



# WATER INSTITUTE SYMPOSIUM

**ABSTRACT COMPILATION**

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# Marine Water and Sand in Concrete: A Sustainable Strategy for Water-Sensitive Coastal Infrastructure in Ecuador

**María de la Caridad Abreu Moreras**

Independent Researcher, Ecuador

This experimental study evaluates the mechanical and environmental performance of concrete mixtures incorporating marine water and sand from the coastal zone of Jipijapa, Ecuador, areas increasingly affected by freshwater scarcity. In alignment with integrated water resource management and climate resilience objectives, the research investigates how non-conventional materials can reduce freshwater demand without compromising structural integrity or durability.

Concrete samples were prepared with varying proportions of seawater and marine sand, then tested under ACI 318 and NEC-SE-HM standards for compressive strength, workability, and durability. Results indicate that optimized saline mixtures achieve compressive strength comparable to conventional concrete after 28 days, enabling a reduction of up to 170 liters of freshwater per cubic meter of concrete, representing a substantial water saving for water-stressed coastal communities.

Beyond structural performance, the study quantifies environmental benefits, including reduced extraction pressure on inland water sources, protection of estuarine ecosystems, and decreased carbon footprint associated with freshwater production and transport. The approach aligns with Ecuador's National Strategy for Water Security (ENSH) and the UN Sustainable Development Goals (SDG 6 & 11), promoting a circular, climate-adaptive framework for resilient coastal infrastructure.

Pilot applications in social housing programs and community construction projects demonstrate the model's scalability and potential to guide water-sensitive urban planning, material selection, and sustainable engineering practices in vulnerable coastal regions. This methodology provides a replicable framework for other water-stressed coastal areas in Latin America, highlighting how innovative material adaptation and sustainable engineering can contribute to resilient infrastructure and local water security.

**BIO:** María de la Caridad Abreu Moreras is an independent researcher from Ecuador specializing in construction materials under water-limited conditions. Her work promotes sustainable and climate-resilient engineering practices in coastal regions, focusing on material adaptation, freshwater reuse, and ecosystem-sensitive infrastructure solutions, with applications in social housing and urban planning.

## Effects of Irrigation with Potassium Fertilization on the Growth of Bamboo in Florida

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Bamboo is a vital renewable resource cultivated for its economic and environmental benefits, including the production of edible shoots, as a source of timber and energy, carbon sequestration, and soil health enhancement. There is a rapid expansion of bamboo production in the US, particularly in Florida, due to increasing market interest and adaptability to the climate. Recently, growers have been investing in bamboo cultivation, especially in fields where citrus groves have been removed or abandoned. Despite this, there is still a lack of information on nutrient and irrigation management requirements for optimal bamboo production. We hypothesized that adequate irrigation and K fertilization would improve bamboo production by enhancing nutrients and water use. This research, therefore, aimed to quantify the optimal irrigation and potassium (K) fertilization rates for sustainable bamboo production in Florida. A split-plot factorial, completely randomized design experiment was established under greenhouse conditions. Four irrigation rates (50% evapotranspiration (ET), 75% ET, 100% ET, and 125% ET) were the main plots and four K rates (0, 112, 224, and 336 kg/ha K<sub>2</sub>O) as subplots, with five replicates and randomized within each irrigation. The results showed that 100% and 125% ET had the highest culm height, especially during the hot seasons, but the 75% ET still performed comparably, suggesting reasonable growth while conserving water. However, K rates were not significantly different across all the irrigation treatments. At low irrigation rates (50% ET), bamboo growth was significantly reduced. Extractable and tissue K concentrations increased at higher K rates using the highest irrigation rate at 125%ET. Also, there was a potential synergistic effect between higher K rates and soil available P, with peak availability at 224 kg/ha K<sub>2</sub>O. The results showed that irrigation significantly influenced soil nutrient availability. Regression analysis will be conducted to evaluate biomass accumulation with respect to K rates under the different irrigation rates.

## Rainfall Trends in South Florida

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As part of the ongoing effort to track trends in mission-specific water and climate data, the South Florida Water Management District (SFWMD) conducted the scheduled five-year update of the rainfall metric trend and frequency analyses using gridded daily data from 1935 to 2024. This update extends the previous 2022 analysis by incorporating six additional years of data (2019–2024). In addition, a new cluster analysis was introduced to identify areas with similar rainfall trends across the SFWMD region, moving beyond the previous approach that relied on predefined water management boundaries.

The updated rainfall trend and frequency analyses provide results across SFWMD's 14 rainfall areas, and the methodology remained consistent with the 2022 analysis. The non-parametric Mann-Kendall test to identify monthly, seasonal, and annual trends, while log-normal distributions supported the analysis of 1-, 3-, and 5-day maxima for extreme events across multiple return periods (2-, 5-, and 10-year). The extended dataset revealed that some previously observed trends weakened or disappeared, while new trends emerged (e.g., Upper Kissimmee in March and Lower Kissimmee in July). Meanwhile, the frequency analysis showed increasing occurrences of short- to medium-duration extreme rainfall events in certain areas.

Extending the long-term trend analyses to enhance understanding beyond regional patterns, clusters were identified using the DBSCAN method and based on shared rainfall characteristics rather than the 14 rainfall areas, and long-term trends were then assessed within each cluster for the 1935–2018 and 1935–2024 periods of record. Unlike traditional basin-based approaches, the DBSCAN method utilized for the analysis identifies dynamic rainfall clusters based on spatial and temporal exceedance characteristics. By testing multiple rainfall thresholds (4.00 to 6.00 inches), the analysis distinguished between persistent clusters and emerging clusters. Trend analysis of peak-over-threshold events revealed intensifying rainfall patterns across Central and Southern Florida, particularly in inland and southern areas.

Together, these analyses aim to improve understanding of long-term rainfall trends across region, supporting resiliency planning and adaptive water management strategies with consideration for evolving conditions and variability in the hydrologic system.

**BIO:** Dr. Al Ali is a Chief Engineer at the South Florida Water Management District with more than 30 years of experience in geostatistics, stochastic modeling of nonstationary processes, and optimization of nonlinear systems under uncertainties. He has extensive development and application experiences in everglades restoration projects.

# Simple Sustainable Intervention to Reverse Ecological Feedback Driving Seagrass Retreat

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Seagrasses are foundation species offering key ecosystem services such as habitat provision, carbon sequestration, and coastal protection, yet they are declining worldwide, often due to synergistic factors. In St Andrew Sound on the Gulf Coast of Florida, a seagrass meadow has rapidly retreated since Hurricane Michael breached a barrier island in 2018, altering sediment dynamics in an area associated with intense grazing pressure. To prevent further retreat while a permanent solution is developed, we tested a biodegradable method to pause and possibly reverse the positive feedbacks between grazing and erosion. Bamboo stakes were inserted in a grid pattern along the retreating grazed edge of the meadow. We hypothesized that the stakes would prevent grazing at the seagrass edge, allowing the seagrass to regrow, trap sediment, overcome changes in sediment dynamics (e.g. burial of grazed shoots) and ultimately slow down the edge retreat. The results after one year revealed that bamboos excluded manatee and turtle grazing, seagrass was able to regrow and the edge retreat within bamboos was slower than in control plots without bamboos. Overall, these findings suggest that simple interventions such as bamboo fencing can play an important role in mitigating seagrass retreat by addressing compounding factors such as erosion and grazing pressures.

**BIO:** Dr. Andrew Altieri is Interim Director of the Center for Coastal Solutions and Assoc Professor in the Environmental Engineering Sciences here at UF. He earned his B.A. in Marine Biology from U.C. Santa Cruz and Ph.D. in Ecology and Evolutionary Biology from Brown University. His research group examines how humans interact with coastal ecosystems during this era of rapid global change to support efforts for a healthy and functional ocean of tomorrow.

# Florida's Hidden Water Supply: Reducing Irrigation to Secure a Sustainable Water Future

**Beth Alviz**

Audubon Florida, Tallahassee, FL, USA

Florida's water demands continue to grow, stretching groundwater supplies beyond sustainable limits. In response, planning often emphasizes costly water supply and resource development projects that take years to complete, while outdoor irrigation, the largest discretionary use, remains largely unaddressed. By rethinking landscape choices, Florida can unlock the quickest, most affordable, and most broadly beneficial source of future water supply.

In North Florida, for example, public-supply withdrawals total more than 600 million gallons per day (mgd). Using conservative estimates, 50 to 100 mgd could be made available simply by limiting outdoor irrigation, volumes comparable to or greater than many supply projects.

This presentation shows how local governments, developers, and state water managers can work together to unlock this hidden supply. It highlights three levers:

1. Updating landscape and irrigation codes, requiring low-water-use landscaping, and linking development approvals to designs that minimize high-irrigation areas.
2. Encouraging developers to limit irrigated turf and incorporate site designs and plant selections that maintain aesthetics and function while reducing water demand.
3. Using consumptive use permitting (CUP) to reinforce local standards and require conservation measures tied to long-term sustainability.

Applying these strategies reduces the need for additional water supply and water resource development projects, strengthens public water supply security, and helps sustain the waters vital to Florida's birds and wildlife. By shifting water from turf irrigation toward higher-value uses for people and ecosystems, decision makers move toward lasting strategies that secure Florida's water future while safeguarding its natural heritage.

**BIO:** Beth Alvi is Audubon Florida's Senior Director of Policy, leading policy and legislative efforts at the local, state, and federal levels on water, Everglades, wildlife, habitat, and climate. With over 25 years of experience, she has held leadership roles in conservation, resource management, and environmental policy.

# Seagrass or Macroalgae: Who Has the Competitive Edge? Implications for Coastal Resource Management

**Chris J. Anastasiou**

Southwest Florida Water Management District, Brooksville, FL, USA

Estuarine ecosystems along Florida's Gulf Coast are increasingly shaped by the converging impacts of climate change, sea level rise, land-use change, and water quality. These stressors can alter the ecological balance from seagrasses, valued for their role in promoting biodiversity, stabilizing sediments, and supporting fisheries, to fast-growing macroalgae that often thrive under nutrient-enriched and thermally stressed conditions. Here we explore how environmental change may be shifting the competitive advantage from seagrasses to macroalgae, with significant implications for estuarine sustainability and resilience using Charlotte Harbor and Tampa Bay as case studies. In these Gulf Coastal estuaries, and across Southwest Florida, increased nutrient loads continue to be a major causative factor driving algae blooms, but not the only one. Minimum winter temperatures have risen several degrees over the past fifty years, most notably in the fall and spring, effectively lengthening the growing season by as much as a month. This could be shifting the competitive advantage toward macroalgae by virtue of their faster growth rates relative to seagrasses. Indirectly, sea-level rise and increasing sea-surface temperatures can also increase sub-lethal stress to seagrasses making them more susceptible to hurricanes, red tide, and disease. However, the news is not all bad. Nutrient load reduction is still the most effective tool to combat macroalgal expansion and seagrass loss. For example, in Sarasota Bay, reductions in dissolved inorganic nitrogen loads have resulted in significant seagrass recovery. Understanding the drivers of macroalgal expansion is essential, yet quantifying macroalgae at landscape scales can be very challenging. Here we highlight the need to invest more resources to better monitor and map macroalgal dynamics by leveraging long-term partnerships, building upon existing monitoring programs, and promoting citizen-science. Through these and other ways, we can better utilize macroalgal expansion as an early warning indicator of coastal degradation to drive management actions.

**BIO:** Dr. Anastasiou is Chief Water Quality Scientist and Seagrass Mapping Program Lead for the Southwest Florida Water Management District. He has over 25 years of experience leading research and restoration projects along the Gulf Coast. Dr. Anastasiou is also a US Navy Reserve Meteorology and Oceanography Officer.

# Assessing the Influence of Spatial Patterns on Hydrologic Response in a Highly Urbanized Watershed

**Sheilla C. Apio**, *Nasrin Alamdari*

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Spatial complexity of impervious surfaces hinders the accurate prediction of runoff and infiltration in urban catchments. Prior studies often use lumped metrics such as Total Impervious Area (TIA) and Effective Impervious Area (EIA) to quantify the overall extent of impervious cover. However, these metrics ignore spatial configuration and heterogeneity of impervious patches. This omission can strongly affect hydrological responses by overestimating flood peaks, thereby reducing the reliability of the results for urban water management strategies.

This research aims to examine how the spatial configuration and heterogeneity of impervious surfaces influence runoff and infiltration in a highly urbanized watershed. The watershed was developed in the Storm Water Management Model (PCSWMM) using 15 years of observations. Different storms and alternative impervious layouts will be tested to evaluate their impact on urban hydrology. The layouts will be developed to vary 3 aspects of the impervious pattern: (i) connectivity to drainage, (ii) degree of clustering versus fragmentation, and (iii) placement relative to flow paths. For each layout, spatial metrics including mean patch size, edge density, and aggregation index will be computed with FRAGSTATS software.

To relate spatial metrics to hydrologic response from PCSWMM, the study will apply two global sensitivity analysis methods (VARS and Sobol) to identify influential spatial configuration metrics. Relationships between PCSWMM hydrologic responses and spatial metrics will be quantified using correlations, multivariate regression, Elastic Net regression, and Generalized Additive Models (GAMs).

Findings will inform stormwater design that accounts for the spatial arrangement of impervious surfaces, with the goal of increasing infiltration and reducing surface runoff. By identifying consistent relationships between spatial patterns and hydrological responses, the study will support targeted landscape reconfiguration. Ultimately, this research can support cities to adopt resilient, spatially informed stormwater strategies suited to continued urban growth and changing rainfall regimes.

**BIO:** Sheilla is a civil engineer with 5 years' experience in conducting hydrologic studies, hydraulic design of drainage systems, and water-management planning. Currently pursuing her PhD in urban stormwater management at the FAMU-FSU College of Engineering, Sheilla continues to advance her interest in driving sustainability and climate-resilient stormwater planning for growing cities.

## **Towards an Algal Bloom Integrated Forecast System in the Caloosahatchee-Lake Okeechobee-St. Lucie System**

*Mauricio E. Arias, David A. Kaplan, Qiong Zhang, Hung Q. Nguyen, Sajad Soleymani Hasani, Enrique Orozco Lopez, Scott Lee Young, Maitane Olabarrieta*

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Water quality is a critical issue in south Florida, where a major metropolis has sprawled along a vast network of interconnected water ecosystems, including Lake Okeechobee and the Caloosahatchee and St. Lucie estuaries. Control of nutrients and algal blooms has been at the forefront of the management discourse about this water network.

Computational modeling is not new in the region, but process-based models alone have not been able to fully capture variability and extremes in water quality indicators that drive major ecological and societal impacts. Considering this challenge, our interdisciplinary team has been developing a computational platform to accurately predict key eutrophication indicators at multiple locations along the south Florida water network. This talk will provide an overview of these efforts, with emphasis on coupled, Machine Learning-based predictive models.

An XGBoost algorithm is used to predict nutrient patterns in Lake Okeechobee, with SHapley Additive exPlanations suggesting that turbidity, lake stage, and water temperature are the main predictors. Algal biomass along the canals connecting the lake with the estuaries was successfully predicted using XGBoost and Random Forest algorithms with a time lag of up to 14 days. To improve the explanatory nature and predictive power of these models, they are being further trained with simulations from process-based 3D hydrodynamic models.

The forementioned models will be driven by Transformer Neural Network (TNN) generating 10-day forecasts of water quantity that consider water operations schedules as well as precipitation forecasts. This forecast system is developed in collaboration with state and federal water management agencies, with the goal of influencing the decision-making process for water management in South Florida.

Together, these efforts advance the development of an operational water quality forecasting framework, providing a pathway toward more informed and adaptive management of south Florida's interconnected aquatic systems.

**BIO:** Mauricio Arias is an associate professor of water resources and environmental engineering. He has published 80 peer-reviewed articles in top scientific journals and he has been an investigator in 18 research projects. He recently returned from being a Fulbright Scholar in Mexico. He enjoys paddling along the Hillsborough river.

## Resilient Water Utility Planning: Balancing Supply and Fiscal Risk

**Tirusew Asefa**<sup>1</sup>, Hui Wang<sup>1</sup>, Sandro Svrclin<sup>1</sup>, Lillian Lau<sup>2</sup>, Dan Li<sup>3</sup>, Patrick Reed<sup>2</sup>, Greg Characlis<sup>3</sup>

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Maintaining a high level of water supply reliability while meeting financial obligations—such as honoring debt covenants and ensuring affordable customer rates—is a core challenge for water utilities. Balancing these objectives is further complicated by uncertainties in water demand projections and hydroclimatic variability.

Financial performance standards are essential to sustaining strong credit ratings and favorable borrowing terms. Traditionally, utilities identify the timing and capacity of new supply infrastructure before conducting financial viability assessments, treating these steps as sequential and based on single, deterministic future conditions. This approach can lead to over- or under-investment in infrastructure.

To address this limitation, Tampa Bay Water and its university partners developed a state-of-the-practice decision support framework that integrates system yield and reliability modeling (Systemwide Reliability Evaluation, SWRE) with a Financial Risk Assessment Tool (FRAT). The coupled SWRE–FRAT framework enables Tampa Bay Water to jointly explore the supply–demand–finance nexus under a wide range of future scenarios. This integration quantifies how uncertainties in hydrology, demand growth, and financial conditions affect key performance metrics such as debt coverage ratios and our uniform water rate.

Moreover, the framework supports strategic exploration of infrastructure and financial adaptation pathways—examining questions such as: *What are the implications of introducing a new supply project in a given year?* and *What is the optimal timing for bond issuance under varying assumptions of inflation, interest rates, and repayment structures?* Together, these capabilities offer utilities a robust, risk-informed approach to aligning infrastructure investment with long-term financial sustainability.

**BIO:** Dr. Asefa leads the Systems Decision Support group at Tampa Bay Water. His group develops and implements a variety of decision support models to guide the agency’s week-to-week operations, seasonal resources allocation, annual budgeting, resources assessment, long-term water supply and financial planning, and climate adaptation.

# Boosting Compliance with Residential Irrigation Restrictions: Evidence-Based Strategies

*A.T. Ayodele, A. Joshi, L.A. Warner, S. Hundemer, & J. Loizzo*

Department of Agricultural Education and Communication, University of Florida, Gainesville, FL, USA

Florida's rapid population growth and reliance on groundwater has intensified concerns about water scarcity, making residential irrigation restrictions a critical conservation tool. This study examined strategies to increase compliance with these restrictions through a statewide message framing experiment. Message framing refers to tailoring communication to highlight specific benefits or values such as landscape aesthetics or financial savings. Florida residents with in-ground irrigation systems (N = 256) were randomly assigned to one of five message types: aesthetic, environmental, financial, social norms, or a neutral message with no frame.

The Elaboration Likelihood Model (ELM) guided the research that will be shared in this poster. ELM explains how people process and respond to persuasive messages. Results showed that a single message exposure did not significantly increase residents' likelihood of seeking information about irrigation restrictions or personally following the rules. Awareness of restrictions was also relatively low, with just over half of respondents (54.3%) reporting that they knew such rules existed. Instead, compliance was more strongly associated with factors such as years lived in Florida.

The poster will describe findings that suggest one-time message exposure is insufficient to influence irrigation restriction awareness or compliance behavior while repeated and tailored communications may be more effective. Beyond one-way messaging, interactive approaches that enable dialogue with local experts, combined with simple self-monitoring tools like adjustable irrigation timers, may help strengthen compliance. This poster will highlight these evidence-based strategies by comparing the tested message frames with a neutral message and presenting what worked and what did not. Recommendations will emphasize repeated and tailored communication, interactive dialogue with trusted local experts, the use of trusted channels, social media platforms, and practical tools to strengthen compliance and promote long-term water conservation through greater adherence to irrigation restrictions.

**BIO:** Adeyinka Ayodele is a graduate student in the Department of Agricultural Education and Communication (AEC) at the University of Florida. His research focuses on water conservation communication, landscaping, and urban sustainability. He applies behavioral and communication theories to improve public compliance with water policies and promote long-term conservation practices.

## Numerical Modeling of Pesticide and Fertilizer Transport in South Florida

*Paige Babushkin<sup>1</sup>, Wei Mao<sup>1</sup>, Marie Cecil<sup>1</sup>, Michael Core<sup>1</sup>, Ming Ye<sup>1</sup>, Ahmed Elshall<sup>2</sup>, Mewcha Amha Gebremedhin<sup>2</sup>, Nikolaos Tziolas<sup>3</sup>*

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The escalating use of pesticides and fertilizers in agriculture poses significant concerns for water quality and environmental health. South Florida is especially vulnerable due to its tropical climate, supporting intensive year-round agriculture and frequent pesticide and fertilizer application, elevating the potential for contamination of surface and groundwater systems. The region's geology and porous limestone promote rapid infiltration, increasing the vulnerability of the Upper Floridan aquifer and nearby surface waters. The Lake Trafford watershed in Collier County encompasses agricultural fields, wetlands, and urban areas, where hydrologic flow directs water and potential pollutants toward the lake. Modeling tools have been used globally to study the transport of pesticides and fertilizers, but there is a lack of research done on the transport in regions with low lying topography, sandy soils, and manufactured canal systems, such as in South Florida. This research aims to develop a numerical model using the Soil and Water Assessment Tool (SWAT) to simulate the transport of pesticides and fertilizers within the Lake Trafford watershed. By integrating hydrologic, soil, land-use, and agricultural management data, the model will quantify pollutant dynamics and assess the ability of SWAT to represent nutrient and pesticide transport. The SWAT model will be constructed using U.S. Geological Survey databases, South Florida Water Management District's DBHYDRO database, and agriculture management practices from the University of Florida's Southwest Florida Research and Education Center. Model outputs will be validated using data from DBHYDRO and water samples collected from surface water sources in Immokalee, Florida in June of 2025. This research will enhance understanding of pesticide and fertilizer transport in subtropical watersheds and inform sustainable agricultural management. The findings aim to protect water resources, support public health, and strengthen the use of modeling tools like SWAT for evaluating pollution mitigation strategies in Florida and similar regions.

**BIO:** Paige Babushkin is a senior at Florida State University studying Environmental Science and Public Health. With experience in hydrologic modeling and water chemistry, she plans to pursue graduate studies. Her research interests center on sustainable food systems, exploring how processes affect water quality, ecosystem health, climate change, and public health.

# GIS-Based Spatio-Temporal Modeling of Green Infrastructure Co-Benefits across the State of Florida

*Jesse Badu Yeboah<sup>1</sup>, Nasrin Alamdari<sup>2</sup>*

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Most urban areas channel stormwater through engineered collection systems (gray infrastructure) and discharge into nearby waterbodies, usually carrying high levels of pollutants. However, green infrastructure makes use of vegetation, soils, and other natural processes to manage water and provide a safe and healthy urban environment.

In addition to these functions of green infrastructure, there are several social, economic and environmental benefits termed as co-benefits. Yet, a major barrier to wider GI adoption is that many of these co-benefits are not readily quantified and monetized. Allocating valid metrics and monetary values is pivotal for the integration into decision-making processes. The seemingly unavailability of a comprehensive monetary value of GI co-benefits makes them invisible in traditional cost-benefit appraisal. As a result, policymakers and planners often struggle to justify GI investments when competing with more easily valued gray infrastructure alternatives.

Over the years, progress has been made in quantifying these co-benefits. However, these quantified co-benefits are not comprehensive and are limited to a few green infrastructures. In addition to the valuation gap, much is not done on the comprehensive spatial and temporal distribution of green infrastructure co-benefits in monetary terms. Again, there is limited knowledge on investment returns and the persistence of co-benefits in the face of changing climate conditions.

This study, therefore, quantifies the monetary value of a full range of co-benefits of green infrastructures across the state of Florida using a comprehensive, multifaceted and consolidated Excel-based tool developed by Dr. Nasrin Alamdari. It further examines the spatial variation of the co-benefits in counties, predict their probable change with different investment time frames, evaluate their relative cost-effectiveness against historical expenditure, and subject them to test under projected future climates. This will provide a practical and actionable framework that can support policy buy-in, funding justification, and strategic planning for green infrastructure investment.

**BIO:** Jesse Badu Yeboah is an Environmental Specialist and Researcher with over nine years of experience in environmental monitoring, water and air quality management, and occupational health and safety. He has proven ability to manage field data, conduct environmental assessments, and contribute to peer-reviewed research.

## Contaminants of Emerging Concern and Antimicrobial Resistance in Great Lakes Water and Fish Species

*Tracie R. Baker, Emma VanderMeulen, May Thongthum, Mallory Llewellyn, Alvin Wu, Joanne Wang, Aidan Keenan, Carol Miller, Joseph Bisesi, Benjamin Anderson, and Bridget B. Baker*  
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Contaminants of emerging concern (CECs), including PFAS and pharmaceutical and personal care products (PPCPs), in aquatic ecosystems pose a significant One Health threat. Prior work in the Lake Huron-Erie corridor (HEC) documented PFAS bioaccumulation and biomagnification across the aquatic food web, and persistence of PPCPs, including antibiotics. The HEC is an international shipping route border with Canadian, contains North America's only International Wildlife Refuge, serves as a drinking water source for up to 4 million people, and is a major destination for recreational and sustenance fishing. We investigated more than 150 PFAS/PPCPs and antibiotic resistance genes (ARGs) in surface water and game fish to characterize sources and distribution in urban- and wastewater-dominant ecosystems and assess potential aquatic and human health risks. PPCP and ARG numbers and concentrations were greater near and downstream of wastewater treatment plant infrastructure; site-specific anthropogenic inputs shaped contaminant profiles, producing significant between-site differences and impacts. To investigate One Health implications of these persistent CECs in this social-ecological system, we collected popular game fish to test: PFAS bioaccumulation in White Bass; and PPCPs bioaccumulation and occurrence of antibiotic resistant genes (ARGs) in Yellow Perch and Walleye across a gradient of known contamination. Results show that PFOS is most commonly implicated in PFAS bioaccumulation across game fish species. ARGs were more prevalent in areas with higher environmental contaminant burden. Controlling for organ type and location, Walleye had 2.52 more ARGs compared to Yellow Perch. PFAS, PPCPs, and ARGs potentially pose a risk to aquatic food webs and public health via ingestion of game fish at environmentally-relevant doses. Establishing an understanding of contaminant distribution in the HEC is critical for long-term monitoring and assessment of future PPCPs management interventions directed at human, wildlife, and environmental health.

**BIO:** Tracie Baker (DVM, PhD) is an associate professor in the Department of Environmental and Global Health at UF. Her laboratory is focused on multidisciplinary, translational toxicology research that bridges human, animal and environmental health.

# Effectiveness of a Peroxide-Based Algaecide Under Flowing Conditions at a Lake Okeechobee Outflow Structure

**Albert S. Barbaretta**<sup>1</sup>, **Bethany C. Ryder**<sup>1</sup>, **Haruka E. Urakawa**<sup>1</sup>, **Serge Thomas**<sup>1</sup>, **Jose V. Lopez**<sup>2</sup>, **Anna Wachinicka**<sup>3</sup>, and **Hidetoshi Urukawa**<sup>1</sup>

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Lake Guard<sup>®</sup> Oxy (LGOxy) is a peroxide-based algaecide that has been shown to be effective in controlling cyanobacterial harmful algal blooms (cHABs), including *Microcystis aeruginosa*, in various regions worldwide. *M. aeruginosa* produces cyanotoxins called microcystins, which cause a variety of negative impacts on socio-ecological systems. This study investigates the effect of LGOxy at the Julian Keen Jr. Lock & Dam (S-77) outflow structure, Florida, USA, during the summer *Microcystis* bloom season. From June to July 2024, three field applications of LGOxy were undertaken. In each test, water quality parameters, hydrogen peroxide, microcystin, chlorophyll, photosynthetic activity, and the phytoplankton, bacterioplankton, and zooplankton communities were measured immediately before and after application, as well as 24 and 48 hours after product application. Basic summary statistics were performed for the water quality data, and nonmetric multidimensional scaling using Bray-Curtis distance measure was performed for the phytoplankton and zooplankton data using R, RStudio, and GraphPad Prism. Results showed that the hydrogen peroxide concentration ( $\leq 0.62$  mg/L) was below the level required to disrupt *Microcystis* cells as the applied dose was insufficient. The necessary doses are determined by chlorophyll *a* levels, which were too low ( $< 50$   $\mu\text{g/L}$ ) during the test. In addition, heavy precipitation and strong winds before and during the field study period likely influenced the results. Chlorophyll levels, photosynthetic activity, and microcystin concentrations were not significantly affected by LGOxy. Similarly, the phytoplankton, bacterioplankton, and zooplankton communities showed no significant response to the treatment. We concluded that the LGOxy treatment strategy under low-chlorophyll conditions should be reevaluated to improve its effectiveness in controlling HABs in lotic systems.

**BIO:** Albert Barbaretta is a graduate student working in Dr. Hidetoshi Urakawa's laboratory, currently working towards his MS in Environmental Science. His research interests include harmful algal blooms and studying the impact of algaecides

## Addressing Stakeholder Goals of Seagrass Conservation through Actionable Research

**Savanna C. Barry**<sup>1,2</sup>, *Holly Abeels*<sup>2</sup>, *Mike Allen*<sup>1</sup>, *Edward Camp*<sup>3</sup>, *Mark Clark*<sup>4</sup>, *Kelly Grogan*<sup>5</sup>, *Joshua Patterson*<sup>3,6</sup>, *Laura Reynolds*<sup>4</sup>

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Florida's aquatic preserves are established by law and managed by FL Department of Environmental Protection to maintain resources for the benefit of future Floridians. The Nature Coast Aquatic Preserve (NCAP) was established in 2020, and extensive seagrasses are the hallmark of this preserve. A multiple stakeholder driven process (MSP) was used to identify and prioritize issues and actions that will occur over the next 10 years. Ten of these actions related to propellor scarring in seagrass, and a surprising amount of conversation revolved around creating no motor zones to reduce propellor scarring. Previous scoping efforts, pilot projects, and stakeholder workshops have identified a suite of broad actions and decisions that could be made to address propeller scarring, but data managers need to inform specifically how and where to act are lacking. Based on these priorities and previous efforts, we assembled a team (managers and scientists from different disciplines) to create an actionable science project to address the uncertainties (scientific, legal, and community buy in) preventing propellor scar management.

First, a large-scale mapping effort is providing spatial specificity and identify the most severely scarred banks in the study area. Then, data about the economic tradeoffs of management actions and data about the ecosystem service losses in scarred banks are being collected and combined to identify optimal zones for action. Finally, practical guidance about how spatial management zones can be implemented, how decision-makers prefer to receive data, and specific characteristics of scarred seagrass banks is being collated to provide practical information that managers need to refine decision-making and enhance communications. Data products and decision pathways are continually discussed with stakeholders through a diverse advisory committee and in a larger stakeholder summit.

**BIO:** Savanna Barry is regional specialized extension agent at UF IFAS Nature Coast Biological Station and Florida Sea Grant

# Automated Mapping of Wetlands and Waterbodies from Mid-20<sup>th</sup> Century USGS Topographic Maps

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It has been estimated that the conterminous United States and the State of Florida have both lost more than half of their wetlands since colonial settlement. However, it is necessary to know where this loss has occurred to identify where function has been impacted and where wetland preservation and restoration should be prioritized. Efficient mapping of wetland loss requires a digitized map of the baseline distribution of wetlands. Scanned images of USGS topographic maps contain standardized cartographic symbols to represent wetlands and waterbodies within a reference system but it has been challenging to isolate this information to create historical maps specifically of wetlands or waterbodies. We have developed a streamlined workflow based on automated extraction of wetland symbology from a historical set (mid-20<sup>th</sup> century) of USGS topographic maps of the Indian River Lagoon Watershed, Florida. Our procedure is based on U-net CNN architecture and is conducted within ArcGIS Pro environment. We created training and testing datasets by heads-up digitization of wetland symbology on historical USGS topographic maps followed by export as binary image-mask pairs. We trained the U-net classifier (RasNet-34 backbone) with a max epoch size 30 and a batch size of 8 and split the data into 90:10 for training and testing. Training and testing loss convergence have indicated stable model performance. The model has achieved strong results for background classification and wetlands have been detected with high recall (> 0.90) and moderate precision (> 0.50). These results demonstrate the potential of convolutional neural networks for extracting wetlands from historical USGS topographic maps, while also highlighting the initial challenge of reducing false positives in wetland prediction.

**BIO:** Dhrubo Barua is a PhD student (Geography, Environment, and Policy) working with the Ecohydrology Research Group in the School of Geosciences at the University of South Florida. His research interests lie in exploring and developing advanced geospatial techniques to enhance spatial analysis and decision-making that improve water resource management across different environmental and socio-economic contexts.

# Effect of Variable Nitrogen Rates on Growth, Yield, and Fruit Quality of HLB-Affected Citrus Trees

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Huanglongbing (HLB), a destructive bacterial disease, has devastated the citrus industry in Florida, causing substantial fruit yield losses each year. With no cure, HLB continues to pose a serious threat to maintaining profitable citrus production. One of the key problems associated with HLB is the loss of fibrous roots, which impairs the ability of trees to absorb water and nutrients from the soil, ultimately leading to tree decline and reduced fruit yields. This makes nutrient management a critical strategy for improving the growth and yield of HLB-affected citrus trees by ensuring optimal nutrient availability. In this context, this study was conducted to evaluate the impact of different nitrogen (N) rates on mature (30-year-old) HLB-affected sweet orange (*Citrus sinensis*) trees. The experiment followed a randomized complete block design with five N treatments (100, 150, 200, 250, and 300 lb/acre) and 4 replications. Tree responses were assessed over two growing seasons (2022-2024) through growth metrics, tissue nutrient concentrations, fruit yield, and postharvest fruit quality. Results indicated that N rates had no significant effect on leaf nutrient concentrations, canopy volume, or trunk cross-sectional area, while seasonal variations were significant, highlighting the season-specific nutrient demands of the trees and the importance of seasonal nutrient management. Fruit yield increased markedly (50–70%) in 2024 compared to 2023, independent of N rates. Similarly, juice percentage rose significantly by 70–75% in 2024, while other fruit quality parameters such as soluble solids, juice percentage, titratable acidity, or the total soluble solids to titratable acid ratio remained unaffected by N levels. These findings underscore the limited impact of N rate alone on mature HLB-affected citrus trees, while highlighting the critical role of seasonal factors in influencing fruit yield and quality, emphasizing the need for seasonally tailored nutrient management strategies to sustain productivity under HLB endemic conditions.

**BIO:** Noor Ul Basar is a Ph.D. candidate in the Department of Soil, Water, and Ecosystem Sciences at the University of Florida. His research focuses on developing and refining Best Management Practices (BMPs) for citrus nutrition, with a particular emphasis on mitigating the impacts of Huanglongbing (HLB) disease. Through optimizing nutrient management strategies, his work aims to sustain citrus productivity while enhancing environmental quality within Florida's citrus production systems.

## Enhancing Public Trust in Drinking Water: Affordable Groundwater Treatment Solutions

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Hydrogen sulfide (H<sub>2</sub>S) is a naturally occurring compound in the Upper Floridan Aquifer that degrades water quality by producing odor, corrosion, and turbidity when oxidized. Although unregulated under the U.S. EPA regulations, elevated H<sub>2</sub>S concentrations reduce drinking water quality, damage infrastructure, and impact aquatic ecosystems. This study seeks to understand the occurrence of H<sub>2</sub>S in groundwater sources and evaluate cost-effective treatment methods to improve water quality and strengthen community confidence in public systems.

Field sampling was conducted at municipal treatment facilities using portable sensors and Hach kits to measure H<sub>2</sub>S concentrations, alongside on-site testing of pH, dissolved oxygen (DO), total dissolved solids (TDS), and total chlorine. Laboratory analyses using a total organic compound (TOC) analyzer, inductively coupled plasma mass spectrometry (ICP-MS), and ion chromatography (IC) further quantified organic content, inorganic species, including sulfates, which influence H<sub>2</sub>S persistence.

As an affordable treatment solution, the performance of surface-functionalized granular activated carbon (GAC) was investigated. Adsorption isotherm experiments were performed with four GAC types to assess reaction kinetics and maximum capacity. Column testing is planned as a future phase to simulate treatment under continuous flow conditions and evaluate scalability for utility operations.

Experimental results indicate that GAC absorption effectively reduces H<sub>2</sub>S concentrations, offering a scalable and economically viable treatment strategy for groundwater systems. This integrated field-laboratory research highlights practical treatment pathways to improve water quality, safeguard infrastructure, and promote public trust in community water supplies.

**BIO:** Hailey Bauer is a research assistant and Director of General Operations for the Student Government Association at Florida Polytechnic University, pursuing an M.S. in Engineering Management. She conducts research on water quality and treatment strategies with Dr. Jun Kim's laboratory team.

# Simulating Soil Hydrologic Dynamics Using Conventional and Machine Learning Techniques

**Haimanote K. Bayabil**

University of Florida, Agricultural and Biological Engineering Department, Tropical Research and Education Center, Homestead, FL, USA

Accurate simulation of field-scale soil hydrology is pivotal for informed agricultural and water resource management decisions. The Agricultural Policy/Environmental eXtender (APEX) model and the Decision-Support System for Agro-technology Transfer (DSSAT) model are established tools that offer insights into hydrological processes and crop performance. With the integration of diverse data sources, including sensors, IoT, and UAV systems, machine learning models have gained prominence in simulating hydrological processes across different scales. However, achieving precise simulation of soil-water dynamics remains a challenge. Model accuracy is contingent on the selection and intended use, necessitating evaluation based on measured data. This study evaluates the performance of APEX, DSSAT, and Machine Learning models using field experiment data under variable irrigation and cropping systems. The presentation underscores the strengths and limitations of each model, providing clarity on their unique contributions to soil hydrology simulation. This comparative analysis aids in identifying the most suitable model or model integration for specific research and management objectives, contributing to improved field-scale soil hydrology simulations and efficient water management practices.

**BIO:** Dr. Haimanote Bayabil is an Associate Professor of Water Resources at the Tropical Research and Education Center, University of Florida, USA. His research focuses on developing data-driven decision support tools and management practices to promote the sustainable use of freshwater resources.

# Waters Through Time: SHINE Project VR/3D Ecopoetic Timelapse of Florida's Springs

**Gabriele Belletti**<sup>1</sup>, **Delaney Johnson**<sup>2</sup>, and **Jennifer Purington**

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<sup>2</sup>Honors alumna, University of Florida, Gainesville, FL, USA

<sup>3</sup>Digital Worlds Institute, University of Florida, Gainesville, FL, USA

SHINE (Sciences, Humanities, Intelligence, Nurturing Emotions) is an interdisciplinary project at the University of Florida that uses ecopoetry, immersive virtual reality (VR), interactive 3D environments, artificial intelligence, and neuroscience to address Environmental Generational Amnesia (EGA) surrounding Florida's springs. In this presentation, we focus on the project's core feature: a newly developed timelapse that makes visible fifty years of ecological change in selected Florida springs. The timelapse, created by a UF alumna from the Digital Worlds Institute who serves as the project's lead digital artist, is embedded within an immersive VR and 3D environment structured by an ecopoem authored by a UF undergraduate from Florida. As participants move through the experience, they traverse a narrative trajectory that juxtaposes historical, present, and projected future conditions of the springs. Visual transformations of water clarity, flow, and surrounding landscapes are synchronized with spatialized poetic voice, soundscapes, and archival materials, inviting users to perceive environmental degradation not as a statistic but as an embodied, emotionally charged passage through time. We will present, for the first time, excerpts of the timelapse experience and discuss insights from initial pilot sessions with undergraduate and community participants. Drawing on EEG-based measures of affective response, self-report surveys (place attachment, nature connectedness, pro-environmental intentions), and qualitative reflections, we explore how this arts- and data-informed timelapse can: (1) counteract EGA by re-establishing a felt sense of ecological "baseline"; (2) foster deeper emotional engagement with freshwater ecosystems; and (3) support communication and education around water quality, groundwater extraction, and spring protection in Florida.

By centering a time-based visual narrative within an interdisciplinary framework, SHINE offers a model for how humanities-driven storytelling, immersive technologies, and environmental sciences can work together to help communities remember—and reimagine—their waters.

**BIO:** Gabriele Belletti is Assistant Professor of Italian and French at the University of Florida and Editor-in-Chief of *Delos: A Journal of Translation and World Literature*. His research spans the environmental humanities, contemporary Italian and French poetics, and neo-phenomenological aesthetics. He is author of *Objet et sujet dans les miroirs de la poésie* and editor of volumes and special issues, including *La «Poetica» e le sue interpretazioni*. His scholarship and translations appear in international journals. As a poet, he has published *Krill* and *Tok*, with reflections by Fabio Pusterla and Serenella Iovino. He coordinates the SHINE project, linking ecopoetry, neuroscience, and technology.

## Trace Elements in the Mara River: Implications for Water and Ecosystem Health

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The release of trace elements from both natural and anthropogenic sources increasingly threatens freshwater ecosystems worldwide. In the Mara River basin, geogenic inputs from soil erosion, rock weathering, and the dissolution of soluble mineral salts are compounded by agricultural runoff, urban stormwater, untreated industrial and hospital effluents, and mining discharges. These metals and metalloids readily sorb to suspended particles and accumulate in river sediments, posing chronic risks to aquatic organisms and downstream water users. Despite mounting concerns, no comprehensive basin-wide assessment of trace element contamination in the Mara River has yet been undertaken. This study, therefore, investigates the spatial and temporal distribution of several trace elements, including lead (Pb), arsenic (As), mercury (Hg), and cadmium (Cd), across surface water, sediments, macroinvertebrates, and fish along the longitudinal gradient.

We found the Total mercury (Hg) concentrations peaked at the upstream Mau Forest site (M1) in both surface water and sediment, then declined steadily toward downstream locations. Within the macroinvertebrate community, members of the family Perlidae accumulated significantly more Hg than all other families sampled. In fish, lead (Pb) levels were highest in *Amphilius lujani*, with *Clarias gariepinus* exhibiting the second-highest concentrations across the basin. Arsenic (As) followed a similar pattern, reaching maximum concentrations in *lujani* and the next highest in *Labeo victorianus*.

These findings highlight the combined influence of headwater contaminant inputs and species-specific bioaccumulation dynamics on the distribution of trace elements in the Mara River. By comparing concentrations among these abiotic and biotic compartments, we provide the first basin-wide baseline data critical for future monitoring and for informing evidence-based management of water quality and ecosystem health in East Africa's Mara River.

# Impact of On-Farm Management Decisions on Corn Production: A Four-Year Analysis from the STEP Program

*Shiva Bhambota*<sup>1</sup>, *Vivek Sharma*<sup>1</sup>, *Kevin Athearn*<sup>2</sup>, *Carson Jones*<sup>2</sup> and *Amanda Phillis*<sup>2</sup>

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The Florida Stakeholder Engagement Program (STEP), also known as UF-TAPS, is an innovative, participatory extension and research platform designed to evaluate agronomic practices while assessing grower perceptions toward the adoption of Best Management Practices (BMPs) and agricultural technologies. From 2022 to 2025, the program engaged 59 grower and partner teams in a competitive, real-world farm simulation, where participants made independent decisions on hybrid selection, seeding rate, irrigation, nitrogen application, insurance, and marketing. The program aimed to address critical challenge of increasing outreach by understanding grower perceptions on BMPs. Over four growing seasons, the study investigated the effects of environmental variability and management decisions on corn yield, profitability, and resource use efficiency. Key indices such as the Water Nitrogen Intensification Performance Index (WNIPI) were calculated to quantify efficiency. Over the years, rainfall varied widely from 492 mm (2022) to 947 mm (2024) and 498 mm (2025) which significantly influenced outcomes. Rainfall had the strongest negative correlation with both yield and profitability ( $R^2 = -0.86$ ), highlighting the risks posed by climatic variability. For example, in 2023, increased nitrogen input and ET were strongly associated with yield. Conversely, nitrogen input and evapotranspiration (ET) showed strong positive correlations with yield ( $R^2 = 0.72$  and  $0.61$ , respectively), with diminishing returns beyond 231–267 kg/ha of nitrogen. Ideal irrigation volumes ranged annually between 7–12 inches. Hybrid performance varied by year, but cultivars such as Pioneer P2042VYHR, P1767TYHR, and Dyna-Gro 57VC51 consistently achieved higher yields. The average yield across all plots and years was 14.4 t/ha, with nitrogen input averaging 217 kg/ha and irrigation 7.55 in. PCA revealed that in 2022 Yield performance was relying less on heavy inputs, while in 2023 yields were driven by higher input intensity, 2024 which is the wettest year was highly affected by rainfall and lastly, 2025 was highly affected by irrigation.

**BIO:** Dr. Shiva Bhambota working as Post Doctoral research associate with more than 7 years of experience in the field of precision agriculture and extension education. He has been working on projects like Florida Stakeholder Engagement program (STEP) and assessing the impact of rotational cover Crops.

# SHAPE-SSA: A region-specific Soil Health Assessment Protocol and Evaluation

*Moges Kidane Biru, Marcio R. Nunes*

Department of Soil, Water, and Ecosystem Sciences/Global Food Systems Institute, University of Florida, Gainesville, FL, USA.

Soil health reflects the interaction of chemical, Biological, and physical processes that shape key ecosystem functions such as nutrient cycling, water retention, and crop productivity. However, large-scale assessment remains challenging in tropical regions due to limited access to reliable data and tools. Using 28,738 georeferenced topsoil samples from across Ethiopia, we develop a scalable framework for predicting and evaluating soil organic carbon (SOC), a primary and integrative indicator of soil health in tropical agroecosystems. We begin by compiling 73 environmental covariates grounded in the SCORPAN framework capturing soil, climate, vegetation, and terrain attributes. To enhance model parsimony and interpretability, we apply seven feature selection methods and aggregate their results using robust rank aggregation. This process yields a Minimum Interpretable Predictor Set (MIPS) dominated by texture, taxonomy, and climate variables, which collectively explain over 75% of SOC variability. Implemented via XGBoost and interpreted using SHAP values, the model achieves a 70% reduction in dimensionality while preserving ecological transparency. Remarkably, just three predictors texture class, WRB suborder, and mean annual temperature account for 78% of global model attribution, aligning with pedogenic theory and offering a mechanistic understanding of SOC dynamics. Building on this predictive core, we introduce SHAPE-SSA, a region-specific SOC assessment tool based on Bayesian hierarchical modeling. By generating cumulative distribution functions (CDFs), this framework expresses SOC scores as percentiles relative to soils with similar inherent properties and climate. Unlike fixed-threshold benchmarks, SHAPE-SSA accounts for local carbon stabilization potential and provides uncertainty-aware, peer-grouped evaluations. Together, these two components offer a practical, interpretable, and regionally adapted solution for soil health monitoring supporting climate-smart agriculture, restoration planning, and evidence-based policy across diverse landscapes.

**BIO:** Moges Kidane Biru is a PhD candidate in Soil, Water, and Ecosystem Sciences at the University of Florida. He has over 14 years of experience in soil, water and ecosystem health research, soil mapping, GIS, and land management. His work develops region-specific soil health assessment tools to support sustainable agriculture and policy.

# Forecasting Monthly Streamflow in West-Central Florida using Statistical Machine Learning

*Jia-Yi Ling, Nikolay A. Bliznyuk*

Department of Agricultural and Biological Engineering, University of Florida, FL, USA

Accurate streamflow forecasting is essential for effective water resource management in west-central Florida, where diverse water sources and sensitive aquifers require careful balancing of human and ecosystem needs, especially during the dry season when efficient water allocation is needed to lower environmental and financial cost. This study systematically evaluates a suite of statistical and machine learning models for monthly streamflow prediction at 13 stations across the region. Models integrate both local hydrometeorological data and large-scale climate drivers, notably Niño indices reflecting ENSO teleconnections, to capture the complex interplay between global climate patterns and local watershed processes. Incorporation of spatial information further improves forecast accuracy in some models; however, station-specific local models remain competitive across most locations. Analysis also revealed that forecast accuracy was highest at stations with larger catchment areas and more agricultural land use, and that model performance varied according to hydrogeological conditions. These findings highlight the value of flexible, data-driven modeling frameworks that leverage both climate signals and local data, providing practical guidance for optimizing streamflow prediction and supporting sustainable water supply planning in ENSO-influenced watersheds.

**BIO:** Dr. Bliznyuk is an Associate Professor of Statistics at UF, with appointments in ABE, Biostatistics, Statistics, and ECE. His research has three intertwined methodological statistics thrusts: (i) statistical machine learning for predictive modeling, (ii) Bayesian analysis for integrative informatics, predictive modeling and uncertainty quantification and (iii) modeling for dependent data.

## **The Swamp for the Springs: An Educational Campaign to Connect the Community with Florida Springs**

**Lexi Bolger, Sadie Mills, Megan Ennes**

Thompson Earth Systems Institute, University of Florida, Gainesville, FL, USA

More than 93,000 students, faculty, and staff make up the University of Florida (UF) community, and many of them visit or recreate in Florida's springs during their time at UF. The Swamp for the Springs campaign aimed to educate the UF community about Florida's springs and how members can protect springs resources. We piloted a survey on the UF campus to collect baseline information about the UF community's knowledge of Florida's springs and how members use them. We distributed the survey in November 2024 and gathered 355 responses, which revealed that 40% of respondents visited the springs in the past year. While 98% of respondents recognized nutrient pollution as a threat, only 75% understood that improper recreation can harm springs. Among respondents, 87% reported engaging in behaviors that may damage springs.

Using the survey results, we developed digital and educational materials to educate the UF community on responsible recreation at the springs. In-person outreach events engaged over 2,000 UF community members through activities like a Florida springs conservation trivia night, an interactive theater event about manatees and springs conservation, and tabling with UF's Marston Science Library and the UF Office of Sustainability. Instagram posts explained key springs terms and shared actions for springs protection. The social media content reached nearly 3,000 users. This fall, we hosted an interactive presentation about Florida LAKEWATCH and how monitoring the quality of our water helps manage and understand the diversity of Florida's aquatic ecosystems. We also created a website that outlines the campaign's main messages, project news, and encourages UF community involvement in conservation efforts. This content can continue to be shared with the UF community after the campaign's end.

**BIO:** Lexi Bolger was the outreach coordinator for the Swamp for the Springs campaign and is a doctoral student in Interdisciplinary Ecology. She is a graduate assistant at TESI and has experience in creating, implementing, and evaluating environmental education and communication programming.

# Physiological and Nutritional Dynamics of Young Macadamias Tree to Nitrogen Fertilization under Acidic Substrate Conditions

**Lopes Bonda, Ahmad A. Omar and Davie M. Kadyampakeni**

UF/IFAS, Citrus Research and Education Center, Lake Alfred, Florida

Nitrogen (N) fertilization is essential for the early development of macadamia trees. However, excessive nitrogen application under acidic conditions impairs root growth and reduces nutrient use efficiency. This study assessed the physiological and nutritional responses of young *Macadamia tetraphylla* trees to increasing nitrogen application rates in acidic substrate. A completely randomized block design (CRBD) was implemented with four nitrogen rates (1, 2, 3, and 4 g per tree), each with five replicates. The selected rates were based on the Australian nursery recommendation of 6 g per tree, with 3 g as the standard for young trees, 1 g representing deficiency, and 4 g simulating excess. Nitrate ( $\text{NO}_3^-$ -N) concentrations increased linearly ( $R^2 = 0.71$ ,  $p < 0.001$ ). Ammonium ( $\text{NH}_4^+$ -N) concentrations were not significantly affected up to 3 g N per tree but increased at 4 g N per tree ( $p < 0.01$ ). Substrate pH declined linearly from 5.0 to 4.2 ( $R^2 = 0.68$ ,  $p < 0.001$ ), indicating progressive acidification. Nitrogen content in leaves, trunk, roots, and total plant increased with higher application rates ( $R^2 = 0.52$ – $0.97$ ,  $p < 0.05$ ). However, total Biomass and nitrogen accumulation did not differ significantly among treatments ( $p > 0.05$ ). Root dry mass decreased linearly ( $p = 0.004$ ), and nitrogen utilization efficiency declined in leaves and roots ( $R^2 = 0.60$ – $0.63$ ,  $p < 0.001$ ). These results demonstrate that while nitrogen fertilization increases tissue nitrogen concentration, excessive application intensifies acidification and inhibits root development.

## Taylor Creek Reservoir / St. Johns River Water Supply Project Water Yield Analysis

*Tara Bongiovanni, and Tom Jobes*

St Johns River Water Management District, Palatka, FL, USA

The Taylor Creek Reservoir (TCR) / St. Johns River (SJR) Water Supply Project aims to enhance the reservoir's water supply potential to meet increasing demands while addressing environmental concerns. The project has two phases: Phase I, the TCR Improvements Project, involves raising the containment dam and increasing the flood control regulation level by 3 feet (ft) to 44.7 ft above the North American Vertical Datum of 1988 (NAVD88). Phase II includes constructing infrastructure to divert water from Lake Poinsett to TCR and deliver water to central Florida.

A long-term hydrologic and hydrodynamic model was developed to evaluate water supply yields for Phase I and Phase II of the project. Between phases I and II, fifteen scenarios were modeled that differed in releases from TCR, diversions from Poinsett, and inclusion of the rediversion projects. Water yield was determined by gradually increasing withdrawals in each scenario until the resulting flows and stages failed to meet the Minimum Flows and Levels (MFLs) criteria at the four assessment locations: Taylor Creek at Nova Road and the St. Johns River near Christmas, Sanford, and DeLand.

Surface water availability in the Middle SJR was also evaluated. Withdrawals of up to 100 mgd, consistent with the 2012 Water Supply Impact Study, were modeled at various sites along the Middle SJR, including Lake Monroe and Yankee Lake. Results indicate that a positive MFLs freeboard exists at the SJR near Sanford and near DeLand, confirming additional water supply potential from the Middle SJR.

**BIO:** Tara Bongiovanni is an Engineering Scientist with the St. Johns River Water Management District. She has extensive experience in water resources, including remote sensing of soil moisture, spring monitoring, and hydrologic modeling. Her current modeling work supports sustainable water management by balancing ecological needs and future regional water supply demands.

# TEK in Tech: Evaluating Baseline Flood Models for Fusion with Traditional Ecological Knowledge (TEK)

*Rio Bonham*<sup>1</sup>, *Rafael Muñoz-Carpena*<sup>1</sup>, *Henry Medeiros*<sup>1</sup>, *Nasser Najibi*<sup>1</sup>, and *Stephen Perz*<sup>2</sup>

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Flooding regularly endangers lives and imposes economic hardships and displacement on affected communities. Climatological and hydrological modelers seek to build useful computer models that assist in understanding flood processes and making estimations about future flooding, with the ultimate goal of informing community mitigation and response practices. Low density, sparse population (i.e. rural, tribal, etc.) lands tend to be disproportionately affected by localized flash flooding. These areas also tend to have a scarcity of local structured data on hydrological, weather and landscape conditions that are needed to build effective models. However, Indigenous communities in these areas hold insightful traditional ecological knowledge (TEK) that is often overlooked. This TEK, encompassing established cultural understanding of the landscape based on deep historical knowledge and records of rare events, can provide crucial information for flood models. Location-specific TEK reaches back thousands of years for communities not fully displaced from their homelands, as is the case with our partners, the Blackfeet Nation, *Amskapi Pikuni*, in northern Montana.

This research aims to develop an artificial intelligence (AI)-based hybrid, multimodal framework that integrates TEK unstructured data (e.g. oral histories, text documents) and structured environmental data (e.g. satellite data, streamflow) to enhance the prediction of floods. One key facet of this overarching work is to choose the best baseline for TEK-enhanced model construction and performance evaluation. This poster will present what models are available for our application, key considerations for their implementation, and performance comparison for locations on the Blackfeet Nation. This is a companion to the oral presentation submitted by Dr. Rafael Muñoz-Carpena about the larger project, aiming to provide additional detail and facilitate increased one-on-one discussion about the work.

**BIO:** Rio Bonham is a PhD student in the Department of Agricultural and Biological Engineering at the University of Florida. His research lies at the intersection of hydrological modeling, advanced Artificial Intelligence techniques, and Traditional Ecological Knowledge of Indigenous communities.

# Optimizing Urban Drainage System with Green Infrastructure for Coastal Cities Resilience

**Artur Borgo<sup>1,2</sup>, Aurélio Azevedo Barreto Neto<sup>1</sup> and Mariangela Dutra de Oliveira<sup>1</sup>**

<sup>1</sup>Federal Institute of Espírito Santo (IFES), Vitória, ES, Brazil

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Globally, many low-lying coastal cities face growing challenges related to urban flooding, intensified by imperviousness and climate change. In Vila Velha/ES, the main mitigation measure is an extensive, costly system of Stormwater Pumping Stations (SPS). Reliance on this gray infrastructure, with uncertain operational longevity and high maintenance and energy costs, highlights the need for sustainable strategies. This study proposes evaluating Green Infrastructure, via a Low Impact Development (LID) approach, as a tool for optimizing the drainage system and enhancing municipal water resilience.

The research develops a Water Infrastructure Optimization Model integrating SPS operation and LID practices. The study area comprises a representative sub-basin within the Canal da Costa Watershed. It was selected for its vulnerability to flooding due to populous neighborhoods and high imperviousness, establishing it as an ideal scenario for validating green infrastructure feasibility. Through hydrological and hydraulic simulations in the SWMM software, different scenarios for the large-scale adoption of Rainwater Harvesting Tanks will be evaluated. The simulation network focuses on macro-drainage and adopts boundary conditions aligned with the original SPS design premises. The model aims to quantify the reduction in runoff volume and the consequent alleviation of the SPS operational load, providing technical subsidies for planning and public policy formulation.

The research proposition is to integrate gray and green infrastructure with a rigorous methodological design, aiming to obtain results that demonstrate the economic and environmental value of LID in mitigating urban floods and reducing the energy and operational costs of the SPS. The study seeks to establish quantitative metrics supporting municipal policies that incentivize the installation of LIDs, simultaneously promoting flood risk reduction and the use of rainwater for reuse. This work directly contributes to the Sustainable Development Goals (SDGs 6 and 11), proposing a replicable model for other coastal cities with high dependence on pumping infrastructure.

**BIO:** Artur Borgo is an Environmental Engineer at the Municipality of Vila Velha, specializing in sustainable projects and climate change. He is currently a master's student in Sustainable Technologies at the Federal Institute of Espírito Santo. His research focuses on integrating LID techniques and hydrological modeling to improve urban water management.

# ASSESSMENT OF HYDROLOGY AND WATER QUALITY FOR THE PEACE RIVER WATERSHED

*Adelbert (Del) B. Bottcher and Andrew I. James*

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An application of the Watershed Assessment Model (WAM) to the Peace River Watershed (PRW) in south Florida and highlights was completed to show the importance of understanding the hydrological, chemical, and Biological processes within the watershed to guide remediation efforts aimed at reducing nutrient loadings, nitrogen (N) and phosphorus (P) in particular. The primary objective of this model was to develop a calibrated model application to assess the current environmental state of the watershed and serve as a baseline for evaluating potential remediation scenarios, including agricultural and urban fertility and stormwater retention best management practices (BMPs), conversion of onsite septic systems to wastewater treatments systems, and regional wetland treatment systems. The model simulated hydrologic and water quality conditions within the PRW and developed estimates of water and nutrient loading to the Charlotte Harbor Estuary for each of the remediation scenarios compared to the current condition simulation. The results were present in terms of nutrient mass load reductions as well as the cost effectiveness of each scenario in terms of dollars per pound of N and P being reduced. This study was a collaborative effort between Soil and Water Engineering Technology (SWET) and Florida Gulf Coast University (FGCU) and is intended to act as a starting point in development of a comprehensive set of models to simulate water and nutrient inflows to Charlotte Harbor from all the surrounding watersheds.

**BIO:** Dr. Bottcher is president with over 40 years of modeling experience including developing the Watershed Assessment Model (WAM). He has modeled over 1/3 of Florida for BMAP, TMDL, and other ecological assessments for USEPA, USACE, FDEP, FDACS, and water managements districts. His multiple research projects has focused improving agricultural and urban BMPs.

## **Tips and Techniques for Communicating with Nonscientists**

***Angela Bradbery***

Karel Chair in Public Interest Communications, University of Florida, Gainesville, FL, USA

It's an easy trap to fall into: If we just present the facts, our audiences will see things our way, change their stances or behavior, or support the policies we deem beneficial. If only it was that easy. Scientists are in the business of presenting data, yet turning those facts into persuasive, resonant messages can be a challenge. In this presentation, we'll explain why facts alone won't change attitudes or behaviors, then show you what you can do about it, using tools based in research in such fields as cognitive linguistics, psychology and behavioral science. You'll learn how to use numbers in a way that will grab people's attention and make them care about an issue, how to identify and message around the worldviews of those you want to reach, how to craft messages around shared values and more. You'll leave with concrete ways to supercharge your work, whether you communicate with local water managers, lawmakers, government administrators or community leaders.

## Developing an IRL Oyster Reef Quick Assessment Guide Through Inter-institution Coordination

*Anna E. Braswell*<sup>1,2</sup>, *Emily Surmont*<sup>1,3</sup>, *Lorae Simpson*<sup>4</sup>, *Nick Curto*<sup>5</sup>, and *Krista McCoy*<sup>5</sup>

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Across coastal regions, resource managers increasingly rely on habitat restoration to address the widespread degradation and loss of oyster reef ecosystems. While the short-term development of artificial oyster reefs has been well monitored and documented, the long-term persistence and ecological functioning of these restored habitats remain less understood. To address this gap, our collaborative team of university, State of Florida, and NGO scientists is evaluating ecosystem service development in aging artificial oyster reefs within the Indian River Lagoon (IRL) region of Florida. We examined artificial reefs ranging from 6 to 14 years old and compared them with nearby natural reefs to assess differences in reef health and persistence, shoreline protection and sediment accumulation, and mobile invertebrate habitat quality. As part of this effort, we piloted a suite of rapid, low-cost monitoring techniques designed for coastal managers to implement efficiently.

Our results suggest that spatial variability across the IRL and St. Lucie Estuary has a greater influence on reef health than restoration age alone. Taken together, artificial reefs are doing just as well as natural reefs, yet we found that there are outliers where artificial reefs are degrading. We also found that simple, standardized metrics, such as oyster spat recruitment and live oyster density, serve as reliable indicators of reef health and long-term persistence. Building on these findings, we are developing a Quick Assessment Monitoring Guide tailored for the Indian River Lagoon. This tool will help managers apply consistent, efficient monitoring methods across aging restoration sites. As adoption of the guide expands, the resulting shared datasets will enable cross-site comparisons and a more comprehensive understanding of restored reef performance throughout the region. Ultimately, this work supports the management and the sustained recovery of oyster reef ecosystems along Florida's coasts.

**BIO:** Dr. Braswell is an Assistant Professor in SFFGS and a state extension specialist with Florida Sea Grant. She is a coastal ecologist interested in aquatic connections between upland watersheds and coastal ecosystems. Her research seeks to understand impacts of anthropogenic pressure on coastal ecosystems including salt marshes and oyster reefs.

# The Social Science of Stewardship: Evaluating The Surface to Springs RCPP

*Megan Brinton, Sarah Cramer, Liam Lieder, Casey Ramey, Jason Evans, and Robert Askew*  
Stetson University, DeLand, FL, USA

In 2024-2025, researchers at Stetson University conducted an evaluation of the Surface to Springs Regional Conservation Partnership Program (S2S RCPP), a program funded through the National Resources Conservation Service (NRCS) and coordinated by Alachua Conservation Trust (ACT). The S2S RCPP is designed to work collaboratively with rural landowners in conserving rural/agricultural landscapes, while also protecting surface and groundwater, soil health, and rare habitats for wildlife. Qualitative interviews revealed that cost-share programs such as this one hold value for program participants (n=11), who often have strong connections to their land and feel compelled towards its conservation. However, while committed to conservation, many participants expressed significant challenges that hinder their ability to fully implement conservation best management practices. Across interviews, participants emphasized the crucial role of technical and logistical support from conservation agencies, and for many, these partnerships meant the difference between pursuing a conservation project and abandoning it altogether. Expertise, resources, and encouragement provided by partner organizations created a supportive environment in which landowners felt empowered to adopt new practices and maintain them over the long term. A quantitative survey of both participants (n=5 of 19 total participants) and eligible non-participants (n=83) in the region found that, overall, program participants were somewhat satisfied with program services and strongly believed in the mission of the S2S RCPP. Even though most of the participants had experience with other cost-sharing programs, many indicated that they engaged in new conservation practices for the first time because of the program. Most also indicated that they would continue these practices into the future, even if no financial or technical support were available, signifying a lasting impact of the program in the community. While most non-participants in the agricultural community had not heard of the program before the survey, upon learning of the program, they likewise expressed support for the work of the S2S RCPP, and they also expressed support for future expansion of the program.

**BIO:** Megan Brinton is the Community Resilience Analyst and Communications Coordinator at Stetson University's Institute for Water and Environmental Resilience. For nearly a decade, her professional background has focused on water quality and green infrastructure education, community resilience facilitation, and video storytelling within the East Central Florida region.

## **Data for Decisions: Facilitating Florida's Enhanced Resilience**

*Lacey Lingelbach*<sup>1</sup>, *Heidi Brockhaus*<sup>1</sup>, *Dr. Gary Mitchum*<sup>2</sup>, *Dr. Jayantha T. Obeysekera*<sup>3</sup>, and *Dr. Amanda Barroso*<sup>1</sup>

<sup>1</sup>Florida Flood Hub for Applied Research and Innovation, St. Petersburg, FL, USA

<sup>2</sup>USF College of Marine Science, St. Petersburg, FL, USA

<sup>3</sup>FIU Sea Level Solutions Center, Miami, FL USA

Established by the State in 2021, the Florida Flood Hub bridges the gap between scientists, policymakers, practitioners, and the public to enhance resilience to flooding. The Flood Hub assembles multidisciplinary workgroups of subject matter experts to investigate the future risk of flooding due to changes in sea level, high tides, storm surge, and rainfall. This session provides an overview of the Flood Hub and updates on the work of the Sea Level Change and Rainfall Workgroups, via four 15-minute presentations. After these presentations, there will be an open question and answer session for the audience.

- Overview of the Florida Flood Hub: Mandates and Progress
- Sea Level Change in Florida: Statewide Best Estimates and Future Workgroup Efforts
- Projected Increases in Extreme Rainfall Across Florida: Change Factors for Future Design Storms
- Collaborative Regional Climate Model – An Effort to Improve High-Resolution Rainfall Modeling in Florida

### **BIO:**

Lacey Lingelbach is a Scientific Liaison at the Florida Flood Hub for Applied Research and Innovation, where she works to connect stakeholders in Florida to data on flood risk and future estimates.

Heidi Brockhaus is a Scientific Liaison at the Florida Flood Hub for Applied Research and Innovation, where she works to translate flood risk data into actionable insights for Florida stakeholders.

Dr. Mitchum is a Professor and an Associate Dean in the College of Marine Science at the University of South Florida. He currently serves as the Chair of the Sea Level Change Workgroup.

Dr. Obeysekera is presently Director and Research Professor in the Sea Level Solutions Center, Institute of Environment, at Florida International University. He currently serves as the Chair of the Rainfall Workgroup.

Dr. Amanda Barroso is a Scientific Liaison at the Florida Flood Hub for Applied Research and Innovation, where she works to translate flood research for stakeholders to implement solutions.

# Biogeochemical and Vegetation Responses to Restoration and Grazing in Florida WRE Wetlands

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The USDA Wetland Reserve Easement (WRE) Program provides financial and technical assistance to landowners to restore, protect, and enhance wetlands on agricultural lands. Restoration of WRE wetlands presents an opportunity to recover lost ecosystem functions and reestablish biogeochemical processes in agricultural landscapes. This study investigated how wetland restoration and grazing influence greenhouse gas emissions, soil properties, and plant communities across ten seasonal wetlands in south-central Florida at Buck Island Ranch and Archbold Biological Station. Sites represented combinations of restored and unrestored wetlands under grazed and ungrazed management, allowing us to isolate the effects of restoration and grazing on carbon and nutrient dynamics.

CO<sub>2</sub> and CH<sub>4</sub> fluxes were measured in-situ, while soil samples were analyzed for total carbon (TC), nitrogen (TN), phosphorus (TP), and bulk density. Vegetation was also collected across plots to assess plant community composition, structure, and TC/TN/TP. Restoration significantly reduced CO<sub>2</sub> fluxes and soil TP while increasing bulk density. Methane emissions were highest in grazed wetlands, driven by modified hydrology and vegetation structure. Seasonal inundation emerged as the primary control on greenhouse gas dynamics, with CH<sub>4</sub> emissions peaking during wet periods and CO<sub>2</sub> dominating during dry intervals.

Vegetation structure and composition varied with both restoration and grazing treatments. Restored wetlands supported hydrophytic species such as *Bacopa* and *Hymenachne*, while unrestored sites were dominated by *Juncus* and *Cyperus*. Grazing increased canopy height and favored graminoids like *Andropogon*, shifting community composition toward less palatable but methane-conductive species. Despite compositional variation, vegetation nutrient concentrations (TC, TN, TP) remained stable. Overall, restoration enhanced hydrologic function and promoted the recovery of wetland vegetation, while grazing modified plant communities and greenhouse gas fluxes. Integrating prescribed grazing within restoration management may optimize both ecological and agricultural outcomes by balancing vegetation control, forage production, and carbon cycling.

**BIO:** Taylor Burgess is a graduate researcher at the University of Florida's Whitney Laboratory studying how restoration and management influence wetland biogeochemistry, vegetation, and soil function across agricultural and coastal ecosystems. His work focuses on developing management strategies that sustain wetland ecosystem functions while supporting human use and value.

## **On-Farm Demonstrations for Improved Irrigation and Nutrient Management**

***Jay Capasso***

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Agricultural production faces challenges in managing water and nutrients efficiently, especially in sandy soils where water drains rapidly and nutrients, particularly nitrogen, leach beyond the crop root zone. This reduces fertilizer use efficiency and increases the risk of contaminating nearby water resources. In North Florida's Suwannee Valley, agricultural Extension programs work to improve water quality while sustaining farm productivity. However, widespread adoption of improved practices requires practical, hands-on training that shows farmers the benefits directly in the field. To address this need, a \$13,700 grant from the Florida Department of Agriculture and Consumer Services supports a project to strengthen Extension agent capacity for conducting irrigation and nutrient best management practice (BMP) demonstrations. The project provides standardized demonstration kits and technical training, allowing agents to lead field-based demonstrations where farmers can observe water and nutrient management practices under real world conditions and learn by doing. This hands on approach builds farmer confidence and encourages adoption of sustainable irrigation and nutrient management practices. The project features several educational irrigation demonstrations including blue-dye infiltration tests showing how deep irrigation water moves in sandy soils; electrical conductivity (EC) flush tests verifying fertilizer delivery and timing in drip systems; portable PVC dye displays visualizing root zone water uptake; and irrigation uniformity tests identifying uneven water distribution to guide irrigation system improvements. These demonstrations are being implemented across multiple counties in North Florida by county Extension agents with support from regional and state specialists. Since August 2025, demonstrations have taken place through farmer field days and on-farm visits, with blue-dye activities already reaching 76 participants. Farmers have responded positively to the visual and practical nature of these demonstrations, which clearly communicate irrigation efficiency, fertigation accuracy, and strategies to reduce nutrient leaching. A final report will summarize farmer feedback and document measurable impacts, including improved irrigation uniformity, water savings, and reduced nitrogen losses.

## Enhancing Nutrient Cycling and Availability Using Sorghum Sudangrass (*Sorghum drummondii*) as a Cover Crop

**Giuliana Caprotti** and **Davie Kadyampakeni**

University of Florida CREC, Lake Alfred, FL, USA

Florida citrus industry has declined due to the effects of Huanglongbing (HLB) or citrus greening, a disease that impairs tree health and severely hinders productivity. The decline of soil health in Florida sandy soils further exacerbates the negative effects of HLB and limits tree productivity. This research evaluated the effects of Sorghum Sudangrass (*Sorghum drummondii*) as a cover crop and four nitrogen (N) rates (0, 50, 100 and 150 kg ha<sup>-1</sup>) on soil health, N cycling, and sorghum biomass accumulation. An experiment was conducted under greenhouse conditions, to analyze the response of Sorghum Sudangrass to four N application rates in two sandy soil types: Candler sand (an Entisol) and Immokalee sand (a Spodosol). Parameters monitored include soil pH, cation exchange capacity, organic carbon, inorganic N fractions, plant physiological and growth measurements, including height, internode length, plant diameter, and chlorophyll content, and biomass accumulation. Two-way analysis of variance (ANOVA) and regression showed strong soil and N effects with several soil and N interactions. Leaf and stem N concentrations increased with N and total N accumulation showed greater results in the Entisol at 100 kg N ha<sup>-1</sup> rate and in the Spodosol at 150 kg N ha<sup>-1</sup>. Tissue and total N accumulation increased with N in both soils, with predominantly linear responses for the Spodosol and quadratic model for the Entisol. Nutrient use efficiency was consistently higher for the Spodosol and declined with increasing N for the Entisol. Results provided by the study will contribute to long-term sustainability of Florida citrus industry, thereby promoting best management practices.

**BIO:** Giuliana Caprotti is a current Master of Science graduate student in the Soil Water and Ecosystem Sciences Department, researching cover crops and soil amendments to improve citrus performance and enhance soil health. She obtained her BS in Environmental Engineering from Zamorano University in Honduras in 2023.

## Are Watering Restrictions Effective in Decreasing Irrigation Water Use?

**Bernard Cardenas**, *Michael D. Dukes*

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Watering restrictions are mandates implemented by counties and municipalities as part of various water conservation programs. The goal of these programs is that the more restrictive the schedule, the less water will be used for irrigation purposes. The objective of this study was to determine whether homes subject to different watering restrictions apply different amounts of irrigation water. Pasco County had a one-day-per-week watering restriction (1DW), while Hillsborough County was limited to two days per week (2DW). Monthly water billing data archived in H2OSAV were used to compare outdoor water use by single-family homes in both counties.

A total of 2,054 homes were analyzed under the 1DW restriction and 823 homes under the 2DW restriction. The average built year was 2008 for 1DW homes and 2009 for 2DW homes, with built-year ranges of 2006–2013 and 2005–2014, respectively. Outdoor water use between 2015 and 2018 was analyzed.

The average total water use for 1DW homes was significantly lower than for 2DW homes (7.5 kgal/mo vs. 11.0 kgal/mo, respectively), suggesting that the watering restriction was effective in reducing outdoor water use. However, the irrigated area of 1DW homes was significantly smaller (4,350 ft<sup>2</sup> vs. 6,510 ft<sup>2</sup> for 2DW homes), influencing the total outdoor water use.

When normalized by irrigated area, both groups applied nearly the same amount of water—1.93 gal/ft<sup>2</sup>/mo for 1DW and 1.98 gal/ft<sup>2</sup>/mo for 2DW. These values correspond to irrigation depths of 0.71 in/wk and 0.73 in/wk, respectively, which are within the range of recommended average irrigation applications for the region. These findings indicate that the watering restrictions in the analyzed counties over the four-year period did not reduce the total amount of water applied per week but rather altered its distribution, with the same volume applied over one irrigation cycle instead of two.

**BIO:** Mr. Cardenas is a research associate at UF with over 20 years of experience in irrigation efficiency and water conservation. His research has helped establish standards for the Irrigation Association and the EPA WaterSense program. He has participated in different multidisciplinary and multi-state projects, and published consistently in peer-reviewed journals.

# OPTIMIZING ENERGY USE IN WASTEWATER TREATMENT PLANTS:COMPRESSORS VERSUS BLOWERS

*Samarth Kathare, Srinivas Shashank Mantha, and **Cristian Cardenas-Lailhacar***

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Wastewater treatment plants (WWTPs) are essential for supporting our quality of life by contributing, through their processes, to reducing waterborne diseases, and a clean environment, playing a fundamental role in our society. WWTPs processes are a solid and well-established technology, where aeration is not only very relevant, but the one that consumes the larger amount of the electric energy in the plant. In some of these plants biogas and nutrients are also generated. In our work we propose a radical change to reduce this energy consumption by about a half.

This work attempts to establish an efficient method of aeration and/or digestion processes for wastewater treatment plants. After analyzing the energy usage for 20 WWTPs, it was found that blowers, widely used in aeration, account for almost 35% of their electric energy consumption in these types of facilities. Accordingly, and to reduce energy consumption in the plants we discuss, and propose, the use of screw compressors as an alternative to the typically used blowers. As per our analysis, and after considering both advantages and disadvantages between these two types of equipment, we found that a compressor of a smaller capacity could compensate for a blower of a larger capacity. Due to the disparity in the power ratings, compressors consume significantly less power compared to the blowers. Also, air compressors are not required to run continuously. This ensures a significant amount of savings, in energy and costs, to a WWTP. Through our calculations, we report over a 50% decrease in the blower's energy consumption, with a practically immediate payback.

**BIO:** Dr. Cardenas-Lailhacar is a faculty in the Department of Mechanical and Aerospace Engineering at the University of Florida. He has over 24 years of experience in energy management. Has led over 400 energy audits to industries in the US, including NASA, and Latin America. He is an international energy consultant.

## The Effects of Midnight Pass Re-opening on Flushing in Little Sarasota Bay

*J. Barrett Carter, Steve Peene*

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Little Sarasota Bay is an approximately 2,000-acre estuarine water body in Southwest Florida with a highly urbanized watershed. Historically, Little Sarasota Bay contained an inlet known as Midnight Pass which connected it to the Gulf of Mexico and facilitated tidal circulation in the Bay. Midnight Pass was purposely closed in 1983, which had a variety of impacts on the Bay, but the Pass was re-opened by Hurricane Helene and further expanded by Hurricane Milton in 2024. A hydrodynamic modeling study was conducted as part of the Little Sarasota Bay Watershed Management Plan to better understand the effects of the re-opened inlet on hydrodynamics, exchange, and residence time in the Bay.

For this study, the existing model for the Bay, which was first developed in 2007, was updated by refining the model grid to better represent the Bay and the Pass and by updating the model bathymetry and forcing data to represent recent conditions (2018 – 2022). Two versions of the model were produced: one with Midnight Pass open and one with it closed. The closed-inlet model was calibrated and evaluated based on water level, temperature, and salinity. Additionally, the open-inlet model was calibrated to recently collected discharge data measured at the Pass and two inland channels that feed the Pass. Water age and conservative tracer simulations were performed to compare flushing between the open and closed-inlet conditions. Results showed significant increases in the overall exchange and flushing within Little Sarasota Bay and the adjacent Roberts Bay and Blackburn Bay due to the re-opening of the Pass. The updated model will provide a baseline for a new water quality model and will serve as a tool for future planning efforts by Sarasota County.

