including farms, food manufacturers, and wastewater treatment plants. Conventional wastewater treatment processes such as activated sludge, anaerobic digestion, and UV treatment have a major focus on suspended and soluble organics reduction, and pathogen removal, but those processes have limited power on controlling nutrient discharge. Microalgae, as primary producers, can potentially assimilate nutrient pollutants to produce value added biomasses (such as protein, lipids, and carbohydrates). In past studies, we have successfully developed a biological pretreatment process which ensured a fast microalgal production in high strength anaerobic digestates without dilution water at lab scale. The major objective of this study was to test the long-term stability in an outdoor (Auburn, AL) system which produces algal biomass using a municipal anaerobic digestion effluent. The algal consortium was able to grow successfully in biologically pretreated digestate during fall, winter, spring and summer, achieving average growth rates of 30, 23, 42, and 66 mg L⁻¹ d⁻¹ respectively. Ammonium nitrogen, phosphorus and sulfur removal were observed during robust algal growth. Based on 18s rRNA sequencing, the eukaryotic community was dominated by *Coelatum* (> 90%), a genus of green algae, during cold seasons, and the dominance transitioned to another green algae genus *Chlorella* (>95%) during warm seasons. This study offers valuable insights for the potential future implementation of large-scale microalgae biomass production, utilizing wastewater as a sustainable and nutrient-rich source.

Abstract #: 020

Title: H2Alabama Water Well Program

Presenter: Stacy McKean

Organization: H2Alabama

Session: Lightning Talk - Outreach

Nearly one-third of residents in Alabama's Black Belt region live outside a public water system. It is often not economically feasible for local water authorities to extend public water services to these communities, and families instead rely on water wells as a source of clean water. Yet hundreds of these wells are failing. Many wells crack and become contaminated with bacteria from nearby septic run-off. Testing from the public health department often reveals the presence of e. Coli and other fecal chloroform bacteria, making the water unsafe to drink or cook with. Other wells fail mechanically, causing a drop in water pressure that makes it impossible to take a shower or wash dishes. Unlike municipal water systems, water wells are the homeowner's financial responsibility. While the state of Alabama has water infrastructure funding available through various programs, only municipalities and water authorities—not individual households—can access this funding. Residents in rural communities must instead rely on personal savings to finance a new water well, which are often prohibitively expensive due to the high cost of drilling in the Black Belt soil. A new water well typically costs between \$10,000 and \$12,000 dollars, a price far too high for most Black Belt families. As a result, countless failed water wells have never been replaced. Residents are instead forced to use bottled water to drink, cook with, and shower in, often spending hundreds of dollars each month to procure clean water for their families. H2Alabama was launched in 2022 as a 501(c)3 to address this problem. Over the past year, H2Alabama has designed a program to refurbish or build new water wells for low-income families throughout the region. Homeowners make a monthly payment, and H2Alabama finances, installs, and maintains a working water well for the family. Applicants to the program are identified and screened through the H2Alabama community coalition, a network of local non-profit organizations throughout the Black Belt. Construction or refurbishment of water wells are financed through a combination of low-interest loans—provided by a partner organization, the Water Well Trust—grant funding, and donated materials. Projects are completed by a certified and bonded local contractor. New water wells receive regular maintenance monitoring and check-ups through H2Alabama's maintenance service, and clients receive targeted education about preventative well maintenance. Most importantly, this program is affordable, and was built with community affordability in mind. Clients make a regular payment—usually no more than \$40 dollars per month—an arrangement which is often cheaper than buying bottled water. Through this program, families that need a new water well can get one for an affordable monthly payment. By refurbishing and building new water wells, H2Alabama hopes to improve clean water access to historically marginalized communities across the Black Belt, one family at a time.

Abstract #: 021

Student

Title: Evaluation of Pathogenic Bacteria in a Pilot-Scale Wastewater Treatment System for Hydroponic Irrigation in Controlled Environment Agriculture

Presenter: Wellington Arthur

Organization: Auburn University

Session: Wastewater Systems

The increasing global water crises and the demand for sustainable agriculture have led to the exploration of wastewater utilization for crop irrigation. Poultry processing wastewater (PPW) is a viable alternative irrigation source due to its high nutrient content, specifically nitrogen, and phosphorus. However, the presence of pathogens in PPW poses a significant risk of produce contamination. In this study, a pilot-scale treatment system was established, incorporating bioreactors inoculated with mixed cultures of algae and nitrifying bacteria, membrane filters, UV disinfection, and hydroponic grow beds. The objective was to evaluate the fate of background pathogenic bacteria during PPW treatment and lettuce production. It was hypothesized that high dissolved oxygen levels (via photosynthetic or mechanical aeration) and bacteria floc filtration would enhance pathogen removal. Water and lettuce samples were collected at harvest, and microbiological analyses were performed for Aerobic Plate Count (APC), coliforms, *Escherichia coli* (*E. coli*), *Salmonella*, and *Campylobacter*. Samples were serially diluted and plated on appropriate petrifilms for the enumeration of bacteria. Samples were enriched, plated, and presumptive colonies of *Salmonella* and *Campylobacter* were confirmed by PCR. The background microbial load in PPW, ranged from 2.8 to 7.5 log₁₀ CFU/mL for APC, 0.4 to 6.8 log₁₀ CFU/mL for coliforms, and 0 to 4.5 log₁₀ CFU/mL for *E. coli*. Although *E. coli*, *Salmonella*, and *Campylobacter* were detected in PPW, none were detected in any of the analyzed lettuce samples thus, confirming the effectiveness of the pilot-scale treatment system in reducing the background microbial load in wastewater. This study highlights the potential utilization of PPW for the production of lettuce while ensuring safety and microbial quality.

Abstract #: 022

Title: Harnessing Precision Agriculture Tools for Accurate and Sustainable Water Management

Presenter: Guilherme Morata

Organization: Alabama Cooperative Extension System

Session: Lightning Talk - Outreach

The rapid advancement of precision agriculture (PA) tools has opened up new possibilities for optimizing crop production while promoting sustainability. This abstract highlights a groundbreaking project that leverages precision agriculture tools, specifically drones and soil sensors, to prescribe irrigation practices in corn fields. By employing these cutting-edge technologies, farmers can enhance their irrigation precision, achieve higher accuracy, and foster sustainable water management practices. The primary objective of this project is to develop a comprehensive framework for precise and targeted corn irrigation using drones and soil sensors. The integration of these technologies enables farmers to obtain real-time data on soil moisture levels, plant health, and other key variables, allowing for data-driven decision-making regarding irrigation practices. By customizing irrigation prescriptions based on specific field conditions, farmers can optimize water usage, minimize waste, and increase overall efficiency. Drones play a pivotal role in this project by capturing high-resolution aerial imagery of corn fields, which provides valuable insights into plant health, growth patterns, and water stress indicators. Equipped with advanced imaging sensors, drones can accurately assess the vegetative indices, such as normalized difference vegetation index (NDVI), which helps monitor crop vitality and detect areas requiring precise irrigation interventions. Complementing the drone imagery, soil sensors are strategically deployed throughout the corn field to continuously monitor soil moisture content at different depths. These sensors offer real-time data on moisture levels, facilitating timely irrigation decisions based on actual field conditions. By combining drone imagery and soil sensor data, farmers can create detailed irrigation prescriptions tailored to specific areas within their fields, leading to optimal water usage and increased crop productivity. The utilization of precision agriculture tools in corn irrigation presents numerous benefits for farmers. Firstly, the enhanced accuracy of irrigation prescriptions ensures that crops receive the appropriate amount of water at the right time, mitigating the risk of over- or under-irrigation. This precision aids in maintaining optimal plant health, minimizing yield losses, and optimizing water resource utilization, which is particularly critical in regions facing water scarcity or drought conditions. Moreover, the project highlights the role of precision agriculture in promoting sustainable farming practices. By avoiding excessive irrigation, farmers can reduce the energy consumption associated with pumping water and minimize the potential leaching of nutrients and agrochemicals into groundwater.

Abstract #: 023

Student

Title: Detecting and quantifying sub-seasonal teleconnections of regional soil moisture flash droughts using causal networks

Presenter: Sudhanshu Kumar

Organization: Auburn University

Session: Lightning Talk - Research

Flash droughts are extreme events distinguished by a sudden onset and rapid intensification of drought conditions causing rapid depletion in root-zone soil moisture and severely affecting crop health, dramatically driving irrigation water demands. They occur on sub-seasonal-to-seasonal (S2S) timescales (weeks to months), which makes it a challenge for prediction. Detecting and quantifying S2S teleconnection patterns and understanding their causal mechanisms is of great importance to understand their predictability and discover new sources of predictability. In this research, we evaluate the causal effect networks (CENs) to explore causal factors of soil moisture FDs, in the southeast United States (SEUS). We analyzed teleconnections of FD events in the SEUS with global surface temperature (T2m), water deficit (WD; precipitation minus evaporation, P-E), and geopotential height at 500m (Z500) at the weekly timescale in the warm season between 1982 and 2018. The correlation maps identified highly significant correlations ($P < 0.01$) in many regions such as the Indian Ocean, parts of the Pacific and Atlantic oceans, and their adjacent land areas. The causal analysis removed spurious correlations and revealed clear patterns of T2m, Z500, and WD influencing FDs in SEUS. T2m in the North Atlantic and North Pacific Oceans shows a higher linkage with the SEUS FD coverage compared to other regions. East Australian T2m shows a direct link with SEUS FD. Z500 shows a larger region with highly significant correlations compared to T2m with a strong teleconnection from South America. For WD, the SEUS regions have a strong influence compared to the other regions. Furthermore, the CENs discovered many direct and indirect links among various regions in the tropics and subtropics driving soil moisture FDs in SEUS. The results obtained in this research revealed global teleconnections in changing the regional soil moisture dynamics and flash droughts.

Abstract #: 024

Student

Title: Towards a More Sustainable Aquaponics System: Investigating Algal-biofloc and Decoupling Effects

Presenter: Shima Rezaei

Organization: Auburn University

Session: Wastewater Systems

Traditional agriculture accounts for 70% of global freshwater withdrawals and is a primary source of water pollution. With the global population projected to reach 9.8 billion by 2050, food demand is expected to increase by 60-100%, highlighting the urgency for sustainable agriculture practices. Aquaponics presents a sustainable solution to the challenges posed by traditional agriculture, offering a way to produce food while using less water and chemicals. By utilizing fish wastewater to fertilize plants, aquaponics systems can create a closed-loop cycle where water is purified and filtered in the plant bed, then returned to the fish tank. However, the combination of fish culture and plant growth requires careful management to ensure that the water quality requirements are met and that the aquaponics cycle is sustained. Nitrifying bacteria floc (biofloc) play a key role in treating fish wastewater and maintaining system stability. This study aims to investigate the potential benefits of integrating algae with biofloc, as algae may improve nitrification function and increase nitrifying bacteria resilience against inhibitors. Through this investigation, we hope to gain a deeper understanding of the impact of algae on aquaponics performance, process quality, and system stability, ultimately contributing to the development of more sustainable food production. In addition to the challenge posed by managing wastewater treatment in the fish tank, aquaponics development also faces the challenge of meeting the different growth conditions of both fish and plants, which is essential for sustainable system operation. Decoupled aquaponics has been developed as a solution to this issue, where water from the grow bed is not returned to the fish tank, allowing for different water quality in each section. This facilitates pH adjustment and the addition of supplements to the grow bed without harming the fish. However, decoupling can impact the system's performance and create difficulties in managing nutrient waste. Our second aim is to investigate the impact of decoupling on aquaponics performance and ease of operation. Four different treatments will be evaluated, testing the presence/absence of algae in coupled versus decoupled aquaponics. The study is taking place in 12 aquaponics systems at Auburn University and 16 systems in regional high schools, which will provide an opportunity to evaluate the designed systems in the hands of novice users. This will also benefit the students with a cool educational resource and teach them about agricultural ecosystems and sustainable food production.

Abstract #: 025

Title: Remaining Barriers to Sustainable Wastewater Solutions in the Alabama Black Belt in a Time of Federal Infrastructure Funds

Presenter: Mark Elliott

Organization: The University of Alabama

Session: Water Law & Policy

Recent federal infrastructure funding provides an opportunity for adequate wastewater management for thousands of U.S. communities that are effectively unserved, including tens of thousands of households in the Alabama Black Belt. However, many small communities continue to struggle to access available funding to provide effective and financially sustainable solutions. While preference for disadvantaged communities (e.g., Justice40) is incorporated into federal funding opportunities and many stakeholders prioritize the neediest communities, the embedded perverse incentives and asymmetric information present substantive obstacles to these goals. For example, most key decisionmakers are incentivized toward the installation of more expensive systems. Additionally, the influx of Federal funding into a tight labor market has driven up prices without adequately expanding the capacity of construction and engineering firms to take on more projects. This presentation seeks to leverage the authors' experiences spanning multiple U.S. states—including Alabama, North Carolina, and West Virginia—to potentially disrupt the wastewater management status quo in small, unserved communities. Accordingly, the objectives are to: (1) describe briefly the major system typologies that can be implemented when a community has no centralized system; (2) identify available funding sources to address both capital costs and ongoing costs, in the context of ARPA and BIL; (3) discuss the challenges and tradeoffs of each system typology for both short-term implementation and long-term system sustainability; and (4) propose approaches that have shown promise for addressing some of the major obstacles to sustainable wastewater management for unserved communities. Liquid-only sewer clusters that connect a community to an existing gravity sewer system, distributed system management, single-property OWTS clusters, managed OWTS, and creative approaches to funding and technical assistance are among the promising paths to appropriate and sustainable wastewater management for Black Belt communities with the greatest need.

Abstract #: 026

Title: Can Alabama's groundwater resources be managed sustainably?

Presenter: Mary Pitts

Organization: Geography Department, University of Alabama

Session: Water Law & Policy

The world's aquifers offer strategic opportunities to support water, food, ecological, and economic security over the coming decades. However, this critical resource has been undervalued, under-researched and as a result we are facing a global groundwater crisis. This paper explores whether the legal statutes and institutional arrangements governing groundwater rights, allocation, and quality in Alabama are robust enough to meet the coming challenges, whether they support and promote a sustainable groundwater management regime and specifically whether they could be incorporated into the developing water management plan for the state. Assessment and analysis of other jurisdictions approach provides insights into potential legislative regimes and policy approaches that could be utilized to achieve sustainable groundwater management. A framework for sustainable management of groundwater resources is proposed which includes the rejection of the traditional common law riparian model currently in place and the adoption of the regulated riparian model. It supports the adoption of a conjunctive system for the management and regulation of the surface and groundwater resources of the state and further recommends that water quantity and quality issues be managed and regulated together.

Abstract #: 027

Student

Title: Concerning Contaminants: Coal Combustion Byproducts in the Coosa River

Presenter: Emma Henderson

Organization: Auburn University

Session: Poster Session

Coal combustion is an important electricity source globally and within the United States. Alabama has three active coal-fired power plants spread throughout the state with Plant Miller on the Warrior River, Plant Gaston on the Coosa River, and Plant Barry on the Mobile River. Coal combustion plays a valuable role as a cheap electricity source; however, it also generates waste that negatively impacts water quality. The waste generated from coal combustion is referred to as coal combustion residuals (CCR), and encompasses fly ash, bottom ash, slag, toxic metals, organic compounds, gasses, and other byproducts of coal combustion. To understand the impact that coal-fired power plants have on water quality in fluvial systems, it is important to separate CCR-derived contamination from other anthropogenic or geogenic sources. To do so, we quantify spheroidal carbonaceous particles (SCPs), which are rounded carbon particles that are only formed through the anthropogenic, incomplete, high temperature combustion of coal or oil. SCPs are morphologically distinct and therefore serve as useful and readily identifiable tracers of coal combustion contamination. SCPs have been used as indicators of CCR contamination in relatively quiescent systems like lakes, ponds, and other reservoir sediments. However, few studies have analyzed or quantified SCPs in fluvial settings where factors like stream discharge and remobilization from sediment disturbances may influence accumulation of SCPs differently than in more quiescent systems. It is important to consider the impact of CCR on fluvial systems, as many coal-fired power plants, such as those in Alabama, are located on the banks of rivers. We address this gap in knowledge by quantifying SCPs in river sediments ($n=14$) from the Coosa River. SCPs were quantified in replicates ($n=30, 50$) from sediments upstream of, adjacent to, and downstream of Plant Gaston and Plant Gadsden, the latter a recently closed power plant with a legacy of coal combustion. SCP sizes were also measured for each site. We found higher SCP count variability was observed in fewer sediment replicates ($n \leq 15$), while larger numbers of replicates follow a normal distribution ($\bar{x}=133-261$ and $\sigma=46-136$). Additionally, we mapped the mean SCP count and size for each site to understand how distance from coal-fired power plants spatially influences the accumulation, transportation, and distribution of SCPs in river sediments. Higher concentrations of SCPs in sediment indicate the increased potential for CCR contamination. The purpose of this study is to advance the current understanding of how and to what extent both present and historic coal-fired power plants impact fluvial systems. Future research will seek to identify what if any relationship exists between SCPs, organic pollutants (e.g., PAHs) and toxic metal concentrations (e.g., As, Pb, V, Sb) in river sediments as additional indicators of CCR contamination.

Abstract #: 028

Title: First Biennial State of the Bays Report: A Health Check-up for the Pensacola and Perdido Bays

Presenter: Haley Gancel

Organization: Pensacola and Perdido Bays Estuary Program

Session: Lightning Talk - Outreach

The Pensacola and Perdido Bays Estuary Program (PPBEP) is a place-based, non-regulatory entity working to restore and conserve Pensacola and Perdido Bays and their watersheds. In Fall 2022, PPBEP released our first Comprehensive Conservation and Management Plan (CCMP) - A Prescription for Healthy Bays, which acts as a road map to restoring and protecting these estuaries. To evaluate the condition of the systems and assess long-term program restoration effectiveness, PPBEP developed their first State of the Bays report (May 2023). The report provides a snapshot of the condition (critical, declining, improving, stable, undetermined) of key ecosystem health metrics to provide the program with a baseline for measuring program impact and provide the public with knowledge of the status of the systems. Current and historical data were compiled and standardized from multiple sources for 13 indicators (i.e., oyster reefs, seagrass beds, dissolved oxygen, nutrients, beach advisories, manatees, etc.) across four categories: habitats, water quality, bacteria, and wildlife. The report is an interactive web platform where data are organized by watershed and includes visuals (e.g., infographics, maps, graphs, photos), data summaries, resource links, and specific calls to action. Furthermore, where applicable, we provided thresholds for existing standards (e.g., bacteria, dissolved oxygen, nutrients) to provide viewers with a reference for condition to make the numbers more meaningful. Condition criteria assigned were based on data availability, historical context, and comparisons between recent datasets (last 2-3 years) for each indicator. For example, oyster reefs were diagnosed as critical in Pensacola Bay because oysters have declined by 70% since the 1980s with only 194 hectares of reef remaining. Conversely, seagrass extent has improved in recent years in Perdido and Pensacola Bays, while nitrogen concentrations have increased across Pensacola Bay, indicating a decline in water quality. Due to widespread data gaps in Perdido Bay, the condition for several indicators was undetermined, highlighting monitoring needs. As PPBEP continues to build a Comprehensive Monitoring Program and collaboratively develop projects, we aim to foster partnerships across state lines to encourage more consistent monitoring and data collection through time. This information will allow us and our partners to adapt our actions for more effective management.

Abstract #: 029

Title: Riverside Chats: Community Conversations towards Protecting Alabama's Freshwater Resources

Presenter: Kelsey Herndon

Organization: The University of Alabama in Huntsville

Session: Poster Session

Alabama the Beautiful is a state rich in freshwater resources, including more than 132,000 miles of rivers and streams and the greatest freshwater biodiversity in the country, including more species of turtles, crayfish, carnivorous plants, freshwater fish, snails, and mussels than any other state. While Alabama's neighboring states have tackled the legislative feat of a comprehensive water management plan, Alabama has yet to fully address the opportunities and challenges of such an exceptional resource. The U.S. State Department through the Citizen Diplomacy Action Fund has provided funding to support Riverside Chats: Community Conversations towards Protecting Alabama's Freshwater Resources. This project, in partnership with the Alabama Rivers Alliance (ARA), will engage three broad audiences with a stake in Alabama's freshwater resources: state-level legislators, environmental NGOs, and local community members. This project will work with these stakeholder groups across three Alabama watersheds (Tennessee River, Coosa River, and Tallapoosa River) to provide information on opportunities and threats unique to each watershed and to facilitate conversations aimed at moving towards improved management of Alabama's rivers and streams.

Abstract #: 030

Title: Updating eWater - OWR's Water Management Database

Presenter: Michael Harper

Organization: Alabama Office of Water Resources

Session: Water Quantity

eWater is the cumulative term used to describe the various hardware and software tools and capabilities that support OWR's management of the Alabama Water Use Reporting Program. Created in the 2002-2004 timeframe, eWater was developed as a client server application with a desktop-based administration application and an MS access report and data querying application. Efforts have been underway to replace the application to allow for more efficiency in the management of the Alabama Water Use Reporting Program and the water use data collected. This presentation will provide an overview of the process to update eWater and highlight the new features associated with the revised eWater application.

Abstract #: 031

Title: Alabama's Drought Planning – Policy Moving Forward

Presenter: Mary Blackmon

Organization: Alabama Office of Water Resources

Session: Drought & Climate 3

In the 2014 legislative session, the Alabama Drought Planning and Response Act (Act 2014-400) was passed and signed into law. Since that time, the Alabama Office of Water Resources has worked with the Alabama Water Resources Commission, the Alabama Drought Assessment and Planning Team (ADAPT) and its technical committee, the Monitoring and Impact Group (MIG), reservoir system operators, stakeholders, and others to develop the specific policies, procedures, regulations, and other tools to fully implement the Act. The Regulations became effective on July 1, 2016. The Alabama Drought Management Plan was revised in 2018 and is now fully in accordance with the Alabama Drought Planning and Response Act. The next step in this effort will be a review to the Alabama Drought Management Plan that is required by the Act. This presentation will provide an overview of the process to date as well as a review of the status of any updates to the Alabama Drought Plan.

Abstract #: 032

Title: A Geodemographic Analysis of Private Well Users in the U.S. Southeast and Beyond

Presenter: Jake Nelson

Organization: Auburn University

Session: Well Water

Recent studies suggest that socially vulnerable communities may face higher contaminant exposure from public drinking supplies in the United States, but research is less clear about the risks posed to private supplies, namely, private groundwater wells. Until recently, the lack of available data on private well water resources have prevented a thorough understanding of the extent that certain communities depend on groundwater for drinking. More importantly, recent studies suggest that the socio-economic characteristics of households dependent on private wells could impede their ability to properly maintain and mitigate contamination. In this study, we take a spatially explicit geodemographic approach to evaluate the distribution of households dependent on private wells in the U.S. and in the southeast region more specifically. We then evaluate the household characteristics of high well-use communities to determine whether these clusters may be at heightened risk of contamination due to economic and social barriers to mitigation strategies. Our results confirm that well users generally live in rural areas with moderate income, although important exceptions exist. Specifically, low-income American Indian communities are associated with some of the highest well use-rates in all regions of the US, including the southeast, which may place them at higher risk of exposure to water-borne contaminants. Our results highlight areas for targeted outreach and mitigation strategies to ensure equitable access to drinking water for households dependent on private wells.

Abstract #: 033

Student

Title: Life Cycle Assessment of Decentralized Wastewater Treatment and Disposal Technologies: A case study in the Alabama Black Belt

Presenter: Rachel Chai

Organization: University of South Alabama

Session: Modeling & Water Management 1

Approximately 25% of the population in the United States of America uses an onsite wastewater treatment system (OWTS). In particular, the Alabama Black Belt has a large number of users on OWTS, with up to 85% of the county's population living in households with an OWTS. The Alabama Black Belt is a 17 county region characterized by its low economic basis and the presence of vertisol clay soils. The Alabama Black Belt has a median household income of \$29K, roughly half that of the United States of America (USA). The poverty line for the USA is \$31K. Because vertisol soils are impermeable to water, many of the more cost-effective OWTS fail in this region. This failure results in the pooling of effluent in proximity to residential areas. Lastly, the Alabama Black Belt's population density is 26.4 people per square mile, which is less than one third of the USA's. Based on the previously stated characterizations, this Life Cycle Assessment aims to determine which decentralized wastewater and collection systems are most effective for the environment and cost-effective for communities in the Alabama Black Belt. Treatment systems used in the Alabama Black Belt and included in this study are the following: constructed wetlands, aerated activated sludge reactors, and lagoons. Collection systems included within this study are the following: Pressure Sewer, Gravity Collection System, and Effluent Collection System. Using programs like RS Means, OpenLCA, and Greet, the factors of: cost, public health concerns, electricity usage, and carbon footprint, and a multiple criteria decision analysis tool, allows stakeholders in the Black Belt to choose the most appropriate treatment and disposal system depending on the available resource, funding opportunities, surrounding environment and effectiveness of the system.

Abstract #: 034

Title: Water Management Districts as a Foundation for State Water Policy Planning

Presenter: Gregory Guthrie

Organization: Geological Survey of Alabama

Session: Water Law & Policy

Comprehensive water management plans should define how all waters within a state are used and managed so policies that are implemented ensure resource sustainability. Plans that employ uniform statewide policies and management strategies may be appropriate for states with unique hydrologic systems, but are inadequate for states with greater hydrologic diversity. Alabama is a hydrologically diverse state, with over 132,000 miles of streams and rivers underlain by five distinct groundwater provinces containing waters ranging from very young, derived from recent precipitation, and renewable to over 50,000 years old and non-renewable. Alabama's major river basins are interstate, providing public water, power and industrial supply, irrigation, and recreational opportunities. The diversity of the state's hydrologic systems and variety of uses create difficulties for applying uniform statewide management policies and strategies. Successful state water management plans in other hydrologically diverse states employ water districts to account for the diversity and to address local concerns. Water district boundaries in these states have been defined through a variety of methods based on hydrologic characteristics, political boundaries, or a combination of the two. We propose a seven-district subdivision of Alabama based on a combination method that will account for hydrologic regime and water use heterogeneities. Watersheds are the principal characteristic used in the subdivision: each proposed district encompasses, in part, a major river basin, as well as an area underlain by a groundwater basin with unique characteristics. Each proposed district also incorporates county political boundaries to facilitate intradistrict water management and policy development. Because a one-plan-fits-all approach will be challenging to employ in Alabama, the use of water districts will better address local resource concerns and provide the flexibility necessary to help to achieve long-term sustainability as the state faces future natural and anthropogenic stresses to its diverse hydrogeologic systems.

Abstract #: 035

Student

Title: Phosphorus Loss at Field Scale: Insights for Enhancing the Alabama Phosphorus Index

Presenter: Anjan Bhatta

Organization: Auburn University

Session: Water Quality 1

Phosphorus (P) loss from agricultural fields is a global concern due to its contribution to algal blooms, eutrophication, and the degradation of water quality. To mitigate water quality problems, it is crucial to incorporate a fundamental risk assessment of phosphorus losses from agricultural lands. The Alabama Phosphorus Index (AL-PI) is a key tool used to assess P loss vulnerability and manage P loss via manure management at the field scale. To improve the accuracy and effectiveness of the PI, the NRCS Nutrient Management (Ac.) (590) Conservation Practice Standard encourages states to revise their PI by incorporating field data. This research aims to study the temporal and spatial variability of different forms of P loss, including dissolved reactive P, dissolved total P, particulate P, and total P, and to identify critical periods and sites of P loss from the field. Edge-of-field monitoring experiments were conducted at three locations, each with a paired watershed, in Alabama. Surface runoff water samples were collected during natural rainfall events and analyzed for different P species in the laboratory. The study revealed that the months from October to February were critical periods for P loss at all three locations. Additionally, there was significant variability in P loss between locations, primarily influenced by field characteristics and management practices such as manure application. Therefore, it is necessary to incorporate temporal variation in P loss in the AL-PI. The current AL-PI only considers manure application rate and method, and does not account for the time of application, which plays a significant role in P loss from fields. This research highlights the necessity of revising the AL-PI, enabling more accurate and targeted approaches to manage P loss from agricultural systems.

Abstract #: 036

Title: Evidence for Hydrologic Engineering in the Ancient Americas using NASA Earth Observations

Presenter: Robert Griffin

Organization: The University of Alabama in Huntsville

Session: Poster Session

At over 21,000 km² the UNESCO-recognized Maya Biosphere Reserve in northern Guatemala is one of the largest regions of intact tropical forests in the Americas. Today approximately 85,000 people live in and around this protected area, however two millennia ago this region was home to much higher numbers of ancient Maya who built large cities and developed complex culture and trade. To support these large populations amid periods of extended climatic drought, the Maya of this area engineered a landscape to effectively manage their scarce water resources. The ancient city of San Bartolo, located within the Biosphere Reserve, is primarily well-known for its murals documenting ancient kingship and creation mythology yet its surrounding landscape also provides evidence for the variety of ways that the ancient Maya adapted to conditions of water scarcity. Newly available aerial Lidar data are helping expose the ancient water reservoirs, canals, and agricultural terrace networks which ensured that water was available for domestic consumption and agricultural irrigation. In addition, multispectral Earth Observation platforms from NASA and commercial satellite data providers are revealing the ancient landscape of seasonal lakes and rivers which today have been reduced to ephemeral and short-lived swamps. By combining archaeological excavation, hydrological modeling, and satellite/aerial remote sensing we are working to develop a comprehensive understanding of the complex prehistoric water management system in this region and to extrapolate lessons for contemporary populations.

Abstract #: 037

Title: Assessment of barriers to connectivity in the Uphapee Creek watershed

Presenter: Susan Fuller

Organization: Auburn University

Session: Lightning Talk - Research

With Alabama having 132,000 miles of rivers and streams and 210,000 miles of roadways they are bound to cross each other. When this overlap happens, structures are created, like culverts, bridges, or fords to keep the waterways connected. These structures are critical points in stream connectivity, but also can pose problems to the aquatic organism populations at these intersections. Alabama is known for its large amount of aquatic organism biodiversity, so the condition of crossing structures is extremely important. Some factors affecting these species are climate change, pollution, siltation, and perched culverts, which limit or eliminate immigration, emigration, reproduction, and spatial distribution. The Alabama Rivers and Streams including Connectivity (ARSNiC) program has been established to assess and report problems that are occurring at these roads and water intersection points. With establishing Strategic Habitat Units (SHUs) there is a focus of efforts and funding on certain watersheds to ensure and establish stable morphology, healthy and normal stream flow, water quality that ensures growth, stability, and viability to the animals, in any life stage, that live in the stream. Uphapee Creek watershed is located in central east Alabama. Uphapee Creek is a critical habitat to many mussel species like the Finelined Pocketbook, Southern Clubshell, and the Ovate Clubshell. The objective of our project in Uphapee Creek watershed is to conduct the Sediment Risk Index survey at each road crossing structure, which includes bridges, culverts, and fords. This survey assesses the stream crossing and determines possible threats to the species that occur or need passage at these crossings. In the Uphapee watershed we have completed SRI surveys on all 748 crossings. Critical survey data that informs sediment risk and barriers to aquatic organism passage include the height of the outfall drops and the overall SRI score of the site. Within Uphapee, of all sites where surveys were completed 21% of crossings had a perched culvert, or an outfall drop that was greater than zero. Of crossings with outfall drops, the average drop height was 1.6 feet and the maximum outfall drop was 6 feet. Of crossings surveyed, 97.4% scored low for sediment risk and 1.9 and 0.7% scored moderate and high risk, respectively. With the completion of these surveys – the data collected can be used to prioritize management, public knowledge and involvement, conservation, and restoration efforts.

