WATER INSTITUTE SYMPOSIUM

ABSTRACT BOOK

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ABSTRACT COMPILATION

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PROJECTING FUTURE LAND USE AND CLIMATE CHANGE IMPACTS ON THE SUWANNEE RIVER ESTUARY

David Chagaris[1], Holden Harris[1], Nathan Reaver[2], David Kaplan[2,3], Wendy Graham[2,4], and ***Micheal Allen**[1]*

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The human population in Florida is projected to continue increasing over the remainder of the 21st century, resulting in urbanization and more intensive agriculture with higher water demands and increased nutrient inputs. This is likely to have downstream effects on coastal ecosystems, such that effective land and water management in Florida will require integrated and interdisciplinary approaches to address tradeoffs related to land-use over the watershed and coastal ecosystem services (water quality, habitat, fisheries, and recreation). Here, we present the Suwannee River Estuary Model (SREM), a spatially explicit trophic dynamic model designed to test the effects of nutrient inputs, temperature, salinity, and habitat change on coastal ecosystems, with emphases on forage species, fisheries, and hard clam aquaculture production. The SREM is calibrated against long-term monitoring data and linked to a hydrological model of the Suwannee River watershed, allowing us to project future land-use and climate effects in the estuary. The model predicts substantial change for economically valuable sportfish and aquaculture production across the scenarios considered thus far, which brackets the extremes in agricultural production and climate change. Feedback loops associated with nutrient inputs, water quality, and seagrass abundance also appear to be important drivers in this system. Thus, the SREM can serve as a tool to evaluate the effects of habitat and water quality/quantity on fisheries production, and the integration with watershed scale modeling serves as example for how to consider future large-scale water and land management in Florida.

<u>PRESENTER BIO</u>: Mike Allen is a professor of Fisheries and Aquatic Science in the School of Forest, Fisheries, and Geomatics Sciences at the University of Florida. His research has focused on population dynamics and ecology of fishes. He uses field studies and computer models to explore population dynamics of fishes that support important recreational fisheries. He has evaluated habitat requirements for fish populations, and identified fisheries management strategies for recreational fisheries in lakes, reservoirs, and marine environments.

MICROWAVE REMOTE SENSING-BASED MACHINE LEARNING METHOD FOR IRRIGATION ESTIMATION IN FLORIDA

Laura Almendra-Martín[1]*, Jasmeet Judge*[1]*, Alejandro Monsivais-Huertero*[2]*, Pang-Wei Liu*[3]*, George Worrall*[4]

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[4]Deep Grain, St Louis, MO, USA

Florida, located within the humid region of the United States, stands as a significant consumer of water resources, with agriculture representing the largest component of freshwater usage. However, determining the precise amount of irrigation water use (IWU) and its timing at a field scale remains a challenging task. Recently, various soil moisture-based methods have explored the potential of microwave remote sensing data to address this issue. Unlike optical and infrared observations, microwave signals are unattenuated by clouds and light rain, and can sense soil through the growing crop. In addition, they are highly sensitive to soil moisture because of the large contrast between electro-magnetic properties of water and soil and crop components. Recent satellite-based microwave missions, such as NASA-SMAP and ESA-Sentinel, have demonstrated the potential for irrigation estimation. Furthermore, when combined with upcoming missions like NISAR, soil moisture information may be obtained at unprecedented spatial and temporal resolutions. This study is conducted to support algorithm development for the utilization of these datasets in Florida. A machine learning (ML)-based framework was developed for estimating irrigation during the growing seasons of corn in Florida. We utilized multiyear datasets from the Florida Automated Weather Network (FAWN) and from a series of season-long Microwave, Water, and Energy Balance Experiments (MicroWEX), as benchmark datasets for training and testing the framework. This study offers a remote sensing-based ML approach for efficient water management and provides valuable insights into the application of microwave remote sensing for irrigation estimation in Florida.

PRESENTER BIO: Dr. Almendra-Martín holds a PhD in applied physics, specializing in European soil moisture analysis. She's received international honors, with a bachelor's in physics and a master's in remote sensing. Her research interests are focused on remote sensing soil moisture and machine learning, with various publications in these fields.

IMPACTS OF HURRICANE ASSOCIATED WQ CHANGES TO ECOSYSTEM HEALTH: IMPLICATIONS FOR FUTURE COORDINATION

***Chris J. Anastasiou*[1]**, *Trevor Fagan[1], Matthew Jablonski[1], Brandon Moody[2] and Dave Tomasko[3]*

[1]Southwest Florida Water Management District, Brooksville, FL, USA

[2]Charlotte County, FL, USA

[2]Sarasota Bay Estuary Program, Sarasota, FL, USA

For millennia, coastal ecosystems have evolved to be resilient to hurricane impacts. However, storms are becoming more intense and more frequent, while ecosystem health continues to be compromised by anthropogenic activities such as habitat loss and water quality degradation. The result is that these ecosystems are more vulnerable to hurricane impacts than ever before. For example, the passage of Hurricane Irma in 2017 preceded the worst red tide event in recorded history along the southwest Florida coast, followed by record losses of seagrass habitat, much of which has yet to fully recover. Now more than ever, it is imperative that resource managers and emergency managers alike have a coordinated response plan to assess ecosystem health associated with hurricanes. In 2022, Hurricane Ian made landfall in southwest Florida as a category 4 storm bringing catastrophic winds and storm surge. Ian also produced a wide swath of extremely heavy rainfall that led to some of the worst and deadliest freshwater flooding ever recorded in the Charlotte Harbor watershed. Immediately following the passage of Ian there were concerns by local officials about potential water quality impacts. State, regional, and local entities came together to formulate and execute a coordinated water quality response plan just days after the storm passed. Here we present a portion of this larger effort focusing on hypoxia severity, extent, and recovery in the Peace River, Myakka River, and Charlotte Harbor estuary. We compare these results with those from a similar effort after Hurricane Charley in 2004. For both Ian and Charley, dissolved oxygen concentrations took 2-3 months to return to pre-storm levels. We also examine other water quality parameters such as total nitrogen and total phosphorus, and share some lessons learned for future hurricane water quality coordination.

PRESENTER BIO: Dr. Anastasiou is Chief Water Quality Scientist for the Southwest Florida Water Management District with 25 years of experience in marine ecology, habitat restoration, water quality monitoring, and seagrass mapping. He is also the District EOC Water Quality Response Unit lead, and a US Navy Meteorology and Oceanography Reserve Officer.

EXPLORING EFFECTS OF MIGRATORY BIRD SPECIES ON FUNCTIONAL DIVERSITY OF AQUATIC HABITATS IN BRAZIL

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[3]Laboratory of Ecology, Systematics and Conservation of Neotropical Birds, Federal University of Mato Grosso do Sul, Três Lagoas, Brazil
[4]Department of Animal and Plant Biology, Laboratory of Ornithology and Bioacoustics, State University of Londrina, Londrina/PR, Brazil

The ecological effect on the functional diversity of migrant birds in Neotropical habitats is poorly understood. Hence, we assess trait space occupancy differences in resident and migrant bird species across three habitats of Center-Western Brazil. We used the bird checklist of the state of Mato Grosso do Sul (MS), 360,000 km^2, which includes 104,000 km^2 of Pantanal, the larger wetland habitat in South America. Based on literature data, we categorized bird species as resident and migratory and on their habitat associations: aquatic, forest and non-forest. We utilized 26 functional traits, grouped into three categories (morphological traits, diet composition, and foraging forest stratum preference), to assess the functional diversity in habitat dependency groups. We calculated the functional richness and functional dispersion for each habitat dependency group, along with the functional beta diversity between resident and migratory species. The results indicated that migratory birds contribute to adding new traits to the aquatic groups, showing high functional turnover. The forest and non-forest groups showed greater nestedness, indicating higher functional redundancy between migratory and resident species in these habitats. In fact, migratory and resident groups show greater overlap in functional volume in forest and non-forest habitats but show minimal overlap in aquatic habitats. Thus, we argue that the effect of migratory species should be higher in aquatic habitats of MS because they add considerable variation in functional traits, which do not exist in the resident species. Our study highlights the importance of conservation of Pantanal with respect to the maintenance of aquatic migratory species due their relevance on ecological functions. In fact, Pantanal is recognized as a Ramsar Wetland of International Importance due to its vast network of aquatic habitats. However, a revaluation of the delicate equilibrium between conservation efforts, fire management and now global warming in this wetland area is needed.

Migrant birds perform different ecological functions than resident birds in wetlands of Center-Western Brazil. Migrants are essential for aquatic systems as Pantanal, the largest wetland area in South America. A revaluation of the delicate equilibrium between conservation efforts and threats, as fire management and global warming, is needed in Pantanal.

<u>PRESENTER BIO</u>: Doctoral degree in Zoology (1993, Brazil). Investigations on the effects of forest fragmentation on bird communities in the Atlantic Forest and on the bird dynamic in wetland areas, with grants from the Brazilian Council for Development of Sciences and Technology (Brasília, CNPq) since 1995. Decline of species richness, sensitivity of bird species, changings in functional diversity, the dynamic of metacommunities are the main topics investigated.

APPLICATION OF 2D HYDRAULIC MODEL TO KISSIMMEE RIVER RESTORATION PROJECT

Jie Zeng[1], *Matahel Ansar*[1], *and Alexandra Serna*[2]

[1]Hydrology and Hydraulics Bureau, South Florida Water Management District, West Palm Beach, FL, USA

[1]Engineering and Construction Bureau, South Florida Water Management District, West Palm Beach, FL, USA

This study presents the application of a two-dimensional hydraulic model to assess the conveyance capacity of the S65A spillway and auxiliary structures in support of the Kissimmee River Restoration (KRR) Project, which was completed in 2022. The KRR project is intended to restore nearly 20,000 acres of wetlands and 44 miles of the historic river channel, creating an environmentally friendly meandering river-floodplain ecosystem. A key challenge within this endeavor is to strike an appropriate balance between river restoration and flood protection, particularly in relation to water control structures hydraulic performance along the Kissimmee River. This paper presents a comprehensive analysis using HECRAS 2D model, including calibration, validation, sensitivity analysis of key parameters, and an assessment of the impacts of different engineering measures to reduce head losses through multiple water control structures installed in parallel across the river, including a gated spillway, a navigation lock, a tieback levee with embedded weirs, and multiple culverts. The paper recommends the most effective engineering measure for minimizing overall energy loss across these combined multiple structures, termed herein the S65A complex.

This case study also highlights the practicality and cost-effectiveness of the 2D HEC-RAS model. It underscores that such modeling tools can serve as a robust alternative or complement to traditional laboratory and field studies typically employed in hydraulic engineering applications.

<ins>PRESENTER BIO</ins>: Dr. Ansar is the Section Chief of the Applied Hydraulics Section at the South Florida Water Management District. He has 26 years of experience designing and implementing water resources projects. He has extensive background in water resources engineering including laboratory experiments, flow computations and numerical modeling at water control structures.

NUTRIENT MANAGEMENT AND OPTIMIZATION FOR ALGAE BLOOM REDUCTION IN LAKE OKEECHOBEE

Mauricio E. Arias*, Osama Tarabih*
Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL, USA

Best Management Practices (BMPs) are typically implemented in agricultural and urban landscapes to reduce nutrient losses at individual parcels. However, BMPs effectiveness at reducing watershed-wide regions remains an open question. This study aims to evaluate the effectiveness of parcel-based agricultural and urban BMP implementations in reducing watershed-wide phosphorus (P) and nitrogen (N) loads. The Lake Okeechobee watershed, covering 10,600 km^2 of mixed agricultural and urban land use, is used as a case study. Hydrological and nutrient transport processes in the watershed were simulated using the Watershed Assessment Model (WAM). The model was calibrated and validated for river discharge and nutrients for each of the six sub-watersheds, with R^2 values ranging from 0.43 to 0.80 for flows and 0.24 to 0.85 for nutrients. Four what-if scenarios were simulated representing different regional BMP implementations and their annual costs were addressed: Baseline (no BMPs implemented), current conditions (1032 km^2 area influenced), maximum potential scenario (5923 km^2 area influenced), and optimal BMP placement. Simulations indicated that the currently implemented BMPs could be reducing P loads from 482 to 468 tons/year (-3%; $9 million/P ton) and N loads from 4384 to 3796 tons/year (-13%; $0.22 million/N ton). Further implementation of potential BMPs could reduce P to 307 tons/year (-37%; $3.25 million/P ton) and N to 3036 tons/year (-31%; $0.42 million/N ton). Dividing the watershed into finer spatial units with different land use distributions illustrated that BMPs in Taylor Creek-Nubbin Slough (50% agriculture) have the potential to reduce P by 55%, and in Upper Kissimmee (23.5% urban) BMPs have the potential to reduce N by 42%. In addition, we evaluated the effect that these nutrient reductions could have on algal blooms using the Lake Okeechobee Optimization of Nutrient Exports model and determined that combining watershed nutrient management with lake operations could be even more effective at decreasing algal blooms.

<u>PRESENTER BIO</u>: Dr. Arias is an Associate Professor at the University of South Florida, where he is the Principal Investigator of the Watershed Sustainability Lab (www.watershedsustainability.org). Areas of research include surface water quantity/quality prediction and Ecological Engineering, with emphasis on tropical and subtropical watersheds. He became a Gulf Research Program Early Career Fellow in 2021 and received USF's 2023 Outstanding Research Achievement Award.

STRENGTHENING CLIMATE RESILIENCE: KEY CERP PROJECTS FOR GREATER EVERGLADES RESTORATION

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

Ecosystem restoration serves as the linchpin of climate resilience planning for the Greater Everglades region. Ecosystem restoration within the South Florida Water Management District's (SFWMD) resilience framework will bolster the Greater Everglades' capacity to face the challenges posed by climate change and other changing conditions, such as population growth and changes in land use. In this context, resilience refers to the Greater Everglades' capacity to endure acute and chronic stressors as climate conditions evolve, including elevated temperatures, extreme weather events, sea-level rise, and altered hydrological patterns. Central to these efforts is the Comprehensive Everglades Restoration Plan (CERP). Several key CERP projects significantly contribute to enhancing the Greater Everglades' resilience capacity. The Central Everglades Planning Project is key to rehydrating the Everglades, reducing risk of peat fires, and providing freshwater to Florida Bay to prevent salinity stress. The Picayune Strand Restoration Project plays a crucial role in improving the Greater Everglades' resilience by rehydrating overly drained wetlands, restoring natural hydrological patterns, including freshwater flow to the estuarine habitats, and enhancing water storage capacity to mitigate flooding during heavy rainfall events and sustain water availability during droughts. Furthermore, the restored wetlands will sequester carbon, contributing to climate change mitigation efforts. Restoration projects targeting coastal habitats, such as mangroves and seagrass beds, exemplified by the Biscayne Bay Coastal Wetlands Project, act as natural buffers against climate-induced impacts like heightened storm surges and sea-level rise, providing vital protection for both ecosystems and communities. Each of these projects provide key ecological benefits to improve the resilience of south Florida. As SFWMD moves forward with resilience planning, maximizing restoration benefits will be key to its success.

PRESENTER BIO: Dr. Armstrong is the Coastal Ecosystem Section Administrator at the SFWMD. She has worked for the District for 10 years. Her work on coastal resiliency issues started with her master's work at the Virginia Coast Reserve, which is part of the Long-term Ecological Research (LTER) program. Her master's, PhD, and postdoctoral work all focused on salt marsh response to sea level rise. Her current work focuses on coastal processes affected by freshwater flow and its use to combat salinity intrusion.

STORMWATER WET POND MANAGEMENT: A PUBLIC ENGAGEMENT APPROACH

Ange Asanzi[1]*, Miranda Carver Martin*[1]*, Michelle Atkinson*[2]*, and Paul Monaghan*[1]

[1]University of Florida, Gainesville, FL, USA

[2]University of Florida, IFAS Extension in Manatee County, FL USA

Stormwater wet ponds (SWPs) are altered ecosystems designed and managed by individuals, communities, and regulatory bodies. In this study, we seek to explore residents' perceptions of their SWPs, specifically their intentions to adopt SWP best management practices (BMPs). While SWPs were engineered to mitigate the consequences of urban stormwater runoff, many residents living near these infrastructures are unaware of their benefits and purpose. A local study site in South Florida was selected to interact with residents and investigate their perceptions and values related to SWPs. Understanding residents' perceptions influences the management of SWPs, potentially maximizing their benefits for natural waterways.

In a collaborative effort between IFAS researchers, Extension, and local stakeholders, workshops were conducted with more than 60 participants, most of them residents living on or near SWPs. They shared their knowledge, experiences, and challenges with SWPs through facilitated group discussion and semi-structured surveys and field trips. Analysis of these qualitative results was used to develop an online survey that utilized the Theory of Planned Behavior to measure residents' intentions to adopt BMPs. These BMPs include behavioral changes to landscape maintenance, such as fertilizing and watering, as well as larger social changes at the neighborhood level regarding the planting and management of SWPs. Our primary focus will be on examining the impact of cost, aesthetics, uncertainty, and neighborhood norms in driving the adoption of these behaviors. Additionally, we will focus on new variables and their contribution to promoting behavior change. This study will provide practitioners with the information needed to design SWP interventions that will encourage behaviors that would lead to the adoption of BMPs.

PRESENTER BIO: Ange is currently pursuing her Ph.D. in Agricultural Education and Communication, with her research primarily revolving around fostering environmental and social behavior change. In her research work, she employs research methodologies that place significant emphasis on community participatory research and mixed methods approach.

TWO DECADES OF MACHINE LEARNING APPLICATIONS IN WATER SUPPLY MANAGEMENT

Tirusew Asefa[1] *and Hui Wang*[2]

[1]Systems Decision Support Manger, Tampa Bay Water, Clearwater, FL USA

[2]Lead Water Resources System Engineer, Tampa Bay Water, Clearwater, FL USA

The last few years have seen a lot of attention given to Artificial Intelligence (AI) and machine learning applications. This is primarily driven by the industry-grade availability of customizable AI/Machine learning programs and software that are now packaged to users, which at times separates the user from understanding the physics or process being modeled. AI/Machine learning approaches have been implemented for water resources management for more than two decades. This talk revisits practical applications of these tools, challenges, and opportunities, beyond academic research. Field-scale development and application of such tools in urban water supply (e.g., automating water treatment processes, seasonal water resource allocations, simulation-optimization frameworks) as well as those in water resources management space (e.g., climate and hydrologic predictions) will be highlighted. Most importantly, despite “one-stop shopping” of popular AI/Machine learning tools offered today, their successful applications require understanding of the physics or other underlying processes that are being modeled.

PRESENTER BIO: Tirusew Asefa is Tampa Bay Water’s managing director for Systems Decision Support group who is responsible for multi-scale decision support tools development and implementation. Tirusew has written over 45 peer reviewed articles and is the chair of the Florida Water and Climate Alliance (check out TBW and Florida WCA Tables).

FARMERS TRUST IN SMS-BASED IRRIGATION THROUGH IN-FIELD DEMONSTRATION PROGRAMS

Akshara Athelly
University of Florida, Fort Pierce, FL, USA

Florida's unique soil and hydrological properties necessitate optimal irrigation practices to sustain agriculture and the environment. Among technology-based irrigation scheduling best management practices (BMPs), soil moisture sensors (SMSs) are the most popular in the USA, with Florida ranking 10th place in terms of adoption. Despite SMS's proven benefits, the adoption rate of SMSs in Florida is still far from anticipated. The practical usefulness of SMSs to farmers as part of their day-to-day water management activities is sometimes burdensome, and the economic benefits of implementing these SMSs are not well understood. The goal of this study is to demonstrate the SMS's data-based irrigation scheduling efficiency in improving water and nutrient savings and its impact on sweet corn growth and yield in commercial farm trials. We implemented our study in a sweet corn commercial farmer's field trial in central Florida during the two main growing seasons from Spring 2022 – to fall 2023 under seepage irrigation. The growth, yield, water, and nutrient use efficiency of sweet corn as influenced by SMS-based irrigation scheduling compared to farmer-based irrigation scheduling was assessed using ANOVA followed by the post hoc Tukey test. Preliminary results favor fewer irrigation events, similar or higher growth and yield parameters, and higher water and nutrient savings with SMS-based irrigation scheduling compared to farmer-based methods. Lowering one irrigation event using SMS based method can save 324,000 liters of water, and this research can contribute extensively to water sustainability. The integrated research collaboration with farmers allows the demonstration of SMS reliability and has the potential to increase the perception of value from the farmers' perspective.

PRESENTER BIO: Akshara Athelly is a doctoral graduate research assistant in the Department of Agricultural and Biological Engineering at the Indian River Research and Education Center, Fort Pierce, FL. Her research involves developing integrated sweet corn extension and research programs to improve farmers' trust in data-based irrigation scheduling and smart irrigation technologies in Florida. Her doctoral research is funded by the Conservation Innovation Grants program at USDA's Natural Resources Conservation

CENTRAL AND SOUTHERN FLORIDA SECTION 216 FLOOD RESILIENCY STUDY: MODELING APPROACH

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

The natural, agricultural, and highly dense urban areas in southeast Florida, served by the Central and Southern Florida (C&SF) Project are experiencing significant flooding now, which is expected to worsen in the future. The more than 70-year-old gravity driven C&SF water management infrastructure system was not designed to manage the current and future conditions of combined runoff, storm surge, high tides and high groundwater table, resulting in a reduction of the system efficiency. Continuous operation of this aging infrastructure is needed to provide flood protection and water supply to more than 9 million people. Flooding events result in property damage (residences, businesses, and critical infrastructure), health and life safety risks, saltwater intrusion into freshwater habitats and Biscayne Aquifer (main source of water supply in the region), and loss of habitats, and threatens economic and recreational activities in this area that are of national and international significance.

The C&SF Flood Resiliency Section 216 Study is a single purpose study focusing on flood risk management. The Study is a feasibility level planning analysis focused on increasing the resilience and function of vulnerable coastal structures and the conveyance of the primary inflow canals.

The Study requires the application of robust and tested technical tools to represent the C&SF system within the study area. The tools should be able to simulate system response to hydrologic, hydraulic, and hydrodynamic stressors that drive flood risk in the area. Due to the unique geology of the region, the tools must be able to incorporate the effect of groundwater induced flooding.

The C&SF system in the study area is heavily managed and the response of the system is significantly influenced by system operation and water management decisions. The ability to simulate the effects of operations is therefore a key requirement for all modeling tools applied for this study.

To date, event modeling has been done within the study area under the South Florida Water Management District (SFWMD) Flood Protection Level of Service (FPLOS) Program for the primary systems in Broward and Miami-Dade Counties. The FPLOS Program has developed hydrologic and hydraulic (H&H) integrated/coupled surface-groundwater models for all watersheds in the Project Study Area which will be utilized for this application. The coupled MIKE SHE/MIKE Hydro (2022) models will be used to simulate the event-based response of the hydrology and hydraulics for the C&SF FRS project area. This talk will present the modeling approach for the Section 216 study using the existing MIKE SHE/HYDRO models including model updates/refinements to the models to meet the goals of the C&SF study.

<u>PRESENTER BIO:</u> Carol Ballard, PE, CFM has over 20 years of experience in applying hydrologic and hydraulic modeling to restoration efforts, design of public works, and flood insurance studies. Ms. Ballard has expertise in developing, managing, and reviewing complex 1D, 2D, and surface/groundwater watershed models which includes managing three Flood Protection Level of Service (FPLOS) projects. Two of the projects, C111/Model Land/L31NS, and Eastern Palm Beach County, use MIKE SHE/Mike 1D modeling tools. Ms.

LOCAL GOVERNMENT TOOLS TO SHIFT OUR LANDSCAPING PARADIGM

Eliana Bardi *and Stacie Greco*
Alachua County Environmental Protection Department, Gainesville, FL, USA

Public supply is the largest use of water in Alachua County, with landscape irrigation representing much of the residential water budget. Alachua County applies a three-pronged approach to water conservation that focuses on education, incentives, and regulations. The County has a robust social media presence with targeted ads to high-water use neighborhoods, in addition to participating in tabling events and providing in-person outreach and training. We offer free irrigation tune-ups to high-water users and provide grant funded rebates to qualifying homeowners and businesses to implement water conserving upgrades. We also enforce local regulations on irrigation, landscaping, and fertilizer use. Our irrigation design standards were updated in 2023 and now limit the area that can be permanently irrigated to 50% of the permeable area and outline additional maintenance requirements for non-residential systems (including common areas in residential developments), among other changes. These changes have resulted in creative approaches to temporary irrigation and shifts in the landscape design to prioritize functional areas for irrigation.

This presentation explores the lessons learned from implementing these programs, focusing on stakeholder engagement, program development and promotion, and initial estimates of water savings.

PRESENTER BIO: Eliana Bardi is a Senior Planner with over 20 years' experience researching and implementing programs to protect natural resources. She holds a B.A. in Economics and an M.S. in Environmental Engineering from UF. Eliana implements regulatory and outreach water conservation programs for Alachua County.

EFFECT OF SITE-SPECIFIC NUTRIENT MANAGEMENT ON HLB-AFFECTED SWEET ORANGE TREES IN FLORIDA

[1]***Noor Ul Basar***, [2]*Muhammad Adnan Shahid and* [1]*Davie M. Kadyampakeni*

[1]University of Florida, Institute of Food and Agricultural Sciences, Citrus Research and Education Center, Lake Alfred, FL, USA

[2]University of Florida, Institute of Food and Agricultural Sciences, North Florida Research and Education Center, Quincy, FL, USA

Citrus is one of the major horticultural crops in Florida contributing about 1.2 to 1.5 billion dollars per year in economy. However, in recent years citrus production in Florida has drastically declined by more than 80 % from 1998 to 2023 due to multiple challenges one among which is huanglongbing (HLB) or citrus greening disease. HLB is a destructive bacterial disease in citrus caused by *Candidatus Liberibacter asiaticus* (CLas) and vectored by the Asian citrus psyllid (*Diaphorina citri*). In Florida, this disease was detected in 2005 and is a major challenge for citrus production due to the lack of a cure. Different management strategies have been proposed for counteracting the deleterious effects of HLB on citrus production among which intensive nutrient management has been a promising tool. Fine root loss is one of the major concerns in HLB management which could be compensated to some extent by optimizing nutrient availability in the citrus rhizosphere. In this regard, this study attempts to exploit site-specific nutrient management as an option for managing HLB in Valencia and Hamlin sweet orange [*Citrus sinensis* (L.) Osbeck] trees with a special focus on nitrogen (N) and phosphorus (P). The objectives of our study seek to evaluate the effects of different levels of N (0, 112, 168, 224 and 280 kg/ha) and P (0, 10, 20, 40 and 80 kg/ha) on HLB-affected sweet orange trees which will help us efficiently customize the current recommendations for N (224 kg/ha) and P (17 kg/ha) that are based on healthy citrus trees before the discovery of HLB in 2005. In addition, nutrient leaching will be studied due to the sandy soil texture of citrus producing soils and impacts on plant growth, fruit yield and water quality will be assessed.

<u>PRESENTER BIO</u>**:** I am Noor Ul Basar from Pakistan, currently pursuing my PhD degree in the department of Soil Water and Ecosystem Sciences. My research focuses on nutrient management in citrus with special emphasis on management of huanglongbing (HLB) disease through modulations in nutrient management guidelines to sustain productivity and improve environmental quality in Florida.

ENHANCED MANATEE POPULATION VIABILITY VIA OCKLAWAHA RIVER AND SPRINGS RESTORATION

***Gian Basili**, Terri Calleson, Scott Calleson*
United States Fish and Wildlife Service, Jacksonville, Florida, USA

Improving access for manatees to natural warm water refugia such as the springs in the Silver and Ocklawaha rivers and the abundant submerged aquatic vegetation (SAV) in the system would be an important positive contribution to creating a sustainable network of regional warm-water habitat necessary for the recovery and persistence of the Florida manatee into the foreseeable future. Historically, manatees relied mostly on natural springs and passive thermal basins to shelter from cold winter temperatures, but in the 20th century, human activities including dam construction blocked manatee access to many of these natural warm water refugia and destroyed or significantly diminished others. At the same time, newly developed power plants and industrial complexes discharging heated effluent into manatee accessible waterways created significant new sources of warm water. Manatee responses to these changes varied, but the most significant outcome is that most of the Florida manatee population now seeks refuge during cold weather at industrial sites throughout much of peninsular Florida. As power plants are decommissioned or modernized, the availability of industrial warm water sites is being reduced. The loss of warm water from some or all these sites is an eventual certainty. Providing manatees easier access to natural warm water springs like those in the Ocklawaha and Silver rivers will contribute to their long-term persistence in Florida. With the large-scale loss of foraging habitat in the Indian River Lagoon and to some degree in the Middle and Lower St. Johns River, this system can also provide abundant sources of natural SAV as well as floating and emergent vegetation. The combination of natural warm water sites and SAV in close proximity presents significant advantages for this subspecies and its long-term viability on the East Coast.

PRESENTER BIO**:** Dr. Basili is the Deputy State Supervisor (Florida) for Ecological Services of the US Fish and Wildlife Service, and he has been working in Florida on landscape-scale conservation and restoration for more than 25 years.

DISCOVERING THE PERCEPTION OF WATER QUALITY AND QUANTITY OF SOUTH CAROLINA'S RESIDENTS

Xavier Basuto[1]*, Lori Pennington-Gray*[1]*, Estefania Basurto*[1]*, and Tammi Richardson*[1]

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Freshwater resources have traditionally served as cornerstones of a state's economic framework. Due to their innate recreational appeal, these water bodies have unfailingly drawn tourists, leading to the strategic development of tourism infrastructures around these ecologically sensitive aquatic environments. The inherent value of water, both aesthetically and recreationally, significantly enriches human experiences (Vigil, 2003). Research indicates that any compromise in the purity and potability of freshwater bodies, like lakes and rivers, can either repel prospective tourists or adversely impact their overall experience. The breadth of tourist activities within the state hinges significantly on the pristine quality and ready availability of its freshwater resources. These valuable resources pave the way for a wide spectrum of activities, from boating and fishing to various water-based sports and scenic waterfront lodgings, fortifying the state's economic landscape and heightening the tourist experience (Ulbrich et al., 1987). When assessing water quality, both objective scientific measurements and subjective perceptions significantly influence the understanding of locals and tourists. Relying solely on quantitative biochemical tests is inadequate. Regrettably, the integration of social science methods to evaluate water quality, whether in tandem with biochemical tests or independently, is seldom pursued. Thus, the primary objective of this academic research is to provide a detailed analysis of prevailing perceptions concerning water quality within South Carolina's geographical boundaries. To achieve this, a structured survey anchored in a quantitative methodology was conducted among South Carolina's inhabitants. The survey was facilitated through Pollfish®, a reputable online platform for the recruitment of research participants. This study was driven by three central aims: (1) to ascertain impressions of aesthetics and nuisances of water quality; (2) to ascertain the changes in perceptions of water quality over time; and (3) to examine future policies that are supported to aid in the preservation of clean recreational water in SC.

PRESENTER BIO**:**

Xavier Basurto Doctoral Student Richardson Family SmartState Center for Excellence in Tourism and Economic Development.

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PARAMETERIZATION OF TEMPORALLY-RESOLVED BENTHIC NUTRIENT FLUXES IN LAKE OKEECHOBEE

Jordon Beckler, *Mingshun Jiang, Mason Thackston, Lynn Wilking, Veronica Ruiz-Xomchuk, Owen Silvera, Hanna Bridgham, Malcolm McFarland, Tim Moore*[1,] *and Dennis Hanisak*

FAU Harbor Branch Oceanographic Institute, Ft. Pierce, FL, USA

Benthic fluxes have been recognized as a substantial nutrient source to Lake Okeechobee for several decades. As part of a highly interdisciplinary effort focused on understanding and predicting Harmful Algal Blooms on Lake Okeechobee, we collected for the first time sub-monthly benthic flux measurements from muddy sediments at several locations for one year. Over seasonal timescales, benthic nutrient fluxes from these legacy nutrient-enriched mud sediments can vary by nearly an order of magnitude, with water column nutrient conditions mirroring those of sediment pore waters. Sediment ammonium fluxes were most elevated coincident with the first observations of early-season HABs, whereas phosphate fluxes were greatest towards late summer. This pattern likely implicates seasonal anaerobic respiration processes (i.e. iron). Together, these findings suggests that predictive numerical models must include temporally-resolved benthic nutrient fluxes to ensure accurate forecasting capabilities. However, a purely empirical parameterization would fail to capture the importance of short-term controls and feedback. For example, sediment resuspension obviously serves as a mechanism for the rapid introduction of nutrient rich sediment pore waters to the water column, but net impacts can be critically convoluted by the relative rates of assimilation versus nitrification or mineral surface phosphate saturation. Overall, it is challenging to determine the optimum modeling approach given tradeoffs between accuracy and complexity, especially given our poor fundamental understanding of these more ephemeral processes. Here, several of the abovementioned phenomena will be highlighted along with a hierarchical approach to develop an optimized parameterization for a benthic nutrient cycling module.

<u>PRESENTER BIO</u>**:** He is currently an Assistant Research Professor and Principal Investigator of the Geochemistry and Geochemical Sensing Lab at FAU with a joint appointment in the FAU Institute for Sensing and Embedded Network Systems Engineering (I-SENSE). He obtained his B.S. and PhD in Earth and Atmospheric Sciences at Georgia Tech in 2014, with a minor in inorganic chemistry. Prior to joining FAU in 2018, he was the Program Manager of the Ocean Technology Research Program at Mote Marine Lab

DAILY ESTIMATES OF EVAPOTRANSPIRATION FOR FLORIDA AND THE SOUTHEASTERN US, 1985-2022

Jason Bellino
U.S. Geological Survey Caribbean-Florida Water Science Center, Tampa, FL, USA

Since the mid-1990s, the U.S. Geological Survey, in cooperation with the five water management districts of Florida, has computed daily estimates of reference and potential evapotranspiration (RET and PET) for Florida at a 2-km resolution using the Penman-Monteith and Priestley-Taylor equations. The dataset spans the period 1985 through 2022 and calculations are driven by solar insolation data from the GOES satellite and meteorological parameters such as temperature, relative humidity, and wind speed from interpolated weather station observations or the 30-km resolution North American Regional Reanalysis gridded climate dataset. Beginning in calendar year 2021, daily estimates of RET and PET are also available at a 1-km resolution for the southeastern United States using meteorological datasets from a high-resolution Weather and Research Forecasting model.

A web application has been developed to allow easy access to the entire dataset which is available as a series of files produced annually which contain all parameters used in the calculations. Prior to 2019, the data are available in text-formatted files and for calendar years 2019 and onward as self-describing, georeferenced binary NetCDF files. The web application allows users to choose between the 2-km product for Florida or the 1-km product for the southeastern US, select one or more parameters, specify the date range of interest, and choose from a variety of methods to spatially subset the data including by uploading a shapefile for a study area. Output is in the form of a text file containing the pixel IDs, pixel locations, and relevant parameter values for the dates selected. A time-series graphic is also generated to show mean values for the selected data.

PRESENTER BIO**:** Jason is a hydrologist with 19 years of experience in a variety of areas including groundwater modeling, groundwater-surface water interactions, bathymetric surveys, evapotranspiration calculations, and climate modeling.

DISPERSED WATER MANAGEMENT – PROGRAMMATIC PERSPECTIVE

Anthony Betts, *Jonathan Madden, and Manuel Zamorano*
South Florida Water Management District, West Palm Beach, FL, USA

Much of South Florida's historic wetlands have been altered to facilitate population growth and economic development. To reverse unintended consequences, the Northern Everglades and Estuaries Protection Program (NEEPP) was established to improve hydrology, water quality, and aquatic habitats within the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. These three Northern Everglades watersheds comprise nearly five million acres and serve as headwaters to the Greater Everglades ecosystem.

In coordination with Florida Department of Environmental Protection and Florida Department of Agriculture and Consumer Services, the South Florida Water Management District (SFWMD) implements watershed construction projects to accomplish NEEPP objectives. These include large-scale storage and treatment projects and "dispersed" storage located throughout the watershed. Launched in 2005, the SFWMD Dispersed Water Management Program is based on a payment for ecosystem services framework and incentivizes landowners to retain direct precipitation and divert regional runoff for storage and treatment on private property. The primary objective of the DWM program is to cost-effectively manage stormwater in the Northern Everglades to restore beneficial flow patterns and improve surface water quality.

Currently, twenty-eight DWM projects provide storage and treatment on more than 76,000 acres of private property. Collectively, these projects provide 200,000 acre-feet of storage and retain 45 metric tons of phosphorus and 260 metric tons of nitrogen annually. In addition to these demonstrated benefits, DWM projects provide a myriad of secondary benefits, including economic support for low-intensity land uses, wetland and habitat restoration, groundwater recharge, and more.

As a governmental agency, the SFWMD is tasked with furthering NEEPP objectives, and public-private partnerships through the DWM program are one tool which has been successfully implemented. A programmatic perspective requires the SFWMD collaborate with stakeholders to maintain cost-effective benefits to the public and identify new opportunities necessary to meet urgent environmental restoration goals in the Northern Everglades.

PRESENTER BIO**:** Anthony Betts is a principal scientist with the South Florida Water Management District Everglades and Estuaries Protection Bureau. He has extensive experience with the Dispersed Water Management Program (DWM) management and implementation, including project development, operation, and evaluation for the District's twenty-eight DWM projects.

INTEGRATING PRECISION AG TECHNIQUES AND NITROGEN APPLICATION METHODS TO ENHANCE NITROGEN USE EFFICIENCY THROUGH SITE-SPECIFIC NITROGEN MANAGEMENT AND PREHARVEST COVER CROPPING

Sukhveer Singh Bhullar *and Sudeep Singh Sidhu*
North Florida Research and Education Center, University of Florida, Quincy FL, USA

Nitrogen (N) losses are one of the critical challenges in modern agriculture for both environmental sustainability and food production. N fertilizer use has increased significantly in recent decades and is expected to increase by 186 million Mg N yr^{-1}. A substantial portion of N (10-30%) is lost due to N leaching (Scchepers and Raun, 2008). This loss causes groundwater contamination along with loss in crop productivity and other environmental problems (Hatfield and Prueger, 2004: Li *et al*, 2007). Addressing this issue and regulating N fertilizer is of paramount importance in sandy soils of North-Central Florida and the Florida Panhandle.

On-farm trials were conducted to investigate efficiency of N split application methods at the front end and cover cropping at the back end of corn production. Each farm is mapped into different soil Electrical Conductivity (EC) zones to evaluate N application methods under different soil types to compare grower practices (fertigation) with efficient methods (banding).

The study will explore the potential of different cover cops to mitigate nitrogen loss. Cover crops will be planted before harvesting corn crop with high clearance equipment to scavenge unused N in the soil and eventually reduce the N losses. Various cover crop species or their blend will be investigated in terms of their establishment, optimum cover crop planting time before corn harvest, and seed rate aiming to maximize their efficiency in reducing nitrogen leaching.

The anticipated outcomes of this research will address the pressing issue of groundwater contamination associated with nitrogen leaching. Moreover, it aims to develop sustainable nutrient management practices, potentially saving 15-20 % nitrogen in the corn production system. The insights of this study into site-specific nitrogen application, proper fertilizer placement, and preharvest cover cropping hold a significant promise for promoting environmentally sustainable agricultural practices and protecting water quality and crop yield.

<u>PRESENTER BIO:</u> Sukhveer Singh Bhullar is a graduate student in Agronomy Department at University of Florida. I am from Punjab, India where farming is our family occupation**.**

QUANTIFYING YEARLY HIGH-LATITUDE LAKE CDOM FROM ICE SHEET TO COAST IN SOUTHWESTERN GREENLAND

***Megan Black*[1]**, *Jonathan B. Martin*[1], *Ellen E. Martin*[1], *Madison K. Flint*[1], *Andrea J. Pain*[2], *Jaehyeon Lee*[3], *Kelly Deuerling*[4]

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Following retreat of the Greenland Ice Sheet, plant communities colonized exposed landscapes in western Greenland. Community succession and greening in response to climate change should increase contributions of organic matter (OM) to terrestrial hydrologic systems. These increases may be evaluated over large regions and through time using remote sensing of wavelengths of light that estimate 1) chromophoric dissolved OM (CDOM), a fraction of total OM, in Arctic lakes, and 2) changes in plant communities and health based on the normalized difference vegetation index (NDVI). We use satellite imagery from a high-resolution sensor to evaluate changes in lake CDOM concentrations and vegetation along a 175 km transect from ice to coast in southwestern Greenland. The transect includes a gradient from negative water balance, cooler temperatures, and younger moraine ages near the ice, to positive water balance, warmer temperatures, and older moraine ages at the coast. NDVI and lake CDOM across the transect were evaluated using Sentinel-2 imagery from 2017 to 2023. CDOM concentration variations were derived using a red/green band ratio (506-595 nm, 632-698 nm) to assess biological optical properties of inland waters. The NDVI data indicate a progressively longer growing season throughout the transect, where values increase yearly at peak growth, with the exception of 2022 and 2023, where mean NDVI values were lower than previous years. Estimates of CDOM concentrations display similarities across the transect between the years of 2017, 2019, 2020, and 2021 but, similar to NDVI, CDOM concentrations were lower in 2022 and 2023 than earlier years. The lower CDOM concentrations may be responding to less productive vegetation during 2022 and 2023, possibly due to greater cloud cover. Changes observed across the southwestern Greenland landscape suggest that CDOM concentrations of lakes is linked to alteration in vegetation patterns and are likely to change with continued Arctic warming.

PRESENTER BIO**:** Megan Black is a PhD candidate at the University of Florida in the Department of Geological Sciences.

AGAINST THE CURRENT: EXPERIENCES AND PERCEPTIONS OF ANGLERS ALONG THE MIAMI RIVER

Michael Borbolla*, Elizabeth Anderson, and Matthew Marr*
Florida International University, Miami, FL, USA

This ethnographic study focuses on the fishing practices of riparian human neighboring communities along the Miami River, FL. Through participant observation and semi-structured interviews, we explored people's perspectives and experiences, including their motivations for fishing, barriers to access, and key concerns for the Miami River. Our study revealed that the engagement of locals with the Miami River for fishing is driven by multifaceted factors including social connections, emotional well-being, and the provision of sustenance. However, existing policies present challenges that compel many individuals to navigate intricate managerial and policy frameworks to sustain their fishing practices. The primary concern of locals is access to the Miami River, mostly attributed to confusing legislation and financial barriers. Considering our findings, our paper provides recommendations derived from participant and researcher conversations. Our study offers further evidence of the benefits of urban fishing and underscores the significance of informed management strategies in public spaces. This informed management is particularly crucial in the context of Miami FL, where expanding private spaces constrict public or open spaces reserved for alternative uses, emphasizing the need for management approaches that acknowledge the diverse motivations and benefits associated with local fishing practices along the Miami River.

PRESENTER BIO**:** Michael Borbolla is a Cuban ecologist and Ph.D. student at Florida International University, specializing in urban ecology and human-wildlife interactions in Miami. He has significant experience in South Florida's diverse ecosystems, leading projects on invasive species and urban fishing. Michael is dedicated to conservation, restoration, and promoting diversity in science.

DEVELOPMENT AND ASSESSMENT OF PAYMENT FOR WATER SERVICE PROGRAMS ON RANCHLANDS IN THE NORTHERN EVERGLADES

***Elizabeth Boughton*[1]**, *Pedro Quintana-Ascencio[2], David Jenkins[2], Patrick Bohlen[2], John Fauth[2], Angelica Lomeu[3], Sanjay Shukla[3], Greg Kiker[3], Greg Hendricks[3], Hilary Swain[1]*

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The Headwaters of the Everglades is a ~1.1-million-hectare watershed with ranchland as the dominant land use. These ranchlands are recognized as valuable not only for food production, but also for biodiversity and water services. The South Florida Water Management District (SFWMD) operates the Dispersed Water Management (DWM) program which includes the Northern Everglades Payment-for-Environmental-services (NEPES) focused on water retention and nutrient removal services in the Northern Everglades basins. NEPES was designed to pay for added water retention on private cattle ranchlands by raising the spillage level of drainage control structures to slow and reduce surface flows. We predicted that increased hydration of previously drained wetlands would benefit biodiversity, a previously unquantified but desirable co-benefit of the program. However, we expected that some tradeoffs such as loss of forage would occur. The objectives of this study were: 1) Examine biodiversity co-benefits of enhanced water retention on ranchlands in the headwaters of the Everglades; 2) Assess potential tradeoffs for ranchers including loss of forage or increased mosquitos; 3) Develop a decision support system to integrate hydrology, biodiversity, user defined preferences and implementation cost. We used general linear mixed models and model selection to evaluate the feasibility of explicit, a priori hypotheses using data from 15 wetlands sampled across four participating ranches. Our study indicated that managing for increased water retention could result in both co-benefits and trade-offs among ecosystem services. Higher water retention increased wetland plants in wetlands and was associated with reduced mosquitoes. Trade-offs included significant declines in forage plant cover and decreases in amphibian abundance with higher water retention. A decision-support-system (DSS) was developed to integrate (i) retention predicted by the hydrologic model, (ii) biodiversity responses predicted by eco-hydrologic models, and (iii) a user-defined preference scheme to assign importance weights to storage, biodiversity, and implementation cost. The DSS calculated a cumulative score for ranking PES proposals. By considering desirable co-benefits and tradeoffs, stakeholders can decide on their preferred level of services, e.g., buyer(s) may settle for less storage if there is a gain in desirable biodiversity. The DSS can identify trade-offs among services, helping stakeholders negotiate. Multidisciplinary collaboration was required to design, implement, monitor, and assess the NEPES program for trade-offs and co-benefits.

<u>PRESENTER BIO</u>**:** Dr. Betsey Boughton is the Director of Agroecology at Archbold's Buck Island Ranch. Her research focuses on the sustainability of grazing lands. She has been a collaborator in developing and monitoring the Dispersed Water Management program in the South Florida Water Management District covering over 20,000 acres for 11 years.

TRANSPORT AND CHARACTERISTICS OF MICROPLASTICS IN A LARGE CONSTRUCTED WETLAND IN FLORIDA, USA

Jessica Boyer
University of South Florida, Tampa, FL, USA

Constructed wetlands play a role in the removal of nutrients, pathogens, and other contaminants from wastewater streams before discharging to natural bodies of water. The inherent role of constructed wetlands makes them hotspots for microplastic accumulation as millions of microplastics leave wastewater treatment plants through effluent every day. These microplastics flow through the wetland system aimed by natural and dynamic forces and can undergo physical, chemical, and biological transformation through the processes of fragmentation, degradation, biofouling, and settling. In order to investigate the transport and characteristics of microplastic pollution in a natural constructed wetland, environmental microplastic samples were collected in the Se7en Wetlands in Lakeland, FL, one of the largest wastewater constructed wetlands in the US (1600 acres) and has been polishing secondary treated municipal wastewater since 1985. The samples include both water and sediment samples collected at all control stations in each of the seven wetland cells. The collected microplastic samples were analyzed for size, shape, and polymer type to inform how microplastics of different properties travel through the system. This study looks to inform how the dynamics of natural systems affect the fate and transport of microplastics and how constructed wetlands fare for the removal of microplastics from treated wastewaters.

PRESENTER BIO: Jessica Boyer is a third year PhD candidate at the University of South Florida in the Arias Watershed Sustainability Lab. She is researching the fate and transport pathways of microplastic contamination in urban aquatic systems through an experimental field work and modelling based approach. When not in the lab, she enjoys hiking, tending to houseplants, and finding the best restaurants in the area!

SOURCES OF WATER IN SALT MARSHES: DETANGLING DRIVERS OF NUTRIENT PROCESSING, AND PLANT PRODUCTIVITY

Braswell, A.E.[1,2], *Maya Montalvo*[3], *Emilio Grande*[4], *Ate Visser*[5], *Bhavna Arora*[6], *Erin C. Seybold*[7], *Corianne Tatariw*[8], *John Haskins*[9], *Charlie Endris*[9,10], *Fuller Gerbl*[9], *Mong-Han Huang*[11], *Darya Morozov*[12], *and Margaret Zimmer*[3,13]

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Salt marshes occupy the dynamic boundary between land and sea, offering crucial ecosystem services like nutrient cycling and carbon storage. Freshwater inputs from upland systems interplay with tides to determine the water sources and solutes within salt marshes. While terrestrial freshwater contributions have gained recognition for their significance in affecting hydrological dynamics in intertidal wetlands, we know very little about freshwater inputs to marshes and how freshwater affects salinity and plant productivity. This study investigates the influence of terrestrial freshwater inputs and tidal forces on salt marsh hydrology and its ramifications on subsurface salinity and plant productivity. Our research focuses on an estuary along California's central coast, where we observe seasonal fluctuations in terrestrial freshwater contributions, porewater salinity, and the productivity of pickleweed (*Sarcocornia pacifica*, also known as *Salicornia pacifica*). Our findings reveal a connection between salt marsh porewater salinity, shallow subsurface saturation, and pickleweed productivity. Elevated water levels in the uplands in winter and spring affect the upper and middle marsh, while during the summer and fall, tidal inputs become more influential throughout the marsh. This seasonal shift underscores the pivotal role of terrestrial uplands in shaping salt marsh connectivity and ecosystem functioning. Moreover, our research highlights the complex relationship between drought, historical precipitation patterns, and salt marsh hydrology. It underscores that the sensitivity of salt marshes to climate change results from interactions between rising sea levels and varying freshwater inputs that operate on seasonal to interannual timescales.

PRESENTER 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.

RAIN BARRELL WATER QUALITY IN SOUTH FLORIDA

***Lorna Bravo*[1]**, *Kimberly Moor*[2], *Mica Mc Millan*[3]
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[3]University of Florida FLREC, Broward, FL, USA

Rain barrels are a great way to conserve water, save money, and contribute to a sustainable landscape. Collecting rainwater reduces the amount of water flowing off our properties into the surrounding environment. However, it can be challenging to get people to adopt rain barrels because of concerns about water quality, especially from different roof types (Shuster et al., 2013; Hamilton et al., 2018. This study evaluated concerns about rain barrels water quality used in South Florida Landscapes so that homeowners can better utilize this water in urban landscapes. We sampled the water from 50 rain barrels in South Florida. We had 25 samples from tile roofs, 20 from shingle roofs, and 15 from metal roofs. To get a better handle on rain barrel water quality, we analyzed the pH, soluble salt levels (electrical conductivity, EC), and nutrient levels in rainwater collected from tile, shingle, and metal roofs in South Florida. We also tested for *E. coli* in the water using test kits available on Amazon. We purchased the Aqua Vial Well Water testing kit (for drinking water, pool, pond, lake, and well water) that tests *E. coli* and coliform. Based on our water analysis, we found it safe and suitable for non-potable uses. The water had no E. coli or harmful nutrients, and the roof type did not affect the water quality. We suspect that the high solar radiation and temperatures in South Florida killed potential pathogens. This is an essential factor in South Florida when testing pathogens' presence in rain barrels connected to roof gutters. Temperatures greater than 149 ^{o}F will kill bacteria in water. Our findings agree with the Southwest Florida Water Management district's guide: rain barrel water is safe for non-potable uses and occasional contact.

PRESENTER BIO**:** Lorna is the Urban Horticulture Agent and County Extension Director for UF/IFAS Extension Broward County, she leads the Master Gardener Volunteer (MGV) program and the Florida-Friendly Landscaping program. She applies her architectural and horticultural skills to create resource-efficient and environmentally sensitive communities through trained MGVs.

GROUNDWATER SUSTAINS SALMON STREAMS: SUPPORT TO STREAM FLOW AND TEMPERATURE IN SOUTH-CENTRAL ALASKA

***Tyelyn Brigino*[1]**, *Kai Rains*[1], *Syverine Bentz*[2], *Jacob Argueta*[2], *and Mark Rains*[1]

[1]University of South Florida, Tampa, FL, USA

[2]Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA

Groundwater support to salmon-bearing streams varies in space and time on the Kenai Peninsula Lowlands, Alaska. In this region, groundwater occurs in the shallow subsurface on hillslopes, discharging to streams from diffuse seeps at topographic discontinuities, and in the deeper subsurface in thin and discontinuous aquifers formed in buried Pleistocene outwash channels, discharging to streams from focused springs at aquifer outcrops. Groundwater discharge augments streamflow and modulates stream temperature, which is especially important in winter months. Groundwater discharge from these seeps and springs also typically first interacts with slope and riparian wetlands and emerges with increased nutrient concentrations prior to discharging to streams. Though crucial for the proper functioning of the streams, these limited groundwater resources also provide most of the domestic, municipal, agricultural, industrial, and commercial water supply. Therefore, these limited groundwater resources are delicately balanced between salmon and people, creating a heightened need for information to support water-resources management. We determined the relative contribution of groundwater to streamflow using a geochemical approach. Over four years, we collected more than 200 samples of direct precipitation, runoff, groundwater, and streamflow, including bimonthly streamflow samples over an entire year. We analyzed these samples for major dissolved ion and isotopic signatures and used mass-balance mixing models to calculate the relative contribution of groundwater to streamflow. We found that groundwater contributes significantly to streamflow, although it varies seasonally. Peak flows during spring snowmelt and fall freshets have >50% relative groundwater contribution whereas baseflows in summer and winter show ~80-100% relative groundwater contribution. Additionally, discharge from the different groundwater sources varies seasonally. We deployed 19 thermistors at representative seeps and springs to measure hourly temperature for two years. While hillslope groundwater may turn on and off and freeze during winter, aquifer-outcrop groundwater remains ~2-5°C throughout the year, crucial for liquid streamflow and thermal refugia for salmonids. Our results emphasize the intricate role of groundwater in sustaining salmon-bearing streams in south-central Alaska and are helping build stakeholder capacity to inform peer and institutional discussions and decision-making.

PRESENTER BIO**:** Tyelyn Brigino earned a B.S. in Chemistry and is currently a Ph.D. student in Geology at the University of South Florida conducting research as part of the Ecohydrology Research Group.

COLLABORATIVE RESTORATION OF COASTAL WETLANDS

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

Coastal wetlands and their ecosystem services are key components of resilience because they mitigate loads of nutrients in runoff; enhance protection from flooding and erosion in extreme weather; provide habitat that maintains the diversity of crustaceans, fish, birds, and other animals; and sequester carbon (Blue Carbon). Unfortunately, people have manipulated wetlands on the east coast of Florida for more than 150 years. Direct impacts include dredging navigational channels and filling wetlands for development. Many of the remaining changes arise from efforts to interrupt breeding by saltmarsh mosquitoes through ditching, filling, and impounding. Rehabilitating damaged wetlands requires local, regional, state, and federal collaboration. In collaboration with partners, the St. Johns River Water Management District has led the reconnection, breaching, or rehabilitation of over 22,000 acres of impounded and impacted estuarine wetlands. This work involves restoring a more natural hydrology by adding culverts or returning dikes or piles of spoil to the elevation of adjacent, healthy wetland. Generally, there is no need for planting or subsequent maintenance as the restored wetlands recruit appropriate plants, exclude invasive plants, and are better able to maintain an appropriate vertical position relative to rising sea level. Much of the past work was completed prior to the increased focus on coastal resilience, and this focus has prompted the district to seek resources for acquisition and rehabilitation of a variety of coastal wetlands. Some examples will be present and more information can be found at Bringing Back our Coastal Wetlands.

PRESENTER BIO**:** With nearly 40 years of research and restoration experience, Mr. Brockmeyer is responsible for development and implementation of coastal wetland projects on Florida's east central and northeast coast. He is co-chair of the Subcommittee on Managed Marshes and incoming chair of the multi-agency Northeast Florida Estuarine Restoration Team (NERT).

SETTLING VELOCITIES OF ENVIRONMENTALLY WEATHERED MICRO- AND MACROPLASTIC FIBERS

Jenna Brooks[1,2], *Jessica Boyer*[2], *Charlotte Haberstroh*[2], *and Mauricio Arias*[2]
[1]Northeastern University, Boston, MA, USA
[2]University of South Florida, Tampa, FL, USA

Terminal settling velocity is an important factor in determining how plastics behave in the environment and thus a crucial parameter in transport models. Most settling equations have been developed with lab-generated microplastic particles or other forms of particulate matter such as sediments. The influences that weathering processes may have on plastic settling have not been well documented or quantified. In this study, the settling velocities of environmentally weathered micro- and macroplastic fibers were measured in a laboratory setting for the first time. Results were used to evaluate the accuracy of several current drag models in predicting the behaviors of weathered particles, and a preferred drag model with relatively low errors for both pristine and environmentally weathered plastic fibers was identified. The impacts of this equation on modeling plastic fate and transport were demonstrated using a riverine plastic transport model. The overall objective was to improve our understanding of plastic flows through the environment, which will ultimately assist in future plastic waste management efforts.

PRESENTER BIO**:** Jenna is a Ph.D. student in civil and environmental engineering at Northeastern University. Her research focuses on microplastic transport mechanisms in coastal systems.

COASTAL RESILIENCE & NATURE BASED SOLUTIONS- A DEED PROJECT

Jules Bruck
University of Florida, Gainesville, FL, USA

This collaborative project funded by the Department of Defense aims to determine the appropriate wetland locations for shellfish-enhanced nature-based living shorelines along the Delaware and Chesapeake Bay Estuaries. The goal is to evaluate sites for the potential to develop, deploy, and evaluate a novel coastal protection strategy consisting of multiple shellfish-based strategies across the shallow subtidal and intertidal expanse. The integrated approach to shellfish/wetland protection features a mosaic of habitats (oyster, ribbed mussel, wetland vegetation) deployed as an array of integrated components to dampen wave energy and facilitate sedimentation at a wide range of elevations, thus maximizing the protective potential. Through evaluation of the installation, we seek to determine the feasibility of regenerative nature-based solutions (NBS) in mitigating the effects of SLR and extreme events on landward regions and infrastructure in local estuaries while considering upland urban pressures, infiltration, and water quality on wetland functions and health. An interdisciplinary team of engineers, scientists, and landscape architects are working together on the project to with the goals of 1) enhancing understanding of sediment movement at the land/water interface through detailed measurements of coupled surface water, subsurface water, and geotechnical characterization; 2) yielding critical data on infrastructure resilience and adaptation, especially important for the numerous military installations in close proximity to the coast; 3) developing numerical models; 4) enhancing understanding of nature-based solutions to adapt and recover from impacts; and 5) determining associated benefits for community members. In year one of this four-year project, we conducted an evaluation of scientific and gray literature to determine primary research gaps, and we developed a site suitability model to determine where a natural or hybrid shoreline would be feasible. The project ecologist tested potential sites for shellfish recruitment and the team is currently working on design and permitting for one installation. This work builds from a theoretical framework developed during an interdisciplinary academic project that focused on blue carbon evaluation as a design and funding driver. For this project, we will employ land use forecasting and the InVEST blue carbon modeling software to describe the blue carbon benefits as well as the loss of carbon sequestration benefits over time.

PRESENTER BIO: Dr. Jules Bruck, RLA is Director of the School of Landscape Architecture and Planning, and Professor and Chair of the Landscape Architecture Department at the University of Florida. Previously, as founding Director of Landscape Architecture at the University of Delaware, she co-founded the Coastal Resilience Design Studio (CRDS) which employs interdisciplinary teams of undergraduate students to create resilience plans for coastal communities. CRDS projects have received numerous state and nation.

IMPACTS OF INVASIVE SPECIES ON ARBOVIRUS TRANSMISSION ECOLOGY IN THE EVERGLADES

***Nathan D. Burkett-Cadena*[1]**, *Erik M. Blosser* [1], *Anne A. Loggins*[2], *Monica Valente*[3], *Maureen Long*[3], *Lindsay P. Campbell* [1], *Lawrence E. Reeves* [1], *Irka Bargielowski* [1], *and Robert A. McCleery* [2]

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The indirect or cascading impacts of invasive species are difficult to quantify and predict yet have the potential to be even more damaging and costly than the direct impacts. Particularly worrisome are the indirect impacts that invasive species may have on human disease, given the profound ways that invasive species shape ecosystems and the importance of these ecosystems in supporting or suppressing the transmission of pathogens. The composition of wildlife communities can have strong effects on transmission of zoonotic vector-borne pathogens, with more diverse communities often supporting lower infection prevalence in vectors (dilution effect). The introduced Burmese python, *Python bivittatus*, is eliminating large and medium-sized mammals throughout southern Florida, USA, impacting local communities and the ecology of zoonotic pathogens. We investigated invasive predator-mediated impacts on ecology of Everglades virus (EVEV), a zoonotic pathogen endemic to Florida that circulates in mosquito-rodent cycle. Mammal activity and diversity, and mosquito host selection and EVEV infection rate, were measured at field sites across a range of predicted python presence. Using binomial generalized linear mixed effects models, we observed a strong effect of the dilution host (non-rodent mammal) diversity on blood meals in the vector, and a strong positive effect of relative cotton rat host use on EVEV infection in vector mosquitoes. The Burmese python has caused a dramatic decrease in mammal diversity in southern Florida, which has shifted vector host selection towards EVEV amplifying hosts (rodents), resulting in an indirect increase in EVEV infection prevalence in vector mosquitoes, putatively elevating human transmission risk. Our results demonstrate how an invasive predator can impact wildlife communities in ways that indirectly impact human health, highlighting the need for conserving biological diversity and natural communities.

<u>PRESENTER BIO</u>**:** Dr. Burkett-Cadena is Associate Professor of Entomology at the University of Florida's Florida Medical Entomology Laboratory (FMEL). His research program focuses on the ecology of zoonotic vector-borne disease, especially how environment shapes host selection and arbovirus transmission by mosquitoes and no-see-ums.

SPATIOTEMPORAL VARIABILITY IN BASEFLOW RELATIVE CONTRIBUTION TO EXTREME ANNUAL STREAMFLOW, FLORIDA

Holli Capps Herron *and Katherine A. Serafin*
Department of Geography, University of Florida, Gainesville, FL, USA

Baseflow is important to the state of Florida for many reasons due to the state's unique hydrology and geology. For example, it provides a significant portion of drinking water supply. Florida is also susceptible to extreme hydrological events due to its varied climate, and geographic location, which is heavily impacted by tropical storms for example. Many studies have evaluated extreme and average streamflow variability in Florida. The statistical estimation of baseflow is also a heavy area of research. There are a number of methods for computing baseflow of a river for example, by separating runoff and baseflow from total streamflow. But given limitations of the baseflow separation methods due to slope of Florida's land, reverse flows, etc. there has not been much research on baseflow estimation in the state outside of a few entities such as the water management districts.

This research aims to investigate how baseflow contributes to extreme streamflow events and how that contribution varies based on baseflow separation technique across the state of Florida. Baseflow estimates are determined for U.S. Geological Survey (USGS) streamflow gages with records beginning in 1950 with little to no missing data using eight baseflow separation techniques from the USGS Hydrologic Toolbox. Next, the Block Maxima Approach is used to generate Annual Maxima streamflow series for each of the gages of interest. The relative contribution and percentage of baseflow and runoff to annual maximum streamflow is then calculated. The spatial variability of the relative contribution of baseflow to extreme streamflow events is compared to climate and river characteristics and the statistical significance of results is examined. This initial series of steps is being carried out at a subset of gages in Florida, with plans to expand across the state.

PRESENTER BIO**:** Holli is a PhD student in the Department of Geography at the University of Florida, with a concentration in Climate Science. Their research interests include hydrology, climatology, and extreme value theory. Previous research has included looking at extreme rainfall and streamflow variability.

IRRIGATION EFFICIENCY AND WATER CONSERVATION: STANDARD SPRINKLER NOZZLES VS. HIGH EFFICIENCY NOZZLES

Bernard Cárdenas *and Michael D. Dukes*
University of Florida, Gainesville, FL, USA

Efficient irrigation systems not only conserve water but also contribute to water quality by reducing runoff and nutrient loading to water bodies. The advancement of irrigation technologies (e.g., sensors, controllers, sprinkler heads, nozzles, etc.) offers great opportunities to develop more efficient irrigation systems. The objective of this study was to compare standard nozzles to high efficiency (HE) sprinkler nozzles. The study was conducted at a UF/IFAS research facility, in Gainesville, Florida. The site consisted of 48 plots (12' x 12'), on a field covered with well-established Bermudagrass *cult. Bimini*.

