# 2025 Poster Presentations List

## Poster Session and Reception, Thursday 5:30 – 6:30 PM

(Alphabetical Listing)

### Riparian Zone of Bell Bottom Creek and surrounding watershed, Pattison, TX

Dr. Debleena Banerji, Prana Foundation, University of Houston

Bell Bottom Creek in Pattison Texas drains to Bessie's Creek watershed and eventually contributes to the Brazos River system to the south. The riparian zone around Bell Bottom Creek is an integral part of the local drainage system and contributes not only to the local groundwater filtration and recharge but also to a healthy ecosystem comprised of a multitude of flora and fauna. Hence, any anthropogenic development upstream will lead to enhanced runoff along the creek resulting in bank-erosion, falling of trees and flooding downstream in the greater Katy and Houston-Galveston area. Absence of continuous riparian zone also results in lack of travel corridors for the wild animals and disruption in the food chain. The Bell Bottom Creek riparian zone project at Pattison is centered around several hundred acres of riparian zone in and around Bell Pattison, TX. Ongoing active urbanization in the greater Katy-Brookshire area has led to significant deforestation in the Brazos flood plain and associated riparian zones such as Bell Bottom creek. Anthropogenic damage inflicted on the local riparian ecosystem has not only resulted in reduction of wild habitat and migration corridor to the local deer, bob-cat, snake and box-turtle population, but also erosion along the banks of the creek system. Conservation and management of the sensitive ecosystem of the riparian zone around the creek is required along with educating all about the importance of preserving such pristine corridors of land surrounding bayous and creeks. The project includes maintaining the health of the riparian zone, preservation of the local flora and fauna, maintaining a wildlife corridor, erosion prevention along the banks, seeding with forbs and grasses specific for riparian recovery and planting trees and wildflowers to increase biodiversity and water infiltration. Satellite imagery studies addressing the impact of active deforestation leading to drastic change in land use in the surrounding area and consequent increase in stormwater runoff leading to erosion and flooding in the surrounding areas and downstream will be conducted.

### Optical imaging and machine learning to identify and enumerate early developmental stages of fish species

Micah Bowman, Baylor University

Larval fish are a key component of biomonitoring to assess the health of aquatic systems but are notoriously difficult to identify. Recent advances in optical imaging and artificial intelligence (AI) have led to testing these technologies for identifying organisms; however, most applications for fish have been used for adults, not juveniles. Here, we assess the capabilities of AI to automatically identify and enumerate larval fish for applications in aquaculture monitoring or taxonomic identification following field studies. Our specific objectives were to test the ability of automated optical imaging and machine learning (ML) to accurately identify and enumerate early developmental stages of three freshwater fish species. Through several experiments, we tested how performance varied according to the choice of ML algorithm, specifically support vector machine (SVM) versus convolutional neural networks (CNN), the diversity of color spectra (grayscale vs color images), and the number of classes (fish species and life stage). We conducted the experiments using the Small Aquatic Organism (SAO) optical imaging system, a high-throughput optical imaging device that incorporates computer vision, optics, and software to identify organisms. We constructed an image training library of early developmental stages of three fish species, channel catfish (CCF), Florida largemouth bass (FLLMB), and koi that included eggs and at least two stages of larval development. The full training library and validation data included all three species and all 10 stages of development, where experiments were conducted on various subsets of these data. When considering all species and life stages, accuracies ranged from 0.34 to 0.65 for SVM and CNNs, respectively; however, when non-target items (i.e., bubbles and debris) were included, accuracies dramatically increased to 0.92 to 0.94 (SVM and CNN). Experiments were also conducted to differentiate life stages for each species individually, where accuracies ranged from 0.53 to 0.72, depending on species and ML algorithm. Inclusion of non-target items again boosted accuracies, ranging from 0.88 to 0.97. Generally, CNNs outperformed SVMs and the number of predicted classes reduced accuracy. Our results suggest that while the system can successfully differentiate larval fish from non-target items, the ability of the system to differentiate amongst larval fish species and life stages is limited and improvement to optics and ML algorithms is required. This work also suggests tradeoffs exist between taxonomic accuracy and sample volume processing between small-volume, desktop systems and high-throughput, field-scale systems, like the SAO.

