BOOK OF ABSTRACTS 2018

6th UNIVERSITY OF FLORIDA WATER INSTITUTE SYMPOSIUM

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Session Title: Forest Ecohydrology

Forest Management for Water Conservation: Understanding Drivers of Forest Water Use and Yield

Management strategies have a significant effect on forest water use and may be used as potential tools for regional water resource management. In this study, we quantified forest water use and water yield (Yw) under a range of forest management conditions at six sites across Florida. At each site, daily water use (evapotranspiration, ET) was estimated for forests under six different silvicultural management conditions (from clearcut to high density plantation and restored stands) using continuous, in-situ soil moisture and groundwater measurements. Estimated water use relative to the potential ET (ET: PET) was strongly associated with leaf are index (LAI), root-zone soil-moisture status, and site hydroclimate, their combination explaining approximately 85% of the variation in the ET:PET ratio. Combined interception losses (Ia) by aboveground forest structures (canopy, understory vegetation and dead litter) was also significant, accounting for 15-30% of annual rainfall across the sites. Annual Yw calculated from these ET and Ia estimates differed significantly among sites and plots (ranging from -0.12 cm/yr to › 100 cm/yr), demonstrating a substantial influence of management regimes. Leaf area index strongly influenced Yw in all sites, and a general linear model with forest attributes (LAI and groundcover), hydroclimate, and site characteristics explained ›90% of variation in observed Yw. The results are useful for understanding potential changes in water yields under different management and climate scenarios and may be used to develop forest best management practices to enhance water yield as an ecosystem service.

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Session Title: Forest Ecohydrology

Economic tradeoffs between carbon sequestration and water yield in southern pine forests

Forests play an important role with respect to water resources, and can be managed to increase surface- and groundwater recharge. With the creation of a forest water yield payment system, privately-owned forests, which comprise the majority of forest area in the Southeastern US, could become an important potential source of additional water supply. We will assess the impact of climate change, thinning schedules, tree planting densities and different forest productivity conditions on the water yield, carbon sequestration and profitability of loblolly pine stands in the southeastern United States. Using the 3-PG model, we will determine different climatic projections and then employ a stand level economic model that incorporates prices for timber, carbon sequestration and increased water yield. The goal of our study is to determine the economic tradeoffs between carbon sinks and water yield to sustainably analyze the role of forest resources for both ecosystem services.

Adams, Damian

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Authors: **Melissa Kreye**, University of Florida
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Session Title: Poster Session - Water Quality - Water Management

Water Resource Protection at the Ballot Box: Understanding Voter Preferences and Behavior

Citizens are often directly involved in land conservation, and the protection of important ecosystem services, by voting in local and statewide ballot initiatives and referendums. To understand demand for environmental goods, investigators will often examine the socio-economic characteristics (e.g., median household income) of communities where these referendums occur. This approach, however, provides a limited understanding of the preferences that give rise to voting behaviors, and encourage the passage of these referendums. Our study broadens the understanding of demand for open space by assessing the benefits described in the ballot statement to determine voter preferences, and the psychology of voting. Observations from 76 open space referendums, held in the Eastern U.S. between 1991 and 2013, were fitted to stepwise weighted least squares regression models to predict voting outcomes. We found much of the information provided in the ballot statement was indeed correlated with a yes vote, but response differed by socio-economic group. Many voters also preferred ballots that contained vague descriptions of ecosystem service benefits and used funding mechanisms that obscured who benefits and who pays (i.e., bonds). We conclude these types of ballot statements likely increased the perceived odds of a favorable outcome (i.e., enhanced provision of most preferred benefits at the lowest cost). We recommend that this type of ballot design could encourage the passage of open space referendums in economically diverse communities.

Albertin, Andrea

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Session Title: Sharing Information: Effective Communication Strategies

Meeting the resource needs of the private well owner community

Public water systems are regulated by the U.S. EPA to ensure safe drinking water; however, private wells are not regulated by the government and the impetus for water quality testing falls on well users. Nationally, 15% of the population relies on private well water (47 million people), and in Florida 2.5 million people (12% of residents) supply their water from private wells. Few public data exist on how many well users regularly test their water or drink from contaminated wells. The risk of contamination is suspected to increase after flooding events.
Through an NSF Rapid Response Research Grant, Virginia Polytechnic Institute and State University, Texas A&M AgriLife Extension Service and UF/IFAS Extension have partnered to offer free well water testing to homeowners impacted by flooding from hurricanes Harvey in Texas and Irma in Florida. Tests include total coliform bacteria, E. coli and inorganic parameters (e.g. nitrate, arsenic, lead and chloride). Participating homeowners are being asked to complete a needs assessment questionnaire regarding their well system characteristics, knowledge of proper maintenance and testing, perceptions of safety of their water and how to best engage them in future outreach and education efforts.
In this presentation, we will include water quality and survey results from both Texas and Florida, and provide insights into the challenges faced by this at-risk population and how best to assist in recovery efforts after future natural disasters. In Florida, this work is serving to launch the UF/IFAS Florida Well Owner Network. The aim is to provide residents with educational materials and classes to address gaps in knowledge regarding well maintenance, the importance of testing and recommended treatments when pathogens are present.