Abstract #: 038

Student

Title: Increasing community self-efficacy to advocate for access to water and wastewater infrastructure in rural West Central Alabama.

Presenter: Jasmine Kennedy

Organization: UAB- UNIVERSITY OF ALABAMA AT BIRMINGHAM

Session: Poster Session

Communities throughout West Central Alabama lack access to safe water and closed sanitation. This situation has evolved through a combination of geography, funding policy, regulatory environment, and structural racism. Due to community distrust, there is a gap between state and federal programs, and the constituents they serve. To gain insight and gather qualitative data onto the experiences and perspectives of community leaders, church leaders, local NGOs, and community residents around water and wastewater infrastructure in rural West Central Alabama our team have conducted numerous focus groups over the past five years (5). Asthma in children, hypertension, diabetes, and mental illness are among the top health concerns amid our target community who are residents of Wilcox, Perry, Dallas, and Sumter counties. These counties are among the west central region of the Alabama Black Belt – predominant African American populations and have some of the highest rates of poverty in the United States. Our team has focused on proven strategies to increase community engagement and increase residents of the target community(s) perceived self-efficacy to advocate and apply for infrastructure resources. In doing so, major barriers such as affordability and sustainability have been identified. Both are indicators that can be related to the Social Determinants of Health (SDOH), i.e., income disparities, education, poverty, and housing assistance – topics that are a collection of factors identified as the fifth highest health indicator for AL. A substantial proportion of the population lives beyond the city limits in unincorporated regions. These households are required to install onsite wastewater systems, the procurement, installation, financing, and installation being the sole responsibility of the homeowner. Due to soil conditions in the region, regular septic systems routinely fail, requiring expensive engineered systems that are unaffordable to most residents. Additionally, many mobile homes are sited amongst traditional homes within the city limits but are unable to be connected to the centralized sewers. Given the lack of resources, residents in this region have resorted to unpermitted systems to dispose of household sewage, many of which discharge untreated sewage to the environment. The health risks of these practices are under-recognized by all who live in these counties, whether they have a functioning system or not.

Abstract #: 039

Student

Title: Performance Evaluation of Sediment Barrier Practices through Large-Scale Testing

Presenter: Brian Roche

Organization: Auburn University

Session: Stormwater 1

Sediment barriers are typically installed on the perimeter of construction sites and aim to protect downstream areas from sediment-laden stormwater runoff by impounding water behind the practices and allowing sediment to be deposited. Sediment that reaches waterways can harm aquatic vegetation and wildlife and reduce the flow capacity of streams and rivers, increasing flood risk. There is currently a lack of performance testing on sediment barrier practices such as silt fences, wattles, and slash mulch berms. This project aimed to evaluate the Nebraska Department of Transportation (NDOT) standard and modified sediment barrier practices using a modified ASTM D351 testing methodology apparatus. Findings from testing indicated that modifications are required to improve the structural performance of NDOT sediment barrier practices; the most feasible and effective installations that improved sediment retention, structural performance, and water quality were recommended based on the testing results. The findings of this testing can further the understanding of sediment barrier performance, especially in preventing structural failure and ensuring consistent performance, for other jurisdictions, including Alabama.

Abstract #: 040

Student

Title: Assessment of Barriers to Connectivity in the Upper Pea River Strategic Habitat Unit

Presenter: Josiah Gullatte

Organization: Auburn University E.W. Shell Fisheries Center

Session: Lightning Talk - Research

The Upper Pea River watershed is approximately 411,690 acres, covering Barbour, Bullock, Coffee, Dale, and Pike counties and is part of the Choctawhatchee-Escambia subregion. This watershed is located in southeastern Alabama and is a critical habitat to the Tapered Pigtoe, Southern Sandshell, Choctaw Bean, Fuzzy Pigtoe, and Southern Kidneyshell. Within the network of Alabama's 132,000 miles of river and stream systems there are overlaps between surface waters and roadways. To keep the connectivity of these waters intact, structures such as bridges, culverts, or fords are created so that the waterways and roadways both function appropriately. Problems can occur at these structures impacting the aquatic organism populations inhabiting the area. Factors that can impact populations include pollution, sedimentation, and structural issues like perched culverts that have an impact on immigration, emigration, reproduction, and spatial distribution. The Alabama Rivers and Streams including Connectivity (ARSNiC) program has been established to assess and report problems that are occurring at these roads and water intersection points. Teaming with Alabama Rivers and Streams Network in Connectivity (ARSNiC), sediment risk index surveys (SRIs) are ongoing to evaluate the conditions of stream crossings in the Upper Pea River. Important data collected from these surveys include the qualitative sediment risk level, the culvert outfall drop, and the overall integrity of the structure. From May '22 - May '23 10% of the 755 crossings within the Upper Pea River have been conducted. Of surveys completed, 48% of culverts had a perched culvert outfall drop, and of perched culverts, the average drop height was 2.7 ft and the largest drop recorded was 10 ft. The surveys are also put into three categories of risk for sedimentation and erosion - low, moderate, and high. Of surveys conducted to date, there are 80% of crossings have been scored as low risk, with 17.5% scoring as moderate and 2.5% high. Surveys for the Upper Pea River watershed are ongoing to complete all 755 crossings. With the completion of these surveys – the data collected can be used to prioritize management, public knowledge and involvement, conservation, and restoration efforts.

Abstract #: 041

Student

Title: Old sediments give new insights into floods, climate and watershed changes in the Clinch River, Tennessee.

Presenter: Mary Eminue

Organization: The University of Alabama

Session: Poster Session

Title: Old sediments give new insights into floods, climate and watershed changes in the Clinch River, Tennessee. Authors: Mary Eminue, Ms Student, Department of Geography, University of Alabama M.A Lisa Davis, Associate Professor, Department of Geography, University of Alabama Ray Lombardi, Assistant Professor, Department of Earth Sciences, University of Memphis Matthew D. Gage, Director of Archaeological Research, University of Alabama

ABSTRACT In this study, we analyzed sediment grain size as a proxy indicator of climate and flood variability in the Clinch River, Tennessee to understand past-environmental changes. We analyzed a 4-meter sediment core from the floodplain of the Clinch River near Norris, Tennessee and conducted microsedimentological analyses. These analyses included detailed particle size and shape measurements with a laser granulometer, end-member modelling to identify sedimentation processes, and change point analyses to spot sedimentation breaks and changes. We used locally estimated scatterplot smoothing (LOESS) regression to identify coarse sand peaks associated with sediment deposition during extreme flood events. Magnetic susceptibility measurements of sediment samples were used to determine sediment provenance. The results from this study revealed details of past extreme floods, changes in flood frequency, and environmental conditions, applicable to understanding river response to Holocene climate changes. In addition to contributing to a clearer understanding of environmental changes that occurred during the Holocene, this study provides insights applicable to flood risk management in the Tennessee River Basin, a regulated river with numerous dams, and other rivers like it in the eastern U.S.

Abstract #: 042

Title: Assessment of Barriers to Connectivity in the Uchee Creek Watershed

Presenter: Colin Nunn

Organization: Auburn University School of Fisheries

Session: Lightning Talk - Research

In addition to an immense amount of freshwater biodiversity, Alabama contains 132,000 river and stream miles and 210,000 miles of roadways. The interface of these roads and waterways create a need for culverts and bridge crossings and create fords. These intersections of aquatic and human life are critical points in stream connectivity as well as ecological factors such as climate change, pollution, and sedimentation; and also impact population factors such as immigration, emigration, spatial distributions and reproduction. The Alabama Rivers and Streams including Connectivity (ARSNiC) program has been established to assess and report on barriers to connectivity, aquatic organism passage, and sediment risk at these “critical points.” The establishment of Strategic Habitat Units (SHUs) within the state allowed for the focused efforts and funding on the watersheds in the state with stable morphology, normal and healthy stream flow, water quality acceptable for normal growth, stability, and viability to the animals and their life stages in the stream, as well as a diversity of channel substrate types with low amounts of filamentous algae and low amounts of fine sediments. Uchee Creek Watershed falls under this umbrella and is one of many systems within the in the Apalachicola drainage. Uchee Creek is home to many species including mussels, snails, fish, and turtles. The objective of this project was to conduct health and risk surveys of this watershed, including Sediment Risk Index (SRI) and the Southeastern Aquatic Resource Partnership (SARP) to provide a baseline for restoration efforts of the habitat where these critical species live. From May '22 – May '23 SRI and SARP surveys have been conducted on 42% and 6.5% of Uchee Creek, respectively. Efforts are continuing in 2023 to complete SRI and SARP surveys on each of Uchee's 586 existing stream crossings, evaluate biotic composition at locations that have been deemed “high” and “low” risk for connectivity and sediment, and provide recommendations for areas in need of restoration and prioritization.

Abstract #: 043

Title: “Now Showing”: The Alabama Rivers and Streams Network Story

Presenter: Rebecca Bearden

Organization: Geological Survey of Alabama

Session: Aquatic Ecology 1

The Alabama Rivers and Streams Network (ARSN) began in 2006 as a diverse group of industries, agencies, landowners, and nonprofits working to assess, restore, recover, and monitor the state’s vital aquatic resources. As of 2022, efforts have included more than 600 fish surveys, over 5,000 stream crossing assessments, five large dam removals, many small fish barrier removals, and implementation of numerous streamside projects that reduce stream sedimentation. As a result, nineteen species of mussels and snails have been reintroduced in sixteen rivers, five crayfish species have been precluded from listing under the Endangered Species Act, and one snail species has been downlisted. As ARSN partners and interested stakeholders work to ensure that restoration and recovery efforts remain successful, the ability to share the ARSN success story with others through outlets such as social media have gained tremendous traction in the last five years. The latest attempt to communicate the ARSN story is a promotional video funded by the United States Fish and Wildlife Service and produced by the Geological Survey of Alabama and Hunter Nichols Productions, now available on YouTube. This presentation will feature a viewing of the video and discuss its effectiveness as an aquatic conservation communication tool.

Abstract #: 044

Student

Title: Guidance for Using Flocculants on Construction Sites

Presenter: Jannell Clampitt

Organization: Auburn University

Session: Stormwater 1

Sediment-laden runoff is a major contributor to surface water degradation. Suspended sediment remains in water for extended periods of time, where it can block sunlight and cause hypoxic conditions, resulting in a variety of other adverse environmental effects. Construction activities are a major driver of sediment discharge into U.S. waterbodies. Flocculants are commonly employed in wastewater treatment, and their use on construction sites to aid in stormwater management is gaining popularity. However, little to no guidance currently exists on best methods to deploy flocculants on active construction sites. Furthermore, there is currently no straightforward, dependable, and simple method for monitoring the actual dosing concentration when it is diluted with water. This study examines how the concentrations of anionic polyacrylamide (PAM) flocculant affect the settling velocity of soil over a range of pH values and temperatures. For estimating the flocculant concentration projection over time, residual flocculant concentrations from field experiments were predicted using a multiple linear regression equation. This research provides contractors with guidance on how to best determine flocculant concentrations in dosed stormwater, which is critical to ensure proper application without overdosing.

Abstract #: 045

Title: Status of the Alabama Dam Safety Program

Presenter: John Newton

Organization: TTL, Inc.

Session: Infrastructure

Alabama is the only state without a dam safety program even though there are around 2,300 dams in our state. The Alabama legislature has funded a dam safety study which is currently in progress. Dam safety legislation was introduced in the 2023 legislative session so progress is being made. Some dam owners have an adequate dam monitoring program that allows them to assess the condition of the dam and to identify appropriate rehabilitation strategies that may be needed improve the integrity of the dam. Other dam owners have done very little to inspect and assess the dam integrity. All dam owners need to develop and implement a comprehensive dam safety program that encompasses all the elements that are found in consensus approaches - don't wait on the state to pass dam safety legislation and promulgate regulations. A risk-informed decision making (RIDM) approach should be considered as a key component of any Dam Safety Program. RIDM uses the likelihood of loading, dam fragility, and consequences of failure to estimate risk. Risk, as related to dam safety, is traditionally defined as the likelihood (probability) of dam failure times its consequences in lives lost, economic damages, and infrastructure and environmental impacts; however, risk can also inform alternative selection, asset management, maintenance, capital improvements, life-cycle costs, divestiture, and other management and dam safety decisions. At minimum, RIDM will be used to determine whether identified risks exceed generally accepted safe levels. Risk estimates and analyses will be used along with standards-based analyses to decide whether risk-reduction actions are warranted and whether dam safety investments are justified, and to assist management in setting priorities. This approach has many benefits, including an improved understanding of the safety of the dams, identification of dam safety vulnerabilities beyond those addressed by standards, cost-effective risk-reduction approaches, and support for authorizing expenditures, when warranted. RIDM adds significant insight and value beyond standards-based evaluations alone and is currently practiced and required by all U.S. federal dam-safety agencies.

This presentation discusses the status of the Alabama Dam Safety program and the benefits of the RIDM process.

Abstract #: 046

Title: Managing forestlands for increased water yields: economic and ecological tradeoffs

Presenter: Steven Brantley

Organization: Jones Center at Ichauway

Session: Restoration 1

In the southeastern United States, water supplies are being strained by rapid population growth, increasing development, and heavy consumption for agricultural irrigation, especially during droughts. Restoring upland forests to low-density, fire-maintained longleaf pine savannas decreases evapotranspiration, improving streamflows for downstream ecosystems while reversing regional losses in biodiversity and providing other ecosystem services. But longleaf restoration comes at significant financial cost. Our goal was to assess the cost of water-centric forest management using a combination of hydrologic and economic models at both stand and watershed scales. First, we compared the potential stand-level water yield of loblolly and longleaf pine managed for income and/or restoration with loblolly income serving as the reference. We quantified cost differences among these alternate forest management regimes with and without cost-share, by calculating AEV or annual equivalency value. Second, we examined tradeoffs between economic returns and hydrologic resilience during drought in a HUC-8 watershed in southwestern Georgia. We assessed the impact of various forest management scenarios on low flow conditions (i.e. 50 cfs), and optimized land cover at the watershed-scale to achieve flow increase objectives while minimizing annual costs across the landscape. Longleaf pine restoration showed the highest water yield per acre at 86% over reference production scenarios. Low density management of existing loblolly pine plantations improved water yields by 55%, and offered a more cost-efficient alternative. Current federal conservation incentives aimed at restoring habitat on private lands increased economic returns for longleaf, but were insufficient to match reference forest income levels by \$19–\$60 acre⁻¹ yr⁻¹. The cost of water from longleaf pine restoration was also higher at \$5.72 Kgal⁻¹ compared to \$3.94 for loblolly pine restoration, reflecting a 31% difference in costs to reach the same increase in flow. At the watershed scale, we found similar results, with longleaf restoration scenarios having the highest potential flow increase of 6.5 cfs, or 13%, during low flow conditions. However, that increase came at substantial annual cost compared to alternative scenarios such as low-density management of existing loblolly pine stands. Our work supports the creation of forest-to-water markets in targeted watersheds where low flows threaten aquatic habitat and land use offers opportunities for forest restoration, but also highlights economic tradeoffs and potential financial barriers of managing forests for water. In the future, the emerging ecosystem service markets in the southeast may steer decisions about potentially competing values of carbon storage, water yield, and native habitat restoration.

Abstract #: 047

Title: Metal bioavailability and toxicity to aquatic organisms: implications for risk assessment and development of relevant environmental quality criteria

Presenter: Tham Hoang

Organization: Auburn University

Session: Water Quality 1

In the aquatic environment, heavy metals interact with inorganic and organic components and form different metal species. Among the metal species, free metal has been believed to be the most bioavailable and toxic to living organisms. Water quality characteristics, such as hardness, pH, alkalinity, and dissolved organic carbon have been found to influence metal speciation and bioavailability and toxicity to aquatic organisms. The relative influence of water quality characteristics on metal toxicity is dependent on metal, water quality characteristics, and species of organisms. Dissolved organic carbon has been reported to have a strong influence on metal toxicity. Therefore, environmental risk assessment and development of water quality criteria for metals should consider the influence of water quality characteristics on metal toxicity. Among the toxic metals, copper toxicity has been studied extensively that yielded the consideration of including quality characteristics in setting environmental quality criteria. For other metals, environmental quality criteria were based on hardness only. This presentation summarizes the results of over 15 years of research on the influence of water quality characteristics on metal bioavailability and toxicity to standard and nonstandard organisms in both freshwater and marine environments. Results have implications for ecological risk assessment and development of relevant environmental quality criteria for protection of aquatic life to support environmental resilience and sustainability.

Abstract #: 048

Title: Environmental toxicology-from fundamentals to applied science: case studies with heavy metals and insecticides

Presenter: Tham Hoang

Organization: Auburn University

Session: Lightning Talk - Research

Environmental toxicology is an interdisciplinary science that studies the effect of contaminants in the natural environment. With a broad study scope, environmental toxicology looks at the effect of contaminants at molecular and ecosystem levels. The molecular level study looks at the cellular, biochemical, and molecular mechanisms by which a chemical produces toxic effects in an organism. The ecosystem level study evaluates potential risks and effects of contaminants on the structure and function of ecological systems. The broad scope of environmental toxicology requires a multidisciplinary approach of a variety of specialists. These specialists interact with a variety of other people's decisions and policy makers, the public, educators, and other individuals in making decisions about the management of ecological systems. This breadth of scope of environmental toxicology and its application as a management tool make the field both a basic and an applied field of study. One of the subjects of this presentation is to address the bioavailability and toxicity of heavy metals and insecticides in the aquatic and terrestrial ecosystems, typically discuss the influence of water quality characteristics on metal toxicity to fish and invertebrate organisms and the toxicity of mosquito control insecticides to larvae (caterpillar) and adult butterflies via different exposure routes. The second subject is to present the application of environmental toxicology data to ecological risk assessment in support of development of environmental quality guidelines and management.

Abstract #: 049

Title: **Recovery and Research Summary for Rare Freshwater Mollusks in Alabama.**

Presenter: Paul Johnson

Organization: Alabama Aquatic Biodiversity Center / AL Dept. of Conservation
Natural Resources

Session: Restoration 2

In 2005 the Alabama Aquatic Biodiversity Center (AABC) was created by the Alabama Department of Conservation and Natural Resources (ADCNR) to initiate recovery efforts for Alabama's rarest freshwater mollusks. With 187 species of freshwater mussels, 202 freshwater snails, 100 crayfishes and 309 freshwater fishes, Alabama river basins harbor the most diverse freshwater species assemblage on the planet. Currently, 103 species of freshwater riverine species are listed by the US Fish and Wildlife Service (USFWS), but an additional 30 species are petitioned for listing. The primary mission of the AABC is to establish new populations of rare species, improving their conservation status. These conservation efforts in turn promote watershed habitat and water quality improvement efforts statewide, through the Alabama River and Streams Project. The AABC also coordinates recovery efforts with other state and federal agencies. The programs address multiple regulatory issues, endangered species act, clean water act simultaneously, improving water resources statewide. To date the program has created 8 new populations of listed and rare freshwater mollusks. In addition to culture and reintroduction efforts with rare species, AABC also assists universities and other partners with various research efforts. AABC recovery activities are generally limited in high priority watersheds where habitat recovery efforts are currently ongoing.

Abstract #: 051

Title: Fostering Resilience through Community Engagement: The Northwest Florida Military Installation Resilience Review

Presenter: Tanya Gallagher

Organization: Jacobs

Session: Outreach, Extension & Partnerships

Communities everywhere face the daunting task of designing and implementing policies, programs, and systems that help local communities cope with an array of threats ranging from terrorist attacks to natural disasters. This task is often compounded by associated problems such as aged, overburdened, and complex critical infrastructure systems. A key component of building resilient communities is communication, whereby mutual understanding, fostered by two-way communication, delivers both needed resources to communities, and intelligence regarding community needs to relevant agencies. The Emerald Coast Regional Council and Jacobs are currently working on the Northwest Florida Military Installation Resilience Review (MIRR) project which seeks to develop a framework for ongoing collaboration to support resilience for the Emerald Coast's military installations and surrounding communities. The Northwest Florida MIRR spans seven counties and six key installations, including Naval Air Pensacola, Naval Air Station Whiting Field, Eglin Air Force Base, Hurlburt Field, Naval Air Station Panama City, and Tyndall Air Force Base. The purpose of the MIRR is to identify the risks, hazards, and vulnerabilities of concern related to the ability of the military to carry out its missions on the installation that could be mitigated through investments and solutions outside the fence line in the community. The project reviews planning horizons of 2040 and 2070 for projections and forecasted vulnerabilities and shocks in addition to everyday stresses the installation faces. Northwest Florida is home to some of the nation's most significant military facilities, all of which rely on transportation, electricity, stormwater, and other infrastructure managed by local governments or utilities. The Gulf Coast is subject to many potential threats to military readiness. These include, among others, flooding, wildfire, extreme heat events, and increased frequency and severity of storms. The Department of Defense – Office of Local Community Cooperation and the Florida Defense Support Task Force are funding the MIRR project to support and deepen the uniquely close relationship among the military installations and communities of the Emerald Coast. Jacobs has partnered with Pharos Mission Critical, APTIM, and FSU/FAMU's Resilient Infrastructure and Disaster Response Center to facilitate community workshops and build partnerships among the region's stakeholders. This project can act as an example for other regions on how to increase collaboration within communities to ensure that commonly used infrastructure is dependable, even in extreme weather events.

Abstract #: 052

Student

Title: Understanding Nitrogen Dynamics from Agricultural Watershed in Alabama

Presenter: Arpita Sharma

Organization: Auburn University

Session: Poster Session

Water quality impairments in surface water caused by nitrogen losses from agricultural lands persist at small and large scales. The intensively managed row crops production, along with the rainfall patterns of Alabama, are the main culprits of the downstream nitrogen exports from agricultural fields. According to the USDA, fertilizers constitute around 35% of farmers operating costs for cereals. Significant concerns arise from the low recovery of applied N fertilizer due to the N losses from nitrate-nitrogen (NO₃ N) leaching, ammonia (NH₃) volatilization, surface runoff, and denitrification. Past research findings show that leaching and surface runoff are significant losses associated with this fertilizer. The current management practices lead to various environmental as well as monetary implications. Estimating nutrient budgets is one of the most trusted ways to assess potential nutrient losses from agricultural systems (Watson and Atkinson, 1999). The edge-of-field (EOF) experiment was initiated to understand nutrient balances in 2021. The study aims to quantify inputs and outflows of nitrogen from Agri fields. A farmer's field (10 acres) was selected on a farm in South Alabama for this study. The seasonal nitrogen application, recovery, and losses were quantified. It was observed that during 2021 (Peanut), 100% of the applied N was recovered, whereas, during Corn, 49% of applied N was recovered. It was observed that approx. 80-82 kg/ha N is carried over to the next season every year during the experiment (2021-2023), and 45 % of applied N is lost during the rainy season (Nov-March). The significant loss pathway during cropping season is leaching, followed by volatilization and Surface runoff during the fallow period (November- March). Nitrogen is an indispensable source and is embedded deep in modern agriculture systems. Harvesting high yields with excess N application is a short-lived phenomenon, and N-driven agriculture systems are not sustainable due to associated environmental consequences. The trade-off between food availability and N pollution can be attenuated by understanding Nitrogen balances and finding modern and integrative approaches to manage this nutrient better.

Abstract #: 053

Student

Title: Developing a geospatial model to identify private well contamination risk in Alabama.

Presenter: Sk Nafiz Rahaman

Organization: Auburn University

Session: Well Water

Contamination of groundwater wells continues to be a problem in the United States. Nitrate, pathogenic bacteria, viruses, and parasites are major contaminants associated with health problems including gastrointestinal illnesses, skin infections, and conjunctivitis. Installing treatment systems, replacing wells, or buying bottled water for drinking purposes can be costly, and because private wells are not regulated by federal, state, or local governments, the burden of contaminant testing, and remediation falls on the well owner. As a result, recent research has considered a mix of demographic, environmental, and geographical attributes that may contribute to contaminant exposure due to private well reliance. Previous research findings indicate that low-income and vulnerable communities have a higher susceptibility to well-water contamination. This is largely attributed to a dearth of knowledge concerning effective well management strategies, coupled with financial constraints that hinder the acquisition of appropriate water treatment technologies. Furthermore, the risk of contamination is heightened by climate-induced hazards like flooding. Though many studies have considered the social and environmental well contaminant factors separately, few have attempted to integrate both into a single model to estimate private well water contamination risk. In this project, we bring together measures of socioeconomic vulnerability and environmental risk factors to develop a comprehensive geospatial analysis of private well contamination risk. A series of geostatistical and clustering techniques are combined to estimate contamination risk to well-owner communities across Alabama. The results suggest that the coastal communities of Alabama, specifically Mobile County and its surrounding areas, together with Tuskegee, carry the highest risk of well contamination for private well users. The results of this work may be used to inform mitigation strategies such as informational workshops and targeted well-sampling campaigns.

Abstract #: 054

Title: **Assessing the Vulnerability of Private Wells to Microbial Contamination Following Flooding**

Presenter: Leigh Terry

Organization: The University of Alabama

Session: Well Water

Private well owners in Alabama, numbering approximately 80,000 individuals, bear sole responsibility for ensuring the quality of their water supply. While the Environmental Protection Agency (EPA), state governments, and Extension programs provide guidance on well treatment and testing, the onus lies on owners to monitor and maintain their private systems. Although groundwater is generally low in contaminants, flooding poses a significant threat to well water quality and human health. Floodwaters can infiltrate wells for extended periods, potentially exposing households to *Escherichia coli*, nitrates, fecal coliforms, and other toxic substances. Here, we begin to quantify the impact of flooding on well water users across the Blackbelt region of Alabama. We do this by (i) using a case-study approach to identify microbial contamination in shallow groundwater wells, (ii) using geospatial modeling to characterize flooding risk across the blackbelt region, and (iii) the development of an affordable water quality testing kit community members can use to characterize microbial well water quality after flooding. This work will contribute to identifying areas at high risk of well contamination, as well as educating and equipping well owners to reduce their exposure to microbial contaminants. By developing a comprehensive flood-induced contamination risk assessment model and providing accessible water quality testing resources, this research will support the protection of private wells and the well-being of communities in the Black Belt region of Alabama. This presentation will give an overview of the project and two student posters presentations will go into further detail of the flood mapping and microbial source tracking (two student poster abstracts submitted separately).

Abstract #: 055

Title: Synthesizing a Decade of Watershed Plan Development and Implementation in Coastal Alabama

Presenter: Christian Miller

Organization: Mobile Bay National Estuary Program

Session: Water Quality 2

In 2013, the Mobile Bay National Estuary Program (MBNEP) initiated a watershed-based approach to guide coastal ecosystem restoration and protection measures. The MBNEP's five-year Ecosystem Restoration and Protection strategy began this novel approach by prescribing the development of watershed management plans (WMPs) to ensure that restoration projects were based on the best available science and fit into a comprehensive management program. A watershed approach differs from traditional planning, where geopolitical boundaries often limit solutions. Conversely, a WMP targets areas, independent of political boundaries, which drain to common receiving waters. A decade later, WMPs have been completed, or are in process, for 19 watershed complexes comprising 41 intertidal HUC 12 watersheds across Mobile and Baldwin counties. These WMPs, through an extensive public engagement process, have identified critical issues across coastal Alabama, prioritized actions to address them, and defined strategies for long-term implementation and watershed-scale monitoring efforts. These plans have been integral to setting the stage for ongoing coastal restoration efforts, with over \$350 million directed to projects identified in a WMP. To aid in the assessment of the 2018-2023 MBNEP Comprehensive Conservation and Management Plan (CCMP), and in support of the MBNEP's upcoming CCMP development process, the MBNEP undertook an analysis of the status of watershed plan findings across the Alabama coast. This synthesis reviewed all WMPs completed or currently under development and evaluated the following components:

- Key Citizen Concerns
- Key Watershed Assets /Characterization
- Key Watershed Issues/Conditions
- Top restoration project recommendations and status
- Top policy recommendations and status
- Top outreach recommendations and status
- Discussion of common themes across watersheds
- Recommendations for consideration in developing strategies for next CCMP

This WMP assessment is a critical component in developing the goals and objectives that will drive the new strategies in the upcoming CCMP, and for protecting what is most important to people living along Alabama's coast; access to water and natural areas, sustainable beaches and shorelines, abundant populations of fish and wildlife, celebration of heritage and culture, environmental health and resilience, and water that is fishable, drinkable, and swimmable.

Abstract #: 057

Title: Research Update for the Auburn University - Stormwater Research Facility

Presenter: Wes Donald

Organization: Auburn University

Session: Stormwater 1

This presentation will provide an overview of topics and some results related to research at the Auburn University - Stormwater Research Facility. This facility is a 10 acre research facility located in Opelika, AL as part of the Department of Civil and Environmental Engineering at Auburn University. The goal of this facility is to provide the industry with the ability to scientifically analyze products and practices related to construction and post-construction erosion, sediment, and stormwater controls. These assessments may be through research and development or product testing from sponsoring agencies or private companies/individuals as well as training and outreach that is based upon research and testing results. This has provided the AU-SRF over 10 years worth of research and product testing that has helped change the way Alabama and other states/regions approach controlling sediment, erosion, and stormwater on their construction sites and beyond. The research projects to be included in this presentation overview will be from sponsored studies from the Alabama, Nebraska, and Iowa Departments of Transportation. Research topics could include: 1) sediment basin performance based upon different basin setups, 2) flocculant implementation and effluent residual findings, 3) simulated rainfall research, 4) sediment barrier performance testing, 5) the use of Unmanned Aerial Vehicles (UAVs or drones) for vegetative establishment determination on construction sites, and 6) optimizing infiltration swales to minimize stormwater runoff. A brief overview of the research topics will be discussed, proposed outcomes will be provided, and available research results will be reviewed. Attendees should come away with a better understanding of the capabilities of the AU - SRF, performance results of different practices used to manage erosion, sediment and stormwater, and be aware of project goals for future works.