Four traditional nozzle manufacturers were chosen for this study: Hunter, K-Rain, Rain Bird, and Toro. From each of these manufacturers, their standard nozzle was compared to their HE counterpart. The traditional nozzles (or non-HE) were tested at a "city pressure" of 60 psi. The HE nozzles were tested at both the city pressure and at their recommended pressure (or "optimized pressure"), which ranged between 20 and 40 psi depending on the HE nozzle model. Each of the 12 treatments was replicated four times, in a completely randomized design. All treatments were programmed to run for the same amount of time, which varied monthly according to UF/IFAS recommendations for the area. The experiment started on 15 July 2021 and ended on 17 October 2022.

The HE nozzles from brands A and B achieved water savings between 63 and 76%, while brands C and D saved between 12 and 59%, compared to their respective standard nozzles. Moreover, the water savings of HE nozzles from brands A and B were achieved without the need for additional pressure regulation. To achieve their maximum water potential savings, HE nozzles from brands C and D will require them to work at their recommended pressure.

PRESENTER BIO**:** Mr. Cárdenas is a research associate at UF with 20 years of experience in irrigation efficiency and water conservation. His research has contributed to creating 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.

CARBON EMISSIONS REDUCTION AND NUTRIENTS RECOVERY IN WASTEWATER TREATMENT PLANTS

Cristian Cardenas-Lailhacar *and S.A. Sherif*
University of Florida, Gainesville, FL, USA

Today's concerns about greenhouse gases (GHG) are a world-wide issue. Wastewater treatment plants (WWTPs) are included. These facilities play a fundamental role in our society. Water recycling helps the environment and contributes to reducing waterborne diseases. Processes performed in WWTPs vary, but typically include headworks, grit removal, mixing, clarifying, nutrients removal, filtering, disinfection, discharging to local water bodies or open fields, and handling and proper disposal of solid objects. In some plants biogas is generated. Although wastewater treatment is a mature technology, there is significant potential for improvements from an economic and energy efficiency perspective, and to reduce the amount of emitted GHG, as are carbon dioxide and nitrogen oxide.

Energy consumption, GHG emissions, waste management, and productivity data from 20 WWTPs in Florida are presented. The plants range in their processing capacity from 5.5-55 million gallons/day of wastewater treated. For all plants, both an energy use baseline and a carbon dioxide (CO_2) emissions baseline has been established. Several assessment recommendations (ARs) have been identified. These ARs were all evaluated technically and ensure a speedy payback. Areas of potential improvements included motors, pumps, aerators, blowers, lighting, compressed air, occupancy sensors, disinfection, boilers, combined heat and power systems, biogas utilization and processing, insulation, heat recovery, photovoltaics, power generators, nutrients recovery, and energy management systems. Many of these improvements show great opportunities for GHG reduction. It was observed that the electric energy rate structure has a significant impact on the operational costs of WWTPs. Plants that further treat their sludge when biogas is being generated onsite can produce biofertilizers of high grade and can sell it for profit, reducing CO_2 and recover some nutrients. The overall cost savings for all WWTPs studied was as high as $20 million, with an associated reduction in energy consumption of 18% and emissions reduction per plant.

PRESENTER BIO**:** Dr. Cardenas-Lailhacar is an engineer in the Department of Mechanical and Aerospace Engineering at the University of Florida. He has more than 24 years of experience in energy management. He has led over 330 energy audits to manufacturing facilities in the US and Latin America, and service in some governments.

DEFINING FLOOD PRONE AREAS AND ESTIMATING FLOOD EXTENT AREA AND VOLUME

Christine L. Carlson[1], *Azizbek Nuriddinov*[2], *Nicole Cortez*[1] *and Carolina Maran*[1]
[1]South Florida Water Management District, West Palm Beach, FL, USA
[2]Florida State University, Tallahassee, FL, USA

As part of its Climate and Water Resilience Metrics effort, the South Florida Water Management District (SFWMD) is compiling flood reports and event impact summaries to identify areas with recurrent flooding to direct collection of high-water marks and remotely sensed data. The overall objective is to identify areas to monitor for the collection of data to support delineation of flood extent and to estimate flood volume. As a first step, information related to flood occurrence in response to rainfall, storm surge, or tidal events, was inventoried from technical reports, internet sources, high water marks, and public and agency flood reports. Areas with known recurrence and areas identified as having multiple event impact records were delineated as preliminary flood prone areas. These areas will be used to inform and prioritize high water mark collection and sensor deployment activities and could potentially be used to task remote sensing data acquisition. Once flood extent is defined, high resolution topographic data will be used to calculate flood volume.

To share this information with South Florida Flood Resiliency partners, a community HUB site is being developed. This site will provide access to data collection tools and reporting that summarizes event information and provides historical context derived from the compiled inventory of events. The long-term vision is to establish a resource that can notify municipalities, counties, and local drainage districts of incoming flood reports to facilitate mobilization of resources to collect high water marks. These high-water marks would then be used validate remotely sensed flood extension delineations and model results or define flood extension within those areas where marks are measured.

PRESENTER BIO**:** Christine Carlson leads a team of geospatial professionals in the development and maintenance of enterprise geospatial data and the deployment of geospatial products and tools. During her over 30-years long career, she has worked in a variety of capacities and fields including modeling, restoration evaluation, and remote sensing.

ONE WATER MASTER PLANNING: ACHIEVING THE FULL BENEFITS OF WATER

Pete Sechler[1], Jon Dinges[2], Mike Britt[3] and ***Keeli Carlton[4]***

[1]GAI Associates Community Solutions Group, Orlando, FL, USA
[2]Black and Veatch Corporation, Tampa FL USA
[3]Sustainable Water Communities, Winter Haven, FL, USA
[3]City of Winter Haven, Winter Haven, FL, USA

One Water is defined by the U.S. Water Alliance as:
A transformative way of viewing, valuing, and managing water. The One Water approach manages all water…in a collaborative, integrated, inclusive, and holistic manner. One Water can change and regenerate the way we live, the opportunities we have, our environment, and our society.

The term One Water also encompasses terms such as Sustainable Water, Resiliency, and Integrated Water. The City of Winter Haven is an on-going case study in how to plan and implement One Water at the local watershed scale. This community is growing rapidly and is located at the headwaters of the Peace River that flows into Charlotte Harbor and the Floridan Aquifer. This area is also a part of the Southern Water Use Caution area due to depleted water supplies. Winter Haven has 50 lakes inside and adjacent to the city limits and is known as the “Chain of Lakes City”. Area residents depend on these natural systems for quality of life, economic, and environmental benefits.

One Water strategies considers many challenges and opportunities: rapid population growth, land use change, scarcity of traditional fresh groundwater supplies, escalating water supply costs, impaired lake water quality and levels, increased flooding, and altered water cycles. If Winter Haven were to address each of these challenges independently, it would be very costly and take a long time to resolve. The One Water approach minimizes the cost and maximizes the benefits of water within a reasonable timeframe. The outcome is efficient and effective planning that will give Winter Haven a well-communicated plan that is understood across all stakeholders. The audience will hear a multi-disciplinary approach about One Water, including planners, engineers and communications professionals.

PRESENTER BIO**:** Keeli Carlton is the City of Winter Haven’s One Water Program Administrator. Her focus is on water conservation, communications and outreach to bring the One Water message to light for a variety of stakeholders. Keeli is also the current chair of the Water Use Efficiency Division of the FSAWWA.

DATA-DRIVEN ANALYSIS OF PATTERNS AND DRIVERS OF FLOW CHANGE IN THE SANTA FE RIVER BASIN OF FLORIDA

***J. Barrett Carter*[1,2]**, *Patricia Spellman*[3], *Sean King*[2] *and Amy Brown*[2]

[1]University of Florida, Gainesville, FL, USA
[2]Suwannee River Water Management District, Live Oak, FL, USA
[3]University of South Florida, Tampa, FL, USA

Characterizing and quantifying the relative impacts of climatic, hydrogeologic, and anthropogenic drivers of stream discharge is a topic of high importance to water scientists and water resource managers. The Santa Fe River Basin in North Central Florida is a well-gaged, hydrogeologically complex system that is known to be impacted by anthropogenic changes in land use and groundwater withdrawals, making it an ideal system for the study of drivers of flow change. While physics-based hydrologic models are available to be used as tools for studying causes of flow change, there is a need to verify the predictions made by these models which are dependent on underlying assumptions and calibration. Further, the high availability of observational data on the system lends itself to a data-driven approach for characterizing patterns of change within and between the many variables interacting in the system. Thus, a suite of timeseries-based, data-driven analysis methods were performed on in-situ, remotely sensed, and derived datasets to characterize patterns of autocorrelation and cross-correlation and to detect causal relationships between variables related to flow, evapotranspiration (ET), precipitation, groundwater levels, and water use. Wavelet coherence results indicate a recent change in rainfall-runoff relationships with coincident increases in remotely sensed actual ET in the Upper Santa Fe River Basin, where the Floridan Aquifer is confined. Convergent cross-mapping results suggest a stronger influence by groundwater on baseflows throughout the basin relative to precipitation. However, a stronger influence by remotely sensed leaf area index, relative to precipitation, on baseflow was only detected for the Lower Santa Fe River Basin where the Floridan Aquifer is unconfined. Our findings could be used to help inform hydrologic modelers regarding model parameterization and decision makers regarding water and land use for the focus area and similarly impacted systems, but the results should be corroborated using other modeling methods.

PRESENTER BIO**:** Barrett Carter is an Engineering Scientist for the Office of Minimum Flows and Minimum Water Levels at the Suwannee River Water Management District and a Ph.D. candidate in the Department of Agricultural and Biological Engineering at the University of Florida. Barrett specializes in big-data analysis and hydrogeochemical modeling.

BARRIERS TO UNDERSTANDING SEA-LEVEL RISE IMPACTS ON EVERGLADES RESTORATION

Stephanie L. Castellano[1]*, Mysha K. Clarke*[1]*, Laura E. D'Acunto*[2]*, and Stephanie S. Romañach*[2]

[1]University of Florida, Gainesville, FL, USA

[2]U.S. Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA

Florida's Everglades restoration partners have long recognized the need to consider the impacts of sea-level rise on restoration efforts. However, many partners are not formally incorporating sea-level scenarios into restoration planning. There are high levels of uncertainty around how sea-level rise will affect the Everglades ecosystem, and what it means for restoration goals and outcomes. To help reduce this uncertainty, partners require tools and methods to confidently include sea-level rise scenarios into restoration plans. We are working with Everglades restoration partners to understand how they each think sea-level rise will impact their restoration efforts, how it may alter their goals and priorities, and which resources will be most helpful for evaluating the impacts of sea-level rise on Everglades restoration. We have conducted focus groups and semi-structured interviews with members of RECOVER (REstoration COordination & VERification), a multi-agency scientific group of government, non-profit, and Tribal organizations that provide input on the implementation of the Comprehensive Everglades Restoration Plan (CERP). The results reveal the potential sea-level rise impacts that partners are most concerned about, gaps in data and model limitations that restrict their ability to plan for those impacts, assumptions and uncertainties embedded in restoration planning, and tools that partners would find most helpful for decision-making. These insights are informing the design of data visualization tools that can help partners choose sea-level rise scenarios most relevant to their unique projects, incorporate those scenarios into current planning processes, and decide between competing restoration plans as CERP projects continue to be implemented across the landscape.

PRESENTER BIO**:** Stephanie Castellano is pursuing an M.S. in Interdisciplinary Ecology from the School of Natural Resources and Environment at the University of Florida. She has a background in journalism and has reported on issues surrounding water conservation, biodiversity in urban areas, and hurricane recovery.

US NITROGEN DEPOSITION: ARE URBAN AREAS UNDERREPRESENTED IN THE N DEPOSITION MONITORING NETWORK?

***Tanya Charan*[1]**, *Mary Lusk*[2]

[1]University of Florida, Gainesville, FL, USA

[2]Soil, Water, and Ecosystems Science Department, Gulf Coast Research and Education Center, University of Florida, Wimauma, FL, USA

Nitrogen (N) serves as one of the vital building blocks to make life possible on Earth. However, N deposition, or the input of reactive N from the atmosphere into the biosphere, can be a concern for both the environment and agricultural specialists, since N in excess of ecosystem needs encourages soil acidification, algal blooms in aquatic systems, and the depletion of vital nutrients from the soil. The National Atmospheric Deposition Program (NADP) has 250 National Trends Network (NTN) monitoring sites which collect data about major ions in precipitation. These sites are mostly located in rural areas and are not fully representative of the N deposition concentrations in urban settings. Due to a high concentration of both stationary and mobile N sources in urban areas, we argue that more monitoring sites for atmospheric N deposition should be in urban contexts and hypothesize that the current national data on N deposition does not adequately capture trends for urban areas. In this study, we accessed N deposition data from the NTN to compare N concentration readings from the sites and their distance to the nearest urban area. This was accomplished by using NH_4 and NO_3 site readings using 2021 data. We also used GIS tools to determine the distance from each NTN monitoring site to the nearest urban area (defined as having 5,000 people or more) and the number of urban areas within a 50 km radius of each monitoring site. We found that more than 90% of NTN monitoring sites are > 20 km from an urban area, showing how urbanized locations are underrepresented in the national monitoring data of atmospheric N deposition. This presentation shows N deposition trends vary in rural versus urban monitoring sites and will discuss implications of urban sites being underrepresented in national N deposition data.

<u>PRESENTER BIO:</u> Tanya Charan is a senior Soil, Water, and Ecosystems Sciences student at the University of Florida, who is also minoring in Computer and Information Science and Engineering and pursuing the Artificial Intelligence Certificate for Undergraduates. She also serves as the Secretary for Girls Who Code at UF's executive board.

LEVERAGING HISTORICAL MOSQUITO IMPOUNDMENTS TO TREAT EUTROPHIC WATERS IN THE INDIAN RIVER LAGOON, FL

***Taryn Chaya**, Todd Z. Osborne*
Whitney Laboratory for Marine Bioscience, University of Florida, St. Augustine, FL, USA

The Indian River Lagoon (IRL) is recognized as an Estuary of National Significance by U.S. Environmental Protection Agency's National Estuary Program (NEP) and boasts the greatest biological diversity of any estuary in North America. Nonetheless, given the adverse effects of excessive nitrogen and phosphorus inputs from the surrounding landscape on water quality, the IRL is currently experiencing frequent severe algal blooms. Since the early 20th century, littoral wetlands throughout the IRL have been impounded to control mosquitos, which has disconnected them hydrologically from the open water portions of the lagoon and greatly reduced their ability to buffer incoming nutrient loading. Rotational impoundment management techniques are currently implemented in many modern mosquito impoundments, but no research has been done to study the optimal hydrologic schemes to maximize nutrient removal whilst maintaining mosquito population control.
The unique structure of mosquito impoundments, coupled with the low tidal range of the IRL can be leveraged to potentially provide an effective estuarine treatment wetland. Herein, we are conducting a pilot study to ultimately determine the nutrient removing potential of varying hydrologic regimes within a mosquito impoundment. The initial phase of this project characterizes seasonal water quality conditions throughout a selected mosquito impoundment. Water samples taken at the inflow and outflow of the impoundment were analyzed for total dissolved nitrogen, nitrate/nitrite (NOx), ammonium, and total dissolved phosphorus. Furthermore, YSI EXO2 multiparameter water quality sondes were placed in-situ at the inflow and outflow sites to measure dissolved oxygen, pH, turbidity, temperature, salinity, chlorophyll-a, and fluorescent dissolved organic matter at 15-minute intervals. This preliminary data will guide subsequent project phases to understand the overall ability for these systems to mitigate the nutrient loading situation occurring in the IRL.

PRESENTER 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 in estuarine biogeochemistry. Taryn previously earned her master's degree in Soil and Water Sciences from the University of Florida.

CONNECTING RED TIDE TO ENVIRONMENTAL CONDITIONS ACROSS SOUTHWEST FLORIDA

***Nicholas Chin**, David Kaplan, Ronald Fick*

Center for Coastal Solutions, University of Florida, Weil Hall 365, Gainesville, Florida, USA

Blooms of the marine dinoflagellate *Karenia brevis* ("red tide") occur almost annually along Florida's Gulf Coast, killing fish and marine mammals, contaminating shellfish, and causing human respiratory irritation. There is growing evidence that blooms are a consequence of climatological, oceanographic and watershed processes, however questions about the drivers of intra- and interannual bloom severity, extent, and duration remain unanswered. Studies suggest that *K. brevis* blooms begin offshore in the Gulf of Mexico and are transported inland by wind and currents, where they are likely fueled by terrestrial nutrient loading. This work applies machine learning to investigate what confluence of environmental variables correspond to different bloom stages. Daily probabilistic *K. brevis* maps were generated using a neural network that took in-situ samples and remote sensing data as inputs. The higher spatial and temporal resolution provided by these maps in conjunction with the self-organizing map algorithm, generated a response variable that helps to characterize distinct bloom stages. A random forest classifier was then used to empirically derive the underlying climatological, hydrologic, and oceanographic mechanisms responsible for the discrete categorical bloom maps. Preliminary results suggest that the dynamics of the Loop Current alongside river flows and seasonality have a strong empirical relationship to distinct bloom stages. By testing different combinations of environmental variables with various time lags in a random forest model, the hope is to identify the drivers of key bloom stages like initiation, rapid growth, and termination.

PRESENTER BIO: Nicholas Chin is a 3rd year PhD student in UF's Watershed Ecology Lab through the Engineering School of Sustainable Infrastructure and the Environment. His research involves modeling estuarine and coastal phenomena using machine learning.

FACTORS DRIVING PERSISTENT COMPOUND FLOODING IN NORTHWEST FLORIDA: 2018 - 2022

Kathleen E. Coates
Northwest Florida Water Management District, Havana, FL, USA

From 2018 through 2022, persistent compound flooding affected residents across a substantial portion of northwest Florida, with numerous properties impacted. Affected areas included the Sand Hill Lakes region of Washington and Bay counties, the Bear and Bayou George creek basins in Bay County, and the Wetappo Creek basin in Gulf County. Flooding was caused by multiple factors. The region experienced multiple years of above-normal precipitation from 2013 to 2018, followed by six named tropical systems from 2018 to 2022. In October 2018, Hurricane Michael brought intensely destructive winds that devastated forests across the region. National Land Cover data indicate Hurricane Michael caused the loss of nearly 80,000 acres of evergreen forests and 28,000 acres of forested wetlands. Fallen trees and associated debris smothered stream channels and floodplains. This reduced the conveyance capacity of affected streams and elevated the stream stages. Both the magnitude and spatial extent of flooding increased near affected stream channels and floodplains. Following Hurricane Michael, evapotranspiration (ET) rates decreased substantially in impacted areas where forest cover was lost. Rainfall continued above average following Hurricane Michael with the two-year cumulative rainfall exceeding the 90th percentile for much of 2019 through 2022. Declines in ET combined with continued extreme rainfall led to an extended period of flooding conditions. High rainfall and low ET also resulted in higher groundwater levels which further contributed to flooding, particularly in karst closed basins. Mitigation of this type of flooding is challenging, particularly in rural karst closed basins.

PRESENTER BIO: Dr. Coates has 25 years of experience in water resource management, including surface and groundwater hydrology, water supply planning, environmental flows, and hydrologic restoration. She is a Deputy Director in the Resource Management Division at Northwest Florida Water Management District.

South Florida Water Management District Sea Level Rise and Flood Resiliency Plan, 2023

***David J. Colangelo*[1]**, *Ana Carolina Coelho Maran*[2]
[1]Earthology Consulting Services, (In-house Contractor, South Florida Water Management District) West Palm Beach, FL
[2]South Florida Water Management District, West Palm Beach, FL

The South Florida Water Management District (District) is committed to addressing the impacts of climate change, including sea level rise (SLR), changing rainfall patterns and evapotranspiration trends. The District's Sea Level Rise and Flood Resiliency Plan (Resiliency Plan) includes a comprehensive list of resiliency projects that aim to reduce risks of flooding and SLR on water resources and increase community and ecosystem resiliency in South Florida. This will be achieved by enhancing water management infrastructure throughout the Central & South Florida Flood Control System and the Big Cypress Basin.

The District's Flood Protection Level of Service (FPLOS) Program has been advancing modeling efforts in critical basins to help understand current and future flood vulnerabilities and identify cost-effective implementation strategies. The District's Capital Improvement Plan (CIP) has been incorporating climate change and SLR considerations into the design of infrastructure projects. Recommendations include flood adaptation strategies that address the vulnerability of existing infrastructure and project recommendations that protect water supply and water resources of the State.

The District seeks to implement projects that benefit South Florida's communities and environment by working with stakeholders. The updated plan, published on September 1st, 2023, includes a ranking approach that supports project prioritization in South Florida, including metrics that identify critical infrastructure, and socially vulnerable communities basin wide. The plan also includes strategies for implementing nature-based solutions, sustainable energy strategies, a resiliency view on ecosystem restoration efforts and potential carbon storage, and water supply. The plan also contains a description of the flood damage cost estimate tool (SFWMD FIAT) used to support cost-benefit analysis. Funding for implementation of priority projects is being sought through Federal and State Resiliency Programs, such as the Federal Emergency Management Agency - Building Resilient Infrastructure and Communities grant program and the Florida Department of Environmental Protection - Resilient Florida grant program.

PRESENTER BIO: David has over 25 years of experience in project management, environmental policy, and wetland ecology. He currently works on contract with the District Resiliency Team.

ADAPTIVE AND PREDICTIVE DECISION SUPPORT SYSTEM FOR IRRIGATION SCHEDULING: AN APPROACH FOR THE INTEGRATION OF THE HUMAN IN THE CONTROL LOOP

***Gregory Conde**, Sandra M. Guzmán*

Agricultural and Biological Engineering Department, UF/IFAS Indian River Research and Education Center, Fort Pierce, FL. USA

In this presentation, our team will introduce the development of an adaptative and predictive irrigation management decision support system (DSS) using seepage irrigation as a case study. The DSS is a feedback plus feedforward algorithm that uses modeling, estimation, prediction, and control strategies. The major feature of this DSS is the consideration of human intervention in the control loop. The DSS integrates field data, including soil moisture, rain, temperature, and irrigation, in addition to weather forecasting. It provides irrigation managers with precise and practical instructions based on the manager's decision of when and how much to irrigate. The DSS will adapt in real-time to provide irrigation volume recommendations that ensure optimal soil moisture levels are maintained. Our approach includes the incorporation of a simplified control-oriented model (COM) to characterize the soil moisture dynamics, a data processing stage that makes the measured data compatible with the COM, a parameter estimation stage that guarantees an optimal adjustment of the COM parameters, a control stage that uses the parametrized COM, measured information from the crop, and weather forecasts to obtain optimal irrigation volume recommendation. To evaluate our DSS, we conducted a test in a commercial sweetcorn field in South Florida, where seepage irrigation is used. Our findings demonstrate that i) the proposed model and estimation stage offer an accurate description of the soil moisture dynamics, reaching R-squared values greater than 0.84 during all the evaluations, ii) the algorithm can consistently regulate soil moisture, ensuring it remains at the desired levels reducing the risks associated with leaching and runoff, and iii) water savings can increase by 30 % if both in-field sensors and the DSS are implemented. Therefore, our DSS has the potential to serve as a standardized platform for providing optimal and practical irrigation recommendations to irrigation managers.

PRESENTER BIO: Dr. Gregory Conde is an Associate Postdoc at the University of Florida's Smart Irrigation and Hydrology Laboratory. An expert in control systems, he specializes in optimizing agricultural practices through applied math and artificial intelligence. Dr. Conde holds a joint Ph.D. in Automatic Control and Engineering and has been recognized for his contributions to improving water management in irrigation systems.

His postdoctoral research is funded by the Conservation Innovation Grants program at USDA's Natural Resources Conservation Service entitled: *"Enhancing the irrigation management in vegetable farms in southeast US by developing root zone soil moisture maps in both high spatial and high temporal resolutions".*

RESULTS OF A DECADE OF MONITORING GROUNDWATER NITROGEN CONCENTRATIONS IN FLORIDA'S SANTA FE BASIN

Rick Copeland
AquiferWatch, Tallahassee, Florida, USA

Background nitrate concentrations in the Upper Floridan aquifer (UFA) are less than 0.05 mg/L (Upchurch et al., 2019). The authors mentioned that by the early 2000s, concentrations in aquifers underlying the karst areas of Florda became elevated, relative to background. The increases are linked to nuisance algae and turbidity changes in spring runs. In the early 2000s the Florida Department of Environmental Protection (FDEP) initiated basin management action plans (BMAPs) to establish a framework to restore the water quality in Florida's impaired water bodies. During the same period, many organizations across the state began increasing their monitoring activities. The activities were not necessarily related to the BMAP efforts, but often took place within the targeted BMAP water bodies, such as the Santa Fe River basin in north-central Florida. One such effort occurred within the basin. In 2014, AquiferWatch, a volunteer groundwater monitoring organization, and Florida LAKEWATCH, a citizen science organization affiliated with the University of Florida, began monitoring groundwater in residential wells tapping the UFA for nitrate. Recent analyses indicate that between 2013-2022, nitrate concentrations have not increased or decreased. Nitrate data from residential wells were also obtained from FDEP and the Alachua County Environmental Protection Department. Data were from the same period, tapped the UFA, and from the Santa Fe River basin. Again, analyses revealed no statistically significant changes. The simplest explanation for the leveling of nitrate concentrations is an increase in precipitation and subsequent recharge. However, other potential drivers include: (1) complex relationships among pH, dissolved oxygen, the ratio of nitrate to ammonium, water temperature, and biological activities, (2) changes in land use practices and (3) BMAP implementation.

PRESENTER BIO: Dr. Rick Copeland is the Director of AquiferWatch Inc. He has worked for over 45 years as a hydrogeologist in Florida. He has established numerous quality monitoring networks, administered Florida's statewide groundwater and surface water monitoring networks, and has authored many papers regarding the analyses of water quality changes.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT'S WATER AND CLIMATE RESILIENCE METRICS IMPLEMENTATION: A STATUS UPDATE

Nicole A. Cortez[1], *Ana Carolina Coelho Maran*[2]
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[2]South Florida Water Management District, West Palm Beach, FL, USA

In 2021, the South Florida Water Management District (SFWMD) began characterizing an initial set of Water and Climate Resilience Metrics. These metrics were established to track and document trends and shifts in historical observations for relevant water and climate data. The metrics effort, along with modeled and projected data, and other relevant local and regional information, supports the delineation of current and future climate condition planning scenarios, operational decisions, and resiliency adaptation priorities.

This presentation will provide an introduction of the current set of Water and Climate Resilience Metrics, the analytical approach used to monitor trends, and an overview of significant findings to date. It will also summarize next steps and future efforts.

In addition, the metrics effort includes the dissemination of compiled data and findings. The Resilience Metrics Hub is a user-friendly online platform that provides access to real time data and automated tend analyses, along with technical reports, published annually as part of the South Florida Environmental Report, is instrumental in ensuring the public, our partners, and stakeholders have access to all information, technical analyses, and the latest work products and findings.

PRESENTER BIO: Nicole Cortez is the Resiliency Coordinator at SFWMD, where she leads the District's Water and Climate Metrics effort. She holds a bachelor's degree in environmental science from Florida International University and has over a decade of experience in a variety of environmental programs.

AN ENDANGERED GRASS "FALLS" FOR A COMPLEX HYDROLOGIC REGIME IN EVERGLADES NATIONAL PARK

Raelene Crandall[1]*, Jimi Sadle*[2]*, Ben Baiser*[1]*, and Owen Schneider*[1]

[1]University of Florida, Gainesville, FL, USA

[2]Everglades National Park, Homestead, FL, USA

Hydrologic regimes strongly influence plant population dynamics over time in seasonally flooded environments. Aspects of the hydrologic regime, such as the seasonal timing, magnitude, and frequency of flooding, should be considered when managing populations of endangered plant species in seasonally wet places. We tested the response of *Digitaria pauciflora*, a federally endangered grass, to different flooding regimes of Everglades National Park, where the extent and duration of flooding is generally greater during the wet season but varies spatially along topographic gradients. We established demography plots at both ends of *D. pauciflora*'s elevation range. We measured vital rates, including growth, survival, and reproduction, annually for four years (2020-2023). Results showed that *D. pauciflora* has a patchy distribution across the landscape, likely because it reproduces seasonally through vegetative reproduction via plantlets. Mature plants produce plantlets that remain on the plant until they become heavy and fall, placing plantlets in direct contact with the ground. The plantlets can then begin rooting, provided they land in suitable microsites that are not flooded. We found that *D. pauciflora* had increasing population growth in lower elevation areas, but only when seasonal flooding ended before plantlets fell to the ground. In these instances, *D. pauciflora* had both higher establishment and survival. During extended flooding events, the establishment of new plants was rare, causing a net decrease in population size (i.e., greater mortality than establishment). We suggest that *D. pauciflora* has a "boom or bust" population demography. Over the long term, this cycle should maintain populations of *D. pauciflora* provided bust years do not outnumber boom years during which the population can recover. *Digitaria pauciflora* and other plant species might be considered indicator species and should be recurrently monitored to guide the restoration of hydrologic regimes in Everglades National Park and elsewhere.

<u>PRESENTER BIO:</u> Dr. Crandall is an Associate Professor in the School of Forest, Fisheries, and Geomatics Sciences with more than 20 years of experience in conservation and restoration of fire-dependent ecosystems. When not igniting fires, you can find her exploring the Everglades and elsewhere looking for and studying new populations of endangered plants.

SEASONAL PATTERNS OF ALONGSHORE SEDIMENT TRANSPORT REVEALED IN NE FLORIDA USING SATELLITE IMAGERY

Copeland W. Cromwell *and Peter Adams*
Department of Geological Sciences, University of Florida, Gainesville, FL, USA

The longshore transport of sediment is a critical component of nearshore sediment budgets and influences the evolution of coastlines. Quantifying longshore sediment transport (LST) over large study areas at the decadal scale requires extensive knowledge of historic shoreline orientations and wave characteristics. These data were previously insufficient (temporally and spatially) to investigate this process. To address these limitations and improve our understanding of LST regimes along the Florida Atlantic coast, we couple a 38-year record of satellite-derived shoreline orientations with hourly wave conditions from the U.S. Army Corps' Wave Information Study to estimate gradients in LST along 24 km of coastline at Anastasia Island, FL. Our results indicate seasonally antithetic directionalities in LST along Anastasia Island with summer LST characterized by northward sediment movement and winter LST characterized by southward transport. When combined to estimate net sediment movement along Anastasia Island, gradients and inflections in our LST estimates correlate with regions exhibiting patterns of shoreline advance and retreat. These results imply that wave climate in NE Florida drives seasonally distinct patterns of LST which contribute to shaping the coastline. This work is among the first to incorporate spatially and temporally robust records of shoreline positions and wave conditions to drive decadal-scale LST models revealing seasonal variability of LST. These results provide valuable insights for coastal management strategies and highlight the importance of incorporating robust databases of shoreline position and wave conditions when investigating LST gradients in evolving coastal systems.

PRESENTER BIO: Copeland Cromwell is a PhD student at the University of Florida's Department of Geological Sciences working with Dr. Peter Adams. Copeland's research focuses on understanding the decadal scale morphodynamic responses of beaches and dunes to wind and wave forcing in coastal settings.

NORTH FLORIDA SPRINGS: AN ENDMEMBER TO UNDERSTAND SPATIAL AND TEMPORAL VARIABILITY IN WATER QUALITY

Lindsey Aman Cromwell[1], *Matthew J. Cohen*[1], *James W. Jawitz*[2]

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[2]Soil, Water, and Ecosystem Sciences Department, University of Florida, Gainesville, FL, USA

Springs represent critical freshwater resources that are often regarded as windows into the health of groundwater. Observations indicating the degradation of spring water quality have prompted investments in high-frequency water quality sampling at select sites. This increased data collection frequency has focused on temporal variation, but spatial sampling density has not increased proportionately, often resulting in spatially sparse datasets. Florida springs have been coined “nature’s chemostats” where water quality discharging from the springs is temporally stable, emphasizing that heterogeneity between springsheds may create spatial variability greater than temporal variability. Thus, North Florida springs, where temporal variability is minimized, may serve as an iconic endmember to understand spatial variability in spring water quality. Water quality datasets were extracted from the Water Quality Portal and Florida’s Water Management Districts representing over 700 springs and 300,000 samples across 10 solutes including pH, temperature, dissolved oxygen (DO) dissolved organic carbon (DOC), specific conductivity, alkalinity, iron, calcium, nitrate, and phosphate. Our results indicate that spatial variability is generally greater than temporal variability for most solutes except pH and temperature showing near negligible spatial variability. Most bioreactive solutes (nitrate, phosphate, dissolved organic carbon, iron) consistently exhibit greater temporal variability than geogenic solutes, consistent with previous studies showing chemostatic responses of geogenic solutes with stream discharge. Unraveling the links between solute variability and landscape heterogeneity is critical for interpreting water quality changes and making water quality projections. Additionally, the relative importance of spatial versus temporal variability in spring water quality informs optimized sampling efforts may need to consider increased spatial density, even at the expense of temporal sample frequency.

<u>PRESENTER BIO:</u> Lindsey is a second-year PhD student in the Ecohydrology Lab at the University of Florida. Along with her research on spatial and temporal variability in Florida springs, Lindsey is involved in the Carbonate Critical Zone-Research Coordination Network to promote collaborate science in carbonate-rich critical zones.

SIMPLIFIED END-TO-END EXECUTION OF NEXT GENERATION WATER RESOURCES MODELING FRAMEWORK

Josh Cunningham
University of Alabama, Tuscaloosa, AL, USA

The Cooperative Institute for Research to Operations in Hydrology (CIROH) oversees the community version of the NextGen water resources modeling framework (NextGen), aimed at facilitating the adoption of promising improvements in hydrology research and operations. This framework promotes model interoperability, standardized workflows, and simplifies the implementation of various modeling options. To showcase its capabilities, CIROH has prepared a continuous research data stream from NextGen-based models, providing access to CIROH members for experimentation and comparison. The data stream generated using the Computational Functional Equivalent (CFE) model within the containerized NextGen In A Box (NGIAB) application, aims to accelerate model development and is accessible through open GitHub repositories and public cloud buckets, making simulations with NextGen more accessible. The presentation outlines the data stream preparation process, updates to the NextGen framework, and invites engagement for further enhancements.

PRESENTER BIO: I got my BSc in Computer Science at Leicester in the UK, worked for a few years as a devops engineer / research software engineer at the Rutherford Appleton laboratory (particle physics and high-powered laser research), and am currently in the final semester of my Masters. At a high level it was my job to make data easier to access and analyze. As a GRA I'm trying to do the same in hydrology, contributing to open-source projects and building tools to unify existing multi-step processes.

BENTHIC AND PELAGIC RESPONSES TO NITROGEN INPUTS IN AN URBANIZING ESTUARY

***Justina Dacey*[1]**, *A.J. Reisinger*[2], *Nikki Dix*[3], *Kaitlyn Dietz*[3], *Jessica Lee*[3], *and Ashley Smyth*[1]

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Coastal urbanization increases nitrogen (N) inputs, threatening the balance of estuarine N budgets. Estuaries play a critical role in regulating N fluxes by moderating benthic-pelagic coupling, the interactions, and feedback between water column and sedimentary processes. To assess the importance of internal regeneration and external loading to benthic-pelagic coupling, nutrient availability, and the ecosystem response, we coupled nutrient limitation bioassays (NLB) with sediment nutrient fluxes and measured responses from elevated nutrient levels in the Guana Estuary (GE), an urbanizing estuary in NE Florida. We measured phytoplankton nutrient limitation in the water column using urea, NO^-_3, and P alone and in combination and nutrient fluxes (NO_x, NH_4^+, PO_4^{3-}) at four sites along a salinity gradient and during three seasons. We also measured sediment-water nutrient fluxes and dissolved gases for two seasons. The degree of phytoplankton nutrient limitation differed between sites, with phytoplankton exhibiting particularly large responses to organic nitrogen (as urea) inputs. Preliminary data suggests N (urea and NO^-_3 additions) limitation occurred at all sites. P was rarely limiting by itself but became limited in the presence of N. Co-limitation of urea + P was present as you moved along the salinity gradient, except the last site which had urea limitation with secondary P limitation, suggesting differences in site characteristics that could be driving varying nutrient limitation. Sediment inorganic nitrogen fluxes differed across sites, but there was no relationship between N fluxes and salinity. Three of the sites exhibited NOx uptake with elevated water column NO_3^-, indicating the system is poised to respond to N additions through both benthic and pelagic processes. Our paired sediment flux and phytoplankton nutrient limitation studies provide a better understanding of the coupled benthic-pelagic processes and their variability, informing their potential sensitivity to anthropogenic pressures.

PRESENTER BIO: Justina Dacey is a Ph.D. student in the Soil, Water, and Ecosystem Sciences Department. She specializes in biogeochemistry of urbanizing coastal ecosystems. She has experience in coastal resiliency, shoreline restoration and environmental education. She is passionate about understanding the complex estuarine processes to preserve Florida's coastal communities.

SPATIAL STABILITY OF WATER QUALITY IN THE LAKE OKEECHOBEE WATERSHED

Dan Dai*, James W. Jawitz, Matthew J. Cohen, and Nicolas Fernandez*
University of Florida, Gainesville, FL, USA

Improving surface water quality in large watersheds is complicated by high spatiotemporal variability. Establishing high-density monitoring sites and conducting high-frequency sampling within the watershed may capture sources and pathways of pollutants, however, it can be a costly endeavor. Lake Okeechobee is the largest freshwater lake in the southeastern United States and the heart of the greater Everglades ecosystem services. Although great restoration efforts have been made to reduce phosphorus (P) loads to the lake, it has still been plagued by frequent algae blooms for years. We examined the spatiotemporal water quality variability in the watershed to help identify hot spots and hot moments, with an emphasis of the stability of the patterns. We chose three groups of water quality parameters reflecting geogenic, biogenic, and anthropogenic sources within the upstream region of Lake Okeechobee watershed. We quantified the spatial stability of stream water quality across the monitoring stations using Spearman's rank correlations between the concentrations rank of individual sampling date and the water quality matrix spanning two decades. Our results showed that spatial stability of the stream water quality in the Lake Okeechobee watershed can be attributed to a higher spatial coefficient variation (CV) than temporal CV, and temporal synchrony of the time series. The spatial stability highlights how infrequent synoptic sampling may be sufficient to accurately represent the spatial patterns of water quality over the past two decades. This information demonstrates that for the Lake Okeechobee watershed, frequent sampling during the wet season is more efficient for quantifying solute loads, but infrequent sampling at additional sites can help locate the sources, determine the water restoration locations, evaluate the efficacy of water quality monitoring regime.

PRESENTER BIO: Dr. Dai is a postdoc at the University of Florida. She has experience in water quality analysis, lake eutrophication and nutrient load control.

IS DROUGHT A DRIVER OF RENEWABLE ENERGY DEVELOPMENT?

Natalia Dambe[1] *and Johanna Engström*[2]
[1] Geography Department, University of Florida, Gainesville, FL, USA

Drought is one of the costliest natural hazards in the United States and globally. When drought strikes farmers are disproportionately impacted, facing partial, and in extreme cases, complete loss of their crops and/or livestock. Federal assistance programs are in place and private crop insurance is also available to alleviate the economic impact of the drought hazard on the individual farmer and the agricultural industry. Yet, after facing a severe drought, or repeated drought-related losses, some farmers look into diversifying their income sources. One way to do so is to sell or lease their land for renewable energy development, i.e. placing wind turbines or solar panels on it. As droughts are becoming more frequent and severe, and there's a continuous push for expanding renewable energy installations to replace traditional energy sources, this study investigates the role of drought in renewable energy development. Based on the hypothesis that drought-stricken farmlands are more likely to be subject to new wind and solar installations, we evaluate the role of drought as a spatial driver of renewable energy development in the U.S.

PRESENTER BIO: Natalia Dambe is a Ph.D. Student and World and Big Data instructor in the Geography Department at the University of Florida with three years of experience in renewable energy development and at least six years of hands-on experience in collection, measuring, interpreting, processing, analyzing, displaying, and managing geographic information.

IOT BASED SENSOR SYSTEM FOR ESTIMATION OF CROP WATER STRESS INDEX AND SMART IRRIGATION SCHEDULING IN MAIZE AND WHEAT CROPPING SEQUENCE

***Susanta Das*[1]**, *Samanpreet Kaur*[2], *and Vivek Sharma*[1]
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[2]Department of Soil and Water Engineering, PAU, Ludhiana, India

Water scarcity is a growing concern, particularly in nations like India. Climate change has prompted the need for water adaptation strategies to safeguard agricultural and human water access. Effective water management, crucial for nations facing water constraints, can be achieved through cost-effective sensor-based irrigation scheduling. However, the high cost of conventional commercial sensors makes their implementation unfeasible for smaller-scale farmers in the agricultural sector. The primary objective of this study was to design an affordable IoT-based sensor system to assess crop water stress in water-intensive crops like maize and wheat, specifically in the Punjab region of India, for efficient irrigation scheduling. Three sensors such as DHT11, DHT22, and SHT15, were calibrated in controlled and field conditions using mercury-in-glass and IR thermometers. The study found that sensor-based irrigation treatments reduced crop water stress index (CWSI) compared to ET_c-based irrigation in wheat (2020-2021) and maize (2021). In wheat, SHT15 had the lowest CWSI (<0.15), followed by DHT22 and DHT11, with corresponding grain yields of 6.89, 6.84 and 6.69 ton/ha. In maize, SHT15 had the lowest CWSI (<0.2) and the highest yield (6.56 ton/ha), followed by DHT22 and DHT11. Sensor-based irrigation saved 15.43% and 19.87% of irrigation water in wheat and maize, respectively, compared to 100% ET_c-based sub-surface drip irrigation. The findings of this study are applicable to large-scale fields and other crops.

Keyword: Sensor based Irrigation, Internet of Things (IoT), Irrigation Scheduling, Crop water stress Index

<u>PRESENTER BIO</u>: Dr. Susanta Das is a Post-Doctoral Research Associate in the Precision Water Management Lab, ABE Department, IFAS. His research focuses on CWSI-based irrigation scheduling using infrared thermometers. In 2022, he earned his PhD from Punjab Agricultural University, India, specializing in CWSI and IoT technology for irrigation scheduling.

CASE STUDY 2: PORT TAMPA BAY AND HURRICANE IAN

Jose De Jesus
Port Tampa Bay, Tampa, FL, USA

Resilient and sustainable, Smart Ponds allow seaports to protect the environment from untreated stormwater discharges generated by industrial activities and shield adjacent neighborhoods against extreme weather events, while ensuring that nearly 100 percent of a port's available land can be dedicated to meeting expansion demands for cargo calling on ports. Seaports are the gateway for America's economy, and resilient, green infrastructure that protects ports is essential to support the supply chain even under extreme storm events. Port Tampa Bay is leading by example, and embracing the future of stormwater management with two Smart Ponds that are improving water quality, while also providing flood protection.

Installed at the beginning of January, the second Smart Pond is located near Port Tampa Bay on State Road 676. It joins Port Tampa Bay's first Smart Pond, installed near the entrance of Port Tampa Bay on South 22nd Street last June. The first Smart Pond quickly demonstrated its value, successfully capturing more than 175,000 cubic feet of stormwater during Hurricane Ian, reducing flooding in neighborhoods and businesses surrounding Port Tampa Bay and preventing this untreated runoff from flowing into Tampa Bay. It did this by using National Weather Service data to determine that it did not have adequate storage capacity to capture the incoming rainfall. It then automatically lowered its water level before the arrival of the storm.

The added stormwater capacity in a Smart Pond is a factor when the Port must evaluate the costs of using high-value property for the construction of conventional stormwater ponds. Before Smart Ponds became available, Port Tampa Bay often used underground, reinforced concrete vaults to save land area. Vaults are extremely expensive to construct and maintain, particularly at seaports, where they experience high loads from heavy cargo handling equipment. Maintenance is not only costly but disruptive to operations.

PRESENTER BIO: Mr. De Jesus is a PE with 20 yrs. of exp. & is currently Director of Engineering at Port Tampa Bay. He previously worked designing and constructing projects in the public and private sectors. He received his BS in Civil Engineering from UF & is active with the American Society of Civil Engineers and the Society of American Military Engineers. He is an alumnus of Leadership Tampa Bay. He has expertise in sustainable design and construction having been certified as a LEED Accredited Professional

SIMULATING NITRATE CONCENTRATIONS AT THE OUTLET OF THE SUWANNEE RIVER BY COMBINING SWAT-MODFLOW WITH MODPATH

Rob de Rooij, *Dogil Lee, Nathan Reaver, Wendy Graham and David Kaplan*
University of Florida, Gainesville, FL, USA

To manage coastal food webs and fisheries in the Suwannee River estuary, it is desirable that we can predict how changes in land use and climate will affect the quantity and quality of water in the Suwannee River. For this purpose, we have developed a SWAT-MODFLOW model for the Suwannee River Basin. However, although this model can handle nitrate transport in surface waters and soils, it cannot simulate nitrate transport in the groundwater domain. SWAT-MODFLOW-RT3D is a model that solves this shortcoming. It simulates solute transport in the groundwater domain by solving the standard advection-dispersion equation. Alternatively, we propose to simulate nitrate transport in the groundwater domain with backwards particle-tracking using MODPATH. The main advantage of our alternative approach is that we can simulate the age and source components of groundwater being discharged along river reaches. Furthermore, our alternative approach avoids the typical problem of excessive numerical dispersion when trying to solve the advection-dispersion equation using a coarse spatial discretization. This problem is particularly limiting for our model domain as our domain has a large spatial extent. To be efficient our approach based on backwards particle-tracking assumes that the nitrate concentrations in groundwater discharged to the river reaches do not change significantly across short time intervals. We discuss the validity of this assumption.

PRESENTER BIO: Rob de Rooij is a Research Assistant Scientist at the Water Institute. He has extensive experience with developing and applying numerical models for challenging hydrogeological problems.

A SOCIO-ENVIRONMENTAL CLUSTER ANALYSIS TO ASSESS VULNERABILITY TO PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) EXPOSURE IN BREVARD COUNTY FLORIDA

Katherine Deliz
University of Florida, Gainesville, FL, USA

As climate change disproportionally impacts more vulnerable communities across the globe, resources need to be allocated more efficiently and equitably. Social vulnerability indices (SVI) are used as a tool for prioritizing communities most vulnerable to the impacts of climate change driven natural disasters. Frequently used SVIs that create a single vulnerability score rely on a high level of assumptions which can diminish the importance of specific variables. This can cause SVIs to overlook the relevancy of interconnected variables and obscure complex patterns, potentially leading to contradictory policy recommendations. Furthermore, indices are limited in their ability to address cascading or cumulative effects because of the way they simplify and flatten the interactions within dynamic systems. To address this issue, we propose a model-based clustering as an alternative analysis that can rapidly identify vulnerable sub-populations by grouping together communities (e.g., census tracts) with similar socio-environmental profiles while avoiding the artificial constraints on the distribution introduced by the assumptions required to create an index. Our quantitative framework for vulnerability assessment incorporates socioeconomic, environmental and flood inundation indicators of vulnerabilities for Brevard County, Florida. We used a Bayesian profile regression (BPR) technique to identify clusters of socio-environmental profiles and jointly model associations between soil PFAS levels and identified clusters. This allowed us to identify communities facing a high level of combined social and environmental vulnerability and disproportionately elevated soil PFAS levels.

PRESENTER BIO:

CHARACTERIZING WATER LEVEL TRENDS AT SOUTH FLORIDA COASTAL STRUCTURES

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

The South Florida Water Management District (District), serving about 9 million people, is responsible for operating the south Florida regional water management system infrastructure that comprises of approximately 2,100 miles of canals and 2,000 miles of levees/berms, more than 800 water control structures and 625 project culverts and over 80 pump stations. The District operates this complex system for flood control, water supply, water quality treatment and ecosystem restoration. At the outskirts of this water management system, the coastal gravity structures play a great role in disposing inland water to tide while preventing salt-water intrusion. The effectiveness of these coastal gravity structures highly depends on the available hydraulic gradient across them. As a result of this, sea water level increase will adversely impact the discharge capacity of coastal gravity structures in effectively disposing inland water to tide. Therefore, to understand and summarize long term water level conditions at coastal gravity structures, trend analysis on water level timeseries was conducted and previous analysis was refined and extended to include more coastal structures and adopt more rigorous trend analysis tests.

The trend analysis on water level data at coastal structures and NOAA tidal gages in South Florida is part of resiliency metrics development that was embarked by the District about three years ago. The trend analysis metric characterizes sea level trend based on observed long-term historical water level data at coastal structures as well as water level data at NOAA tidal stations. This effort also includes quantifying coastal structure water level trend associated with sea level rise, change in rainfall and other factors. The results of this analysis will assist planners and water managers in designing or retrofitting adaptive water management infrastructure as well as operational protocols.

PRESENTER BIO: Dr. Tibebe Dessalegne is a Section Leader 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 Diplomate Water Resources Engineer with over 20 years of experience.

THE "BATHY-DRONE" FOR UNDERWATER SURVEY AND MAPPING

***Tony Diaz**, Henry Tingle, Andres Pulido, Jaejeong Shin, Peter Ifju*
Mechanical and Aerospace Engineering Dept., University of Florida, Gainesville, FL, USA

A unique drone-based system for underwater mapping (bathymetry) was developed at the University of Florida. The system, called the "Bathy-drone", is comprised of a drone that drags, via a tether, a small vessel on the water surface in a raster pattern. The vessel is equipped with a COTS sonar unit that has down scan, side-scan and chirp capabilities and logs data onboard. Data can then be retrieved, post mission, from the vessel and plotted in a variety of ways. The system provides both isobaths (underwater topo plots) and contours of bottom hardness. Extensive testing of the system was conducted on a 5-acre pond, located at the University of Florida Plant Science and Education Unit in Citra, FL. Prior to performing scans of the pond, ground truth data was acquired with a RTK GPS unit on a pole to precisely measure the location of the bottom at over 300 locations. An assessment of the accuracy and resolution of the system was measured by comparison to the ground truth data. During testing, our research group found that there are numerous advantages and attributes of the Bathy-drone system including ease of implementation and the ability to initiate surveys from the land without the need for a boat. The system is also inexpensive, light-weight, thus making transport convenient. The Bathy-drone can raster at speeds of between 0 and 12 mph, and thus can be used in waters with swift currents. Additionally, there are no propellers underwater, so the vessel does not have a tendency to snag on floating vegetation. We have been able to raster an area of more than 10 acres in one battery charge and in less than 25 minutes. Surveys for the SFWMD were conducted on the Kissimmee River and canals in the Lake Worth District.

PRESENTER BIO: Tony Diaz is a Ph.D. student in the Mechanical and Aerospace Engineering Department at the University of Florida. He is a member of the UF Unmanned Aircraft Systems Research Program and has been developing systems for water-based survey and mapping and water sampling.

EDUCATING THROUGH TECHNOLOGY: INFLUENCING DECISION MAKERS AND THE PUBLIC ON WATER QUALITY

Lee Hayes Byron[1]***, Michael D'Imperio***[1], *Ashley Ellis*[1], *Forest Hecker*[1], *Jackie Lebouitz*[1], *Cosimo Fragomeni*[2], *Claire Craigmile*[3]

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[3]Sarasota County Communications, Sarasota, FL USA

Sarasota County has experienced dramatic impacts from red tide and other harmful algal blooms in recent years, leading residents to come together to demand action. The County Commission identified water quality as its highest priority issue in 2018 and made significant policy and financial commitments. Educating both decision makers and residents on the complicated issue has continued to be a challenge and Extension was asked to take the lead across all county departments. The initiative has been successful in applying innovative technology-based strategies to educate the greatest numbers.

The most recent effort was the development of a Water Quality Story Map, communicating the diversity of actions taken by the county and the opportunities for residents to make changes in their own backyards. This interactive and appealing online tool took nearly a year to develop, involved over a dozen county staff, and was ultimately presented to the County Commission on May 9, 2023. In addition, there have been annual "Water Quality Virtual Update" webinars summarizing the state of water quality in the county, as well as county and individual actions to make a difference. These live virtual events have reached hundreds and continue to be accessed online. Throughout the year, monthly videos are filmed, interviewing county staff from various departments on the latest water quality accomplishments. Additional efforts include development of a new asynchronous course for neighborhoods on environmental best practices, a contract with a local consulting firm for a creative social media campaign on fertilizer reduction, and much more.

This comprehensive approach using virtual tools to educate the public and decision makers has improved understanding of this complicated issue, increased awareness of the diversity of efforts, and encouraged residents to be part of the solution by implementing changes in their behavior and cultural practices that can affect water quality.

PRESENTER BIO: Michael D'Imperio is the Water Resources Agent with UF/IFAS Extension Sarasota County. His work includes outreach and education focused on the protection, enhancement, and awareness of water quality and water supply. Michael specializes in stormwater ponds, drinking water, reclaimed water, water conservation, and practices for reducing non-point source pollution.

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YOUTH RELATE WATER QUALITY TO MACROINVERTEBRATE BIODIVERSITY IN A HANDS-ON LAB

*Katherine Clements, **Michael D'Imperio**, Jacqueline Lebouitz and Sarah Davis*
UF/IFAS Extension Sarasota County, Sarasota, FL, USA

Today, young people are increasingly isolated from the natural world, highlighting the need to provide opportunities for youth to explore their environment in ways that are interactive and thought-provoking while modeling future career opportunities in the sciences. To this end, a Water Quality and Biodiversity Lab was developed and delivered as part of *Learning in Florida's Environment* (LIFE), an environmental education program coordinated by UF/IFAS Extension Sarasota County in partnership with Florida State Parks, Sarasota County Parks, and Sarasota County Schools. Our objective was to introduce students to water quality and scientific equipment by measuring several parameters and relating measured values to macroinvertebrate biodiversity observed at Lake Osprey in Oscar Scherer State Park.

An initial lesson was delivered in the classroom where youth were introduced to biodiversity, water quality, and the types of equipment to be used in the field. The field lesson took place at Lake Osprey and began with exploring water quality by measuring the pH, temperature, and dissolved oxygen of a sample collected from the lake. Discussion based inquiry explored the ecological importance of each parameter. Students were asked to use data collected to develop a hypothesis about the level of biodiversity they might observe in Lake Osprey. All student groups demonstrated the ability to develop a logical hypothesis using what they learned about each parameter. Each group was presented with a collection bin containing live macroinvertebrates collected from the lake. Students examined the contents of the bins, recording macroinvertebrate diversity and abundance. All groups asserted that their hypotheses were correct, demonstrating that the students were able to use critical thinking to connect the concepts of water quality and biodiversity. Youth demonstrated an average knowledge gain of 70% on pre- compared to post-testing with 72% reporting a first time visit to Oscar Sherer State Park.

<u>PRESENTER BIO</u>: Michael D'Imperio is the Water Resources Agent with UF/IFAS Extension Sarasota County. His work includes outreach and education focused on the protection, enhancement, and awareness of water quality and water supply. Michael specializes in stormwater ponds, drinking water, reclaimed water, water conservation, and practices for reducing non-point source pollution.

THE RATE OF NUTRIENT CHANGE IN STORMWATER PONDS IN RESPONSE TO ABUNDANCE OF VARIED VEGETATION TYPES

D. M. Chamoda P. Dissanayake[1], *Mary G. Lusk, Eban Z. Bean, Michelle Atkinson, Alexander J. Reisinger, Matthew J. Cohen, Piyush Agade, John L. Nemenyi, and B. V. Iannone III*

University of Florida, FL, USA

Global urbanization intensifies stormwater runoff due to increased impervious surfaces. Stormwater ponds, common urban features, mitigate impacts of urbanization by controlling floods and removing nutrients from urban stormwater runoff. Over the roughly 76,000 stormwater ponds in Florida that play a vital role in flood control and are accredited by the Florida Department of Environmental Protection to remove 80% of total nitrogen (TN) and total phosphorus (TP) from urban runoff. However, nutrient removal goals are not met, highlighting the need for sustainable strategies. This study explores the potential of stormwater pond plantings as a Best Management Practice (BMP) to improve nutrient removal efficiency. We examined eight ponds in Manatee and Sarasota County, investigating three planting styles: planted banks and littoral shelves, no-mow buffer zones with planted littoral shelves, and conventional stormwater ponds with turfgrass banks. The objective was to determine if ponds with abundant vegetation outperform stormwater ponds with turfgrass banks in nutrient removal. To achieve this, we measured plant cover and collected water samples during ten separate storm events. Water samples were collected at the beginning and at three-hour intervals for up to 18 hours after the storm ceased, from the center of study ponds using autosamplers triggered by GatorByte microcontrollers. This approach assesses changes in TN and TP removal rates over time using chloride concentration as a conservative tracer to address changes in nutrient levels not associated with fluctuations in pond water volume due to evaporation. We observed significant variations within each planting style in nutrient levels and plant cover, suggesting that it is more appropriate to model TN and TP in response to plant abundance on banks and littoral shelves rather than categorical planting styles. Our findings will enhance urban stormwater management and are being incorporated into focus group data collection to identify barriers in adopting novel BMPs.

PRESENTER BIO: Chamoda Dissanayake is currently a second-year master's student in the School of Forest, Fisheries, and Geomatics Sciences, IFAS, University of Florida. Her academic journey has provided her with valuable experience in both fieldwork and laboratory analysis in water quality, with a specific focus on nutrient analysis in water.

WATER QUALITY IN THE GUANA TOLOMATO MATANZAS NATIONAL ESTUARINE RESEARCH RESERVE

***Nikki Dix**, Shannon Dunnigan, Katie Petrinec*
Guana Tolomato Matanzas National Estuarine Research Reserve, Ponte Vedra Beach, FL, USA

The Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) is one of 30 reserves in the U.S. specializing in water quality monitoring and research to inform coastal management. The NERRS System-Wide Monitoring Program (SWMP) is designed to track short-term variability and long-term change in our nation's estuaries. Standard protocols, regular training, rigorous QAQC, and public data access contribute to the program's success. Analysis of 20 years of chlorophyll *a* data collected by the GTMNERR SWMP revealed that most of the estuary does not experience regular algal blooms and is relatively resistant to impacts from excess nutrients. However, chlorophyll *a* concentrations above state standards at some stations and increasing trends at other stations are indications that eutrophication may be stressing the system, making timely preventative measures imperative.

At a local scale, GTMNERR uses principles of the SWMP to monitor waterbodies where data gaps exist and share data with decision-makers. Water samples are collected according to Florida Department of Environmental Protection protocols and results are entered into the Watershed Information Network database so that the data are used in the statewide assessment process. These efforts have resulted in the Guana estuary being listed as impaired for nutrients in 2022, which began the regulatory process of restoration. The detection of degraded water quality in the Guana estuary has also spurred three collaborative science projects with University of Florida aimed at developing remediation strategies, illustrating a repeatable process for other estuaries in the state to go from data gaps to informed management.

PRESENTER BIO: Dr. Nikki Dix has been the Research Director at the Guana Tolomato Matanzas National Estuarine Research Reserve since 2013. Her research interests involve understanding how estuaries respond to natural and anthropogenic change with the intent of informing natural resource management.

EVALUATING HISTORICAL BIOSOLIDS APPLICATIONS IN FLORIDA SOILS: IMPLICATIONS FOR WATER QUALTIY

JoAnn B. Donald*, Allan R. Baco, Yang Lin*
University of Florida, Gainesville, FL, USA

Biosolids, organic materials derived from wastewater treatment, serve as valuable resources for soil enhancement and agricultural benefits. With rising global populations, biosolids production and use are increasing due to their capacity to boost crop yields and improve land quality. However, biosolids contain trace heavy metals that can potentially accumulate upon repeated application. This issue may be amplified in Florida, with its humid climate and predominantly sandy, susceptible to leaching soils, posing significant water quality concerns.

Our collaborative research with the St. Johns River Water Management District focuses on historical biosolids applications in Florida soils and their impact on water quality. Utilizing X-ray Fluorescence (XRF) analysis, magnetic susceptibility measurements, and geospatial analysis, we explore heavy metal persistence and behavior in soils from historical biosolids applications. XRF facilitates rapid, cost-effective, and non-destructive soil elemental analysis to quantify and assess heavy metal concentrations. Magnetic susceptibility, another quick and non-destructive method, will be measured and analyzed for correlation with heavy metals and geospatial analysis. The usefulness of magnetic susceptibility measurements for identifying heavy metal pollution will also be assessed.

In conclusion, understanding the effects of biosolids applications is especially important when considering potential land use changes in Florida and their potential impacts on our water resources. Our research contributes valuable insights into the environmental impacts of historical biosolids applications on Florida's sandy soils and, consequently, on water quality. Employing XRF and magnetic susceptibility alongside geospatial analysis, we provide actionable data to guide sustainable land management and environmental protection in response to shifting land use patterns.

PRESENTER BIO: JoAnn Donald is an MS student in Soil, Water, and Ecosystem Sciences at the University of Florida. A recipient of the USDA National Needs Fellowship, her research focuses on soil health and data science. She earned a bachelor’s degree in geology and is passionate about sustainable land and water management.

FLOOD DISTURBANCES IMPACT THE AUTOTROPHIC COMMUNITIES IN THE KARST SPRINGS OF THE SUWANNEE RIVER, FL

***Paul Donsky**, Matthew J. Cohen, Sam Howley, and Geraldine Klarenberg*
University of Florida, Gainesville, FL, USA

The karst springs of the Suwannee River Basin in northern Florida have experienced a dramatic loss of submerged aquatic vegetation (SAV) and increased proliferation of nuisance algae in recent decades. While most explanations focus on press-disturbances such as nutrient pollution, this ecosystem shift may be principally driven by flow-reversal and brownout pulse disturbance events. During these events, tannic and acidic floodwaters from adjacent blackwater rivers displace the clear, alkaline groundwater in the spring, reducing light availability and depleting dissolved oxygen (DO) with potentially dramatic consequences for autotroph communities. The spatial variation in pulse disturbance frequency between springs provides a natural laboratory to investigate their effects on autotrophic community structure. I surveyed the autotrophic community at 62 springs across the disturbance gradient. My results show disturbance frequency has a significant impact on both algae and SAV cover. The impact of disturbance on algae cover was shown to be mediated by DO concentrations, with more frequent flood disturbances associated with increased algal cover in high DO springs but reduced algal cover in low DO springs. Those high DO springs are also more likely to support SAV, suggesting that disturbances promote algal proliferation by reducing the competitive advantage of SAV. My results indicate springs experiencing flood disturbances greater than 20% of the time do not support SAV. This threshold is relevant for SAV protection and restoration efforts. We also observed evidence of alternative stable states, possibly arising through interactions between DO and flood disturbances. Considering these findings, I investigated variables that predict a springs disturbance rate, finding that a spring's elevation relative to its adjacent river and the magnitude of the local flood pulse were strong predictors. These findings illuminate how the interacting effects of press and pulse disturbances shape autotrophic communities and will help water managers set restoration targets to protect them.

PRESENTER BIO: Mr. Donksy began his PhD. at UF after receiving his master's there in 2023. He currently serves as an Ambassador for the Water Institute and on the board of the Ichetucknee Alliance, a local nonprofit. His main career goal is to protect and restore Florida's springs and aquifer.

TIME-SCALE OF GROUNDWATER RECHARGE IN COASTAL PLAIN SOILS

***Qing Du**, and Mark A. Ross*
University of South Florida, FL, USA

Understanding and properly modeling the time-scale of groundwater recharge from rainfall infiltration through vadose zone percolation is important because the flux is being acted on by root zone evapotranspiration (ET). This study elaborates on the considerable time of the wetting front arrival and ultimate bulk recharge of rainfall infiltration in shallow water table fine sandy soils typical of coastal plain environments such as Florida. Calibrated Hydrus-1D modeling of Florida (Myakka) fine sandy soil were used with varying depths to water table and hydraulic conductivities to bracket the timing of arrival of front and bulk fluxes. Useful normalized arrive timing parameters are defined. Also, this research further quantifies the concept of "wet equilibrium", and the considerable vadose zone storage potential that is over and above hydrostatic pressure equilibrium that must be overcome to achieve any significant water table recharge in typical seasonal hydrologic timescales. Results indicate recharge timescales for water table depths of 1m are approximately 1 day but are considerably longer for 2m (1 week) and 3m and 4m (1 month +) conditions. Given that daily vadose zone potential ET demand can exceed 0.5 cm/day in this environment, estimating recharge from rainfall infiltration is likely unreliable unless this timescale and plant root zone uptake processes are properly modeled in surface-groundwater models.

PRESENTER BIO: Qing Du is a PhD candidate at University of South Florida in civil water resources where she has studied surface and groundwater hydrological modeling of shallow-water table environments.