Alfieri, Michael

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Sam Upchurch, Associate

Session Title: Challenges & Opportunities for Spring System Restoration 4

Groundwater quality source evaluation for the Rainbow Springs group, Marion County, Florida: A pilot program

There are more than one hundred-fifty springs within the Southwest Florida Water Management District (District). All of which have become threatened in varying degrees by anthropogenic activities and other factors. Traditional “catch-all” approaches to springs protection and restoration have focused on areas proximal to the spring or spring group. The intent of this pilot program was to evaluate a “surgical” approach linking aqueous geochemical statistics to potential karst features and land uses over three, consecutive 10-year time frames. Like any hydrogeological investigation, the foundation of this pilot program was a sound conceptual site model. This included a regional and site-specific review from a stratigraphic, geomorphic, and karst-science perspective. Once potentially relatable karst features were identified, statistical analyses of District water-quality data were completed to cluster the water-quality data into process-related factors. Site-specific loadings of water-quality data to process-related factors can be mapped to identify potential sites of interest within a springshed. The statistical approach included: geochemical fingerprinting by pattern recognition and analysis; principal component analyses; and factor analyses. These geostatistical/geochemical analyses along with the karst hydrogeological evaluation allowed for the identification of potential “hot spots”. Areas impacted by direct, rapid recharge through drainage wells and sinkholes, as well as by slow, natural recharge into the upper Floridan aquifer. Three factors which represent different chemical processes were identified and their relative aerial extent determined. These processes were: (1) regional dissolution of the aquifer limestone and/or dolostone matrices and recharge of meteoric water; (2) recharge from local, urban, and agricultural fertilizer runoff; and (3) recharge from local, urban, and agricultural soil amendment runoff. The results of this pilot program can be used develop strategies for cost-effective improvement of the quantity and quality of District spring systems.

Al-Quraishi, Ali

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Session Title: Poster Session - Wetlands

Reducing the Accumulated Salt Concentration by Changing the Water Hydrodynamic of the Western Al-Hammar Marsh.

The Al-Hammar marsh is one of the three major marshes in Iraq which experienced great changes in the period 1990-2003. The total area is approximately 2,800 km2 which includes permanent and seasonal marshes and lakes. The marsh is divided into two parts: the eastern part which feeds from the Tigris River, and the western part which feeds from the Euphrates River. In addition, Hammar marsh is in the worst condition of all the Iraqi marshes because it feeds from the Euphrates River, which has serious problems including increasing salinity concentrations and reduction in water flow. Therefore, the Main Outfall Drain (MOD) water, which is a drainage water with high salinity, has been used as an alternative water source to reduce the water shortage in the Euphrates river. Also, non-existence outlet to the western marsh as well as the high evaporation rate in the region help to accumulate the salts within the marsh. Consequently, the increased salinity concentration has killed most aquatic life, such reeds, fish, and water buffalo. In contrast, finding a method to flush the accumulated salts out of the western marsh is a challenge to preserve the marsh ecosystem. Therefore, in this study we design a multiple feeder canal system with outlets which can change the hydraulic pattern within the marsh, and create an active mixing that can help to reduce the salinity concentration over time. This also creates mixing zones within the marsh which can have profound effects on the entire ecosystem.

Asefa, Tirusew

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Session Title: Engaging Stakeholders in Developing Solutions to Water Issues

Understanding Climate Variability and Climate change in Planning for Future Water Supply: A Stakeholder- Scientist Collaborative Approach

Florida in general and west central Florida, in particular, just saw one of a kind extreme weather swing in recent history: from one in a century driest dry season to one of the most active summer storm season since 2004. This puts water utilities who are tasked in meeting an ever-increasing regional demand for water supply into a unique situation. While they prepare for an extended drought, they also need to keep an eye on a climate that is more and more extreme and may require capturing flows when they are available during short period of time. This has changed the risk profile of many water supply managers across the state. Understanding inter- and intra-year climate/weather variability, onset and demise of summer seasons, as well as changes in frequency of storms is some of the issues they wrestle with. A number of Utilities, regulatory agencies, and University researchers have recently coae together under the umbrella of Florida Water Climate Alliance (www.FloridaWCA.org) with the sole objective of producing actionable science, data, and methods for decision making. This talk highlights recent events, scientist-stakeholder collaborative efforts in advancing this effort.