**BIO:** Dr. Carter is a senior staff professional at Geosyntec Consultants with a Ph.D. in agricultural and Biological engineering from the University of Florida and approximately three years of experience working with water resources in Florida. His experience includes water quality sensing, hydrodynamic and groundwater modeling, and data analysis related to water management.

# Impacts of Chlorothalonil on Ion Concentrations in Surface Waters in the South Florida Region

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The state of Florida is recognized to have a prominent agricultural presence, especially the south Florida region due to the environment allowing for longer growing seasons. South Florida agriculture yields a variety of horticultural products. To meet increasing demands for high quality agricultural crops, farmers rely on heavy pesticide applications to farmlands. Pesticides are substances used to rid crops of unwanted pests and plant growth. Chlorothalonil, a fungicide, is a type of pesticide that is used extensively worldwide in agricultural settings. Like other pesticides, chlorothalonil follows natural flow pathways that empty into larger reservoirs after application. Chlorothalonil then enters the surrounding natural environment, which in turn has negative impacts on water quality. Water chemistry, a parameter of water quality, has been limitedly studied in relation with chlorothalonil contamination in field conditions. To better understand the impacts chlorothalonil pesticide has on surface water chemistry, this study investigates if ion concentrations in surface waters can be used as an indicator for chlorothalonil's impacts on surface water chemistry. To determine a correlation between chlorothalonil and major ion concentrations in south Florida, surface water samples were collected within the study site, Immokalee, an agriculturally relevant community in south Florida. Liquid chromatography Mass Spectrometry (LC-MS) analysis determined chlorothalonil concentrations in selected surface water samples from the study site. Ion chromatography analysis determined major ion concentrations ( $\text{Cl}^-$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{NH}_4^+$ ,  $\text{PO}_4^{3-}$ ) in the same surface water samples collected from the study site. Data analysis was utilized to examine existing major ion and chlorothalonil concentration data in surface waters within the South Florida Water Management District's (SFWMD) DBHYDRO database. The results from this study illustrate correlations between chlorothalonil and major ion concentrations in surface water bodies across the south Florida region, showcasing ion concentrations can be used as an indicator for chlorothalonil's impacts on surface water chemistry.

**BIO:** Marie Cecil is a second-year master's student at Florida State University pursuing a degree in Geology. Her research incorporates hydrology, hydrogeology, and water chemistry to better understand how agricultural practices impact surface water chemistry in south Florida.

## Drivers of Sustained Algal Blooms in the Indian River Lagoon, FL

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Multiple intense algal blooms have occurred in the Indian River Lagoon since 2011, resulting in a decrease in light penetration, consequent loss of vegetated benthic habitats, and ensuing effects on fauna. Sustainable management of the lagoon will benefit from an understanding of which nutrient parameters elicit a stronger driving effect on blooms as characterized by increased concentrations of chlorophyll-a. Data on water quality collected across six sublagoons between 1996 and 2024 were used to develop generalized additive models describing the relationships between concentrations of chlorophyll-a and concentrations of dissolved nutrients before and after the 2011 bloom. Changes in concentrations of chlorophyll-a for both blocks of time were related to changes in concentrations of nitrogen in some but not all sublagoons, whereas changes in concentrations of chlorophyll-a were more consistently related to changes in concentrations of phosphorus. Thus, an increase in available phosphorus appeared to be the factor driving the occurrence of major algal blooms. Additionally, the average nitrogen to phosphorus ratio across the sublagoons declined from 23% to 16% following the 2011 bloom. This decline in N:P ratio seems to be in step with current generalized trends in the Indian River Lagoon for phosphorus concentration that shows an increase while nitrogen concentration trends show little change. Understanding the role of phosphorus provides guidance for strategies to abate loads of nutrients and the algal blooms they fuel. With continued monitoring, models based on additional data may yield more insights into the system's response to moderating loads of nutrients.

**BIO:** Stacy Cecil is an environmental scientist with the St. Johns River Water Management District, analyzing the water quality data in the Indian River Lagoon. Throughout her career, she has worked in water quality and restoration coordination, and she has experience in coastal habitat assessment, fisheries observation, and aquaculture. She holds a B.S. in Marine Science from Coastal Carolina University and a M.S. in Environmental Biology from the University of West Florida.

## Exploring Variability in Irrigation Return Flow to Groundwater

*Cristel Cedeno*<sup>1</sup>, *Rob de Rooi*<sup>2</sup>, *Dogil Lee*<sup>4</sup>, *Wendy Graham*<sup>3</sup> and *David Kaplan*<sup>1</sup>

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<sup>4</sup>The Ohio State University, Columbus, OH, USA

Agricultural irrigation accounts for the largest share of freshwater withdrawals, with an increasing reliance on groundwater sources. Understanding Irrigation return flow (IRF), the portion of irrigated water that is not consumed by evapotranspiration and returns to a water body, is important to effectively manage impacts of agricultural irrigation on these water bodies. In recent years, the study of quantity and quality of IRF to groundwater has increased, from field-scale measurements to watershed-scale modeling, underscoring the importance of accounting for IRF as a separate water balance component. Studies indicate that a substantial portion of irrigation becomes groundwater recharge and a significant source of pollution, with soil properties, irrigation methods, crop types, climatic condition and management practices identified as primary drivers that affect IRF estimates. Furthermore, quantification of IRF is important for water management, especially for groundwater protection, water allocation and regulatory frameworks.

In this study, we explored how IRF varies across different combinations of crop rotation, management system, aquifer confinement, soil types and watershed characteristics. To do so, a previously developed SWAT-MODFLOW model of Santa Fe River Basin in North Florida was used to simulate annual IRF and IRF ratios (IRF/irrigation). For each combination, two instances of the model were run, one with agricultural irrigation and one without, and the difference in percolation between the two was taken as an initial estimate of IRF. Overall, at the annual scale, spatial variability in return flow is driven mainly by irrigation volume and aquifer confinement, while soil type and crop rotation have smaller effects.

**BIO:** Cristel is a second-year graduate student in the Department of Environmental Engineering Sciences at the University of Florida. Her research interests include assessing agricultural water use impacts on groundwater quantity and quality through field and watershed-scale modeling.

## Key Ecological Indicators Reveal Changes in Seagrass Meadows in an Anthropogenic Influenced Estuary

**Amanda R. Chappel**<sup>1</sup>, Megan E. Sanford<sup>1</sup>, Andrew H. Altieri<sup>1</sup>, Edward J. Philips<sup>2</sup>, Elise S. Morrison<sup>1</sup>

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Cultural eutrophication is one of the largest threats to coastal ecosystems globally, with excess nitrogen (N) and phosphorus (P) being the primary drivers of ecosystem disequilibrium. These nutrients have shifted the coastal ocean to become net autotrophic, resulting in increased primary productivity and leading to eutrophication events that threaten essential habitats such as seagrass meadows. Chronic eutrophication is further exacerbated by changes in other stressors, such as increased temperature and salinity, driven by climate change. To understand the short and long-term responses of seagrasses to a wastewater discharge event from an industrial phosphogypsum facility, we measured a suite of seagrass metrics, tissue nutrients, stable isotopes of carbon (C) and N, and water quality parameters from stations in Tampa Bay. Main, back, and outer bay stations were studied for two years following the event. Data were evaluated using the classification system of Congdon et al. (2023) to rank seagrass changes as either “Acceptable,” “Concerning,” or “Alarming.” Seagrass abundance increased by 1–9% (“Acceptable”) at the outer bay stations while the main and back bay stations exhibited a 11–24% decline (“Alarming”) over the sampling period. Declines in seagrass leaf area (24–54%) and leaf length (20–58%) were observed at all stations over the sampling period, ranking these changes as either “Concerning” or “Alarming”. The Species Dominance Index indicated that some stations had no change or a slight increase in species diversity, while other stations showed a decline in species diversity that ranked as “Alarming”. The seagrass stoichiometry revealed P limitations at the main and back bay stations, while N limitations at the outer bay stations determined by the Nutrient Limitation Index. Nitrogen isotopes revealed nutrient sources, while C isotopes were used to assess irradiance and temperature changes spatially and temporally. A suite of ecological indicators were used in this study to assess changes in ecosystem structure and environmental factors driving changes in seagrass condition. These indicators can be useful and affordable tools to develop a comprehensive assessment of seagrass status and help resource managers develop strategic plans to improve ecosystem resilience.

**BIO:** Amanda Chappel is a PhD Candidate in the Engineering School of Sustainable Infrastructure and Environment at UF with a focus on Coastal Ecosystem Dynamics. Chappel has 10 years of experience in coastal biogeochemistry, with her research efforts centered around improving estuarine eutrophication.

# Seasonal Biogeochemical Dynamics in a Managed Mosquito Impoundment in the Indian River Lagoon

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Wetlands throughout the Indian River Lagoon have been extensively modified for mosquito control. Managed mosquito impoundments are diked wetlands equipped with pumping systems that add lagoon water into the wetland and use outflow structures to control water depth. During the summer, this infrastructure maintains elevated water levels to submerge exposed sediments where mosquitoes typically lay their eggs. This seasonal management protocol, known as Rotational Impoundment Management, may influence the system's biogeochemistry; for example, winter water drawdowns can expose organic matter and promote nutrient efflux. To investigate these potential impacts, long-term monitoring was conducted in an actively managed mosquito impoundment to identify seasonal nutrient concentrations, physicochemical parameters, and soil characteristics. Results show increased inorganic nitrogen and dissolved oxygen both inside and outside of the impoundment in the cooler season compared to the summer, suggesting physicochemical conditions—often closely linked to hydrological changes—play a central role in driving nutrient dynamics.

**BIO:** Taryn Chaya is currently pursuing her PhD in Interdisciplinary Ecology from the University of Florida's School of Natural Resources and Environment, with a focus on estuarine and coastal wetland biogeochemistry. Taryn previously earned her master's degree in Soil and Water Sciences from the University of Florida.

# Identifying the State Dependent Drivers of Florida Red Tide (*Karenia brevis*) Dynamics

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Harmful algal bloom (HAB) initiation, proliferation, and termination occur across highly variable spatial and temporal scales, complicating efforts to link bloom dynamics to environmental drivers. This study presents a novel approach to identifying state-dependent drivers of *Karenia brevis* (red tide) blooms, which occur nearly annually along Florida's southwest coast. Bloom coverage and environmental drivers—including contemporaneous and antecedent conditions—were clustered simultaneously using a self-organizing map (SOM) to define distinct environmental regimes. By reducing the dimensionality of this multivariate, time-lagged dataset, we delineated seven red tide states: no bloom, bloom initiation, expanding medium bloom, expanding widespread bloom, contracting widespread bloom, contracting medium bloom, and bloom termination, each representing a unique combination of co-occurring environmental conditions. Our results reinforce previous studies linking *K. brevis* to temperature and watershed loading, while revealing that the influence of managed freshwater discharges is state dependent and shaped by broader environmental context. During severe bloom years, a consistent bloom initiation state emerged, characterized by strong positive correlations between bloom expansion and multiple drivers—most notably Caloosahatchee River discharge (median  $r = 0.73$ ), as well as elevated temperatures, Loop Current position, and Peace River inputs. Likewise, atmospheric conditions, Loop Current position, and diminished hydrologic loads generally coincided with bloom contraction and termination states. Overall, these findings reveal the dependence of management actions to inhibit bloom initiation or hasten bloom contraction on environmental conditions and highlight the value of this novel methodology for identifying, interpreting, and potentially forecasting HABs and other ecological dynamics by leveraging temporally clustered environmental states.

**BIO:** Dr. Chin is a post-doctoral researcher with the Water Institute at the University of Florida.

# Water Quality Modeling of the St. Johns River Estuary during Sea-Level Rise and Disaster Scenarios

*Piash Chowdhury, Florentino De la Cruz, Chu-En Hsu*

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The St. Johns River Estuary (SJRE) is a critical ecological and economic resource in northeast Florida, yet it faces increasing stress from sea-level rise (SLR), storm-induced flooding, and pollutant discharges. These pressures threaten the estuary's water quality and resilience. This study addresses a key gap in understanding the estuary's residence time, a fundamental indicator of its self-purification capacity. An integrated modeling and field-based framework is developed to evaluate the hydrodynamic and water-quality responses of the SJRE using Delft3D. The model domain extends from Little Marsh Hill to the river mouth and employs a curvilinear grid (3–69 m resolution) constructed from bathymetric data provided by the U.S. Army Corps of Engineers and NOAA's BlueTopo dataset. Hydrodynamic forcing incorporates tidal boundaries from the OSU TPXO global model and riverine inputs from USGS and SJRWMD datasets, with observed water levels used for model calibration.

Delft3D-FLOW simulates water circulation, while Delft3D-WAQ solves the advection–diffusion–reaction equation to model suspended solids and dissolved oxygen dynamics. Delft3D-WAQ is also used to compute residence time, which serves as the primary diagnostic for assessing estuarine flushing and retention capacity. In parallel, Delft3D-PART is applied for Lagrangian particle tracking to simulate transport pathways and dye dispersion, supporting the design of a fluorescein dye tracer experiment by optimizing release locations, timing, and sampling intervals. While the tracer simulations generated by Delft3D-PART primarily serve to validate model performance, the main analyses and outcomes are derived from residence time calculations obtained through Delft3D-WAQ.

Previous studies have suggested that SLR may enhance tidal asymmetry and increase residence time in low-gradient reaches, thereby intensifying pollutant accumulation. The combined modeling and field framework developed in this study is expected to improve the predictive capability for the SJRE's water quality and supports adaptive management strategies under evolving climatic and anthropogenic pressures.

**BIO:** Piash Chowdhury is a Graduate Research Student in Civil Engineering at the University of North Florida. His research focuses on hydrodynamic and water quality modeling of estuarine systems using Delft3D. He specializes in GIS, remote sensing, and numerical modeling for coastal and riverine environmental studies.

# Quantifying Morphological Response of Oyster Reef Breakwaters to Tidal and Wave Forcing

*Jacopo Composta<sup>1</sup>, Daniele Pinton<sup>1</sup>, Alberto Canestrelli<sup>1</sup> and Pietro Lazzarini<sup>2</sup>*

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Coastal areas, home to over 80% of the global population, are increasingly threatened by sea level rise, erosion, and extreme events. Nature-based solutions like oyster reefs offer sustainable protection by adapting to sea level rise, recovering after storms, and providing ecosystem services. While previous research has primarily focused on breakwaters in wave-dominated environments, the role of oyster reefs in estuarine settings, where small waves (0.1 to 0.5 m) and strong tidal currents govern sediment dynamics, remains insufficiently explored.

This study employs a coupled Delft3D FLOW and SWAN model to investigate sedimentation landward of oyster reefs, focusing on short-term morphological changes under varying reef configurations and hydrodynamic conditions. It examines how tidal currents, water levels, tidal flat profiles, and reef geometry affect sediment dynamics. Particular attention is given to reef layout and wave–current interactions, emphasizing their combined influence on sediment transport and estuarine morphodynamics.

Model results indicate that oyster reefs reduce erosion, dissipate wave energy, and promote sediment deposition. The orientation of incoming waves plays a critical role in reef performance. Oblique waves result in greater sediment accumulation, while perpendicular waves provide less effective protection, especially when narrower barriers are used. Therefore, dominant wave direction must be considered when designing reef configurations.

The simulations also show that wider reefs are more effective than narrower ones, as they dissipate more wave energy and enhance sediment retention near the shoreline. Reefs located closer to shore promote larger sediment accumulation, making them more effective for shoreline protection. In addition, wider gaps between reef segments help reduce erosion within the gaps and should be preferred in design.

In conclusion, oyster reefs offer an effective, nature-based approach to shoreline protection. Their success depends on well-informed design choices, especially regarding geometry and hydrodynamic conditions. These findings provide important insights for optimizing coastal protection strategies.

**BIO:** PhD student in Coastal Engineering at the University of Florida with a master's in hydraulic engineering. I study wave dynamics, sediment transport, and nature-based shoreline protection, integrating theory, numerical modeling, and lab data. Focused primarily on oyster-reef breakwater design and shoreline resilience.

# Physics-Informed Neural Networks for Predicting Crop Water Needs

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Accurate data-driven modeling has the potential to optimize water management efficiency in crop production. These modeling approaches open possibilities to identify and localize crop water needs for water management. However, formulating a dynamic model to capture plant-soil-water interactions at multiple depths is highly complex. Challenges include: i) varying plant growth and water uptake with species, phenology, and conditions; ii) nonlinearity of Richards' equation for unsaturated soil flow, requiring complex numerical methods; iii) empirical constitutive models (e.g., Gardner, van Genuchten, Brooks–Corey) demanding labor-intensive calibration without universal applicability; iv) limited temporal and spatial data resolution forcing coarse discretizations, that leads to numerical instability. In light of these challenges, we propose the evaluation of physics-informed neural networks (PINNs), which incorporate the function approximation universality of neural networks, the power of machine learning tools, and the well-established knowledge about soil-water dynamics. In this work, we propose using Richards' equation as a framework to formulate a PINN that describes plant-soil-water dynamics. We discretize Richards' equation into soil layers, developing equations that describe water movement in each layer and how they interact with external factors like precipitation, irrigation, and evapotranspiration. We also incorporate plant water uptake as an outflow that depends on evapotranspiration and soil moisture levels across layers. In the PINN framework, these flow terms are represented by neural network components, constrained by physical laws to ensure realistic behavior. The PINN is trained in two stages: first, by minimizing errors against measured soil moisture variations, and second, by tuning with the inclusion of the numerical solution in the cost function. The proposed framework is validated with field data from an experimental citrus field, demonstrating that soil moisture dynamics are precisely estimated and that crop water uptake can be inferred from soil moisture and environmental data. This capability opens possibilities for innovative water management approaches that enable the timely application of optimal water amounts, ensuring crop needs are met at specific times and locations while enhancing overall water use efficiency in agricultural systems.

**BIO:** Dr. Gregory Conde is a Postdoctoral Associate at the University of Florida's Smart Irrigation and Hydrology Laboratory- Indian River Research and Education Center in Fort Pierce FL. He specializes in advanced control systems, dynamic modeling, and automation to enhance agricultural water efficiency. His research focuses on data-driven models, estimation, and optimal control for irrigation systems, including sensors integration, cloud computing, and AI for sustainable practices.

## **Wekiva River Eel Grass Mapping Using High Definition Stream Survery**

**Brett Connell**, *James Parham, PhD, Dane Shuman*

Trutta Environmental Solutions, LLC, Panama City, FL, USA

The Wekiva Wild and Scenic River System, including the Wekiva River, Rock Springs Run, and Blackwater Creek, faces ecological pressures from watershed changes, raising concerns about submerged aquatic vegetation (SAV) declines similar to those documented in the St. Johns River Basin. To support the Wekiva Wild and Scenic River System Comprehensive Management Committee, Trutta Environmental Solutions, LLC conducted a High Definition Stream Survey (HDSS) to map Eelgrass and evaluate habitat conditions across 34.5 mile).

HDSS is a rapid, single pass approach that integrates GPS, video, depth, side scan sonar, and water quality sensors (pH, temperature, dissolved oxygen, conductivity, turbidity) to generate continuous, meter resolution GIS data. Each second of georeferenced video is tied to a GPS point, providing managers with a robust baseline inventory that can extend upstream and downstream as needed. This comprehensive dataset allows identification, prioritization, and monitoring of multiple water resource issues, including instream habitat distribution, infrastructure impacts, mitigation strategies, restoration outcomes, and public education through virtual tours.

The survey incorporated 35 bathymetric transects and produced georeferenced video and GIS layers. Eelgrass occurred in dense beds across approximately 4 km (8 percent) of the system, with hotspots near the Wekiva Parkway Bridge and Wekiva Island but was absent in areas such as Blackwater Creek despite predicted suitability. An ordinal logistic regression model linked eelgrass occurrence to depth and channel width, highlighting habitat factors that can inform management strategies.

HDSS provides a powerful tool for resource managers by rapidly documenting baseline conditions and enabling data driven decisions. Results from the Wekiva system demonstrate how this approach can detect current SAV status, identify ecological hotspots, and guide future restoration and monitoring efforts in sensitive river systems.

**BIO:** Brett Connell is a co-founder of Trutta Environmental Solutions and key developer of the High Definition Stream Survey (HDSS) methodology. With 20 years of professional experience in water resources and fisheries Biology, he has led 1,800 miles of projects across the Southeast focusing on innovative technologies for stream habitat assessment.

## **Nitrate Concentration Declines in Groundwater of the Santa Fe River Basin, Florida (2014 – 2024)**

*Rick Copeland, Hailey Hall, Gary Maddox, and Thomas Seal*

AquiferWatch Inc, Tallahassee, FL, USA

Since 2007, water quality in several springsheds have been declared impaired for nitrate by the Florida Department of Environmental Protection. Once impaired, basin management action plans by the Department are implemented to restore water quality to a corresponding threshold. For most springsheds the level for nitrate is 0.35 mg/L. Each plan requires monitoring to evaluate restoration progress. Monitoring includes nitrate concentrations and nitrate loading where applicable. Resource costs needed to acquire sufficient monitoring data are expensive. Consequently, the Department solicits assistance from other monitoring entities. Efforts by AquiferWatch, Alachua County Environmental Protection Department, and Florida LAKEWATCH reveal that since 2014, concentrations in groundwater have decreased. AquiferWatch and LAKEWATCH depend on citizen volunteers to collect water samples. Nitrate loading data at springs, spring runs, and streams tend to be project driven, which creates data sets that are difficult to make meaningful time-series correlations with groundwater nitrate concentrations. Improvements in the coordination of the collection of loading data will improve the ability of the Florida Department of Environmental Protection to track restoration efforts. This study demonstrates that coordinated efforts of monitoring entities and volunteers can economically and effectively monitor changes in nitrate concentrations in impaired springsheds.

**BIO:** Dr. Copeland has 50 years of experience monitoring Florida's groundwater water quality. He has administered the Florida Department of Environmental Protection's water quality monitoring program. He is the past supervisor of the Florida Geological Survey's Hydrogeology Program. He is currently the director of AquiferWatch, a volunteer groundwater monitoring organization.

## Enhancing Regional Resilience Through Flood Occurrence Data collection and stakeholder ENGAGEMENT

Ana Carolina Coelho Maran<sup>1</sup>, Christine Carlson<sup>1</sup>, **Nicole Cortez**<sup>1</sup>, Azizbek Nuridinov<sup>2</sup>, Madelyn Rinka<sup>1</sup>, Diana Alvarez<sup>1</sup>, Aaron Duecaster<sup>3</sup>, and Stephanya Salazar<sup>3</sup>

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<sup>2</sup>Florida State University, Tallahassee, FL USA

<sup>3</sup>Working under contract with SFWMD

As part of its goal to safeguard South Florida's water resources, ecosystems, and communities, the South Florida Water Management District (SFWMD) is advancing a set of water and climate resilience metrics to monitor trends, identify emerging patterns, and support risk-informed and data-driven decision-making. These metrics inform regional planning and adaptation strategies.

This presentation focuses on the development and implementation of a flood occurrence metric and the establishment of a robust framework for its continued use, *The South Florida Flood Information Resource*. Initial efforts included compiling historical flood data from internal and external sources in GIS to identify flood-prone areas. GIS-based data collection and storing tools were developed to standardize flood reporting, enable photo documentation, and consolidate legacy and new flood event records. The flood metric supports flood risk characterization, identification of flood-prone areas, flood risk model calibration and validation, evaluation of mitigation and adaptation scenarios, and grant applications and funding requests with data-driven evidence.

Progress also includes staff training and expanded access for local government partners, including counties, municipalities, water control districts, and other agencies. These efforts align with a broader statewide initiative. SFWMD is collaborating with the Florida Silver Jackets, the Florida Department of Emergency Management, the Florida Flood Hub for Applied Research and Innovation, the state's water management districts, and other government agencies to enhance observed flood data collection and storing statewide. The inter-agency *Flood Observations – Regional Coordination and Community Engagement* project is a collaborative effort to improve the consistency and coverage of flood data collection throughout Florida. Partner engagement remains critical to enhancing coordination and enabling more standardized, statewide data collection and storage practices.

This presentation is relevant to water resource managers, planners, emergency management professionals, and policy makers engaged in resilience planning and flood risk management.

**BIO:** Nicole Cortez is the Resiliency Coordinator at the South Florida Water Management District, leading stakeholder engagement and overseeing the monitoring and development of water and climate metrics for water resource planning and adaptation, drawing on her background in environmental evaluation and outreach.

# Addressing Floridan Aquifer Resource Concerns Through Management in Coastal Northwest Florida

**Tony Countryman**

Resource Management Division, Northwest Florida Water Management District, Havana, FL, USA

The Northwest Florida Water Management District is one of five water management districts created by the Water Resources Act of 1972 and is charged with managing the water resources across 16 counties. The District periodically completes Water Supply Assessments to evaluate the sufficiency of water resources within each of seven planning regions to meet demands for a 20-year planning horizon. If water needs are likely to exceed available supplies, the District prepares a Regional Water Supply Plan which identifies alternatives to meet future demands, as required by section 373.709, Florida Statutes.

Region II, including Santa Rosa, Okaloosa, and Walton counties, is the District's largest and fastest growing planning region. A Water Resource Caution Area was established in 1989 due to concerns for saltwater intrusion in the Upper Floridan aquifer. The first Regional Water Supply Plan was approved in 2000, and most recently updated in 2024. Plan implementation has achieved partial recovery of the Upper Floridan aquifer potentiometric surface, from --130 ft. to -65 ft. below mean sea level. This recovery has been achieved through collaborative multi-party projects to shift groundwater withdrawals away from the coast, develop inland wellfields, and utilize the sand-and-gravel aquifer. Expansion of the Upper Floridan aquifer cone of depression and saltwater intrusion remain significant concerns. Groundwater modeling results indicate that the cone of depression will expand and deepen to more than -140 ft. below mean sea level by 2045. A total of 25 production wells will be "at risk" in 2045, with water in the Upper Floridan aquifer below the production zone not meeting drinking water standards for saline parameters.

The District is collaborating with local governments and utilities to address this issue. Planned activities include feasibility studies of surface water sources and managed aquifer recharge. The District is investigating the redistribution of groundwater pumpage from within the Water Resource Caution Area to areas further north. Potential solutions are expensive, with cost estimates for surface water supplies ranging from \$200 million to \$498 million. Minimum aquifer levels may be needed to set quantitative thresholds for groundwater withdrawals and create a framework for funding and project implementation through a prevention or recovery strategy. These efforts pose significant technical and fiscal challenges, as local governments and utilities have historically invested millions of dollars in infrastructure to withdraw groundwater from coastal areas. To shift to new water sources or implement aquifer recharge projects will require consensus building, considerable state and federal funding, and years of collaboration for a successful outcome. This presentation will highlight the results of ongoing and planned efforts to achieve these ambitious goals.

# Temporal Lags between Discharge and Water Chemistry in Florida Springs

*Lindsey Cromwell<sup>1</sup>, and Matthew Cohen<sup>1,2</sup>*

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Florida springs are unique environments that provide diverse ecosystem services and serve as natural outlets for the Floridan Aquifer System. However, these springs are experiencing visible habitat degradation and water quality decline across both spatial and temporal scales. This deterioration has been linked to reductions in flow and changes in dissolved oxygen (DO), a keystone variable in aquatic environments. Yet, the relationships between DO and flow remain poorly constrained, as long residence times and aquifer storage dynamics often decouple synchronous concentration–discharge (C–Q) relationships.

To address this gap, we compiled a comprehensive statewide water quality dataset that integrates grab samples and continuous sensor data from the Florida Water Management Districts, the Florida Department of Environmental Protection, and the U.S. Geological Survey. Using this dataset, we investigated temporal lags between discharge and key water chemistry parameters including DO, temperature, pH, specific conductivity, and NO<sub>x</sub>-N across Florida’s most data-rich springs.

Our findings indicate that these temporal lags are both solute- and site-specific. Reversing springs—those that experience back-flooding from adjacent blackwater streams—exhibit shorter lags between discharge and chemistry, whereas non-reversing springs display longer lags. By quantifying this decoupling between discharge and chemistry, we can better identify potential sources and processes driving DO consumption along the flow path as the springshed integrates the surrounding landscape. These insights can help inform conservation and management strategies aimed at mitigating DO and flow decline in Florida’s spring ecosystems.

**BIO:** Lindsey Cromwell is a PhD Candidate in SFFGS with a research focus on the controls on water quality variation in Florida springs.

# Seasonal Patterns in Solute Concentrations in the North Lake Okeechobee Basin

*Dan Dai<sup>1</sup>, Matthew J. Cohen<sup>2</sup>, James W. Jawitz<sup>1</sup>*

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Understanding the factors influencing temporal variability in stream solute concentrations is crucial for water management. We observed persistent and repeatable seasonal signals in stream solute concentrations in the North Lake Okeechobee Basin (NLOB), Florida. By concatenating the ChemLotUS water quality and StreamCat watershed attribute datasets, we examined stream concentrations for five target solutes representing geogenic (calcium,  $\text{Ca}^{2+}$ ), biogenic (total organic carbon, TOC), and anthropogenic (nitrate,  $\text{NO}_3^-$ , soluble reactive phosphorus, SRP, and total phosphorus, TP) sources. From comparative fitting of a suite of sinusoidal models, we found that seasonal patterns are the dominant driver of solute temporal variability in the NLOB, explaining over 50% of concentration variability. Moreover, this temporal variability of solute concentrations remains relatively stable over decades for all solutes. Seasonal patterns differed by solute, with higher seasonal amplitudes for anthropogenic solutes compared to biogenic and geogenic solutes. Seasonal timing also varies by solute, with  $\text{NO}_3^-$  concentrations peaking from late fall to spring, while TOC, SRP, and TP reach their maxima in summer and fall, and  $\text{Ca}^{2+}$  peaks in spring. We considered the role of land use as a contributor to seasonal patterns, finding that agricultural land use significantly influenced nutrient seasonal amplitude and mean concentration. Notably, however, land use and land cover did not affect the timing of peak concentrations suggesting these attributes of the export pattern are not controlled by short-term variation in applications, but rather seasonally varying transport and removal processes. Variations in  $\text{Ca}^{2+}$ , TOC, SRP, and TP were largely synchronized with flow, whereas  $\text{NO}_3^-$  was better synchronized with temperature, implying a critical role for denitrification. This analysis highlights the interaction between hydrological and biogeochemical processes in understanding seasonal variations in water quality. Our findings underscore the importance of spatial sampling intensity over temporal frequency as seasonal signals are strong and predictable, while spatial heterogeneity requires more comprehensive coverage.

# Soil Water Deficit & Irrigation Impacts on Ohio Maize & Soybean Yields Using Machine Learning

Rajveer Dhillon<sup>a</sup>, **Susanta Das**<sup>b</sup>, Vinayak S. Shedekar<sup>c</sup>, Vivek Sharma<sup>b</sup>

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Enhancing agricultural productivity and water management requires understanding how climate factors affect crop yields and irrigation requirements. This study examined how Ohio's maize and soybean yields were influenced by monthly precipitation, temperature, and soil water deficit (SWD) from 1991 to 2022. A soil water balance approach combined with Random Forest (RF) identified the key climatic and hydrological variables in predicting the impact of supplemental irrigation on county-level maize and soybean yields. The RF model performed best, with RMSE = 0.60 Mt/ha and  $R^2 = 0.77$  for maize, and RMSE = 0.21 Mt/ha and  $R^2 = 0.64$  for soybean. July SWD, September maximum temperature, and August precipitation were primary factors influencing maize yield, while soybean yield mainly depended on rainfall in May and August. Soybeans demonstrated greater resilience to SWD stress. Supplemental irrigation of 50.8 mm per month (~2 inches per month) increased maize yields by approximately 598 kg/ha and decreased year-to-year variability for both crops, whereas 101.6 mm per month offered no significant additional benefits. Yield gains were more noticeable during dry years and cooler September months. Regionally, southwestern Ohio counties experienced the most significant maize yield increases (~22.6% or 1.2 Mt/ha), while soybean gains averaged 9.2% (~0.21 Mt/ha). This study offers a scalable framework for assessing climate-driven yield variability and optimizing regional irrigation strategies.

**BIO:** Dr. Das is a Postdoctoral Research Associate at the University of Florida's Precision Water Management Lab. His research focuses on sensor-based irrigation automation, IoT systems, and remote sensing applications for crop water and nutrient management, combining field experiments with machine learning and hydrological modeling to improve agricultural sustainability and water productivity in diverse cropping systems.

# Influence of Land Use and Land Cover Changes on Water Quality in Everglades STA Watersheds

**Ankita Datta**<sup>1</sup> and *Patrick Inglett*<sup>2</sup>

<sup>1</sup>School of Natural Resources (SNRE) & Soil, Water and Ecosystem Sciences (SWES), University of Florida, Gainesville, FL, USA

<sup>2</sup>Soil, Water and Ecosystem Sciences (SWES), FL, USA

The Everglades Stormwater Treatment Areas (STAs) constructed wetlands developed as part of the Everglades restoration effort to reduce nutrient loads, particularly phosphorus, from agricultural and urban runoff before the water enters the downstream natural ecosystem. These treatment wetlands have been highly effective in improving water quality, yet their performance is not uniform and depends greatly on the characteristics of the contributing watersheds. Land use and land cover (LULC) patterns surrounding these systems influence the type and number of nutrient inputs, hydrologic connectivity, and sediment transport, ultimately shaping the inflow water quality and treatment efficiency.

This study investigates how LULC patterns affect inflow water quality across four major Everglades STAs: STA-1E, STA-2, STA-3/4, and STA-5/6—representing distinct hydrologic basins and land management histories. Using two decades of water-quality data from the South Florida Water Management District (SFWMD), combined with GIS-based analyses of remotely sensed land-cover datasets, spatial and temporal relationships between watershed composition and total phosphorus (TP) concentrations were examined. Preliminary findings indicate that watersheds dominated by agricultural and urban land uses show consistently higher TP levels, reflecting the influence of fertiliser applications, soil erosion, and stormwater runoff. In contrast, areas with greater wetland and vegetated cover tend to exhibit lower nutrient concentrations, highlighting the capacity of natural landscapes to retain and transform phosphorus through Biological and geochemical processes.

By linking landscape changes at the watershed level to water-quality outcomes, this research offers new insights into how human land use interacts with wetland restoration infrastructure. The findings highlight that sustainable water-quality management in South Florida requires not only effective treatment of wetlands but also proactive watershed planning and best management practices (BMPs) that minimize nutrient loading at the source. Understanding these land-water connections is essential for advancing Everglades restoration objectives, maintaining ecosystem health, and protecting the environmental and economic services that these wetlands provide to both wildlife and neighboring communities.

**BIO:** Ankita Datta is a Ph.D. candidate at the University of Florida studying water quality and ecosystem services in the Everglades. Her research integrates wetland biogeochemistry, land-use dynamics, and environmental economics to evaluate how watershed conditions influence nutrient retention and sustainability of Stormwater Treatment Areas (STAs) in South Florida

# Water Schools Build Local Capacity for Water Resources Management in Central Florida

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The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Extension Water School program provides county-specific education for elected officials, department heads, and community leaders who make decisions affecting water resources. Each Water School blends expert presentations, interactive discussions, and field experiences to connect science with policy. Programs are held once every two years in each participating county, ensuring continuity while staying responsive to emerging issues.

Since 2015, UF/IFAS Extension has conducted multiple Water Schools across Central Florida, including five in Marion County and two in Sumter County, most recently in 2025. The 2025 Marion County Water School, Balancing Growth and Water Resources, engaged 42 participants with sessions on hydrogeology, regulations, conservation practices, and field visits highlighting water-efficient landscaping and advanced reclamation technologies. Participants reported 100% satisfaction, with more than 75% affirming the program would positively influence local policy. The 2025 Sumter County Water School, Challenges Facing Urban Communities, convened 26 participants and focused on homeowner behavior, green stormwater infrastructure, and water policy. More than 90% of participants indicated they were likely to use or recommend UF/IFAS resources, emphasizing the program's value in filling knowledge gaps for leaders.

Evaluation results across counties consistently show that Water Schools raise participants' knowledge levels from "low/medium" to "medium/high," foster collaboration across agencies, and increase the likelihood of policy impacts. Participants particularly value the balance of technical expertise, real-world demonstrations, and opportunities for cross-sector dialogue.

UF/IFAS Extension will continue offering Water Schools in Marion and Sumter Counties and expand to additional Central Florida counties. Future programs will address emerging issues such as PFAS contamination, stormwater vulnerability, septic-to-sewer conversions, and climate resilience. By tailoring topics to local needs and directly engaging decision makers, Water Schools provide a proven model for community-based water education that informs decisions, builds capacity, and drives collective action.

## **Agricultural and Urban Pesticides in Florida and Florida Manatees**

**Maite De Maria**<sup>1</sup>, *Michelle L. Hladik*<sup>2</sup>, *Erin L. Pulster*<sup>3</sup>, *Landon Keele*<sup>3</sup>, *Rachael F. Lane*<sup>4</sup>, *Dana W. Kolpin*<sup>5</sup>, *Margaret E. Hunter*<sup>6</sup>

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Florida urban and agricultural activities rely on pesticides to produce food and manage landscapes by controlling vectors, pests, and disease. Pesticides such as herbicides, insecticides, and fungicides enter the aquatic environment through direct application to waterbodies or via transport from the surrounding landscape. Further, per- and polyfluoroalkyl substances (PFAS) have commonly been found in the aquatic environment and in aquatic species including Florida manatees. PFAS have a variety of uses (e.g., food packaging and firefighter foams) and can be found in agricultural materials including biosolid application to farmland, food production wastewater, and as adjuvant formulation to improve pesticide application. Many of these chemicals, or combinations of chemicals, might have toxic effects on wildlife. The objective of this study was to analyze the prevalence of 183 pesticides and 52 PFAS in Florida manatee plasma collected from five Florida locations between 2013–2024. During 2021–2022, a manatee unusual mortality event occurred in south Florida and the Indian River Lagoon due to reduced food availability. In all five locations, bifenthrin, a widely used insecticide, was ubiquitously found in Florida manatee plasma. Manatees sampled during the unusual mortality event contained higher total pesticide plasma concentrations (all lipophilic), suggesting a link to mobilization of the chemicals through metabolism of fat tissue associated with starvation. We also found a statistically significant increase in perfluorooctane sulfonic acid (PFOS) and other PFAS in manatee plasma during the unusual mortality event, compared to the years that followed. Additionally, water and submerged vegetation samples were collected from the Indian River Lagoon in 2022 and 2023, and from waterbodies surrounding Lake Okeechobee in 2023. Vegetation and water samples showed the presence of 13 pesticides including herbicides (e.g., atrazine and diuron) and insecticides (e.g., bifenthrin and imidacloprid). Total pesticide concentration in vegetation ranged from 1–75 ng/g (dry/weight). Pesticides were found to be more prevalent in water samples proximal to Lake Okeechobee compared to other areas of south Florida, with 36 pesticides detected and total pesticides ranging from 53 to 804 ng/L. Atrazine was ubiquitous in Lake Okeechobee water samples. Our work provides insight on PFAS and the number and prevalence of pesticides of potential concern in Florida aquatic species and environments. Additional monitoring in vulnerable areas, such as the Indian River Lagoon and the Everglades, may support ongoing restoration efforts. Manatee plasma analyses helped identify potential sources of contaminant exposure and the resulting body burdens associated with these globally concerning contaminants.

# UNRAVELING IRRIGATION RETURN FLOWS: HOW MUCH OF THE WATER MAKES IT BACK TO THE AQUIFER?

**Rob de Rooij<sup>1</sup>**, *Cristel Cedeno<sup>1</sup>*, *Wendy Graham<sup>1</sup>* and *David Kaplan<sup>1</sup>*

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Water pumped from an aquifer for irrigation is either evaporated, transpired, transported by lateral flow processes like runoff, stored in the subsurface zone above the aquifer or percolates into the aquifer. The amount of water making it back to the aquifer by means of percolation is typically referred to as irrigation return flow (IRF) and is an important quantity to infer the effect of irrigation on groundwater resources.

However, IRF is difficult to quantify as the water from irrigation is mixed with water from precipitation. The classical numerical approach is based on simulating the difference in aquifer recharge between a model with and a model without irrigation. We have applied this approach using a SWAT-MODFLOW model for the Santa Fe River basin, but we now seek alternative modeling approaches to gain more insights into the simulated IRFs. To check the dependence of the IRF on simulated soil water content and soil water fluxes we compare the IRF as simulated by a SWAT model with the IRF as simulated by a more physics-based variable saturated flow model like HYDRUS1D. We also explore a promising novel approach based on particle-tracking to compute the proportion of aquifer recharge originating from irrigation.

Rob de Rooij is a research assistant scientist at the Water Institute and his research focuses on solving quantitative and qualitative hydrogeological problems. He has a particular interest in unraveling the age and source components of groundwater.

# Groundwater–Surface Water Dynamics and Green Stormwater Infrastructure-Based Adaptation

*Mohana Debnath, Nasrin Alamdari*

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Watershed management is one of the most challenging topics nowadays, especially in the coastal urban areas due to the intricate allocation of the groundwater table in these areas. In addition, projected changes in precipitation and sea-level dynamics introduce uncertainty on this issue, intensifying both hydro-climatological and socio-economic vulnerabilities. The research explores the dynamics of groundwater and surface water under varying climatic conditions and provides insights on how green stormwater infrastructure (GSI) management can be used to sort out the issues while focusing on promoting sustainability in urban communities.

The physically based hydrological model MIKE SHE performed hydrologic simulations to determine flood areas and the MODFLOW model captured groundwater level response in a specific coastal urban area. The groundwater and overland flow due to surface flow showed positive correlation under more extreme climatic condition. Pairwise empirical relationships using regression model was created between these two elements. Using Green Stormwater Infrastructure siting tool, locations where GSIs can help analyze socio economic condition by incorporating economic optimization has been prioritized. Intersecting Flood Induced Economic loss calculated by HAZUS-MH with the Socially Vulnerable area, the Compound Vulnerability Index was calculated to show the allocation of areas vulnerable to abrupt groundwater elevation change and flooding, and their affiliation to socio-economic vulnerability.

**BIO:** Mohana Debnath is a Ph.D. candidate in Civil and Environmental Engineering at Florida State University. Her research focuses on coastal watershed management, integrating hydrological modeling and climate projections to mitigate flooding, groundwater rise, and saltwater intrusion while promoting sustainability.

# Spatio-Temporal Downscaling and Forecasting of SMAP Soil Moisture using Hybrid Machine Learning

*Nikhil Raj Deep and Ebrahim Babaeian*

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Soil moisture is a key variable that influences vegetation growth, water balance, and hydrological processes. Accurate monitoring and forecasting of soil moisture are essential for efficient irrigation planning, improved water management, and reducing the impacts of floods and droughts. However, the Soil Moisture Active Passive (SMAP) mission, despite providing reliable global soil moisture observations, is limited by its coarse spatial resolution (9 km) and relatively infrequent revisit time, constraining its application at regional and watershed scales across Florida's heterogeneous landscapes. This study addresses these limitations through a spatio-temporal downscaling and forecasting framework designed to generate high-resolution and short-term predictive soil moisture information. The Enhanced Spatial and Temporal Adaptive Reflectance Fusion Model (ESTARFM) was employed to downscale SMAP data to 30 m resolution by integrating multi-sensor datasets, including Landsat-8, Sentinel-2, Sentinel-1, MERIT-DEM, and SOLUS soil properties, TerraClimate, and OpenLandMap data. Subsequently, a hybrid forecasting model combining Seasonal Autoregressive Integrated Moving Average with Exogenous Variables (SARIMAX) and Random Forest (RF) was implemented to predict soil moisture up to 14 days in advance. This hybrid approach effectively captured both temporal dependencies and nonlinear relationships, outperforming other baseline models such as ConvLSTM, and Random Forest. The downscaling results demonstrated a strong correlation between high-resolution soil moisture and the SMAP product, with additional validation against Florida Automated Weather Network (FAWN) in-situ data showing improved correspondence across diverse soil and vegetation types. Forecasted soil moisture exhibited similar performance, maintaining strong predictive accuracy and temporal consistency. A web-based visualization platform was developed to enable real-time exploration of downscaled and forecasted soil moisture dynamics, offering a powerful decision-support tool for stakeholders in agriculture, water resource management, and environmental monitoring across Florida.

**BIO:** Mr. Deep is a PhD student in the Soil, Water, and Ecosystem Sciences Department at the University of Florida. His research focuses on passive microwave remote sensing for field-scale soil moisture estimation across Florida. He has broad experience in remote sensing, GIS, cloud-based geospatial programming, Python, and R.

## C7 Basin FPLOS Phase II Study ECONOMIC ASSESSMENT

**Michael DelCharco, P.E., CMF<sup>1</sup>, Pat Lawson, GISP<sup>2</sup>, Ashley Lein, EI<sup>3</sup>, and Gerry Evenwel<sup>4</sup>**

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The C-7 Basin in northeast Miami-Dade County is a low-lying, highly urbanized watershed that discharges through the S-27 structure to Biscayne Bay as part of the Central and Southern Florida (C&SF) Project. The South Florida Water Management District's Flood Protection Level of Service (FPLOS) Adaptation Planning and Mitigation Study is evaluating future flood resiliency under projected sea-level rise and rainfall change scenarios. Building on detailed hydrologic and hydraulic modeling, the study quantifies the risk-reduction and economic benefits associated with a Strategically Selected Plan (SSP)—a suite of regional and local projects designed to sustain flood protection, limit damages, and enhance community resilience.

The analysis develops Expected Annual Damages (EAD) and Benefit-Cost ratios to quantify avoided losses to residential, commercial, and transportation assets across four design storms and multiple sea-level conditions. It then expands to capture broader economic and social benefits using outputs from the District's FIAT tool and public datasets. Components include property-damage avoidance, economic-activity impacts expressed as Gross Value Added derived from avoided business downtime, and stabilization of property-tax revenue through spatial linkage of 2024 Miami-Dade County tax-roll data to exposure areas.

A major innovation is the partnership with National Flood Experts (NFE), who are applying FEMA's Risk Rating 2.0 methodology to calculate parcel-level flood-insurance premiums for both "without-project" and "with-project" conditions. This approach allows direct estimation of household insurance savings and aggregate community benefits attributable to flood-mitigation investments.

Together, these analyses translate modeled flood-risk reductions into measurable financial outcomes—demonstrating how engineering interventions can reduce damages, sustain economic productivity, and improve affordability for residents across one of South Florida's most flood-vulnerable basins.

**BIO:** Michael leads Taylor Engineering's Coastal Strategies group and is charged with developing the next advancements in coastal and riverine flood resiliency - moving communities from planning to action. He serves as project manager on ongoing resiliency studies, development of innovative tools for communities, and larger coastal and water resources projects.

## Machine Learning Reveals Environmental Drivers of PFAS Distribution in Soils

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Per- and polyfluoroalkyl substances (PFAS) are globally pervasive and highly persistent contaminants that endanger both human and ecological health. Identifying the environmental drivers of their soil distribution is key to improving risk assessment and protecting interconnected soil–water systems. This study showcases how machine learning (ML) approaches can accurately predict regional-scale PFAS distributions in soils by leveraging environmental and spatial features as proxies for contamination sources and retention mechanisms. Using 77 soil samples from Brevard County, Florida (USA), we build predictive models for nine common PFAS compounds employing Random Forest and Extreme Gradient Boosting algorithms, with SHapley Additive exPlanations (SHAP) used to interpret the underlying mechanisms. Our models identify compound-specific contamination drivers, with soil organic matter consistently governing PFAS retention, while military installations, airports, fire services, and waste management facilities emerge as dominant sources for certain compounds. Random Forest achieved optimal accuracy for PFOA, PFTTrDA, PFTTeDA, and PFOS, while Extreme Gradient Boosting performed best for PFUdA and PFDoA. Model accuracy declined by up to 19 percentage points when high-resolution soil chemistry data were replaced by county-scale estimates, underscoring the critical role of geochemical detail in predictive modeling. By quantitatively linking land-use characteristics and soil geochemistry to PFAS occurrence, this study provides a transferable framework for contaminant source attribution and spatial risk mapping. This framework improves assessment of contaminant exposure pathways and supports more effective management of soil–water systems. The findings emphasize the need for fine-scale environmental data to guide risk assessment and protect downstream water quality and ecosystem integrity.

**BIO:** Dr. Deliz is an environmental scientist with over 15 years of professional and academic research experience specializing in fate and transport, biogeochemistry, and microbial ecology. Her research focuses on understanding pollutant behavior in soil–water systems and advancing sustainable remediation technologies to protect water resources and promote resilient ecosystem management.

# Flood Control Effectiveness Evaluations at South Florida Coastal Structures

***Tibebe Dessalegne***

South Florida Water Management District, West Palm Beach, FL, USA

The South Florida Water Management District (District) serves approximately 9.3 million residents and is responsible for operating the regional water management system in South Florida. This extensive infrastructure includes more than 2175 miles of canals and 2,130 miles of levees and berms, over 936 water control structures and 620 project culverts, and 98 pump stations. The District manages this complex system to safeguard and restore South Florida's water resources and ecosystems, protect communities from flooding, and meet the region's water needs.

At the outer boundaries of this system, gravity-driven structures play a critical role in discharging inland water to tide while preventing saltwater intrusion. The performance of these structures is highly dependent on the hydraulic gradient across them. Rising sea levels reduce this gradient, thereby diminishing the discharge capacity of coastal gravity structures and compromising flood control effectiveness.

To assess the long-term performance of these structures, the District conducted an analysis of historical water level time series and operational data from coastal structures and NOAA tidal gauges across South Florida. This analysis is part of a broader effort to develop and monitor water and climate resiliency metrics. It also includes evaluating trends in water levels at coastal structures in relation to sea level rise, rainfall variability, and other influencing factors. The findings will support planners and water managers in designing and implementing resilient infrastructure enhancements and refining operational strategies.

**BIO:** Dr. Tibebe Dessalegne is a Section Chief within Hydrology and Hydraulics Bureau at the South Florida Water Management District. He holds a professional Engineering license from state of Florida. In addition, he is a registered Professional Hydrologist and is a Board-Certified Water Resources Engineer with over 20 years of experience.

## Fluorine-free, Chemically Modular Polymer Adsorbents for Capturing PFOA

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PFAS are synthetic chemicals known as per- and polyfluoroalkyl substances introduced into the industry since the 1940s. These chemicals bioaccumulate due to their non-degradable nature, attributed to the strong C-F bond chemistry that imparts thermal and chemical stability, rendering them valuable in various applications. In humans, they are known to be potentially related to multiple health issues, which calls for immediate action.

Researchers have explored various methods for PFAS remediation, including activated carbon, ion-exchange resins, advanced oxidation processes, and filtration membranes. However, there remains a deficiency in adsorbents capable of effectively removing PFAS compounds at environmentally relevant concentrations.

To overcome the shortcomings of commercial sorption material, we have developed non-fluorinated tunable polymers that can effectively remove PFAS compounds. These modular polymers are crosslinked polymer networks synthesized from poly (ethylene glycol) di-acrylate (PEGDA) and different monomer units of poly (ethylene glycol) methyl ether acrylate (PEGMEA), dodecyl acrylate (DA), and pentafluoro phenyl acrylate (PFPA). Using 'click chemistry', we functionalized these polymers with five Lewis's base ligands at different grafting % by substituting PFPA from the polymer backbone, essentially creating a polymer library. These non-fluorinated polymers were evaluated for equilibrium sorption and kinetic study of PFOA. Moreover, it was found that the maximum PFOA sorption capacity for some of these polymers was higher than that of commercial adsorbents. Additionally, transport of PFOA in these polymers was also studied using PFG NMR techniques, which elucidate the changes in diffusivity and T2 times of PFOA with changes in polymer properties. Quantification of the removal efficiency and sorption quantity was done using liquid chromatography-mass spectroscopy (LC-MS), and polymers were characterized using Fourier transform spectroscopy (FTIR) for substitution reaction and water uptake measurements. We believe these functionalized tunable polymers will be a breakthrough in PFAS remediation technologies and the effects of ligand basicity on sorption.

**BIO:** I am a 3rd-year PhD student in the chemical engineering department at the University of Florida. For the last 3 years, I have been working on making polymer and separation technologies for PFAS compounds. During my undergrad, I also worked on developing bioadsorbents for the removal of methylene blue organic dye.

## **Establishing Suspended Sediment Targets to Support Continuing Expansion of Submerged Aquatic Vegetation**

*Jian Di, Lori McCloud, and Andy Canion*

St. Johns River Water Management District, Palatka, FL, USA

Light availability has been identified as a key limiting factor for submerged aquatic vegetation (SAV) growth and distribution in Lake Apopka. Prior to restoration efforts, Secchi depths were very shallow (< 0.2m) due to high algal biomass and suspended flocculent sediment derived from algal biomass. Recent improvements in water clarity can be attributed to: 1) reduced algal biomass resulting from significant reductions in Phosphorus (P) loading, 2) the cumulative effects of projects to remove existing P and 3) limited sediment resuspension due to sustained periods of higher lake stage. These factors have resulted in in-lake P concentrations approaching the target concentration (55 µg P/L) and a resurgence in SAV abundance in the lake. The St. Johns River Water Management District has set a long-term restoration goal of achieving 30% SAV coverage of the lake area. We evaluated light attenuation and water quality data from 2009 to 2021 to determine a total suspended solids (TSS) threshold that would support the goal of providing sufficient light for expanding SAV coverage to 30% of the lake area. A defined TSS target concentration, linked to light penetration and SAV requirements, enables managers to (1) evaluate whether current water quality conditions can support the SAV coverage goal, 2) guide future project actions and 3) to be used as a criterion for evaluating minimum flows and levels development for Lake Apopka would be protective for the SAV habitat in the lake.

**BIO:** Jian Di is an Environment Scientist at St. Johns River Water Management District. He earned a master's degree in Range Science from Utah State University. Jian has over 20 years of working experience in water quality related subjects for the Ocklawaha River Basin.

# Engineered Wetlands to Treat Reclaimed Water: A Solution for Current Water Quality Concerns?

*Chamoda P.D.M. Dissanayake<sup>1</sup>, AJ Reisinger<sup>2</sup>, Ashley Hennessey<sup>2</sup>, Michael Mantone<sup>2</sup>, and Basil Iannone<sup>1</sup>*

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Protecting water resources is a major challenge in water reuse, with concerns over the continued use of reclaimed water (RW). Constructed wetlands (CWs) provide an opportunity for tertiary treatment in water reclamation plants, improving wastewater quality before groundwater recharge. These engineered systems mimic natural wetlands (NWs) and have shown potential to remove pollutants like nutrients, heavy metals, and pharmaceuticals through physical, chemical, and Biological processes. CWs can function as standalone wetland cells or in hybrid systems with sequential treatment cells. While CWs are widely used and monitored, their overall chemical characteristics relative to NWs remain underexplored. This study compared the chemical signatures of single and hybrid CWs with NWs to assess whether CWs resemble NWs. We sampled 22 wetlands across north-central Florida during the wet season, including 7 NWs, 6 single CWs, and 1 hybrid CW system comprised of 3 primary, 3 secondary, 2 tertiary, and 1 quaternary treatment cells. At each site, water samples were collected from multiple habitats (e.g., rooted vegetation, open water, and floating vegetation) to capture internal variation. Samples were analyzed for various nutrient forms (nitrogen and phosphorus, both dissolved and particulate, inorganic and organic), carbon (dissolved and particulate), and in situ physical parameters including temperature, dissolved oxygen, pH, and conductivity. Multivariate analysis revealed clear differentiation in chemical signatures between NWs and CWs, with CWs associated with higher nitrogen, phosphorus, and conductivity, while NWs showed higher dissolved oxygen and temperature. Chemical signatures varied among the CWS, reflecting distinct BIO:geochemical characteristics. Chemical signatures in hybrid systems shift as reclaimed water moves through the treatment process, but detailed analysis is needed to identify which specific chemical signatures change during the treatment process. These findings highlight the need to better understand how specific treatment stages influence chemical signatures to improve CW designs that more closely resemble natural wetland conditions.

**BIO:** Chamoda Dissanayake is a second-year Ph.D. student and a member of the 2024 UF Water Scholars BREWs Program. Her research focuses on constructed wetlands (CWs) that receive reclaimed water, exploring different CW designs and comparing them to natural wetlands to assess nutrient cycling and microbial dynamics.

# QUANTIFYING PHOSPHORUS DESORPTION KINETICS IN SANDY SOILS: IMPLICATIONS FOR FLORIDA WATERSHED HEALTH

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Excess phosphorus from BIO:solids-amended soils is a major driver of nutrient loading in Florida's watersheds, contributing to eutrophication and harmful algal blooms. Predicting long-term P release remains a challenge, especially in sandy soils where leaching potential is high.

To address this gap, we developed a flow-through reactor system to simulate soil leaching under controlled conditions. Sixteen soils from ranches with contrasting biosolids application histories, along with controls, were subjected to 10-day leaching experiments at a constant flow rate ( $0.1 \text{ mL min}^{-1}$ ). Daily and cumulative P release were measured, along with calcium, aluminum, and iron, to parameterize a two-pool kinetic model of P desorption. The model distinguishes between a fast pool (labile, short-term release) and a slow pool (long-term release), providing insight into sustained leaching risks beyond the experimental timeframe.

Building on these experiments, we are testing soils freshly amended with biosolids to compare release dynamics against legacy fields, while evaluating how biosolids composition, application history, and soil properties influence P mobility. Early analyses show strong correlations between M3P and cumulative leaching, suggesting its potential as a cost-effective tool for estimating P loss risk.

Our results show a distinct two-pool release pattern consistent with mesocosm studies of BIO:solids-impacted soils (Lin et al., 2025). Soils with extensive biosolids histories exhibited higher total P release and a larger residual slow pool, indicating sustained long-term leaching potential. In contrast, control and low-application soils released most labile P within the first few days, reaching a rapid plateau. Calcium losses also tracked closely with P, particularly in limed BIO:solids, suggesting the important role of calcium in stabilizing P in these biosolids-amended soils. Together, these patterns demonstrate that soils with greater biosolids legacies retain substantial P reserves vulnerable to slow, persistent leaching.

**BIO:** JoAnn Donald is a Ph.D. student in Soil, Water, and Ecosystem Sciences at the University of Florida. She holds a master's degree in the same field and a bachelor's degree in geology. Her research focuses on phosphorus dynamics in biosolids-amended soils and their implications for sustainable land and water management.

# MOLECULAR INSIGHTS INTO PFHxA TOXICITY: TRANSCRIPTOMIC ANALYSIS IN ZEBRAFISH AND EASTERN OYSTERS

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Per- and polyfluoroalkyl substances (PFAS) have raised significant concern due to their environmental persistence, widespread contamination, and extensive use in consumer products. While their chemical properties are useful for consumer and industrial goods, they also have been linked to potential deleterious environmental and human health effects following exposure. Research has largely focused on the “legacy”, long-chain PFAS. However, in recent years, these legacy PFAS have been phased out in many countries, ultimately leading to short-chain PFAS becoming prevalent in manufacturing and the environment. To address this knowledge gap for less studied PFAS, molecular tools are vital in identifying novel toxicity pathways and reducing reliance on animal testing. Thus, the overall goal of the current research is to evaluate the transcriptomic effects of PFHxA on zebrafish and eastern oysters. Adult zebrafish were exposed to 100 ng/g of PFHxA via a dietary exposure, and oysters were exposed to 200 ng/L, and 2000 ng/L of PFHxA via waterborne exposure. At the conclusion of the exposure, fish were euthanized, weighed, and measured and oysters were measured, shucked, and weighed. Sex was determined for zebrafish to evaluate sex-specific transcriptomic responses. Zebrafish liver and oyster hepatopancreas were collected for mRNA extraction and RNA-seq library preparation. Gene set enrichment analysis was conducted using iPathways. The exposure is still underway for the oysters with sequencing results awaiting to be collected and analyzed. However, we anticipate that there will be evident differences in gene expression between control and exposed oysters. While the exact differences are unknown, the overall goal of the current study is to generate hypotheses on the specific effects of PFHxA in a bivalve. In zebrafish, lipid metabolism was identified as a potential target of PFHxA exposure in both sexes. In males, the PPAR signaling pathway was specifically impacted, suggesting that PFHxA may exert toxic effects through PPAR-mediated regulation of lipid metabolism. While the PPAR signaling pathway was not impacted in females, genes regulated by PPAR $\alpha$  and PPAR $\gamma$  were differentially expressed suggesting that PFHxA may still exert toxic effects via the PPAR signaling pathway in both females and males. In addition to effects via PPAR, bile secretion, essential for lipid digestion and absorption, was the only pathway significantly altered in both sexes. Once again suggesting that lipid metabolism may be one of the main targets of PFHxA toxicity in zebrafish. Both studies are the first to evaluate sub-chronic dietary and waterborne exposure to PFHxA and its effects on the zebrafish and oyster transcriptome, respectively. Our findings support the development of new approach methodologies (NAMs) for high-throughput screening of the thousands of PFAS with unknown toxicological profiles, which is critical for accurate risk assessment.

**BIO:** Jessica is a PhD candidate whose dissertation focuses on PFHxA’s effects on recreationally and economically important aquatic species. While her background is in marine biology, her multifaceted work at UF includes projects assessing the impacts of pesticides, heavy metals, and herbicides on freshwater and marine organisms.

# hypoxia AND Dissolved Oxygen Dynamics During River Intrusion Events in Florida's Springs

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River intrusion events (RIEs) occur frequently in the springs of the Suwannee River Basin (SRB). During these events, floodwaters from adjacent blackwater rivers displace groundwater within the system, introducing water much richer in dissolved organic matter (DOM) than typical groundwater-derived flow. This DOM influx drives increased microbial respiration and oxygen consumption in springs and their connected cave systems. The resulting chemical shifts can produce transient hypoxic conditions which may be responsible for fish and stygofauna die-offs which have been observed in association with RIEs. To improve our understanding of the relationship between RIEs and oxygen dynamics, we analyzed high-frequency flow and water-quality data from four springs within the SRB.

We developed and tested a new hydrologic method, the Net River Intrusion Flow (NRIF) approach, to characterize the storage and release of river water during RIEs. The NRIF method integrates continuous discharge data to estimate the timing and duration of intrusion and was validated against independent measures of surface-water intrusion, including specific conductance and visual-clarity records, achieving 86–89% agreement.

Across the four springs, 60 RIEs were analyzed, ranging in duration from 1 to 317 days. Longer events induced hypoxia more consistently than shorter ones and post-event low-oxygen conditions persisted longer during them as well. This indicates longer RIEs may impose greater physiological stress on springs flora and fauna. Intrusions of colder river water were less likely to produce hypoxia, likely due to temperature-limited respiration rates.

Together, the NRIF framework and oxygen-response analyses reveal how surface–groundwater exchanges drive recurring hypoxia in Florida's springs. Changes in flow conditions have the potential to increase the frequency and duration of RIEs at springs within the SRB. Thus, understanding the nature of these events is key to protecting the ecological integrity of these globally unique karst ecosystems.

**BIO:** Paul Donsky is a Minimum Flows and Levels (MFL) Scientist with the Suwannee River Water Management District and Ph.D. student at the University of Florida. His research focuses on the relationships between flow, oxygen, and submerged aquatic vegetation in Florida springs.

## River DNA Long-Read Sequencing: Rapidly Monitor Biodiversity, Wildlife, Pollution & Ecosystem Health

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Biodiversity and species are declining at unprecedented rates. Freshwater habitats have experienced the largest decline in biodiversity since the 1970s. Therefore, it is more vital than ever to accurately understand the current state of natural habitats, their constituent species, and their stressors; and have scalable quantitative tools to measure the success of habitat and biodiversity restoration efforts. We tested a single assay: long-read shotgun metagenomic sequencing of environmental DNA (eDNA), to monitor species from across the tree of life, from viruses to complex multicellular organisms, in two river systems, the Matanzas River, Florida and the Avoca River, Ireland.

We conducted aquatic eDNA sampling and long-read shotgun metagenomic sequencing from high and low human habitation areas (Florida) and from a mountain tributary through to the sea (Ireland). We could detect and quantify organismal DNA present in water, from microbes (including DNA viruses) to algae and mammals. Rather than the traditional siloing of microbial and multicellular studies of DNA recovered from environmental samples, simultaneously considering viruses, microbes and eukaryotes (animals, plants and fungi) can provide deeper insights. This single assay can simultaneously quantify differences in DNA abundance for a broad range of species and pathogens across sites, enabling wide-ranging biodiversity assessments. This included human, wildlife, plant and microbial pathogens and parasites with health, agricultural and economic importance.

This approach could point-source locate biotic pollution sources, including improperly treated sewage wastewater release and septic tank leakage. The environmental genomic data enabled animal population genetic applications (e.g. humans [*Homo sapiens*] and blue mussel [*Mytilus edulis*]) even from natural complex community settings. Long-read sequencing of environmental samples provides a rapid and quantitative approach for river biodiversity, pollution and environmental health monitoring. It also offers holistic water quality monitoring, biodiversity surveillance, and to assess whole ecosystems; and the ecological, host-pathogen, and trophic interactions occurring within them.

**BIO:** Dr. Duffy is a Condron Family Endowed Associate Professor at UF's Whitney Laboratory/Sea Turtle Hospital, with over 20 years' experience in molecular, genomics, wildlife conservation, cancer and environmental studies. His team conducts laboratory-, clinical-, computational- and field-based research, including eDNA analysis from air, sediment and aquatic (freshwater, seawater, estuarine) sources.

## **Lead-Resistant Bacterium VMI-TD-ORR from Oak Ridge Reservation Site Soil: A Feasible Candidate for Lead Removal from Polluted Water**

*Tia Duke, Veera LD Badisa, Benjamin Mwashote, Rajesh S. Rathore, Victor Ibeanusi*

Core Laboratory, School of The Environment, Florida A&M University, Tallahassee, FL, USA

Lead (Pb) metal pollution is a significant global environmental concern due to its toxicity and persistence in ecosystems. It can enter water, soil, and the atmosphere via industrial waste, posing significant risks to humans and wildlife. Due to its toxic and non-degradable nature, there is an urgent need for cheaper and eco-friendly remediation techniques. Bioremediation, using bacteria, provides a sustainable approach to mitigate the metal pollution. This study focused on the isolation and identification of Pb-resistant bacterium from the Oak Ridge Reservation (ORR) site soil as a preliminary step towards the bioremediation of Pb from the environment. The 16S rRNA gene sequencing was performed for identification of the bacterium. The Pb resistance capacity of the bacterium was determined by growing the bacteria at different Pb concentrations (100, 250, 500 ppm). Bacterial growth was measured using spectrophotometer at 600 nm. The optimum growth temperature of the bacterium was determined by growing at various temperatures (25, 30, and 37 °C) in an incubator with continuous rotation speed of 100 RPM. The Pb remediation potential was measured by exposing the bacterium to different concentrations of Pb for 24 h. After the incubation time, the remaining Pb concentration in the supernatant was measured with the inductively coupled plasma optical emission spectrometer. The Pb-resistant bacterium VMI-TD-ORR was identified as *Raoultella ornithinolytica* (97.44% identity). The results showed that the bacterium resisted 500 ppm Pb. The optimum growth temperature of the bacterium was found to be 30 °C. It showed  $84.3 \pm 4.0$  and  $97 \pm 0.6\%$  respectively after treatment with 10 and 25 ppm Pb for 24 h. The results of this research study suggest that this Pb-resistant bacterium VMI-TD-ORR is feasible for the removal of Pb from the polluted water.

## Introduction to BMPs - Overview of the UF/IFAS Nutrient Management Program

**Michael D. Dukes**

University of Florida, Gainesville, FL, USA

Growers have criticized many UF/IFAS fertilizer rate recommendations for being outdated, as they do not reflect modern production systems. For example, the grain corn recommendation is nearly 50 years old, even though modern production systems — incorporating improved genetics, narrower row spacing, denser planting, and center pivot irrigation — have become standard practice. Other agricultural commodities and horticultural crops have advanced similarly.

In 2021, UF/IFAS began receiving annual legislative funding to reassess fertilizer application rates (initially for tomatoes and potatoes), with a focus on agronomic and economic efficiency and on incorporating BMPs to maximize yield and quality while minimizing environmental nutrient losses. Since then, UF/IFAS launched a Nutrient Management program with \$20.6 million allocated as of FY24-25. The legislative mandate also extended to other crops, prompting studies on corn, cotton, hemp, sod, limpgrass, lettuce, blueberry, citrus, and peaches, and on optimal soil tests for plant-available phosphorus, artificial intelligence for nutrient management, and biosolids use on pastures.

Over 60 UF/IFAS faculty, staff, post-docs, and students are involved in these projects from the western panhandle to Miami-Dade County. The initiative has significantly enhanced the organization's extension services and research capacity through upgraded soil labs and modern equipment. To date, three years of experiments on potato and tomato, and two years on other crops, have been completed, with research on perennial fruits expected to continue for another four to five years. Interim phosphorus recommendations have been developed for potato, tomato, and snap bean, while additional data is being collected to update other fertilizer guidelines.

**BIO:** Dr. Dukes is a Professor, Associate Dean of Extension and Director Center for Land Use Efficiency. He has 30 years of experience working in irrigation related topics such as efficiency, plant water requirements, nutrient fate and transport.

## Spatial and Temporal Variability of Water Quality in U.S. Rivers

**Seyed Abolfazl Ebrahimi**<sup>1</sup>, Nicolas Fernandez<sup>1</sup>, Dan Dai<sup>1</sup>, Jaehyeon Lee<sup>1</sup>, Lindsey Aman Cromwell<sup>1</sup>, Luwen Wan<sup>2</sup>, Jasmine Krause<sup>3</sup>, Sajad Soleymani Hasani<sup>4</sup>, Linus Schauer<sup>5</sup>, Deandre Presswood<sup>6</sup>, Andrew Abagai Ali<sup>7</sup>, Aléxia Oliveira<sup>8</sup>, Luisa Vieira Lucchese<sup>9</sup>, Kate Maher<sup>2</sup>, Adam Ward<sup>3</sup>, Mauricio E. Arias<sup>4</sup>, Andreas Musolff<sup>6</sup>, Joanna Blaszcak<sup>6</sup>, Ariel Shogren<sup>7</sup>, Harald Klammler<sup>8</sup>, John Gardner<sup>10</sup>, Matthew Cohen<sup>1</sup>, James Jawitz<sup>1</sup>

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<sup>10</sup>University of North Carolina, Chapel Hill, NC, USA

Effective design of water quality monitoring networks requires a deep understanding of how water quality varies across space and time. We quantified and compared the spatial and temporal variability for nine solutes across the contiguous United States using the ChemLotUS dataset, which is an integrated compilation of national-scale water quality observations. We analyzed variability patterns across stream orders and Hydrologic Unit Codes (HUC2–HUC8) to investigate how spatial and temporal coefficient of variability ( $CV_s$  and  $CV_t$ ) respond to changes in hydrologic scale. Across all solutes, spatial variability ( $CV_s$ ) consistently exceeded temporal variability ( $CV_t$ ), highlighting the dominance of spatial drivers in shaping water quality patterns. More anthropogenically impacted solutes generally showed the highest  $CV_s$  values, followed by biogenic solutes; geogenic solutes, as well as dissolved oxygen showed the lowest spatial variation. Spatial variability increased with spatial scale reflecting greater regional heterogeneity at larger spatial extents, as variations in climate, geology, and land use increase. However, when controlling for scale, spatial variability always decreased with increasing stream order, especially beyond order 8, primarily due to hydrologic blending effects in higher-order rivers. In contrast,  $CV_t$  was relatively stable across temporal scales, suggesting stationary temporal drivers. These insights underscore the importance of tailoring monitoring network design to the extant nature of solute variation and watershed scale. First and foremost, these results prioritize sampling densely in space rather than time. However, instead of uniformly increasing sampling density, targeted placement in regions with high spatial heterogeneity and variable anthropogenic impact can enhance the efficiency of measurements to better support localized management strategies.

## Co-design of Green Infrastructure to Improve Water Quality and Advance Environmental Justice

**Serena A. Echols<sup>1,2</sup>, Emily Walsh<sup>1,2</sup>, E. Christian Wells<sup>1</sup> Sarina Ergas<sup>3</sup>**

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Stormwater ponds are mainly designed to reduce flooding. In the Tampa Bay region, they can also partially attenuate the flow of nutrients into the Tampa Bay estuary, which can cause harmful algal blooms that produce toxic effects on people and marine life. However, with increasing frequency and intensity of extreme wet weather events due to climate change, many stormwater ponds have become polluted from runoff from residential, commercial, and industrial land uses, which contribute to poor water quality that negatively impacts human and environmental health. This research works with community residents and environmental engineers using principles of design anthropology to co-design solutions to stormwater pond pollution in the University Area Community, an urban, disadvantaged, underserved community experiencing environmental justice challenges from chronic pluvial flooding events. and underutilized, leading to public health and environmental justice challenges. Our research seeks to develop pathways for residents and other stakeholders to collaboratively co-design infrastructure interventions and redevelopment for neglected stormwater ponds. Through interviews, focus groups, and participant observation with residents and engineers, we assess how both groups engage in collaborative co-design of green infrastructure solutions.

**BIO:** Serena Echols (B.S., Environmental Science, Spelman College) is pursuing concurrent M.P.H. and M.A. degrees in Applied Cultural Anthropology at USF. Her research advances environmental justice through collaborative design, storytelling, and policy-community bridging. She is the author of *Msitu: The Old-Growth Forest*, and her research has been published in the journal *Local Environment*.

Emily Walsh (B.S., Public Health, University of South Florida) is pursuing concurrent M.P.H. and M.A. degrees in Applied Cultural Anthropology at USF. Her research explores the intersection of culture, health equity, and lived experience, with a focus on community-centered approaches to public health practice that center inclusivity and collaboration.

# TRACKING WATER QUALITY IN THE NATURE COAST AQUATIC PRESERVE

*Morgan Edwards<sup>1,2</sup>, Laura K. Reynolds<sup>1</sup>, Savanna C. Barry<sup>2</sup>*

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Aquatic preserves (APs) are established by law as exceptional areas of submerged lands and associated waters that are to be maintained in their natural or existing conditions for future generations. The Nature Coast Aquatic Preserve (NCAP) was established in June 2020. Water quality is one of the valued resources and thus key monitoring components. There are nine coastal river systems associated with NCAP, and these rivers and their estuaries are monitored monthly through the Project COAST program initially established at the University of Florida and reinstated after NCAP was established. Using both the data from the historical and current programs, we analyzed temporal trends using generalized additive models (GAMS), and compared the geometric means against established numeric nutrient criteria (NNC) for each region to assess exceedances of established NNC. Water quality was mostly stable. In total, we found only 39 significant trends (out of 1,440 possible). There were 9 trends that could be considered “favorable”, such as declines in total nitrogen concentrations, while 30 trends (77%) could be considered “unfavorable”, such as increases in total phosphorus or color concentrations. The most northern and southern regions had the most negative trends. There were multiple regions that exceeded their numeric nutrient criteria more than once. Total nitrogen was exceeded in the Crystal, Homosassa, and Weeki Wachee River regions. Total phosphorus was exceeded in the Homosassa and Chassahowitzka River regions and the Chassahowitzka and Aripeka/Hudson estuary regions. Chlorophyll criteria were not exceeded more than once in any region. In general, historical data collected from the estuaries within the NCAP combine to indicate water quality conditions are good and relatively stable; however, given repeated evidence of water quality trends, many of which are in a potentially concerning direction, more research is needed to characterize driving factors and trends should continue to be monitored closely.

**BIO:** Morgan Edwards is a biologist at UF IFAS Nature Coast Biological Station and UF IFAS Soil Water and Ecosystem Sciences Department. She leads the monitoring work in the Nature Coast Aquatic Preserve which is managed by Florida Department of Environmental Protection.

# GIS and Remote Sensing for Spatio-Temporal Interpolation of Climate Variables in Ungauged Watersheds

*Rabi Elabor<sup>a</sup>, Hirwa Hubert<sup>a</sup>, Gang Chen<sup>b</sup>, Benjamin Mwashote<sup>a</sup>, Veera L. D. Badisa<sup>a</sup>, Victor Ibeanusi<sup>a</sup>*

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<sup>b</sup> Department of Civil and Environmental Engineering, FAMU-FSU College of Engineering, Tallahassee, FL, United States

Climate variability is a major constraint on the effective management of water resources, especially in data-scarce watersheds with diverse terrain. This study aimed to address data gaps and evaluate spatial interpolation variability of climatic variables in the Hickahala Creek Watershed using 30 years (1991-2020) to support sustainable water and farming management. Spatial interpolation methods using GIS and remote sensing were implemented to map the minimum and maximum temperatures, precipitation, solar radiation, and vapor pressure. The spatial autocorrelation was analyzed using Moran's I, with a value of 0.8548, a predicted index of 0.0250, and a P-value of 0.0000, indicating significant clustering.

The Inverse Distance Weighting (IDW) and Ordinary Kriging (OK) techniques were employed for interpolation via cross-validation to assess model performance, including Root Mean Square Error (RMSE) and Mean Bias Error (MBE). The performance assessment also indicated that neighborhood size, sector configuration, and semivariogram models significantly affect interpolation accuracy. Optimized climatic maps ranged from 9.58 to 10.77 °C and 21.97 to 22.57 °C for minimum and maximum temperatures, 22.08 to 22.48 mm of precipitation, 7.96 to 8.10 MJ/m<sup>2</sup>/day of solar radiation, and 0.56 to 0.94 hPa of minimum vapor pressure. The findings showed that OK produces more accurate and reliable climatic surfaces than IDW, making it suitable for watershed climate analysis.

These findings provide an effective framework for GIS-based water management that enables policymakers to introduce high- and low-variability zones, adaptive cropping plans, precision irrigation, and the incorporation of spatial climate models. This approach would help allocate water equitably and sustainably to meet agricultural demand in a humid subtropical watershed, such as the Hickahala watershed.

## TALKING OPERATIONS IN THE C&SF PROJECT

*Jason A. Engle, US Army Corps of Engineers, Jacksonville District, Jacksonville, FL, USA*

The Jacksonville District USACE works with South Florida Water Management District (SFWMD), indigenous tribes, local/state/federal agencies, and the public to develop operational plans for the C&SF system and the new water resources projects that modify that system. The operational plans strike a balance between the need to be specific about operational decision making and the need for flexibility.