ACCELERATED WATER RESTORATION APPROACHES IN FLORIDA

***Pamela J. Dugan**, Scott Shuler*
EutroPHIX, Spring Hill, FL, USA

Water resources across the globe are under severe pressure due to increasing anthropogenic impacts caused by excess nutrient loading, in particular phosphorus. Lakes and streams that were once oligotrophic and healthy are rapidly becoming highly eutrophic with recurring harmful algal blooms that put human health, wildlife, and local economies at risk. There is significant demand for accelerated lake restoration and the development of operationally and technically efficient technologies for sustainable water resource management. This paper will provide an overview of new water resource management and nutrient-mitigation strategies for accelerated restoration of phosphorus-impaired water bodies. Innovative ways to implement these technologies will be highlighted along with current and upcoming restoration efforts within the State of Florida and the benefit these projects would bring to Floridians.

PRESENTER BIO: Dr. Dugan is a Water Quality Technical Specialist based in Florida with more than 20 years of experience planning, designing, and implementing water resource restoration projects. She has extensive experience with nutrient mitigation strategies and harmful algal bloom management for accelerated water quality improvement.

FLOWING FORWARD: HOW DOES PUBLIC WATER SCIENCE KNOWLEDGE AFFECT WATER POLICY PREFERENCES?

Madison A. Dyment*, Matthew Gold, and Sadie Hundemer*
University of Florida, Gainesville, FL, USA

The Floridan Aquifer is an essential component in the success of the state agricultural industry and associated practices, playing a large role in the daily lives of Florida residents and supplying much of their water. We often want people to know more about water to make good water choices. Knowledge should enable audiences to make science-informed decisions. Efforts to increase science literacy have often focused on supplying scientific facts to audiences, specifically using the knowledge deficit model. Multiple studies suggest that utilizing the model and knowledge-based approaches and facts to persuade or alter beliefs are not necessarily enough and additional factors must be recognized, such as personal values. As such, we may question if having more water knowledge equates to different, improved water decisions? Using results from a state-wide survey, we explored knowledge influences on Floridians' attitudes and behaviors surrounding regional Floridan Aquifer water quality topics. Researchers examined which responses were influenced by participants' knowledge about water issues, exploring the nature and level of influence scientific knowledge had on participant perceptions. Overall, results showed that knowledge did not impact the policy choices they favored. However, we found that participant water topic knowledge influenced many other responses that play a role in forming policy solutions and minimizing partisanship. Such topics included *understanding perceptions of stakeholders, desired influence for stakeholders, perceptions of bias in provided information,* and *desired considerations for increasing water quality*. Knowledge had the highest impact on understanding the perceptions of stakeholders and, of the significant factors, the lowest influence on desired consideration for ecosystem quality.

PRESENTER BIO: Madison Dyment is a PhD student in the University of Florida Agricultural Education and Communication department, specializing in agriculture and natural resource communication. Her main research interests include curriculum development and consumer perceptions of agriculture and natural resource issues.

IN-NETWORK STORAGE EFFECTS ON THE RELATIVE SPATIAL AND TEMPORAL VARIABILITY OF WATER QUALITY

Seyed Abolfazl Ebrahimi*, Matthew Cohen, James Jawitz*
University of Florida, Gainesville, FL, USA

The spatiotemporal variability of water plays a crucial role in human health and ecological processes. Understanding and quantifying spatiotemporal variability in water quality is essential for effective environmental management, resource protection, and ecosystem health assessment. This research investigates the spatial and temporal variability of solute concentrations in rivers, focusing on understanding the drivers and patterns of water quality fluctuations and on the relative importance of space vs. time in variability. We focus on water quality parameters in three contrasting solute groups (geogenic, biogenic, and anthropogenic) across which we expect significant pattern differences.

One goal of this research is to optimize monitoring strategies across spatial and temporal scales to ensure that water quality monitoring programs are efficient and effective at capturing real-world environmental variation. By identifying key regions ("hot spots") and periods ("hot moments") of water quality variability, resource managers can allocate monitoring resources more efficiently to safeguard water resources. Recently, this has meant expensive investments in high-frequency water quality sensors, tacitly prioritizing temporal variation over spatial variation. This work critically explores this assumption via data synthesis.

We also aim to investigate the significant influence of in-network storage on the complex interplay of space-time variations in water quality. We place particular emphasis on addressing the hypotheses, which suggest that in-network storage may lead to a noteworthy reduction in temporal variation while concurrently amplifying spatial variation when compared to watersheds with lesser network storage. These hypotheses add a layer of anticipation and intrigue to our research as we seek to unravel the intricate dynamics governing water quality in the context of water storage systems, offering valuable insights into sustainable water management practices.

PRESENTER BIO: Seyed Abolfazl Ebrahimi is a Ph.D. student at the School of Natural Resource and Environment of the University of Florida.

ENVIRONMENTAL JUSTICE FROM THE GROUND(WATER) UP: COPING WITH CONTAMINATION IN TALLEVAST, FLORIDA

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This research explores the history of groundwater contamination (TCE, 1,4-dioxane) in Tallevast, Florida and how community residents have responded with coping strategies and environmental justice organizing. Tallevast is an historically segregated African American community in central Florida where residents discovered groundwater contamination from a local manufacturing plant. Since then, studies have documented high rates of cancer and other diseases. Using oral history interviews, we document the social, political, and economic strategies community residents developed in response to the contamination and health outcomes. These strategies focus on environmental justice activism that emphasizes community organizing, local citizen science efforts, and university-community partnerships.

PRESENTER BIO: Serena Echols, a Chicago native with Mississippi roots, is a passionate advocate for the environment and environmental justice. As a Spelman College Alumna and University of South Florida Masters Student, she educates all ages about environmental justice issues while engaging in community development.

CHEMICAL DOSAGE PREDICTION FOR DRINKING WATER TREATMENT USING RANDOM FOREST AND POLYNOMIAL REGRESSION

Sally Elrashedy[1,2], Hui Wang[3], Tirusew Asefa[3], Jack Thornburgh[3], *and Dingbao Wang*[1]

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Modeling chemical usage in drinking water treatment (sulfuric acid, ferric sulfate, and Actiflo polymer) using random forest and polynomial regression is presented in this study using water quality parameters measured in the Tampa Bay area. From 2014 to 2021, daily chemical dosages and measurements of eight water quality parameters (including alkalinity, chloride, color, conductivity, pH, sulfate, temperature, and turbidity) were recorded daily. The dataset was divided into two subsets: a training set comprising 80% of the data and a testing set containing the remaining 20%. For the training set, random forest has better performance than polynomial regression for all three chemical usages. However, random forest and polynomial regression have comparable performance for the testing set; particularly, the performance of polynomial regression on modelling sulfuric acid is slightly better than that of random forest, but random forest has a slightly better performance on modeling ferric sulfate and Actiflo polymer. However, for the testing set, random forest and polynomial regression perform similarly; in particular, polynomial regression performs slightly better in the model of sulfuric acid than random forest, but random forest performs slightly better in the model of ferric sulfate and Actiflo polymer. Polynomial regression models have the advantage of being robust because the algorithm uses an explicit polynomial equation and accounting interactions among water quality parameters. Results indicate that random forest and polynomial regression are both effective in modeling sulfuric acid and ferric sulfate dosages, while they adequately model the dosage of Actiflo polymer.

PRESENTER BIO: Sally Elrashedy is a Ph.D. student in Water Resources Engineering at University of Central Florida, and her research interests include applications of AI and machine learning in water resources engineering.

A LONG, HARD LOOK AT INVASIVE AQUATIC MACROPHYTES AND WATER ISSUES IN FLORIDA

Stephen F. Enloe[1] *and Jason Ferrell*[2]
[1]Professor, UF/IFAS Center for Aquatic and Invasive Plants, University of Florida, Gainesville, FL, USA
[2]Professor and Director, UF/IFAS Center for Aquatic and Invasive Plants, University of Florida, Gainesville, FL, USA

Aquatic plant management is essential to the function of many water bodies in Florida. Historic introductions of invasive plants such as water hyacinth, torpedo grass, and melaleuca have resulted in tremendous environmental problems and high management costs. While the current paradigm of maintenance control has facilitated efforts for many troublesome invaders in Florida, continued plant introductions and increasing social issues have greatly increased the complexity of management. This presentation will examine both historic and current aquatic plant management issues and discuss the critical problems that aquatic plant management must address in the coming decade.

PRESENTER BIO: Dr. Enloe is a professor and extension specialist at the UF/IFAS Center for Aquatic and Invasive Plants. His area of focus is invasive plant biology, ecology, and management. Dr. Enloe earned his PhD at UC Davis in Plant Biology, MS in weed science from Colorado State University, and a BS in Agronomy from N.C. State.

CLIMATE CHANGED: HOW RESEARCH, SCIENCE, AND REPORTING TRANSLATE TO POLICY AND PRACTICE

***Jason Evans*[1]*, Thomas Ruppert*[2]*, Tara McCue*[3]*, Jennison Searcy*[4] *and Gerald Murphy*[4]**

[1]Stetson University, DeLand, FL, USA
[2]UF/IFAS Florida Sea Grant, Gainesville, FL, USA
[3]East Central Florida Regional Planning Council, Orlando, FL, USA
[4]UF/IFAS Extension, Program for Resource Efficient Communities, Gainesville, FL, USA

Changing climate has altered policy development in Florida. Learn how communities can respond to changing climate dynamics by embracing these policy changes and implementing comprehensive plan policies, land development regulations, and stormwater management criteria. Community leaders, planners, stormwater professionals, and interested citizens can better address increasing stormwater quantities and improving water quality with adopted community adaptations for a changing climate.

PANEL

DEVELOPMENT AND DEMONSTRATION OF A SENSOR-BASED METHOD FOR MONITORING CONTAINER SUBSTRATE FERTILITY

***Michelle Ezequelle**, Kaiwen Xiao, Ying Zhang and Ana Martin-Ryals*
University of Florida, Gainesville, FL, USA

Substrate electrical conductivity (EC) measurement is a required Best Management Practice (BMP) for the application of supplemental fertilizers in nursery and greenhouse industries to protect and conserve water resources. The EC is measured to determine the conductivity of the liquid fraction of the substrate or extractable liquid that is considered representative of that encountered by the roots. This measurement provides producers with immediate information for guiding fertility management. The current method of measuring substrate EC is the Pour-through (PT) procedure, a multi-step method in which representative plants are selected for EC measurement, and a predetermined volume of water is poured on the surface of each test plant. The resulting leachate is collected, and EC is determined using an EC meter. This process can be extensive for large-scale nursery production zones, requiring a significant amount of time and manual labor.

With the personnel shortages that exist in production nurseries, technologies are needed to improve and optimize EC measurement and recordkeeping, so the BMP is effective. This project aims to develop a new, sensor-based method for determining EC to reduce the time invested by the producers compared to the current PT method and provide real-time information on the fertility status of container-grown plants. A variety of soil-based EC sensors were selected for measuring container substrate EC. Tests were conducted to evaluate the impact of various environmental parameters on sensor performance, and data collected using these sensors was compared to EC data obtained using the PT procedure to develop a protocol for sensor deployment in nurseries. A modular system was designed, and a prototype was assembled to assess power consumption, heat resistance, wireless communication, and sensor connection. Wireless communication using LoRa LPWAN will be established, and an educational event will be conducted to introduce the new substrate EC monitoring method to industry personnel.

PRESENTER BIO: Michelle Ezequelle is a second-year master's student in the Department of Agricultural and Biological Engineering at the University of Florida. Her research interests include controlled environment agriculture and circular economies.

VEGETATION VARIATION AND ELEMENTAL COMPOSITIONS OF WATERSHEDS ALONG A DEGLACIATED ARCTIC LANDSCAPE

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[1]Department of Biology, University of Florida, Gainesville, Florida USA.

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An existing gap in biogeochemistry is elucidating the connection between landscape vegetation variations and crustal elemental nutrient composition of deglaciated landscape. The warming of the Arctic and retreating icesheet drives plant community changes across the region. Vegetation variations may influence the suites of low molecular weight organic acid available for metal chelation and biogenic weathering of exposed landscapes. Solubilized mineral elements are either taken up by plants or leached into adjoining streams. Plant community change in a warming Arctic could alter downstream nutrient availability on the landscape or watershed. To assess plant species composition and abundance, we used a combination of Floristic Habitat Sampling and modified Point Quarter method to survey plant communities in forty-five 1.25m^2 plots across five watersheds in 2022. These locations represent the margins of ~10kya deglaciation gradient. The plant abundance data from the surveys were used to conduct an NMDS analysis which indicates that the species compositions of the study locations were distinct (stress score = 0.15). An ANOSIM test ($\alpha = 0.05$) analysis indicates the species compositions of the study sites were significantly different ($p =$ 1e -04, R = 04025). The vegetation distribution data was combined with the elemental composition of dissolved nutrient elements (Li, Mg, Al, P, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Si) from adjoining streams which were analyzed, and the results used to conduct Mantel test (method = Spearman, permutation = 9999). The result indicates a significant ($p = 0.0043$) interaction between the variables. The correlation between the two matrices suggests that plants and nutrients may be responding to other intervening environmental variables. To this end, we are currently conducting mesocosm weathering experiments to investigate likely factors mediating between nutrient elements dissolved in streams and vegetation across locations.

PRESENTER BIO: Izuchukwu is a PhD student with UF Biology. His research is focused on Plant mediated biogenic weathering of deglaciated Arctic landscapes with mosses or bryophytes as model organisms. Izu is equally a recipient of the 2019 Water Institute Graduate Fellowship at the University of Florida.

CONNECTING STUDENTS TO POLAR SCIENCE THROUGH COMMUNITY OUTREACH

Quincy Faber[1] *and the SILA Science Team*[2]
[1]Microbiology and Cell Science University of Florida, Gainesville, FL, USA
[2]University of Florida, Gainesville, FL, USA

Global climate change is driven primarily by processes occurring in lower latitudes, but due to climate system feedback, the temperature response is magnified in the Arctic, resulting in Arctic temperatures rising 3-4 times faster than the global average. The resulting ice melt and associated sea level rise then have a large impact on the lower latitudes. It is critical for students in the United States to understand how polar regions are impacted by climate change and to understand how those changes affect their local communities. Teaching students about how climate change links these regions, providing a context to help them understand the causes and consequences of climate change. Although students in the US are greatly impacted by changes in polar regions, they face barriers to understanding the Arctic due to their geographical locations. Throughout the past several years, our team has participated in several local outreach programs in Florida as well as the national program Skype a Scientist. Our goal has been to introduce students to Arctic science and the impact that polar regions can have on us. In this presentation, we will present the activities and visualization tools we have developed and discuss future improvements.

PRESENTER BIO: Quincy Faber is a PhD candidate in the Christner Lab in the Microbiology and Cell Science Department at the University of Florida. Her research focuses on the composition and function of microbial communities in glacial environments.

CRITICAL SOURCE AREAS IDENTIFYING TO ENHANCE WATER QUALITY: A CASE STUDY IN PANHANDLE FLORIDA

***Shubo Fang**, Matthew J. Deitch, Tesfay G. Gebremicael*

Soil, Water, and Ecosystem Sciences Department, University of Florida/IFAS/West Florida Research and Education Center, Milton, FL, USA

Non-point source pollution (NPS) management remains a pressing global challenge. Due to the characteristics of source diffusion, the random occurrence of spatiotemporal patterns, and the multiple underlying processes that directly or indirectly impact NPS, effective management strategies for NPS remain difficult to initiate and implement. The concept of critical source areas, or priority management areas (hereafter CSAs for brevity), has gained significant attention as an approach to efficiently identify and manage the primary sources of NPS. CSAs are areas that contribute disproportionately to NPS pollution and require targeted management interventions. Various measures have been proposed to identify CSAs. These measures can be categorized into two classes: those based on multi-variable statistical analyses and those based on physical-process modeling, such as the Soil and Water Assessment Tool (SWAT). By integrating SWAT modeling and land use and land cover (LULC) based multi-variable statistical analysis, this study aimed to identify driving factors, potential thresholds, and CSAs to enhance water quality in southern Alabama and northwest Florida's Choctawhatchee Watershed. An unsupervised machine learning algorithm, i.e., the self-organizing maps (SOM), also known as a Kohonen map or a Kohonen network, was employed for data visualization and clustering. The results revealed the significance of forest cover and of the lumped developed areas and cultivated crops ("Source Areas") in influencing water quality. The stepwise linear regression analysis based on SOMs showed that a negative correlation between forest percent cover and total nitrogen (TN), organic nitrogen (ORGN), and organic phosphorus (ORGP), highlighting the importance of forests in reducing nutrient loads. Conversely, Source Area percentage was positively correlated with total phosphorus (TP) loads, indicating the influence of human activities on TP levels. The receiver operating characteristic (ROC) curve analysis determined thresholds for forest percentage and Source Area percentage as 37.47% and 20.26%, respectively. These thresholds serve as important reference points for identifying CSAs. Based on the threshold of forest percentage (< 37.47%), it was determined that 46% of the entire Choctawhatchee Watershed fell within the identified CSAs. These areas accounted for approximately 67% of the total TN loads in the watershed. Similarly, applying the threshold of Source percentage (> 20.26%), it was found that 33% of the entire watershed was prioritized as CSAs, covering approximately 54% of the TP loads. But if considering both thresholds (forest percentage < 37.47% and Source percentage > 20.26%), it was identified that 28% of the entire watershed was prioritized as CSAs. These areas covered approximately 47% of the total TN loads and 50% of the total TP loads in the watershed. The study underscores the importance of considering both physical process-based modeling and LULC for a comprehensive understanding of watershed water quality management.

<u>PRESENTER BIO</u>: Shubo Fang is now a postdoctoral research associate at Soil, Water, and Ecosystem Sciences Department, University of Florida/IFAS/West Florida Research and Education Center, Milton. Dr Fang's research encompasses coastal wetlands degradation, coastal wetlands conservation and watershed ecology. By different kinds of quantitative methods Dr Fang try to reveal the interactions between the geo-surface pattern and the associated processes.

OPTIMIZING SEPTIC TO SEWER CONVERSION PROJECTS

Ronald Fick*, Tricia Kyzar, and Christine Angelini*
Center for Coastal Solutions, University of Florida, Gainesville, FL, USA

Nutrient pollution from septic systems contributes to the water quality challenges seen across the state of Florida. There is significant interest from state and local authorities to convert the approximately 2.6 million septic systems to sewer. Given the significant costs associated with these conversions, there is a question to be asked of how different projects should be prioritized to best use the available funds.

We present a data driven approach to identifying the most cost-efficient conversion projects available. This tool takes in data about a utilities' existing sewer infrastructure and considers different ways in which that existing network could be expanded. Those expansions form the basis for potential expansion projects. The potential expansion projects are sorted according to their cost-efficiency and provide a justification for pursuing funding of the top identified projects.

PRESENTER BIO: Dr. Fick is a research assistant scientist with the Center for Coastal Solutions. His background is in computer science, particularly machine learning. He has extensive experience using remote sensing data to address ecological and water quality challenges.

A COLLABERATIVE APPROACH TO RESILIENCE

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

Florida, known for its unique environmental and climate characteristics, faces ever-evolving challenges in water management. Sea-level rise, increased severity of tropical storm events, and shifting rainfall patterns are effects of a changing climate that are expected to impact Floridians, property, and the state's natural resources. These increased risks pose many challenges to state and local governments including saltwater intrusion in our water supplies, changes in wetland communities and function, and flooding. The St. Johns River Water Management District is committed to assisting communities to become more resilient in preparing for and adapting to the impacts of these changes. This presentation will review the District's resilience priorities and how they are incorporated into the core missions of the water management district by highlighting the necessity of integrated strategies to manage water resources, both in the present and future. We will discuss regional and local approaches that, along with efforts from our state and local government partners, create more resilient communities across the District. We focus on fostering long-term coordination among stakeholders, ensuring that progress in resilience and restoration efforts is sustained over time. A case study focused on flooding in Central Florida from Hurricane Ian will be discussed.

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

EXPLORING OPPORTUNITIES FOR CLIMATE ADAPTATION IN CEDAR KEY

*Jeffrey Carney, Christian Calle, **Andrea Galinski**, Mike Volk, Changjie Chen, Savanna Barry*
University of Florida, Gainesville, FL, USA

While Cedar Key is a small municipality on Florida's Gulf Coast, the city has an outsized influence on Florida's $14 million hard clam aquaculture industry. However, Cedar Key also faces particularly high exposure to climate hazards. To address the challenges of sea level rise and storms, the City has partnered with the University of Florida on the "Resilient Cedar Key" project, which aims to develop a comprehensive vulnerability assessment and adaptation plan for the municipality. This presentation will discuss the results of this vulnerability assessment and explore the actions needed to make the community more resilient.

Undertaken by the Florida Institute for Built Environment Resilience, City of Cedar Key, IFAS Nature Coast Biological Station/ Florida Sea Grant, Center for Landscape Conservation Planning, Shimberg Center for Housing Studies, and IFAS Food and Resource Economics Dept, the project goal is to determine the actions needed to build a more resilient future through a process informed by meaningful community engagement.

Key results: Cedar Key is particularly low-lying and will be increasingly subject to sea level rise inundation, which, over time, will cause disconnects that threaten community access and continuity. Our guiding framework is that Cedar Key was historically a less contiguous archipelago, and reestablishing hydrologic connectivity through the island will reduce flood risk overall. Furthermore, the city's natural ecosystems have defined its past and will sustain its future. These principles (and others) underly a series of adaptation actions that focus on 1) restoring Cedar Key's natural hydrology, 2) maintaining connectivity, 3) enhancing ecologic infrastructure, and 4) safeguarding homes, businesses, and critical infrastructure. Following Hurricane Idalia, specific project ideas such as relocating city services to higher ground, buying out vulnerable properties, and relocating the city's wastewater plant inland are now at the forefront of community conversations and gaining additional momentum for implementation.

PRESENTER BIO: Andrea Galinski, mla, cfm, is an Assistant Professor in the UF Landscape Architecture Department, and research affiliate with the Shimberg Center for Housing Studies. Previous to UF, she worked in Louisiana on the state's Coastal Master Plan to protect and restore the coast in the context of a changing climate.

A NEW MODEL FOR VULNERABILITY ASSESSMENTS: COMPOUNDING VULNERABILITIES + CRITICAL HOUSING ASSETS IN EAST CENTRAL FLORIDA

Andrea Galinski
University of Florida, Gainesville, FL, USA

Grappling with the impacts of sea level rise and flooding, Florida is investing in forward-thinking vulnerability assessments that are being undertaken by many prescient cities and counties across the state. The requirements for these assessments are specific –however, one element stands out on the list with a particular importance for the resiliency, equity, and economic prosperity of our state – public housing.

The East Central Florida Regional Resilience Collaborative (ECFR2C) has conducted an equity-embedded vulnerability assessment, which serves as a new VA model that focuses on affordable housing analysis, its compounding vulnerabilities to flood hazards, and the planning/policy recommendations that will make the region better prepared for the next disaster event. As part of a 2-year initiative between ECFR2C and the University of Florida Shimberg Center, the region has developed an inventory of its affordable housing stock, assessed its exposure to current and future flood risks, as well as taken a deeper dive into the analysis of the compounding vulnerabilities that make disaster impacts more severe and recovery harder. This detailed assessment aims to explore the interconnected vulnerabilities facing the region's residents who are more susceptible to climate impacts (low-income renters), and to better understand some of the complexities that can affect housing stability after a disaster.

Climate change disproportionately affects low-income communities, as lower-cost housing options tend to be more vulnerable to flooding due to their age and structure types. Additionally, the lack of insurance and emergency savings, not to mention the increasing cost of housing prices, maintenance, and repair, makes these households even more vulnerable as well. Further, low-income households – particularly renters – have more difficulty obtaining adequate post-disaster housing assistance. Therefore, planners must approach pre-disaster preparedness and post-disaster recovery planning in an interdisciplinary way that emphasizes the important role of housing to these endeavors.

PRESENTER BIO: Andrea Galinski, mla, cfm, is an Assistant Professor in the UF Landscape Architecture Department, and research affiliate with the Shimberg Center for Housing Studies. Previous to UF, she worked in Louisiana on the state's Coastal Master Plan to protect and restore the coast in the context of a changing climate.

CONTINUOUS IMPROVEMENT FOR THE INTEGRATED HYDROLOGIC MODEL AND INTEGRATED NORTHERN TAMPA BAY MODEL

Jeffrey S. Geurink*, Hui Wang, Erin Hayes and Kay Parajuli*
Tampa Bay Water, Clearwater, FL USA

The Integrated Northern Tampa Bay (INTB) model, a calibrated application of the Integrated Hydrologic Model (IHM) simulation engine, has been used for more than two decades in west-central Florida to support decision-making for: water-supply planning, sustainability assessment, and operations; ecologic systems protection; and assessment of hydrologic response due to changes in water use, climate, and land use. The IHM dynamically couples HSPF with MODFLOW. A continuous improvement program is used to ensure the INTB model includes the most recent advancements in hydrological modeling and can continuously provide decision support in response to changing operational and regulatory requirements. The four phases of the continuous improvement cycle include: identify potential gaps, recommend corresponding improvements for identified gaps, plan for implementing improvements and resource allocation, and implement improvements.

All four phases of the continuous improvement cycle are focused on the intersection of categories within three evidence domains of hydrologic flow systems, decision support questions, and water resource constraints, uniquely suitable for applications of integrated surface-groundwater models. Within the context of the three evidence domains, multiple sources of uncertainty lead to inaccuracies or large variance error in modeling results. Four primary sources of uncertainty in hydrologic model results include: suitability match among simulation engine, model domain, and model purpose; conceptualization and discretization of model domain; resolution and quality of time series inputs; and resolution and quality of calibration targets and constraints. Continuous improvement program goals for the IHM and the INTB model can be met by reducing uncertainty through improving codes of HSPF, MODFLOW, and IHM integration; accurately representing land use change and applying suitable discretization; using Bayesian radar rainfall (fusion of gauge and radar); and providing sufficient and accurate calibration targets for streamflow, spring flow, aquifer heads, and actual evapotranspiration. This presentation will include discussion of example projects and methods within the continuous improvement program.

PRESENTER BIO: Jeff Geurink is lead water resources system engineer with Tampa Bay Water, a wholesale regional water supply utility. He has over 35 years of water resources experience and 25 years of experience in fully-integrated hydrologic modeling including development of simulation code, user training, and water resources and sustainability applications.

ENHANCING SOIL MOISTURE RETRIEVAL IN IRRIGATED AGRICULTURE: HYBRID MODEL OF L-BAND RADIOMETRY AND MACHINE LEARNING

Alireza Ghaderi Bafti*, and Ebrahim Babaiean*

Soil, Water and EcosystemSciences Department, University of Florida, Gainesville, FL, USA

Irrigated agriculture stands as a significant water consumer in Florida but concurrently presents unparalleled potential for conservation. Excessive water use in Florida's irrigated sectors leads to the loss of water and vital nutrients, thereby deteriorating both surface and groundwater quality. An accurate understanding of the soil moisture (SM) state is crucial for optimal irrigation scheduling and ensuring water and nutrient balance in Florida's soil. However, current L-band passive microwave sensors are limited to providing surface-level soil moisture data at a coarse spatial and temporal resolution. This constraint makes them less viable for detailed, small-scale agricultural applications. Traditional algorithms employed by L-band sensors, such as single or dual channel algorithms (SCA/DCA), cannot retrieve root zone soil moisture (RZSM) data and rely on several sensitive parameters that require precise determination. In recent years, machine learning and deep learning (ML/DL) techniques have gained increased attention for hydrologic studies due to their ability to identify complex nonlinear relationships and extract spatiotemporal patterns from data. The objective of this study is to address mentioned limitations by evaluating the potential of a hybrid modeling approach based on L-band passive radiometers from stationary sensors in tandem with integrate model based on the SCA/DC and ML/DL algorithms to accurately estimate surface, and RZSM in sandy terrains. Our investigative experiment employed an L-band radiometer along with various sensors to measure various attributes, including brightness temperature, soil and plant physical temperatures, SM at differing depths, and meteorological variables. We then compared the derived estimates of RZSM from our integrative physical and deep learning models against in-situ TDR measurements. Based on the promising performance of this approach, which significantly outperformed equivalent satellite SM, the proposed model can offer cost-effective and efficient applications for field-scale monitoring of RZSM, thereby facilitating more informed irrigation management in Florida's sandy soils.

PRESENTER BIO: Alireza Ghaderi Bafti, currently a Soil and Water Ecosystem Sciences PhD candidate with a Master's degree in Water Resources Management (WRM), has strong expertise in projects related to soil moisture estimation using satellite data and AI modeling, as demonstrated by his Master's dissertation and his professional experiences.

ENHANCING HYDROLOGICAL STUDIES THROUGH PRECISE WETLAND SHAPE MAPPING WITH LIDAR-DERIVED DEMS

Katie Glodzik *and Matt J. Cohen*
University of Florida, Gainesville, FL, USA

Recent advancements in Light Detection and Ranging (LIDAR) technology have led to significantly improved digital elevation models (DEMs). Key enhancements include a higher frequency of laser pulses emitted from the aircraft and the ability of the receiving sensor to collect multiple reflected returns from a single pulse, resulting in richer point cloud datasets. For instance, a decade-old LIDAR data covering Bradford Forest, FL had an average ground point spacing of 0.7 meters, barely sufficient for a 1-m resolution DEM. In contrast, a 2023 dataset boasts 0.18 meter point spacing, plus reduced instances of vegetation misclassified as ground.

These improvements create immense promise for using LIDAR DEMs in local-scale hydrological studies. Accordingly, our focus was on utilizing the recent DEM for analyzing depressional wetland basin shapes in Bradford Forest. Yet even with highly accurate DEM, challenges persist, primarily related to the inability of DEMs to depict culverts and bridges that convey water underneath roads. This creates false dams and therefore false isolated depressions in the elevation data. Fortunately, the DEM’s precision enables us to successfully employ an automated method for burning in culvert flow paths. We adapted a USGS method, which leverages the DEM data itself to identify culvert-impacted areas, draw a flow path, and lower them to an appropriate elevation. Bradford Forest posed unique challenges, including extremely flat elevations, road structures ranging from unpaved logging roads to wide paved roads, and the prevalence of real depressions that make it more difficult to identify false depressions. Our adapted method addresses these challenges by enabling flow paths that can navigate obstacles of varying sizes, without overcorrecting or erroneously draining areas that are not culvert-impacted. As a result, our method successfully depicts wetlands and their basin shapes, supporting ecohydrological research in Bradford Forest.

PRESENTER BIO: Dr. Katie Glodzik is a Postdoctoral Associate in UF’s School of Forest, Fisheries and Geomatics Sciences. She specializes in geospatial analysis and remote sensing to support watershed ecology and water resources management. She earned her PhD from UF’s Center for Wetlands and Masters of Environmental Management from Duke’s Nicholas School.

WHEN PONDS FLOW: TESTING THE BIOLOGICAL EFFECT OF STORMWATER POND DISCHARGE ON RECEIVING STREAMS

***Audrey H. Goeckner*[1]**, *Amanda Subalusky*[1], *Chris Dutton*[1], *Forrest Lefler*[2], *H. Dail Laughinghouse*[2] *and AJ Reisinger*[1]

[1]University of Florida, Gainesville, FL, USA
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Stormwater ponds (SWPs) are implemented in developed landscapes to intercept runoff and reduce the downstream loading of sediment and nutrients. Although built to protect downstream ecosystems, SWPs can support distinct planktonic communities, produce bioavailable forms of carbon and nutrients, and export these microbes and resources downstream following storm events. We tested the effect of SWP discharge on the planktonic community and ecosystem functioning of a receiving stream by experimentally combining SWP water and stream water across a pond water:stream water gradient (six treatments of 0% to 100% pond water plus two tap water-only controls) in artificial recirculating stream mesocosms (S.T.R.E.A.M Facility, University of Florida). We collected water chemistry (DOC, TDN, DIN, SRP, Chl-*a*) and microbial community (16S rRNA metabarcoding) samples and measured gas fluxes (carbon dioxide, methane) immediately after filling mesocosms (T0) and after five days of incubation (T1). After T1, we added a nutrient spike to measure nutrient uptake and collected water chemistry samples the next day (T2). During the incubation permanently installed water quality sondes in each stream logged 10-min. interval data for dissolved oxygen, temperature, pH, ORP, and conductivity. We predict that increasing fractions of pond water will increase the relative abundance of pond-associated taxa that persist by T1. In treatments with pond and stream water (excluding the 0% and 100% pond water), some rare (low abundance) stream- or pond-associated taxa will increase in relative abundance due to optimal environmental conditions introduced by the opposing site water (i.e., rare stream taxa emerging when mixed with pond water and vice versa). Finally, we predict that a greater proportion of pond water will enhance functional rates (gas flux, nutrient uptake). This study allows us to evaluate the services and/or disservices SWPs provide to downstream ecosystems by quantifying mechanistic responses of stream processes and microbial communities to pond water additions.

PRESENTER BIO: Audrey Goeckner is a 4th year PhD student in the Soil, Water, and Ecosystem Sciences Department. Her dissertation focuses on the biogeochemistry and ecosystem ecology of stormwater ponds and the effect of pond discharge in receiving streams.

IDENTIFYING FLORIDIANS' PREFERENCES IN RESPONSE TO REGIONAL AQUIFER CHALLENGES

Matthew Gold*, Madison A. Dyment, and Sadie Hundemer*
University of Florida, Gainesville, FL, USA

Significantly impacting many of the agricultural processes throughout the state of Florida, the Floridan Aquifer is vital for the continued support of Floridians' daily lives. This study aimed to determine Floridians' policy preferences for improving aquifer water quality, examining three potential options: new agricultural best management practices (BMPs), the conversion of vulnerable agricultural land to forests, and business as usual. While the BMPs and forestry can improve water quality, they have limitations for stakeholders, rural communities, and taxpayers who would supplement the transition. The study examined how participants of different ideologies weigh these options and considerations. Additionally, the participants were asked how much they would consider the perspectives of others if those new thoughts would impact their preferences, and who or what they feel is the most important consideration when making their selection. Results from the study found that agricultural BMPs were the most preferred option (n = 676, 61.6%) by the 1,098 participants. Notably, participants' scientific water knowledge and partisan identity had little impact on their preferences. Regarding the specific considerations of participants, the top three were water quality impact, ecosystem impact, and farmer impact, which all show a connection to the effect their choice would have on the environment.

PRESENTER BIO: Matthew Gold is a master's student in the University of Florida Agricultural Education and Communication department, specializing in agricultural leadership education. His research interests include the utilization of popular culture artifacts in the classroom to enhance learning and generational differences in higher education.

CAN WE RELIABLY FORECAST THE FUTURE WITHOUT KNOWING THE PAST? UFA LEVEL PREDICTIONS IN NORTH FLORIDA

Fatih Gordu
St Johns Water Management District, Palatka, FL, USA

Long-term groundwater management relies on forecasts of decadal or longer groundwater levels driven by nested scales of variability in climate for establishing predevelopment benchmark groundwater conditions and developing climate change adaptation strategies to reduce risks and increase resiliency. A Physically Constrained Wavelet-Aided Statistical Model is utilized to hindcast the predevelopment groundwater levels back to early 1900s at three sites in North Florida. Hindcasting yielding 110 years of monthly levels is used to assess the effect of climate change and pumping on the frequency of critical low levels. At all three sites, the frequencies of critical low levels increase significantly in the 1960-2015 period when compared to the 1904-1959 period. Long-term groundwater level trends are also forecasted and examined using a large ensemble of global climate model (GCM) projections under low and medium emission scenarios. The forecasts from 2020 to 2099 indicate groundwater levels may continue to decline, however, at an accelerated pace after 2040s reaching critical levels by the end of this century. Results show highly divergent groundwater response to projected hydroclimatic changes in that future long-term rainfall trend may lead to rising groundwater levels, which, however, may be overshadowed by heightened ET loss driven by global warming and increased groundwater pumping. This study also reveals poor performance of predictions driven by GCM projections in replicating the timing of high and low extremes, attributed to failure of GCM projections and downscaling methods to capture the timing of climatic cycles, controlling hydrologic memory. Additionally, a multidecadal harmonic trend analysis exposes presence of potential centennial cyclic trends in groundwater levels, critical for future predictions. Thus, GCM-based forecasts are recommended to be cautiously utilized for groundwater resource planning when significantly departing from historical long-term cyclic patterns.

PRESENTER BIO: Dr. Gordu is a chief water resource engineer at SJRWMD with more than 20 years of experience in groundwater and surface water modeling, MFL studies, aquifer recharge investigations, statistical analysis, water supply planning and climate change studies. He currently serves in the state rainfall projections and drought resiliency workgroups.

NITROGEN LOAD REDUCTION FROM ALACHUA COUNTY'S FERTILIZER ORDINANCE AND BEHAVIOR CHANGE CAMPAIGN

Stacie Greco
Alachua County Environmental Protection Department, Gainesville, FL, USA

Water resources within Alachua County are impaired by too many nutrients, with landscape fertilizers being one of the sources. Alachua County amended its Landscape Fertilizer Ordinance in 2019 to include a ban on nitrogen fertilizers from July through February. Funding was obtained from the Florida Department of Environmental Protection Department to design, implement, and evaluate a behavior change campaign to decrease fertilizer use and to quantify the resultant nitrogen load reduction.

This presentation highlights social marketing concepts and data used in campaign development, implementation, and evaluation. Survey data was used to identify homeowners' perceived benefits and barriers to reducing fertilizer use, segment the audience, market test campaign strategies, and evaluate results. The initial campaign cost $44,000. Campaign strategies have included television, social media, billboards, print media, and direct mail since 2019. Alachua County continues to fund the campaign and it has been seen over 19 million times at a media budget of $84,000 to date.

The campaign is evaluated each year with a post-campaign survey. In 2021, respondents that said, "My lawn is not fertilized" jumped to 65% compared to 55% in the pre-campaign survey. This value increased to 68% in 2022. Respondents were asked to provide their level of agreement to the statement, "Residential fertilizer use causes algal blooms in waterbodies." In 2022, 80% of participants agreed, which is a considerable increase from the 68% agreement in the 2019 pre-campaign survey.

Survey, spatial, and literature data were combined with fertilizer label information to estimate a 20% reduction in annual nitrogen loading in Alachua County. We calculated an 8,000 pound nitrogen reduction to surface water using the Simple Model, and a 12,000 pound reduction to groundwater using the Nitrogen Source Inventory Loading Tool (NSILT), thus quantifying the cost of reducing nitrogen loading at, $1.4 - $8.3 per pound.

PRESENTER BIO: Stacie Greco is the Water Resources Program Manager with the Alachua County Environmental Protection Department. She received a B.S. from Warren Wilson College in Asheville, NC prior to her M.S. in Environmental Engineering from UF. She also has a graduate certificate in Social Marketing for applying marketing tools to influence behaviors.

PILOT SCALE SEPTIC-TO-SEWER CONVERSION PRIORITIZATION MAP USING ANALYTIC HIERARCHY PROCESS

***Edgar Guerron-Orejuela*[1]**, *Kai Rains*[1], *Moses Okonkwo*[2], *and Mark Rains*[1]
[1]University of South Florida, Tampa, FL, USA
[2]Florida Department of Environmental Protection, Tallahassee, FL, USA

In Florida, there are approximately 2.4 million onsite sewage treatment disposal systems (OSTDS) serving roughly one-third of the state's population. Though an important part of the statewide wastewater treatment system portfolio, some OSTDS contribute to nutrient loading and water-quality degradation in nutrient impaired waterbodies, including the Indian River Lagoon (IRL). Therefore, the state annually provides millions of dollars of funding for septic-to-sewer conversions through the Florida Department of Environmental Protection (FDEP) Water Quality Improvement Grant Program. However, large-scale decision support tools to assist in the prioritization among septic-to-sewer projects are lacking. Therefore, FDEP, in partnership with the University of South Florida Ecohydrology Research Group, undertook a pilot project to identify locations where nutrient addition would be particularly harmful to waterbodies. The pilot project location is St. Lucie County, which borders the IRL. This effort brings together public data and relies upon expert knowledge organized and analyzed through analytical hierarchy process (AHP). AHP provides a systematic methodology selecting and weighting heterogenous datasets to define parameter hierarchy representative of fundamental processes. We engaged subject matter experts in a guided AHP exercise to reach consensus on dataset selection and weights to model and visualize waterbody vulnerability. The parameters included in the model, and their corresponding weights, are distance to waterbody (30%), depth to groundwater (21.6%), hydraulic conductivity (20.7%), potential for flooding (10.9%), topography (9.8%), and depth to limestone (7.0%). By overlaying these datasets in a GIS environment, we developed a map that may be used to visualize waterbody vulnerability to nutrient loading from OSTDS, prioritize regions where septic-to-sewer conversions may be particularly beneficial to water quality, and inform new septic permitting and construction. This vulnerability map will be made freely available to stakeholders in St. Lucie County and can serve as a framework for similar efforts in other regions.

<u>PRESENTER BIO</u>: Edgar Guerrón-Orejuela is a Ph.D. Candidate at the University of South Florida. Edgar's interest in understanding and communicating the interrelations between groundwater 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.

IOT AND MACHINE LEARNING FOR IRRIGATION MANAGEMENT IN FLORIDA

Sandra M. Guzmán*, Gregory Conde, Eduart Murcia, and Akshara Athelly*
Agricultural and Biological Engineering Department, UF/IFAS Indian River Research and Education Center, Fort Pierce, FL, USA

To fully tap into the possibilities of efficient commercial scale irrigation management in Florida, the integration of sensors, data, and Internet of Things (IoT) platforms is essential. These platforms must have the capacity to adapt to the distinct needs of users and the sensors deployed in the field. This adaptation capacity is especially crucial in the context of advancing smart irrigation systems, which rely on IoT technology and sophisticated Machine Learning data processing methods. In this presentation we explore a series of research advancements related to IoT, machine learning, and decision support systems for irrigation management in Florida's specialty crop production. Our focus encompasses current approaches for centralizing data from multiple sensor and data providers, evaluating data quality, real-time adaptation to changes based on human intervention, and fostering technology adoption. By combining IoT and machine learning technologies, we created IrrigMonitor, a centralized decision support system for irrigation management. The centralization of data from multiple providers is pivotal, ensuring that users have access to comprehensive and reliable information for making informed decisions. In an era where data-driven decision-making is rapidly becoming the norm in agriculture, our project underscores the paramount importance of interoperability. This means that different systems, technologies, and sensors can work together harmoniously, allowing users to extract valuable insights from a wealth of data. By enhancing interoperability, we aim to make smart irrigation more accessible and effective for farmers, ultimately contributing to more sustainable and efficient agricultural practices.

PRESENTER 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.

EVALUATING PHOSPHORUS RECOVERY FROM BIOSOLIDS TO ADDRESS EUTROPHICATION IN FLORIDA

Vickie Hoge[1], Mark Lang[2], Kevin Coyne[3] , ***Sarah Guzman**[4]* , *and Tony Janicki[5]*
[1] St. Johns River Water Management District, Jacksonville, FL, USA
[2]Black & Veatch, Rochester, NY, USA
[3]Black & Veatch, Tallahassee, FL, USA
[4]Black & Veatch, Salt Lake City, UT, USA
[5]Janicki Environmental, Inc., St. Petersburg, FL, USA

The St. Johns River Water Management District (District), with support from the Florida Department of Environmental Protection (FDEP), has undertaken a project entitled "Resource Enhancement and Recovery of Domestic Wastewater Residuals". This project aims to identify and evaluate technologies to reduce the phosphorus (P) content and availability in biosolids and, subsequently, the potential for the P to be transported into surface water and groundwater. The project includes:

-Evaluation of existing technologies and assessment of regional needs.
-Review empirical data from technology vendors to quantify expected P-recovery performance.
-Comparison of feasible technologies based on cost, performance, and capacity.

The presentation will summarize the modeling of Water Reclamation Facilities (WRFs) in the State to estimate the ability of technologies to recover P from their solids. The presentation will also include a Life Cycle Analysis conducted on the selected technologies, a feasibility summary, and communication tailored to educate elected officials and the public on the project findings.

Twenty P-recovery technologies were screened using criteria established by the District, and seven technologies and two management practices, composting and thermal drying, were selected for further evaluation. The evaluation compared the relative cost of implementing the technologies and the associated reduction of P availability in the biosolids. The evaluation also included non-monetary criteria to identify the technologies that can support a wide range of WRFs throughout Florida.

This presentation provides a summary of the work performed and the benefits of biosolids management programs. The presentation also included information regarding how utilities can get involved in P-recovery demonstration programs should they be conducted as a next step.

PRESENTER BIO: Sarah Guzman, a process engineer at Black & Veatch, has 4 years of experience in wastewater and biosolids industry. Sarah holds a BS in biological engineering and an MS in environmental engineering from Utah State University. Sarah is the immediate past chair of the WEF Residuals and Biosolids Young Professional Committee, and she is the Co-chair of the 2024 National Residuals and Biosolids Conference.

COMPREHENSIVE CENTRAL AND SOUTHERN FLORIDA STUDY – MULTIPURPOSE STUDY FOR BUILDING RESILIENCY NOW AND IN THE FUTURE

Eva B. Vélez *Presented by:* ***Timothy Gysan***
United States Army Corps of Engineers Jacksonville District, Jacksonville, FL, USA

Community resilience means systems that are adaptive to change and can overcome acute events. Healthy ecosystems and water management infrastructure are a foundation leading to more resilient water supply, enhance economies, increase recreational opportunities, and improve and protect social well-being.

Building this community resilience requires coordinated efforts from all levels of government; no single entity can build resilience alone. The problems related to climate change 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.

In central and south Florida, our water resource infrastructure is the great connector between all these efforts and the backbone of that system is the Central and Southern Florida Project. The C&SF Project is a large, multipurpose water resources project initially authorized by the Flood Control Acts of 1948 and 1954 for the purposes of providing flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, recreation, groundwater recharge, water supply for Everglades National Park, and preservation of fish and wildlife resources. The key infrastructure of the system stretching from Orlando to the Florida Keys includes approximately 2,200 miles of canals, 2,100 miles of levees/berms, 84 pump stations, and 778 water control structures. The regional system serves a population of approximately nine million residents in two water management districts. However, the region which it serves, and the drivers of flood risk have drastically changed the water resource needs since the 1950’s due to urbanization and climate change.

The Comprehensive Central and Southern Florida Study was authorized in the Water Resources Development Act of 2022 to address these changed conditions and changed needs of the region. The study authorization allows the USACE to conduct a study for resiliency and comprehensive improvements or modifications to existing water resources development projects in the central and southern Florida area, for the purposes of flood risk management (including all drivers of flood risk), water supply, ecosystem restoration (including preventing saltwater intrusion), recreation, and related purposes. The intent is to conduct a strategic long-term planning effort through collaboration with Federal, state, and local entities, to focus on comprehensive benefits, to address effects from compound flooding, climate variability, and land use changes, and to incorporate natural and nature-based features to enhance benefits. The USACE anticipates Federal funding in FY2025 to begin this effort in coordination with partners at the South Florida Water Management District (SFWMD) and St. Johns River Water Management District (SJRWMD).

PRESENTER BIO:

IS YOUR WATER WELL? PRIVATE WELL TEST AWARENESS AND NITRATE MONITORING IN THE SUWANNEE RIVER BASIN

Hailey Hall
AquiferWatch, Tallahassee, FL, USA

Private well owners must take personal responsibility to ensure the safety of their water supply. Socioeconomic class and barriers of knowledge, risk perception, and inconvenience prevent many well owners from testing their wells often enough or at all. This leaves well owners at risk of water quality health hazards, particularly in regions with vulnerable geologies and intensive land uses.

Nitrate contamination is widespread in Florida's aquifers. The state of Florida and the U.S. Environmental Protection Agency have adopted a Maximum Contaminant Level (MCL) for nitrate to guard against methemoglobinemia, or "blue baby syndrome," which can cause suffocation or death.

Is Your Water Well? is a community-based public health awareness campaign focused on addressing barriers to private well testing and identifying nitrate pollution in the groundwater of the Suwannee and Santa Fe River basins, Florida. This presentation will include findings from groundwater nitrate data and spatial information collected with permission from private well owners. Clusters of MCL exceedances for nitrate in private well water have been mapped using data obtained from state agencies through public records requests. Strategies used to communicate with private well owners, including outreach to target vulnerable populations and homes in areas of previous MCL exceedances, will be presented.

PRESENTER BIO: Hailey Hall is Secretary/Treasurer of AquiferWatch and project manager of *Is Your Water Well?* She has a bachelor's degree from the University of Florida in environmental geosciences and five years of work experience in hydrology, GIS, and science communication.

AN UPDATEABLE STATISTICAL MODEL FOR ESTIMATING FUTURE WATER QUALITY EXCEEDANCES AND UNCERTAINTY

***Casey Harris**, AJ Reisinger, and Wendy Graham*
University of Florida, Gainesville, FL, USA

Estimating surface water quality under future climate scenarios is of interest for water supply planning and for protecting/improving aquatic ecosystems. To expand our capabilities for predicting the influence of climate change on surface water quality, we develop and evaluate generalized additive models (GAMs) using a Bayesian inference approach to incorporate current and future uncertainties. Due to the complex relationship between climate and water quality and the uncertainties of future climate projections, these methods warrant more attention in water quality research. With these models, we estimate parameters relating various water quality constituents to hydroclimatic variables, using Markov Chain Monte Carlo simulations. We use previously collected water quality and hydroclimatic data from the Hillsborough and Alafia Rivers, important sources of drinking water for the Tampa Bay region in Florida. These parameter estimates are then coupled with previously-estimated future hydroclimatic projections for 2030–2060 and 2070–2100 (Chang et al., 2018) to make projections of future water quality and summarize probabilities of exceedance of relevant water quality thresholds. Although relationships between water quality and hydroclimatic conditions may not remain static into the future, and future water quality will depend on watershed management and land use, these models highlight the potential influence of hydroclimatic conditions on future water quality and facilitate the identification of water quality constituents of concern under changing hydroclimatic conditions. Over time, these types of models can be updated with more recent water quality and hydroclimatic data, and easily run with updated climate projections to provide useful information to water suppliers for long-range water supply planning.

PRESENTER BIO: Casey Harris is a PhD student in Soil, Water, and Ecosystem Sciences at UF. She previously worked for the PacFish/InFish Biological Opinion Monitoring Program in the Columbia/Missouri River basins and the St. Johns River Water Management District.

MACRONUTRIENT DELIVERY FROM A FREE-FLOWING OCKLAWAHA: IMPLICATIONS FOR THE LOWER ST. JOHNS RIVER

John Hendrickson
SJRWMD (Retired), Fernandina Beach, FL, USA

Rodman Reservoir, the roughly 9000-acre in-line impoundment of the lower Ocklawaha River, traps and transforms, to varying levels, inflowing sediments and chemical constituents. The restoration to a free-flowing condition has raised concerns that loss of the absorption of inflowing nitrogen and phosphorus within the reservoir's 21-mile reach could exacerbate eutrophication of the downstream freshwater Lower St. Johns River (LSJR). A 2016 nutrient budget analysis quantified this net nutrient change (calculated as inflowing mass load – outflowing) and concluded that the potential phosphorus load increase is small, and of a magnitude that can be mitigated with a variety of projects of demonstrated efficacy. Most of the nitrogen delivered to Rodman Reservoir originates from Silver River as nitrate-nitrite-N, a form that is readily reduced within the reservoir, and if the simple net difference mass load were to traverse the reach unabated under the free-flowing condition would constitute a proportionally larger increase. Cultural eutrophication in the freshwater LSJR is manifested in chronic, spring and summer blooms, in which prevailing nitrogen limitation is routinely overcome by nitrogen-fixing cyanobacteria. An examination of the long-term phytoplankton monitoring data indicates that higher ambient nitrate-nitrite-N preceding bloom seasons is associated with lower cyanobacteria abundance and higher proportions of more desirable eukaryotic algae, enhancing upward trophic transfer in an estuary where phytoplankton provide the overwhelming supply of primary production. This seemingly contradictory postulate is supported by research worldwide on the alteration of nutrient stoichiometry by dams, adversely affecting downstream phytoplankton communities. This apparent enhancement to the phytoplankton composition of the LSJR through the rebalancing of N:P (and silica resupply, which is also retained within the reservoir) further supports the benefits to the pelagic and littoral ecology of the LSJR achievable with the restoration of a free-flowing Ocklawaha.

PRESENTER BIO: John Hendrickson is a former Supervising Environmental Scientist with the St. Johns River Water Management District, where he worked to develop of sound, achievable management recommendations to preserve the health and ecosystem services of northeast Florida's water resources. He is currently a co-chair on the science committee of the Reunite the Rivers Coalition.

CLIMATE CHANGE IMPACT ON THE WATER QUALTY OF THE KISSIMMEE RIVER – LAKE OKEECHOBEE SYSTEM

***Young Gu Her*[1]*, and Sat-Byeol Shin*[2]**
[1]University of Florida, Gainesville, FL, USA
[2]University of Michigan, Ann Arbor, MI, USA

Lake Okeechobee and its drainage basins, the Northern Lake Okeechobee (NLO) watershed, have faced climate changes. This study evaluated the impacts of climate change on the water quantity and quality of the NLO watershed–Lake Okeechobee system using a spatially integrated modeling framework combining watershed loading and receiving waterbody models together. Future climate projections and water level operation scenarios were incorporated into the modeling to investigate how the watershed–lake system may react to projected climate changes and how management practices can mitigate the impacts. The modeling experiments found that the flow and TSS loads from the upstream drainage basins of the lake might decrease in the future. The projection of TN load to the lake varied depending on the basins, their land uses, and RCPs. The TP load was projected to increase in the future when the current manure and fertilizer rates were maintained the same in agricultural lands. The water quality of Lake Okeechobee was projected to degrade in the future due to the projected increase in air temperature and/or in the external nutrient loads from the upstream watersheds. The water level operation was found to be able to reduce the TN and TP concentrations of Lake Okeechobee but led to little change in the Chl-a concentrations. The modeling experiment found that the Chl-a and DO concentrations of the lake would be more sensitive to the climate forcings, while the TN and TP concentrations would be more responsive to the external loadings from the upstream basins and the water level operation scenarios. The results demonstrate that the water quality of the lake was a function of air temperature and internal hydrodynamics driven by lake water level operation and wind as well as nutrient loads from the upstream areas.

PRESENTER BIO: Young Gu 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.

SEA LEVEL RISE AND CLIMATE CHANGE IMPACT ON GROUNDWATER AND SALTWATER INTRUSION IN MIAMI-DADE COUNTY

Young Gu Her[1]*, and Jung-Hun Song*[2]
[1]University of Florida, Gainesville, FL, USA
[2]Seoul National University, Seoul, South Korea

Sea level rise is expected to bring additional challenges to agriculture in south Florida. This study investigated how projected changes in climate and sea level may affect groundwater quantity and quality in Miami-Dade County. A groundwater model, the Urban Miami-Dade (UMD) model developed by USGS, was used to mathematically represent the aquifer of Miami-Dade County including agricultural areas and its interaction with seawater. Two climate change scenarios and three sea level rise scenarios were fed to the UMD groundwater model to understand how groundwater flow and seawater intrusion processes may look in the future. Under the most commonly used climate scenario of SSP2-4.5, the climate projection found that air temperature may increase by 1.5 to 1.8 degrees Celsius in the near future period of 2026 to 2050, compared to the historical period average. Precipitation was projected to slowly increase with large fluctuations and uncertainty. Under the NOAA Intermediate High sea level scenario combined with SSP2-4.5, the overall groundwater elevation was projected to increase by 0.25 m in the near future period. Areas that may be affected by brackish water would increase by 0.5% in the near future period while areas affected by seawater would increase by 3.7% for the same time frame. Groundwater elevation was expected to increase mainly due to projected sea level rise. Seawater and brackish water were projected to intrude into the fresh groundwater aquifer; however, the impacts might be limited to 15 to 20 km from the shoreline. The groundwater modeling results indicate that the groundwater level rises may be controlled mainly by the distance from the coastline rather than the land uses and covers and may be more sensitive to the projected sea level changes than the projected climate changes.

PRESENTER BIO: Young Gu 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.

OCKLAWAHA RIVER RESTORATION: A CRITICAL FLORIDA WILDLIFE CORRIDOR CONNECTION

Tom Hoctor
Center for Landscape Conservation Planning, Department of Landscape Architecture, University of Florida, Gainesville, FL, USA

The Florida Ecological Greenways Network (FEGN) is part of the legislatively adopted Florida Greenways Plan administered by the Office of Greenways and Trails (OGT) in the Florida Department of Environmental Protection (Florida Statutes, Chapter 260). The FEGN guides ecological corridor conservation efforts and promotes public awareness of the need for and benefits of a statewide ecological network. The FEGN identifies areas of opportunity for protecting a statewide network of ecological hubs and linkages designed to maintain large landscape-scale ecological functions including focal species habitat and ecosystem services throughout the state. The newest FEGN was completed in June 2021, and the top three priorities of the FEGN are now also recognized as the Florida Wildlife Corridor as part of the state law passed in 2021. The state legislature, the governor, and state natural resource agencies have all adopted the protection of the Florida Wildlife Corridor as a high state priority, and this initiative has renewed Florida's commitment to appropriate funding levels of our conservation land protection programs including Florida Forever and Rural and Family Lands Protection.

Restoring the Ocklawaha River will significantly enhance connectivity between conservation lands south and north of Rodman Reservoir within the heart of the Florida Wildlife Corridor. Ocklawaha River restoration will have a very significant habitat connectivity benefit for wide-ranging and landscape dependent focal species in Florida including the Florida panther and Florida black bear. Restoring the Ocklawaha River's rare floodplain forest will also allow it once again to stretch from the St. Johns River to the Ocklawaha River headwaters, which will provide an unbroken source of abundant food and shelter and a safe route of travel for many terrestrial and aquatic species that use riverine corridor systems.

PRESENTER BIO: Dr. Hoctor is Director of the UF Center for Landscape Conservation Planning and specializes in GIS applications for identifying conservation priorities and policies for maintaining biodiversity and ecosystem services. He has served as principal investigator on many regional-scale conservation analysis and planning projects including the Florida Wildlife Corridor.

COMMUNITY STORMWATER PONDS: INTERSECTING SCIENCE, STAKEHOLDERS & DECISION-MAKING

Russell Hoffman[1], Steven Postle[2], Alexander Reisinger[3], Mary Lusk[3] and Paul Monaghan[4]

[1]Beautiful Ponds, FL, USA
[2]Country Club East Stormwater Pond, FL, USA
[3]UF/IFAS Department of Soil, Water and ecosystem Sciences, FL, USA
[4]UF/IFAS Department of Agricultural Education and Communication, Gainesville, FL, USA

Stormwater ponds are designed and managed by individual, community, and regulatory levels of society. These ponds are designed to provide primary services (flood control, pollutant removal) but also provide numerous secondary services. Management of these ponds may limit their potential to provide multiple ecosystem services. This panel will explore various management styles and some of their consequences on social, economic, and environmental conditions within the community and beyond.

PANELIST BIOS:

#1 Mr. Russ Hoffman has been a research manager for a pond maintenance company, Beautiful Ponds, Inc., for five years after being the general manager for fifteen. He received a bachelor's degree in environmental design from Iowa State University and a master's from Wheaton University. Russ has worked with homeowner's associations on issues concerning stormwater ponds and has contributed to University of Florida research in these areas. Beautiful Ponds, Inc. encourages littoral plantings and management with reduced use of chemicals.

#2 Dr. Steve Postle is chair of the facilities, ponds, and landscape committee in Central Park, Lakewood Ranch, FL. He obtained his bachelor's, masters and doctorate in organic chemistry from the University of Oxford. Following a research fellowship at the University of Cambridge, he entered the specialty chemicals industry, where has held a number of senior management positions in marketing, intellectual property management, and R&D. Steve holds over fifty first-issue patents in areas as diverse as dyestuffs, inks, coatings, color management, security systems, photovoltaics, stained-glass windows, and ultraviolet-curable materials. He is a Fellow of the Royal Society of Chemistry.

#3 Dr. Alexander "AJ" Reisinger is an assistant professor of urban soil and water quality and specializes in the ecosystem ecology and biogeochemistry of urban environments. He is a member of the Sustainability Human and Ecological Development group. He focuses on the ecosystem functions of nutrient and energy cycling and the effect of traditional (e.g., nutrients) and novel (e.g., pharmaceuticals) contaminants on these functions. Dr. Reisinger received his Ph.D. from the University of Notre Dame.

#4 Dr. Mary Lusk is an assistant professor and Extension specialist in urban soil and water quality and specializes in the flux and storage of nutrients in managed urban landscapes, and the linkages between landscape management practices and urban soil and water quality. Dr. Lusk's Extension program aims to ensure that Florida residents, homeowners, urban landscaper managers, city and county officials, and others have the knowledge they need to make scientifically sound decisions about water use and water supply management. She received her PhD in urban biogeochemistry from the University of Florida.

#5 Dr. Paul Monaghan, Associate Professor in Agricultural Education and Communication, specializes in Community Based Social Marketing (CBSM). His research evaluates CBSM's efficacy in behavior change, predicting adoption of new behaviors, and measuring program effectiveness. His Extension work applies CBSM to public issues and promotes collaborative conflict management via the Florida Natural Resources Leadership Institute. He received a PhD in anthropology and a MA in Latin American studies, both from the University of Florida

MODERATOR BIO:

Mrs. Michelle Atkinson is an Environmental Horticulture agent based in Manatee County, FL, specializing in pond and landscape best management practices. She also oversees a mobile irrigation lab focused on promoting outdoor water conservation and water quality. Michelle received her bachelor's degree at Stetson University and her master's degree in natural resource policy and administration from the University of Florida.

COMMUNITY ADVISORY COMMITTEES & COMMUNICATION TOOLKITS: CREATING SOLUTIONS FOR WATER-RELATED ISSUES

Sydney Honeycutt
University of Florida, Gainesville, FL, USA

Water and natural resources are vital to the ecological health and economic well-being of many Florida communities. Implementing water-focused research recommendations is necessary to ensure the conservation of resources. However, without community involvement in the research process, findings are less likely to be integrated. Community advisory committees (CACs) provide valuable input at various stages of community-based participatory research, guiding the development of research and outreach initiatives. The UF/IFAS Center for Public Issues Education (PIE Center) has organized CACs for multiple water-related research projects to provide feedback, test messages, and disseminate outreach materials to populations of interest. This paper details how CACs and communication toolkits can bridge the gap between science and stakeholders, leading to the implementation of sustainable solutions.

In recent years, the PIE Center has engaged in several projects that aim to address water issues like harmful algal blooms, effects of land use and climate change on coastal ecosystems, and aquaculture adoption. These projects utilized CACs to better understand local needs and perspectives. The PIE Center facilitated CAC meetings and collected feedback from stakeholders, allowing researchers to identify concerns and additional factors to consider. This iterative process provided an opportunity for stakeholders to directly participate in efforts to address water-related issues in their communities.

In addition to research, the PIE Center utilized CAC feedback to develop comprehensive communication toolkits. Toolkits are composed of various multimedia pieces such as infographics, fact sheets, social media content, webinars, informational videos, and podcast episodes. By translating research results into engaging communication materials, toolkits help disseminate key findings to target audiences. CACs are instrumental in tailoring communication strategies to the local context. This paper will provide suggestions for integrating CACs in the development of water-related communication deliverables.

PRESENTER BIO: Sydney Honeycutt is the media coordinator for the UF/IFAS Center for Public Issues Education (PIE Center), where she leads the development of communication materials and strategy. She earned a bachelor’s degree in agricultural education and communication and a master’s degree in family, youth, and community sciences from the University of Florida. Sydney is currently pursuing a doctorate in agricultural communication. Her research interests include international development, agricultural extension, and policy communication.

ENGAGING STAKEHOLDERS TO ENHANCE RESILIENCE IN THE SUWANNEE RIVER BASIN

***Sydney Honeycutt**, Angela B. Lindsey, Ricky Telg, and Aly Morrison*
University of Florida, Gainesville, FL, USA

Background

The National Academy of Sciences (NAS) Suwannee project is an interdisciplinary initiative that utilizes modeling to predict future outcomes in the Suwannee River Basin. To better understand the potential impacts of future climate and land use scenarios, the project team has worked closely with an advisory council comprised of local stakeholders. The council represents the interests of industries in the Suwannee River region such as agriculture, forestry, fishing, tourism, and natural resources management. Gathering local input has enabled researchers to address community concerns in the development of models and scenarios.