Abstract #: 058

Title: Alabama Drought Reach Program

Presenter: Brienne Minton

Organization: Auburn University Water Resources Center

Session: Lightning Talk - Outreach

The Auburn University Water Resources Center (AUWRC) is excited to announce a new program, Alabama Drought Reach (ADR), which aims to improve drought communications and agricultural impact monitoring from drought in Alabama. ADR is a collaborative partnership between the AUWRC and the Office of the State Climatologist with support from the Alabama Cooperative Extension System (ACES), and the Alabama Agricultural Experiment Station (AAES). Alabama, at any given time, is only two weeks away from experiencing a drought. Some of these occurrences include flash droughts, which are rapid onsets of drought conditions during drier than normal periods. Flash droughts are pervasive in the Southeast due to the region's warm temperatures, evapotranspiration rates, and low soil moisture that creates a "perfect" combination for sudden drought events and thereby rapid decline in agriculture, forest, and private land health. The ADR program aims to better document drought's agricultural impacts in Alabama by developing a systematic approach to drought impact monitoring, conducting training throughout the state, increasing drought impact literacy among Alabama farmers and the general public, and providing timely agricultural impact data to the State Climatologist. The new ADR Coordinator and Extension Drought Outreach Specialist, Brienne Minton, has spent the summer cultivating a relationship between the ACES Agents and the State Climatologist Offices, developing a workflow for the ADR drought impact tool, and preparing training materials for ACES personnel starting in February 2024. Ultimately, this program will build the capacity of ACES to prepare for and communicate drought impacts by filling drought impact information gaps, increasing information transfer amongst relevant state and federal agencies, and expanding drought knowledge to Alabama producers, landowners, and homeowners.

Abstract #: 059

Student

Title: Characterizing the Influence of Rainfall on Groundwater Microbial Indicator Organisms and Sources of Contamination

Presenter: Jaylin Jones

Organization: Miles College

Session: Poster Session

As a primary freshwater resource, groundwater plays a crucial role to secure drinking water. Within the Black Belt Region of Alabama, groundwater serves as the source of most residents' water, either from private wells or as the source for distribution systems. However, wells and groundwater sources can be potentially contaminated by fecal coliform bacteria traveling with infiltrating water during heavy rainfall and flooding events. Furthermore, fecal coliform bacteria can survive for extended periods in the groundwater, maintaining the risk of waterborne diseases and impacting the overall quality of the water supply. Therefore, understanding the impact of rainfall on microbial contamination within groundwater sources will contribute toward best management practices to safeguard the health and safety of drinking water for Black Belt residents. This project uses tap and groundwater samples from monitoring wells within the University of Alabama Tanglewood Biological Station located in Hale County, AL collected pre- and post-rainfall events. Using monitoring wells as the probable source of microbial contamination for tap water samples, the objective of this study is i) to conduct culture-based enumeration screens for total and fecal coliform bacteria and ii) to determine the probable source of fecal indicator microorganisms in tap water samples using microbial source tracking (MST) and sequencing methods. This project will serve as an opportunity to make water-quality-centered environmental literacy a focal point in undergraduate research training experiences at Miles College, in addition to providing key insights into non-point sources contributing to the measured total maximum daily load (TMDL) and environmental drivers which dictate their prevalence in groundwater.

Abstract #: 060

Student

Title: Understanding the effect of climate and land use on sedimentation rates in geographically isolated wetlands with the Modified Universal Soil Loss Equation (MUSLE) supported by a GIS framework.

Presenter: Suranjana Chatterjee

Organization: Auburn University

Session: Poster Session

Geographically isolated wetlands (GIWs) are wetlands with no direct surface water connection to perennial rivers, streams, estuaries, or the ocean. They exchange materials and energy with surrounding ecosystems, contributing to landscape functions such as nutrient and sediment retention and biogeochemical transformations. This study investigated the spatial and temporal variability in the mediation of nutrients and sediment runoff received by GIWs in southwest Georgia - a karstic region with abundant GIWs and intensive irrigated row crop agriculture. Rain gauges, water level loggers, and sediment traps were installed in four wetlands, two in crop fields and two in forests, and water samples were collected monthly for water quality analysis. Sediment traps were collected monthly to find the dry mass of sediment deposited per unit time. Results showed substantial variation in sedimentation rate among the four wetlands, with the mean over a one-year period ranging from 9 to 190 mg cm⁻² of wetland area per month. To further investigate the mechanisms driving this variability, the Modified Universal Soil Loss Equation (MUSLE) was used to model sediment yield from each wetland catchment. MUSLE is a simple model applied to individual storm events using runoff volume, peak flow rate, soil erodibility factor, slope length and gradient factor, cover management factor, and erosion control practice factor as input variables to find sediment yield. We predicted runoff volume and peak runoff from 15-minute 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. We determined the slope length and gradient factor from a USGS 10-m Digital Elevation Model using the ArcHydro extension for ArcGIS Pro. Cover management and erosion control practice factors and site-specific curve numbers were determined from site assessments and previous literature. Model results for the first wetland showed sedimentation rates of 0.2-1.7 g cm⁻² yr⁻¹, which are very similar to values of 0.3-2.5 g cm⁻² yr⁻¹ from a separate study that used paleolimnological analysis and excess ²¹⁰Pb to establish sedimentation rate. These rates are similar to or higher than sediment storage by other types of water bodies in agricultural regions, indicating that GIWs store substantial amounts of sediment. Ongoing work will compare MUSLE model results across the four GIWs with contrasting characteristics to determine the interacting effects of climate, land cover, and wetland characteristics on sedimentation rate.

Abstract #: 061

Student

Title: Enhanced PFAS Removal Through Synergistic Biofiltration and Nanofiltration Treatment

Presenter: Sarah Ortbal

Organization: The University of Alabama

Session: Poster Session

Per- and polyfluoroalkyl substances (PFAS) are long-lasting chemicals that are slow to break down. They have widespread use and are found to have contaminated many aspects of the environment, including drinking water sources and human blood. They constitute a class of emerging contaminants that previous studies have shown to be carcinogenic and otherwise harmful to humans and animals. Thousands of PFASs exist and are found in many popular consumer products, including non-stick pans, carpets, and food packaging. The purpose of this study is to assess PFAS removal through the combined efforts of biological filtration (biofiltration) and nanofiltration treatments. Studies have shown that when nanofiltration is used as a treatment technology, organic matter, which is naturally occurring in all source waters, fouls the nanofiltration membrane. Through biodegradation of this organic matter, biofiltration is anticipated to improve nanofilter performance by preventing fouling. This study evaluates two source waters: a lake water spiked with PFAS and a synthetic laboratory water blend that includes organic matter and PFAS. The results of this bench-scale study will inform decisions made by utilities going forward as they face the challenge of PFAS contamination and removal to comply with EPA drinking water regulations and protect public health in the coming years.

Abstract #: 062

Title: Biochar-Enabled Platform Emerges as a Cost-Effective and Efficient Solution for PFAS Removal from Water

Presenter: Kevin Wang

Organization: Auburn University

Session: Water Quality 1

Per- and polyfluoroalkyl substances (PFAS) pollution in water is a national crisis. The UV/sulfite-based advanced reduction process (ARP) has the potential to effectively degrade per- and polyfluoroalkyl substances (PFAS) from water. However, the UV/sulfite-ARP system often operates at very high alkaline pH conditions (pH > 10), since the generated hydrated electrons (e_{aq}^-) responsible for PFAS degradation can be easily deactivated by protons (pH < 7). To overcome this challenge, we introduced cost-effective biochar to enhance PFAS sorption and degradation in the UV/sulfite-ARP system. We found that degradation and defluorination efficiencies of PFAS are highly dependent on solution pH, sulfite, and biochar concentrations. At high pH (8–11), adding biochar had a negligible impact on PFAS degradation and defluorination, since the degradation and defluorination efficiencies are always high enough to differentiate. However, significant enhancement of PFAS degradation and defluorination was observed at low pH (5–7), suggesting the critical role of biochar on PFAS destruction in UV/sulfite-ARP system. The biochar-enabled platform provides a more realistic way to degrade PFAS cost-effectively and efficiently in water under environmentally relevant pH conditions.

Abstract #: 063

Title: Deer River Coastal Marsh Restoration

Presenter: Jason Kudulis

Organization: Mobile Bay National Estuary Program

Session: Restoration 2

Located within the Deer River Watershed, the Deer River marsh system, one of the largest intact marsh complexes on the western shore of Mobile Bay, has long suffered from the impacts of winds, tides, wakes, and storm surge. Protecting this 275-acre tract of salt marsh is a priority recommendation of the Western Shore Watershed Management Plan. With funding from the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund and National Coastal Resilience Fund restoration activities are underway. Objectives of the project include:

- Stabilize and enhance up to 5,600 linear feet of shoreline.
- Reestablish hydrologic connectivity of the Middle Fork of Deer River, which is extremely shallow and impaired by siltation, limiting tidal exchange and circulation necessary to sustain the currently healthy marsh.
- Creating up to 30 acres of additional marsh.

In development since 2019, the project is currently being bid for construction. The marsh-protection concept consists of an offshore constructed marsh island (3,000' long by 300' wide) with a segmented breakwater on its outer face. The marsh island will make beneficial use of 200,000 cubic yards of dredge material from the Mobile Harbor Channel deepening and widening project. As part of the Deer River hydrology enhancement approximately 50,000 cubic yards of soft organic material will be dredged from the Middle Fork channel, improving tidal flow and aquatic habitat. Thin-layer placement of this material in the adjacent marsh will enhance resiliency to storms and sea-level rise for approximately 50 acres.

Abstract #: 064

Title: Reconnecting the Alabama River

Presenter: Jason Throneberry

Organization: The Nature Conservancy

Session: Restoration 2

The Mobile River Basin drains more than 32,000 square miles in Alabama, equating to approximately 63% of the total land area. The Tombigbee and Alabama Rivers converge to form the Mobile River about 50 miles northeast of Mobile. The Alabama River is one of the most biodiverse ecosystems in the Southeastern United States. Many species that are supported by these rich waters are migratory, either from the Gulf of Mexico upstream into the Alabama River and its tributaries or locally migrant within the river and tributaries. The Cahaba River boasts the most aquatic biodiversity in the Alabama River system and was the historic endpoint for many of these migratory fish species on their journeys to fulfill their life history requirements. Since construction of Claiborne and Millers Ferry locks and dams on the Lower Alabama River a historic and ecologically important migratory corridor was closed. For thousands of years aquatic organisms moved freely from the Gulf of Mexico into the Alabama River and into the Cahaba River. Several species relied on this corridor for completion of life history requirements (i.e., fish and freshwater mussels). Since dam construction federal, state, and private partners have tried to slow and mitigate species decline via conservation locking. Recent studies by Auburn University have yielded that these efforts have not been successful. In response to species decline and recognition of critical timelines for species survival, The Nature Conservancy of Alabama (TNC) entered into an agreement with the U.S. Army Corps of Engineers (USACE) to complete a Feasibility Study for fish passage at Claiborne and Millers Ferry Locks and Dams on the Alabama River. Implementation of fish passage at these structures would yield ecological reconnection of 236 miles of the Alabama River and 152 miles of the Cahaba River. With 388 miles of reconnected migratory corridor and given the monumental aquatic biodiversity of this system, this will be the most ecologically significant river restoration in North America. Twenty-six alternatives have been considered by the Project Development Team. Throughout the process these alternatives were narrowed down to 5 potential fish passage scenarios. Ecological and economic modeling was then completed to yield the Tentatively Selected Plan (TSP), which is a natural bypass channel at each dam structure. The TSP is the starting point for true alignment of the bypass channels and engineering for the implementation phase. Public comments have been collected and responded to by USACE. TNC and USACE are in the process of finalizing alignments for the bypass channels and working with private landowners to mitigate and/or lessen impacts to private property. The Feasibility Study will be completed November 2024 and the implementation phase will begin. TNC is working with government officials, state and federal partners, and private partners to align funding mechanisms for implementation.

Abstract #: 065

Title: A PFAS Special Session - Who, What, When, Where, and How?

Presenter: PFAS Focus Group Jeaniece Slater, Bryan Pate, Mike McGill, Lindsay Boone

Organization: West Morgan-East Lawrence Water & Sewer

Session: PFAS

This 80-minute PFAS Special Session will attempt to address all of your utility's concerns relating to the who, what, when, where, and how your utility is impacted by UCMR5 as well as current and proposed PFAS advisories and regulations. Each segment will be covered by an expert who has dedicated a minimum of 10 years of their career to PFAS-related issues in drinking water. Mike McGill will provide a breakdown of EPA's recent PFAS-related actions, including the proposed MCLs, "Hazard Index," and health advisories, and detail the public communication strategies and content to use with the press, public, elected officials, and community leaders to successfully manage the challenges the actions are creating. McGill will also show attendees how to develop and implement communication plans related to their UCMR 5 testing, which is work that virtually guarantees water providers will have to address the PFAS issue with their customers and key stakeholders. Jeaniece Slater will tell the story of how a Center for Disease Control Blood Serum Study coupled with EPA's 2016 Health Advisory for PFOA and PFOS impacted the West Morgan-East Lawrence Water & Sewer Authority in north Alabama, ultimately leading to a "Do Not Drink" order and the installation of a \$32 million reverse osmosis water treatment plant. Slater will discuss the consumer confidence issues, construction and operational issues, and real-world costs of operation of a 10.33 MGD RO system at a surface water treatment plant. Bryan Pate will provide a summary of the various treatment options available to remove PFAS from both ground water and surface water sources at various levels of PFAS concentrations and the operational concerns associated with each technology. Pate will share the results of multiple pilot studies and full-scale installations utilizing various technologies to inform attendees of the options available for consideration at their PFAS-impacted production facilities. Lindsay Boone will provide an update on current and future analytical methods for PFAS and Organic Fluorine and how the EPA's consistent updating of regulations and advisories in a wide array of sample matrices impacts drinking water, wastewater, and solid waste agencies. Boone will provide attendees with a high level understanding of the most up to date PFAS methods available to utilize at their project sites to aid in analytical decision making for cost efficiency and time management.

Abstract #: 066

Student

Title: Impacts of Soybean Expansion on Hydrological Characteristics and Nitrogen Use in the La Plata River Basin, South America

Presenter: Hua Yan

Organization: Auburn University

Session: Poster Session

Maintaining water quantity and reducing agricultural nitrogen pollution is crucial for promoting sustainable development in a basin where agriculture flourished. The La Plata River Basin (LPRB) in South America is one of the most productive agricultural regions in the world, covers an area of over 3 million square kilometers and supports a population of over 100 million people in transnational regions including Brazil, Argentina, Bolivia, Paraguay, and Uruguay. During the past two decades, the expansion of soybean cultivation has rapidly increased by 1.5 million in LPRB, driven by the growing demand for soybean cultivation as a primary source of protein and vegetable oil. However, this expansion has led to significant changes in land use, with potential implications for streamflow and water quality. The response of agricultural nitrogen uses and losses to soybean expansion at temporal and spatial scales have not been fully characterized, which is essential for controlling non-point source pollution in LPRB. Here, we present an ongoing effort to analyze the spatiotemporal variations of maximum, mean, and minimum annual streamflow and the response to changes in land use, tillage types, and crop intensities driven by soybean expansion in LPRB from 2001 to 2015. Additionally, we assessed the characteristics of fertilization application, atmospheric nitrogen deposition, nitrogen use efficiency, and nitrogen surplus in soybean areas at a fine spatiotemporal scale, using remote sensing data and spatial statistical techniques. Our study highlights the high-resolution hydrological response and agricultural nitrogen use and loss induced by increasing soybean expansion in LPRB, contributing to the trade-offs and synergies between agricultural production, ecosystem services, and water resources.

Abstract #: 067

Student

Title: Assessing Flood-Induced Contamination Risks in the Coosa River Basin: A Geospatial Approach

Presenter: AL ARTAT BIN ALI

Organization: Auburn University

Session: Poster Session

Water-related disasters, stemming from both natural and human-induced hazards, constitute some of the most pressing environmental threats in the present era, posing substantial challenges to human security and societal advancement. The Coosa River, a significant waterway traversing substantial regions of Alabama and the northwestern quadrant of Georgia, has been adversely impacted by pollutants from industrial and agricultural operations. Exposure to these pollutants has been associated with a range of detrimental health outcomes. Moreover, the Coosa River Basin is susceptible to flooding, presenting additional hazards to both human settlements and their properties within the surrounding region. Historical records reveal instances of severe rainfall and storm events that lead to breaches in the river's banks, and flooding of adjacent areas. Consequently, the inundation could potentially result in the dispersion of contaminants throughout the river's neighboring regions. This study leverages geospatial analyses to identify regions within the Coosa River Basin that are at risk of flooding and increased exposure to contamination threats due to their proximity to hazardous release facilities situated along the Coosa River. Mapping areas that are at risk of flooding and contamination can facilitate targeted efforts to reduce pollution and ensure public health safety. In addition, low-income communities, indigenous populations, and other marginalized groups often bear the brunt of pollution's adverse effects. Evaluating where and to what extent flooding and contaminant exposure impact the surrounding communities can support targeted mitigation and response strategies that decrease the potential for inequitable exposure to environmental hazards. Delineating these susceptible regions will ultimately help to reduce the social and environmental effects of pollution and protect the fragile ecosystems within the Coosa River.

Abstract #: 068

Student

Title: Enhancing Water Quality Analysis to Benefit Sustainable Irrigation in Alabama: Addressing Data Limitations with Modeling Approaches

Presenter: Alexandria Cox

Organization: UAH

Session: Lightning Talk - Research

Water quality assessment in Alabama, particularly concerning sustainable irrigation and ecosystem services, is limited by the lack of data statewide. Our collaborative work with Auburn University on the Watershed Planning for Irrigation Project is focused on developing watershed plans for priority areas in Alabama to encourage sustainable irrigation in existing agricultural areas. However, the lack of comprehensive data hinders the ability to obtain a holistic understanding of water quality dynamics and associated ecosystem services. Therefore, a key objective of our research is to identify the limitations and challenges associated with data scarcity in water quality analysis. Our approach to fill the data gaps include utilizing the SPARROW (SPATIally Referenced Regression On Watershed attributes) model as a valuable tool to identify, analyze, and compare baseline nitrogen concentrations in watersheds across irrigated and non-irrigated farms throughout the state. Also, we are actively exploring alternative modeling approaches such as SWAT (Soil & Water Assessment Tool) and TerrSet models in collaboration with other researchers to generate data on streamflow and water quality constituents. By incorporating these models, we aim to overcome the current obstacles and enhance our understanding of water quality in Alabama's ecosystems, paving the way for more effective and sustainable water management practices.

Abstract #: 069

Student

Title: Predicting and Equipping Private Well Owners at Risk of Microbial Contamination After Flooding Events

Presenter: Jourdan Kiaupa

Organization: The University of Alabama

Session: Poster Session

Across the Black Belt of Alabama, approximately 800,000 residents rely on private wells as the primary source of drinking water. Due to frequent extreme weather in this region, these wells are susceptible to floodwater contamination. While the Environmental Protection Agency (EPA) offers guidance on well treatment and testing, private well owners bear the sole responsibility of actively monitoring and maintaining their private system. The occurrence of flooding poses a significant threat to the quality of well water, potentially exposing households to various hazardous contaminants such as E. coli, fecal coliforms, nitrates and heavy metals; thereby endangering human health. The overarching goal of this research is to (i) develop a flood-induced contamination risk assessment model using spatial analysis and (ii) equip private well owners for the occurrence of flooding by developing a user-friendly water quality testing packet including educational resources concerning well water contamination. The development of a flood-induced contamination risk assessment model aims to serve as a critical resource tailored specifically for the underserved Black Belt region of Alabama. To explore the spatial extent of flood risk, we utilized a combination of flood extent data with modeled wells user locations. Modeled flood extent data was derived from state regulatory databases and modeled well user location was derived from national USGS well user database. Using samples collected from monitoring wells located on the University of Alabama campus in Tuscaloosa, Alabama and the University of Alabama Tanglewood Biological Station in Hale County, AL, sophisticated laboratory equipment will be utilized to test the efficacy of prefabricated, affordable water quality testing kits. By proactively identifying areas that are particularly vulnerable to floodwater contamination before an actual flooding event occurs, this assessment model will allow private well owners in the Black Belt region to enhance their preparedness and exercise greater control over the quality of their well water. The research seeks to provide individuals in the region with the necessary knowledge and tools to safeguard their water supply and bolster the overall resilience of the community in the face of potential flood-related challenges. This work will also be used to empower the next generation of scientists. In partnership with the Scientific Research and Education Network (SciREN), we will develop lesson plans suitable for students of various grade levels that will help garner interest in STEM topics at a young age and strengthen science literacy in Alabama classrooms. Working with SciREN will help generate a deeper understanding of groundwater well health and raise awareness of the risk of contamination after severe weather events.

Abstract #: 071

Title: Potential of flue gas desulfurization gypsum used as a litter amendment in broiler house to mitigate phosphorus loading during runoff events

Presenter: Debolina Chakraborty

Organization: Auburn University

Session: Agriculture & Irrigation

Long-term poultry litter (PL) applications on agricultural lands cause the soil phosphorus (P) buildup to levels exceeding the agronomic optimum ranges. The problem is more severe in watersheds where greater amount of PL is generated and applied to lands in close proximity to poultry houses to minimize transportation costs. Excess P from agricultural lands is susceptible to loss risk during runoff or leaching events and is one of the primary contributors for water quality deterioration. Use of soil amendments such as gypsum offers potential to reduce environmental P mobility. Gypsum can be found naturally occurring or synthetic gypsum such as flue gas desulfurization (FGD) gypsum. Air pollution regulation in the United States requires coal-burning electric power plants to adopt installation of FGD scrubbers to reduce SO₂ emissions. The scrubbing process has resulted in generation of more than 29 million MT of FGD gypsum as a byproduct. Since gypsum has the ability to absorb moisture and reduce soluble P concentrations, one potential reuse of this material is as bedding in poultry houses. The implementation of this practice can be instrumental in reducing the impacts of poultry waste on water pollution. Hence the objective of this research was to understand the effectiveness of FGD gypsum used as a litter amendment to reduce P loss risk after surface application. A broiler chicken pen trial was established in a broiler house comprising of seven treatments (built-up litter top-dressed with and without PLT or FGD gypsum; built-up litter + shavings (3:1 v/v) top-dressed with and without FGD gypsum; built-up litter + FGD gypsum (3:1 v/v) top-dressed with and without FGD gypsum). Sequential water extraction was conducted for seven cycles to determine the solubility of P between untreated and FGD gypsum treated litters. The filtrate of each extraction cycle was analyzed to determine water extractable total P referred as Water-Pt. There was a significant difference in P solubility between untreated and FGD gypsum treated PL. For the untreated litter, Water-Pt (expressed as a percent of litter total P) was significantly higher in the 1st extraction cycle compared to the FGD gypsum treated litters. After seven extraction cycles, FGD treated litters were able to reduce 20 to 30% P solubility compared to untreated litters. This indicates the effectiveness of FGD gypsum treated PL in reducing soluble P loss during successive rainfall events after it is surface applied.

Abstract #: 072

Title: Baldwin County Land Use Trends: Water Quality and Quantity Patterns

Presenter: Ann Arnold

Organization: Geological Survey of Alabama

Session: Water Monitoring

Population growth in coastal Alabama counties has the potential to impact water resources. Understanding water availability and water use patterns in light of this growth is critically important for sustainable resource governance. A mosaic of historical land use changes across Baldwin County from 1992 to 2016 has been developed utilizing the USGS Land Use - Land Cover (LULC) classification scheme and ArcGIS. Trends of rapid development can be readily identified in the mosaic. The cumulative land use change map (LUCM) for the 24-year period highlights the areas of greatest impact from development. Three regions of Baldwin County are now highly developed: 1) the coastal cities of Gulf Shores and Orange Beach, 2) the corridor along Highway 59 south of Interstate-10, and 3) the Eastern Shore eastward from Highway 98. The LULC changes reveal a pattern of land-use conversion from agriculture to suburban housing development in these areas. Concomitant with these changes is the installation of impervious surfaces that effectively inhibit shallow aquifer recharge in a county that is highly dependent on groundwater for public and domestic supply, irrigation, and industrial uses. Evaluation of hydrographs and stream gages using water-level elevations from groundwater wells and streams can provide information on long-term water availability trends. Coupling this information with water quality data from USGS, EPA, ADEM, GSA, and local water authorities provides an overview of surface water and shallow groundwater quality trends in these areas as they relate to land use changes, particularly in areas of recent construction, which may have a deleterious impact to water quality. The results from these analyses can provide valuable information for the county to maintain a sustainable source of fresh water to support future growth.

Abstract #: 073

Student

Title: Assessing the accuracy of at-home test kits for well water monitoring

Presenter: Sidney Millner

Organization: Auburn University

Session: Well Water

At-home test kits can serve as a first alert for citizens to assess their water quality. However, the accuracy can vary between assays and kits as does the citizen's interpretation of the results, which all impact citizens' perceptions of their water quality. Here, we investigated whether at-home test kits are able to serve as an accurate method for citizens to evaluate their well water quality when compared to laboratory analysis. To accomplish the study goals, we tested the water quality parameters in household groundwater of thirty-four private wells in Mobile and Baldwin counties in Alabama. Two sampling campaigns were performed in the Fall of 2022 (n=22) and the Spring of 2023 (n=30) and Kit-1 and Kit-2 were distributed, respectively. The well owners autonomously performed the pH, nitrate, and bacteria measurements using those test kits. Both pH and nitrate were dip-strip colorimetric assays where a color comparator chart was used to assign values; the bacterial test was a reagent colorimetric assay for presence/absence of total coliforms. We compared citizen reported results to laboratory measurements and evaluated the kit accuracy considering the reporting increments and detection limits of the assays. We found that accuracy of the kits varied between individual tests within the same kit, but also between kits. The accuracy of the pH test was 7% and 27% for Kit-1 and Kit-2, respectively. For Kit-1, the color comparator range was 6 to 10, and citizens overestimated the results if water pH < 6. When given a broader pH range of 2 to 12 in Kit-2, citizens underestimated pH, although the test was generally more accurate. Similarly, the nitrate assay increased in accuracy switching from Kit-1 (36%) to Kit-2 (86%). Increased accuracy for nitrate may be attributed to differences in the reporting increments on the color comparator chart between the kits. Kit-1 showed four increments on the comparator chart for values below the EPA MCL compared to Kit-2 that showed two increments. The bacterial assay was the same between Kit-1 and Kit 2, so here, we interpreted the accuracy of the aggregated dataset. The bacterial assay showed 85% accuracy, with the majority of the tests showing true negatives (no coliforms present in the kit and in the lab measurement). Importantly, we found a 12% false negatives (no coliforms present in the kit and positive lab measurement). False negative results could be related to lower detection limits in the laboratory tests (>1 MPN/ 100 ml) compared to the test kits. The detection limits of the kit bacterial tests is currently being explored. Critically, false negative results can create a false sense of security in the quality of their water. From a well user perspective, we found that the measurement range, the reporting increments, and the accuracy are relevant to the suitability of the test kit. Reliable and accurate test kits can become a tool for citizens to effectively monitor their own water quality.

Abstract #: 074

Title: Demonstrating Uplift in Ecological Function for Alabama's Restoration

Projects using Natural Capital Accounting

Presenter: Eldon Blancher

Organization: Moffatt & Nichol

Session: Restoration 1

While restoration ecologists have used multiple measures for determining the success of restoration projects, it is important that the measures used represent an accurate accounting of environmental capital stocks and flows produced by nature based restoration projects, and provide meaningful accounts of natural capital stocks. Natural capital stocks are the durable physical or biological elements of nature that persist through time to contribute to current or future economic production. Since the White House Office of Science and Technology introduced a national strategy to develop statistics for environmental decision making and proposed creating a system of natural capital accounting and associated environmental-economic statistics, compilation of natural capital data will likely become a standardized requirement for federally funded projects in the future. We have demonstrated natural capital increases for several nature-based environmental restoration projects in Alabama using natural capital accounting techniques. For example, for a living shoreline project in South Mobile County, Alabama we have demonstrated a 4:1 increase in habitat benefits, in terms of marsh and food chain production, and 3:1 BCR on a dollar:dollar basis. This accounting considers both the value of the environmental assets (stocks) of the various ecosystem elements (primary, secondary and tertiary producers standing crop) as well as an estimate of the annual productivity the habitats generate (ecosystem services or flows). We illustrate the increase in natural capital for several current projects including living shorelines, and for a marsh creation nature based restoration projects. These projects show significant increases in net-natural capital benefits and illustrate the methods used to provide meaningful quantitative measures, which can be used to document the natural capital values of nature based restoration projects.

Abstract #: 075

Title: From flood particles to flood plans: using extreme paleoflood data to revise flood frequency analyses used in TVA river infrastructure safety assessments

Presenter: Lisa Davis

Organization: The University of Alabama

Session: Drought & Climate 1

Extreme floods are underrepresented in instrumented flow records. Consequently, flood frequency model estimates of extreme floods contain large uncertainty. Quantitative paleoflood hydrologic analyses can increase the number of extreme flood discharges applied in flood frequency analyses. These data come from sediment, organics, or other physical evidence left by past floods that have been analyzed with statistical, hydraulic, and sedimentological analyses to allow discharge reconstruction. Here we develop and apply an extreme paleoflood chronology for a 1 km segment of the Tennessee River and use it to improve flood frequency model estimates of large, rare floods. We test the “extremeness” of the historic-flood-of-record given that historic floods are traditionally assumed in flood frequency models to represent rare, large floods. On the middle Tennessee River, the 1867-flood-of-record is a design flow for the dams built and managed by the Tennessee Valley Authority, including Guntersville Dam, which is located within the 1 km study segment. The extreme paleoflood chronology consisted of 5 paleodischarges, with three exceeding the estimated discharge for the 1867-flood-of-record. Placed within the context of the extreme paleoflood chronology, the historic 1867 CE was the largest flood to occur within the last 2,000 years and coincided with the conclusion of a cooler, wetter climate phase. The three highest magnitude extreme floods, however, occurred during a peak in Northern Hemisphere temperatures 6,000 to 5,000 years ago. Different iterations of a Bayesian flood frequency model showed that removing the three most extreme paleofloods resulted in a rarer annual exceedance probability for the 1867 CE flood-of-record, changing it from an .002 AEP (500-year event) to an 0.0007 AEP (1300-year event) and underestimation of annual exceedance probabilities for design flows commonly used in river management and infrastructure design, including the 100-yr, 500-yr, 1,000-yr, and 10,000-yr floods. These results suggest that flood frequency models in which historic-floods-of-record are the most extreme floods analyzed may be underestimating key design flows. These findings have significant implications for regulated rivers worldwide, which now includes most large rivers. Including the previously unknown extreme paleofloods significantly altered the estimates of the final flood frequency model. This finding makes a compelling case that flood frequency analyses should be revised for many rivers with dams and levees where precipitation is expected to intensify in the future.