Athearn, Kevin

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Session Title: Agricultural Water and Nutrient Management 1

Improvements in Water and Nutrient Management by Suwannee Valley Watermelon Growers

Watermelons are grown on about 6,000 acres in the Suwannee Valley region, accounting for nearly one-third of Florida's watermelon production. Over the past 25 years, UF/IFAS Extension and agencies such as the Florida Department of Agriculture and Consumer Services, the Suwannee River Water Management District, and the USDA Natural Resources Conservation Service have assisted growers in adopting best management practices (BMPs) that conserve water and protect water quality. Our study documented changes in watermelon production practices, water use, fuel use, fertilizer use, and efficiency in the Suwannee Valley region of Florida from 1990 to 2015. Through semi-structured interviews with nine growers in spring 2016 and a review of publications, we documented improvements in water and nutrient management by watermelon growers in the Suwannee Valley. Watermelon growers reported reducing water use by 50-80% and fuel use by 50-86%. Most growers reported reductions in applied nitrogen per acre ranging from 15-30%, and all reported improvements in nitrogen efficiency. Over the same time period, typical watermelon yields increased from 25,000-40,000 pounds per acre to 50,000-60,000 pounds per acre. Growers and extension agents reported that watermelon production practices are similar across the region. Based on the results of our study, we estimated that 2.1 billion gallons of water have been saved each year because of improved irrigation efficiency in Suwannee Valley watermelon production.

Ayankojo, Ibukun

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Session Title: Agricultural Water and Nutrient Management 2

The Use of Smartphone Application (SmartIrrigation Vegetable) for Irrigation Scheduling in Tomato (Solanum Lycopersicon) Production

Increase in agricultural water consumption through irrigation and the demand for water conservation are reasons for a global effort in the reduction of agricultural water use through increasing water use efficiency (WUE). Increasing WUE will increase water savings and reduce the negative environmental consequences of excessive irrigation. The focus of this study was to evaluate and compare irrigation schedule by a real-time scheduler - SmartIrrigation vegetable App (SI) with a historic ET irrigation recommendation by UF/IFAS (HI). We compared both scheduling methods (SI and HI) for water savings, productivity, and efficiencies in open-field tomato production. Irrigation schedule from both scheduling methods was evaluated at four water application volumes (66% SI, 100% SI, 150% SI, and 100% HI) in a randomized complete block design over two production seasons (fall 2015 and spring 2016). Nutrient application was the same for all treatments according to UF/IFAS recommendation. For both seasons, depth of irrigation water applied increased in the order of 66% SI < 100% SI < 100% HI < 150% SI. Total water savings was higher for 100% SI schedule compare to 100% HI at 17% and 15% for fall and spring seasons respectively. Based on productivity, 66% SI was highest in WUE at 161 kg m-3 during fall season but WUE was similar with 100% SI during spring. Nitrogen use efficiency (NUE-N) was highest for 100% SI (0.44 kg.g--N and 0.36 kg.g--N for fall and spring seasons respectively) compare to other irrigation volumes for both seasons. Lower yield and efficiencies observed for both 100% HI and 150% SI was attributed to nutrient leaching from excessive irrigation water application. Our results suggest that the use of a real-time irrigation scheduler (SmartIrrigation vegetable App) for irrigation scheduling in tomato production can increase water savings, reduce the possibility of groundwater contamination by reducing nutrient leaching and also maximize tomato yield.

Barber, Lynn

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Session Title: Urban Water and Nutrient Management 2