Methods

The advisory council was formed by identifying key opinion leaders in the region, who then referred the names of individuals who would be interested in contributing to the project. Referrals were contacted in early 2021 to confirm their willingness to participate. In April 2021, the first council meeting was held in Cedar Key, Florida. During the meeting, a focus group session was facilitated to understand the council's perceptions and concerns. After developing preliminary project models, the council convened for a virtual meeting in November 2021. A second focus group was conducted to collect input related to scenario development. As researchers implemented feedback in 2022, the council was updated on progress. In August 2023, a third council meeting was held to present the revised scenarios. Through a guided activity, council members identified additional factors to consider in the scenarios.

Next steps & implications

The advisory council will be instrumental in determining the best channels to disseminate results and policy recommendations. Sharing the scenarios with decision-makers and the public will create awareness for the social-ecological impacts of land use and climate change. Prioritizing the perspectives of stakeholders throughout the project has generated local buy-in, encouraging sustainable practices that will protect the future of the Suwannee River Basin and its resources.

PRESENTER BIO: Sydney Honeycutt is the media coordinator for the UF/IFAS Center for Public Issues Education (PIE Center), where she leads the development of communication materials and strategy. She earned a bachelor's degree in agricultural education and communication and a master's degree in family, youth, and community sciences from the University of Florida. Sydney is currently pursuing a doctorate in agricultural communication. Her research interests include international development, agricultural extension, and policy communication.

IPLANGREENS^2: INTEGRATED PLANNING TOOL FOR GREEN INFRASTRUCTURE SITING AND SELECTION IN FLORIDA

*Sara Kamanmalek**, S M Mushfiqul Hoque**, and Nasrin Alamdari*
Florida State University, Tallahassee, FL, USA

With rapid urbanization and climate change, the importance of urban stormwater management has surged. Though Low-impact Development (LID) techniques, interchangeably known as Best Management Practices (BMP) or Green Infrastructure (GI), offer promising solutions for nutrient reduction, they are often challenged by environmental and socioeconomic factors. Systematic planning and optimization can strategically address these constraints. Our study presents a multi-objective decision support tool – Integrated Planning Tool for Green Infrastructure Siting and Selection [iPlan-GreenS2]) through the implementation of numerical routines. iPlan-GreenS2 is a user-friendly and open-access tool with several key features that allow users to filter suitable GI locations and types based on various factors such as the GI type or land ownership. The planning tool was developed to help in the evaluation of GIs to control nutrients in urban watersheds across FL. The tool encompasses a life cycle cost assessment module that incorporates all phases of a project's lifespan, including construction, operation and maintenance, and end of life. In doing so, we identified suitable sites for 11 different GIs in Florida based on various environmental criteria such as land use, slope, imperviousness, hydrological soil type, and groundwater elevation. Subsequently, we developed a cost equation, focusing on GI's life cycle cost and performance. This equation was integrated with the NSGAII multi-objective optimization algorithm to assess various GI applications. Results highlight the most economical GI strategies tailored for Florida's watersheds. The framework of the tool proposed in this study is adaptable and can be easily applied to both smaller and larger geographical scales. iPlan-GreenS^2 serves as a valuable decision-making tool for urban planners and state officials, facilitating the identification of sustainable and equitable stormwater management solutions.

PRESENTER BIO:

A JUSTICE-BASED DECISION SUPPORT TOOL FOR INTEGRATING STORMWATER BMPS IN NUTRIENT REMOVAL IN FLORIDA

Sara Kamanmalek and Nasrin Alamdari *Presented by:* ***S.M. Mushfiqul Hoque***
Florida State University, Tallahassee, FL, USA

Stormwater runoff is a significant contributor to nutrient pollution, leading to water quality degradation and ecological imbalances. The management of stormwater runoff and nutrient pollution faces significant challenges due to inadequate assessment tools for evaluating nutrient loads across multiple watersheds at the state level and the absence of an open-source tool that can comprehensively assess the effectiveness of stormwater Best Management Practices (BMPs) in nutrient removal while incorporating environmental justice (EJ) considerations. To address these challenges, we developed an innovative online statewide tool that identifies areas where BMP planning needs to be prioritized to address environmental disparities resulting from high pollutant loads intersecting with disadvantaged communities, alongside tracking pollutant loads after various BMP implementations. In doing so, we estimated pollutant loads including total phosphorus (TP), total nitrogen (TN), biochemical oxygen demand (BOD), and total suspended solids (TSS) from urban land use in 1378 HUC-12 watersheds across Florida using EPA's pollutant load estimate tools (PLET), which calculates loads based on factors such as land use, septic systems and wastewater discharge, soil characteristics, and precipitation. To integrate BMP implementation with EJ considerations, an equity index was developed to identify tiers of sociodemographic disparities using racial/ethnicity metrics (e.g., % black, % Hispanic, etc.) and socioeconomic metrics (e.g., median household income, educational attainment, etc.). We then investigated the effectiveness of 28 urban stormwater BMPs in reducing pollutant loads and estimated post-BMP loads for each watershed. Hotspots of nutrient pollution were primarily identified in coastal areas, with residential land use as the main contributor. Miami-Dade, Broward, and Hillsborough counties had the highest sociodemographic disparities. In addition, central and southern Florida exhibited a disproportionate exposure of disadvantaged communities to pollutant loads. The developed online tool contributes significantly to holistic watershed management by features including visualizing the distribution of nutrient pollution loads across state watersheds, identifying areas with high pollutant loads intersecting with disadvantaged communities, and quantifying pollution load reductions post-BMP implementation. This research promotes equitable outcomes and empowers stakeholders in Florida to adopt sustainable and inclusive practices for water quality improvement.

PRESENTER BIO:

RIVER REVERSALS AND THE METABOLIC REGIMES OF FLORIDA'S SPRINGS

Samantha Howley[1], *Matthew Cohen*[2]
[1]University of Florida, School of Natural Resources and Environment
[2]University of Florida, School of Forest, Fisheries, & Geomatics Sciences

Florida spring-runs are often viewed as chemostatic systems, with remarkably constant thermal, hydrologic, and chemical conditions arising from Floridan aquifer storage enabling high rates of ecosystem metabolism. While a constant metabolic regime may be common in some spring-runs, interactions with downstream rivers can induce flood-like disturbances (backwater floods). Backwater floods range from high-stage events which slow flow velocity to brownouts where tannic water from downstream rivers mixes with water in the spring-run, and even flow reversals where downstream river water flows "upstream." These floods alter benthic light availability by changing both water depth and clarity, impacting spring-run gross primary production (GPP) and ecosystem respiration (ER). Given concerns backwater floods are changing in incidence, I sought to understand how they influence spring productivity and resilience by measuring metabolism along with CO_2 dynamics in five springs spanning flood-disturbance regimes. I observed normal stage supported greater productivity, higher DO, and lower CO_2 concentrations than high stage while brownouts had lowered productivity, anoxic conditions, and elevated CO_2 concentrations for the duration of the disturbance. While flow reversals are considered more hydrologically impactful than brownouts, brownouts occur in greater frequency, suggesting they are more ecologically consequential. Even the more modest high-stage events significantly altered spring-run metabolism, leading to a consistent negative relationship between stage and net ecosystem productivity (NEP). However, GPP, ER, DO and CO_2 returned to normal following these disturbances quicker than hydrological conditions, indicating resilience. Backwater floods are associated with slower or even reversed flow, making them distinct from typical flood disturbances in most rivers, observed impacts on metabolic regimes are general. These findings demonstrate that backwater floods significantly impact spring-run metabolism and portray spring ecosystems as spanning a gradient of natural flow regimes, including large, chemostatic springs to springs that are prone to highly consequential flooding.

PRESENTER BIO: Sam Howley is a PhD student in Dr. Cohen's Ecohydrology Lab. Her research interests concern flowing water metabolism and biogeochemical functions.

CLIMATIC DRIVERS OF EXTREME PRECIPITATION IN A COSTA RICAN BASIN: A SPATIOTEMPORAL ANALYSIS.

Caroline Huguenin*, Katherine Serafin, Peter Waylen*
University of Florida, Gainesville, FL, USA

The Tempisque-Bebedero River Basin (TBRB) in northwest Costa Rica is facing significant water challenges due to interannual variability of rainfall extremes and the potential for changing patterns of regional rainfall caused by global climate change. This basin plays a crucial role in supporting key sectors such as tourism, agriculture, ranching, and fish farming, all of which heavily rely on its water resources. To address these concerns, our study employs a non-stationary extreme value analysis to understand the underlying climatic drivers of extreme precipitation events within the TBRB. We employ a peak-above-threshold method to identify daily extreme precipitation events at five monitoring stations across the TBRB. To account for the evolving climatic conditions, we incorporate interannual climate variability as time-varying covariates within a non-stationary point process model. Specifically, our investigation focuses on three regional climate indices: the Caribbean Low-Level Jet (CLLJ) index, the Oceanic Niño Index (ONI) representing the El Niño Southern Oscillation (ENSO), and the Atlantic Multidecadal Oscillation (AMO) index. Our findings reveal that the magnitude and frequency of extreme precipitation events within the basin are primarily influenced by the CLLJ and the AMO. The ONI only emerges as a significant driver of extreme precipitation in the northwestern sector of the TBRB. This may be attributed to the ONI's role in modulating the strength of the CLLJ, suggesting that the dominant impact of ENSO on precipitation in the TBRB is encapsulated within the CLLJ component of our model. This research enhances our understanding of the evolving rainfall dynamics in the TBRB and offers crucial insights for effective water resource management strategies. It highlights the importance of proactive monitoring and adaptation to changing climatic conditions to ensure the continued sustainability of vital sectors, including agriculture, tourism, and fisheries, within the region.

PRESENTER BIO: Caroline is a civil engineer, a hydrologist, and a PhD candidate at the University of Florida in Geography. Her research, focused on extreme climate, is part of the University of Florida's Water Institute Graduate Fellows studying the resilience of water subsidized systems.

ALTERNATIVE LANDSCAPING AS A WATER CONSERVATION STRATEGY IN EXPANDING RESIDENTIAL LANDSCAPES

***Basil V. Iannone III*[1]**, *Patrick Bohlen[2], Richard Levey[3], Brooke L. Moffis[4], Victoria Cope[1], Jennison Kipp[1], Nicholas Taylor[1], and Pierce Jones[1]*

[1]University of Florida, Gainesville, FL, USA
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Residential and urban areas are the most rapidly expanding land cover type globally, resulting in the replacement of natural and agricultural habitats with simplified landscaped plant communities dominated by lawns and limited ornamental species. In Florida, greater than 60% of household water usage goes towards maintaining landscaping, with most of this outdoor water usage occurring in lots built after the 1980's that have outdoor irrigation systems. The fertilizers and pesticides used in landscaping management raise further environmental concerns. Here we report on an academic-municipal-private-NGO collaboration aimed at protecting water resources in an ongoing 37,000-home development southwest of Orlando, Florida. The key water-conservation strategies being tested are drought-tolerant, native planted-dominated landscaping and soil compost amendments. Two on-site studies are revealing the benefits of these water-conservation strategies and future research needs. The first study, a manipulative field experiment aiming to identify strategies to establish native plants in degraded development soils, has determined that irrigation can be reduced by at least 75% after initial establishment of native plants and that soil organic amendments can help to maintain plant health and appearance. The second study quantifies differences in irrigation, management efforts, and resources for higher trophic levels (floral and arthropods) between yards having native-dominated landscaping and yards in a nearby development having conventional turf-dominated landscaping. Despite the water conservation potential of the native-dominated landscaping, these savings are not yet fully realized, demonstrating the need to educate on how to manage alternative landscaping styles. In addition to water conservation potential, we are also seeing benefits to arthropod communities, including a doubling of pollinator abundance in plots receiving soil-compost amendments. Our findings are informing landscaping decisions in future development phases, while showing that separate landscaping conservation goals, e.g., water conservation and supporting biodiversity, are not mutually exclusive and can be met through integrative approaches.

PRESENTER BIO: Dr. Iannone is an Associate Professor and State Extension Specialists who uses his background in plant community ecology, ecological restoration, and biological invasions to increase the ecological value of designed and constructed ecosystems in urban and residential landscapes.

USING COMMUNITY BASED RESEARCH TO ADVANCE EQUITABLE INFRASTRUCTURE

Beatriz Inacio*, Michelle Henderson, Maya Trotz, Christian Wells*
University of South Florida, Tampa, FL, USA

It is well known that communities of color experience disproportionate exposure to dangerous environmental pollutants, which has a negative impact on their health. The historical practices of discrimination, which have aided in residential racial segregation, can be linked to many of these exposures. While there has been substantial success in the environmental justice movement's incorporation of public health research into these issues, there hasn't been as much focus on the movement's inclusion of environmental engineering education. The NSF-funded research purpose was to implement a comprehensive, interdisciplinary, community-based training program with an anti-racism focus for undergraduate civil and environmental engineering students at the University of South Florida. The goal is to provide students with the tools they need to effectively address environmental justice issues.

In this project, fields of anthropology, environmental engineering, and STEM education are combined to rewrite current civil and environmental engineering curriculum, with an emphasis on promoting fair development in particular communities. At the same, a more comprehensive educational framework is offered to deal with environmental engineering problems, attend to demands indicated by the community, and take structural racism's systemic effects into account. The results of incorporating environmental engineering, anthropology, and justice themes into engineering curricula will be demonstrated in the presentation.

PRESENTER BIO: Beatriz is a senior in environmental engineering at the University of South Florida, passionate about tackling pressing environmental issues. She is engaged in research on environmental justice and strives for a more equitable and sustainable world. She's an active member of Engineers Without Borders (EWB) and the Society of Women Engineers (SWE).

CHARACTERIZING HISTORICAL AND PROJECTED FUTURE DROUGHTS FOR SOUTH FLORIDA

***Michelle Irizarry-Ortiz*[1], *Carolina Maran*[2], *Jayantha Obeysekera*[3], *Tarana Solaiman*[2], and *Brett Johnston*[1]**
[1]United States Geological Survey, Orlando, FL, USA
[2]South Florida Water Management District, West Palm Beach, FL, USA
[3]Florida International University, Miami, FL, USA

The United States Geological Survey, in collaboration with the South Florida Water Management District (SFWMD) and Florida International University, is evaluating projections of future drought event characteristics based on downscaled climate datasets from the Coupled Model Intercomparison Project phase 5. This study will inform water-supply vulnerability assessments at the SFWMD to determine the capacity of local and regional water resources to meet future water needs. Future changes in drought may exacerbate pressures on the water-resource system which would require development of alternative water-supply sources and other adaptation strategies.

Gridded historical timeseries of the Standardized Precipitation-Evapotranspiration Index (SPEI) were developed to understand drought characteristics and identify critical thresholds and timescales that capture historically significant drought events. Principal component analysis (PCA) identified regions with similar historical evolution of SPEI that generally coincide with existing water supply planning regions in the SFWMD and were selected for evaluating projected future changes in droughts. Projected SPEI timeseries were generated at grid points from monthly estimates of reference evapotranspiration (RET) and precipitation derived from downscaled climate datasets which were evaluated for completeness and bias correction. Sensitivity analysis using various estimates of plant stomatal response to changing carbon dioxide concentrations will be applied to future SPEI timeseries. SPEI projections will be clustered to identify a subset of models and datasets representative of ranges of future projected changes in drought. Precipitation and RET timeseries from the identified models and datasets will be available to drive hydrologic and groundwater models to support vulnerability assessments that will inform water-supply planning efforts at the SFWMD.

PRESENTER BIO: Michelle Irizarry-Ortiz is a hydrologist with the U.S. Geological Survey Caribbean-Florida Water Science Center with more than 20 years of experience in hydrologic modeling and statistical hydrology. She has extensive experience modeling the hydrology and water management system of south Florida and its vulnerability to climate change.

CONNECTING HYDROLOGY AND SOIL ORGANIC CARBON STORAGE IN SOUTHEASTERN US FLATWOODS WETLANDS

***Alexis Jackson**, David Kaplan, Matthew Cohen*
University of Florida, Gainesville, FL, USA

Wetlands are essential for providing multiple ecosystem services to humans. They play a crucial role in the global carbon cycle and are thus considered a valuable terrestrial carbon sink. Hydrology is critical in driving wetland ecosystem services, as it affects multiple biophysical processes. 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 and thus enhance carbon storage, but the specific connections between long-term wetland hydrology and carbon storage remain uncertain. To quantify how wetland soil carbon responds to changes in water table and land use, 25 wetlands with ongoing hydrological data collection were randomly selected across a contiguous pine flatwoods site in Bradford County, Florida. Soil samples were taken to a depth of 60 cm, incremented by 4 cm, and analyzed for soil carbon content. Using this data, this study will answer two connected questions: 1) How does the location, size, and hydrological connectivity of wetlands influence wetland soil carbon across a wetland-scape? And 2) How does the depth of the water table affect the rates of wetland soil carbon accumulation? Data collection and analysis are still ongoing, but preliminary results support the hypothesis that water table depth influences soil organic carbon stock and accumulation rates. The results can be applied to guide wetland management, conservation, and policy decisions that better account for potential future changes in carbon storage.

<u>PRESENTER BIO</u>: Alexis Jackson is a 3rd year Ph.D. student in the Center for Wetlands at UF. Her research focuses mostly on wetland soil carbon and hydrology. She served as the Florida crew leader for the 2021 Environmental Protection Agency's National Wetland Condition Assessment (EPA NWCA).

TIMESCALES AND MAGNITUDE OF LEGACY BIOSOLIDS PHOSPHORUS TRANSPORT

***James W. Jawitz*[1]**, *Nicolas Fernandez*[1], *Jaehyeon Lee*[1], *Andy Canion*[2], *Dean Dobberfuhl*[2]
[1]Soil, Water, and Ecosystem Sciences Department, University of Florida, Gainesville, FL, USA
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How long will legacy phosphorus (P) from biosolids application continue to impact waterways in the St. Johns River basin? We report on synthesis of information from ongoing co-funded laboratory and field experiments to inform a conceptual model to provide quantitative predictions of P export from biosolids application sites and their corresponding timescales. The data synthesis provides local-scale estimates for individual field sites and generalized guidance about translating these to the landscape scale. The model framework scales up from sites to landscapes to evaluate controls on time lags between land use shifts and water quality changes in the context of watersheds and river networks. We used the resulting model to develop loading and transport mass balance budgets that represent the legacies of P accumulated in the soils, which is an important step towards the goal of predicting P export and evaluating the resultant impact on water quality. We included fundamental information about P transport through soils typical of biosolid application sites, with emphases on biosolid sources, soil types, and water table position. To assess the relative contribution of biosolids application to the whole-landscape nutrient mass balance, we evaluated current and legacy loads, their storage and release based on soil characteristics, and correlations with P source strengths and travel times to receiving waters.

PRESENTER BIO: Dr. Jawitz's research emphasizes hydrology and water quality at the landscape scale. His notable contributions are related to landscape-scale coupled hydrologic and biogeochemical modeling, restoration of degraded ecosystems, and water resource sustainability.

CLIMATE RESILIENCE INITIATIVES ALLEVIATE DROUGHT IMPACT ON INTIMATE PARTNER VIOLENCE IN BANGLADESH

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Climate change impacts are not gender-neutral. Women, especially those in developing nations, are disproportionately affected due to their extensive involvement in agriculture, existing political, social, and economic inequities, entrenched power dynamics, and gender-specific roles rooted in cultural norms. In developing countries where women's economic stability is significantly tied to the agricultural sector, environmental anomalies could act as a "threat multiplier" through channels of lost income as well as intra-family dynamics (UN Women, 2022), intensifying susceptibilities to gender-based violence.

In light of these considerations, the objective of this paper is twofold. First, we quantify the effects of climate shocks, particularly drought, on women's attitudes towards intimate partner violence (IPV) across various socio-economic strata. We construct a novel dataset by linking gridded data on rainfall, temperature, and other climatic variables to individual-level information on women's agency, obtained from the Bangladesh Demographic and Health Surveys (BDHS).

Our empirical analysis reveals a strong relationship between an increase in the frequency of dry months and an elevated tolerance for IPV among women in agriculture-dependent communities and those with less wealth. These findings are particularly concerning in the context of Bangladesh, where nearly 40% of the population is directly employed in agriculture, and the World Bank estimates that climate variability could lead to a potential loss of one-third of the country's agricultural GDP by 2050.

Secondly, we explore mechanisms that could alleviate the negative impacts of climate shocks on women. We focus on the Bangladesh Climate Change Trust (BCCT), a nationally-funded initiative that reflects the government's commitment to fostering climate resilience. BCCT provides community-based projects that promote climate adaptation and resilience, including some directly targeting women. We digitize the list of approved and finalized BCCT projects and investigate whether they effectively counteract the negative impacts of climate shocks on women's agency.

Our results suggest that proximity to an active BCCT project entirely neutralizes the effect of droughts on IPV tolerance across all wealth strata. These findings remain robust after controlling for various pre-treatment covariates and possible selection effects. We find no statistically significant attenuation effects for inactive BCCT projects and other development assistance projects, highlighting the unique effectiveness of BCCT in improving various welfare facets for women.

PRESENTER BIO: Dr. Ji is an assistant professor at the Food and Resource Economics Department, University of Florida. His research focuses on quantifying the social and economic impact of environmental change, including water scarcity, climate change, and air pollution. He is also interested in understanding adaptation towards environmental change and the role of social and economic institutions in facilitating adaptation.

WATER, WATER EVERYWHERE, NOR ANY DROP TO DRINK? OCEAN SALINITY, EARLY-LIFE HEALTH, AND ADAPTATION

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Sea level rise poses serious threats to vulnerable coastal communities in developing nations, with children especially vulnerable. In this study, we examine the health and social impacts of salination caused by seawater intrusion. Specifically, we examine whether these early life health impacts result from in-utero salinity exposure in the spirit of the fetal origin hypothesis.

We focuses on the coastal belt of Bangladesh, an area with more than 10 million poor people and one of the most severely impacted by salt intrusion in the world. We construct a panel dataset on the birth history and health outcomes of children under the age of 5 from the Bangladesh Demographic and Health Surveys (DHS) spanning 1993-2018. We then link that with geospatial data on ocean salinity levels, ocean chemistry, and local weather and climate. To examine the impact of salinity exposure, we use a saturated panel fixed-effects regression model that includes location-specific seasonality and regional trends while also controlling for child, mother, and household characteristics.

Results show that increased in-utero salinity exposure significantly raises the chances of a child experiencing nutritional deficiencies. A one-standard-deviation increase in such exposure reduces a child's height-for-age z-score by 0.114 standard deviations. Salinity exposure also increases the chances of wasting and underweight conditions. The impact is likely driven by the income channel: salinity exposure prompts agriculture to shift from irrigated to rainfed rice, which is salt-tolerant but has less yield. Families with higher salinity exposure also tend to neglect formal prenatal care, neonatal care, and vaccinations.

Our work complements the growing literature quantifying the unequal social impact of climate change. Few studies have investigated to social impact of coastal salination in a developing country context, a problem that will exacerbate in the next century due to climate change. We also complement public health and economics literature on the link between prenatal environment shocks and later-life outcomes, and on the public health impacts of salt intake.

PRESENTER BIO: Dr. James Ji is an assistant professor at the Food and Resource Economics Department, University of Florida. An environmental economist, his work seeks to understand the economic, social, and public health impact of environmental and climate change domestically and globally.

ENHANCING FLOOD RESILIENCE: A REAL-TIME FLOOD FORECASTING MODEL FOR THE UPPER ST. JOHNS RIVER BASIN

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

In response to the rising challenges posed by increased flood frequency and severity within the Upper St. Johns River Basins, the St. Johns River Water Management District has developed an ICPR4 real-time flood forecasting model. This model covers a significant portion of the Upper St. Johns River Basin and provides real-time forecasts, offering an invaluable window of up to 10 days, for flows and stages at both regional and neighborhood scales. These outputs will empower local and regional authorities with timely and precise information that can be utilized to expedite emergency response and mitigate potential flooding impacts. Furthermore, the model's versatility extends to broader resiliency planning, enabling applications such as regional flood assessment and optimized structure operation.

PRESENTER BIO: Dr. Yanbing Jia is the Bureau Chief of the Bureau of Watershed Management and Modeling at the St. Johns River Water Management District. He leads a dedicated team responsible for developing hydrologic models to support the District's water supply planning, water use permitting, Minimum Flows and Levels assessment, and the development of flood control projects. He holds a Ph.D. in Civil Engineering from the University of Virginia and is a registered Professional Engineer in Florida.

APPLICATION OF PHOSPHORUS IMMOBILIZING TECHNOLOGY ON A LEGACY BIOSOLIDS SITE

***Jonathan D. Judy*[1]**, *Yang Lin*[1], *Vimala Nair*[1] *and Todd Osborne*[2]
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Phosphorus (P) flux from agricultural areas and ranchlands receiving P inputs (e.g., inorganic fertilizers and biosolids) presents a risk to the downstream, oligotrophic ecosystems of South Florida. Recent work has reported an increase in downstream P correlated in time with increasing biosolids additions within the St. John's River basin. Any biosolids that can be diverted from landfill/incineration and safely applied to land is a net benefit to society. However, preserving surface and groundwater quality is of paramount importance. Here, we investigate the performance, potential hazard and cost-effectiveness of adding immobilizing-phosphorus technologies (IPTs) as soil amendments to reduce P loss from soils receiving biosolids additions. IPTs to be investigated include freely-available waste byproducts such as drinking water treatment residuals and residuals from the processing of alum, as well as materials such as biochar and commercially-available remediation products. Investigation will initially include bench-scale sorption studies examining a larger suite of IPTs, then transition to column studies examining P loss/retention from soil amended with a smaller suite of IPTS before transitioning finally into field trials using only the most promising candidate IPTs. Evaluation of IPTs will include consideration of method of land-application, such as the potential for IPTs to be applied to drainage features and at the edge of fields, as well as the need for strategic, site-specific environmental engineering that considers site hydrology and P input locations.

<u>PRESENTER BIO</u>: 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.

OPTIMIZING CITRUS IRRIGATION MANAGEMENT WITH SOIL AND PLANT-BASED SENSORS

Davie Kadyampakeni
University of Florida, Citrus Research and Education Center, Lake Alfred, FL, USA

Water management has been based on farmer perceptions of plant water needs or on indirect estimates of water use, such as evapotranspiration estimates based on weather data. The latter approach is still of interest but is well explored by other modeling approaches. Our work is focused on all aspects of using sensors, sensor systems and sensor networks to advance and enable more effective water management, particularly, but not exclusively, in irrigated agriculture. Sensor development and testing, conjunctive use of sensors to arrive at more complete knowledge of plant response and soil water status, the relationships between sensor signals and plant and soil properties related to water stress, and automation and control of irrigation systems using sensor networks are just some of the areas of interest. In this presentation, real-wide and on-farm examples of soil and plant-based sensors for irrigation management will be discussed and shared with the scientific community. Merits and caveats for using some of these tools will also be shared.

PRESENTER BIO: Dr. Kadyampakeni is an Associate Professor for Water and Nutrient Management in the Soil, Water and Ecosystem Sciences Department. He is the 2019 UF Water Institute Early Career Fellow. His research interests include crop and soil modeling, water conservation, irrigation management, nutrient management, and hydrology.

AQUIFER WATER CHEMISTRY VARIABILITY AND CONTINUOUS MONITORING SENSOR COMPARISON

Mahnoor Kamal[1], *Patricia Spellman* [2]
[1]University of South Florida, Tampa, FL, USA

Water quality disruption, as changes in major ion covariance and increasing nitrate (NO_3^-), has become an increasing concern in the springs of northern Florida. These springs drain primarily into the Upper Floridan Aquifer (UFA), which is a highly transmissive and heterogeneous karst aquifer whereby pollution can rapidly infiltrate into and through the aquifer. Rapid and extensive water quality changes have prompted intensive monitoring at several priority springs. However, springs are a discrete discharge point of expansive phreatic cave networks that can intersect different land uses, receive discrete and diffuse recharge, and contain convergent passages from different aquifer sections. These factors may contribute to varying water chemistry across passages that generates convoluted water quality signals at springs. However, our understanding of the extent of water quality variability in phreatic caves is limited but plays a crucial role for interpretation of water quality changes and remediation practices from spring basin management.

We focus on Peacock Springs in Northern Florida, a first magnitude, priority spring. With the help of cave divers, we conduct water quality surveys using a YSI EXO^2 multiparameter sonde which continuously records pH, dissolved oxygen (DO), and specific conductance. At pre-selected locations, we also collect discrete water quality samples including NO_2+NO_3^- as N (NO_x-N), major ion chemistry, and dissolved organic carbon (DOC).

Significant differences can be observed in the water quality parameters, but most notably in NO_x-N, DO, and DOC at discretely sampled locations. The NO_x-N data varied over 2 mg/L across passages in Fall after the wet season but less so (~1.2 mg/L) in Spring during the dry season. Overall, NO_x-N was higher at each site in Fall as opposed to early Spring. DO and DOC were also variable (> 2 mg/L variation), but did not correlate significantly with NO_x-N. Our YSI EXO^2 sensor comparisons between spring vent and spring basin monitoring points showed significantly contrasting values for all physiochemical parameters, highlighting the need for the selection of proper spring sampling locations. Understanding water quality changes within and outside the cave system informs monitoring protocols developed at individual springs.

PRESENTER BIO: Mahnoor "Mahu" Kamal is a graduate student starting her doctoral studies in Spring 2024 in the School of Geosciences at the University of South Florida. Her study focus is on hydrogeology, specifically water quality and its impacts. Her past research includes work on Northern Florida spring systems.

MANGROVE FREEZE DAMAGE AND RECOVERY ACROSS A TROPICAL-TEMPERATE TRANSITIONAL ZONE

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Freeze events govern the distribution and structure of mangrove ecosystems, especially in tropical-temperate transitional zones. Understanding how mangroves respond to freezing is crucial for predicting the poleward range expansion of mangroves under climate change. After an extreme winter storm in December 2022, we conducted a post-freeze field assessment (spring 2023) and an ongoing recovery assessment (fall 2023), built on a pre-freeze assessment in summer 2022. We measured stratum- and species-specific mangrove damage and recovery across 12 sites along Florida's Gulf of Mexico coast. Across this temperature gradient, tagged individuals of *Rhizophora mangle* exhibited significant threshold responses for leaf damage, with a threshold temperature of -4.1 ℃. *Laguncularia racemosa* individuals were damaged by temperatures between -2.0 to -3.9 ℃; however, we lacked sufficient data to quantify significant threshold relationship. *Avicennia germinans* showed a linear increase in damage at lower temperatures, rather than a threshold response, with the greatest intraspecific variation at damaged sites. This variation indicates that the lowest temperature recorded (-6.4 ℃) was insufficient to cause damage to all *A. germinans* individuals near the species' northern range limit. Plot-level data show that for tall *R. mangle* individuals there was a significant negative relationship between damage and temperature, while short *R. mangle* and *A. germinans* individuals were temperature-insensitive, suggesting regeneration of *R. mangle* may depend on the higher resistance of shorter individuals. Data to be collected regarding mortality and recovery rate this fall may further illustrate mangrove response mechanisms. Collectively, our findings advance mechanistic understanding of mangrove responses to freeze events and quantify species-specific biological temperature thresholds, providing insights for predicting mangrove poleward expansion under a changing climate.

<u>PRESENTER BIO</u>: Yiyang 'Calvin' Kang is a PhD student in Interdisciplinary Ecology at UF. He studies how mangrove ecosystems in Florida respond to climatic factors, to project coastal wetland transformation under a changing climate.

EFFICIENT ACCESS PATTERNS FOR NATIONAL WATER MODEL DATA

Sepehr Karimiziarani
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The National Water Model (NWM) input and output datasets, made freely available on cloud platforms through the NOAA Open Data Dissemination program, represent a treasure of hydrologic information to support research and accelerate improvements in continental-scale hydrologic prediction. The existing format of the NWM files reflects a reasonably efficient configuration for operational simulations, but the cloud-stored files become cumbersome when used for case studies and other retrospective analyses common in research scenarios. CIROH has developed a community-focused dataset to accompany the NWM files that, when combined with simple methods of parallel computing, allows flexible, high-speed access to the NWM operational and retrospective datasets. While this auxiliary reference dataset will be of great value to the hydrologic research community, the methods may also be a guide for provisioning output datasets in future operational hydrology modeling programs. We present here the details of the development of this new dataset along with examples of applications in model evaluation and input preparation for retrospective simulations. We invite the community to explore the dataset and example applications and share feedback at dataaccess.ciroh.org.

<u>PRESENTER BIO</u>: Sepehr is a Research Software Engineer who is deeply passionate about using his technical skills to contribute to the important work of the Alabama Water Institute. With a Bachelor's degree in Computer Science from Sharif University of Technology and a Master's and PhD degree from The University of Alabama, he is proud to have had the opportunity to learn from some of the best minds in his field.

A STOCHASTIC FRAMEWORK IMPLEMENTATION TO FORECAST STAGES IN THE EVERGLADES FOR OPERATIONAL PLANNING

Yogesh P. Khare, *Alaa Ali*[1], *Walter Wilcox and Jason Godin*
South Florida Water Management District, West Palm Beach, FL, USA

Incorporation of predictive uncertainty in operational planning models used by water managers for decision making is of paramount importance. Understanding the response of water stages to anticipated rainfall is at the crux of choosing the optimal path forward in South Florida's complex Everglades ecosystem. Due to low skill of weather models in predicting precipitation on medium- to long-range timescales, projections are often made in terms of probabilities of above, below, and normal rainfall conditions (a.k.a., tercile probabilities) on seasonal scale. System wide simulation modeling tools, e.g., South Florida Water Management District Dynamic Position Analysis (DPA); rely on historical rainfall information to assess potential future stage trajectories over an annual timeframe, indirectly ignoring the forecasted precipitation pathway and stochastic nature of rainfall. Other planning tools (e.g., USGS's EverForecast) that incorporate rainfall projections make stage predictions that are not constrained by current operational practices.

Conditional Position Analysis (CPA), Ali 2017, relies on stage data generated with process-based model that incorporates current system operations during DPA and then stochastically generates the range of possible stage trajectories over the period of next 11 months for a given rainfall projection. This study implements CPA methodology at 200 locations encompassing the Everglades. While a range of hypothetical precipitation projection scenarios can be explored, a methodology that transforms El Niño-Southern Oscillation strength projections into rainfall tercile probabilities was developed specifically for CPA implementation. This framework first improves DPA stage data for known model biases and deviations in initial stages that occur as artifacts of DPA simulations. This stochastic framework, to be implemented monthly, would provide more reliable data to other ecological models that depend on hydrologic information. Also, this tool will provide a better perspective to decision makers about potential state of the Everglades system in medium-term to long-term future in the face of rainfall projections.

PRESENTER BIO: Dr. Khare is a systems data modeler with more than 10 years of experience in hydrologic and water quality modeling. He has published over 20 peer-reviewed journal articles. In his current role at South Florida Water Management District he focuses on developing and applying simulation models for operational planning.

INVESTIGATION OF HISTORICAL CHANGES IN AIR TEMPERATURE AND RAINFALL EVENTS IN FLORIDA

Dong-Hyeon Kim *and Young Gu Her*
University of Florida, Gainesville, FL, USA

Changes in weather patterns have significant implications for agriculture and infrastructure. However, it is often not straightforward to understand how quickly the weather patterns have changed and what the changes look like, especially at local and regional scales. This study investigated historical weather records made in Florida to understand the progress of climate change in the subtropical and tropical regions and help develop an information-driven decision-making process for the mitigation of potential climate change impacts. We compiled historical daily weather observations made at 950 stations across the state of Florida between 1892 and 2022. Then, we quantified the characteristics of air temperature, such as the numbers and frequencies of hot and cold days and rainfall events, including depths, intensities, durations, and pause periods. Results showed the daily average temperature, PET, and rainfall have increased by 3.6% (0.8°C), 5.4% (59 mm), and 6.7% (61 mm) on average in the past 30 years, respectively. The daily minimum air temperature increased more rapidly than the daily maximum air temperature. The number of hot days and tropical nights increased by 0.6 and 12.6 days, respectively, and the number of cold days decreased by 2.4 days on average. Southern Florida experienced relatively higher increases in the air temperature and PET, compared to other Florida areas. These findings indicate the hardiness zone expansion might move toward the north, and drought frequency and severity might increase in South Florida, suggesting increases in water demand for agriculture. Overall, the depths of daily rainfall events with varying return periods (or design daily storms) relatively more increased in North Florida. In addition, rainfall events tended to happen more frequently in the recent ten years. The findings suggest an increased frequency of extreme events and the resulting need to review agricultural management practices and technical criteria for infrastructure design.

<u>PRESENTER BIO</u>: Dong-Hyeon Kim is a post-doctoral associate working at the Tropical Research and Education Center, IFAS/UF. His current research focuses on evaluating the effectiveness of conservation practices with hydrological models and the implications of climate changes on agricultural and water resources management.

UNDERSTANDING TOURISTS GENERAL AND CONTEXT-SPECIFIC PRO-ENVIRONMENTAL BEHAVIORS

***Mina Kim**, and Lori Pennington-Gray*
University of South Carolina, Columbia, SC, USA

Given that lakes and rivers serve locals as a leisure and recreation source, simultaneously playing a role as a tourism attraction (Hall & Harkonen, 2000), water activities enjoyed by locals and tourists result in more stress on water sources (Haigh et al., 2004). Thus, environmentalists believe it is important to motivate both locals and tourists to engage in pro-environmental behaviors (PEBs) to protect water sources. Although leisure, recreation, and environmental studies have examined whether recreationists in general engage in PEBs, (e.g., Larson et al., 2011; Lee & Lee, 2021), little is known about whether tourists engage in PEBs in recreational water use. Rather, tourism studies have focused on tourist PEBs and whether they are consistent across daily lives as well as vacation contexts (e.g., Xu et al., 2020). Because recreationists often travel from greater than 50 miles one way, they are also deemed tourists. Thus, this study aims to investigate the relationship between environmental perceptions and PEBs of tourists both recreationally as well as while on a trip. Specifically, tourist environmental perceptions will be measured based using the value-belief-norm (VBN) theory. General PEBs, such as recycling, and energy conservation will be asked. The same participant will be asked about PEBs when they travel. Finally, PEBs pertaining to water use will be asked regarding both recreational behaviors and travel behaviors. A structural equation model will be developed to capture the links among tourist environmental perceptions, general PEBs, and water-specific PEBs. Theoretically, this study will reveal the relationship among environmental perceptions, general PEBs, and context-specific PEBs, addressing differences between general and context-specific PEBs. Practically, the results of this study will help destination managers foster general PEBs and recreational water use PEBs among tourists.

PRESENTER BIO: Mina Kim is a Doctoral Student in the Richardson Family SmartState Center for Excellence in Tourism and Economic Development, at University of South Carolina. Her research interest focuses on promoting tourist pro-environmental behaviors.

IDENTIFYING CAUSES OF WATER CHEMISTRY CHANGES AT SPRINGS IN AN EOGENETIC KARST AQUIFER

Sunhye Kim *and Patricia Spellman*
University of South Florida, Tampa, FL, USA

Northern Florida is a region where intensive and increasing agricultural activity over the past few decades has degraded water quality at freshwater springs draining the Upper Floridan Aquifer (UFA). Crop cultivation and livestock operations have affected overall spring water quality by increasing nitrate concentrations, and possibly disrupting major groundwater ion covariance. In addition, pumping from agriculture and industry has impacted water quantity by potentially lowering local hydraulic heads which could increase contribution from the Lower Floridan Aquifer (LFA) to springs via fractures, or change the length of contributing flow paths to springs, further altering spring water chemistry.

Changes in specific conductance and major ion concentrations have been widely observed at springs across the UFA, and the consequences of these additional changes are uncertain. Because the causes would be a result of various activities (i.e., pumping vs surface operations), different strategies are needed to mitigate future changes. As spring ecosystems respond negatively to decreases in water quality and flow, identifying the causes is critical to effective spring restoration.

We report on preliminary results at Fanning Springs, a first magnitude spring where water quality has been steadily declining. We collected sulfur ($\delta^{34}S$) and oxygen ($\delta^{18}O$) isotopes of sulfate (SO_4^{2-}), major ions, organics, and water isotopes at the spring and at shallow wells in agriculturally impaired and natural recharge areas for a comprehensive geochemical analysis of causes of water quality changes and development of mixing models. We highlight the usefulness of $\delta^{34}S$ and $\delta^{18}O$ of SO_4^{2-} as unique identifiers to determine ratios of source water contributions to spring. Specific conductance at Fanning Spring almost exceeds what's expected of natural limestone weathering, indicating flow path changes are not the sole cause. A substantial depletion of $\delta^{34}S$ similar to locally analyzed fertilizers is observed, suggesting remaining water quality changes are likely from agricultural applications.

<u>PRESENTER BIO</u>: Sunhye Kim is a graduate student pursuing a Ph.D. in Geology at the University of South Florida. Her research interests include karst aquifers, stable isotopes, and water resource management. She has recently participated in a project to identify causes of water chemistry changes in Northern Florida springs.

EMERGING CONTAMINANTS, INCLUDING MICROPLASTICS AND PFAS, DISCOVERED ACROSS THE FLORIDA EVERGLADES

***Emily K. Kintzele**[1], Nolan Lyons[1], Mallory Llewellyn[2], Rachel Caspar[1], Gabrielle Gonzalez[1], Tracie R. Baker[1]*

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The Florida Everglades is one of the most extensive and renowned wetland ecosystems world-wide, comprised of marshes, freshwater ponds, and prairies. This unique environment was thought to be one of the most pristine natural habitats in the world, largely untouched by human civilization and anthropogenic pollution. In 2022, a group of explorers, including Dr. Tracie Baker, ventured across the Everglades from the Gulf of Mexico to the Atlantic Ocean by canoe to recreate the 1897 Willoughby Expedition where we collected water samples to examine and compare the water chemistry as well as multiple environmental contaminants that have emerged since the original expedition.

The discovery of microplastics and PFAS (per- and polyfluoroalkyl substances) in the depths of the Everglades were significant in this study. These pollutants originate from anthropogenic sources and highlight the fact that contaminants are reaching concerning levels in nearly all aquatic environments. There were 12 sites sampled in the Everglades that spanned from the Gulf of Mexico to the Atlantic Ocean. Microplastics were found at all 12 sites at varying quantities in the water, with cellophane being the most common occurrence. Similarly, PFAS were found at every site as well with PFOA being the most common among the 12 sites. The highest concentration of PFAS in the water was found at site 12 which is the closest site to the urbanized area of Miami, contributing to the fact that the contamination is a direct result of human activity infiltrating natural environments.

In addition to microplastics and PFAS found in the Everglades water, the water quality parameters including nitrogen and phosphorus compounds were examined along with contaminants like PPCP (pharmaceuticals and personal care products), pesticides, metals, and antibiotic resistant genes. Identifying these water quality drivers will allow researchers to better understand toxicological impacts on public, wildlife, and ecosystem health.

<ins>PRESENTER BIO</ins>: Emily Kintzele is a first 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.

SUWANNEE RIVER ESTUARY NON-MARKET VALUATION STUDIES OF RECREATIONAL SALTWATER FISHERIES

***Roberto F. Koeneke*[1]**, *Olesya Savchenko*[1], *Kelly A. Grogan*[1], *Christa D. Court*[1] *and Jana Hilsenroth*[2]
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Two non-market valuation studies of recreational saltwater angling associated with changes in environmental conditions in the Suwannee River estuary and on Florida's Nature Coast were recently conducted. The first study used a choice experiment survey to estimate willingness to pay for hypothetical environmental programs resulting in changes in populations of recreationally and economically important fish species (red drum, seatrout, snook) and abundance of seagrass. The results suggest that respondents are willing to pay to prevent declines in populations and abundance of all aquatic resources. However, respondents are only willing to pay for increases in spotted seatrout and seagrasses. The analysis further shows that female respondents, individuals with a bachelor's degree or higher, and those who have visited or fished on the Nature Coast are more likely to pay for an environmental program to reach specific environmental conditions.

The second study employed an angler survey with two delivery methods (in-person intercept survey and online Qualtrics survey) to estimate recreational saltwater angling demand. The travel cost method (TCM) using a random effects negative binomial model was employed to elicit willingness to pay in the face of hypothetical changes to target recreational fish species in the Suwannee River estuary. Preliminary analysis shows that the most sought-after species are catfish, red drum, and spotted seatrout. On average, respondents traveled 35.10 miles (56.49 km) per trip and spent $321.60 per trip. Also, 53% of respondents would alter the number of trips in response to changes in fish populations, and 38% would make the same number of trips regardless of changes in fish populations.

These results can inform resource management decisions aimed at preserving estuarine and coastal resources on the Nature Coast threatened by the negative impacts of human activities and climate change.

PRESENTER BIO: Roberto Koeneke is a third-year PhD student in the Food and Resource Economics department at the University of Florida. He studies natural resource and environmental economics and focuses on water and coastal resource issues and policy analysis, and regional economic impacts and contribution analysis.

PROGRESS & PRIORITIES FOR CYANOHABS IN FLORIDA: INSIGHTS FROM THE STATE OF THE SCIENCE SYMPOSIUM II

Lisa Krimsky[1] *and Betty Staugler*[2]

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Algal blooms are a pervasive problem for Florida and successful management decisions must rely on the best available science. In 2019, following concurrent red tide and blue-green algal blooms UF/IFAS and Florida Sea Grant convened a forum of harmful algal bloom (HAB) scientists for the first Harmful Algal Bloom State of the Science Symposium. The goals of the two-day forum were to develop consensus statements identifying the current state of the science regarding what we know and what we think we know, data gaps and areas of uncertainty, and research priorities, with a focus on *Karenia brevis* red tides and *Microcystis aeruginosa* cyanobacterial harmful algal blooms (cyanoHABs).

In 2023, a second symposium was convened at the request of the Florida Blue-Green Algae Task Force. The Blue-Green Algae State of the Science Symposium II (BGASOS II) aimed to build upon the 2019 symposium, offering an update and complement to its findings. The symposium addressed five major thematic areas: Drivers, Detection and Monitoring, Prediction and Modeling, Mitigation and Management, and Public Health. Unlike its predecessor, BGASOS II widened its scope to encompass various cyanobacterial bloom-forming taxa across Florida.

Over fifty researchers and managers from state and federal agencies, academia, non-profits, and industry convened in Florida in May 2023. The symposium employed a dynamic format, featuring lightning round presentations, panel Q&A, facilitated discussions, and breakout groups. This process resulted in updated consensus statements summarizing what we've learned since 2019, identified new research and management priorities, as well as best practices for HAB research and management efforts. The consensus statements will be used to inform Florida's Blue-Green Algae Task Force and facilitate more effective research and management by aligning and prioritizing the needs and efforts of agencies and respective scientific institutions.

<u>PRESENTER BIO</u>: Dr. Lisa Krimsky is a Water Resources Regional Specialized Agent with the University of Florida IFAS and the Florida Sea Grant College Program. Lisa's extension work focuses on coastal water quality and harmful algal blooms in Florida.

CHALLENGES AND SUCCESSES OF COMMUNITY SCIENCE: PERSPECTIVES FROM MULTIPLE PROGRAMS IN THE SOUTHEAST

Shelly L. Krueger
University of Florida IFAS Extension, Florida Sea Grant, Monroe County, Key West, FL, USA

Community science is an efficient and cost-effective means to engage stakeholders, accelerate scientific research, provide hands-on learning, and build social capital. Coastal water quality monitoring has a long history of volunteer partnerships, and many recent peer-reviewed articles confirm volunteer collected data is equivalent to that collected by scientists. Training members of the public to collaborate and work with scientists to collect scientific information is incredibly rewarding for the practitioners and the volunteers. But there are challenges. It is important to involve the data end-users and volunteers early and often or volunteer retention can plummet. Even with training and equipment provided, community science is not a no-cost endeavor, and this can exclude diverse audiences. Recruiting from under-represented communities can be difficult if they do not have access to coastal resources. Continued program funding may be indeterminate, so having other options to continue to engage, recognize, and build stakeholder relationships are key. This presentation will discuss these, and other benefits / challenges of community science based on 10 years of coordinator experience from 3 water-based programs: Coastal Georgia Adopt-A-Wetland, Florida Water Watch, and Stony Coral Tissue Loss Disease Underwater Observers.

PRESENTER BIO: Shelly Krueger has been the Florida Sea Grant Agent for the University of Florida IFAS Extension, Monroe County for 10 years. As an Extension agent and a marine biologist, Shelly provides excellence in marine and environmental science outreach, education, and research to conserve and protect coastal resources and enhance economic opportunities and quality of life for the people of Florida.

FLORIDA-FRIENDLY LANDSCAPING™: BEAUTIFUL LANDSCAPES PROTECTING FLORIDA'S WATER

Emily Lang
Florida Department of Environmental Protection, Tallahassee, FL, USA

As Florida's population continues to grow, responsible landscaping practices are more important than ever. The Florida-Friendly Landscaping™ Program continues to expand to meet Florida's landscape education needs. Hear program updates and new initiatives including green stormwater infrastructure resources, revisions to the state's Irrigation Standards, and new educator resources.

PRESENTER BIO: Emily Lang is an Environmental Administrator within the Florida Department of Environmental Protection's Nonpoint Source Management Program. Emily is the project manager for the Florida-Friendly Landscaping™ Program and leads the Nonpoint Source Management Program's green stormwater infrastructure and public education initiatives.

IDENTIFYING TEMPORAL AND SPATIAL VARIATION IN GATORSPEC LOCAL CALIBRATION CURVE ACCURACY

Ethan M. Lantzy*, J. Barrett Carter and Eban Bean*
University of Florida, Gainesville, FL, USA

It is vital to have an accurate measure of a water sample's chemical composition. However, chemical composition analysis is expensive and time-consuming with current methods. This limits the use of this by resource managers, researchers, and other entities. Spectroscopic techniques hold promise as a low-cost and accurate method of water quality analysis, especially when coupled with machine learning. The Urban Water Resources Engineering lab in UF's Agricultural and Biological Engineering Department has developed a low-cost UV-Vis spectrophotometer (GatorSpec) that measures electromagnetic radiation in the UV and visible light range. Coupled with machine learning techniques, GatorSpec has the potential to provide high frequency water quality information for a variety of parameters at a low cost.

The machine learning model used for GatorSpec requires a local calibration curve (LCC) to translate absorbance spectra to analyte concentrations. For streams, LCCs are typically developed by sampling from 1-2 discrete locations. However, there is a knowledge gap for the length of time that an LLC will return accurate results (temporal variation) and the distance from LCC development points that samples could be taken (spatial variation).

This study collected grab samples from five locations along Hogtown Creek in Gainesville, Florida. The UV-Vis absorbance spectra (via GatorSpec) and nitrate and orthophosphate concentrations (via laboratory analysis) will be recorded. Absorbance data will be input into a machine learning model developed for Hogtown Creek to predict nitrate and orthophosphate concentrations. The outputs will be compared to laboratory analysis to test model (esp. LCC) accuracy. This will indicate spatial variation (i.e. re-sampling at 2 points used to develop the LCC, and 3 new points) and temporal variation (i.e. sampling 1+ years after the LCC was developed). This will provide practical guidance on the development and use of LCCs for surface waters and advance low-cost UV-Vis spectroscopic water quality analysis.

PRESENTER BIO: Ethan Lantzy is a third-year undergraduate at the University of Florida studying Biological Engineering with a specialization in Land and Water Resources Engineering. He is part of the Urban Water Resources Engineering Lab in the Agricultural and Biological Engineering Department. With past research experience in plant science and environmental economics, Lantzy is passionate about sustainable resource use and conservation.

FORENSIC WETLAND AND DEEPWATER HABITAT MAPPING FOR SETTING PRE-DEVELOPMENT CONDITIONS

Stephanie Lawlor*, Kai Rains, Shawn Landry and Mark Rains*

University of South Florida, Tampa, FL, USA

Mapping wetlands and waters prior to modern settlement is difficult due to the lack of spatially explicit data on conditions prior to the middle of the 20th century. We overcame this by using Public Land Survey System data and other ancillary historical data to map those habitats in the 1850s in the mainland portion of St. Lucie County, Florida. Using just the Public Land Survey System data, a first draft map indicated there was 754 km^2 of wetlands and deepwater habitats covering 52% of the study area. After two iterations using other ancillary historical data, a third and final draft map indicated there was 1,222 km^2 of wetlands and deepwater habitats covering 84% of the study area, an overall increase of 62%. We assessed the internal consistency of the final map by comparing the frequency of occurrence of wetlands and deepwater habitats the surveyors documented along section lines (i.e., expressed as a proportion of the total section line length) to the total area of the wetlands and deepwater habitats mapped (i.e., expressed as a proportion of the total study area). These values differed by 1%. We further assessed the accuracy of the final map by comparing the total area we mapped to the area ceded to the state (1,131 km^2) as per the Swamp Act of 1850. These values differ by less than 10%. Our results show that PLSS data can be used to map wetlands and deepwater habitats prior to modern settlement, but the use of other ancillary historical data can make maps more accurate and trustworthy. The outcome is a first-of-its-kind map of wetlands and deepwater habitats in the mainland portion of St. Lucie County, which is now representing baseline conditions in ongoing projects seeking to both quantify and mitigate for widespread land use-land cover change.

PRESENTER BIO: Stephanie Lawlor is a post-graduate researcher at the University of South Florida. She obtained her M.S. degree at USF in Environmental Science and Policy with a research focus on historical land use mapping.

ANALYZING IMPACTS OF CLIMATE CHANGE ON WATER AVAILIBILTY IN THE SANTA FE RIVER BASIN, FL

Dogil Lee[1], *Rob de Rooij*[2], *Nathan Reaver*[2], *David Kaplan*[3] *and Wendy D. Graham*[1,4]

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[2]Water Institute, University of Florida, Gainesville, Florida, USA

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[4]Division of Research, Innovation, Synergies, and Education, Directorate for Geosciences, National Science Foundation, Alexandria, Virginia, USA

The Floridan Aquifer is one of the most productive aquifers in the world and an important water source for both Georgia and Florida. However, like many aquifers throughout the world, it is threatened by increasing water withdrawals and climate change. The state of Florida has set minimum flows and levels for the Suwannee River and associated tributaries and springs, which are fed by the Upper Floridan Aquifer, to maintain healthy natural systems while providing adequate public water supply. However, changes in temperature, evapotranspiration, and precipitation due to climate change create uncertainty in predicting future water availability and ecosystem resilience in the Suwannee River Basin. Furthermore, climate change may affect cropping systems and crop cultivation practices, which may impact water demand. Quantifying the potential impacts of climate change on water demand, streamflow, and groundwater elevations is needed to predict water availability and ecosystem health in the future and to establish long term, sustainable water management plans and policies. In this study, characteristics of a suite of future climate scenarios were analyzed and future water demand, streamflow and groundwater elevation change were quantified using an integrated SWAT-MODFLOW hydrologic model for the Santa Fe River Basin, a tributary of the Suwannee River. Climate data from North American Land Data Assimilation System (NLDAS) and Coupled Model Intercomparison Project Phase 5 (CMIP5) global climate models downscaled by the Multivariate Adaptive Constructed Analogs (MACA) technique were utilized as baseline scenario and future climate scenarios for this analysis. The results of this study should be useful for establishing future minimum flow and level criteria and policies for managing water resources in the Santa Fe River Basin and Suwannee River Basin under a changing climate.

PRESENTER BIO: Dogil Lee is a PhD student in the Agricultural and Biological Engineering Department at the University of Florida. His research interests include field and watershed scale modeling of the impacts of agricultural management practices and climate change on water quality and quantity.

EFFECTS OF CLIMATE SEASONALITY AND SNOW STORAGE ON CURRENT AND FUTURE INTRA-ANNUAL RUNOFF PATTERNS

***Jaehyeon Lee*[1]**, *Harald Klammler*[2], *Nathan G.F. Reaver*[3] *and James W. Jawitz*[1]
[1]Soil, Water, and Ecosystem Sciences Department, University of Florida, Gainesville, Florida, USA
[2]Department of Geosciences, Federal University of Bahia, Salvador, Bahia, Brazil
[3]Water Institute, University of Florida, Gainesville, Florida, USA

Climate seasonality exerts strong control on hydrologic phenomena such as the timing of floods and droughts. The aim of this study is to extend current understanding of the effects of seasonal variability of climate on both mean annual water balance and intra-annual patterns by incorporating snow storage into an analytical framework. We also seek to understand the spatial distribution of the importance of snow storage on annual water balance and runoff patterns at the scale of the conterminous US. Furthermore, we examine the importance of snow storage effects on runoff for future climate change scenarios. We developed a supply-demand limit model based on the sinusoidal characteristics of water balance components that expresses the hydrological response of evaporation, snow storage, and recharge. The model quantifies each hydrological component, enabling analysis of how and which factors affect the supply-demand concept of partitioning of precipitation into evaporation and recharge. Four archetypal seasonal discharge patterns were identified based on observed discharge data, each with distinct spatial patterns at the continental scale and distinct spatial patterns coincide with sinusoidal characteristics of precipitation and temperature. Regions that have winter or summer dominant discharge patterns, such as in the western coastal region and mountains regions of the US, are more vulnerable to climate change.

<u>PRESENTER BIO</u>: Jaehyeon Lee is a Ph.D. student in Soil, Water, and Ecosystem Sciences Department. He is a member of the 2019 Water Institute Graduate Fellows program cohort. He seeks to understand how climate variability affects water balance, water quality, and human society.

VALUE BEYOND MONEY–HEALTH BENEFITS OF RECREATIONAL WATER ACCESSIBILITY

Seonjin Lee *and Lori Pennington-Gray*
University of South Carolina, Columbia, SC, USA

When considering the value of water, its monetary value often first springs to attention. Research questions such as, “Does water quality impact nearby property values?” (Gibbs et al., 2002; Poor et al., 2001) or “How much are people willing to pay for blue spaces?” (Carson & Mitchell, 1993; Park & Song, 2018; Söderberg & Barton, 2014) have been examined by multiple disciplines in the past decades. One notable exception to this neoliberalistic stream of research is the public health domain, where researchers empirically verified the physical and mental health benefits of blue spaces for residents (Georgiou et al., 2021). Although, the majority of public health studies related to blue spaces have focused on the proximity of residence to these natural spaces (Gascon et al., 2017; White et al., 2021).

We argue that dollar-to-dollar substitution is insufficient to evaluate the value of blue spaces, while also acknowledging that neighborhood health benefits of blue spaces only give a partial picture. Thus, this study examines the relationship between accessibility to water bodies and health with a broader geographic scope. Our state-level analysis examines two types of recreational water bodies (i.e., lakes and rivers) in South Carolina. Accessibility to recreational waters will be measured based on the gravity model (Hansen, 1959), which accounts for geographic distance, size, and demand for water bodies. The study will utilize longitudinal physical and mental health survey data, collected by the Centers for Disease Control and Prevention. This study will employ a two-stage spatiotemporal analysis technique (Bhattacharjee et al., 2016) that can account for local and global level spatial impacts, while also controlling for potential neighborhood-level effects based on Census data.

PRESENTER BIO: Seonjin Lee is a Doctoral Student and Presidential Fellow in the Richardson Family SmartState Center for Excellence in Tourism and Economic Development, at the University of South Carolina.

SOURCES AND SEASONAL DISTRIBUTIONS OF ORGANIC MATTER IN THE CALOOSAHATCHEE RIVER ESTUARY: IMPACTS OF HURRICANE IAN

***Shin-Ah Lee*[1]**, *Eric Milbrandt, David Kaplan*[1], *Edward Phlips*[1], *and Elise Morrison*[1]

[1] Environmental Engineering Sciences, University of Florida, Gainesville, FL, USA

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Management of the Caloosahatchee River estuary has been a long-standing water quality challenge. Discharge events from Lake Okeechobee (Lake O) have previously contributed to the occurrence of Harmful Algal Blooms (HABs) and are known to affect estuarine water quality. However, the contributions of the Caloosahatchee River watershed on the estuary have been less studied. To monitor the water quality and identify sources of organic matter in the system, we conducted monthly sampling from April 2022 through September 2023, spanning from Lake O to the Gulf of Mexico. Noticeable seasonal patterns were observed, including an increase in dissolved organic carbon (DOC) and colored dissolved organic matter (CDOM) during the early wet season (May to July) and a decrease during the wet season through dry season (August to May). The source of organic matter appears to be more influenced by the flow from the surrounding watershed during the wet season than by the flow from Lake O. During our sampling campaign, Hurricane Ian altered water quality throughout the region, characterized by elevated levels of DOC and fluorescent DOM (FDOM) at a mesohaline site (mid-estuary), indicating the delivery of terrestrially derived organic matter after the storm. Additionally, a notable increase in autochthonous FDOM was observed in meso/euhaline sites, indicating increased nearshore biological productivity after the hurricane, followed by a red tide bloom in the Gulf of Mexico. Evaluating the delivery of terrestrial and autochthonous DOM to the nearshore allows us to better understand how coastal biogeochemistry and phytoplankton communities respond to hurricanes, which are predicted to increase in frequency and intensity due to climate change.

<ins>PRESENTER BIO</ins>: Dr. Lee is a research assistant scientist in environmental engineering science 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.

RELATION BETWEEN SCIENCE AND CURRENT MANAGEMENT IN THE APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN (100 CHARACTERS WITH SPACE)

Steve Leitman[1], *Ebrahim Ahmadisharaf*[2], *Ken Jones*[3]

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[2]Florida State University
[3]Rhumbline Consultant PLLC

The Apalachicola-Chattahoochee-Flint (ACF) rivers and estuary is a basin that has been caught up in legal and management-based turmoil for the past three decades. In this presentation, the focus will be on the relationship between current science-based understanding of the watershed and current management policies and approaches. In 2016, the U.S. Army Corps of Engineers adopted a Water Control Manual (WCM), in which the preferred alternative was selected primarily based on historical flows from 1939 to 2012. Our analyses of 100 alternative stationary synthetic hydrology sets (developed by a stochastic model), which varied magnitude, duration, frequency and timing of historical flows, found that, in some instances, the WCM did not result in acceptable basin conditions in terms of drought control, water supply, composite storage and hydropower generation, when evaluated through a regional river system model of the WCM.

When the ACF water management projects were designed in the 1930s, the Apalachicola River and Estuary were considered to be two separate entities since the knowledge of the ecological relationships between rivers and estuaries was lacking at that time. Consequently when the recent WCM was developed, the effects of alternative approaches on the Apalachicola estuary was not considered despite the fact that it is now understood that river flow into an estuary is integral to its ecosystem.

Thus, the question is how do we design management of a watershed so that it considers current scientific understanding and looks towards the future instead of basing management approaches on concepts which when devised may have represented current understanding, but which now are known to be faulty. One way to approach this problem is to develop scientifically based, transparent and publicly vetted metrics upon which current management approaches are based.

PRESENTER BIO: Dr. Leitman is an environmental hydrologist who has worked in the ACF watershed for the past 50 years. He currently is a contract employee of the US Fish and Wildlife Service and is a contributing scientist in the Apalachicola Bay Systems Initiative.

WATER MATTERS DISPLAY MEASURES FLORIDA RESIDENTS' KNOWLEDGE OF WATER CONSERVATION

Vivienne Lewis[1], *Anna Sheridan*[1], *Gavin Hart*[1], *Jacqueline Marshall*[1], *Norma Samuel*[2], *Yilin Zhuang*[3] *and Judy Jean*[4]

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Water Matters is an ongoing districtwide project established by the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Extension Central District. The goal of the project is to enhance Floridians' understanding of the importance of water conservation and water quality protection. The Water Matters team travels around the district to community events with a "wall of water" displaying plastic gallon water jugs to depict the average daily water usage by a Florida resident. The display has a Qualtrics quiz to encourage participation, either electronically or by paper. The Water Matters project conducted surveys in Seminole, Sumter, Flagler, and Marion County, as well as a general online survey that is not county-based. In total, the Water Matters surveys received 284 responses. The survey consists of 10 multiple-choice questions, 1 ranking question, and 1 open-ended question. The average quiz score was 72%. The most frequently missed question was "Which of the following is not identified as a cause of waterbody impairment." Only 11% of participants answered correctly. When asked to select a number 0-10 representing how likely they are to share the information from the quiz with a friend or family member, 83% of participants selected 8 or above, demonstrating most participants were likely to share this information. The Water Matters display attracted youth participation, but the quiz was not designed to match their comprehension level. Therefore, the Water Matters team is developing quizzes for elementary, middle, and high school students respectively, as well as creating additional educational resources and activities for K-12 teachers. Overall, this project has played a crucial role in gaining insight into the current level of public knowledge regarding water quantity and quality challenges in Florida and using that knowledge to encourage water conservation and water quality protection.