Abstract #: 078

Student

Title: Optimization of Sediment Basin Configurations

Presenter: Megan Armstrong

Organization: Auburn University

Session: Stormwater 2

Highway construction projects typically involve the disturbance of existing on-site vegetation, leaving bare soil vulnerable to erosion from environmental factors such as rainfall and wind. Soil erosion caused by precipitation events is transported via stormwater runoff and is deposited into receiving waterways. To reduce downstream sedimentation in receiving waterbodies, stormwater regulations mandate on-site control of pollution produced by construction activities. These regulations require designing, installing, and maintaining erosion and sediment control (ESC) practices on construction sites. One of the more commonly used sediment control practices in Alabama are sediment basins. Sediment basins are temporary sediment control structures used to capture, detain, and remove sediment from stormwater runoff. While standardized sediment basin design guidance exists, further research is necessary to optimize designs and ensure that guidance is backed by engineering principles. This research focuses on understanding the performance of sediment basin designs in terms of their geometry and the effectiveness of various treatment elements. A performance-based testing methodology and apparatuses were developed in the Stormwater Lab at Auburn University to address this need. Three intermediate-scale sediment basins were constructed for this project, each with a trapezoidal cross-section configuration. A standard basin with a 2:1 length-to-width ratio and an in-channel basin with a 10:1 length-to-width ratio were constructed, each with a volume of 431 L (114 gal). A third basin was designed with a volume of 215 liters (57 gal); half the volume of the standard geometry. Intermediate-scale testing allowed a higher degree of control of sediment basin parameters and conditions to optimize settling conditions. Nine treatment methods were tested in the standard basin [2L:1W]. This included (1) an open basin without energy dissipators, (2) the addition of three coconut coir baffles, (3) increased flow path length using impervious barriers, (4) a single coconut coir baffle (5) the addition of a level spreader forebay (6) a check dam constructed in the inflow channel with a single coir baffle, (7) a level spreader forebay with a single coir baffle, (8) no energy dissipators and no skimmer, and (9) flocculant with a single coir baffle. This paper investigates the performance of the most feasible and effective installation (MFE-I) in the standard basin [2L:1W], then replicating the MFE-I within the in-channel and undersized basins. Results indicate that the undersized sediment basin was nearly as effective (73%) in capturing sediment than the standard geometry basin (87%) without the addition of flocculants. Research is ongoing and the next task is to identify the most efficient sediment basin geometry. This research aims to improve sediment basin efficiency by modifying small-scale basins and performing tests to improve geometric properties combined with addition

Abstract #: 079

Student

Title: Bankfull Channel Geometry Estimation over the Continental United States (CONUS)

Presenter: Reihaneh Zarrabi

Organization: The University of Alabama

Session: Poster Session

The river, a dynamic component of the earth's nature, can play a significant role in the lives of humans, flora, and fauna. The evolution of river geometry (such as width and depth) under different flow conditions can, in general, have a significant impact on how water and sediment are transported along the channel, which primarily causes flood events to occur, the river ecosystem to alter, and the water quality to change downstream. The research into estimating channel geometry started when Leopold and Maddock proposed a set of power-law equations to predict the hydraulic geometry attributes based on flow discharge (Leopold and Maddock, 1953). A similar methodology, which is known as Regional Hydraulic Geometry Curves, is proposed by Dunne and Leopold to estimate the hydraulics attributes based on drainage area (Dunne and Leopold, 1978) and this method is calibrated for the US with improved accuracy in 2017 (Blackburn-Lynch et al., 2017). Blackburn-Lynch et al. method, which currently is the main widely-used method in the US, is limited by insufficient dataset size and quality, spatial and temporal variability, and lack of consideration of catchment and reach characteristics. This research enhances a large dataset's quality by removing outlier and noisy observations that may have been reported incorrectly or from locations other than streams. Then, additional filtrations are added to extract a subset of a dataset that includes specific hydraulics geometry attributes for each site that most closely represents the bankfull condition. Afterward, the development of multi-regression models is then done on the extracted subset to overcome the limitations of the existing estimate models and identify the hydrological and catchment features that can influence the estimation of channel geometry at bankfull conditions. Having been created, the models are evaluated and validated. The derived models can be taken into account to estimate the bankfull hydraulics properties of channels over the Continental United States (CONUS), which may be used for generating flood inundation mapping that can be useful in terms of planning and mitigating flood risks.

Abstract #: 081

Student

Title: Reconstructing sediment transport rates using magnetic susceptibility analysis of floodplain sediments in the Ocoee River, Tennessee.

Presenter: Emma Butler

Organization: The University of Alabama

Session: Poster Session

Sediment cores extracted from floodplains are archives of past environmental changes. Here we use floodplain sediment cores extracted near the mouth of the Ocoee River (Tennessee) with the aim of determining fine sediment (< 2 mm diameter) transportation rates. Tennessee's Copper Basin is located in the headwaters of the Ocoee River. The Copper Basin (Ducktown and Copperhill, Tennessee), was a center of heavy metal smelting that operated from the 1840s until the 1980s, resulting in acidification and heavy metal contamination of soils and sediments within its proximity. We sampled a floodplain sediment core > 3 m in length. Sediment ages were determined using optically stimulated luminescence dating, radiocarbon dating, and archeological data. We measured peaks in heavy metal concentration to identify deposition of sediment originating from the Copper Basin; in effect, using the heavy metal contamination as a sediment tracer. Sediment ages and distance from the Copper Basin were used to determine sedimentation rates. Microsedimentological and statistical analyses were used to detect shifts in sedimentation patterns through time associated with watershed changes, such as the installation of dams and human settlement to provide more context for understanding sediment transportation rates. . These measurements were used to discern changes in sedimentation processes and patterns through time. This poster will present preliminary findings of this research.

Abstract #: 082

Student

Title: Investigating the Impacts of Inundation on Cambium Cell Growth in Bald Cypress

Presenter: Zachary Foley

Organization: The University of Alabama

Session: Poster Session

As anthropogenic climate change progresses, it is more important than ever to have detailed climate models of the southeast and understand how ecosystems will respond to changes in precipitation regimes. Currently, bald cypress (*Taxodium distichum*) tree rings are used to reconstruct streamflow but are restrained to an annual or in some cases seasonal resolution. Through the application of wood anatomical techniques, this study aims to lay the groundwork for a significant increase in the resolution of these models through investigating the relationship between streamflow, surface water inundation, and characteristics of newly formed cambium cells. More specifically, the goals of this study are to use a combination of traditional dendrochronology and novel wood anatomical techniques to: 1) quantify impact of surface inundation on cambium cell development in bald cypress trees, 2) explore drivers of "false ring" development in bald cypress trees, and 3) develop a long term record of streamflow for the Sipsey River in western Alabama. Compared to other rivers in Alabama, the Sipsey is relatively unaltered allowing for the investigation of anthropogenic and climatic effects on the hydrology of unobstructed southeastern rivers. Additionally, a USGS gauge with 94 years of streamflow data provides a large calibration window for the streamflow reconstruction. To begin to investigate relationships between inundation and cambium cell formation, we will collect cambium cell samples from five cypress trees over the course of one growing season. Then we will use advanced spectroscopy techniques to quantify cell growth metrics and structural characteristics. In addition to examining cell development, we aim to investigate variation in false ring formation between individuals using tree ring chronologies and historic flow records along the Sipsey River. Finally, we will use our updated understanding of bald cypress wood anatomy to develop a high-resolution flow reconstruction of the Sipsey River. Using our results, we aim to demonstrate how wood anatomical techniques can improve flow reconstructions and provide insight into how bald cypress may respond to future land use and climatic changes.

Abstract #: 083

Title: Generational Funding Opportunity for Water and Wastewater Infrastructure

Presenter: Eric Reidy

Organization: Alabama Department of Environmental Management

Session: Infrastructure

GENERATIONAL FUNDING OPPORTUNITY“NOW IS THE TIME TO FUND YOUR PROJECT”Speaker(s): Eric Reidy, P.E., Chief - State Revolving FundSPEAKER

ORGANIZATION: ADEM, P&S DIVISION, SRF SECTIONDate: TBDTime:

TBDRoom: TBDABSTRACT: The passage of the Bipartisan Infrastructure Law

(BIL) and the America Rescue Plan Act (ARPA) created an additional funding opportunity for large communities and Disadvantaged, Rural, Small, and Tribal communities in both the Clean Water and Drinking Water State Revolving Fund (CWSRF and DWSRF). The BIL program is a five (5) year program. The ARPA program is a two (2) year program. BIL is an additional appropriation with multiple tranches of funds available for eligible projects. In addition to increased funding for the DWSRF and CWSRF programs, BIL provides funding with a large portion in grant available for those projects which would address emerging contaminants (PFOA, PFAS, etc.) in both the drinking water and clean water programs and lead service line identification and removal for drinking water. The role of ADEM'S SRF Section is to assist communities in accessing these funds. We are there to guide a community as needed through the process to help them have a successful experience. This presentation is intended to help the listener understand the projects that will qualify, funding sources available, and how to go about qualifying for these funds. The goal of ADEM is to maximize these funds for the benefit of the citizens of Alabama and those most in need.

Abstract #: 084

Title: Impacts of Watershed Land Use and Land Cover Changes on Estuarine Hydrography: Case Studies of Wolf-Perdido Bay, Saint Andrew Bay, and Saint Joseph Bay

Presenter: Zhilong Liu

Organization: University of South Alabama; Dauphin Island Sea Lab

Session: Coastal Issues 2

Urbanization in the northern Gulf of Mexico region drives the conversion of forestlands into urban, agricultural, and pasture areas. The conversion or loss of forested areas in the watersheds can cause an increase in discharge and nutrient loading that drains into downstream estuaries. Yet the potential impacts of enhanced discharge and nutrient on estuarine physical and biogeochemical processes are not well characterized. Hence, by using integrated watershed models and ocean models, this study investigates the responses of estuarine processes, such as vertical stratification, transport, and mixing, to various levels of land use/land cover changes in the watershed of three typical estuaries: Wolf-Perdido Bay, Saint Andrew Bay, and Saint Joseph Bay in the northern Gulf coast. The results from this work will reveal the relevant importance of forest changes in watershed in relation to natural variability of downstream estuaries and improve our understanding and predictions of how the estuarine hydrography will evolve in the future.

Abstract #: 085

Student

Title: Meta-Analysis of Predictors of GHG Emissions from Wetlands

Presenter: Ana Flavia Brancalion Costa

Organization: Auburn University

Session: Drought & Climate 3

Wetlands can be optimal ecosystems for carbon sequestration, although they are also natural sources of greenhouse gas (GHG) emissions. The objective of this study is to identify and analyze environmental predictors of GHG emissions from wetlands. To this end, we conducted a meta-analysis of two open-source data sets. The primary focus was on the analysis of potential drivers of methane (CH₄) fluxes such as wetland type, biomes, management practices, and plant types, using a worldwide data set from Knox et al (2021), and the second focus was the prediction of CH₄ and carbon dioxide (CO₂) fluxes from a suite of environmental predictors (air and soil temperature, soil moisture, water depth, and flood conditions) using the data set obtained by Gutenberg et al. (2019). The data set by Knox et al. (2021) combines 23 observation sites of methane emissions from wetlands, measured using eddy covariance flux towers across the globe. To identify the potential drivers of methane emissions, we applied several clustering methods (such as hierarchical, k-means, fuzzy k-means, birch, and a backpropagation neural network for classification) to the data set. The results showed that the backpropagation neural network yielded the best results among all the clustering methods, which suggests that this method is suitable for identifying the drivers of methane emissions. The categories of the biome predictor (boreal, temperate, tropical, and sub-tropical) were slightly better clustered compared to the other categories of management regime (natural, managed, and restored) and wetland types (bog, marsh, drained, rice, fen, swamp). This suggests that the wetland biome might be a stronger predictor of methane emissions. The second data set (Gutenberg et al., 2019) included measurements from the Great Dismal Swamp, a forested wetland situated between Virginia and North Carolina. We applied the backpropagation function approximation neural network to this data set to predict methane and carbon dioxide emissions. 75% of the data was allocated to train the neural network and 15% to the test set. The normalized mean squared error (NMSE) for CH₄ flux prediction was 0.0028 for the training subset and 0.0008 for the test subset. Regarding CO₂ predictions, the NMSE was 0.0039 for the training subset and 0.0091 for the test subset. The results indicated that the neural network could accurately predict methane and carbon dioxide emissions from the forested wetland using the selected drivers. The findings from this study emphasize the importance of the understanding of the carbon emissions drivers from freshwater wetlands. Additionally, the results from both data sets highlight the usefulness of neural networks, such as backpropagation, as a valuable tool in studying carbon emissions. Overall, these methods are potentially applicable to other locations and can help outline the role of wetlands in the carbon cycle on a global scale.

Abstract #: 086

Student

Title: Detecting global declines of stoneflies at a local scale: measuring changes in stonefly diversity in a tributary of the Cahaba River of central Alabama.

Presenter: Gabriella Gentry

Organization: Jacksonville State University

Session: Poster Session

Projections of a 40 percent global decline in overall insect diversity are particularly concerning for stonefly (Plecoptera) diversity. Stoneflies are sensitive to the water pollution caused by land-use changes where forested watersheds are converted to industrial, agricultural, or urban landscapes and the runoff from these areas flows into creeks. Because the life cycles of these insects require them to be in the water for at least a year before emerging as adults, chronic exposure to pollutants, siltation, scouring, and other trends in impaired waterways can cause localized extinction events. Previously, ten genera in four families were found along the Cahaba. The headwaters of the Cahaba River start in a very urbanized area and become more rural as it flows an almost 200-mile journey away from Birmingham, AL. With increased development at the headwaters, we can expect a likely reduction in stonefly diversity as the river becomes more impaired. Utilizing land-use and land cover imagery of the Little Cahaba River from 2000-2018, we will observe how both increased development at the headwaters and shifts in land-use around the main stem affect stonefly diversity in the river. The Little Cahaba River, a major tributary of the Cahaba River with a high land-use gradient, was surveyed in 5 sites along the length of the creek from 1993-2018. A comparison of stonefly taxa at a local scale along the Little Cahaba River will show trends in diversity changes through time and highlight the importance of long-term monitoring for Alabama streams.

Abstract #: 087

Student

Title: **Scaling up: Can point scale calibration using NEON observations improve coupled carbon-water cycle in Community Land Model (CLM) at a regional scale?**

Presenter: Thomas Kavoo

Organization: Auburn University

Session: Modeling & Water Management 2

Carbon-water cycle interactions in climate models exhibit considerable uncertainty, impacting their accuracy in simulating key land surface processes. The Community Land Model version 5 (CLM5) has shown discrepancies, such as overestimating the leaf area index in the Southeast US and exhibiting a positive bias in response to elevated CO₂ concentration. Addressing these challenges necessitates the development of accurate models, achievable through parameter calibration and optimization, while also considering the computational demands associated with global-scale efforts. Fortunately, the NCAR-NEON simulation tool provides a unique opportunity for point-scale parameter calibration and optimization studies, leveraging computational efficiency and quality control observations from three National Ecological Observatory Network (NEON) sites in the Southeast US including Talladega National Forest, Oak ridge National Laboratory, and Ordway-Swisher Biological Station. The goal of the study is to constrain water cycle projection uncertainties in CLM5 through perturbed physics ensemble (PPE) experiments. A subset of 30 parameters affecting water-carbon cycle processes was identified and resampled using the Latin Hypercube technique generating 400 parameter sets. The simulation protocol involved point-scale simulations (200 years of spin-up run and four years of production run), parameter sensitivity analysis, and regional scale simulations. At the point scale, we performed a total of 244,800 years of simulation (3 sites × 400 parameter sets × 204 years) and such an exhaustive experiment is only feasible due to the availability of the NCAR-NEON Tool. Our results show that land surface model performance analysis at the point scale is limited by the spatial coverage of observations and surface heterogeneity. The CLM5 performance improved by 25% which is consistent with previous studies and demonstrates the potential of PPE approaches to improving water-carbon cycle predictions. The sensitivity analysis results show that photosynthetic, and hydrology parameters have the highest influence on water-carbon cycle processes. Besides, while point-scale simulations demonstrated significant improvements, up-scaling the calibrated parameters to the ecoregional level did not yield comparable enhancements. We attribute this result to the limitations of up-scaling, as the calibrated parameters depend on site-specific characteristics and may not adequately capture and represent vegetation dynamics. This study highlights the effectiveness of point-scale CLM5 simulations using NEON observations to improve our understanding of key land surface processes. By identifying influential parameters and their optimization potential, we demonstrate the value of perturbed physics ensemble experiments in developing more accurate models for water-carbon cycle processes. However, challenges in up-scaling from point scale to regional scale call for continued research in this area.

Abstract #: 088

Title: Assessing the predictive capability of National Water Model in the coastal and higher-order watersheds in Alabama

Presenter: Md Shahabul Alam

Organization: Alabama Water Institute, The University of Alabama

Session: Modeling & Water Management 1

The current operational model such as the NOAA's National Water Model (NWM) v2.1 uses simple Muskingum-Cunge routing method which is more suitable for the low-order headwater watersheds. So, the NWM with the simple routing method cannot account for some key hydraulic conditions such as flow hysteresis and backwater effects. Consequently, the NWM model may not perform accurately in the low-gradient rivers and coastal areas where backwater flooding occurs quite frequently. However, diffusive wave approximation of St. Venant equations is more suitable for higher-order streams/rivers and coastal areas. There is a routing algorithm called t-route allows users to select between the simple Muskingum-Cunge and computationally more intensive diffusive wave routing methods depending on the routing conditions. Before deploying t-route in the NWM, it would be valuable to evaluate how the NWM with the existing routing algorithm performs in coastal and higher-order streams/rivers in Alabama. A Python-based, user friendly, fast, and model agnostic streamflow evaluator tool was used to evaluate the performance of NWM. This tool can be used for any model that uses NHDPlus dataset including NWM. The tool was used to evaluate the performance of the NWM at the collocated USGS gauges and NWM reaches. This Python-based tool helped us to visualize the results and investigate the model performance interactively. Several watersheds were selected from diverse areas, such as coastal areas around Mobile Bay, urban areas around Birmingham and Montgomery, and suburban areas to the north of Birmingham. These selected locations were used to show how the NWM performs in diverse watersheds in Alabama. Overall, the NWM performs quite well in simulating streamflow for the rivers in Alabama. However, if we take a closer look, the model under- or overestimates the peaks in the coastal watersheds of Alabama although the performance metric, such as KGE might be quite high. As the model could not capture the peaks, it may be critical for large events like Hurricane Katrina or the 2014 flooding in Alabama. Out of four coastal watersheds in Alabama, the KGE is quite high (>0.79) for two watersheds, while KGE value is quite low for the remaining two watersheds. The NWM could not simulate the streamflow with high KGE values at the selected higher-order watersheds located near two urban areas and one suburban setting. These examples of NWM performance evaluation show that there is still room for improvement of the NWM performance in coastal and higher-order watersheds in Alabama. This study will help hydrological modeling group to focus at the watersheds/locations where NWM has difficulty in simulating streamflow accurately and push them to further investigate the causes of poor model performance.

Abstract #: 089

Student

Title: Does manure type and their application rate affect runoff, sediment and nutrient losses in a Conventional Tillage System?

Presenter: Chhabi Raj

Organization: Auburn University

Session: Poster Session

Organic manure improves the soil's physical, biological, and chemical properties as well as provides nutrients to crops. Manure differs in nutrient composition between animal species. Additionally, soil properties vary among types of tillage systems which in turn affect nutrients and sediment losses. The concentration of nutrients and sediments in runoff water is also influenced by the intensity of rainfall during a given day. We hypothesize that runoff volume, sediment, and nutrient concentrations of nitrogen (N) and phosphorus (P) in runoff water will differ between manure type and application rate on conventionally tilled soil during a rainfall event. Hence, an artificial rainfall simulation was conducted in a conventionally tilled soil to evaluate how manure types (poultry and swine), application rates (poultry litter: 1-, 2-, 3-, and 4-ton acre-1; swine manure: 5k, 10k, 15k, and 20k gallons acre-1) affect runoff volume, sediments, and various species of N and P during a one-inch rainfall event. Our secondary objective was to evaluate the short-term (1, 2, and 3 weeks after manure application) and long-term (2 months) effects of rainfall on nutrient and sediment losses. The soil was collected in pans (21×12×2.5, in3) from a conventionally tilled field in Town Creek, Alabama. These pans were placed under a rainfall simulator to simulate one acre-inch of rainfall. Runoff water samples were collected and analyzed for total suspended solids and IN, DRP, TP, PP, TDP, and TOP using the standard protocols. Runoff volume was only affected by the time of rainfall event and a maximum runoff of 18,731 gallons/a was observed on day 21. We also found that manure rate, manure type, time of rain event, and their interactions significantly affected sediment losses. Sediments lost in SM treatments were 200% more than in PL treatment. Manure type and application rate also significantly affected DRP, inorganic nitrogen, TDP, and TOP loads. The losses for IN and DRP were 2 and 10 times higher in PL treatments compared to the SM treatments with increasing application rates. Total dissolved phosphorus and TOP exhibited a similar pattern as the DRP. TP and PP were solely affected by the time of rainfall event and peaked at 2 lb/a on day 21. It was also found that rainfall event after day 21 led to a sharp decline in the runoff volume, sediments, and nutrients losses. Additionally, nutrients and sediment losses were dependent on the type and rate of manure application. SM (Swine manure), PL (Poultry litter), dissolved reactive phosphorus (DRP), inorganic nitrogen (NO₃-N + NH₄-N), TP (Total Phosphorous), PP (Particulate Phosphorous), TDP (Total Dissolved Phosphorous), TOP (Total Organic Phosphorous)

Abstract #: 090

Title: Computational Assessment of an Amine-Based Solvent Library for High-Salinity Brine Desalination

Presenter: Gabriel Duarte Barbosa

Organization: The University of Alabama

Session: Modeling & Water Management 2

Human population growth has increased the demand for freshwater. Simultaneously, improvements to high-salinity brine desalination technology are needed to treat wastewater from expanding industrial activities. Temperature-swing solvent extraction (TSSE), initially proposed in the 1960s for low-salinity brine desalination, has recently been found to be effective for processing high-salinity brines. Although there have been several individual investigations performed to test the TSSE performance of various amine-based solvents, the desired molecular properties of the best solvent candidates remain unknown. Using molecular simulation data and an unsupervised learning method, the molecular characteristics of 60 different amine-based solvents are analyzed and grouped into clusters based on their thermodynamic properties, such as density, the heat of vaporization, volumetric thermal expansion coefficient, solvent-solvent binding free energy, solvation free energy, and the number of hydrogen-bonds. Solvents with features most similar to one of the best current TSSE solvents (diisopropylamine) were analyzed further by simulating brine-water interfacial systems. Among the 59 amine-based solvents compared to diisopropylamine, we find that secondary amines with a six-carbon branched or linear structure display the most promising TSSE performance and should be experimentally investigated in the future.

Abstract #: 091

Title: Flooding and rural drinking water resources along the Gulf Coast

Presenter: Nate Jones

Organization: The University of Alabama

Session: Water Quality 2

Along the Gulf Coast, private drinking water wells play an important role in delivering water to rural communities. Yet, these systems also present a public health concern due to inconsistencies in water quality testing, regular maintenance, and construction practices. Here, we focus on how hurricanes and the associated inland flooding impact private well systems using a combination of community science sampling campaigns and geospatial modeling. We conducted a community science sampling campaign after Hurricane Ida, and our results highlighted widespread bacterial contamination of private drinking water wells. To put these results into context, we used a combination of modeled well locations and remotely sensed inundation estimates to quantify the potential extent of flooding impacts on the well user community. Taken together, these initial results highlight widespread impacts of hurricanes on rural drinking water resources.

Abstract #: 092

Student

Title: A New Perspective on Water Quality Trends: Exploring Spatial and Temporal Patterns of Impaired Waters in Alabama

Presenter: Mallory Jordan

Organization: Auburn University

Session: GIS

Every two years, each state is required to assess its surface water quality and compile a list of impaired surface waters. This list includes waterbodies that do not meet water quality standards for their designated usage and is referred to as the 303(d) List as it is required by Section 303(d) of the Clean Water Act. The purpose of the 303(d) List is to identify impaired waters so that the source(s) of impairment are described, and corrective action is taken to reduce pollutant loads and improve water quality. Understanding historic river impairment trends across space and time can inform current and future management decisions. However, analysis of trends and patterns in impaired waters is lacking, and impaired water data could provide a contextualized perspective on water quality. Thus, here we leverage the Alabama 303(d) List of impaired waters to present a new perspective for investigating spatial and temporal water quality trends that could improve the analysis of spatially and temporally heterogeneous water quality data. Using GIS, a space-time cube was created to analyze and visualize spatiotemporal trends of the impaired rivers added to the Alabama 303(d) Lists from 1996 to 2022. Space-time cubes allow for the investigation of changes in geographic data over time. To conduct this analysis, the percentage of river length impaired out of the total length of National Hydrography Dataset (NHD) flowlines, with a visibility filter greater than or equal to 1:10,000, was summarized within sub-basins (HUC 8) in Alabama (n = 51). Trend and hot spot analyses were conducted on the summarized river impairment to analyze spatial and temporal patterns. Results showed an uptrend in river impairment for eight sub-basins across the state and a downtrend in river impairment in the Perdido sub-basin. Additionally, coastal sub-basins were found to be a hot spot for river impairment, meaning there was more river impairment relative to river impairment in all other sub-basins. Understanding spatiotemporal trends of river impairment could indicate sub-basins with degrading water quality or sub-basins with relatively higher amounts of impairment. These sub-basins could be prioritized for further investigation of water quality changes or be prioritized for pollution mitigation and reduction efforts.

Abstract #: 093

Title: Simple Stream Simulation Design Overview for Aquatic Organism Passage (AOP) using the United State Forest Service (USFS) Design Method and Guidelines.

Presenter: Fred Halterman & Natasha Sewell

Organization: Moffatt and Nichol

Session: Infrastructure

Sponsorships: Georgia Aquatic Connectivity Team (GA-ACT) and Moffatt & Nichol (M&N). Presenters: Fred Halterman, PE and Natasha Sewell, PE with M&N. Abstract: The southeastern United States is home to an extraordinary diversity of aquatic-dependent wildlife. Yet where roads and streams intersect, poorly designed culverts, bridges and other structures often fragment aquatic habitats – contributing to the Southeast also having one of the highest fish imperilment rates in the world (Elkins et al, 2016; 2019). Poorly designed or degraded stream crossings also alter hydrology, impact water quality, and often fail during extreme weather events. Large numbers of aging, undersized and poorly maintained stream crossings in a watershed can result in widespread failures, closing roads and stranding communities during extreme rainfall and flood events. Georgia's more than 70,000 miles of rivers and streams flow from the Appalachian Mountains to the Atlantic and Gulf coasts and intersect with more than 85,000 roads. Through different physiographic regions, these streams create unique and diverse habitats that support many types of species. About three-quarters of fish species and more than 90 percent of all mussel and crayfish species native to the United States reside in a 500-mile radius of Chattanooga, Tenn. (Elkins et al, 2019) – a diversity of life that is nationally and globally significant. The GA-ACT team will be presenting an overall summary of the USFS design method for AOP in a series of training videos. This series of videos is based on the USFS training for designing AOP at road-stream crossings. We will cover and summarize this training series ranging from ecological continuity, history of design methods, site assessment, fluvial process/channel characteristics for site assessment, riverine interpretations, hydrology, simple stream simulation design, and the general project phases for AOP. The Southeastern Aquatics Research Partnership (SARP) will be making this series available in the future.

Abstract #: 094

Title: Assessment of the drought cycle impact on the uppermost aquifer across Alabama: utilizing groundwater elevation data from ADEM LUST sites and drought data from the National Integrated Drought Information System.

Presenter: Terri Osborne

Organization: Geological Survey of Alabama

Session: Drought & Climate 2

Terri E. Osborne and Guohai Jin, Geological Survey of Alabama. The Geological Survey of Alabama (GSA) assessed groundwater elevation data from Leaking Underground Storage Tank (LUST) sites administered by the Alabama Department of Environmental Management (ADEM) as part of its ongoing efforts to better understand the impacts of drought cycles to aquifers across the state. The GSA believes this data can be an invaluable addition to its current real-time and periodic groundwater monitoring network. GSA staff evaluated groundwater elevation data maintained by ADEM on selected LUST incident sites in over 60 counties of Alabama. These investigative actions involve the drilling of soil borings and construction of groundwater monitoring wells that are screened across the water table of the surficial aquifer for the purpose of collecting soil and groundwater samples to be tested for the presence of petroleum hydrocarbons. A LUST site in each county of the state was selected that had a long history of groundwater monitoring activity as part of this investigation. Drought data for each county was obtained from the National Integrated Drought Information System. Groundwater data from these wells show profound impacts from drought and wet cycle periods in Alabama over the past 30 years. Most sites show rapid depletion of the water table within six months of the onset of a drought period and rapid recovery when the drought ends irrespective of the subsurface geology. The groundwater elevation data obtained from the ADEM reports will be added to the Alabama WaterSTAR database for easy access of the collected data. Adding specific LUST wells, with cooperation from ADEM, to the GSA real-time monitoring network will provide important data to aid in understanding the impact of drought cycles to the uppermost aquifers across the state and their subsequent impacts to the deeper aquifers used for public water supplies.

Abstract #: 095

Student

Title: Exploring the role of hydrologic connectivity on denitrification in non-perennial headwater streams

Presenter: Kaci Zarek

Organization: The University of Alabama

Session: Aquatic Ecology 1

Headwater networks play an important role in physical, chemical, and biological functions of downstream waters, yet many headwater reaches dry regularly. Compared to their perennially flowing counterparts, non-perennial headwater networks are understudied with regards to their physical and biogeochemical functions, which limits our understanding of how they impact downstream waters. This is of particular concern in Alabama, where the majority of headwaters dry regularly, despite Alabama being one of the wettest states in the US. Recent work hypothesizes that lateral hydrologic connectivity – whether the network is gaining or losing water from the surrounding riparian zone – controls biogeochemical processing and downstream fluxes of solutes. To test this hypothesis, we focus on nitrogen processing in a forested Piedmont non-perennial headwater stream. Our objectives are to examine the spatial and temporal variability of hydrologic connectivity and its impact on nitrogen processing across an annual drying cycle. We used a combination of continuous water level measurements in both stream and adjacent riparian zones, synoptic sampling campaigns to measure dissolved inorganic nitrogen and water chemistry, and potential denitrification rate measurements. Initial results highlight seasonal patterns of hydrologic connectivity between streams and its adjacent riparian zone, dissolved inorganic nitrogen concentrations, and potential denitrification rates. Our findings provide initial insights into the role of hydrologic connectivity on biogeochemical functions of Southeastern headwater networks during seasonal dry-down.