Water managers from Jacksonville District and SFWMD make continuous adjustments to operations, based on day-to-day system conditions. Through monitoring of system responses, our understanding of hydrologic and ecological systems is continuously advancing. As new water resources projects are completed, we are developing updated operational plans that incorporate those lessons learned. As new science emerges, we are evaluating present and future resilience of the C&SF system.

During the development of new operational plans, operational scenarios are simulated using numerical modeling tools that can assess system operations across a long period of record. These models are an essential tool for evaluating different combinations of new infrastructure and new operations to establish operational alternatives that achieve the best balance for the whole system. The writing of our operational plans is where the jump is made from simulations to real water management. This challenging phase of the process draws on the partnerships and relationships among the agencies, tribes, and the public to develop operational plans that are optimized across a wide range of conditions and allow for a wide array of information to be considered in water management decisions.

**BIO:** Mr. Engle is the Chief of the Water Resources Engineering Branch of the Jacksonville District, USACE. He has more than 20 years of experience with the planning, design, construction, and operation of water resources projects. This includes coastal storm risk management, flood risk management, navigation, and ecosystem restoration projects across Florida and Puerto Rico.

## How Vulnerable is Florida to Drought? A National Comparison

*Johanna Engström<sup>1</sup>, Keighobad Jafarzadegan<sup>2</sup> and Hamid Moradkhani<sup>3</sup>*

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<sup>3</sup>University of Alabama, Tuscaloosa, AL, USA

The state of Florida is no stranger to drought, yet it's not a region that nationally is considered as drought prone. This research project takes into account different factors that make a state vulnerable to drought, as well as aspects that serve to ameliorate drought impacts. Results indicate that drought vulnerability isn't limited to arid states but rather is closely linked to a state's capability to prepare for and respond to the hazard when it happens. Findings also highlight what adaptation measures could be taken to lessen drought vulnerability.

**BIO:** Dr. Engström is an Assistant professor in the Department of Geography at the University of Florida. Her research interests include hydroclimatology, water resources, drought impacts, and renewable energies, with a particular focus on the Southeast U.S.

## Simulation and Calibration of Tampa Bay Water's Regional Hydraulic Model

*Solomon Erkyihun<sup>1</sup>, Hui Wang<sup>1</sup>, Tirusew Asefa<sup>1</sup>, and Matthew Azarian<sup>2</sup>*

<sup>1</sup> Tampa Bay Water, Clearwater, FL, USA

<sup>2</sup> Black and Veatch

Strategic planning is crucial for Tampa Bay Water to reliably meet the growing water demand in its service area. A critical component of this planning process is the assessment and evaluation of existing infrastructure, identification and prioritization of future supply sources and infrastructure and implementation of cost-effective upgrades or expansions that support sustainable water delivery for the short- and long-term. For planning purposes, the agency utilizes multiple models to identify operating parameters and thresholds as input to optimize future water delivery simulations, master water supply planning and understand financial risk.

An EPANET based hydraulic model was designed to utilize input data on supply sources (surface water, ground water, or desalinated seawater) from decision support tools such as the Optimized Regional Operations Plan (OROP) to meet projected water demand at the regional water delivery locations. The hydraulic model is continuously updated to respond to infrastructure expansion, changes in demand conditions, and operations of the regional water transmission system. Calibration parameters of the hydraulic model such as the pipe roughness coefficients, water demand patterns, pump curves, and valve settings are adjusted iteratively to capture the actual flow and pressure at water delivery locations. In each iteration, the simulation performance is measured by comparing simulation results with observations until the deviation between the two is minimized while keeping the calibration parameter values within their allowable ranges. The calibrated model was able to replicate the observed flow and pressure conditions at the water delivery locations, providing feedback to decision support tools including the OROP for efficient, sustainable and cost-effective water production from the agency's multiple water sources.

**BIO:** Solomon Erkyihun is a water resources system engineer in Tampa Bay Water with experience in water demand forecasting and hydraulic modeling. He is working towards improving the accuracy of the regional hydraulic model to inform the decision support tools for reliable and optimal operation of potable water delivery.

## BEYOND THE SCIENTIFIC ECHO CHAMBER

**Jason Evans**<sup>3</sup> [Session with Cynthia Barnett<sup>2</sup>, Angela Bradbery<sup>2</sup>, Kellie Keys<sup>1</sup>, and Andrew Opel<sup>1</sup>]

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<sup>3</sup>Stetson University, DeLand, FL, USA

In today's polarized era of increasing misinformation and public distrust, there's an understandable tendency for environmental scientists to gravitate towards two very different types of echo chambers. One is the familiar and comforting halls of the ivory tower, where research is pursued for the sake of tenure, promotion, publications, and – ideally – curiosity, while public engagement is an afterthought slipped into only those proposals that mandate a “broader impacts” section. This might be called the “stay in your lane” approach. Another echo chamber, perhaps more appealing to those with longstanding tenure or otherwise emboldened, is a hard turn towards political activism, where one's scientific credentials are openly leveraged for specific policy or partisan goals. This might be coined as the “get out the pitchforks” approach.

Admittedly, each of these paths has certain virtues and appeal, and I certainly mean no offense to those who may see themselves in either of these descriptions. But to keep with the theme of this session, this presentation will explore my personal experiences – and a few stumbles – along a “third way.” Over the past two decades, I've had opportunities to engage with practitioners, policymakers, activists, and the “general” public on a variety of (often) contentious issues, including sea-level rise, forestry management, land cover change, invasive species, and harmful algal blooms. Through these experiences, I've learned that the most effective science communication – at least for me – should not be aiming solely at simple dissemination or audience persuasion. Instead, I've found it crucial to openly and actively embrace opportunities for co-learning, even while maintaining core guardrails in defense of evidence and objectivity. While I won't pretend to have all the answers for others looking to move beyond their echo chambers, I do hope that some of these reflections will be at least somewhat illuminative and thought-provoking.

**BIO:** Dr. Evans is Executive Director of Stetson University's Institute for Water and Environmental Resilience and Co-Editor in Chief for the Journal of Environmental Management. He has extensive experience working on applied environmental research projects across Florida, especially related to sea-level rise vulnerability and conservation planning.

# The Economic Costs and Benefits of Land Conservation Easements in North Central Florida

**Alex Faulkner**

Stetson's Institute for Water and Environmental Resilience, DeLand, FL, USA

Conservation easements offer a market-based mechanism to incentivize environmental stewardship. By compensating landowners for voluntarily restricting development and adopting sustainable land management practices, these easements serve as a commitment device—ensuring long-term conservation while building trust among neighboring landowners and communities. Although not a new tool, conservation easements continue to deliver significant ecological, social, and economic benefits ([Foster et al., 2017](#); Bawa and Dwivedi 2019; Raucher et al., 2011):

- **Water Resource Protection:** Easements help reduce aquifer depletion and extend the longevity of water supplies by preserving natural landscapes that support groundwater recharge.
- **Cost Savings:** By maintaining natural filtration systems, easements can reduce the financial burden on municipal water treatment infrastructure and/or wastewater treatment before discharging wastewater.
- **Spillover Effects:** While applied at the parcel level, the benefits of conservation easements extend beyond property lines—enhancing regional water quality, biodiversity, and property values.

Failure to implement aquifer conservation strategies may lead to reduced agricultural productivity due to declining borehole yields, as aquifer saturation levels fall below thresholds needed for high-volume pumping ([Foster et al., 2017](#); Hecox, 2002). In Florida, conservation easements are particularly relevant to eco-tourism and recreational water use, which can potentially impact the suburban real estate markets (Beever & Walker, 2016).

While some stakeholders perceive easements as limiting economic growth, evidence suggests otherwise. Conservation easements can enhance property values and generate positive externalities that benefit entire communities. A recent Willingness to Pay (WTP) study by Klizentyte et al. (2025) found that residents value aquifer conservation at \$129.65 per household, indicating strong public support for sustainable water management.

This study investigates the economic impact of conservation easements by estimating the value of nearby properties. By using a hedonic pricing model of property values in counties where some conservation easements are present, we find that properties within a one-mile radius of the conservation easement experience an increase in their property value by 14%, which amounts to \$46,228 in 2025's dollar terms. This implies that conserved green space, i.e., conservation easements, can be a valuable attribute for homeowners and buyers. Therefore, it makes economic sense for homeowners to consider the economic possibilities associated with living within a close proximity to a land conservation easement.

## Florida Water Quality and Quantity Enhanced Synthesis Tools – FLOW Q<sup>2</sup>UEST

*Nicolas Fernandez<sup>1</sup>, Seyed Abolfazl Ebrahimi<sup>2</sup>, Nicholas Chin<sup>3</sup>, Xiaohui Qiao<sup>4</sup>, Nathan G Reaver<sup>1</sup>, James Jawitz<sup>5</sup>, Wendy Graham<sup>6</sup> and Matthew Cohen<sup>1,2</sup>*

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Florida has an unparalleled water quality monitoring program, with the highest proportion of streams ever sampled in any state (5% of 400,000 segments), and more than 4 million measurements since 1901. Although this enables informed water quality management and supports scientific advancements, challenges remain to maximize the utility of this extraordinary data archive. For example, recent work highlights data density differences between federal repositories (water quality portal - WQP) and those maintained by local water management districts, respectively offering better spatial and temporal coverage. Ensuring access to the best available information requires harmonizing multiple data sources. Furthermore, water quality analyses greatly benefit when integrated with discharge measurements and landscape attributes, but concatenating these datasets is complex and time consuming. We sought to create an integrated statewide inventory for nutrient concentrations, and their key covariates in Florida streams, to enable new insights into the causes, controls, and trajectories of statewide water quality. We sourced data from the WQP and four water management districts, linked these with hydrographic units, and conjoined every observation with contemporaneous values of discharge either measured (USGS gages), when available, or modeled (National Water Model). We also coupled sampling locations to a wide array of upstream watershed attributes including geology, climate, land cover, and infrastructure. The connection of these attributes, concentrations and discharge is a key refinement enabling critical flow controls, water quality variations, and exported loads, to be estimated as a function of upstream characteristics. Finally, we designed a WebGIS data platform, FlowQ<sup>2</sup>uest, to visualize and share the resulting integrated product. In this talk, we describe the development of FlowQ<sup>2</sup>uest and explore some of the research and water management opportunities enabled. While we focus on the drivers of nutrient concentrations, there are ample opportunities to address a wider suite of ecological, hydrological, and land management questions.

**BIO:** Dr. Fernandez is Data Scientist at UF Water Institute with more than 15 years of experience transitioning from the private sector (patents, technical sales and environmental consulting) to research and education at the intersection of water quality, hydrology, and big data

## **Comprehensive Everglades Restoration Plan: A Puzzle Piece of the Central & Southern Florida Project**

***Bradley A. Foster, Ph.D.***

U.S. Army Corps of Engineers, Jacksonville, FL, USA

The Central and Southern Florida Project provides benefits of flood risk reduction, increased water supply, and prevention of saltwater intrusion throughout south Florida. The Project also generated unintended ecological water depths in the natural system, declining estuary health, declining water quality, and spread of invasive vegetation. In 2000, Congress approved the Comprehensive Everglades Restoration Plan (CERP) as a framework for modifications and operational changes to the Central and Southern Florida Project to restore the Everglades ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The CERP includes 68 components that work together to achieve ecological restoration. The components must undergo a planning phase before additional authorization to begin design and construction phases. In addition to the ecological benefits, each study assesses and ensures that the structural and operational changes of the project will not increase flood risk and will not reduce water supply for existing users. This session will share examples of the interaction of ecosystem restoration with flood risk and water supply provided by the Central and Southern Florida Project.

**BIO:** Dr. Foster is a senior ecologist and planner with more than 25 years of experience planning Everglades restoration projects. He has led more than 10 different projects dedicated to restoring wetlands in south Florida.

## **A New Geoinformatics Approach for Spring Protection Zone Delineation**

**Sandra Fox<sup>1</sup>, Wei Jin<sup>1</sup>, Qing Sun<sup>1</sup>, Fatih Gordu<sup>2</sup> and Andrew Sutherland<sup>1</sup>**

<sup>1</sup>St Johns River Water Management District, Palatka, FL, USA

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A new springshed delineation methodology has been developed at the St. Johns River Water Management District (SJRWMD). This method is rapid, accurate, repeatable and automated. Because this method was developed to support minimum flows and levels (MFLs) development for springs, it was important that it be based on a dataset derived from a physical parameter that is influenced by groundwater pumping, and that in turn influences springshed delineation. Initially, this geospatial (geoinformatics) springshed delineation method was developed for six springs with input from SJRWMD groundwater modelers: Wekiva, Alexander, Silver Glen, DeLeon, Volusia Blue and Gemini springs. The method iterates 65 USGS potentiometric surfaces using ModelBuilder in ArcGIS Pro, applying tools from esri's ArcHydro DEM Manipulation toolset, with additional steps in ModelBuilder to compile and simplify output. Over the course of this project a revision was undertaken to extend application to additional springs when it was found that the original method faltered; both the original and revised method will be described. Other factors that affect springshed delineation methodology include variability of potentiometric surfaces, spring magnitude and topographic locations of springs.

**BIO:** Sandra Fox, MS, GISP has more than 30 years' experience working with geospatial data and analyses primarily at SJRWMD, including 8 years as Associate Editor for Geospatial Analysis for the Journal of the American Water Resources Association.

## Manganese Resistant Bacterium VMI-NF-ORR: A Potential Candidate for Manganese Removal from Polluted Water

Noah Francis, Veera LD Badisa, Benjamin Mwashote, Rajesh Rathore, Victor Ibeanusi

Core Laboratory, School of The Environment, Florida A&M University, Tallahassee, FL, USA

Manganese (Mn) metal pollution has become a widespread environmental problem. Due to the mining activities, fossil fuel combustion, erosion, and industrial waste, Mn is released into water, soil, and accumulates into the vegetables and other food items. Manganese can be harmful to humans causing chronic and acute disorders such as metal fume fever, eye and nose irritation. Owing to its non-degradability and harmful effects, there is a high demand for the cheaper and sustainable remediation technique of Mn removal from the environment. Recently, BIO:remediation using bacteria is becoming one of the most cost effective and sustainable ways of remediation in the environment worldwide. Metal resistant bacteria are potential candidates for metal remediation. In this study, Mn resistant bacterium was isolated from the Oak Ridge reservation site soil and identified by 16S rRNA sequencing. Bacterial growth was measured at 600 nm using spectrophotometer. The optimum temperature for the growth of the bacterium was determined. The Mn remediation potential was also measured. After the incubation time, the remaining Mn concentration in the supernatant was measured with the inductively coupled plasma optical emission spectrometer (ICP-OES). The bacterial response to Mn exposure on the protein expressions was also investigated. The proteins in total cell lysate, membrane and cytoplasmic fractions were analyzed on 10% SDS PAGE gel. **Results:** The Mn resistant bacterium was identified as *Raoultella ornithinolytica* (95.17 percent identity). The growth results of Mn resistant bacterium showed that 30°C was optimum temperature for growth. It showed 61.4 and 55.1% Mn removal from the medium with 5 and 7.5 ppm Mn treatment after 72 h. The differential expression of proteins was observed in bacterial cells exposed to Mn in comparison to untreated control cells and was shown by the heat map. This study clearly shows that this Mn resistant bacterium can be a potential candidate for Mn removal from the polluted water.

**BIO:** Noah Francis is a third year Environmental Studies student at Florida A&M University. His minor concentration is in Agribusiness. He has undergraduate experience working on the conglomerate project of Manganese bioremediation. He also worked for the FDEP and was a note-taker at the 2025 NEXUS summit in Miskolc, Hungary.

## Unique Potential Uses for Real-Time Flood Forecasting

**Tom Frick**

St. Johns River Water Management District, Palatka, FL, USA

In response to the escalating challenges posed by increases in frequency and severity of storms within the Upper and Middle St. Johns River Basins, the District has developed and is currently expanding its capabilities to perform real-time flood forecasting modeling. This model currently provides valuable forecasting data across a substantial portion of the Upper St. Johns River Basin and is being expanded to the Middle St Johns River. Our objective has been to establish a comprehensive regional flood forecasting model that encompasses the entirety of the Upper and Middle St. Johns River Basins. The main focus of the project has been to empower local and regional authorities with timely and precise information that can be utilized to expedite emergency response and mitigate potential flooding impacts. Recently, the District has been exploring expanding the use cases for real-time flood forecasting to natural systems and water supply management. This talk will discuss potentially unique ways to use these models.

**BIO:** Mr. Frick is the St. Johns River Water Management District's Resilience Coordinator and has spent more than 30 years in the public and private sectors focused on environmental data, ecological assessments, and waterbody restoration.

# EFFECTS OF HUMAN, LIVESTOCK, AND WILDLIFE USE ON MICROBIAL COMMUNITIES OF KENYAN WATER PANS

*Ava Gabrys*<sup>1</sup>, *Audrey Goeckner*<sup>1</sup>, *Brian Marvi Waswala-Olewe*<sup>2</sup>, *Romulus Abira*<sup>2</sup>, *Faith Jepkemei*<sup>2</sup> and *Christopher Dutton*<sup>1</sup>

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Water pans are small reservoirs that store rainwater in arid and semi-arid landscapes for livestock and pastoralist communities, particularly in times of water scarcity and in the droughts prolonged by climate change. Water pans can be used by humans, livestock, wildlife, or a mix of users, each of which can affect the water quality of the pans they access via inputs of resources (i.e., feces) and microorganisms or pathogens. This study sought to characterize microbial community structure and function of water pans in the Eastern Rift Valley of Kenya to assess human-animal usage effects on water quality and human health. We collected water samples from 28 sites across four sampling periods between March 2024 and April 2025 and passed them through 0.2 um filters for subsequent DNA extraction. We used 16S rRNA gene metabarcoding to characterize microbial community structure, digital PCR to quantify bacterial copies, and shotgun metagenomics to explore microbial metabolism effects on water quality. We expect water pan communities to be uniquely shaped by their users, such that each usage class harbors distinct taxa and community structure from one another. We anticipate extensive interplay between environmental microbes and those anthropogenically introduced, with water pans serving as aggregators and dispersers of pathogens (e.g., cyanobacteria, *E. coli*) particularly in smaller, mixed-use sites. We also expect that, along with a higher concentration of antimicrobial resistance genes, livestock-associated pans will support a higher degree of low redox metabolisms for carbon degradation and nitrogen cycling due to large inputs of animal waste. As water pans increasingly serve as a contact point in the human-livestock-wildlife interface, disentangling routes of microbial transmission is critical to identifying risks to human and ecosystem health.

**BIO:** Ava Gabrys is a first-year PhD student in the Dutton Lab at the University of Florida. She is interested in the intersections between microbial dispersal through environments and hosts, microbial competition, and ecosystem functioning and health.

# Breaking the Unbreakable – A Hybrid CD-TiO<sub>2</sub>/Non-Thermal Plasma System for Enhanced PFAS Degradation

*Ryan Gains, Katherine Deliz*

University of Florida, Gainesville, FL, USA

Per- and polyfluoroalkyl substances (PFAS) represent one of the most pressing environmental contamination challenges of our time, requiring immediate technological solutions. The exceptional stability that C–F bonds confer to this large group of chemicals enables their widespread use across aerospace, electronics, textiles, and consumer industries, but also renders these synthetic compounds virtually indestructible under natural conditions, leading to persistent bioaccumulation throughout ecosystems and humans. Epidemiological studies have established clear associations between PFAS exposure and severe health outcomes including cancer, hepatotoxicity, and immunosuppression.

Current PFAS degradation technologies suffer from critical limitations that prevent widespread implementation, including limited degradation capacity for the broad range of PFAS commonly detected in the environment and prohibitively high energy and material demands. Traditional photocatalysts like TiO<sub>2</sub>, while promising, exhibit fundamental drawbacks including poor visible light absorption, large bandgap, high electron-hole recombination rates, and inadequate performance in pure form. Carbon dots (CDs) are emerging photocatalytic nanomaterials that can be sustainably synthesized from lignin precursors and possess many attractive characteristics, including low toxicity, tunable surface chemistry, and excellent visible light activity. CDs represent an ideal photocatalyst to combine with TiO<sub>2</sub> because they enhance PFAS adsorption through electrostatic interactions while suppressing electron-hole recombination in the heterojunction, significantly improving overall photocatalytic performance. Our preliminary research with magnetic nitrogen-functionalized carbon dots (N-MCDs) demonstrates effective sorption and degradation of dyes and consistent reusability, confirming the viability of this sustainable nanomaterial approach.

Further enhancement has been explored through strategic integration with non-thermal plasma (NTP) technology, which has demonstrated synergistic effects when combined with photocatalysts. Furthermore, UV photons generated during plasma discharge simultaneously activate photocatalytic reactions, creating a self-reinforcing treatment system that overcomes traditional photocatalytic deficiencies through enhanced visible light activity and reduced electron-hole recombination. The proposed hybrid technology could offer additional advantages including low cost, ambient operating temperatures, reduced energy demands, and scalability for large-volume applications.

**BIO:** Ryan Gains is a second year PhD student in the Environmental Engineering Department focusing on water treatment topics. His research focuses on addressing emerging contaminants for the purpose of potable water reuse, as well as monitoring of pathogenic bacteria and toxicological studies of pollutants.

# **From the Pearl of the Inner Harbor to Noah's Ark: The Transformation of the National Aquarium**

**Weilan Ge**

University of Florida, Gainesville, FL, USA

This paper explores the development of the National Aquarium from the 1980s to the present from the perspective of environment history, urban history, oceanic history, and animal history. It asks several fundamental questions: What is the driving force behind the successive transformations of the Baltimore Aquarium? Does the aquarium's transformation reflect the changing relationship between the city and the sea? The success of the National Aquarium shows that urban renewal is not only the work of urban elites and ordinary people but also the marine life, and its transformation reflects the continuous adjustment of the boundary between the city and the sea to cope with the crisis of the ocean. By weaving the story of the National Aquarium with urban renewal, marine science and conservation, and the movement of animal rights, this paper aims to contribute to discussions such as the history of aquariums and zoos, the environmentalist movement in the United States, and the changing attitudes towards whales and other marine life.

The story of the National Aquarium illustrates how the aquarium, as a miniature marine ecosystem within the city, created by humans and nature, blends different ideas and needs to change the environment and change people's understanding of the city and the ocean. After establishing cities, humans have continuously encroached on marine territory, drawing sustenance from marine ecosystems for their own development. The aquarium served the urban renewal strategy of "returning Baltimore to the sea," leveraging marine resources and power to develop the city's economy. In the 21st century, the marine crisis has become the greatest threat to sustainable urban development, prompting a reintroduction of marine ecosystems into cities, a proactive reduction in urban expansion, and a readjustment of the boundaries between cities and the ocean. The National Aquarium has become an important component of urban-marine environmental protection, actively promoting harmonious coexistence between humans and the ocean. In addition, the aquarium has profoundly changed people's perception of marine life. Visitors have had close encounters with marine life during their aquarium visits, transforming their attitudes from fear to affection. The magical marine creatures and mini marine ecosystem in the water tank make tourists feel deeply connected to the ocean, prompting them to support the protection of the ocean. To some extent, the captive breeding of marine life in aquariums has fostered forces opposing captive breeding policies and advocating for animal rights, thus driving progress in areas such as animal conservation and environmental protection. Environmental inequality not only exists widely across race, gender, and class, but also includes non-human life living in the cities and oceans. Since its founding, the aquarium has served as a significant bridge between Baltimore and the ocean, both economically and ecologically.

## Testing Microbial Infections as a Stress Marker to Grazing and Water Quality in Florida's Nature Coast Seagrasses

*Ella Gerace*<sup>1</sup>, *Enie Hensel*,<sup>2,3</sup> *Savanna C. Barry*<sup>2</sup>, *Laura Reynolds*<sup>3</sup>

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Seagrass ecosystems provide important ecological functions which include providing structurally complex habitats for a wide diversity of marine fauna, yet they are declining worldwide. Therefore, active management of these systems is essential. Seagrass monitoring programs are useful to measure changes in seagrass ecosystem function, but programs often focus on variables that can be influenced by human activities (e.g., nutrient run-off), and don't include natural stressors such as grazing. Here we test if visible microbial infections on seagrass leaves can act as a stress indicator of both grazing pressure and changes in water quality. Grazing from small invertebrates damage seagrass leaves via complete removal or scarring of plant tissue. These grazing wounds facilitate visible microbial infections, or lesions, amplifying the impact. Additionally, invertebrate community composition has been shown to change across differing nutrient concentrations, spatially altering grazing impacts. The Nature Coast Aquatic Preserve on Florida's Gulf Coast is an ideal location for this study as it offers a unique and natural phosphorus gradient that can be leveraged as a natural control of nutrient availability, and its seagrass monitoring program can directly benefit from our findings. We used four locations for seagrass shoot samples across this gradient: Crystal River, Homosassa, Weeki Wachee, and Hudson-listed here from high to low ambient phosphorus levels, respectively. From these systems, we collected three sample shoots in up to ten unique sites per location. Using the second oldest leaf from each shoot, we measured the total grazing and microbial infection area to the blade area. We hypothesize that grazing intensity and nutrient availability will both positively correlate to microbial infections and potentially demonstrate an interactive effect between these variables. As the impacts of climate change increase, identifying indicators to measure stress in seagrass is vital for proactive management practices.

**BIO:** Ella Gerace is a senior undergraduate with a major in wildlife and ecology conservation and minors in agriculture and natural resource communications and international studies. During her time as an undergraduate, she has focused on gaining experience in coastal conservation and science communication through the Gulf Scholars Program.

## Hydrological and Water-Quality Responses of a Grazed Pasture: Field Monitoring and APEX Simulation

**Namrata Ghimire**, Golmar Golmohammadi, Seyed Mostafa, Saba Shaghghi, Gurjoban Tiwana  
University of Florida, Range Cattle Research and Education Center, Ona, FL, USA.

Management practices such as rotational grazing, stocking rate and prescribed fires strongly influence the hydrological process, including groundwater and surface-water quality, in subtropical pastures. This study includes the ranch-level hydrological observations with the Agricultural Policy/Environmental eXtender (APEX) model to evaluate water flow and nutrient dynamics in a rotationally grazed bahiagrass (*Paspalum notatum*) pasture in Florida. Groundwater wells were installed in one pasture (~8 ha) for continuous water-level and water-quality data collection, as well as in three ditches for surface and sub-surface hydrological responses. Field measurements of water-level, discharge, nitrate, total phosphorus (TP) were used to calibrate the APEX's surface runoff, baseflow, and nutrient transport modules. Nash-Sutcliffe Efficiency (NSE) evaluated the model's performance whereas percent bias (PBIAS) metrics were used for flow and nutrient loads. Different scenarios were simulated to understand the management effect on infiltration, runoff generation, and nutrient export. This integrated ranch-level approach demonstrates the potential of APEX for quantifying the hydrological trade-offs associated with pasture management practices.

**BIO:** Ms. Namrata is pursuing her PhD at the University of Florida-RCREC. Before her PhD, she worked as a Biological Scientist and led different projects from Long-Term Agroecosystem Research Network (LTAR) related to pasture management. Currently, she is focused on integrating watershed simulation models and different AI models.

## Forest Management for Water and Carbon: Leaf Area and Groundwater Trends in Florida's Wetlandscapes

*Katie Glodzik*<sup>1</sup>, *Beatriz Pace-Aldana*<sup>2</sup>, ***Beth Lewis***<sup>2</sup>, *Kristina Serbesoff-King*<sup>2</sup>, *David Lewis*<sup>3</sup>, *Cristina Cervantes*<sup>3</sup>, *Matthew J. Cohen*<sup>1</sup>

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<sup>3</sup>University of South Florida, Tampa, FL, USA

Understanding how forest management influences water yield and carbon storage is a central issue in Florida's wetland-rich landscapes. In the southeastern United States, decades of fire suppression and intensive silviculture have produced dense closed-canopy forests unlike the open pine savannas that once dominated uplands. Restoration now focuses on reestablishing open-canopy systems to recover native biodiversity and ecosystem structure. Because leaf area index (LAI) and water yield (precipitation minus evapotranspiration) are inversely related, open-canopy restoration may also help counter groundwater declines. In partnership with The Nature Conservancy (TNC), University of Florida (UF), and University of South Florida (USF), this research evaluates whether practices that lower LAI (prescribed fire and thinning) can enhance water availability without reducing carbon storage. Increasing upland water yield may provide additional water for embedded wetlands, thereby enhancing wetland soil carbon storage. We integrate remote sensing, groundwater monitoring, and elevation-based modeling across two TNC preserves—Disney Wilderness Preserve and Tiger Creek Preserve—to quantify long-term changes in LAI and hydrology.

Using satellite-derived time series (1985-2024), we find declines in LAI, consistent with increased prescribed fire. Groundwater records (1997-2024) show a general rise in water levels, largely tracking precipitation. While these broad patterns initially appear consistent with the inverse LAI-water yield relationship, regression analysis reveals an unexpected positive link between preserve-wide annual LAI and groundwater. In these ecosystems, wet years may simultaneously raise groundwater and promote vegetation growth, masking the underlying negative effect of LAI on water yield. To examine spatial patterns, we developed pixel-based inundation maps to quantify wetland hydroperiods and characterize their expansion after 2010, when groundwater levels began rising. Inundation maps will be paired with upcoming soil carbon sampling to link upland properties, hydroperiods, and carbon storage. This project exemplifies an applied science-management partnership and provides insights to help balance water yield and carbon outcomes.

**BIO:** Dr. Katie Glodzik is a geospatial scientist at the University of Florida specializing in remote sensing and geospatial analysis to inform forest and watershed management. She earned her Ph.D. from UF's Center for Wetlands and her Master of Environmental Management from Duke University's Nicholas School.

## Hydrologic Variability Shapes Soil Moisture, Microbial Communities and Carbon Cycling functions Across Wetland Terrestrial–Aquatic Interfaces

*Audrey H. Goeckner, Matt Cohen, Christopher Dutton Josh Epstein, James Maze, Amanda Subalusky*  
University of Florida, Gainesville, FL, USA

Freshwater wetlands contribute substantially to the global carbon cycle by storing large quantities of organic carbon in sediments and emitting methane and carbon dioxide gases to the atmosphere. Dynamic water level fluctuations control the spatiotemporal occurrence of terrestrial-aquatic interfaces (TAIs) in wetlands, zones that may process C differently from their end-members. TAIs represent a critical and understudied component of wetland C budgets, across which microbial structure and function are seldom characterized. To improve our understanding of wetland carbon cycling, we monitored water levels, soil physical and chemical properties, and the microbial communities that mediate carbon cycling along the terrestrial-aquatic interface of 12 central Florida wetlands that vary in inundation frequency and duration. At five topographic points along a TAI transect from lower to higher elevation (basin to upland), high frequency soil physical property measurements (moisture, temperature, conductivity) were logged with SenseCAP LoRaWAN sensors beginning July 2024. From the same points we conducted four separate sampling events (Nov. 2024 to July 2025) under varying water level conditions to collect 30cm soil cores and characterize the community structure (16S rRNA metabarcoding) and carbon-cycling functions (shotgun metagenomics) of microbial communities, in addition to organic matter, carbon, and nitrogen content. Preliminary results from >1 year of sensor records reveal substantial inter- and intra-site variability in soil moisture driven by inundation frequency, and organic matter content. Further, the composition and diversity of microbial carbon cycling functional genes suggest a strong association with wetland topography. We expect that microorganisms will also vary based on topographic zone, and that less water level variation will produce less diverse communities, whereas greater water level variability will support more diverse communities. This research advances our understanding of how dynamic aquatic interfaces contribute to wetland carbon cycling and how water level variation plays a role in regulating wetland ecosystem functions.

**BIO:** Dr. Goeckner is a freshwater ecologist and postdoctoral researcher in the UF Biology Department. She studies carbon and nitrogen cycling from microbial to ecosystem scales and is currently focusing on how water level variability influences microbial activity and carbon fluxes at terrestrial-aquatic interfaces to better understand wetland carbon dynamics.

# Flood Susceptibility Mapping of Florida

***Golmar Golmohammadi<sup>1</sup>, and Nikolaos Tziolas<sup>2</sup>***

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Flood susceptibility maps are crucial for identifying high-risk areas and guiding mitigation strategies tailored to regional conditions. In this study, we machine learning models with the SHapley Additive exPlanations (SHAP) framework to produce interpretable flood susceptibility maps for Florida. This analysis was conducted statewide, incorporating Thirteen geospatial conditioning factors, including elevation, slope, soil drainage, land use/land cover, and precipitation. The results were compared with the traditional approaches. Deep learning models, such as convolutional neural networks (CNNs) and residual networks (ResNets), have improved predictive performance compared to traditional methods by capturing complex spatial patterns.

## Lake Alice Watershed Management Plan

Charles Kammin<sup>1</sup>, Linda Dixon<sup>1</sup>, **Amy Goodden**<sup>2</sup>, and Scott Knight<sup>2</sup>

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Lake Alice, the largest waterbody on the University of Florida campus, functions as the primary permitted stormwater feature, receiving, attenuating, and providing a degree of water quality treatment for stormwater generated from more than 1,000 acres of campus and adjacent portions of the City of Gainesville. The streams that flow across campus and feed Lake Alice serve as the primary conveyances receiving stormwater from overland flow and stormwater infrastructure. The purpose of the Lake Alice Watershed Plan (WMP) was to create a living document that acknowledges the importance of this natural feature, presents a vision for the watershed, and makes recommendations for short-term and long-term management decisions for the lake and watershed.

Development and implementation of the Lake Alice WMP allows UF to manage the lake and its drainage features, and to respect this multifaceted role, while enhancing these ecosystem services. The WMP will guide the University as it seeks to integrate the natural resources of the lake and watershed with those of the built environment to create a healthy and balanced urban ecology. As the University and Lake Alice continue to evolve, the WMP will adapt to achieve long-term incremental progress towards a healthy and well-balanced lake and watershed.

The overall vision is expounded by four vision themes that describe aspirational goals and focus for the plan strategies:

1. Environmental Conditions and Stormwater Management
2. Recreation, Access and Accessibility, and Education
3. Conservation and BIO:diversity
4. Organizational Accountability, Collaboration, and Responsiveness

The presentation will provide an overview of the process used to develop the WMP, gather community perspectives and gain stakeholder commitment to inform management decisions.

**BIO:** Ms. Goodden is a Senior Engineer at Wetland Solutions, Inc., specializing in design and modeling of wetland restoration, stormwater treatment, and wastewater treatment systems. Her experience also includes extensive knowledge of environmental permitting regulations.

## **SAV Recovery at Scale: Response of Managed Wetlands to Drawdown and Large Lake to Turbidity Controls**

*Kevin Grace<sup>1</sup>, Holly Andreotta<sup>2</sup>, Jake Dombrowski<sup>2</sup>, Camille Herteux<sup>2</sup>, Jessica Jenison<sup>2</sup>, Mike Jerauld<sup>1</sup>, Stacey Ollis<sup>2</sup>, and Zachery Welch<sup>2</sup>*

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Submerged aquatic vegetation (SAV) is a critical component of both natural (nearshore marine environments, lakes, streams and spring runs) and engineered aquatic systems (e.g., stormwater treatment area (STA) wetlands for Everglades restoration). Loss of SAV due to relatively deep, turbid water conditions can occur over large areas, so techniques to restore these critical habitats must also work at a large scale. Two recent large-scale efforts to promote SAV recovery highlight the associated opportunities and challenges. In a large managed treatment wetland (2,300 acre), well-established SAV provided nutrient removal for many years before deep water conditions from intense rainfall in 2017 preceded a switch to a turbid, unvegetated state, and SAV has been slow to recover. Managers conducted a water-level drawdown in 2025 to promote SAV germination through soil consolidation. Timing and duration were informed by earlier applied experimentation. Recovery evaluation is underway. Separately, high water levels following Hurricane Ian in 2022 led to loss of SAV in Lake Okeechobee. Water level control for SAV recovery in this large lake is challenging. A pilot project investigated a scalable approach to reduce turbidity and improve spring light conditions within littoral SAV beds. At each of two sites, 1200 linear feet of turbidity controls were installed, partially enclosing ~5 acres and sheltering larger areas from wind-waves from multiple directions. The controls improved turbidity and light penetration only slightly but nonetheless showed promise for SAV habitat restoration for the lake's sport fishery. The two projects represent ecosystem-engineering approaches to coordinate SAV recovery after losses from light limitation from deep, turbid water. In both systems, water level reduction for SAV recovery creates trade-offs with other ecosystem services. Interestingly, herbivory was a conspicuous factor apparently limiting more rapid SAV recovery in both systems; engineered refugia merit further investigation as a potential SAV sustainability and recovery strategy.

**BIO:** Kevin Grace, Senior Scientist at DB Environmental, has conducted and supervised a wide range of environmental research projects in south and central Florida since 1997. His projects often couple field surveys of vegetation and soil chemistry with mesocosm and laboratory experiments to improve wetland treatment of agricultural drainage waters.

## **Local Government's Uphill Battle to Meet Basin Management Action Plans (bMAPS)**

*Stacie Greco*

Alachua County Environmental Protection Department, Gainesville, FL, USA

Across the State of Florida many waterbodies are failing to meet water quality standards, triggering the Florida Department of Environmental Protection (FDEP) to adopt Total Maximum Daily Loads (TMDLs) which establish the maximum amount of pollution a waterbody can receive and still meet water quality standards. To meet the TMDLs, FDEP works with stakeholders to create Basin Management Action Plans (BMAPs) with the goal of improving water quality. BMAPs identify sources of pollution and then allocate load reductions to responsible entities, such as local governments, agriculture producers, golf courses, and private wastewater treatment facilities.

This presentation will explore the local government experience with meeting BMAP allocations through the lens of the Alachua County Environmental Protection Department. Alachua County is within three BMAPs and has a proposed total allocation of 270,760 pounds of nitrogen and 1,206 pounds of phosphorus per year. Despite having spent hundreds of thousands of dollars on watershed-scale nutrient evaluations, implementing the most protective fertilizer ordinance in the State, and offering rebates for septic system upgrades, Alachua County is still struggling to meet its allocation. This presentation will highlight the magnitude of this challenge and provide examples to illustrate the issues.

**BIO:** Stacie Greco is Alachua County's Water Resources Program Manager, where she has worked for the past 22 years. She received a B.S. in Environmental Science from Warren Wilson College prior to obtaining her M.S. in Environmental Engineering Sciences from the University of Florida and a graduate certificate in Social Marketing.

# **Alachua County's Florida-Friendly Landscaping™ Code: Implications for Statewide Efforts**

***Hollie Greer***

Alachua County Environmental Protection Department, Gainesville, FL, USA

This presentation will provide an overview of Alachua County's Homeowner Association Florida-Friendly Landscaping™ (FFL) code, which mirrors State Statute 373.185 and was adopted into local code in 2019. Alachua County's implementation and enforcement of the code at the local level is unique and has provided opportunities for important collaborative partnerships with other agencies that share common environmental goals and a mission to promote FFL regionally and statewide. The process for code adoption and implementation will be discussed, along with a recent code enforcement case where the County prevailed against an HOA. We hope to inspire other local governments to adopt an HOA Florida-Friendly Landscaping™ code in their ordinances by highlighting positive implications for statewide conservation, resiliency, restoration and stewardship efforts.

**BIO:** Hollie Greer is a Senior Environmental Specialist with the Alachua County Environmental Protection Department. She implements the County's HOA Florida-Friendly Landscaping™ and Irrigation Design Standards codes and advances efforts that encourage sustainable residential and commercial landscape approaches to foster water conservation and reduce pollution impacts to the state's water.

# Evaluating the Economic Feasibility of Shellfish Aquaculture to Generate Nutrient Credits

*Kelly A. Grogan<sup>1</sup>, William Corcoran<sup>2</sup>, Gabrielle Foursa<sup>2</sup>, Ashley Smyth<sup>2</sup>, and Shirley Baker<sup>2</sup>*

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The state of Florida currently allows point sources to purchase nutrient credits to meet Basin Management Action Plan requirements. This market, however, is rarely utilized, potentially due to a lack of available credits. While only point sources can use credits to meet their regulatory requirements, non-point sources can supply nutrient credits to point sources. This paper examines the economic feasibility of incorporating shellfish aquaculture into nutrient credit trading programs. We surveyed shellfish aquaculture producers to determine the reservation price at which they would be willing to produce shellfish to generate nutrient credits in different water classifications, and we surveyed wastewater treatment plants to determine the lowest possible price that they would be willing to pay for nutrient credits.

We found that the majority of shellfish producers would need to receive credit prices at least as high as the prices they currently receive for producing shellfish for human consumption, resulting in a median reservation price of \$740/kg N for littleneck clam producers and \$2,919/kg N for oyster producers. Many also reported uncertainty about their willingness to produce shellfish in waters where the sale of shellfish for human consumption is forbidden. Given their relatively high reservation price, shellfish producers would not be competitive suppliers of nutrient credits under current nutrient credit trading market conditions, where wastewater treatment plants are the only purchasers of credits (median willingness to pay = \$2.87/kg N). However, if the market expanded to include non-point sources such as municipalities managing stormwater runoff, which incur significantly higher abatement costs (\$505.62 - \$42,786/kg N depending on practice and conditions), shellfish producers would become competitive producers of nutrient credits. Given the high costs associated with reducing stormwater runoff and other non-point sources of nutrients, allowing non-point sources to purchase credits could also significantly lower the costs of achieving water quality targets.

**BIO:** Dr. Grogan is an associate professor in the Department of Agricultural and Applied Economics at the University of Wyoming. She has 19 years of experience investigating the economics of water conservation and water quality programs in agricultural systems.

## What Are the Chances? A Geospatial Tool for Predicting Nutrient Loading to Florida's Waterbodies

*Edgar Guerron-Orejuela<sup>1</sup>, Kai Rains<sup>1</sup>, Moses Okonkwo<sup>2</sup>, and Mark Rains<sup>1</sup>*

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<sup>2</sup>Florida Department of Environmental Protection, Tallahassee, FL, USA

Excess nutrient loading remains one of the most significant water-quality challenges in Florida, contributing to eutrophication, harmful algal blooms, and the degradation of freshwater and coastal ecosystems. The Northern Everglades and Estuaries Protection Program (NEEPP) region is particularly vulnerable due to its complex hydrology, extensive agricultural and urban development, and diverse nutrient sources, including agricultural and urban stormwater runoff and numerous onsite sewage treatment and disposal systems (OSTDS). Targeted restoration and protection efforts require spatially explicit tools that can identify where nutrient additions are most likely to reach and impact waterbodies. To address this need, the University of South Florida Ecohydrology Research Group (USF-ERG), in partnership with the Florida Department of Environmental Protection (FDEP), developed a large-scale decision support tool to assess nutrient loading potential to waterbodies. The resulting model, LANLoad (Landscape Assessment of Nutrient Loading to Waterbodies), integrates publicly available geospatial datasets and expert knowledge through the Analytic Hierarchy Process (AHP). AHP was used to define, weight, and combine key parameters influencing nutrient transport potential, including distance to waterbody, depth to groundwater, hydraulic conductivity, hydraulic gradient, potential for flooding, and depth to surficial karstic geologic deposits. These parameters were integrated within an ArcGIS environment to produce a map representing relative nutrient loading potential to all waterbodies within NEEPP. Model performance was evaluated using two independent approaches: a numerical nutrient loading model (ArcNLET-Py) and expert-based assessments. LANLoad demonstrated strong agreement with both methods, achieving 100% concurrence with ArcNLET-Py and 92% concurrence with expert-based assessments. LANLoad provides a transparent and reproducible framework for visualizing nutrient loading potential and prioritizing management interventions such as septic-to-sewer conversions, stormwater retrofits, or land-use modifications. Its adaptability across diverse hydrologic settings makes it a valuable science-based tool to support nutrient management, restoration planning, and policy development aimed at improving water quality across Florida's surface waters. It is now made widely available through a collaboration between USF and the FDEP.

**BIO:** Edgar Guerrón-Orejuela is a Postdoctoral Fellow in the Ecohydrology Research Group at the University of South Florida. Edgar's interest in understanding and communicating the interrelations between groundwater, surface water, and society have allowed him to conduct research geared towards serving different communities in Alaska and Florida by creating shared understanding of resource distribution and limitations.

# CHARTING CHALLENGES AND OPPORTUNITIES AHEAD: EXPERT CONSENSUS ON STORMWATER POND MANAGEMENT

*Cody Gusto, Paul Monaghan, and Basil Iannone*

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Stormwater ponds (SWPs) are ubiquitous across Florida's residential landscapes, yet their environmental performance is often constrained by homeowners' aesthetic expectations, uneven management, and limited long-term planning. Insights from a UF/IFAS Extension-led workshop series with homeowners and homeowner association (HOA) representatives underscored these challenges—highlighting aesthetic resistance, governance complexity, and uncertainty over costs and responsibilities as recurring barriers to implementing best management practices (BMPs) such as pond plantings. These findings informed a subsequent Delphi study to facilitate expert consensus on critical pond management challenges, actionable “success strategies” to improve management outcomes, and emergent trends likely to influence SWP practice over the next decade.

We conducted a three-round Delphi process with a remote panel of 35 Floridian stakeholder experts—including HOA board members, pond management professionals, landscape architects, stormwater engineers, Extension agents, and grassroots water quality advocates—to identify and prioritize the most salient barriers, success strategies, and emerging trends influencing residential pond management. In Round 1, panelists generated 91 unique items across these categories. In Round 2, participants rated each item on a 7-point scale, reaching consensus ( $\geq 67\%$ ) on 13 barriers, 26 strategies, and 4 future trends. In Round 3, panelists classified these items into short-, medium-, and long-term priorities for implementation, offering researchers and practitioners alike a foundational roadmap for the targeted and strategic mobilization of scarce resources.

Findings underscore persistent normative and structural constraints—such as aesthetic resistance to vegetated buffers, reliance on “silver-bullet” chemical treatments, and reluctance to allocate proactive budgets—while emphasizing the importance of demonstration projects, sustained HOA education, and embedded long-term financial planning. These consensus-driven outcomes integrated community-informed context with expert foresight, offering a pragmatic foundation for researchers, Extension professionals, and grassroots stakeholders to further collaborate to strengthen SWP quality across Florida's residential landscapes.

**BIO:** Dr. Cody Gusto is a researcher at the University of Florida specializing in evaluating behavior change and decision-making in agricultural, natural resource, community development, and public health contexts. His work integrates program design, behavioral change theories, and participatory research methods to foster community-level change and sustainable resource management.

# Integrating Physical Knowledge and Machine Learning for Agricultural Water Management: Field Applications

**Sandra M. Guzman** and *Gregory Conde*

University of Florida, Agricultural and Biological Engineering Department, Indian River Research and Education Center, Fort Pierce, FL, USA

Integrating mechanistic processes with machine learning and on-farm water management practices has the potential to accelerate water savings, improve reliability, and enable real-time control, critical needs for Florida's diverse crops, soils, and water management practices. In this presentation, we discuss state-of-the-art methods for embedding hydrological knowledge with in-field sensor data to schedule irrigation and track root water uptake. We use a case study from a citrus research trial that implemented an adaptive, receding-window Physics-Informed Neural Network (PINN) fusing discretized Richards' equations with irrigation, rainfall, and evapotranspiration inputs, and discuss pathways for practical adoption. Our study explained 81% of observed variability in soil moisture and identified the zone of maximum root water absorption for site-specific scheduling. Studies have demonstrated that physics-informed machine learning approaches reduce data needs, enforce mass/energy consistency, and improve out-of-sample robustness relative to black-box ML. PINNs and hybrid strategies have shown accuracy in groundwater and infiltration problems, but practical deployment requires careful hyperparameter tuning, uncertainty quantification, and robust data management. Scaling to Florida water management at the field level would require a layered cyber-physical architecture with dense in-field sensor networks, data preprocessing, and user-inspired front-end interfaces. Current applications and proposed developments will be discussed.

**BIO:** Dr. Sandra M. Guzmán is an assistant professor of smart irrigation and hydrology in the Department of Agricultural and Biological Engineering at the Indian River Research and Education Center in Fort Pierce, FL. Her research program focuses on sustainable agricultural water management, using sensor networks and data analytics to optimize water use efficiency and crop productivity.

## **Integration of Flood Risk Management Projects into Regional Resilience Efforts**

***E. Timothy Gysan, P.E., PMP***

U.S. Army Corps of Engineers, Jacksonville, FL USA

Building resilience requires coordinated efforts from all levels of government; no single entity can build resilience alone. The problems related to long term resilience are uncertain, broad, and complex and it is essential to survey and assess relationships among all public and private sector deliverables and capabilities at local, regional, state and federal levels – to determine the most appropriate and effective packaging of programs, projects, and services to accomplish resilience and sustainability objectives. Each level of government has an important part to play and understanding how solutions fit together is vital to achieving resilience goals.

In low lying areas like south Florida, the inland and coastal drivers of flooding must be viewed together to understand the risks to these coastal communities and how to plan projects to increase community resilience. The inland drivers and coastal forcings tend to meet in the coastal ridge area resulting in compounded water levels and increased damages. Increased rainfall runoff, due to loss of inland storage resulting from urbanization and loss of natural ecosystems, combines with higher groundwater levels, exacerbated by sea level rise, to negatively impact flood risk in these communities. To address the many drivers of flood risk, the multiple lines of defense concept are being employed to combat different climate change variables and increase community resiliency. Federal, state, and local efforts from the coast to inland areas work together to address the various sources of flooding. This presentation will explore the mechanisms of integrating flood risk management efforts with other resilience focused efforts to achieve successful resilience outcomes.

**BIO:** Mr. Gysan has over 25 years' experience as a civil engineer and project manager with the US Army Corps of Engineers developing water resource projects including flood risk management, ecosystem restoration, and water management operational planning efforts.

## Wetland Soil Organic Matter Storage as a Response to Hydrologic Variation

Faith Hale<sup>1</sup>, David Lewis<sup>1</sup>, and Nicholas Ward<sup>2</sup>

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<sup>2</sup>Pacific Northwest National Laboratory, Coastal Sciences Division, Sequim, WA, USA

Wetlands are ecosystems characterized by unique Biological, chemical, and hydrological features, which include intermittent or permanent inundation of hydric soil and associated storage of carbon (C). Wetland soils are one of the largest terrestrial C sinks, making the role of wetlands in climate change mediation vital. Wetlands experience dynamic inundation, causing the terrestrial-aquatic interface (TAI) to constantly expand and contract across wetland basin slopes. A key uncertainty is how this hydrological variability influences the patterns of C storage across topographically complex wetland TAIs. This study examined soil organic matter (SOM) stocks as a function of historic inundation across the TAIs of six wetlands embedded in a low-relief landscape of deep, well-drained sands in the humid subtropics of northern Florida, USA. The studied wetlands were chosen to span a gradient in water level variation. In each wetland, about ten ~60-cm deep soil cores were extracted along a transect spanning the range of dynamic inundation, from approximately the basin's deep point, through the TAI, and into the uplands. Loss-on-ignition SOM stocks in the top 20 cm of soil were 70-80 % of soil dry mass in the most inundated soils, at or near the basin deep points, and declined with increasing topographic position to 5-30 % in the sandy upland soils. Wetlands with low temporal hydrologic variability (i.e., lower standard deviation in water-level elevation) exhibited more abrupt decreases in SOM stock across this topographic gradient. Conversely, wetlands exhibiting relatively high hydrologic variability showed a more gradual decrease in SOM stock from the deep-basin position to the uplands. The top 20 cm of soil had a greater SOM stock than deeper (40-60 cm) soil regardless of topographic position across the TAI. Variation in SOM in the top 20 cm was explained by hydroperiod (percentage of time inundated), with SOM increasing from 20 to 75% as hydroperiod increased from 15 to 100%. This study highlights the essential role of dynamic changes in inundation (i.e., hydroperiod), rather than simply mean water level, in regulating wetland carbon storage and, by extension, the influence of wetlands in mediating climate change. Further research could assess the health of the wetland ecosystem and water quality by exploring the relationship between carbon storage and inundation regimes.

**BIO:** Faith is a third-year master's student at the University of South Florida pursuing a degree in biology with a concentration in Ecology and Evolution. Faith had a four-month internship in 2023 with the U.S. Department of Energy (DOE) at the Los Alamos National Laboratory in New Mexico. She is currently part of a research team working on a DOE-BER project focusing on water and carbon dynamics of coastal plain wetlandscapes since the beginning of her graduate program.

## **One Water in Action: Breaking Silos, Building Resilience, Managing Ever Drop**

*Gary Hubbard<sup>1</sup>, Brett Goodman<sup>2</sup>, David Rathke<sup>3</sup>, **Lee Hale<sup>4</sup>**, and Cassidy King<sup>1</sup>*

<sup>1</sup>City of Winter Haven Water Department, Winter Haven, FL, USA

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<sup>3</sup>Hale Innovation, Maitland, FL, USA

Achieving One Water goals demands consistent, long-term investment. This session explores how Florida communities are aligning funding strategies across utilities, agencies, and local governments to advance integrated water solutions. Presenters will share approaches for navigating evolving state, federal, and resilience funding opportunities; leveraging partnerships to maximize return on investment; and designing projects that deliver multiple benefits—from improved water quality to enhanced climate resilience. Attendees will gain practical insights into how coordinated funding strategies can transform vision into action and generate enduring, cross-sector impact.

**BIO:** As founder of Hale Innovation, Lee Hale helps communities modernize water systems through practical engineering and technology solutions. With roots in West Virginia and a career shaped by Florida's utilities and consulting sectors, he focuses on making water infrastructure modern, safe, and affordable. His work ensures innovation translates into real-world results.

# ESTIMATING PREFERENCES FOR STRATEGIC PROPERTY RELOCATION PROGRAMS IN US COASTAL REGIONS

*Nicholas Haley<sup>1</sup>, Olesya Savchenko<sup>1</sup>, and Leah Palm-Forster<sup>2</sup>*

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<sup>2</sup>Applied Economics and Statistics Department, University of Delaware, Newark, DE, USA

Rising sea levels and more severe weather events due to climate change pose a substantial threat to coastal communities, which are among the most vulnerable to displacement and property damage from flooding. Historically, policymakers in coastal areas have relied on structural interventions, such as levees or seawalls, to mitigate hazards. However, these measures are increasingly recognized as unsuitable for many coastal environments. In response, adaptation policies now place greater emphasis on strengthening natural defenses and relocating vulnerable property away from high-risk areas. In the U.S., voluntary buyouts are a federally subsidized grant initiative that allows local governments to purchase flood-prone properties and permanently convert them into undeveloped open spaces. These green spaces better absorb water during heavy rainstorms and storm surges, helping to reduce flooding risks for the community while also providing recreation opportunities and other ecosystem services. Buyouts are traditionally conducted after flooding emergencies, but some communities have already begun investing in proactively relocating properties to improve resilience. While voluntary buyouts are a beneficial long-term strategy, they have substantial short-term costs, which can prevent many coastal communities from implementing them.

To better understand support for strategic property relocation policy in US coastal regions, we distributed a choice experiment to 1,000 residents in 34 Atlantic coastal counties. A choice experiment is a commonly used valuation method in environmental economics to value tradeoffs among policy alternatives. Our choice experiment asks respondents to choose between potential relocation programs for their area based on different eligibility criteria, relocation support, future land use and increases in stormwater service fees. We also estimate the impact of individual flood risk perception and risk preferences on willingness to help fund buyout programs. Our results will help inform policymakers in coastal regions without existing buyout programs, and contribute to the literature on preferences for climate adaptation.

**BIO:** Nicholas Haley is a Ph.D. student in the Food and Resource Economics Department. His research combines economic valuation methods and survey design to understand how individuals respond to environmental challenges. He has worked on several projects that bridge academic research with policy applications, from evaluating the benefits of floodplain improvements to incorporating ecological impacts into agribusiness management best practices.

## Florida's Crossroads: Building Flexible Environmental Policies for Florida's Communities

*Kira Hansen PhD, PE<sup>1</sup>, Kim Arnold PG<sup>1</sup>, Kelley Klepper AICP<sup>2</sup>, Trace Lanson<sup>3</sup>*

<sup>1</sup>Kimley-Horn, Fort Myers, FL, USA

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<sup>3</sup>Kimley-Horn, West Palm Beach, FL USA

Florida stands at a crossroads: rapid scientific progress, significant environmental shifts, and evolving policies are redefining the future of its communities. The state's continued population growth and intense demand for new development (residential, commercial, solar farms, data centers) have placed mounting pressure on the availability and quality of water resources and the native ecosystems that rely on them. Also present is an increase in frequency and severity of extreme weather events like hurricanes, heat waves, and flooding. This mix is resulting in economic and quality-of-life impacts that are impossible to overlook. Local officials have recognized that outdated ordinances and regulations may not adequately address these challenges, creating a need for comprehensive review and modernization beyond routine state requirements. These updates reflect best planning *and* development practices and are designed to incentivize resilient solutions to the growing challenges. Legislative actions, like Surface Water Discharge Elimination Mandate (SB 64), 2024 Statewide Stormwater Rule (SB 7040), and Direct Potable Reuse Mandate have served as catalysts for change, encouraging municipalities to prioritize adaptation in their planning and implementation approach while also considering the impacts of the 2025 Emergencies Rule (SB 180).

In response, municipalities have adopted the use of combined gray and green infrastructure and have further promoted low impact development practices. These include green spaces, stormwater parks, rain gardens, and ecosystem restoration projects, all of which can help mitigate future risks and safeguard natural resources. By leveraging advanced GIS technologies including platforms like *StoryMaps* for communicating spatial data and *Survey123* for gathering community input, municipalities are better positioned to understand vulnerabilities and engage stakeholders. Utilizing crowdsourced data and drawing on the hyper-local expertise of residents, planners, scientists, and policymakers can help craft a policy framework that encourages adaptable and forward-thinking solutions. As such, a holistic and technologically integrated approach to planning updates and code reform is essential to ensure local policies are resilient, flexible, and responsive to both current and emerging environmental and legislative drivers. Our presentation will dive into the real-life implementation of these approaches in communities across Florida.

**BIO:** Dr. Hansen is a professional engineer with nine years of experience involving water resources master planning, hydrologic and hydraulic modeling, agricultural water and nutrient management, grant writing and compliance, stakeholder engagement/ communication. She is passionate about the intersection between land and water resources and the communities that they impact.

## **Working with Stakeholders on Policy Wins**

### ***Chad Hanson***

The Pew Charitable Trusts, Crawfordville, FL, USA

Managing natural resources for long-term sustainability is often a balance of process, data and science, stakeholder or public input and of course politics. This balance is especially true in fisheries where people's and communities' economic livelihoods are at stake, as well as the health of the resource. Following the science is often a good starting point. Talking with affected stakeholders about that science is important to see how that may or may not comport to their real-world perspectives. Working through the science and perspectives in the decision-making process can lead to "win-win" management solutions, especially when compromise and consensus on issues can be offered to decision-makers by stakeholders. A case study on how integrating science and stakeholder insights to protect nearly 500 square miles of deep-sea coral habitat across twenty locations in the Gulf of Mexico (America) from certain bottom fishing activities will be discussed.

**BIO:** Chad Hanson is a science and policy analyst for The Pew Charitable Trusts based in Wakulla County, Florida. Prior to Pew, he was a fisheries biologist for the Florida Fish and Wildlife Conservation Commission. Chad received his Masters of Science in Oceanography from Florida State University.

## **Assessing Freshwater Quality through Nutrient, Metal, and Microbial Indicators**

*Xavier M. S. Harrell, Charles Jagoe, Benjamin Mwashote, Veera LD Badisa, Victor Ibeanusi, Rajesh S. Rathore*

Core Laboratory, School of the Environment Florida Agricultural and Mechanical University, Tallahassee, FL 32307

Freshwater is one of the planet's most limited resources, with only 2.5% classified as freshwater and less than 1% directly accessible for human, agricultural, and industrial use. Although the United States holds nearly 7% of global renewable freshwater, regional disparities create localized vulnerabilities. In Florida, where water covers 18.5% of the surface area, groundwater supplies nearly 90% of drinking water, highlighting dependence on sensitive aquifers and interconnected surface systems. Intensifying pressures from agriculture, recreation, biodiversity conservation, and emerging demands such as Artificial Intelligence (AI) data center cooling exacerbate freshwater stress. In Tallahassee, lakes including Bradford and Piney Z are hydrologically linked to Wakulla Springs, a nationally recognized manatee habitat. This connectivity creates watershed-level risks, where localized contamination can propagate system-wide, threatening ecological integrity and public health.

To assess these risks, water samples from nine Tallahassee sites were analyzed using field probes, ion chromatography (Dionex ICS-2100), and ICP-OES to quantify nutrient and trace metal concentrations. Fish tissues were examined for metal bioaccumulation, while gut microbiota and gill swabs characterized microbial communities and stress biomarkers. Microbial indicators provide early and sensitive signals of ecological disturbance, while nutrient and metal concentrations reveal eutrophication, toxicity, and contaminant pathways. Together, these complementary indicators offer a robust framework for monitoring ecosystem health and detecting freshwater stress before irreversible damage occurs. This integrated approach underscores the value of microbial, nutrient, and metal indicators in freshwater assessment, with implications for Florida's water security and broader strategies for sustainable national water management.

# Simulating the impacts of land-use change with the Suwannee River Ecosystem Model

*Holden Harris<sup>1,2</sup>, David Chagaris<sup>1</sup>, and Micheal Allen<sup>1</sup>*

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In estuaries, freshwater combines with coastal marine waters to drive environmental conditions and determine key ecological processes. Coastal systems are thus strongly influenced by the quality, quantity, and timing of freshwater delivery, which is affected by climate change and land-use changes to meet the needs of a growing human population. Here, we present research and findings from part of the cross-disciplinary and cross-departmental University of Florida project, “Ecological and Economic Impacts of Land Use and Climate Change on Coastal Food Webs and Fisheries.” Specifically, this presentation showcases the ecosystem model, the Suwannee River Estuary Model (SREM), and the end-to-end modeling framework linking a basin-scale hydrology model (SWAT–MODFLOW) to a data-statistical Estuary Linkage Model. The SREM (developed using Ecopath with Ecosim and Ecospace) represents a spatially explicit and trophic dynamic food web model to simulate ecological and fisheries impacts. It includes 66 functional groups and eight fishing fleets for recreational, commercial, and aquacultured fisheries.

We simulated 30 future land use and climate scenarios that were co-developed with stakeholders. Overall, the strongest effects in the SREM were observed in scenarios where higher increases in agricultural land use resulted in higher nutrient runoffs. Increased nutrients drove higher primary and secondary production, which resulted in higher final biomasses for most functional groups. We concurrently modeled how increased phytoplankton production (resulting from higher nutrient levels) caused shading effects and affected seagrass growth and survival, a key habitat for many species in the estuary. To our knowledge, this represents the first attempt to examine non-trophic mediation dynamics between eutrophication and submerged aquatic vegetation with an ecosystem model. Doing so identified trade-offs. Some species, including aquacultured shellfish and most key fisheries species, ultimately benefited from the increased nutrient runoff from higher agricultural land use; meanwhile, seagrasses and seagrass-associated species showed relative declines.

**BIO:** Holden Earl Harris, PhD, is a systems ecologist with over 15 years of experience in conducting applied research on marine and coastal resources. His research programs integrate physical, ecological, and socioeconomic approaches to examine the effects of environmental changes and human impacts on ecosystems and their services for society.

## Acclimation in Action: Recycled Water Boosts Nutrient Uptake Overtime

**Ashley Hennessey**<sup>1</sup>, *Chamoda PDM Dissanayake*<sup>2</sup>, *Audrey Goeckner*<sup>3</sup>, *Ashley Smyth*<sup>4</sup>, *Michael Mantone*<sup>1</sup>, and *AJ Reisinger*<sup>1</sup>

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Wetlands, both natural and constructed, play an essential role in protecting water quality and are increasingly used as tertiary “polishing” systems in recycled water (RW) treatment. However, the ecological consequences of RW inputs on wetland function are poorly understood. To better understand how RW affects the ability of wetlands to protect water quality, this study used controlled microcosm experiments to isolate and quantify the effects of RW on biogeochemical processing within natural and constructed wetland sediments across seasons. Sediments from six Florida wetlands (3 natural, 3 constructed) were incubated with either water collected from the same wetland or RW collected from three treatment facilities in the region under wet- and dry-season conditions. Acute (Day 0) and chronic (Day 7) incubations were conducted to measure ecosystem respiration, net N<sub>2</sub> flux, and nutrient (NH<sub>4</sub><sup>+</sup>, NO<sub>x</sub>, PO<sub>4</sub><sup>3-</sup>) uptake rates. Preliminary wet-season results indicate that exposure to RW enhanced nutrient uptake following short-term acclimation. On Day 0, ammonium was primarily released from natural wetland sediments, but by Day 7, all RW treatments exhibited net NH<sub>4</sub><sup>+</sup> and PO<sub>4</sub><sup>3-</sup> uptake, suggesting a microbial or chemical response that increased nutrient assimilation over time. Nitrate dynamics were variable across treatments, indicating complex nitrogen transformations. Future research will focus on disentangling the role of microbial communities or nutrient availability as drivers of biogeochemical processes. Together, these findings demonstrate that short-term RW exposure can stimulate nutrient processing in wetland sediments, particularly after brief adaptation periods. Ongoing analyses of seasonal trends and site-specific differences will clarify how RW influences wetland biogeochemical function and inform management strategies to optimize water reuse while maintaining ecosystem integrity.

**BIO:** Ashley Hennessey is a first year PhD student in the Soil, Water, and Ecosystems department and a member of the Water Institute Scholars BREWS Program. Her research examines how recycled water influences nutrient cycling and ecosystem function in freshwater systems. She currently serves as Treasurer of the SWES Graduate Student Association.

# Tropicalization and Thermal Refugia: Fish Community Dynamics on Florida's Nature Coast

**Katherine Henning**<sup>1,2,3</sup>, **Robert Lamb**<sup>1,3</sup>, **Debra Murie**<sup>1,2</sup>

<sup>1</sup>University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS), Gainesville, FL, USA

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Climate change is driving tropicalization of subtropical-temperate transition zones, where rising average winter temperatures and increasing frequency of marine heat waves allow tropical species, such as common snook (*Centropomus undecimalis*), to expand poleward. This introduces novel competitors and predators into estuarine communities, while resident temperate species face increased thermal and biotic stress, potentially leading to reduced condition, population declines, or local extinctions. Access to thermal refugia, habitats where water temperatures remain stable year-round, may be critical for both tropical and temperate species. Florida's Nature Coast, with its abundance of aquifer springs and seeps and their relatively constant temperature, provides a unique system to study these dynamics.

This project aims to evaluate the role of estuarine aquifer springs and seeps as essential fish habitat and thermal refugia under tropicalization. We have identified thermal anomalies that may serve as thermal refuges along the Nature Coast utilizing aerial thermal infrared imagery. We will monitor 15 refugia sites and paired ambient control sites, recording year-round temperature data and characterizing fish communities across seasonal extremes. Fish community metrics, including richness, diversity, and trophic structure, will be compared between habitat types. Representative species will be analyzed for diet habits and trophic position utilizing stomach contents, while growth and physiological performance, including reproductive condition, will be assessed through length-weight relationships and gonadosomatic indices.

By integrating environmental monitoring, community ecology, and physiological assessments, this research will clarify how thermal anomalies influence fish assemblages, trophic interactions, and individual performance. Findings will illuminate how tropicalization reshapes estuarine communities and identify critical habitats for management and conservation. Ultimately, this work will support strategies to sustain both tropical range-expanding species and vulnerable temperate residents under a warming climate.

**BIO:** Katherine Henning is an MSc candidate in Fisheries and Aquatic Sciences at the University of Florida. Her research investigates the effects of tropicalization on estuarine fish communities, focusing on how aquifer outflows function as thermal refugia, shaping fish distribution, trophic interactions, and resilience of temperate and tropical species.

# Entropy Matters: How Information Quantity & Quality Shape Hydrological ML Predictions

*Minhyuk Jeung<sup>1</sup>, Young Gu Her<sup>1</sup>, Sang-Soo Baek<sup>2</sup> and Kwangsik Yoon<sup>3</sup>*

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Machine learning (ML) is now commonly employed as a tool for hydrological prediction due to recent advances in computing resources and increases in data volume. The prediction accuracy of ML (or data-driven) modeling is known to be improved through training with additional data; however, the improvement mechanism needs to be better understood and documented. This study explores the connection between the amount of information contained in the data used to train an ML model and the model's prediction accuracy. The amount of information was quantified using Shannon's information theory, including marginal and transfer entropy. Three ML models were trained to predict the flow discharge, sediment, total nitrogen, and total phosphorus loads of four watersheds. The amount of information contained in the training data was increased by sequentially adding weather data and the simulation outputs of uncalibrated and/or calibrated mechanistic (or theory-driven) models. The reliability of training data was considered a surrogate of information quality, and accuracy statistics were used to measure the quality (or reliability) of the uncalibrated and calibrated theory-driven modeling outputs to be provided as training data for ML modeling. The results demonstrated that the prediction accuracy of hydrological ML modeling depends on the quality and quantity of information contained in the training data. The use of all types of training data provided the best hydrological ML prediction accuracy. ML models trained only with weather data and calibrated theory-driven modeling outputs could most efficiently improve accuracy in terms of information use. This study thus illustrates how a theory-driven approach can help improve the accuracy of data-driven modeling by providing quality information about a system of interest.

**BIO:** Dr. Her is an associate professor of hydrology and agricultural engineering at the Tropical Research and Education Center, IFAS/UF. He has extensive experience with hydrological modeling and monitoring, and his research focuses on evaluating and developing management practices under changing environments for improved sustainability.

# Potential Effects of Climate Change on Groundwater Availability & Temperature, South-Central Alaska

*Md Omer Hossain, Kai C. Rains, Mark Rains*

School of Geosciences, University of South Florida, Tampa, FL

Groundwater plays a vital role in maintaining the chemical, physical, and Biological integrity of aquatic ecosystems such as wetlands, lakes, streams, and estuaries. In south-central Alaska, groundwater discharge augments streamflow, providing 70% of annual streamflow; modulates stream temperatures, keeping streams warmer in the winter and cooler in the summer; and delivers nutrient subsidies to streams, especially nitrogen fixed by hillslope alder patches. These streams, in turn, provide critical habitats for salmonids, which have economic and cultural significance throughout the region. However, groundwater resources may be threatened by a purported drying and warming trend on the southern Kenai Peninsula Lowlands (KPL). Numerous studies have been conducted on the purported drying and warming trend on the southern KPL, but all have relied on proxies such as shrinking of waterbodies, vegetation changes, and increased frequency and severity of wildfires. None have systematically analyzed historical and projected climate data to determine whether the purported drying and warming trend is supported by decreases in precipitation (P) and/or increases in air temperature (T) and evapotranspiration (ET). Nor has the potential effect of such changes on groundwater been explored in this region. We used best available historical and projected long-term climate records (1941-2100) from three meteorological stations and the Scenarios Network for Alaska + Arctic Planning (SNAP) dataset to investigate primary evidence of drying and warming trends. By analyzing historical data for P and air T, we found no evident change in average annual P ( $R^2 = 0.00$ ) but a systematic increase in average annual air T of 4.16 °C ( $R^2 = 0.29$ ). A monthly analysis supports the hypothesis that the increase in air T has increased the length of the growing season and the average annual ET. Therefore, though P has not decreased, P-ET has decreased, thereby reducing the surplus water available for groundwater recharge. We also developed and validated a model of groundwater T response to air T. Model results indicate increases in air T have been accompanied by increases in groundwater T which may limit the ability of groundwater discharge to sufficiently modulate summer stream T in some circumstances. The results of this study will provide information to support community conversations focused on water-resources management and salmon-habitat protection.

**BIO:** Md Omer Hossain is a M.S. student (Environmental Science and Policy) working with the Ecohydrology Research Group in the School of Geosciences at the University of South Florida. He earned a B.S. and M.S. in Geography & Environment from University of Dhaka, Bangladesh. His research interests are focused on the integration of hydrology, soil, and climate. He uses a combination of geospatial methods, climatic and hydrologic modeling, statistics and programming techniques.

# Temporal and Spatial Carbon Dynamics in Flatwood, Blackwater Streams: the Internal-External Pendulum

**Samantha Howley**<sup>1</sup>, Matthew J. Cohen<sup>1</sup>, and Amanda Subalusky<sup>2</sup>

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Streams link terrestrial and marine environments by transporting, storing, and transforming terrestrial carbon before reaching the oceans. Terrestrial debris and solutes enter low-order streams, accumulate in high-order rivers, and eventually discharge into coastal marshes and oceans, emitting CO<sub>2</sub> throughout their course. Flowing waters emit CO<sub>2</sub> externally (as vectors for terrestrial-atmospheric exchange) or internally (via in-situ CO<sub>2</sub> production), with high-discharge events driving greater total CO<sub>2</sub> fluxes dominated by internal carbon (i.e., pulse-shunt dynamics). However, the internal-to-external CO<sub>2</sub> ratio in response to spatiotemporal fluctuations, as well as the contribution of internal CO<sub>2</sub> across flow regimes has yet to be thoroughly explored.

We hypothesized that external CO<sub>2</sub> would dominate across flow regimes, with internal CO<sub>2</sub> becoming more prominent during baseflow conditions. To test this, we used high-frequency sensor observations (CO<sub>2</sub>, dissolved oxygen, pH, and depth) and discrete water sampling (CO<sub>2</sub>, CH<sub>4</sub>, DOC, DIC, and POC) to examine spatiotemporal carbon dynamics across nine tannic, headwater streams in the flatwoods of North Florida—a wetland-dense ecosystem with high rates of carbon storage and export. Stream metabolism distinguished between internal and external CO<sub>2</sub> pathways, while DIC, DOC, and POC concentrations were analyzed for discharge responses and correlation to stream CO<sub>2</sub> emissions.

Total stream CO<sub>2</sub> fluxes were positively correlated with discharge, with internal carbon contributing 53% of total CO<sub>2</sub> fluxes, though with considerable variation dependent on flow regime and baseline alkalinity. The ratio of internal-to-total CO<sub>2</sub> fluxes was inversely correlated with discharge—external carbon contributed 70–90% during high-discharge, whereas internal carbon dominated (~75%) during baseflow. DOC concentrations remained high (~50–110 mg/L) and positively correlated with discharge, suggesting flow state rather than DOC supply dictates ecosystem respiration, and thus internal carbon production. These findings challenge assumptions about carbon dynamics in blackwater streams, emphasizing the need to further study carbon-rich, shallow-water table landscapes to understand their role in regional and global carbon cycling.

## **CALIBRATING A 2D HEC-RAS MODEL OF AN OUTSTANDING FLORIDA SPRING WITH ADCP MEASURED FLOW VELOCITIES**

**Shaw Huang**<sup>1</sup>, Sean King<sup>1</sup> and Amy Brown<sup>1</sup>

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Springs are a ubiquitous feature of the Suwannee River Basin and contribute significant baseflows to the river which are important for maintaining recreation, fish and wildlife habitat, fish passage, sediment loads and other water resource values (WRVs). There are 61 Priority Springs on the Suwannee River Water Management District's (District) 2025 Priority MFL list and the District is tasked to develop or re-evaluate minimum flows and levels (MFLs) to protect them from groundwater withdrawals. The District is piloting new methods to evaluate spring-specific WRVs at Lafayette Blue Spring (LBS), an Outstanding Florida Spring, with the intention to apply the new methods on the other priority springs.

A 2D HEC-RAS model was developed for LBS to simulate depths, velocities, stream powers, and shear stresses to assess the critical flows throughout the 2D flow area which includes the spring vent, pool and shoal area where LBS discharges to the Suwannee River. The District used a moving-vessel Acoustic Doppler Current Profiler (ADCP) to collect velocity data along cross sections (XSs) within the spring run to calibrate the 2D model by adjusting Manning's  $n$ . Due to irregular ship tracks of ADCP passes, the USGS Velocity Mapping Toolbox was used to project data collected along the passes onto a straight-line plane that defines measurement XS. The velocity data from individual pass were averaged for the XS to produce a composite representation of the three-dimensional velocity fields. The processed data were then output at the 2D model's grid size interval and converted to shapefiles to compare against RAS Mapper velocity output. Model calibration performance statistics such as Nash-Sutcliffe efficiency, percentage bias, root mean square error ratio, and coefficient of determination were calculated to ensure adequate model calibration.

**BIO:** Dr. Huang is a senior engineer scientist with more than 18 years of experience in hydrological modeling and minimum flows and levels research.

## **Lessons Learned from Winter Haven's One Water Program**

**Gary M. Hubbard, P.E.**

City of Winter Haven, Winter Haven, FL, USA

Winter Haven's One Water program showcases how a city can effectively plan, fund, and implement integrated water management on a large scale. This session will share valuable lessons learned from integrating drinking water, wastewater, stormwater, and natural systems under a unified vision. The presenter will discuss how collaboration across departments and early engagement with stakeholders have strengthened public confidence and informed smarter investment decisions. The discussion will emphasize both the technical innovations and the shifts in organizational culture necessary to maintain momentum. Attendees will leave with practical strategies for applying One Water principles—aligning people, policies, and projects—to enhance resilience and manage every drop of water for future generations.

**BIO:** Mr. Hubbard brings 43 years of experience dealing with environmental issues to central Florida. Mr. Hubbard is a Board Member of Resiliency Florida and Chairman of the Florida One Water Commission. He has been a leader in the State of Florida advocating for integrated water resource management.

## Recent and Future Advancements of the MODFLOW Configurable Multi-Model Hydrologic Simulator

*Joseph D. Hughes<sup>1</sup>, Christian D. Langevin<sup>2</sup>, Alden M. Provost<sup>3</sup>, Martijn J. Russcher<sup>4</sup>, Michael Reno<sup>5</sup>, Eric D. Morway<sup>6</sup>, Wesley Bonelli<sup>5</sup>, and Michael N. Fioren<sup>7</sup>*

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MODFLOW is an open-source software program originally developed by the U.S. Geological Survey (USGS) in 1984. Currently, technical oversight of community-based MODFLOW maintenance and enhancement activities are coordinated by a technical steering committee that includes software developers from federal, research, and applied research organizations. The latest version of MODFLOW is based on an object-oriented design, which allows users to include multiple types of models and multiple instances of the same model type within a single simulation. The flexible multi-model capability allows users to configure MODFLOW simulations to represent the local-grid refinement (LGR) capabilities available in MODFLOW-LGR, the multi-species transport capabilities in MT3DMS, and the coupled variable-density capabilities available in SEAWAT, for example. First released in 2017, the latest version of MODFLOW continues to evolve to meet the simulation needs of the hydrologic modeling community. Recent advancements include (1) a Groundwater Transport (GWT) Model, (2) an Application Programming Interface (API), (3) a particle tracking (PRT) model with capabilities available in MODPATH, (4) parallel numerical solution of multiple tightly coupled models using PETSc and the Message Passing Interface, (5) a revised input and output data processor for support of alternative input and output formats, such as NetCDF, and (6) comprehensive pre- and post-processing support using the Python FloPy package. Features currently under development include (1) channel and overland flow and transport models, (2) a Richard's Flow formulation for groundwater flow model, and (3) a process-based stream temperature model. With these recent and future advances, MODFLOW will be capable of simulating stand-alone and tightly coupled hydrologic flow and transport problems in surface and subsurface domains at scales ranging from bench to global scales.