PRESENTER BIO: Vivienne Lewis is studying Psychology. Anna Sheridan is studying Environmental Science with an Agriculture and Natural Resource Law minor. Gavin Hart is studying Psychology. Jacqueline Marshall is studying Applied Physiology and Kinesiology and a Nutritional Sciences minor. All presenters are in the ALP Internship Program.

GRASS SPECIES DIFFER IN THEIR EFFECT ON P RUNOFF FROM PHYTOREMEDIATION HARVEST STRIPS IN A FL RANCH

***Haoyu Li*[1]**, *Amartya Saha*[1], *Alma Reyes*[2], *Dan Petticord*[3], *Jiangxiao Qiu*[4], *Jed Sparks*[3], *Ran Zhi*[4], *Elizabeth Boughton*[1]

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In some agricultural landscapes, a long history of Phosphorus (P) fertilizer application at levels exceeding crop needs has resulted in elevated P levels in soils, ditches, riparian zones, wetlands, streams and lake sediments. Such accumulation of P in soils over time can serve as a long-term regional non-point source of P to surface waters downstream (i.e., a phenomenon known as 'soil legacy P'), even decades after the discontinuation of P inputs, thus delaying or compromising intended reductions in the catchment P fluxes associated with best management practices. At Archbold Biological Station's Buck Island Ranch (BIR) located within the Northern Everglades Watershed, even 12-17 years after P fertilization ceased, P loadings in runoff were still five to seven times higher than reference sites due to legacy P effects. In this study, low soil P storage capacity areas were identified at BIR and planted with phytoremediation harvest strips using three different species (Bahia grass, limpo grass, and stargrass), intended to mitigate legacy P by increasing plant P uptake. Surface water quality responses were measured and compared to grazed Bahia grass controls. Results from two years of weekly surface water sampling from ditches indicated that all harvest strip types consistently had lower TP (0.29-0.32 mg/l) and higher TKN (4.39-4.68 mg/l) concentrations than controls (0.52 and 3.38mg/l respectively); however, these differences were not statistically significant. Both TP and TKN were negatively correlated with increasing water depth in ditches ($F=6.85$, $p=0.0002$; $F=7.25$, $p=0.0001$), suggesting dilution over wet season. This negative relationship was more pronounced in Bahia grass and stargrass strips suggesting higher P uptake by vegetation in these two buffer strips. Surface water nitrate levels were similar in vegetation strips and controls. Further studies will assess the P budget of phytoremediation harvest strips compared to grazed control sites and impacts to soil P and soil P storage capacity.

PRESENTER BIO: Mr. Haoyu Li (MS) is an Environmental Specialist at Archbold's Buck Island Ranch. He holds a Master degree from UCF and is an ESA certified Ecologist. His current work focuses on ranchlands water resource and nutrient management in the North Everglades watershed.

SMART POND TECHNOLOGY FOR IMPROVED WATER RESOURCE BENEFITS

Jeff Littlejohn
National Stormwater Trust, Tallahassee, FL USA

Conventional stormwater ponds are designed and built to hold a predetermined amount of runoff, but these ponds release partially treated stormwater during and immediately after rain events. With large storms, conventional ponds can overflow and flood the surrounding area with untreated stormwater, impacting communities and the environment.

The latest innovation in stormwater technology incorporates live weather forecast data to automatically operate equipment and lower the pond water level before a storm arrives. While the sun is still shining, a smart pond can automatically release treated water into the environment and thereby increase its flood storage capacity and water quality performance.

The improvements to Florida's water resources from the use of smart ponds are tangible, and they go beyond just the benefits of flood control and water quality. Much of Florida is confronted with other water resource challenges, such as overallocated aquifers, and these challenges are forcing engineers, scientists, and community leaders to seek out alternative sources of water. Stormwater is generated in such significant quantities that, if appropriately managed and treated, it can effectively supplement or even replace groundwater as a source of drinking water or irrigation water supply.

The challenge has been how to cost-effectively manage and treat this water so that it may become beneficially reusable. Conventional approaches have involved extremely large stormwater reservoirs and costly treatment processes to get water of the appropriate quality in the right place and time to be reused. Smart pond technology can help lower these barriers to cost-effective stormwater reuse and change the way we think about stormwater. This presentation will examine two potential applications of smart pond technology using stormwater as an alternative water supply. [274 words]

PRESENTER BIO: Jeff Littlejohn is a professional engineer with more than 20 years of experience planning, designing, and implementing programs and projects to improve Florida's water quality. He has particular expertise in water quality regulations and policy, having served as the Deputy Secretary for Regulatory Programs at the Florida Department of Environmental Protection.

FORMIDABLE DETECTION AND QUANTIFICATION OF PFAS IN ENVIRONMENTAL AND BIOLOGICAL MATRICES

Mallory J. Llewellyn[1], *Rachel J. Caspar*[1], *Sarena E. George*[1], *Brianna K. Vo*[1], *Emily K. Griffin*[1], *John A. Bowden*[1], *Bridget B. Baker*[1,2], *and Tracie R. Baker*[1,2]
[1]University of Florida, Gainesville, FL, USA
[2]Wayne State University, Detroit, MI, USA

PFAS are contaminants of emerging concern that have spilled into global ecosystems from industrial and urban areas. Properties that make PFAS desirable for manufacturing also prevent them from degrading in the environment. Two compounds, PFOS and PFOA, have been phased out of use due to evidence of biomagnification and adverse biological health outcomes. Both compounds continue to be health threats. Furthermore, the phasing out of PFOS and PFOA has led to replacements with structural analogs of equal or greater concern.

Our 6-year study has analyzed PFAS mixtures yearly at 15 sites on average by collecting water and sediment samples. The Lake Huron to Erie corridor (HEC) is an EPA Area of Concern, the drinking water source for 4 million people, and hub of >30% of Michigan's fishing effort. From 2018 - 2021, we investigated HEC water and sediment samples for 32 PFAS and quantified 20 at ng/L or ng/kg levels. In 2022, we expanded to 33 sites to include tributaries and utilized a novel LC-MS method that simultaneously analyzed 92 PFAS. We quantified 19 PFAS. PFOS and PFOA were detected in all samples at concentrations orders of magnitude higher than the EPA's recommended lifetime health advisories.

For the past two years, we analyzed 40 PFAS from non-lethal muscle biopsy and serum samples of HEC sport fish to assess PFAS bioaccumulation and potential human-health implications related to consumption. Three fish species were used to represent 3 trophic levels: walleye, yellow perch, and round gobies. Eight congeners were detected in muscle and 15 in serum, revealing 5 novel PFAS in Great Lakes fish. PFOS was again identified in all samples. Furthermore, we demonstrated PFOS biomagnification in the studied food webs. This multi-pronged approach aims to inform human and ecosystem health and public health agencies about lake fish consumption and water quality.

<u>PRESENTER BIO</u>: Mallory Llewellyn is a 3rd year toxicology PhD student interested in the negative health effects of humans drinking contaminated water. Specifically, she is using the zebrafish model to assess the potential risks of ingesting microplastic fibers in combination with PFAS.

COLLABORATIVE FLOOD MODELING FOR INCLUSIVE AND TIME-EFFICIENT CLIMATE ADAPTATION

Katharine J. Mach[1,2], *Brett F. Sanders*[3,4]

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Climate change is intensifying flood risks, but achieving flood adaptation that is both effective and equitable is extremely challenging. Flooding dynamics are complex and uncertain, decision-making is limited by sociopolitical and institutional constraints and power structures, and participatory processes are very time consuming. To date, neither the processes nor the outcomes of flood adaptation have delivered upon aspirations for environmental justice. It is reasonable to be skeptical that future investments in flood adaptation will offer greater benefits to underserved communities than past projects—or that they will sustain lasting benefits in a warming climate. To address the need for effective, time-efficient, and equitable flood adaptation, we present an innovative collaborative flood modeling platform consisting of a fast-response flood simulation engine and an equitable-access, participant-driven control mechanism. The platform is designed to support interactive and inclusive exploration of adaptation options and pathways at neighborhood to regional scales. The platform, which is being deployed and tested in Southeast Florida, fills a gap in flood simulation methods between regional modeling tools lacking detail required for adaptation planning and local-scale modeling tools impractical to apply at the metropolitan scale due to computational bottlenecks. Breakthrough simulation speeds are made possible by the Parallel Raster Inundation Model (PRIMo), which can be flexibly configured to explore relevant flood scenarios (e.g., combinations of rainfall and storm surge, across different time horizons, for extreme versus frequent events), and the responses desired by community stakeholders across geographical locations (e.g., infrastructural options, nonstructural adjustments, policy/management options). Performance metrics such as flood depth, frequency, and intensity can be measured with household-scale resolution across scenarios. Currently, pilot studies are under development in Miami-Dade County to quantitatively measure the benefits of the new platform such as increasing participation of underserved groups in flood adaptation planning, shortening planning timelines, and more equitably distributing benefits and costs of flood management measures across individuals and neighborhoods through time. Widespread adoption of the approach could help climate adaptation across the United States and beyond to be more time-sensitive, equitable, and cost-effective.

PRESENTER BIO: Katharine Mach is a professor at the University of Miami. Her research assesses climate change risks and response options to address increased flooding and other hazards. Through innovative approaches to integrating evidence, she informs effective, equitable adaptations to the risks. Mach was the 2020 recipient of the Piers Sellers Prize for world leading contribution to solution-focused climate research. Mach received her PhD from Stanford University and AB summa cum laude from Harvard College.

PUBLIC HEALTH IMPACTS OF FLORIDA COMMUNITIES EXPOSED TO CYANOBACTERIAL HARMFUL ALGAL BLOOMS

***Daniela Maizel*[1]**, *Addison Testoff*[2], *Erik Swanson*[3], *Courtney Broedlow*[3], *Natasha Schaefer Solle*[2], *Nichole Klatt*[3], *Larry Brand*[1], *Helena Solo-Gabriele*[2], *Cassandra Gaston*[1], *Alberto Caban-Martinez*[2], *Kimberly J. Popendorf*[1]
[1]Rosenstiel School of Marine and Atmospheric Science, University of Miami
[2]MSOM - Environmental and Public Health, Miller School of Medicine, University of Miami
[3]Department of Surgery, Medical School, University of Minnesota

Cyanobacterial Harmful Algal Blooms (HABs) have been a major Public Health concern affecting water in Florida and across the United States with increasing impacts over the last several decades. Environmental exposure to cyanobacterial toxins results in both short and long-term health effects since they can enter the body via multiple exposure pathways, including dermal, ingestion and inhalation.
Along with the increase in frequency, intensity and geographical distribution of HAB events in recent years, there has been a rise in the Public Health impacts of populations that live, work or recreate near contaminated waters in Florida, especially in Lake Okeechobee (and surrounding areas), where many HAB events have been reported.

The DISPEL to HABs study was created in 2019 to assess the health risks of Florida communities exposed to HABs. In this "citizen science" study, a cohort of participants comprised of Florida residents, workers and visitors was designed. Participant enrollment began in February 2020 and the study is ongoing, with the primary goal of conducting long-term and repeated evaluation of survey and biomonitoring data for the cohort. Participants contributed home tap water samples, outdoor surface water samples from their local waterways, as well as nasal swabs which were analyzed for congener-specific toxin concentrations using HPLC-MS. In addition, enrolled participants contributed oral and stool samples for microbiome analysis and pulmonary function tests (PFT), which were analyzed before and after exposure to HABs.

PRESENTER BIO: Dr. Maizel is an Environmental Scientist with extensive experience in water quality research, with a focus on microbial processes. She has published and collaborated with more than 10 different publications dedicated to the analysis of contaminants naturally present in environmental waters.

LOSOM: BRINGING TOGETHER DATA, MODELS AND WATER MANAGEMENT LESSONS-LEARNED

Jason Engle, Eva Velez, ***Jessica Mallett****, Savannah Lacy*
U.S. Army Corps of Engineers (USACE), Jacksonville District, Jacksonville, FL, USA

The Lake Okeechobee System Operating Manual (LOSOM) represents a significant shift in the operational philosophy for Lake Okeechobee to a system wide benefits approach. Lake Okeechobee water levels will be managed to focus on making beneficial releases at times and in quantities that enhance fish and wildlife in the region (Caloosahatchee River Estuary low flows, flows south for Central Everglades, and no flows to St. Lucie Estuary most of the time) and improve water supply availability (Seminole Tribe of Florida, Lake Okeechobee, and Lower East Coast Service Areas). LOSOM manages Lake Okeechobee stage within an operational zone (Zone D) that provides benefits to the system by:

- Providing beneficial flows to the Central Everglades and Caloosahatchee Estuary throughout the operational Zone D.
- Providing beneficial flows to Lake Worth Lagoon during the dry season.
- Sending no flow to the St Lucie Estuary through S-308 in Zone D during normal operations.
- Keeping flows to the Caloosahatchee River Estuary from Lake Okeechobee from exceeding the stressful threshold of 2100 cubic feet per second (cfs) by limiting flows to 2000 cfs in Zone D measured from S-79.
- Sending flows south to the Central Everglades through the entire schedule all the way down to the Water Shortage Management Band.

LOSOM improves the ability of water managers to adapt to real time conditions to make smart informed decisions on lake releases. Water managers will use system wide analysis and real time knowledge of climate conditions, weather data, climate projections and system needs to inform the decision process. LOSOM includes more robust and structured communication and collaboration between the USACE and stakeholders as operational decisions are made. LOSOM aims to maintain beneficial releases out of the lake to the maximum extent possible.

PRESENTER BIO: Ms. Mallett is a lead civil engineer with 24 years of experience in planning, designing, and implementing Everglades restoration projects. She has extensive experience in integrated surface water/groundwater modeling, operational planning, and risk assessments. She has led multiple projects dedicated to preserving and restoring wetlands within Florida.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT' RESILIENCY EFFORTS AND COORDINATION

Ana Carolina Coelho Maran
South Florida Water Management District, West Palm Beach, FL, USA

South Florida Water Management District (District) is strongly committed to address the impacts of land development, population growth and climate change, including sea level rise, changing rainfall patterns and evapotranspiration trends. As a key part of its resiliency strategy, the District evaluates the status of its flood control infrastructure, water supply operations and ongoing ecosystem restoration efforts, and implements infrastructure projects to continue to successfully implement its mission in anticipation of future climate conditions.

The District's Sea Level Rise and Flood Resiliency Plan, updated annually, is the District's initiative to compile a comprehensive list of priority resiliency projects with the goal of reducing the risks of flooding, sea level rise, and other climate impacts on water resources and increasing community and ecosystem resiliency in South Florida. This goal will be achieved by updating and enhancing water management infrastructure and implementing effective, resilient, integrated basin-wide solutions.

In addition, comprehensive restoration efforts have been supporting South Florida overall resiliency and the District's ability to better manage water for the benefit of people and the environment, with consideration of anticipated sea level rise and extreme weather events into the future. In particular, the restoration of beneficial freshwater flows throughout the system slows down saltwater intrusion, promoting more sustainable aquifer recharge rates, healthier estuaries and bays, more stable coastlines, reduced marsh dry-outs and greater coastal resiliency, as well as higher flexibility and storage options to address water management response to extreme and seasonal needs.

This presentation will summarize the District's strategies for overcoming challenges posed by changing conditions and fostering long-term coordination to ensure sustained progress in resilience and restoration efforts.

PRESENTER BIO: Dr. Maran is the Chief of District Resiliency with SFWMD. In her role, she is responsible for coordinating resilience efforts across federal, state, regional and local agencies, advancing scientific research and data analysis to ensure the District's resilience planning and projects are founded on the best available science; and, developing and implementing comprehensive resiliency goals to mitigate and adapt to the challenges facing the District's infrastructure from climate change impacts.

HOW DO ENVIRONMENTAL RISKS AFFECT THE PROFITABILITY OF THE AQUACULTURE INDUSTRY IN FLORIDA?

Edgar Marcillo
University of Florida, Gainesville, FL, USA

Hard clam aquaculture substantially contributes to U.S. shellfish production, accounting for 30.1% of total production and generating $136 million in revenue in 2018 (Perdue & Hamer, 2019). Hard clam production in Florida is concentrated in the Gulf of Mexico, where the state has designated over 300 hectares of coastal mudflat for commercial aquaculture leasing (Black Jr, 2021). However, clam aquaculture faces strong environmental challenges. We use a stochastic bioeconomic model to calculate the profitability of Florida's Gulf Coast clam aquaculture sector. The model considers the most significant environmental threats that local producers face, including high temperature, low salinity, and harmful algal bloom (HAB) events. High temperature and low salinity events restrict clam development and increase mortality, reducing profitability. During HAB events, the algae produce toxins that can accumulate in clam tissues, making them unsuitable for human consumption. Consequently, state authorities close harvesting areas, preventing any harvest by local growers until water quality has returned to safe levels. This delay in harvesting allows for continued mortality of clams to occur and potentially allows the clams to grow beyond the marketable size, both of which impact profits. These risks vary by county. Low salinity primarily affects northern counties, particularly Franklin, reducing the net present value by 81.6% for Franklin County compared to the scenario without any risk. Conversely, high temperature and HABs significantly impact southern counties, especially Lee, resulting in an 83.2% reduction in net present value for Lee County. When evaluating the economic implications for each county, Levy and Franklin stand out as the most affected. These two counties produce approximately 90% of clam production along the west coast of Florida. Climate change and land use change are expected to worsen the risks faced by the Florida aquaculture industry, further impacting the water quality and profitability of the industry.

PRESENTER BIO: Postdoctoral Research Associate in the Food and Resource Economics Department at the University of Florida, Ph.D. in Food and Resource Economics from the University of Florida, M.Sc. in Applied Economics, and B.Sc. in economics from the Universidad del Valle in Colombia.

WATER QUALITY TREND ANALYSIS FOR THE CHARLOTTE HARBOR ESTUARY IN SOUTHWEST FLORIDA, 2000–2021

Miles Medina
ECCO Scientific, Gainesville, FL, USA

This study investigates water quality dynamics in the Charlotte Harbor estuary in southwest Florida between 2000 and 2021, including nitrogen, phosphorus, chlorophyll-a, oxygen, carbon, and physical parameters within the upper 1 m of the water column. Data were collected by the Coastal Charlotte Harbor Monitoring Network (CCHMN) following a spatially stratified random sampling design that divides the estuary into 13 segments of relatively homogeneous habitat and water quality conditions. For each water quality parameter at each segment, we fit a generalized additive model (GAM) to the available data, estimated annual mean values (with 95% confidence intervals), and estimated trends in the means over a sliding 5-year window using a linear mixed effects model that accounts for uncertainty in the mean estimates. For nitrogen, phosphorus, and chlorophyll-a parameters, we estimated trends over the 5-year period 2017–2021 and the 10-year period 2012–2021 and interpreted these results in the context of thresholds based on segment-specific regulatory criteria. Annual mean concentrations of total nitrogen at most segments increased between 2012–2021 and appear to have more recently stabilized at levels near or above regulatory criteria. In contrast, annual mean concentrations of total phosphorus were typically below regulatory criteria in 2021, with some notable exceptions, and trend directions varied across the estuary between 2012–2021 and 2017–2021. Annual mean chlorophyll-a concentrations were below regulatory criteria in 2021 and showed either downward trends or no significant trends between 2012–2021 and 2017–2021. Our analysis identified nitrogen as an important pollutant of concern throughout the Charlotte Harbor estuary, corroborating earlier studies suggesting that the achievement of restoration goals will require nutrient source and transport controls throughout the highly developed watershed.

<u>PRESENTER BIO</u>: Dr. Miles Medina is an environmental scientist specializing in water quality dynamics, trends, and drivers throughout Florida. Last year, he founded a private consulting firm, ECCO Scientific, to develop actionable, data-driven insights that inform management interventions for cleaner water and ecological restoration.

LINKING BURMESE PYTHON ECOLOGY WITH REMOVAL EFFORTS IN THE EVERGLADES

Melissa A. Miller
University of Florida, Fort Lauderdale Research and Education Center, Davie, FL, USA

The invasive Burmese python (*Python bivittatus*) is established across South Florida and is implicated in negative impacts to native wildlife. For over a decade, scientists and natural resource managers have investigated python ecology to understand its habits and develop targeted removal and control tools. However, due to their incredible crypsis, pythons have proven extremely difficult to assess, and no tractable abundance estimates have yet been made. Several successful python removal programs and tracking efforts have been implemented across South Florida. With few exceptions, these programs are focused in accessible areas or high ground habitats containing a mix of hardwood hammock, pinelands, prairie, cypress swamps, and estuaries that constitute only a portion of South Florida wildlands. In addition, most pythons removed from the region are captured while crossing roads or levees transecting vast wild habitats that may be flooded year-round. As such, there is an informational gap regarding python ecology and removal efficacy in the eastern Greater Everglades Ecosystem region, where landscapes primarily consist of sawgrass marsh interspersed with sloughs and tree islands. To address this need, we initiated a collaborative multifaceted study to integrate radio-telemetry field techniques and advanced modelling approaches to estimate population-level metrics to inform python removal efforts within the eastern Everglades. Additionally, we initiated a scout snake program, where adult pythons are tracked during the breeding season to lead researchers to mating aggregations, to increase the ability to detect and remove pythons from the interior of the landscape and provide critical information on movements, behaviors, and demographic rates (i.e., survival and reproduction). Knowledge of python spatial ecology in the eastern Everglades can inform targeted removal efforts, allowing for more effective management strategies while reducing resources necessary for python control.

<u>PRESENTER BIO</u>: Dr. Miller has studied biological invasions of large reptiles in the Greater Everglades Ecosystem for over a decade with focus on understanding how invasions impact native ecosystems. Through her research, she addresses ecological and evolutionary questions to further our understanding of invasions and aid natural resource managers in control efforts.

EMPOWERING THE PUBLIC TO MAKE CHANGE THROUGH WATERSHED EDUCATION AND STEWARDSHIP

Lara Milligan[1], Michelle Atkinson[2], Michael D'Imperio[3]and ***Shannon Carnevale[4]***

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The Florida Waters Stewardship Program (FWSP) was launched in 2016, taking inspiration from successful "Master" water programs across the United States. Its primary mission is to reshape participants' perceptions of water, motivating them to take proactive steps to protect and support local water resources. Despite the challenges posed by the COVID-19 pandemic, FWSP displayed remarkable adaptability by transitioning to an online format in 2020, followed by a hybrid model in 2021. Currently, the program is operational in Pinellas, Sarasota, Manatee, and Polk counties, demonstrating significant potential for localized impacts.

FWSP employs a comprehensive approach to inform, inspire, and connect participants. It enhances knowledge through professional presentations featuring research-based information. The program fosters a sense of place by conducting class sessions at various locations, each with a water-focused mini-tour to establish a stronger connection with local water resources.

FWSP also promotes a sense of connection by exploring relevant water information, engaging with local stakeholders, and investigating local case studies. Additionally, the program cultivates a sense of possibility by sharing success stories and equipping participants with tools to address contentious water issues.

Expanding networks is a key component, as FWSP builds a sense of community within each class cohort and introduces participants to local guest speakers, fostering connections with water stewardship experts.

Crucially, FWSP emphasizes action. Participants are encouraged and supported in implementing group or individual water stewardship projects, translating their knowledge and enthusiasm into tangible initiatives that benefit local water resources.

Since its inception, FWSP has offered 14, multi-session, 24-contact-hour courses, reaching 239 participants with critically important state and local water resources information. These FWSP course offerings have also resulted in the implementation of over 40 local stewardship projects to improve or educate about local water resources. FWSP highlights the power of education and community engagement in driving positive change.

PRESENTER BIO: Lara is the Natural Resources Agent with UF/IFAS Extension Pinellas County. She earned her masters and bachelors in Natural Resources Conservation from the University of Florida. Lara is also a graduate of the Florida Natural Resources Leadership Institute. Her Extension work focuses on wildlife and water resources.

ENHANCING WATER CONSERVATION AND POLLINATOR-FRIENDLY LANDSCAPES THROUGH INDUSTRY EDUCATION

***Brooke Moffis*[1]**, *Pierce Jones[2], Jennison Kipp[2], Patrick Bohlen[3] and Basil Iannone[4]*

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Residential landscapes impact natural resources as habitat loss decreases biodiversity, irrigation stresses water resources, inappropriate fertilization reduces water quality, and misapplied pesticides harm non-target organisms. While many Floridians are aware of these issues, landscape aesthetics remain prioritized over mitigating their effects. In 2022, UF/IFAS Extension Lake County partnered with the University of Central Florida, the UF/IFAS Program for Resource Efficient Communities, the Nature Conservancy-Florida Chapter, green industry partners, and developers to conduct a research educational session and tour at the annual statewide Outside Collaborative Conference. Our objective was to educate green industry and built-environment professionals about the ongoing efforts to improve soil health to increase irrigation efficiency and biodiversity of pollinators in landscapes. We aimed for 90% of surveyed attendees to self-report increased knowledge. Our team delivered a 90-minute lecture on preliminary research findings of these water-conserving and pollinator-attracting sustainable landscaping efforts. We guided participants through our living laboratory research sites, where we evaluated soil remediation, arthropod food webs, and drought-tolerant landscaping. A Qualtrics survey using a Likert scale was administered to conference attendees two- and six-week post-event. Fifty-six participants completed the survey, with a response rate of 57%. Ninety-six percent of respondents increased their knowledge of development processes, 98% increased their knowledge of sustainable landscaping practices, and 98% percent stated that they were encouraged to contribute to sustainable development and landscaping efforts because of the sessions. Additionally, 83% of forty-one respondents reported that the educational sessions provided new ideas for entrepreneurial opportunities. After the conference, one developer adopted a master-managed landscape plan for 33,000 homes using the methods we discussed. A developer in Nassau County is contemplating the adoption of similar practices, and Lake and Seminole County Commissioners are considering incorporating these approaches in their landscaping codes. Through the adoption of water-efficient and biodiversity-enhancing approaches in residential landscapes, we can mitigate the impact of water use and pave the way for a more sustainable future.

PRESENTER BIO: Brooke Moffis, Commercial Horticulture Agent at UF/IFAS Extension Lake County, specializes in Florida-Friendly Landscaping. With a B.S. in Horticulture from TN Tech, M.S. in Entomology from UF, and ongoing Ph.D. studies, her extensive experience, including work with Walt Disney World, enables her to connect research with landscape solutions for sustainable beauty.

WATER RESOURCES MANAGEMENT AND OPERATIONAL DECISIONS IN THE CONTEXT OF EVOLVING CONDITIONS

John Mitnik, Ana Carolina Coelho Maran Presented by*: **Asif Mohamed***
South Florida Water Management District, West Palm Beach, FL, USA

In the context of managing around-the-clock water control operations and monitoring of one of the largest and most complex regional water management system in the United States – the Central and Southern Florida (C&SF) Project, decision-making is anchored in real time information and the expertise required to operate a system of such magnitude. Furthermore, critical investments are strategically allocated by South Florida Water Management District (SFWMD), addressing structure inspection report recommendations and refurbishment needs of essential system components as part of ongoing Operations and Maintenance (O&M) efforts, alongside the design and construction of new projects and system components. While this approach addresses immediate needs, it does pose challenges in the face of evolving conditions, such as land development, sea level rise and climate change.

This discussion delves into the intricacies of navigating the balance between addressing immediate needs and preparing for the long term, especially in the context of climate change and funding limitations. The SFWMD's continuous response and system operation incorporates climate projections and risk assessments into its decision-making processes, integrating resilience considerations into a spectrum of priorities. Day-to-day operations and infrastructure investments ensures the response to immediate needs also accommodates the implications of shifting conditions and deviations from historical norms.

In essence, an adaptive planning strategy is in place, ensuring that infrastructure investments are made not just as a response to pressing concerns, but with the goal of achieving long-term sustainability and resilience and ensuring overall system reliability. In summary, this abstract illustrates the multifaceted nature of decision-making in the context of water control operations and urgency of addressing immediate system maintenance needs, with the vision to build community resilience into the future.

PRESENTER BIO: Asif Mohamed is a supervising Principal Engineer - Water Manager in the Office of Operations at SFWMD. Asif and his team of engineers actively manage the District's vast network of lakes, canals and control structures supporting the mission of providing flood control for our communities, meeting the regional water supply needs and safeguarding the water resources of South Florida.

HURRICANE IAN AND WATER QUALITY IN CHARLOTTE COUNTY: COLLABORATIONS, OBSERVATIONS, LESSONS LEARNED

Brandon Moody
Charlotte County Board of County Commissioners, Port Charlotte, FL, USA

In the aftermath of Hurricane Ian, multiple local, regional, and state entities coordinated alongside academic institutions to collect surface water chemistry data throughout coastal SW Florida, in an effort to identify potential near-term impacts of the storm event on water quality in the region. In Charlotte County, expected increases in fecal indicator bacteria (FIB) counts and 5-day biochemical Oxygen Demand concentration were observed in the days and weeks following the hurricane, alongside declines in dissolved oxygen. Recovery and return to pre-storm conditions in certain areas occurred within as little as three to four weeks, while other regions showed heightened FIB bacteria counts in the months following. Limited microbial source tracking studies in areas with protracted elevated FIB sample counts indicated untreated wastewater may not have been the primary contributing factor to said high counts. However, sucralose was detected in most samples, possibly due to discharges from multiple reclaimed water holding ponds found throughout the region.

In addition to providing insight into Ian's impacts upon our coastal ecosystem, this joint sampling effort highlighted the strength of the interagency partnerships throughout the region. Within a few days of Hurricane Ian's landfall, multiple entities swiftly coalesced around a sampling strategy, pooling what resources were available within each organization at that time. Still, many logistical hurdles had to be navigated in the moment that, with sufficient pre-planning, could potentially have been avoided. The experiences of this effort shine a spotlight on the need to establish a formal process for future storm response sampling events, alongside allocation of resources dedicated to supporting such efforts.

PRESENTER BIO: Brandon Moody is the inaugural Water Quality 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.

QUANTIFYING CONTAMINANTS IN SUBSISTENCE FISH FROM TRADITIONAL TERRITORY OF WAHNAPITAE FIRST NATION

***Taylor Nicholls*[1]**, *Sara Lehman*[2], *Brian Laird*[3], *Thomas A. Johnston*[1,4], *Brian Branfireun*[5], *John M. Gunn*[1], *Gretchen L. Lescord*[6]

[1]Vale Living with Lakes Center, Laurentian University
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[5]University of Western Ontario
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Wahnapitae First Nation (WFN) is a small Anishinaabe Community in Ontario, Canada, that regularly harvests fish for subsistence. Thus, like many Indigenous Communities, the quality and health of the fish from their Traditional Territory is of great concern. The goal of this project is to better understand contaminant levels in subsistence fish in lakes from WFN's Traditional Territory, which has been heavily impacted by mining activity. As a community science project, we represent a collaboration between academic and community researchers, and we relied on community input to inform our study design and sampling. We specifically focused on five species of freshwater fish from two lakes, which are relied on as a food source by the community. We sampled three tissues commonly eaten by community members (i.e., muscle, liver, and pyloric ceca), with a total of 346 samples. Approximately half of our samples have been analyzed for total arsenic, selenium, cadmium, and copper, as well as total and methyl mercury, at an accredited lab; the remaining half are currently being analyzed for the same endpoints. Preliminary results show that mercury, arsenic, and selenium are the contaminants of most concern in these fish. However, there is a wide range in elemental concentrations between the two lakes. Furthermore, the initial data also suggest significant differences in elemental concentrations between the three tissues, within the same fish. Future analyses will focus on quantifying these differences and investigating the driving factors thereof. We will also look at the ratios of the various elements, given that selenium can have a protective effect on the accumulation of mercury and arsenic. In addition to improving our understanding of contaminant distributions amongst tissues in key subsistence fish species, this project will provide WFN with the resources for more informed fish consumption and guide future monitoring efforts.

<u>PRESENTER BIO</u>: Taylor Nicholls is an Indigenous M.Sc. candidate at Laurentian University from WFN. She grew up in her community and remains an active member, often participating in traditional and educational events. With a passion for aquatic science and learning her culture, she was a perfect fit for this community-based project.

FLORIDA'S SPRINGS- A PERSONAL JOURNEY

Steven Noll

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

This PowerPoint presentation and paper examines the history of Florida's iconic springs through the lenses of literature, science, and personal experiences. Examining the interaction between humans and springs throughout recorded history, it looks at the changing perceptions people have had about their connection to water in general and springs in particular. It also looks at the complicated nature of this relationship in a time period of a rapidly expanding Florida population combined with climate change and sea level rise. The use of historical pictures and photographs provide visual clues to how Florida's spring have changed over time and how humans have affected and exacerbated that change. Finally, it offers an example of how the use of a humanities centered approach can enrich and inform a discussion about Florida's water usually focused on science and technology.

PRESENTER BIO: Dr. Steven Noll is an instructional professor in the department of history at the University of Florida. His work examines Florida environmental history, especially the relationship of human activity to Florida's unique aquatic ecosystems. He has worked for over 20 years on the Ocklawaha River, the Cross Florida Barge Canal, and the continuing struggle over the removal of the Kirkpatrick (Rodman) Dam on the Ocklawaha.

SURFACE WATER-GROUNDWATER INTERACTIONS AND CARBONATE KARST AQUIFER DEVELOPMENT

Andrew Oberhelman *and Jonathan B. Martin, Madison K. Flint*
University of Florida, Gainesville, FL, USA

Recharge through dissolution features and temporary storage of surface can dissolve the matrix of carbonate karst aquifers. Dissolution results from the initial undersaturation of recharged water with respect to calcite by the formation of carbonic acid from the hydration of dissolved atmospheric and respired CO_2. Additional acids may be formed by redox reactions of solutes injected into the subsurface with surface water recharge. We investigate relative contributions to dissolution from initial surface water undersaturation and subsurface redox reactions at a spring vent that receives surface water during stream flooding and a stream sink-rise system in north-central Florida using chemical mixing and geochemical (PHREEQC) models. Results indicate that during a single spring reversal, 9.2×10^5 kg of limestone dissolved, with ~50% of the dissolution caused by sources other than the initial undersaturation. Mixing calculations indicate subsurface oxidation of organic carbon, ammonium, pyrite, and/or manganese during the reversal are sufficient to produce the required additional dissolution but that available dissolved oxygen is insufficient for these reactions, indicating some acidity must be generated under anerobic conditions. At the sink-rise system, periods of both limestone dissolution (10^2-10^4 kg, n=14) and precipitation (10^4-10^5 kg, n=25) occur. Surface water undersaturation was sufficient to explain sink-rise system dissolution, which dominated during flood events because they enable exchange of surface water in the conduit system with the aquifer matrix. At both sites, calcite dissolution rates reach a maximum of ~10 µM hr^{-1} when surface water has a subsurface residence time of 30-50 hours. This work shows that the acids generated by redox reactions in addition undersaturation of surface water are important to limestone dissolution and the formation of high permeability flow paths during surface water-groundwater interactions, but that the contribution of redox reactions to dissolution depends on water subsurface residence time.

<u>PRESENTER BIO</u>: Andrew is a PhD Candidate in Jon Martin's lab at the University of Florida and is on track to graduate in Spring 2024. His research interests include karst hydrogeology, hydrogeochemistry, and redox reactions mediated by surface water-groundwater interactions in the carbonate critical zone.

WATER SUPPLY VULNERABILITY ASSESSMENT FOR FLORIDA'S LOWER EAST COAST PLANNING REGION

***Anushi Obeysekera**, Pete Kwiatkowski, Alicia Magloire, Ana Carolina Coelho Maran*
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 impact regional water supply.

The WSVA will leverage water supply planning methodologies and independently analyze climate effects on growth rates, 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 is developing the East Coast Surficial Model (ECSM), which is a density-dependent groundwater flow and transport model of the Surficial Aquifer System (SAS). ECSM will be calibrated to daily water levels and monthly water quality for a period of record from 1985 – 2016. Once calibrated, the model will be capable of evaluating the impact of projected increases in 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 impacts due to future conditions, including potential impacts into 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 development and the data that will be utilized to conduct the WSVA.

PRESENTER 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 is currently serving as the lead modeler and project manager on the development and calibration of the East Coast Surficial Model.

ASSESSMENT OF TRENDS IN SOUTH FLORIDA SUB-DAILY RAINFAL

***Jayantha Obeysekera*[1], *Michelle Irizarry-Ortiz*[2], *Carolina Maran*[3], *Anupama John*[1], *Oscar Guzman*[1], *Brett D. Johnston*[2]

[1]Florida International University, Miami, FL, USA
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[3]South Florida Water Management District, West Palm Beach, FL, USA

The frequency and magnitude of local and regional flooding hold significant implications for the resilience of communities grappling with the challenges posed by climate variability, climate change, and urban growth. In coastal areas, these flooding events are particularly complex, driven by a confluence of factors, including the intensification of extreme rainfall events, rising sea levels, and elevated groundwater levels. To comprehensively understand the evolution of both past and future conditions, it is imperative to assess the significance of observed and projected trends in these contributing factors to flooding. While there have been numerous studies focusing on assessing trends in climatic drivers at daily and longer timescales, there is a conspicuous gap when it comes to sub-daily events. This study, a collaboration of the United States Geological Survey, the South Florida Water Management District (SFWMD), and Florida International University, narrows its focus to explore trends in extreme rainfall magnitude and frequency at sub-daily timesteps. This effort will expand SFWMD's Water and Climate Metric development effort which is assessing spatiotemporal trends in rainfall across south Florida.

While assessing trends in extreme rainfall events, we observed a scarcity of publicly available datasets suitable for trend assessment at sub-daily timesteps. However, we have gathered available data from a variety of sources, including rainfall gage data and radar data from the SFWMD, the Florida Automated Weather Network, NOAA, and a variety of other sources. Our analysis utilizes a combination of parametric and nonparametric methods to evaluate changes in extreme sub-daily rainfall events and average event characteristics including event frequency, duration, and maximum intensity. In summary, this study will bridge a critical knowledge gap by examining trends in rainfall extremes at sub-daily timesteps.

PRESENTER BIO: Dr. Jayantha Obeysekera is a Research Professor and the Director of the Sea Level Solutions Center in the Institute of Environment at the Florida International University with over 30 years of experience in the field of Stochastic Hydrology with recent emphasis on climate change and sea level rise.

CITIZEN SCIENCE; AN EFFECTIVE METHOD OF EDUCATING THE PUBLIC ABOUT THE HEALTH OF THEIR BAY

Rick O'Connor

University of Florida IFAS Extension, Florida Sea Grant, Escambia County, Cantonment, FL, USA

There is an old adage that states, "the best way to learn science, is to do science". As a county Sea Grant extension agent, one of my jobs is to educate the public about the health of their bay and how they can help improve it. Using this adage, I have found citizen science projects a very effective method of providing education on the condition of their bay as well as how the science process works. The information collected is used by extension to educate those who do not participate as well as fill needed data gaps for state and local agencies. Many of the volunteers give presentations in the community, or serve as volunteers for other education programs, expanding this knowledge.

In Escambia County we currently have nine such projects where volunteers monitor water quality, habitat restoration, coastal wildlife, and invasive species in the bay area. Since 2012 we have trained 528 volunteers, who have conducted 3,979 surveys, logging 4,738 hours.

This presentation will discuss how the projects were selected, how we recruit and maintain our volunteers, how we train them, what resources we provide them, how the data is used, the benefits for both the volunteers and the community, and lessons learned over the years.

PRESENTER BIO: Rick has been a marine educator for 38 years teaching courses in marine science at Dauphin Island Sea Lab, Pensacola State College, and Washington High School's Marine Science Academy. He has directed citizen science projects since 1992. He currently serves as the Sea Grant Extension Agent in Escambia County.

SOIL HEALTH RESPONSES TO RECLAIMED WATER IRRIGATION, AND NITRATE LEACHING FROM PINE BARK AMENDMENTS

Justina Awele Odogwu, *Mary G. Lusk, Davie M. Kadyampakeni*
Department of Soil, Water and Ecosystem Sciences, University of Florida, Wimauma, FL, USA

The use of reclaimed water (former domestic wastewater treated for reuse) for agricultural irrigation has been reported to increase tree and fruit crop production. However, many researchers have reported the buildup of salts, heavy metals, organic compounds, and nutrients in soils under reclaimed water irrigation which may significantly impact soil health and environmental quality. Only a few studies have been undertaken to study the specific impact of reclaimed water irrigation on soil microbial ecology even though soil microbes play key roles in nutrient mineralization, contaminant decomposition, and plant nutrition and are critical to soil/crop health and productivity. This research is focused on the effects of reclaimed water irrigation on soil microbial ecology as an indicator of soil health. Its specific objectives are to study the effects of reclaimed water irrigation on nutrient cycling and microbial activities under three substrate conditions (native soil, pine bark amended soil, and pine bark only) under greenhouse conditions. Using blueberry as our test crop, and three water sources (2 reclaimed water sources and 1 clean water source) for irrigation, we will have 9 treatments with 5 replicates each. Water will be supplied through drip irrigation and fertilizer in micro-doses. Carbon and nitrogen mineralization rates, enzyme activities, and microbial community structure will be determined, and leachates will be collected and analyzed for nitrate to quantify nitrate losses, the data obtained will be subjected to analysis of variance using R, and significant means will be separated with Duncan's multiple range test ($p \leq 0.05$). The results of this study will consolidate existing knowledge and supply important information on the current and potential effects of reclaimed water irrigation on soil health to stakeholders in soil health and water quality management to facilitate the design/adoption of appropriate measures/best management practices in reclaimed water use for agricultural irrigation.

PRESENTER BIO: Justina is a Ph.D. student, and research/teaching assistant with interests in water quality, soil health, and sustainable agriculture. She is a research enthusiast who has contributed to game-changing research in soil health management and sustainable agriculture locally and internationally through scholarly publications, posters, and oral presentations at conferences/workshops.

FORECASTING THE IMPACTS OF LAKE OPERATIONS ON THE ESTUARINE HYDRODYNAMICS AND POLLUTANT TRANSPORT

Maitane Olabarrieta*, Scott Lee Young, Jiahua Zhou, Hithaishi Hewageegana, Jose Maria Gonzalez Ondina, Jorge Armando Laurel, David Kaplan, Nicholas Chin and Enrique Orozco*[1]

University of Florida, Gainesville, FL, USA

Water quality in an estuary is directly influenced by physical forcings (e.g. freshwater discharge and wind forcings) which modify water quality by altering the fluxes and concentrations of different chemical constituents and changing residence times. Motivated by the current urgency for improved water quality-related coastal hazard predictions, we have developed and verified a system that forecasts the main physical parameters that affect the estuarine circulation and pollutant pathways (water levels, water temperature, salinity, and the 3D velocity field). The forecasting system can be adapted to forecast hazards such as flooding and erosion during extreme storms, the evolution of algal blooms, eutrophication, estuarine heat waves, and hypoxia.

The current version of the system is being applied and tested in the Caloosahatchee River Estuary (CRE) and the St Lucie Estuary (SLE). These estuaries are located on the west and east coasts of the Florida peninsula, respectively. They are connected to Lake Okeechobee through a series of dams and canals. Freshwater discharges from Lake Okeechobee into the CRE are frequent and highly regulated. However, direct discharges from the lake into SLE are less frequent and occur when lake water elevations are extreme. Both estuaries have been affected by water quality issues for decades. They have different tidal regimes and morphologies. Therefore, hydrodynamics and pollutant transport pathways differ for each.

In this study, we describe the development of the forecasting system, and we analyze the influence of freshwater discharges from Lake Okeechobee on salinity, water temperature patterns, and the overall circulation in the estuaries. This allows us to determine the spatio-temporal variations in residence times and pollutant transport in the estuaries. Initial results indicate that freshwater discharge plays a significant (first-order) role in the residence times of the estuaries and that accurate forecasts of freshwater discharge are necessary.

PRESENTER BIO: Dr. Olabarrieta is an Associate Professor at the Civil and Coastal Engineering Department of the University of Florida. Dr. Olabarrieta has worked for more than 25 years on modeling coastal hazards, including coastal erosion and flooding, tsunamis, meteotsunamis, and water quality hazards. Her research goal is to improve the capabilities of modeling and forecasting coastal hazards.

EVALUATING AUTOMATED DRAIN TILE SYSTEM IN SUBIRRIGATED VEGETABLE PRODUCTION AREAS

***Judyson de Matos Oliveira*[1]**, *Mark W. Clark*[2], *Lincoln Zotarelli*[1]

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Most of vegetable production in Florida is subirrigated using seepage (SEP) which has low irrigation efficiency requiring large volumes of groundwater to raise the water table level (WTL). Alternatively, drain-tile (SDT) offers a more precise WTL control and uniformity of soil moisture in the rootzone. Proper management of the WTL is still a determinant factor for achieving benefits to water conservation expected from SDT. Automation of the SDT can optimize the WTL management, increasing water conservation. This study aimed to identify a suitable irrigation/drainage strategy for WTL control using automated SDT to optimize soil moisture (SW) in the rootzone and minimize nutrient leaching compared to SEP (benchmark). A field study was established at the UF/IFAS-Hastings Agricultural Extension Center in a sandy soil under SDT and SEP side-by-side. SDT was equipped with an automated (open/close) irrigation/drainage valve remotely monitored and managed using Smart Drainage Website (AgriDrain Corp.); while irrigation/drainage in SEP was conventionally controlled. Irrigation schedule was adjusted to crop stages using desired WTL and SW. WTL and SW were remotely monitored and weather data was recorded onsite. Volume of irrigation/drainage were measured using flowmeters. Nitrate+nitrite, ortho-phosphorus, and total-phosphorus were determined in water samples collected in two main ditches and in ten observation across the field. Data was analyzed using descriptive statistics. In 2023, the averages of total yield ranged from 33-39 $Mg.ha^{-1}$ and 33-43 $Mg.ha^{-1}$ in SEP and SDT, respectively. The concentration of N and P in the drainage water were similar between irrigation systems. However, the total irrigation volume in SEP exceeded SDT by 35%; while the irrigation water productivity was 7.9 and 12.6 $kg.m^{-3}$ for SEP and SDT, respectively. The total drainage volume in SEP was 27% higher than in SDT. Preliminary results indicated automated SDT reduced irrigation needs by enhancing drainage control during crop growth.

PRESENTER BIO: Judyson Oliveira holds a Ph.D. in Agronomy and is currently pursuing a second Ph.D. in Horticultural Sciences. He specializes in the modeling of soil physical-hydrologic processes to enhance water conservation. Through his research projects, he aims to ensure that contemporary farming practices are sustainable, efficient, and environmentally friendly.

CHARACTERIZATION OF A MARINE ALGAE FOR JOINT BIOREMEDIATION & BIOPRODUCTION FROM A WASTEWATER SOURCE

Nathan O'Neil, *Amor Menezes, Pratap Pullammanappallil, Ana Martin-Ryals*
University of Florida

The use of algae bioremediation systems for the purpose of upgrading biogas from anaerobic digestion (AD) or as part of wastewater treatment has gained renewed focus in the growing field of circular bio economics. The activity of algae biomass accumulation can offset the energy-intensive processes conventional techniques employ while also assisting in localized energy demands. Currently, halophilic microalgae or adapted freshwater strains are used, which can desalinate and bioaccumulate contaminate compounds with variable success however at the cost of increased retention times and reduction of direct biomass application. Here we preset the results of a series of batch acclimation experiments to determine the ability of a marine cyanobacteria, Cyanothece BG11, to utilize and remove nutrients from AD effluent. The water quality post treatment is assessed along with the quality of the bioproducts produced for total removed carbon (TOC) nitrogen (TN) and phosphate (TP) and mineral allocation. Resulting measurements of elemental balance show a removal of above 50% of TN and TOC with 70%-90 removed as ADE concentration is increased.

<u>PRESENTER BIO</u>: Nathan O'Neil is a 4th year doctoral candidate within the collage of agricultural and biological engineering at the University of Florida with a focus on bioproduction. Before coming to UF he received a master’s in cell and molecular biology at San Francisco State University. Nathan wishes to pursue a career within space biosciences.

INTERPRETABLE TRANSFORMER NEURAL NETWORK PREDICTION OF DIVERSE ENVIRONMENTAL TIME SERIES

Enrique Orozco-Lopez *and David Kaplan*
University of Florida, Gainesville, FL, USA

Transformer Neural Networks (TNNs) have caused a paradigm shift in deep learning domains like natural language processing and gathered immense interest due to their versatility in other fields such as time series forecasting (TSF). Most current TSF applications of TNNs use only historic observations to predict future events, ignoring information available in weather forecasts to inform better predictions, and with little attention given to the interpretability of the model's use of explanatory inputs. This work explores the potential for TNNs to perform TSF across multiple environmental variables (streamflow, stage, water temperature, and salinity) in two ecologically important regions: the Peace River watershed (Florida) and the northern Gulf of Mexico (Louisiana). The TNN was tested and its uncertainty quantified for each response variable from one- to fourteen-day-ahead forecasts using past observations and spatially distributed weather forecasts. A sensitivity analysis was performed on the trained TNNs' attention weights to identify the relative influence of each input variable on each response variable across prediction widows. Overall model performance ranged from good to very good ($0.78<NSE<0.99$ for all variables and forecast horizons). Through the sensitivity analysis, we found that the TNN was able to learn the physical patterns behind the data, adapt the use of input variables to each forecast, and increasingly use weather forecast information as prediction windows increased. The TNN's excellent performance and flexibility, along with the intuitive interpretability highlighting the logic behind the models' forecasting decision-making process, provide evidence for the applicability of this architecture to other TSF variables and locations.

PRESENTER BIO: Dr. Orozco-Lopez is an Assistant Research Scientist at the Center for Coastal Solutions at the University of Florida. He has extensive experience developing and implementing advanced machine learning algorithms for optimization and forecasting of hydrologic processes in coastal environments.

INVESTIGATING N_2O CYCLING BY MINERAL-HOSTED MICROBIAL COMMUNITIES IN KARSTIC AQUIFER CAVE SYSTEMS OF THE UPPER FLORIDAN AQUIFER.

Kelenna Osimiri*, Brent C. Christner*
University of Florida, Gainesville, FL, USA

The Upper Floridan Aquifer (UFA) is among the world's largest and most productive aquifer systems with extensive cave networks that facilitate dynamic water-rock interactions and mineral processes. Importantly, these processes are intimately connected to rock surfaces the microbes are attached to, providing a synergistic microbial niche where rocks may provide energy and trace nutrients, and in turn, the microbes impart chemolithoautotrophic controls on nutrient cycling in the aquifer. Few investigations have been initiated on the chemolithotrophic responses of attached communities residing in these cave systems to contamination of nitrates from agricultural runoff, specifically in springs in the Suwannee River Basin (SRB) which has seen an increase in the environmental abundance of reactive nitrogen species (i.e., NH_4^{+}, NO_2^-, and NO_3^-) by ~50- fold in the UFA over the last few decades. This research aims to utilize cave systems in the SRB region of the UFA to characterize the attached prokaryotic communities and investigate their responses to nutrient loading of reactive nitrogen species. To fulfill these objectives, 16S rRNA sequencing and metagenomics of bacterial communities in the caves will undergo correlation analysis with biologically relevant minerals, such as Fe^{2+} and Mn^{4+} oxides. Utilizing these substrates, microcosm experiments will be used to look at nitrate-dependent Fe^{2+} oxidation in response to nitrate loading and will then be used to quantify production or consumption rates of N_2O.

The proposed research is motivated by the critical need to better understand the role of subsurface microbial ecosystems in karst groundwater health and their response to anthropogenic pressures as neglected subsurface microbiomes may provide novel insights into biogeochemical processes unique to oligotrophic environments.

<u>PRESENTER BIO</u>: Kelenna Osimiri is a 3rd year PhD student in Dr. Brent Christner's lab at the University of Florida, Microbiology and Cell Science Department. She is currently studying geomicrobial processes in the Upper Floridian Aquifer (UFA) and is interested in ecosystem maintenance and restoration of freshwater systems.

COMPARISON OF EVAPOTRANSPIRATION BETWEEN CROPLANDS AND FOREST LANDS IN A HUMID SUBTROPICAL REGION

Ying Ouyang
USDA Forest Service, Southern Research Station, Mississippi State, MS, USA

There is currently a general consensus that forested lands lose more water through evapotranspiration (ET) than croplands, particularly in semi-arid and arid regions. However, several studies have reported that forest lands may ET at certain tree ages and under specific management practices in the humid subtropical region. Using remote sensing data from MODIS (Moderate Resolution Imaging Spectroradiometer) with an 8-day and 500m spatial resolution, I conducted a comparative analysis of ET rates between croplands and forest lands in the humid subtropical region of the Yazoo River basin (YRB), Mississippi, USA, over a 21-year period from 2001 to 2021. Annual ET trends for croplands and forest lands were determined using Mann-Kendall statistics (τ), while annual differences between the two were assessed with the Kolmogorov-Smirnov test. The results show that there was a significant increasing trend in ET for croplands over the past 21 years, based on the Mann-Kendall test, but no such trend was observed for forest lands. The study further reveals that the differences in ET between croplands and forest lands were highly significant (at $\alpha = 0.05$) over the most recent 11 years, from 2011 to 2021, with ET rates in croplands exceeding those in forest lands. I attribute this finding to the greater availability of water for ET in croplands due to intensive groundwater pumping for crop irrigation in the YRB. This new perspective challenges our traditional understanding of how forests and crops influence ET in the humid subtropical region.

PRESENTER BIO: Dr. Ouyang is a research hydrologist with more than 30 years of research experience in vadose zone, surface water and groundwater hydrology and water quality.

FPLOS: ASSESSING VULNERABILITY OF SFWMD'S FLOOD PROTECTION ASSETS AND PROPOSING ADAPTIVE SOLUTIONS

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

The South Florida Water Management District (SFWMD) is a regional agency in the state of Florida responsible for the operation and maintenance of the primary flood control system in a 16-county service area stretching from Orlando to the Florida Keys. The primary flood control system, the Central and Southern Florida (C&SF) Project, was constructed by the US Army Corps of Engineers starting in the 1950s and serves a population of over 9 million people. Several of the flood control assets, including canals, and gravity spillways, are approaching the end of their design life. These assets are experiencing loss of efficiency due to conditions, such as higher sea level and denser and more spatially extensive urbanization, than was assumed during the original design. To address these issues, SFWMD implemented the Flood Protection Level of Service (FPLOS) Program. Under the program, SFWMD assesses the vulnerability of the region to increased flood risk under current and future conditions, determines mitigation and adaptation strategies to manage flood risk, and provides a strategy to facilitate implementation of the recommended adaptation and mitigation strategies.

This presentation outlines the FPLOS Program and highlights insights from a recent study on the C-8 and C-9 Water-shed in Miami-Dade and Broward Counties. In order to address the vulnerabilities identified in earlier study, the adaptation study underscores the significance of identifying strategies that effectively manage flood risks while considering constraints like water quality impacts and the transfer of residual flood risk. The study for the C-8 and C-9 watersheds produced adaptation strategies and mitigation projects to reduce flood risk under current and future conditions, including land use changes and sea level rise. This was accomplished through a systematic public planning process, which incorporated stakeholder engagement, hydrologic and hydraulic modeling, economic analysis, flood damage assessment, and adaptation pathway planning.

PRESENTER BIO: Akin Owosina is Chief of Hydrology and Hydraulics Bureau at the South Florida Water Management District. He is a certified professional engineer with over 33 years' experience in water resources and modeling. He oversees the work of engineers and modelers responsible for flood and restoration studies in South Florida.

HINDCASTING FLOOD INUNDATION DEPTHS ACROSS CENTRAL AND SOUTHERN FLORIDA DURING HURRICANE IAN USING SPATIALLY-DISTRIBUTED MACHINE LEARNING ALGORITHMS

Maryam Pakdehi*, Ebrahim Ahmadisharaf*
Florida State University, Tallahassee, FL, USA

Hindcasting flood characteristics is integral to advancing our capacity to predict future events accurately. While machine learning (ML) algorithms have proven efficient in forecasting flood features, previous ML research primarily fixated on predicting flood extents, neglecting vital characteristics like flood depths. In this study, we present a spatially-distributed ML model to hindcast maximum flood depths during Hurricane Ian across Central and Southern Florida. Our approach integrated geospatial analyses and meticulous feature selection to forecast flood depths at various stream locations. Key features, representing crucial physical processes such as topography, regulating water infrastructure, levees, soil moisture, hydrodynamics, land surface, hydrology, hydrogeology, and meteorology, were acquired from public domain databases and incorporated into the model. We trained and validated this model using flood depths recorded at stream gauges (USGS' HCDN and SFWMD's DBHYDRO). Our evaluation of the model performance for hindcasting maximum flood depths affirmed the model competence in rivers, with high R-squared values. However, the ML model, when solely trained on river flood data, demonstrated unsatisfactory performance for flood depths on floodplains. To augment the accuracy of flood depth hindcasts on floodplains, we implemented an innovative approach that combines streamflow data with satellite imagery (e.g., MODIS, Sentinel and Landsat) and high-water marks (HWMs). This approach yielded a significant enhancement in the overall hindcast accuracy of the ML model. The model provides a computationally efficient platform to hindcast maximum flood depths during historical major events across Central and Southern Florida.

PRESENTER BIO: Maryam Pakdehi is a third-year Ph.D. candidate in the civil and Environmental Engineering Department at Florida State University, specializing in characterizing major flood events via ML models. She has over a decade of expertise in industry, and has contributed to planning, design, and rehabilitation of water distribution networks. Her research has been published in peer-reviewed articles.

INNOVATION AND TECHNOLOGIES IN AGRICULTURAL NUTRIENT MANAGEMENT: SENSING TECHNIQUES AT FIELD-SCALE

***Daniel Palacios-Linares**, Sandra Guzmán*
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Efficient crop water and nutrient management is vital for sustainable agriculture. However, this requires adequate tools to measure soil and plant nutrient status. Without these tools, crop production might be reduced, and surrounding freshwater systems could be compromised. Additionally, in situ nutrient assessment and real time monitoring has been a challenge for researchers because of the spatiotemporal variability of nutrient movement in soils. Multiple sensing technologies have been implemented in agricultural systems to a164ddress this issue, including in-field techniques, Unmanned Aerial Vehicles (UAVs), and remote sensing techniques using satellite-based imagery. These technologies can be applicable at both, field, and watershed levels. Additionally, multiple in-ground sensors such as biosensors, on-the-go spectroscopy, and Volumetric Ion Content methods have been developed to provide in-situ insights into soil nutrient status. However, these technologies still have accuracy and spatial variability limitations, as well as temporal constraints that hinder their effectiveness in long-term soil nutrient status assessment. In this study, we conducted an exploratory review of sensing techniques used in agricultural nutrient management, with a primary focus on field scale applications. Multiple features including sensor direct and indirect measurements, time scale and other assumptions used, calibration process, accuracy, and the output provided in relation to practicality for the decision maker were used to assess the efficiency of these systems and to explore avenues for sensor improvement. The results from this review will provide valuable insights for stakeholders in Florida interested in field-based agricultural nutrient management and the adoption of sensing technologies.

PRESENTER BIO: Daniel Palacios is a master student in the agricultural and biological department at the University of Florida with experience in the industry and research fields, has been part of the design and implementation of irrigation projects and has helped in the development of research projects related to the use of sensing technologies for water management. His master research program is part of the Science and Technologies for Phosphorous Sustainability (STEPS) NSF Science and Technology Center.

FACTORS CONTROLLING MICROBIAL DISTRIBUTIONS IN GLACIAL ICE SURFACES ON THE GREENLAND ICE SHEET

***Katelyn Palmer**, Quincy Faber, and Brent Christner*
University of Florida, Gainesville, FL, USA

The effects of accelerated melting of glaciers and ice sheets due to global climate change is an area of concern for its impact on sea level rise. Melting in the Arctic is influenced by the distribution of microbial communities that colonize habitats on and within the ice. A weathering crust aquifer (WCA) forms seasonally in the upper ~1 m of porous, water-bearing ice, temporarily storing meltwater before hydrological transport off the ice sheet to proglacial environments. In western Greenland, near Kangerlussuaq, the ice sheet margin is readily accessible, providing an ideal field location and opportunity to study microbes in the WCA during high ablation periods. In the summers of 2022 and 2023, water samples collected from the WCA through shallow ~2 m boreholes were used for cell enumeration using a cyanine dye and epifluorescence microscopy. In the 2022 season, we observed an increase in cell density throughout the season, with cell densities higher in the WCA than in supraglacial streams and increasing with depth in the WCA, consistent with in situ growth of communities in the icy habitat. However, cell densities did not follow this trend in 2023. 2022 samples showed more numerous cells attached to sediment particles when compared to 2023 samples. The marked differences in biomass trends between the two seasons may be due to increased levels of precipitation in 2023, or due to the ice having decreased input of sediment at our sampling location. The summer of 2023 had higher levels of precipitation than the 2022 season, perhaps affecting the capability of the ice to transport water. Thus, levels of precipitation and amounts of sediment could correlate with the residency of microorganisms in the WCA. The residency of microorganisms could have implications for the productivity and development of microbial communities in the Arctic in a changing climate.

PRESENTER BIO: Katelyn Palmer is an undergraduate senior at the University of Florida pursuing dual Bachelor of Science degrees in microbiology and geology. She works with Dr. Christner's lab group in environmental microbiology and conducted field work with the Significance of Ice-loss to Landscapes in the Arctic (SILA) research team.

EVALUATION OF NUTRIENT SOURCES AND LOADING TO WATERBODIES IN THE UPPER ST. JOHNS RIVER BASIN

Joshua Papacek*, Andy Canion, and Dean Dobberfuhl*
St. Johns River Water Management District, Palatka, FL

The Upper St. Johns River Basin (USJRB) contains over 116,000 ha of floodplain, including 65,000 ha of natural and restored wetlands and shallow reservoirs managed by the St. Johns River Water Management District (SJRWMD) as part of the USJRB Project. Watershed sources of nutrients to the expansive headwater wetlands are the dominant drivers of water quality in the downstream river-lakes. In 2003, the SJRWMD established a Pollutant Load Reduction Goal (PLRG) for the USJRB river-lakes based on a 0.09 mg L^{-1} total phosphorus (TP) concentration limit to reduce the frequency of cyanobacteria blooms. The same target TP concentration was adopted for three total maximum daily loads set by the Florida Department of Environmental Protection (FDEP) within the USJRB in 2006. Since then, several additional waterbodies within the USJRB are currently not meeting the state's numeric nutrient criteria for TP, including the historically pristine Blue Cypress Lake. Leveraging available water quality and hydrologic data, the SJRWMD estimated TP loading within the USJRB watersheds contributing to the river-lakes. For these lakes, we observed a noticeable increase in TP flux over the last several years in exceedance of established reduction targets. This trend appears to be primarily driven by increases in TP loading from tributaries on the western side of the USJRB, corresponding with recent increases in the land application of Class B biosolids. Additional uncertainties in nutrient budgets also point to under-quantified sources like internal lake and wetland nutrient fluxes potentially driven by legacy loading. Overall, these trends in water quality are likely to have a significant impact to lake ecology, as recent monitoring of blooms by SJRWMD and FDEP shows frequent dominance of cyanobacteria taxa in multiple USJRB lakes, as well as concerns for increased export to downstream basins.

PRESENTER BIO: Dr. Joshua 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 address nutrient source identification and loading.

FORECASTING OF COASTAL INUNDATION RISK IN CURRENT AND FUTURE CLIMATES

Vladimir A. Paramygin *and Y. Peter Sheng*
Civil and Coastal Engineering Department, University of Florida, Gainesville, FL, USA

Coastal communities worldwide are subject to increasing inundation risk due to rapidly accelerating sea level rise, more intense and frequent storms, and extreme precipitation under a changing climate. Florida communicates have suffered catastrophic flood induced losses during several major hurricanes in the last two decades. For example, southwest Florida was hit by Hurricane Irma in 2017, then again by Hurricane Ian in 2022. Data showed that these hurricanes underwent very rapid intensification prior to landfall due to the much warmer ocean and atmospheric temperature induced by climate change. The very rapid intensification of hurricanes not only resulted in much higher damages but also made the forecasting of hurricanes highly uncertain. To enhance the resilience of coastal communities, it is necessary to significantly improve the capacity to provide timely and accurate forecasting of potential coastal flooding and flood losses prior to the hurricane landfall.