### Water chemistry and stable isotopes reveal complex subsurface and surface water interactions in a highly altered urban stream in north-central Texas

Juan Camacho, University of Texas at Arlington

Persistent droughts, extreme precipitation events, and increasing water demands are reshaping urban environments in Texas. Urban streams are influenced by complex networks of natural and engineered flow paths where groundwater, stormwater, irrigation, and wastewater effluents interact. A significant load of nutrients and sediments are transported in streams during storm events. Therefore, understanding the hydrological processes that drive solute transport to urban stream ecosystems is crucial for effective urban water management. Our study integrates a) Bayesian endmember mixing analysis, b) concentration-water level relationships, and c) hysteresis loop analysis to understand water transit times and water source mixing in Rush Creek, Arlington, Texas. We sampled 6 peak flow events and multiple baseflow periods for water chemistry (nitrate, phosphate, iron, TOC, turbidity, and tannins & lignin) and 17 events for water stable isotopes. Endmember (precipitation, baseflow, irrigation, and soil water) mixing analysis showed that stormwater contributions to Rush Creek ranged from nearly 100% during peak flows to 17.7% during the baseflow recession, with an average of 55.9±22.1%. The latter shows the influence of relatively fast travel times and the persistence of subsurface interflow after peak flows. We identified three mobilization mechanisms in the stream water chemistry during storm events. Phosphate, TOC, turbidity, and tannins & lignin increased with rising water levels (mobilization), while nitrate concentrations showed minimal variation (chemostasis). In contrast, iron concentrations decreased during peak flows (dilution). These patterns are linked to storm

intensity, catchment wetness, season, and event-water contributions of solute inputs. Future research will focus on tracer-aided modeling and assimilation of high-resolution stream imagery intro Machine Learning models to predict water quality.

### New Collaboration: Texas Arundo Working Group

Angela England, Texas Parks & Wildlife Dept.

Giant Reed (Arundo donax) is a 20-foot-tall, invasive grass that commonly forms monocultures in riparian areas of the southern United States. These canebreak thickets grow densely, crowding out native vegetation, with negative effects to biodiversity, water quality and quantity, channel morphology, and flooding and wildfire risk. In Texas, management of Arundo is distributed among a variety of agencies with differing scopes and goals. A new working group is proposed, with the intention to build community and act as a resource for information sharing and collaboration among professionals.

### Determining wastewater impacts on benthic macroinvertebrate communities in under-monitored streams using a novel modeling approach

Jordan Jatko, Baylor University

Urban encroachment on rural streams is becoming increasingly common, yet many rural streams remain relatively under-monitored. The need for modeling approaches for biomonitoring in observation-scarce systems is becoming more relevant due to rural streams being increasingly influenced by urban areas to meet population demands. In 2013, Waco Metropolitan Area Regional Sewerage System (WMARSS) finished construction of a wastewater treatment plant next to a rural stream in Lorena, TX. This study utilizes a nearby reference stream, Cow Bayou, to determine impacts of a wastewater treatment plant on benthic macroinvertebrate communities in Bullhide Creek using a novel modeling approach. Benthic macroinvertebrates were sampled monthly for 13-months using Hester-Dendys and seasonally using Hess samplers. Community structure was assessed using Hilsenhoff Biotic Index, which is commonly used to assess water quality. We determined background influences on benthic macroinvertebrate communities in Cow Bayou using generalized linear mixed models with in-stream and land cover variables, such as discharge, nutrient concentrations, land-use/land-cover, and geological composition of the stream bed. These models are then used to predict community structures for Bullhide Creek in the absence of the wastewater treatment plant. We then compared the modeled results with the sampled results to quantify the impact of wastewater on benthic macroinvertebrate communities.