Abstract #: 096

Student

Title: An Inventory of Private Well Programs across the United States

Presenter: Bethany Foust

Organization: Auburn University

Session: Well Water

Approximately 15% of people in the United States get their drinking water from private well water. There are no federal policies governing private well water and vast differences exist between states. All states regulate well construction, while less than half of all states regulate water quality. Whether a state level policy exists or not, private well owners are solely responsible for the management of their drinking water source. The management of private well water quality is critical for ensuring that drinking water does not contain contaminants that could cause serious health issues. Management of water quantity is also important for maintaining a reliable amount of drinking water. In some states, private well programs (PWP) have emerged to fill this need. PWPs are non-regulatory bodies established through different agencies, that provide resources and guidance for well owners to make informed management decisions. Other states have online resources, and some states have no information to aid private well owners in management. Thus, understanding what makes a useful program and why is important to building effective PWPs and to share information across PWPs. All 50 states were inventoried to: identify the states which have established PWPs, understand how the programs were established, and elucidate how private well owners might engage with state programs. The inventory was created by internet search methods of PWPs and interviews with PWP directors and coordinators about the establishment and function of programs. Preliminary results show that southeastern states have newer PWPs (i.e., created within the last three years) through cooperative extension, while PWPs in northeastern states are hosted by various state agencies (e.g., Department of Health, Department of Natural Resources). Of all 50 states inventoried, 36% (n = 18) had an established PWP, 30% (n = 15) provide resources but have no official program, and 34% (n = 17) had no resources identified through the search. Interviews with PWP contacts will take place during summer 2023 and will provide further information about why the program was established in that state and how they assist and engage with private well owners. This inventory could be a useful resource for states establishing new programs to model after successful programs. Additionally, states with existing programs may also benefit by learning about new ways to interact with private well owners such as webinars or workshops that had not previously been implemented in that state. The creation of a PWP inventory across the U.S. will allow states to compare programs and fill gaps in statewide resources and education.

Abstract #: 097

Title: Quantifying Heat Risk in Alabama: A Comparative Analysis of Wet Bulb Globe Temperature (WBGT) and Heat Index (HI)

Presenter: Robert Junod

Organization: The University of Alabama in Huntsville

Session: Poster Session

The Wet Bulb Globe Temperature (WBGT) is a heat stress index used by several federal, state, and recreational entities. In comparison to the Heat Index (HI), which is commonly used by the National Weather Service, WBGT is a better indicator of heat stress for people exposed to direct sunlight. The WBGT incorporates air temperature, relative humidity, wind, and solar radiation in comparison to the HI, which only uses relative humidity and air temperature. This research aimed to utilize soil climate analysis network (SCAN) sites in Alabama and leverage their archived data to generate derived WBGT and HI values. By leveraging the available data at each SCAN site, climatologies were constructed for these indices, thereby enabling the accurate identification and characterization of heat events. In this study, heat events were defined as days when one of these indices exceeded its 95th percentile threshold for five consecutive hours. Preliminary findings suggest a notable disparity between the number of heat events identified by the HI compared to those identified by the WBGT, with the HI defining considerably fewer heat events overall.

Abstract #: 098

Title: Building a Statewide Soil Moisture Network Data Portal

Presenter: Krel Haynes

Organization: The University of Alabama in Huntsville - Earth System Science Center

Session: Lightning Talk - Outreach

As part of a NOAA funded project, low cost soil moisture sensors are being developed and deployed across Alabama. Improving the quality and extent of monitoring will improve state and federal agencies' capacity to provide information that affects a wide range of stakeholders. A distributed network of soil moisture can provide measurements to the scientific community for the calibration of remote sensing products and models. Ensuring this data is open, available, and accessible is a priority. Here we showcase the development of a publicly available online interactive portal created for the distribution environmental dataset. An ESRI dashboard was created through ArcGIS Online to allow for interactive data inquiry. Users can select hosted sensor locations to display soil moisture percentiles from the surface and root zones that are updated daily. These dynamic charts combined with configurable dates, allows for the displaying of data trends over time such as wet and dry periods. Currently we are hosting soil moisture datasets from existing federal databases and new sources from the low-cost sensors. Future updates include adding additional sensor locations and soil moisture databases to the dashboard.

Abstract #: 099

Title: Mapping Bayou la Batre Stormwater for Community Resilience

Presenter: Mary Kate Brown

Organization: The Nature Conservancy

Session: Stormwater 2

Bayou La Batre and its surrounding communities experience frequent heavy rainstorms and tropical events with heavy flooding that the current infrastructure cannot manage. The 2018 Bayou La Batre Watershed Management Plan strongly suggested mapping the existing stormwater infrastructure and identifying flood-prone areas with remedial actions to help provide the framework for the City of Bayou La Batre's future stormwater management plan and support Mobile County's public stormwater infrastructure. The Nature Conservancy acquired funds from EPA to help the City of Bayou La Batre improve their stormwater management, flood control, and water quality, as this comprehensive knowledge does not exist for this community, and to assist the Mobile County's Public Works Department with better information to guide future improvements and needs. Data and findings generated from this ongoing project will reduce future costs associated with the maintenance of outdated, undersized, or absent drainage infrastructure, floodplain restoration in the watershed, and costs associated with degraded water quality in Portersville Bay and Grand Bay in Mississippi Sound, home to productive commercially-and recreationally-important fishery habitats. Current and future nonpoint source pollution and inadequate stormwater and flood control infrastructure could further degrade the watershed by impacting water quality, decreasing resilience to flooding, and lowering habitat availability and functionality. Therefore, strengthening the City's and County's resilience will reduce hardships of businesses and citizens in an underserved area suffering from current flooding events and degraded water quality. Currently, this project is performing an inventory of all existing structures and mapping catchment areas, identifying areas of localized flooding with inadequate infrastructure and prioritizing the repair and/or replacement of structures in poor condition, and monitoring sub-basin water quantity and quality during stormwater flow events. This project is a unique effort involving a wide realm of key partners, including Mobile County, the City of Bayou La Batre, Dauphin Island Sea Lab, Alma Bryant High School and Goowyn, Mills & Cawood (GMC). In addition, more stakeholders from Mobile County Public Works Department, Bayou La Batre Utilities Board, NRCS and AL DOT have been engaged with this project. Once mapping is complete by GMC, areas within the watershed will be identified and prioritized by most prone to flooding and causing hardship, most appropriate for regional detention, the availability of open space, and least suitable for development. The mapped data plus the designs of stormwater improvement demonstration sites will set the stage and leverage future opportunities for the City and County to implement future stormwater improvement components efficiently.

Abstract #: 100

Title: Everything Water Resources Starts Here

Presenter: Sytske Kimball

Organization: University of South Alabama

Session: Lightning Talk - Outreach

If we don't observe how much water falls out of the sky, we don't know what is happening once it hits the ground. Rainfall totals as well as rainfall rates need to be measured to effectively predict drought, forest fires, and water quality and to provide information for decision making like crop irrigation and issuing flash flood warnings. Rainfall can be measured using remote sensing tools (radar and satellite) and using rain gauges on the ground. While remote sensing rainfall products provide a spatial distribution of rainfall, measurements are derived from remote sensing signals using algorithms. Rain gauges provide a point measurement, but it is a direct measurement.

While rain gauge measurements can be less accurate under certain conditions, Mesonets provide reliable and consistent measurements of weather data, including rainfall. The American Association for State Climatologists (AASC) defines a Mesonet as follows: "A mesonet is a network of real-time, automated weather stations for monitoring mesoscale meteorology. To effectively characterize mesoscale meteorology, stations must be deployed and operated in a certain way. Measurements of meteorological parameters (temperature, relative humidity, rainfall, wind, solar radiation etc.) typically take place at the surface (from 40" below to 33 ft above), every few hundred square miles, and at 5-minute intervals". This means that research-grade rain gauges are chosen and installed according to World Meteorological Organization (WMO) guidelines which stipulate height above the ground and the minimal distance to surrounding obstructions. The gauge must be leveled, cleaned, and calibrated on a frequent basis using professional practices. The South Alabama Mesonet currently consists of 26 automated weather stations located in 8 of the southern-most counties of Alabama and is part of the National Mesonet Program (NMP). The NMP is a NOAA-funded network of Mesonets across the United States with the goal to support and ensure a weather-ready nation. As such, the Mesonets deliver critical information required for accurate and targeted weather prediction and warnings to the National Weather Service. Rainfall data of this quality is critical to long- and short-term drought and flood prediction, agricultural decision making, issuing of warnings, water quality, ground water concerns, and everything else that will be addressed in this conference. But, as will be illustrated during the lightning talk, data of this quality is not free. Many states have state-wide mesonets, Alabama, unfortunately, does not. It is time for us to band together, so we can address Alabama's water resources concerns and plan for the future. This will consist of advocating with the state legislature and state-level agencies for a consistent and reliable measurement system. I.e. we need an Alabama Mesonet. The expertise exists, but we need funding to make it happen.

Abstract #: 101

Title: Towards a distributed soil moisture network in Alabama: Opportunities for low-cost, easy deployable sensors

Presenter: Lee Ellenburg

Organization: The University of Alabama in Huntsville

Session: Drought & Climate 2

Soil moisture (SM) is recognized as a key variable for assessing the magnitude of adrought, but accurately measuring it over a large spatial extent and systematically reporting it has proven to be challenging. Improving the quality and extent of SM monitoring as well as that of the derived higher-level products will improve state and federal agencies' capacity to provide information that affects a wide range of stakeholders. Additionally, a distributed network of soil moisture can provide measurements that are vital to the scientific community for the calibration of remote sensing products and models. As part of a NOAA funded project, the University of Alabama in Huntsville has developed a low cost soil moisture sensor and are in the process of deploying 30+ sensors across the state in collaboration with volunteer and citizen science organizations. This talk will focus on the success of the project and highlight exciting collaborations with Alabama Forestry Commission (AFC) within the Alabama Gulf State Park (GSP) in lead-up to a controlled burn. This to better understand water storage in the duff layer and the role of SM in fire prediction, prescribed burns, and secondary fire effects such as tree mortality. These sensors in conjunction with fire modeling will help AFC and GSP to more intuitively monitor fire danger to accurately implement burn restrictions to prevent wildfires. This presentation will demonstrate how the flexibility of low-cost, easy deployable sensors can create new opportunities, bring to light the role of soil moisture in the forest community, and showcase a novel case study just a few miles from the conference.

Abstract #: 102

Student

Title: Evaluating the use of sustainability indicators in crop management on peanut and cotton rotation as an engagement tool

Presenter: Marina Duarte de Val

Organization: Auburn University

Session: Poster Session

Increasing consumer awareness about the environmental impact of agriculture has highlighted the need for sustainable crop management practices that balance productivity and profitability. Despite the desire among producers to minimize environmental harm while maximizing yield, the adoption of sustainable methods remains limited. This study aims to evaluate the environmental impact of conservation practices in fields with a peanut-cotton rotation and employs the Fieldprint Calculator to identify areas for improving sustainable metrics. Three farms in central Alabama were analyzed, utilizing four years (2019 to 2022) of crop management data. Two farms employed strip-till practices, while the third farm used conventional tillage. The Fieldprint Calculator, provided by the Field to Market alliance, was employed to assess the environmental impact of crop management using eight sustainability indicators: biodiversity, energy use, greenhouse gas emissions (GHG), irrigated water use, land use, soil carbon, soil conservation, and water quality. Through preliminary analysis, a comparison of crop management practices among the farms was facilitated, with a particular focus on the effects of conservation practices on soil health, GHG emissions, and energy use. All three farmers achieved a reduction of over 60% in energy use during peanut cultivation. However, conventional tillage consistently demonstrated higher cotton and peanut rotation scores than strip-till practices. The findings of this study will be presented during farmers' meetings to raise awareness about the influence of specific crop management practices on sustainability metrics. Future research will employ sustainability indicators as benchmarking tools to promote knowledge exchange and encourage the adoption of conservation practices by farmers.

Abstract #: 103

Student

Title: Molecular level analysis of microbial communities in different seasons of the Alabama River in Montgomery, Alabama

Presenter: MD IMAM UL KHABIR

Organization: Alabama State University

Session: Poster Session

Molecular level analysis of microbial communities in different seasons of the Alabama River in Montgomery, Alabama MD Imam UI Khabir, Jannatul Ferdous, and Muhammad Saleem Ph.D. Program in Microbiology, Department of Microbiology, Alabama State University Ensuring high water quality is important for both aquatic organisms and human beings while microbial communities play a pivotal role in the health and functioning of the freshwater ecosystem. Meantime, several environmental factors such as water pH, temperature, nutrient contents, and seasonal variations can also impact the composition and diversity of aquatic microbial communities. Thus, it is essential to understand the diversity and composition of microbial communities in relation to water chemistry and seasonal variations. We hypothesize that the abundance of microbial taxa (e.g., from phylum to species level) will change with different seasons (spring, summer, fall, winter) in the Alabama River system at the downtown location. The turnover in microbial taxa or species will also lead to changes in the microbial community composition. These changes will be further translated to changes in microbial networks, which are based on their positive or negative interactions between microbial taxa. To test the abovementioned hypotheses, we are collecting water samples twice a month for one year. Then, we are filtering water samples using the filter machine (AIR CADET, Model:420-1901-00FK) and filter (Whatman Nylon membrane filters, 0.2 μ m Diameter). After filtration, we will keep this filter paper in the -20oC freezer. We will use this water to measure the physical and chemical properties of water. Using the Dneasy Power water kit (Qiagen), we will extract DNA. We will use a Nano-drop machine to measure DNA contents. We will amplify bacterial 16S rRNA genes (V3–V4 regions) using standard primers to profile microbial communities. We will also use standard community ecological and statistical methods to profile microbial taxa, their networks, and their interactions with water properties across different seasons. In this study, we have already processed samples for DNA extraction and just a few sampling periods are left. As soon as samples are processed, we will send DNA samples for analysis of microbial communities. Using next-generation sequencing and analysis of water samples, we will try to find out the key changes in the water chemistry and microbial communities at the different time points of the sampling year. Understanding the water chemistry and microbial community composition in different seasons may provide us with valuable information regarding the turnover of microbial communities in spring, summer, fall, and winter in the Alabama River. We will try to find out evidence of whether human activities, weather conditions, and seasonal variations are altering water chemistry and different aspects of microbial community ecology.

Abstract #: 104

Title: Measuring Rainfall with the South Alabama Mesonet

Presenter: Sytske Kimball

Organization: University of South Alabama

Session: Poster Session

Measuring rainfall is a difficult endeavor no matter how you do it. While satellite- and radar-based rainfall products provide a spatial distribution of rainfall, the rainfall amounts are estimated from remote sensing data using algorithms. Rain gauges, on the other hand, measure rainfall directly, but only provide point observations. As a result, rainfall measurements used for forecasting, decision make, and other purposes are usually combinations of remote sensing and ground-based observations. An example is the National Stage IV Quantitative Precipitation Estimate (QPE) Product available from the National Centers for Environmental Prediction (NCEP) which is part of the National Oceanic and Atmospheric Administration (NOAA) and consists of rain gauge and radar data merged together. Added to this is the inaccuracy of measuring rainfall with rain gauges during high winds when raindrops fall into the gauge at an angle and wind shear just above the gauge causes raindrops to miss the gauge opening. A further complexity arises because of manual (collection) gauges versus automated gauges. Automated gauges are incredibly useful, because they do not need to be read by a human being and can be programmed to measure rainfall at any given time interval. The latter provides rainfall rates, which can be critical to predicting flash flooding events. However, automated gauges suffer from their own inherent inaccuracies. For example, tipping bucket gauges notoriously under-collect rainfall during heavy rainfall events as a result of the internal tipping mechanism. A Mesonet is a network of automated weather stations that uses consistent instruments. Stations are spaced 30-50 km apart, and data is collected at 5 (or less) minute intervals. In order to ensure the best possible direct, ground-based, point measurements of rainfall, mesonets follow strict guidelines set by the World Meteorological Organization (WMO), American Association of State Climatologists (AASC), and other organizations. These guidelines include how and where a rain gauge should be installed, how it should be cleaned and calibrated, and quality control of rainfall data. The South Alabama Mesonet consists of 26 weather stations in the southern part of Alabama and adheres to these guidelines. The poster will demonstrate the challenges involved with collecting quality rainfall data. The South Alabama Mesonet and its automated rain a will be introduced and example measurements of rainfall will be presented. The costs associated with providing research-quality data will be explained and the need for a state-wide Alabama Mesonet will be emphasized.

Abstract #: 105

Student

Title: Evaluating the impact of soil water deficit levels on peanut yield using simulation modeling

Presenter: Marina Duarte de Val

Organization: Auburn University

Session: Agriculture & Irrigation

Assessing irrigation management strategies is essential for comprehending the influence of irrigation on peanut yield and optimizing irrigation water use efficiency. This research aims to evaluate the effects of various soil water deficit levels on peanut yield by a model simulation conducting seasonal analyses based on 30 years of weather data. To accomplish this, the peanut growth model within the Decision Support System for Agrotechnology Transfer (DSSAT) platform was calibrated and validated using on-farm experimental data from fields in Lee County, AL, during 2021 and 2022. Model calibration utilized parameters such as leaf area index, leaf and stem biomass, and peanut yield, along with volumetric water content measurements at soil depths of 20, 40, and 60 centimeters. The irrigation treatments consisted of four levels of soil water deficit: 30%, 50%, 70%, and 90% water depletion over the top 30 cm of soil depth. These deficit levels were imposed on the crops from the initiation of the flowering growth stage until harvest. The focus is to study the impact of these soil water deficit levels on peanut yield during seven years when August rainfall was below the average water demand for peanuts. Simulation results demonstrated that as soil water depletion decreased, yield consistently increased across all years. A similar trend was observed in terms of irrigation frequency. The 30% depletion treatment, which involved more frequent irrigation events, yielded greater peanut harvests compared to the 50%, 70%, and 90% depletion treatments. In certain years, the 90% depletion treatment did not require any irrigation, resulting in the lowest yield among all treatments. Notably, in the years 2022, 2014, 2011, and 2010, there was no significant difference in yield between the 30% and 50% depletion treatments, indicating the potential for reduced irrigation without compromising yield. These preliminary findings emphasize the significant impact of implementing optimal irrigation strategies, encompassing appropriate amounts, frequencies, and timing, particularly during peak peanut water usage, to enhance peanut yield.

Abstract #: 106

Student

Title: Physical drivers of streamflow and drying vary across a physiographic gradient in the Southeastern US

Presenter: Delaney Peterson

Organization: The University of Alabama Dept. of Biological Sciences

Session: Water Quality 2

Non-perennial streams (i.e., streams that dry regularly) comprise over 50% of the global river network and play an important role in influencing the physical, chemical, and biological characteristics of downstream waters. In the Southeastern United States, non-perennial streams most often occur in the headwaters of river networks, yet their unique patterns of drying have not been well-characterized. In these systems, heterogeneity of watershed physical features, including stream slope, subsurface architecture, and preferential flowpaths, play a key role in spatial and temporal variation in streamflow and drying. Our goal is to develop a predictive understanding of spatiotemporal patterns of stream drying across watersheds representative of three distinct physiographic regions in Alabama: the Coastal Plain, Piedmont, and Appalachian Plateau. We characterized longitudinal network connectivity over two annual drying cycles with empirical water presence data collected using Stream Temperature Intermittency and Conductivity (STIC) loggers dispersed throughout the watersheds. We also characterized watershed structural features, including elevation, slope, soil depth, stream incision, and valley shape using publicly available data. Combining these data sources allowed us to compare spatial and temporal patterns of network drying to identify potential drivers. Our initial results suggest that each physiographic region may have a unique drying regime (i.e., bottom-up vs top-down drying), and that drying occurs hierarchically within watersheds (i.e., smaller spatial scales with similar features dry first, before larger spatial scales with heterogeneous features). Our work provides insight into the drivers of stream drying in the Southeast, better informing our understanding of the structure and function of these important stream networks.

Abstract #: 108

Title: Shift Of Stakeholder Perception Through Knowledge Co-Development In Mobile Bay

Presenter: Wanyun Shao

Organization: The University of Alabama

Session: Coastal Issues 1

Coastal decision-making for flood risk mitigation can be either a top-down or a bottom-up approach. A coastal stakeholder workshop was organized by a nature-based solution project team funded by the Cooperative Institute for Research to Operations in Hydrology at UA (CIROH) in April 2023 at Mobile Bay, Alabama. In this workshop, the project team adopted a bottom-up approach, soliciting stakeholders' input with the goal to integrate it into hydrological and ecological modelling. The workshop's main purpose was to engage the stakeholders closely with a multidisciplinary team to understand the goals, objectives, timeline, and the stakeholder's role in shaping the project outputs. Specifically, the workshop was divided into several major segments. In the first segment, the stakeholders participated in a pre-workshop survey where they expressed their initial perceptions of compound flood risk. In addition, the survey prompted the stakeholders to think about nature-based solutions. The workshop then continued throughout the day in the other segments where the project scientific team and the stakeholders participated in knowledge co-development. Overall, the workshop was goal-oriented, starting with the introductory questionnaire, a fun ice-breaking session about storm events, introduction to the project's end goal - flood risk mapping through modeling and risk mitigation through nature-based solutions. The stakeholders actively mapped the storm and flood locations: the approximate sites where flood events tend to be concentrated. The information about the compound flood and risk mitigation that was exchanged between the scientists and the stakeholders was tracked through a mental model. At the end of the workshop, the stakeholders were given a post-workshop questionnaire to see how the knowledge co-development process shifted their perceptions of compound flood risk and nature-based solutions. This process of knowledge co-development can be adopted by policymakers, scientists, and planners for effective risk-decision making.

Abstract #: 109

Title: CIROH Water Resources Research Tools: The Streamflow Evaluator Tool – Evaluate Your Model

Presenter: Ryan Johnson

Organization: The University of Alabama

Session: Modeling & Water Management 2

With the NOAA transitioning the National Water Model (NWM) to the Next Generation Modeling framework, pushing research dollars towards open science, and awarding the University of Alabama a \$360 million Cooperative Institute in Research to Operations in Hydrology award, there is a critical need to create model agnostic water resources model evaluation tools and establish flexible standards to assess hydrological model predictive skill. During the first year of the award, the Alabama Water Institute (AWI) at the University of Alabama developed the open-source Streamflow Evaluator tool to assess the performance of new hydrological model formulations to USGS in-situ observations for CONUS. Using a standard data model linking USGS NWIS site ids to NWM NHDPlus reach ids, we support three evaluation classes: 1) Reach Class allowing the user to input the NWIS site(s) of interest, 2) a State Class allowing for an in-depth analysis of statewide model performance with respect to watershed characteristics such as land use land cover, and 3) a Hydrological Unit Code (HUC) Class allowing the user to input any regional USGS HUC of interest for a spatial evaluation. For each evaluation class, the user can investigate model performance with respect to a specific date range, temporal resolution, and as a traditional hydrograph or flow aggregate with the latter supporting a supply-oriented analysis. CIROH supports the Streamflow Evaluator through GitHub where the user can download the tool to their machine to evaluate the performance of their model and as a Tethys-based interactive web application allowing the user to assess the performance of the NWM v2.1 for their needs. In this presentation, we will demonstrate the capabilities of the Python-based tool for the great state of Alabama as well as other locations to exemplify the flexibility and diversity of the Streamflow Evaluator tool.

Abstract #: 110

Student

Title: Nitrification Inhibition Potential of Ammonium Thiosulfate and Potassium Thiosulfate in Soils and Corn (*Zea mays* L.) and Cotton (*Gossypium hirsutum* L.) production.

Presenter: Lane Galloway

Organization: Auburn University Crop, Soil and Environmental Sciences

Session: Poster Session

Nitrogen use efficiency (NUE) of various fertilizers can be variable due to factors such as soil type, precipitation and others. Nitrification inhibitors or enhanced efficiency fertilizers show potential to increase NUE by decreasing the amount of N losses from nitrate leaching and denitrification of nitrous gases by keeping N in an ammonium form preventing water quality degradation. The objective of this study was to evaluate the effectiveness of ammonium thiosulfate (ATS) and potassium thiosulfate (KTS) products to inhibit nitrification in three soil types: an Alabama loamy sand Ultisol (AL), an Illinois silt loam Mollisol (IL), and a California loamy sand Entisol (CA). A 10-week incubation experiment was performed, and soil ammonium, nitrite, and nitrate concentrations were measured for the duration of the incubation to determine the effectiveness of ATS and KTS to inhibit nitrification compared to an untreated control, urea, urea + ammonium sulfate, and urea + dicyandiamide (DCD) treatments. Incubation results showed that ATS and KTS reduced nitrification compared to urea and urea + DCD in the California loamy sand and compared to urea in the Illinois silt loam. No treatments reduced nitrification compared to the untreated control in the AL soil type. Greenhouse studies on corn (*Zea mays* L.) and field trials on corn and cotton (*Gossypium hirsutum* L.) were conducted to determine effects on plant growth and yield. Analysis of results still to be determined.

Abstract #: 111

Student

Title: Evaluating the Impacts of Different Cover Crop Grazing Intensities on Soil Health and Crop Yields

Presenter: Wade Reiter

Organization: Auburn University

Session: Drought & Climate 2

Introducing integrated crop-livestock systems into row crop production may provide incentives for producers to plant cover crops that can reduce erosion, increase soil water retention, and improve soil health. but the effects of these practices on crop yields and soil health in southeastern Ultisols are not well established. A four-year study was established at the Wiregrass Research and Extension Center in Headland, Alabama to test the effects of different grazing regimes on soil health and crop productivity. Three cattle grazing regimes (mid-February, mid-March, and mid-April cattle removal dates) and an ungrazed control were included in a randomized complete block design and replicated three times. Chemical soil health indicators (soil organic carbon, permanganate oxidizable carbon), physical soil health indicators (water stable aggregates, penetration resistance), biological soil health indicators (microbial biomass carbon, arbuscular mycorrhizal fungi colonization), crop yield, and cover crop biomass were evaluated. Cover crop biomass at termination was reduced for all grazed treatments compared to the ungrazed control, and the mid-March and mid-April treatments resulted in the lowest amount of cover crop biomass. No treatment effects were observed for chemical and physical soil health indicators. Penetration resistance was significantly higher for the mid-April treatment compared to the other treatments in 2021 and for the mid-March and mid-April treatments than the other treatments in 2022, indicating that longer grazing periods can result in greater penetration resistance. Soil water content was also lower under the more intense grazing treatments at the time of penetration resistance measurements. Grazing also had a negative impact on water stable aggregates at deeper depths. The results from this study suggest that grazing cover crops has no effect on biological and chemical soil health indicators in the short term, but can negatively impact some physical soil health indicators. Shorter grazing periods allowed for regrowth of cover crop biomass, leaving more residues to prevent soil erosion and reduce soil compaction.

Abstract #: 112

Title: Understanding new invasions by Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *Hypophthalmichthys molitrix*: Drivers of occupancy and recruitment

Presenter: Shannon Brewer

Organization: AL Cooperative Fish and Wildlife Research Unit

Session: Aquatic Ecology 1

The importance of understanding multi-scale habitat use is well established as related to developing meaningful conservation and management actions for both native and non-native species. Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *Hypophthalmichthys molitrix* are two invasive fishes, and their habitat use has been documented in portions of the central United States; however, new invasion fronts have occurred in novel river catchments with different physicochemical conditions. Bighead Carp and Silver Carp were first detected in the lower Red River catchment in 2012, and very little is known about this population. We assessed Bighead and Silver Carp summer habitat use within an occupancy framework across reaches nested within river segments and catchments. We surveyed 44 sites 2-3 times using electrofishing and gill netting during the summer of 2021 and 2022. Preliminary modeling results indicated that Silver Carp detection was positively associated with electrofishing effort (seconds), whereas Bighead Carp detection was positively associated with water temperature (°C). Occupancy of adult carp was negatively associated with river segment sinuosity and reach-scale width-to-depth ratios and positively associated with reaches containing backwater habitats. We did not capture any juvenile carp (< 3 years old) during 2 years of sampling effort though adult females captured were full of well-developed oocytes. Removal efforts would be most efficient in backwater and disturbed areas of the stream network. Moreover, preventing immigration of carp from the MS River basin in a timely manner may prevent population capacity that would facilitate spawning though source locations connected during flood years have also been identified.

Abstract #: 113

Student

Title: Impact of Prescribed Fire on Carbon and Nutrient Cycling in a Hurricane-Damaged Coastal Ecosystem in Weeks Bay, Alabama

Presenter: Sushant Bhandari

Organization: Auburn University

Session: Coastal Issues 2

Coastal forests like the Weeks Bay National Estuarine Research Reserve, located on Mobile Bay's eastern shore, provide indispensable ecosystem services but are susceptible to anthropogenic and climatic events, such as wind and fire disturbances. The interplay of hurricane-induced disturbances, fire suppression, and prescribed burns has significantly transformed these forests. The effects of these elements on the dynamics of soil carbon and nutrient cycling, which are critical for ecosystem health and resilience, are unknown. To bridge this knowledge gap, we analyzed soil samples from 26 plots that had exhibited a gradient of damage by Hurricane Sally (2020), and a prescribed burn in spring, 2022. The samples were collected before a prescribed burn, immediately after, one month, and finally, a year after the fire. Our analysis includes changes in the soil pH, electrical conductivity (EC), concentrations of dissolved organic carbon (DOC), dissolved nitrogen (DN), and molecular characterization of DOC. We observed an initial pH increase of 0.24 ± 0.11 , followed by an additional increase of 0.24 ± 0.16 one month post fire in plots that were close to the water line ($n=9$), which can be attributed to higher ash deposition due to extensive vegetation combustion. These plots also demonstrated DOC decrease of $18.74 \pm 16.98 \text{ mg/l}$, owing to the combustion of biomass and soil organic matter into ash and gases, reducing the amount of soluble organic carbon left in the soil. In contrast, inland plots with less vegetation ($n=9$) initially exhibited a pH decrease of 0.36 ± 0.31 and DOC increase, potentially linked to incomplete combustion and deposition of acidic pyrogenic carbon (PyC), with pH value rising in the subsequent month. EC in 14 plots initially surged, then decreased, suggesting ash deposition and leaching. The pH increases and EC fluctuation indicated ecosystem resilience and adaptability to prescribed burns. In some plots, we observed a constant increase in DOC and DN likely from the release of soluble PyC during combustion. Other plots showed an initial rise then a drop, likely resulting from soluble PyC being washed out post-fire. Some plots saw initial loss and recovery, reflecting ecosystem adaptation to diverse fire intensities, while others had continual organic matter loss, possibly from combustion or post-fire decomposition. These results demonstrate the complex impact of fire-hurricane interactions on soil chemistry. Our study reinforces the role of prescribed burns in risk mitigation and forest management, emphasizing the importance of strategically timed fires for soil recovery and PyC incorporation. Further DOC molecular characterization will elucidate the potential contribution to carbon sequestration in wind-damaged forests through timely prescribed burns.