## Public support for new agricultural best management practices to protect Florida water quality

*Sadie Hundemer<sup>1</sup>, Matt Gold<sup>2</sup>, and Madison Dymont<sup>3</sup>*

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<sup>2</sup>The Ohio State University, Columbus, OH, USA

<sup>3</sup>New Mexico State University, Las Cruces, NM, USA

The adoption of modified land management practices has the potential to substantially reduce groundwater contamination in the Floridan Aquifer system; however, such changes are likely only possible with substantial public support and funding. In this session, we will discuss two studies that measured public support for new land management programs and the considerations that affected that support.

Our research examined three categories of potential policy options for the Floridan Aquifer region: (1) transitioning agricultural land to forests in vulnerable aquifer areas, (2) implementing new agricultural best management practices (BMPs) in vulnerable aquifer areas, and (3) making no changes. We recruited 1,523 Florida residents and provided information on the three policy options as well as tradeoffs between the options related to: environmental impacts, agricultural operational impact, tax/economic impacts, and rural community impacts. Our results indicate that informed residents were largely in favor of incentive programs that financially support farmers' adoption of new BMPs (option 2).

Because the sample was educated about the options and their tradeoffs, we find the results to be a strong indicator of the public's true preferences (not simply a reflection of their degree of issue awareness). Therefore, these results suggest that financial incentive programs for the adoption of new water protective BMPs can meet the expressed environmental, economic, and agricultural interests of Florida residents.

This session will include detailed information on the considerations that affected public support levels including role identity, political identity, and desired policy outcomes. After detailing the results of the two studies, we will discuss how the results can be used to support progress toward water protective programs in the Floridan Aquifer region.

**BIO:** Dr. Sadie Hundemer is an assistant professor in the Department of Agricultural Education and Communication (AEC) at the University of Florida. Hundemer examines how communication combines with values and worldviews to affect support for water sustainability initiatives among agricultural producers, environmental interests, and the general public.

## Leveraging Long-term Water Quality Data and Partnerships for Assessment of Charlotte Harbor

*M. Medina<sup>1,2</sup>, M. W. Beck<sup>3</sup>, N. Iadevaia<sup>4</sup>, J. Hecker<sup>4</sup>, B. Moody<sup>5</sup>, C. Anastasiou<sup>6</sup>, D. Tomasko<sup>7</sup>, E. Milbrandt<sup>8</sup>, D. Kaplan<sup>2</sup>, C. Angelini<sup>2</sup>*

<sup>1</sup>*ECCO Scientific LLC, St. Petersburg, Florida*

<sup>2</sup>Center for Coastal Solutions, University of Florida

<sup>3</sup>Tampa Bay Estuary Program

<sup>4</sup>Coastal & Heartland National Estuary Partnership

<sup>5</sup>Charlotte County Government, Charlotte County, Florida

<sup>6</sup>Southwest Florida Water Management District

<sup>7</sup>Sarasota Bay Estuary Program

<sup>8</sup>Sanibel-Captiva Conservation Foundation

Tracking symptoms of eutrophication over time with multiple lines of evidence provides critical information to support environmental management and restoration efforts. Long-term water quality monitoring data from the Greater Charlotte Harbor estuary system in southwest Florida (USA) were synthesized to estimate trends and evaluate current hot spots. These data represent 22 years of monthly water quality data collected by numerous public entities as a collective partnership facilitated and funded in part by the Coastal and Heartland National Estuary Program. Trends were estimated in annual mean concentrations of nitrogen, phosphorus, and chlorophyll-a across 13 monitoring strata over a sliding 5-year window between 2000 and 2021 and hot spots were identified where annual mean concentrations were increasing or elevated between 2017 and 2021, relative to stratum-specific thresholds informed by regulatory criteria. The water quality trend analysis methodology, based on generalized additive models (GAMs), captured seasonality and nonlinear inter-annual tendencies while accounting for uncertainty in the sampling design. Concentrations of total nitrogen increased and exceeded stratum-specific thresholds during the 2010 decade, while concentrations of total phosphorus and chlorophyll-a typically decreased to levels near or below thresholds. Low concentrations of inorganic nitrogen fractions indicated rapid Biological assimilation consistent with eutrophication, while low chlorophyll-a concentrations indicated that nitrogen enrichment did not translate into excessive phytoplankton production. Instead, macroalgal proliferation and substantial seagrass losses were observed following Hurricane Irma (September 2017). We speculate that nitrogen enrichment during the 2010s increased the system's vulnerability to Irma's effects and helped tip the system toward these profound ecological changes. Collectively, this work demonstrates the value of long-term monitoring data supported by public and private partnerships and use of innovative trend analysis methods that can inform regional estuary management paradigms.

**BIO:** Nicole Iadevaia serves as Director of Research & Restoration for the Coastal & Heartland National Estuary Partnership; her work includes science communication and management of water resource and habitat projects in Southwest Florida. She has a background in science communication and policy, water quality and fisheries monitoring, and stormwater management.

## **DIGITAL TWIN & AI for Resilience**

**Nicola Ianeselli, MBA<sup>1</sup>, F. Warren McKinnie, PE, CFM, GISP<sup>2</sup>**

<sup>1</sup>WGI, Inc., Miami, FL, USA

<sup>2</sup>Streamline Technologies, USA

As Florida faces increasingly complex challenges from compound flooding, traditional reactive methods have become insufficient. This presentation demonstrates how the integration of Digital Twin technology and Artificial Intelligence is creating a new paradigm of proactive resilience, moving beyond theory to proven, practical applications.

The core of this innovation is the development of a dynamic Digital Twin, which combines WGI's high-fidelity geospatial and engineering reality capture data with Streamline Technologies' advanced StormWise™ model. This creates a virtual replica that is then powered by FloodWise™, an AI-driven forecasting system. The system automates the ingestion of real-time and forecast data from multiple sources, including NOAA and USGS, and uses a widely accepted numerical engine to deliver accurate flood forecasts days in advance.

This AI-powered Digital Twin enables active flood mitigation rather than just passive prediction. It empowers decision-makers to run "what-if" scenarios, simulating operational changes to infrastructure like gates and pumps before a storm hits to maximize storage and reduce flood impacts. The system's predictive accuracy was validated during Hurricane Ian, where it forecasted flood impacts with a 72-hour lead time, enabling the pre-positioning of resources and specific public warnings.

Ultimately, this presentation will show that Digital Twins and AI are now operational tools that offer a clear return on investment by protecting communities, safeguarding critical infrastructure, and saving lives.

**BIO:** Nicola Ianeselli is the Innovation and VDC Leader at WGI, Inc. A civil engineer and architect with over 11 years of experience, he specializes in applying AI and Machine Learning to the AEC industry. He serves as the Data & AI Subcommittee Leader for ACEC. Mensa Member. Distinguished Member of the American Society For Artificial Intelligence.

# SELF-SUPERVISED LEARNING (SSL) FOR CYANOBACTERIAL BLOOMS PREDICTION

**Syed Usama Imtiaz**<sup>1,2</sup>, *Mitra Nasr Azadani*<sup>1,2</sup> and *Nasrin Alamdari*<sup>1,2</sup>

<sup>1</sup>Department of Civil and Environmental Engineering, FAMU-FSU College of Engineering, Florida State University, Tallahassee, FL, USA

<sup>2</sup>Resilient Infrastructure and Disaster Response (RIDER) Center, FAMU-FSU College of Engineering, Florida State University, Tallahassee, FL, USA

Cyanobacteria blooms (cHABs) are harmful to aquatic ecosystems and human health alike. The bloom in situ sampling is labor-intensive, and results are often delayed due to prolonged laboratory analyses. Artificial intelligence (AI)-based models provide early warnings to stakeholders. However, they face major challenges in regions with limited sample availability, data sparsity, and irregularity. Remote sensing (RS) data is a promising avenue that complements in situ samples and provides valuable spectral information for monitoring water bodies over regular intervals. However, utilizing RS for predictive modeling is challenging due to the complexity of environmental factors influencing bloom occurrences. This letter presents a novel deep learning framework in environmental applications that uses self-supervised learning (SSL) with a Wide & Deep architecture to predict next week's cHABs probability using the newly launched NASA (Plankton, Aerosol, Cloud, Ocean Ecosystem) PACE mission and meteorological data. The SSL module extracts semantically rich feature embeddings from unlabeled raw RS data via contrastive learning and inputs them into the Wide & Deep architecture, which jointly memorizes domain-specific wide features and learns high-order ions from deep spectral raw inputs. This enables reliable generalization to unseen regions. We evaluated our model on two known bloom-prone lakes in the US (Erie and Okeechobee), and our model achieves an ROC-AUC of 0.912 and a PR-AUC of 0.968, demonstrating high predictive accuracy. A zero-shot evaluation on Lake Okeechobee shows promising generalization with an accuracy of 74%. Compared to existing methods, our approach offers competitive performance and highlights the novel potential of SSL with hybrid deep learning models in environmental monitoring tasks.

**BIO:** Syed Usama Imtiaz is a PhD candidate in Civil and Environmental Engineering at FAMU-FSU College of Engineering. Syed's research is mainly focused on river microbial health, with a particular emphasis on investigating the intricate relationship between environmental and morphological factors using advanced numerical techniques to predict various parameters related to inland water quality.

# Connecting Hydrology and Soil Organic Carbon Storage in Southeastern US Flatwoods Wetlands

*Alexis R Jackson , David Kaplan, Matthew Cohen*

University of Florida, Gainesville, FL, USA

Wetlands are essential for providing various ecosystem services to humans. They play a crucial role in the global carbon cycle and are thus considered a valuable terrestrial carbon sink (Li et al., 2023). Hydrology is the most vital factor in driving wetland ecosystem services, as it affects multiple biophysical processes within wetlands. In the southeastern United States, flatwood ecosystems (a matrix of upland pine and mostly isolated wetlands) have the potential for upland restoration (i.e., thinning of plantation pine) to increase wetland hydration (Jones et al. 2018) and thus enhance carbon storage. In this study, 15 wetlands with water-level loggers were randomly selected across a contiguous pine flatwoods site in Bradford County, Florida, covering 27,000 acres. Soil samples were collected to a maximum depth of 60 cm using two different sampling methods to quantify the relationship between hydrology and soil carbon dynamics. The objective is to gain insight into how wetland soil carbon responds to changes in water table depth and land use. This study focuses on two connected questions: 1) What is the spatial variation of SOC within wetlands? 2) How does wetland location and hydrological connectivity influence soil carbon across a wetland-scape? Analysis is still ongoing, but preliminary results support the hypothesis that water table depth influences soil organic carbon storage. These finds can help guide wetland management, conservation, and policy decisions that better account for potential future changes in carbon storage.

**BIO:** Alexis Jackson is a fifth-year PhD candidate at the University of Florida and an NSF Graduate Research Fellow. She studies how hydrology and vegetation influences wetland soil organic carbon across different scales. She also serves as a Water Institute ambassador.

## **statewide coupled ocean-atmosphere regional climate model**

**Charles Jacoby<sup>1</sup>, Benjamin Kirtman<sup>2</sup>, Vasubandhu Misra<sup>3</sup>, C.B. Jayasankar<sup>3</sup>, and John Stamm<sup>4</sup>**

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Many of Florida's communities flood following heavy rainfall, a risk that is expected to escalate in the future. The importance of accurately estimating extreme rainfall in the decades ahead is recognized by planners and engineers engaged in managing stormwater across multiple levels of government and in the private sector. In fact, many existing guidelines and standards may prove inadequate for addressing the increasingly extreme rainfall expected to result from a warming atmosphere. Rigorous estimates of flooding due to rainfall underpin planning to mitigate its detrimental effects and complement efforts to address the risk of flooding due to rising sea levels, surge from more intense storms, and other drivers. Overall, updated estimates of extreme rainfall that reflect likely future conditions are essential to ensuring that drainage and retention are scaled properly, lives and property are protected, and resources are deployed effectively and efficiently.

Estimates of future extremes in rainfall cannot be produced directly by current general circulation models due to their relatively coarse spatial and temporal resolutions. Experts acknowledge known biases in predicting extreme rainfall and agree that fully accurate projections will not be available in the near term. In advance of improved global modeling, practitioners can build on the existing approach to planning and account for future conditions by incorporating adjustments known as change factors. Nevertheless, Florida will benefit from estimates of changes in extreme rainfall generated by high-resolution models that retain details of neighboring seas (i.e., the west Florida Shelf, the Bahama Bank, and the Florida Current) and simulate how sea breezes, lakes, land use, coastal geometry, and narrow gradients in coastal temperatures influence convective storms. The modeling comprising our study will improve estimates of future changes in depth, duration, and frequency of extreme rainfall at the resolution needed to plan for resilience in Florida. Initially, a Community Earth Systems Model (CESM) will simulate global atmospheric processes at a ~50-km spatial resolution and oceanic processes at a ~10-km spatial resolution. Next, those outputs will become boundary and initial conditions for the Regional Spectral Model-Regional Ocean Modeling System (RSM-ROMS). This modeling dynamically simulates both atmospheric and oceanic processes at a 10-km spatial resolution. The resulting outputs become initial and boundary conditions for a Weather Research and Forecasting model that simulates key processes at a 4-km spatial resolution. All three models will run five ensembles for a 10-year historical period and two sets of five ensembles for 10-year periods with warmer atmospheric temperatures. Comparing outputs for the historical and future periods will highlight estimated changes in the depth, duration, and frequency of extreme rainfall resulting from a nonstationary environment.

# NITROGEN FATE AND LEACHING DYNAMICS UNDER MATURE BAMBOO (*DENDROCALAMUS ASPER*) ON THE FLORIDA SOILS

Cyrus J. Januarie<sup>1</sup>, Lakesh Sharma<sup>2</sup>, Joao Vendramini<sup>3</sup> and Davie M. Kadyampakeni<sup>1</sup>

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<sup>3</sup>Texas A&M Agrilife Research & Extension Center – Stephenville, Stephenville, TX 76401, USA.

The Florida sandy soils are prone to nutrient leaching, posing challenges for sustainable water and nutrient management. This two-site field study evaluated nitrogen (N) fate and groundwater nitrate concentrations under mature (>3 yr) *Dendrocalamus asper* stands on contrasting Florida soils: a well-drained Ridge site (Frostproof, Tavares sand) and a poorly drained Flatwoods site (Wauchula, Smyrna sand). Four N rates (0, 28, 56, 112 kg N ha<sup>-1</sup>) plus a grower standard were tested in a randomized block design with repeated sampling during 2024–2025 to assess effects on groundwater N concentration and growth of bamboo plants. Leachates were collected from lysimeters installed at a depth of 50 cm and analyzed for NO<sub>3</sub><sup>-</sup>-N using the EPA Method 353.2 via automated colorimetry. Other variables measured included growth, culm production, tissue, and soil nutrient concentration. Linear mixed-effects models were used to evaluate the effects of N rate, site, and time on growth, soil inorganic N, tissue N, and leachate composition. No significant differences in culm diameter, productivity, or tissue N were detected among fertilizer rates, indicating limited growth in mature bamboo. Wauchula soils exhibited higher soil NH<sub>4</sub><sup>+</sup>-N/NO<sub>3</sub><sup>-</sup>-N and organic matter (~1.1–1.3%) than Frostproof (~0.5–0.7%). Leachate NO<sub>3</sub><sup>-</sup>-N remained minimal (~0.04–0.06 mg L<sup>-1</sup>), far below the U.S. EPA threshold for drinking water (10 mg L<sup>-1</sup>), suggesting that bamboo mitigates groundwater contamination risks via leaching. These results confirm the potential of bamboo to limit nutrient leaching while maintaining growth under optimal N fertilization. Thus, site-specific fertilization can enhance both crop sustainability and water-quality protection in sandy agricultural landscapes of Florida.

**BIO:** Cyrus Januarie holds a BS in Agricultural Sciences from Earth University in Costa Rica and an MS in Soil, Water, and Ecosystem Sciences (SWES) from UF. He received several awards from the Florida State Horticultural Society, American Society of Horticultural Science, UF/IFAS, and SWES.

# Assessing water conservation potential of a tabletop strawberry production system in high tunnels

*Yifan Jing, Bikash Adhikari, and Xin Zhao*

Horticultural Sciences Department, University of Florida, Gainesville, FL, USA

In Florida, the second leading state in strawberry (*Fragaria × ananassa*) production in the U.S., open-field strawberry growing systems dominate, and overhead irrigation is commonly used for field establishment of bare-root transplants in plastic mulched raised beds. In response to the market demand, organic strawberry acreage has been growing in recent years. Given the existing and new challenges associated with water and nutrient management and disease, pest, and weed control in both conventional and organic strawberry production, integrated practices and alternative approaches have been at the core of research to improve crop resilience and long-term sustainability. In a research project exploring the use of high tunnel tabletop structures for soilless culture of organic strawberries, we compared the water usage between a substrate-based tabletop strawberry system trial versus an open field strawberry production trial on certified organic land at the University of Florida Plant Science Research and Education Unit (Citra, FL) during the 2024-2025 growing season. A pine bark and compost mixture was used as the substrate for growing high tunnel tabletop strawberries. While overhead irrigation was employed for crop establishment and frost protection, together with drip irrigation for plasticulture in the open field strawberry trial, a microirrigation system with drippers supplied water and nutrients in the high tunnel tabletop strawberry trial. During crop establishment, the high tunnel tabletop system reduced per-plant water usage by over 80% relative to open field production. The water saving reached over 70% across the growing season. In the per-acre calculation using the highest-yielding cultivar grown in each trial, the tabletop system also demonstrated a pronounced level of water conservation while improving strawberry fruit yield in comparison with open field production.

**BIO:** Yifan Jing is a Ph.D. student in the organic and integrated vegetable cropping systems lab led by Dr. Xin Zhao. His dissertation project focuses on developing tabletop organic strawberry cultivation systems using high tunnels and locally available substrates toward enhancing input use efficiency, crop resilience, and fruit quality.

## **HOW LOW-COST CONTINUOUS SENSOR ARRAYS CREATE A NEW MONITORING PARADIGM FOR UTILITIES AND LOCAL GOVERNMENTS**

**Alex Johnson**

Virridy, Boulder CO USA

### **Effective water-quality management requires data that are both timely and spatially representative.**

Yet most monitoring programs—whether for drinking water, recreational water, or stormwater compliance—still rely on discrete grab sampling and culture-based assays for *E. coli*, which provide results only after 18–48 hours and often miss short-duration or localized contamination events. This limitation constrains public-health protection, regulatory compliance, and adaptive watershed management.

Virridy's Lume™ technology represents a step-change in microbial monitoring by combining tryptophan-like fluorescence (TLF) sensing with machine-learning analytics to continuously estimate *E. coli* contamination risk. Each Lume sensor operates autonomously and transmits near-real-time data via cellular or satellite link to a secure cloud dashboard and API. Arrays of these low-cost sensors can be deployed across watersheds, stormwater networks, or distributed drinking water systems to provide continuous, in-situ, quantitative estimates of fecal contamination.

Arrays overcome the spatial and temporal gaps inherent to grab-sample programs. By recording measurements every few minutes and bracketing key reaches, confluences, or outfalls, they detect transient pollution pulses, localize contamination sources, and verify remediation outcomes. Continuous datasets support same-day risk communication, better public advisories, and faster regulatory response—while reducing the logistical and financial burden of field sampling and laboratory analysis.

This presentation discusses how low-cost fluorescence-based arrays are transforming monitoring from a compliance-oriented activity to a proactive, information-rich management system. Applications in drinking water safety, recreational water advisories, and stormwater infrastructure management demonstrate that digital, autonomous monitoring networks can deliver higher data density, improved decision accuracy, and greater transparency for utilities, regulators, and the public alike.

**BIO:** Alex Johnson is Chief Strategy Officer at Virridy, a technology company advancing digital monitoring and carbon finance solutions for global water resilience. He leads Virridy's strategy to scale low-cost, continuous sensor networks and data-driven management systems that help utilities and governments improve water quality, public health, and climate outcomes.

## Panel Session: New Frontiers of Remote Sensing in Hydrology

Chair/Moderator: **Jasmeet Judge** Co-convener: Nargiza Ludgate

The session will be conducted as a world cafe-style lightning talks followed by rotating discussions with a total duration of 90 minutes. The interactive session explores the emerging frontiers of remote sensing technologies in hydrology across diverse sectors, including GeoHealth (Antar Jutla, ESE), Terrestrial water (John Conklin, MAE), Aquaculture (Shirley Baker, SFFGS), Geology (Mickey MacKie, GEOL), Bathymetry (Peter Ifju, ECE/MAE) etc. Designed as a World Café-style session, this format promotes dynamic dialogue through short lightning talks followed by small-group rotating discussions. The goal is to promote multidisciplinary dialogues, peer exchange, and practical insights into the real-world applications of remote sensing.

The session will be organized as: 0-5 min Welcome & overview; 5-80 min Café Rotations (4 tables X15 min; 0-3 min lightning talk at each table; 3-14 minutes interactive discussion; 14-15 min rotation); 80-90 minutes takeaways and summary

	<i>Lightning Talk Title</i>	<i>First Name</i>	<i>Last Name</i>	<i>Affiliation</i>	<i>Email Address</i>
Session Organizer	Welcome & overview	Jasmeet	Judge	CRS	jasmeet@ufl.edu
Speaker 1	From space to species: GeoHealth Innovations for climate-sensitive disease and nutrition surveillance	Antarpreet	Jutla	ESE	Antar.juta@ufl.edu
Speaker 2	New frontiers in aquaculture monitoring for water quality	Shirley	Baker	SFFGS	Sbaker25@ufl.edu
Speaker 3	Remote sensing in glaciology	Mickey	MacKie	GEOL	Emackie@ufl.edu
Speaker 4	UAV-based remote sensing for underwater applications	Peter	Ifju	ECE/MAE	ifju@ufl.edu
Speaker 5	Sensors for next generation gravitational measurements for terrestrial water	John	Conklin	MAE	conklin@ufl.edu

# PFAS CONCENTRATIONS AND PARTITIONING TRENDS IN WASTEWATER AND DRINKING WATER TREATMENT WASTES

*Jonathan D. Judy<sup>1</sup> and Caleb Gravesen<sup>1</sup>*

<sup>1</sup>University of Florida, Gainesville, FL, USA

Human activity results in a variety of waste streams that require management. Drinking water treatment often produces a solid residual byproduct (drinking water treatment residuals, DWTRs), as does wastewater treatment (biosolids). These materials are incinerated, landfilled and, whenever possible, beneficially recycled/land applied. However, public concerns exist that land-application of waste residuals such as these may result in the release of PFAS into terrestrial ecosystems. Here, we present recent findings examining occurrence of PFAS in these two different waste residuals in the context of residual properties and facility management practices. In wastewater treatment, we examined PFAS concentrations and partition coefficients in biosolids in the context of residual characteristics including oxalate-extractable Fe and Al, organic matter (OM), dissolved organic carbon, and total protein content. Total PFAS concentrations ranged from ~480 to 3500  $\mu\text{g PFAS kg}^{-1}$  dry weight. PFAS partitioning to biosolids was not only correlated with bulk OM but also oxalate extractable Al and Fe and protein content, suggesting that facilities generating biosolids high in these characteristics are likely to have relatively high biosolids PFAS content. For drinking water treatment, we examined PFAS occurrence in seven DWTRs, including Ca-, Fe- and Al-dominated materials, and one wastewater effluent treatment residual (WWETR) produced using aluminum chlorohydrate (ACH). Only perfluoroalkyl acids (PFAAs) were detected, with total PFAA concentrations in the seven DWTRs produced from naturally recharged water sources ranging from 0 to ~3.3  $\mu\text{g kg}^{-1}$ . No PFAS were detected in either of the Ca-DWTRs examined. Overall, PFAS concentrations in DWTRs were orders of magnitude lower than those in biosolids, with the finding suggesting that Ca-DWTRs are likely to have below detect PFAS having particular value in the context of beneficial reuse.

**BIO:** Dr. Judy's research program focuses on examining interactions between contaminants of concern and biological and non-biological soil constituents. Contaminants of interest include nanomaterials, per- and polyfluorinated compounds, antibiotics, microplastics and nutrients. Dr. Judy's areas of expertise include ecotoxicology, nano and micro scale characterization, metals analysis and environmental chemistry.

## Trends in the Novel Nitrogen and Phosphorus Rates for Developing New Rates for Citrus Trees

**Davie M. Kadyampakeni**<sup>1</sup>, *Alisheikh Atta*<sup>1</sup>, *Kelly T. Morgan*<sup>2</sup>, *Mark A. Ritenour*<sup>3</sup>, *Muhammad A. Shahid*<sup>4</sup>, *Alan Wright*<sup>3</sup>, *Flavia Zambon*<sup>3</sup>, *Kimberly Morgan*<sup>5</sup>, *Mongi Zekri*<sup>6</sup>, *Chris Oswalt*<sup>7</sup>, and *Danielle Williams*<sup>4</sup>

<sup>1</sup>University of Florida, Lake Alfred, FL

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<sup>3</sup>University of Florida, Fort Pierce, FL

<sup>4</sup>University of Florida, Quincy, FL

<sup>5</sup>University of Florida, Immokalee, FL

<sup>6</sup>University of Florida, Labelle, FL

<sup>7</sup>University of Florida, Bartow, FL

Nutrient management practices have been developed to suppress the problems associated with citrus greening or huanglongbing (HLB). The leaching of plant nutrients below the root zone is aggravated by 70–80% because of HLB-induced root damage. Leaching nutrients from agricultural fields and citrus groves into groundwater sources may bring about severe economic loss and environmental hazards that may affect downstream ecosystems. Therefore, researchers developed and evaluated best management practices (BMPs) to preserve the environment while maintaining sustainable agricultural productivity. Thus, the study's objective was to optimize site-specific variable nitrogen (N) and phosphorus (P) rates on tree growth of Hamlin, Valencia, and Satsuma Mandarin citrus tree growth and fruit yield, and postharvest. The studies were conducted on trees in south, southwest and central Florida and the Florida panhandle from 2022 to 2025. N rates varied 100 to 300 lbs/acre while P treatments varied from 0 to 80 lbs/acre per year. The experiment was arranged in a randomized complete block design with four replications. Semi-annually, soil and nutrient concentration, trunk cross-sectional area, and canopy volume were determined while fruit yield and postharvest attributes were analyzed annually. Results indicated a significant soil ammonium nitrogen (NH<sub>4</sub>-N) and nitrate nitrogen (NO<sub>3</sub>-N) in the topsoil layer. Similarly, soil NH<sub>4</sub>-N, was higher by a factor of 1.5–2.0× in the lower soil layers ~ indicating limited leaching. Soil NH<sub>4</sub>-N is a buffer for soil NO<sub>3</sub>-N, and soil NO<sub>3</sub>-N was detected significantly in the topsoil layer, with a significant amount of soil NH<sub>4</sub>-N and NO<sub>3</sub>-N in the top (0–6 in) soil layer. Soil P and K were significantly accumulated in the topsoil layer regardless of the nutrient rates. This implied that soil P was not liable to leach substantially in the soil. Soil K might be prone to leaching because of excess irrigation and rainfall. No differences were determined in fruit yield and juice quality, though excess levels of leaf P were observed in the Florida panhandle, suggesting the need for a lower P rate or complete omission of P in the fertilization programs of Satsuma Mandarins. Impacts from N and P rates on fruit yield, quality and tree size appear to be more site-specific driven by either soil characteristics such as soil pH, cation exchange capacity, and horticultural management. Results in the fourth and fifth years of the project should help confirm these observations and lead to new guidelines in N and P fertilization in HLB-affected citrus.

**BIO:** Dr. Kadyampakeni is an Associate Professor of Soil, Water, and Ecosystem Sciences located at Citrus REC, Lake Alfred, FL. He is the UF Water Institute Early Career Fellow and a Fellow of the African Academy of Science. His research interests focus on best water and nutrient management practices.

# Incorporating Operational Decision-Making to Forecast Estuarine Discharges and Water Quality

*Enrique Orozco López<sup>1</sup>, David Kaplan<sup>1</sup>, Nikolay Bliznyuk<sup>2</sup>, Mauricio Arias<sup>3</sup>, Maitane Olabarrieta<sup>1</sup>, José González<sup>1</sup>, Eric Milbrandt<sup>4</sup>, and Edward Phlips<sup>5</sup>*

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Forecasting in managed water systems presents significant challenges due to the unpredictable nature of anthropogenic interventions. Traditional hydrological models often struggle to capture the complex interactions between regulatory actions, natural drivers, and system responses, whereas data-driven frameworks may offer greater flexibility and adaptability to handle such complexity efficiently. This study introduces an operational, medium-range (i.e., 1-2 week) forecasting framework using a Transformer Neural Network (TNN) to predict discharges from Lake Okeechobee, a pivotal component of a highly regulated water system in Florida (USA), and their downstream impacts on water quality in the St. Lucie and Caloosahatchee estuaries. The model integrates spatiotemporal precipitation forecasts from NOAA's Global Forecasting System and regional hydrological observations to forecast freshwater discharges and estuarine water quality, sequentially propagating predictions through a network of lake and canal nodes to capture both natural variability and management-driven flows. The TNN forecasts lake stages, canal discharges, and estuarine water quality indicators (temperature, salinity, conductivity) over a 10-day horizon, achieving good overall accuracy (average KGE = 0.70, NSE = 0.67) while outperforming ensemble learning (XGBoost) and numerical hydrological forecasting models (the National Water Model). While the TNN can robustly forecast hydrologic responses at upstream control points, forecast skill declines with increasing lead time in areas heavily influenced by human operations. Despite these limitations, the framework successfully reproduced major runoff events, baseflow variations, and downstream estuarine water quality impacts, offering substantial improvements over existing decision-support tools. By integrating AI-driven modeling with operational hydrological forecasting, this framework enhances water management strategies for Lake Okeechobee and offers a scalable approach for other managed water systems where regulatory frameworks and human decision-making play a central role in controlling lake and reservoir discharges.

**BIO:** Dr. David Kaplan is a Professor in the Department of Environmental Engineering Sciences within the Engineering School of Sustainable Infrastructure and Environment at the University of Florida. He also serves as Director of the Howard T. Odum Center for Wetlands and Associate Director of the UF Center for Coastal Solutions.

## Recharge Wetlands for Environmental Restoration and Public Access

*Chris Keller*<sup>1</sup>, *Kristen Sealey*<sup>2</sup>, *Rick Hutton*<sup>2</sup>

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Gainesville Regional Utilities (GRU) has implemented a series of constructed wetland projects that improve water quality, support local and regional ecosystems, and provide beneficial use of reclaimed water. GRU began operating its first demonstration recharge wetland at the Kanapaha Middle School in 2008 and currently operates three recharge wetland systems, in addition to the Sweetwater Wetlands Park. Typical constructed wetland projects discharge to downstream surface waters. In contrast, the reclaimed water applied to recharge wetlands discharges to groundwater as it infiltrates through the subsurface soils and replenishes aquifer levels. The application rate, and therefore recharge wetland size, is controlled by regulatory hydraulic loading limits, nutrient removal requirements, subsurface hydrogeologic conditions, and the hydrologic needs of the wetland plant community. Natural wetland biogeochemical processes reduce nitrogen to low levels as water moves through the surface water compartment and percolates into the ground. The data collected from these systems demonstrates the ability to attain exceptional finished water quality with nitrate levels well below 1 mg/L and total nitrogen below 3 mg/L. GRU has a project underway to create a groundwater recharge wetland park in western Alachua County to increase aquifer recharge and support flows to the Santa Fe and Ichetucknee Rivers. The new wetland will be located on a 75-acre site and will provide up to 3 million gallons per day (MGD) of recharge initially, with plans to expand up to 5 MGD. This project is part of the North Florida Regional Water Supply Plan and is a centerpiece in GRU's water reuse program that will allow GRU to continue to provide 100 percent beneficial reuse of reclaimed water. The presentation will provide an overview of GRU's experience with constructed wetlands, summarize performance and water quality data, highlight ecological and community benefits, and share an update on the groundwater recharge wetland project currently under development.

**BIO:** Mr. Keller is the president and a senior engineer at Wetland Solutions, Inc., an environmental consulting firm that specializes in the study and design of natural systems for water quality improvement, habitat creation, and public use. He holds bachelor's and master's degrees in environmental engineering from the University of Florida, is a Professional Wetland Scientist, and maintains Professional Engineering licenses in Florida, South Carolina, and Oregon.

## Regulations, Research, and Reaching Out: The Martin County Water Ambassadors Program

*Elizabeth Kelly<sup>1</sup>, Lisa Krimsky<sup>2</sup>, and Vincent Encomio<sup>3</sup>*

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Since 2016, Martin County Public Works and the UF/IFAS Florida Sea Grant Extension Program have collaborated on a program called Water Ambassadors. The program originated from the need for public outreach as part of the County's Municipal Separate Storm Sewer System (MS4) and has expanded to encompass research, community events, and educational experiences.

Water Ambassadors was originally a series of one-day workshops combined with special events and talks at local events and HOAs. The focus during the first years was to promote increased awareness and fostering behavioral change toward reducing the use of fertilizer and pesticides. The program closely followed the development of the County Fertilizer Ordinance and grew to include information on how human activities result in stormwater pollution and how changes in behavior can help reduce stormwater pollutant loads. Graduates of the program receive continued education on topics such as regional water management projects, water quality and harmful algal blooms, ecosystem health and restoration, and best practices and citizen engagement. The program was a strong voice for science and the public during the cyanobacteria blooms in the St. Lucie River in 2018 and thrived during COVID-19 shutdowns by moving to webinars that reached researchers, agencies, and residents throughout the state of Florida. Since 2020, more than 2,000 individuals have participated in webinars and have become knowledgeable and motivated volunteers in the community. Pretests and posttests are used to determine attendee interest/satisfaction, knowledge gained, and willingness to adopt new behaviors. Follow-up evaluations indicate that 68% of participants have adopted best practices, including volunteering, participating in community science efforts, contacting elected officials, and adopting Florida-Friendly Landscaping practices.

Future work includes presentation of results from County research and projects, public workdays, and citizen science on water quality, inspired by Havens et al 2012 "A Practical Guide to Estuary Living."

**BIO:** Elizabeth Kelly, Ph.D., PWS, Certified Ecologist, is a research scientist investigating the impact of microbial ecology, soils, and hydrology on water quality (FIB, HABs, and nutrients) in freshwater, coastal, and estuarine environments. She is the Environmental Scientist at Martin County's Environmental Resource Division and manages the County NPDES MS4 program.

# **labyrinth to fort: on the opacities of rivers and the ethnographic promise of bringing close**

***Richard Kernaghan***

Department of Anthropology, University of Florida, Gainesville, FL, USA

When waters recede during catastrophic drought to reveal colonial remains of a Portuguese garrison—as they did in 2024 near the Brazilian Amazon city of Tabatinga—what might that suggest about the ways rivers not only have territories but contribute to legal phenomena? This paper is an exercise in ethnographic description, focused on passage through a dense network of intermittent streams, not far from where that Portuguese fort once stood on the main course of the Amazon River in what is today the triple border region of Peru, Colombia, and Brazil. From experiences of water transportation guided through a maze of tiny channels on the Peruvian side of the river, I describe material complexities of terrains that in high water season oscillate between worlds ordinary and other legally proscribed—namely coca and its traffic. Those worlds run together yet remain separate in a landscape that mixes peoples and nationalities with different kinds of claims to the earth. How to appreciate what is unfathomable between distances contiguous to one another? How to recognize what a maze of temporary streams confers to relationships saturated with (il)legality? And when might labyrinths of water find their counter-image in barrier fortifications—even in the remains of frontier forts beckoning from the past? Here I focus on empirical qualities of water, light, and shadow, which are no less contiguous yet appear to be of little consequence in lived situations where the legal weight of bordering nation-states feels at times overbearing and at others seemingly fades away. Sitting near the bow of a speedboat, it is easy to imagine the lines of the path to follow within this floodplain thicket, but when the person operating the engine from the stern takes unexpected shortcuts, is it whim or evasive maneuvering? We see the same terrain, but not the same opportunities it offers. Now and then, boats approach in the opposite direction passing by with gestures that lend themselves to uncertain interpretation. Greeting waves cross paths with hunched bodies pointing straight ahead like arrows, never returning our gaze. Along this route opaque things appear between what can be seen and that which is barely perceived. An apprehensive “air” makes the skin suddenly bristle, leaving imaginations to wander, creating a ground for legal dangers to swell. Faced with opacities—premonitions of hidden forces, distances always at hand—there are techniques for contending with what can never be rendered transparent. This presentation brings together three: techniques for motoring watercraft through labyrinthine streams; techniques for facing atmospheres laden there with peril; and techniques for describing complexities of terrain. These “skills” matter because they bring close what rivers confer to legal phenomena, including afterlives of law persisting still in this part of Amazonia where the seasonal pulse of floods threatens now to contract in even greater extremes.

# **Assessing Salt Marsh Degradation and Flood Vulnerability in the Tampa Bay Area (2015–2025) Using Remote Sensing: Impacts of Urban Development and Sea Level Rise**

***Rachel Kerr***

University of South Florida, Tampa, FL, USA

Salt marshes are a vital component of Tampa Bay's coastal ecosystem, providing flood regulation, supporting carbon sequestration, and sustaining biodiversity. Between 2015 and 2025, Tampa Bay has experienced significant urban growth and rising sea levels, posing threats to marsh stability and increasing flood risk for surrounding communities. This study aims to quantify changes in salt marsh extent and vegetation condition in Tampa Bay over this period, evaluate how marsh degradation influences flood vulnerability, and examine the effects of urban development and sea level rise on these dynamics. Geographic information systems and remotely sensed data will be used, including surface water products, land cover and land use datasets such as the United States Geological Survey National Land Cover Database, and county level socioeconomic datasets, to assess changes in Tampa Bay's salt marshes and quantify wetland loss from 2015 to 2025. By integrating this data with literature and government reports on urban development and sea level rise, the study will link marsh degradation to flood risk and urban pressures. This approach highlights the relevance of geographic information systems and remote sensing for understanding coastal hydrology, supports water practitioners in flood and wetland management, and contributes to ecological conservation and planning strategies.

## HOW TO identify the expert in the room

**Kellie Keys**<sup>1</sup> [Session with Cynthia Barnett<sup>2</sup>, Angela Bradbery<sup>2</sup>, Jason Evans<sup>3</sup>, and Andrew Opel<sup>1</sup>]

<sup>1</sup>Florida State University, Tallahassee, FL, USA

<sup>2</sup>University of Florida, Gainesville, FL USA

<sup>3</sup>Stetson University, DeLand, FL, USA

This presentation will cover basic concepts of strategic communication. Specifically, we will explain and explore the ideas of target audiences and expertise as they relate to scientific communication. We will discuss why identifying target audiences may be “the most important factor to consider when tailoring scientific communication” ([Hutchings, 2021](#)) and describe why asking simple questions like “Who am I trying to reach?” and “Where will they encounter this information?” can dramatically increase the comprehension and acceptance of scientific information by the audiences who most need to understand it. Good communication in business involves considering the demographics, motivations, and behaviors of groups of people ([Gibson, 2025](#)). This same approach can be applied for creating effective, engaging, and memorable science communication.

Understanding target audiences will prepare us to explore the different meanings of expertise. Expertise is commonly acknowledged among researchers in connection with academic accomplishment. However, recognizing the significance of expertise gained through lived experience can provide scientists “insight into stakeholders’ needs and concerns, enabling development of better communication products” ([Stephens & DeLorme, 2024](#)). Stated simply, sometimes the expert in the room is the person who holds valuable information about a community or a place which may be necessary to the success of an outreach effort. Elevating and centering this type of knowledge can avoid wasted effort and lead to successful communication endeavors.

**BIO:** Kellie Keys teaches environmental communication and is the communication director for the Wakulla Springs Lab at FSU. She leads tours of the Wakulla springshed which are designed to make complex information friendly and accessible to the public. The team also researches environmental communication techniques and produces scientifically accurate educational videos.

## **Sustainable water-ecosystem development through city-university partnership**

*Jun Kim<sup>1,2</sup>, Sabrina Roggero<sup>1</sup>, Hailey Bauer<sup>1</sup>, Maya Stuhlmann<sup>1</sup>, Maks Kruc<sup>1</sup>, Nolan Nguyen<sup>1,3</sup>, Aaron Medley<sup>2</sup>, Gary Hubbard<sup>3</sup>*

<sup>1</sup>Florida Polytechnic University, Lakeland, FL, USA

<sup>2</sup>Florida Industrial and Phosphate Research Institute, Bartow, FL, USA

<sup>3</sup>City of Winter Haven, Winter Haven, FL, USA

Florida Polytechnic University (FPU) partnered with the City of Winter Haven to address technical challenges and foster innovation and community development: improving the city's water quality and treatment processes. In exchange for FPU's advanced analytical expertise, the city offered real-world applications for FPU students. Environmental engineering undergraduates gained extensive knowledge of water management by conducting weekly samplings for 9 water treatment plants (WTPs).

Through the on-site fieldwork, students gained practical skills in using portable probes, proper sample handling, and analyzing physicochemical properties. They also honed their analytical skills using software like ArcGIS, AutoCAD, statistical tools, and proficiency in operating instruments, such as Ion Chromatograph (IC), Total Organic Carbon (TOC) analyzer, and Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Students and the Principal Investigator investigated over 900 water quality data points and developed data-driven decision tools to enhance the water treatment process.

The insights from this project have directly shaped FPU's curriculum, integrating the procedures into courses, such as Foundations of Environmental Engineering (ENV 2003), Physicochemical Processes (ENV 4412), and Water and Wastewater Treatment (ENV 4514). The collaboration has fostered a new generation of highly skilled and project-oriented graduates prepared for positions in the utility industry and local government. Beyond the curriculum, the initiative also enabled continuous community engagement through internships, capstone projects, K-12 outreach, and more.

**BIO:** Dr. Kim is a Technical Advisory Committee member of the Florida Industrial and Phosphate Research Institute and a faculty member at Florida Polytechnic University. For over 20 years, Dr. Kim's research has focused on advanced water treatment processes for residential drinking water, seawater desalination, municipal wastewater, ultrapure water, and industrial process waters. Dr. Kim holds leadership roles in the water industry, such as a voting member of the NSF Joint Committee for ANSI National Standards. Dr. Kim received numerous awards, including the WQA's Next Gen award and KSCEA's faculty of the year.

## **Benthic Flux to the Suwannee River Between Dowling Park and Ellaville, Florida**

*Jeffrey N. King and Douglas Durden*

Suwannee River Water Management District, Live Oak, FL, USA

Benthic flux is the flow rate across the bed of a water body per unit area of bed. Benthic flux includes discharge and recharge components; baseflow and springflow are benthic discharge fluxes from the subsurface to a stream. Streamflow is the sum of surface-runoff and benthic flux.

The Cody Escarpment is a geologic transition in Northern Florida that conforms to an eroded Pleistocene shoreline. The Floridan aquifer system is unconfined downgradient of the escarpment toe and confined upgradient of the escarpment head. The Suwannee River flows across the escarpment near White Springs, Florida.

The USGS measured and published Suwannee River streamflow at Dowling Park and Ellaville, downstream of the escarpment. Annual-averaged, measured streamflow decreased 190 cubic feet per second (cfs) from Ellaville to Dowling Park during 2001. In version 1.1 of NFSEG, SRWMD simulated order-of-magnitude  $10^{[0]}$  cfs surface runoff to this 15-mile reach during 2001. Most precipitation on this unconfined part of the Floridan infiltrates to the aquifer and does not run off. Precipitation on this reach was order-of-magnitude  $10^{[0]}$  cfs in 2001; evaporation from this reach is order-of-magnitude equivalent to precipitation.

Almost all the 190-cfs decrease in measured streamflow from Ellaville to Dowling Park fluxed to the subsurface during 2001. Preliminarily, benthic recharge flux to the Suwannee River from Ellaville to Dowling Park was order-of-magnitude  $10^{[-1]}$  foot per day during 2001. Consequently, the Floridan aquifer system does not net-baseflow to the Suwannee River along this reach, at the annual timescale. Published analyses showed (i) this to also be a net-benthic-recharge reach during 2001 and 2010; and that (ii) the Floridan aquifer system net-baseflowed to the Suwannee River downstream and upstream of this reach during 2001, 2009, and 2010.

**BIO:** Dr. King and Mr. Durden support Floridians as engineering scientists by simulating groundwater flow, springflow, and benthic flux in Northern Florida.

## **One Water in Action: Breaking Silos, Building Resilience, Managing Every Drop**

***Kassidy King***

City of Winter Haven, Winter Haven, FL, USA

Successful One Water implementation relies as much on public trust as on technical performance. This session examines how transparent communication, early engagement, and straightforward storytelling can simplify complex issues and strengthen community understanding. Through real-world examples, speakers will demonstrate how building relationships with residents, regulators, and decision-makers fosters lasting support for integrated water initiatives. Attendees will gain practical tools to communicate the value of One Water, cultivate community champions, and reinforce confidence that every drop—and every dollar—matters.

# NEW METHODS FOR DEVELOPING MINIMUM FLOWS AND LEVELS FOR SPRINGS IN THE SUWANNEE RIVER BASIN

*Sean King, Paul Donsky, Xiaoqing Huang and Amy Brown*

Suwannee River Water Management District, Live Oak, FL, USA

The Suwannee River Water Management District (SRWMD) is responsible for conducting environmental flow evaluations to develop minimum flows and levels (MFLs) for priority waterbodies in the region. These MFLs set the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. As required by state rule, ten environmental values are considered during the MFL development process to address important recreational and ecological aspects of each waterbody as applicable. The SRWMD contains over 450 identified springs including nineteen first magnitude spring systems and fourteen Outstanding Florida Springs. Many of these springs are situated along the Suwannee and Santa Fe Rivers, where river levels can affect discharge from the springs. During river flood events, tannic river water may periodically intrude into the springs, creating brown-out conditions that can have negative effects on the recreational and ecological values of these spring systems. This is a natural phenomenon for these springs; however, data shows that higher aquifer levels can limit the persistence of these brown-out conditions by creating a head gradient that lessens the amount of river water that can enter a spring. To address these flood events in the MFL evaluation process, SRWMD staff are utilizing flow estimation techniques and two-dimensional hydrologic models that account for aquifer levels, spring flows, and river levels. We have proposed new and modified MFL metrics that focus on the unique characteristics of springs in the Suwannee River basin, such as maintaining flow velocities that scour away algal mats and flush sediment from gravel bed habitats. The frequency and duration of brown-out conditions due to river intrusion events appears to be a promising new metric that is linked to aquifer levels and can be exacerbated by groundwater withdrawals.

**BIO:** Dr. King is the Minimum Flows and Water Levels Office Chief at the Suwannee River Water Management District where he serves as a technical expert in aquatic ecology and water resources engineering and leads a team of scientists and engineers to establish MFLs for priority waterbodies and develop hydrologic models.

## Emerging Contaminants Discovered Across Everglades Matrices: Water, Sediment, and Manatee Feces

*Emily Kintzele*<sup>1</sup>, *Baylie Reisch*<sup>1</sup>, *Angelica Ahrens*<sup>2</sup>, *Maite de Maria*<sup>3</sup>, *Nolan Lyons*<sup>1</sup>, *Bridget B. Baker*<sup>4</sup>, *Margaret Hunter*<sup>5</sup>, *Tracie R. Baker*<sup>1</sup>

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<sup>3</sup>Cherokee Nation System Solutions in support of U.S Geological Survey, Wetland and Aquatic Research Center

<sup>4</sup>University of Florida, Department of Wildlife Ecology and Conservation

<sup>5</sup>U.S Geological Survey, Wetland and Aquatic Research Center

Water quality parameters from 12 sites spanning the Gulf to the Atlantic Ocean documented the co-occurrence of microplastics, per- and polyfluoroalkyl substances (PFAS), and other emerging contaminants including pesticides, pharmaceuticals, metals, and illicit drugs, providing a broader understanding of contaminant drivers in this ecosystem. The most remote sites within the Everglades rivaled the contamination profiles of the metropolitan area of Miami with similar, if not higher, concentrations or counts of contaminants. This discovery prompts further investigation into the widespread nature and impact of emerging contaminants in natural, seemingly pristine, environments.

We further investigated microplastics, defined as plastic particles 5 mm or less in size, which are pervasive pollutants of emerging concern across marine ecosystems. Microplastics are widespread in sediment, water, plants, and animals, raising concern for vulnerable species such as the Florida manatee (*Trichechus manatus latirostris*). Ingested microplastics can cause mechanical injury to the gut lining and disrupt nutritional balance, potentially altering the gut microbiome. This study introduces a novel, noninvasive approach to evaluate microplastic exposure and microbiome shifts in manatees through fecal analysis of fresh and archived samples (2011–2025) obtained from Brevard County, Crystal River, and Everglades National Park. Microplastics were detected in fecal samples dating back to 2011, with ongoing FTIR analysis identifying polymer types. Preliminary 16S rRNA sequencing analysis and pairwise comparisons are underway to assess associations with water quality, dietary, anthropogenic, or ecological stressors, including unusual mortality events.

Together, these investigations demonstrate that Florida's waterways, including the protected Everglades, are impacted by diverse pollutants with implications for wildlife and ecosystem health. By integrating microplastic and microbiome analyses in manatees with ecosystem-scale contaminant monitoring, this research advances understanding of pollutant exposure pathways and highlights the role of manatees as sentinel species for conservation strategies.

**BIO:** Emily Kintzele is a third year Public Health PhD student at UF with a One Health concentration. She conducts research on environmental toxicology doing field work and using zebrafish as an animal model. Emily is focusing on the Everglades and how emerging contaminants affect environmental, wildlife, and public health.

## Can Eager Beavers or Beaver Analogs Rehydrate Wetlands in South-Central Alaska?

**Michael Knight**<sup>1</sup>, Kai C. Rains<sup>1</sup>, Tyelyn Brigino<sup>1</sup>, Mark C. Rains<sup>1</sup>, and Spencer Johnson<sup>2</sup>

<sup>1</sup>University of South Florida, Tampa, FL, USA

<sup>2</sup>Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA

There is growing interest in innovative approaches to wetland restoration which can enhance hydrologic functions, including those that delay (i.e., lag functions), retain (i.e., sink functions), and release (i.e., source functions) water. In south-central Alaska, wetlands are undergoing a multidecadal drying trend caused by climate change and isostatic and/or tectonic uplift. Simultaneously, beavers have been extirpated in many parts of this region. We are investigating how restored beaver dams and constructed beaver dam analogs (BDAs) affect wetland hydrology, including if, under what circumstances, and to what extent they can be used to rehydrate wetlands. We established study sites in three adjacent tributaries bordered by streamside wetlands. We installed five water level monitoring wells at each site at 60cm elevation intervals, four along the stream channel, including one downstream of the treatment locations, and a fifth off-channel. We monitored baseline water levels (hourly readings) for one year, then instituted treatments by repairing a recently breached beaver dam at one site, constructing a BDA at another site, and retaining the third site as a control. Pre-treatment water levels were generally near or above the ground surface, increasing periodically by up to 35 cm due to seasonal conditions such as fall precipitation, including rain-on-snow events, winter ice dams, and spring snowmelt. Restoration of the beaver dam and construction of the BDA have resulted in a baseline increase in water levels up to 25 cm above ground level proximal to the beaver dam and BDA, and an increase in the spatial extent of inundation. Our next steps are to explore what physical and hydrologic features of the beaver dam and/or BDA control the depth, extent, and duration of inundation. Four features will be assessed using Soil and Water Assessment Tool Plus (SWAT+) and presented: height of the beaver dam or BDA, permeability of the beaver dam or BDA, height of the water table prior to the construction of the beaver dam or BDA, and permeability of the subsurface. Though ongoing, our study is already serving as a physical laboratory and demonstration for local partners to visually see the effects of beaver dams and/or BDAs on wetland rehydration.

**BIO:** Michael Knight is a M.S. student (Geology) working with the Ecohydrology Research Group in the School of Geosciences at the University of South Florida. His research interest is in the use of field work and hydrologic modeling to understand the connection of hydrology in the environment which has led to working on projects with beaver dams/ BDAs in Alaska and modeling (ArcNLET) nitrogen plumes from septic tanks for project evaluation (LANLoad) in support of water quality management in Florida.

# FLUORESCENCE IN THE FIELD: VALIDATING AND APPLYING A TLF SENSOR TO MONITOR MICROBIAL WATER QUALITY

**Whitney N Knopp**<sup>1,2</sup>, Josh T Klaus<sup>1</sup>, Matt Ross<sup>3</sup>, Mike Vlah<sup>3</sup>, and Evan Thomas<sup>1,2</sup>

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<sup>3</sup> OpenCurrent, Fort Collins, CO USA

Over half the world lacks access to safe drinking water, with fecal contamination cited as a primary source of pollution. Microbial contamination of global surface waters, from sewer overflows and runoff, pose threats to humans during recreation and environmental health. *E. coli* is widely used as an indicator of fecal contamination in freshwater systems; however existing monitoring methods limit spatially and temporally dense data collection. Conventional regulatory methods require field sampling, lab analysis and incubation, which inhibits capacity for action toward improving water quality and transparency with users.

Tryptophan-like fluorescence (TLF) is a wavelength of fluorescence whose presence is correlated with microbial activity. TLF offers a mechanism for real-time detection or semi-quantification of *E. coli*. Here, we present preliminary data on a novel internet-connected TLF sensor that we have developed. Approximately 12 sensors were deployed from March to September 2025 in recreational surface waters across the US (Boulder, CO; Chicago, IL; Cleveland, OH; Manchester, MA) and France (Paris). Sensor readings were uploaded daily via cellphone networks. Grab samples were collected (weekly or daily, site-dependent) collocated with deployment sites and enumerated with EPA and ISO approved methods, membrane filtration and Colilert. Using this data, we built a labelled modelling dataset pairing known *E. Coli* concentrations with raw sensor readings.

The model outputs categorical predictions of contamination risk aligned with typical recreating standards, ~ 300 CFU/100 mL, and low risk drinking water, < 10 CFU/100 mL, with 70% accuracy. Site-level holdout balanced accuracies range from 65%-90% using sensor data alone. Monitoring applications include safety, source attribution and regulatory compliance of recreational waters and public health protection, process control and validation for carbon-credit generating projects for drinking water. Next steps include validation of newest sensor version and pilot deployment as monitoring technology for a drinking water program in Rwanda.

**BIO:** Knopp is an environmental engineering PhD student at the University of Colorado Boulder and an environmental engineer with Virridy. Her research validates and applies technology for real time detection of *E. coli* contamination with TLF in drinking and surface waters. She works across Kenya, Rwanda, United States and France.

# Evaluating the use of satellite Imagery for Stormwater Pond Quality Management in Florida, USA

*Hannah Knotts<sup>1</sup>, Trista Brophy-Cerquera<sup>2</sup>, Eban Bean<sup>1</sup>*

<sup>1</sup>University of Florida, Department of Agricultural and Biological Engineering, Gainesville, FL, USA

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As urban landscapes continue to expand in response to an increasing global population, effective stormwater control measures have become increasingly important for maintaining acceptable water quality standards. Stormwater wet ponds are among the most widely implemented stormwater control measures, designed to capture incoming stormwater runoff and pollutants that may impact downstream water bodies. These ponds play a vital role in protecting public and environmental health by reducing nutrient loads and improving water quality. However, stormwater wet ponds require routine inspections and observation to ensure ecosystem function is not compromised. Traditional inspection methods fall short because they are laborious, costly, and lack temporal and spatial coverage.

Remote sensing may serve as a substitute for traditional water quality monitoring for marine and in-land water bodies alike. ESA's Sentinel-2 has gained attention as a water quality assessment tool in recent years for its relatively high spatial resolution and open-access data policy. This study evaluates the use of Sentinel-2 imagery for water quality monitoring of stormwater ponds compared to in-situ data. This creates an opportunity for ex-situ monitoring techniques for urban stormwater wet ponds. Previous studies using multispectral satellites, like Sentinel-2 and Landsat-8, have demonstrated strong potential for monitoring water quality in lakes and reservoirs. The performance of Sentinel-2 imagery and supporting algorithms as a water quality monitoring alternative versus lake water chemistry data from Florida's LAKEWATCH will be assessed. By comparing remote sensing data with LAKEWATCH data, we plan to contribute to improving the understanding of stormwater pond performance and to advance the use of remote sensing as a reliable, scalable method for managing urban water quality.

**BIO:** After receiving her bachelor's degree from Mississippi State University in geosciences with a concentration in professional meteorology and a minor in chemistry in 2024, Hannah began her master's at the University of Florida in agricultural and biological engineering.

# ECONOMIC VALUATION OF CONCURRENT FRESHWATER AND COASTAL HARMFUL ALGAL BLOOMS IN SOUTHWEST FLORIDA

*Roberto F. Koeneke, Christa D. Court, James “Xinde” Ji, and Weizhe Weng*

University of Florida, Gainesville, FL, USA

Algal bloom events occur naturally in freshwater and coastal ecosystems under conditions of excessive algal growth. Some species of algae that bloom, such as *Karenia brevis* in marine environments and cyanobacteria in freshwater environments, can have negative impacts on human and natural systems (Berdalet et al., 2016; Fleming et al., 2002; Reif et al., 2023; Stumpf et al., 2022; Turley et al., 2022). These bloom events are known as harmful algal blooms (HABs), and impacts include human health issues, changes in water quality, decreased property values, and significant economic losses across sectors such as accommodations, commercial fishing, and water-related recreation (e.g., Ferreira et al., 2023; Fleming et al., 2002; Watkins et al., 2008). Due to various anthropogenic and natural factors, Florida experiences both red tide (linked to *K. brevis*) and blue-green algal blooms (linked to cyanobacteria). Some of these HAB events can be severe and long-lasting, including the concurrent red tide and blue-green algal bloom event in 2018 in Southwest Florida. This research study estimates the impacts of concurrent red tide and blue-green algal bloom events in Lee County, Florida, using a hedonic property model.

Our identification strategy leverages the distinct spatial and temporal patterns of these two bloom events to quantify their individual and interactive effects on property values. Our empirical specification compares the sales prices of HAB-impacted vs. not impacted properties observed during and outside of the HAB event windows (Banzhaf, 2021; Butts, 2023) for a 24-year panel of daily water quality, property, and HAB event data. This study contributes to the literature by being the first to estimate the economic impacts of concurrent coastal and freshwater HAB events. The results can be applied outside of Florida to other regions that are subject to multiple types of HABs and other coastal and aquatic water quality impairments.

**BIO:** Mr. Koeneke is a PhD candidate in Food and Resource Economics, specializing in environmental and natural resource economics and regional economics and applications. He has worked on various interdisciplinary projects focused on the relationships between environmental and human systems, including the economic impacts of land use changes in Florida watersheds.

# Field Comparison of Hydrodynamics on Mangrove-Vegetated, Unvegetated, and Hybrid Shorelines

*Megan Kramer<sup>1</sup>, Mauricio Arias<sup>1</sup>, and Steven Meyers<sup>2</sup>*

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Coastal wetlands offer numerous ecosystem services including wave reduction, sparking interest in their utility for coastal resiliency planning. The rise of nature-based solutions that make use of the provisions of mangrove wetlands has increased the need for comprehensive hybrid infrastructure design guidelines. In this study, we explore the potential to combine mangroves with hard infrastructure by comparing wave and velocity dissipation across three shoreline types: narrow mangrove belt (<10 m) shoreward of a seawall, seawall only, and natural mangrove forest. We conducted field campaigns at two locations in Tampa Bay, Florida, where we measured hydrostatic pressure and velocity using pressure transducers and acoustic doppler current profilers along cross-shore transects at each of the three shoreline types (six total transects) for a period of 2.5 weeks. We then calculated and compared the change in wave energy and velocity that occurred from offshore to onshore transect points among the different shorelines. All shorelines demonstrated an increase in long period (1 – 40 min) wave energy and velocities from offshore to onshore transect points, with slightly larger amplifications at the vegetated shorelines. Overall, the mangroves demonstrated a minor impact on hydrodynamics at the local scale under typical conditions in shallow sheltered estuarine environments.

**BIO:** Megan Kramer is a PhD Candidate in Environmental Engineering at the University of South Florida. Her research focuses on coastal resilience and nature-based solutions. In her dissertation, she investigates the flood mitigation abilities of mangroves in urban coastal areas and the potential benefits of hybrid coastal infrastructure.

## **Navigating Florida house bill 1379: A case for unified septic system education**

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Conventional septic systems contribute significantly to nitrogen pollution in Florida's Springs Basin Management Action Plan (BMAP) areas. The 2016 Florida Water Bill (SB 552) mandated remediation in Priority Focus Areas (PFAs), requiring sewer connections or enhanced nitrogen-reducing systems for developments on lots under one acre. In 2023, Florida House Bill 1379 (HB 1379) expanded these requirements statewide, including the Indian River Lagoon and full BMAP areas. However, the bill's implementation remains unclear due to insufficient guidance.

To assess statewide needs and challenges, UF/IFAS Extension and the UF/IFAS Center for Public Issues Education conducted focus groups with regional representatives and industry stakeholders. Key findings revealed widespread concern over the cost of implementation, inconsistent experience with sewer systems, and varying levels of knowledge about HB 1379's specifics. Participants cited confusion over which state agency is responsible for implementation. The rollout was described as rapid and disorganized, with unclear timelines, enforcement strategies, and resource availability.

Stakeholders identified affected groups as homeowners, utilities, septic businesses, developers, and builders. Barriers included funding, infrastructure limitations, community engagement, and maintenance challenges. To address these, participants recommended increased funding, clear agency leadership, targeted education campaigns, strategic communication materials, and a reassessment of implementation timelines. There was strong support for forming a statewide septic and sewer working group to coordinate efforts and share best practices.

This research highlights the urgent need for coordinated action, education, and support to ensure effective implementation of HB 1379 and reduce nitrogen pollution from septic systems across Florida.

# Impacts of Future Land Cover on Nutrient and Sediment Load Across the Southeast United States

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Large-scale models (regional and sub-regional) predict nutrient loads under various conditions and support decisions related to water pollution mitigation, which is a coordinated multi-agency problem. This study refined the SPATIally Referenced Regression on Watershed attributes (SPARROW) model to better project annual loads of total nitrogen (TN), total phosphorus (TP), and suspended sediment (SS) for the Southeastern United States. The refinements included adding more detailed land use/land cover (LULC) classifications alongside geomorphic and geologic variables to improve regional prediction of TN, TP, and SS by SPARROW. Our re-calibration of the existing SPARROW against observed data that demonstrated excellent performance, with Kling–Gupta Efficiency (KGE) values of 0.87 for TN, 0.70 for TP, and 0.80 for TSS, respectively. The numbers show substantial improvements in the model, particularly for TP (40% improvement). These improvements reflect the importance of more detailed LULC in capturing spatial variability of nutrient sources and delivery. Forests and wetlands primarily acted as nutrient and sediment sinks, although in well-drained ecoregions, they may facilitate limited dissolved nitrogen transport. Croplands and urban areas were dominant nutrient and sediment sources, while forests and wetlands reduced downstream delivery. Spatial patterns revealed high loads in the Piedmont, Dougherty Plain, and Black Belt ecoregions and lower loads in forested and wetland-rich areas of the Coastal Plain. Using the improved RSPARROW and existing projections of LULC, we predicted future annual loads of TN, TP and TSS. We evaluated the impacts of LULC across a range of ecoregions and spatial scales—from subwatershed (HUC12) to sub-regional (HUC4) scales.

**BIO:** Anjali K. is a Ph.D. student at Florida State University focusing on large-scale water quality modeling using the RSPARROW framework. Her research explores how land use and climate variability influence nutrient and sediment transport across the Southeastern United States to support science-based watershed management.

# Temporal Effects of DOM Quality on Hg Bioaccumulation across the Wet Season in a Hypereutrophic Lake

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Mercury (Hg) is a contaminant of global concern whose availability, uptake, and bioaccumulation in freshwater ecosystems can be influenced by the source and composition of dissolved organic matter (DOM). Most of what is known about the relationship between DOM quality and quantity originates in northern ecosystems, with little focus in subtropical ecosystems. It is likely that the distinct wet and dry seasons that Florida experiences can lead to temporal variability in the source, composition and quantity of DOM within lakes and this may impact Hg cycling. As such, the goals of this study were to 1) examine whether DOM composition and quantity vary temporally, and 2) if this variability affects Hg concentrations ([Hg]) of pelagic and littoral biota. From April to October 2025, we intensively sampled Lochloosa Lake, a hypereutrophic lake representative of lakes in Central Florida. Specifically, we collected monthly water samples for common chemistry parameters (i.e., nutrients, sulfate, DOM quantity), as well as optical-based DOM composition measurements, and pelagic (i.e. zooplankton, midge larvae, and shad species) and littoral (i.e. mosquito fish, grass shrimp, and water scorpions) biota. While field and lab work are on-going, methylmercury concentrations and total [Hg] of biota are being evaluated to determine temporal variation, and their relationship to DOM composition and quantity. We hypothesized that [Hg] of biota would increase temporally, over the wet season, due to increased wet Hg deposition and increased imports of terrestrial DOM- bound Hg caused by frequent rewetting of riparian areas. Preliminary analyses suggests that DOM quality and quantity vary temporally, with smaller and more biologically active DOM of terrestrial origin prevalent as the wet season progresses. Yet, [Hg] in pelagic fish remain relatively stable, whereas [Hg] in littoral fish show site-specific differences. This work provides new knowledge on what environmental parameters influence seasonal variability in Hg dynamics in understudied subtropical lakes and may assist in the development of future monitoring plans for Hg risk and remediation efforts in Florida's freshwater ecosystems.

## **'WATCHING' PONDS TO UNRAVEL FERTILIZER INFLUENCES ON AQUATIC VEGETATION IN COASTAL ENVIRONMENTS**

***Ernesto Lasso de la Vega***

Lee County Hyacinth Control District, Lehigh Acres, FL, USA

Since the implementation of the Lee County Fertilizer Ordinance (No. 08-08) in 2008, nutrient dynamics in urban stormwater ponds have been closely monitored, particularly nitrogen species such as nitrites and nitrates (NO<sub>x</sub>). A key provision of the ordinance is the prohibition of fertilizer application during the rainy season, designated as the Black Out Period (BOP), from June 1st to September 30th. This study analyzes long-term nutrient data collected through the Lee County Hyacinth Control District's Pond Watch Program, a citizen science initiative that has monitored water quality in stormwater ponds since 1993. Monthly water samples from 2009 to 2025 reveal consistent seasonal patterns in NO<sub>x</sub> concentrations. As expected, NO<sub>x</sub> levels typically decline from May to June, coinciding with the onset of the BOP. However, a recurring and concerning trend has emerged: NO<sub>x</sub> concentrations often spike in October, surpassing those in September. This suggests that fertilizer application resumes immediately after the BOP, potentially before the rainy season has fully subsided. This pattern has become more pronounced in the past four years, raising questions about the ordinance's effectiveness under shifting climatic conditions. Extended rainfall into October may render the current BOP timeframe insufficient, allowing nutrients to enter stormwater systems and degrade water quality. These findings underscore the importance of adaptive management strategies and enhanced public awareness regarding landscaping practices.

Citizen monitoring programs play a critical role in identifying nutrient trends and empowering communities to mitigate their environmental impact. By tracking nutrient levels in outflow waters, residents can better understand and manage the contributions of their neighborhoods to downstream water bodies and coastal ecosystems.

**BIO:** Dr. Lasso de la Vega has been working at the Lee County Hyacinth Control District in Fort Myers, Florida since 1991 as a biologist controlling aquatic weeds. He is also the coordinator of the Pond Watch Program, a volunteer monitoring program that educates homeowners about ways to minimize aquatic weed problems.

## Evaluating Development Scenarios to Protect Vital Sportfish Habitat in SW Florida

**Kallan Latham**, Eban Bean PhD, PE

University of Florida, Gainesville, FL, USA

Rapid urbanization on coastlines is known to impact fragile ecosystems such as estuaries, salt marshes, and mangrove forests by changing the natural hydrologic regime and interrupting habitat continuity. In Charlotte County, FL, a mosaic of coastal ponds and creeks serves as a critical sport fish nursery habitat for Tarpon and Common Snook, supporting a major economic driver for the region which attracts visitors from around the world. These sensitive habitat areas are situated within an area that was platted for future development in the 1980s but has remained relatively undeveloped, though further development is anticipated in the coming years. The increased runoff from future development could degrade these nursery habitats and ultimately impact the regional economy. Additional threats to these areas include the impacts of climate change and sea level rise (SLR). Modifying the development plan by including green stormwater infrastructure (GSI) or focusing development density in lots further away from the habitat could reduce the impacts on these habitat areas. To evaluate this, StormWise, a hydrologic and hydraulic (H&H) model, was developed to simulate current and future conditions of the area. This model has been calibrated and validated by comparing results to observations from select rainfall and hurricane events. Various future development scenarios will be simulated, including variations in development densities and their spatial orientation, climate change impacts, and SLR scenarios. Combinations of land development and GSI configurations will be used to evaluate how development rules could be used to minimize impacts of urbanization, climate change, and SLR on this fragile ecosystem and the base of this county's economy. Results of this study will inform Charlotte County's future land use plans and regulations to protect these fragile sportfish nursery habitats.

**BIO:** Kallan Latham is a master's student in the Agricultural and Biological Engineering department at the University of Florida. She received her bachelor's degree from The Ohio State University in Food, Agricultural, and Biological Engineering with a specialization in ecological engineering. Her research interests include urban hydrology and green stormwater infrastructure.

# INTRODUCTION OF A PROTOTYPE FOR AN AUTOMATED IN-SITU ENTEROCOCCI MONITORING SYSTEM

*Hai Le and Chamteut Oh*

University of Florida, Gainesville, FL, USA

Enterococci are fecal indicator bacteria that have been used as regulatory markers to evaluate microbial water quality in both freshwater and saltwater environments. Accurate measurement of enterococci levels is important for protecting public health and supporting the economy. For example, enterococci data are used to assess the safety of irrigation water and determine public access to recreational waters. Enterococci levels can change rapidly over short time scales—within hours or even minutes—depending on weather conditions and point-source pollution discharges. Despite this variability, measurements are typically performed only on daily, weekly, or even seasonal intervals, because conventional analysis requires sample collection and transportation to a laboratory. We envision that an automated in-situ enterococci analysis system, which eliminates the need for field sampling campaigns, would allow a much better understanding of real-time microbial water quality dynamics. In this work, we present our effort to develop such a system. Our prototype includes an incubator with a programmable pump that enables automated liquid handling for enterococci analysis without the need for personnel. The system also incorporates a cooler with UV lamps for long-term preservation of culture media. In addition, it can transmit analytical results remotely to the laboratory. We believe this prototype demonstrates strong potential for realizing a fully automated in-situ enterococci monitoring system.

**BIO:** Dr. Hai Le earned his first Ph.D. in Electrical Engineering. He is currently pursuing his second Ph.D. in the Department of Environmental Engineering Sciences at the University of Florida, where he develops automated in-situ microbial water quality measurement systems.

# Climatic and Hydrologic Drivers of Concentration-Discharge Relationship Non-Linearity

*Jaehyeon Lee<sup>1</sup>, Dan Dai<sup>1</sup>, Matthew J. Cohen<sup>2</sup>, and James W. Jawitz<sup>1</sup>*

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<sup>2</sup>Water Institute, University of Florida, Gainesville, Florida, USA

The relationship between concentration (C) and discharge (Q) is a useful indicator of Biological and hydrological processes. The slope of a single fitted C-Q power function is widely interpreted to denote dilution, enrichment, and chemostatic transport behaviors. However, C-Q curves often exhibit bending, challenging the convention of fitting a single power function to the data, and implying more complex underlying biogeochemical or hydrological processes. In this work, we sought to differentiate the factors that affect non-linearity in C-Q relationships. We tested effects of climatic and hydrologic drivers on the C-Q relationship using over 30 years of data for nitrate, calcium, and dissolved organic carbon data across the conterminous United States from the CAMELS-chem dataset. We quantified seasonal characteristics of solute concentration and discharge by fitting sine functions where seasonal timing manifests as phase and intensity as amplitude. We found that C-Q non-linearity arises primarily from the phase difference between seasonal patterns of C and Q, and the degree of non-linearity increases with the seasonal variability of C. These findings emphasize the crucial role that seasonal dynamics, including both the strength of the seasonal signal and the phase relationship between C and Q, have in shaping the curvature and slope of the C-Q relationship.

**BIO:** Jaehyeon Lee is a postdoctoral researcher at the University of Florida. His research focuses on understanding the effects of climate seasonality on water quantity, water quality, and lakes. He received his bachelor's and master's degrees from Hongik University in Korea, and his Ph.D. degree from the University of Florida.

## Coupled C, N, and P Cycling within an Agriculturally Dominated Watershed

*Shin-Ah Lee*<sup>1</sup>, *Hector Fajardo*,<sup>2</sup> *Natalie Nelson*<sup>2</sup>, *Rebecca Muenich*<sup>3</sup>, *Daniel Obenour*<sup>4</sup>, *Luke Gatiboni*<sup>5</sup> and *Elise Morrison*<sup>1</sup>

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Understanding the coupled behavior of carbon (C), nitrogen (N), and phosphorus (P) cycles provides the foundation for predicting nutrient fluxes and improving water-quality management in agricultural environments. Stable isotope analyses offer a powerful approach to trace nutrient sources and transformations across soil–water systems. To determine seasonal changes in the sources of key elements and nutrients in an agricultural area, we collected soil samples from the Tidewater Research Station (Plymouth, NC) and water samples from surrounding canals and creeks. Within the agricultural research station, we compared fields with low and high inorganic P fertilizer application with fields that received swine lagoon effluent. We applied multiple isotope tracers, including  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ , and  $\delta^{18}\text{O}$  of phosphate ( $\delta^{18}\text{O}\text{-PO}_4$ ), to identify dominant nutrient sources and evaluate their mobilization and mixing processes within an intensively managed watershed. The isotopic compositions of C, N, and P differed markedly between fields receiving inorganic fertilizer and those receiving swine lagoon effluent. The swine spray field exhibited elevated organic matter and organic N, whereas the low-P fertilizer field had higher inorganic N and the high-P fertilizer field showed elevated P concentrations. In addition to inorganic fertilizers and swine lagoon effluent, freshwater phytoplankton, wastewater treatment effluent, and  $\text{C}_3$  plants were included as potential endmembers for isotopic and chemical characterization. A deconvolutional Bayesian mixing model framework (D-MixSIAR) integrating  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  data indicated higher freshwater phytoplankton production during June. Selected sites were also analyzed for  $\delta^{18}\text{O}\text{-PO}_4$  to assess spatial variability in agricultural fields and potential isotopic equilibration during phosphate cycling. This integrated multi-isotope and modeling framework advances our understanding of C, N, and P cycles and identifies key pathways of nutrient transfer within agricultural landscapes, which supports development of targeted management strategies to mitigate nutrient losses and eutrophication risks.

**BIO:** Dr. Lee is a research assistant scientist in the Department of Environmental Engineering Sciences at the University of Florida. She has a strong background in marine biogeochemistry, with a focus on coastal environments. Her ongoing research focuses on investigating various systems using multiple biogeochemical tracers, including stable isotopes.

## **Enhancing Resilience of Green Infrastructure with Mitigation Banking**

***John Lesman***

Vice President of Mitigation Banking at Bio-Tech Consulting, Orlando, FL, USA

Mitigation banking has long been used to offset unavoidable wetland and habitat impacts, but it also provides lasting benefits that strengthen community and ecosystem resilience. This presentation will discuss how mitigation banks contribute to flood storage, water quality improvement, and habitat connectivity, which are key functions that support the reliability of green infrastructure. Drawing on examples from Florida, it will highlight how thoughtful site selection, design, and long-term management create stable systems that complement local and regional resilience efforts. The session will also touch on opportunities for planners, engineers, and project developers to integrate mitigation banking into watershed planning and nature-based solutions.

**BIO:** John Lesman brings 36 years of environmental permitting experience and is Vice President of Mitigation Banking at Bio-Tech Consulting. He has worked with local, state, and federal agencies on mitigation banking, UMAM assessments, wetland delineation, and regulatory permitting. John has served as President of the Florida Regional Councils Association and the Central Florida and Florida Chapters of Environmental Professionals. He is also an Eagle Scout.

# CONDITION-BASED OPERATIONS: REAL-TIME INTELLIGENCE FOR FLORIDA'S WATER QUALITY MANAGEMENT

**Terri Lewis**

Cerebulb, Fort Myers, FL USA

Florida's communities face mounting challenges in managing water quality—from aging infrastructure to nutrient-driven impairments and more intense rainfall events. Many municipalities remain constrained by periodic, laboratory-based monitoring that limits their ability to detect, diagnose, and communicate contamination events in real time. As a result, compliance efforts are often reactive rather than predictive, leaving communities vulnerable to repeated E. coli exceedances and storm-driven discharges.

Emerging advances in Internet of Things (IoT) connectivity, low-cost sensing, and cloud analytics are now transforming this paradigm. Continuous water-quality monitoring systems, coupled with fluorescence-based and optical sensors, can detect contamination indicators within minutes instead of days. When integrated into secure Industrial IoT (IIoT) platforms, these data streams become the foundation for *condition-based operations*—where utilities respond to actual system conditions rather than static sampling schedules.

CereBulb's work with cities and utilities demonstrates that actionable intelligence arises not merely from data collection but from contextualization and analytics. By aggregating data across sensors, SCADA systems, and GIS layers, utilities can visualize system health in real time, apply machine learning to predict emerging risks, and automate alerts or maintenance workflows. This integration converts compliance datasets into operational insight—helping identify root causes, optimize resources, and prevent service disruptions.