### Management of invasive plant species in Bull Creek. A community effort.

Ian Massey, A Rocha USA

The Bull Creek watershed, located in Northwest Austin, has been called by locals “The Galapagos of Texas” due to its ecological diversity and geological features. It is home to the endangered Golden-cheeked warbler, Jollyville Plateau salamander, and more than 600 native plant species. One of the factors affecting Bull Creek is the widespread presence of invasive plant species. A Rocha USA and the Bull Creek Foundation have mobilized the community to map and remove invasive plant species since 2022. With the help of more than 100 volunteers and the long-term involvement of Texas Master Naturalists, we have identified and mapped the distribution of invasive plant species in 45 acres of public land using EDDMapS. We are removing and treating the most abundant and problematic invasives, Ligustrum lucidum, Nandina domestica, and Bothriochloa ischaemum from 25 acres of Water Quality Protection Land. For Ligustrum lucidum, we uproot saplings manually or with a weed wrench. We girdle mature trees following a methodology perfected by Cliff Tillick, a local volunteer (personal communication). For Nandina domestica, we cut and bag the berries. Then, we uproot plants up to 2 feet tall and cut and leave plants higher than 2 feet. We pull Bothriochloa ischaemum manually when plant coverage is less than 50%. When coverage is above 50%, we use solarization followed by native seed planting. Our volunteers have been particularly successful in removing Ligustrum lucidum. They have girdled 465 trees and uprooted 2,736 saplings. The death rate for girdled trees is 90% with trees dying between 6 to 12 months after girdling. Our work involves rigorous training for volunteers, support and supervision from staff, and continued monitoring to prevent new invasive colonization in the treated areas. This model of community work could be replicated in other urban watersheds to manage invasive plant species.

### Extending Future Water Supply Infrastructure Scenarios to the Shared Socioeconomic Pathways

Perpetua Okoye, Baylor University

Increasing water scarcity, along with widespread declines in water quality, necessitates the exploration of alternative water infrastructure futures to address potential resource conflicts from growing populations. Multisector and integrated assessment modeling approaches can evaluate these alternative Water Supply Infrastructure (WSI) futures and their inherent uncertainties. To align with other regional modeling efforts, these approaches require constructing scenarios that integrate mitigation and adaptation strategies as localized extensions of the Shared Socioeconomic Pathways (SSPs). In this study, we develop a set of interrelated storyline elements for integrated WSI scenarios as subnational-sectoral extensions of the global SSP storylines. These extensions explicitly quantify future socioeconomic challenges and tradeoffs. We formalize the extension of subnational SSP narratives to local scales and address socioeconomic trade-offs among the narratives by developing an indicator framework. This framework evaluates and quantifies alternative WSI futures within the storyline elements. Our indicators aim to quantify key components of the storylines, facilitating a deeper understanding of the synergies and potential tradeoffs in future scenarios concerning water availability, water quality and treatment, infrastructure, and capital and operating costs. Our findings provide significant insights for water resource sustainability, guiding future research and policy for WSI planning under changing global conditions.

### Impact of Rapid Solar Farm Development on Land Management and Water Quality

Emeka Orji, Baylor University

Solar energy is a fast-growing source of renewable energy, and installations of large utility-scale solar panels, i.e., solar farms, are quickly springing up. The rapid growth of solar farms, however, can negatively impact land and water management because they cover significant acreage and alter the land surface. Therefore, there is a need to ensure environmental sustainability practices to preserve natural ecology in renewable energy installation, expansion, and operation. The study assesses the impact of three solar farm developments of varying size in McLennan and Falls County, Texas on the water quality and hydrological process in watersheds across Blackland Prairie and Cross Timbers Ecoregions. The research objectives were to understand how land management and land cover is impacted and how these changes are influencing runoff and turbidity in streams. A solar panel land cover classification was developed to understand the nature and land alteration of solar farm development, including natural or agricultural vegetation impacts, Event-based turbidity data, water level, and rainfall data were collected to determine the relationship between precipitation characteristics, hydrology, and water quality. Findings from the study provide valuable information for sustainable land management, especially for natural land resource and vegetation management, as well as sustaining water quality in regions impacted by rapid solar farm development.