This talk will present a robust coastal inundation forecasting system, built upon the coupled CH3D-SWAN surge-wave modeling system, and the simulation of coastal inundation in southwest Florida during Hurricane Irma and Ian. While the forecasting system is highly accurate, it takes a few hours to complete a forecast cycle. To enable rapid (within one minute after a hurricane track becomes available) forecasting of coastal inundation, we have developed a Rapid Forecasting and Mapping System (RFMS). The RFMS has been used for forecasting several recent hurricanes (Wilma, Charley, Michael, Irma, and Ian) along the Florida Gulf coasts. The RFMS is being further improved by using machine learning algorithms.

To represent the current and future inundation risk in coastal communities, we will showcase probabilistic (1% annual chance) coastal flood maps with and without the effect of inland flooding for 2020 and 2100. These maps can be used by coastal communities for building resilience.

PRESENTER BIO: Dr. Paramygin is a Research Assistant Scientist with extensive experience in coastal processes and modeling. He has been responsible for the modeling effort of several projects on the current and future coastal flood risk, including the development of a real time Florida-wide forecasting system of water level, currents, and salinity.

THE ROLE OF DISPERSED WATER MANAGEMENT IN THE NORTHERN EVERGLADES – A RANCHER PERSPECTIVE

Matt Pearce
President, Pearce Cattle Co, Past-President Florida Cattlemen's Association, Okeechobee, FL

The cattle industry and ranches are sustainable and best suited to assist with the State's environmental initiatives (storage, recharge, water quality, habitat, carbon sequestration). Ranchers are generationally environmental stewards and have the most noble purpose: to feed the world. Cattle ranching is the oldest ag land use in Florida, and it remains the most natural (in balance with the landscape) celebrating 500 years of cattle. Cattle production is generally a net total phosphorus exporter (more exported than imported) with relatively low nutrient concentrations, just large acreages of land. Most of the wildlife corridor is on ranchlands and approximately 40% of endangered species are only found on private land. The University of FL Institute of Food and Agricultural Sciences has estimated over $4 billion in annual value of non-marketed ecosystem services are provided by Florida pastures and rangelands for wildlife habitat, biodiversity, water storage and treatment, carbon capture and outdoor recreation. There is an immediate need for support of programs and incentives (easements, payment for environmental services) that assist landowners in continuing to provide and expand these services as a productive business venture. Land in Florida is being lost on a daily basis to development – more concrete means less habitat and food production. There needs to be a concerted effort to sustain family ranches to protect wildlife and water. Programs need to have a more simplified entry processes which will result in increased interest and participation with landowner's extensive knowledge of the landscape driving the project design. Agriculture in general needs to be able to produce and market food without excessive regulation and burden. Viable agriculture is the best assurance of a safe, secure, abundant and reasonably priced food supply.

PRESENTER BIO: Matt Pearce is President of Pearce Cattle Company (Okeechobee), Chairman of Conservation Florida and Past-President of the Florida Cattlemen's Association. Matt is a 7th-generation Florida cattle rancher who is passionate about protecting ranching and wildlife habitat. His goal is to successfully pass down the ranching lifestyle to the next generation.

CHARACTERIZING COMPOUND FLOODING POTENTIAL AND ASSESSING ADAPTATION STRATEGIES IN COLLIER COUNTY

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

The vulnerability of South Florida to pluvial, fluvial, coastal, and groundwater flooding is rooted in its hydrogeology, low-lying topography, geographical location, climatic factors, and complex water management system. Adding to this complexity, projections indicate an escalating trend in sea level rise along with intensified extreme rainfall events. In recent years, Collier County has experienced flooding from storm surge as well as rainfall events, which has resulted in compound flooding, causing impacts for both urban and rural areas. A highly detailed urban flood model was developed to gain comprehensive understanding on the combined impacts of both flood drivers. This model is characterized by the representation of urban elements, including buildings, channels, hydraulic structures and a complex storm drain system, featuring 6,500 inlets, 1,400 manholes and 6,600 conduits., and allowing characterization of compound flooding, differentiating between two flood mechanisms: rainfall-induced inland flooding and coastal storm surge flooding.

This presentation primarily centers on how the calibrated and validated FLO-2D model was used, with a 3-day temporal rainfall distribution for four subdomains. This model integrates data from a vegetation-resolving coastal surge-wave model (CH3D-SWAN) and a rainfall-driven inland flooding model (BCB-FLOOD). Simulations cover hurricane storm surge and rainfall-driven design events at various recurrence intervals (10-YR, 20-YR, 50-YR and 100-YR), while considering different sea level rise scenarios. Furthermore, we explore the effectiveness of mangrove restoration scenarios in mitigating storm surge impacts. While the results highlight a reduction in flood-affected areas resulting from mangrove restoration, the SFWMD-FIAT tool is being employed to quantify estimated annual damages and compare the economic benefits of flood reduction under mitigation and non-mitigation scenarios.

Dissecting the roles played by different flood drivers enables decision makers to distinguish areas affected by pluvial or coastal flooding, as well as to identify the transition zone. This understanding is critical for the design and development of more precise, locally tailored mitigation measures for specific flooding conditions at both local and regional levels.

<ins>PRESENTER BIO</ins>: Francisco Peña, PhD. is a Resiliency Project Manager at the SFWMD. Francisco has extensive experience in 2D hydraulic modeling, compound flooding, resilience planning, GIS, and disaster risk reduction, having work with international organizations in Latin America and Europe. He holds two Ph.D. degrees in Earth Systems Science and Civil Engineering from the US and Italy. Currently, Francisco serves as the International Committee Co-Chair of the Association of Floodplain State Managers (ASFPM).

GRASS SPECIES INFLUENCES PHOSPHORUS LOSSES IN HISTORICALLY FERTILIZED PASTURE SOIL: A MESOCOSM STUDY

Daniel Petticord[1]*, Elizabeth H. Boughton*[2]*, Haoyu Li*[2]*, Jiangxiao Qiu*[3]*, Amartya Saha*[2]*, Ran Zhi*[3]*, Jed P. Sparks*[1]

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[3]University of Florida, Gainesville, FL, USA

The gradual accumulation of phosphorus from historical fertilization can contribute to the eutrophication of surface waters by increasing the potential for subsurface leaching losses. Rangeland areas are a priority for concern, and phytoremediation efforts in rangelands have prioritized grasses that may be used as forage for cattle. This study investigated the influence of three different forage species: *Paspalum notatum*, *Hemarthria altissima*, and *Cynodon nlemfuensis* on the loss of phosphorus in leachate from surface soils. The experiment used a nested pot mesocosm design that allowed us to monitor leachate volume and concentration biweekly over the course of three months. Pots containing *P. notatum* plants leached more phosphorus than pots containing *C. nlemfuensis* or empty pots with no plants growing in them, despite losing an equivalent amount of water. *H. altissima* lost equivalent amounts of phosphorus in leachate water but removed approximately 2-3 times the phosphorus removed by *P. notatum. C. nlemfuensis* was the obvious best candidate, with the highest average Harvest:Leachate Efficiency (HLE). *C. nlemfuensis* had lower average leachate phosphorus concentrations at each biweekly sampling, and accordingly the lowest leachate loss overall. This, combined with its slightly higher-than-average aboveground P content and overall aboveground biomass expression, suggest it is the best possible phytoremediation candidate. As even minor leachate P loads can be critically threatening to neighbor oligotrophic water bodies, if the conservation of downstream environments is the priority, the short-term threat of increased leachate must be considered. Further research is needed to explore the underlying mechanisms and field-scale implications of these findings.

PRESENTER BIO: Dan Petticord is a graduate student from Cornell University and a former Archbold Visiting Scholar. He explores context-dependency in plant-microbe interactions. In his PhD, he has focused on studying how belowground plant traits may influence phytoremediation of legacy phosphorus from pasture.

EVERGLADES STORMWATER TREATMENT AREAS: THE WORLD'S LARGEST CONSTRUCTED TREATMENT WETLAND PROJECT

Tracey Piccone*, Cassondra Armstrong, Jacob Dombrowski*
South Florida Water Management District, West Palm Beach, FL, USA

The Everglades Stormwater Treatment Areas (STAs) comprise the largest constructed treatment wetland project in the world with a current treatment area of over 62,000 acres. The STAs are designed to remove phosphorus (P) from agricultural and urban stormwater runoff, and when there is available capacity, they can also treat water from Lake Okeechobee. STA-treated water is sent south to support restoration of the ecologically sensitive Everglades. Operation of the STAs is governed by permits and consent orders issued to the South Florida Water Management District (SFWMD) by the Florida Department of Environmental Protection. The permits and consent orders set forth a stringent water quality-based effluent limit (WQBEL) of 13 µg P/L annual average that must be met by each STA upon completion of all the projects in the Restoration Strategies Regional Water Quality Plan. These projects include flow equalization basins (FEBs), expanded STA treatment areas, and canal conveyance improvements. FEBs built upstream of the STAs assist in moderating high flows to the STAs during the wet season and providing water in the dry season to maintain minimum stages. Flow attenuation helps to reduce the duration that STA treatment cells are above target stage, reducing vegetation stress and improving P removal performance. The FEBs provide water quality improvement as well, reducing P loading to the STAs. In addition to the Restoration Strategies projects, SFWMD has conducted extensive research on treatment wetland function and P dynamics at low P concentrations to help inform management approaches to assist the STAs in meeting the WQBEL for discharges to the Everglades.

PRESENTER BIO: Tracey Piccone is a licensed Civil Engineer with over 30 years of experience in water resources engineering. As Chief Consulting Engineer, she is a key participant in investigating factors that influence phosphorus reduction in the STAs and management approaches to ensure the STAs achieve the mandated discharge phosphorus concentrations.

HYDROLOGIC IMPACT OF AGRICULTURAL MANAGEMENT AND CLIMATE IN THE LITTLE RIVER EXPERIMENTAL WATERSHED

***Kathryn Pisarello**, Alisa Coffin, David Bosch, Oliva Pisani, and Timothy Strickland*
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Science has evolved toward a new era of data abundance, where empirical evidence is available more than ever to build and support conclusions about agricultural biophysical systems that are increasingly subject to spatiotemporally varying climate and land management drivers. Research in the USDA Little River Experimental Watershed (LREW) in Tifton, GA has provided more than 50 years of hydrological, climatological, and agricultural data, which has been frequently applied to enhance our collective understanding of agroecological systems across scales. Ongoing LREW research data are integrated with modeling efforts to help improve regional and national characterizations of agriculturally relevant data products. These products have important implications for evaluating physical and biological responses to alternative agricultural management practices as well as climate change impacts. In this study, we used our large multi-disciplinary datasets to evaluate how conservation management practices (i.e., conservation tillage and winter covers) and anticipated changes in rainfall and temperature will impact water quantity and quality in a sub-basin of the LREW across time and space. These relationships were modeled statistically for the purpose of informing and refining process-based models, like SWAT, and to advance our comprehensive understanding of the hydroclimatic-agronomic system at both local and regional scales.

PRESENTER BIO: Dr. Pisarello is a research scientist and lead modeler for the Southeast Watershed Research Laboratory at USDA-ARS in Tifton, GA. She specializes in statistically evaluating agricultural, hydroclimatological, and socioeconomic systems from an interdisciplinary, multiscale perspective. She also supervises the unit’s multi-disciplinary database management effort.

OPTIMIZING IRRIGATION AND NITROGEN FERTILIZATION TO MAXIMIZE POTATO GROWTH, YIELD AND N-EFFICIENCY

Varshitha Prasanna*, and Vivek Sharma*
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The availability of soil moisture and nitrogen are the primary limiting factors for potato growth on sandy soils. It is possible to maximize potato production and quality by effectively managing irrigation and fertilization, thereby improving tuber yield and quality and reducing nitrogen leaching. A two-year field experiment was conducted to investigate the effects of different irrigation and nitrogen rates on potato growth, yield, and water and nitrogen uptake efficiency (NUE) under sprinkler irrigation. To monitor nitrogen availability and leaching during the years 2022 and 2023, soil, plant tissue, and biomass samples were collected at regular intervals. For both years, two irrigation rates (FIT; 75%FIT) and eight nitrogen fertilization rates were applied, of which six were conventional fertilizers (ranged from 112 to 392 kg ha^{-1}) and two were controlled release fertilizers (224 and 280 kg ha^{-1}). The experimental design was RCBD, with a control plot to compare yields and other parameters. Increasing nitrogen application rates resulted in greater plant heights and LAI for both years. The highest plant height was found with a CRF application rate of 280 kg ha^{-1}. However, the highest LAI was found with conventional nitrogen applications of 336 kg ha^{-1}. Tuber yields were highest at conventional nitrogen at 392 kg ha^{-1} but were not significantly different from conventional treatments at 280, 336 kg ha^{-1} and CRF treatments at 224 and 280 kg ha^{-1}. As the nitrogen application level increased, nitrogen uptake efficiency decreased, and it ranged from 31 to 82 percent. FIT had the highest plant height, LAI, and yield among the irrigation treatments, and it was not significantly different from 75%FIT. The Crop Water Use Efficiency for 75%FIT was consistently highest in both years. Based on our findings, potatoes can be produced with acceptable yields while conserving water and minimizing nitrogen use through a combination of irrigation and nitrogen application.

<u>PRESENTER BIO</u>: I am Varshitha Prasanna, a Ph.D. student in the SNRE, with a concentration in ABE. My research focuses primarily on optimizing irrigation and nitrogen management for potato cultivation. In addition to using modeling tools such as DSSAT, I use remote sensing techniques, such as UAV drone imaging, to further my research.

HOW WETLAND GEOMORPHIC CHARACTERISTICS SHAPE ECOHYDROLOGIC METRICS IN ISOLATED REFERENCE WETLANDS

***Renee Price**[1,2] and David Kaplan[2]*
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Wetland hydrology, vegetation, and soils have been established as drivers of wetland structure and function. Unique combinations of these attributes have been associated with swamps, marshes, wet prairies and other wetland types. However, previous evaluations of wetland hydrology as a function of wetland type suggest this variation is poorly understood due to the lack of long-term datasets. Since that time, the implementation of state and federal wetland monitoring programs has led to the availability of widespread and consistently collected wetland data, providing an opportunity to test and refine how comparable hydrology is among wetland types. To elucidate landscape, geomorphic, and/or structural features that best explain hydrologic similarity (and differences) among individual wetlands, water level data from 28 central Florida reference wetlands with period of records greater than 20 years were analyzed. The data set included isolated cypress, marsh, cypress marsh, mixed continuous, and wet prairie wetlands. Ecohydrologic metrics (including magnitude, timing, duration, and frequency) were compared to geomorphic characteristics (such as perimeter, perimeter:area, depth, soil type, surrounding land use, etc.) via hierarchical cluster analysis. Preliminary results identified clusters containing multiple wetland types (e.g., both marsh and cypress wetlands) as well as clusters composed of a single wetland type (e.g., only marsh wetlands). These results suggest that different wetland types may have similar hydrologic tendencies, which may further be explained by geomorphic characteristics and climate variation. Ongoing work seeks to further explore hydrologic and vegetation variation as a function of wetland attributes.

PRESENTER BIO: Renee Price is a quantitative ecologist with AtkinsRéalis and doctoral student the University of Florida focused on wetland hydrologic and vegetation responses to potable water withdrawals and passive restoration.

IMPACT OF POTASSIUM SILICATE ON PERFORMANCE OF MATURE CITRUS TREES

Jose Prieto *and Davie Kadyampakeni*
UF/IFAS Citrus Research and Education Center, Lake Alfred, FL, USA

In this ongoing field experiment, we investigate the interactive effects of potassium silicate (Si) and phosphorus (P) on orange trees to determine the optimal Si-P ratio for enhancing both tree growth and fruit quality. The study is conducted on Candler fine sand, utilizing specific tree spacing to achieve a tree density of 717 trees per hectare. The citrus variety is Valencia on swingle rootstock, planted in February 2013. Using a completely randomized block design, the experiment comprises 28 plots with 10 trees per plot including 2 border trees, with a focus on sampling the central six trees within each plot. Treatments, involving Si and P doses, are applied quarterly from October 2022 to February 2024. The treatment structure includes seven combinations of Si (1x, 2x, 3x) and P (1x, 2x) doses. Measured variables encompass soil and leaf Si and P analysis. Additionally, canopy size measurements and trunk diameter assessments, are performed semi-annually and fruit yield evaluations done annually. Fruit quality is determined by examining total soluble solids (TSS) and acidity levels. This study seeks to provide valuable insights into optimizing Si-P ratios for the cultivation of orange trees and the enhancement of fruit production.

PRESENTER BIO: Jose Prieto is a second-year master’s student majoring in Soil, Water, and Ecosystem Sciences. Originally from Honduras, Jose completed his bachelor’s in Environmental Science in Zamorano University, Honduras.

BAYESIAN CALIBRATION USING DATA FROM BIOSENSORS: PREDICTING *E.COLI* CONCENTRATION IN WATER

Hanyu Qian
University of Florida, Gainesville, FL, USA

Excessive bacterial contamination in irrigation water can pose an immediate threat to the public health. Rapid and accurate identification of pathogenic organisms, such as shiga-toxin producing Escherichia coli (*E. coli*), is therefore crucial for resource management. Electrochemical biosensors are widely used to detect the contamination of *E. coli* in water. When the biosensors are used to test the target water, the output signals from the biosensors are a function (f) of *E. coli* concentrations and the sensors working frequencies. The presence of biosensor variation may increase the data uncertainty, causing a negative influence on biosensor detection ability. To address this challenge, we have developed a Bayesian calibration framework to quantify the model uncertainty in the biosensor data, particularly the uncertainty caused by biosensor fabrication variations. Using the Bayesian framework, we calibrate *E. coli* concentrations for new water samples with unknown concentrations based on the emulator constructed from the training set. Our results demonstrate that, with a sufficient number of sample replicates and a wide range of concentrations in the training set, the proposed Bayesian calibration can accurately estimate the predictive distribution of *E. coli* concentrations. Additionally, we investigate the influence of biosensor replication numbers and the range of prepared sample concentrations used in the training data on the calibration ability of the models. Our findings suggest that preparing samples from a broader concentration range is more critical than increasing the number of biosensor replications for a single concentration level. When coupled with the biosensor, the Bayesian statistical method presented in this manuscript provides a valuable tool for calibrating *E. coli* concentrations in water.

PRESENTER BIO: Mr. Hanyu Qian is a fourth-year Ph.D. student at the University of Florida in the Agricultural and Biological Engineering Department, working under the guidance of Drs. Nikolay Bliznyuk and Eric McLamore. His areas of research are Bayesian statistics, biostatistics, statistical machine learning, and spatial and spatio-temporal modeling.

UNRAVELLING SPATIAL HETEROGENEITY OF SOIL LEGACY PHOSPHORUS IN SUBTROPICAL GRASSLANDS

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Agriculturally-driven changes (e.g., P fertilization, manure application) have resulted in pronounced P accumulations in soils – known as 'soil legacy P.' These legacy P reserves serve as long-term non-point sources, inducing downstream eutrophication and ecosystem services degradation. While there is considerable scientific and policy interest in legacy P, its fine-scale spatial heterogeneity, underlying drivers, and scales of variance remain unclear. Here we present an extensive field sampling and analysis of 1,438 surface soils (0-15 cm) across two typical subtropical grasslands – Intensively-Managed (IM) and Semi-Natural (SN) – managed for livestock production. We ask: (*i*) What is the spatial variability and hotspots of soil legacy P? (*ii*) Does soil legacy P vary primarily within pastures, among pastures, or between pasture types? (*iii*) How does soil legacy P relate to land management and soil characteristics? and (*iv*) What is the relationship between soil legacy P and aboveground plant tissue P concentration? Our results showed that soil legacy P (total P, Mehlich-1 and Mehlich-3 extractable P representing labile P pools) varied substantially across the landscape. Soil organic matter, pH, available Fe and Al, elevation, and grassland management were crucial predictors for spatial patterns of soil P, although models were more reliable for predicting total P than labile P. Our analysis further demonstrated that total variance in soil legacy P was greater in IM than SN grasslands, and intensified human activities rescaled spatial patterns of soil legacy P. Our results suggest that broad pasture- or farm-level best management practices may be limited, especially for high-intensity grasslands. Rather, management to curtail legacy P should be implemented at fine scales and spatially target P 'hotspots.' Our research improves understanding of patterns, drivers, and variances of soil P, and can inform models to evaluate and predict impacts of landscape management to mitigate P loadings and losses under shifting environmental conditions.

PRESENTER BIO: Dr. Qiu is an Associate Professor of Landscape Ecology and Ecosystem Service at the University of Florida, in the School of Forest, Fisheries, and Geomatics Sciences. Through varied research projects, his work aims to understand how global environmental changes affect ecosystem services in agricultural and urban landscapes.

ANNUAL MAXIMUM TOTAL WATER LEVELS VARY ACROSS STORM SEASONS ALONG THE U.S. ATLANTIC COAST

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The annual maximum (AM) method, which subsamples time series to retain the maximum event per year, has a long history in determining return periods of flood events. The extreme value distributions applied to AM data often assume that the data comes from the same statistical population. Locations across the world, such as the United States (U.S.) Atlantic coastline, however, experience storms with different driving mechanisms during different seasons. This research investigates for the first time when AM total water levels (TWLs) occur during the year along the U.S. Atlantic coast and whether the individual components, such as waves, tides, and storm surge, contributing to TWLs vary across regions and during the year. We find that AM TWLs from 1980 to 2020 occur during both the extratropical and tropical seasons, and the relative proportion of AM TWLs occurring during the extratropical season increases moving northwards. Tides drive spatial variability in AM TWL magnitude, while wave climate drives differences in the magnitude of AM TWLs calculated for the extratropical and tropical seasons separately. The month-to-month variability in the composition of AM TWLs varies more than the spatial variability, highlighting the importance of understanding the components driving extremes at different times during the year. Seasonal variations in the processes contributing to extreme TWLs may have implications for how large-scale changes to the climate impact local coastal hazards, and variations across storm seasons may influence the robustness of extrapolating rare events from a model fit to a single population.

PRESENTER BIO: Gabrielle P. Quadrado is a Ph.D. student in the Department of Geography at UF and a UF Water Institute Ambassador. Her main research interests include sea level variability, coastal hazards, extreme value analysis, and the effects of climate change on coastal processes and communities.

MAPPING FLORIDA ROOT ZONE SOIL MOISTURE IN REAL-TIME WITH SATELLITES, SOIL DATA, USING AI ALGORITHMS

***Saman Rabiei**, Ebrahim Babaeian, Sabine Grunwald*

Soil, Water and Ecosystem Sciences Department, University of Florida, Gainesville, FL, USA

Detailed and accurate Soil Moisture (SM) information is important for irrigation scheduling and precision water management in agriculture. Recently, farmers in Florida (FL) have begun employing in-situ SM sensors for irrigation management. The installation and removal of these sensors is a labor-intensive and expensive process. Furthermore, it results in collecting localized and infrequent measurements. Satellite remote sensing observations in microwave, optical and thermal domain have been used for spatiotemporal SM estimation at large scale. NASA's Soil Moisture Active Passive (SMAP) SM maps with its course 9- and 36 km spatial resolution and 2–3-day updates, isn't suitable for precise field-scale irrigation management. This study aims to develop a new framework for producing high-resolution 'real-time' root zone SM maps for irrigated farms in FL. This study combines SMAP's low-res SM data with detailed soil property maps using AI techniques such as convolutional neural network and long short-term memory (ConvLSTM). This fusion provides real-time, high-resolution root zone SM information for agricultural water management in Florida. The high-resolution (100 m) physical soil properties map multiple soil depths, sourced from NRCS's Soil Landscapes of the United States (SOLUS100) dataset, and SMAP level 3 SM data are incorporated into a CNN-LSTM deep learning model to produce high-resolution (100 m) nowcasts and forecasts of root zone SM across FL. To validate the accuracy of our models, we compared real-time root zone SM estimates with ground reference SM measurements obtained from the U.S. Climate Reference Network (CRN) and the Soil Climate Analysis Network (SCAN) networks. The results indicate that the CNN-LSTM model can accurately estimate surface and root zone SM for near- and distant future time frames. This new high-resolution 'real-time' SM product can be a valuable tool for mapping water deficit at the field-scale, aiding farmers to precisely determine the amount, location, and timing of irrigation.

PRESENTER BIO: Saman Rabiei, currently a Soil and Water Ecosystem Sciences PhD candidate with a Master's degree in Water Resources Management (WRM), has strong expertise in projects related to soil moisture estimation using satellite data and AI modeling, as demonstrated by his Master's dissertation and his professional experiences.

TOOL FOR WETLAND AND WATER PROJECT PRIORITIZATION IN THE INDIAN RIVER LAGOON WATERSHED

Kai Rains, *Edgar Guerron, Stephanie Lawlor, Shawn Landry, Mark Rains*
University of South Florida, Tampa, FL, USA

Florida has been transformed from an entirely natural to a largely built environment, mostly since it achieved statehood in 1845. This has resulted in widespread loss of natural capital, and the ecosystem services it supports. An example is St. Lucie County, in the Indian River Lagoon Watershed. In the 1850s, 90% of the county was wetland and there were 0.1 km of channels per km^2; today, 9% of the county is wetland and there are 25 km of channels per km^2. We are now living with the unintended consequences, which include poor water quality and associated harmful algal blooms. We cannot restore all the lost natural capital because it would not be compatible with the ways and qualities of life of the 22M residents 140M annual visitors. However, we can and should use wetland conservation and restoration, to the extent possible. Unfortunately, we generally lack regionally calibrated tools for prioritizing among potential wetland restoration and conservation projects, so decision-making is typically ad hoc. We are overcoming this by calibrating a geospatial tool for prioritizing among wetland conservation and restoration opportunities in St. Lucie County. The tool is flexible, as the user defines the weights assigned to prioritization criteria, which include land use history, hydrological connectivity, present and future land condition, and opportunities for interagency collaboration. The user enters the weights through a series of straightforward queries, lending transparency and objectivity to the project screening process. The tool is being incorporated into wetland conservation and restoration discussion and decision-making in St. Lucie County and is serving as the framework for a planned expansion throughout the entirety of the Indian River Lagoon Watershed.

<u>PRESENTER BIO</u>: Dr. Kai Rains is a Research Associate Professor at the University of South Florida. Her research interest is in ecosystem response to environmental stress from the organismal to the landscape scale and in development of geospatial tools for natural resource assessment and management with a focus on waters and wetlands.

SPATIAL AND TEMPORAL VARIABILITY IN HYDROLOGICAL CONNECTIVITY IN STREAM-WETLAND FLOW NETWORKS

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The geographic extent of stream-wetland flow networks changes seasonally as variable source areas expand and contract. Our understanding of these patterns and processes is limited by a lack of map products which reflect this seasonality. Furthermore, existing map products are often least reliable in headwater settings, where much of the variability occurs. We overcame this limitation by constructing and field validating a seasonally varying flow-based hydrography (FBH) for a 150,500-ha region in west-central Florida. We constructed the FBH by combining LiDAR data with long-term streamflow data to generate a cubic meter-per-second grid. We then used the FBH to predict the location and magnitude of flowing streams on monthly timesteps, which we then intersected with wetlands in the National Wetlands Inventory. We field validated the FBH and compared the FBH to the National Hydrography Dataset (NHD) by visiting 241 field sites. The FBH performed well overall and consistently outperformed the NHD, especially in headwater settings. The maximum extent occurs in August, with 2,526 km of flowing streams connecting 41,085 ha of wetlands to one another and to downstream waters. The minimum extent occurs in May, with 681 km of flowing streams connecting 25,635 ha of wetlands to one another and to downstream waters. Flowing stream length varies annually by 3.7x, with 73% of stream length being intermittent. The intermittent stream length is in the headwaters, with all 1st-order, ¾ of 2nd-order, and ¼ of 3rd-order stream length being intermittent. Surface-water connected wetland area varies annually by just 1.6x, because wetland area is disproportionately on the floodplains of the larger, perennial streams. The flood-pulse concept was previously defined in terms of lateral expansion and contraction connecting channels and floodplains. Here, we describe a variant defined instead in terms of the longitudinal expansion and contraction connecting streams and wetlands within a flow network.

PRESENTER BIO: Dr. Mark Rains is a Professor of Geology at the University of South Florida and the Chief Science Officer for the State of Florida, with expertise on hydrological connectivity, the roles hydrologic connectivity plays in controlling ecosystem structure and function, and the roles that science plays in informing water-related decision-making.

RIPPLES OF RED TIDE: QUANTIFYING RECREATIONAL LOSSES FROM HARMFUL ALGAL BLOOMS IN FLORIDA

Abhishek Rajan*, Olesya Savchenko, Christa Court*

Globally, the frequency of harmful algal blooms (HAB) has been on the rise, posing significant threats to the environment, economy, and public health [1, 2]. These blooms have detrimental effects on sectors like aquaculture, fisheries, and tourism [1, 2]. In United States, all 50 states grapple with HAB challenges, but Florida frequently confronts intense HAB episodes, especially those caused by *Karenia brevis*, commonly known as red tide [3]. Between October 2017 and January 2019, a notable red tide event affected both the Gulf and Atlantic coasts of Florida [4]. Given Florida's economic reliance on aquaculture and tourism, this persistent red tide event led to severe losses across lodging, restaurant, fishery, and seafood sectors [4, 5, 6].

Historically, environmental crises have influenced visitation and recreational behaviors [7, 8].
Previous studies suggest that red tide toxins caused concerns among coastal visitors, affecting visitation rates and experiences. [4, 5, 6, 9]. Our study aims to quantify the impacts of the 2017-2019 red tide event on recreational use in Florida, particularly focusing on alterations in visitation rates and the associated economic loss.

Using an online survey, we elicit information on visitors' trip frequency, altered trip plans, and visitation experience before, during, and after the 2017-18 HAB event. Additionally, we collect information on expenses during the trip, awareness about HAB events, plans for future trips to affected areas when HAB is present or absent, and social demographics of respondents. The information collected about recreation experience and respondents' demographics is used to estimate a recreation demand model on the determinants of trip frequency, following the travel cost method. Further, the study also presents a counterfactual scenario contrasting the actual trips taken during the red tide event against the projected trips without the HAB occurrence to estimate the recreational losses due to the HAB event. Preliminary results indicate a substantial reduction in consumer surplus and recreational loss due to HAB events.

PRESENTER BIO: Abhishek is a PhD candidate specializing in Natural Resource Economics at the University of Florida's Department of Food and Resource Economics. His research intersects environmental challenges, human behavior, and developmental issues. His research explores diverse topics, ranging from managing aquatic invasive plants in Florida lakes to assess the influence of irrigation access on diversity of Indian farming households.

QUANTIFYING IMPACTS OF CLIMATE AND LAND USE CHANGE ON THE WATERS OF THE SUWANNEE RIVER BASIN

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The Suwanee River is a large wild river that traverses Georgia and Florida and empties into the Gulf of Mexico where it supports economically and culturally important coastal ecosystems. The quantity and quality of the waters of the Suwannee River Basin (SRB) and associated coastal ecosystems are heavily influenced by the climate and land use within the region. While there is a substantial agricultural and silvicultural footprint within the river's watershed, the population density is relatively low. However, it is projected that development pressure and agricultural intensity will dramatically increase in the coming decades. Additionally, there are large uncertainties in the future climate for this region. Understanding impacts of such climate and land use changes is critical for the sustainable management of the basin's water resources and ecosystems. In this study, we develop and simulate various climate and land use scenarios using a landscape hydrologic model (SWAT-MODFLOW) and quantify their impacts to the waters within the SRB. The implemented scenarios were co-developed with stakeholders and can be qualitatively classified to the following categories: 1) Agricultural intensification/expansion; 2) Urban expansion; 3) Restoration/conservation; and 4) Climate extremes. Climate projections were obtained from Coupled Model Intercomparison Project Phase 5 global climate models downscaled by Multivariate Adaptive Constructed Analogs technique. Hydrological impacts were assessed by quantifying changes in aquifer recharge and levels; riverine and spring nitrate concentrations, water temperature, and river discharges across the basin, with a particular focus on freshwater flows to coastal ecosystems. Results indicate that water quantity is most significantly impacted by changes in climate, while water quality is most significantly affected by changes in land use. Our analysis also included "bookend" scenarios within each of the scenario categories which could potentially be used to inform the possible maximum effectiveness of proposed large-scale water and land management policies.

PRESENTER BIO: Dr. Reaver is a Research Assistant Scientist at the University of Florida Water Institute. He has expertise in hydrology, ecology, complex system dynamics, and mathematical modeling. At the Water Institute, he applies his multi-disciplinary experience to the understanding of hydrological, ecological, and social dynamics in karst watersheds.

TAMPA BAY GROUPS WITH FEW FINANCIAL RESOURCES LACK BENEFITS FROM NATURAL & ARTIFICIAL WETLANDS

Abigail Reed *and Kai Rains*
University of South Florida, Tampa, FL, USA

Wetlands perform important ecological and social functions such as water storage, water quality enhancement, temperature modulation, wildlife viewing, and opportunities for recreation. Within the Tampa Bay Watershed (TBW) (570,000 hectares), over one-third of the wetland area present in the 1950s has been lost while artificial water features (AWFs) (e.g., reservoirs) have increased in area by 1554% between the 1950s and 2007 (Rains et al 2023). The functions performed by wetlands and AWFs likely differ as well. The simplified landscape bordering AWFs leaves little opportunity for biogeochemical processing and removal of excess nutrients, but they still provide some ecosystem services, such as flood control, limited wildlife habitat, and opportunities for recreation. We investigated whether AWFs are more common than wetlands in neighborhoods inhabited by low income or non-white residents. We performed geospatial analysis (ArcGIS Pro, ESRI) using publicly available land use and census data to parse the wetland area remaining and the AWF area present by census tract and analyzed the data by quintiles. We found no predictive relationship between the distribution of non-white residents and AWFs (R^2 = 0.035) or wetlands (R^2 = 0.0724). However, there is a predictive relationship between the distribution of residents below the poverty line and percentages of both AWFs (R^2 = 0.9331) and wetlands (R^2 = 0.9969). As the percentage of residents below the poverty line within census tract quintiles increases, both the percentage of area in census tract quintiles comprised of AWFs or of wetlands decreases. The results of this study indicate that neighborhoods with the highest percentage of individuals below the poverty line have less direct access to the ecosystem services provided by natural wetlands or AWFs.

PRESENTER BIO: Abigail Reed is a senior undergraduate student at University of South Florida majoring in Environmental Science with minors in Geology and Biology. She has researched with the USF Ecohydrology Research Group under mentorship of Dr. Kai Rains. She hopes to pursue biogeochemistry in graduate school and someday work for NOAA.

FLORIDA POLICY AND INNOVATIONS IN WATER QUALITY AND RESILIENCE

Michael A. Register
St. Johns River Water Management District, Palatka, FL, USA

Florida is well known for its abundant and beautiful water resources. Without appropriate stormwater management, the rainfall that created these resources can also make them vulnerable to water quality impacts and put development at risk from flooding. Fortunately, Florida also has a long history of being on the leading edge of stormwater management and water quality treatment. The original regulatory framework put in place to protect our water resources from impacts and our developments from flooding have evolved over the years as additional data, modeling and technology have increased not only our understanding of the characteristics of our water resources, but also our tools for implementing more effective stormwater management measures.

As new resource needs are identified, new strategies and technologies must be developed and implemented to meet the challenges of protecting our water resources while accommodating Florida's rapidly increasing population and economic expansion. The solutions to these challenges need to consider our water quality, flood protection and water supply needs together wholistically in order to move toward a truly resilient Florida.

This presentation will provide an overview of the evolution of stormwater management in Florida and explore how new and innovative technologies can be integrated into programs and strategies to protect water quality, enhance flood protection, and enhance water supplies.

PRESENTER BIO: Mike Register is a registered P.E in Florida with more than 30 years of experience in water resource engineering. He has a Bachelor of Science and a Master of Engineering degree from the University of Florida – both in Agricultural and Biological Engineering. Mr. Register has extensive experience with Florida's Environmental Resource Permitting, Consumptive Use Permitting, Minimum Flows and Levels and Water Supply Planning programs. He currently serves as the Executive Director of the SJRWMD.

IDENTIFYING CONTROL POINTS FOR NUTRIENT MANAGEMENT IN AN URBANIZING ESTUARY USING STABLE ISOTOPES

***Jenna Reimer*[1, 2]**, *Ashley Smyth*[2], *and AJ Reisinger*[1]

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Population growth and urbanization have increased nutrient loads (e.g. fertilizer, yard waste, and fossil fuel combustion) to coastal ecosystems. In excess, nitrogen (N) is considered a pollutant and can cause eutrophication. However, estuaries have the potential to reduce eutrophication by removing bioavailable nutrients through assimilation into plant biomass and mineralization. Identifying ecosystem control points (places and/or times with greater amounts of mineralized and assimilated anthropogenic N compared to the rest of the system) can pinpoint where an estuary is storing the most anthropogenic N. The Guana Estuary (GE) is an urbanizing estuary in northeast Florida and was recently designated as impaired for nutrients by the Department of Environmental Protection. The myriad of point and non-point sources of anthropogenic N to the GE make it hard to identify specific sites where nutrient management would be most beneficial. Additionally, seasonality and storm events impact timing and magnitude of anthropogenic N sources entering the GE. However, identifying control points in the GE can direct implementation of nutrient management strategies.

To locate control points, we used isotope source tracking. Anthropogenic N has a distinct isotopic signature (elevated δ15N enrichment) caused by various human activities. Sites and times with enriched isotope signatures indicate control points of anthropogenic N removal. To locate control points for anthropogenic N and carbon (C) inputs in the Guana Estuary, we collected quarterly sediment samples and apical foliage from the dominant vegetation from six sites spanning a salinity gradient in GE. We analyzed these samples for δ15N, δ13C, and C:N. We predict the most enriched isotope signatures will be at Mickler's Weir, where water from the from the urbanized headwaters enters the GE. Focusing on control points of anthropogenic N removal in estuaries can help us manage and mitigate increasing nutrient loads and prevent eutrophication resulting from increasing urbanization in Florida.

<u>PRESENTER BIO</u>: Jenna Reimer is a Ph.D. student at the University of Florida , studying estuarine biogeochemistry under the advisory of Drs. Ashley Smyth and AJ Reisinger. She received her BA in Geology, with honors, from the University of Maryland in 2019.

PARASITE-MEDIATED INVASION OF FRESHWATER CRAYFISH

***Lindsey S. Reisinger**, Cheyenne E. L. Stratton, Sara Bolds, Donald C. Behringer, Jamie Bojko*
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Parasite release may be a key factor that allows invasive species to outcompete native species, reach high densities, and have strong ecological impacts. However, we know little about the role of parasitism in most freshwater invasions. Crustaceans, especially crayfish, are among the most common and impactful freshwater invasive species. Here we describe our research focused on the role of parasites in two crayfish invasions, the invasion of rusty crayfish (*Faxonius rusticus*) in Wisconsin lakes and the invasion of white tubercled crayfish (*Procambarus spiculifer*) in Florida streams. Both invasions result in the extirpation of native crayfish species. In each region, we collected crayfish from lakes or streams and examined symbiont abundance and community composition in invasive and co-occurring native crayfish. We also used laboratory experiments to investigate the impacts of common parasites on crayfish survival, growth, and behavior. In each case, some parasite taxa (e.g., trematodes, microsporidians) were shared between the native and invasive crayfish. In Wisconsin, rusty crayfish had lower symbiont richness (per crayfish) than the co-occurring native crayfish species, and the native species had higher symbiont richness in invaded lakes than uninvaded lakes. Some parasites had substantial impacts on crayfish survival, growth, and behavior. For example, in Wisconsin, trematode parasites reduced crayfish antipredator behavior, and microsporidian parasites reduced crayfish activity level and condition. In Florida, microsporidian parasites reduced crayfish condition and survival. Overall, our findings suggest that parasites are often shared between native and invasive crayfish species and that parasites can have strong effects on crayfish traits and mortality rates. Therefore, parasites may play an important role in crayfish invasions by modifying the traits, abundance, and/or impacts of invasive species.

<u>PRESENTER BIO</u>: I am a freshwater community ecologist, and my research program focuses on using invasive species to answer ecological and evolutionary questions. I am particularly interested in how evolution over short timescales alters the traits of species and their ecological impacts. I also study interactions between native and invasive species, especially interactions between parasites and their hosts.

SEAGRASSES: BOTH INDICATORS AND DRIVERS OF COASTAL WATER QUALITY

Laura K. Reynolds[1], *Morgan Edwards*[1], *Jamie Hammond*[2], *Savanna Barry*[3]
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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) is the newest Florida aquatic preserve and the hallmark resource in this preserve is its extensive seagrass meadows. Seagrasses and water quality are closely linked. Nutrients are required for plant growth, and plant biomass both sequesters nutrients and drives nutrient cycling. Conversely, high nutrient loads from rivers can decrease water clarity and shade out sunlight that grasses need for photosynthesis. Since water itself also attenuates light, seagrasses in deeper water may be more susceptible to issues associated with increases in nutrients. At high nutrient loads, algae can proliferate more quickly than seagrasses and community may shift from seagrass dominated to algal dominated where algae block light from seagrasses. Finally, seagrass growing on the Gulf Coast of the Florida peninsula show variation in morphology, shoot density, growth rates, and elemental composition in relation to a gradient in water column total phosphorous concentrations. Areas with higher total phosphorous produced taller shoots with wide leaves, and shoots were less dense. Therefore, effective water quality and seagrass monitoring programs should be linked. Here we present a cohesive water quality and seagrass monitoring program aimed at documenting trajectories and identifying early signals of change for these protected resources.

PRESENTER BIO: Laura Reynolds is an assistant professor in the soil water and ecosystem sciences department at UF.

DATA INTEGRATION, ANALYSIS, AND FORECASTING FOR COASTAL AREAS: AN OVERVIEW OF USGS PORTALS AND TOOLS

Tara Root

U.S. Geological Survey, Caribbean Florida Water Science Center, Davie, FL, USA

The sustainability of coastal areas is being affected by climate change, sea level rise, and modifications to land use and hydrologic systems. To prepare for and respond to these drivers of change, coastal managers and planners need the most current data available, an understanding of temporal and spatial trends, information about how current and historical data compare, and forecasting tools. Providing these types of information and tools to help managers and policy makers foster sustainable and resilient communities and ecosystems is a central component of the U.S. Geological Survey's (USGS) mission. The USGS has developed many online tools to make data and analyses readily available, including the National Water Information System Mapper, which provides real-time and historical surface-water quality and water-level data for both surface water and groundwater as well as surface-water discharge data. The Total Water Level and Coastal Change Viewer combines water level predictions (including wave run-up) with local beach slope and dune observations to forecast the probability of coastal dune erosion, overwash, and inundation. The Coastal Data and Analysis Tool hosts a variety of data types from surface-water and groundwater monitoring sites as well as assessments of temporal and spatial trends in those data. This presentation will provide an overview of these USGS web portals with a specific focus on their applicability for resilience planning in the coastal areas of South Florida.

PRESENTER BIO: Dr. Root is a hydrologist with the U.S. Geological Survey Caribbean-Florida Water Science Center. She has extensive experience working on groundwater chemistry and groundwater-surface water interaction projects. She has 15-years of prior experience in academia where she taught hydrogeology and water resources courses and supervised graduate student research.

FRAMEWORK TO IMPROVE SIMULATION PROCESSES OF THE INTEGRATED HYDROLOGIC MODEL

***Mark A. Ross*[1]**, *Jeffrey S. Geurink*[2], *Qing Du*[1] *and Kay Parajuli*[2]

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The framework for proposed improvements to simulation processes of the Integrated Hydrologic Model (IHM) are motivated by recommendations from external peer review, observations from application, synthesis of field observations, and anticipation of future water management challenges. The IHM dynamically couples HSPF with MODFLOW to simulate the surface water and groundwater systems, and feedback between these systems for uplands, water bodies, and groundwater. The IHM has been used for more than two decades to support decision-making for: water-supply planning, sustainability assessment, and operations; ecologic systems protection; and assessment of hydrologic response due to changes in water use, climate, and land use.

Insights from the stated motivations highlight the need to reduce streamflow variance error and to improve magnitude and timing of recharge to saturated groundwater. To accomplish the desired improvements, several processes within HSPF were targeted for modification. The framework for proposed improvements to HSPF includes increasing vertical discretization of the vadose zone from one zone to maximum of seven zones, adopting the Brooks-Corey model to represent soil moisture storage, replacing existing infiltration with the Green-Ampt infiltration model, and allowing dynamic transitions between infiltration-excess and saturation-excess surface runoff. Additionally, proposed HSPF improvements include adding vertical percolation between vadose zone layers that ultimately results in percolation as recharge to saturated groundwater and partitioning evapotranspiration (ET) among the vertically-discretized vadose zones and groundwater. The proposed HSPF improvements also include simulation of depth to water table with active feedback to the vadose zone layers through the Brooks-Corey model.

IHM uses integration paths to dynamically transfer mass-conserving flows, fluxes, and storages between HSPF and MODFLOW and to dynamically modify model parameters. Proposed improvements to HSPF require substantially modifying some existing and adding new IHM integration paths for both HSPF and MODFLOW. The conceptual framework was built and tested against field and theoretical results using Hydrus 1-D.

PRESENTER 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.

LANDSCAPE-LEVEL MINIMUM FLOWS DEVELOPMENT METHODS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Kym Rouse Holzwart
Southwest Florida Water Management District, Brooksville, FL, USA

The Southwest Florida Water Management District (District) is one of five water management districts in Florida, including all or part of 16 West-Central Florida counties. The District's mission is to protect water resources, minimize flood risks, and ensure the public's water needs are met. To address this mission, District activities can be grouped into four major categories: water supply, water quality, natural systems, and flood protection. Because numerous impacts that occur in the upstream landscape affect the downstream environment, most of the District's natural resource management activities address multiple categories.

This is true for the establishment of minimum flows for flowing systems. The District is required by state law to establish minimum flows for flowing waters within its boundary, which along the Gulf Coast, is from southern Levy County through Charlotte County. Minimum flows are defined as "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." They protect water resources and are used for water supply planning and water use permitting.

The District is constantly improving its minimum flows development methods. Its approach to developing minimum flows typically evaluates habitats at the landscape level. The amount of habitat available in the absence of ground and surface water withdrawals is determined, and changes in habitat as a result of flow reductions in the river, spring run, or springs due to withdrawals is evaluated. Examples of habitats that are evaluated to protect from significant harm when developing minimum flows include instream habitat for numerous groups of fish and benthic macroinvertebrates, inundated floodplain wetlands habitat, low-salinity habitat critical to many flora and fauna in estuaries, habitat for estuarine fish and nekton, and thermal refuge habitat in coastal springs systems for the Florida manatee (*Trichechus manatus latirostris*) and Common Snook (*Centropomus undecimalis*).

PRESENTER BIO: Ms. Rouse Holzwart is a lead ecologist with more than 35 years of experience as an aquatic ecologist designing, managing, and participating in an extensive variety of projects in both the regulatory and research arenas. The majority of her project work has been on aquatic ecosystems in Florida.

IMPROVING THE SURFACE WATER QUALITY OF COASTAL BASINS WITH RESILIENT LAND COVER SCENARIOS

Jules Bruck[1], Eric Bardenhagen[2], ***Martha Ryan[2]****, Afsheen Sadaf[1], and Mojtaba Tahmasebi [1]*

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[3]Water Resources, Washington, D.C., USA

Coastal watersheds provide crucial water resources to coastal communities for various purposes, such as drinking, farming, fishing, and recreation. The coastal wetlands within these watersheds play a significant role in maintaining water quality by removing pollutants and reducing flood waters. Many coastal wetlands are currently facing threats due to inland development and sea level rise (SLR). Previous studies have used land change and water quality models to predict changes in land cover, assess their impact on water quality, and test the effectiveness of management interventions. However, these modeling techniques have only been used in a limited capacity for sites in coastal watersheds. This has prevented regulators of coastal development from preparing for future changes in water quality and deploying appropriate management interventions. Therefore, this study will use land cover and water quality modeling to create future predictions that will identify the best ways to protect threatened wetlands so regulators can make informed decisions regarding their land use. The study will focus on the coastal watersheds of eastern Delaware because they contain important coastal communities and large swathes of threatened coastal wetlands.

First, future land cover and water quality predictions without any interventions will be created using TerrSet's Land Change Model and the Long-Term Hydrologic Impact Assessment model. The results will indicate the main drivers of historic coastal wetland loss, how current trends in SLR and land development will affect wetlands, and which portions of coastal wetlands are at greatest risk.

Next, the same models will be used to manually alter the future land cover predictions to mimic the application of land management interventions and gauge the subsequent impact on water quality predictions. The results will highlight which management interventions will help retain the most coastal wetland land cover and maintain current water quality standards.

<u>PRESENTER BIO</u>: Martha Ryan is a Ph.D. student at the University of Delaware with an interdisciplinary background in ecology, geospatial modeling, statistics, and regional planning. They are currently focused on improving the water quality of Delaware's coastal watersheds through land use intervention.

COASTAL RESILIENCE THROUGH NATURE-BASED SOLUTIONS – A GIS SUITABILITY ANALYSIS MODEL FOR LIVING SHORELINES AT ABERDEEN PROVING GROUND, MARYLAND

*Dr. Jules Bruck[1], **Afsheen Sadaf**[1], Mojtaba Tahmasebi[1], and Martha Ryan[2]*
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Coastal ecosystems, habitats, coastline infrastructure, and communities are increasingly vulnerable due to sea level rise (SLR), storm surge, coastal erosion, and population growth in coastal areas. Traditionally, shorelines have been protected using hardened approaches such as seawalls, bulkheads, revetments, etc. but recently there has been a shift towards more sustainable soft engineering approaches such as living shorelines and hybrid solutions. These nature-based solutions are considered more ecologically balanced methods to protect and enhance shorelines and coastal habitats by dissipating wave energy, unlike hardened approaches which can lead to permanent habitat loss. Several tools have been developed to help evaluate the feasibility of constructing and maintaining a living shoreline in a specific location. However, this study incorporated methodology from a regionally specific integrative tool called the Living Shoreline Feasibility Model (LSFM)" developed by the Partnership for the Delaware Estuary to spatialize model output. The LSFM guides users in collecting information on physical, ecological, and community (social) characteristics. Output includes a relative evaluation of a site brought to the model. In this study, conducted at Aberdeen Proving Ground (APG) located in Harford County, Maryland, a GIS model was developed based on the LSFM to spatialize output for use as a predictive tool.

Three scenarios of suitability analysis are identified by the GIS model including suitable for living shorelines (LS), suitable for hybrid solutions (HS), and not suitable for living shorelines (NLS) through a scale with assigned values of 3,2, and 1 respectively. The GIS spatial data input includes shapefiles and raster data set on "elevation/slope, bathymetry (contours), shoreline sensitivity (geomorphology), topography, marsh, dunes, structures, and submerged aquatic vegetation (sav) presence, erosion level, tree canopy, threatened and endangered species, wetlands, storm surge and wind energy, wave hazard, fetch and current shoreline type". The weighting method includes assessing each parameter separately and later assigning a weighting method based on percentage calculation derived from LSFM. All GIS raster data was converted into 10m x 10m cell size and analyzed using the "Suitability Modeler" in ArcGIS Pro 3.1.0. Ultimately, this project will demonstrate the thorough integration of shoreline and upland data through mosaic and overlay analysis and will identify the most suitable sites for the installation of living shorelines at APG.

<u>PRESENTER BIO</u>: Afsheen Sadaf received her Ph.D. in Urban & Regional Planning from the School of Landscape Architecture and Planning, UF. Currently, she is a Post-Doctoral Research Associate at the Department of Landscape Architecture & Planning at UF. Her research interests include Coastal Resilience, GIS, Sustainability and Environment, Health & Built Environment, Health Inequalities (SES & Gender). She has earned several prestigious awards including ACSP-FWIG Marsha Ritzdorf Award, ACSP Diversity Fellowship etc.

PARTITIONING OF RAINFALL AND FLOWPATH PROCESSES TWO CONSTRACTING PINE PLANTATIONS, NORTHERN FLORIDA

Seyed Mohammad Moein Sadeghi, *Azade Deljouei, Joshua M. Epstein, Franklin J. Gorora, Matthew J. Cohen*

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Forests play a crucial role in the water cycle by partitioning rainfall into various components, including throughfall, stemflow, litterflow, soil discharge, wetland storage, groundwater recharge, and streamflow. Therefore, assessing the influence of forests on water movement and solute transport in aquatic systems is of paramount importance. From a silvicultural perspective, when forest biomass decreases due to natural events (e.g., fire and hurricanes) or human-induced disturbances such as forest harvesting, or due to stand development (like tree competition), the water that was previously released through transpiration or intercepted as rainfall by the vegetation that has been removed gets redistributed to other ecohydrological processes. To gain a comprehensive understanding of the impact of changes in forest structure on hydrological cycles, it is essential to track rainfall in different parts of the flow paths. While studies on hydrological processes in plantation forests have primarily focused on streamflow, there has been little attention given to tracking rainfall events in different flow paths. To address this gap, we conducted weekly measurements of throughfall, stemflow, litterflow (both in open areas and under canopy cover), and recharge into the topsoil (at a depth of 15 cm) and subsoil (at a depth of 45 cm) in two contrasting forest stands located in Austin Cary Forest, a flatwoods landscape in North Florida. Our preliminary findings indicate that the quantity of water passing from the canopy via throughfall, stemflow, and net rainfall significantly varies between the stands, with the younger stand showing significantly higher throughfall, stemflow, and net rainfall volumes. This supports the conclusion that changes in canopy structure have a notable impact on the pathways and storage of rainwater in managed pine ecosystems. This information is vital for understanding how alterations in forest structure and flow paths affect the timing and volume of hydrological cycles at the landscape level.

PRESENTER BIO: Dr. Sadeghi, a postdoctoral researcher with 12+ years of experience, specializes in silviculture, hydrological cycles, and biochemical cycles. His expertise lies in pine plantation management, and he has published 50+ peer-reviewed international papers on silviculture and water resources disciplines.

ESTIMATING WATER/NUTRIENT RETENTION OF PAYMENT FOR WATER SERVICES PROGRAMS ON S. FLORIDA RANCHLANDS

***Amartya Saha*[1]**, *Elizabeth Boughton*[1], *Boyd Gunsalus*[2], *Benita Whalen*[3], *Hilary Swain*[1]
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The Northern Everglades Payment for Environmental Services (NE-PES), a part of the SFWMD's Dispersed Water Management (DWM) program, commenced in 2011 as a multi-stakeholder solution to provide water retention and nutrient removal in the Northern Everglades Basin. In NE-PES water retention projects, water is held back on ranches by weirs kept at a predetermined height (service elevation) in culverts on major drainage ditches; the resulting back-flooding decreases grazing areas for which ranchers are compensated. Nutrient retention projects involved pumping water from regional canals into either reservoirs where nutrients were taken up by soil and growing vegetation, or into fallow fields to grow forage grasses that are then harvested for winter cattle use. This talk describes calculation methods and summarizes performance of these projects over the last 11 years. Water levels in the ditches are monitored at a 15-minute resolution. The amount of water retained annually on individual ranch basins was equated to the sum of rainfall (over the periods when the water level lay between baseline and service elevations) multiplied by basin area (acres) and divided by 12" to get volume in acre-ft. For 4 representative water retention projects over 2011-2021, we estimated an average annual storage above baseline at 1.47 acre-feet/acre. For the nutrient removal projects, a wetland flow-through project retained on average 75% of the phosphorus and 47% of the nitrogen pumped in or received via rainfall (2011-2021). The forage harvest project annually removed around 3200 lbs. of phosphorus and 15000 lbs. of nitrogen from 188 acres (2018-2021). These results point to the efficacy of such approaches, which would need to be scaled up to cover wider areas across the Northern Everglades watershed and monitored to effectively address downstream water quantity and quality issues.

PRESENTER BIO: Amartya Saha has worked with ecohydrology across South Florida since 2004, in the Everglades National Park (2004-2012), Loxahatchee National Wildlife Refuge (2012) and the Northern Everglades Basin (2016-present). Current areas of research include evapotranspiration estimation across different plant communities and plant-soil-nutrient-hydrology relations.

HEALTHY FARMS-HEALTHY BAYS – FINDING COMMON GROUND WITHIN UNCOMMON PARTNERSHIPS

***Darlene Saindon Velez*[1,2]**, *Wendy-Lin Bartels*[2] *and Kelly Aue*[2,3]
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[2]University of Florida, Gainesville, FL, USA
[3]Suwannee River Partnership, Live Oak, FL, USA

Healthy Farms-Healthy Bays is a new initiative through Florida Climate Smart Agriculture with collaborative partners that is connecting upland farmers and ranchers and downstream aquaculture and aquatic ecosystem stakeholders to identify common ground and explore ways to work together toward a shared future vision. This joint effort focuses on enhancing sustainability of agricultural and fishing operations and improve water quality, fisheries, and habitat in key rivers, bays, and estuaries. Beginning in the Suwannee River watershed, Healthy Farms-Healthy Bays aims to unite a diverse team of industry leaders, using collaborative problem solving, to work together towards a future where healthy and productive ecosystems, bays, rivers, and streams are underpinned and supported by a vibrant and sustainable agricultural and fishing economy.

Healthy Farms-Healthy Bays is completing the first phase of these efforts for the Suwannee River Basin in March 2024. The goals of this phase are to 1) recruit industry representatives to form a Stakeholder Leadership Team, 2) identify shared interests and concerns, 3) share knowledge about existing restoration and sustainability projects and practices, 4) assess potential solution pathways using best available science, and 5) develop roadmap on how to move forward together toward common goals. The second phase will focus on continuing to bring together research, funding, and stakeholder partners to collaboratively put the roadmap created into action.

PRESENTER BIO: Mrs. Velez is an experienced environmental scientist, manager, and facilitator with more than 20 years of experience in natural resources research, management, outreach, and facilitation. She currently specializes in project management, meeting facilitation, stakeholder engagement, and strategic planning.

ND ISOTOPES IN STREAM WATER AND SEDIMENT IN GREENLAND: INCONGRUENT WEATHERING AND ICE RETREAT PROXY

Tatiana Salinas, *Ellen E. Martin, and Jonathan B. Martin*
University of Florida, Gainesville, FL, USA

Seawater Nd isotopes preserved in marine sediments track water masses and have been used to reconstruct past ocean circulation; however, seawater Nd isotope signals in the North Atlantic during glacial retreat (∼-26 εNd units, the measured $^{143}Nd/^{144}Nd$ normalized to bulk Earth in parts per 10^4) are lower than any known water mass. These low values may be attributed to chemical and physical weathering inputs from reactive fine-grained glacially-derived sediment, yet limited published data exist from terrestrial environments to test this hypothesis. We report Nd isotopes from water, bedload, and suspended sediment from streams draining Precambrian terranes covering a 175 km coast-to-ice transect in southwest Greenland. The ice retreated from the coast to its present location between ∼11 and ∼7 ka. Stream waters near the ice sheet have εNd values of -39.4±1.2, which is ∼7 εNd units lower than the corresponding bedload (-31.7±2.7), while stream water εNd values near the coast (-29.3±1.6) are similar to bedload εNd values (-27.9±2.1). These results suggest that easily weathered accessory minerals near the ice, such as apatite, monazite, and allanite with low Sm/Nd ratios and thus non-radiogenic Nd isotopes are preferentially dissolving, while radiogenic Nd is preferentially retained in weathering-resistant garnets. In contrast, Nd isotope ratios in near-coast watersheds suggest a decreased influence of trace mineral dissolution and greater contributions from major rock-forming minerals such as feldspar and hypersthene. Lower dissolved rare earth element concentrations in near-coast versus near-ice watersheds support this interpretation. These results demonstrate that unusually low seawater Nd isotopes may reflect inputs of dissolved Nd and reactions between seawater and fresh glacial sediments during past intervals of glacial retreat. The incongruent weathering defined by Nd isotopes may also impact the export of nutrients, such as P, and the atmospheric CO_2 consumption by silicate weathering during future ice sheet retreat.

PRESENTER BIO: Tatiana Salinas is a geologist interested in the geochemical interpretation of water-rock interaction processes based on the analyses of radiogenic isotopes and trace elements in water, minerals, sediments, and rocks. She has worked on developing a hydrogeological model for Central Mexico and is currently studying weathering processes in SW Greenland.

THE PHYSIOLOGICAL RESPONSES OF CITRUS TREE ROOTS TO SOIL ACIDIFICATION

Duplicate Sambani[1], *Tripti Vashisth*[2], *Davie Kadyampakeni*[1] *and Lorenzo Rossi*[3]

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Citrus tree roots are vital in nutrient uptake, water absorption, and overall plant health. Soil pH alters the availability and mobility of essential nutrients in the soil, thus influencing root physiological processes; like most plants, citrus trees are particularly vulnerable to changes in soil pH levels. The root apoplast is the plant component that first encounters changes in chemical conditions; hence, the conditions in the root apoplast determine a plant's response. This study aims to investigate the physiological responses of citrus tree roots to soil acidification, focusing on the impact of varying soil pH on root morphology, nutrient uptake, and overall root health. A controlled three-month greenhouse study was conducted at the Citrus Research and Education Center (CREC), hypothesizing that soil acidification will alter apoplast and phloem pH, reducing CLas population and root damage. This study was conducted utilizing citrus trees subjected to different soil pH levels. Forty trees were used and divided into four groups by pH treatment (n=10). These trees were irrigated three days a week with four different pH treatments, 5.5, 6.5, 7.5, and 8.5. Soil acidity and alkalinity were routinely monitored with pH probe sticks. Once soil pH stabilized, feeder root samples were taken for apoplastic and phloem pH experiments. The pH-sensitive fluorescent stains were used for microscopy and vacuum infiltration to collect apoplastic fluids. Parameters such as root length, root surface area, and root diameter were measured to assess the morphological changes in citrus tree roots under different pH treatments. The concentration of essential macro- and micronutrients from the soil, plant tissue, and leachates was also analyzed weekly to evaluate nutrient uptake efficiency. Preliminary results indicate that soil acidification increases feeder root density significantly. By ascribing the specific mechanisms underlying root responses, this research provides valuable insights into the adaptive capabilities of citrus trees. It informs future practices to preserve the health and productivity of citrus groves.

Abbreviation: *Candidatus* Liberibacter asiaticus =CLas

PRESENTER BIO: Duplicate is a dedicated and passionate graduate student in the Soil, Water, and Ecosystem Sciences Department. Currently pursuing a master's degree, she possesses a profound interest in the complex dynamics of soil and water systems. Duplicate aspires to contribute to the advancement of knowledge in this field and make a positive impact on the management and conservation of soil and water resources for future generations.

DURATIONAL PATTERN ANALYSIS OF EXTREME WATER LEVEL EVENTS TO UNDERSTAND COMPOUNDING COASTAL RISKS

***Md. Shamsudduha Sami**, Katherine A. Serafin*
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Coastal water levels are driven by a combination of processes such as tides, storm surges, mean sea level, and sea level anomalies. While understanding the magnitude of extreme events is often what's used to assess the severity of impact of an event, events that persist for a longer period of time also have the potential to cause severe damage. The spatio-temporal pattern in the duration and frequency of compound flooding events is thus crucial to understand for assessing impacts on coastal areas. The focus of this study is to evaluate the correlation between intensity and duration of extreme storm surge events across Florida and quantify how long-duration storm surges combine with other processes to elevate coastal water levels. To do this, measured water levels from National Oceanographic and Atmospheric Administration (NOAA) tide gauges across the Florida coastline are used to assess the spatio-temporal durational pattern of extreme storm surge events and their relation to event magnitude. The methodology uses a Peak Over Threshold (POT) approach to extract extreme storm surge events. Declustering techniques are employed to ensure that these events are independent. Subsequently, time-series analysis techniques are incorporated to evaluate the temporal duration of these events, aiming to uncover changes in duration over time as well as the correlation between extreme storm surge events and extreme coastal water levels across different locations. This multi-scale approach will offer new insights into how durational changes in extreme events may intensify impacts on coastal regions.

<u>PRESENTER BIO</u>: Md. Shamsudduha Sami is a Ph.D. student in the Department of Geography at the University of Florida. He works in "Climate Risk and Storm Hazards" lab under the supervision of Dr. Katherine (Katy) Serafin. His focus is on studying compounding events in the coastal regions using spatial and statistical modeling.