Condition-based operations also strengthen public trust through transparency. Real-time dashboards provide communities and regulators with visibility into water quality trends, supporting accountability and early intervention. Importantly, utilities do not need “high AssetIQ” to begin; even modest sensor deployments combined with contextual data can deliver meaningful insight through rules-based, physics-informed, or AI-enhanced models.

Florida's ongoing water-quality challenges present both a need and an opportunity: to move from periodic reporting toward continuous understanding. By embracing IoT-enabled monitoring, contextual analytics, and condition-based operations, utilities can transform reactive compliance into proactive stewardship—making water systems smarter, safer, and more resilient for the communities they serve.

**BIO:** Terri Lewis is a global technologist and strategic advisor with CereBulb, driving Industrial IoT and AI innovation across water, energy, and transportation sectors. With over three decades of experience, she helps Florida utilities modernize stormwater and water-quality operations through connected systems, real-time analytics, and data-driven decision tools for resilient infrastructure.

# ADVANCING HISTORICAL WETLAND AND LAKE MAPPING WITH GEOAI-DRIVEN ANALYSIS OF GRAYSCALE AERIAL IMAGERY

*Zamil A. Limon, Edgar Guerron-Orejuela, Mark C. Rains, Kai C. Rains*

Ecohydrology Research Group, School of Geosciences, University of South Florida, Tampa, FL, USA

Historical aerial photographs provide critical information for assessing environmental change and establishing restoration priorities. However, challenges such as grayscale tonal ambiguity, hand-drawn artifacts, embedded photo labels, black borders, and variations in spatial resolution complicate automated detection of target features. In this study, we introduce an automated workflow for mapping historical wetlands using mid-20th-century grayscale aerial photographs in St. Lucie County, Florida, which forms a key sub-basin of the Indian River Lagoon (IRL). We acquired, georeferenced, and mosaicked 222 historical (1940s) aerial photographs and relied on a training and testing dataset developed through heads-up digitization of wetlands and lakes depicted in the photomosaic. To evaluate methodological efficiency in detecting wetlands and lakes, we applied two parallel approaches: an unsupervised binarization-based segmentation pipeline (comprising blurring, thresholding, and edge detection) requiring no training data, and a supervised deep learning framework (U-Net CNN with a ResNet34 backbone) trained on image chips derived from mosaics. Model performance was assessed using confusion matrices, F1-scores, and accuracy metrics across St. Lucie County. Results indicate the U-Net model consistently outperformed the binarization approach, achieving robust delineation of wetlands and lakes with overall accuracy exceeding 83%. Moreover, the F1-score of 0.87 indicates a well-balanced and reliable performance in distinguishing wetlands from non-wetlands. While the binarization method effectively captured darker tonal wetlands and irregular wetland shapes, it often misclassified active agricultural areas as wetlands. In contrast, the U-Net deep learning model showed better performance in handling tonal variability, excluding labels and hand-drawn artifacts, and avoiding misclassification of channels. This comparative framework establishes a replicable methodology for integrating historical imagery with modern machine learning techniques, offering critical insights into wetland extent, wetland loss trajectories, and regional-scale restoration planning.

**BIO:** Zamil Ahamed Limon is a master's student (Geography) working with the Ecohydrology Research Group in the School of Geosciences at the University of South Florida. Broadly, his research interests include remote sensing, spatial modeling, and ecohydrological analysis aimed at understanding the interactions between land cover change, surface hydrology, and wetland ecosystem function.

## **DIFFERENT TOOLS, DIFFERENT GOALS: HYDROLOGIC MODELING OF SOUTH FLORIDA'S WESTERN BASINS**

***Stephanie Long-Marquez, PhD, PE and Laura Vogel, PhD, PE***

Chen Moore and Associates, West Palm Beach, FL, USA

The Western Basins Region of South Florida includes the C-139, C-139 Annex, Feeder Canal, and L-28 Interceptor drainage basins, located primarily in Hendry County, south of Clewiston, Florida. Land use in this area consists of a mix of citrus farming, cattle ranching, and natural lands, with multiple private and public ownerships. Several recent and ongoing efforts have focused on modeling the Western Basins Region for various purposes. These modeling efforts highlight the importance of selecting the appropriate modeling tool to accurately represent the region's hydrologic processes and to meet specific study objectives.

This presentation will examine two recent modeling studies of the same area within the Western Basins Region, each using a distinctly different modeling approach to achieve widely different goals. The first approach utilizes a 2D HEC-RAS model to develop a high-resolution representation of the Feeder Canal drainage basin. This model has been applied to evaluate flow paths and inundation areas before and after the implementation of water quality improvement projects. The second approach employs an integrated groundwater/surface water model using MIKE SHE and MIKE+ to evaluate regional flooding across the entire Western Basins Region. Both modeling tools have been successfully implemented—despite their respective limitations—and each has proven effective in achieving its intended objectives. This presentation will discuss the strengths and weaknesses of both approaches and offer insights into strategies for selecting the most suitable modeling toolset for future studies.

**BIO:** Dr. Long-Marquez and Dr. Vogel are senior engineers at Chen Moore and Associates with a combined 25 years of experience in hydrologic modeling, including regional models designed to explore flooding, water quality, and storage.

# Assessing Nutrient and Pesticide Dynamics from Agricultural Fields to Lakes in South Florida through Machine-Learning MODELS

*Wei Mao<sup>1</sup>, Ming Ye<sup>1</sup>, Marie Cecil<sup>1</sup>, Paige Babushkin<sup>1</sup>, Michael Core<sup>1</sup> Elshall, Ahmed<sup>2</sup>, Nikolaos Tziolas<sup>3</sup> and Mewcha Amha Gebremedhin<sup>2</sup>*

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South Florida's subtropical climate and intensive agricultural production have resulted in some of the highest nutrient and pesticide application rates in the United States. The region's frequent rainfall, sandy soil, and dense lake network enhance the mobilization of agricultural chemicals, raising concerns about long-term contamination of surface waters. Numerous studies have investigated field-scale processes or regional water-quality trends, yet the linkage between agricultural applications and observed concentrations in downstream lakes remains poorly constrained. Regional hydrological models such as SWAT are widely applied to simulate nutrient and pesticide transport, but their representation of chemical fate is simplified—typically relying on a first-order decay to approximate inherently nonlinear attenuation processes governed by complex biogeochemical reactions and environmental heterogeneity. This assumption may limit their ability to capture the dynamic responses of nutrients and pesticides under varying conditions. To address these limitations, this study develops multiple machine learning models including LSTM, Random Forest, and LightGBM to predict nutrient and pesticide concentrations in representative lakes of South Florida and to identify key environmental. Spatial application data for nutrients and pesticides will be reconstructed from publicly available datasets, including USGS EPest pesticide estimates, county-level fertilizer and manure inputs, and crop distribution maps, by converting coarse inputs into monthly, catchment-level estimates. Environmental covariates such as land use, soil hydraulic properties, and meteorological drivers will be incorporated to examine how these factors jointly influence nutrient and pesticide transformation during transport. The results will clarify how agricultural intensity, hydroclimatic forcing, and catchment characteristics co-vary with observed concentrations at the lake scale, providing a transferable, data-driven framework for source–pathway–receptor assessment in subtropical lake systems.

**BIO:** Wei Mao is a postdoctoral researcher in the Department of Earth, Ocean, and Atmospheric Science at Florida State University (FSU). He received his Ph.D. in Hydraulic Engineering from Wuhan University, China, in 2019, and joined FSU in 2023. His research focuses on subsurface hydrology, and he has extensive experience in numerical modeling.

## **INNOVATION IN RESILIENCY: INTEGRATING GREEN AND GRAY CRITICAL FLOOD INFRASTRUCTURE PROJECTS**

**Ana Carolina Coelho Maran, PhD, PE**

South Florida Water Management District, West Palm Beach, FL

The South Florida Water Management District (SFWMD) is committed to assessing changing conditions, identifying increasing flood and water supply risks and vulnerabilities, and developing resilient adaptation strategies. In this session, we will explore the cutting-edge strategies and technologies being implemented to enhance resiliency against flood risks, focusing on the integration of green and gray critical flood infrastructure projects. Drawing on the comprehensive findings and recommendations from the 2025 SFWMD Sea Level Rise and Flood Resiliency Plan, we will examine how these approaches are being utilized to safeguard South Florida's communities, economy, and ecosystems.

The session will highlight key projects and initiatives that exemplify the integration of natural and engineered solutions to address the risks posed by urbanization, shifting weather patterns, and sea-level rise. Attendees will gain insights into the strategic planning and coordination efforts required to develop and implement resilient adaptation strategies that are both scientifically sound and practically effective.

By presenting case studies from the SFWMD's portfolio, we will showcase how green infrastructure, such as restored wetlands, enhanced detention storage and others are being harmoniously integrated with traditional gray infrastructure, like canal enhancements and pump stations. One of these examples, funded by the FDEP Innovative Tech Grant, the WIPE-Out Project, aims to pilot innovative technologies in the Snake Creek (C-9) Canal to protect water systems by capturing stormwater contaminants before they reach water bodies. This and other examples illustrate the multifaceted benefits of such an integrated approach, including enhanced flood protection, sustainable water resources, improved water quality and environmental restoration.

This session aims to provide valuable knowledge on the importance of a holistic and adaptive approach to flood management, emphasizing the need for ongoing assessment and innovation to keep pace with changing environmental conditions. South Florida is leading the way in creating resilient and sustainable water management solutions for the future.

**BIO:** Dr. Maran is the Division Director, Flood Control and Water Supply Planning and Chief of District Resiliency with SFWMD. In her role, she is responsible for coordinating flood control, water supply and resilience planning efforts across federal, state, regional and local agencies, advancing scientific research and data analysis to ensure the District's planning and projects are founded on the best available science; and, overseeing the advancement of critical flood infrastructure and comprehensive water supply projects that are essential to South Florida's economy, quality of life, and environment. Dr. Maran has a Ph.D. in Civil and Environmental Engineering from Colorado State University.

# Analyzing LAKE WATER LEVEL EXTREMES IN THE CONTINENTAL UNITED STATES

*Hunter Markowich, Fangfang Yao*

University of South Florida, Tampa, FL, USA

Reservoirs provide critical infrastructure for water supply, irrigation, hydropower generation, navigation, and recreational opportunities. However, their functions have been threatened by changing water patterns. For example, the Colorado River Basin is experiencing prolonged periods of drought with record-low water levels in the national largest reservoir, whereas the Southern Atlantic Drainage Basin is experiencing frequent flooding due to hurricanes and storm surges. In this presentation, I will use a recently compiled in-situ database of water levels for hundreds of reservoirs to document extreme water level events across the contiguous United States. The frequency, duration, and intensity of extreme water level events will be quantified using daily in-situ water levels spanning at least 30 years in recent decades. I will also analyze the trends in extreme level events. To further understand potential causes of the trending patterns, I will conduct a few case studies based on the water balance model using climate and hydrological data, such as precipitation, evaporation, runoff, and human water release. These findings will provide new insights into critical changes in water resources and can better inform water resources management for achieving sustainable goals.

**BIO:** Hunter Markowich is a graduate student at the University of South Florida studying Geographic Information Systems, with a focus on hydrology and water resources. He studied mathematics and statistics at the undergraduate level. He has given presentations on research conducted in both mathematics and geography.

# Elucidating toxicity mechanisms of perfluorinated chemicals in the zebrafish model

**Chris Martyniuk**

Center for Environmental & Human Toxicology, Department of Physiological Sciences, College of Veterinary Medicine,  
University of Florida, Gainesville, FL, USA

Per- and polyfluoroalkyl substances (PFAS) are ubiquitous pollutants in environmental matrices. However, there is a lack of understanding regarding their mechanism of action and their adverse effects in aquatic species. As such, environmental regulations on this broad chemical class are absent with many unknowns. New approach methods or NAMs (e.g., *in silico*, *in vitro*, computational biology) are expanding in use for chemical hazard and risk assessment. Here, I provide examples of how behavioral, biochemical, and omics-based assessments using zebrafish and other aquatic species can reveal potential toxicity mechanisms of PFAS. We have conducted *in silico* molecular docking across different fish species to investigate perfluorinated chemicals like perfluorobutanoic acid (PFBA) and perfluorobutane sulfonic acid (PFBS), demonstrating these chemicals may interact with estrogen receptors. Using transcriptomics and behavioral assays, we show that chemicals like PFBA may affect circadian rhythm and locomotor responses in larval zebrafish, bridging the gap molecular changes to apical level endpoints. Other PFAS like perfluorododecanoic acid (PFDoDA) affect transcriptome responses related to cell and hormone signaling in zebrafish. Opportunities for the zebrafish model in high throughput toxicity testing of chemicals, and the development of transcriptional points of departure for PFAS toxicity, will be discussed.

# The Implications of Biosolids Management in the St. Johns River Watershed

## *Erich Marzolf*

St. Johns River Water Management District, Palatka FL, USA

Implementation of state regulation changes in 2013 resulted in a shift of Class B biosolids (CBBS) land applications out of the Okeechobee, St. Lucie, and Caloosahatchee watersheds. As a result, pasturelands of the Upper St. Johns River Basin (USJRB) began receiving most of the CBBS applications in the state. The application of CBBS based on the nitrogen (N) demand of pasture grasses resulted in phosphorus (P) application rates between 3- and 8-fold greater than recommended fertilization rates between 2013 - 2024 because the N:P ratio of CBBS is low relative to crop demand.

Coincident with CBBS application increase in the USJRB, some ambient water quality sites monitored by the St. Johns River Water Management District (SJRWMD) began to exhibit significant upwards trends in P beginning in 2013, suggesting that the excess P was being exported. A study conducted by SJRWMD found strong correlative evidence between the timing, location, chemistry and magnitude of water quality impacts and intensified CBBS land application. In 2021, SJRWMD initiated studies under a funding agreement with the Florida Department of Environmental Protection (DEP) to collect data on the water quality impacts of CBBS land application.

Recent changes to CBBS management will reduce the land available for CBBS application. First, DEP's updated rules will prevent application on some lands by requiring greater separation from the water table, requiring enrollment in Florida Department of Agriculture and Consumer Services Best Management Practices program and requires nutrient management plans with CBBS application rates limited by crop needs for both N and P. Second, consideration of the effects of emerging contaminants have led some landowners to cease CBBS land application.

Key findings to date of SJRWMD's studies include:

- Watersheds with the highest application of CBBS had average P concentrations 9-fold higher than pastures without CBBS land application. Watersheds with intensive CBBS application had runoff P concentrations frequently above 1 mg/L and as high as 6.9 mg/L.
- The soils of pastures in the USJRB have limited ability to store P and P loss occurs via both surficial groundwater and surface water runoff.
- The observed annual P loss rates from CBBS applied fields strongly correlates with the increasing P loads downstream in the USJRB.

These results highlight multiple management concerns:

- Increasing P impairment of the St. Johns River,
- Ability to meet downstream P concentration goals and TMDLs,
- Increased frequency and intensity of algal blooms,
- Increased incidence of cyanobacteria harmful algal blooms in Lake Washington, a potable water supply, and
- Concern that the reduction in areas available for application of CBBS could result in a shift in disposal of biosolids to other products (soil amendments, composts) that are not as closely regulated as CBBS.

**BIO:** Erich Marzolf serves the St. Johns River Water Management District as the Director of Water Resources. He oversees the District's aquatic restoration and data collection programs. Erich has over 30 years of experience managing water resource issues in Florida, including Lake Apopka and the Upper St. Johns River.

# WATER QUALITY TRENDS IN NORTHERN COASTAL BASIN, FL, AND IMPLICATIONS FOR COASTAL HABITAT MANAGEMENT

*Shannan McAskill and Loraé T. Simpson*

St. Johns River Water Management District, Palatka, FL, USA

The Northern Coastal Basin (NCB) spans 193 km of coastline from the Florida-Georgia border to the Ponce De Leon Inlet and is characterized by extensive salt marsh, mangrove, and intertidal oyster reef habitats. Good water quality supports healthy estuarine ecosystems, and long-term water quality monitoring helps identify stressors and guide management and resiliency strategies. This study examined long-term changes in physical and chemical water quality parameters at 29 monitoring stations, across the St. Marys, Nassau, Tolomato, Matanzas, and Halifax Rivers, Pellicer Creek and the Intracoastal Waterway, with data spanning 9 - 39 years per station. Parameters at individual stations were analyzed for monthly variation through a Kruskal-Wallis (KW) test followed by trend analysis using either a Seasonal Kendall (KW  $p < 0.05$ ) or Mann-Kendall test ( $p \geq 0.05$ ). While water quality parameters were stable at some stations, others showed evidence of increasing water temperature, nutrients, and/or chlorophyll-*a* and decreases in dissolved oxygen (DO). These changes can affect estuarine habitat condition and resilience. Warming temperatures are expected to reduce DO, increase primary productivity, and exacerbate eutrophication which can negatively impact aquatic communities. Nutrient enrichment can contribute to shifts in coastal habitat by accelerating mangrove range-expansion and increasing mangrove freeze resistance. Additionally, eutrophication, declining DO, and widespread water quality impairments raise concerns for oyster health and shellfish harvesting. Effective water quality and coastal habitat management requires robust and comprehensive monitoring to identify trends, assess impacts, and guide mitigation strategies. Current monitoring efforts suggest further investigation of drivers of water quality trends and their potential impacts to coastal vegetation and oyster habitats.

**BIO:** Dr. McAskill is an environmental scientist at SJRWMD, where she focuses on estuarine water quality and management. She has 12 years of experience in marine ecology including fisheries independent monitoring, ichthyoplankton community dynamics, nekton habitat use, seagrass monitoring and reproduction, invasive species management, and submerged aquatic vegetation restoration.

# Proactive Resilience: Protecting Communities with Real-Time Flood Forecasting

**F. Warren McKinnie, PE, CFM, GISP**

Streamline Technologies, Winter Springs, FL, USA

Heavy rain, coastal storm surge, coincident peaks, and other compounding factors can cause severe flooding, posing significant risks to both coastal and inland communities. Accurately analyzing flood risk to determine the extent, duration, and likelihood of occurrence is beneficial for communities, planners, and emergency responders. As the frequency and intensity of storm events continue to increase, the need for effective disaster preparedness and response has become paramount for community resilience. Real-time flood forecasting is an essential tool in mitigating flooding impacts, providing critical time prior to events and spatial specificity to assist emergency managers and, most importantly, to inform and protect the public.

Real-time flood warning systems can be used to mitigate risks and damage, as well as to reduce post-storm recovery efforts. This includes messaging systems to notify the public, protection of critical assets, informed operation of control structures, and strategic allocation of resources before and after these flood events. By integrating hydrologic and hydraulic modeling with real-time data inputs, these systems can forecast flood conditions with increasing accuracy and relevance.

This presentation will provide Florida-specific case studies using FloodWise™, a real-time flood forecasting platform that includes compound flooding. The FloodWise™ dashboard is designed to be intuitive and accessible, allowing users to visualize forecasted flood impacts. This tool can be leveraged to proactively prepare for, mitigate, and recover from major storm systems in coastal and inland areas. The discussion will focus on practical techniques, core concepts, and visualization methods that communities can readily apply to enhance preparedness, empowering them to make informed decisions, prioritize recovery efforts, and mitigate potential impacts. Furthermore, it will highlight the value of integrating forecasting tools into local emergency management workflows and the importance of clear, visual communication in high-stakes scenarios.

**BIO:** F. Warren McKinnie has over 22 years of experience in the water resources field. He has been directly involved with numerous stormwater master plans and watershed studies. He has extensive experience in integrating stormwater infrastructure data with GIS applications, H&H model development, and Real-Time Flood Forecasting™.

# The Impact of Restrictive Irrigation Ordinances on Establishment of Newly Planted Landscape Trees

**Megan McKinsey<sup>1</sup>, Teagan Young<sup>2</sup>, Shoshana Over<sup>3</sup> Ryan Klein, and Grace P John<sup>1</sup>**

<sup>1</sup>University of Florida College of Liberal Arts and Sciences, Department of Biology, , Gainesville, FL, USA

<sup>2</sup>University of Florida/IFAS College of Agricultural and Life Sciences, Department of Environmental Horticulture, , Gainesville, FL, USA

<sup>3</sup>Water Resources, Washington, D.C., USA

Street trees play a critical role in city water cycles by intercepting rainwater, mitigating runoff, and cooling the atmosphere. However, cities present harsh environments for tree development, such that the establishment and maintenance of street trees has an explicit irrigation cost. As cities become more arid, recently implemented irrigation restrictions may threaten these trees' establishment. Therefore, the success of new plantings will depend on more precise irrigation practices and a more nuanced understanding of the physiology of water limitation during establishment.

We monitored leaf water status and physiological performance during the establishment of live oak (*Quercus virginiana*), an important landscaping tree in the American South, exposed to 0, 30, 60, 90, or 120 days of irrigation following planting. Trees irrigated for less than 60 days were more sensitive to abiotic environmental changes. Trees receiving no irrigation exhibited stomatal behavior indicative of water limitation immediately following transplantation, and stomatal conductance quickly declined when irrigation ceased for the 30-day group. While water use for well-watered trees was strongly dependent on evaporative demand, stomatal behavior in water limited trees decoupled leaf water status from evaporative demand. Despite stress avoidant stomatal behavior and an apparent recovery of leaf water with rainfall, mortality was common in the less irrigated groups, and even surviving trees experienced a loss of leaf relative fluorescence, indicating metabolic damage. These findings suggest that *Q. virginiana* in the urban environment require a minimum irrigation length of 60 days. The decline in conductance and fluorescence provides insights into the physiological limitations of this species. We present a novel framework for quantifying the abiotic conditions that best predict tree water use and tools for early stress detection. This more precise evaluation of irrigation practices will improve tree health, decrease water usage, and enhance city sustainability throughout the Southeastern United States.

**BIO:** Megan McKinsey is a Master's student in the CLAS Biology Department at the University of Florida. She graduated from UNC Chapel Hill with a B.S. in Environmental Science, and a background in botany. She is now using this knowledge as a foundation to explore urban tree ecophysiology in her research

# Impact of Developmental Aquatic Exposure to Environmentally-Relevant Levels of PFAS and PFAS Mixtures on Multi-Tissue Transcriptomic Profiles in Adult Zebrafish

**A. Meyers**<sup>1</sup>, Danielle Meyer,<sup>1</sup> Alex Haimbaugh,<sup>2</sup> Mackenzie L. Connell,<sup>1,2</sup> Brianna Vo,<sup>1</sup> Ashley Guarino,<sup>1</sup> Emma Cavaneau,<sup>1</sup> Grace Winny,<sup>1</sup> Chia-Chen Wu<sup>2</sup>, Camille Akemann<sup>2</sup>, and Tracie R. Baker<sup>1</sup>

<sup>1</sup>Department of Environmental and Global Health, University of Florida, Gainesville, FL

<sup>2</sup>Institute to Environmental Health Sciences, Wayne State University, Detroit, MI

Concern over the potential effects of per- and polyfluoroalkyl substances (PFAS) commonly present in the environment (including drinking and recreational water) has risen since the early 2000s. Although certain PFAS, including perfluorosulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are no longer used in manufacturing in the United States, they are ubiquitous in the environment due to their strong carbon fluorine bonds rendering them effectively indestructible. Harmful effects have been documented in both humans and aquatic wildlife including reproductive toxicity, immune suppression, and developmental disorders. In this study, we sought to determine the effect of an environmentally relevant levels of exposure (70ng/L) of PFOA, PFOS (240 ng/L), and a mixture of each on larval zebrafish that were then raised to adulthood. RNA-Seq transcriptomic analyses was used to analyze the brain, gonad, liver, and kidney tissue of male and female control and exposed fish. Comparisons between larval and adult-onset differential gene expression revealed significantly higher effect later in life. The number of DEGs were low (ranging from 1-106) in larval fish, whereas adult fish exposed during development were found to have anywhere from 2-9360 DEGs. Zebrafish are an important animal model that can inform not only on potential effects in human populations due to their genetic similarity but also serve as a model for toxicity in aquatic wildlife. IPA analysis of DEGs revealed significant enrichment of several disease pathways, including cancer, lipid metabolism disruption, endocrine disruption, organismal survival, cancer, and reproduction in PFAS exposed fish. Outcomes were found to be highly elevated in the mixture exposure. Early life PFAS exposure at environmentally relevant levels has multisystemic effects months after the initial exposure. This research is important to determining the effect of PFAS on public health and aquatic wildlife as well as regulating relative safe levels of PFAS in drinking water.

**BIO:** Alyssa Meyers is a first year PhD student in the Baker Water Lab at the University of Florida. During her undergrad Alyssa did research on the drivers and mitigation techniques surrounding harmful algal blooms common to Florida. Now she plans to use that experience to study the potential effects of environmental contaminants on human health and the environment.

# Microplastics Transport within an Interconnected Surface Water Ground Water Hydrogeologic System

*Katherine A. Milla, Ogechi Judith Madukwe and Odemari Mbuya*

Florida A&M University, Tallahassee, FL, USA

The hydrogeologic framework of Florida is influenced by its underlying geology, which is composed of a carbonate platform mantled with siliciclastic terrestrial sediments. Continuous dissolution combined with erosional stripping of overburden from the carbonate lithology gives rise to sinkholes and other karst features. The karst landscapes of Florida are characterized by extensive connectivity between surface and ground water, leaving these unconfined or poorly confined aquifers vulnerable to contamination and other imprints of human activities.

Tallahassee, the capital city of Florida located in Leon County, draws its municipal water supply from deep wells in the Floridan Aquifer, which is well confined in the northern part of the urban area, with some notable karst feature exceptions. Just south of Tallahassee is the Cody Scarp, a physiographic east-west escarpment that delineates the northward extent of the last sea level rise. As the Pleistocene sea retreated, it eroded away the less-permeable clayey sediments to the north, exposing the Floridan Aquifer as it withdrew. This eroded terrain south of Tallahassee (southern Leon County and Wakulla County) has numerous and notable karst features, including sinkholes, swallets, sinking streams, and Wakulla Springs, one of the world's largest and deepest freshwater springs and a prized tourist attraction in Wakulla County that has a significant positive economic impact for the region.

Ongoing studies over the past decades have delineated direct connectivity between surface waters from the Tallahassee urban area and Wakulla Springs. Methods used in these studies include cave and tunnel diving, dye tracing, modeling, and isotopic analysis. This presentation summarizes findings from our recent study on microplastics transport from surface to ground water in the Tallahassee region and explores implications for ground water quality.

**BIO:** Dr. Milla is a professor in the Center for Water Resources at Florida A&M University. She teaches classes in geospatial technologies and watershed dynamics and conducts research on ground water-surface water interactions using geochemical and geospatial techniques.

# **Borrowing from Australia: Comparing Florida's Stormwater and Flooding Regulations to Abroad**

**Alexander Miller<sup>1</sup> and Larissa Aguiar<sup>2</sup>**

<sup>1</sup>HDR, Tampa, FL, USA

<sup>2</sup>HDR, Melbourne, VIC, Australia

With Florida's water quality and quantity challenges, an international perspective on stormwater offers immense benefit. Australia provides useful comparison due to similar climate, regulations, and water challenges. This presentation aims to compare our international differences and offer ways to borrow approaches from Australia to better handle our water challenges in Florida.

The presentation will provide an overview of the two areas' regulations and approaches to stormwater management and flooding. Four key areas will be covered:

## **Water Quality and Nutrient Analyses**

With new ERP changes, Florida is moving towards net nutrient reduction criteria, an area where Australia has more experience and advanced software. MUSIC, a common water quality software used in Australia, is a continuous stochastic simulation which can estimate nutrient loading at 6-minute intervals across a project, capturing rainfall variability and treatment performance more accurately. Similar to BMPTRAINS, this software estimates nutrient loading and treatment efficiencies, but the stochastic approach may capture additional variability and uncertainty compared to a volume-based method.

## **Blockage Analyses**

Blockage analysis represents a fundamental divergence in flood risk assessment between our two areas. Florida, and the USA at large, typically do not consider the blockage of our infrastructure due to sediment and debris, yet this is common practice in Australia through ARR2019. The consideration of blockage in Australia provides a more robust look at true flood risk compared to Florida and could inform better operation and maintenance of storm sewer systems.

## **Critical Duration Assessments**

The Florida Department of Transportation (FDOT) is ahead of many other states in their adoption of critical duration assessments for Drainage Connection Permits. However, the consideration of different storm durations on flood risk is not universally performed within Florida and the USA. In Australia, different storm durations are enveloped into a single floodplain. This creates a truer representation of a "100-year" or 1% AEP floodplain, compared to looking at a single duration such as the 100-year, 24-hour floodplain.

## **Affluxes vs. "No Rise"**

A key difference in how to determine a project causes "no adverse impact" in floodplains is the idea of affluxes. In Australia, the allowable "afflux", or the increase in water surface elevation caused by development or infrastructure, varies based on state and land cover type. The use of critical duration assessments provides a more robust understanding of the floodplain, but with it comes challenges in meeting a "no-rise" in water surface elevation. Instead, Australia typically allows certain affluxes, such as up to 50-mm, for projects to impact the floodplain.

In summary, there are many similarities between Australian and Floridian stormwater management approaches and borrowing ideas internationally can greatly improve the resiliency of our state.

**BIO:** Mr. Miller has over 10 years of experience in stormwater engineering and flood risk assessments. He has an BS and MS in Civil Engineering from USF and is a published researcher in the field of flood exposure estimation. He currently serves as the Vice Chair of the WEF Stormwater Community.

## **A 20-Year Performance Analysis of a Constructed Wetland's Use to Improve Lake Apopka**

***Jennifer Mitchell***

St. Johns River Water Management District, Palatka, FL, USA

Constructed treatment wetlands have become a common method for improving water quality, but they are relatively new and long-term data are just becoming available. The Marsh Flow-Way (MFW), a 308-hectare constructed recirculating wetland system at Lake Apopka began operation in 2003. At the time of its construction, it served as a model treatment wetland designed to maximize total suspended solids (TSS) and phosphorus (P) removal, not effluent concentration. The MFW is composed of four independent continuous flow through cells which cumulatively treat 30% of the lake's volume annually. The MFW is operated with a target mean hydraulic loading rate (HLR) of 29 m/yr, which allows TSS and the associated nutrients to settle out of suspension while minimizing the release of legacy soluble soil P. Over the past 20 years of operation, it has removed 34.1 Metric Tons of P, over 68,401 Metric Tons of TSS and over 1,270 Metric Tons of nitrogen (N). Weekly water quality sampling provides high-frequency data to inform operational changes to water levels and HLR and indicates when larger maintenance activities are needed. Over the entire period of operation, cost of P removed is \$391/kg, N is \$9.84/kg, and TSS is \$0.20/kg. Although the incoming lake water quality has improved and decreased the total potential nutrient removal, the MFW still provides excellent TSS and associated nutrient removal, helping to improve Lake Apopka's water clarity and ability to support submerged aquatic vegetation.

**BIO:** Dr. Mitchell is an Environmental Scientist IV at the St. Johns River Water Management District with a background in wetland biogeochemistry. The past four years, her role has been the lead scientist over the Lake Apopka Marsh Flow-Way. She has eight years of experience in wetland restoration and monitoring.

## **Past, Present and Future with the Central and Southern Florida Project**

*John Mitnik, PE Ana Carolina Coelho Maran, PhD, PE*

South Florida Water Management District, West Palm Beach, FL

The Central and Southern Florida (C&SF) project is a multi-purpose initiative covering about 18,000 square miles across 15 counties, initially authorized by the US Congress in the Flood Control Act of 1948. The project aims to provide flood control, water supply for municipal, industrial, and agricultural uses, protection of the Everglades National Park, prevention of saltwater intrusion, preservation and enhancement of fish and wildlife resources, and providing recreational opportunities. Over time, land development, population growth, sea-level rise, and impacts on the South Florida ecosystem have decreased the project's performance. This presentation focuses on the past, present, and future of the C&SF.

The South Florida Water Management District (SFWMD) and the US Army Corps of Engineers are collaborating to assess changing conditions, identify increasing flood and water supply risks and vulnerabilities, and develop resilient adaptation strategies. Initially, the USACE led the project design and construction, while the state agency responsible for maintaining and operating the system was established. This agency, now known as the SFWMD, was created a year later to manage the project. Currently, the SFWMD continues to operate and maintain the extensive system, in collaboration with USACE, to ensure that all original purposes are served. The system today includes more than 2,175 miles of canals, over 2,130 miles of levees/berms, 936 water control structures, 620 project culverts, 98 pump stations, and about 3,537 hydrological monitoring stations. Through a strong capital improvement and structure inspection program, the SFWMD fulfills its mission, acting as the regional water resources agency responsible for ecosystem restoration, water supply, and flood protection.

Recognizing changing conditions like urbanization, shifts in weather patterns, and sea-level rise, the SFWMD is planning for the future. The SFWMD is committed to addressing these impacts and as part of its resiliency strategy, and evaluates its flood control infrastructure, water supply operations, and ongoing ecosystem restoration efforts, when implementing projects that anticipate future climate conditions.

Comprehensive restoration efforts support South Florida's overall resiliency, improving water management for both people and the environment. These efforts consider anticipated sea-level rise and extreme weather events, restoring beneficial freshwater flows to slow saltwater intrusion, promote sustainable aquifer recharge rates, and stabilize coastlines. This fosters healthier estuaries and bays, reduces marsh dry-outs, and increases coastal resiliency, providing greater flexibility and storage options for extreme and seasonal water management needs.

**BIO:** John Mitnik serves as the Assistant Executive Director and Chief District Engineer at SFWMD. Before joining the District in 2004, he worked as an environmental administrator and engineer for the Florida Department of Environmental Protection. Mitnik has a Bachelor of Science in Environmental Engineering from the University of Florida and an MBA specializing in Environmental Resource Management from Florida Atlantic University.

# Community Hydropower for Sustainable Forests and Livelihoods in Honduras

**Mirian Y. Molina**

University of Florida, Gainesville, FL, USA

In Honduras, several community-based initiatives have successfully reduced deforestation and illegal logging while generating local employment and income. The Social Forestry System (SFS) of Honduras has been central to these achievements, enabling community-based organizations (CBOs) to participate in forest production, processing, and trade. Despite the remarkable positive outcomes, many communities struggle to sustain their forestry activities due to weak political commitment, insecure land tenure, and the restrictive, top-down market-based nature of the SFS framework.

This study focuses on two communities—Copen and El Venado—located near the Río Plátano Biosphere Reserve (RPBR) in northeastern Honduras. Despite the escalating deforestation and illegal logging pressures faced by the RPBR, issues that have drawn international concern, Copen and El Venado have shown remarkable resilience. They have gained international recognition for their sustainable forest management practices, notably in the responsible harvesting of *Swietenia macrophylla* (mahogany) for the production of high-value guitar components. In 2011, both communities established independent micro-hydroelectric (MHE) systems through partnerships with local governments and nonprofit organizations. Each system—comprising a small dam and river basin—generates 5 to 20 kW of power by channeling water through a turbine connected to a generator. This electricity supports approximately 40 households. Notably, part of the communities' mahogany-derived income financed the installation of these MHE systems. Beyond energy access, the MHE systems became a symbol of community innovation, linking forest-based income to hydro energy and local development.

Over more than 15 years of engagement and observation since 2009, I have followed the evolution of these forest management efforts and the emergence of the MHE systems. As part of a preliminary assessment for my doctoral research, I conducted 32 semi-structured interviews in the summer of 2025 with key actors involved in the development and governance of these systems. Findings from these case studies suggest that small-scale hydropower generation can serve as an effective strategy for advancing forest conservation in community-based contexts where market-based mechanisms are limited. However, the success of such initiatives depends less on electricity generation itself and more on the strength of community governance and collective decision-making. Through comparative analysis, this study explores how variations in governance processes and policy frameworks shape community experiences with micro-hydropower, influencing both forest conservation outcomes and rural livelihoods. It could provide insights into more effective policy decisions and scalable solutions to support local communities and enhance conservation efforts.

**BIO:** Yadira Molina is a second-year PhD student in the Forests and Conservation (FRC-SFFGS) Program at the University of Florida. She is a forest scientist and practitioner with more than 25 years of experience in Honduras. She co-founded a nonprofit organization that collaborates with local and indigenous communities, implementing practical approaches to sustainable development and advocating for the role of civil society in the sustainable management of tropical forests in Honduras and elsewhere.

**Disclaimer:** I used AI tools, Grammarly, and Word for translation and editing to the required length.

## Using Diverse Knowledge Sources to Drive Research Questions in Florida's Second Largest Estuary

**Brandon Moody**

Charlotte County Board of County Commissioners, Port Charlotte, FL, USA

The significant environmental and economic impacts of the red tide blooms in 2018-2019 spurred Charlotte County into creating a position charged with establishing programs and partnerships to identify and collaborate with water quality-related activities occurring in our region, expand our knowledge of influences and drivers of water quality in our watersheds, and understand the county's contributions to, and responsibility for, the health of the estuaries around it. This presentation provides a brief history of Charlotte County's relationship with Charlotte Harbor and Lemon Bay, and how that informs today's water management challenges and future direction in management activities.

The county's surface water sampling program has identified a few "hot spots" of consistently high total nitrogen, total phosphorus, or ammonia concentrations, while also indicating the role stormwater/discharge events are playing in nutrient loading into receiving waters. Additionally, the program highlights locations with chronic high chlorophyll issues while lacking comparably high nutrient concentrations, illustrating why simply looking at ecological health through the lens of nitrogen and phosphorus concentrations alone may not be enough to understand drivers of water quality. Attention has been given to exploring reclaim water and groundwater aquifers as potential sources of nutrients, which can be an input into the harbor from irrigation activities. Finally, movement is underway to integrate micronutrients, isotope tracking, and circulation monitoring into the program to gain a more holistic picture of the sources that might drive blooms in our waterways and the estuaries.

In addition to sampling and ecosystems studies, the lessons learned thus far emphasize the need to integrate behavioral/communications research into this process, as water managers must understand how our residents interact with our aquatic resources, ways managers can better educate the community on their role in water quality management, and how to instill a sense of ownership over their natural environment.

**BIO:** Brandon Moody is the inaugural Water Quality and Resiliency Manager for Charlotte County, developing monitoring and protection strategies while fostering inter-departmental coordination of related activities. Previously, Mr. Moody spent nearly 20 years in watershed regulation, monitoring, and assessment with the South Florida Water Management District and Georgia Environmental Protection Division.

# Numerical Simulation of Hurricane-Driven Sediment Transport Processes of a Florida Barrier Island

*Dushan Kavishka Mulkirigala Kankanamalage, Chu-En Hsu*

University of North Florida, Jacksonville, FL, USA

Tropical cyclones significantly reshape coastal barrier islands through breaching, washover, and sediment redistribution, driven by complex interactions among tides, storm surge, and offshore waves. Hurricanes Matthew (2016) and Dorian (2019) dramatically altered Florida's east coast, yet predictive understanding of storm-driven sediment transport remains limited. This study develops a process-based numerical framework using a coupled Delft3D–SWAN model to investigate hydrodynamics and sediment dynamics south of Matanzas Inlet, Florida, during extreme hurricane events. The model employs an idealized bathymetry simplified from the NOAA post–Hurricane Matthew (2016) dataset, preserving essential topographic features while reducing local complexity to facilitate the analysis of sediment transport processes. The computational setup includes a large-scale parent grid spanning Cape Canaveral to Savannah and a high-resolution (1–10 m) child grid that resolves nearshore dynamics between Matanzas Inlet (29°42'20.4" N, 81°13'33.7" W) and Marineland (29°40'06.9" N, 81°12'42.8" W). Hurricane forcing is represented using the Holland analytical model, with semi-diurnal tides applied as boundary conditions. This configuration isolates the contributions of waves, tides, and storm surge to sediment transport, enabling detailed analysis of depth-dependent morphodynamic processes.

Expected outcomes include quantifying spatial and temporal variability in sediment transport and identifying potential breaching locations during extreme storms. The results will enhance understanding of hurricane-induced coastal change and demonstrate the model's capability to assess coastal vulnerability. Limitations in Delft3D–SWAN, such as its inability to resolve infragravity wave–driven processes, highlight the need for future integration with XBeach to simulate washover and breaching dynamics. By incorporating long-term fair-weather simulations and a Morphological Acceleration Factor, the model ensures realistic initial conditions for circulation and sediment transport. This framework advances predictive modeling of coastal responses to tropical cyclones, providing insights into barrier island resilience and informing coastal management strategies to mitigate storm impacts.

**BIO:** Dushan Kavishka is a graduate research assistant at the University of North Florida, focusing on numerical modeling of coastal processes, and has experience in various international coastal design projects. Dr. Hsu, Assistant Professor at the University of North Florida, has 10 years of experience in coastal and hydraulic modeling, focusing on storm surge, waves, morphodynamics, and water-quality simulations.

# INTEGRATED EFFECTS OF COMPOST, IRRIGATION, AND CONTROLLED-RELEASE FERTILIZERS ON CITRUS TREE GROWTH AND SOIL HEALTH IN FLORIDA

*Mark N. Mumpande, Jonas Pereira de Souza Júnior and Davie M. Kadyampakeni*

University of Florida, Citrus REC, Lake Alfred, Florida, USA

Citrus production in Florida sandy soil is limited by reduced organic matter, low nutrient retention, and water use efficiency, which together decrease tree vigor and soil resilience. This study examined the interactive effects of compost (7 lb./tree and no compost), irrigation rates, and three controlled-release fertilizer (CRF) formulations on citrus tree growth parameters and soil-health indicators such as volumetric water content and organic matter. A 13.5 gallons hr<sup>-1</sup> and 10.5 gallons hr<sup>-1</sup> irrigation rates were used. The fertilizer programs included the grower's standard (10-2-13 applied four times per year at 1.72 lb./tree (March, April, June and October) at 1.72 lb./tree, controlled-release fertilizer (CRF 1) (5-1-7 applied twice per year at 5.17 lb./tree (April and October), and a split CRF 2 approach combining 10-2-13 (March, 2.07 lb./tree) and 10-2-13 (June), applied at 1.38 lb./tree, and 5-1-5 applied at 1.72 lb./tree in April and October. A 2×2×3 factorial design field experiment was carried out (Compost, Irrigation, and fertilizer) at the University of Florida's Citrus Research and Education Center in Lake Alfred, Florida, to evaluate how integrated nutrient and water management practices influence tree performance in sandy soils. Data were analyzed through three-way analysis of variance (ANOVA) and Tukey's Honest Significant Difference (HSD) to separate the means. Although treatment effects (fertilizer, irrigation, and compost) were not statistically significant ( $p > 0.05$ ), plots amended with compost showed a higher volumetric water content trend and an increased trend of organic matter buildup, thereby improving trunk diameter and canopy volume, even at a lower irrigation rate (10.5 gallons hr<sup>-1</sup>). Among the fertilizers, the CRF 2 formulation showed a higher nonsignificant average growth rate in comparison with the other formulations (CRF 1 and grower standard) studied, indicating enhanced nutrient availability. These results suggest that compost application enhances water-holding capacity, leading to improved nutrient and water-use efficiency. Combining compost, CRFs, and optimized irrigation rates offers a sustainable approach to boost citrus productivity and soil health in water-limited conditions in Florida.

**BIO:** Mark Mumpande is a Master of Science graduate student in the Soil, Water, and Ecosystem Sciences Department researching integrated soil water and nutrient management and understanding soil health in Florida sandy soils. He obtained his Bachelor of Science in Agricultural Sciences at Earth University in Costa Rica.

# On Trade-Offs Between Short-Term Resilience and Long-Term Sustainability in Infrastructure Systems

*Rachata Muneeppeerakul<sup>1</sup> and Ning Lin<sup>2</sup>*

<sup>1</sup>University of Florida, Gainesville, FL, USA

<sup>2</sup>Princeton University, Princeton, NJ USA

Resilience and sustainability are often seen as desirable properties of infrastructure systems, where resilience refers to the ability for the system to recover from disruptions and sustainability refers to the ability of the system to maintain functionality and/or performance in the long run. However, they can become conflicting objectives, especially when available resources to improve them are limited, in which case the trade-offs between short-term resilience and long-term sustainability are inevitable. Therefore, there is a need to study such trade-offs, but systematic analysis of such trade-offs is lacking. In this work, we address this issue by developing a stylized, minimalist, stochastic model of recovery of an infrastructure system subjected to a series of disruptions. The results highlight the nature of the trade-offs between short-term resilience and long-term sustainability. Depending on the effectiveness of investments in resilience and sustainability, there can be sub-optimal allocations of investments that should be avoided. The analysis yields clear relationships that show how various biophysical and investment effectiveness interplay to influence the nature of such resilience-sustainability trade-offs.

**BIO:** Dr. Muneeppeerakul is a Professor in the Agricultural and Biological Engineering Department at UF. His research program focuses on modeling and analysis of complex systems, making use of a variety of analysis techniques across different fields.

## **Tek in tech: Merging Physics & ai with Traditional Ecological Knowledge (TEK) for Flood modeling – Cannot exceed 100 characters with spaces**

*Rio Bonham<sup>1</sup>, Rafael Muñoz-Carpena<sup>1</sup>, Henry Medeiros<sup>1</sup>, Nasser Najibi<sup>1</sup>, and Stephen Perz<sup>2</sup>*

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Flooding regularly endangers lives and imposes economic hardships and displacement on affected communities. Climatological and hydrological modelers seek to build useful computer models that assist in understanding flood processes and making estimations about future flooding, with the ultimate goal of informing community mitigation and response practices. Low density, sparse population (i.e. rural, tribal, etc.) lands tend to be disproportionately affected by localized flash flooding. These areas also tend to have a scarcity of local structured data on hydrological, weather and landscape conditions that are needed to build effective models. However, Indigenous communities in these areas hold insightful traditional ecological knowledge (TEK) that is often overlooked. This TEK, encompassing established cultural understanding of the landscape based on deep historical knowledge and records of rare events, can provide crucial information for flood models. Location-specific TEK reaches back thousands of years for communities not fully displaced from their homelands, as is the case with our partners, the Blackfeet Nation, *Amskapi Pikuni*, in northern Montana.

This research aims to develop an artificial intelligence (AI)-based hybrid, multimodal framework that integrates TEK unstructured data (e.g. oral histories, text documents) and structured environmental data (e.g. satellite data, streamflow) to enhance the prediction of floods. The objectives of this work include: 1) collaborating with Blackfeet Community College (BFCC) and Medicine Spring Library (BFCC-MSL) to develop a digitized collection of archive documents and interview transcripts; 2) assess and quantify performance increase of TEK-enhanced AI flood model compared to baseline; and 3) identifying and explaining influential factors in the TEK-enhanced model, both from the structured environmental data and the incorporated Blackfeet TEK.

**BIO:** Dr. Rafael Muñoz-Carpena is a Distinguished Professor in Hydrology and Environmental Modeling at the University of Florida, USA. His work focuses on integrated environmental systems modelling, including interactions between hydrological, ecological and human components.

# Super-Resolution of Sentinel-2 Imagery for Model Calibration in Florida's Stormwater Treatment Areas

*Eduart Murcia, Sandra M. Guzmán*

Indian River Research and Education Center - University of Florida, Fort Pierce, FL, USA

Aquatic vegetation strongly influences phosphorus cycling in the South Florida stormwater treatment areas, shaping nutrient retention and water quality outcomes. Accurately calibrating these mechanistic biogeochemical models to varying conditions in the stormwater treatment areas requires time series data that capture fine spatial detail while maintaining consistent temporal coverage. Achieving this balance is challenging because no single open-source satellite currently offers both attributes at the resolution needed for modeling vegetation processes in these managed wetlands. In this study, we explore a multi-sensor integration approach using open-source Sentinel-2 imagery and commercial PlanetScope data to address this gap. We assessed geometric alignment, spectral harmonization, and radiometric consistency across sensors, which are essential for producing reliable vegetation time series. Preliminary results indicate that combining these datasets can achieve an effective spatial resolution of 2.5 meters while maintaining temporal coverage aligned with Sentinel-2 observations. These early findings suggest that integrated imagery can provide the level of detail required for more representative phosphorus cycling simulations. By leveraging multiple satellite sources, this study has the potential to enhance scenario analyses for stormwater treatment areas and inform cost-effective monitoring strategies. This approach presents a scalable framework to improve predictive modeling of nutrient dynamics, optimize management efforts, and support long-term water quality goals.

**BIO:** Eduart Murcia is a second-year doctoral graduate research assistant in the Department of Agricultural and Biological Engineering at the Indian River Research and Education Center in Fort Pierce, FL. His research focuses on developing a remote sensing-based framework to refine calibration routines in biogeochemical models for constructed wetlands, using South Florida's stormwater treatment areas as a case study.

# ADAPTIVE DECISION TOOL FOR SUSTAINABLE WATER MANAGEMENT IN THE OLD BRAHMAPUTRA RIVER, BANGLADESH

*Taznin Naher and Md Nurul Kadir*

University of Florida, Gainesville, FL, USA

Sustainable river management in deltaic systems requires decision frameworks that integrate hydrology, sediment dynamics, and community priorities. This study develops an adaptive decision-support tool to improve water management and ecosystem connectivity in the Old Brahmaputra River, Bangladesh. Using hydrologic balance modeling, participatory planning, and sediment management simulations, the research quantifies seasonal water variability and evaluates restoration options for maintaining river connectivity. Results show that groundwater supplies nearly 80% of total dry-season demand, while sedimentation at the offtake restricts surface inflow to  $\sim 354 \text{ Mm}^3$ . By combining stakeholder input with system-based modeling, the tool identifies strategic dredging and flow-guiding structures that can enhance dry-season flow, navigation, and ecological resilience. The adaptive framework promotes knowledge exchange between engineers, policymakers, and communities, serving as a model for decision-making in data-limited and climate-sensitive river systems. This interdisciplinary approach demonstrates how technology and education can jointly improve water governance in rapidly changing delta environments.

**BIO:** Taznin Naher is a graduate research student at the University of Florida with over ten years of experience working with the IHE-Delft Institute for Water Education in the Netherlands and water institutes across South Asian countries. Her research focuses on stakeholder-driven, data-based decision models for resilient and integrated water resources management under changing climate and human pressures.

# OPTIMIZING FERTILIZER USE TO PROTECT WATER QUALITY: MANAGING PHOSPHORUS IN FLORIDA'S DIVERSE SOILS

**Vimala Nair**

University of Florida, Gainesville, FL, USA

Florida's soils span a wide array of orders—including Alfisols, Entisols, Histosols, Spodosols, and Ultisols—each with unique physical and chemical characteristics that influence phosphorus (P) dynamics. Effective P management across these diverse soils is critical not only for sustaining crop productivity but also for protecting water quality. Acid mineral soils, for example, retain P primarily through interactions with iron and aluminum oxides. The unique biogeochemistry of Histosols (muck soil) presents a significant challenge for managing nutrients, particularly P. Phosphorus, not retained by the soil or taken up by the crop increases the risk of P loss via runoff, subsurface flow, or leaching. These losses contribute to environmental issues such as eutrophication in Florida's water bodies. This study aims to optimize fertilizer use by refining crop- and site-specific P recommendations tailored to Florida's varied soil types. We evaluate alternative soil testing methods—including the iron oxide strip, Haney H3A, and Soil Phosphorus Storage Capacity (SPSC)—to better assess bioavailable and releasable P pools. A positive SPSC indicates a need for P fertilization, whereas a negative value signals a heightened risk of environmental P loss. The widely used Mehlich 3-P test is insufficient for certain soil types, particularly those with high organic matter, potentially leading to misinformed fertilization practices. By integrating improved soil testing protocols with precision nutrient management strategies, this research seeks to enhance P use efficiency, support sustainable agricultural productivity, and minimize nutrient runoff and leaching—ultimately safeguarding Florida's water resources.

**BIO:** Dr. Vimala Nair, Research Professor at UF/IFAS, earned her Ph.D. in soil biogeochemistry from Göttingen University, Germany. Internationally recognized for research on phosphorus fate and transport, she is a Fellow of SSSA and ASA, and a 2021 SSSA Soil Science Research Awardee.

# Spatiotemporal Learning of Clustered Weather Extremes in a Changing Climate

*Nasser Najibi, Ph.D.*

Department of Agricultural & Biological Engineering

Understanding how large-scale atmospheric circulation governs the clustering of weather extremes is critical for advancing predictive capability and climate resilience across the Southeast U.S. This work develops a process-informed machine learning (ML) framework that integrates Principal Component Analysis (PCA) with Non-Homogeneous Hidden Markov Models (NHMMs) for probabilistic regime classification and transition modeling. The focus is on identifying and characterizing Weather Regimes (WRs), i.e., recurrent large-scale atmospheric flow patterns over the Eastern North America–Western Atlantic sector, and their evolving influence on precipitation and temperature extremes across different scales.

The PCA decomposes high-dimensional daily geopotential height fields into a reduced set of principal components that capture dominant modes of atmospheric variability and their spatiotemporal coherence. These components serve as dynamic predictors for the NHMM, which learns a discrete set of WRs and the probabilistic transitions between them. Through conditioning the built NHMMs on regional precipitation and temperature observations, the framework provides a process-based mapping from large-scale atmospheric states to the likelihood, duration, and co-occurrence of instantaneous and multi-day extremes.

Applied to multi-decadal reanalysis datasets, the framework reveals statistically robust relationships between WR phases and compound hydroclimatic extremes. Preliminary analyses indicate that the frequency (how often WRs occur) and intensity (strength of dynamic anomalies such as pressure gradients or moisture convergence) of WRs have evolved and become partially decoupled under a changing climate. Some WRs appear more frequent but weaker, while others occur less often yet exhibit stronger dynamic intensity. This emerging frequency–intensity decoupling suggests a nonlinear modulation of both the timing and spatial distribution of hydroclimatic hazards.

Through coupling data-driven learning with physical process understanding, this framework moves beyond empirical correlations and toward interpretable models that diagnose the mechanisms of extreme event clustering. Importantly, the resulting WR-conditioned probability fields offer new opportunities for bias-aware downscaling, operational forecast calibration, and risk scenario generation that preserve realistic space-time dependencies among extremes. Such capability is particularly valuable for water resource systems management and infrastructure resilience in the Southeast U.S., where planning decisions depend on the evolving frequency and severity of flood, drought, and heat extremes.

Overall, this framework provides a pathway for integrating ML and hydroclimate science to improve the detection, attribution, and prediction of clustered weather extremes in a changing climate, thereby supporting more adaptive and risk-informed strategies for regional climate resilience.

## **Black Creek Water Resource Development Project**

### ***Robert Naleway***

St. Johns River Water Management District, Palatka, FL, USA

The Black Creek Water Resource Development Project is a regionally-significant water resource development project developed and managed by the St. Johns River Water Management District (SJRWMD) to enhance aquifer recharge, augment water supply, and restore hydrologic conditions in northeast Florida. The project withdraws sustainable and primarily wet-weather flows from the South Fork of Black Creek. The water is pumped through a 17-mile long pipeline to a passive, media-based treatment system that removes color and minor nutrients before discharging to Alligator Creek and eventually Lakes Brooklyn and Geneva. Lakes Brooklyn and Geneva are sinkhole lakes and are hydraulically connected to the Upper Floridan aquifer. The lakes are located at the top of a regional potentiometric high and therefore ideally positioned to recharge the Upper Floridan aquifer and provide regional water resource benefits. SJRWMD manages the overall project and CDM-Smith designed, permitted, and provided construction management services. The project was funded through a combination of a legislative appropriation, SJRWMD funds, and funding from four partnering utilities (JEA, Clay County Utility Authority, Gainesville Regional Utilities, and St. John County).

# Quantifying Drivers of Cyanobacterial Blooms with Causal Spatiotemporal AI

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Harmful cyanobacterial blooms (cHABs) pose a major threat to inland lake water quality, affecting ecosystems, human health, and local economies. Predicting these blooms is challenging because traditional machine learning models often capture correlations rather than true causal factors in complex environmental systems. We address this gap by combining causal inference methods with deep learning to improve cyanobacterial bloom predictions. Our study develops a novel causal transformer-based approach that learns spatiotemporal patterns from large-scale remote sensing and environmental data sets. By incorporating both temporal dynamics and spatial context, the model explains how environmental factors are interacting over space and time to drive bloom events. We include varied drivers such as meteorological factors (air temperature, precipitation, day length), atmospheric chemistry measures (NO<sub>2</sub> and SO<sub>2</sub> concentrations, aerosol loading), and deposition rates of nutrients, to represent conditions leading to bloom formation. Our causal deep learning technique enables direct counterfactual inference, allowing us to evaluate how hypothetical changes in these drivers (e.g., altered rainfall or nutrient availability) could affect bloom occurrence. We demonstrate the strength of our framework on a dataset of more than 731 Florida lakes, with robust predictive accuracy  $R^2 = 0.67$  (current) and 0.51 (next week) and revealing region-specific insights. Model-predicted key drivers align with known bloom initiators, confirming the fundamental roles of warm temperatures, extended photoperiods (day length), and nutrient availability, among others. However, SHAP values reflect that some associations may be spurious and are not necessarily mechanistic. This requires a more reliable interpretation of bloom dynamics that can enhance trust in predictions. The integration of causal reasoning with deep learning provides a powerful new tool for cHABs predictions. Our results highlight the potential to extend this approach beyond Florida to inland waters across the continental United States, data-informed, scenario-driven predictions of bloom risk to support evidence-based water management.

**BIO:** Mitra Nasr Azadani is a Ph.D. candidate in Civil and Environmental Engineering at Florida State University. Her research focuses on watershed modeling, water quality prediction using data driven models and remote sensing for inland water systems. She aims to advance predictive tools for managing inland water systems under changing environmental conditions.

## Follow the Water: An Immersive Educational Approach to Building Water Resource Awareness

*Cynthia Nazario-Leary<sup>1</sup>, Savanna Barry<sup>2</sup>, Taylor Clem<sup>3</sup>, Erin Harlow<sup>4</sup>, Luke Harlow<sup>5</sup>, Alicia Lamborn<sup>6</sup>, Lisa Strange<sup>7</sup>, Victor Blanco<sup>7</sup>, Larry Figert<sup>8</sup>, and Laura Warner<sup>9</sup>*

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What happens when a drop of water travels from a remote swamp to the Gulf? In Florida's Suwannee River basin—one of the Southeast's last undammed river systems—this journey reveals the growing pressures on water resources due to urbanization and increased consumption. As Florida's population expands, so does the need for public engagement in water conservation. Research shows that individuals who feel more connected to water are more likely to adopt conservation behaviors. To foster this connection, extension agents in Florida's Northeast Extension District developed *Follow the Water* (FTW), a four-day immersive educational tour that traces the path of water from southern Georgia to the Gulf. The program is designed to deepen participants' awareness and sense of stewardship for Florida's water resources. Annual FTW Alumni Events offer continued learning, storytelling, and long-term impact evaluation.

FTW uses transformative learning to shift participants' environmental perspectives. Over four days, participants explore the Okefenokee Swamp, the Suwannee River Valley, urban watersheds, and coastal communities. Each location highlights key issues such as aquifer science, water quality, nonpoint source pollution, and ecosystem conservation.

Since 2020, FTW has been offered seven times with 68 participants, including two alumni events. Each received 32 hours of education, totaling an estimated \$108,800 in value. Surveys show a sustained increase in water connectedness, with 13 of 14 alumni reporting behavior changes after one year. One participant even pursued a career in water communication. Collectively, participants shared FTW insights with over 2,200 individuals.

FTW demonstrates how experiential, place-based education can drive environmental stewardship. Its success has inspired in-service training for other extension agents, stakeholders, and agencies to replicate the model and promote water conservation across Florida and beyond.

**BIO:** Dr. Cynthia Nazario-Leary is the UF/IFAS Environmental Horticulture Extension Agent in Alachua County. With 15 years of extension experience, she leads Master Gardener Volunteers, promotes Florida-Friendly Landscaping™, and supports community gardening. She holds degrees from Penn State and the University of Hawai'i, and is passionate about science-based outreach and education.

## **Cedar Key GSI: How a community partnership can lead to a greener future**

*Eban Bean<sup>1</sup>, Savana Barry<sup>1</sup>, Jiayang Li<sup>1</sup>, **John Nemenyi<sup>2</sup>**, Austin Wood<sup>2</sup>*

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<sup>2</sup>Jones Edmunds & Associates, Inc., Gainesville, FL USA

Cedar Key is a small coastal community on the west coast of Florida that is heavily reliant on the fishing industry. It is also threatened by sea-level rise and extreme storm events. Through funding from the National Academies of Science Engineering and Medicine, UF-IFAS (University of Florida's Institute of Food and Agricultural Sciences) secured funding to partially address these by designing Green Stormwater Infrastructure (GSI) retrofits. GSI options were initially presented to the residents of Cedar Key through public meetings. The stormwater system was monitored from April 2024- April 2025, which allowed the team to better understand how the system reacts to both regular and extreme storm events. During this time, Hurricanes Debby and Helene significantly affected the community. Jones Edmunds partnered with UF-IFAS on the effort, digitizing city plans in GIS (geographic information systems), inventorying utilities, and developing a StormWise hydraulic and hydrologic (H&H) model to analyze watershed dynamics. The H&H modeling and design of GSI solutions were focused on reducing flooding and water quality impacts of stormwater runoff. The Cedar Key GSI project demonstrates how UF-IFAS, Jones Edmunds, local government, and residents combined community input with advanced technical analysis to identify effective GSI solutions, quantify nutrient reduction, and strengthen local resilience through science-based decision-making. Guided by community input and technical insights, potential GSI sites were selected, and nutrient removal quantified for each option. This approach ensured informed decisions and continuous engagement, showing how science and collaboration advance resilient, green infrastructure.

**BIO:** John Nemenyi is a Water Resource Engineering Consultant with Jones Edmunds & Associates, Inc with a focus on watershed modeling and green stormwater infrastructure.

## INTENSIFIED TREATMENT MARSH FOR NITROGEN REMOVAL IN HURRICANE DISASTER RELIEF EFFORT

*Abigail Neufarth<sup>1</sup>, Rafael Vazquez-Burney<sup>1</sup>, Pieter De Wolf<sup>1</sup>, Beth Carsten<sup>2</sup>, Lee Snyder<sup>2</sup>*

<sup>1</sup>Jacobs, Tampa, FL, USA

<sup>2</sup>City of Arcadia, Arcadia, FL USA

The William Tyson Wastewater Treatment Plant (WWTP) in Arcadia, FL is under consent order for ammonia exceedances. Following Hurricane Ian in 2022, the Federal Emergency Management Agency (FEMA) stepped in to aid local government in building their capacity and capabilities to carry out community-based recovery planning. As a result, Arcadia, an underserved and disadvantaged community, was able to improve recovery outcomes and develop a path forward to achieve compliance.

The existing WWTP uses trickling filters to treat organic loads but does not provide nitrification. While the City is actively designing a new WWTP with advanced nutrient removal capabilities, an interim solution was developed to repurpose the existing infrastructure to meet regulatory requirements. The project consists of retrofitting a 3-acre reclaimed water storage pond and a 4-acre underperforming rapid infiltration basin into an intensified constructed treatment wetland. The system incorporates super-oxygenated recirculation to achieve complete nitrification of seasonally variable flows ranging from 0.7 to 3 million gallons per day.

This innovative approach utilizes pure oxygen delivery to drive high-rate nitrification, reducing ammonia concentrations from 28.9 mg/L to below the permit limit of 1.3 mg/L on a monthly average basis. The system also mimics natural Florida wetland hydropatterns to support native emergent marsh vegetation which provides essential surfaces for microbial attachment and nitrification. Recirculation flow rates, oxygenation equipment size, and the wetland footprint configuration were carefully balanced to ensure effective ammonia removal while maintaining ecological function and operational efficiency.

The Arcadia Treatment Wetland exhibits how FEMA is supporting communities in the aftermath of Hurricane Ian through the development of a cost-effective, ecologically beneficial solution that not only addresses immediate compliance needs but also contributes to the long-term resilience of the City's WWTP.

**BIO:** Abigail Neufarth, E.I. is an Environmental Engineer at Jacobs with a bachelor's in chemical engineering and a master's in environmental engineering from Northwestern University. She works on wastewater treatment and nature-based solutions, with experience in design, permitting, and process optimization.

# EVALUATING RESIDENTIAL IRRIGATION POLICIES AND COMMUNITY WATER SUSTAINABILITY

*Nolan Nguyen<sup>1,2</sup>, Maksymillian Krucs<sup>1</sup>, and Jun Kim<sup>1</sup>*

<sup>1</sup>Florida Polytechnic University, Lakeland, FL, USA

<sup>2</sup>City of Winter Haven, Winter Haven, FL, USA

Florida relies heavily on the Upper Floridan aquifer as its primary source of drinking water, making sustainable water management a critical issue for both policymakers and communities. One often-overlooked component of this challenge is residential lawn irrigation. Across Florida, municipalities and water management districts enforce irrigation schedules that limit watering to specific days and times, often requiring the use of reclaimed water when available. These policies aim to reduce aquifer over-withdrawals, improve soil adsorption, and promote long-term water sustainability.

Working within a municipal water department, I have observed both the benefits and challenges of irrigation regulations. Despite clear conservation goals, public awareness and compliance remain inconsistent. Many residents overuse automatic irrigation systems, sometimes unknowingly, leading to a significant amount of wasted water and inflated utility bills.

This study adopts a descriptive, policy-focused approach to evaluate irrigation-related water use patterns in Florida. Public datasets from the Southwest Florida Water Management District (SWFWMD) are analyzed using Python-based statistical and visualization tools. Quantitative indicators such as average daily consumption, seasonal variation, temperature, weather events, and reclaimed water usage % are examined. Findings will contextualize broader behavioral trends within existing policies to assess their practical effectiveness and community-level implications.

Ultimately, this work highlights that sustainable water management depends not only on infrastructure but also on effective policy design and public engagement. As Florida explores initiatives such as aquifer recharge through unconventional water resources, evaluating current irrigation policies provides an essential foundation for building long-term resilience in the state's water supply systems.

**BIO:** Nolan Nguyen is a research assistant (RA) at Florida Polytechnic University and an intern with the City of Winter Haven Water Department. As an RA, he researches on water quality and treatment strategies with Dr. Kim's laboratory team. As an intern, his role has provided direct insight into municipal water policy, community consumption, and sustainability practices. He is passionate about bridging the gap between technical knowledge and public policy to promote responsible water management.

## **Manatees in Florida History and Culture**

***Steven Noll***

University of Florida, Department of History, Gainesville, FL, USA

This paper examines the interactions between humans and manatees in Florida history and culture and how this docile sea mammal has become a Florida icon while its very existence is threatened by human activity. Combining science and history, Dr. Steven Noll looks at how the manatee is important to Florida's very "hu-manatee." By looking at this relationship in historical perspective, the paper shows how connections between people and manatees have changed over time. It aims to show how these connections are more complicated than it seems and how various stakeholders- government officials, wildlife experts, conservation groups, tourists, fishing interests- all play a part in different ways in this story.

**BIO:** Dr. Noll is an instructional professor in the history department at UF. His work focuses on Florida environmental history, especially the relationship of water to people. He has written extensively on issues surrounding the Cross Florida Barge Canal and the Ocklawaha River and the fate of the Rodman River.

## LOWER EAST COAST WATER SUPPLY VULNERABILITY ASSESSMENT

*Anushi Obeysekera, E.I.T., Karin Smith, P.G., Ana Carolina Coelho Maran, P.E., Ph.D.*

South Florida Water Management District, West Palm Beach, FL, USA

Groundwater supply from coastal wellfields is the major water supply source for over 6 million people in South Florida. The South Florida Water Management District (SFWMD) is conducting a Water Supply Vulnerability Assessment (WSVA) aimed at understanding how future development and climate conditions may affect regional water supply. The WSVA will leverage water supply planning methodologies and independently analyze climate effects on withdrawal rates and water supply availability. Sea-level rise, extreme rainfall and evapotranspiration projection datasets will inform scenario formulation.

In support of the Lower East Coast Water Supply Plan and the WSVA, the SFWMD developed the East Coast Surficial Model (ECSM), which is a density-dependent groundwater flow and transport model of the Surficial Aquifer System (SAS). ECSM is calibrated to daily water levels, monthly water quality and monthly structure flows for a period of record from 1985 – 2016. The model will be used to evaluate the effects of projected increases on withdrawal rates, sea level rise, and future climate conditions on groundwater quality and availability, with consideration of surface-groundwater interactions.

To properly analyze the long-term effect of climate change, 50-year model scenarios are being developed. Scenario formulation is proposing degrees of warming, dryness, and sea level rise, along with growth scenarios and withdrawal rates. A set of model runs will be conducted and compared to an existing baseline to identify differences in water levels, water quality, and determine regions within the SAS that may have adverse effects due to future conditions, including potential changes to groundwater recharge from surface water systems. The outputs of these scenario runs should allow SFWMD to understand how future conditions may impact water availability throughout the system, and mainly within the SAS. This presentation will focus on ECSM calibration and the development of the data sets that will be utilized to conduct the WSVA.

**BIO:** Anushi Obeysekera is the Section Leader of the Groundwater Modeling Unit at South Florida Water Management District. She has worked on various regional groundwater models across South Florida and was the lead modeler and project manager on the development and calibration of the East Coast Surficial Model.

# IMPROVED PREDICTION OF FUTURE COMPOUND COASTAL FLOODS BY BETTER REPRESENTING THE PHYSICAL PROCESSES

*Cody O'Brien<sup>1,2</sup>, Husnain Tansar<sup>1,2</sup>, Samiul Kaiser<sup>1,2</sup>, Ebrahim Ahmadisharaf<sup>1,2</sup>*

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Accurate predictions of compound flood events, accounting for coastal and inland processes and the representative variables, are crucial for protecting communities and infrastructure from future flood hazards. Inland hydrodynamic models typically lack the capability to incorporate wind on coastal flood inundation, while ocean circulation models also like ADCIRC cannot properly simulate the underlying inland processes. Recent developments in flood modeling, such as HEC-RAS version 6, include capabilities to model the impact of wind on coastal flooding. Using this advanced feature, we developed 2D hydrodynamic models using HEC-RAS 6.6 to simulate compound flooding events and the interactions of hydroclimatic variables (e.g., storm tide, rainfall, river flow, and wind) in the Pensacola Bay area. We calibrated and validated the model against water level measurements at a tidal gauge during Hurricanes Sally (2020) and Michael (2018) as well as a rainfall-driven flood event (2014) with average tide levels. Initial conditions, Manning's  $n$ , the curve number, and the infiltration rate were adjusted to maximize the model performance. The validated model was used to project future flooding as impacted by changes in precipitation, sea levels and land cover. The model simulations were compared against the conventional modeling, which overlooks the wind impacts. Our comparisons showed that overlooking wind can underestimate the extent of changes in precipitation, sea levels and land cover on future compound floods in coastal areas. The proposed modeling approach highlights the importance of explicitly considering wind in compound flood predictions that are important to support efforts of enhancing the resilience of local communities and infrastructure such as Resilient Florida program.

**BIO:** Cody O'Brien is a graduate research assistant and M.S. Civil Engineering student with a background in coastal environment stability and flood protection. He is using HEC-RAS 6.6 to model compound flooding events in the Pensacola Bay region and study the impact of land use changes on these predictions.

# HISTORICAL WETLAND MAPPING UTILIZING READILY AVAILABLE GEOSPATIAL DATASETS

*Bethany O'Donnell, Mark C. Rains, Savannah Morgan, Leah Perez, Kai C. Rains*

University of South Florida, School of Geosciences

Wetlands play important roles in the proper functioning of landscapes, including protecting the chemical, physical, and Biological integrity of downstream waters. We know that both the conterminous United States and the State of Florida lost more than half of their wetlands since colonial settlement. However, these traditional estimates are aspatial, so they may imply that wetland restoration is desirable but cannot be used to understand where wetland restoration may be successful. Spatially explicit maps are needed but are time-consuming to develop through heads up digitization and therefore are rare. Many related geospatial datasets are readily available, free, and easy to use, but the accuracy of using them as proxies to identify high probability locations where wetlands have historically occurred is largely unknown. We are assessing the accuracy the using some of these readily available geospatial datasets to map the locations of wetlands and lakes in St. Lucie County, Florida in the 1940s. Readily available geospatial datasets include U.S. Geological Survey (USGS) topographic maps with standardized symbology indicating the location of wetlands and waterbodies; the Soil Survey Geographic Database (SSURGO) which includes the locations of hydric soils; land use-land cover (LULC) data from the South Florida Water Management District and the St. Johns River Water Management District; contours derived from contemporary LiDAR; and a representation of potential wetland features created by the National Oceanic and Atmospheric Administration (NOAA) Coastal Change Program (C-CAP) using a combination of wetland-related data and modeling methods. We compared maps of wetlands derived from these readily available, spatially explicit datasets to maps of 1940s wetlands and lakes produced through heads up digitizing of wetlands and lakes in 269 subsample circles (1-km<sup>2</sup>) distributed randomly across and covering approximately 15.4% of St. Lucie County, Florida. Preliminary results indicate the consistency between hand digitization of wetlands and lakes in the 1940s and maps derived from NOAA C-CAP Wetland Potential Layer or SSURGO hydric soils is approximately 70% and 56%, respectively. Future efforts will include similar testing against LULC maps (available since the 1990s) and historical USGS topographic map symbology, followed by testing of different combinations of these datasets. This approach offers an economical and low-tech method to map the high probability locations of historical wetland distribution and identify high priority areas for preservation and restoration to enhance and protect regional water quality.

**BIO:** I graduated with my Bachelor of Science in Biology with a concentration in Ecology and Evolution in December 2021 from the University of South Florida. I subsequently worked for two years in a private lake and wetland management company and for one year at the Florida Department of Agriculture, Division of Plant Industry. I returned to school to pursue my Master of Science in Environmental Science and Policy in January 2025 and am a research assistant with the University of South Florida Ecohydrology Research Group. I plan to pursue a career in state or private sector environmental work.

## Mechanisms by Which Hurricane Milton Impacted Microbial Water Quality in Coastal Environments

Van-Khuong Trinh and **Chamteut Oh**

University of Florida, Gainesville, FL, USA

Extreme weather events increasingly threaten coastal water quality, yet the mechanisms by which tropical cyclones impair microbial conditions remain poorly quantified. We develop a Large Language Model–Assisted Microbial Source Tracking (LAMST) framework to trace the origins of microbial threats—fecal indicator bacteria (FIB), pathogens, and antimicrobial resistance genes (ARGs)—and apply it to coastal waters impacted by Hurricane Milton along Florida’s Gulf Coast. LAMST integrates 16S rRNA sequencing with species-level metadata from the NCBI Bio Sample database to probabilistically classify detected taxa as marine, terrestrial, or wastewater in origin. Across 30 sites and three time points (1 week, 2 weeks, and 7 months post-storm), twelve analytes—spanning total bacteria, FIB, pathogens, and ARGs—were quantified by digital PCR. Both terrestrial and marine bacteria showed significant increases in total bacterial concentrations in the coastal waters following the hurricane, indicating concurrent mobilization of land-derived inputs and marine sources. Site fixed-effects regressions showed that terrestrial and wastewater bacteria were strongly associated with enterococci and two ARGs (*sul2* and *tetA* genes), whereas marine bacteria correlated with *Vibrio parahaemolyticus*. Despite rapid declines in enterococci within two weeks, several pathogens and ARGs remained elevated, underscoring the limitations of FIB alone as a regulatory indicator of post-storm microbial impairment. LAMST provides a quantitative and generalizable framework for source-resolved microbial tracking without reliance on regional reference sequences, offering actionable insights for post-storm water-quality assessment and coastal resilience planning.

**BIO:** Dr. Oh is an assistant professor in the Department of Environmental Engineering Sciences at the University of Florida. His lab analyzes environmental DNA and RNA to determine which microorganisms are present in the environment and what they do. Our targets include pathogens, antibiotic-resistant bacteria, and microbes involved in nutrient cycling.

## Soil and Water Interactions Drive Crop Seeding Growth

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Good seedling growth is important to achieve maximum crop productivity but is often constrained by complex soil-water interactions. The soil physical properties can be quantitatively expressed using the least limiting water range (LLWR). However, LLWR thresholds, particularly penetration resistance, may alter the interpretation of soil constraints on root development. This study assessed the impact of soil physical quality on the growth of maize root seedlings using the LLWR index across clay, sandy loam, and sandy-textured soils. LLWR was computed using moisture coefficients: air-filled porosity ( $0.10 \text{ m}^3 \text{ m}^{-3}$ ), field capacity (10 kPa), permanent wilting point (1500 hPa), and penetration resistance (conventional = 2.0 MPa; modified = 3.0 MPa). Results showed that LLWR was bounded by field capacity and penetration resistance as upper and lower limits for moisture contents between air-filled porosity and permanent wilting point. LLWR varied with soil texture, which was smaller for finer textured soils compared to coarser textures. Root growth was severely restricted by aeration at saturated soil conditions, and by available water and penetration resistance when the moisture content is towards the permanent wilting point. In clayey soils, penetration resistance above 3.0 MPa was the major limiting factor. The modified penetration resistance (3.0 MPa) resulted in wider LLWR and supported higher relative root growth compared to the original approach (2.0 MPa). These findings underscore LLWR as an effective tool for assessing soil physical quality, which controls crop growth.

## **PGPB-Biochar Improves Soil–Water–Nutrient Management in Citrus under Reclaimed -Water Irrigation**

*Tunde S. Oluwatuyi<sup>1</sup>, Davie M. Kadyampakeni<sup>1</sup> and Mary L. Lusk<sup>2</sup>*

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Florida has historically been the leading citrus-producing state in the U.S., particularly for orange juice processing. However, over the past two decades, industry has faced a sharp decline due to the prevalence of Huanglongbing. Compounding this challenge, Florida's sandy soil contributes to significant water and nutrient stress, further limiting citrus productivity. The use of reclaimed water for irrigation is increasing, but concerns remain about the potential for leaching of nutrients and heavy metals into groundwater. biochar, a pyrolyzed organic material, has shown promise as a soil amendment in sandy soils. While plant growth-promoting bacteria (PGPB) are known to help plants maximize nutrient uptake. However, combined application of biochar with PGPB under reclaimed wastewater irrigation has not been fully explored in citrus systems. This study examines the interactive effects biochar and plant growth-promoting bacteria (PGPB) on the hydraulic properties, water and nutrient dynamics of Candler fine sand, as well as citrus tree growth under reclaimed water irrigation. A greenhouse experiment was conducted under reclaimed water irrigation using a randomized complete block design with seven treatments: three biochar rates (2.5%, 5.0%, and 7.5% v/v), each with or without PGPB, and a control. These treatments were applied to one-year-old citrus trees grafted on two rootstocks (Valencia on Carrizo and X-639). Soil water retention, nutrient dynamics and citrus growth parameters were observed. Results showed that biochar and PGPB-inoculated biochar significantly improved soil hydraulic properties, and citrus growth performance, with the 7.5% v/v biochar rate combined with PGPB showing the greatest effect in both rootstocks. These findings show that PGPB-inoculated biochar can enhance water and nutrient management, as well as citrus growth, in sandy soils under reclaimed water irrigation.