Abstract #: 114

Student

Title: Using Private Well Contamination Risk Visualizations to Educate Impacted Communities

Presenter: Ellie Tidwell

Organization: Auburn University Department of Geosciences

Session: Lightning Talk - Outreach

When examining the water resources in Alabama, it is clear that many communities rely on private groundwater wells. A variety of environmental factors, such as precipitation levels, flooding, sea level rise, and agricultural use can have a detrimental impact on the quality of private well water. These pollution sources are distributed unevenly throughout Alabama, resulting in difficulties when attempting to identify the primary threats to well water contamination. Moreover, the spatial relationship between socially vulnerable communities in Alabama and contamination sources may result in a heightened risk of exposure to the health effects of contaminated well water. The project, "Building a Private Well Contamination Risk Model to Reduce Environmental Inequity," has utilized geospatial data and analysis software to map the distribution of private well use and the areas that are high risk for private well contamination due to environmental and social factors across the State of Alabama. We created an accessible web mapping application to communicate the results of this project. The map application works to serve two primary functions. The first is that the application serves as a tool to communicate essential information to both the scientific community and private well-water stakeholders in the region. More specifically, the application allows the dissemination of a large amount of data to policy advocates, healthcare officials, and other programs that can initiate community education services and organize targeted outreach events. The secondary function is that the application serves as a user-friendly program to view all the data and results of the analysis. In addition, using the results of this project, practitioners and Extension personnel can determine the areas with the highest potential for well water contamination to help allocate resources and ensure equitable access to high-quality drinking water. In this talk, we discuss how we can move education from reactionary to an ideal of preventative, as well as the promise of educating well-owners and professionals who work directly with communities at higher risk.

Abstract #: 115

Title: 1D/2D Hydraulic Modeling for Stream Restoration Optimization

Presenter: Annelise Dodd

Organization: Volkert, Inc.

Session: Restoration 1

Restoration is often used to improve water quality, reestablish floodplain connectivity, restore ecological services, and enhance resilience against future stressors within degraded or impaired streams. While designers strive to meet these goals, long-term resiliency of a stream restoration project is the ultimate measure of success. Successful restoration in urban watersheds is complicated not only by increases in stormwater flows, but also in riparian vegetation loss, floodplain encroachment, utility conflicts, and a myriad of other factors that threaten long-term success. This presentation will discuss how 1-dimensional and 2-dimensional hydraulic modeling can be utilized to further optimize the natural stream design approach to ensure long-term project success. 1D modeling using HEC-RAS is an accessible option for analyzing how a design could impact water surface elevations and floodplain widths both downstream and upstream of the project, as well as throughout the project reach. This is critical in urban watersheds where restoration of streams and adjacent floodplains could result in increases in water surface elevation or changes in flooding potential. Iterative design using first a 1D approach allows for rapid assessment and design optimization to ensure water surface elevations will not increase and better assess floodplain storage. 2D modeling can then be utilized to analyze channel velocities and perform a shear stress analysis of the channel, near bank, and floodplain. Aquaveo's Surface-water Modeling System (SMS): SRH-2D allows the modeler to prepare visual outputs showing target areas within the design that are exceeding design criteria. The design can be further optimized using the outputs allowing for a context-sensitive approach to restoration. This allows for optimization of design at specific locations where target variables are not achievable due to project limitations allowing for targeted placement of In-stream and floodplain structures to provide energy dissipation. This methodology helps predict potential project failure, identifies weaknesses within the design, and allows designers to optimize stream restoration design to ensure long-term resilience.

Abstract #: 116

Student

Title: Evaluating Irrigation Strategies with the DSSAT CERES-Maize Model: A Study on Water Conservation and Crop Yield for Corn Farmers in Alabama

Presenter: Lucas Nunes

Organization: Auburn University

Session: Modeling & Water Management 2

Increasing efficiency in irrigation water management is crucial for ensuring an adequate water supply for crop cultivation, particularly in the context of corn production in Alabama. This study aims to achieve two primary objectives: I) calibrating a maize cultivar coefficient, and II) evaluating the impact of different irrigation strategies using the DSSAT CERES-Maize model. The calibration process utilized two years of data (2019 and 2022) collected from a specific 16.3-hectare corn field located in Samson, Alabama. The predominant soil type in the study area is Eunola Sandy Loam, consisting of 71.2% sand and 18.4% clay. The volumetric water content (mm³ mm⁻³) at field capacity and permanent wilting point were determined to be 0.355 and 0.139, respectively. To achieve the second objective, the seasonal analysis tool DSSAT (v. 4.8.0) was employed to evaluate the impact of six irrigation treatments based on two levels of maximum allowable depletion (MAD) - 65% and 35% - and three levels of maximum available water (MAW) - 100%, 90%, and 80%. The seasonal simulations were conducted using 21 years of NASA POWER meteorological data (from 2000 to 2020) for the field location. The calibration of the DSSAT CERES-Maize model resulted in accurate predictions for essential aspects of maize growth, including phenological components, biomass, and yield. Interestingly, no significant differences in yield were observed among the various irrigation strategies. However, the irrigation strategy that combined a MAD of 65% with a MAW of 90% demonstrated the most efficient water management, requiring only two irrigation applications throughout the entire growing season. This result emphasizes the potential for conserving water and improving crop profitability by reducing water usage while maintaining satisfactory yield levels. The findings of this study provide valuable guidance for farmers in optimizing maize production while conserving precious water resources. By tailoring irrigation strategies to local conditions, farmers can enhance their agricultural practices and contribute to sustainable farming approaches. Ultimately, this research contributes to the advancement of knowledge in irrigation management and its practical application in the context of maize farming in Alabama.

Abstract #: 117

Title: Partnerships Between Academics and Consultants Enhance Applications of FEMA Flood Risk Products in Alabama

Presenter: Kelley Rich

Organization: WSP Environment and Infrastructure, Inc.

Session: Outreach, Extension & Partnerships

As consultants produce FEMA Flood Risk deliverables for communities in Alabama it is important that the end-users of these datasets be able to utilize the available products. Since these products must adhere to federal standards, guidelines, and specifications, the functionality of the GIS datasets produced as part of the FEMA Flood Risk Program is not always straightforward. Consultants, in partnership with the Alabama Department of Economic and Community Affairs' Office of Water Resources (OWR), are the technical producers of these GIS datasets and are in a unique position to help communities with understanding what information is included in the Flood Risk Products and how to apply these products to each community's unique needs. Over the past decade, personnel from WSP have increasingly partnered with colleagues at academic institutions across Alabama to provide end-users of FEMA Flood Risk Products with trainings and outreach activities geared towards using the digital GIS datasets produced as part of the FEMA Flood Risk program. We are increasingly building stronger relationships with our colleagues in the academic sector and are evolving new ways to partner with universities to help communicate flood risk in Alabama. This presentation will detail the flood risk outreach activities WSP and OWR have provided to Alabama communities over the past decade, including GIS tools classes, FEMA Flood Risk Product trainings, guest lectures at universities in the State, and FEMA "Open House" events, highlighting the importance of our partnerships with Alabama's universities to ensure the success of these events.

Abstract #: 119

Student

Title: Assessing Crop Evapotranspiration and Rainfall Impact on Corn Water Supply by Integrating MODIS and CHIRPS Data

Presenter: Lucas Nunes

Organization: Auburn University

Session: Poster Session

Corn (*Zea mays*) is the most irrigated crop in the United States. Accurate estimation of crop evapotranspiration (ET_c) is vital for efficient water management and optimizing crop productivity. This study aims to bridge the knowledge gap by utilizing MODIS (Moderate Resolution Imaging Spectroradiometer) data to estimate corn ET_c during different growth stages and investigate the impact of rainfall on the water supply in Alabama. Integration of remote sensing techniques, such as MODIS and CHIRPS (Climate Hazards Group InfraRed Precipitation with Station) data, offers significant advantages in accurately estimating corn ET and assessing rainfall impacts. The MOD16A2 algorithm, based on the Penman-Monteith equation, estimates reference evapotranspiration (ET_o) using MODIS data, while the CHIRPS dataset combines satellite-based infrared measurements and ground-based gauge observations to estimate precipitation. By integrating MOD16A2 and CHIRPS data in the Google Earth Engine platform, this study provides a cost-effective and efficient method for monitoring crop water use at a large scale. Four stages of corn development with different crop coefficients (K_c) were defined to assess corn crop evapotranspiration accurately. A developed code in Google Earth Engine enables the estimation of ET_c and the calculation of water supply or deficit due to rainfall for each growth stage. The results highlight the importance of the mid-stage of corn growth, which exhibits the highest ET_c, emphasizing its significance in terms of water supply. Accurate estimation of corn ET_c using remote sensing data can aid farmers in determining optimal irrigation timing and quantities to achieve desired crop yields. Future research should involve statistical analysis to validate the results by comparing observed ET values with simulated values from the code. Statistical analysis will help identify discrepancies and uncertainties associated with the estimates, facilitating decision-making for crop and water resources management. The integration of MOD16A2 and CHIRPS data has the potential to become a valuable tool for enhancing water management planning for corn and other crops. This tool provides insights into crop water usage, soil moisture levels, and precipitation patterns, leading to improved agricultural practices, reduced water waste, and enhanced overall sustainability.

Abstract #: 120

Student

Title: Differences in tolerance and responses to thermal stress in hyposaline conditions between diploid and triploid oysters

Presenter: Kayla Boyd

Organization: Auburn University

Session: Coastal Issues 2

Oysters in the Gulf of Mexico are exposed to a variety of rapidly shifting environmental conditions including temperature and salinity. While the Eastern Oyster, *Crassostrea virginica*, is tolerant of a wide range of thermal and salinity regimes, these oysters have been experiencing mass mortality events across the Gulf of Mexico. It has been observed that high oyster mortalities have occurred when high temperatures ($>30^{\circ}\text{C}$) coincide with low salinity events (<5 ppt). There is also some evidence that triploid oysters experience higher mortalities than diploids. Ongoing climate change may continue to raise ocean surface temperatures and increase the frequency of rapid salinity shifts in coastal habitats. This has the potential to decimate farmed diploid and triploid oyster crops in the coming decades. We conducted a series of experiments to test for differences between diploid and triploid oysters in terms of sublethal responses to physiological and behavioral responses to thermal and hyposaline stress, and for differences in lethal thermal limits to acute thermal stress during hyposaline exposure. We utilized half-sibling diploids and triploids to minimize confounding effects of genetic differences between groups. Oysters were subjected to a rapid salinity drop from 18 ppt to 5 ppt over the course of 12 hours followed by acute thermal stress by raising temperatures from a baseline of 25°C at a rate of $2^{\circ}\text{C}/\text{h}$. As temperatures increased, physiological response was measured via intermittent respirometry. Behavioral responses were quantified in terms of valve closure, valve gaping, and mantle retraction. Preliminary results suggest that metabolic and valve closure responses to thermal stress differed with salinity (i.e. 18 ppt vs 5 ppt), within and between ploidies. However, there was no significant effect of ploidy or salinity on the temperature that induced gaping behavior ($\sim 43^{\circ}\text{C}$) or on upper thermal limits (45°C). Data analysis is ongoing. Results of this study will assist with ongoing efforts to develop environmentally tolerant genetic lines of oysters by identifying tolerance differences between triploids and diploids and potential physiological and behavioral characteristics to select for.

Abstract #: 121

Title: A review of temperature, hypoxia, and other water quality stressors to freshwater mussels

Presenter: Kaelyn Fogelman

Organization: Auburn University

Session: Aquatic Ecology 2

Freshwater mussels of the order Unionoida are currently one of the most imperiled groups of organisms in North America. The southeast U.S. has the greatest diversity of unionid freshwater mussels in the world – with 181 species of mussels in Alabama alone. Accurate risk assessments and development of effective management strategies for remaining populations requires knowledge of the effects of water quality stressors on species' viability. We conducted a systematic literature review to (1) summarize existing lethal and sublethal effects of temperature and hypoxia on unionids by life stage and taxonomy, (2) discuss ecological and climate change implications of existing water quality stressor data (3) identify needs for future research and methodological standardization. Our literature review identified lethal thermal tolerance estimates for 28 of 302 (9%) of species in the families Unionidae and Margaritiferidae. The 90th percentile of acute median lethal temperatures was 31.7°C for glochidia (19 species), 36.5 °C for juveniles (13 species), and 37.8°C for adults (4 species). An ongoing review of sublethal thermal tolerance revealed wide range of sublethal effects including, but not limited, to altered ecosystem services, energetics, physiological processes, horizontal and vertical movement, reproductive activities, and glochidia success. The review of hypoxia tolerance is ongoing, but our preliminary synthesis revealed that low DO concentrations affect mussel's ability to regulate oxygen consumption rates and affect behaviors such as movement, mantle and siphon extension, gaping, glochidia release, and increased respiration rates following re-exposure to normoxic conditions. The survival of species during emersion events is dependent upon habitat selection and behaviors of the species and life stage. We have identified trends in small subsets of the species that have been evaluated for thermal tolerance and future directions could benefit from work to fill data gaps in life stage, phylogeny, or ecologically relevant exposures. Combining known tolerance limits with a comprehensive database of stream temperatures and dissolved oxygen concentrations would be useful for modeling the frequency and duration of sublethal stress ranges and lethal limit exceedance in North American ecosystems where populations are currently living at or near their upper lethal limits. In addition to the effects of temperature, hypoxia, and desiccation, reviews are in progress to evaluate the effects of conductivity, salinity, and agricultural contaminants on North American unionids.

Abstract #: 122

Title: Water quality and hydrologic dynamics of a permeable pavement and bioretention in series

Presenter: Frances O'Donnell

Organization: Auburn University

Session: Poster Session

Green infrastructure practices are a sustainable solution to treat and control stormwater runoff generated by large precipitation events. The hydrologic and water quality benefits of adopting these practices have been reported in the literature, but few studies address multiple practices used on the same site. This study examined the dynamics of water quality and quantity in a green infrastructure system draining a municipal parking lot in Auburn, AL. The parking lot is 25% covered by permeable interlocking concrete pavers with an underdrain connecting the subgrade of the permeable pavement system to a bioretention basin. A surface drainage also conveys runoff from the parking lot directly to the bioretention basin. Water level was monitored at the surface drainage and in the bioretention. These measurements and local rainfall data were used to develop a calibrated hydrologic model for the site using the Environmental Protection Agency (EPA) Storm Water Management Model (SWMM). To evaluate water quality, samples were collected at the surface drainage, two points inside the bioretention, two points from shallow groundwater between the parking lot and bioretention, and from a novel apparatus that allowed sampling of the outflow from the permeable pavements without mixing with the bioretention. These samples were tested for parameters of concern for parking lots and for stormwater more generally: turbidity, total suspended solids (TSS), nitrate, chromium, copper, zinc, and nickel. The hydrologic modeling results demonstrated that the curve number (CN) method for rainfall-runoff calculation within SWMM provided good prediction of pavement outflow in the calibrated model, with R² and Nash-Sutcliffe model efficiency both greater than 0.8. This contrasts with previous studies that suggested that permeable pavements should be modeled as detention storage rather than as a land cover type. However, the calibrated value of the runoff CN for permeable pavement was 60, much lower than what is recommended in many design guidelines for the underlying soil type at the research site. Future research will integrate water quality results with the hydrologic model to understand the interactions between water quality and quantity dynamics.

Abstract #: 123

Title: Developing Riverscapes of Local Hydrology Using Terrestrial LiDAR

Presenter: Ranbir Kang

Organization: Kennesaw State University

Session: Restoration 1

Aerial vehicles to map riverscapes have been successfully used in different locations. However, the canopy cover along stream banks makes it difficult to image stream banks at high resolution especially in case of low order streams. Therefore, this paper extends that approach to the terrestrial level i.e. surveying the continuous riverscapes using a terrestrial Lidar from the river bed instead of an aerial platform. It involved a continuous 3d scanning of the main stem of two low order streams using a terrestrial LiDAR. The process of scanning included the capturing of both point cloud and 260 orthoimages at each scan site in the downstream direction. The individual scans were registered with the help of Leica Cyclone Software Suite as one continuous point cloud of the streamscape for each stream. The data on channel morphology was extracted by creating transects at a uniform interval along each streamscape. While providing an extremely large sample size, this approach allows us to analyze stream bank and bed profiles at much higher resolution for an overall analysis of the system without any canopy interference. The continuous point cloud of a streamscape also allows use to estimate the channel change over time at high spatial resolution. The future work will focus on quantifying the variability within as well as among different streams using high resolution data generated by this approach. Keywords: Stream, channel, fluvial, survey, terrestrial LiDAR

Abstract #: 124

Student

Title: A Decade of Irrigation - Crop Yield Response to Watering Alabama Black Belt Soils

Presenter: Issa Diaz

Organization: Auburn University

Session: Agriculture & Irrigation

The world population increases every year, and as a result, food production must be increased to meet the demand. Likewise, the multiple catastrophic climate events brought on by accelerating climate change are also significant for ecosystems. Drought is one of the events that have the highest effect on human lives worldwide. Because the agricultural sector is particularly susceptible to droughts due to its close connection to water use, farmers frequently use irrigation as a management practice to mitigate their effects and increase their production. Climate-smart agriculture is necessary to reduce the impacts on water resources and maintain the amount and quality of surface water. In Alabama, many farmers have made investments in pivot irrigation systems. However, the soils in the Black Belt region are difficult to manage due to their unique characteristic behavior of shrinking and swelling, which, together with the spatial soil variability, makes it difficult to measure the effects of irrigation on crop yield. The main goal of this project is to explain how crop yields respond to irrigation while considering terrain, soil, and climate variables, and the objective of the study is to determine which dynamic and static variables have the most significant impact on crop production to achieve a high yield. In 3,400 ha of pivot irrigated and rainfed fields in the Alabama Blackbelt, 280 yield datasets from 32 fields were collected using a combine harvester. Spatial derivatives were calculated using the National Elevation Database (NED) elevation information. The POLARIS database and the National Soil Information System (NASIS) were used to retrieve soil data, while the US Drought Monitor was used to retrieve data for the computation of drought indices. All data layers were correlated with corn and soybean yield—irrigated fields produced high yields of corn and soybeans. Additionally, variables related to terrain attributes resulted in the highest effect on producing high yields, followed by soil properties and climate variables, which had less impact on high yields.

Abstract #: 125

Title: **Five Good Neighbor Policies**

Presenter: Wade Burcham, Christian Miller & Ashley Campbell

Organization: 5020 Engineering Resource Group

Session: Stormwater 2

Across Mobile and Baldwin counties, local governments have recognized the need to proactively manage stormwater and conserve natural habitats by updating regulations and ordinances related to stormwater management, natural resource protection, and coastal issues (e.g. shoreline stabilization). Reviews of regulatory drivers within a given watershed completed as part of coastal watershed plan development and a formal review of existing laws and regulations at the federal, state, and local levels for Mobile and Baldwin counties (including 27 city and county jurisdictions) have identified opportunities to improve regulations intended to protect natural resources. Five low-cost, practical, and implementable recommendations to protect our natural resources emerged from Mobile Bay National Estuary Program's recent watershed planning efforts. If enacted, these recommendations, coined as "Good Neighbor Policies", will reduce harm to downstream neighbors from development. If you are associated with regulations that require "No Adverse Impact," want to promote practices that minimize downstream damage from urbanization or are looking for a practical way to incorporate Green Infrastructure into local regulations, you may find this presentation helpful. It will review resources available to county and municipal resource managers, provide model ordinances, links to detailed engineering guidance, and a case study of how one community took steps to become a Good Neighbor.

Abstract #: 127

Title: The use of drones for monitoring water quality: considerations and best practices

Presenter: Stephanie Rogers

Organization: Auburn University

Session: Water Quality 3

Drones, aka unoccupied aerial systems (UAS), have proven to be revolutionary for geographic data collection and knowledge production. Environmental applications have especially benefitted from the ability to adjust the spatial and temporal scales of data collection based on the needs of the project, and ultimately the research questions at hand. Water quality is a particularly challenging application to tackle using drones due to its heterogeneous and dynamic nature. This presentation will offer an overview of work conducted in freshwater environments in Alabama using a variety of drones and sensors, including Red Green Blue (RGB) and multispectral systems. We will discuss the challenges associated with collecting drone imagery in different aquatic environments (e.g., lakes, ponds, streams) to quantify a variety of water quality parameters (e.g., chlorophyll, phycocyanin, E. coli, CDOM). The goal will be to provide insight into best practices in the field and address how drones can be effectively used to monitor water quality at varying spatial, temporal, and spectral scales.

Abstract #: 128

Title: Simulating how freshwater diversions impact salinity regimes in an estuarine system

Presenter: Anna Linhoss

Organization: Auburn University

Session: Coastal Issues 1

The Bonnet Carré Spillway is a large flood control structure that diverts Mississippi River floodwaters into Lake Pontchartrain and the Mississippi Sound to prevent flooding in southern Louisiana and specifically New Orleans. When operating at full capacity, the Spillway releases water at a rate of 7,080 m³/s. Spillway openings regularly last a month or more. The enormous amount of freshwater that is diverted through the Spillway impacts salinity and nutrients in the Mississippi Sound. The objective of this research is to use a hydrodynamic model to simulate the impact of Bonnet Carré Spillway openings on the salinity of the Mississippi Sound over multiple years. Specifically, four hypothetical simulations of Spillway openings are compared to simulations during the same time when the Spillway is closed. The results show how much, how long, and where salinity is impacted in the estuarine system. The maximum difference in salinity, at any given location over the mapped dates between the non-opening and hypothetical opening scenarios, vary between 22 and 30 in each year. Differences in salinity between the opening and non-opening scenarios begin to decline in the study area approximately 18 days after Spillway closure. Decreases in salinity in Lake Borgne persist over a year. The Bonnet Carré Spillway affects salinity mostly in Lake Borgne and along an east/west ribbon that embraces the Mississippi coastline. Decreases in salinity caused by Spillway openings are seen up to 200 km east of the Spillway. These results are important for planning management strategies of estuarine resources during Spillway openings.

Abstract #: 129

Student

Title: Coastal nature-based solutions to mitigate flood impacts and enhance resilience in Mobile Bay, Alabama

Presenter: Javier Robles Camacho

Organization: The University of Alabama

Session: Lightning Talk - Research

The current conditions of a changing climate and a continuous growth of coastal settlements pose a major challenge to decision makers. For instance, the severe impacts of compound coastal flooding in communities and the economy call for novel approaches to such problematics. This research takes as case Mobile's Bay system and the implementation of hydrodynamic numerical modeling to accurately simulate water levels during storm conditions and marsh migration under different sea level scenarios. Additionally, the numerical experiments include the interaction of various nature-based solutions (NBS) into the hydrodynamic modeling framework to evaluate the potential benefits of NBS in mitigating coastal flooding events. These data can provide decision makers with information they need about potential solutions to increase flood resiliency. To ensure a bottom-up approach, the compound flooding scenarios will focus on needs identified by stakeholders during 'Workshop I: Mobile Bay compound flood modeling project' (Apr 17th, 2023), that reflects their perspective towards future planning and development strategies. The ongoing work is currently in the stage of gathering reliable information for implementation and validation of the numerical model and designing the test scenarios.

Abstract #: 130

Student

Title: Plant Growth Evaluation of Novel Poultry-Litter Derived Fertilizer

Presenter: Austin Lindquist

Organization: Auburn University

Session: Water Quality 1

Poultry litter has historical usage as an organic fertilizer and soil amendment. However, the improper application of raw litter may cause water quality issues and invoke legal liability; one result being decades of legal battles between Arkansas and Oklahoma over the Illinois River. Multiple processes have been developed to reduce the negative effects of raw litter application by altering the physical and chemical nature into a more suitable plant nutrient product. This investigation focused on a novel aerobic digestion process utilizing Cleaned & Green's (C&G) proprietary method to extend the nutrient release time of fertilizer while eliminating potential pathogens. Chemical and physical characteristics were assessed on C&G fertilizer by conducting plant assays and physical testing. Substrate pH and EC were evaluated and plant growth index, dry weight, and foliar analysis were recorded. Physical characterization assessed prill hardness, particle size distribution, and friability. Increasing rates of fertilizer application resulted in increased EC rates and decreased plant growth two weeks after planting. Electrical Conductivity two weeks after planting was 0.84, 4.56, 5.52, and 7.56 mS/cm for 0 lbs N/yd³, 0.75 lbs N/yd³, 1.5 lbs N/yd³, and 3 lbs N/yd³. Growth indices two weeks after planting indicated the control had the lowest size, in comparison to 120%, 220%, and 250% total size for the 3 lbs N/yd³, 1.5 lbs N/yd³, and 0.75 lbs N/yd³, respectively. Across all treatments, poultry litter applied at 0.75 lbs N/yd³ produced the largest plants. Plants grown at the lowest poultry litter rate were 117%, 121%, and 134% larger than C&G, a blend (1:1 N) of C&G and synthetic, and synthetic fertilizers at the same rate, respectively. Initial results suggest the C&G fertilizer may be utilized similar to synthetic fertilizer without the potential environmental burdens imposed by raw poultry litter applications.

Abstract #: 131

Student

Title: Nutrient Release Characteristics of a of Novel Poultry-Litter Derived Fertilizer

Presenter: Austin Lindquist

Organization: Auburn University

Session: Poster Session

Poultry litter, a common soil amendment, can be applied to soils as a plant nutrient source. Due to a balanced nitrogen: phosphorous ratio applying poultry liter based on nitrogen rates may result in an overapplication of phosphorous. Increased phosphate levels may result in eutrophication within aquatic environments. To reduce contamination risks, poultry litter can be altered through several different processes, such as anaerobic or aerobic digestion, and pelletized for more uniform product distribution. Product assessments were made of a proprietary process which combines aerobic digestion and ammonification to physically and chemically alter poultry litter. Through this process, standard poultry litter is transformed from a 1.5-1.5-1.5 N-P-K chemical formulation to a 11.5-2-2 N-P-K granulated product (C&G fertilizer). Nutrient release rates were investigated using a soil incubation test and a rapid water incubation test. Nutrient release rates in soil were evaluated at a 1.5 lbs N/yd³ rate with soil maintained at 0.3 cm³/cm³ volumetric water content at 30 C over a 55-day period. Rapid water incubation was conducted by adding one gram of fertilizer (C&G, Synthetic, or Osmocote) to 100 milters of water for 24-hour period. Electric conductivity was monitored to evaluate nutrient release over time. Within the first 10 minutes, 82% of C&G and 95% of synthetic nutrient release had occurred in water-based method. Osmocote had the slowest and most variable release rate. In soil, significant and increasing quantities of phosphorous, potassium, ammonium, and nitrate were released in the first six days of incubation. After six days, nitrate and potassium continue to increase while phosphorus and ammonium plateaued in release. Initial results suggest the C&G fertilizer may be utilized similarly to synthetic, uncoated fertilizers.

Abstract #: 132

Student

Title: Investigating the effects of freshwater mussel density on the bedload characteristics of a gravel-bedded stream: Sipsey River, Alabama

Presenter: Taylor Tatum

Organization: The University of Alabama

Session: Poster Session

Freshwater mussels dominate benthic biomass in many rivers of the eastern U.S. and are well established ecosystem engineers hypothesized to provide significant and long-lasting impacts on both biotic and abiotic characteristics of stream systems. As such, they have many important function traits such as bioturbation behaviors that suggest they have potential to affect sediment dynamics in rivers. Previous work in both flume and field studies find that both individual and multi-species populations of mussels affect erosion and accretion rates, but little is known about the full extent of these effects on sediment. In this study, the relationship between freshwater mussel density (mussels per square meter) is compared to bedload sediment characteristics in the lower Sipsey River downstream of Tuscaloosa, Alabama. The Sipsey River contains one of most intact mussel communities in North America, making it an ideal location to examine mussel impacts on sediment. Previous research conducted in a single 60-m reach showed that mussels increased bedload sorting and D50 diameter. Here we examine whether mussel influences on sediment characteristics can be detected across multiple river reaches within the lower Sipsey River. Mussel density surveys and pebble counts were conducted at five river reaches ranging in length from 40-80 meters during the months of July-September 2019. We then examined the relationship between mussel density and sediment size (D20, D50, and D80) using statistical tests including correlation, regression, ANOVA, and basic numerical modeling. Our preliminary analysis shows that there is a positive and significant correlation ($p < 0.01$) between mussel density and sediment size (particularly D50). These findings occurred for all sites, but stronger statistical relationships existed within individual study reaches compared to relationships among reaches. These findings suggest that mussels may play a role in determining particle size distribution of bedload and may be an overlooked factor in determining sediment particle size distributions in gravel-bedded rivers. On a broader scale, these findings inspire a need to further examine the relationship between ecosystem engineers like freshwater mussels and their impacts on stream sediment dynamics in order to provide better holistic understanding of stream systems and create better predictions.

Abstract #: 134

**Title: Case Study on the Locust Fork and Village Creek Nutrient TMDL:
Tracking Implementation and Observed Instream Nutrient Reductions**

Presenter: James Mooney

Organization: Alabama Department of Environmental Management

Session: Water Quality 3

The goal of this presentation is to provide insight into the Alabama Department of Environmental Management's approach for developing Total Maximum Daily Loads (TMDLs) to address nutrient impaired waterbodies by illustrating a specific case study, specifically the Locust Fork and Village Creek Nutrient TMDL. In 2018 the Department finalized the Locust Fork and Village Creek Nutrient TMDL to address the existing nutrient impairments on those waterbodies. As a result of the TMDL, numeric nutrient effluent limitations were mandated for over thirty NPDES regulated point sources located throughout the Locust Fork watershed. Since 2018, the Department has been conducting routine water quality monitoring in the Locust Fork watershed. Based on the continued ongoing implementation of the TMDL, the Department has observed a significant reduction in total phosphorus loading discharged from point sources in the watershed. Consequently, the instream nutrient concentrations have also been reduced considerably. Finally, the presentation will provide an update on the extensive work completed in conjunction with the USEPA to develop a dynamic water quality model to address the existing nutrient impairment on the Tennessee River (Wheeler Lake).

Abstract #: 135

Title: Use of Geospatial Technologies to Spatially Assess the Sea Level Rise Impacts on Coastal Infrastructure

Presenter: Kate Grala

Organization: Mississippi State University

Session: GIS

Coastal infrastructure systems are significantly impacted by high tide flooding, storm surge, and recurring extreme weather events, resulting in considerable infrastructure management challenges. The assessment of these impacts often relies on geospatial technologies. However, the availability of customized geospatial tools capable of facilitating prompt evaluations of these impacts remains scarce. This limitation is particularly evident when it comes to supporting adaptive management decisions that must consider unknown factors while evaluating critical infrastructure systems such as roads, powerlines, and wastewater disposal sites. In our study, we utilized Geographic Information Systems (GIS) to enhance data analysis and evaluate both present and future threats associated with projected sea level rise (SLR) scenarios. Our presentation highlights two geospatial efforts aimed at infrastructure assessments at both regional and local scales. These efforts encompass a vulnerability assessment of the impacts of SLR on transportation infrastructure across multiple states and a localized analysis of on-site wastewater disposal systems. The methodologies employed in these projects are based on geospatial science and take into account spatial relationships between the SLR layers and various segments of infrastructure systems. Our findings are effectively communicated through interactive web-based applications, including maps and dashboards, which aid in identifying the coastal communities most susceptible to SLR impacts. We created geospatial tools that automate the assessment of projected SLR scenarios and facilitate data extraction across multiple layers. By incorporating these developed tools, decision-makers can enhance their decision-making processes and identify adaptive management solutions that foster increased resilience against potential SLR impacts on coastal communities.