NITROGEN FORMS AND DISSOLVED ORGANIC MATTER OPTICAL PROPERTIES IN A SUBTROPICAL URBAN CATCHMENT

Mary G. Lusk[1], ***Paula Sanchez Garzon***[1], *and Amanda Muni-Morgan*[2]
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The study of nitrogen (N) transformation in urban ecosystems is crucial in the protection of coastal water bodies because excess N may fuel harmful algae blooms (HABs). The purpose of this investigation was to study and identify the forms and concentrations of N in rainfall, throughfall, and stormwater runoff for 4 storm events in a subtropical urban ecosystem and to use fluorescence spectroscopy to evaluate the optical properties and expected lability of dissolved organic matter (DOM) in the same samples. The rainfall contained both inorganic and organic N pools, and organic N as nearly 50 % of total dissolved N in the rainfall. As water moved through the urban water cycle, from rainfall to stormwater and from rainfall to throughfall, it was enriched in total dissolved N, with most of the enrichment coming from dissolved organic N. Throughfall fluxes of total dissolved N were as high as 0.67 kg ha^{-1} , compared to 0.44 kg ha^{-1} from rainfall, suggesting that the urban tree canopy can facilitate anthropogenic subsidies of N to the urban water cycle. Through analysis of sample optical properties, we saw that the throughfall presented the highest humification index and the lowest biological index when compared to rainfall, suggesting throughfall likely consists of higher molecular weight compounds of greater recalcitrance. This study highlights the importance of the dissolved organic N fraction of urban rainfall, stormwater, and throughfall and shows how the chemical composition of dissolved organic nutrients can change as rainfall is transformed into throughfall in the urban tree canopy.

PRESENTER BIO: Paula Sanchez Garzon is a graduate research assistant pursuing her Master’s degree in Soil, Water, and Ecosystem sciences in wetland studies. She has 2 years of experience researching water quality from nutrients and harmful algae blooms in stormwater ponds. She has a research publication on nitrogen transformation in urban ecosystems.

WISER LAWNS AND LANDSCAPE WORKSHOPS FOR NEW RESIDENTS LEAD TO WATER SAVINGS

L. Sanderson
Residential Horticulture Extension Agent, UF/IFAS Extension, Bushnell, FL, USA

Sumter County is located northeast of Tampa, west of Orlando, and encompasses 580 square miles which includes 33 square miles is surface water. Sumter County has a rapidly expanding population due to exponential growth of The Villages, a 55+ retirement community of 138,000 residents as of 2022 noted in thevillages.com. A significant number of residents moved to Florida, making it crucial to educate all individuals on sound environmental practices, particularly regarding the protection of water quality and quality. The Floridan Aquifer, responsible for providing approximately 90% of our drinking water, can become depleted and degraded when inefficient irrigation practices are used or when irresponsible fertilizer usage leads to pollution. Therefore, it is essential to implement programming efforts that emphasize the nine principles of Florida-Friendly Landscaping^{TM} (FFL) to address these concerns.

WISER Lawns and Landscapes Workshops for New Residents, offered twice monthly in person and once by webinar, introduce residents to environmentally sound landscaping practices leading to the protection of water quality and quantity through FFL. Residents responding to a follow-up survey after attending a WISER Lawns and Landscapes Workshop demonstrated change: For example, 28% (n=476) adjusted run times based on seasonal weather changes; 28% (n-476) checked for broken heads or leaks; 31% (n=117) reduced irrigating from three to two days per week; 25% (n= 208) set their irrigation on manual and water on an as needed basis; 15% (n=270) used a slow or controlled release fertilizer on landscape plants; and, 22% (n=389) minimize fertilization in the winter months . Changes in irrigation practices of residential horticulture program participants' survey results led to an estimated water savings of 34,408,481 gallons with an estimated savings of $118,709 based on $3.45 per 1,000 gallons.

WISER Lawns and Landscapes Workshops continues to educate residents to conserve water quality and quantity, protecting Florida's fragile waters.

PRESENTER BIO: Lisa Sanderson holds a Masters in Agricultural Education and a BS in Horticultural Science from NCSU. Lisa educates new residents on ways to conserve and protect water resources in Sumter County. She reaches clients through weekly newspaper articles, monthly training in person and by webinar, and other educational outreach.

MICROBIAL COMMUNITY COMPOSITION OF THREE SWEDISH FJORDS

Megan Sanford *[1], Robert J. Scharping [1], Emily Watts [2], Thomas S. Bianchi [2], Astrid Hylén [3], Per Hall [4], Elise Morrison [1]*

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Human activities have altered the carbon (C) cycle in the Anthropocene, and research to understand hotspots and drivers of organic carbon (OC) burial is increasingly urgent. Fjords, or high-latitude estuaries formed by glacial retreat, are hotspots of OC burial and can exhibit varying oxygen regimes due to differences in stratification and water residence time. Fjord sediments are important in the global C cycle, as they have the highest area-normalized OC burial rates compared to other ocean sediment types. Characterizing microbial community structures in fjord sediments can provide information about microbes' role in C cycling and biogeochemical processes. This study investigated three Swedish fjords of varying oxygen regimes— the By (anoxic), Gullmar (seasonally hypoxic), and Hake (oxic) fjords. Sediments were collected at the head, center, and mouth of each fjord from both oxic and anoxic sediment layers when present. DNA was extracted for 16S ribosomal RNA gene sequencing (Oxford Nanopore MinION). The relative abundance of each bacterial phylum and class was evaluated. The phylum Actinobacteriota was most abundant in the Gullmar head station (~26%), possibly due to greater terrestrial OC delivery at this site since members of this phylum can be important drivers of the breakdown of terrestrial OC. The Desulfobacteria class was more abundant in anoxic sediment layers (1.2-4.9%) when compared to aerobic sediments (0.3-3.6%), especially in the Hake and Gullmar fjord, and members of this class have been described as sulfate reducers in fjord sediments previously. The differences captured here will be coupled with further analyses to inform what microbial drivers of nutrient cycling and OC degradation exist in these ecosystems.

PRESENTER BIO: Megan received her B.S. in Biology and Wildlife Ecology and Conservation from UF. Her undergraduate research focused on investigating the microbial drivers of biogeochemical cycling in hotspots for organic carbon burial. In spring 2024, Megan will begin her PhD in the Engineering School of Sustainable Infrastructure and Environment at UF.

INTERNAL PHOSPHORUS LOADING FROM USJRB LAKES

***Tracey B Schafer*[1,2]**, *Ashley R. Smyth*[1,3], *Mark Brenner*[1], *K. Ramesh Reddy*[1], *Rex Ellis*[4], *Joshua Papacek*[4], *and Todd Z. Osborne*[1,2]

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[4]St. Johns River Water Management District, Palatka, FL, USA

Harmful algal blooms (HABs) are an environmental problem in aquatic ecosystems across Florida, including within the Upper St. Johns River Basin (USJRB). Although large amounts of the nutrients that fuel these blooms come from allochthonous sources, internal nutrient cycling within lake systems can also supply bioavailable nitrogen (N) and phosphorus (P). To evaluate the importance of this internal source, it is necessary to assess sediment biogeochemistry and the flux of nutrients from the sediments to the water column. We studied these characteristics in two lakes in the USJRB that experience HABs, Blue Cypress Lake and Lake Washington. We collected 10-cm-long, mud-water interface (MWI) cores for P-fractionation analysis and 80-cm-long MWI cores to generate depth profiles of total nutrients (C, N, P). Additionally, short MWI cores were used in a laboratory experiment that measured flux of dissolved N and P forms from benthic sediments to the overlying water column. This study yielded new information on how internal nutrient cycling affects primary production in two Florida lakes and provided insights into the importance of legacy nutrient loading.

<u>PRESENTER BIO</u>: Dr. Schafer is a research scientist at the University of Florida's Whitney Laboratory for Marine Biosciences located in St. Augustine, Fl. She conducts biogeochemical research on brackish and freshwater aquatic systems throughout the state of Florida.

LEVELING THE PLAYING FIELD: TAKING SOCIAL EQUITY INTO ACCOUNT IN ADAPTATION ALTERNATIVES

Angela Schedel
HDR Engineering, Inc. Jacksonville, FL, USA

Industry experts leading vulnerability assessments are experimenting with various methods to incorporate social equity in the prioritization of local mitigation strategies. Social equity, or environmental justice, is defined by the federal government as the "fair treatment and involvement of all people and communities—regardless of race, gender, national origin, or income level—in the development, implementation, and enforcement of environmental laws, regulations, and policies." Economists and policy makers have long debated the fairness of the federal standard for calculating benefit-cost analyses (BCA) for federally-funded infrastructure. With a focus on coastal resilience, engineering consultants are guiding local governments with the addition of a social equity element to supplement decision making for local flood mitigation and adaptation projects.

Policy guidance from the current administration directs that social equity be evaluated in federal agency assessments. For example, the Justice40 Initiative sets a goal that 40% of the benefits of federal investments should support disadvantaged communities. In 2022, FEMA published guidance permitting an alternative cost-effectiveness method for calculating BCA for Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA) grants. This experimental method used publicly available geospatial data, produced by the CDC's Social Vulnerability Index (SVI) to identify areas of social equity. Other federal social equity tools using Census data to determine pockets of increased vulnerability are the EPA's Environmental Justice mapping and screening tool, EJScreen, and CEQ's Climate and Economic Justice Screening Tool.

Adaptation strategies for reducing localized flooding in one of SFWMD's basins will be presented, as well as how social equity could be included in the evaluation and prioritization of potential projects. A preliminary analysis will show the benefits of linking today's needs with future planning via Dynamic Adaptive Policy Pathways. An alternative method of calculating BCA demonstrates possibilities for changing the way adaptation projects are evaluated.

PRESENTER BIO: Dr. Angela Schedel is the Director of Coastal Programs at HDR. A licensed Professional Engineer, she manages client development, proposal reviews, and project performance evaluations for coastal work. In this position, her main role is to strengthen and accelerate the firm's efforts in helping communities face coastal zone impacts.

DYNAMIC INTERACTIONS BETWEEN SUBMERGED AQUATIC VEGETATION AND FLOW IN FLORIDA SPRINGS

***Kathleen Schoenberger**, and David Kaplan*
University of Florida, Gainesville, FL, USA

Submerged aquatic vegetation (SAV) plays a critical role in aquatic systems. In lotic ecosystems, SAV provides habitat and resources to species by forming the energic base of the trophic pyramid, promoting sediment stability, and modifying hydrodynamics within the stream channel. However, the relationships between structural properties of SAV canopies (flexibility, height, blade morphologies) and their impacts on flow across different scales are not well understood. Given the foundational nature of SAV to aquatic communities, a better understanding of these relationships is necessary for improved natural resource management. Florida springs and spring-fed rivers support robust SAV canopies, making them ideal locations to study the dynamics of SAV and flow interactions. Additionally, Florida springs have seen a reduction of rooted SAV in recent years while algae have proliferated. We hypothesize that SAV canopy structural properties have a significant impact on hydrodynamics above and within SAV canopies and control algal establishment and abundance through canopy motion and blade-to-blade interactions. We plan to test our hypothesis using both observational and experimental approaches. In our observational approach, we will conduct multiple field campaigns to collect hydrodynamic data using in situ flow velocimeters and capture vegetation canopy movement using underwater video cameras. These field observations will be used to qualitatively validate a high-fidelity computational fluid dynamics model of SAV-fluid interactions. In our experimental approach, we will manipulate flow and alter SAV structure at the canopy and individual blade scales to quantify the impacts on canopy movement and blade-to-blade interactions. This approach will create a novel framework for modeling flow over SAV and advance our understanding of SAV behavior under different flow conditions with different blade properties. Based on 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.

<u>PRESENTER BIO</u>: Kathleen is a first-year master's student in the Interdisciplinary Ecology program and received her BS in Environmental Science from the University of Florida. She is a certified scientific diver with research experience studying biogeochemistry cycles in urban aquatic systems.

FLORIDA LAKEWATCH: 37 YEARS OF VOLUNTEERISM DRIVING RESEARCH OF FLORIDA'S AQUATIC RESOURCES

***Marina Schwartz**, Jason "Mo" Bennett, Dan Willis, Christine Horsburgh, Mark Hoyer, Gretchen L. Lescord*
LAKEWATCH, School of Forest, Fisheries, & Geomatics Sciences, University of Florida, Gainesville, FL, USA

Florida LAKEWATCH is one of the country's largest volunteer science programs. Since its inception in 1986, LAKEWATCH has monitored the monthly water quality of over 6000 sites across more than 2000 lakes, rivers, and coastlines around the state of Florida. All water samples were collected by our 1800 robustly trained and dedicated volunteers, some of whom have been a part of our program for 37 years. The resulting >437,000 data points have been shared with collaborating scientists from over 25 countries and used in over 60 peer-reviewed papers and 40 student theses. This talk will highlight the LAKEWATCH program's impact on our collective understanding of sub-tropical limnology through discussion of major research milestones. For example, we will highlight our past work on how: (1) geological and weather patterns influence lacustrine chemistry, (2) the abiotic environment alters bird and fish community structures, and (3) invasive plant management alters nutrient storage and cycling. Additionally, we will discuss the future research interests and objectives of the LAKEWATCH program as we transition to new leadership. This includes our plans for expanded laboratory capacity and enhanced data management and sharing protocols. Furthermore, we will present a new mission statement and discuss our future vision for the program. Moving forward, the Florida LAKEWATCH program will maintain its core focus on reporting of long-term trends of nutrient levels within the state's inland and coastal waters. Our data will continue to be shared with the Florida Department of Environmental Protection's Watershed Information Network, as well as with other water researchers, within the University of Florida community and beyond.

PRESENTER BIO: Marina Schwartz is the Database Manager at Florida LAKEWATCH. She works closely with LAKEWATCH staff in multiple aspects of limnological research and data management. Marina loves to travel and is always in pursuit of the perfect cup of coffee.

SHIFTING MACROPHYTES: THALASSIA AND CAULERPA SUPPORT UNIQUE ECOLOGICAL COMMUNITIES

***Adam R. Searles*[1,2,3]**, *Laura K. Reynolds*[1,2], *Charles W. Martin*[1,3,4]

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Macroalgae are replacing seagrasses in marine ecosystems across the globe. Macroalgae beds can support unique faunal assemblages compared to seagrasses and can therefore drive changes in community structure and ecological function as they increase in abundance. However, large changes in the relative abundance of marine macrophytes often occur as a result of anthropogenic impacts such as eutrophication and associated light limitation. These background environmental conditions often hamper attempts at isolating the effects of seagrass replacement by macroalgae on ecological communities. To understand how changes in macrophyte abundance may affect ecological communities, we sampled *Thalassia testudinum*, *Caulerpa prolifera*, and *Caulerpa paspaloides* monocultures as well as mixed habitats for benthic invertebrates and fishes in a low-nutrient and minimally-impacted system: Crystal Bay, Florida. Species composition and diversity differed significantly among habitats and sampling times. Temporal changes in species composition reflected seasonal shifts in macrophyte relative abundance. Differences among habitats and seasons were driven primarily by differences in the abundance of several numerically dominant species and, to a lesser extent, species turnover. The results of our sampling efforts suggest that seagrasses and macroalgae support complex, yet unique communities, in Floridian waters.

<u>PRESENTER BIO</u>: Adam R. Searles is a 4th year PhD Candidate in SNRE at UF. His research focuses on the ecological processes driving fauna community differences between seagrasses and macroalgae. His other research interests include global change biology and fisheries ecology.

EVALUATING THE IMPACTS OF FUTURE LAND USE AND CLIMATE CHANGE ON HIGHLY DEVELOPED COASTAL BASIN

Yvanna Serra
University of Florida, Gainesville, FL

The Peace River basin is located in southwest Florida and comprises 2334 mi2. The river begins in northern Polk County and flows 105 miles downstream to the Charlotte Harbor Estuary. The Peace River is an important source of water for domestic and agricultural supplies, as well as for regional ecology and recreation. The flow of water and nutrients from the Peace River into Charlotte Harbor directly affects the estuary's health. These watershed-scale changes could cause estuarine and marine water quality and ecosystem degradation . While phosphorus loads have declined in recent decades, nitrogen loads have increased. In the last 150 years, there have been substantial changes in the Peace River watershed, and there is concern and uncertainty over the ecological impacts of future development and climate change in the region. To explore alternative potential watershed futures, a hydrologic model of the Peace River basin was developed using the Soil and Water Assessment Tool (SWAT). SWAT uses information about watershed soils, topography, land use, and climate to calculate river flow, evapotranspiration, and nutrient flux, among other data. Topography was extracted from the USGS 30-m digital elevation model, soil data came from the USDA STATSGO database, and land use was compiled from the Florida Department of Environmental Protection, with cropping systems confirmed using the USDA CropScape database. Weather data was extracted from the North American Land Data Assimilation System. The Peace River SWAT model is currently being calibrated using measured flow, nutrient, and Evapotranspiration data along the main stem and multiple tributaries. Preliminary calibration shows results of NSE=0.61; R2=0.67 and validation of NSE=0.54; R2=0.64. Once completely calibrated, the model will be used to identify critical nutrient source areas and simulate the effects of future climate, land-use changes, best management practices in agricultural activities, as well as the potential impacts of reducing the number of septic tanks in the basin. Scenarios of interest are being developed with regional stakeholders, with a focus on understanding how alternative land use and climate change scenarios affect Peace River flows and nutrient fluxes and their ultimate effects on the Charlotte Harbor Estuary.

PRESENTER BIO: Yvanna Serra, a second-year master's student in environmental engineering, focuses on researching the Peace River. Her watershed model of the region addresses impacts of agricultural, mining, and urban activities. With a bachelor's in civil engineering from the Technological University of Panama, she conducted acclaimed research on wetland water balance.

COUPLED WATERSHED WATER QUALITY MODEL AS A DECISION SUPPORT TOOL FOR WATER RESOURCES PROTECTION

Shimelis Gebriye Setegn
Applies Science Bureau, Water Resources Division, South Florida Water Management District, West Palm Beach, FL, USA

This study introduces an integrated modeling system applied in coastal watersheds, focusing on utilizing hydrology and watershed models as decision support tools to implement alternative management strategies for water resources allocation, Minimum Flow Level (MFL) maintenance, and estuary ecosystem restoration.

The intricate interplay among climate change, sea level rise, and watershed hydrology and water quality presents significant challenges for managing water resources and protecting the environment. This study presents a comprehensive coupled watershed water quality model, designed as a decision support tool to assess the impacts of sea level rise scenarios and climate change on water quality in coastal watersheds. To address this information gap, we have developed a comprehensive watershed water quality model, WaSh. The WaSh model is a time-dependent, coupled hydrologic and hydraulic simulation model. It includes representation of basic surface hydrology, groundwater flow, surface water flow, and water quality fate and transport. The model is capable of simulating hydrology in watersheds with high groundwater tables and dense drainage canal networks, which is typical in South Florida.

The model integrates hydrological, hydraulic, and water quality components, enabling a holistic assessment of how shifting climate patterns and rising sea levels affect watershed hydrology and water quality. Additionally, the model helps identify vulnerable areas within the watershed that may face heightened water quality challenges due to sea level rise and changing climate conditions.

The study underscores the importance of incorporating advanced modeling techniques and integrating interdisciplinary data to improve the accuracy and applicability of watershed hydrology and water quality predictions in evolving environmental conditions. The results emphasize the potential of the coupled watershed water quality model as a valuable tool for adaptive water resources management, ensuring the resilience and sustainability of freshwater ecosystems amidst a changing climate and rising sea levels.

PRESENTER BIO: Dr. Shimelis Setegn holds a PhD in Land and Water Resources Engineering and MS & BS in Agricultural Engineering. He completed postdoctoral research in Earth & Environment. Dr. Setegn joined the SFWMD in April 2017 and currently serves as the Lead Scientist at the Applied Science Bureau. Prior to joining SFWMD, he was Assistant Professor and led geospatial modeling and water resources programs at the Department of Environmental Health Sciences & the Global Water for Sustainability Program at FIU

DO WE NEED SULFUR APPLICATION FOR POTATO IN NORTHEAST FLORIDA?

***Ayush K. Sharma*[1], *Simranpreet Kaur Sidhu*[1], *and Lincoln Zotarelli*[2], *Lakesh K Sharma*[1]**
[1]University of Florida, Soil, Water, and Ecosystem Sciences Department, IFAS, Gainesville, FL, USA
[2]University of Florida, Horticulture Sciences Department, IFAS, Gainesville, FL, USA

Sulfur (S) deficiency in agriculture has increased due to reduced atmospheric S deposition, risen application of pure fertilizers, and improved S withdrawal by crops attributable to increased yields. As S represents the fourth most pivotal nutrient for optimal development of crops, it plays a crucial role in amino acid and protein biosynthesis, simultaneous with its favorable impact on crop nitrogen assimilation. This investigation delves into the dynamic aspects of S application within the potato cultivation systems of northeast Florida, encompassing a series of various experiments executed at three distinct locations during the years 2021 and 2022. These trials were instituted to scrutinize the effects of S application to comprehend its interrelation with nitrogen, phosphorous, and the sources of the S. The findings of this investigation showed that the rate of S application did not impart a statistically notable influence on tuber yield, quality, and crop growth. Nevertheless, an unconventional pattern of S availability in the soil was delineated, wherein soil S concentration exhibited an early-season rise, followed by a subsequent mid-season decline, culminating in a resurgence at harvest time. This trajectory deviates from the anticipated consistent decline due to S uptake and leaching losses. The discovered trends across all experiments were ascribed to the heightened SO_4^{2-} concentrations in the irrigation water, sampled from five discrete wells at three distinct locations during the potato production season. Seawater incursion may partly account for the observed escalation in SO42- concentration within the irrigation water in this geographic area. Hence, it is imperative to factor in the nutrient concentration of irrigation water when formulating decisions pertaining to crop nutrient management strategies.

PRESENTER BIO: Ayush K. Sharma is a Ph.D. candidate in the Soil, Water, and Ecosystem Sciences Department, IFAS, University of Florida. I worked in the Northeast Florida tri-county region to develop the S application guidelines for potato-growing farmers. The learning experience of two years, 2021 and 2022, helped generate new knowledge in S dynamics.

FLORIDA AGRICULTURAL STAKEHOLDER ENGAGEMENT PROGRAM TO ENHANCE BEST MANAGEMENT PRACTICES

Vivek Sharma[1] and KevinAthearn[2]

[1]Agricultural and Biological Engineering Department, University of Florida, Florida, USA
[2]UF/IFAS North Florida Research & Education Center - Suwannee Valley, Florida, USA

The Florida Stakeholder Engagement Program (STEP) engages farmers and other agricultural stakeholders in friendly crop management competitions focused on water and nutrient efficiency and profitability. The purpose of this program is to engage stakeholders in shared experiences that will lead to improved crop management and adoption of agricultural best management practices (BMPs) that protect water quality while maintaining the farm profitability. Whereas traditional extension programs use presentations to disseminate information, this program creates active learning experiences for farmers, extension agents, researchers, policymakers, and industry representatives. It also allows participants to experiment with alternative management practices without incurring the costs or risks of doing so. In 2022, the Florida STEP program featured a corn management competition under the variable-rate, linear-move irrigation system at the University of Florida, North Florida Research and Education Center, Suwannee Valley. Each competing team was assigned four randomized plots and given control over several parameters, including corn hybrid variety, seeding rate, irrigation management, nitrogen management, insurance selection, and grain marketing. The teams competed for three awards: (i) most profitable, (ii) highest water-and-nutrient-use efficiency, and (iii) lowest cost per bushel. Participants especially liked the competition aspect, the risk-free environment to test different management strategies, and the ability to see how other teams chose to manage their corn crop. In the 2022 competition, ten teams with 27 members participated. The program also collaborated with 17 industry partners to provide the latest technology to the participating teams. In 2023, fifteen teams participated. Team members include more than 20 farmers, as well as extension agents, crop consultants, industry partners, and government agencies. The stakeholder engagement created by the Florida STEP is enhancing understanding of crop management and support progress toward the shared goals of protecting water quality and farm profitability. This presentation includes the results from 2022 and 2023 corn contest.

PRESENTER BIO: Dr. Vivek Sharma is an Assistant Professor in the Agricultural and Biological Engineering Department at the University of Florida. His research and extension program addresses the application and development of precision agricultural water management technologies and strategies to enhance water-use efficiency while reducing the impacts of agricultural management practices on water quality.

INTEGRATION OF SENSOR, IOT, AND MACHINE LEARNING (ML) IN PRECISION IRRIGATION AND NUTRIENT MANAGEMENT

Vivek Sharma

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

The world's agricultural and water resources enterprises have been facing formidable challenges of optimizing crop yields with reducing water inputs while minimizing environmental degradation. Adequate amount of crop yield to feed the rapidly growing population largely depends on the irrigated agriculture and fertilizer inputs. However, climate variability and water scarcity along with intensification of agricultural practices has resulted in a dramatic change in water and fertilizer inputs in agriculture sector around the world. Successful advancements in precision agriculture sensor technologies along with IoT and Machine learning in the last two decades have enabled the optimization of water and nitrogen application to manage spatial and temporal variabilities within agricultural fields. For example, the acquisition of real-time irrigation and nitrogen (N) nutritional status is of utmost importance for effective crop production. However, the current standard methods for reliable and accurate measurement are to collect leaf or soil samples and transport samples from field sites to laboratory for assessment and experimentation. Such an invasive approach does not allow timely measurements and prevents us from accurately characterizing and modeling processes occurring in plant and soils. Thus, there is a need for real-time in-situ information from agricultural fields through continuous sensing along with the development of IoT to automate the process. This presentation will focus on two independent studies (i) Integration of sensor technologies and IoT framework to automate the strawberry irrigation scheduling during plant establishment based on leaf, mulch, and air temperature, and (ii) to establish a machine learning (ML) technique for predicting the leaf nitrogen content (LNC) and crop yield of maize through the utilization of unmanned aerial vehicles (UAVs)-based imagery.

<u>PRESENTER BIO</u>: Dr. Vivek Sharma is an Assistant Professor in the Agricultural and Biological Engineering Department at the University of Florida. His research and extension program addresses the application and development of precision agricultural water management technologies and strategies to enhance water-use efficiency while reducing the impacts of agricultural management practices on water quality.

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MANGROVES PROVIDE SIGNIFICANT FLOOD PROTECTION SERVICE IN A CHANGING CLIMATE

Y. Peter Sheng *and Vladimir A. Paramygin*
Civil and Coastal Engineering Department, University of Florida, Gainesville, FL, USA

Mangroves are known to provide useful ecosystem services including biodiversity, fishery habitat, carbon sequestration, and shoreline stabilization. While a few recent studies have suggested that mangroves can provide flood protection for coastal communities, their results contain large uncertainties due to the lack of consideration of the pertinent physical and biogeochemical processes and the lack of validation of their methods and results. This study, funded by the NOAA National Centers of Coastal and Ocean Sciences, used the best available climate, coastal, ecological, and economic models and data to assess the value of mangroves for reducing coastal flood and flood loss of structures in southwest Florida where the largest mangrove forest of the Gulf of Mexico region resides.

A robust coastal surge-wave model CH3D-SWAN, which resolves the horizontal distribution and vertical structure of the mangrove forests, was used to simulate the coastal inundation during recent hurricanes including Irma in 2017 and Ian in 2023. The flood-induced loss of structures was estimated with the best loss model developed by FEMA and USACE, with and without the mangroves. The simulated coastal inundation values were found to compare well with over one hundred data points. The simulated losses were then compared to the FEMA NFIP loss payout data to ensure reliability of the flood loss estimation. It was determined that during Hurricane Irma, mangroves helped the communities to avoid 20% of the observed loss (~$65M) in Collier County, Florida. During Ian, which is a much stronger hurricane with very rapid intensification, mangroves helped to avoid 15% of the observed loss (~$2B) in Collier County.

Simulations have shown that the mangroves in southwest Florida will continue to provide valuable flood protection service even by 2100. These findings can help communities to develop mangrove protection and restoration plans.

PRESENTER BIO: Dr. Sheng is Emeritus and Adjunct Research Professor. He has extensive experience in coastal, estuarine, atmospheric processes and modeling. Since 2006, he has focused on the impact of climate change on coastal flooding and ecological processes. He led numerous projects on the role of coastal wetlands for flood protection.

ABIOTIC CONTROLS OF METABOLIC REGIMES IN GREENLAND STREAMS

***Yuseung Shin*[1]**, *Sam Howley*[1], *Hugo Enrique Aldana-Reyes*[2], *Jonathan B. Martin*[3], *Matthew J. Cohen*[4]

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[4]School of Forest, Fisheries, and Geomatics Sciences, University of Florida, Gainesville, FL, USA

The Arctic is experiencing the most rapid climate change on the globe. How these changes impact stream metabolism has important implications for local and downstream (e.g., coastal oceans, fjord) carbon and nutrient cycles (e.g., CO2 emission, nutrient export to the ocean). However, despite recent expansion of stream ecosystem metabolism data in temperate and tropical regions, continuous records of stream metabolism are not widely available in the Arctic. To better understand metabolic regimes of Arctic streams, we measured ecosystem metabolism—gross primary production (GPP) and ecosystem respiration (ER)—in 4 southwestern Greenland streams during summer for two years (2022-23). Two streams were near the ice sheet and two were near the coast. We used GPP and ER to calculate net ecosystem production (NEP; the balance between GPP and ER) and examined the relationship between stream metabolism and abiotic factors (light, temperature, flow). We found that all streams exhibited negative NEP, implying that these Greenland streams are heterotrophic and thus carbon sources to the atmosphere. Relationships between metabolism and abiotic factors were not consistent in coastal streams potentially due to dynamic light and flow regimes resulting from changing weather conditions. At inland streams, where weather was more consistent, light was not correlated with GPP but both GPP and ER had strong positive linear correlation with temperature. ER varied more with temperature than GPP, and thus higher temperatures generated increasingly negative NEP. This result suggests that temperature can be the primary driving force of stream metabolism for inland Arctic watersheds, implying rapid warming in the Arctic can cause an outsized impact on in-stream carbon cycling.

<u>PRESENTER BIO</u>: Yuseung Shin is a PhD candidate studying river ecosystems. He received a master's degree in biogeochemistry studying carbon dynamics between streams and soils. His current works focus on temporal patterns and controls of ecosystem-level photosynthesis and respiration in flowing waters by data analysis and field work in Greenland.

RETHINKING WATER SUPPLY STRATEGIES FOR A RESILIENT FUTURE

Ann B. Shortelle
Bio-Tech Consulting Inc. Orlando, FL, USA

Water supply is carefully planned, permitted, and managed throughout Florida to ensure all water users can rely on their supplies over the terms of their permit, and to allow for growth, while protecting water resources. For water allocations to be permitted, the applicant demonstrates that the need is reasonable, and that the use will not adversely affect permitted water users or water resources. Monitoring data and modeling results help to inform decision-making to ensure success. Currently, however, challenges loom related to rising sea levels and intensifying storms, increased flooding or drought, and other challenges related to climate change and growth in Florida. Incorporating these elements into current and future projects to mitigate these effects, and updating water policy to guide water use planning and permitting into the future is necessary. Issues for consideration include, but are not limited to, risk of saltwater intrusion on groundwater and surface water supplies, challenges and opportunities for various source waters, including alternative water supplies, water storage challenges including aquifer recharge, updating of regional water supply plans and water resource protections (and the associated data and models) to account for changing conditions, and updating of associated consumptive use permitting rules and policies. This presentation will focus on resilient strategies and challenges based upon the current scientific understanding of Florida's water supply vulnerabilities.

PRESENTER BIO: Dr. Shortelle is a limnologist with over 30 years of experience managing water resources, and innovative solutions for water policy and restoration projects throughout Florida. She led the FDEP Office of Water Policy and two water management districts for over ten years before recently returning to the private sector.

WATER LEVEL CONTROLS ON WETLAND NET PRIMARY PRODUCTIVITY ACROSS COASTAL PLAIN WETLANDSCAPE

Sunita Shrestha*, Esther Lee, Katie Glodzik and Matthew J. Cohen*
School of Forest, Fisheries and Geomatics Sciences, University of Florida, Gainesville, FL, USA

Hydrologic conditions exert a dominant control on the productivity of wetlands. However, the shape of these relationships remains poorly quantified, particularly with respect to the subsidy vs. stress thresholds of prolonged inundation. This study assesses the relationship between wetland hydrologic regime and primary productivity of wetlands. We assessed how hydrological factors, such as water depth, hydrologic state (dry, inundated, and connected), and the shifting terrestrial aquatic interface, influence net primary productivity across the wetlandscapes of Bradford Experimental Forest and Ordway-Swisher Biological Station. Continuous water level time series data from over 60 wetlands over the last 3 years are used to obtain probabilistic descriptions of the time-varying extent of water depth and inundation, the shifting terrestrial aquatic interface geometry, and the episodic connectivity of these depressional landscape features. We link these hydrological data to time series of net primary productivity, extracted using normalized difference vegetation index (NDVI) and leaf area index (LAI) from satellite images. From these time series, we quantify the spatial and temporal patterns in net primary productivity across different hydrological regimes and explore the local and hydrological controls on wetland net primary productivity across coastal plain wetlandscapes.

PRESENTER BIO: Mrs. Sunita Shrestha is a PhD student in School of Forest, Fisheries and Geomatics Sciences at University of Florida, USA. She did her M.Sc. in Environmental Science from Central Department of Environmental Science, Tribhuvan University, Nepal. Her research interest is in water ecology and its conservation.

OPTIMIZING CORN YIELD AND WATER QUALITY: A CERES-MAIZE MODEL ANALYSIS OF CONTROLLED-RELEASE FERTILIZERS (CRF)

***Rakesh Singh**, Morgan Morrow, Uday Bhanu Prakash Vaddevolu, Vivek Sharma*
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In sandy-soil terrains, such as North Florida's Suwannee Valley, the nexus between nitrogen dynamics and water quality preservation is of paramount significance. Amidst rising environmental concerns about nitrogen pollution, it is imperative to adopt sustainable nitrogen management paradigms. Controlled-release fertilizers (CRFs) stand out as an innovative strategy, promising both agronomic efficiency and environmental protection. Utilizing the CERES-Maize model within the DSSAT framework, this study systematically examined the influence of varied CRF application rates on corn yield, while concurrently evaluating the consequent nitrogen leaching patterns at the North Florida Research and Education Center - Suwannee Valley.

The model, precisely calibrated through the generalized likelihood uncertainty estimation methodology (GLUE), was optimized to closely emulate the agricultural characteristics intrinsic to the Suwannee Valley ecosystem. A rigorous evaluation matrix, encompassing metrics such as RMSE, r-square, and a comparative analysis of simulated versus observed datasets, authenticated the model's accuracy and reliability.

Preliminary findings elucidated the pronounced positive impact of CRFs on corn yield. Specifically, with nitrogen inputs escalating from 168 kg N/ha to 336 kg N/ha, there was a corresponding augmentation in yield, spanning 11290 kg/ha to 14606 kg/ha. Furthermore, the CERES-Maize model proficiently simulated the nuanced interrelation between Leaf Area Index (LAI), yield, and biomass across varying CRF gradients. Of critical note was the discerned trend of amplified nitrogen leaching with increasing CRF concentrations. The conventional fertilizer benchmark further reinforced this observation, indicating comparable nitrogen leaching trajectories with certain CRF rates, thereby emphasizing the critical equilibrium between yield optimization and sustainable environmental practices.

In synthesis, this research accentuates the dual efficacy of CRFs in bolstering corn yield while emphasizing the imperative of judicious application rates to safeguard water quality. Through the meticulously simulated and calibrated CERES-Maize model in DSSAT, the study unveils the intricate dynamics of CRFs, solidifying their pivotal role in sculpting a sustainable and productive agricultural trajectory for sandy soil.

PRESENTER BIO: Rakesh Singh is a Ph.D. student in the Precision Water Management Lab at the Department of Agricultural Engineering, UF/IFAS, University of Florida. Under the guidance of Dr. Vivek Sharma, Rakesh employs DSSAT crop modeling and statistical techniques to fine-tune nitrogen management. His primary focus is to enhance yield and water quality in corn cultivated under a sprinkler irrigation system, aligning with the principles of the 4R Nutrient Stewardship.

BUILDING ADAPTIVE FOUNDATIONAL RESILIENCE FOR COASTAL WETLANDS: A POTENTIAL EVERGLADES EXPERIMENT

Fred H. Sklar[1]*, Carlos Coronado-Molina*[1]*, Tiffany Troxler*[2]*, Michael Brown*[1] *and Walter Wilcox*[1]
[1]South Florida Water Management District, West Palm Beach, FL, USA
[2]Southeast Environmental research Center, Florida International University, Miami, FL, USA

Sea level rise (SLR) is expected to affect natural and urban areas by shifting habitats and inundating coastal developments in South Florida. Given this challenge of SLR, building resiliency within South Florida's natural communities is imperative, not only to protect the natural habitat where fish and wildlife species thrive, but also as a means of reducing risk to the built environment from coastal storm hazards and saltwater intrusion. For coastal wetlands to exist into the future, soil accretion must match or outpace SLR. Adaptive Foundational Resilience (AFR) is the ability of the foundational vegetation (freshwater marshes and mangroves) to adapt to sea level rise by building elevation as a function of water depth and hydroperiod, porewater salinity, water quality and flow. It is based upon some 20 years of understanding the process of peat collapse, subsidence and coastal accretion. Here we describe the use of the AFR as an evaluation of coastal resilience in the face of SLR and as a function of water management and wetland restoration plans. Also, as the goal of an "active adaptive management" experiment and as an implementation of AFR, an Everglades Mangrove Mitigation Assessment (EMMA) program has been designed, but not yet funded, to enhance scrub mangrove productivity and transgression into fresh and brackish marsh habitats as an adaptive mechanism for SLR. The EMMA project is field manipulation of freshwater flow, phosphorus addition, and sediment increase to enhance the resilience of coastal mangroves, increase land elevations, and evaluate the ability of coastal plant communities to shift to communities that are resilient to sea level rise. This scientific experiment will primarily evaluate the ability of Thin Layer Placement (TLP), an innovative nature-based management measure that spreads "clean" dredge/spoil sediments across a scrub mangrove community, to enhance net primary productivity and increase sediment accretion rates within coastal wetlands.

PRESENTER BIO: Dr. Sklar is Director of the Everglades Systems Assessment Section of the SFWMD, has over 100 scientific publications associated with wetland and coastal ecology, and has over 30 years' experience planning, designing, and monitoring Everglades restoration projects.

BUILDING A BETTER BASIN MANAGEMENT ACTION PLAN FOR THE SANTA FE RIVER

Ryan Smart *and Bob Palmer*
Florida Springs Council, Gainesville, FL, USA

Senate Bill 552, passed in 2016, requires the Florida Department of Environmental Protection (FDEP) to assess water quality in 30 Outstanding Florida Springs (OFS) and adopt a Basin Management Action Plan (BMAP) capable of achieving water quality goals within 20 years for each impaired OFS.

Three OFS systems within the Santa Fe River and Ichetucknee River Basin were determined to be impaired by excessive nitrate pollution, requiring FDEP to draft and adopt a BMAP capable of reducing nitrate loading by about two-thirds in these springsheds by 2038. To achieve water quality goals in the Santa Fe would require significant reductions in agricultural pollution, which accounts for approximately 70% of nitrate loading within the Basin.

FDEP's Santa Fe BMAP, however, relied on the same agricultural best management practices that have been shown to have no benefit to water quality in the Santa Fe basin. As a result, the Santa Fe BMAP only proposed approximately one-quarter of the nitrate reductions necessary to achieve water quality standards. Additionally, and incredibly, the BMAP predicted no increase in pollution from development or agriculture over the next 20 years. Because the Santa Fe BMAP did not meet the minimum requirements of Florida Statute, it was challenged by two non-profit organizations and two individuals. Those petitioners prevailed in the 1st District Court of Appeals which overturned the Santa Fe BMAP in 2023.

In order to demonstrate that creating a credible plan for achieving water quality goals is possible, the Florida Springs Council created a "Better BMAP for the Santa Fe River." This presentation highlights the shortcomings of FDEP's proposed BMAP and the findings and recommendations of our "Better BMAP", including ways to reduce agricultural, urban fertilizer, and wastewater pollution within the Santa Fe Basin to achieve state water quality goals while addressing future growth in nitrate pollution.

PRESENTER BIO: Ryan Smart is the executive director of the Florida Springs Council and president of Three Rivers Trust. Bob Palmer is the treasurer of the Florida Springs Council. He was formerly staff director of the U.S. House Committee on Science, Space, and Technology.

THE ROLE OF MFLS IN CONSERVING AND PROTECTING WATER RESOURCES IN SOUTHEAST FLORIDA

Karin A. Smith
South Florida Water Management District, West Palm Beach, FL, USA

In populous southeast Florida, the primary source of fresh groundwater for human needs is the Surficial Aquifer System. Consequently, protecting the groundwater from saltwater intrusion is vital. The low-lying southeast coast is particularly susceptible to lateral saltwater intrusion due to multiple factors, including rising sea levels. Fresh water, in canals within the southeast Florida region, supplies recharge to the Biscayne aquifer to help maintain preventative groundwater levels. Slowing the inland movement of the saltwater interface results in a more resilient system.

To ensure the sustainability of water resources in Florida, water management districts are provided with several tools, including water use permits and Minimum Flows and Minimum Water Levels (MFLs). MFL criteria are flows or levels at which the water resources or the ecology of the area would experience significant harm (water resource functions require more than 2 years to recover) from further ground water or surface water withdrawals. There are three MFLs – Biscayne Aquifer, Lake Okeechobee, Everglades – that are linked by their contribution to protecting the Biscayne aquifer via canals from saltwater intrusion.

Based on the existing flow or level in a water body, the SFWMD implements a MFL recovery or prevention strategy to protect the long-term viability. MFL Recovery and Prevention strategies can include capital projects, regulatory measures, water shortage measures, environmental projects, and other research and monitoring. The data collected for the Biscayne Aquifer MFL is tracked as part of the overall Water and Climate Metrics program at the South Florida Water Management District (SFWMD) to monitor potential impacts as sea levels and climate conditions evolve.

The SFWMD is also conducting a Water Supply Vulnerability Assessment (WSVA) to understand how future development and climate conditions impact our regional water supply. This allows for development of targeted adaption and mitigation strategies to increase resilience of the Biscayne aquifer.

PRESENTER BIO: Karin Smith is a Professional Geologist with over 30 years of experience in water use regulation, hydrogeologic research, groundwater modeling and water supply planning. As a Water Supply Resiliency project manager at SFWMD, she formulates resilient solutions to sea level rise and climate impacts on water supply resources.

WORKING WATERFRONTS WORKING FOR YOU: USING SHELLFISH AQUACULTURE FOR WATER QUALITY RESTORATION

***Ashley R. Smyth*[1]**, *Gabrielle Foursa*[1], *Angela Collins*[2] *and Leslie Sturmer*[3]
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[3]University of Florida, Nature Coast Biological Station, Cedar Key, FL USA

Anthropogenic impacts on ecosystems, especially habitat loss and impaired water quality, continue to warrant restoration efforts in estuaries worldwide. Restoration of certain species can improve estuarine health and mediate negative impacts by improving water quality and providing other ecosystem services. Many coastal states are interested in incorporating shellfish (clams and oysters) aquaculture into water quality restoration plans because there is compelling evidence that shellfish can reduce and remove nitrogen (N). Shellfish can serve as N removal 'hotspots' by transferring nutrients in phytoplankton to sediments, resulting in denitrification, the microbial-mediated conversion of harmful nitrogen to harmless nitrogen gas. Florida recently approved restoration leases, where shellfish can be planted exclusively to support ecosystem restoration, including water quality improvement. Yet, data on denitrification from Florida shellfish are noticeably lacking, despite Florida ranking 5th in the nation for bivalve shellfish aquaculture and where many estuaries suffer from N pollution. We conducted sediment sampling at commercial-scale oyster (*Crassostrea virginica)* and clam (*Mercinaria mercinaria)* aquaculture farms in the Big Bend and Tampa Bay regions to determine how differences in species, locations, and husbandry practices influence the effectiveness of shellfish aquaculture at removing nitrogen. We compared sediments from shellfish farms to control sediments without aquaculture influence to determine the net effect of shellfish aquaculture on sediment N cycling. Oysters and clams increased denitrification in Tampa Bay but did not affect denitrification in the Big Bend. The effect of shellfish on denitrification is likely due to increased organic carbon load to the sediments from shellfish biodeposition, but since control sites and shellfish sites had similar organic matter content in the Big Bend, the effect was muted. Our results highlight the importance of shellfish in coastal N cycling but suggest that site-specific environmental conditions should be considered when developing guidelines for using shellfish aquaculture for water quality restoration.

PRESENTER BIO: Dr. Smyth is an Assistant Professor in the Soil, Water, and Ecosystem Sciences Department located at the Tropical Research and Education Center. She is a biogeochemist, studying how human activities impact the transformations and fate of nutrients in coastal ecosystems.

ISLAND-WIDE FLOOD HAZARD RISK MAPPING AND ASSESSMENTS IN GRAND BAHAMA

***Sangdon So**, Steve Peene, and Nicolas Pisarello*
Applied Technology and Management, A Geosyntec Company, Gainesville, FL, USA

Grand Bahama is characterized by numerous low-lying and coastal areas that are highly vulnerable to various forms of flooding, including storm surges, heavy rainfall, and tidal inundation. Situated within the Atlantic hurricane belt, Grand Bahama is particularly susceptible to tropical storms and hurricanes during the Atlantic hurricane season. These meteorological events, marked by intense rainfall, formidable winds, and storm surges, contribute to extensive flooding and consequential property damage. To comprehensively assess the existing coastal flood hazard risks and evaluate the potential impacts of a proposed concept, Applied Technology and Management (ATM), a Geosyntec Company, conducted island-wide mapping efforts focused on coastal storm surge and wave risks.

The methodology involved numerical modelling of historical and theoretical storm events, statistical analyses, analytical wave estimates, and mapping techniques. The ADvanced CIRCulation (ADCIRC) hydrodynamic model simulated storm surges using hurricane wind and pressure fields derived from the Holland parametric model. These fields were calculated using input data, including the storm track and characteristics obtained from the National Hurricane Center database. Subsequent analysis utilized an extreme value analysis (EVA) statistical technique to determine the frequency relationships, specifically for 25-, 50- and 100-year return period surge values. The impact of waves was considered using simplified analytical methods based on depth-limited wave breaking and the depth of storm surge at specific locations. The resulting storm wave heights, atop the storm surge, were integrated to produce the final flood elevation results. The generated flood data was transformed into raster layers for use in Geographical Information System (GIS). This comprehensive approach enhances the understanding of coastal flood hazards and provides crucial insights for informed decision-making and mitigation strategies.

PRESENTER BIO: Dr. So is a water resources and coastal engineer at Applied Technology and Management, a Geosyntec company. He possesses extensive experience in statistical and time-series analysis, field data collection, as well as expertise in storm surge, sediment transport, flood inundation, marina flushing, and water quality modeling.

WHAT DOES IT MEAN TO BE A SOCIALLY RESPONSBILE WATER SCIENTIST?

Gabriel Spandau, *Sadie Hundemer, Jamie Loizzo, Samuel J. Smidt, Alice Akers, Jehangir H. Bhadha, and Young Gu Her*

University of Florida, Gainesville, FL, USA

Scientists have many perceived responsibilities including communicating their research in a way that is understandable to the public, considering the benefits and harms their research could have on society, participating in government policy deliberations, and mitigating bias. Effectively engaging these responsibilities requires communication and ethical decision-making skills that are beyond typical scientific training. We created a documentary film and hosted a watch party to prompt thinking among early career scientists about how they should engage these obligations. The film examined the ethical decisions made by University of Florida researchers on a study of agricultural management practices in the Everglades Agricultural Area (EAA). After viewing the film, early career scientists discussed their views on social responsibility and communicating science for public impact. In this session, we will share the perspectives of early career scientists and provide recommendations for helping scientists negotiate responsibilities that may not be examined in their graduate curriculum.

PRESENTER BIO: Gabriel Spandau is a doctoral student in agricultural communication with a focus on cannabis. He received his bachelor's degree from the University of Florida in Agricultural Education and Communication and received a master's degree from the University of Maryland in Medical Cannabis Sciences and Therapeutics.

CONSTRUCTED WETLAND PERFORMANCE: TRENDS OF P REMOVAL IN THE EVERGLADES STORMWATER TREATMENT AREAS

***Zoe A. Spielman**[1], Praveen Subedi[1], Jacob Dombrowski[2], and Patrick W. Inglett[1]*

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[2]South Florida Water Management District, West Palm Beach, FL USA

Constructed wetlands (CWs) are being implemented worldwide to reduce excess phosphorus (P) from agricultural and urban runoff. Many biogeochemical processes affect P removal and storage within a CW. Currently, it is unknown if the P removal rates of CWs will change based on certain parameters (e.g., P loading rates, seasonality, size, age, vegetation stress). This study assesses P removal patterns by calculating P loading, removal, and retention rates for six CWs (Everglades Stormwater Treatment Areas: STA-1E EFW, STA-1E CFW, STA-2 FW3, STA-2 FW4, STA-3/4 CFW, and STA-5/6 FW1) from the start of CW operation to April 2023 (15-25 years). In WY2023 (May 1st, 2022 to April 30th, 2023), the CWs retained 56-92% of P loads, with STA-5/6 FW1 (25 years old) having the highest percent reduction and STA-2 FW3 (22 years old) having the lowest percent reduction. Declines in CW P removal were evident in years where disturbances occurred (e.g., large-scale vegetation declines, soil dry out). Additionally, variability in P removal between years has declined over time. Results from this study suggest that reducing large scale disturbances to CWs may produce more stable P removal rates and can be used to make recommendations for maintenance or improvement of CWs to maximize their nutrient removal rates and improve overall water quality.

<u>PRESENTER BIO</u>: Zoe is a master's student majoring in Soil, Water, and Ecosystem Sciences at UF. Her master's thesis focuses on P removal efficiency and storage patterns within the Everglades Stormwater Treatment Areas. She also conducted undergraduate research looking at the impacts of land cover change on Florida streamflow.

THE GREAT FLORIDA RIVERWAY: HOW ECONOMICS, RECREATION AND SOCIAL MARKETING SHIFTED PUBLIC OPINION

Margaret Hankinson Spontak
President, Great Florida Riverway Trust, Ocala, FL, USA

Ever since the Rodman Kirkpatrick Dam was built in 1968, part of the failed Cross Florida Barge Canal, conservationists have worked to remove the dam and restore the Ocklawaha River. The canal project was halted in 1971 by President Nixon due to the leadership and work of Marjorie Harris Carr, founder of Florida Defenders of the Environment, and other conservation organizations. It blocked fish and wildlife migration from the Atlantic Ocean to Silver Springs, destroyed 7,500 acres of forested wetlands, inundated 20 springs, and continues to damage Silver Springs and the Ocklawaha and St. Johns Rivers. A coalition of sixty conservation, user groups and small businesses, formed in fall of 2019, has helped dramatically shift public awareness and support for restoration of this Great Florida Riverway, an internationally significant 217-mile system involving four ecosystems.

Using documented economic and environmental benefits, integrating outdoor recreation opportunities, broadening the constituency of support, toning down the rhetoric, and deploying social marketing strategies has helped change public opinion particularly in Putnam and Marion counties. This shift is evidenced by scientific polls of active voters in Putnam and Marion Counties by Barcelo & Company and a St. Johns River Water Management survey with almost 10,000 responses from across that state and nation. Florida TaxWatch has also endorsed the project in a briefing paper entitled *A River (No Longer) Runs Through It*, 2020.

Subject matter experts from universities, state agencies (retired employees), national conservation organizations, and private consulting groups have contributed data and analysis to assure coalition strategies and messaging are accurate and well documented. The work of IFAS economist emeritus Alan Hodges, PhD, *Economic Benefits of Ocklawaha River Restoration*, 2020, and *Economic Importance and Public Preferences for Water Resource Management of the Ocklawaha River*, 2017, authored with Tatiana Borisova, PhD, Xiang Bi, PhD, Alan Hodges, PhD and Stephen Holland, PhD provided much of the data on the economic benefits of a restored Ocklawaha River. Dr. Tom Hoctor's foundational work on the Florida Ecological Greenway Network and innovative new student design concepts for recreation along the riverway opened doors and discussions in unique and successful ways. Teachings and workshops of Cynthia Barnett, Ann Christiano and Annie Neimand from University of Florida informed communication advocates on how to use effective messaging and outreach approaches to bring citizens closer together on an issue that has been contentious for more than fifty years.

Strategies and tools used by the coalition include deploying online focus groups, integration of recreation concepts in public settings, using change management techniques, and making the economics and science understandable and embraceable over social, print media and key leader presentations. This session explores successful strategies and additional work needed in the areas of science, economics, recreation, marketing and community engagement to bring America's next great restoration project to fruition.

PRESENTER BIO: Margaret Hankinson Spontak is president of the Great Florida Riverway Trust. Her related career experiences include director of development Audubon Florida, director of policy and planning SJRWMD, assistant director UF Leadership Institute, executive director for corporate and continuing education Central Florida College, and stakeholder philanthropy manager Duke Energy Foundation.

INCLUDING HYDROECOLOGIC CONNECTIONS AT THE LAND-SEA INTERFACE IN CONSERVATION OF SPORTFISH HABITAT

Philip Stevens[1]*, Courtney Saari*[1]*, David Blewett*[2]*, and Corey Anderson*[3]

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Throughout much of Florida, coastal wetlands include tidal creeks, many of which have headwaters comprised of coastal ponds, that are the primary habitat used by juvenile Common Snook and Tarpon, two iconic sport fishes. Research has shown that successful emigration of these species from nursery habitat to the open estuary hinges on hydroecologic connections in the landscape. As fisheries management evolves to include habitat and ecosystem function, we are seeking partnerships with managers that govern at finer spatial scales to conserve or restore these connections. In southwest Florida, county government is part of a collaboration to characterize the locations and physical attributes of fish nursery habitats (e.g., elevations, frequencies of tidal inundation, landscape resistance). One of the goals is to integrate sportfish habitat into county GIS used in land-use planning and stormwater engineering to influence local decision-making. Workshops supported by NOAA RESTORE Science Program were held to plan actionable science using a facilitated co-production process that aimed to bridge gaps between science and policy. The findings were incorporated into a research plan that will be implemented over the next five years. The development of highly site-specific information will allow targeted actions that encourage sustainability of coastal wetlands and supporting fisheries.

PRESENTER BIO: Philip Stevens is a Research Scientist that oversees FWC's Fish Biology group at the Fish and Wildlife Research Institute. Dr. Stevens received his PhD from the systems ecology program at the University of Florida. His background is in marine fish ecology, coastal restoration, and movements of aquatic animals.

THE PAST 10 YEARS OF WATER QUALITY RESEARCH ON THE INDIAN RIVER LAGOON: AN ONGOING REVIEW

***Zoë J. Stroobosscher**, Sandra M. Guzmán*

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

The Indian River Lagoon (IRL) is a subtropical estuary situated along south Florida's Atlantic coast. Scientific literature on the lagoon has been published since the early 20th century, but research concerning the health of the lagoon has increased as the ecosystem reaches what scientists are referring to as a 'potential crash' because of Harmful Algal Blooms caused by poor water quality. The goal of this study is to provide a state-of-the-art review on the most recent 10 years of published research about the IRL's water quality challenges. The review focused on analyzing metrics related to discipline and field of the study, major outputs or scientific contributions, pollutant source from point or non-point sources, and who overall has been contributors in the last two decades of IRL focused published research. These metrics were collected from peer-reviewed documentation with the keywords 'Indian River Lagoon', 'Water Quality', and 'Harmful Algal Blooms' collected from Google Scholar and Scopus between the years 2013 and 2023. Expected outcomes from this review will identify which areas of study might have been overlooked, highlight major scientific progress, provide insight into who the research stakeholders are in each field, and open a discussion on where efforts could be more focused in future research to improve efficiency in combating the water quality challenges. It will also serve as a resource to stakeholders interested in specific challenges regarding the IRL by informing them of the past and ongoing research contributors working in those areas.

PRESENTER BIO: Zoë Stroobosscher is a master's student in interdisciplinary Ecology with the School of Natural Resources and Environment at the University of Florida. Her master research program is also part of the Science and Technologies for Phosphorous Sustainability (STEPS) NSF Science and Technology Center.

BIOAVAILABILITY OF DISSOLVED ORGANIC PHOSPHORUS VARIES WITH VEGETATION TYPES IN THE EVERGLADES STORMWATER TREATMENT AREAS

Praveen Subedi[1], *Patrick W. Inglett*[1], *Julie Meyer*[1], *Elise Morrison*[2], *Joao Fernandes Amaral*[2], *Jake Dombrowski*[3], *Susan Newman*[3]

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The bioavailability of dissolved organic phosphorus (DOP) is important for understanding P recycling and retention in the Everglades Stormwater Treatment Areas (STAs), wetlands constructed to remove P in runoff prior to discharge to the Everglades. Currently, the extent and rates of microbial processes transforming DOP in these systems is poorly understood, especially with regard to vegetation types. Here, we compared microbial growth, respiration, and fractions of enzymatically hydrolysable DOP (<0.45 µm) in leachates from floc and litter of emergent aquatic (EAV) and submerged aquatic vegetation (SAV) collected from an in-situ litterbag decomposition study. Results show that DOP bioavailability differed among leachates from 20-day field-incubated materials. Alkaline phosphatase and phosphodiester hydrolysable P (% of total dissolved P) were respectively 4.8 and 13.5 in EAV floc, 0 and 9.1 in EAV litter, 2.6 and 19.5 in SAV floc, and 3.3 and 6.3% in SAV litter leachates. Interestingly, leachates from EAV floc and litter did not have measurable phytase hydrolysable P, whereas SAV floc and litter leachates had about 17 and 23% of TDP hydrolysable by phytase. Results further suggested that net phytase hydrolyzed SRP for EAV floc and litter tended to increase between day 0 and day 20 leachates. Microbial cell counts were significantly higher for the SAV sources than EAV sources (6.9×10^4 vs. 5.6×10^4/mL) after 3-week incubation. Specific respiration rates were higher for EAV sources than SAV sources. Results also suggested that microbes of floc and litter leachates of EAV and SAV were more P- relative to C-limited. Despite these differences, most DOP (<0.45 µm) being unavailable for hydrolysis by P-enzymes highlights the potential difficulty in lowering water column P concentrations through biotic conversion. Future work on DOP bioavailability should focus on other processes such as potential enzyme synergism (C-N-P) and enzyme complexation with DOM.

<u>PRESENTER BIO</u>: Dr. Subedi manages the wetland biogeochemistry laboratory at the Soil and Water Sciences Department, University of Florida.

REUSE, RESTORE, RECHARGE, REDUCE, & RECREATE—THE OCALA WETLAND RECHARGE PARK

Gabriela Sullivan[1], *Allison Lewis*[2]
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[2]Jacobs, Tampa, FL USA

Silver Springs is world famous for its crystal-clear waters and is the ecological and economic engine in the area. However, Silver Springs is subject to restrictive Total Maximum Daily Load (TMDL) regulations for nitrate and has a recovery strategy to help meet its established Minimum Flows and Levels (MFL).

The City of Ocala, located within the Silver Springs springshed, constructed a treatment wetland park designed for groundwater recharge to offset their use of groundwater and nutrient loads associated with municipal water and wastewater management. This 35-acre infiltration wetland system treats up to 5 million gallons per day (mgd) of reclaimed water and stormwater to recharge the aquifer, protect water quality, and recover and enhance the flows to Silver Springs.

Based on wetland treatment performance calculations at rates assessed from other groundwater recharge wetlands in the state, it is estimated that this system will remove up to 29,000 pounds per year of total nitrogen, 23,000 pounds per year of nitrate, and 30,000 pounds per year of total phosphorus.

The wetland park provides a unique opportunity to address water supply and water quality while giving back to the community. In addition to the environmental benefits that drive this project, the City created a public park with educational exhibits related to wetland ecology and the park's connectivity to Florida springs. The wetland park includes boardwalks, trails, lookouts, and other park amenities for public enjoyment. Since opening in September 2020, over 100,000 visitors and 170 bird species have been observed at the park. In 2021, the park's innovation was recognized by the National Recreation and Park Association as they awarded the park with both the 2021 Innovation in Conservation Award and the 2021 Best in Innovation Award. In 2023, it was listed on the Great Florida Birding and Wildlife Trail by FWC.

PRESENTER BIO: Gabriela Sullivan is the Water Conservation Coordinator for the City of Ocala. She graduated from the University of Florida in 2021 with a bachelor's degree in natural resource conservation. Gabriela's interests in conservation behavior and environmental education guide her approach to addressing water issues on an individual and community level.

IMPACTS OF LAND USE AND LAND COVER CHANGES ON SOIL ORGANIC CARBON IN ABERDEEN PROVING GROUND

Mojtaba Tahmasebi [1], *Jules Bruck*[1], *Afsheen Sadaf*[1], *Eric Bardenhagen*[2], *and Martha Ryan*[2]
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Soil Organic Carbon (SOC) exhibits a remarkable capacity to adapt promptly to shifts in land use and land cover (LULC), playing a pivotal role in guiding sustainable land management practices. Additionally, SOC makes a substantial contribution to wetland conservation, emphasizing the necessity for a deeper understanding of SOC dynamics. This study aims to calculate the carbon storage and sequestration over time within the Aberdeen Proving Ground (APG) area in Maryland.

While robust prediction data are readily available for other carbon pools, such as aboveground and belowground biomass, a notable gap exists in estimating SOC, especially in APG. Hence, we meticulously evaluate SOC across diverse LULC types, investigating the repercussions of LULC changes on SOC storage and creating a map of LULC for the future scenario to bridge this critical knowledge gap.

Our methodology is organized around three robust processes that are intended to give a thorough understanding of SOC dynamics and changes in LULC. First, we utilize Google Earth Engine to harness the power of sophisticated satellite picture processing and the deployment of cutting-edge machine learning techniques. This stage enables us to collect precise SOC data and essential insights for our research.

The second step involves an in-depth examination of LULC changes. We meticulously investigate how alterations in LULC impact SOC, and this process allows us to uncover the intricate relationships between land cover transformations and SOC dynamics. The regional assessment of carbon sequestration values under potential future scenarios is the focus of the final step. To accomplish this, we employ the InVEST tool (Ver. 3.13.0), which features a sophisticated carbon storage and sequestration model.

This stage is crucial for predicting how SOC and carbon storage may change in response to shifting environmental circumstances and land use scenarios, offering insightful information for attempts to manage the environment sustainably. These findings hold relevance for future research aimed at conserving blue carbon ecosystems as part of adaptive strategies to mitigate climate change.

PRESENTER BIO: Mojtaba Tahmasebi is a Master of Landscape Architecture student at the University of Florida with a diverse academic background in Architecture, Landscape Architecture, and Urban Planning. His research focuses on blue carbon ecosystems and quantifying various carbon pools to enhance coastal resilience.

ACCIDENTIAL INTERVENTION: PRESCRIBED BURNING ALTERS TIDAL MARSH NITROGEN PROCESSING

***Corianne Tatariw*[1]**, *Taylor C. Ledford*[2], *Elaine Rice*[2], *Julia A. Cherry*[2], *and Behzad Mortazavi*[3]
[1]Rowan University, Glassboro, NJ USA
[2]The University of Alabama, Tuscaloosa, AL USA
[3]Syracuse University, Syracuse, NY USA

Tidal marshes are control points for water quality improvement, intercepting and removing terrestrial nitrogen (N) loads before they reach coastal waters. Prescribed burns are human interventions employed in coastal forests to restore habitat and promote native vegetation growth. Prescribed burns often extend into adjacent tidal marshes, altering vegetation biomass and community composition, but the impact on marsh N removal capacity is unknown. We investigated the impact of a prescribed burn on N processing in a tidal marsh at the Weeks Bay National Estuarine Research Reserve (WB-NERR) (AL, USA). WB-NERR uses prescribed burns to promote the growth of native understory vegetation in the forest and promote marsh landward migration. Using isotope pairing technique on sediment slurries, we measured N removal potential via microbial denitrification in plots dominated by one of three plant species (*Cladium mariscus*, *Juncus roemerianus*, and *Spartina patens*) leading up to and following a prescribed burn. We also measured plant above- and belowground biomass, porewater dissolved inorganic N concentrations, porewater sulfide concentrations, and soil bulk carbon and N concentrations. Following the burn, we observed a spike in porewater sulfide concentrations concomitant with reduced aboveground plant biomass across all three vegetation zones. Denitrification potential rates were highly variable but generally decreased in the months following the prescribed burn. We hypothesize that lower plant activity following the prescribed burn limited radial oxygen loss to the rhizosphere, which increased sulfide accumulation and inhibited denitrification rates. Additionally, the controlled burn dampened differences in N removal rates between vegetation types. Although prescribed burns may dampen N removal potential, they can also promote marsh landward migration into upland environments, providing a pathway for retreat in response to sea level rise. Thus, while burning may impact ecosystem functions in the short term, it may enable them to persist in the long term.