Community Water Wise Award Program: Hillsborough, Pasco and Pinellas Counties

The purpose of the annual Community Water Wise Awards is to recognize individuals and businesses committed to conserving our water resources and protecting the environment by using Florida-Friendly Landscaping™ (FFL) principles. The nine FFL principles, integral to the landscape evaluation process for this award program, are promoted locally/regionally utilizing several media sources. These principles are: right plant right place, water efficiently, fertilize appropriately, mulch, attract wildlife, manage yard pests responsibly, recycle, reduce stormwater runoff and protect the waterfront. Homeowners, businesses, non-profit organizations, community associations and other entities can view photos/videos of past winners and complete an entry form at http://tampabaywaterwise.org. Submissions are followed by on-site landscape evaluations. This process provides landscape advice to entrants. Landscapes are scored in categories of businesses, homeowners, etc. and the highest scoring landscape in each is the winner. Winning entries receive a handmade mosaic stepping stone or a plaque for businesses. Winners are acknowledged by city councils/county commissioners which increases the visibility of the award, further promotes water wise programs and the FFL principles to the public and city/county administration. Hundreds of thousands of residents attend these meetings, view televised presentations, read website and newspaper articles about the award winners. There has been a 125% increase in award applications in these counties. Behavioral changes associated with this program have been identified by landscape changes implemented and impacts on water conservation as identified through county/city water consumption record reviews. Combining a county proclamation to recognize April as Water Conservation Month with recognition of local winners has proven highly successful in promoting the program which has been replicated in other Florida counties and is ripe for statewide utilization/national application.

Barrett, Charles

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Kelly Morgan, University of Florida Southwest Florida Research and Education Center
Charles Barrett, UF/IFAS Extension

Session Title: Poster Session - Agricultural/Silvicultural Water

Inter-Agency partnerships: What makes them work, what makes them challenging, and what is your role as an Extension professional

Extension professionals are compelled to participate in a broad range of partnerships to develop their programmatic expertise and fulfill obligations or expectations in the community. This professional development program was developed to prepare Extension agents to more effectively engage in multi-stakeholder inter-agency partnerships in their counties. The specific objectives of the program were to: 1) Examine diverse examples of inter-agency partnerships to identify elements that lead to success and key barriers associated with creating and sustaining these multi-stakeholder groups; 2) Reflect on the multiple roles Extension professionals play (as leaders and participants); 3) Discuss experiences with monitoring, documenting, and reporting partnership success; and 4) Explore Extension agent needs for further training and available resources. The professional development program combined a panel of speakers, PowerPoint presentations and interactive activities. Fifteen Extension professionals spent over four hours discussing the complexities and opportunities associated with inter-agency partnerships. A diversity of Extension areas were represented, including family and consumer services, production agriculture (vegetables and row crops), water resources, insects, and coastal systems. To close the program, participants considered the challenges they confronted as Extension professionals and listed the types of support that might help them to be more effective in catalyzing and sustaining inter-agency partnerships. Following the program, participants were provided an Executive Summary highlighting the topics discussed during the program: Key insights on inter-agency partnerships; support needed for extension professionals; main take home messages; main challenges and barriers; and key opportunities and issues.

Barrett, Charles

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Session Title: Engaging Stakeholders in Developing Solutions to Water Issues

The Suwannee River Partnership Education Team improves communication, builds relationships and improves adoption of Best Management Practices

The Suwanee River Partnership Education Team (SRP) has held regular monthly breakfast meetings since 2004. These meetings emerged from an inter-agency partnership agreement that was signed in January 1999, forming a group known as the Suwannee River Partnership. Although the SRP Education Team has held meetings open to anyone, primary participants include representatives from agencies that interact with production agriculture and/or focus on water issues. The SRP breakfast meetings were designed to provide a relaxed, informal atmosphere where participants could eat breakfast and share information without a formal agenda or assigned speakers. Meetings typically take up to an hour and a half and are facilitated by a designated coordinator. The primary themes of the group include: “communication,” followed by “cooperation,” “sharing,” and “awareness.” Participants also noted networking, working together, partners, and problem solving as benefits of involvement. The objective of this program is to build relationships and improve the adoption of Best Management Practices (BMPs). Between 2008 and 2015 71 people attended 1 or more of the 60 meetings held. Upon assessment of program participants, 75% will report the meetings are moderately useful, very useful, or extremely useful to their work on BMPs. Additionally, more than 50% of participants will report the meetings are moderately effective, very effective, or extremely effective to improve relationships between agencies and employees in the Suwannee River basin There have been numerous perceived impacts of the group that show the value and importance of this enduring group: improved understanding and adoption of BMPs, expanded research and funding, collaborations with farmers, engaging farmers in new issues, and a raised profile for Extension.