Abstract #: 136

Student

Title: Persistence of host-associated bacterial and mitochondrial DNA markers in sediment

Presenter: Wenjing Ren

Organization: Auburn University

Session: Water Quality 3

Monitoring microbial water quality traditionally focuses on measuring microbial parameters in the water column. Sediment, however, has been shown to be a reservoir for fecal bacteria in aquatic environments, and the decay of fecal bacteria and host-associated genetic markers in sediment is understudied. Here, we utilized laboratory microcosms set up in sentinel chambers to examine the persistence of bacterial and mitochondrial DNA (mtDNA) markers associated with humans (HF183 and HcytB), cattle (CowM3 and QMIBo), and chickens (LA35 and Chicken-ND5), as well as the general Bacteroidales marker AIIBac, in freshwater sediments, using quantitative polymerase chain reactions (qPCR). The microcosms containing freshwater sediment were spiked with sewage, cattle feces, and poultry litter and were buried in saturated sediment. The microcosms were held for a 40-day period, and samples were collected from the sentinel chambers at various time intervals. The results showed that all host-associated bacterial markers decayed faster than mtDNA markers. Cattle-associated markers (CowM3 and QMIBo) exhibited prolonged persistence compared with human- and chicken-associated bacterial and mtDNA markers. Additionally, the abundance of the general Bacteroidales marker AIIBac remained stable throughout the experimental period and showed greater persistence than host-associated bacterial markers. The time required to inactivate 90% of plateable *E. coli* was significantly longer in microcosms inoculated with cattle feces and poultry litter than in sewage-inoculated microcosms. These findings provide valuable insights into the fate of bacterial and mtDNA markers in sediment. Knowledge of the variability in inactivation rates of *E. coli* from different fecal sources will lead to the development of more reliable predictive models for microbial risk assessment.

Abstract #: 137

Title: Using a Community-Engaged Framework in Groundwater Research

Presenter: Ann Ojeda

Organization: Auburn University

Session: Well Water

Groundwater is a critical water resource, particularly for private well users that rely on groundwater exclusively for household needs. Here, we describe ways that we bridge the gaps between well users and researchers to better understand groundwater quality and private well management in coastal Alabama. We use a community-engaged research (CEnR) framework so that the private well users are engaged in some or all elements of the research study. The CEnR framework can exist along a continuum from community-informed research, where the community members act as advisors, to community-involved, where the community members are collaborators, to community directed, where members are leading the project. For groundwater research, the CEnR framework benefits participants, research teams, and the larger private well community. For the participants, it addresses direct concerns related to drinking water quality, while for researchers, it provides access to sites that are otherwise difficult to reach. We work with a core group of well users in Mobile and Baldwin counties, Alabama to collect data about water well water quality, perceptions of water quality, and well management decisions. Together, these elements create a foundational understanding of groundwater quality and well management in coastal Alabama. We use the data to understand primary controls on water quality like local geology or land use, and share those results with the community at the individual, well level and at the aggregated, county level. The dataset will be used to extrapolate results to understudied areas, resulting in better informed decision making for well users that were not part of the initial study. This data also guides resource development and planning through the Alabama Private Well Program, part of Alabama Cooperative Extension, to ensure the lessons learned are shared with the community at large. We hope the CEnR framework leads to an increased community trust in research and a deeper connection between the community, Extension, and researchers.

Abstract #: 138

Title: Alterations to Organismal Behavior due to Micro- and Nanoplastic Exposures

Presenter: Andrew Barrick

Organization: Auburn University

Session: Aquatic Ecology 2

Plastics are ubiquitous substances with approximately 42,000 tons entering the environment annually. Once entering the environment, plastics can be broken into microplastics (1 μm < 5 mm) and nanoplastics (<1 μm), which increases their potential for bioaccumulation and transfer through the food chain in the natural ecosystem. Since plastics are hydrophobic to many chemicals, especially organic pollutants, plastics can ab/adsorb pollutants in the aquatic environment. In addition, most plastics contain chemical additives that have been reported to be toxic to living organisms. Therefore, ingestion of micro, and nanoplastics are a potential vector for co-pollutants, enhancing their ecotoxicity towards aquatic organisms. Much of the ecotoxicological research has focused on plastics as particles with endpoints targeting bioaccumulation, subcellular and developmental effects, and mortality. The presence of plastics can alter the behavior of organisms through either neurotoxicological effects or changes to behavior to avoid contamination, which can lead structural changes in a population and ecosystem communities. At present micro- and nanoplastics and their relationship to neurotoxic additives, such as phthalates and phenols, is poorly understood. This presentation supplies a synopsis of current research of how micro- and nanoplastics can influence the behavior of exposed organisms. The research focuses on three main categories: 1) changes in behavior due to plastic exposure, 2) changes in behavior due to exposure to chemical additives, and 3) alterations to behavior due to micro- and nanoplastics presence in the environment. The purpose of this presentation is to highlight behavioral research as an emerging research topic for micro- and nanoplastic research and provide perspectives on future research directions. As micro- and nanoplastic exposure studies are beginning to focus on smaller scale plastics, the presentation highlights the need for future research on zooplankton, such as copepods and daphnia, to fully understand environmental risks associated with micro- and nanoplastics. Keywords: behavioral effects, microplastic exposure, nanoplastic exposure, mechanism of toxicity

Abstract #: 139

Title: **AlabamaFlood.com: How to Use It (and Upcoming Improvements)**

Presenter: Jeff Zanotti

Organization: WSP Environment and Infrastructure, Inc.

Session: GIS

For years now the State of Alabama's Office of Water Resources has used AlabamaFlood.com to promote outreach for stakeholders of all backgrounds. It is a one stop shop for flood risk data for completed FEMA Risk MAP projects as well as ongoing projects. Users can look up FEMA regulatory products such as floodplains, base flood elevations, cross sections, etc as well as FEMA non regulatory products that promote mitigation activities instead of focusing on an "in or out" approach to floodplain mapping. The presentation will go over each set of these products and go over how a wide array of users can utilize them. The user friendly interface also makes it easy to navigate by address look up, county zoom, or even just on your own searching. There is no specific target demographic for this site so it can be used by private citizens, realtors, city clerks, scientists, and students as well as flood professionals. While it can be used for basic functions the site also provides detailed information for flood professionals such as model downloads and floodway data tables. While the site has been useful for years we do understand that we need to grow the pool of those that know about it and will use it on a regular basis. We also understand that we need to progress as technology and community needs change so we will be covering new updates to help keep the site as useful as possible for future use.

Abstract #: 140

Title: Water Quality Considerations for Solar Project Development and Management in the Southeast U.S.

Presenter: Richard Hall

Organization: Auburn University

Session: Water Quality 2

Solar project development is projected to increase dramatically throughout the southeast U.S. over the next ten years. This surge in development is being driven by significant financial incentives included within the climate provisions of the Inflation Reduction Act (IRA), ongoing commitments to renewable energy as part of net-zero climate commitments and a range of other factors. Solar projects have unique attributes that can have significant impacts on regional water quality, especially when taking into account the large geographic footprint associated with large utility scale solar projects. This presentation will highlight key water quality management considerations as part of the development and management of solar projects in the southeast U.S. This presentation will also provide a brief overview of relevant regulatory guidelines and frameworks that directly relate to regional water quality impacts from solar projects in the southeast U.S.

Abstract #: 141

Student

Title: Exploring the influence of stakeholders' opinions on the selection and weighing of social vulnerability/community resilience variables in flood risk management

Presenter: Md Munjurul Haque

Organization: Department of Geography and Environmental Studies

Session: Drought & Climate 1

The incorporation of social vulnerability and community resilience variables is crucial for effective flood risk management strategies aimed at reducing the impact of flooding on vulnerable populations. This study examines the influence of stakeholder perspectives on the selection and weighing of these variables in the context of flood risk management. A comprehensive literature review was conducted to identify key indicators, which were then used to develop a Qualtrics questionnaire. The questionnaire was administered to emergency managers, policymakers, meteorologists, researchers, and engineers responsible for flood management in the mobile bay area. Purposive sampling was used to collect quantitative data. The findings from the survey responses indicate that stakeholders' locational background and professional experience significantly influence the selection and weighing of indicators. Proximity to rivers or coastlines and historical inundation were identified as the most significant indicators for determining social vulnerability. In contrast, community awareness and preparedness were prioritized as the most essential indicators for evaluating community resilience. Stakeholders play a vital role in the development of flood risk management policies and strategies due to their diverse perspectives and expertise, which provide valuable insights into the local context. By considering stakeholder opinions, decision-makers can ensure that the selected variables accurately reflect the unique characteristics of the at-risk community. This study contributes to a greater understanding of the socio-political dynamics that shape effective flood risk management strategies by examining the influence of stakeholder opinions on the selection and weighing of social vulnerability and community resilience variables. It highlights the need for collaborative and inclusive approaches in flood risk management decision-making processes, ensuring that the interests and perspectives of all stakeholders are considered. In conclusion, this research emphasizes the importance of incorporating stakeholder perspectives to develop comprehensive flood risk management strategies. By considering the opinions of diverse stakeholders, decision-makers can enhance the relevance and effectiveness of their approaches, leading to more resilient communities in the face of flood events.

Abstract #: 142

Title: Alabama Envirothon Program Update and Opportunities for Water Resource Professionals

Presenter: Courtney Curenton Baker

Organization: Alabama Association of Conservation Districts

Session: Lightning Talk - Outreach

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

Abstract #: 143

Student

Title: Integrating amplicon sequencing and community science to survey the biodiversity of organisms with complex life cycles

Presenter: Sarah Shinker Connelly

Organization: The University of Alabama at Birmingham

Session: Poster Session

Many organisms, including algae, exhibit life cycles with more than one free-living stage. In some cases, these stages are morphologically distinct, such that they can be easily mistaken as separate species. These life cycles can prove challenging for scientific studies, especially if one or multiple life stages are microscopic, because one needs to collect samples of all stages to understand the natural history of the organism. Freshwater red algae are typically found in streams with high dissolved oxygen and low nutrients. They provide food and habitat for aquatic macroinvertebrates yet are not currently included in biodiversity surveys in Alabama. These algae have a microscopic, perennial stage called the 'Chantransia'. The Chantransia is the spore-producing stage called the sporophyte. It produces macroscopic, seasonal stages that produce gametes, called the gametophytes. Most studies have focused on the macroscopic gametophytes, largely because they can easily be collected and identified. Yet, the gametophytes are only present during part of the year and can be easily missed if the populations are small and patchy or if sampling occurs during the part of the year when gametophytes are absent. To survey the perennial, microscopic Chantransia, we scraped the biofilm from rocks in ponds and streams. We visually observed biofilm under the microscope to detect Chantransia. However, the species of Chantransia cannot be determined visually. To differentiate among freshwater red algal species from the Chantransia stage, we extracted environmental DNA from the biofilm samples, then sequenced a portion of the *rbcL* gene. This gene is involved in photosynthesis and can be used as a barcode to identify species. Using microscopy and sequencing, we detected Chantransia in several streams where gametophytes were absent. These results suggest that monitoring the microscopic stage may help us to catalog the biodiversity of freshwater red algae more accurately. The sampling methods are relatively simple, so we have initiated a community science project to train volunteers to collect and send biofilm samples to our lab for processing. This project was initiated with the dual goals of i) expanding our lab's monitoring capacity and ii) engaging local communities in biodiversity monitoring.

Abstract #: 144

Student

Title: Reservoir Hydrologic Residence Time Drives Nitrogen Deposition in Reservoirs Observed from Aquatic Sediments

Presenter: Benjamin Webster

Organization: Auburn University

Session: Drought & Climate 3

Reservoirs are hotspots for sediment and nutrient deposition however, less is known of how these systems transport deposited nutrients throughout a watershed with linked reservoirs. The phosphorus dynamics, including deposition, have been widely considered but sediment nitrogen processes have received less attention. In this study, we compared average annual hydrologic residence time along with other potentially exploratory variables to the sediment nitrogen concentrations for eight reservoirs in the transboundary ACF (Apalachicola-Chattahoochee-Flint) watershed. Residence time is a function of water storage in a reservoir and the rate of outflow, which can be considered as the rate the reservoir empties. Reservoir residence time is understood to be a dynamic value dictated by the amount of water within the reservoir and discharge regulations. Residence time is an important quality that drives many ecological mechanisms including nutrient depositional efficiency from the water column. The eight reservoirs varied regarding residence time, type (surface area, water volume, land use, catchment area, unimpeded upstream river distance, primary usage (hydropower and storage), and placement along regulated and unregulated rivers. Using long-term reservoir flow datasets, federal long-term drought indices, geographic information systems, and classical paleolimnological techniques (i.e. sediment core analysis), average annual residence time was found to have the strongest relationship out of all of the physical reservoir parameters with sediment nitrogen concentrations, $R^2 = 0.79$. Residence time is expected to drive nitrogen deposition by allowing for longer periods of algal growth followed by deposition of nitrogen in particulate organic form. This is seconded by the photosynthetic pigments diagnostic cyanobacteria ($R^2 = 0.73$), diatoms ($R^2 = 0.56$), and a combination of green algae+cyanobacteria ($R^2 = 0.40$) showing positive asynchronous responses with average annual residence time. In periods of drought dam and reservoir managers are forced to abide by critical yields and base flow regulations to maintain reservoir water storage and supply a minimum dam release flow downstream thus increasing water retention times. Following regressions, we created during these extreme drought periods increased residence time by 45 – 60%, which was estimated to increase nitrogen deposition by roughly 2.5 – 4% and cyanobacteria group concentrations by roughly 8 – 13%.

Abstract #: 145

Student

Title: A Comparative Study of Different Manning's Coefficients on Flood Inundation in a Modeled River System

Presenter: Parvaneh Nikrou

Organization: The University of Alabama

Session: Poster Session

As the frequency and magnitude of high-impact floods continue to escalate, there is an urgent imperative to accurately predict and delineate the extent of flood inundation. Hydraulic models play a vital role in accomplishing this task by simulating the intricate interactions between water and the surrounding terrain. Among the key variables that significantly influence the precision of hydraulic models is the characterization of surface roughness. Roughness coefficients are employed to model the frictional resistance encountered by water as it traverses diverse surfaces, including floodplains and natural channels. This study focuses on Brays Bayou in Harris County, Texas, examining the influence of roughness coefficients on floodplain and channel flow. The investigation reveals that augmenting the roughness coefficient results in an expansion of the flood inundated area.

Abstract #: 146

Title: The Commercial Oyster Aquaculture Sector Training (COAST) Program

Presenter: Andrea Tarnecki

Organization: Auburn University

Session: Poster Session

In 2023, the Commercial Oyster Aquaculture Sector Training (COAST) program was launched. This program is a workforce development initiative aimed to recruit workers to the oyster aquaculture industry and provide them with training to meet industry demand. Current funding allows for the teaching of 10 apprentices over the course of two years in various aspects of oyster farming, including production and rearing, business management, food safety, and serving. Participating businesses from Alabama and Mississippi receive a portion of the apprentice's wages to support training efforts. This presentation will provide a 6-month update on the COAST program, including general logistics, business and apprentice recruitment, and an update on participants.

Abstract #: 147

Title: **Responsible Remediation: Balancing Environmental Cleanup and Habitat Preservation**

Presenter: Alan Fowler

Organization: Geosyntec Consultants, inc.

Session: Restoration 2

Risk management decisions for the cleanup of hazardous waste sites are complex and based on achieving a unique balance of site-specific factors including effectiveness, implementability and cost. This presentation will focus on effectiveness-related considerations including a remedial action's ability to be protective over the long-term while preserving critical habitat. Finding this balance can be challenging. The implementation of remedial actions can be destructive and so the potential for the cure to be worse than the ailment exists. To assist in achieving this balance, an understanding of site-specific cleanup concentrations and the function and values of habitat where the remediation activities are planned is required. For example, the challenges of restoring a hayfield where soils and vegetation have been removed during remediation are limited in comparison to attempts (likely futile), to restoring an old-growth riparian corridor bordering a creek. While the hayfield can be easily restored, and the riparian corridor cannot, the habitat value of the riparian corridor significantly exceeds that of the hayfield. The net result of this balancing process, termed Responsible Remediation, ensures that environmental improvements tied to cleanup activities are not outweighed by negative impacts to sensitive habitats where restoration of the disturbed areas may not be possible. This presentation will review cleanup considerations for floodplain soils and in-creek sediment at the Anniston PCB Site. An evaluation of potential cleanup levels will be presented including the supporting scientific basis (toxicity), application of these cleanup values to the Site's footprint including the use of different statistical approaches (surface weighted average concentrations (SWACs), the areal extent of impacts to sensitive terrestrial and aquatic environments, and the challenges associated with potential restoration. Considerations of toxicity will include the multiple layers of overprotectiveness that are intrinsically built into the development of ecologically based cleanup levels through application of the precautionary principle. Similarly, the need to include an additional layer of overprotection by applying high confidence statistical methods for future exposure conditions will be assessed. And finally, impacts to sensitive ecological habitats of collectively applying these overly protective approaches will be examined to identify a Responsible Remediation approach that balances environmental cleanup objectives while preserving sensitive habitats.

Abstract #: 148

Student

Title: **Campylobacter prevalence in seabirds associated with floating oyster gear**

Presenter: Luke Matvey

Organization: Auburn University Shellfish Lab

Session: Poster Session

Campylobacteriosis, caused by bacteria in the genus *Campylobacter*, is reported as the most common source of human bacterial gastroenteritis worldwide. The disease typically causes bloody diarrhea, muscle cramps, and fever. It often resolves without treatment, but may be more serious in young children, elderly, and individuals with underlying conditions. The bacterium is present in food animals and pets, with consumption of contaminated food suspected to be the major contributor to illnesses. *Campylobacter* has been found in oysters and a recent outbreak in Rhode Island implicated raw oysters as the source of these infections, resulting in harvest closures for the area. It is suspected that birds indirectly transfer *Campylobacter* to oysters, as wild birds are natural reservoirs for the bacterium and floating aquaculture gear provides roosts for seabirds which defecate around the rearing cages. As a result of these concerns, the National Shellfish Sanitation Program encourages farmers to incorporate bird deterrents on floating aquaculture gear to reduce seabird interactions. This causes economic strain on the industry by incurring additional labor and increasing the cost of production. Despite suspicions, investigations into the prevalence of *Campylobacter* spp. in seabirds and the potential of pathogen transfer to oysters are lacking. Preliminary observations from our laboratory indicate that 4 out of 22 fecal samples contained putative *Campylobacter*, with all suspected positives originating from *Thalasseus maximus* (Royal Tern). The goal of this study is to determine which seabirds carry *Campylobacter* in the Gulf of Mexico and if the bacterial prevalence changes throughout the year. This research will evaluate the frequency of *Campylobacter* spp. in bird species that frequent floating oyster aquaculture gear such as *Sterna hiruno* (Common tern), *Hydroprogne caspia* (Caspian tern), and *Pelecanus occidentalis* (Brown pelican). Opportunistic sampling will be conducted weekly over a one-year period, with fecal material from approximately 10 birds collected per week. Suspected *Campylobacter* colonies grown on *Campylobacter* CHROMagar will be confirmed and identified to the species level using polymerase chain reaction techniques. The potential for seabirds to carry this pathogen will be determined across bird species and season. In addition, cameras will be deployed at an oyster farm to determine the frequency of bird interactions with floating aquaculture gear. These data will inform on the interactions between seabirds and oyster farms in the Gulf of Mexico and guide future investigations into potential risks associated with relationships.

Abstract #: 149

Title: Ecotourism Opportunities for Choccolocco Creek

Presenter: Jennifer Yates Hudson

Organization: Choccolocco Creek Watershed

Session: Outreach, Extension & Partnerships

Ecotourism provides hands-on opportunities for water resources education and funding to support long-term stewardship activities. The ecotourism concept is fully embodied through the Choccolocco Kayak experience being implemented by the Choccolocco Creek Watershed Conservancy District (CCWCD) in Oxford, Alabama. This kayak program is part of the CCWCD's efforts to protect the waters and riparian corridor of Choccolocco Creek located in northeast Alabama. Choccolocco Creek flows for approximately 65 miles from its head waters in the Talladega National Forest southeast to its confluence with the Coosa River and receives inputs from a surrounding drainage basin that is approximately 500 square miles in size. This presentation provides an overview of the kayak program and how over the past 4 years it has provided hundreds of kayakers with a unique opportunity to explore the natural beauty of this creek and its bordering riparian corridor. Choccolocco Kayak is conveniently located near major recreational and public interest areas including Choccolocco Park and the Oxford Exchange retail center, and area roadways. The kayak program includes full serve opportunities where participants can be outfitted with everything needed and streamlined options for those with their own equipment. Its proximity to Choccolocco Park also provides opportunities for participants to experience other recreational activities. The wide range of outdoor activities at Choccolocco Park includes a network of trails along the Creek, disk golf, a fitness court, and the opportunity to support family members participating in baseball, softball, track and field, or soccer events. The Choccolocco Creek Archaeological Complex is also nearby and provides educational opportunities to become familiar with the extensive Native American history for the area. The kayak trip along Choccolocco Creek takes 1.5 to 2 hours, and the range of available kayak equipment allows for participation across a wide range of age groups. The experience includes transportation of participants and their equipment to an upstream location where they can begin their several-mile downstream kayak journey at their own pace. Twenty five percent (25%) of the revenue generated by Choccolocco Kayak is provided directly to the CCWCD to further their educational outreach and stewardship efforts to protect the Watershed. Equally important, Choccolocco Kayak provides a convenient opportunity for a direct on-water experience that provides participants with a personal connection to the local natural environment.

Abstract #: 150

Title: Recent Operational Applications of the SPoRT-Land Information System

Presenter: Robert Junod

Organization: NASA Marshall Space Flight Center

Session: Drought & Climate 3

Several core products and data sets from the NASA Short-term Prediction Research and Transition (SPoRT) Center have been evaluated and utilized operationally at the National Weather Service (NWS) office in Huntsville, AL, including those from SPoRT's real-time instance of the NASA Land Information System (hereafter, "SPoRT-LIS"). The SPoRT-LIS is a near real-time configuration of the Noah land surface model as run within the Land Information System framework, updates four times daily, and produces hourly temporal output at ~3-km spatial resolution. In 2011, SPoRT-LIS data were initially utilized for the purposes of drought monitoring, but were also incorporated into the local Weather Research and Forecast model run at the Huntsville and several other NWS forecast offices. The successful transition of these data into the Automated Weather Interactive Processing System II (AWIPS II) enabled closer inspections and evaluations of the data, and their subsequent use for flooding threat assessment as well. The application of the data for drought and flooding applications was also evaluated at NWS offices in Raleigh and Houston in 2014 with some demonstrated success. Motivated by the 2016 Gatlinburg wildfire and recent western U.S. wildfire seasons, SPoRT also began analyzing relationships between soil moisture and vegetation inputs to wildfire events. More recently, to provide a more objective and quantitative threat assessment for areal river and stream flooding, SPoRT began a project to deliver forecasts of local stream gauge height in the Huntsville county warning area by applying machine learning techniques that incorporate inputs from SPoRT-LIS and rainfall analyses. This has led to the development of other potential applications of the SPoRT-LIS for various operational applications ranging from the prediction of flooding, to blowing dust events, wildfire initiation and even fog forecasting. This presentation will discuss ongoing and planned future research projects at NASA SPoRT utilizing the SPoRT-LIS and its expanding applications at some collaborative NWS offices and the U.S. Forest Service.

Abstract #: 152

Student

Title: DEVELOPMENT OF SOIL MOISTURE AND PRECIPITATION THRESHOLDS FOR A GIS-BASED LANDSLIDE PREDICTION TOOL FOR ALABAMA

Presenter: Abraham Alvarez

Organization: Auburn University

Session: Poster Session

Landslide occurrences near existing roads and urban areas are a significant problem for the Alabama Department of Transportation (ALDOT). High-intensity rainfall and soil moisture have been identified as triggering factors for landslide events as rainfall affects slope stability and soil moisture increases stress and reduces soil strength. Thus, several methods to identify landslide thresholds considering precipitation and soil moisture have been developed. However, a prediction tool based on current data and threshold identification methods is still a topic of study that requires further testing. The identification of potential landslide events can help plan preventative maintenance of roads and avoid road closures. This project aims to develop a tool that can relate precipitation and soil moisture data with soil displacement at specific locations throughout the state for developing warning thresholds in real-time. Published threshold methods based on rainfall intensity and duration per storm and normalized soil moisture per event data will be used to identify landslide activation. Soil displacement data from an inclinometer database provided by ALDOT is used to identify when landslide events occurred. ArcGIS Pro software with Python scripting language will be used for the structure of the prediction tool. The tool extracts precipitation data from National Oceanic and Atmospheric Administration (NOAA) and soil moisture from the NASA Soil Moisture Active Passive (SMAP) project and identifies storms that occurred before each landslide. Consecutive days with rainfall are classified as storm events and cumulative rainfall with the respective number of days per storm are calculated as well. Soil moisture data is normalized and grouped per storm event to determine the relationship between maximum accumulated precipitation and levels of soil moisture per storm. Moreover, data collected will be processed with soil displacement to establish two thresholds that define non-landslide events as changes in displacement less than 1 mm and landslide events with changes greater than 5 mm. The product will have a real-time feature for continuously updating the data and calculations required for the landslide indicators. Preliminary results identify a good fit of the data with the ID threshold curve proposed by a previous author, and soil moisture improves prediction by getting false positive points (non-triggering events that fall above the threshold curve) with drier-than-average soil moisture values at the non-landslide thresholds.

Abstract #: 153

Title: Large Inland River sampling in Alabama: an update on the USGS National Water Quality Program Surface Water-Quality Sampling

Presenter: Amy Gill

Organization: U.S. Geological Survey

Session: Lightning Talk - Research

Two large inland river sites in Alabama are sampled multiple times each year as part of the U. S. Geological Survey National Water-Quality Program. Samples are analyzed for field parameters and concentrations of nutrients, major ions, pesticides, and suspended sediment. Sampling results are used to evaluate long-term trends of selected water-quality constituents. Standardized sample collection and analysis methods allow comparisons of estimated loads and yields from contributing watersheds of the Alabama sites with other sites across the Nation. The Alabama River at Claiborne (USGS 02429500) and Tombigbee River below Coffeerville Lock and Dam (USGS 02469762) are adjacent watersheds of approximately 22,000 and 18,400 square miles, respectively, representing about 92 percent of the entire Mobile River watershed. The Alabama River site is approximately 5 miles downstream of Claiborne Lock and Dam in Monroe County and the Tombigbee River site is sampled about 2 miles downstream of Coffeerville Lock and Dam on the border of Clarke and Choctaw Counties. Samples are collected 14 times a year at the Alabama River site and 18 times a year at the Tombigbee site. Sample collection is throughout the year to capture a range of streamflow conditions and the agricultural growing season. Land use is similar in the two river watersheds, about 60 percent forest and about 20 percent agricultural, and exerts a strong influence on the water-quality characteristics of the streams. Data summarized for the Alabama River are from 2014 to the most current available, and data from the Tombigbee River site are from 2013 to the most current available. Nutrient concentrations are generally slightly greater at the Tombigbee River site, with the exception of total Kjeldahl nitrogen, which is very similar between the two sites. Some pesticide compounds are present in most samples, but the most frequently detected compounds differ between the sites. AMPA, a degradate of glyphosate included in sampling for the 2014 and 2015 water years, was detected in 100 percent of samples from both sites. In descending order of detection frequency, azoxystrobin, atrazine, simazine, and 2,4-D were the next most commonly detected compounds at the Alabama River site, while atrazine, metolachlor, OIAT (atrazine degradate), and dechlorometolachlor were the most commonly detected at the Tombigbee River. Suspended sediment concentrations were similar between the two sites, ranging from 6 to 244 milligrams per liter at the Alabama River and 6 to 329 milligrams per liter at the Tombigbee site.

Abstract #: 154

Student

Title: LINKING THERMAL TOLERANCE AND DISTRIBUTION AMONG FRESHWATER MUSSEL SPECIES IN THE PEA RIVER.

Presenter: Hannah Adkins

Organization: Auburn University

Session: Aquatic Ecology 2

Freshwater mussels are highly imperiled and vulnerable to the effects of climate change. Estimates of thermal tolerance exist for only a small fraction of freshwater mussel species, and the relationship between thermal tolerance and distribution is not well understood. To address this gap, we quantified interspecific differences in thermal tolerance among 3 sympatric species from the Pea River and investigated the relationship between thermal tolerance and distribution of these species within the watershed. Measures of thermal tolerance included sublethal indicators of thermal stress, temperature at occurrence of peak resting metabolic rate (RMR_{peak}) and behaviors (e.g., foot extension, gaping valves), and the critical thermal maximum (CT_{max}: functional death). Wild-caught individuals of *Elliptio pullata*, *Leunio lienosus* and *Lampsilis straminea* were compared ex-situ. After acclimation, intermittent-flow respirometry was used to measure resting metabolic rate of eight individuals/species during a 10-12 hour exposure to increasing temperature at a rate of 2°C/hr. Simultaneous observations of eight additional individuals/species were used to determine the temperature at occurrence of behavioral indicators and CT_{max}. Qualitative surveys were executed at 28 sites on the mainstem and tributaries of the Pea River to determine the distribution and abundance of species. Mean RMR_{peak} of *E. pullata* (39.57°C) was significantly different ($F_{2,21} = 30.73$, $p < 0.001$) from *L. lienosus* (37.30°C) and *L. straminea* (38.15°C). There were no significant differences among species in the temperature at occurrence of behavioral indicators or CT_{max}. *E. pullata* showed evidence of adaptive temperature-insensitive metabolism, a thermal response known to occur in some intertidal mollusks that are frequently emersed and experience strong temperature fluctuations. *Elliptio pullata* was also the most abundant of the species tested and occurred at more sites than *L. lienosus* or *L. straminea*. These patterns suggest that sublethal physiological responses to acute temperature fluctuations, and possibly to emersion, vary among sympatric species and may play a role in the local distribution of these species. Understanding the factors leading to differences in species distribution and abundance is vital for the conservation and management of freshwater mussel assemblages.