**BIO:** Tunde S. Oluwatuyi is a PhD student in the department of Soil, water and ecosystem Sciences, University of Florida. He is one of the 2024 Water Institute Interdisciplinary Cohort (Water Scholar) currently working on the beneficial reuse of wastewater and biosolids.

## Visual Scientific Storytelling

**Andrew Opel**<sup>1</sup> [Session with Cynthia Barnett<sup>2</sup>, Angela Bradbery<sup>2</sup>, Jason Evans<sup>3</sup>, and Kellie Keys<sup>1</sup>]

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<sup>2</sup>University of Florida, Gainesville, FL USA

<sup>3</sup>Stetson University, DeLand, FL, USA

Drawing on a series of interdisciplinary environmental communication projects over the past decade, this presentation will summarize the lessons learned from these applied experiences. From the Apalachicola River Project (<https://apalachicolariverproject.org/>) to the Climate Witness Project (<https://www.climatewitnessproject.org/>), to a collaboration with NOAA creating media for *Science on a Sphere* (<https://sos.noaa.gov/catalog/datasets/marine-debris-introduction-to-marine-debris-in-the-ocean/>), connecting local storytellers and science has been shown to be an effective tool for translating complicated issues for public audiences. This process requires active work between the scientists, the local social actors living and working in an environment, and communication scholars and media producers. This work – and the barriers to effective science communication – is detailed through a review of previous case studies that reveal recurring dynamics between scientists, the public, and science communicators. From the connections to local story tellers to the iterative editing process to the suspicion of scientists to value of stories, this presentation maps out the tensions in the science communication process and offers suggestions for more effective collaboration and visual media production processes.

**BIO:** Andy Opel, Ph.D., is the James E. Kirk Professor of Communication in the School of Communication at Florida State University. As a founding member of the International Environmental Communication Association, he works at the intersection of media and the environment. You can see his work at <https://www.andyopel.net/>.

# Hidden Mineral Drivers of Microbial Diversity and Function in Nitrate-contaminated Karst Aquifers

*K.O. Osimiri<sup>1</sup>, Madison Flint<sup>2</sup>, Patricia Spellman<sup>3</sup>, Bobby Scharping<sup>1</sup>, Amy Williams<sup>2</sup>, Jonathan Martin<sup>2</sup>, Dogancan Yasar<sup>2</sup>, Brent Christner<sup>1</sup>*

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<sup>3</sup>University of South Florida, Tampa, FL USA

Karst aquifers host extensive groundwater–rock interactions that create highly heterogeneous chemical and physical niches. The Upper Floridan Aquifer (UFA) is one of the most productive and vulnerable karst systems in the world and has seen a ~50-fold increase in nitrate ( $\text{NO}_3^-$ ) over the past four decades, largely from agricultural runoff. Elevated nitrate is known to alter dissolved oxygen (DO) availability and redox conditions, potentially reshaping microbial communities that mediate biogeochemical cycling. However, the relative influence of nitrate versus mineral substrates on microbial diversity and function in karst aquifers remains unresolved.

We characterized microbial communities across groundwater and cave substrates (fine and coarse sediments, quartz, clay, Fe-oxide minerals, and carbonate rock) from seven spring-cave systems in the Suwannee River Basin (0.66–4.36 mg/L  $\text{NO}_3^-$ ). Community composition varied significantly across sites and substrates (NMDS, PERMANOVA), with mineral-associated biofilms forming distinct niches compared to planktonic groundwater communities. Nitrate and DO were strongly negatively correlated ( $r = -0.61$ ,  $p < 0.0001$ ) yet nitrate alone explained less variation in microbial communities than substrate type and broader geochemical gradients. These results suggest that mineral substrates may act as biogeochemical hotspots that decouple nitrate levels from microbial structure. Ongoing analyses are quantifying functional potential through qPCR of nitrogen cycling genes,  $\text{N}_2\text{O}$  production assays, and carbon cycling measurements to determine how microbial niches translate to ecosystem-level processes. The dynamic interplay between microbial communities and their geological environment may act as functional indicators of aquifer health, revealing potential management priorities that nitrate monitoring alone might overlook.

**BIO:** K.O. Osimiri is a PhD candidate at the University of Florida studying the intersection of microbial ecology, geology, and water quality in karst aquifers. Her research explores how nitrate and mineral substrates shape microbial communities and biogeochemical processes to inform groundwater protection and ecosystem health.

## Political Affiliation and Florida Red Tide Risk Perceptions

*Dylan Pace, Sadie Hundemer*

Department of Agricultural Education and Communication, University of Florida, Gainesville, FL, USA

Florida red tides have impacted the west coast of Florida for many years and pose a variety of risks to economies, the environment, and people's health. Individual risk perceptions vary across the political spectrum, which may lead some individuals not to take precautions to avoid the risks presented by red tide blooms. In this study, Florida west coast residents were surveyed to determine if political affiliation and ideology play a significant role in their perception of risk from red tide blooms. The results indicate that only political ideology, not political affiliation, is a significant predictor of red tide risk perception. The more conservative an individual, the less risk they perceived. Furthermore, higher perceived risk was associated with increased perceived behavior change in response to red tide. Additionally, both conservative and liberal respondents perceived more community-level risk than personal-level risk related to economics, health, and overall well-being. To address the discrepancies in risk perceptions, we recommend that policymakers and communicators develop messaging that resonates with the worldviews of conservatives, emphasizing personal risks and informed choices rather than mandates.

**BIO:** Dylan Pace is a Master of Science student in the department of Agricultural Education and Communication. He also received his undergraduate degree from the University of Florida in Agricultural Education and Communication. His current research interests include studying the interaction and relationship of agriculture and natural resources with individual's political identification and behavior.

## HARMFUL ALGAL BLOOM MONITORING IN THE ST. JOHNS RIVER

*Joshua Papacek*

St. Johns River Water Management District, Palatka, FL

Previous Harmful Algal Bloom (HAB) monitoring in the St. Johns River (SJR) was predominantly a reactive and event-based response, with a bias towards significant or recognizable HABs. Beginning in 2020, the St. Johns River Water Management District (SJRWMD), in partnership with the Florida Department of Environmental Protection (DEP), began routinely monitoring several locations in the SJR, with the purpose of providing observations across a wide range of conditions. Surface water samples are collected at 10 stations spanning the river and its lakes on a monthly (November-March) or biweekly (April-October) basis. Samples are then analyzed by the DEP lab for dominant taxa and concentrations of four major cyanotoxins (microcystin—MC, cylindrospermopsin—CYL, anatoxin-a—ATX, and saxitoxin—STX) and by the SJRWMD lab for various water quality analytes. Timing of HABs in the SJR varied by location and year. While HABs often occurred in summer months, blooms were observed outside of “peak” season likely due to a combination of favorable temperatures and increased water residence times. Results from this sampling effort emphasized that cyanobacteria are ubiquitous HAB-formers in the SJR and were identified as the dominant or co-dominant taxa in most bloom samples. While MC and CYL were the most frequently detected cyanotoxins, few samples at routine sites exceeded recreational guidance thresholds (8 µg/L and 15 µg/L, respectively), and high phytoplankton biomass (as chlorophyll-a) could not be used as a significant predictor of toxin detection. However, continued response sampling identified cyanobacterial HABs at additional locations with significant toxin concentrations measured at these new “hotspots.” This effort underscores the tradeoffs of a fixed-location sampling network compared to the dynamic nature of HABs. Furthermore, there is a need for supplemental HAB detection and prediction strategies, such as remote sensing tools, to monitor a large geographic area.

**BIO:** Josh Papacek is an Environmental Scientist with the St. Johns River Water Management District where his work focuses on water quality in the Upper St. Johns River Basin, harmful algal blooms, and managing projects to monitor nutrient sources and quantify loading. He has a PhD in Soil and Water Sciences from the University of Florida and a BS in Biological Sciences from Michigan Technological University.

# INITIAL STEPS TO ASSESS WATER SUPPLY SUSTAINABILITY CHANGE DUE TO LAND USE CHANGE

*Kshitij (Kay) Parajuli and Jeffrey Geurink*

Tampa Bay Water, 2575 Enterprise Rd., Clearwater, Florida, USA

Tampa Bay Water, a regional water supply utility, is responsible for assessing change in water supply sustainability to ensure adequate future water supplies for the Tampa Bay Florida region. Since the early 1990s, the Tampa Bay region has experienced significant land use transformation, with agricultural and grassland areas increasingly converted to residential and urban development. These transitions have important implications for regional hydrological processes, particularly evapotranspiration (ET), groundwater recharge, and streamflow dynamics. This study provides a quantitative analysis of land use changes between 1995 and 2010 and their expected effects on the water budget across gauged watersheds within the Integrated Northern Tampa Bay (INTB) model domain. The INTB model is a calibrated application of the Integrated Hydrologic Model (IHM) which is used to evaluate water supply sustainability.

Target ET values, which represent long-term average annual actual ET based on land use and depth to water table, were used to evaluate potential hydrologic shifts. Results indicate more than 20–30% of land area in several Tampa Bay-area watersheds (e.g., Trout Creek, South Branch Anclote, Fox Branch, Delaney Creek, and Anclote at Elfers), transitioned to urban development, resulting in increased impervious surface area. These transitions are projected to reduce ET and groundwater recharge while enhancing surface runoff and streamflow. Potable water supply wellfields are located within some of the named watersheds.

The analysis demonstrates noticeable spatial variability in ET change across the region and establishes linkages between dominant land use transitions and hydrologic responses. The findings provide preliminary insights into the potential cumulative impacts of land use change on water balance by watershed. The results are generally consistent with earlier modeling efforts by the University of Central Florida and Tampa Bay Water and may guide future evaluations of long-term water supply sustainability under future land use scenarios within the updated INTB model.

**BIO:** Kay Parajuli is Water Resources System Engineer at Tampa Bay Water.

# Forecasting the Future of Mangroves: Modeling Migration, Flood Protection, and Resilience to Sea Level Rise

*Vladimir A. Paramygin*<sup>1</sup>, *Kevin Buffington*<sup>2</sup>, *Y. Peter Sheng*<sup>1</sup>, *Karen Thorne*<sup>2</sup>

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Mangroves are critical components of coastal defense systems, offering multiple protective functions including wave attenuation, shoreline stabilization, and reduction of coastal flood losses. Despite their well-recognized role in mitigating coastal hazards, the long-term dynamics of mangrove distribution under changing climatic and sea-level conditions remain poorly quantified. This study introduces a high-resolution, process-based framework that explicitly links dynamic-timescale hydrodynamic forcing with long-term ecological and geomorphic responses to sea level rise. A mangrove-resolving three-dimensional surge–wave model (CH3D-SWAN) is dynamically coupled with WARMER (Wetland Accretion Rate Model for Ecosystem Resilience), a soil cohort model that simulates vertical accretion and soil development processes in wetlands. The coupled modeling system captures vegetation–flow–turbulence and vegetation–wave interactions, enabling more realistic simulation of storm-driven flooding and sediment transport under tropical cyclone conditions.

On longer timescales, the framework integrates mangrove–salinity and mangrove–sediment feedback to project shifts in mangrove extent and species zonation resulting from gradual sea level rise and altered hydrodynamic regimes. The approach is applied to Southwest Florida, where multiple sea level rise scenarios from 2000 to 2100 are used to assess changes in mangrove habitat distribution and associated ecosystem service values, particularly flood protection benefits. Without considering the dynamic coupling of hydrodynamic and ecologic processes, mangrove migration in the 21st century is very different from that obtained in this dynamic study, demonstrating the importance of coupling hydrodynamic and ecological processes for evaluating the resilience and adaptive capacity of mangrove systems. As mangroves migrate further inland and replace freshwater marshes, their value for flood protection diminishes, highlighting the need for mangrove restoration.

**BIO:** Vladimir Paramygin is a research scientist at Engineering School of Sustainable Infrastructure and Environment, University of Florida. He has over 20 years of experience in numerical modeling specializing in coastal hydrodynamics. Involved in numerous projects assessing value of wetlands in flood prevention.

## Optimizing Zinc Fertilization to Resilience of HLB-affected Citrus

*Monika Peddapuli and Davie Kadyampakeni*

UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL, USA

Zinc (Zn) plays a crucial role in citrus physiology through enzyme activation, protein metabolism, and chlorophyll synthesis, thereby influencing canopy growth, photosynthetic efficiency, and fruit production. Deficiency symptoms including interveinal chlorosis, twig dieback, and poor fruit set are intensified in Huanglongbing (HLB)-infected trees due to compromised root function and nutrient uptake. Micronutrient responses are often nonlinear, with growth improving up to an optimum application rate before diminishing or causing toxicity. We proposed that supplying Zn to HLB-affected trees would enhance canopy development and yield until an optimal threshold is reached. To test this, a field trial was initiated in 2024 at the Citrus REC in Lake Alfred, Florida on twelve-year-old 'Valencia' sweet orange trees grafted on Swingle citrumelo rootstock. Treatments included four Zn rates (16.8, 25.2, 33.6, and 42 kg ha<sup>-1</sup>) in a completely randomized design with four replications. Initial findings showed that soil Zn rose significantly ( $p \leq 0.05$ ) with increasing application rate, reaching 96.56 mg kg<sup>-1</sup> at 42 kg ha<sup>-1</sup>. Although leaf Zn concentrations did not differ statistically, the highest value (28.8 mg/kg) was observed at 25.2 kg ha<sup>-1</sup>. Similarly, canopy volume (11.3 m<sup>3</sup>), leaf area index (2.83), and SPAD chlorophyll readings (69.3) peaked at 25.2 kg ha<sup>-1</sup>. Fruit yield increased by 152% between 2024 and 2025, with relative gains ranging from 136% at 16.8 kg ha<sup>-1</sup> to 175% at 42 kg ha<sup>-1</sup>, while the maximum absolute yield (6.05 lbs tree<sup>-1</sup>) occurred at 33.6 kg ha<sup>-1</sup>. Collectively, these results suggest that the 25.2 kg ha<sup>-1</sup> Zn treatment provides a balanced fertilization strategy, supporting canopy growth and productivity in HLB-affected citrus.

**BIO:** Monika Peddapuli is a second-year Ph.D. student specializing in plant nutrition with strong academic performance and hands-on research experience. She has earned multiple travel awards (ASHS, FSHS), served as vice president of GSPO, received the 2025 FFAA award, and secured third place in the 2025 Inter-REC poster competition.

## Upper Kissimmee Basin Flood Direct and Indirect Benefits

*Francisco Peña<sup>1,2</sup>, Ana Carolina Coelho Maran<sup>2</sup> and Hongying Zhao<sup>2</sup>*

<sup>1</sup>Galt Group Inc, Wellington, FL

<sup>2</sup>South Florida Water Management District, West Palm Beach, FL

Flood damage assessments and benefit-cost analyses traditionally focus on quantifying direct structural benefits (reduction in impacts to buildings, contents, and roads) when comparing Future Without Project (FWOP) and Future With Project (FWP) scenarios. To advance this methodology, the South Florida Water Management District (SFWMD) has applied the SFWMD Flood Impact Assessment Tool (SFWMD-FIAT) to evaluate Expected Annual Damages (EADs) across multiple return periods (5-, 10-, 25-, and 100-year events). These outputs are then used to calculate the Benefit-Cost Ratio (BCR) for a range of mitigation strategies. The tool integrates flood depth maps, exposure data, and depth-damage functions consistent with FEMA standards and methodologies and has supported the justification of District's flood resiliency projects since 2022.

This presentation focuses on the importance of, in addition to quantifying direct benefits, also quantifying indirect benefits to more comprehensively capture the economic value of proposed regional mitigation projects, using an ongoing study in the Upper Kissimmee Basin as an example. These benefits account for avoided losses and secondary costs that extend beyond direct physical damages to properties, including agricultural losses, vehicle replacement, displacement costs, lost revenue, business impacts, reduced emergency response expenditures, and mental health impacts. In the example, the approach also considers future land use projections, as Osceola and Orange Counties are among the fastest-growing Counties in Florida and continue to experience rapid urbanization.

Results demonstrate that including indirect benefits significantly enhances total flood risk reduction estimates. Incorporating them into the EAD ensures a more accurate reflection of a project's economic and societal benefits, particularly in areas where flood events trigger cascading effects on households, mobility, and local economies. This expanded framework provides a stronger, evidence-based foundation for demonstrating that regional resiliency investments are both cost-effective and strategically valuable for long-term flood risk management.

**BIO:** Dr. Peña is a resilient project manager with more than a decade in the field of flood modeling. He has extensive experience in developing H&H Modeling and Economic Damage Assessment Memorandums for multiple efforts. He has supported more than 50 different grant applications since joining District Resiliency in 2022.

## **WATER FIRST NORTH FLORIDA PROJECT**

***Timothy E. Perkins, P.E.***

St. Johns River Water Management District, Palatka, FL, USA

Florida law requires Minimum Flows & Water Levels (MFLs) to be established to protect water bodies from significant harm due to surface and groundwater withdrawals. The Florida Department of Environmental Protection (DEP) has proposed MFLs for the Lower Santa Fe and Ichetucknee Rivers and Priority Springs (LSFIR). Since some of the LSFIR MFLs are not being met, DEP and the St. Johns River Water Management District (SJRWMD) and Suwannee River Water Management District (SRWMD) are developing a recovery and prevention strategy to meet the MFLs while also ensuring the future water supply needs of the region. To identify the best path forward, a collaborative effort was launched by the SJRWMD, SRWMD, DEP, and select utilities in the north Florida region. After evaluating numerous alternatives, the Water First North Florida project was identified as the most effective and cost-efficient solution. The project will utilize an estimated 40 million gallons per day of high-quality reclaimed water from JEA's Buckman and Southwest Water Reclamation Facilities, which will be further polished in treatment wetlands to further reduce nutrients and other pollutants, if needed receive additional treatment at recharge facilities, and then transported via pumping and transmission piping to the water to recharge site(s). A more detailed study has been initiated to identify potential treatment wetland and recharge sites, further define treatment and permitting requirements, and refine design concepts and estimated costs. Water First North Florida, in conjunction with conservation and other efforts, will restore the hydrology of the Lower Santa Fe and Ichetucknee rivers and springs.

**BIO:** Mr. Perkins is a Supervising Professional Engineer with more than 46 years of experience planning, designing, permitting and implementing water and wastewater treatment, pumping and transmission projects. He has experience with regional water resource development, water supply and reclaimed water projects. He has significant experience in water/wastewater operations & maintenance, facilities planning and development of capital budgets.

## **Refining Phosphorus Diagnostics in Organic Soils: Bridging Agronomic Needs and Water Quality Goals**

*Dinesh Phuyal<sup>1</sup>, Vimala D. Nair<sup>1</sup>, Shabnam Sadeghibaniani<sup>2</sup>, Lilit Vardanyan<sup>1</sup>, Germán V. Sandoya<sup>2</sup>, Niguss S. Hailegnaw<sup>2</sup>, and Dereje A. Birhan<sup>2</sup>*

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<sup>2</sup>University of Florida, Everglades Research and Education Center, Belle Glade, FL, USA

The organic soils (Histosols) of the Everglades Agricultural Area (EAA) are vital to Florida's crop production. While these soils contain large reservoirs of total phosphorus (P), their availability to plants is often limited by high pH and calcium content due to oxidation and the mixing of underlying calcium carbonate into the plow layer as soils become shallow. Their unique biogeochemistry creates a significant challenge in managing P. To ensure crop yields, fertilizers are often applied at rates that exceed plant uptake, resulting in the accumulation of legacy P and posing a substantial risk of nutrient loss to aquatic ecosystems. A key barrier to addressing this issue is the inadequacy of conventional soil P tests. Although there are P extraction methodologies that are specifically developed for muck soils, there is still a need for improved soil extractants that better correlate with crop yield and guide P management. The objective of this study is to quantify the relationships between different soil P extraction methods and determine how the choice of analytical procedure impacts management decisions that affect water quality. To investigate this, soil samples were collected from representative muck soils across the EAA, and extraction methods such as traditional water-extractable P (P<sub>w</sub>), Mehlich-1 (M1P), and Mehlich-3 (M3P), as well as the FeO-P and H3A-P techniques were compared. This analysis is expected to highlight differences among testing protocols, demonstrating how they may lead to varying interpretations of soil phosphorus status. Future work will leverage these results to design field trials for establishing modern, site-specific fertilizer recommendations that balance agricultural productivity with environmental stewardship. Ultimately, this research provides the foundational science for a more robust decision-making tool to improve water management in Southern Florida.

# CROP NUTRIENT PROFILE LINKAGES TO WATER RESOURCES ACROSS CONUS

*Katie McCurley Pisarello and Samuel Smidt*

American Farmland Trust National Research Initiative, Washington, DC USA

Water availability and use as it relates to domestic food crop production has been well studied, but the relationship between water use and crop nutrient production remains unexplored. Moreover, consideration of food nutrients has been of increasing national interest, and yet we do not have a comprehensive quantification of domestic nutrient production in the United States. Here we present a novel Crop Nutrient Profile (CNP) dataset, consisting of 32 nutrients for 77 unique food crops within a total of 95 land cover types as outlined by USDA's Cropland Data Layer (CDL). The CNP dataset was appended to the 2023 CDL to provide a geospatial accounting of CONUS nutrient production at 30m resolution. This kind of comprehensive nutrient profiling is crucial for beginning to address important questions as they relate to United States nutrient production. Using the CNP dataset, we modeled relationships between CNP index values and location-specific crop water use in CONUS hydroclimate zones of varying degrees of aridity, following the zoning formation framework in McCurley Pisarello & Jawitz, 2021. We found that there were significant relationships between CNP index values and crop water use in specific hydroclimate zones, suggesting that "water cost" may not homogeneously align with nutrient production intensities across zones. Understanding the breadth of domestic food and nutrient production and their relationships to local water resources are important matters of national security and ultimately inform optimal production as they relate to human needs and natural resource availability.

**BIO:** Dr. Pisarello is a Senior Research Scientist and systems modeler at American Farmland Trust. She has worked within a variety of biophysical and socioeconomic disciplines in the agricultural and environmental sciences at scales ranging from plot to global. Dr. Pisarello has led projects in academic, federal, and nonprofit research settings.

## **NORTH FLORIDA WATER IMPACTS OF AUTOMATION TECHNOLOGY EXTENSION PROGRAMMING FOR DRIP IRRIGATED CROPS**

*Henry T. Pittman, Ph.D., CWB*

University of Florida, Institute of Food and Agriculture Science Gilchrist County Extension, Trenton, FL USA

Water quality and quantity conservation is an important topic throughout the state of Florida, with no exception for the Suwannee Valley region of North Florida. Drip irrigated vegetables are one of the largest crops in the Suwannee Valley totaling approximately 8000 acres annually and are a focus point of water use and nitrogen nutrient inputs regulations. Before 2021, drip irrigated vegetables in the SV were managed manually which severely limited the ability of farmers to control both irrigation and fertigation. In 2021 I began an extension program focused on the development and adoption of automation technology in these crops for Gilchrist County and the greater Suwannee Valley. In 2024, I assessed the impacts of automation from the perspective of nutrient usage, water usage and economic benefits. With help of our Suwannee Valley Extension Team, we surveyed 9 of 12 producers in the Suwannee Valley that adopted automation technology during the 2024 growing seasons. In total these farmers automated 1,883 acres of watermelon and other vegetables in the Suwannee Valley. These 9 farmers all reported that automation decreased the amount of fertilizer and water they used throughout the season. Farmers reported they used 44 pounds of nitrogen per acre less and 24.3% less water per day than without automation. Based on the acreage (1,883) the farmers automated, farmers realized a total reduction of 54,682 pounds of nitrogen used. Assuming standard irrigation system characteristics and a 100-day growing season, farmers reduced their water usage by 873 gallons of water per day per acre or 164 million gallons of water during the growing season. Automation technology is becoming quickly adopted because of extension driving the conversation in drip irrigated vegetables across the Suwannee Valley with potential for saving almost 1 billion gallons of water and over 300,000 lbs. of nitrogen annually.

**BIO:** Dr. Pittman is an agriculture and natural resources extension agent in Gilchrist County Florida with a focus on commercial horticulture and water quality and quantity conservation. He has 15 years' experience in natural resources conservation and water quality monitoring and management with various state and federal agencies and land-grant universities.

## **JEA H2.0 PURIFICATION AND REPLENISHMENT**

***Ryan Popko, P.E.***

JEA, Jacksonville, FL, USA

JEA is the largest municipally owned utility in the state of Florida, providing water and electric services to over one million people. JEA's water recycling program started with implementing reclaimed water back in the early 2000s. Building upon the award-winning reclaimed water program, the next step of the water recycling journey is JEA's H2.0 Purification Program which began in 2014. This three-phase H2.0 Purification Program is a nod to the 2.0 version of JEA's water supply. The program further purifies reclaimed water to drinking water quality so it can be used to replenish the aquifer. After completion of the pilot testing phase, JEA is now completing construction on Florida's first full-scale potable reuse facility. The facility utilizes membrane filtration, reverse osmosis and ultraviolet advanced oxidation to purify water. Since public education of potable reuse is so important the facility also includes a world-class visitor center. By mimicking what nature does to replenish the aquifer, only over a shorter amount of time and a smaller footprint, JEA is strategically implementing resilient water infrastructure to ensure reliable and sustainable water supplies for future generations.

**BIO:** Ryan Popko, P.E. leads JEA's H2.0 Purification Program. He has Bachelors and Masters Degrees in Environmental Engineering from Rensselaer Polytechnic Institute and University of Massachusetts – Amherst, respectively. Ryan serves as President of the Board of the Southeast Desalting Association and board member of the American Membrane Technology Association.

## Water Quality Impacts of Phosphorus from Soil Amendments in Florida's Sandy Soils

*Aaron Portmess, Johnathan Ballou\*, Dinesh Phuyal, Lilit Vardanyan and Vimala Nair*

University of Florida, Gainesville, FL, USA

Organic fertilizers, such as manures and biosolids, are increasingly promoted as sustainable alternatives to inorganic fertilizers due to their ability to recycle nutrients and improve soil health. However, the perception that “organic” implies lower environmental risk can obscure potential negative impacts. Like inorganic sources, organic fertilizers contribute to P losses that degrade water quality, especially as legacy P accumulates and is gradually released. biochar, derived from the pyrolysis of organic materials, has emerged as a potential amendment that may reduce P leaching while maintaining long-term P availability.

This study comparatively evaluates the water quality impacts of fresh manures, their corresponding biochars, and inorganic fertilizers (concentrated superphosphate) in Florida's sandy, acidic soils. A controlled column leaching study is conducted using surface soil samples from two representative soil orders, Ultisols and Spodosols. Each soil type receives surface applications at equal total P rates using one inorganic fertilizer, four fresh manures (beef, dairy, poultry, biosolids), and their four corresponding biochars. Leachate will be collected and analyzed over time to assess water-soluble and total P loss. We hypothesize that the high solubility of inorganic P will cause elevated initial leaching, followed by a rapid decline whereas, organic sources will exhibit lower initial but more sustained P release due to microbial mineralization. Pyrolysis is expected to alter manure chemistry, reducing P solubility and leaching potential. The outcomes will demonstrate how soil properties and P source characteristics jointly determine P mobility. This study aims to advance understanding of P dynamics in sandy soils and assess biochar as a lower-risk alternative to fresh manures and inorganic fertilizers, offering a potentially more sustainable strategy for managing P in agricultural systems.

**BIO:** Aaron Portmess and Johnathan Ballou are analysts and lab technicians at the Environmental Soil Chemistry Lab, University of Florida. They support the Best Management Practices (BMP) Project, which develops sustainable agricultural practices to improve nutrient efficiency and reduce environmental impact. Their work involves comprehensive soil chemical analyses, including nutrient quantification.

# Field and Modeling Approaches to Irrigation and Nitrogen Management in Potato

Varshitha Prasanna<sup>1</sup> and Vivek Sharma<sup>1</sup>

University of Florida, Gainesville, FL, USA

Potato (*Solanum tuberosum* L.) is an important spring commodity in Florida, where sandy soils with low water and nutrient holding capacity make irrigation and fertilization critical for sustaining yield. Excessive nitrogen (N) and water inputs can lead to nitrate leaching whereas insufficient inputs reduce productivity. Hence, it is essential to optimize irrigation and N application in potato production. A two-year field study was conducted at the UF/IFAS North Florida Research and Education Center (NFREC), Suwannee Valley, Live Oak, Florida, evaluating two irrigation regimes; full irrigation (FIT) and 75% FIT with six N treatments ranging from 112 to 392 kg N ha<sup>-1</sup>, along with a rainfed control (0 kg N ha<sup>-1</sup>). Results showed that yield increased with higher N rates but yield differences between FIT and 75% FIT were not significant. Among N rates, 280 kg N ha<sup>-1</sup> produced yields comparable to higher rates, while nitrate availability at 60–90 cm was lower, indicating reduced leaching. Water use efficiency was consistently higher in 75% FIT, whereas nitrogen use efficiency decreased with increasing N. Due to the high cost of lysimeter installation, leaching was not quantified in the field; therefore, the SUBSTOR-Potato model was used and calibrated with non-stressed treatments. The model simulated LAI, dry tuber yield, and N uptake with acceptable d-stat values. Leaching was greatest under FIT and increased with higher N application. Recent remote sensing technologies, such as UAV-derived vegetation indices (NDVI, SAVI, NDRE, etc.) combined with machine learning models (random forest, support vector machine, and multiple linear regression), were also tested for estimating crop coefficients ( $K_c$ ). Results highlighted the potential of integrating remote sensing with modeling to improve  $K_c$  estimation which guides irrigation scheduling and enhances resource use efficiency. Overall, these findings support sustainable potato production with optimized irrigation and N management while minimizing environmental impacts.

**BIO:** I am Varshitha Prasanna, a Ph.D. Candidate in the SNRE (Conc. ABE). My research focuses primarily on optimizing irrigation and nitrogen management for potato cultivation. In addition to using DSSAT crop modeling, I use remote sensing techniques, such as UAV drone imaging and Machine learning to further my research.

## **Vegetation Dynamics and Community Divergence in Central Florida Reference Wetlands**

*Renee Price and David Kaplan*

University of Florida, Gainesville, FL, USA

Wetlands provide invaluable ecosystem services but have experienced significant degradation and filling over the past century. More contemporarily, the focus to protect and restore wetlands has emphasized the need for reference wetland systems to serve as both design templates and benchmarks for restoration success. However, due to limited access to long-term hydrology and vegetation data with replicates, the similarity of these attributes across wetland types remains poorly understood. This research aims to further our understanding of vegetation community stability and similarity of isolated cypress reference wetlands in central Florida. Specifically, we ask: 1. How have vegetation communities in these wetlands shifted over a 17-year period and 2. Are these wetland communities similar? To answer these questions, we leveraged 17 years of annual vegetation monitoring data from 12 isolated cypress wetlands located in close geographic proximity. Data included species composition and percent cover data for groundcover, shrub, and tree strata. For Question 1, we analyzed Non-Metric Multidimensional Scaling (NMDS) scores of each wetland by year and applied the Mann-Kendall test to identify significant trends over time. We also calculated dissimilarity indices between the baseline survey and each subsequent year. For Question 2, we derived NMDS scores by strata and year and applied PERMANOVA to assess community similarity. Preliminary results revealed significant shifts in groundcover communities in five wetlands, shrub communities in one wetland, and tree communities in six wetlands. Dissimilarity indices were generally highest for groundcover, followed by shrubs and trees; however, groundcover and shrub indices were commingled in two wetlands. NMDS revealed two distinct wetland groups as well as annual variation. Temporarily, groundcover variance between wetlands appeared to decrease over time. All strata were found to be significantly different. These findings suggest that variation in vegetation communities exists within reference systems, with implications for restoration design and monitoring benchmarks.

**BIO:** Renee Price is a PhD candidate at the UF Center for Wetlands where she investigates wetland dynamics that assist with designing effective monitoring and restoration strategies. She also has extensive experience in the consulting industry with focus on water quality and quantity projects.

# **Water and Power in the Ancient Andes: 5000 years of water management in the Southern Hemisphere**

***Gabriel Prieto***

Department of Anthropology, University of Florida.

This study examines the co-evolution of water management systems and political complexity in the Andean Southern Hemisphere, tracing a 4000-year trajectory that links hydraulic control directly to the consolidation of power. In this hyper-arid environment, access to and effective management of water—from early coastal fog-catching structures to monumental canal networks—was the critical determinant of agricultural viability and state formation.

This paper synthesizes archaeological, paleoclimatic, and ethnohistoric data to analyze how emerging elites, spanning the Initial Period (1500-1200/1100 BC) through the sophisticated engineering of the Chimu Empire (AD 1050-1450), leveraged control over water resources to organize mass labor, generate agricultural surplus, and justify territorial expansion. We demonstrate that the political investment in large-scale irrigation projects created durable, yet vulnerable, social structures. Furthermore, the research specifically investigates how the technological and ritualistic management of water scarcity, particularly in response to severe El Niño-Southern Oscillation (ENSO) events, became the ideological bedrock for stratified societies. The findings reveal that these hydraulic systems were not merely engineering feats, but deeply embedded expressions of power that fundamentally shaped the political landscape and long-term resilience of ancient Andean civilizations.

# Soil and Crop Monitoring using Microwave Satellites for Improved Water Management

**Michelle Prieto-Sanchez<sup>1</sup>, Laura Almendra Martin<sup>1</sup>, Jasmeet Judge<sup>1</sup>, Mawiyah Abdelkarim<sup>1</sup>, and Sarah Daly<sup>2</sup>**

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<sup>2</sup>Department of Earth, Environmental, and Planetary Sciences, Washington University in St. Louis, St. Louis, MO, USA

Field-scale soil and crop information is essential for irrigation scheduling, crop management, and hydrologic assessment. Yet direct measurements are limited in space and time, while agricultural water management decisions often change daily. Satellite-based microwave (wavelengths >1mm) sensors are highly sensitive to water in soil and crops. They observe the land surface day and night, offering reliable all-weather observations. For example, active microwave radar monitors soil moisture (SM) over large areas with consistent, repeatable coverage.

Until now, satellite-based soil and crop monitoring has relied mainly on radar at 6 cm (C-Band) from the European Sentinel-1 satellites, which provide SM and vegetation products every 6–12 days at 1km resolution. Because C-band has a shorter wavelength than L-band (20-cm), it doesn't penetrate deeper into vegetation and upper soil but is more sensitive to vegetation canopy. The new NASA-ISRO Synthetic Aperture Radar (NISAR) mission introduces L-band radar and will provide a global SM product at 200-meter resolution twice every 12 days. Together, Sentinel's and NISAR's observations will provide complementary soil and crop conditions, improving satellite-based monitoring.

UF's Center for Remote Sensing is evaluating Sentinel-1 and NISAR observations to support the development of soil and crop products for the NISAR two missions. The Plant Science Research and Education Unit in Citra, Florida, has been designated as an agricultural calibration and validation site. Two 200m x 200m fields equipped with *in situ* sensors recording soil conditions every 15 minutes. Crop conditions will be observed during times of NISAR overpass. These fields represent mixed surface and crop conditions, including bare soil and growing wheat.

This presentation evaluates Sentinel-1 and NISAR observations to understand how differences in wavelength affect radar sensitivity to SM and crop growth and helps understand the sensitivity of L- and C-band data to growing crops.

**BIO:** Michelle Prieto-Sanchez is a Biological Engineering student at the University of Florida specializing in Land and Water Resource Engineering. She works with the Center for Remote Sensing on combining field sensors and radar data to improve agricultural monitoring and satellite calibration in Florida.

# Incorporating water-related processes for Quantifying Hurricane Impacts on agricultural production

*Xiaohui Qiao, Christa D. Court*

Department of Food and Resource Economics, University of Florida, Gainesville, FL, USA

Florida agriculture frequently experiences substantial adverse impacts following hurricanes due to damage and losses associated with crops, livestock, and infrastructure. Quantifying the impacts of hurricanes on agricultural production remains challenging because losses arise from compound hydrometeorological hazards (wind, rainfall, and flooding) that jointly affect crops and livestock in complex ways. Existing studies of hurricane impact assessment often emphasize wind damage while underrepresenting the water-driven components of the impact chain; however, excessive rainfall and flooding are major drivers of crop yield reduction, soil degradation, and long-term field recovery challenges. In addition, compared with growing attention to multi-hazard impacts in urban areas, limited research has focused on agricultural systems. This study presents a comprehensive review of (1) existing approaches for multi-hazard impact assessment, highlighting their methodological strengths, limitations, and applicability to agricultural studies; (2) current research on crop vulnerability/loss curves related to strong wind, extreme rainfall, and flooding. Building on these insights, we develop a compound hazard modeling framework incorporating agricultural baseline data, hydrometeorological datasets, a Hurricane Composite Intensity Index (HCII), and crop vulnerability/loss curves to quantify agricultural production losses resulting from hurricane wind, rainfall, and flooding. The framework integrated rainfall and flooding processes into the impact analysis, improving the understanding of water-related damage to agricultural production during hurricanes. Taking Hurricane Milton (2024) in Florida as an example, we present a case study to demonstrate how the framework supports rapid assessment of hurricane impacts on agricultural production and provides accurate and data-driven estimates to inform decision-making for disaster response and recovery planning.

**BIO:** Dr. Qiao is a Research Assistant Professor at the UF/IFAS Economic Impact Analysis program. Her work focuses on integrating remote sensing, GIS, and statistical modeling to assess the impacts of natural disasters on agriculture, advancing data-driven resilience planning and decision support through advanced geospatial analysis and WebGIS tools.

# AUTOMATED SPECTRAL DECONVOLUTION FOR QUANTITATIVE DYE TRACING

*Fabian Quichimbo-Miguitama*<sup>1</sup>; *Seonkyoo Yoon*<sup>1,2</sup>; *Jana Kramer*<sup>3</sup>; *John, D. Barry*<sup>4</sup>; *Scott C. Alexander*<sup>5</sup>; *Peter K. Kang*<sup>3,6</sup>

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Fluorescent dye tracing is a widely applied technique for characterizing complex, interconnected flow paths and delineating the extent of flow-accessible domains. Breakthrough curves (BTCs), continuous time series of dye concentrations at downstream monitoring points, provide quantitative insights into flow velocity, travel time distributions, dispersion, and sorption processes. However, accurate dye concentration estimation is often challenging due to fluorescence interference from natural organic matter (NOM) such as humic/fulvic acids and chlorophylls. The interference by the background fluorescence signals can be particularly significant at low concentration regimes. To address this challenge, we present a spectral deconvolution-based concentration estimation technique that isolates multi-dye signals from background NOM signals using automated multi-curve fitting. We applied the approach to three hydrogeologically complex field sites: two karst aquifers in Florida and Minnesota and a fractured limestone aquifer in Minnesota. The method can quantify accurate dye concentration even at low concentrations where in situ fluorometers often fail. Moreover, the framework efficiently processes large-volume, high-frequency datasets, providing an efficient platform for high-resolution BTC analysis. Computed BTCs can be integrated with spatially distributed process-based numerical models for flow and transport simulations, serving as calibration targets. This linkage facilitates more reliable estimation of model parameters, enhancing the robustness and reliability of groundwater models and transport contamination.

**BIO:** Fabian is a PhD student in the Geological Sciences department at the UF. He is a hydrologist investigating flow and transport processes across spatiotemporal scales by integrating tracer data with computational modeling. Fabian employs a holistic approach, combining theoretical, computational, experimental, and field methods, to advance understanding of karst water dynamics and support strategies for the sustainable management of water resources and ecosystems.

# Coupling Vertical Distribution of Marine Algal Biomass and Ocean Hydrodynamics

*Sumon Hossain Rabby, Md Iftekhar Sayeed Khan and Ebrahim Ahmadisharaf*

FAMU-FSU College of Engineering, Tallahassee, FL, USA

Marine Harmful Algal Blooms (HABs) threaten coastal ecosystems, fisheries and human health by toxin production, water discoloration, and oxygen depletion (hypoxia or anoxia). Substantial efforts have been made on their detection, prediction and forecasting, and dynamics with environmental stressors (climate change, sea-level rise, etc.). However, a knowledge gap remains in characterizing them following hurricanes. This gap stems from the lack of studies coupling the characteristics of HABs (phenology, vertical and horizontal structures and taxonomic compositions) with oceanic processes and their hurricane-led anomalies (i.e., upwelling of nutrient-rich waters, ocean cooling, etc.). Addressing this gap requires better understanding depth and magnitude of deep chlorophyll-a maxima or peak chlorophyll-a levels in the water column and their relationship with ocean hydrodynamics. Limited availability of in-situ data on algal biomasses' water column distribution challenges such studies. To address these gaps, we propose a spatiotemporally-distributed framework that couples empirical distribution, machine learning (ML), and hydrodynamic properties to approximate the vertical distribution of algal biomass within the epipelagic layer (200m). First, we derive empirical distribution parameters (magnitude, depth, and standard deviation of peak) on the available depth-resolved in-situ data of chlorophyll-a collected from Argo-Float. Second, we estimate different hydrodynamic properties (i.e., relative water column stability, water density, mixed and isothermal layer depth, and barrier layer thickness). Third, we apply ML algorithms to approximate the empirical distribution parameters based on those oceanic properties. Our results show that algal vertical distribution in the Florida Gulf follows single-peak Gaussian distribution ( $R^2 > 0.80$ ). The shape parameters of the Gaussian distribution can be predicted from the hydrodynamic properties with high accuracy ( $R^2 > 0.89$ ) using ML regression. Further, our inferential analyses highlight that different hydrodynamic properties control different shape parameters. This study contributes to better understanding post-hurricane algal blooms through coupled modeling that connects HAB and ocean properties.

**BIO:** Sumon is a Ph.D. candidate in Civil and Environmental Engineering at the FAMU-FSU College of Engineering. His doctoral research focuses on quantifying the impacts of hydroclimatic extremes (i.e., hurricanes and droughts) on coastal and estuarine water quality across the Florida Gulf using advanced statistical modeling and inferential analyses.

## Coastal Monitoring during Hurricane-induced Storm Surge

*Zanti Rains<sup>1</sup>, Ehsan Ahmadi Afzadi<sup>1</sup>, Scott Powell<sup>2</sup>, Brian Phillips<sup>1</sup> and Elise Morrison<sup>1</sup>*

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Hurricanes often create storm surge and freshwater flooding which can be destructive to coastal infrastructure, beach morphology, coastal ecosystems, and water quality. Storm surges are initiated by physical interactions between atmospheric forces and coastal waters, and understanding those interactions has important implications for evacuations and human health and safety. However, there is limited data at the point of landfall during hurricanes, and even fewer datasets that couple meteorological, physical, and biogeochemical measurements in the path of a landfalling hurricane. We fill this gap by deploying advanced wind, wave, and water-quality monitoring stations (“Sentinel towers”) on beaches in the predicted path of incoming hurricanes. These towers are engineered at the University of Florida and are designed to carry an array of sensors to capture changes in atmospheric and hydrologic conditions at landfall. Two Sentinel towers were deployed for the first time in the paths of Hurricane Helene and Hurricane Milton in 2024 to capture the most extreme wind and wave conditions. Coupled Sentinel data on atmospheric pressure, wind speed and direction, water depth, and salinity provided a timeline during hurricane landfall. These data revealed site-specific differences in physical interactions that influenced freshwater-saltwater mixing as well as the timing, duration, and depth of storm surge. To prepare for hurricane season 2025 and beyond, we have designed a first-of-its kind protective mount to hold a YSI EXO2, Nortek ADCP, and erosion sensor at the base of the tower. This will allow us to obtain unprecedented observations of water quality, current dynamics, and beach morphology during and immediately following landfall. With this addition, the Sentinel will collect more novel, fundamental data to improve our understanding of the interactions between storm surge and freshwater flooding contributing to hurricane-induced changes in water quality.

**BIO:** Zanti Rains is a master’s student in the Department of Environmental Engineering Sciences working with Dr. Elise Morrison. She has a bachelor’s degree in environmental science from Florida State University. Her research interests are focused on addressing the challenge of balancing resilient communities and ecosystems.

# Clean Lakes, Higher Prices: Evaluating the Economic Returns of Improved Water Quality

**Abhishek Rajan** and *Olesya Savchenko*

Food and Resource Economics Department, University of Florida, Gainesville, FL, USA

Lake water quality is a major environmental concern due to the influx of nutrients and other pollutants. Policy actions to protect lake water quality are often divisive and not sufficient. A key reason for that is the inadequate quantification of monetary benefits from water quality improvements. In the absence of credible evidence of the benefits of water quality improvements at large spatial scales, policy costs get more emphasis than benefits in the public discourse. To address this gap, our study employs a hedonic pricing model to estimate how improved lake water quality affects residential housing markets, providing evidence of economic gains of clean water at a policy-relevant scale.

We focus our analysis on Florida, which has the most heavily polluted lakes in the country, and provide the first large-scale assessment of lake water quality on housing markets in the state. We use *Secchi depth* as a measure of water clarity in 88 lakes obtained from Florida LAKEWATCH. We merge water quality data with data on residential property transactions and characteristics obtained from CoreLogic to analyze property sales within 0.1 miles of the lake shoreline from 2015 to 2020. Our hedonic model defines the sale price of a house as a function of lake water clarity, proximity to a lake, house characteristics, and other attributes. Our results show that a 0.1 m improvement in *Secchi depth* increases the average home price by \$3,645. We further combine this water-clarity effect with an ecological model to show that reducing phosphorus concentration to target levels in 57 polluted lakes can increase the market value of homes within a 0.1-mile buffer by \$215 million, a five percent increase in market values.

As Florida faces growing lake water quality challenges, our study quantifies the economic benefits of cleaner lakes through their impact on local housing markets and recreational values, providing evidence to support water quality regulations and interventions to improve lake water conditions.

**BIO:** Abhishek Rajan is a doctoral candidate at the University of Florida with ten years of research experience in water economics and policy. His current research focuses on water quality management in coastal and lacustrine environments.

# One Water in Action: Breaking Silos, Building Resilience, Managing Every Drop

**David Rathke**

Resiliency Florida, Tallahassee, FL, USA

Florida's water management framework is undergoing significant transformation driven by new legislation, evolving regulatory priorities, and increasing demands on water supply and quality. From the implementation of the Clean Waterways Act to the expansion of Resilient Florida and emerging nutrient reduction and permitting mandates, local governments and utilities face a complex and rapidly shifting compliance landscape.

This presentation will explore the intersection of these emerging policies and their implications.

Key topics include integrated One Water planning and the growing role of resiliency and data-driven decision-making.

Drawing on recent case studies and legislative trends, the discussion will offer a forward-looking perspective on how agencies and utilities can proactively adapt—leveraging strategic planning, interagency collaboration, and funding alignment to stay ahead of regulatory changes. Participants will gain insight into what lies ahead for Florida's legislative environment and actionable strategies to translate policy shifts into practical, resilient solutions.

**BIO:** David Rathke is the Executive Director of Resiliency Florida he is also a water consultant and lobbyist for the City of Winter Haven. He has successfully pushed policy and appropriations through the legislative process for nearly thirty years.

## Microbial Gatekeepers of Mercury Fate: Geochemical and Metagenomic Insights from the Oak Ridge Reservation (ORR) Water System

**Rajesh Singh Rathore**, Veera Badisa, Jada Taylor, Amari R. Desouza, Xavier M. Harrell, Benjamin Mwashote, Victor Ibeanusi

Core Laboratory, School of the Environment, Florida A&M University, Tallahassee, FL, USA

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he Oak Ridge Reservation (ORR), Tennessee, remains one of the most mercury-impacted aquatic ecosystems in the United States due to legacy nuclear operations. To elucidate the coupled mercury–sulfate–organic interactions and corresponding microbial community dynamics, surface water samples collected in June 2024 were subjected to detailed geochemical and metagenomic analyses.

Geochemical profiling revealed an alkaline environment ( $\text{pH} = 8.15 \pm 0.22$ ) with moderate redox potential ( $180 \pm 7.7$  mV) and elevated metal concentrations, notably Mg (256 ppm), Mn (25 ppm), Se (11 ppm), and Pb (1.9 ppm). High-throughput 16S rRNA sequencing indicated the predominance of *Proteobacteria* (46%), *Verrucomicrobiota* (16%), *Actinobacteriota* (15%), and *Bacteroidota* (12%), with *Polynucleobacter* and the *hgcl* clade identified as key mercury-transforming taxa.

Machine learning (ML) models are being developed to integrate microbial taxonomic and functional datasets for predictive assessments of mercury fate and ecosystem resilience. Preliminary diversity indices (Shannon = 3.9; Simpson = 0.96) suggest a robust microbial consortium capable of sustaining mercury transformation processes. This integrative metagenomic–ML framework provides novel insights into microbial adaptation, biogeochemical cycling, and natural attenuation mechanisms in mercury-contaminated aquatic systems, offering a data-driven foundation for targeted bioremediation strategies at legacy industrial sites such as ORR.

# MICROPLASTIC ANALYSIS ORIGINATING FROM WATER AND SEDIMENT SAMPLES IN FLORIDA: A MULTI-SITE STUDY

*Baylie Reisch, Emily Kintzele, Tracie Baker*

University of Florida, Department of Environmental and Global Health, Gainesville, FL, USA

Microplastics are ubiquitous materials derived from macroplastics. These byproducts lead to health concerns in aquatic environments. This study aims to evaluate the presence of microplastic pollution in waterways of Florida. Multiple sites were evaluated in order to create a representative picture of the state's water quality. The sample sites include Brevard County, Crystal River, and the Everglades where surface water and sediment samples were collected with a microplastics collection net and a stainless-steel petite ponar, respectively. Each sample underwent wet peroxide oxidation followed by density separation in order to separate any microplastics present from organic matter. Samples were then vacuum filtered on to a 1.2 micron filter and the flow through vacuum filtered on to a 0.8 micron filter. The filters were then imaged and suspected microplastics collected. Morphological data including shape, coloration, and size give indicators of potential sources. Fourier transform infrared spectroscopy (FTIR) is underway to identify the chemical composition/polymer type of each collected sample. The combination of morphological and chemical characteristics will aid in narrowing the sources of contamination and potential Biological effects downstream. Thus far, the majority of collected samples are black fibers, indicating that much of the microplastic pollution in the aquatic environment likely originated from textiles and rope materials. As for chemical composition, polyethylene and polypropylene appear to be the most abundant among the sites based on preliminary results. Identifying the major sources of aquatic contaminants can guide future initiatives to reduce waste throughout Florida.

**BIO:** Baylie Reisch is a fourth year undergraduate student at the University of Florida. She is studying zoology with minors in religion and wildlife ecology and conservation. Her prior work in sea turtle nesting as well as devotion to environmental toxicology led her to take on this research endeavor.

## **PFAS risks of repurposing wastewater and Biosolids for environmental benefits**

**Alexander J. Reisinger<sup>1</sup>, Chamoda Dissanayake<sup>2</sup> and Ashley Hennessey<sup>1</sup>**

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As human society expands, wastewater production will also expand accordingly, and those waste materials must go somewhere. The repurposing of liquid (reclaimed water) and solid (biosolids) products of wastewater treatment facilities represents an opportunity for a rare win-win-win from environmental, economic, and social perspectives. Reclaimed water and biosolids can provide environmental benefits by providing nutrients needed for plant growth. biosolids also enhance soil health and physical conditions by increasing soil organic matter, microbial activity, and soil structure. Ultimately, both of these waste products have been shown to enhance plant productivity. These benefits are further enhanced by the fact that these products can offset our reliance on limited (e.g., groundwater) and/or external (e.g., synthetic fertilizer) resources while also sustainably reusing a 'waste' material. However, these benefits do not come without potential costs. Increasing nutrients can be beneficial to plant productivity on the landscape. However, when nutrient supply exceeds plant demand, nutrients can be transported offsite, becoming a pollutant rather than a benefit. Additionally, both reclaimed water and biosolids can have a range of contaminants present, including heavy metals, pharmaceuticals, personal care products, and per/polyfluoroalkyl substances. Although heavy metals have guided regulatory principles associated with biosolids application, there is increasing recognition of PFAS as a human and environmental health contaminant. Therefore, there is growing scrutiny for how and where biosolids are applied due to potential risks associated with PFAS. This presentation will discuss the current approaches to repurposing wastewater in the state of Florida, highlighting specific opportunities for increasing benefits and reducing risks, particularly in terms of PFAS. The use of these repurposed waste materials has the potential to provide society with a rare win-win-win across the triple-bottom-line. However, to truly maximize the use of these waste products, we must consider potential environmental risks as well.

**BIO:** Dr. Reisinger is an Associate Professor and state extension specialist in the Department of Soil, Water, and Ecosystem Sciences at the University of Florida. His Extension and Research programs focus on urban water quality, enhancing our understanding of how human actions influence nutrient fate and transport in freshwater ecosystems

# MONITORING TRENDS IN THE LARGE INTACT SEAGRASS MEADOWS FLORIDA'S NATURE COAST

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The Nature Coast Aquatic Preserve (NCAP) encompasses some of Florida's most intact seagrass meadows, and maintaining seagrass expanse and health is a top management priority. In 2021, we initiated a seagrass monitoring program spanning seven subregions—dominated by different rivers, with varying seagrass species, plant size, and environmental stressors— within this 450,000+ acre aquatic preserve.

Cover and canopy heights for all seagrass species— *Thalassia testudinum*, *Halodule wrightii*, and *Syringodium filiforme*— were highest in the southern and northern regions, and lowest in central NCAP. Conversely, macroalgae cover increased from south to north. Generalized Additive Models (GAMs) revealed that vegetative patterns exhibit multiple non-linear relationships with environmental variables such as nutrient concentrations, water color, horizontal secchi distance, and chlorophyll-a. Notably, both total phosphorus and total nitrogen concentrations were positively associated with seagrass cover and canopy height, suggesting nitrogen limitation and/or nutrient co-limitation may be more widespread than previously documented.

Canopy height trends show mostly gentle but persistent increases, which may reflect seagrass responses to changes in light availability or shifts in nutrient limitation. Threshold analyses indicate that several systems, particularly Crystal River, are experiencing excursions from baseline canopy height values that warrant concern. Species-specific responses to light stress remain poorly understood, especially for *H. wrightii* and *S. filiforme*, and further research is needed to validate canopy height as a reliable early warning indicator for these species. Time series analyses of percent cover revealed mostly declining trends across NCAP, with Crystal River again showing the most severe declines. Anclote was the only system with a modest increase in seagrass cover (~6%).

Overall, seagrass condition indices suggest that NCAP's *Thalassia*-dominated meadows remain spatially extensive and stable. However, subtle shifts in canopy height and percent cover across multiple systems, and the pronounced decline in Crystal River, underscore the need for continued monitoring and adaptive management.

**BIO:** Laura Reynolds is marine ecologist and associate professor in the Soil Water and Ecosystem Sciences Department at the University of Florida

# Deep Learning of CONUS Spatial Heatwave Structures Uncovers Distinct Heat Patterns

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Understanding the spatial structure of heatwaves across the contiguous United States (CONUS) is essential for improving climate risk assessments and guiding regional adaptation strategies. Here we identify six recurring heatwave regimes over the period 1981–2023, based on patterns in the Heat Severity and Coverage Index, a metric that captures both intensity and spatial extent of extreme heat. These regimes correspond closely with major U.S. climate zones and reproduce known gradients in heatwave behavior, while also revealing new transitional hotspots that conventional regional classifications fail to capture. Statistical analysis of large-scale climate drivers shows that mid-latitude atmospheric patterns—including the Pacific–North American pattern—exert the strongest influence on the occurrence of different heatwave regimes. In contrast, the El Niño–Southern Oscillation shows limited impact during summer. These findings highlight the dominant role of mid-latitude wave activity in shaping U.S. summer heat extremes and provide a new framework for understanding how shifting climate dynamics affect regional heat-wave risk—offering critical insights for early warning systems, infrastructure planning, and public health preparedness.

# PFAS remediation mechanisms in solid matrices and mechanochemical DEGRADATION POTENTIAL in Biosolids

*Fabiola Y. Rodríguez Rodríguez, Katherine Y. Deliz Quiñones*

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Per- and polyfluoroalkyl substances (PFAS) are highly persistent synthetic compounds that accumulate in soils, sediments, and biosolids, posing significant environmental and human health challenges. While considerable research has focused on PFAS removal from aqueous systems, remediation within solid matrices remains underexplored. Understanding these pathways is essential to developing effective and sustainable treatment strategies for PFAS-contaminated solids, particularly biosolids that are frequently land-applied.

This literature review synthesizes current advances in PFAS remediation technologies targeting solid matrices, categorizing them into immobilization, mobilization, and extraction and destruction-based approaches. Destruction technologies such as thermal, electrochemical, and mechanochemical methods are critically assessed in terms of degradation mechanisms, efficiency, scalability, and environmental implications.

Findings indicate that conventional thermal treatments can achieve high PFAS removal but at the expense of high energy demand and potential formation of secondary pollutants. In contrast, non-thermal technologies, especially mechanochemical degradation (MCD), demonstrate growing potential as low-energy, solid-phase processes capable of cleaving carbon–fluorine bonds through mechanically induced reactions. Despite this promise, significant knowledge gaps remain regarding mechanistic understanding, material selection, and the influence of complex biosolid matrices on PFAS degradation rates and defluorination efficiency.

This review establishes a foundation for future research aimed at applying and optimizing MCD for PFAS destruction in biosolids. By integrating insights from existing remediation strategies with emerging mechanochemical approaches, this work contributes to the development of sustainable, scalable, and circular solutions for mitigating PFAS contamination in solid environments.

**BIO:** Fabiola Y. Rodríguez Rodríguez is a second-year Ph.D. student in Environmental Engineering Sciences at the University of Florida and a 2024 Water Institute Graduate Fellow Water Scholar. Her work focuses on advancing PFAS remediation in biosolids through mechanochemical degradation, bridging environmental chemistry, materials innovation, and process engineering to protect water resources and human health.

# Probabilistic Compound Flood Inundation Mapping FOR the LOWER Suwannee River FL

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Compound flooding, driven by the co-occurrence of storm surge, river discharge, and heavy rainfall, poses a significant and growing threat to low-gradient coastal estuaries. While previous studies identified the Lower Suwannee River, FL, as a region susceptible to compound events, existing assessments rely on one-dimensional models and bivariate statistics, limiting their ability to represent spatial inundation and the full spectrum of flood drivers. This study advances the understanding of flood risk by developing a comprehensive, probabilistic framework to produce compound inundation maps and quantify their associated uncertainty. A two-dimensional (2D) hydrodynamic model was developed and validated for the study area, benchmarking its performance against extensive observational data from Hurricane Idalia (2023). To characterize the flood drivers, we implement multivariate statistics to capture the joint dependence between coastal still water level, river discharge, and local rainfall. By integrating statistical and 2D hydrodynamic models, we simulated a thousand plausible event scenarios to generate probabilistic flood hazard maps. The primary output is a suite of high-resolution inundation maps that include a spatially explicit uncertainty envelope, illustrating the range of potential flood extents for a set of return periods. This research provides a more physically realistic and robust assessment framework for compound flood mapping, offering a critical tool for coastal management and planning.

**BIO:** Aditia Rojali is a post-doctoral associate at Engineering School of Sustainable Infrastructure and Environment, University of Florida. He has 10 years of experience in various water resources and coastal projects. He has been involved in coastal structure design, regional flood modeling, and remotely operated siphons for controlled wetlands.

## **Copper Resistant Bacterium VMI-RR-ORR from Oak Ridge Reservation Site: A Suitable Candidate for Copper Removal from Polluted Water**

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School of the Environment, Florida A & M University, Tallahassee, FL, USA

Copper (Cu) metal can be toxic at high concentrations, even though it is an essential micronutrient for all living organisms. Anthropogenic activities such as mining and fungicide usage led to copper contamination in the environment. It mostly enters the food chain from plants and accumulates in the human body which can cause brain and kidney damage, liver cirrhosis and chronic anemia. Due to its harmful effects and non-degradability, there is an urgent need for cheaper, and eco-friendly remediation of Cu from the environment. Bioremediation is the usage of living organisms such as bacteria to degrade pollutants in the environment restoring the environment. In this study, Cu resistant bacterium from Oak Ridge Reservation site soil was isolated and identified using 16S rRNA sequencing. The tolerance level of Cu was determined by growing the bacteria at different Cu concentrations (50, 100, 125 ppm). Bacterial growth was measured using spectrophotometer at 600 nm. The optimum growth temperature of the bacterium was determined by growing at various temperatures (25, 30, and 37 °C) in an incubator with continuous rotation speed of 100 RPM. The Cu remediation potential was measured by exposing the bacterium to different concentrations of Cu for 48 h. After the incubation time, the remaining Cu concentration in the supernatant was measured with the inductively coupled plasma optical emission spectrometer (ICP-OES). The results showed that this bacterium was able resist 100 ppm Cu. At 30 °C, this bacterium showed the optimum growth. The bacterium showed  $41.9 \pm 3.2$  and  $64.6 \pm 6.2\%$  remediation with 50 ppm Cu treatment after 24 and 48 h respectively. This study clearly shows that this isolated Cu resistant bacterium VMI-RR-ORR can be used to remove Cu from the polluted water.

## USING PARTICIPATORY SCIENTISTS TO TRACK NUTRIENTS AND HABITAT CHANGE IN FLORIDA'S SEAGRASS MEADOWS

Tori Guarino<sup>1,2</sup>, S. Carter Oleckna<sup>1,2</sup>, **Katherine Rose**<sup>1,2,3</sup>, Brandon Moody<sup>2</sup>, Laura K. Reynolds<sup>1,3</sup> Betty Staugler<sup>1,3</sup>

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<sup>3</sup>Florida Sea Grant, Gainesville, FL, USA

Since 2012, macroalgae has been increasing in Southwest Florida estuaries, a trend linked to eutrophication, seagrass loss, and broader community regime shifts. In response, Eyes on Seagrass was founded as a participatory science initiative to monitor these changes. By training volunteers to use scientifically rigorous methods to quantify seagrass and macroalgae, the program provides data on spatial and temporal scales not previously accessible to natural resource managers.

Eyes on Seagrass collects in situ data that integrates with agency-led estuary health assessments and offers early insights into nutrient cycling pathways and estuarine ecosystem shifts. Volunteers have already contributed to the discovery of new cyanobacteria species *Sirenicapillaria stauglerae* and are generating critical data on nutrient dynamics and bloom drivers in Southwest Florida estuaries. The program incorporates specific protocols for macroalgae quantification, including sample collection for stable isotope analysis to better understand nutrient source dynamics. Preliminary results reveal distinct, locally specific nutrient signatures in Charlotte Harbor. Additional data will assess the ecological impacts of Hurricane Ian, the third-costliest storm in United States history.

Currently operating in 10 Florida counties, Eyes on Seagrass provides roughly \$300,000 annually in monitoring services. The program also fosters a deeper connection between the community and the ecosystem. A follow-up survey conducted in 2023 revealed that 91% of Charlotte County participants had implemented at least one conservation behavior up to six months after participating.

Eyes on Seagrass highlights the power of participatory science to not only enhance ecological monitoring capacity but to engage communities to address environmental concerns. By capitalizing on local knowledge and engagement, the program rapidly addresses dynamic ecological phenomena while cultivating an informed and proactive citizenry. This collaborative model represents an underutilized resource for estuarine management and resilience in the face of accelerating environmental change.

**BIO:** Katherine “Kate” Rose is an environmental Extension professional specializing in coastal ecosystem health and public engagement. She currently serves as the UF/IFAS Florida Sea Grant Agent in Charlotte County, FL where she works to foster community stewardship of coastal ecosystems and water quality.

## New Physical Process Simulation of Surface and Vadose Zone Hydrology for HSPF

**Mark A. Ross**<sup>1</sup> and Jeffrey S. Geurink<sup>2</sup>

<sup>1</sup>University of South Florida, Tampa, FL, USA

<sup>2</sup>Tampa Bay Water, Clearwater, FL USA

Improvements to simulation processes of the Integrated Hydrologic Model ([IHM](#)), motivated by recommendations from external peer review, observations from applications, and in anticipation of future water management challenges, have been developed and tested for prototype implementation. The IHM dynamically couples [HSPF](#) with [MODFLOW](#) to simulate the surface water and groundwater systems and their dynamic interactions. The IHM has been used for more than two decades to support decision-making for water-supply planning, water-supply and ecologic sustainability assessment, water-supply operations, and assessment of hydrologic response due to changes in water use, climate, and land use.

For the IHM, the single-layer vadose zone processes of HSPF are being replaced with a new 7-layer vadose zone formulation that incorporates Brooks-Corey soil moisture retention, relevant vertical unsaturated Darcian flow, dynamic transitions between infiltration-excess and saturation-excess surface runoff, variable contributing area for surface depression storage, and partitioning evapotranspiration (ET) among the vertically-discretized vadose zones and groundwater. Rigorous validation testing has been completed at unit and system scales, and against field observations and Hydrus 1D model simulation results. Testing included depth-to-water table conditions spanning zero (i.e., at land surface) to very deep (>4 m) by applying stresses which moved the water table both upward and downward. Additional testing included varying soil properties, rainfall and potential ET rates, and groundwater stresses. Results of validation testing will be presented.

**BIO:** Dr. Ross is a Professor in the Department of Civil and Environmental Engineering at the University of South Florida with more than 40 years of experience teaching, conducting laboratory research, field studies and modeling surface-groundwater hydrology and interaction in Florida, national and international venues.

## Skip the Proxy: trustworthy, direct modeling of water quality constituents

**Matt Ross**<sup>1</sup>, **Mike Vlah**<sup>1</sup>, **Whitney N Knopp**<sup>2,3</sup>, **Josh T Klaus**<sup>2</sup>, and **Evan Thomas**<sup>2,3</sup>

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Historically, water quality observations were collected infrequently—ranging from weekly to annual grab samples—analyzed in laboratories with high precision (repeatable) and accuracy (close to true values). These measurements underpin how we understand, model, and regulate water quality.

Over the past two decades, however, water quality estimation has added another method of analysis: real-time, high-frequency sensors capable of measuring every 5 minutes. Some sensors directly measure key parameters like temperature, conductivity, or pH with close to lab-level accuracy and precision. Many others, however, record only *proxies* for water quality—such as turbidity (for suspended sediment), chlorophyll-a fluorescence (for algal biomass), fluorescent dissolved organic matter (for total organic carbon), and tryptophan-like fluorescence (TLF, for microbial abundance). While these proxies are measured precisely, their relationships to target parameters vary greatly across sites, seasons, and conditions.

Here, we present a modeling framework that removes the proxy step and directly estimates *E. coli* concentrations using TLF sensor readings and environmental data. By targeting *E. coli* directly, we can integrate millions of historical *E. coli* observations along with weather data, wastewater treatment plant locations, and other relevant variables.

Unlike many other water quality parameters, even the most common lab-based *E. coli* test, Colilert, shows 13–36% error on repeat samples, which makes it an excellent target parameter for sensor-model fusion that achieves similar performance. Our modelling approach aims to produce direct estimates of *E. coli* with error on par with Colilert, but available in real-time, providing a dynamic, clear understanding of *E. coli* variation at swimming beaches, drinking water sources, and more. Critically, our framework carefully accounts for the inclusion of external datasets, providing trustworthy estimates of *E. coli* in new locations, in new environmental conditions, and at sites with long-term records.

**BIO:** Matt Ross is an Associate Professor of Watershed Sciences at Colorado State University and a co-founder of OpenCurrent. His research focuses on open harmonization of public water quality data-sets to encourage the use of machine learning for water quality estimation and prediction.

## Enhancing Broad-Spectrum Urban Stormwater Treatment with Biochar-Amended Bioretention Media

**Chase Royall**, Kidanya Favaro, Sarina Ergas<sup>1</sup> and Mahmood Nachabe

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Stormwater pollution is a challenge in urban areas. Runoff carries a range of pollutants from roads, lawns, and developed areas, including nutrients, synthetic industrial compounds, and pathogens that threaten human and environmental health. Removing these pollutants remains a challenge. Bioretention systems are a widely implemented green-infrastructure solution to treat urban runoff, but these systems fall short of the desired treatment in urban areas. Biochar has emerged as a promising, innovative, and sustainable amendment to traditional bioretention media, offering double porosity, water retention, and reactive surface chemistry.

This study evaluates the pollutant removal capacity of laboratory bioretention columns under controlled hydraulic and chemical loading conditions to mimic urban implementation (system <1% basin area). Flow rate and storm duration were modeled by analyzing meteorological data for the Tampa Bay area. Two columns were constructed: a) a control with 80% high permeability media (HPM) and 20% woodchips, and b) an experimental column consisting of 40% biochar, 40% HPM, and 20% woodchips. Semi-synthetic urban stormwater runoff was created by mixing stormwater from a parking lot catch basin with 1% municipal wastewater and orthophosphate. Effluent water quality was analyzed for NO<sub>x</sub>, NH<sub>4</sub><sup>+</sup>, chemical oxygen demand (COD), Ortho-P, total suspended solids (TSS), and *E. coli*.

Results indicated enhanced removal of COD, NO<sub>x</sub>, NH<sub>4</sub><sup>+</sup>, TSS, and *E. coli* in the biochar-amended column compared to the HPM. The HPM column performed better only for Ortho-P removal. Biochar improved COD removal after the first flush by approximately 30% and retained FIB, with the HPM column exporting *E. coli* during first flushes. Over four storm events, COD removal in HPM declined from 20% to 5%, while biochar increased from 0% to 18%. Biochar also prevented clogging and loss of hydraulic conductivity. These findings suggest that biochar enhances broad-spectrum pollutant removal and demonstrates favorable long-term behavior compared to conventional media.

**BIO:** Chase Royall is a first-year master's student at the University of South Florida, studying environmental engineering. He has over 2.5 years of research experience in water quality and has worked on multiple stormwater projects. Chase is also an active member of the university area community, attending many stakeholder engagement meetings.

## **ANALYZING HYDROGEN PEROXIDE AND ECOLOGICAL RESPONSES FOLLOWING THE APPLICATION OF LAKE GUARD OXY IN LAKE OKEECHOBEE**

**Bethany C. Ryder**<sup>1</sup>, Albert S. Barbaretta<sup>1</sup>, David A. Rue<sup>1</sup>, Hannah Min<sup>1</sup>, Haruka E. Urakawa<sup>1</sup>, Serge Thomas<sup>1</sup>, Jose V. Lopez<sup>2</sup>, and Anna Wachnicka<sup>3</sup>, Hidetoshi Urakawa<sup>1</sup>

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Harmful algal blooms (HABs) are a regular occurrence in southern Florida due to an excess of available nutrients especially within Lake Okeechobee and its connected waterways. These HABs are often dominated by the toxic cyanobacterium *Microcystis aeruginosa*. Hydrogen peroxide may be effective in mitigating cyanobacterial blooms without causing major ecological harm to the aquatic environment. Hence, to test the effect of hydrogen peroxide on HABs, two field applications were conducted at the S-352 outflow structure on the east shore of Lake Okeechobee near Canal Point from September 3–5 and 10–13, 2025. During these trials, Lake Guard<sup>®</sup> Oxy (LGOxy), a floating peroxide-based algaecide, was applied to an experimental area adjacent to the structure (0.2 acres, 0.08 ha), while a control station was established farther upstream into the lake. Moderate surface blooms of *Microcystis* were observed, with chlorophyll concentrations exceeding 50 µg/L. In the first test, LGOxy was applied at 294 lb/acre (329.5 kg/ha), and in the second test at 98 lb/acre (109.8 kg/ha) twice at a 24-hour interval. Water quality was monitored using a YSI ProDSS multiparameter sonde equipped with total chlorophyll and phycocyanin sensors. Hydrogen peroxide was measured using a photometer. Chlorophyll *a* (Chl-*a*) was extracted with 90% acetone for about 24 hours and measured using a Trilogy fluorometer with the Chl-*a* acidification module. Photosynthetic activity was measured using an AquaPen portable fluorometer (noninvasive Pulse Amplitude Modulation method), both immediately after the sample collection. After the treatments, increased hydrogen peroxide concentrations were detected within the treatment zone. In addition, water dissolved oxygen and specific conductivity also increased. Preliminary results showed decreases in Chl-*a* concentration and phytoplankton photosynthetic activity, indicating that the LGOxy application was effective in these field experiments.

**BIO:** Bethany Ryder is a graduate student in the Environmental Sciences M.S. program at Florida Gulf Coast University working in Dr. Hidetoshi Urakawa's laboratory. Her research focus is currently the characterization of HABs in southern Florida, and the larger phytoplankton community, as well as bloom mitigation.

# GROWTH AND PHYSIOLOGICAL RESPONSES OF SOUTHERN Highbush BLUEBERRY TO RECLAIMED WATER IRRIGATION

**Yasmeen Saleem**<sup>1</sup>, **Davie Kadyampakeni**<sup>1</sup>, and **Shinsuke Agehara**<sup>2</sup>

<sup>1</sup> Citrus Research and Education Center, Soil, Water and Ecosystem Sciences Department, Institute of Food and Agricultural Sciences, University of Florida, Lake Alfred, FL, USA

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Reclaimed water has long been used to irrigate citrus and golf courses in Florida; however, its application to unpeeled fruit crops such as blueberries remains limited due to food-safety concerns. This study evaluated optimal and safe reuse levels of reclaimed water for Southern Highbush blueberry (*Vaccinium corymbosum*) through an integrated assessment of plant growth, food safety, and environmental impact. Two greenhouse experiments compared reclaimed water irrigation (25%, 50%, 75%, 100%) with well-water and NaCl-matched controls simulating equivalent electrical conductivity (EC) for two cultivars 'Arcadia' and 'Kestrel'. Plants were grown for three months in a 60:40 pine bark–peat substrate and evaluated for biomass, nutrient dynamics, physiology, and leaching.

Reclaimed-water irrigation enhanced overall growth compared with well-water and NaCl-matched controls, with Arcadia showing the greatest gains (44% higher shoot fresh weight, 25% greater dry weight, and 99% higher root fresh weight than Kestrel). Within the reclaimed-water treatments, chlorophyll content and stomatal conductance remained unaffected by irrigation level. Reclaimed-water irrigation substantially reduced toxic heavy metals, with mercury almost eliminated and cadmium reduced by roughly half, while calcium and iron increased by 16% and 4%, respectively. Compared with well-water irrigation, reclaimed-water treatments showed typical leaf macronutrient dilution (3–8%) and micronutrient enrichment (16–91%) consistent with vigorous growth. Substrate and leachate analyses indicated comparable environmental performance between reclaimed- and well-water systems. Leachate nitrate concentrations ( $\sim 105 \text{ mg L}^{-1}$ ) exceeded WHO drinking-water limits but did not differ significantly between irrigation sources, underscoring that nutrient leaching was driven primarily by fertilizer management rather than water quality. Reclaimed-water irrigation up to 100% proved safe and sustainable, maintaining plant growth, improving food safety, and protecting environmental quality in blueberry production systems.

**BIO:** Yasmeen Saleem is a Ph.D. candidate in Soil, Water, and Ecosystem Sciences at the University of Florida. Her research integrates reclaimed water and biochar application to promote sustainable blueberry production and soil–water stewardship. She collaborates internationally and has presented her findings at national and interdisciplinary conferences.

## AI-Based Prediction of *E. coli* in Urban Watersheds Using Interpretable Models

Ali Salou Moumouni<sup>1,2</sup>; Syed Usama Imtiaz<sup>1,2</sup>; Mitra Nasr Azadani<sup>1,2</sup>; and Nasrin Alamdari<sup>1,2</sup>

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Predictive modeling of microbial contamination, specifically *Escherichia coli* (*E. coli*), represents a high public health concern. In urban watersheds, elevated impervious surfaces can significantly increase the risk of *E. coli* concentration in stormwater-runoff-driven waters. Detection techniques are tediously laborious and are temporally sensitive (e.g., 18–24-hour culturing), which hinders early warnings. Existing predictive models lack lagged and spatiotemporal understanding (e.g., antecedent precipitation and spatial variability) and thus are inefficient at identifying lagged microbial responses during storm events. This study introduces an interpretable artificial intelligence (XAI) framework for predicting *E. coli* concentrations under four operational scenarios: (i) near real-time prediction, (ii) same-day prediction without prior data, (iii) same-day prediction with lagged inputs, and (iv) next-day forecasting. The models integrate diverse environmental predictors, including hydrometeorological variables (e.g., precipitation, streamflow) and landscape metrics (e.g., impervious cover, patch density). Using a long-term dataset (2007–2023), we trained and evaluated four machine learning models: XGBoost, Random Forest, Support Vector Regression, and Extra Trees. We then tested transferability on an independent downstream sub-watershed. The results show that the proposed models produce strong predictive results, with the near real-time scenario achieving a validation  $R^2$  of 0.67. SHAP analysis identified turbidity (+1.25 units) and 4-day cumulative rainfall (+0.40 units) as influential predictors. In addition, a probabilistic classification model (XGBoost) successfully identified exceedances of the U.S. Environmental Protection Agency's (EPA) Beach Action Value (BAV) recreational water quality benchmark with 84.9% accuracy. This research provides a transferable, explainable AI framework that can be integrated into stormwater management and public health decision-making systems to reduce human exposure risks in recreational and urban water bodies.

**BIO:** Ali Salou Moumouni is a PhD candidate in Civil and Environmental Engineering at the FAMU-FSU College of Engineering. His research focuses on hybrid AI and process-based modeling for predicting and mitigating microbial pollution in urban watersheds.

## Internal Phosphorus Recycling in Lake Jesup: A New Focus for Restoration

*Shannon Salvatori, Joseph Stewart, Joshua Papacek, Andy Canion*

St. Johns River Water Management District, Palatka, FL, USA

Building on a long history of restoration, efforts by the St. Johns River Water Management District (District) and its state and local partners are currently underway to study and restore the water quality of Lake Jesup. Internal recycling of sediment phosphorus (P) accounts for approximately one-third of the annual P loading to the lake. Thus, restoration planning requires an understanding of the sediment P bioavailability and the timing and mechanisms for internal P recycling. Seasonal relationships between lake stage and water quality offer evidence of enhanced sediment-water exchange of P at low lake stages, likely driven by resuspension of nutrient-rich legacy sediment. Upcoming data collection efforts include characterization of P fractions, re-measuring P deposition rates, and estimating sediment mixing depth. To evaluate planned restoration projects, District staff are updating a coupled hydrodynamic-water quality model (EFDC-WASP) model for the lake. The updated model will be used to evaluate a recirculating media treatment project and a large-scale chemical sediment treatment to reduce internal P recycling.