Barry, Savanna

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Session Title: Poster Session - Climate Change/Hydrology

Evidence and Effects of Climate Change in Florida's Nature Coast

Florida's Nature Coast, spanning from Hernando to Wakulla County in the northeast Gulf of Mexico, is one of the most undeveloped estuarine ecosystems in the Southeastern United States. The region contains an abundance of diverse habitats, including tidal creeks, salt marshes, oyster reefs, seagrass meadows, and mangroves, as well as an economy driven by natural resources (farming, fishing, forestry, ecotourism, and aquaculture, among other industries). Despite the presence of numerous wildlife refuges and protected lands, the area is still under threat from a number of disturbances, including global climate change. The gradual elevation gradient makes the Nature Coast extremely susceptible to climate change, as even small changes to sea level or the timing and magnitude of freshwater discharge become exacerbated. Here, we synthesize the available evidence for the existence of climate change along the Nature Coast, including changes to temperature, sea level, and large scale weather patterns that may influence freshwater discharge from the Suwannee River, one of the largest and most pristine rivers in the Southeast. In addition, we provide examples of tropical and subtropically-associated fauna (groupers, snappers, snook, parrotfish) and flora (black, red, and white mangroves) that exhibit expanding distributions into the northern Gulf of Mexico. The objective of collating this information is to develop a more comprehensive understanding of the risk of climate change to this estuary and highlight critical knowledge gaps that should be prioritized in future efforts.

Barry, Savanna

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Session Title: Poster Session - Climate Change/Hydrology

Characterizing blue carbon stocks in Thalassia testudinum meadows subjected to different long-term phosphorus supplies: a lignin biomarker approach

Seagrass meadows represent globally important stores of carbon. However, environmental heterogeneity in shallow, estuarine environments may shape the quantity, composition, and post-depositional processing of organic carbon stocks (Corg) in these meadows. Along a persistent gradient in total phosphorus concentrations in the water column and a parallel gradient in seagrass morphology, we measured traditional bulk carbon parameters (Corg stocks, bulk density, %Corg, Corg:N, and δ13C) and lignin biomarkers in live and dead tissue of Thalassia testudinum and in the sediments beneath the seagrass meadows. We found that Corg stocks and sources differed among systems, but consistent patterns related to extant standing stocks of seagrass and historical nutrient concentrations were not evident in sedimentary Corg. We estimated that seagrasses contributed 44–73% of the total sedimentary Corg throughout the region, with the remainder derived from allochthonous sources (e.g., phytoplankton, marsh grasses, and mangroves). The system with intermediate phosphorus concentrations and seagrass standing stock had more Corg overall, more Corg from phytoplankton, and sediments with lower bulk density, which suggested hydrodynamics played a key role in determining stocks. Phenolic acid-to-aldehyde ratios were high in fresh T. testudinum tissues, and lower values in the sediments indicated extensive leaching of acidic lignin phenols. After this initial decay and selective leaching, most of the lignin deposited in the upper layers of sediment was retained in the T. testudinum meadows, but detailed identification of sources and degradation pathways for lignins will require new indices designed for submerged estuarine sediments.

Bean, Eban

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Session Title: Agricultural Water and Nutrient Management 2

Soil Moisture Time Series Analysis for Estimating Field Capacity: Person vs. Machine

Management of soil water is critical to sustaining crops within agricultural and urban settings. Ideally, sufficient water content would be maintained within the root zone to not result in plant stress, while minimizing excess irrigation resulting in drainage. Field capacity is commonly defined as the water content in the soil once excess water has drained away and is the upper limit of water content available to plants for determining irrigation scheduling efficiently provide plants water by estimating the field capacity. SMS data can provide detailed fluctuations in water content over time to identify field capacity. Field capacity has been determined by visual assessment of SMS data and professional judgement, although this is subjective and often time intensive. We developed two divergent approaches for estimating field capacity from SMS time series to estimate an objective field capacity value. Each approach separated the time series into individual wetting and drying cycles and then used screening criteria to eliminate inadequate or false cycles. The first approach used the 'findpeaks' routine in R to identify critical points within each cycle and estimate field capacity, and machine learning techniques to screen out invalid cycles. The second approach developed in Matlab used a regression approach to estimate change in water content over time based on physical processes. A subroutine also estimated field capacity as the water content just before the morning following a wetting event (irrigation or precipitation). These two approaches were run on three data sets (conventional turf irrigation, ET controlled turf irrigation, and conventional irrigation on citrus) with hourly data and compared to field capacity estimates by an experienced researcher. Both approaches agreed very closely to the human reference with each providing novel approaches to this problem. These tools could be used to improve soil water management in the future.