### Wells Branch's Creek Restoration

Shelley Palmer, Wells Branch Mud/Director

Wells Branch - Education and Outreach of Creek Restoration Ten years ago, on the heels of several years of steady tree planting, a move to plant mostly natives in our public gardens and many volunteer invasive pulls, it was obvious to the Wells Branch board that our biggest gain for improving our little Urban Forest would be to restore our riparian zone. Our creek is the Wells Branch of Walnut Creek and had been mowed to the creek edge in places and not maintained in a natural way. We stopped mowing and let it grow. We have gained hundreds of trees with such little effort. We borrowed ideas from Austin, the A&M Urban Foresters and others for this project. We had the great luxury of being able to spend money on eradicating invasives so you won't see the big china berries, ligustrums and giant reeds that are choking nearby waterways. Perhaps those that gained the most from our restoration efforts are those downstream of us. Our visual is part of the education to our residents about our grow zones. Not a lot of outreach was done before we started this effort but we caught up with that at our next step which was to create an Urban Forest Management Plan. Wells Branch does have big groups of birders, gardeners, environmentalist, and hikers that are vocal on their appreciation of the direction the Wells Branch board has taken with our creek and other green spaces. Something that has probably assisted the positive reaction to the grow zones is that although all our creekside trails our decidedly wilder than they used to be, we left many areas like Katherine Fleischer Park with all of the human play zones that it has always had.

### Large-scale Environmental Data Collection with First-year Undergraduate Students

Stuart Reichler, The University of Texas at Austin

At many universities faculty research and teaching are at odds. The Freshman Research Initiative (FRI) unifies these two central missions. Starting in their first year at university, FRI students are placed in research labs where they learn critical skills performing research while receiving credit towards their degrees. The Urban Ecosystems research group starts with 80 first-year students each Spring training the students about research, urban ecology, and lab techniques. In the following Summer and Fall they focus on specific projects collecting environmental data in and around Austin. With three faculty members with a wide variety of expertise, senior students to mentor the freshmen, and so many student researchers, we can collect large amounts of diverse data. We have collected thousands of data points about stream microbiology, macrobiology, molecular biology, chemistry, species diversity, and carbon capture. By teaching through research, we can collect valuable data while teaching students about ecology, chemistry, and biology along with valuable career skills benefiting students and faculty.

### Achieving the GBF's 30x30 target for U.S. streams and rivers by overcoming the protection-impairment paradox

Levi Sweet-Breu, Baylor University Center for Reservoir and Aquatic Systems Research

Despite covering a relatively small portion of the Earth's surface, freshwater ecosystems offer habitat for a diverse range of species. However, they are also uniquely threatened from human stressors and climate change. To safeguard biodiversity, the 2022 Kunming-Montreal Global Biodiversity Framework (GBF) set international goals for conservation by 2030 and 2050. Target 3 of the GBF, in particular, sets an objective to protect 30% of terrestrial and inland water areas, specifically those of significant importance for biodiversity. Here, we measure progress against Target 3 for streams within the conterminous U.S., in terms of quantity, representation, and effectiveness of protection for biodiversity under different protection strategies, either via land ownership and management or corridor protection via the National Wild and Scenic River System (NWSRS). We evaluated the geophysical and biogeographical diversity of streams falling under these protection measures. Additionally, we assessed the extent of protected systems that simultaneously suffer from human disturbances. Approximately 25% of streams are protected explicitly for land-based biodiversity conservation, whereas 35% are protected by any land-based protection scheme. Less than 1 % of streams have corridor protection via the NWSRS. Despite rates of land protection approaching GBF targets, only 5% of the most prevalent forms of stream physical diversity are protected. Furthermore, anywhere from 8% to 19% of streams designated as protected under land management also exceed thresholds of potential habitat impairment.  More effective conservation strategies, particularly targeted and intentional protection for unrepresented stream types, are necessary to achieve the GBF 30x30 target for U.S. lotic ecosystems.