**BIO:** Ms. Salvatori is an environmental scientist, working primarily on projects concerning water quality within the Middle St. Johns River Basin. Her professional experience includes water quality model development, sediment and vegetation data collection, and R scripting for environmental data processing.

# The Impact of Organic Acids on Soil Health and Acidification for Enhanced Nutrient Uptake and Tree Productivity in HLB-Affected Citrus Trees

*Duplicate Sambani and Davie M. Kadyampakeni*

University of Florida, Institute of Food and Agricultural Sciences, Citrus Research and Education Center, Lake Alfred, FL, USA

The global citrus industry is severely declining due to Huanglongbing (HLB), associated with a bacterium, *Candidatus Liberibacter asiaticus*. This study evaluated the effectiveness of organic acids and practical strategies that can improve root density and nutrient uptake efficiency and rehabilitate the productivity of HLB-affected citrus trees. A randomized complete block design with six blocks for each treatment was conducted in two citrus orchards in Central Florida. Treatments were used: Humic Acid, Fulvic Acid, Sulfuric Acid, and Control; plots were split into with or without granular sulfur (S) subplots. Tree canopy volume, soil nutrient concentration, root density, and post-harvest variables were analyzed. All treatments maintained a moderate acidity to near-neutral soil pH throughout the experiments at both orchards. A positive correlation between soil pH and soil Ca, Mg, Zn, Mn, and B suggests that the availability of these soil nutrients increased as pH levels increased. A negative correlation was observed between soil pH and soil Fe, S, K, and P, indicating decreased nutrient concentration in soil solution as pH increased. Fulvic acid + S showed a substantially higher root density of 0.8g/L in 2021, while Humic acid + S resulted in a significantly lower root density of 0.5g/L. Yield decreased drastically with years due to natural weather disasters such as Hurricane Ian in 2022, Hurricane Idalia in 2023, and freezes that caused extreme premature fruit drop. Results show no significant difference in fruit quality parameters in all treatments. In both sites, soil pH positively correlated with soluble solids and total soluble solids to titratable acidity (TSS/TA) ratio, but negatively with titratable acidity. The positive correlation between soil pH and certain vital nutrients highlights the potential benefits of soil acidification using organic acids. In contrast, the negative correlation with other nutrients underscores the need for targeted management approaches tailored to specific soil and environmental conditions.

**BIO:** Duplicate Sambani is a Ph.D. student in Soil, Water, and Ecosystem Sciences at the University of Florida. Her research integrates biostimulants to enhance citrus resilience against HLB disease. Her research experience has equipped her with the skills to design and conduct experiments, analyze data, and communicate her findings effectively. She has also gained experience working with various laboratory equipment and techniques. A passionate leader, she advances soil health, grower collaboration, and sustainable agriculture through science and outreach.

## UNDERSTANDING THE MICROBIAL COMMUNITY RESPONSE TO SIMULATED SEA-LEVEL RISE ALONG A SALINITY GRADIENT

**Megan Sanford**<sup>1</sup>, Charles Schutte<sup>2</sup>, Lauren Kipp<sup>2</sup>, Jorge Lorenzo-Trueba<sup>3</sup>, Audrey Goeckner<sup>4</sup>, Lis Trams<sup>2</sup>, Mary Lipchock<sup>2</sup>, Adriana Gomez<sup>2</sup>, Eric Dammann<sup>3</sup>, Elise Morrison<sup>1</sup>

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Tidal coastal marshes are crucial wetlands to prioritize for conservation efforts as they function to store carbon, regulate water quality, and protect coastal communities from storms. Despite this, coastal marshes can produce and potentially release a significant amount of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) into the atmosphere due to microbial-mediated processes. Coastal marshes are expected to be altered by sea level rise (SLR) through shifts in inundation and salinity regimes, which affect microbial community composition and activity within their sediments. Changes in inundation, salinity, and the microbial community response are expected to drive changes in carbon dynamics in marshes affected by SLR. To explore how carbon dynamics will change under SLR scenarios, in-field mesocosm experiments, “marsh organs,” were deployed in the Jacques Cousteau National Estuarine Research Reserve (JC-NERR) along the Mullica River Estuary in New Jersey. The organs are designed to capture the response of the dominant salt marsh cordgrass, *Spartina alterniflora*, at different elevations representing SLR scenarios and were positioned across a naturally occurring salinity gradient (annual salinity range across sites: low, 0-15; intermediate, 5-25; and high, 20-32). Plant physiology and geochemical data were collected four times throughout 2024. In October of 2024, the organs were destructively sampled, and sediment was collected at three depths (0-5 cm, 10-15 cm, and 25-30 cm) for microbial analysis. Sequencing is currently ongoing for 16S rRNA amplicon sequencing to understand the microbial community response to simulated SLR. Coupling the environmental data with the microbial community response will help elucidate the mechanisms that shape the microbial community composition. Future work will aim to uncover microbial interactions that influence biogeochemical cycling in salt marshes facing change. This work will provide the basis for understanding at what elevation marshes function optimally and garner insights into pathways forward for marsh conservation and renourishment techniques.

**BIO:** Megan Sanford is a PhD student in the Department of Environmental Engineering Sciences at the University of Florida. Megan aims to leverage microbial ecology to better understand how coastal ecosystems are shifting in the face of global change, with the ultimate goal of providing insights for restoration and management.

# The context dependency of facilitation: potential pitfalls of seagrass-bivalve co-restoration

*Katharine Schlachter*<sup>1</sup>, *Marc Hensel*<sup>2</sup>, and *Laura Reynolds*<sup>3</sup>

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Foundation species and the positive interactions they facilitate are vital tools in ecosystem management, but as environments change those interactions may become harder to predict and utilize. Seagrasses and bivalves are two frequently co-occurring foundation species, and their proposed facultative relationships (predation shelter, light availability, nutrient inputs, etc.) have inspired a large, coordinated effort to increase co-restoration. However, after many years of study (at least 132 papers published between 1974 and 2023), little consensus has been reached on the direction, consistency, and significance of seagrass-bivalve interactions. Here, we synthesize the global literature on seagrass-bivalve interactions and review the mechanisms and directions of documented relationships. We find that different cohorts of bivalves (e.g. mussels, oysters, hard clams, and scallops) have unique functional roles and relationships with seagrass. Moreover, ecosystem context (e.g. nutrient background or hydrodynamic patterns) has a strong effect on the outcome and strength of seagrass-bivalve interactions, and thus longer studies that quantify relationships across variable environmental conditions are more comprehensive. However, we found that many studies were short, lasting only a few months and displayed strong spatial bias in study location resulting in species examined in small geographic clusters. Thus, we suggest that the temporal and spatial scales of most seagrass-bivalve studies are not broad enough to capture the context dependency of seagrass-bivalve relationships. To confidently apply these relationships to improve restoration success, we suggest that future studies examine the broad range of interaction changes that occur under different spatial, temporal, or disturbance conditions.

**BIO:** Katharine Schlachter is a second year PhD student studying the ecological and restoration implications of positive and competitive interactions between filter feeders in coastal seagrass meadows. She is advised by Dr. Laura Reynolds and Dr. Marc Hensel and works out of the Nature Coast Biological Station.

## **From Model Results to Environmental Understanding: Planning for Ecosystem Sustainability**

*Dan Schmutz and Carlos Moros*

Greenman-Pedersen, Inc., Maitland, FL, USA

Protection of wetlands and lakes from ecologically significant changes due to anthropogenic water table drawdown requires an understanding of the tolerances the various types of environmental systems have to expected hydrologic changes. It is also important to understand the accuracy of modeled estimates of those changes in the context of natural variability.

Past studies in Southwest and Central Florida have identified unique hydrologic thresholds linked to negative ecological changes in specific wetland types, including connected wetlands, isolated cypress and marsh wetlands and lakes in mesic soil settings, and isolated wetlands and lakes in xeric soil settings. The methods for determining these Wetland Condition Metrics—based on multiple past studies and current work—are reviewed and their application in water supply planning and management are presented.

Analyses of spatially and temporally extensive wetland and lake datasets from the Northern Tampa Bay Area are presented that demonstrate continuing environmental recovery associated with reduced regional groundwater withdrawal. These analyses provide empirical support for water supply planning through statistical characterization of water table levels and Wetland Condition Metrics by wetland type in the context of the recent hydrologic regime.

**BIO:** Dan Schmutz is a Chief Environmental Scientist for GPI, an 1,800-person consulting firm. He has 30 years' experience developing ecohydrological and data science solutions for water resource managers. He received an MS (Zoology) from USF, Tampa (1997), and he is the Immediate Past President of the Florida Lake Management Society.

# Hydrodynamics of Submerged Aquatic Vegetation Motion: A Case Study in Florida Springs

*Katie Schoenberger<sup>1</sup>, David Kaplan<sup>2</sup>, Xiao Yu<sup>2</sup> and Hyun Dong Kim<sup>3</sup>*

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<sup>3</sup>Old Dominion University, Norfolk, Virginia

Understanding interactions between submerged aquatic vegetation (SAV) and water flow is essential for predicting ecological processes and informing aquatic ecosystem management. This study quantified plant motion and flow-vegetation dynamics across eleven SAV patches in three Florida spring-fed rivers using underwater video and velocity data. An image-based method was applied to canopy imagery to extract motion signals, enabling frequency and temporal analysis through Fast Fourier Transforms (FFT) and autocorrelation. Plant motion was categorized as erect, swaying, monami, or prone based on visual and spectral characteristics, with this approach being novel in its application to complex, real-world SAV environments rather than in controlled laboratory settings.

Results show that periodic waving motion in vegetation (monami), combined with certain plant structures, significantly influences the overall hydrodynamic conditions. FFT and autocorrelation analyses revealed consistent low-frequency oscillations in swaying and monami regimes, with dominant frequencies typically below 0.1 Hz. These dominant frequencies are lower than those reported in flume studies, likely due to longer, more flexible blades and thicker shear layers in natural systems. These results challenge assumptions derived from lab studies and highlight the need for field-calibrated models that account for blade variability and natural flow conditions. Based on these observations, we hope to better understand the effects of SAV on hydrodynamics and apply this to key ecosystem processes, such as sediment transport and algae growth dynamics. This work can be used to inform ongoing efforts to refine environmental flow criteria, such as Florida's minimum flows and levels, by linking flow structure to SAV motion and ecosystem function.

**BIO:** Katie is currently a Minimum Flows and Levels (MFL) Scientist at the Suwannee River Water Management District and is presenting her master's research she conducted at the University of Florida. Her research background includes biogeochemical cycling in urban aquatic systems and hydrology of Florida spring-fed rivers.

## **C&SF FLOOD RESILIENCY (SECTION 203) STUDY FOR BROWARD BASINS – ENGINEERING PROCESS**

*Shawn Waldeck, P.E. and **Raymond Sciortino, P.E., F.ASCE***

Jacobs Engineering Group, Inc., Palm Beach Gardens, FL, USA

Through a coordinated effort with the South Florida Water Management District (SFWMD), the U.S. Army Corps of Engineers (USACE) and other stakeholders, Mr. Waldeck and Mr. Sciortino are leading a multi-disciplinary team of engineers to complete the planning level engineering investigations, analyses and design required for this feasibility study (Study). The Study's goal is to develop, evaluate and recommend technically feasible, environmentally acceptable and economically justified flood risk management (FRM) measures and adaptation strategies that provide flood resiliency in vulnerable areas served by the Central and Southern Florida (C&SF) system, now and in the future. The Study's objective is to enhance the C&SF system's water control structures by improving their functionality, resiliency and capacity to reduce flood damage caused by inland inundation and changed conditions in Broward County over a 50-year period of analysis from 2035-2085. Engineering work completed to date for the Study has supported the formulation of the Study's project alternatives and advanced the development of the preliminary engineering design for the Study's Tentatively Selected Plan (TSP). The Study's final integrated feasibility study and environmental documentation report is scheduled to be completed in April 2026, so that the Study's TSP may be recommended for state-federal cost share funding in the Water Resources Development Act of 2026.

The talk will provide an overview of the engineering processes followed for the Study, beginning with the planning level engineering to support the development of the project alternatives, followed by the engineering investigations, analyses and design work needed to complete the preliminary engineering design of the TSP. Topics will include, but not be limited to:

- Overall process followed to complete required engineering tasks within the Study's expedited schedule.
- Method for frequent coordination/collaboration with USACE and SFWMD team members to overcome design challenges/constraints and confirm project specific design criteria.
- Process followed for translating proposed FRM measures represented in the Study's regional hydrologic/hydraulic model, into scaled conceptual engineering designs to determine the actual feasibility of the modelled FRM measures, in terms of their cost effectiveness, environmental suitability, constructability and ongoing operability/functionality.
- Overview of engineering investigations and analyses performed to ensure that the required level of design maturity was achieved for the TSP to obtain USACE's cost certification of the TSP.
- Presentation of the 2D hydraulic modeling used for the design of the TSP's proposed pump stations and gated spillway structures. This modeling simulated canal bypass flow conditions for these structures that would occur during their construction; and simulated flow conditions for these structures that would occur when operated after their construction.

**BIO:** Mr. Sciortino is a senior civil/water resources engineer with over 21 years of experience in planning, designing, constructing, and managing civil/environmental engineering projects, including: water management and environmental restoration projects for the South Florida Water Management District as well as land development, water/wastewater utility, and FDOT highway projects.

# TOWARD IMPROVED FLOOD-RISK PLANNING: HYBRID MODELING OF COMPOUND FLOOD HAZARDS IN RIVER SYSTEMS

***Katherine A. Serafin***

Department of Geography, University of Florida, Gainesville, FL, USA

Flood transition zones are stretches of river where extreme water levels arise from the interaction of multiple drivers, such as elevated river discharge, storm surge, and high tide, occurring simultaneously or in close succession. Because flooding drivers can co-occur due to shared weather patterns, integrating separately derived fluvial and coastal flood maps can lead to mischaracterizations of actual flood risk. To address this challenge, a scalable hybrid statistical-numerical model was developed, which merges hundreds of thousands of statistically simulated joint coastal and river conditions with a hydraulic model using surrogate models to efficiently model compound river-coastal flood probabilities. This presentation explores insights gained from this modeling approach and its practical applications.

Using the Suwannee River, Florida as a case study site, we show a distinct zone where the 100-year along-river water surface elevation results from lower-magnitude coastal and river processes than individual events of equal probability, emphasizing the need to capture local spatial variability in flood drivers. When the model is applied to multiple river systems, we show flood transition zones can extend to over 40 km in length and may begin anywhere between 0.5 and 150 km upriver of the river mouth. These zones are highly sensitive to boundary condition changes, such as sea-level rise or increased river discharge, which can shift, shrink, or expand their extent and location.

Finally, we demonstrate the model's application to San Francisquito Creek, California, where collaboration with local planning agencies revealed that infrastructure designed to reduce overall river flood risk may inadvertently increase it in specific areas. These findings underscore the need to consider a wide range of events and potential unintended consequences in flood adaptation planning to support transparent and resilient risk management in an uncertain future.

**BIO:** Dr. Serafin is an assistant professor in the Department of Geography at the University of Florida. Her research examines extreme sea levels, flooding, and erosion to understand changing coastlines and their impacts on communities. Her outstanding contributions to water research and education were recognized with the UF Early Career Water Institute Faculty Fellowship in 2024.

# Estimating Small CII Water Use Within the Suwannee River Water Management District

*Amelia Sewell<sup>1</sup>, Emily Ducker<sup>2</sup>, and Ron Fox<sup>2</sup>*

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<sup>2</sup>Suwannee River Water Management District, Live Oak, FL

The Suwannee River Water Management District (District) estimated water use associated with small commercial, industrial, and institutional (CII) wells that are not required to hold individual Consumptive Use Permits (nonCUP CII wells). These wells lack withdrawal data, yet they contribute to the District-wide water demand. Estimating this water use provides additional detail to improve regional water use estimates. This effort represents the first application of non-CUP water use estimation in the state. The methodology applies the most current and comprehensive data available, ensuring a robust and defensible approach. The framework is replicable statewide and improves understanding of unaccounted water withdrawals.

The methodology outlines how water use estimates were applied to the Department of Health Florida Water Management Inventory (FWMI) Parcel data. First, monthly water use data from the Florida Department of Environmental Protection's Monthly Operating Reports (MORs) was aggregated into annual averages for each system, filtered by location and type, and cleaned to remove duplicates and outliers. Statistical analyses, including ANOVA and non-parametric tests, assessed differences by county, system type, and sub-use category (commercial, industrial, institutional). Mean annual water use rates were calculated for each sub-use type and used to estimate water use for nonCUP CII wells in the DOH dataset. Parcels were filtered and assigned a likelihood factor (1.0, 0.75, or 0.5) to reflect well presence certainty. Final water use estimates were calculated for each parcel by multiplying each parcel's sub-use average by its likelihood factor. These adjusted values were summed to produce total estimates at district, county, and sub-use levels. Based on the method applied for 2023, the total District-wide estimate of unaccounted water from nonCUP CII wells is 3.55 million gallons per day.

**BIO:** Amelia Sewell is a combined BA/MA student in Economics at the University of Florida and a 2025 NCBS intern at the Suwannee River Water Management District. Her research focuses on sustainable water-resource management, non-CUP water-use estimation, and data-driven methods to improve water-supply planning across Florida.

# IMPROVING RETURN INTERVAL CALCULATIONS FOR MINIMUM FLOWS AND LEVELS EVENT-BASED METRICS

**Courtney Shadik**

St. Johns River Water Management District, Palatka, FL, USA

The St. Johns River Water Management District (SJRWMD) establishes minimum flows and levels (MFLs) for priority waterbodies within its boundaries. MFLs describe a minimum hydrologic regime and define the limits at which further consumptive use withdrawals would be significantly harmful to priority water bodies. The minimum hydrologic regime is determined from a series of relevant hydrologic events; the aim of SJRWMD's event-based metrics is to prevent significant harm due to an excessive change in event frequency caused by water withdrawal. Protective event frequencies (i.e., recommended return intervals) are determined using hydrologic event probabilities called Surface Water Inundation and Dewatering Signatures (SWIDS).

While conceptually strong, to date providing the best estimate of return intervals for MFLs events, the SWIDS approach often results in a very large range of frequencies for a given event. This large range can introduce uncertainty in the recommended minimum frequency for specific MFL events. To address this concern, SJRWMD updated the SWIDS approach to tailor frequency calculations more specifically to individual sites and metrics. Measures of local landscape and vegetation characteristics were assembled at the transect level of MFL sites. Groups suitable for comparison were determined using a cluster analysis of these local characteristics. This updated method results in substantial reductions in the ranges of event frequencies. This improved method reduces return interval calculation uncertainty which is critical because MFLs are one of the primary tools SJRWMD uses to make sound water management decisions and prevent significant adverse impacts due to water withdrawals.

**BIO:** Dr. Courtney Shadik is an Environmental Scientist in the Bureau of Water Supply Planning and Assessment at the St. Johns River Water Management District. She is part of the Minimum Flows and Levels team responsible for setting new and assessing existing MFLs water bodies within the District.

# Predicting Water Quality and Quantity in Florida Using Soft Computing Techniques

**Saba Shaghghi**, *Golmar Golmohammadi, Seyed Mostafa Biazar, Gurjoban Tiwana, Namrata Ghimire*

Department of Soil, Water and Ecosystem Sciences, University of Florida, IFAS/RCREC, Ona, Florida, USA

Accurate prediction of water quality and quantity is crucial for effective watershed management and sustainable agricultural practices. In this study, Soft Computing (SC) techniques were applied to forecast both nitrogen concentration, as an indicator of water quality, and streamflow discharge, representing water quantity. Two gradient boosting algorithms, Extreme Gradient Boosting (XGBoost) and Light Gradient Boosting Machine (LightGBM), were employed to predict nitrogen levels, while four deep learning architectures, N-BEATS, N-HiTS, Transformer, and Long Short-Term Memory (LSTM), were utilized to predict water quantity. The results demonstrated that XGBoost outperformed LightGBM in predicting nitrogen concentration, achieving higher correlation coefficients and lower error metrics. For water quantity prediction, N-BEATS showed superior performance compared to the other deep learning models, yielding the highest correlation and lowest prediction errors. Overall, the findings highlight the strong potential of advanced SC models, particularly XGBoost and N-BEATS, for accurately modeling and forecasting water quality and hydrological dynamics, offering valuable tools for data-driven water resources management.

**BIO:** Saba Shaghghi is a Ph.D. student in Soil, Water, and Ecosystem Sciences at the University of Florida. Her research focuses on integrating soft computing, hydrological modeling, and field data to predict water quality and quantity, optimize fertilizer use, and improve water resource management in agricultural watersheds.

## EmRiver table as an interdisciplinary teaching tool in landscape architecture visualization

*Aishwarya Shankar<sup>1</sup>, Jules Bruck<sup>2</sup>, Peter Adams<sup>3</sup>*

<sup>1</sup> Instructional Assistant Professor, UF Department of Landscape Architecture

<sup>2</sup> Professor, UF Department of Landscape Architecture

<sup>3</sup> Professor, UF Department of Geological Sciences

In Spring 2025, the Advanced Design Communications course (LAA 3395/6905, taught by A.Shankar, MLA) partnered with the Coastal Resilience Design Studio (J.Bruck, PhD) and the UF Geomorphology Lab (P.Adams, PhD) to integrate the EmRiver stream table into the course curriculum for BLA3 and MLA3 students. The semester long research-by-design project entitled “Visualizing Dam Removals on the Bronx River, NYC”, was conducted in collaboration with the NYC Department of Parks and Recreation and funded by the NYS Water Resources Institute at Cornell and the NYS Department of Environmental Conservation.

Students generated five landscape design scenarios for the Bronx Zoo’s double dam site. Each scenario began as a digital parametric model created in LandKit and Rhino 3D, and then materialized as a physical prototype on the EmRiver table. This analog test stage disrupted the conventional workflow that proceeds from hand sketching and hand modelling, to digital modelling, rendering and AI-enhanced visualization. By observing their designs interact with flowing water, moving sediment and topography on the stream table, students gained immediate, embodied feedback that sharpened their understanding of site context and design intent.

The physical experiments were captured with LiDAR scanning and hi-resolution videography, then re-plugged into the digital pipeline for further refinement and final presentation. Reflective assignments prompted the students to compare the iterative analog phase with subsequent digital stages, highlighting how tactile interaction enriched their visualization skills and design thinking.

The exercise was a convergence of parametric design, digital modeling, digital fabrication, hand drawing, photogrammetry, and video documentation into a single multimedia workflow. The cross-disciplinary and inter-disciplinary collaboration among landscape architecture, design communications, and geomorphology, mediated by the EmRiver table, produced a disruptive yet fluid visualization method that amplified student communication, critical thinking and representation capabilities. The project demonstrates that integrating dynamic, water-based physical modelling into visualization workflows can serve as a powerful learning tool for contemporary landscape design education.

**BIO:** Aishwarya Shankar, MLA, is an architect-landscape architect with six years of practice across India and the United States. She specializes in interdisciplinary design communication that foregrounds climate-adaptation strategies, water-equity initiatives, and indigenous research, forging collaborative solutions that bridge built and natural systems.

## **New BMP development and adoption in row crops: lessons learned and steps forward.**

***Lakesh Sharm***

Soil and Water Sciences Dept, IFAS, University of Florida, Gainesville, FL, USA

Best Management Practices (BMPs) are central to balancing agricultural productivity with environmental stewardship in Florida's row crop systems. Over the past several years, our program has focused on developing science-based BMPs for nutrient management in corn, cotton, potato, hemp, and snap beans, with particular emphasis on nitrogen (N), phosphorus (P), potassium (K), and sulfur (S). This work has been driven by the dual objectives of optimizing yields while protecting water quality in sensitive regions impacted by state regulations such as BMAPs, TMDLs, and SB712. One key lesson learned is that nutrient recommendations must be dynamic, reflecting crop genetics, soil conditions, and site-specific yield potential. For example, new N guidelines for corn (1.37 lb. N per bushel of yield potential) were developed using multi-site trials and modeling tools (DSSAT to model N budget). These recommendations, now adopted by the Plant Nutrition Oversight Committee and published in *ask IFAS*, highlight the value of linking agronomy, modeling, and grower-level decision tools. Similar advances are in progress in potato through sulfur and potassium optimization studies, and in hemp through pioneering research on phosphorus requirements. Another important insight is the need to evaluate alternative nutrient sources and controlled-release strategies. Likewise, field studies on controlled-release fertilizers in potatoes are providing critical data on synchronizing nutrient release with crop demand, enhancing nutrient use efficiency (NUE). Equally vital have been the mechanisms of BMP adoption. Through grower collaborations, advisory committees, cost-share programs, and annual extension summits, we have documented that adoption improves when recommendations are communicated as flexible, science-based tools rather than rigid prescriptions. Lab tours, field days, and decision-support calculators co-developed with growers and interns have proven to be effective outreach models. Economic analyses showing yield benefits (e.g., 22 cwt/acre potato yield increases) and input savings have further incentivized adoption. Moving forward, the next steps include integrating remote sensing and artificial intelligence for real-time nutrient diagnostics, strengthening economic models to demonstrate profitability alongside environmental benefits, and expanding grower-researcher partnerships. By building adaptive, technology-enabled BMPs (variable N application), the agricultural community can continue advancing productivity while meeting evolving water-quality goals. The lessons learned underscore that successful BMPs require both rigorous science and collaborative adoption strategies tailored to local contexts.

# DETERMINING Site-Specific Soil Water Retention CURVES for Precision Subirrigation in Florida

**Sankalp Sharma**<sup>1,2</sup>, *Judyson de Matos Oliveira*<sup>1</sup>, *Marcio R. Nunes*<sup>3</sup>, *Lincoln Zotarelli*<sup>1</sup>

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<sup>3</sup>Soil, Water, and Ecosystem Sciences Department, University of Florida, Gainesville, FL, USA

A substantial volume of fresh water is required to raise the water table level in subirrigation. The soil available water (AW) to plants can be estimated using soil water retention curves (SWRC), which vary substantially across the state due to differences in soil texture, organic matter, and aeration. However, a direct measurement of SWRCs is time-consuming and costly. Conversely, texture-based SWRC (laser diffraction and hydrometer methods) estimated twenty sites in northeast Florida showed over 90% agreement with experimentally determined curves, offering a rapid, low-cost alternative for conventional SWRC determination. Nonetheless, its applicability to sandy soils in southern Florida remains untested. This study aimed to determine AW using site-specific SWRCs obtained through both conventional and texture-based methods across representative sandy soils in Florida. Overall, particle-size distribution varied low between soil layers with averages of clay (particle diameter >0.002 mm) and silt (0.002-0.05 mm) content ranging from 13.3±6.7 to 32.8±7.1 g kg<sup>-1</sup> and 1.7±0.5 to 21.6±13.7 g kg<sup>-1</sup>, respectively. Sites showed similar contents of total sand (940-980 g kg<sup>-1</sup>). However, they differed in proportions between fine (0.05-0.25 mm) and coarse sand (>2 mm), ranging from 137.7±30.0 to 683.8±28.0 g kg<sup>-1</sup> and 291.4±82.0 to 818.2±29.0 g kg<sup>-1</sup>, respectively. These differences in coarse-to-fine ratio affected the AW content, particularly in 0-20 cm soil layer.

For instance, the average of the experimentally determined AW contents for sites with a low coarse/fine sand ratio (0.79), sites (1 and 2) ranged from 0.15-0.20 m<sup>3</sup> m<sup>-3</sup>, while AW for higher coarse/fine ratio (5.57), sites (8 and 9) ranged from 0.11-0.13 m<sup>3</sup> m<sup>-3</sup> at 0-20 cm layer. These preliminary results indicate that AW content varies significantly across sites. Therefore, irrigation recommendations should account for site-specific SWRC. Particle-size distribution data obtained from the nine sampled sites will also be used to estimate SWRC as an alternative method for AW determination.

**BIO:** Sankalp Sharma is pursuing an MSc in Environmental Engineering and Sciences at the University of Florida. He also serves as a Research Assistant in the Horticultural Sciences Department, where he focuses on modelling soil physical-hydrological processes to enhance irrigation efficiency for Florida's vegetable production systems.

## Role of Mangroves for Reducing Hurricane-Induced Flood Losses

Vladimir A. Paramygin, **Y. Peter Sheng**

University of Florida, Gainesville, FL, USA

Mangroves are essential components of coastal defense systems, providing wave attenuation, shoreline stabilization, and flood loss reduction. However, large-scale assessments frequently overestimate their economic flood protection value due to reliance on coarse-resolution models and generalized benefit transfer functions lacking local validation. This study presents a high-resolution, empirically grounded framework for quantifying mangrove flood protection benefits. A vegetation-resolving three-dimensional surge-wave model CH3D-SWAN coupled with depth–damage functions is used to evaluate structure-level flood losses under observed and hypothetical storm events in Southwest Florida, an area with frequent rapidly-intensifying hurricanes (Charley, Wilma, Irma, Ian, Helene, and Milton), rising sea level, increasing extreme rainfall events, and growing population and developments.

The analysis, which includes verification of flood elevation and validation of loss estimate with FEMA NFIP loss data during recent hurricanes, demonstrates that mangroves significantly reduce structural flood losses during both historical hurricanes and synthetic flood scenarios. While the value of mangroves for flood loss reduction varies from one hurricane to another, the results indicate that many previous assessments have likely significantly overstated mangrove protection values underscoring the necessity of locally validated, process-based valuation approaches. The study further reveals spatial heterogeneity in flood mitigation effectiveness driven by variations in local flood elevation, property exposure, and mangrove extent.

This methodological framework is transferable to other hurricane- and typhoon-prone coastal regions, including those in the Gulf of Mexico, the Caribbean, and Southeast Asia. By integrating high-resolution hydrodynamic modeling with empirically derived economic loss functions, this work provides a scalable and replicable approach for accurately valuing nature-based flood protection. The findings support more robust decision-making for policymakers, insurers, and conservation planners seeking to incorporate mangrove ecosystems into climate adaptation and disaster risk reduction strategies.

**BIO:** Y. Peter Sheng is a research professor at the Engineering School of Sustainable Infrastructure and Environment, University of Florida. He has over 40 years of experience in coastal hydrodynamics and coastal hazards. Dr. Sheng led numerous projects related to coastal flooding, water quality, and valuing wetlands for flood reduction.

# STREAM METABOLISM INCREASED WITH CONTINUOUS NUTRIENT ENRICHMENT IN WESTERN GREENLAND

*Yuseung Shin*<sup>1</sup>, *Sam Howley*<sup>2</sup>, *Jonathan B. Martin*<sup>2</sup> and *Matthew J. Cohen*<sup>2</sup>

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Although nutrients are key limiting factors affecting productivity and respiration in aquatic ecosystems, their impact on lotic ecosystem functions remain unclear due to pervasive light limitation overriding nutrient limitation. Additionally, many common nutrient enrichment experiments are conducted at spatial and temporal scales too fine to capture persistent, whole-reach ecosystem responses. To address these challenges, we conducted continuous nutrient—nitrogen (N) and phosphorous (P)—dosing experiment for 21 days during peak summer in a well-lit the interior stream of western Greenland, where light limitation is minimal (no canopy, clear water). The 300-meter study reach was divided into two segments (+N and +N+P enriched), with nutrients delivered via upstream drippers. High-resolution dissolved oxygen (DO) sensors were deployed at the end of the control (upstream of dosing), +N, and +N+P segments. Ecosystem metabolism was estimated using a one-station model at all three reaches, and a two-station model at the nutrient-enriched segments. One-station model results showed a persistent increase in gross primary production (GPP) with nutrient addition, even when the dosing temporarily ceased due to malfunctioning drippers. However, ecosystem respiration (ER) responded minimally. The +N+P segment exhibited higher metabolic rates than the +N segment, indicating N and P co-limitation. Two-station model estimates also showed increased metabolism, particularly GPP in the +N+P segment, but produced substantially higher rates than the one-station model. This discrepancy suggests that nutrient-driven reach-scale changes may be underestimated by one-station model, underscoring the value of two-station models in capturing whole-reach ecosystem responses. Our findings demonstrate that nutrients can be primary limiting agents of ecosystem functions in well-lit streams and highlight the necessity of nutrient management in the face of climate or land-use changes that may alter nutrient availability.

**BIO:** Dr. Shin is an ecosystem ecologist focusing on lotic systems. He received Ph.D. on ecology by the temporal patterns and nutrient controls of river metabolism. His current work focuses on spatiotemporal patterns of greenhouse gas concentration and fluxes in flowing waters, and their local- and continental-scale drivers.

# MOBILE DRIP IRRIGATION TO IMPROVE WATER USE AND MINIMIZE NITRATE LEACHING IN SANDY SOIL

*Bhimsen Shrestha and Vivek Sharma*

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Nitrate leaching from agricultural fields can contaminate groundwater and degrade the water quality of natural springs, posing risks to both human and environmental health. This study evaluated the effectiveness of a precision mobile drip irrigation (MDI) system in improving crop water use and reducing nitrate leaching from corn field grown in sandy soil. A split-plot design with four replications was implemented during the 2024 and 2025 growing seasons. The main plot consisted of three irrigation systems - mobile drip irrigation (MDI), center-pivot sprinkler irrigation (CPSI), and sub-surface drip irrigation (SSDI) (replaced by surface drip irrigation (SDI) in 2025) while the subplots included four nitrogen rates (N1, N2, N3, and N4: 0, 168, 269, and 336 kg N/ha, respectively). In both years, corn yields under MDI and CPSI were superior to those under SSDI (2024) and SDI (2025). Plant growth parameters, including plant height, leaf area index (LAI), and aboveground biomass, were significantly higher under MDI and CPSI compared to SSDI and SDI. Within each irrigation system, all nitrogen-treated plots resulted higher plant height, LAI, and aboveground biomass than the control. Leaf nitrogen concentration also increased with higher nitrogen rates, with MDI and CPSI maintaining higher leaf N levels across growth stages. MDI system showed more stable trend with soil N-concentrations across soil depths compared to other irrigation systems 2024. The irrigation water productivity (IWP) ranged from 0.003 to 17.67 kg m<sup>-3</sup> in 2024 and 0.03 to 11.98 kg m<sup>-3</sup> in 2025, being highest under MDI, followed by CPSI. Agronomic nitrogen use efficiency (aNUE) varied from -7.6 to 123.1 and from 13.5 to 74.3 kg yield per kg N applied in 2024 and 2025, respectively. SSDI and SDI irrigation systems had poor performance and required more intensive management for corn production under sandy soil conditions.

**BIO:** Mr. Bhimsen Shrestha is a PhD student in the Precision Water Management Lab working under Dr. Vivek Sharma at Agricultural and Biological Department, UF. His research focuses on evaluating Mobile Drip Irrigation (MDI) technology and its environmental and economic impacts on corn production in sandy soils of North Florida.

# Operational Seasonal Streamflow Forecasts with Rainfall Uncertainty for Water Supply Availability

*Manoj Shrestha<sup>1</sup>, Hui Wang<sup>2</sup>, Jeffrey Geurink<sup>2</sup>, Kshitij Parajuli<sup>2</sup>, Tirusew Asefa<sup>2</sup>, and Dingbao Wang<sup>1</sup>*

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Assessing surface water availability is crucial to support short-term water supply decisions for Tampa Bay Water, a potable water supply utility in the Tampa Bay region. To enhance in-house decision support tools, this study aims to develop an operational forecasting framework using the Integrated Northern Tampa Bay (INTB) model, a calibrated application of the Integrated Hydrologic Model (IHM), to generate seasonal probabilistic streamflow forecasts.

The framework is driven by stochastic operational rainfall forecasts, sampled from the pre-generated multiple realizations of rainfall in the INTB basins over a 25-year period. The selection is conditioned on the [National Oceanic and Atmospheric Administration](#)'s seasonal categorical precipitation forecasts for the target season. Additional operational time-series inputs for the forecasting period include climate-driven fluxes (potential evapotranspiration), human-induced stresses (well pumping, diversions, and irrigation), and groundwater boundary conditions. A key component of the framework is to identify a similar, if not the exact, initial condition for the forecast period from a set of possible scenarios (i.e., candidates). These candidates are generated from multi-decade INTB inputs and simulated outputs derived from 1000 stochastic realizations, each representing the meteorological and hydrological conditions at a specific time within a given realization. Initial efforts aim to match observed antecedent conditions (groundwater heads at observation wells and lake/wetland storage) and fluxes (rainfall, streamflow, and evapotranspiration) to candidates using a principal component-based nearest-neighbor approach. This study presents the evaluation of each component of the framework and demonstrates its application for seasonal streamflow forecasting.

**BIO:** Manoj Shrestha is a Ph.D. student in the Department of Civil Engineering at the University of Central Florida, specializing in water resources.

# Carbon Dynamics along Terrestrial-Aquatic Interface in Coastal Plain Wetlandscape

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Terrestrial-aquatic interface (TAI) of wetlands are global hotspots of biogeochemical activities and play a critical role in carbon cycling. However, there is lack of studies on TAI which are required to adequately understand the key processes that interact in TAIs and feedback on the Earth system. So, this research aims to study the carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) fluxes along the TAIs gradient in coastal plain wetlandscapes of northern Florida, USA. We have been conducting this study on two contrasting wetlandscapes since 2024; Bradford Experimental Forest and Ordway Swisher Biological Station. They are low relief depressional wetlands, where small stage changes lead to large changes in TAI gradient. In each wetlandscapes, 6 wetlands were selected based on biologic, geomorphic and hydrologic variation. In each wetland, monthly carbon dioxide and methane flux measurement were done along TAIs gradient from upland (U) to increasingly wetter zones (W1–W4) using GasScouter G4302. Water depth measurement was also done using water level transducers in each wetland. Soil dissolved oxygen, soil moisture, and conductivity were also measured through sensors connected via a LoRa network. The carbon stable isotopes (<sup>13</sup>CO<sub>2</sub> and <sup>13</sup>CH<sub>4</sub>) were also measured using static headspace equilibration to trace carbon pathways. In addition, Water samples were also collected to estimate dissolved, particulate, organic, inorganic carbon to delineate the linkages between these parameters and fluxes. The study found that along the TAI gradient, wetter areas had lower CO<sub>2</sub> but higher CH<sub>4</sub> emissions, reflecting reduced soil aeration under saturation. CO<sub>2</sub> and CH<sub>4</sub> flux along TAI strongly explained by water depth, through its interactions with soil oxygen, and temperature ( $R^2 = 0.60$ ,  $p < 0.001$ ). Therefore, this study highlights the complex biogeochemical interactions shaping carbon dynamics across TAI.

**BIO:** Ms. Shrestha is a PhD Student at School of Forest, Fisheries and Geomatics Sciences, University of Florida, USA. She is working in water and carbon dynamics of wetlands in Florida.

# WATER LEVEL SEASONALITY IN WETLANDS OF THE US ATLANTIC COASTAL PLAIN

**Suraj Shrestha**<sup>1</sup>, *James W Jawitz*<sup>1</sup>, *Matthew Cohen*<sup>2,3</sup>

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Wetland water levels are dynamic, influencing water storage, habitat functions, and carbon sequestration. In US Atlantic Coastal Plain wetlands, restoring hydrology to enhance storage and related functions is becoming increasingly important. However, capturing the spatial patterns of inundation and recession remains difficult. To predict how wetland water levels respond to landscape restoration efforts, we simulated the water table and connectivity dynamics of selected wetlands using the Advanced Terrestrial Simulator (ATS), a comprehensive, multiscale tool designed for solving distributed hydrology problems. We examined two wetland-rich study areas, including a flatwoods forest managed for timber production and a sandhill landscape used as a Biological research station. We simulated the effects of local and regional hydrological restoration, finding that the model accurately describes spatial and temporal patterns in ponding. The model also effectively predicts the timing and extent of fill-and-spill events in both landscapes, aligning with field observations. Notably, ATS allows us to estimate detailed water budgets and exchanges across space, revealing that winter conditions (low ET, high rainfall) involve bi-directional exchange, both infiltration and exfiltration, between wetlands and upland water stores. During other seasons with higher ET, exfiltration dominates. This study demonstrates that ATS provides a solid foundation for understanding the spatial and temporal dynamics of water levels in wetlandscapes.

**BIO:** Dr. Shrestha is a research scholar at SWES, UF. His research interests include eco-hydrology and its modeling. He has over 10 years of experience conducting hydro-meteorological measurements in Nepal, including numerous field campaigns for high- and low-flow measurements, glacier mass balance assessments, and meteorological station maintenance in rugged terrain.

## Ecotoxicological Impacts of PFAS Mixtures: Mechanistic Insights from *Menidia beryllina*

**Amanda L. Sills**, Katherine Deliz Quinones

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Per- and polyfluoroalkyl substances (PFAS), often called “forever chemicals,” are a class of about 15,000 synthetic compounds valued for their resistance to heat, water, and oil. These same properties make them highly persistent, allowing PFAS to accumulate in organisms and biomagnify through food webs. In aquatic ecosystems, PFAS can impair growth, reproduction, and immune function, with higher-order species and ultimately humans facing disproportionate risks. Despite their widespread presence, ecotoxicological research has largely focused on two legacy compounds, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). This narrow scope limits regulatory efforts and risk assessments, leaving thousands of PFAS understudied and gaps in understanding mixture toxicity.

This research aims to fill these gaps by evaluating the aquatic toxicity of PFAS mixtures through an acute ecotoxicity study on *Menidia beryllina*. Objectives include (1) determine the concentrations at which mixtures cause measurable harm to aquatic species and (2) identify toxic effects and underlying biochemical pathways. The approach integrates standard aquatic toxicity testing with molecular analyses to link organism-level responses to mechanistic pathways. We hypothesize that PFAS mixtures produce additive effects at concentrations lower than those predicted from single-compound data. Confirming this would highlight the inadequacy of relying on legacy compounds alone for ecological risk assessment and emphasize the need to consider mixture toxicity. Integrating data on PFAS mixtures with findings from single-compound toxicity studies will strengthen ecological risk assessment frameworks, improve screening thresholds, and inform more effective environmental policies. In doing so, this research will contribute to protecting ecosystems and the communities that depend on them.

**BIO:** Amanda Sills is a second-year PhD student in Environmental Engineering whose research investigates the effects of PFAS contamination on ecosystems. She conducts aquatic toxicity studies to examine PFAS bioaccumulation, biomagnification, and dose-dependent responses to better understand how these persistent chemicals move through food webs and impact aquatic organisms.

## Yield Goal-Based Nitrogen Recommendations for Cotton in Florida with a Focus on Water Quality

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For cotton production in Florida, current nitrogen (N) fertilizer recommendation is 60 lbs. N acre<sup>-1</sup> and has not changed in the last 40 years. However, changes in cultural practices, development of new cultivars, and grower dissatisfaction with existing recommendations indicated a need for reassessment of this rate. Thereby, research was conducted in 2022 and 2023 to reassess the N requirement for cotton production in Florida and to move towards a yield-goal based N recommendation. A study was conducted at two locations to re-evaluate cotton [cv. Delta Pine 2038 B3XF (DP 2038)] response to six N rates (0, 45, 90, 135, 180, and 235 lbs. acre<sup>-1</sup>), using a randomized complete block design with four replications on sandy soils. The objectives of this study were to quantify N rate effects on (1) growth, (2) in-season petiole nitrate-N (PNN), and (3), yield and N use efficiency, with the goal of N rate optimization. Statistically no significant increase in biomass, and lint yield was found beyond the treatment of 90 lbs. N acre<sup>-1</sup>. A negative correlation was found between N applied and fertilizer N use efficiency ( $r=-0.85$ ), and internal N use efficiency ( $r=-0.61$ ). The yield-goal based analysis shows that 0.09 lb. of N is needed for every pound of lint produced, and 45 lb. N/acre is required to produce one bale (500 lb.) of cotton lint per acre. These updated recommendations will assist growers in achieving economically viable yields while minimizing risks of both under- and over-fertilization.

**BIO:** Dr. Hardeep Singh is an Assistant Professor and Cropping Systems Specialist at the University of Florida's West Florida Research and Education Center. His research focuses on developing best management practices for row crops, including optimizing nutrient use, improving soil health, and enhancing sustainability and resource-use efficiency in southeastern U.S. agriculture.

# PROTECTING GROUNDWATER BY PLACEMENT: NITRATE AND DRAINAGE OUTCOMES IN NORTH FLORIDA CORN

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Irrigated corn on sandy, karstic soils in North Florida creates a rapid pathway from field to groundwater and to the springs, making groundwater protection a management priority. We report a three-season (2023–2025) randomized complete block trial evaluating six nitrogen placement strategies at a fixed rate (269 kg N ha<sup>-1</sup>): conventional fertigation, conventional banding, CRF broadcast, CRF side-dress, CRF side-dress incorporated, and a 0-N control. Using weather records, soil nitrate profiles (0–120 cm), continuous plot monitoring, and lysimeter water quality data, we closed seasonal nitrogen and water balances and paired them with yield to derive decision-ready outcomes.

Across years, placement—not rate—governed fate. Averaged across seasons with leaching measurements (2023–2025), CRF side-dress reduced seasonal nitrate loss by 58% versus fertigation and 38% versus banding, while maintaining yield (+2.5% vs fertigation on the three-year yield average). CRF side-dress (incorporated) reduced nitrate loss by 51% versus fertigation and 27% versus banding and delivered the highest multi-year yield (+12.7% vs fertigation; +19.6% vs banding). Year-by-year results show the same direction of effect under both wet and dry conditions: treatments that lowered percolation below the root zone also lowered nitrate export while sustaining grain.

This field-measured, verification-ready framework identifies placement strategies that produce clean grain with lower groundwater risk in the Suwannee Basin. We propose the use of seasonal nitrate loss (kg N ha<sup>-1</sup>), drainage (mm), and crop efficiencies (WUE/NUE) as transparent indicators for springs-focused BMPs in irrigated sandy soils, in order to save water quality and promote sustainable farming.

**BIO:** Rakesh Singh is a Ph.D. candidate in Agricultural & Biological Engineering at UF/IFAS studying nitrogen–water interactions in irrigated sandy soils. His multi-year field trials apply field-measured balances to produce auditable drainage and nitrate-loss metrics, advancing 4R nutrient stewardship and precision irrigation, using DSSAT and machine learning.

## defining the landscape of PFAS in Florida WaterWayss Using tampa bay as a model

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The Tampa Bay (TB) region is known to be a heavily polluted area due to its high density of pollution sources adjacent to the bay. These pollution sources pose great threats to the bay, which is vital for both the environmental health of the ecosystem, but also for the citizens who rely on the bay for drinking water, food, agriculture, recreation, and tourism. To date, there is limited knowledge of the presence and concentration of per- and polyfluoroalkyl substances (PFAS) in the Tampa Bay region. Thus, the primary objective of this study was to comprehensively focus on the characterization of PFAS in surface water to create a baseline of knowledge of the current state of pollution in the bay, coupled with a total organic fluorine (TOF) approach to establish an upper limit of PFAS contamination. To represent an accurate baseline, over 500 surface water samples were collected, where we employed crowdsourcing efforts to achieve a large geographical spread, while simultaneously educating the public on the growing concern of PFAS. The samples were extracted using solid phase extraction and were analyzed via targeted ultra-high-performance liquid chromatography tandem mass spectrometry (UHPLC-MS/MS). The respective TOF samples were extracted using a granular activated carbon filter and analyzed using proton-induced gamma emission (PIGE). This study provides more information on the overall TB-PFAS landscape, while also allowing for the comparison between targeted data and the true upper boundary of PFAS contamination. Furthermore, this data allowed for the geographic comparison of diverse surface water profiles within the region, making heat maps of PFAS concentrations to help visually identify hotspots across the entire bay. We hope that this comprehensive analysis will provide more attention toward solutions, community awareness, and statewide regulations aimed at mitigating these harmful chemicals in our surface water.

**BIO:** Thomas Sinkway is a Ph.D. candidate in the final semester of his program. His thesis is focused on the identification, quantitation, and optimization of establishing the fate of emerging contaminants such as per- and polyfluoroalkyl substances or drugs of abuse in surface waters.

## USACE PROJECT INTEGRATION IN SOUTHEAST FLORIDA

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The complex nature of resilience challenges faced by communities in Southeast Florida and the way the U. S. Army Corps of Engineers (USACE) Civil Works support building long term resilience, which requires the involvement of multiple USACE missions. Projects focused on Aquatic Ecosystem Restoration (AER), Coastal Storm Risk Management (CSR), Flood Risk Management (FRM), Navigation (NAV) and Continuing Authority Program (CAP) are ongoing within the region. Due to the complexity of these projects, with different missions, in various phases of implementation, integration of USACE projects is needed to ensure that the projects planning objectives across multiple these multiple missions are met. This poster presents on an overview of the USACE Civil Works phases of project development including the Feasibility, Preconstruction Engineering and Design, Construction, and Operation and Maintenance (O&M) and how integration is being approached. The USACE integration effort focuses on collaboration through active and frequent communication with stakeholders, sponsors, project team leads, other federal agencies, local governments, and Tribes; technical coordination with multidisciplinary teams; and coordination with USACE policy advisors to identify and assess impacts, risk, constraints, connections, dependencies, timing, sequencing, future changing conditions including climate and sea level change, and benefits of the existing and future projects in the area.

**BIO:** Jennifer Smith is a project manager with over 20 years' experience as a wetland scientist. She has managed multiple resiliency studies developing structural, non-structural, and nature-based features to re-establish native riparian, upland, and riverine habitats and promote flood risk management, water storage, and habitat, while improving recreational and navigational benefits.

# BRINGING CRITICAL FLOOD CONTROL INFRASTRUCTURE PROJECTS INTO DESIGN AND CONSTRUCTION

*Tarana A. Solaiman and Ana Carolina Coelho Maran*

South Florida Water Management District, West Palm Beach, FL, USA

The increasing frequency and severity of flood events have emphasized the urgent need to develop, refurbish, and enhance essential flood control infrastructure. Aging infrastructure along with changing climatic and hydrologic conditions, expose communities to increasing risks, threatening public safety, economic stability, and vital services. Advancing projects from concept to construction demands a coordinated, multidisciplinary approach addressing technical, regulatory, financial, and social considerations.

Successful implementation depends on securing funding, developing design that outlines criteria, assumptions, methodologies, data sources and evaluation of alternatives. Navigating permitting requirements, ensuring environmental compliance, and engaging diverse stakeholders early is also critical. Comprehensive hydrologic and hydraulic analysis, risk-based assessments, and adaptable design alternatives must consider future challenges like sea level rise, extreme rainfall, population growth, and land use changes. Effective collaboration among public agencies, private sector partners, and communities enables integrated strategies that support parallel planning and implementation across regions, leveraging project opportunities and overcoming logistical challenges and promote a collaborative path forward.

This paper highlights the effectiveness of modern project delivery methods, in accelerating timelines while maintaining safety and environmental standards. It also emphasizes the role of real-time data, advanced modeling tools, and adaptive infrastructure designs in enhancing flood control systems that are responsive to evolving risks.

While planning sets the strategic framework, implementation transforms concepts into operational infrastructure through detailed engineering, procurement, and construction guided by current codes, technical standards, and sustainability goals. The process involves securing multi-source funding, obtaining permits, negotiating and acquiring required land and coordinating with relevant stakeholders to adapt to field conditions and evolving project needs.

Through case studies, this paper demonstrates how early collaboration, innovative delivery methods, and integrated strategies can streamline sustainable flood infrastructure enhancements. A proactive and coordinated approach is essential to safeguard communities, minimize economic losses, and build resilient systems for future climate challenges.

**BIO:** Dr. Solaiman is a Principal Project Manager and a Water Resources Engineer with 18+ years of public and private sector experience in planning, modeling, designing, and implementing water infrastructure projects with special focus on future climate conditions. She specializes in ecosystem restoration and resiliency implementation. She currently oversees grant-funded initiatives and provides strategic, grant and project management support for resiliency implementation efforts within the Office of District Resiliency and Flood Control Planning.

# Fluorescence Spectroscopy for the Real-Time Detection of Faecally Contaminated Freshwater

**Dr. James Sorensen**

British Geological Survey, Maclean Building, Wallingford, OX10 8BB, UK

Rapid detection of fecal contamination remains a central challenge in safeguarding global water quality. Conventional micro biological tests, though reliable, are slow, resource-intensive, and unsuitable for real-time risk management. Over the past decade, a growing body of research has demonstrated that fluorescence spectroscopy—specifically the measurement of tryptophan-like fluorescence (TLF)—can serve as a near-instantaneous indicator of fecal pollution in both surface and groundwater systems.

TLF is abundant in human and animal waste and correlates strongly with thermotolerant coliform and, specifically, *E. coli* concentrations. Field and laboratory studies across diverse hydrological and climatic contexts consistently show that elevated TLF intensity signifies heightened microbial risk. Portable, low-power fluorometers can now measure this signal directly in situ, providing continuous, reagent-free data suitable for integration with digital monitoring and early-warning systems; therefore, offering clear advantages for public health protection and catchment management.

Fluorescence spectroscopy therefore represents a paradigm shift in water quality assessment, enabling proactive and adaptive management of microbial contamination. Continued research and deployment of these techniques will enhance our ability to monitor, predict, and ultimately prevent fecal pollution events, supporting progress toward resilient, safely managed water systems worldwide.

**BIO:** Dr. James P. R. Sorensen is a Hydrogeologist at the British Geological Survey specializing in groundwater quality, monitoring, and novel field techniques. His research includes a focus on fluorescence spectroscopy for real-time detection of faecal contamination and the sustainable management of groundwater resources under changing environmental and climatic conditions.

## **A Decade of Data Stewardship: Evolving the Water Resources Data Collection Assessment Process**

*Sandie Will, Catherine Wolden, **Robin Speidel***

Southwest Florida Water Management District, Brooksville, FL, USA

The efficient and strategic use of water resources data is critical for effective management decisions. In 2013, the Southwest Florida Water Management District (SWFWMD) implemented the Water Resources Data Collection Assessment Process (WRDCAP) to systematically review and align all resource monitoring activities – including surface water, groundwater, and rainfall – with strategic goals, ensuring data quality and cost control. WRDCAP employs a transparent, repeatable methodology that has continually evolved, adapting from initial comprehensive reviews to structured three-year evaluation cycles. This presentation will detail WRDCAP's history, key successes, and optimization efforts, culminating in recent recommendations to transition toward specialized District Data Evaluation Workgroups (DDEW) for more focused portfolio management. We aim to provide a practical blueprint for other water resource agencies seeking to establish robust and adaptive data governance.

**BIO:** Robin Speidel, P.G., is a Professional Geologist at the Southwest Florida Water Management District. His role is overseeing regional groundwater quality monitoring across 16 counties. He holds a BS in Geology and actively contributes to statewide data standards and springs inventory. He also chairs the USF Geology Alumni Society, mentoring future geologists.

# Modeling infiltration and runoff during strawberry transplants establishment using Hydrus 1D

*Josue St Fort*<sup>1</sup>, *Davie M. Kadyampakeni*<sup>1</sup>, *Vivek Sharma*<sup>2</sup>, *Carlene A. Chase*<sup>3</sup>, *Michael Dukes*<sup>2</sup>, and *Shinsuke Agehara*<sup>4</sup>

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The establishment of strawberry transplants using impact sprinklers is a water-intensive process that can generate runoff or excessive infiltration, which may lead to nutrient leaching depending on the soil's hydraulic properties. Measuring infiltration and runoff directly in strawberry fields during establishment is complex and impractical due to plastic mulch covering the beds and furrow geometry limiting instrumentation. Therefore, using models like HYDRUS-1D is crucial to predict soil water dynamics under different irrigation systems and rates. This study compared the performance of the HYDRUS-1D in simulating runoff and infiltration generated by the traditional impact sprinkler (5.78 mm/h) used during strawberry transplant establishment and four micro-sprinklers on Candler sandy soil at two depths (0–15 cm, 15–30 cm). The micro-sprinklers included the SuperNet Jet (4.07 mm/h), Xcel Wobbler (3.34 mm/h), Mini-Revolver (3.26 mm/h), and Mini-wobbler (3.39 mm/h). The model performance was assessed using six indices, including the Root Mean Square Error (RMSE) and the coefficient of determination ( $R^2$ ). Runoff prediction was zero for all irrigation systems. The model prediction of water content showed low to strong agreement with measured data, with RMSE values ranging from 0.01 to 0.04 and  $R^2 < 0.3$ . The model achieved the highest accuracy for water content prediction at 0-15 cm depth. A global sensitivity analysis using the Sobol method revealed that residual water content was the most influential soil hydraulic parameter, explaining 80% of the variation in the simulated soil water content. Predicted cumulative infiltration depths differed significantly among the systems, with the impact sprinkler showing the highest infiltration (>62 cm) and the Mini-Revolver the lowest (7 cm). These findings underscore the potential infiltration and runoff generated by each irrigation system. HYDRUS 1D was helpful in simulating soil water dynamics under each irrigation system, providing insight into selecting the most efficient irrigation systems for strawberry establishment.

**BIO:** Dr. St Fort is a postdoctoral research associate at the Citrus Research and Education Center, where he models nutrient fate in citrus and bamboo grown in Florida's sandy soils. He has extensive experience in irrigation modeling, soil-water dynamics, and sustainable crop production, contributing to improved agricultural practices in subtropical systems.

## Stakeholder-Driven Innovation during Development of DinoSHIELD HAB Control Technology: A Case Study

**Elizabeth Staugler**<sup>1</sup>, Alexandria G. Hounshell<sup>2</sup>, Madison Horgan<sup>3</sup>, Christopher L. Cummings<sup>3</sup>, Alan J. Kennedy<sup>4</sup>, Yanfei Wang<sup>5</sup>, Kathryn Coyne<sup>5</sup>, Kaytee Pokrzywinski<sup>2</sup>

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Effective stakeholder engagement is critical for the successful development and implementation of novel environmental technologies, especially for ecologically sensitive challenges like harmful algal bloom (HAB) control. DinoSHIELD is an innovative Biological HAB control strategy designed to mitigate growth of toxic dinoflagellates (e.g., *Karenia brevis*) by releasing a naturally derived algicide, IRI-160AA, produced by *Shewanella* sp. IRI-160, immobilized within a non-toxic hydrogel for controlled marine application. This study marks the first application of stakeholder driven technology R&D, following the Responsible Research and Innovation (RRI) framework, to emerging marine HAB control technologies. Following the RRI, we applied an iterative, two-way stakeholder engagement process in southwest Florida, which included workshops, surveys, and feedback sessions initially targeted to resource managers and HAB scientists. These activities explored stakeholder understanding, concerns, and preferences regarding DinoSHIELD's efficacy, deployment, and ecological safety.

Pre- and post-workshop survey results showed that 97% of participants gained a better understanding, and 85% felt more comfortable with DinoSHIELD after engagement. In addition, stakeholder feedback obtained during the workshop series helped shape future R&D priorities, including alternative deployment methods, ecological risk assessment, and long-term sustainability.

Ongoing R&D updates sent to workshop participants continue to support transparency and trust, illustrating how iterative engagement enables responsible innovation by aligning technology development with societal and management needs. This approach moves beyond typical outreach activities to co-produce knowledge and co-design solutions, and offers a replicable model for integrating stakeholder input into environmental technology R&D. The RRI-guided development of DinoSHIELD R&D provides a valuable blueprint for advancing marine HAB control technologies responsibly.

**BIO:** Elizabeth Staugler is the NOAA Harmful Algal Bloom Liaison, a partnership position serving as link between NOAA NCCOS and Sea Grant programs. With over 20 years of experience in stakeholder engagement, she leads efforts to assess stakeholder needs, share NCCOS research and obtain feedback to drive continued research and refinements.

## RECOVERY OF RARE EARTH ELEMENTS USING ELECTROCHEMICAL REACTOR

*Maya Stuhlmann, Maksymilian Kruc, Nolan Nguyen, Jun Kim*

Florida Polytechnic University, Lakeland, FL, USA

Rare earth elements (REEs) are critical components in modern technologies, such as smartphones, LED lights, and electric vehicles. Current extraction methods are challenging due to their widespread and low-concentration occurrences in the environment. Global supplies remain constrained due to limited reserves and environmentally unfavorable mining practices. Existing REEs-recovery methods are often energy-intensive, chemically demanding, and costly. There is a need for sustainable technology that enables the recovery of these critical materials while protecting water resources. This research explores the use of an electrochemical reactor to recover REEs from phosphate mining process water.

Initial experiments focus on cyclic voltammetry analysis using carbon electrodes. This establishes a baseline for electrochemical behavior and ensures proper operation of the electrosorption process inside the reactor. Further work will be done to evaluate ion separation performance to determine the potential of the system for rare earth element recovery. The system is anticipated to demonstrate measurable sorption of REEs from aqueous solutions, providing insight into its potential recovery scheme for various REEs.

This work demonstrates the feasibility of a porous carbon-based electrochemical reactor as a sustainable approach to recovering REEs from process water. By providing a method that combines water purification and resource recovery, this system could contribute to more sustainable water and resource management in Florida.

**BIO:** Maya Stuhlmann is a senior environmental engineering student at Florida Polytechnic University. She has completed two NASA L'SPACE programs as Project Manager and Lead Systems Engineer, and an REU at FIU. Her research focuses on water treatment processes and resource recovery. She is passionate about advancing solutions for clean water.

## **Addressing Change Conditions with the Central and Southern Florida Flood Resiliency (Section 216) Study**

***Gustavo A. Suarez-Narvaez***

United States Army Corps of Engineers, Jacksonville, FL, USA

The Central and South Florida (C&SF) Project, authorized by the US Congress beginning in 1948, is a large-scale, multi-purpose water resource initiative collaboratively managed by the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD). Originally designed to serve a population of approximately 2 million, the C&SF Project provides critical flood control, water supply, and ecosystem support across South Florida. The system comprises approximately 2,175 miles of canals, 2,130 miles of levees, 89 pump stations, and 915 water control structures, integrated with extensive local drainage networks. Currently serving a population of approximately 9 million, the C&SF Project represents one of the nation's most complex water management systems.

This Flood Resiliency (Section 216) study assesses the feasibility, environmental acceptability, and economic justification for federal investment in enhanced Flood Risk Management (FRM) measures. The study focuses on Miami-Dade County, Florida, evaluating alternatives to mitigate increasing flood risks and associated economic damages resulting from factors such as extreme weather events, sea level change, land development, and population growth.

**BIO:** Mr. Gustavo A. Suarez-Narvaez, P.E., serves as the Planning Technical Lead for the USACE, Jacksonville District. A professional engineer with approximately 20 years of combined experience in the private, state, and federal sectors, with expertise in hydrologic and hydraulic design, risk assessments, and water resource planning and policy.

# Stakeholder Perceptions of Sustainable Urban Landscapes in Florida

*Gabriela Sullivan, Sadie Hundemer, Paul Monaghans and Basil V. Iannone III*

University of Florida, Gainesville, FL, USA

Outdoor landscapes can account for up to 70% of household water use; therefore, the sustainable design and management of urban landscapes is critical to reducing Florida's growing water demands. However, in recent years, differences in stakeholder perspectives on the future of Florida's urban landscapes, particularly residential lawns, have become apparent. Currently, stakeholders, like developers, county officials, and green industry business owners in Lake County, Florida, are in conflict over proposed landscape codes for Wellness Way, a master-planned community in southeast Clermont. While the proposed ordinances aim to conserve water, stakeholders disagree over what the ordinance should include, like restrictions on the use of predominantly native plants, and others are upset that they were not a part of the conversation. Similarly, in 2019, internal conflict over the role of turfgrass in sustainable landscapes led to quarterly meetings among University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) faculty members on the development of science-based recommendations for urban landscapes. These community and scientific disagreements, along with inaccuracies in stakeholders' perceptions of each other's views, lead to ineffective communication and conflict, ultimately hindering the mutual goal of reducing landscape inputs and conserving Florida's water resources.

To understand stakeholders' perceptions of sustainable urban landscapes and work toward shared definitions and approaches, we conducted 24 in-depth, semi-structured interviews with stakeholders, including members and leaders of the Florida Nursery Growers and Landscape Association (FNGLA), UF/IFAS experts, government officials, homeowner associations, builders, and developers. Participants were selected using criterion sampling based on their stakeholder self-identity and institutional leadership. Each participant chose a sustainable urban landscape as the location for a walking interview. During the interview, participants were asked to discuss their attitudes, beliefs, and experiences, which shaped their perceptions of sustainable urban landscapes. Transcripts were analyzed using thematic analysis in MAXQDA software. The results from this study identified overarching themes and various approaches to sustainability in urban landscapes. We identified aspects of sustainable landscapes that stakeholders mutually agreed on. Based on these findings, we proposed communication strategies to increase stakeholder agreement and mutual understanding. The outcomes of this research will help scientists and community stakeholders alike better understand conflicting perspectives on sustainable urban landscapes and implement strategies to effectively communicate across disciplines and perspectives. This will help manage stakeholder conflicts, strengthen partnerships, and promote collaboration to address Florida's water issues.

**BIO:** Gabriela Sullivan is a graduate student in agricultural education and communications. Her research centers on understanding stakeholder perspectives and the conflict surrounding sustainable urban landscapes in Florida. Sullivan previously served as Water Resources Conservation Coordinator for a Florida public utility, where she worked with stakeholders to increase residential water efficiency through education and communication campaigns.

# DELINEATION OF SELECTED SPRINGSHEDS UTILIZING REGIONAL NUMERICAL GROUNDWATER FLOW MODELS

*Qing Sun, Wei Jin, Edwards W. Carter*

St. Johns River Water Management District, Palatka, FL, USA

A springshed is defined as those areas within ground water and surface water basins that contribute to the discharge of the spring (Florida Geological Survey, 2003). In this study, a springshed is defined as the area within the Upper Floridan Aquifer (UFA) where groundwater discharges to the spring(s).

The objective of this study is to delineate springsheds in the UFA capturing groundwater for Silver Glen Springs, Alexander Springs, Volusia Blue Spring, De Leon Springs, Gemini Springs and springs within the Wekiva River Basin. There are four regional groundwater flow models that include these springs - the North Florida Southeast Georgia model, the East-Central Florida Transient Expanded model, the Volusia County model, and the Central Springs Model. These models and the particle tracking program MODPATH were used to delineate groundwater contribution areas for these springs. There were different contributing areas produced from these models with varied recharge scenarios and two particle tracing algorithms. The differences were most likely caused by recharge, hydro stratigraphic setup, aquifer hydraulic properties and boundary conditions assigned to each model simulation.

**BIO:** Dr. Sun is a senior engineer scientist with more than 20 years of experience in water resource studies of groundwater flow and transport models, integrated surface and ground water models, saltwater intrusion, and water supply analysis.

## St. Lucie Estuary, where is the carbon and nitrogen coming from?

**Madeline J. Sutherland<sup>1</sup>, Shin-Ah Lee<sup>1</sup>, Megan Sanford<sup>1</sup>, Barbara Welch<sup>2</sup>, Thomas Behlmer<sup>2</sup>, Scott Lee Young<sup>1</sup>, Robert J. Scharping<sup>1</sup>, Mauricio E. Arias<sup>3</sup>, Elise S. Morrison<sup>1</sup>**

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<sup>3</sup>University of South Florida, Tampa, FL, USA

The St. Lucie Estuary is a subtropical, anthropogenically influenced estuary on the southeastern coast of Florida. This system faces numerous issues including harmful algal blooms and hypoxia driven by a complex series of freshwater contributors, seasonality, and variable residence times. These issues have prompted the need to better predict changes in water quality. This work was conducted as part of a larger project (CLOSE-HABS) focused on addressing this need through monitoring and modeling. Over the period of study, May 2023 to December 2025, management of the estuary changed (Lake Okeechobee System Operating Manual, August 12, 2024) impacting freshwater flows into the South Fork. With high agricultural activity and urbanization in the watershed, the St. Lucie Estuary serves as a model system to observe the impacts of anthropogenic activity from a hydrogeochemical perspective. We sampled nine sites along a salinity gradient including the North and South Forks, their confluence, downstream marine inflows, and dominant freshwater sources to capture changes of carbon (C) and nitrogen (N) in the system. Dissolved organic carbon (DOC), total dissolved nitrogen (TDN), stable isotopes of C and N in suspended particulate material, and colored dissolved organic matter (CDOM) were combined to evaluate dominant C and N forms and sources in the system. Variation in seasonality was spatially dependent, and similar variation was seen for sites that were related with similar salinities. DOC changes significantly ( $p < 0.05$ ) from the wet to dry season at 8/9 sampled sites. TDN changes significantly at only 3/9 sites with all sites having low salinity ( $< 5$ ) away from tidal influence. CDOM and stable isotopes were used to identify nutrient sources, ranging from humic material to human waste. From this, we can better understand the impact of human activities in the estuary and how they influence estuarine biogeochemistry along different spatial and temporal scales.

**BIO:** Madeline is a first year PhD student in ESSIE with a focus on nutrient dynamics and transport in salinity variable systems such as estuaries.

## Enhancing Water Quality through Innovative Canal Restoration – A Multi-stage Channel Design Pilot Study

*Mary Szafraniec, Renee Price*

Resource Environmental Solutions, Tampa, FL, USA

Implemented through a public-private partnership (P3) between Martin County and Resource Environmental Solutions, LLC (RES), this pilot project will demonstrate a nature-based approach to improving regional water quality by enhancing a one-mile segment of the S-1 Canal in Martin County, Florida. The canal drains approximately 1,000 acres of agricultural land and discharges to the C-44 Canal and ultimately the St. Lucie River, which has an adopted Total Maximum Daily Load and a Basin Management Action Plan (BMAP). The project employs a multistage channel design—a stream restoration technique that integrates in-channel treatment and floodplain wetland benches—to reduce nutrient and sediment loads from agricultural runoff and stormwater.

This P3 pilot-scale project encompasses design, permitting, construction, monitoring to establish nutrient load reduction efficiencies, and long-term operations and maintenance. The multistage channel design slows water velocities, increases residence time, and enhances contact with aquatic vegetation, promoting sedimentation, biogeochemical processing, nutrient uptake, and denitrification. Anticipated benefits include load reductions in total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS), delivered from the watershed, which will be developed from a robust monitoring program where pollutants and hydrologic data will be collected. While final load reductions are pending design completion and monitoring, the project is expected to demonstrate the effectiveness of canal enhancement as a best management practice (BMP) for nutrient reduction in both agricultural and urban drainage systems. Results from the monitoring program will be provided to the FDEP to obtain BMAP credits to help meet the BMAP allocations for involved stakeholders. Beyond water quality improvements, the project offers co-benefits including enhanced flood resilience, habitat creation, and recreational value. It serves as a replicable model for integrating ecological restoration into canal infrastructure and advancing regional water management goals.

**BIO:** Dr. Mary Szafraniec, National Director of Water Solutions at RES, leads large-scale collaborative efforts to implement innovative, science-based ecologically engineered solutions for improving aquatic ecosystems and water resource sustainability in Florida and beyond.

## Enhancing Public Health Monitoring Through Wastewater Epidemiology

**Shisbeth Tabora-Sarmiento**<sup>1</sup>, Sarah Robinson<sup>1</sup>, Francisco Paneques<sup>1</sup>, Jeantel Cheramy<sup>1</sup>, Nicole Winn<sup>2</sup>, Thomas Sinkway<sup>1</sup>, Tara Sabo-Attwood<sup>3</sup>, Linda Cotler<sup>1</sup>, John Bowden<sup>1</sup>, Joseph H. Bisesi<sup>1</sup>

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<sup>3</sup>University of South Carolina, Columbia, SC, USA

Substance use remains a growing public health challenge globally, demanding innovative, data-driven approaches for community-level surveillance. Wastewater-based epidemiology (WBE) has emerged as an effective method to assess drug consumption trends through chemical indicators present in municipal wastewater. By integrating environmental monitoring with public health science, WBE offers a scalable approach for real-time population assessment. However, the complexity of wastewater matrices introduces analytical challenges related to recovery efficiency, analyte stability, and reproducibility. This study introduces a refined workflow for detecting and quantifying multiple classes of drugs in wastewater, emphasizing reliability and cross-site comparability. Weekly 24-hour composite samples were collected over a one-year period from more than 20 wastewater treatment facilities across four major U.S. metropolitan regions. Two solid-phase extraction (SPE) materials, Oasis HLB and Oasis MCX, were evaluated to optimize analyte recovery and precision. The MCX sorbent produced higher consistency and reproducibility across most target compounds. Analytical validation yielded correlation coefficients above 0.99 and recovery rates ranging from 65–120% with relative standard deviations under 20%, confirming strong method performance. A wide array of opioids, stimulants, cocaine-related metabolites, and emerging psychoactive substances were quantified, and population-adjusted consumption estimates revealed clear regional and seasonal patterns in drug usage. This work establishes a robust, standardized protocol for multi-residue drug analysis in complex wastewater samples and demonstrates the utility of WBE as a practical tool linking water quality monitoring and public health. These findings highlight how advances in environmental analytics can inform timely, evidence-based responses to the substance use crisis and enhance integrated water management strategies.

**BIO:** Dr. Shisbeth Tabora is a Postdoctoral Associate at the University of Florida's Center for Aquatic and Invasive Plants. Her research spans wastewater-based epidemiology, aquatic toxicology, and invasive species management, advancing interdisciplinary approaches for understanding chemical and Biological stressors in aquatic systems.

## **The Construction and Calibration of a Hydrodynamic Model of the Upper Withlacoochee to Support MFLs**

*Patrick Tara, and Mary Gerlach*

INTERA, Southern Division, Gainesville, FL, USA

As part of the Southwest Florida Water Management District (SWFWMD) Minimum Flow and Level (MFL) program, the Upper Withlacoochee River HEC-RAS model underwent a comprehensive reconstruction and recalibration effort. A critical review of the previous study identified key issues with model calibration and conceptualization, which had divided the river into three separate domains: the Upper, Middle, and Lower segments of the Upper Withlacoochee River. Dividing the river into several segments created internal boundary conditions that limited and interfered with the application of the models to represent the MFL alternatives.

To address these limitations, the redevelopment effort combined the three domains into one single, comprehensive model that encompassed the entire domain of 77 miles of river channel. Updates included revised cross sections, Removal of internal boundaries, and implementation of time varying boundary conditions to capture interactions with lateral systems such as the Tsala Apopka Chain of Lakes, Lake Panasoffkee as well as many tributaries. The structure operation schedule was also programed into HEC-RAS to dynamically represent the operation of the structure.

The re-calibration was performed using an un-steady approach calibrating the model parameters to achieve a good fit with the observed stage data. The calibration was challenging due to the complex inflows and periods where the river occasionally dried out. Ranked percentile flows were then used to define the inundated area. The inundated floodplain was used to constrain the MFL criteria.

# Examining Single Family Residence Reclaimed Water Use In A Changing Florida

*Nicholas Taylor<sup>1</sup>, Kirsten Burns<sup>2</sup> and Michele Neibergs<sup>2</sup>*

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Florida has become the nation's fastest growing state, while sweeping regulatory changes and increasingly extreme weather events have reshaped public water utilities. These dynamics pose a complex planning puzzle: utilities must support rapid population growth, build resilient systems that withstand hurricanes and droughts, and meet evolving regulatory mandates—especially the critical goal of eliminating non beneficial discharge of reclaimed water by 2032 under FL Senate Bill 64. This legislation promotes beneficial reuse to reduce demand on limited freshwater supplies and protect receiving water quality.

Many utilities plan to expand reclaimed water delivery to new customers, dovetailing with ongoing expansions of potable and wastewater infrastructure. Rapid suburban development—particularly single family residential (SFR) projects—has amplified the need, yet historical data show SFRs consume more reclaimed water than they produce, because the supply of treated wastewater is limited. Consequently, a one to one wastewater–reclaimed water connection for all new development is unlikely.

This presentation examines the supply demand imbalance and seasonal availability constraints that accompany reclaimed water expansion. Drawing on data from the University of Florida's H<sub>2</sub>OSAV program—covering state, local, and water management district sources—the analysis includes utilities with reclaimed water connections ranging from 1,600 to 40,000. We evaluate how reclaimed water rates influence usage, how irrigation rate estimates shift between older and newer developments, and how irrigable lot size estimates evolve. The findings provide actionable insights for utilities working toward the SB 64 mandate while navigating growth, resilience, and economic challenges.

**BIO:** Dr. Taylor is a UF/IFAS state specialized extension agent whose research focuses on utility data analysis for water and energy conservation and land-development impact evaluation. He leads the H<sub>2</sub>OSAV Extension program, offering statewide data tools and insights that help utilities, government agencies, and extension agents optimize regional water conservation efforts.

# Predictive Groundwater Quality Responses to Land Cover and Lithology in the Upper Awash River Basin (Ethiopia) with Stacking Ensembles

**Bewuket B. Tefera<sup>1</sup>**, Jane Southworth<sup>1</sup>, Joann Mossa<sup>1</sup>, Mashoukur Rahaman<sup>1</sup>, Mohammad Safaei<sup>1</sup>, Di Yang<sup>1</sup>, Shankar Karuppanan<sup>2</sup>

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<sup>2</sup>Department of Applied Geology, School of Applied Natural Science, Adama Science and Technology University, Adama, Ethiopia

Groundwater resources are vital for human and environmental needs, especially in humid and semi-arid regions. Conventional groundwater quality models, including statistical and single-algorithm machine learning techniques, often lack accuracy, interpretability, and scalability. This study presents an advanced ensemble machine learning framework for assessing groundwater quality in Ethiopia's Upper Awash River basin, Africa. The Entropy Weighted Water Quality Index (EWQI) consolidates 13 hydrochemical parameters, including electrical conductivity, total dissolved solids, pH, and major ions. Data preprocessing involved imputation, standardization, and partitioning into training sets (70%) and testing sets (30%). Predictors include elevation, slope, land cover, lithology, and soil characteristics (type, moisture, temperature). A novel stacking ensemble model was developed using Random Forest, Gradient Boosting, Support Vector Regression, K-Nearest Neighbors, and Extreme Gradient Boosting. The stacking model outperformed individual models, achieving training metrics of MSE 17.96, RMSE 4.24, and  $R^2$  0.97, as well as testing metrics of MSE 76.29, RMSE 8.73, and  $R^2$  0.87. The validation results showed an MSE of 67.18, an RMSE of 8.2, and an  $R^2$  of 0.89. Beyond accuracy, SHAP interpretation shows that soil temperature, land cover, and soil moisture are the dominant drivers of EWQI, exceeding terrain and lithologic controls. By coupling an objective EWQI target with broadly available covariates and an interpretable stacked ensemble, the study links prediction to actionable land and water management in a data-scarce basin and outlines a transferable workflow.