Bean, Eban

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Session Title: Urban Water and Nutrient Management 1

Mitigating Compaction in New Residential Developments: Effects on Urban Vadose Zone Hydrology and Soil Quality

Florida's demand on limited water resources continues to grow coincident with residential housing and population. Activities associated with home construction and site grading often create a vadose zone characterized by compacted soils, diminished infiltration, high bulk densities, and limited organic matter and nutrients. The altered vadose zone provides little to facilitate the establishment and health of landscape plants and results in either less efficient irrigation or greater frequency of irrigation. While tillage and soil amendments are commonplace in agriculture, their potential to mitigate residential soils in not yet realized. To evaluate the effects of tillage and soil amendments on plant available water in residential settings we partnered with On Top of the World in Ocala, FL. Nine model homes received one of three treatments (compacted, tilled to 5 in., tilled to 5 in. with 1 in. of compost incorporation) between final grading and installation of landscaping (empire zoysia turfgrass, shrub beds, and trees). All home were landscaped to comply with Water Star and irrigation run times were adjusted based on calculated ET from on-site weather conditions. Soil moisture was recorded every 15 minutes, rainfall and atmospheric data with an on-site weather station, continuously monitoring irrigation rates, and continuously monitoring soil from at two depths (0-15 and 15-30 cm) with repeated sampling and Cone penetrometers. Pre-treatment bulk densities exceeded values for compact urban soils in previous studies and soils were too compact for some cone indices and sub-surface soil samples to be collected. Rainfall patterns during the monitoring period were abnormal, with extreme drought leading up to May, and excess rainfall during June and July, followed by Hurricane Irma in August. Although this study will continue through early 2019, preliminary results suggest that these measures increase the plant available water and jump-start the soil regeneration process, with compost providing additional benefit.

Bi, Xiang

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Session Title: Water and Regional Science

Public Preferences for Water Resource Management of the Ocklawaha River

Special Session–Christa Court
(for consideration in the special session on Water and Regional Science)
Abstract: The natural flow of the Ocklawaha River was altered by a dam built more than forty years ago as part of the abandoned Cross Florida Barge Canal. The impoundment created Rodman reservoir, a managed ecosystem with such recreation opportunities as fishing. Restoring the natural flow of the river may revive several natural springs, the river-based ecosystem, and the upstream Silver River and Silver Springs, improving related recreation.
This study examined visitation and public preferences for Ocklawaha River management, to help find acceptable solutions to the long-standing controversy. The economic tradeoffs related to Rodman Reservoir management were evaluated by estimating the value of recreational experiences on the Ocklawaha River and Rodman reservoir and the economic contributions of river- and reservoir-based recreation to local economies.
Surveys of visitors at five sites along the Ocklawaha and Silver Rivers were conducted under a “normal” reservoir management regime and during a scheduled drawdown period when the water level was reduced to manage aquatic plants and improve habitat. The survey elicited information on visitation frequency, types of recreation activities, trip expenditures, knowledge and opinions about the issues around the Ocklawaha River and Rodman Reservoir management, and demographics.
To assess the direct and indirect economic contributions to the local economy associated with recreational activities and visitor spending, regional economic modelling was conducted with the IMPLAN software and associated database for three Florida counties. To estimate visitors’ willingness to pay for the uses of the resource, travel cost method was applied.
We find that Florida residents derive economic benefits from both river-based and reservoir-based recreation, with river-based recreation generating greater economic impact than the reservoir. Policy implications of these findings are discussed.

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Session Title: Agricultural Water and Nutrient Management 2

Soil water dynamics of shallow water table soils cultivated with potato crop

Agricultural areas with shallow water table use subirrigation relying on upward soil water flux to supply the crop evapotranspiration. The objectives of this study were to determine soil hydraulic conditions and soil water capillary movement under four different irrigation systems to estimate groundwater recharge and ideal water table level for potato irrigation. Potato was grown under seepage, tile drainage, subsurface drip irrigation (SDI) and sprinkler irrigation systems. Soil hydraulic conditions were measured at 15, 30 and 45 cm depths and van Genuchten parameters determined to calculate the soil water flux using Darcy's law. Soil texture and soil organic matter directly affected soil water dynamics. Loamy sand soils with soil organic matter ranging 13.5-26.1 g.kg-1 had volumetric water content at field capacity of 0.25 cm3.cm-3, while sandy soils with soil organic matter of 5.2-7.0 g.kg-1 had an average field capacity of 0.16 cm3.cm-3. Water table level managed at 69 cm below the soil surface provided an adequate upward soil water flux to potato root zone for loamy sand soils under seepage. While, for sandy soils under tile drainage and SDI the optimum water table level was at 42 and 45 cm below the soil surface, respectively. About 26% of potato crop evapotranspiration demand was supplied via upward soil water flux under sprinkler. After rainfall, water table elevation ratio was 34.4 and 25.6 for loamy sand and sandy soils, respectively. Improved drainage capacity of tile drainage system returned the water table to an optimum level in half of the time required for other systems. Soil type and texture were major factors to determine the ideal water table level for potato production.