Abstract #: 156

Title: A Geospatial Framework for the Assessment of Coastal Vulnerability for Improved Resilience

Presenter: John Cartwright

Organization: Mississippi State University

Session: GIS

Coastal areas are increasingly vulnerable to the impacts of climate change, including sea-level rise, storm surges, and coastal erosion. Our framework is built with the geographic approach integrates and compiles needed information within the spatial context. A framework with this approach can more effectively assess and characterize coastal vulnerability, providing improved resilience in the face of future challenges. The developed framework incorporates various data layers and utilizes geographic information systems (GIS) to analyze and visualize these datasets at multiple scales. The framework incorporates numerous data types for the spatial assessment of vulnerability, including physical, environmental, and socio-economic. By considering multiple factors influencing vulnerability, such as sea-level rise, storm surge potential, shoreline erosion, and population density, the framework provides a more holistic assessment than traditional approaches that focus on individual parameters. The application of this geospatial framework supports informed decision-making processes, leading to improved resilience measures. It provides decision-makers (planners, coastal managers, policy officials, etc.) with a comprehensive understanding of coastal vulnerability, allowing for the prioritization of resources and adaptive strategies. By incorporating socio-economic data, the framework enables the consideration of equity and social justice aspects, ensuring that vulnerable communities are adequately supported. The framework's holistic approach ensures that coastal communities are better equipped to face future challenges and build resilience against the impacts of climate change and coastal hazards. This presentation highlights an application of this framework in the development of a resilient housing plan for the city of Foley, Alabama.

Abstract #: 157

Title: High Resolution Site Characterization for Targeted Groundwater Remediation at the Robertsdale Elementary School ADEM Tank Trust Fund Site

Presenter: Kendall Rich

Organization: WSP Environment and Infrastructure, Inc.

Session: Modeling & Water Management 1

Robertsdale Elementary School was newly constructed at its current location in Baldwin County, Alabama, USA during the early 2000s, and as part of the school facility, a new refueling station was planned at the site for their school bus fleet. A previous bus-refueling station there included one 1000-gallon underground storage tank (UST) for unleaded fuel and one 3,000-gallon aboveground storage tank (AST) for diesel fuel. Removal of the UST in 2009 revealed gasoline-contaminated soil and groundwater, and the site was subsequently enrolled in the Alabama Department of Environmental Management (ADEM) Underground and Aboveground Storage Tank Trust Fund program to fund reimbursement of costs for removal and remediation of contaminated soil and groundwater associated with the discovered release of fuel. Preliminary and secondary investigations were conducted in 2013 and 2014, respectively, and an Alabama Risk Based Corrective Action evaluation was performed in 2016 to characterize potential exposure pathways and to determine appropriate remediation goals. A corrective action plan (CAP) for groundwater remediation was developed and subsequently revised in 2020 to include in-situ chemical oxidation (ISCO) with high-vacuum extraction (HVE). Following a feasibility study, full-scale ISCO treatment was approved by ADEM and implemented at the site in early 2022. ISCO demonstrated the potential for successfully meeting cleanup goals by reducing gasoline-related constituents of concern (COCs) in localized zones where ISCO was in contact with COCs in groundwater. However, the full extent of the contaminant source area was not in direct contact with ISCO materials, and as a result, COCs were detected above corrective action limits in groundwater during quarterly groundwater monitoring events in 2022 and 2023. ADEM approved a high-resolution site characterization (HRSC) study of the site to better characterize the nature and extent of COCs in groundwater with the ultimate goal of developing a more targeted, follow-up remediation design. Using direct push technology (DPT) in an estimated 26 boreholes, HRSC tools including a membrane interface probe and hydraulic profiling tool (MiHPT) will be used to create a detailed, 3D conceptual site model (CSM) visualizing zones of where COC are present and better characterize groundwater flow at the site. This presentation will provide a brief description of the ADEM Tank Trust Fund program and an explanation of HRSC methods with results of the Robertsdale Elementary HRSC study that will be used for a targeted, more efficient remediation design to clean up groundwater at this sensitive locale in Baldwin County, Alabama.

Abstract #: 158

Student

Title: Investigating the Changing Patterns of Severity and Frequency of Multi-year Hydrological Droughts

Presenter: Savalan Naser Neisary

Organization: The University of Alabama

Session: Drought & Climate 2

Hydrological droughts are a complex and highly destructive phenomenon in various sectors such as agriculture, water utilities, and power generation. As climate impacts intensify, there is critical importance to gain a deeper understanding of spatiotemporal patterns in hydrological droughts and identify the contributing factors to these patterns. This information also helps to inform the appropriateness of water prediction models and tools. In this study, we used the mean daily streamflow values of the USGS streamflow gauges to characterize the severity and duration relationship of hydrologic drought by producing Severity-Duration-Frequency (SDF) curves for drought durations from 2 to 10 years. Then, we used classification and non-parametric testing methods to evaluate the changing patterns of drought characteristics (e.g., duration, severity, frequency) and discover if there is a linkage between drought patterns and hydroclimate and land surface variables (e.g., precipitation, soil moisture, and land use). The analysis for this presentation will focus on the State of Alabama and the southeast region. The results from this study help policymakers and water planners understand potential changes in hydrologic droughts and indicate the types of factors that influence drought changes.

Abstract #: 159

Student

Title: Impacts of DEM Resolution on Rapid Flood Inundation Mapping Using a Deep Convolutional Neural Network

Presenter: Reza Saleh Alipour

Organization: The University of Alabama

Session: Water Quantity

With the significant growth of spatiotemporal hydrologic and physiographic data, machine learning methods have become more widespread in rapid flood inundation mapping. This presentation presents the results of a study of how the spatial resolution and type of terrain elevation model affect the accuracy of flood depth prediction using a deep learning convolutional neural network (CNN) method. To this end, training data (i.e., water depth) for the CNN method were generated using a 2D hydrodynamic model (LISFLOOD-FP) considering different resolutions of a LIDAR-based 1m resolution digital terrain model. As hydrological boundary conditions for the 2D model and training input for the CNN, synthetic hydrographs are randomly generated. The performance of the trained CNN models is then evaluated and compared with the outputs of LISFLOOD-FP for hypothetical and observed flood events. The methodology is applied to a case study catchment. Results indicated that the CNN model outperforms the hydrodynamic model in terms of efficiency dependent on terrain resolution. This study emphasizes how deep learning methods could be a reliable alternative to hydrodynamic models, but the spatial resolution must be carefully considered.

Abstract #: 160

Title: Crossing the Valley of Death: Ways CIROH Enables Operations to Research and Research to Operations in Hydrologic Forecasting

Presenter: Steve Burian

Organization: The University of Alabama

Session: Drought & Climate 1

Guiding research by practical needs and translating research into societal benefit are common goals in academic research. Use-inspired research and convergence research are recent new incarnations of terms that encompass the well-known operations to research (O2R) and research to operations (R2O) concepts. There are many challenging barriers that prevent the effective achievement of R2O and O2R in many fields. The National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute for Research to Operations in Hydrology (CIROH) is facilitating R2O2R in hydrologic forecasting by forming communities of practice that bridge the valley of death and deploying research enabling technologies making available big data analytics, machine learning, and large-scale hydrologic modeling to all. Further, CIROH in, and introducing ways to puncture the R2O2R wall. This presentation will summarize the emerging challenges and successes for R2O2R, provide an overview of CIROH R2O2R strategies, demo enabling tools for large-scale water prediction research, and solicit ideas to continue to enhance the effectiveness of hydrologic forecasting R2O2R.

Abstract #: 161

Student

Title: Tree cover as a predictor of the Rate of Bank Erosion in a channelized portion of Shades Creek in Homewood, Alabama

Presenter: Karis Cook

Organization: Samford University

Session: Poster Session

The increased urbanization of floodplains and streams has had negative impacts on waterways, including reduced groundwater recharge rates, increased stormwater runoff, and accelerated stream discharge rates. These combined effects have led to issues such as bank scour, sediment deposition, and intensified flooding. In addition, the loss of riparian vegetation can accelerate erosion and bank slumping. Shades Creek in Birmingham, Alabama, which flows through urban and residential areas, has experienced intense local erosion since it was channelized over 60 years ago. To address bank loss, localized mitigation efforts were implemented in 2010, including in-stream modifications (rock vanes and step banks), as well as bank revegetation. However, initial results from a 6-month study conducted in 2022 showed an average bank lip loss of 2.2 cm per month. We hypothesized that local, upstream tree cover would reduce bank lip erosion. We studied four 100-meter stretches of Shades Creek bank along a suburban greenway and characterized tree coverage, tree communities, and bank lip stability from February to May 2023. Upstream tree coverage was critical in maintaining bank stability. The stretches without tree cover experienced significantly greater bank failure, including a spectacular loss of 35 linear cm in just two months in a sandy bank section with no tree cover. It is worth noting that the mean rainfall during the study period was 12.9 cm per month, which was above the long-term monthly mean since 2000. Climate change will increase summer rainfall and rain intensity, which suggests that our data may underestimate annual rates for local bank erosion.

Abstract #: 162

Student

Title: Clustering Methods for Analyzing Predictors of CH₄ Fluxes from Wetlands

Presenter: Ana Flavia Brancalion Costa

Organization: Auburn University

Session: Poster Session

Clustering methods are recognized as effective tools for analyzing and categorizing data sets based on their inherent patterns and similarities. These algorithms aim to group data points together based on shared characteristics, allowing researchers to uncover underlying structures and relationships within the data. In this study, our objective is to analyze the predictors of CH₄ fluxes from wetlands worldwide using an open-source data set obtained from Knox et al. (2021). This data set includes methane emissions measured in eddy covariance flux towers at 23 observation sites, and originally investigated the dominant environmental predictors of freshwater wetland methane fluxes across different time scales. To achieve our objective, we applied hierarchical (agglomerative and divisive), k-means, fuzzy k-means, and Birch clustering methods, along with a backpropagation neural network for classification. The inputs for the clustering methods included CH₄ flux, CH₄ concentration emissions, and vegetation variables such as moss type, and the presence of parenchymatous, ericaceous shrubs, and trees. The resulting clusters were compared with three class types: wetland type (bog, fen, marsh, rice, drained, and swamp), biome (boreal, temperate, and tropical & subtropical), and management regime (natural, managed, and restored). Among the clustering methods employed, the backpropagation neural network yielded the best results, suggesting its suitability for identifying drivers of methane emissions from wetlands. Furthermore, the biome class exhibited slightly better results compared to the other classes (management regime and wetland type), indicating that the biome of the wetland may serve as a stronger predictor. However, it is essential to acknowledge the limitations of this study, primarily the relatively small size of the data set (only 23 observations), which necessitates further analysis to validate and refine the findings.

Abstract #: 163

Student

Title: SWAT vs SWAT+ comparison in the Pampa Region of South America

Presenter: Elzon Rippel

Organization: Auburn University

Session: Water Quantity

Global food demand has increased pressure on natural ecosystems and transform forested and grassland areas to intensive agriculture. This is the case in the Pampa region, that lost 15% of its natural grasslands to a complex and dynamic agricultural scenario, led by soybean production since the 2000s. However, agriculture is normally mapped at a low level of thematic detail, consisting in a broad class of annual agriculture, which does not consider the cropping practices and rotation systems, impairing the ability to represent these situations. To fill the gaps in LULC dynamics, the Vegetation Indexes, such as the EVI or NDVI presents as a possible solution, as they are available with a temporal resolution of around one to two weeks. The purpose of this study was to identify if the added use of NDVI could improve LULC dynamics description and provide better results for hydrologic modeling simulations. The new version of the Soil and Water Assessment Tool (SWAT+) was set up in the Ibicuí River (42.650 km²), an important regional hotspot for LULC change. LULC scenarios were: (a) SWAT+ default land use with single class for annual agriculture; and (b) seasonal LULC dynamics as captured by pairing NDVI datasets with available databases. The results for the uncalibrated model showed a better fit using the dynamic LULC description, as the single LULC class artificially created multiple peaks. Using SWAT+Toolbox to calibrate the models, both scenarios showed very good statistics or validation NSE = 0.78 and PBIAS = -6%, NSE = 0.81 and PBIAS = -1.8%, respectively. The water balance parameters were very close between the models, being the main difference in the Evapotranspiration and Revap components. Results shows that it is extremely important to correctly characterize the LULC dynamics, especially in ungauged basins, and that NDVI could help in this representation.

Abstract #: 164

Title: Stormwater Detention: How Effective Is it from a Regional Perspective?

Presenter: Jon Rasmussen

Organization: Flood-Con LLC

Session: Stormwater 2

For this abstract we will look at the hydrologic changes that take place when an 80-acre sub-basin of a 1.6 sq. mi. rural watershed is developed over time with conventional detention and detention provided by our patented Automated Outlet Structure (AOS). The watershed we will use is located in Jefferson County, AL . The webinar will focus on the fact that the timing of the peak flow is just as critical as the peak flow itself. Our AOS is an intelligent device that replaces the traditional outlet structure. It could be described as a robot dam that is comprised of a rain gauge, depth sensor, mechanically controlled gates and an onboard microcontroller. The microcontroller is the brain that take readings from the rain gauge and depth sensor and uses those reading to open the gate to a specific width to control the release of water from the pond. The AOS knows exactly how much water to release because the microcontroller has onboard programming that uses hydrologic factors specific to the pond and the watershed. Using this intelligence, the AOS requires anywhere from 30 to 50% less volume of pond to meet regulatory requirements. For above ground ponds that means less disturbed land and more property to develop creating more value for the developer. For underground ponds it proves significant saving to the developer in materials and construction cost. The AOS also has two-way cellular IoT communication with our cloud-based API's and Management Console. With every storm event the AOS is sending up valuable data on a minute-by-minute basis. This data is great for monitoring and auditing the performance of the AOS, but it is invaluable for furthering our knowledge of how developed land reacts to storm events and how Flood-Con can improve its technology to solve problems at a larger scale. our AOS is a unique product because it can hold back stormwater runoff so that it does not contribute to the peak flow of a downstream tributary- like a river or creek. Take for instance Patton Creek here in Jefferson County Alabama. In the urban areas it will overtop its banks and flood over a state highway, flooding businesses from a 3.5" rain or more. The characteristics of the basin changed over time from a rural to urban footprint. Even with more demanding stormwater regulations, the creek is still a prominent flood source. Conventional methods to fix the problem require invasive modifications to the stream to increase its capacity. This is costly and practically impossible due to environmental habitat. Our system is a non-invasive approach to correcting the problem because we install our systems offline of the creek in existing ponds and lakes. So, we attack the problem at its source. This method restores, not only the creek, but also the existing streams that flow into the creek which is good for environmental habitat, pedestrians, home owners, and business all throughout the watershed.

Abstract #: 165

Student

Title: Bankfull Channel Geometry and Attribute Estimation Using a Large Observational Dataset Across the US

Presenter: Riley McDermott

Organization: The University of Alabama

Session: Poster Session

Previous methods for estimating channel geometry were limited by dataset size and quality. The availability of a new dataset containing Acoustic Doppler Current Profiler (ADCP) measurements of channel dimensions, now enables us to develop more robust empirical and Machine Learning models. The dataset includes measurements during in-stream and overbank flow conditions, which greatly complicates its use for channel geometry estimation. □ This study compares different approaches for automatic identification of in-channel and over-bank observations. To this end, 113 sites were selected for which bankfull conditions can be visually identified. Polynomial regression lines of varying degrees were fitted on the Width/Depth ratio for each site. The results show that the combined third-degree polynomial yielded the strongest correspondence to visual bankfull identification

Abstract #: 166

Title: Engaging partners and empowering communities: establishing a well water network in Alabama

Presenter: Jessica Curl

Organization: Auburn University Water Resources Center

Session: Lightning Talk - Outreach

Cooperative Extension Services serve as a repository of information to a wide breadth of clients nationwide in search of reliable, science-based materials. The Alabama Private Well Program (APWP) was initiated in 2020 and serves as a resource to empower, equip, and engage well owners with the resources needed to protect their home water systems, following the precedent of established Extension led well water programs across the nation. The APWP's purpose is to build capacity for County-based Extension professionals through trainings and resources to address frequent questions and concerns from well owners in their communities. As the program continues, entities from across Alabama continue to express interest in well water educational materials. In response, the APWP formed multi-agency partnerships with the Alabama Department of Public Health, Geological Survey of Alabama, AU Department of Geosciences, ACES Ag-Water Safety Program, and Alabama Rural Water Association to assist in the distribution of information to well owners. Now in its third year, the APWP provides information to communities through in-person educational workshops. These workshops give an opportunity to well owners to have their water screened for bacteria, meet staff from Auburn University, the Geological Survey of Alabama, and the Alabama Rural Water Association, and learn more about the importance of maintaining well water systems and testing water annually. The APWP directly benefits homeowners who rely on private wells for drinking water while addressing a statewide need for well water educational resources. This presentation will explore the impact of a multi-agency partnership on building a new Extension program.

Abstract #: 167

Title: Twelve years after: Disparate effects of a stream restoration project on benthic communities

Presenter: Elizabeth Dobbins

Organization: Samford University

Session: Poster Session

Urban and suburban streams are degraded by thermal, chemical, and mechanical stressors. Storm water runoff, riparian buffer removal, and artificial straightening of natural channels create positive feedback loops that accelerate erosion and the collapse of aquatic communities. Shades Creek, located in the Cahaba River watershed in north central Alabama, has headwaters impacted by light industry, storm water run-off, channelization, and intense local erosion. In 2004, the EPA established Total Maximum Daily Loads (TMDL) for "Siltation, Turbidity, and Habitat Alteration" in Shades Creek. In an attempt to rehabilitate and restore a channelized and rapidly-eroding stretch of Shades Creek, ten rock vanes were installed along a 330 m section in 2010. The goals were to reduce erosion and trap sediment. It was predicted that there would be supplemental benefits including improved water quality and habitat downstream of the vanes and that these benefits would accrue over time. Using EPA rapid bioassessment protocols, macroinvertebrates upstream, in the restoration area, and downstream of the rock vanes were sampled prior to construction then one-, four-, ten- and twelve-years post-construction. The results were heterogeneous. The restoration area, which included tree removal and insertion of vanes and a step bank, had persistently degraded community structure across all twelve years. The upstream (control) site retained a similar community structure with the imprint of added years of upstream construction and sedimentation. The results from the sites downstream of the restoration project were inconsistent, with riffles and runs showing disparate effects. The community structure in the riffles improved with an increase in the sensitive orders of Ephemeroptera, Plecoptera, and Trichoptera (EPT) and a decrease in tolerance values (from Fair to Good), while in the runs appeared degraded with an increase in chironomid taxa and tolerance values. These results suggest that in-stream restoration structures may provide local downstream benefits but cannot compensate for accelerated stormwater runoff, riparian buffer removal, and artificial straightening of natural channels that mark urban and suburban growth.

Abstract #: 168

Title: An Introduction to Karst - Features and Landforms

Presenter: Gheorghe Ponta

Organization: Geological Survey of Alabama

Session: Water Monitoring

Karst landscape formation is the result of complex interactions over geologic time between geology, lithology, stratigraphy, climate, topography, hydrology, etc. They typically form on carbonate rocks that are subject to chemical, rather than mechanical erosion. Karst landscapes are characterized by sinkholes, sinking streams, closed depressions, towers, subterranean drainage, vertical shafts, springs, subsurface drainage systems and caves, estavelles, vauclusian springs, and submarine springs and are characterized by an epikarst (subcutaneous) zone and an internal drainage system or karst aquifer in which permeability, flow, recharge, and storage characteristics are dominated by connected conduits enlarged by dissolution of rock. About 18% to 20% of the earth's surface has areas where karst landforms have the potential to impact human infrastructure, and therefore, play an essential role in water management decisions. This presentation summarizes some of these karst properties and their main features.

Abstract #: 169

Title: Mississippi Private Wells: Water Quality Characteristics and Owner Demographics

Presenter: Jason Barrett

Organization: Mississippi Water Resources Research Institute

Session: Outreach, Extension & Partnerships

Mississippi private well owners do not have the luxury of knowing the quality of their drinking water on a regular basis unless they are making the effort to have their water screened and tested. Without knowing and understanding the safety of drinking water, private well owners do not know if and when treatment is needed. Approximately 12% of Mississippi citizens are served by a private well and they are free to own, operate, and maintain their wells because there is no regulatory oversight. For some private well owners, this freedom is welcome but others want to know the quality of their drinking water and best practices for proper maintenance. No demographic data about private well owners has been compiled since the 1990 census. Since the inception of Mississippi State University Extension's Mississippi Well Owner Network, private well characteristics and demographic data has been collected and workshops have allowed private well owners the opportunity to have their well water screened for bacteria. Characteristics may prove beneficial when analyzed against the presence of bacteria to assist well owners in making improved decisions on the treatment or introduction of treatment to their well water.

Abstract #: 170

Student

Title: Exploring the role of land use on headwater wetland functions in coastal Alabama

Presenter: Kurtis Fisher

Organization: Auburn University

Session: Poster Session

Headwater slope wetlands are forested wetlands located at the headwaters of coastal streams. They are a ubiquitous wetland type in the Alabama and southeastern U.S. Coastal Plain. These gentle slopes tend to move water gradually through these wetlands as shallow groundwater discharge. They are a critical element to the coastal Alabama landscape because they occur at the interface of uplands and coastal drainages and provide important functions related to water storage, nutrient cycling, and habitat. There is concern that past and current land use changes in the region may be severely altering the capacity for these wetlands to provide these functions. To investigate this, over 50 headwater wetlands in coastal Alabama (i.e., Mobile and Baldwin County) were evaluated for important functional attributes (habitat, nutrient cycling, and hydrology) over a range of surrounding land uses. Assessment of each wetland was conducted in 2022-2023 using the Hydrogeomorphic Method (HGM) approach for the functional assessment of headwater wetlands in coastal Alabama (Noble et al. 2007). Functional capacity index (FCI) scores from each wetland were combined with a dataset of HGM scores from over 25 other wetlands assessed along the Alabama coast in the past. We present results from current and past HGM work and evaluate initial analyses showing the relationship between land use and headwater wetland FCI scores. We discuss the implications of continued land use along the coast and potential measures to sustain headwater wetland functions under increasingly urban conditions. Ultimately, the information gained from this study will assist watershed managers interested in maintaining and potentially improving coastal drainages to the Alabama Gulf coast.

Abstract #: 171

Title: Using paleohurricane records and coastal geomorphology to contextualize 21st century storms along the northern Gulf of Mexico

Presenter: Emily Elliott

Organization: The University of Alabama New College

Session: Poster Session

Since the beginning of the 21st century, the northern Gulf of Mexico (nGoM) has experienced some of the most damaging tropical cyclones (TCs) in the modern record, prompting concern that the frequency of intense TCs is increasing. While unprecedented in the instrumental period, our understanding of the TC frequency prior to ~1850 is limited, hindering our ability to understand the drivers of these extreme events, and leaving coastal communities vulnerable. TCs can further change the geomorphology of barrier environments. If we want to increase coastal resiliency, it is critical that we develop an understanding of the drivers and areas of greatest vulnerability to storm impact along the nGoM. We must establish longer (millennial), high-resolution records of TC activity along the nGoM to contextualize recent storms and the impact these storms have had along the coast. To investigate this, we collected multiple sediment cores along the Alabama coastline in Bon Secour Bay and the back-barrier of Dauphin Island, where the geomorphology reflects washover and inlet formation from prior events. We analyzed and compared these cores to established multi-proxy archives from the region to develop an overall record of storm activity during the Late Holocene. By comparing records of back-barrier overwash, including deposits produced by modern intense storms, we characterized surge conditions associated with pre-instrumental TC impacts. Further, by comparing our overwash records at two distinctly different elevation thresholds (i.e., < 1 masl and > 4 masl), we examined how differences in barrier island geomorphology and underlying geology affect the types of storm surges preserved in paleotempestological records. Our multi-millennial length sediment archives, coupled with other reconstructions from the Southeast US, provide high-resolution compilations of the spatial variability of TC impacts over the Late Holocene, helping to contextualize intense TC events in the 21st century. These records provide data on the pre-observational baseline conditions and dynamic controls on coastal geomorphology through time, aiding in the assessment of coastal resiliency for the northern Gulf Coast.

Abstract #: 172

Title: Agricultural and Aquacultural Water-Use Withdrawals: Metering, Modeling, and Lessons Learned.

Presenter: Vincent White

Organization: United States Geological Survey

Session: Agriculture & Irrigation

Water resource management requires an understanding of the hydrologic cycle and the anthropogenic interaction with it. The water-use component of this equation is often the part most focused on from a management perspective and yet is the least developed as a discipline. Agriculture and aquaculture frequently are together one of the largest if not the largest users of water in a given region. Current efforts to further water-use understanding have been by means of models relying on remote sensing to measure water movement or using literature values which say that a particular commodity will use a particular amount of water. One of the least common methods to understanding water use is to actively measure withdrawals at a limited number of groundwater and/or surface water intake points and to interpolate or extrapolate from the known data points to unknown data points. U.S. Geological Survey efforts have resulted in water-use estimation approaches using all three methods. One of those methods is the development of the Mississippi Alluvial Plain (MAP) water-use metering and modeling program. This program meters and models the groundwater withdrawals component of an agricultural system that contributed over \$11 billion in economic impact in 2017 and in 2015 originated 23 percent of total groundwater use nationally. Agricultural and aquacultural withdrawal metering and modeling are not in widespread use, particularly when compared to monitoring and modeling of the other parts of the hydrologic cycle such as precipitation, surface water levels and discharge, and groundwater levels. The first round of this project in the Mississippi Alluvial Plain is drawing to a close and lessons have been learned in order to benefit internal planning for the next stage. As part of the mission of a public service agency, what can be shared with others to assist in their efforts to better understand water use from a withdrawals perspective? The presentation will exhibit these unique metering and modeling efforts and their results and share lessons learned as we plan for a new and improved phase of work.

Abstract #: 173

Title: Advancing Aquatic Connectivity Through Collaboration and Partnerships

Presenter: Shawna Fix

Organization: Southeast Aquatic Resources Partnership (SARP)

Session: ARSNiC

Fragmentation of river and stream habitats by anthropogenic barriers is one of the primary threats to aquatic species in the Southeast. The Southeast Aquatic Resources Partnership (SARP) helps to facilitate teams across the Southeast United States with the common goal of increasing aquatic connectivity. These Aquatic Connectivity Teams (ACTs) work together to identify, prioritize, and remove structures such as dams and culverts that block aquatic organism passage. There are currently 9 ACTs in the Southeast including Alabama, Arkansas, Tennessee, Texas, Georgia, North Carolina, South Carolina, Florida and Virginia. Each team is unique and has different sets of specific goals, but all are working towards the common goal of aquatic connectivity. The ACTs work directly with SARP, who has developed a comprehensive living inventory of dams and assessed road-stream crossing barriers. Teams are able to contribute to this database through a user-friendly online tool that can prioritize barriers for removal or remediation. The National Aquatic Barrier Prioritization Tool provides summaries of barrier densities within user specified areas of interest and allows users to prioritize barriers for removal or remediation based on ecological metrics using various filters. The results provided by the tool help identify high priority projects to implement and allow resource managers to access information regarding barrier locations and attributes that were not readily accessible prior to SARP's work. In the Southeast, over the past 10 years, this inventory and tool process has resulted in or contributed to the remediation of 20 road crossing barriers and 19 dam removals, a positive example of success as the inventory and tool expands nationally. Completing a successful barrier removal project is a collaborative effort and one that can be eased with the participation in an Aquatic Connectivity Team.

Abstract #: 174

Title: Sedimentation Risk Index Manual Updates: Evaluating Stream Connectivity, Aquatic Organism Passage, and Habitat Through Stream Crossing Assessments

Presenter: Jennifer Grunewald

Organization: U.S. Fish and Wildlife Service

Session: ARSNiC

Aquatic systems in the Southeast are faced with the threat of road-stream crossings that can cause habitat fragmentation, increased sedimentation, aquatic organism passage barriers, introduction of pollutants, among other concerns. The Alabama Rivers and Streams Network (ARSN) recognizes the importance of habitat fragmentation and the need to assess stream crossings. The ARSN partnership has collected stream crossing data since 2012 based on the Sedimentation Risk Index methodology, originally developed by Witmer and others (2009). Since that time, our understanding of aquatic systems and the needs of the partnership have evolved, therefore the methods to assess stream crossings has also evolved. Established in 2022, the ARSN including Connectivity (ARSNiC) teams are now collecting this data throughout the state of Alabama. Updates have been made to the SRI manual to clarify the methods and better align with the objectives of ARSN and ARSNiC while maintaining a 'rapid' protocol. The SRI remains part of the protocol and updates to the manual have been made for a more wholistic survey of the crossing. The method will now be titled Stream Crossing Rapid Assessment Protocol (SCA). The updates will also better align with the Southeastern Aquatic Resources Partnership's Stream Crossing Survey so that more data can be shared between the two partners. The SCA's objectives are to evaluate stream connectivity, aquatic organism passage (AOP), and habitat. The results will assist in identifying AOP barriers, excess sedimentation, pollutant concerns, and prioritize restoration efforts, thereby aiding in the improvement of watershed connectivity and habitat availability for aquatic organisms.

Abstract #: 178

Title: Effects of select herbicides for management of American frogbit grown in mesocosms

Presenter: Gray Turnage

Organization: Mississippi State University

Session: Aquatic Ecology 1

Limnobium spongia (frogbit) is a free-floating aquatic plant that can produce extensive floating mats that cause negative ecological, social, and economic impacts, which can have negative effects on aquatic fauna (i.e., dissolved oxygen depletion) and restrict waterbody access, navigation, and recreational usage by humans. Literature describing effective control measures for frogbit is minimal. Control efficacy of high and low doses of seven foliar applied herbicides (2,4-D, floryrauxifen-benzyl, flumioxazin, glyphosate, imazamox, imazapyr, and triclopyr) were evaluated in a mesocosm setting in the summers of 2018, 2020, and 2021. Both emergent and submersed frogbit biomass were reduced 99 to 100% by imazamox (0.56 and 1.11 kg a.i. ha⁻¹) and imazapyr (0.42 and 0.84 kg a.i. ha⁻¹) 8 weeks after treatment (WAT) compared to non-treated reference plants. Triclopyr (6.71 kg a.i. ha⁻¹) reduced frogbit biomass 92% and flumioxazin (0.42 kg a.i. ha⁻¹) reduced biomass 87 to 93% compared to reference plants. 2,4-D (2.12 and 4.24 kg a.i. ha⁻¹), glyphosate (2.83 and 5.67 kg a.i. ha⁻¹), triclopyr (3.36 kg a.i. ha⁻¹), floryrauxifen-benzyl (0.02 and 0.05 kg a.i. ha⁻¹), and flumioxazin (0.21 kg a.i. ha⁻¹) did not reduce frogbit biomass 8 WAT compared to reference plants. Future research should consider the efficacy of different herbicide combinations to control frogbit, as well as the role of diluent volume per unit area, especially with imazamox and imazapyr. Field studies also will be useful in determining whether the results observed in this study will translate to management of frogbit in natural settings.