# SPATIAL MODELING OF *ESCHERICHIA COLI* IN ST. JOHNS RIVER ECOSYSTEMS, FLORIDA

Thanaporn Thongthum<sup>1,2</sup>, Benjamin D. Anderson<sup>1,2</sup>

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<sup>2</sup> Emerging Pathogens Institute, University of Florida, Gainesville, FL, USA

*Escherichia coli* (*E. coli*) is a key microbial indicator of fecal contamination and a useful proxy for assessing microbial water quality risks in aquatic ecosystems. This study aims to characterize the spatial distribution of *E. coli* in U.S. surface waters and develop geospatial modeling approaches to identify hotspots and environmental drivers of elevated abundance. By integrating water quality data, land use information, and pollution source indicators, this work seeks to establish a spatially explicit framework for predicting microbial contamination risks and supporting water quality management.

As a preliminary analysis, *E. coli* abundance data from the U.S. EPA Water Quality Exchange (2018–2024) were compiled and evaluated. Mean *E. coli* concentrations increased from 1,281 CFU/100 mL (2018–2020) to 1,499 CFU/100 mL (2022–2024), with comparable increases in median and interquartile ranges. Histogram analysis revealed a non-normal distribution, supporting the use of log transformation in subsequent statistical modeling. For spatial analysis, data were aggregated by site and 30-day periods, and spatial weights were defined using the five nearest neighbors. The Getis-Ord  $G_i^*$  statistic identified 19 hotspots and 60 cold spots of *E. coli* abundance, and Moran's  $I$  confirmed significant positive spatial autocorrelation ( $I = 0.46$ ,  $p < 0.0001$ ).

These results demonstrate strong spatial structure in *E. coli* distribution across freshwater monitoring sites in the lower St. Johns River, suggesting that local land use and hydrological connectivity influence microbial contamination patterns. The next phase will integrate site-level environmental variables—such as nutrient levels, temperature, and land cover—to build predictive spatial models of *E. coli* abundance and risk. This work provides a foundation for dynamic, spatially informed water quality assessment tools that can enhance surveillance and management of microbial contamination in aquatic systems.

**BIO:** Thanaporn (May) Thongthum is a PhD Candidate in Public Health (One Health Concentration) studying how land use, water quality, and pollution sources influence microbial communities in aquatic ecosystems. Her research integrates statistical and geospatial approaches to improve understanding and prediction of waterborne microbial risks.

# DEEP LEARNING FOR FLASH DROUGHT MONITORING AND FORECASTING

*Di Tian*<sup>1</sup>, *Sudhanshu Kumar*<sup>1</sup>, and *Kyle Lesinger*<sup>1,2</sup>

<sup>1</sup>Auburn University, Auburn, Alabama, USA

<sup>2</sup>Now at University of Alabama, Huntsville, Alabama, USA

Flash droughts pose growing challenges for water, agricultural, and ecosystem management due to their rapid onset, intensifying variability, and limited predictability. This presentation highlights recent advances in deep learning for monitoring and forecasting flash droughts. For monitoring, we introduce DEMS (Deep Learning Emulator for Monitoring Soil Moisture), which learns spatiotemporal soil moisture dynamics from physics-based land data assimilation systems (LDAS) and transfers that knowledge to fine-scale satellite and digital soil data through transfer learning. DEMS generates daily 30-m soil moisture and flash drought estimates that outperform existing satellite- and LDAS-based products, offering a globally adaptable and physically consistent pathway for next-generation drought monitoring. For forecasting, we present a hybrid framework that integrates the RISE-UNet deep learning model with dynamic model forecasts, achieving skillful predictions of root-zone soil moisture and flash droughts up to four weeks in advance. This hybrid approach substantially outperforms state-of-the-art dynamic models across diverse hydroclimatic regions. Overall, these advances demonstrate how deep learning can bridge physics-based modeling and Earth system data, offering a new paradigm for accurate and precise flash drought early warning to strengthen water, agriculture, and ecosystem resilience.

**BIO:** Dr. Di Tian is an Associate Professor in the Department of Crop, Soil, and Environmental Sciences at Auburn University. His research focuses on hydroclimatology, integrating terrestrial hydrology, climatology, data science, and artificial intelligence to understand, monitor, and predict hydroclimate dynamics and extremes (e.g., drought) driven by land-atmosphere interactions and teleconnections.

## Effects of Nitrogen Fertilization on Silage Corn Yield and Water Quality in Florida

**G. Tiwana**<sup>1</sup>, *G. Golmohammadi*<sup>1</sup>, *S. Mostafa*<sup>1</sup>, *S. Shaghghi*<sup>1</sup>, *N. Ghimire*<sup>1</sup>, *S. Kumar*<sup>2</sup>

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Field corn production in Florida, primarily used for silage, is vital for supporting the local beef and dairy industries. With increasing demand for high-quality animal feed, optimizing fertilization management is crucial to maximize yield while minimizing environmental impacts. This study investigates the effects of nitrogen fertilizer applications on silage corn yield, nutrient uptake, and water quality in an experimental farm at Range Cattle Research and Education Center at the University of Florida. Seven nitrogen treatments, ranging from 0 to 420 lb/acre, were applied in split doses at key growth stages. The study employs a randomized complete block design with four replications to evaluate crop yield, nutrient partitioning, and environmental outcomes, including nitrate leaching and groundwater quality. To monitor water quality, 2 lysimeters, 1 groundwater well and 14 units of pore water samplers, were installed to collect subsurface drainage samples for nitrate analysis. Water quality parameters, such as pH, electrical conductivity, and nutrient concentrations, are also being monitored to assess the impact of fertilization subsurface drainage water and groundwater. This research aims to provide Florida growers with updated nitrogen fertilizer recommendations to promote sustainable silage corn production that balances high yields with environmental stewardship.

**BIO:** I am a first-year master's student in the Department of Soil, Water, and Ecosystem Sciences, maintaining a GPA of 4.0. My commitment to advancing sustainable agricultural practices through innovative soil management techniques is demonstrated by my research on optimizing nutrient cycling to enhance ecosystem resilience, which I presented at the FL ASABE 2025 and Graduate Research Forum 2025 conferences.

# Development and Implementation of the Pollutant Load Reduction Goal for Sarasota Bay

*David Tomasko<sup>1</sup>, Mike Wessel<sup>1</sup>, Jon Perry<sup>1</sup>, Chris Anastasiou<sup>2</sup>, and Ryan Gandy<sup>3</sup>*

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<sup>3</sup>Sarasota Bay Estuary Program (SBEP), Sarasota, FL, USA

This presentation summarizes recent efforts to develop and then implement a Pollutant Load Reduction Goal (PLRG) for Sarasota Bay, focused on loads of Dissolved Inorganic Nitrogen (DIN). Comparing data from an identified degraded period of 2013 to 2019 against an identified reference period of 2006 to 2012, annual average concentrations of Total Nitrogen (TN) were 12 to 35% higher during the degraded period. Annual average chlorophyll-a (Chl-a) concentrations were 24 to 45% higher across most bay segments, comparing values from the degraded period to the prior reference period. Where data were available, the abundance of drift macroalgae increased by between 68 and 139% from the reference to degraded periods. Seagrass coverage, which had increased by 28% during the reference period, decreased by 21% during the degraded period. A Water Quality Restoration Workshop, held in 2021, determined that there were sufficient large-scale wastewater upgrade and stormwater retrofit projects either underway, or on the verge of being implemented to likely meet the 20% DIN load reduction set as the bay's PLRG. During the years of 2020 to 2024, double-digit percent declines in annual average TN and Chl-a concentrations were documented, along with substantial reductions in the amount of drift macroalgae. Likely in response to the improved water quality and decreased abundance of drift macroalgae, seagrass coverage increased by 774 ha between 2022 and 2024, a 19% improvement.

# A SYSTEMATIC LITERATURE REVIEW ON WATER QUANTITY AND WATER QUALITY MODELING TOOLS

*Ngoc Trieu, Osama M. Tarabih, Mauricio E. Arias, Qiong Zhang*

Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL, USA

Models are critical tools in water resources management, as they simulate physical processes and generate time-series data for key water parameters. Additionally, they enable analysis of climate and land-use impacts on quantity and quality of water, particularly for regions with limited observational datasets. While the variety of models provides flexibility to address diverse objectives, it also presents challenges in selecting the most suitable tool for specific case studies. Thus, this study aimed to synthesize recent research on watershed modeling and develop a tool to assist researchers and managers in selecting the most appropriate model for their specific objectives. Literature published between 2020 and 2024 were identified from Scopus. Manual screening methods and Random Forest machine learning techniques were employed to remove irrelevant studies from the initial dataset. From the remaining 438 papers, relevant data were extracted manually or with the Elicit AI tool, depending on the complexity and nature of the data required. Next, a Python-based meta-analysis highlighted the dominance of the Soil and Water Assessment Tool and its applications in addressing water quality challenges. Flow, total phosphorus, and total nitrogen were identified as the most evaluated parameters for water quality studies, with insights into the typical ranges of model performance. These findings provide a reference for modelers to assess simulation reliability. Future work will explore integrated modeling approaches, optimization algorithms, and strategies to address data availability challenges. This study offers a framework to support modelers in selecting appropriate tools for their contexts and purposes.

**BIO:** Ngoc Trieu is a civil engineering student at the University of South Florida. She contributed to developing a web platform that evaluates the capabilities of 54 watershed and waterbody models. Her research also focuses on microplastics, where she analyzes parameters to classify particles based on their unique characteristics.

# Novel Approach for Monitoring Biofilm Dispersion in Drinking Water Distribution Systems

*Van-Khuong Trinh and Chamteut Oh*

University of Florida, Gainesville, FL, USA

Biofilm growth and dispersion in drinking water distribution systems (DWDS) pose significant risks to water quality and public health. Although monitoring biofilm formation in DWDS is essential for mitigating the risk of waterborne diseases, current approaches that analyze effluent properties cannot distinguish between bacteria dispersed from biofilms and planktonic bacteria originating from the source water. Quorum sensing (QS) systems—microbial communication mechanisms that regulate gene expression based on population density—are known to be more active in biofilm-associated bacteria than in planktonic cells. We hypothesize that bacteria dispersed from biofilms in DWDS influence QS-related mRNA levels in tap water effluent. Using *Pseudomonas aeruginosa*, a common DWDS bacterium, as a model organism, we examined the expression of the *lasI* gene, a key component of the *las* QS system responsible for synthesizing QS signaling molecules. Specifically, the transcriptional activity of *lasI* was systematically analyzed in both planktonic and biofilm-associated bacteria and was found to be especially elevated at the biofilm surface, where dispersion primarily occurs. Additionally, we quantified *lasI* mRNA in effluent under two conditions known to trigger biofilm dispersion: (1) low free chlorine levels combined with extended stagnation, and (2) transitions to oligotrophic water quality. These experiments support that biofilm growth and dispersion in DWDS can be accurately and non-invasively monitored by analyzing *lasI* mRNA in the effluent. This rapid, non-invasive approach offers potential for large-scale assessments and routine monitoring of Biofilm dynamics in DWDS, ultimately contributing to improved public health.

**BIO:** Mr. Van-Khuong Trinh is a Ph.D. student in the Department of Environmental Engineering Sciences at the University of Florida. He studies environmental genomic surveillance to track microbial threats (pathogens and antimicrobial resistance genes) in natural and engineered water systems.

## DRIVERS OF BENTHIC MACROALGAE IN FLORIDA'S COASTAL SPRINGS

***Madison Trowbridge***

Southwest Florida Water Management District, Brooksville, FL, USA

Florida's spring-fed rivers are known for their submerged aquatic vegetation (SAV), which provides habitat for fish and aquatic crustaceans and food for the Florida manatee. Elevated nitrate concentrations have often been attributed to the proliferation of benthic macroalgae within these systems. However, this paradigm does not always reflect the apparent biogeochemistry. More recent studies have indicated that other factors, including salinity and micronutrients such as iron, may play a more critical role in benthic macroalgal coverage than previously thought. This study investigated whether there was a correlation between benthic macroalgae and iron concentrations in the freshwater portions of the Chassahowitzka River (Citrus County, FL, USA). Both porewater and water column iron concentrations were used to determine potential impacts to benthic macroalgal coverage and thickness. Immediately following Hurricane Idalia (2023), iron concentrations in the porewater and water column correlated with macroalgal cover and thickness and appeared to be the major driver of macroalgal succession following the storm. Several months later, during more normal conditions, salinity correlated with macroalgal cover and thickness. Understanding the effects of iron and salinity on benthic macroalgae will be useful in understanding the SAV dynamics in Florida's spring systems.

**BIO:** Dr. Madison Trowbridge is the Springs Scientist and the Springs Team Lead for the Southwest Florida Water Management District. She holds a Ph.D. in Cell and Molecular Biology from the University of South Florida and her doctoral research focused on groundwater microbial ecology.

# Enhancing Satellite Image Resolution through UAV-Based Ground Truth Using GenAI and Diffusion Models

**Boaz B. Tulu<sup>a</sup>**, *Yiannis Ampatzidis<sup>b</sup>*, *Changying Li<sup>c</sup>*, *Willingthon Pavan<sup>d</sup>*, *Golmar Golmohammadi<sup>e</sup>*, *Haimanote K. Bayabil<sup>e</sup>*

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High-resolution data are required in precision agriculture to resolve plot- and row-scale indicators of crop water status (e.g., canopy temperature and the Crop Water Stress Index (CWSI)); however, the spatial resolution of most operational satellite imagery is insufficient for these tasks, so the requisite detail is typically obtained only from unmanned aerial vehicle (UAV) imagery. At the same time, frequent UAV flights incur substantially higher per-area costs than satellite imaging, limiting routine deployment at scale. To bridge this gap, a generative AI approach is proposed to super-resolve satellite imagery to near-UAV resolution, enabling detailed crop monitoring without intensive UAV deployment. Super-Resolution Generative Adversarial Network (SRGAN), the Enhanced Super-Resolution Generative Adversarial Network (ESRGAN), and Real-ESRGAN (a real-world blind super-resolution framework) are employed for 4× super-resolution, and a Denoising Diffusion Probabilistic Model (DDPM) is applied to refine image quality, recover fine details, and suppress artifacts. Training and evaluation are conducted on a multi-season (2020–2023) dataset of paired UAV (high-resolution) and satellite (low-resolution) images from sweet corn and green bean field trials at the University of Florida’s Tropical Research and Education Center, with UAV-level detail learned from coarse satellite inputs. Substantial improvements in image fidelity are anticipated; the super-resolved outputs are expected to exhibit higher peak signal-to-noise ratio (PSNR) and structural similarity index (SSIM) than the original satellite imagery. Claims for improvement are prospective; quantitative results will be presented during the conference presentation. If effective, the super-resolved outputs could serve as high-resolution proxies for UAV acquisitions, enabling plot-scale water-stress monitoring and crop-health assessment at lower marginal cost and higher temporal resolution, thereby supporting timely, data-driven irrigation scheduling and field-management decisions.

**BIO:** Boaz B. Tulu is a PhD student in Agricultural & Biological Engineering at the University of Florida. With a background in Computer Engineering, he integrates AI-based technologies to address agricultural challenges. He was a 2022 Mandela Washington Fellow at Purdue University.

## **An Interactive Chat-Map Platform for Rapid, Uncertainty-Aware EO Insights**

*Anastasia Kritharoula, Nikolaos Tziolas*

University of Florida, Immokalee, FL, USA

Florida's communities and working lands face escalating risks from hurricanes and other extreme weather, with cascading effects on flooding and crop losses. To support faster, evidence-based decisions, we introduce GAIA Bot, a conversational AI platform that fuses satellite Earth observation (EO) data, field-trial evidence, and large language models into an interactive chat-map experience tailored to Florida's resilience needs. GAIA Bot runs an automated pipeline that continuously ingests and harmonizes Sentinel-2 Level-2A imagery from an EO data cube. Non experts users can simply ask natural-language questions such as "What percent of crops were damaged after the hurricane?" and "How does that compare to the same period last year?" and receive map-based answers in seconds. Analytics include event-aware baselining (pre/post windows), vegetation change metrics, statistics, and severity class mapping to quantify crop-damage extent and persistence of inundation. The platform is being presented in seminars and stakeholder workshops, where live demos and Q&A are informing iterative improvements based on real user feedback. By translating advanced remote-sensing workflows into dialogue, GAIA Bot accelerates situational awareness for growers, policy makers, and emergency responders, while lowering the technical barriers to geospatial intelligence. The platform is designed to scale, with plug-and-play updates for new products such as flood-risk maps.

**BIO:** Dr. NikolaosTziolas is Assistant Professor at UF/IFAS SWFREC specializing in soil science, Earth observation, and AI. He leads projects that fuse satellite and in situ data into decision tools for Florida agriculture, improving soil health, and resilience to extreme weather through stakeholder-driven research, extension, and education.

# Efficacy and Ecological Implications of Hydrogen Peroxide for Cyanobacterial Bloom Mitigation

*Hidetoshi Urakawa*<sup>1</sup>, *Albert S. Barbaretta*<sup>1</sup>, *Bethany C. Ryder*<sup>1</sup>, *Haruka E. Urakawa*<sup>1</sup>, *Serge Thomas*<sup>1</sup>, *Jose V. Lopez*<sup>2</sup>, and *Anna Wachinicka*<sup>3</sup>

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Hydrogen peroxide has gained increasing attention as a rapid, selective, and environmentally friendly algaecide for mitigating harmful cyanobacterial blooms. Its effectiveness arises from the higher oxidative sensitivity of cyanobacteria compared with eukaryotic phytoplankton, enabling targeted suppression of bloom-forming cyanobacteria while minimizing adverse effects on non-target phytoplankton. Laboratory, mesocosm, and field studies have shown that effective treatment concentrations generally range from 2 to 100 mg L<sup>-1</sup>, depending on bloom density, morphology, and physicochemical conditions. At the cellular level, hydrogen peroxide induces oxidative stress that overwhelms cyanobacterial antioxidant defense mechanisms, leading to damage of photosystems and loss of membrane integrity, though extracellular polysaccharides and colony structure can confer partial resistance. Treatment efficacy varies with formulation type (liquid, floating, or solid sodium percarbonate), waterbody size, depth, flow regime, turbidity, and light exposure, emphasizing the importance of site-specific dosing strategies. Combined use of hydrogen peroxide with other physical or chemical control measures may enhance dispersion and reduce total chemical demand. Nevertheless, ecological trade-offs remain, including alterations in microbial community composition, potential inhibition of archaeal nitrification, and oxidative impacts on zooplankton and other non-target organisms. To ensure sustainable implementation, hydrogen peroxide applications should be guided by adaptive management, continuous monitoring, and a clear understanding of ecological responses. As a residue-free and rapidly degradable oxidant, hydrogen peroxide offers a promising short-term tool that complements long-term nutrient management strategies. Future research should prioritize standardized dosing frameworks and integrative treatment designs to optimize efficacy while maintaining ecosystem health.

**BIO:** Dr. Urakawa is an aquatic ecologist and professor at FGCU. He has been studying cyanobacteria and hydrogen peroxide dynamics since 2016 in a project supported by the National Science Foundation. He is interested in environmental mitigation and biodiversity.

# EVALUATION OF PHOSPHORUS SORPTION MATERIALS FOR AGRICULTURAL AQUATIC ECOSYSTEMS APPLICATION

*Berson J. Valcin, Yicheng Yang, and Jehangir Bhadha*

Everglades Research and Education Center - University of Florida, Belle Glade, FL, USA.

Phosphorus (P) is considered a limiting nutrient in most freshwater systems, and it can promote water eutrophication, leading to harmful algal blooms that threaten both environmental and human health. Agricultural aquatic systems often contain very low P levels but involve large water volumes, presenting a significant challenge for removal. Sorption material-based technologies offer a promising approach if they are effective and scalable under these dilute and large water-volume conditions. This study assessed the performance of three available sorption materials: lanthanum, iron, and calcium-based. Laboratory batch and equilibrium experiments were conducted at pH 8.0 to determine various adsorption parameters and sensitivity to freshwater chemistry. Adsorption data fit well with the Langmuir isotherm for all materials tested, with the iron oxide-based material showing the highest monolayer adsorption capacity ( $12.7 \text{ mg P g}^{-1}$ ). Kinetics modeling indicated the pseudo-second order model best described the adsorption behavior, suggesting chemisorption as the primary mechanism. However, the iron-based material showed the lowest adsorption rate constant  $k_2$  ( $0.0394 \text{ g mg}^{-1} \text{ min}^{-1}$ ), while the lanthanum-based product had the highest ( $10.07 \text{ g mg}^{-1} \text{ min}^{-1}$ ). All materials showed reduced adsorption capacity as pH increased. Notably, the lanthanum- and iron-based materials experienced 56% and 47% reductions, respectively, from pH 3.0 to 12.0. Similarly, the calcium-based material experienced an 80% decrease from pH 3.0 to 10.0, with a significant increase at pH 12.0. Common freshwater anions such as chloride, sulfate, and nitrate showed no competition with P for adsorption sites. These findings suggest that iron oxide-based material may offer advantages for field-scale application, such as a longer lifetime and higher removal efficiency near typical aquatic ecosystem chemistry. This work contributes to the effort of identifying scalable technologies relevant for P mitigation in freshwater systems.

**BIO:** Valcin is a Ph.D. student at the University of Florida, majoring in Soil, Water, and Ecosystem Science. He has experience working in the fertilizer industry, particularly phosphate fertilizer, as an associate researcher for product development and evaluation. His current project focuses on technology-driven treatment for phosphorus capture in agricultural ecosystems.

## PERSISTENTLY DISTINCT PPCP PROFILES IN THE LAKE HURON-ERIE CORRIDOR: A MULTIYEAR NMDS STUDY

*Emma A. VanderMeulen, Bridget B. Baker, Tracie R. Baker*

University of Florida, Gainesville, FL, USA

The Lake Huron to Lake Erie Corridor (HEC), spanning between Michigan and Canada, is a vital shipping route, a diverse wildlife habitat, and the source of drinking water for nearly 4 million people. Previous studies have consistently detected pharmaceuticals and personal care products (PPCPs) in HEC waters at ng/L levels. PPCPs can disrupt endocrine function, promote antibiotic resistance genes (ARGs), and cause adverse health outcomes in aquatic organisms and humans through exposure or consumption. Because PPCPs occur as complex mixtures, assessing their cumulative effects is challenging. This study applies nonmetric multidimensional scaling (NMDS) to identify persistent contaminant profiles representing PPCP mixtures across multiple years. Surface water samples were collected from 14 sites in or near the HEC in June 2022, May 2023, May 2024, and May 2025, expanding on Baker et al. (2022). Sites were selected based on proximity to anthropogenic influences such as tributaries. NMDS, beta dispersion, and PERMANOVA analyses were used to identify and compare PPCP contaminant groupings across the years. All data was log-transformed and standardized prior to Bray–Curtis distance calculation, clustering, and NMDS.

The 2025 ordination produced a low stress value (0.1), indicating a good fit. Beta dispersion was not significant, confirming homogeneity of variance, while PERMANOVA results were significant ( $F = 5.9$ ,  $R^2 = 0.52$ ,  $p = 0.001$ ), showing distinct contaminant clusters. Historical data (2022–2024) yielded similar outcomes (stress = 0.07,  $F = 13.10$ ,  $R^2 = 0.71$ ,  $p = 0.001$ ). Both datasets revealed recurring contaminant profiles associated with urban, agricultural, and upstream/intake sites, with an additional industrial cluster in earlier years. Consistent PPCP contaminant profiles provide a practical framework for environmental risk assessment. These profiles allow complex chemical mixtures to be represented by identifiable contamination types, informing health risk evaluations and management strategies for the HEC region.

**BIO:** Emma is a PhD student in Environmental Health at the University of Florida. Her research focuses on pharmaceuticals and personal care products (PPCPs), along with other contaminants of emerging concern, in aquatic environments and their health impacts. She is a Graduate Research Assistant in the Baker WATER Lab.

# Water Quality Risks and Phosphorus Retention in Florida Soils

*Lilit Vardanyan, Vimala D. Nair, and Paul DeHart*

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Phosphorus (P) is an essential nutrient for plant growth and crop production. However, its accumulation in agricultural soils can pose serious environmental concerns to water quality through runoff and leaching. Soil P retention depends on sorption and buffering capacities, which vary with soil type, mineralogy, organic matter and depth. These processes were assessed using Langmuir sorption isotherms to describe the equilibrium between soil-bound and solution P.

This study evaluates the P sorption in surface (0-15cm) and subsurface (15-30cm) soils from three research sites across Florida: Beef Research Unit (BRU) in Gainesville, Plant Science Research and Education Unit (PSREU) in Citra and North Florida Research and Education Center (NFREC) in Marianna. These sites represent three major soil orders found in the state, such as Spodosols, Entisols and Ultisols, respectively, each with distinct physicochemical properties that influence P retention and mobility.

Isotherm parameters including bonding energy ( $K_L$ ), maximum P sorption capacity ( $S_{max}$ ), equilibrium P concentration ( $EPC_0$ ), initial soil P ( $S_0$ ) and linear distribution coefficient ( $K_d$ ) were used to evaluate P retention potential. Analysis of these parameters revealed that soils from PSREU (Entisols) and BRU (Spodosols) had similar values for  $EPC_0$ ,  $S_0$  and  $K_d$ , while NFREC soils (Ultisols) characterized by higher clay content, demonstrated significantly higher values of  $S_0$ ,  $K_d$ ,  $S_{max}$ , and  $K_L$ , indicating a greater P retention capacity. The elevated  $K_L$  values suggest stronger P bonding energy, while the higher  $S_{max}$  reflects a larger pool of sorption sites. These results are consistent with the mineralogical differences among the soil types, with Ultisols generally containing more iron and aluminum oxides known to facilitate P retention.

Spodosols from BRU presented unique P dynamics, particularly in the subsurface horizon, where upward P movement was observed. This behavior, likely driven by fluctuating water tables and capillary action, complicates the prediction of P leaching and surface runoff risks in these sandy, poorly drained soils.

To complement the sorption data, soil P extraction tests were conducted, including Mehlich-3 P (M3-P), iron oxide strip P (FeO-P),  $H_3A$ -extractable P ( $H_3A$ -P) and water-soluble P (WSP). Across all sites, surface soils exhibited elevated P saturation levels, as indicated by high concentrations in all extraction methods. Although NFREC soils demonstrated relatively better P retention, overall retention was low across all sites, highlighting a potential for P loss. The integration of sorption parameters ( $S_{max}$ ,  $K_L$ ,  $EPC_0$ ,  $K_d$ ) with extractable P tests (M3-P, FeO-P,  $H_3A$ -P, WSP) and indices such as the P Saturation Ratio (PSR) and Soil P Storage Capacity (SPSC) provides a comprehensive framework for assessing P loss potential. This approach supports more informed nutrient management planning, aiming to enhance P use efficiency while mitigating water quality risks.

**BIO:** Dr. Lilit Vardanyan is a Biological Scientist at the University of Florida with over 20 years of international experience in soil science. Her research focuses on soil Biochemistry, phosphorus dynamics, and nutrient management in agricultural and wetland systems. She works on developing sustainable, science-based practices to enhance soil health, improve nutrient use efficiency, and reduce environmental impacts across diverse ecosystems.

## LANDSCAPE IRRIGATION RETROFITS AND WATER SAVINGS IN MIAMI-DADE COUNTY

*Laura Vasquez<sup>1</sup>, Jesus Lomeli<sup>2</sup>, Dalton Goolsby<sup>2</sup> and Patrick Martin<sup>3</sup>*

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Miami-Dade County, Florida's most populous region, faces growing strain on freshwater resources due to population growth, development, sea-level rise, and saltwater intrusion. To address these challenges, UF/IFAS Extension Miami-Dade County's Florida-Friendly Landscaping™ (FFL) Program partnered with the South Florida Water Management District (SFWMD) in 2006–2007. In 2008, a long-term collaboration with the Miami-Dade Water and Sewer Department (WASD) began. Together, they launched the Landscape Irrigation Rebate Program (LIRP) to promote outdoor water conservation through landscape and irrigation assessments, retrofit recommendations, and rebate incentives.

The program encourages property owners with in-ground irrigation systems to adopt water-efficient technologies based on UF/IFAS research. Participants who implement recommended retrofits receive rebates, supporting the transition to more sustainable irrigation practices. Over the past 16 years, the program has adapted to evolving technologies and community needs, producing measurable water savings across residential and commercial landscapes.

The most frequently adopted retrofits include converting mechanical irrigation systems to EPA WaterSense-labeled smart controllers, upgrading digital controllers to EPA-certified smart irrigation models, and replacing standard spray heads with multi-stream, multi-trajectory (MSMT) nozzles. UF/IFAS shows these technologies can reduce outdoor water use by 70–90% during normal rainfall and by 30–40% in dry periods. Proper installation, accurate programming, and site conditions remain key to achieving optimal results.

Program growth has been driven by partnerships with irrigation contractors, rebate promotions, and community education. These outreach efforts strengthen public awareness of water-efficient practices and reinforce the importance of behavioral and technological solutions working together.

As Miami-Dade continues to face climate and population pressures, programs like LIRP offer a replicable model for integrating education, infrastructure, and environmental stewardship. By aligning incentives with proven research-based practices, the county advances sustainable water management and builds long-term community resilience.

**BIO:** Laura Vasquez has served UF/IFAS Extension Miami-Dade County for over 20 years and became the Residential Urban Horticulture Agent and Master Gardener Coordinator in 2020. She holds a B.A. in Education and is pursuing an M.S. in Agricultural Education. Certified in Florida-Friendly Landscaping™, Florida Water Star, and GI-BMPs, she helped launch the Landscape Irrigation Rebate Program to promote water-use efficiency across diverse audiences.

## **BRIDGING THE CIVIC GAP: ENGAGING STUDENTS IN GULF COMMUNITIES IN FLORIDA'S WATER CHALLENGES**

*Rebecca Burton*<sup>1</sup>, *Marianne Vernetson*<sup>2</sup>

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Florida's future depends on how well we understand, manage, and protect our waters. Yet decisions about water use, restoration, and resilience often unfold without broad civic participation or public understanding. The Bob Graham Center for Public Service at the University of Florida seeks to bridge this gap by preparing students to connect science, policy, and civic action—especially in the Gulf region, where the impacts of water challenges are most visible.

Founded by former Florida Governor and U.S. Senator Bob Graham in 2006, the Center equips students with the civic knowledge, and practical skills needed to address issues at the intersection of people, policy, and place. Through interdisciplinary coursework, public programming, and experiential learning, the Center prepares students to be informed citizens who can translate theory into action and strengthen Florida's civic capacity.

The **UF Gulf Scholars Program**, housed at the Center, exemplifies this mission. Supported by the National Academies' Gulf Research Program, it prepares students to address coastal challenges through five thematic "Gulf Streams" including Policy and Advocacy. Students complete Gulf-focused coursework, community-engaged learning, and a capstone Gulf Impact Project, which range from studying sea-level adaptation to documenting cultural resilience in coastal towns, turning classrooms into laboratories for civic problem solving.

Through Gulf Scholars and related civic engagement initiatives, the Center empowers students to engage in public discourse and practices that make complex water issues accessible to broader audiences. Collaborations with NGOs and governments give students firsthand experience in how policy decisions shape environmental outcomes. Through these collaborations, the Center advances Governor Graham's belief that effective government begins with citizens who are engaged, informed and inspired to "do the most good for the most people." The Center's work demonstrates how universities can integrate civic learning with environmental education to strengthen democratic participation in water governance.

**BIO:** Marianne Vernetson, MPA is senior lecturer and interim director, Bob Graham Center for Public Service with 20+ years of experience in organizational management and economic development. Rebecca Burton, MS is lecturer and program coordinator, UF Gulf Scholars. Both are skilled at building and sustaining cross-organizational and cross-functional partnerships.

# From Loopholes to Landscapes: Legal Pathways for Water Resilience

**Valentina Wagner**

University of Florida, Gainesville, FL, USA

Water governance in Florida presents both legal and ecological challenges, where questions of allocation, scarcity, and resilience directly impact agricultural production, community well-being, and ecosystem restoration. This poster investigates how freshwater and groundwater systems are governed in Palm Beach County, one of Florida's most productive agricultural regions and also one of the most vulnerable to climate change, sea level rise, and rapid urban growth. The project combines a literature review, legislative review, and jurisprudential analysis to examine how statutes, regulatory frameworks, and case law influence the trajectory of water management in agricultural landscapes.

The literature review situates Florida's water governance within broader sociological and environmental debates, highlighting how water scarcity and competing claims are increasingly framed as not only hydrological but also socio-legal issues. Scholarship on resilience, institutional lock-in, and adaptive governance provides the theoretical foundation for analyzing how law interacts with environmental change.

The legislative review focuses on state and federal statutes that shape agricultural water use and restoration policy. Florida's long-standing protections for agriculture, coupled with regulatory exemptions and entrenched water rights, demonstrate how law can stabilize farming systems while simultaneously creating rigidity that complicates restoration and adaptation.

The jurisprudential review examines relevant Florida case law and administrative rulings that interpret water rights, land use, and environmental protections. These decisions illustrate how courts mediate conflicts between agricultural stakeholders, environmental advocates, and urban constituencies, setting precedents that define the balance between human needs and ecological priorities.

Findings indicate that policies designed initially to secure agricultural productivity often "lock in" water use patterns that are difficult to reconcile with restoration goals. As climate pressures intensify and sea level rise threatens freshwater supplies, these legal arrangements can undermine resilience by privileging short-term stability over long-term adaptability. At the same time, court rulings reveal growing recognition of the need to treat water as both a private entitlement and a shared public good.

By integrating insights from law, policy, and sociology, this research reframes water governance as a socio-legal process at the heart of Florida's future. The poster emphasizes that achieving equitable and sustainable water outcomes will necessitate adaptive governance that balances agricultural needs with ecosystem restoration, incorporates community perspectives, and revises legislative and judicial tools to promote resilience across both human and ecological systems.

**BIO:** Valentina Wagner is a Ph.D. student in Sociology at the University of Florida. Her research explores sustainable farming, water governance, and ecosystem resilience in Florida. A qualified lawyer in Colombia and solicitor of England and Wales, she bridges law, policy, and community to advance equitable and sustainable water futures.

# Environmental Performance Metric Evaluation for Master Water Plan Feasibility Studies

*Nisai Wanakule<sup>1</sup>, Jeffrey Geurink<sup>2</sup>, Hui Wang<sup>2</sup> and Tirusew Asafa<sup>2</sup>*

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<sup>2</sup>Tampa Bay Water, Clearwater, FL, USA

Tampa Bay Water, a wholesale water supply utility in West Central Florida, is completing feasibility studies for potential water supply projects to support its Long-term Master Water Plan Update. One of the potential projects focuses on increasing groundwater production at the Consolidated Permit Wellfields. GSI Environmental and Tampa Bay Water are applying a stochastic operations model to evaluate the project's environmental sustainability. The model assesses operational reliability under multiple sources of uncertainty, including projected demands and climate variability, using integrated gage and radar rainfall data.

This paper presents methods based on a Reliability, Resiliency, and Vulnerability (RRV) framework to evaluate Environmental Performance Metrics (EPMs). The analysis focuses on monitor well water levels, streamflow, and spring flow in relation to their Minimum Flow and Level (MFL) criteria. Applications of these methods to model outputs are demonstrated, and the role of EPMs in assessing environmental sustainability is explored.

**BIO:** Dr. Wanakule has over 40 years of experience in applying optimization and system engineering analysis to water resources planning and supply operations management. He was a Lead Water Resources Engineer at Tampa Bay Water before he retired and joined GSI.

# MACHINE LEARNING-BASED TIME-SERIES FORECASTING OF WATER QUALITY DYNAMICS IN A DRAWDOWN LAKE

*Alexander Wang*<sup>1</sup>, *Ming Ye*<sup>2</sup>, *Wei Mao*<sup>2</sup>

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<sup>2</sup>Florida State University, Tallahassee, FL USA

Lake Munson, a eutrophic lake in Leon County, Florida, underwent a complete drawdown between November 1, 2022, and May 17, 2024, in an effort to mitigate algal blooms driven by elevated concentrations of chlorophyll-a, nitrogen, and phosphorus. As part of a connected watershed, excess nutrient runoff from Lake Munson has potential downstream effects on nearby water bodies such as Ames Sink and Wakulla Springs. Although the city commission has reported that the drawdown successfully restored the lake, residents continue to report signs of eutrophication. This study conducts a comprehensive time-series analysis of Lake Munson's water quality parameters—specifically total nitrogen, total phosphorus, total suspended solids, and chlorophyll-a—across pre-drawdown and post-drawdown periods. A hybrid machine learning framework was developed to forecast and analyze temporal trends in these parameters using limited observational data. To address sparse quarterly sampling, linear interpolation was applied to generate daily estimates, supplemented with rainfall data to evaluate external hydrological influences. Model performance was assessed using root mean square error (RMSE) between forecasts and observed data. The results aim to provide an improved understanding of post-drawdown water quality dynamics in Lake Munson and to demonstrate the potential of machine learning methods for forecasting ecological recovery in data-limited aquatic systems.

**BIO:** Alexander Wang is a current high-school senior looking to pursue a career in data science/artificial intelligence. He has done multiple machine learning projects from natural language processing to spatiotemporal forecasting.

# **A Review of *In SITU* PFAS TREATMENT TECHNOLOGIES IN GROUNDWATER AND SOIL**

***Dengjun Wang and Chongyang Wang***

University of Florida, Gainesville, FL, USA.

Per- and polyfluoroalkyl substances (PFAS) have become widespread in global water and soil, including groundwater and vadose zone soil. Consequently, developing technologies that can remediate PFAS pollution in groundwater and vadose zone soil is crucial, especially with respect to *in situ* remediation strategies. Colloidal activated carbon (CAC) has emerged as one of the few adsorbents that can effectively immobilize PFAS in groundwater and vadose zone through in situ adsorption. This presentation will provide state-of-the-art knowledge of CAC-enabled in situ remediation for PFAS-impacted groundwater and soil, including technology feasibility, effectiveness, efficiency, and longevity. The adsorption mechanisms of CAC for different types (short-chain and long-chain) of PFAS will be discussed to evaluate technology effectiveness and efficiency. Significant efforts will be devoted to predicting the longevity of CAC-based barriers for treating PFAS plumes in groundwater, with an emphasis on modeling approaches and field observations. Key factors affecting technology longevity will be identified, including PFAS type and mass flux, groundwater chemistry, hydrogeologic variation, CAC distribution, and competitive sorption from co-contaminants and dissolved organic matter. Issues on how nonuniform distribution, migration, and potential loss of CAC affect CAC barrier continuity and PFAS breakthrough will be discussed. Finally, challenges and future directions of using CAC for in situ site remediation will be highlighted.

**BIO:** Dr. Wang is an assistant professor in the Department of Agricultural and Biological Engineering at the University of Florida. Dr. Wang's research group focuses on the fate, transport, and remediation of emerging contaminants, including PFAS, in the subsurface environment.

## **Assessment of Future Need: Timing and Quantity of New Supply Infrastructure Investments**

*Hui Wang, Tirusew Asef, and Fikadu Getachew*

Tampa Bay Water, Clearwater, FL USA

Increasing water demand driven by socio-economic growth requires water supply utilities to expand supply infrastructure, yet the timing and magnitude of these investments have inherent uncertainty. Tampa Bay Water, a regional wholesale water utility on the west coast of Florida, has developed a reliability-based planning framework to identify when and how much to invest in new water supply infrastructure. The framework integrates probabilistic demand projections, stochastic streamflow generation, Latin Hypercube Sampling representing joint uncertainty in supply and demand, a daily mixed-integer optimization of system operations, and post-optimization performance evaluation. Widely used industry metrics, including annual reliability, probability of unmet demand, and water shortage magnitude, are used to assess system performance under alternative futures. Demand projections for 2026–2055 reflect socio-economic growth and climate signals inferred from historical statistics. The mixed-integer program minimizes operating costs subject to operational constraints and preferences (e.g., withdrawal permit limits, facility capacities, and production priorities). A baseline scenario reflects current infrastructure and permit limits; a few alternative scenarios to be presented examine increased permitted groundwater production at different magnitudes. The framework quantifies the reliability benefits of expanded groundwater production. More broadly, the approach links long-term uncertainty to day-to-day operations in a transparent, risk-informed process that supports defensible, timely capital planning for water supply systems.

# The Influence of Dissolved Organic Carbon on Water Quality in Florida Springs and Groundwater

*Katherine Wardinski<sup>1</sup>, Lindsey Cromwell<sup>2</sup>, Madison Flint<sup>3</sup>, Katie Glodzik<sup>1</sup>, Darlene Saindon Velez<sup>1</sup>, Jonathan Martin<sup>3</sup>, and Matthew Cohen<sup>1</sup>*

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<sup>3</sup>Department of Geological Sciences, University of Florida, Gainesville, FL, USA

The Floridan Aquifer is one of the most productive aquifers in the world, providing water supply to over 10 million people in the southeastern United States and serving as the water source for Florida's numerous spring ecosystems. However, there has been a visible decline in ecological conditions and water quality in the springs over the past 30 years, and this has been attributed to declines in dissolved oxygen (DO) at the spring vents. Concurrently, human activities impact water recharge and flow within the Floridan Aquifer System (i.e., water usage demands, land use change). The link between water recharge inputs, aquifer processes along water flow paths, and water quality variability at the spring vents is not well constrained. For example, dissolved organic carbon (DOC) loading during aquifer recharge fuels microbial respiration which consumes oxygen and contributes to aquifer weathering through the production of carbonic acids. Further work is needed to understand the role of DOC on DO and other water quality indicators within the Floridan Aquifer and springs. We synthesized the spatial and temporal variability of DOC across Florida springs and groundwater using a comprehensive statewide water quality dataset. This data set contains DOC monitoring observations for 650 spring and 4,390 groundwater sampling locations compiled from the Florida Water Management Districts, the Florida Department of Environmental Protection, the U.S. Geological Survey, and local county agencies. Preliminary results suggest that in both springs and groundwater, DOC has higher spatial variability relative to temporal variability. Groundwater collected in recharge areas that may contribute water to springs typically had higher mean DOC than spring water samples, indicating the potential for carbon processing along aquifer flow paths. These results are poised to inform water resource management efforts to protect water quality and ecosystem health in springs and the Floridan Aquifer System.

**BIO:** Katherine (Katie) Wardinski recently joined the UF Water Institute as a postdoctoral researcher after completing her Ph.D. in Biological Systems Engineering at Virginia Tech. Katie's research blends hydrology, biogeochemistry, and soil science to inform water resource management.

# A Novel HPLC–GIS Framework for Tracking Septic Tank Leachate Using Caffeine as a Biomarker

**Alex J. Webster**<sup>1,2</sup>

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<sup>2</sup>Ocean Research & Conservation Association, Vero Beach, FL, USA

Monitoring septic tank contamination often relies on anthropogenic tracers such as sucralose and acetaminophen. However, both compounds present critical limitations: sucralose exhibits rapid dilution in aquatic environments and partial degradation under photolytic and microbial processes, whereas acetaminophen is highly labile, undergoing rapid attenuation, frequently dropping below detection limits within days. These constraints reduce their reliability as long-term tracers of septic effluent.

This study advances a novel approach by employing caffeine as a robust and universally applicable biomarker. Caffeine is consistently consumed worldwide, exhibits minimal natural occurrence, and demonstrates high chemical stability in aquatic systems, with degradation driven primarily by microbial and photolytic pathways over decadal timescales. Its distinct molecular structure facilitates separation from environmental organic matter, making it an ideal candidate for tracking leachate. This study demonstrates the application of ultraviolet (UV) absorbance spectroscopy, coupled with high-performance liquid chromatography (HPLC) and geographic information system (GIS) mapping, to detect caffeine as a tracer of septic tank leachate in the Indian River Lagoon (IRL), Florida.

Water samples were collected across septic-influenced, sewer-connected, and natural sites. Samples were filtered and analyzed at 274 nm to quantify caffeine absorbance, with GIS used to resolve spatial contamination gradients. One-way ANOVA and Tukey-Kramer post hoc tests were applied to assess statistical differences in caffeine concentrations among site types. Results revealed maximum caffeine absorbances exceeding 0.029 AU in enclosed residential canals adjacent to dense septic clusters, moderate values (0.0076–0.018 AU) in semi-enclosed canals, and negligible levels (<0.001 AU) in open water. Statistical analysis confirmed significant differences among septic, sewer, and natural environments ( $p < 0.05$ ).

These findings establish caffeine as a superior tracer compared to conventional biomarkers, while demonstrating the effectiveness of a novel HPLC–UV–GIS framework for environmental monitoring. This cost-effective, reproducible approach offers strong potential for community-scale assessments of leachate impacts in vulnerable coastal systems.

**BIO:** Alex Webster is an undergraduate student researcher with more than 5 years of experience in ecotoxicology, seagrass ecology, and aquatic biochemistry. He has extensive experience leading interdisciplinary research with multiple institutions related to PFAS, HPLC/GC-MS, PCR, and ELISA. His work continues to advance coastal conservation within the Indian River Lagoon.

# LONG-TERM URBAN WATER DEMAND FORECASTING: A BAYESIAN HIERARCHICAL APPROACH

*Fikadu Welidehanna, Tirusew Asefa, Solomon Erkyihun, and Hui Wang*

Tampa Bay Water, Clearwater, FL, USA

Reliable forecasting of urban water demand is vital for utilities facing rapid population growth, climate variability, and shifting socio-economic conditions. In this study a potential application of a Bayesian Hierarchical Modeling (BHM) framework is explored to forecast urban water demand in the Tampa Bay region through 2056. Multiple data sources, including billing records, socio-demographic data from the American Community Survey (ACS), regional economic and population projections from Moody's Analytics, Bureau of Economic and Business Research (BEBR), and climate indicators such as rainfall and temperature are used during the exploratory data analysis. By modeling demand across Water Demand Planning Areas (WDPAs), the BHM allows one to accommodate spatial variation across larger scales (e.g., price of water at county or city water service areas) while leveraging statistical strength across smaller geographical resolutions such as Traffic Analysis Zones (TAZs) and block groups level data for certain variables (e.g., income). Moreover, the approach generates probabilistic forecasts, quantifying uncertainty in parameters, scenarios, and outcomes, which will allow the implementation of risk-informed infrastructure planning. Initial results of the BHM framework will be presented.

**BIO:** Fikadu Welidehanna is a water resources engineer at Tampa Bay Water focused on long-term water demand forecasting (LTWDF) and hydro-climatological analytics. He implements Bayesian and machine-learning models to make LTWDF more robust and to support reliable, optimized potable-water operations.

## Stakeholder Perspectives on Advancing Water-efficient Landscapes in Florida

*Ondine Wells<sup>1</sup> and Yilin Zhuang<sup>2</sup>*

<sup>1</sup>University of Florida, Ocala, FL, USA

<sup>2</sup>University of Florida, Apopka, FL, USA

Florida's population, now exceeding 23 million, continues to grow rapidly, placing increasing pressure on limited freshwater resources. Regional water supply plans project that the public water supply demand will grow by 24% from 2020 to 2040, equivalent to an increase of 612 million gallons per day. Residential landscape irrigation can account for 50–70% of household water use, making the adoption of water-efficient landscapes a critical conservation strategy. Installing and maintaining these landscapes requires a coordinated approach that engages all stakeholders, including nursery growers, turf producers, builders, developers, landscape architects, irrigation professionals, and homeowners. Researchers engaged these stakeholders to better understand the barriers and opportunities to implementing water-efficient landscapes in Florida.

Between October 2024 and August 2025, twelve key informants participated in in-depth interviews, five virtual focus groups engaged twenty participants, and surveys captured insights from 31 growers. A socio-ecological model (SEM) was developed to articulate the relationships between stakeholders, pinpoint where key stress points occur, and identify elements that stakeholders believe are most critical to achieving water savings.

Stakeholders share a holistic view of water-efficient landscapes as integrated systems involving plant choice, irrigation design and maintenance, soil quality, aesthetics, and ecological function. However, significant challenges persist, including high upfront costs, limited availability of drought-tolerant plant materials, regulatory inconsistencies, mismatched landscape expectations, and lack of professional licensure or training. The establishment period for new landscapes emerged as a key challenge, impacting stakeholders in all phases of landscape development. Older communities face additional hurdles, such as aging irrigation systems, mature landscapes, and entrenched landscape preferences.

Opportunities for progress include developing drought-tolerant turf and groundcover cultivars, increasing native plant production, improving soil health practices, expanding irrigation training, and leveraging technologies such as digital water metering and water budgeting. Stakeholders identified several elements that were most often present in communities that had achieved water savings through landscape initiatives. Many stakeholders participating in the focus groups valued the opportunity to hear perspectives from professionals in other sectors and expressed a desire for continued cross-disciplinary dialogue.

Findings will be used to further research and to develop educational resources on best practices through the University of Florida Extension.

**BIO:** Ondine Wells is the Water Resources Extension Agent for UF/IFAS Marion County and a PhD student in Interdisciplinary Ecology at the University of Florida. Yilin Zhuang is a Regional Specialized Agent focusing on integrated water resources management.

## **Broward Basins C&SF Flood Resiliency Project (Section 203) Alternatives and Comprehensive Benefits**

**Walter Wilcox**<sup>1</sup>, **Carolina Maran**<sup>1</sup>, **Carol Ballard**<sup>1</sup>, **Michael Tadesse**<sup>2</sup>, **Katie Magoun**<sup>3</sup>, **Eli Brossell**<sup>1</sup>, **Hongying Zhao**<sup>1</sup>

<sup>1</sup>South Florida Water Management District, West Palm Beach, FL, USA

<sup>2</sup>Hazen and Sawyer, Tampa, FL USA

<sup>3</sup>Tetrattech, Baton Rouge, LA, USA

The South Florida Water Management District (SFWMD) has led the Broward Basins Flood Resiliency Study to identify proposed improvements to the primary Central & South Florida (C&SF) water management system originally authorized in 1948 and built decades ago. While this system has performed admirably and well beyond its original design considerations and project life, change conditions stemming from land use evolution and sea level rise stressors necessitate an investigation into water infrastructure improvements. Under the Section 203 Authority of the Water Resource Development Act of 1986, the SFWMD advanced a feasibility study that proposes significant changes in the form of gravity spillway expansion, forward pump construction, canal conveyance enhancements and operational refinements to the primary water management system in Broward County.

The study utilized a calibrated and validated integrated surface water and groundwater MIKE SHE / MIKE HYDRO model to simulate existing and future (2085) conditions. Several scenarios were developed to simulate different combinations of rainfall, storm surge, sea level and groundwater conditions. Across this broad range of conditions, several adaptation strategies were modeled, and these alternatives were compared to each other and to the “no action” condition with a set of comprehensive benefit evaluation tools. These tools evaluated not just hydrologic changes, but also economic damages both directly to damaged infrastructure and also stemming from traffic/business interruption, etc... Additionally, other environmental, social & cultural effects were evaluated. All these results were comprehensively compiled, vetted by subject matter experts and discussed with the public through several in-person and virtual meetings. Results of this open and technically robust planning effort concluded with the identification of a recommended set of infrastructure improvements that will be considered for federal authorization in 2026.

**BIO:** Walter Wilcox, P.E. is Chief of the Water Resources & Systems Modeling Bureau at the South Florida Water Management District. Walter oversees development and application of hydrologic, hydraulic, hydrodynamic and water quality computer models used for planning Everglades Restoration and Coastal Resilience infrastructure and operations in South Florida.

# Texas-sized Resilience: How Galveston's Smart Water Network Endured Hurricane Beryl

**Patrick Williamson, PMP, MBA**

Senior Solution Architect, Badger Meter, Orlando, FL, USA

In recent years, the City of Galveston has endured multiple natural disasters, including the 2021 deep freeze, which had a devastating impact on infrastructure and, in turn, its ability to manage operations effectively. While devastating at the time, these events ultimately led to changes in the way the City prepared for and operated its Water Utility through the deployment of several smart water solutions.

Following the deep freeze of 2021, Galveston developed a strategic plan to upgrade several aspects of its distribution system, which included a comprehensive meter replacement program and the integration of cellular-based advanced metering infrastructure (AMI). This upgrade included ultrasonic meters equipped with enhanced features, one of which was a remotely controlled flow restriction valve in residential meters. In addition to flow measurement, each meter also collects data on pressure and temperature. The ability to monitor system-wide pressure and remotely restrict flow to its approximately 29,000 meters allows Galveston to manage its distribution dynamically during events.

Galveston implemented strategically placed, intelligent pressure sensors along its 32-mile coastline to further enhance system monitoring. High-frequency pressure sensors provided increased visibility into pressure conditions while improving the city's ability to manage water demand fluctuations and stabilize pressure during storms.

Multi-parameter water quality monitoring stations revolutionized Galveston's approach to water quality management. The water quality stations provided a more detailed and accurate picture of water quality while minimizing the time required from personnel to monitor distribution system conditions through manual sampling methods. The combination of this sensor data with data collected through the AMI and SCADA system contributed significantly to operational resilience, enabling Galveston to understand the best ways to manage its system. However, when power is lost on the Island, which is frequent, these battery-powered water quality stations are often the only source of water quality data.

In July 2024, when Hurricane Beryl and tornadoes struck Galveston, the City depended on these technologies to maintain control of its distribution system. Throughout the storm, Galveston relied on its distributed cellular and battery-powered solutions when power was lost for hours at a time. Leveraging these solutions in post-storm recovery was equally important. With the activation of the flow restriction valves through their AMI system, operators were able to identify areas with the highest potential of leaks, allowing them to be strategic in their movements. The high-frequency pressure sensors enabled the detection of leaks and facilitated pressure management, allowing for new pumping schemes ensuring compliance. Distributed water quality stations were continuously monitored through the storm to ensure water quality standards were being met.

**BIO:** Patrick Williamson is a Senior Solution Architect for Badger Meter, helping water utilities in the southeastern U.S. implement smart water solutions. With over 20 years of experience in technology leadership across multiple industries, he brings expertise in IT, project management, and technology integration. Patrick holds a bachelor's in Management Information Systems, a Master's in Business Administration from the University of Central Florida, and a PMP® certification.

## Operation TRAP – Using Interceptor Devices for Trash Reduction in Florida’s Aquatic Preserves

*Monica Wilson, Ph.D.<sup>1</sup>, Savanna Barry, Ph.D.<sup>1</sup>, and Laura Reynolds, Ph.D.<sup>2</sup>*

<sup>1</sup>UF/IFAS Nature Coast Biological Station, Cedar Key, FL, USA

<sup>2</sup>University of Florida Soil, Water, and Ecosystem Sciences, Gainesville, FL, USA

The U.S. is the number one producer of plastic waste globally and mismanages 1.13 and 2.25 million tons of plastic annually. Data indicates that 0.51-1.5 million metric tons of plastics end up in U.S. coastal environments, where stormwater drainage systems are a primary conduit for the delivery of litter to coastal waters. Our team has partnered with local governments (Pasco County, City of Cedar Key) and state Aquatic Preserve systems in the Big Bend and Nature Coast region of Florida’s Gulf Coast to implement Operation TRAP – Trash Reduction for Aquatic Preserves. Litter interception technologies such as storm drain traps, boom catchment devices, and monofilament tubes installed in municipal areas are designed to catch debris before entering coastal waterways. Locations for storm drain traps were determined by characterizing debris hot spots based on storm drain work order history and sites with direct input into the marine waters were prioritized. As of today, we have installed 26 storm drain traps, 4 booms, and monitor 12 monofilament tubes. Interceptor devices are cleaned out once a month. Data regarding debris collected is recorded by type and quantity, including weight of total debris collected and weight of debris sorted by category. As of September 2025, we collected ~1,830 lbs. of trash in the boom catchment devices, ~13,000 pieces of large debris in the storm drain traps, and 17.5 lbs. of fishing-related debris in the monofilament tubes. By intercepting debris at known litter concentration points, we are increasing the efficiency of litter collection efforts, reducing the risk of wildlife entanglement or ingestion, and improving the socio-economic value of the coastal areas by improving aesthetic value. All data is shared through the Operation TRAP website, education and outreach opportunities, with the Ocean Conservancy’s International Trash Trap Network, and local government entities and land/resource managers to further steer decision making regarding litter management and single use items. At the end of the project, a municipality toolkit will be produced that will contain answers to frequently asked questions, Florida-specific information, and local government points of contact that will encourage other local governments to implement similar approaches in their communities.

**BIO:** Dr. Wilson is the Coastal Debris Project Coordinator for Operation TRAP. She oversees all aspects of the project which focuses on prevention, removal, and research of common debris entering Florida’s Gulf Coast Waterways. She coordinates deployment, maintenance, and data collection of litter catchment devices.

## **Aligning Data with Purpose: Southwest Florida Water Management District's Data Governance Journey**

*Sandie Will, Catherine Wolden, and Robin Speidel*

Southwest Florida Water Management District, Brooksville, FL, USA

Strategic alignment of data collection activities is essential to support effective decision-making. To ensure the optimal use of its data collection resources, the Southwest Florida Water Management District (SWFWMD) has implemented a data governance framework. This presentation will provide an overview of SWFWMD's data governance process, including the key drivers that led to its development, as well as the policies, roles, and workflows that are now in-place to guide data collection efforts. It will also touch on how the SWFWMD's governance model promotes collaboration between technical and business units, enhances data quality, and aligns with broader organizational goals. By sharing lessons learned and key milestones, this session aims to inform other agencies and entities in developing or refining their own data governance strategies.

**BIO:** Catherine is the Manager of the Water Quality Monitoring Program at the Southwest Florida Water Management District. She has over 20 years of experience implementing and managing water quality monitoring projects. Her areas of expertise include surface water quality monitoring design, data management, quality assurance and interagency coordination. She is also actively involved in statewide initiatives to improve data sharing and collaboration among water resource agencies.

# A SPATIOTEMPORAL ASSESSMENT OF URBANIZATION AND CYANOBACTERIA PROLIFERATION IN POLK COUNTY

*Savanna Wooten, Matthew N. Waters*

Auburn University, Auburn, AL, USA

Polk County is the ninth most populous and fastest growing county in Florida. Additionally, the county contains over 300 lakes, roughly a quarter of which are impaired. Efforts to mitigate nutrient loading and ensuing eutrophication in these systems range from chemical (e.g., alum treatment) to physical (e.g., sediment dredging) to natural (e.g., rain garden construction, stormwater retrofits) with mixed results. Here, we combine results from a paleolimnological study of Lakes Parker and Howard spanning the last ~150 years with results from a surface sediment inventory of 19 urban lakes throughout Polk County to understand urban-specific drivers of pollutant loading and algal community change in both managed and unmanaged systems. We leverage a biogeochemical dataset including measurements of heavy metals and nutrients with the primary producer biomarkers of photosynthetic pigments and cyanotoxins as response variables. From the paleolimnological dataset, we find that nutrient loading, primary producer increases and cyanobacteria dominance happen contemporaneously between the two unconnected lakes. Further, the onset of persistent cyanobacteria dominance in both lakes occurs around 2000 CE, following decades of nutrient loading and subsequent management and policy efforts. In the surface sediment dataset, impervious surface cover is most strongly correlated with the pigment aphanizophyll ( $R^2 = 0.622$ ), representing N-fixing cyanobacteria. Across these two datasets, both cyanobacteria and aphanizophyll dominance correspond with declines in N/P. Collectively, these results underscore the challenges inherent in managing urban systems and the unique impacts conferred by urban-associated infrastructure.

**BIO:** Savanna Wooten is a PhD candidate at Auburn University. Her graduate work is focused on the relationship between urbanization and water quality, relying heavily on lake sediments from Polk County, FL. She has also held environmental roles in the private, government and non-profit sectors.

# SWOT Satellite Observations of Reservoir Storage Declines from Sedimentation

*Fangfang Yao<sup>1</sup>, J. Toby Minear<sup>2</sup>, Balaji Rajagopalan<sup>2</sup> and Shawn Landry<sup>1</sup>*

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<sup>2</sup>University of Colorado Boulder, Boulder, CO, USA

Reservoirs provide important socioeconomic functions that sustain water, food, and energy security and reduce the risk of flooding. Reservoir storage capacity is steadily being lost to sediment trapped in the reservoir, undermining the associated benefits to society. In the United States, model estimates suggest that reservoir storage per capita has declined by 35% over the past 50 years as a combined result of sedimentation and population growth. The reduction in reservoir capacity due to sedimentation is expected to increase with time without a substantial reworking of reservoir operating rules and policy to allow for sediment management. Our knowledge of reservoir sedimentation rates and trends is limited due to the expense of sedimentation surveys and challenges in modeling sediment deposits in reservoirs. Satellites can capture sediment deposits through repeated observations of reduced inundation areas to sediment at different water levels and have been utilized for estimating sedimentation rates for dozens of reservoirs. In this presentation, we will show new opportunities from NASA's recent mission, Surface Water and Ocean Topography (SWOT), to estimate sedimentation rates using a novel and generic method. This work is highly relevant to sustainable water resources management given that sedimentation is a major factor impacting reservoir capacity for which we are increasingly dependent for controlling and managing water resources under climate extremes.

**BIO:** Dr. Yao is an assistant professor at the University of South Florida. He is specialized in hydrological remote sensing with major research interests in hydrologic extremes, trends and drivers of freshwater storage, and reservoir regulation and sedimentation. He has worked with colleagues from multiple disciplines and water practitioners on management.

# Hotspots of Coastal Groundwater Risk: Data–Model Synthesis of Response to Sea-Level & Climate Change

*Melika Yavari Nia*<sup>1</sup>, *Harald Klammler*<sup>2</sup>, *Michael Annable*<sup>3</sup>, *Alberto Canestrelli*<sup>4</sup> and *James W. Jawitz*<sup>1</sup>

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<sup>4</sup> Department of Civil and Coastal Engineering, University of Florida, Gainesville, FL, USA

Coastal groundwater systems are on the frontlines of climate change, facing compounded pressures from accelerating sea-level rise, shifting recharge patterns, and intensive human use. These interacting pressures threaten freshwater availability, elevate flood risk, and undermine the resilience of infrastructure and ecosystems in vulnerable coastal regions. Sea-level rise pushes groundwater upward, raising inland water tables while simultaneously driving saltwater intrusion from the coast.

In this study, we adopt a dual approach: long-term groundwater level observations provide empirical evidence of change, while a reduced-order model predicts groundwater table elevation and saltwater interface depth. The model conceptualizes the aquifer–ocean system as two vertically coupled reservoirs, consisting of a freshwater zone between water table and saltwater interface, and an underlying saltwater zone connected to the ocean. This allows capturing the essential dynamics of coastal groundwater response to changes in recharge and sea level.

We focused on long-term groundwater level records from coastal monitoring wells with multi-decadal continuous measurements from the USGS National Water Information System (NWIS). Analysis of these records revealed that most sites exhibit clear, discernible long-term trends in groundwater levels broadly consistent with regional sea-level rise and climate change, while a smaller subset shows weak or noisy signals likely influenced by anthropogenic disturbances such as local pumping or data discontinuities. To ensure reliable comparisons, sites with consistent, interpretable trends were categorized and prioritized for further analysis. These selected monitoring wells were compared with reduced-order model outputs that incorporated local climate conditions and site-specific hydraulic conductivity derived through recession analysis, enabling an integrated assessment of observed and modeled coastal groundwater response to sea-level rise.

This comparison not only validated the reduced-order framework but also clarified the mechanisms driving variability across different coastal settings. Finally, the validated model was applied to future sea-level rise scenarios to identify regions most at risk of water table rise and saltwater intrusion, highlighting geographic hotspots of vulnerability where adaptation measures are most urgently needed.

**BIO:** Melika Yavari Nia is a Ph.D. student in Soil, Water and Ecosystem Sciences Department at the University of Florida. Her research focuses on coastal groundwater response to sea-level rise and climate change, integrating long-term groundwater observations with the reduced-order model to predict water-table elevation and saltwater-interface depth in coastal regions.

## Analytical Prediction of Estuarine Salinity and Hysteresis

**Mohsen Yavary Nia**<sup>1</sup>, **Alberto Canestrelli**<sup>1</sup>, **Harald Klammler**<sup>2</sup>, **Michael D Annable**<sup>3</sup>, **Daniele Pinton**<sup>1</sup> and **James W Jawitz**<sup>4</sup>

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<sup>4</sup>University of Florida, Department of Soil, Water, and Ecosystem Sciences, Gainesville, FL, USA

Estuarine salinity is a critical determinant of water quality that influences habitat suitability, nutrient cycling, and the availability of freshwater for ecosystems and human use. Seasonal changes in freshwater inflow and tidal exchange strongly influence salinity, yet field observations show that the salinity-discharge relationship is not unique. Instead, estuarine salinity exhibits a time-lagged response to hydrologic forcing, forming hysteretic loops that reflect system memory and delayed adjustment. These nonlinear dynamics complicate the prediction of salinity extremes that affect aquatic populations and habitats, freshwater intakes for drinking, farming and industry, and coastal ecosystem health. This study introduces a transient reduced-complexity model that analytically predicts spatially averaged seasonal salinity while explicitly accounting for the time-dependent interaction between riverine and tidal discharges. Derived from water and salt mass conservation, the model incorporates a constant estuary size and variable river and tidal discharges to reproduce observed hysteresis loops. Application to 11 estuaries spanning diverse climatic and geomorphic settings demonstrates that the model accurately captures observed salinity variations and loop structures, with mean absolute errors below 2 psu. Results demonstrate that the maximum vertical loop size, a measure of hysteresis magnitude, scales positively with estuarine response time, highlighting the role of storage volume and mixing in regulating salinity variability. Estuaries with shorter response times approach steady-state behavior relatively fast, while larger systems exhibit pronounced transient delays and hysteresis. By linking hydrologic forcing, estuary size, and salinity variability, this framework provides a physically based and computationally efficient decision-support tool for managers and stakeholders. It can be used to anticipate seasonal salinity changes affecting aquatic species, drinking-water sources, and agricultural uses, and to guide sustainable ecosystem management under climate and sea-level-rise scenarios.

**Bio:** Mohsen Yavary Nia is a Ph.D. candidate in Civil and Coastal Engineering at the University of Florida. His research focuses on reduced-complexity modeling of estuarine salinity dynamics, providing a physically grounded framework to elucidate system memory, nonlinear responses, and implications for ecosystem processes and coastal water resource management.

## Correcting the Climate Conversation: What Drives Experts to Challenge Misinformation on Social Media?

*Masoud Yazdanpanah*<sup>1</sup>, *Maryam Tajeri Moghadam*<sup>2</sup>

<sup>1</sup>University of Georgia, GA USA

<sup>2</sup>Gorgan University of Agricultural Sciences and Natural Resources

Climate change is one of the greatest environmental and social challenges of the twenty-first century, posing profound consequences for ecosystems, food security, and sustainable development. In this context, social media play a dual role, as they can both enhance public awareness and contribute to the spread of misinformation about climate change. The dissemination of such information undermines trust in science, creates social confusion, and reduces participation in environmental actions. Although users have opportunities to correct misinformation, there is limited knowledge regarding the predictors of corrective tendencies, especially among experts. This study employs the extended Theory of Planned Behavior (TPB) to identify factors influencing agricultural extension experts' willingness to correct climate change misinformation on social media. Data were collected through a survey of 200 extension experts in Kohgiluyeh and Boyer-Ahmad province, located in southwestern Iran, and analyzed using structural equation modeling (SEM). The results showed that the constructs of attitude (instrumental and affective), injunctive norms, perceived behavioral control, and moral norms directly affected willingness to correct misinformation about climate change, while organizational support, beliefs, and values of self-transcendence and self-enhancement had indirect effects on experts' willingness. Organizational support emerged as the strongest predictor of behavioral willingness to correct misinformation. Overall, this study, by integrating cognitive and value-based factors, enhances the explanatory power of TPB in the context of climate misinformation correction, and provides valuable theoretical and practical evidence for designing effective communication and educational interventions, strengthening experts' corrective actions on social media, and improving crisis management.

**BIO:** Dr. Masoud Yazdanpanah. Specializing in conservation social science and evaluation, Masoud explores the human dimensions of sustainability. His work focuses on social acceptance of natural resource management and the evaluation of programs that drive environmental and societal change

## Long- and Short-Term Impacts of Lake Dry-Downs on Groundwater Geochemistry for a Sinkhole Lake

*Kyle Compare and Ming Ye*

Department of Earth, Ocean & Atmospheric Science, Florida State University, 1011 Academic Way, Tallahassee, FL, 32306

Lake Jackson in Florida, USA has experienced multiple lake dry-downs, in which the lake partially drained through sinkholes within the lakebed into the karstic Upper Floridan aquifer. This study focused on the lake dry-downs in 2021 – 2022 and investigated their impacts on groundwater geochemistry at a groundwater monitoring well about 5.6 miles (9 km) downgradient of the lake and at Wakulla Springs, a first-magnitude spring about 20 miles (32 km) downgradient of the lake. Major ion concentrations were measured for water samples collected at the lake, the monitoring well, and the spring throughout the dry-down occurrences to monitor hydrochemical changes over these events. Following the dry-down events, the hydrochemical facies at the monitoring well shifted from a calcium magnesium bicarbonate hydrochemical facies to a mixed type hydrochemical facies, followed by a return to the original hydrochemical facies within eight days. Notable shifts in ionic concentrations were marked by decreases in calcium and sharp increases in sulfate and fluoride, suggesting that a pulse of lake water diluted the calcium carbonate-rich aquifer water and transported ions from weathered minerals in a confining unit below the lakebed. These chemical impacts were not observed at Wakulla Springs, suggesting that the lake water was undetectable after flowing 20 miles (32 km) in the carbonate aquifer. This study showed for the first time in literature that, while lake dry-downs had notable short-term impacts on the water chemistry of karst aquifers, these impacts did not persist over long time periods or long distances.

**BIO:** Ming Ye is a Professor in the Department of Earth, Ocean, and Atmospheric Science at Florida State University (FSU). He received a Ph.D. degree in Hydrology from the University of Arizona in 2002, and joined FSU in 2007. He has extensive experience in numerical modeling, field investigation, and laboratory analysis.

# Application of Central Springs Model (CSM) in Spring MFL Evaluation in SWFWMD

**Hua Zhang**

Southwest Florida Water Management District, Brooksville, FL, USA

The Central Springs Model (CSM) is a groundwater flow model jointly developed in 2024 by the St. Johns River Water Management District (SJRWMD) and the Southwest Florida Water Management District (SWFWMD). Representing hydrologic conditions from 2005-2018, the model's steady-state and transient versions were rigorously calibrated to groundwater levels, river baseflow, spring flow, and lake leakage using a combination of a priori knowledge and automated procedures. Input from technical experts and stakeholders further enhanced the model's performance and applicability.

The CSM is a key tool for quantifying the impacts of groundwater withdrawals on aquifer water levels, river baseflows, and spring discharges in the northern planning region of SWFWMD. It supports regional water supply planning, minimum flows and levels (MFL) evaluations, and regulatory decisions. The model has been successfully applied to evaluate how current and future groundwater demands may affect MFLs established for first-magnitude springs (Rainbow, Crystal River/King Bay, Homosassa, Chassahowitzka, and Weeki Wachee) and the second-magnitude Gum Slough spring system. Simulations indicate that most of these spring MFLs will be met despite projected increases in withdrawals.

Model results predict that drawdown in the Upper Floridan Aquifer (UFA) will remain under one foot in most areas. However, greater impacts are anticipated in northeast Sumter and western Hernando counties due to concentrated public supply withdrawals. To mitigate these potential effects, targeted management strategies are being promoted, including enhanced monitoring, conservation, the use of reclaimed water, and the development of alternative water supplies.

**BIO:** Dr. Zhang is a chief hydrogeologist with more than 20 years of experience developing hydrologic and water quality models of groundwater and surface water. He has played key roles in developing regional models including CSM, EXFTX, INTB, DWRM, SWUCA, PRIM for planning and regulatory purposes.

## Improving Effectiveness and Efficiency of Hydrologic Modeling Using Multiple Spatial Scales

*Yu Zhang<sup>1</sup>, Jeffrey Geurink<sup>2</sup>, Kshitij Parajuli<sup>2</sup>, and Dingbao Wang<sup>3</sup>*

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The Integrated Hydrologic Model (IHM) dynamically couples HSPF with MODFLOW to simulate surface water and groundwater systems and their feedback. The IHM includes a subdomain and multi-scale modeling (SMSM) framework which is demonstrated through application of the Integrated Northern Tampa Bay (INTB) model. The INTB model is a well-calibrated regional application of the IHM. Decision-makers can employ the SMSM framework to improve efficiency and effectiveness of water resources management by both reducing simulation time and applying a spatial scale appropriate for the decision support needs. As a demonstration, the framework is applied to the ANCLOTE model which represents the Anclote River Watershed as a subdomain (3%) of the INTB model domain. The ANCLOTE model includes both large- and small-scale representations with groundwater boundary conditions derived from INTB model output. Simulations are conducted for both scales of the ANCLOTE model using historical inputs consistent with the INTB calibration and verification periods. Simulation results for flows, heads, and evapotranspiration within the Anclote River Watershed are compared and evaluated between the original single-scale INTB model and the ANCLOTE model, providing a comprehensive assessment of consistency and accuracy in multi-scale performance. The SMSM framework is expected to improve representation of dynamic hydrologic processes and to increase confidence in scenario evaluations by capturing local climatic, hydrologic, and physical differences. In particular, the framework is expected to better represent cross-scale groundwater–surface water interactions and to reduce boundary-condition uncertainties when scaling down. The framework preserves transferability of calibrated parameters across scales and supports more targeted evaluation of resource management alternatives. By integrating subdomain detail with regional system context, the SMSM framework can advance assessments of water supply and ecosystem sustainability, wellhead protection zones, and the impacts of sea-level rise and climate change on water resources in study regions.

**BIO:** Dr. Yu Zhang is a Civil Associate in Water Resources at Michael Baker International. She has five years of experience using the Integrated Hydrologic Model (IHM) to quantify anthropogenic and climate impacts on hydrology. Her current work focuses on hydrologic modeling to support stormwater management and resilience planning.

## Biochar Adsorption of PFAS, with Emphasis on Biosolid Biochar

**Andrew R Zimmerman**<sup>1</sup>, *Nishika Samarakoon*<sup>1</sup>, *Erlend Sørmo*,<sup>2,3</sup> *Hans Peter H. Arp*<sup>2,4</sup>, *Nicolas Estoppey*<sup>2</sup>, *Aleksandar I. Goranov*<sup>5</sup>, *Gerard Cornelissen*<sup>2,3</sup>

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<sup>5</sup>Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, USA

Biochar is produced by the incomplete combustion of biomass in an oxygen-limited environment (pyrolysis). It can have both hydrophilic and hydrophobic functional groups, a heterogeneous porous structure and large surface area that can bind pollutants including in PFAS in contaminated soil. Application of biochar to soil has the sustainable side effect of providing long term carbon storage, which in turn counteracts climate change, and increasing soil fertility.

Over the past five years, we have carried out adsorption experiments to determine the effectiveness of biochar of various types in reducing PFAS leaching from soils, and the mechanisms and controls of PFAS adsorption. This talk presents an overview of our findings which include: 1) An amendment of 20% biochar reduces PFOS leachate concentration by 86% in low TOC soil but is less effective in high TOC soil. 2) Effectiveness of PFAS sorption is greater for sewage sludge biochar than wood-based biochar and similar to activated carbons. 3) The PFAS adsorption ability of biochar increases proportionally with PFAS-fluorocarbon chain length, demonstrating the role of hydrophobic interactions in reduction of PFAS leaching. 4) Reduction in PFAS leaching by biochar is proportional to its activation degree and temperature and can be predicted by its condensed aromatic carbon content. 5) PFAS sorption capacity is linked to biochar pore volume and surface area within pore diameters ranging 3 – 10 nm. 6) Biochar iron content is related to its PFAS sorption ability, particularly for short chain PFAS, by providing positively charged surfaces that bind PFAS head groups. Iron content of biomass may also be a factor in creating pores in the nanopore range needed for PFAS sorption.

These results point to the great potential of biochar, particularly that produced from sewage sludge or biosolids, to stabilize PFAS in contaminated soil, or serve as a co-amendment with biosolids.

**BIO:** Dr. Zimmerman is an organic geochemist and Professor of Geological Sciences at the University of Florida. His focus over the past 15 years has been on pyrogenic carbon, particularly the conversion of waste biomass to charcoal (biochar) for contaminant adsorption and soil carbon sequestration for climate change mitigation.

## Enhanced Aquifer Recharge in the Santa Fe River Basin

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Suwannee River Water Management District's (SRWMD's) hydro-geologic framework provides unique challenges when conceptualizing aquifer recharge projects. The Upper Floridan Aquifer (UFA), SRWMD's primary freshwater source, receives recharge and subsequently provides riverine baseflow and discharges for over 450 springs all within relatively short distances across the landscape. Furthermore, most surface water sources available for aquifer recharge ultimately drain internally to the UFA and already contribute to the groundwater system. Water resource development projects located in the Santa Fe River Basin to assist in the recovery of Lower Santa Fe/ Ichetucknee (LSFI) rivers and springs minimum flows and levels (MFLs) are, therefore, limited in sources and scope; and must be strategically located to maximize aquifer residence time.

Beginning in early 2024, SRWMD began identifying surface water sources with surplus water that could be stored for later release, recharged more efficiently by restoring natural karst connections, or treated for immediate recharge to benefit the LSFI MFLs. Recharge concepts include drainage wells, slow-rate and rapid infiltration basins (RIBs), sinkhole alluvium removal, and reduction of evaporative losses from open UFA exposures. Initially, SRWMD developed 15 project concepts, but has eliminated several due to numerous challenges including project site access difficulties, land ownership, availability of surplus surface water, surface water quality and treatment concerns, and other cost-benefit limitations. Remaining concepts that SRWMD continues to develop include a flood storage project in Alachua County near Rocky Creek, a drainage well project in Columbia County near Little Suwannee Creek, and a RIB project in Gilchrist County near Cow Creek.

**BIO:** Warren Zwanka is SRWMD's Chief Hydrogeologist with over 30 years of experience at both St. Johns and Suwannee River Water Management District. He is currently applying his understanding of North Florida's hydro-geology in the development of aquifer recharge project concepts to recover MFL waterbodies