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Session Title: Poster Session - Agricultural/Silvicultural Water

Spatial and temporal distribution of soil N under four irrigation systems as function of N fertilizer rate and timing of application in potatoes

Agricultural areas with coarse-texture soils and shallow water table may require greater nitrogen (N) fertilizer supplementation than plant N requirements, which leads to N losses irrigation are not properly managed. The study objective was to evaluate the spatial and temporal distribution of soil N in coarse texture soils under seepage, tile drainage, subsurface drip (SDI) and sprinkler irrigation under a combination of different N fertilizer rates and timings of application. A factorial randomized complete block design with three N rates (0, 56, 112 kg.ha-1) applied at planting (Npl) and two N rates (56 and 112 kg.ha-1) at emergence (Neme) and at tuber initiation (Nti) was setup within each irrigation system for two seasons in Hastings, FL. Soil mineral N was determined in the 0-15, 15-30 and 30-60 cm soil depth layers at five-potato growth stages. Under seepage, tile drainage and SDI the water table was raised to irrigated the crop and the upward soil water flux held soil N longer in the root zone compared to sprinkler. A combined management of water table level and sprinkler irrigation can potentially reduce the downward movement of soil N. The application of 112 kg.ha-1 of N at planting resulted in higher soil residual N at the harvest compared to 56 kg.ha-1 in 2015 due to lower precipitation compared to 2016. Nti above 56 kg.ha-1 of N increased soil N at tuber maturation stage but there was no increase in tuber yield. In 2016 regardless of irrigation system and N rates, soil N concentration was lower than 5.8 mg.kg-1 at the potato harvest. The application of 56, 112 and 56 kg.ha-1 of N fertilizer at Npl, Neme and Nti, respectively, provided enough N to supply the potato crop with lowest soil N residual.

Bolson, Jessica

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Session Title: Engaging Stakeholders in Developing Solutions to Water Issues

A stakeholder-science based approach for understanding urban water sustainability challenges across the U.S.

Urban water systems across the United States are struggling to adapt to an evolving set of threats. Understanding the nature of specific pressures on urban water systems and the factors characterizing regional responses to those pressures requires input from local experts. Interactions with stakeholders with deep knowledge of technological and social aspects of managing water are needed to inform our understanding. The Urban Water Innovation Network (UWIN) provides a unique opportunity to engage local stakeholders and area researchers, interested in all aspects of water resources, across five case study regions (Southeast Florida, the Sun Corridor, the Mid-Atlantic, the Pacific Northwest, and the Front Range). Analysis of qualitative data collected from a national scale engagement approach across UWIN study sites on pressures, states, and responses underway provides insight into the challenging context of urban water management in the U.S. Top pressures on urban water systems identified across regions include climate change impacts, aging infrastructure, water quality impairments, and funding limitations. More than technological solutions, responses desired focus on strategies to improve coordination of diverse water management efforts, strengthen communication with elected officials, and to motivate behavioral change among citizens. Results are analyzed using the pressure-state-response framework and discussed within the context of socio-technical transitions literature. The utility of the pressure-state-response model as a framework for guiding analysis of data collected through stakeholder-based research approaches in the water context is analyzed and recommendations for future studies are presented.

Bommidi, Jyothi Swaroop

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Authors: **JYOTHI SWAROOP BOMMIDI**, University of Florida
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Session Title: Who are they? Understanding Audiences to Design or Improve programs

Exploring Rural and Urban Residents Perceptions on Agriculture Water Use

Public engagement is an important factor in attaining the goals of any natural resource management program. The U.S. population is trending towards urban areas and away from rural areas. The research found rural and urban residents differ in their feelings about the environment, especially residential and agricultural water use that leads to disparities in agricultural policy formation. This research used audience segmentation to understand differences in agriculture water use perceptions based on whether a resident was from an urban or rural area. An online survey research design was employed to study the perceptions. Results from the survey show that excluding age of the rural and urban residents, all the other demographic characteristics are significantly different. Differences in perceptions were observed between the two groups in their trust in farmers' use of water and the relationship farmers have with the natural environment. It is worthwhile noting that means for trust in farmers' use of water and the relationship farmers have with the natural environment for rural residents is higher than that of urban residents. This suggests the point that extension professionals should design distinct initiatives for both the audiences to educate them on agricultural water use and its impact on the environment. Qualitative follow up studies could provide rich data describing agricultural water use perceptions.