PRESENTER BIO: Dr. Tatariw is an ecosystem biogeochemist who specializes in nitrogen transformations in variably inundated ecosystems. Her research addresses how human disturbances such as land use change and climate change impact nutrient processing in both natural and human built systems, ranging from inland wetlands to coastal marshes to roadside ditches.

THE THIRST OF OUR URBAN LANDSCAPES

Nick Taylor
UF/IFAS Energy Extension Service, Gainesville, FL, USA

Florida's rapid population growth is placing an unprecedented strain on our water resources. This presentation explores the critical issue of water use within urban landscapes. We will examine overall water consumption patterns, the proliferation of permanent in-ground irrigation systems, and the high variability in water usage, all of which underscore the necessity for a change in landscape design practices.

By dissecting how water is used in urban landscapes, we can identify areas where conservation efforts should be targeted. High variability in water consumption illustrates the importance of a tailored approach to water conservation.

This presentation underscores the urgency of addressing the water crisis in our urban landscapes as Florida's population continues to grow. By understanding water consumption patterns, recognizing the impact of in-ground irrigation systems, and acknowledging the significant variability in water use, we can develop targeted conservation strategies. Embracing sustainable landscaping practices is essential for the long-term health of our water resources and the sustainability of our urban environments.

PRESENTER BIO: Dr. Taylor works with the Program for Resource Efficient Communities (PREC) and the Center for Land Use Efficiency (CLUE) as an IFAS State Specialized Extension Agent. His research interests include utility data analysis to identify effective water and energy conservation measures and evaluation of land development impacts. Dr. Taylor leads the H2OSAV extension program, providing data analysis tools and data-driven insights that help regional utility providers, governmental agencies and extension agents optimize water conservation efforts.

CAROSEL: ADVANCING WATER QUALITY MONITORING WITH A NOVEL AUTONOMOUS BENTHIC FLUX SENSING PLATFORM

[1]***Mason Thackston***, [2]*Don Nuzzio*, [1]*Jordon Beckler*

[1]Florida Atlantic University Harbor Branch Oceanographic Institute

[2]Analytical Instrument Systems Inc.

Submerged sediments play a crucial role in regulating the health and functioning of aquatic ecosystems. Chemical exchanges between sediments and overlying waters, known as benthic fluxes, may significantly impact eutrophication, harmful algal blooms, hypoxia, and carbon sequestration, among other related phenomena. In conjunction with conventional field sampling, in situ sensing platforms, as part of the water quality monitoring Internet of Things, provides valuable in situ data for several physical, chemical, and biological parameters. However, sustained, in situ sediment monitoring is rarely implemented beyond fundamental research and semi-routine sediment chemical inventory mapping. Traditional methods like benthic chamber incubations yield only a single flux measurement per deployment per analyte, making them unsuitable for ongoing water quality monitoring programs. An augmented benthic flux monitoring capacity could, however, identify sediment-water feedback with high temporal resolution, parameterize numerical models, and inform ecosystem restoration efforts. To address this need, we introduce CAROSEL (Chamber ARray for Observing Sediment Exchanges Long-term), an innovative autonomous benthic lander specifically designed for continuous, long-term monitoring of benthic fluxes for any environmental analyte with a compatible, commercially available sensor. Inspired by traditional in situ benthic flux chamber incubation methods, CAROSEL incorporates many unique characteristics, such as its sensor-agnostic design, compact size for deployment from small boats, and the ability to provide uninterrupted time series data on isolated sediment-based biogeochemical processes. In the long term, we foresee this platform becoming an essential tool for global water quality monitoring networks, enabling more informed decision-making in water management.

PRESENTER BIO: Mason is a graduate student at FAU Harbor Branch Oceanographic Institute where his thesis project is focusing on developing autonomous technologies for in situ observation of biogeochemical processes at the sediment-water interface as well as iron and sulfur cycling in the carbonate-dominated sediments of Florida Bay and how it relates to water column hypoxia.

INNOVATIVE SMART PONDS: HOW DO THEY WORK?

Mark P. Thomasson
National Stormwater Trust, Inc., Tallahassee, FL, USA

Stormwater storage assets, such as ponds, constructed wetlands, and underground vaults, are often designed to provide both water quality and flood mitigation for a range of critical storm events (e.g., 2-year, 10-year, and 100-year storms), consequently, by design, these assets do not perform optimally for any individual storm event.

Advances in communications and control technology, cloud-computing, weather forecasting, and sensing technologies have now made it possible to optimize stormwater infrastructure for each individual storm event. One approach that leverages these technologies is continuous monitoring and adaptive control (CMAC). CMAC systems monitor the local weather forecast, compare the forecast runoff to existing field conditions by reading on-site sensors, and automatically control the timing and rate of stormwater discharge by actuating on-site valves, gates, or pumps. With adaptive controls, stormwater facilities discharge water in advance of storms, creating capacity for flood mitigation. CMAC systems then hold water during and after storms to increase hydraulic residence time, settle sediment and nutrients, and improve water quality. Adaptive controls are being used across the country to optimize stormwater management for water quality and flood mitigation.

The ease with which existing stormwater facilities can be retrofitted with CMAC lends itself to innovative project delivery models. For example, stormwater ponds owned by the Florida Department of Transportation are being retrofitted with adaptive controls to generate nutrient removal credits. These credits are then purchased by other entities to meet water quality goals. Because CMAC systems collect real-time continuous data on the weather forecast, precipitation, storage volumes, discharge rates, residence time, and water quality parameters, performance is being documented to assure regulatory compliance.

This presentation will provide a technical overview of CMAC, and present case studies of Florida communities using CMAC to improve water quality and mitigate flood risk with existing stormwater infrastructure. Quantitative performance data will be presented.

PRESENTER BIO: Mr. Thomasson is an Executive Vice President and Chief Stormwater Engineer with more than 30 years of experience planning, designing, and implementing stormwater projects. He has extensive experience with Environmental Resource Permitting and innovative stormwater treatment practices and has developed the proprietary models used for permitting in Florida.

DOCUMENTING IAN'S EFFECTS ON SARASOTA BAY – IMPACTS AND TIMELINE FOR RECOVERY

***David Tomasko*[1]**, *Chris Anastasiou*[2], *and Jay Leverone*[1]

[1]Sarasota Bay Estuary Program, Sarasota, FL, USA

[3]Southwest Florida Water Management District, Tampa, FL, USA

On September 28, 2022, Hurricane Ian made landfall in Southwest Florida. While Sarasota Bay was not directly impacted by storm surge, the bay's watershed experienced winds up to 81 mph, which brought down trees and defoliated the landscape across much of the lower portion of the watershed. Over a three-day period, the bay's watershed experienced between 5 and 15 inches of rainfall. In response to the pulse of freshwater inflow, pollutant loads were delivered far in excess of typical amounts. Within a week, the lower portions of Sarasota Bay experienced bacteria levels well above guidance criteria, a condition that persisted for at least two weeks. Runoff from the bay's highly urbanized watershed brought a substantial nitrogen load into the bay, which resulted in phytoplankton levels much greater than guidance criteria. High levels of phytoplankton existed for at least two weeks.

Little Sarasota Bay exhibited salinity stratification and bottom water hypoxia, phenomena not seen in the adjacent systems of Roberts Bay and Blackburn Bay. Recovery of water quality that occurred between two and four weeks after landfall was likely was related to tidal exchange between the bay waters and the Gulf of Mexico, which preceded a widespread red tide event in the nearshore waters of the eastern Gulf of Mexico.

PRESENTER BIO: Dr. Tomasko is the Director of the Sarasota Bay Estuary Program, with more than 30 years' experience developing water quality restoration plans across Florida, California, the Caribbean Sea, and in the Middle East. David has more than 50 papers published in scientific journals and/or book chapters.

IDENTIFYING FLOOD TRANSITION ZONE VARIATION ACROSS MULTIPLE ATLANTIC AND GULF COAST RIVERS

***Brianna Tomko*[1]**, *Katherine A. Serafin*[1], *Robert A. Jane*[2], *Md Mamunur Rashid*[3], *Ahmed Nasr*[2], *Thomas Wahl*[2], *Lauren Schmied*[4], *and Christina Lindemer*[4]

[1]University of Florida, Department of Geography, Gainesville, FL, USA
[2]Civil, Environmental, and Construction Engineering & National Center for Integrated Coastal Research, University of Central Florida, Orlando, FL, USA
[3]School of Ocean Science and Engineering, University of Southern Mississippi, Hattiesburg, Mississippi, USA
[4]Federal Emergency Management Agency, Washington, D.C., USA

The frequency of coastal flooding is increasing, leaving millions of residents at risk while causing billions of dollars in damage to property and infrastructure each year. Flood transition zones are stretches of river where multiple processes like elevated river discharge, high tides, and storm surge compound to amplify water levels. Flood transition zones are difficult to delineate from observations alone, as large distances often separate river gages along with short or incomplete temporal records of joint inland and coastal processes. We, therefore, apply a hybrid modeling framework, which links a statistical and numerical model through surrogate modeling, to evaluate what combinations of upstream river discharge and downstream coastal water levels result in extreme water levels. The hybrid modeling framework consists of running a subset of statistically simulated boundary conditions through a Hydrologic Engineering Center – River Analysis System (HEC-RAS) steady flow model to output along river water surface elevations. This subset of conditions is then used to generate surrogate models for the efficient extraction of water surface elevations from any combination of upstream discharge and downstream coastal water level. From these simulations, we empirically extract along-river return levels, like the 100-year water level, at a high spatial resolution and investigate whether they are driven by river discharge, coastal water level, or a combination of both processes. This approach is applied to vulnerable coastal rivers across the United States Atlantic and Gulf coasts, including the Suwannee River, Potomac River, Nueces River, and Savannah River. We compare the location and extent of flood transition zones with different variables such as climate, depth and width of the channel, river gradient, and tidal influences. By identifying and understanding these variations in morphologic characteristics and their potential relationship with flood transition zones, we can gain further insight when making flood risk assessments.

PRESENTER BIO: Brianna Tomko is a second-year master's student in the Climate Risk and Storm Hazards (CRASH) Lab under the leadership of Dr. Katy Serafin. In addition to her passion for hydrogeography and GIS, she is interested in the effects of climate change on extreme events, including coastal compound flooding.

STREAMFLOW RECONSTRUCTIONS USING TREE-RING BASED PROXIES AND AI

Glenn Tootle
The University of Alabama, Tuscaloosa, AL USA

Water managers and planners rely on instrumental (observed, historic) streamflow data in decision-making processes including water supply and reservoir operations. Instrumental streamflow data is often very limited in that the period of record may extend (only) ~50 to ~100 years in the past. Thus, critical water operations decisions are based on limited data. Tree-ring datasets provide an opportunity to skillfully extend the instrumental period of record, thus capturing extremes (droughts, pluvials) not observed in the instrumental record. Recent research at The University of Alabama (UA) funded by the EPA Gulf of Mexico program and the NSF Paleo Perspectives on Climate Change (P2C2) program resulted in streamflow reconstructions in southeast U.S. interstate streams including several streams in Florida (Perdido River, Escambia River, and Choctawhatchee River). Through the U.S. Fulbright Scholar program, this knowledge was extended to Italy and Slovenia, in which streamflow reconstructions were developed for the Adige River (Italy), Po River (Italy) and Sava River (Slovenia). While traditional methods rely on regression-based techniques, UA, via a recent NSF NRT award (Water: Research to Operations – R2O) is exploring novel AI techniques to potentially improve reconstruction skill.

PRESENTER BIO: Glenn is a proud two-time graduate of UF and is currently a Professor in the Department of Civil, Const., and Env. Engineering at The University of Alabama. He (and his students) conduct research in using tree-ring datasets to reconstruct (extend) instrumental hydrologic records. Through a recent (2021) Fulbright award, this knowledge and the use of AI has been extended to Italy and Slovenia. Glenn is most proud of his oldest child (Julia) as she will graduate from UF (BS BME) this Spring :)

INVESTIGATING HYDROLOGIC ALTERATION AS A MAIN DRIVER OF FOREST COMPOSITION SHIFTS IN A FLORIDA RIVER FLOODPLAIN

John Tracy[1], *Daniel Johnson*[2], *Matthew Deitch*[1], *Stephanie Bohlman*[2], *and Ajay Sharma*[3]

[1]University of Florida- WFREC, Milton, FL, USA
[2]University of Florida, Gainesville, FL USA
[3]Auburn University, Auburn, AL, USA

Mounting evidence of shifting forest species composition in the Apalachicola River floodplain of Florida's panhandle indicates a response to decades of altered river hydrology. Construction of dams and increased water demands throughout the Apalachicola-Chattahoochee-Flint River Basin and poorly executed dredging operations in the Apalachicola have impacted flow regimes and exacerbated drought conditions. Previous research suggests that longer and more frequent periods of dry conditions are driving a decrease in dominance of highly flood tolerant tree species at low elevations and promoting an increase in dominance of less flood tolerant species. However, new data from a study of the first-year development of competing floodplain tree species suggests that changes in the frequency of early-season stresses such as flood pulses may be a more important driver behind shifting species composition. Less flood tolerant species in this floodplain can be heavier-seeded and more tolerant to early season stresses, thus promoting their ability to survive and compete for resources. Shifts in tree species composition can indicate changes to nutrient transport laterally and downstream to bay estuaries where important fisheries rely on river inputs such as freshwater, dissolved oxygen, detritus, and nutrients. This research helps to inform floodplain flow restoration efforts in focusing not only on increasing the amount of water distributed throughout the floodplain but also restoring the seasonality of flooding.

<u>PRESENTER BIO</u>: John Tracy is a 4th year PhD student and practicing forestry consultant. Before joining University of Florida, he was a private forestry consultant in Louisiana mostly managing industrial timberlands of the bottomland hardwood forest type in the lower Mississippi River alluvial valley.

FORECASTING COSTS OF MEETING FUTURE WATER DEMAND UNDER CLIMATE VARIABILITY AND SOCIOECONOMIC CHANGE

***Dat Q. Tran**[1] and Tatiana Borisova[2]*

[1]Economist at the Florida Legislative Office of Economic and Demographic Research and former postdoctoral scholar at the School of Public Policy, University of California, Riverside, CA, USA

[2]Former Associate Professor at the University of Florida, Gainesville, FL, USA

Sea-level rise, population growth, and changing land-use patterns will pressure Florida's already constrained groundwater and surface water supplies in the coming decades. Significant water supply and water demand management investments are needed to ensure sufficient water availability for human and natural systems. Section 403.928(1)(b) of the Florida Statutes requires estimating the expenditures needed to meet the future water demand by 2040 and avoid the adverse effects of competition for water supplies. This study considered the 2020-2040 planning period and forecasts (1) future water demands and supplies and (2) the total expenditures necessary to meet the future water demand. We develop an integrated framework that combines statistical and machine learning techniques to forecast future water demand in Florida and expenditures needed to meet the demand. County records and projections on weather, water use, and socioeconomic data from the U.S. Geological Survey, Florida's Water Management Districts, the Florida Legislative Office of Economic and Demographic Research, and the Florida Department of Environmental Protection are used to evaluate the influence of weather and socioeconomic factors on water use and expenditures, with a series of cross-validation and sensitivity tests used to evaluate the robustness of perceived effects. The findings show that the total water use is projected to increase by 843 million gallons per day (+13.5%) by 2040, driven primarily by urbanization. Cumulative expenditures for the additional water supplies by 2040 are estimated at $1.7 billion, with the projected Florida state expenditure of $327.5 million. However, the expenditures could be reduced to $163.8 million when considering the water conservation potential. This study highlights the need to develop effective local, regional, and state funding strategies to finance additional water supply infrastructure. We also show that consistent water demand and supply data available on a regional level can enhance the forecast development across a full range of spatial and temporal scales.

PRESENTER BIO: Dr. Dat Tran is an environmental economist. Before joining the Florida Legislative Office of Economic and Demographic Research, he was a postdoctoral scholar at the School of Public Policy, University of California, Riverside. He has extensive experience with the economics of land use and water management. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of EDR and/or USDA. No official agency endorsement should be inferred.

MANAGED AQUIFER RECHARGE AND IRRIGATION DECISIONS UNDER RISK AND CLIMATE VARIABILITY

Dat Tran[1], *Kieu Le*[2], *and Thanh Bui*[3]

[1]Economist at the Florida Legislative Office of Economic and Demographic Research and former postdoctoral scholar at the School of Public Policy, University of California, Riverside, CA, USA

[2]Lecturer, Department of Environmental Management, College of Environment and Natural Resources, Can Tho University, Can Tho, Vietnam; Previously Assistant Professor, Department of Agricultural and Biological Engineering, University of Arkansas at Fayetteville, Arkansas, USA

[3]PhD Candidate, Department of Electrical Engineering and Computer Science; University of Arkansas at Fayetteville, Arkansas, USA

Groundwater supplies large, irrigated areas and plays a vital role in buffering against climate variability. Over-groundwater pumping for irrigation causes groundwater depletion at an alarming rate, threatening food security. Agricultural Managed aquifer recharged (Ag-MAR), an intentional process of storing excess surface water underground for later recovery or environmental benefits, is a promising approach to increase groundwater availability and support agricultural production. To date, most studies on groundwater depletion and crop production have primarily focused on the effects of MAR, groundwater withdrawal, and climate factors on groundwater resources and the extent to which these variables affect groundwater availability for future use; however, the feedback mechanisms between these variables are not well understood under the presence of climate uncertainty and risk. Risk-averse farmers often not only seek to maximize profits but also try to stabilize their income by minimizing risks through irrigation more intensively and using more reliable water supply sources. We present a stochastic dynamic hydro-economic model that accounts for the interactions of water withdrawal, MAR, on-farm reservoir, and irrigation use under uncertainty of climate and risk. We apply the proposed model to the Mississippi River Alluvial Aquifer, the second most pumped aquifer in the U.S. These groundwater withdrawals primarily used for irrigation have resulted in substantial areas of water-level decline in parts of the aquifer. We find that MAR reduces groundwater depletion moderately because of increased irrigation toward more water-intensive crops. Risk-averse farmers favor jointly using on-farm reservoir and irrigation efficiency techniques over MAR use due to the uncertainty of surplus surface water for MAR, even if the surplus surface water is abundant and the costs of MAR are low. Not considering the level of risk aversion and stochastic nature of surplus surface water may thus lead to overestimating MAR use.

PRESENTER BIO: Dr. Dat Tran is an environmental economist. Before joining the Florida Legislative Office of Economic and Demographic Research, he was a postdoctoral scholar at the School of Public Policy, University of California, Riverside. He has extensive experience with the economics of land use and water management. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of EDR. No official agency endorsement should be inferred.

IRON: A LIMITING NUTRIENT FOR BENTHIC MACROALGAE IN FLORIDA SPRINGS?

Madison Trowbridge
Southwest Florida Water Management District, Brooksville, FL, USA

Elevated nitrate concentrations have often been attributed to the proliferation of benthic macroalgae within Florida's spring-fed rivers. However, this paradigm does not always reflect the apparent biogeochemistry of these systems. More recent studies have indicated that other factors, including micronutrients such as iron, may play a more critical role in the benthic macroalgal coverage than previously thought. This study investigated whether there was a correlation between benthic macroalgae and iron concentrations in Rainbow River (Marion County, FL, USA) to determine if iron was a potential driver of benthic macroalgal coverage. Both porewater and water column iron concentrations were used to determine potential impacts to benthic macroalgal coverage and thickness. Porewater typically had higher concentrations of iron compared to the water column, likely due to the presence of clay sediments. A correlation between porewater iron concentrations and macroalgal coverage was confirmed through statistical analyses. Since algal demand for iron is an order of magnitude greater than vascular plants, iron availability may allow for the proliferation of benthic macroalgae. Understanding the effects of iron on benthic macroalgae will be useful in understanding the submerged aquatic vegetation dynamics in Florida's spring systems.

PRESENTER 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.

APPLICATION OF VIRTUAL REALITY (VR) FOR URBAN FLOOD MODELING AND MITIGATION

***Seneshaw Tsegaye*[1,*]**, *Thomas M. Missime*[2], *Serge Thomas*[3], *Ahmed S. Elshall*[4]

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Rapid urbanization, ecological stress, climate change, and associated extreme rainfall events pose a threat to the urban environment. Many cities recognize the potential of nature-based solutions (NbS) in managing and mitigating urban stormwater runoff, yet most lack systematic strategies for transitioning away from their existing conventional drainage systems. This paper introduces a comprehensive strategy that combines Virtual Reality (VR) based 3D Flood Visualization and Grey to Green (G2G) transition tools. These tools are designed to assess the impacts of extreme rainfall events and identify flood mitigation measures. They are intended to provide natural resource managers, planners, foresters, and engineers with a step-wise approach to aid the flood modeling and planning process for NbS. The strategic approach includes: (i) GIS-based model setup, (ii) 1D/2D flood model, (iii) Virtual Reality (VR) based 3D flood visualization, and (iv) G2G for assessment and selection of flood mitigation measures. First, GIS mapping is employed to establish hydrology, map green infrastructure, identify areas for protection and restoration, tailor development projects to the site, and identify NbS opportunities while considering site conditions and existing drainage systems. Second, 1D/2D flood modeling is carried out using the Interconnected Channel and Pond Routing (ICPRv4) hydrologic and hydraulic model. Third, a 3D model of areas under investigation is developed using dronedeploy and linked with the 1D/2D flood model in the VR platform. Fourth, G2G scenario analysis is applied to quantifying volume and pollutant load reduction while exploring the use of different NbS. The final stage involves the selection of the most suitable combination of current stormwater systems and NbS. This choice takes into consideration site constraints, the objectives of minimizing water quality and quantity issues, and the noteworthy additional social and ecological benefits, such as aesthetics, air quality, and addressing heat island effects. When used in combination, the strategic approach identifies a prioritized, optimal transition pathway from existing conventional drainage systems to NbS. The impacts of flooding are presented using 3D animation that places viewers at the center of the flooding event. In this way, the urgency and need to address flood risks are effectively communicated—making it hard for viewers not to be affected by and act on what they see. The outcomes demonstrated the efficacy of the strategic approach and tool, and its application for cities flood resiliency.

PRESENTER BIO: Dr. Seneshaw Tsegaye is an Associate Professor and serves as the Interim Chair of the Department of Bioengineering, Civil Engineering, and Environmental Engineering at Florida Gulf Coast University. In addition, he has been appointed as the Backe Chair for Sustainable Water Research within the U. A. Whitaker College of Engineering. For a span of 15 years, Dr. Tsegaye has accrued experience in the realms of integrated urban water management and flood mitigation.

STREAMLINING PRECISION IRRIGATION: DEVELOPING A DECISION SUPPORT TOOL FOR SENSOR DATA PROCESSING

***Boaz B. Tulu*[1]**, *Haimanote K. Bayabil*[1], *Yiannis Ampatzidis*[2]

[1]University of Florida, Agricultural and Biological Engineering Department, Tropical Research and Education Center, Homestead, FL

[2]University of Florida, Agricultural and Biological Engineering Department, Southwest Florida Research and Education Center, Immokalee, FL

In the era of digital agriculture, precision irrigation has become important, especially in area facing water scarcity. However, data collection, storage, and processing needed for precision irrigation are challenging. The objective of this research was to develop a user-friendly web-based decision support tool that can be used to streamline canopy temperature data used to assess plant water stress. Above canopy temperature, drone-based thermal and RGB images were collected from 32 research plots at the Tropical Research and Education Center. A DJI Matrice 210 v2 UAV drone equipped with the DJI Zenmuse XT2 thermal camera was used for the data collection. Different image processing techniques were employed, including OpenCV, a renowned open-source computer vision software library for real-time image processing, Microsoft's Image Composite Editor (ICE), a tool for creating panoramic images, and OpenDroneMap (ODM). Designed for aerial drone image processing, ODM proved to be better at maintaining georeferenced information from stitched images, ensuring each pixel accurately reflected its actual location. Crop water stress level is computed using temperature readings of pixels with plant canopy. The canopy temperature dataset is used to develop a web-based machine-learning model optimized as an irrigation decision support tool. This presentation will highlight advanced image processing tools, canopy temperature-based machine-learning algorithms, and the challenges of using such data to implement precision irrigation at plot and field scales.

PRESENTER BIO: Boaz B Tulu: is a graduate student in Agricultural and Biological Engineering at the University of Florida. With a background in Computer Engineering, Boaz specializes in integrating AI based technologies to address agricultural challenges. He was the 2022 Mandela Washington fellow at Purdue University.

TRACING SOURCE AND MOBILITY OF LEGACY PHOSPHORUS IN RANCH SOILS – INSIGHTS FROM URANIUM ISOTOPES

***Benjamin T. Uveges**[1], Dan Petticord[1], Amartya Saha[2], Jiangxiao Qiu[3], Elizabeth Boughton[2], Jed Sparks[1]*

[1]Cornell University, Ithaca, NY, USA
[2]Archbold Biological Station, Lake Placid, FL, USA
[3]University of Florida, Davie, FL, USA

In many modern agricultural settings long-term phosphorus (P) fertilization has led to the buildup of residual P in soil that is not immediately accessible to plants, commonly known as legacy P. This legacy P, aside from being indicative of the inefficient use of a finite resource, can be a source to local water bodies long after the cessation/reduction of P fertilizer application. Excess P loading in P-oligotrophic systems such as the Everglades can lead to harmful algal blooms and subsequent eutrophication and water column hypoxia. Understanding the form and fate of fertilizer derived P is key to inform best practices toward the management and mitigation of adverse ecological outcomes. However, natural P is monoisotopic, precluding the use of stable isotope ratios to trace sources and cycling processes as is commonly done with other major nutrient elements. Uranium (U) can serve as an analog for P in environments where their mobility is similar and has several isotopes that are long-lived relative to human timescales. In agricultural systems, elevated concentrations of U coupled with distinctive fertilizer-like U activity ratios, $(^{234}U/^{238}U)_A$, can be used to trace the influence and mobility of legacy P derived from past fertilizer applications both within a catchment, as well as through a soil profile. Here we present U isotope measurements of subtropical pastureland spodosols from Archbold Biological Station's Buck Island Ranch. Spodosols are soils common in Central Florida that are generally very sandy but are typified by a deep layer enriched in organic matter and aluminum and iron bearing minerals, otherwise known as a spodic layer. We investigate the spatial distribution of fertilizer derived U, and by extension P, in surface soils, as well as across soil depth to better understand the long-term "buffering" effect of the spodic layer on legacy P.

<u>PRESENTER BIO</u>: Dr. Uveges is currently a Postdoctoral associate working in the Sparks Lab at Cornell University. He received his PhD from Syracuse University, followed by a Postdoctoral associate appointment at MIT. He specializes in tracing biogeochemical nutrient cycling and microbial ecology using stable isotope ratios and organic biomarker signatures.

OPTIMIZING IRRIGATION PRACTICES: THE ROLE OF SOIL MOISTURE SENSORS IN FLORIDA AGRICULTURE

Uday Bhanu Prakash Vaddevolu, *Vivek Sharma, Yvette Goodiel, Lisa Hickey, Craig Frey, Anna Meszaros, Shawn Steed, Mark Warren, Christian Kammerer, and Wael Elwakil*

Soil moisture sensors have been a great resource to measure the soil moisture levels throughout the soil profile, allowing for informed decisions about irrigation needs. In traditional agriculture, irrigation schedules are often determined by a more intuitive "feel" method based on experience, which can sometimes lead to either over- or under-irrigation. Soil moisture data driven based irrigation system can be a great alternative for optimal use of water resources by scheduling the irrigation based on field conditions. To facilitate this transition, a soil moisture sensor network was formed in 2018 in Florida. The goal is to promote and implement best management practices for irrigation. To achieve this, an extension network has been working closely with local growers across the state to advise growers on irrigation scheduling. Currently, approximately 62 soil moisture sensors (SMS) are distributed across 18 Florida Counties covering 300,000 acres in different crop production systems. The network is bringing cultural and behavioral changes in technology implementation as a result of improving irrigation management. In addition, the project demonstrates effective irrigation management strategies by monitoring irrigation water supply, and soil moisture, which will conserve water and enhance crop water and nutrient use efficiencies. For example, on average, the water conservation that was observed/reported by network ranged from 0.5 inches to 1.5-inchs per growing season depending on the crop type and climatic conditions. In addition, extensive soil sampling was conducted across 13 diverse locations in South Florida, including sandy soil, muck soil and sandy clay soils to accurately quantify the soil moisture characteristic limits. This data will serve as a reliable source for making well-informed decisions regarding irrigation schedules, ultimately promoting best management practices for irrigation.

PRESENTER BIO: Uday Bhanu Prakash Vaddevolu is a Postdoctoral Research Associate at the Precision Water Management lab within the Department of Agricultural and Biological Engineering at the University of Florida. He is currently working on the Florida Soil Moisture Sensor Network. The primary objective of this project is to promote Best Management Practices (BMPs) for irrigation to enhance water use efficiency.

IMPACTS OF PFAS AND MICROPLASTICS IN AQUATIC SYSTEMS: A CRITICAL REVIEW

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Human and aquatic system health is currently compromised by the persistence of widespread per- and polyfluoroalkyl substances (PFAS) introductions into the environment. Occurrence of these enduring chemicals result from both direct and indirect emissions from industrial production. They are introduced into aquatic systems through runoff, PFAS product breakdown or wastewater discharge. Despite their useful properties such as high chemical resistance, heat resistance, and hydrophobicity their chemical composition and structure of strong carbon-fluorine bonds and charged hydrophilic functional groups promote bioaccumulation and can cause physiological damage to living organisms.

Previous research concerning toxicity pathways has shown PFAS exposure as a participant of physiological damage to aquatic fish, influencing tissue interactions, which vary by species, sex, and stage of pregnancy. For instance, PFOA exposure to *Danio rerio*, exhibited lipid buildup in the liver in males, increased antioxidant activity, and apoptosis in larvae. Subsequently, PFAS have also been found to concentrate in microplastics, another type of an abundant anthropogenic contaminant within aquatic systems. These microplastics negatively impact the metabolic and physiological functions of aquatic biota through ingestion. They provide a surface for biofilms to form, facilitating the establishment of diverse microbial communities with distinct ecological functions. Interactions between microplastics and biofilms can serve as carriers for pathogenic bacteria, contribute to antibiotic resistance genes, and act as sorption sites for heavy metals and co-existing PFAS, presenting a risk through trophic transfer.

Microbial composition and ecological functions of biofilms may also be adversely affected by PFAS exposure. Co-existence of these contaminants may have additive ecotoxicological effects, causing significant damage through the ingestion of contaminated food sources. Further understanding of these complex interactions between PFAS – microplastics – biofilms is essential for revealing impacts on essential ecological processes, human health risks and acquire novel knowledge regarding fate, transport, and behavior of associated contaminants, thus addressing co-contamination research gaps.

PRESENTER BIO: Mileisha L. Velázquez-López, a PhD. graduate student from the Environmental Engineering Sciences Department in the University of Florida. Her academic background consists of a bachelor's degree in biology coupled with a master's degree in marine sciences from the University of Puerto Rico, determined to contribute solutions to water system pollution.

WATER QUALITY CHARACTERIZATION AND NUTRIENT MASS BALANCES IN HYDROPONIC LETTUCE PRODUCTION SYSTEMS

Kelsey Vought
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Hydroponics is considered an efficient vegetable production system; however, limited quantitative data exists on hydroponic water composition dynamics and nutrient fates. This study evaluated the dynamics and fate of macro and micronutrients (N, P, Ca, Mg, K, Fe, Mn) in a recirculating, zero-discharge nutrient film technique lettuce production system. Water and tissue samples were collected throughout multiple lettuce cultivations, and mass balance calculations were used to estimate nutrient losses to the environment. In the recirculating water, an increase in aqueous Ca concentration with a corresponding decrease in K and Mn occurred during all growth trials, signifying a potentially antagonistic interaction. Ammonia nitrogen was almost completely removed, while nitrate decreased only in the final days, suggesting possible nitrification and denitrification. The mass balance results indicated that the average N loss was 18 - 27%, presumably through denitrification, while 10 - 19% of N assimilated into the plant biomass, and 50 - 62% of N remained in the recirculating water. The average P loss was 11 - 35%, likely due to precipitation, while 52 - 77% remained in the water. Nutrient uptake efficiencies averaged 19 - 31% K, 12 - 21% P, 9 - 16% Mn, 4 - 6% Ca, 3 - 4% Mg, and 2 - 4% Fe. These results suggest excess nutrients lead to losses and underutilization, and potential focus areas for nutrient optimization include Ca, Mg, and Fe. The percent of N and P assimilated by the plants increased over time, indicating greater uptake efficiency at later production stages. Based on these results, hydroponic nutrient media management should consider the phase of plant development when determining EC setpoints and nutrient additions. Advancements in water quality monitoring, including ion-selective electrodes and optimal nutrient dosing at each cultivation stage, could improve nutrient management in recirculating hydroponics.

PRESENTER BIO: Kelsey is a fourth-year Ph.D. student in the UF Agricultural and Biological Engineering Department. She specializes in resource utilization, water quality, and nutrient management in controlled environment agricultural production systems (CEA). Her interests involve applying resource bio-circular economic principles to agricultural production. Kelsey integrates wastewater and water treatment technology with CEA to reuse water, nutrients, and energy.

LEARNING FROM THE PAST TO INFORM LAKE OKEECHOBEE MANAGEMENT IN THE LOSOM ERA

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

Long-term water quality and phytoplankton monitoring in Lake Okeechobee plays a key role in identifying sources of impairment, providing input for complex modeling, and supporting scientifically based management decisions. Complex multivariate statistical analyses of the data, coupled with process-based and/or statistical models of water quality are critical for a better understanding of possible impacts the newly developed Lake Okeechobee System Operating Manual's (LOSOM) operating schedule may have on water quality, and consequently on the bloom dynamics and Lake ecology.

Hierarchical cluster analysis of the historic water quality data revealed that the lake can be divided into ten site clusters and three major zones with distinct water quality conditions. Ordination analysis showed that a combination of different physicochemical variables drove phytoplankton community dynamics and toxin concentrations across different Lake regions and periods. The lake often exhibited nitrogen limitation during summer, when cyano-blooms were widespread resulting in higher nutrient uptake. Increases in ammonium concentrations at nearshore sites were common in mid-summer, which most likely helped to sustain cyano-blooms later in the season. Nitrogen enrichment in spring and early summer favored the dominance of non-diazotrophic *Microcystis aeruginosa*, while N-limitation later in the season increased the abundance of diazotrophic species. Highest microcystins concentrations were detected early in the bloom seasons, but toxin concentrations were not always positively correlated with total cyanobacteria or *M. aeruginosa* cell densities. The strength of correlations between biotic and abiotic water quality parameters varied in space and time. The magnitude and toxicity of cyanobacterial blooms varied annually and can be viewed as probabilistic events that depend on highly complex non-linear interactions between different biotic and abiotic factors that are subject to chaotic dynamics in the lake, which need to be further investigated and modeled to effectively manage Lake Okeechobee water releases under the new LOSOM regulation schedules.

PRESENTER BIO: Dr. Anna Wachnicka is a principal scientist with >20 years of experience in designing and leading interdisciplinary projects aimed at optimizing strategies for the management of change in coastal and inland waters driven by climate change and watershed hydrologic alterations. She is currently leading Lake Okeechobee HAB and mitigation research initiatives.

POTENTIAL IMPLICATIONS FOR FISH POPULATIONS OF A RESTORED FREE-FLOWING OCKLAWAHA RIVER

Stephen J. Walsh
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Dams and their associated impoundments have a myriad of impacts to native aquatic communities of lotic ecosystems. Adverse effects include habitat loss and fragmentation, altered flow regimes, impaired water quality, disrupted sediment deposition, barriers to migratory species, and focal points for the introduction and establishment of non-native plants and animals. Most of these factors apply to the impounded Ocklawaha River, largest tributary of the St. Johns River drainage in northeastern Florida. There are concerns among a sector of the boating and angling community that breaching of Kirkpatrick (=Rodman) Dam might eliminate or greatly reduce a world-class recreational fishery for Florida Bass (*Micropterus salmoides*) and Black Crappie (*Pomoxis nigromaculatus*). Many scientists agree that there would be shifts in the diversity, abundance, and local distribution of some fish species, resulting in a different aquatic community than currently established. However, improved habitat integrity and water quality would be expected to provide a viable angling environment with novel opportunities for anglers, including increased abundance of currently less-targeted species. Restoration of natural flows would reestablish the important functional relationship between the floodplain and the mainstem river during flood pulses. Moreover, hydrologic restoration would reduce the need for drawdowns and herbicide applications in the impounded pool to control noxious aquatic plants, thereby also contributing to improved water quality. A restored free-flowing system would benefit both game and nongame lotic species that have experienced historic declines from habitat alterations, including several uncommon taxa. Another expected positive outcome of improved fluvial connectivity would be greater access to upriver segments and tributaries, including the Silver River, for diadromous fishes, manatees, and other species that make long migrations between the Atlantic Ocean, estuaries, and freshwater habitats that are critical for phases of their life cycles.

<u>PRESENTER BIO</u>: Dr. Walsh is a retired research biologist and served over 30 years in the U.S. Geological Survey and U.S. Fish and Wildlife Service. He has extensive experience studying the effects of hydrologic alteration on fish and invertebrate populations in springs, streams, and rivers of the southeastern U.S.

MULTI-OBJECTIVE OPTIMIZATION FOR MONTHLY WATER RESOURCES ALLOCATION FROM MULTIPLE SUPPLY SOURCES

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Tampa Bay Water, Clearwater, FL, USA

Complexity of considering tradeoffs among various objectives often limits water managers to explicitly incorporate multi-objectives in decision-making processes. This study presents a framework for determining monthly resource allocation from multiple supply sources that considers multiple objectives, including deviation from fiscal year budget, under or over-utilization of a given portfolio of resources, and total cost of water production. This framework is comprised of a simulation model, the production allocation model (PAM), and a multi-objective evolution algorithm (MOEA). The MOEA is used to search for Pareto optimum solutions across different objectives and the PAM uses MOEA output and considers operational constraints to achieve preferential operations within a given objective function. Stochastic demand and supply realizations were generated to capture a wide range of uncertainties which were then sampled by a Latin Hyper Cube to make the computation tractable. A parallel computing environment was used to implement this near real-time decision support tool, allowing the generation of timely guidance for water resource managers. Application of the proposed framework is demonstrated for a regional wholesale water supply utility, Tampa Bay Water, on the west coast of Florida in the United States. The framework can be applied to other regions with similar challenges in water resources management.

PRESENTER BIO: Dr. Wang is a lead water resources system engineer with more than 15 years of experience studying, simulating, and planning projects for water resources planning and management. He has extensive experience with decision support tools for decision-making at multiple time scales in the field of water resources engineering.

A HUMAN DIMENSIONS-DRIVEN VIEW OF IRRIGATION WATER RESTRICTIONS TO IMPROVE CONSERVATION OUTCOMES

***Laura A. Warner**, Dharmendra Kalauni, Sravani Pasula, and John M. Diaz*
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Reducing the water used for residential landscape irrigation remains at the forefront of contemporary conservation dialogue. Irrigation water restrictions are one of the most commonly used water demand management tools, and substantial technical research supports their use in places like Florida, where much of the state employs these regulations all year. Despite the available technical data, there is minimal understanding of the human dimensions of these policies, which may lead to, or prevent, people's compliance. An understanding of the associated human dimensions can determine the impact of irrigation restrictions. Recent Florida-specific research has demonstrated a concerning extent of unawareness among those subject to these restrictions. Researchers have also demonstrated that perceived complexity (e.g., pertaining to the policies and to irrigation technology operation) is among the top barriers to Floridians' irrigation restriction compliance. Experts recognize behavior change (i.e., compliance with irrigation restrictions) is reliant on using interventions framed around social science theory, and the present study integrated the Theory of Planned Behavior and Transtheoretical Model of Change to understand residents' compliance. Building upon the two aforementioned studies, a cross-sectional survey inquiry was conducted in 2023, targeting a quota (i.e., representative) sample of 2,300 Florida residents. Data collected included the extent to which residents believed they understood the irrigation restrictions that applied to them, the degree to which they believe they comply with these restrictions, and the outcomes (positive or negative) they believe may result from compliance. Such outcomes can include perceived benefits like improved yard health and perceived consequences such as homeowners association fines. Respondents were filtered so only residents residing in regions with active irrigation restrictions who were not exempt from these regulations were included in the final data set. This presentation will highlight the factors that relate to compliance with irrigation restrictions. The practical implications water conservation professionals can use to improve compliance with irrigation restrictions will be discussed.

PRESENTER BIO: Dr. Warner is an associate professor and extension specialist focused on understanding the human dimension of environmental behaviors. Specifically, she examines factors that relate to adoption of water conservation practices and other environmental behaviors and translates these factors into innovative behavior change strategies.

NO MORE SPRINKLERS IN THE RAIN! – INSIGHTS FROM AN INNOVATIVE RAINFALL COMMUNICATION INTERVENTION

Laura A. Warner[1], *Colby J. Silvert*[2], *Nick Taylor*[1], *John M. Diaz*[1], *and Robin Grantham*[3]

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Among Florida residents, rainfall may be perceived as bonus irrigation rather than a primary water source, leading to irrigation waste. Thus, there is an opportunity to conserve water in residential landscapes by helping residents align their irrigation usage with their landscape's actual water needs accounting for varying precipitation. Interventions targeting water conservation have historically relied on information dissemination, but more strategic and innovative approaches are needed. A 2016 research study (Survis, 2016) demonstrated providing information about local rainfall effectively reduced residents' water consumption. The intervention described in this presentation is drawn from a newly completed "Rainfall Signage to Reduce Residential Irrigation" project intended to build on the previous research. Initiated by the Southwest Florida Water Management District, key project elements — intentionally omitting educational activities — included robust measures of water consumption in experimental and control neighborhoods through UF/IFAS' H2OSAV program, pre- and post-survey data collected using behavioral theory, and 52 weeks of remote weekly rainfall data updates supported by cellular connectivity and solar power. Key findings included no changes to self-reported conservation practices or knowledge, no apparent influence of the sign on irrigation water use, positive perceptions of adjusting irrigation based on recent local rainfall, the rainfall sign becoming a primary source of rainfall data, and concerns over limited community buy-in. There is a possibility that the sign raised awareness of the lack of precipitation during drier times and encouraged some increase or no change in irrigation. Implications for others considering similar projects include: a need to determine the duration/timing of such interventions and possibly align them only with Florida's rainy season, opportunities to integrate participatory planning and educational activities and outreach, opportunities to increase the visibility of benefits of adjusting irrigation based on precipitation, and a need to ensure community policies and irrigation decision-making are aligned with water conservation programs.

<u>PRESENTER BIO</u>: Dr. Warner is an associate professor and extension specialist focused on understanding the human dimension of environmental behaviors. Specifically, she examines factors that relate to adoption of water conservation practices and other environmental behaviors and translates these factors into innovative behavior change strategies.

ANALYSIS OF FLORIDA PRIVATE WELL SURVEY DATA: WELL OWNERS, SEPTIC SYSTEMS AND WATER TESTING

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Florida has approximately 800,000 private wells that an estimated 12% of residents depend on for daily water consumption, but limited data is available regarding private well water quality. The U.S. Safe Drinking Water Act (1974) requires all public water systems to comply with drinking water standards set by the EPA; however, no such regulations exist for private well owners. Private well owners are often unaware of potential contamination despite it being their responsibility to verify and uphold the safety standards of their drinking well water and septic systems. Due to the limited scope of data pertaining to private well owners in Florida, a statewide survey was conducted from 2018 to 2023 to collect data on private well systems, establish a baseline for well water quality, and identify issues related to well water quality testing.

In total, 315 usable surveys were collected and analyzed. Survey data showed that nearly 95% (n=315) of private well owners surveyed have a septic system on their property to treat and dispose of household wastewater, and nearly a third (n=298) of private well owners have yet to empty their septic systems. Additionally, many respondents did not know much about their wells: roughly half (n=315) were unaware of the depth of their wells or in what year their well was constructed. Furthermore, almost half of respondents (n=315) have never tested their well water before, with the most common reason being that they did not know where to get their water tested. The survey results demonstrate a need to educate private well owners in Florida about their wells and potential contamination issues. Further research is needed to gain more insight on more counties in Florida and broaden educational outreach.

PRESENTER BIO: Rebekah Warrick is a senior undergraduate majoring in Environmental Management in Agricultural and Natural Resources at the University of Florida (UF). During summer 2023, she participated in the UF Active Learning Program and interned with the Florida Well Owner Network assisting with private well owner survey data entry and analysis.

FLDPLN CAN IMPROVE CONTINENTAL SCALE FORECAST OF FLOOD EXTENT AND DEPTH

***David Weiss**, Junho Song, Jack Edwards, James Halgren, Jude Kastens, Xingong Li, Jim Coll, Kenneth Ekpetere*

FLDPLN (Floodplain) is a low-computational-cost flood inundation mapping (FIM) model for inland basins that considers both backfill and spillover flow mechanisms. FLDPLN has been implemented for operational flood inundation mapping in the state of Kansas. Height Above Nearest Drainage (HAND) FIM is incorporated in the current version of the National Water Model (NWM), and its implementation was designed to permit mapping at scale across the continental United States (CONUS), while maintaining a modest computational cost. Our experiment documents the skill and efficiency of the FLDPLN model relative to the HAND model with respect to reference data sourced from satellite and aerial imagery, hydrodynamic models, and ground-observed watermarks. Results show that including FLDPLN in the suite of tools used with the NWM process has the potential to improve FIM accuracy beyond Kansas and to benefit communities across the country. The study dataset and instructions for processing and modeling simulations in this study will be publicly available via web repository.

PRESENTER BIO:

ASSESSING HEALTH AND ECONOMIC IMPACTS OF NITRATE POLLUTION: AN ANALYSIS OF FLORIDA PRIVATE WELLS

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Nitrate is a widespread nonpoint source pollutant in the U.S., posing serious risks to environmental and public health. Exposure to nitrate-contaminated drinking water can have negative impacts on human health, particularly in children and immunocompromised individuals.

Due to the presence of the Florida aquifers, groundwater serves as the primary source of drinking water for most Floridians. Like other states in the U.S., private wells are not regulated by the Safe Drinking Water Act, and routine monitoring is not mandated. The lack of comprehensive monitoring and regulation by public agencies shifts the monitoring and treatment responsibility entirely to private well owners. Previous research shows that private well owners often possess a limited understanding of critical aspects in private well maintenance, such as the importance of water quality, potential sources of contamination, and methods for water quality testing. This gap in awareness and preventive measures could lead to uninformed decisions, thereby escalating the associated health risks.

To pinpoint avenues for bolstering private well testing and monitoring, we proposed an integrated analytical framework to quantify both the health and economic impacts associated with nitrate exposure in private drinking wells. This presentation elucidates the methodologies employed to link environmental testing outcomes with potential economic and health outcomes. It also offers a synopsis of preliminary findings derived from the analysis of existing well testing data in Florida.

PRESENTER BIO: Dr. Weng is an Assistant Professor in the Food and Resource Economics Department at the University of Florida. As an environmental and natural resource economist, she has published 16 papers on topics related to the valuation of ecosystem services, water policy, climate change, and coupled and human natural systems.

A TALE OF FISH AND WATER: HOUSING MARKET CAPITALIZATION OF FRESHWATER FISHERIES

***Weizhe Weng*[1]**, *Xinde James Ji*[1], *Kevin Boyle*[2], *Lars Rudstam*[3], *and Kelly Cobourn*[4]
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Human societies benefit in numerous ways from ecosystem services generated by fish populations, from recreational fishery to biodiversity and ecosystem health. Evaluating the economic values of fishery related ecosystem services would provide critical information for project evaluation and decision making and serve as an important tool and indicator to engage relevant stakeholders to raise the awareness of the interdependence between nature and people.

In this paper, we propose to quantify the economic value of freshwater lake fish species using the hedonic property value method (hereinafter Hedonic). The Hedonic model has been widely used to establish the linkage between water quality and its capitalization effect on the housing market The intuition underlying hedonic model is that property buyers' willingness to pay for environmental amenities, i.e., water quality and fish population would be captured in the housing sales prices (Bishop et al. 2020). Changing in fish populations would bring the biggest impacts to lakefront homeowners due to their year-around access to angling, boating, or visiting. To our knowledge this is the first study that utilizes the hedonic method to quantify the economic value of fish species, likely because of scant longitudinal fish population data that is necessary to identify a hedonic model.

We use Oneida Lake in New York State, USA as a case study for exploring relationships between fish abundance and lakefront property values. Oneida Lake nurtures a diverse fish community and has seen a long history of recreational fishery activities. Our empirical results suggest a statistically significant capitalization effect for an increase warmwater gamefish, the main attraction for anglers in Oneida Lake. A one-standard-deviation in the abundance of warmwater gamefish increases housing price by 8.8%. Our results suggest that the aggregated capitalized value for a one-standard-deviation increase in warmwater gamefish amounts to $51.9 million.

<u>PRESENTER BIO</u>: Dr. Weng is an Assistant Professor in the Food and Resource Economics Department at the University of Florida. As an environmental and natural resource economist, she has published 16 papers on topics related to the valuation of ecosystem services, water policy, climate change, and coupled and human natural systems.

DEVELOPMENT OF PAYMENT FOR WATER SERVICES IN THE NORTHERN EVERGLADES

Benita Whalen
Dispersed Water, LLC, Jupiter, FL

As a result of human growth, ecosystem native communities have experienced an alteration of natural water flows resulting in water quality changes and invasion of non-native species. In the Northern Everglades, changes are due to hydrologic alterations from a government-built drainage system and urban and agricultural development. Agency watershed activities have consisted of regulatory, best management practice programs and public investment in regional reservoirs, stormwater treatment areas and technologies. Field testing innovative approaches is essential to the identification of environmentally, socially, and financially effective program components. In 2005, the Florida Ranchlands Environmental Services Project, a pioneering water services pilot, was initiated through a multi-stakeholder collaboration. This market-like environmental services approach proposed a program that would provide financial incentives to landowners for implementation of natural water management activities on portions of their ranches that cumulatively would lead to watershed-scale improvements. The implemented water management activities were providing water retention or nutrient reduction services. Market-like program development concepts include: (1) identify the environmental services and service buyers; (2) evaluate/document performance of the service activities; (3) streamline processes e.g., regulatory that are critical to participation; and (4) negotiate the terms and conditions of the payment for services contract including the service payment. After years of planning, design, testing and pilot implementation, managed through a multi-stakeholder process, the South Florida Water Management District (SFWMD) in 2011 issued the first solicitation under its Dispersed Water Management – Northern Everglades Payment for Environmental Services (NE-PES) Program. NE-PES converted the theory of water services into an operational program. Utilizing a collaborative multi-stakeholder development approach offers the opportunity to build credibility and trust across landowners, agencies, and environmental groups. In addition, sources of funding are expanded because of the wide-spread support for the program. Payment for water services is being discussed statewide in relation to the Florida Wildlife Corridor.

PRESENTER BIO: Benita Whalen is the President of Dispersed Water, LLC and the Water and Environmental Manager of the Florida Cattlemen's Association. Her work focuses on the sustainability of ranchlands. She developed the Dispersed Water Management and Payment for Environmental Services Program during her tenure at the South Florida Water Management District.

CASE STUDY 1: BABCOCK RANCH AND HURRICANE IAN

Amy N. Wicks
Wicks Consulting Group, Babcock Ranch, FL, USA

Babcock Ranch is a community situated in Southwest Florida that was designed carefully with sustainability in mind. While the words sustainability do have several meanings, on September 28th, 2022, Babcock would endure one of its biggest design tests to date as Hurricane Ian slowly churned just off the Southwest Florida Coast.

As part of the sustainable community design, the founders of the new community placed an emphasis on storm resiliency, and this meant the threat of extreme rainfall. Hurricane Ian made landfall as a strong category 4 Hurricane around 4:00 in the afternoon, brining with it rainfall in some locations in excess of 20”.

Months prior to the storm, National Stormwater Trust installed monitoring stations at several control structure locations throughout the community to monitor water levels; and to ultimately place future operational structures throughout the community. Though, the operable structures were not in place in time for the hurricane; the data that was obtained during the storm was able to be incorporated into a security plan for the community throughout the duration of the storm, including important messaging to residents; and in follow up to the community’s proven resiliency from the storm, the data was able to be used to make better decisions on the location of future operational weirs; three of which are now operable onsite, with a commitment to implement approximately 20 structures throughout the community over time to increase the storm resiliency of the community.

PRESENTER BIO: Amy is the founder and president of Wicks Consulting Group; a Civil Engineering Consulting firm based on integrated stormwater designs that propose development as a complete systems approach. Amy has been the lead Engineer for much of Babcock Ranch, leading the design and implementation of their resilient stormwater management systems that successfully managed the extreme rainfall event of Hurricane Ian.

AN OVERVIEW OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT'S AVAILABLE MONITORING DATA AND MAPS

Sandie Will
Southwest Florida Water Management District, Brooksville, FL, USA

The collection of high-quality data is essential for water management decisions today and into the future. At the Southwest Florida Water Management District, the Data Collection Bureau is responsible for providing accurate, cost-effective, and defensible data for use in the management and protection of the state's water resources and related natural systems as well as flood protection. The Data Collection Bureau is comprised of four sections including Geohydrologic Data, Hydrologic Data, Water Quality Monitoring and Mapping/GIS. Staff collect hydrogeologic, hydrologic, water quality, and survey data throughout sixteen counties and disseminate data and reports through an online data portal, web viewers, and other websites.

This informative presentation will provide an understanding of the Data Collection Bureau as well as how to navigate through the District's Water Matters webpage to find available data, maps, and various technical reports to help make informed water resource management decisions. Included will be insights into what types of data and maps are available, how they are collected, and where they are stored. An overview of how data are checked for accuracy and what data governance processes are in place will also be provided. Following this presentation, attendees will gain a clearer understanding of the scientific and geographic data resources available from the District and how to find them.

PRESENTER BIO: Sandie Will is the Data Collection Bureau Chief at the Southwest Florida Water Management District. She has over 25 years of experience in hydrogeology and water resource management, 15 of which have been at the District. She is responsible for the collection of scientific and geographic data, laboratory analyses, mapping services, database management, and report releases.

INFLUENCE OF REDOX CONDITIONS ON LONG-TERM CARBON SEQUESTRATION IN SWEDISH FJORD SEDIMENTS

***Kira Zautcke*[1,2]**, *Emily G. Watts*[2], *Per Hall*[3], *William F. Kenney*[4], *Mats Eriksson*[5], *Thomas Bianchi*[2]

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Fjords are the most efficient marine ecosystems in terms of organic carbon (OC) burial per unit area. A better understanding of the long-term carbon storage, as related to changes in OC sources inputs and redox conditions, is needed to better constrain coastal carbon budgets. The prevailing view on OC burial is that terrestrial OC is more recalcitrant than marine OC and oxic mineralization of OC is more efficient than anaerobic mineralization. To address the effects of redox and OC source on long-term OC burial, 200 cm sediment cores were collected from Hake and Gullmar fjords (long-term oxic and seasonally hypoxic water column, respectively). Sediments were analyzed for %OC, %N, $\delta^{13}C$, $\delta^{15}N$, and ^{210}Pb. Bulk OC profiles indicated diagenesis occurring through the first 70 and 100 cm for the Gullmar and Hake fjords, respectively. Beyond this, the %OC asymptotes at 1% for the Hake fjord and 2% for the Gullmar fjord. The carbon/nitrogen molar ratios (C/N) and $\delta^{13}C$ values showed a predominantly marine signature throughout the entire 200 cm Hake core, with a more terrestrial influence in the Gullmar core. In the Hake fjord, a more depleted $\delta^{13}C$ signal coincides with the decrease of OC content with depth, reflecting preferential mineralization of marine OC. In contrast, the Gullmar fjord displays a stable $\delta^{13}C$ profile throughout the 200 cm core. Long-term organic carbon burial rates were 12.7 g OC m^{-2} yr^{-1} and 23.16 g OC m^{-2} yr^{-1} for the Hake and Gullmar fjords, respectively. Long-term degradation rates will be calculated. Sterol biomarkers are currently being investigated to better elucidate sources and degradation of OC in these sediment cores. Sterols are useful because of their resistance to degradation, source specificity, and known degradation products. Preliminary results suggest OC burial was more efficient in the seasonally hypoxic fjord than the long-term oxic fjord.

<u>PRESENTER BIO</u>: Kira Zautcke is a third-year student at the University of Florida with a double major in Biochemistry and Marine Science. She plans to further pursue organic geochemistry research in graduate school.

A MULTI-SCALE FRAMEWORK FOR THE INTEGRATED HYDROLOGIC MODEL

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The Integrated Hydrologic Model (IHM) dynamically couples HSPF with MODFLOW to simulate the surface water and groundwater systems, respectively, and feedback between these systems. A multi-scale framework is applied to the Integrated Northern Tampa Bay (INTB) model which is a well-calibrated application of the IHM. Decision-makers can employ the multi-scale framework to obtain simulation results at an appropriate spatial scale for effective water resources management. The transition efficiency between model spatial scales is improved by developing C# Windows Forms Applications and Python tools to automate the process of model input preparation for different subdomains and scales. The comprehensive set of applications and tools include: (1) Spatial Window Selection and Extraction facilitates selection and extraction of shapefile data for all scales within a subdomain of the primary (e.g., INTB) domain through GIS operations and database queries; (2) Database Table Population Application populates tables within the model input database; (3) Boundary Condition defines and applies boundary condition inputs for HSPF and MODFLOW; (4) Climate and Irrigation defines and populates time series data for spatial flux inputs including rainfall, potential evapotranspiration, and irrigation; and (5) Point Inputs and Calibration Targets assigns calibration target time series (e.g., observation wells and streamflow gauges) and point location inputs (e.g., production wells and diversions) to the appropriate simulation unit for each spatial scale. As a demonstration, the applications and tools are employed to extract the Anclote Watershed subdomain within the primary model (INTB) domain as a separate model, referred to as the ANCLOTE model. Simulation results for flows, heads, and evapotranspiration in the Anclote Watershed are compared and evaluated between the INTB model and the ANCLOTE model. The multiscale framework can provide locally-focused water resources assessments, with regional hydrologic support, for land use change, climate change, sea-level rise, wellhead protection, and more.

<u>PRESENTER BIO</u>: Yu Zhang is a Ph.D. Candidate in Water Resources Engineering at University of Central Florida, and her research interests include quantifying anthropogenic impacts on hydrology and understanding the roles of surface water and groundwater interactions in hydrology using the Integrated Hydrologic Model.

NUTRIENT DISTRIBUTION ACROSS DEEP SOIL PROFILES UNDER DIFFERENT MANAGEMENT PRACTICES

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Phosphorus (P) loss from agricultural fields constitutes a significant and persistent challenge, resulting in the deterioration of downstream aquatic ecosystems and protracted eutrophication. An important process controlling P transport in agricultural soils is the mineralization and subsequent mobilization of organic matter near the soil surface and up to depths of 100 cm within the soil profile. This phenomenon underscores the critical role that both surface and deep soil layers play in P dynamics within agricultural systems. These dynamics are further influenced by a combination of natural conditions and agricultural management practices. This study aims to elucidate variations in soil attributes across different depths within two distinct long-term management systems employed in Florida's beef cattle production grasslands: intensively-management and semi-native management. A total of 47 deep soil cores were sampled throughout our ranch, encompassing a depth range from 0 to 100 cm. Total P, Mehlich-1 P, Mehlich-3 P, Al, Fe, organic matter, pH, nitrogen, and carbon were quantified at each soil depth. The results showed that all three forms of P exhibited higher concentrations in the uppermost soil layer (0-15 cm) and the deepest soil layer (90-100 cm) under both management practices, with relatively lower P concentrations observed in the middle soil depths. Intensively managed grasslands exhibited reduced P concentrations in the upper soil layer, gradually increasing as depth extended toward the lower layers. Concurrently, soil nitrogen, carbon, and organic matter predominantly accumulated in the uppermost soil layer, with minimal representation below a depth of 30 cm for both management systems. Most sampled sites displayed negative Soil Phosphorus Storage Capacity (SPSC), signifying reduced soil P retention and the potential as P sources. These soil characteristics with substantial negative SPSC may significantly threaten subsurface water quality, emphasizing the need for comprehensive soil management to curb phosphorus losses and safeguard regional water quality.

PRESENTER BIO: Mrs. Ran Zhi is an interdisciplinary ecology Ph.D. student at the University of Florida. Her current research area centers on the management of legacy phosphorus in agricultural ecosystems. In her work, she aims to develop models for legacy phosphorus behavior in ecosystems and devise management strategies to mitigate its environmental impact.

ET TRENDS AND THE INFLUENCING FACTORS AND CORRELATIONS

Yibing Kevin Zhu
South Florida Water Management District, West Palm Beach, FL, USA

Studies have been reporting global climate changes in the past decades. The increased level of greenhouse gases and the subsequent warming have altered the hydrological cycle to different extents at locations around the Earth (IPCC 2021). To address the challenge, the SFWMD is implementing several water and climate resiliency metrics to identify the regional trends, using the best available data from the District, USGS, and NOAA. Along with rainfall and surface flow, evapotranspiration (ET) plays a critical role to the sustainable development of our infrastructure, e.g. in agriculture and water supply. A recent look at the observation data shows that South Florida has been experiencing an upward trend of ET over the past 30 to 60 years, with an averaged change ratio of +0.11 inch/year. This trend is a compound reflection of environmental changes. ET rate is usually affected by four meteorologic factors, i.e. solar radiation, air temperature, relative humidity and wind speed. Historical data show that increasing solar radiation and increasing air temperature contribute to the upward ET trend most (R^2 = 0.52 and 0.26 respectively), followed by the declining relative humidity and no-trend wind speed. When all considered, the correlation between the upward ET trend and the four driving factors can be as high as R^2 = 0.9. The variation of annual ET amounts also oppositely corresponds to annual rainfall amounts very well.

PRESENTER BIO: Kevin is a professional engineer with more than 25 years of experience in water resources, from hydraulic structures' design, to H&H modeling, to environmental assessment. Most recently, he is working extensively on hydrological data quality and the investigation of monitoring issues.

FLORIDA WELL OWNER NETWORK: EXTENSION OUTREACH TO IMPROVE PRIVATE WELL WATER QUALITY AND STEWARDSHIP

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An estimated 2.5 million Floridians rely on private wells for home consumption. Different from public water systems, private wells are not regulated and private well users control the management and protection of their wells. Limited public data exist on how many well users regularly test their water or drink from contaminated wells. To meet the needs of private well users, UF/IFAS Extension developed the Florida Well Owner Network (FWON), a drinking water quality and septic system education program. Our goals are to educate residents about well water quality and best management practices to ensure well and groundwater protection as well as facilitate access to regular well water testing and testing after extreme weather events. To successfully achieve these goals at state and local levels, FWON has brought in multi-level partnerships and collaborations. These include internal and external state specialists, county extension agents, local health departments, water management districts, and state-certified water quality testing labs. Since 2017, over 2,000 well users have been educated about private well management through FWON and 458 people have submitted water samples for bacteria testing. Bacterial contamination was detected in 19% samples during the routine water sampling events and in 38% samples after storms and hurricanes. Annual bacteria testing is recommended, but about 65% participants reported never testing their water, mainly because they did not know where to test it and what to test for. This Extension program not only increases well owners' knowledge of best practices for well management and groundwater protection, but also provides easy access for them to test well water quality to help ensure the safety of their drinking water.

<u>PRESENTER BIO</u>: Yilin Zhuang is the Regional Water Resources Agent in the Central Extension District. Her area of specialization is integrated water resources management in urban and rural environments. Andrea Albertin is the Regional Water Resources Agent in the Northwest Extension District. She specializes in groundwater quality in agricultural and urban areas.

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