Borger, Ruth

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Dorothy Zimmerman, Florida Sea Grant
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Session Title: Sharing Information: Effective Communication Strategies

Florida's water storytellers: How the media communicate about Florida's water issues and what it means for scientists working on water issues

Florida's water narrative is influenced by traditional and new media on multiple platforms (print, radio and television, and digital). Journalists, editors, decision makers, and interested citizens all play a role in contributing to what information is disseminated, how opinions are formed and what issues are considered a priority. Scientists and extension agents wanting to communicate research findings and their impact on the quality of life across the state have a challenging time getting attention from the media, explaining the complex issues involved in their work and ensuring that the information presented is factual. Recent coverage has also attacked the academic integrity of UF/IFAS scientists, and questions the veracity of the entire scientific process.

This presentation will focus on trends in water coverage across Florida media over the past 18 months: what topics were covered, how they were presented, who was talking about water, what issues were presented in what areas in the state and when water topics were "headline news." The presentation will also include findings on how UF/IFAS was associated with water and water issues and results from a survey of reporters and media leaders about their knowledge of UF/IFAS water programs.

Finally, presenters will share recommendations as to how researchers and UF/IFAS Extension faculty can be successful in raising the visibility of water research as well as awareness of water quantity and quality issues with Florida residents and decision makers.

Bottcher, Del

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Authors: **Del Bottcher**, Soil and Water Engineering Technology, Inc.

Session Title: Challenges & Opportunities for Everglades System Restoration

Load Estimation Tool for the Lake Okeechobee Watershed

The Load Estimation Tool (LET) for the Lake Okeechobee Watershed, which is used by the Florida Department of Environmental Protection (FDEP) and other state and local agencies as well as private consultants to evaluate water control abatement programs and projects for meeting the Lake Okeechobee BMAP targets and goals, has been recently upgraded. LET now provides both surface and groundwater total nitrogen (TN) and total phosphorus (TP) source loads on a spatial scale of one hectare, as well as, how much of these individual sources loads will reach the nearest stream, and ultimately how much of the source loads will make it to Lake Okeechobee. Therefore, LET now provides stakeholders with the ability to evaluate the relative benefits of various projects or BMP implementation programs based on their spatial location within the watershed. Thus, when combined with project costs can generate the cost effectiveness or efficiency of the water quality projects, so that they can be appropriately ranked and optimized for implementation based on available funding. The presentation will summarize how the LET was developed based on the recently recalibrated WAM model for all of the sub-watersheds that can contribute nutrient loads to Lake Okeechobee, which now includes the Everglades Agricultural Area. LET provides a series of ArcMap grids and shapefile feature classes that contain the TN and TP source loads, the amount of the source TN and TP loads reaching the nearest stream and their associated attenuation factors, and finally the TN and TP loads reaching Lake Okeechobee and their associated attenuation factors from every individual one-hectare source cell. The attenuation factors can be directly applied to new TN and TP loads of a proposed water quality control project(s) to predict the project's relative nutrient load impact on Lake Okeechobee, thus providing its relative load reduction benefits compared to other projects in the Watershed. Examples of how LET has been applied will also be presented.

Brasil, Walterlina

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RENATA NOBRE, UNIR

Session Title: Impacts of Dams and Socioecological Systems 1

The Scientific Community in Projects of Dams in the Amazon

The study presents the mapping of researchers and groups that work on strategic issues, with the dam areas as the "core" from the estudy. The data source is related to the Machado River Dam (Tabajara HPP, 350 MW, Machadinho D'Oeste) and Madeira River (UHE Santo Antonio and Jirau, 3,750 MW, Porto Velho). It uses the database produced in the Project: STUDY OF SOCIAL NETWORKS AND INSTITUTIONAL STRATEGIES IN THE DEVELOPMENT OF RESEARCH IN STRATEGIC THEMES, which tries to establish a cartography about research groups and post-graduation projects in the interdisciplinary area, in Postgraduate Programs in Brazilian Amazonia, and refines them around the performance of these researchers in action for and inside that projects. Makes this option considering that it is fundamental to invest in the study of the development and organization of the scientific community in the Amazon and considers that the large Projects in the region are important case study to deepen understanding about these communities.

Bronson, Stan

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Session Title: Water Policy, Planning and Management

A Global Strategic Initiative: Actionable Solutions for International Water Management

In September of 2017 a team of scientists, engineers, business executives and NGO representatives convened a workshop in Delft, The Netherlands to develop a global knowledge exchange platform in water resources. Transforming data into actionable knowledge in our rapidly changing global environment is an increasing imperative for science, education, practitioners, decision makers, and stakeholders. A new trans-national, multi-disciplinary initiative proposes to address the grand challenges and frontier problems in water resources and water security by working at the intersection of water management and science, technology, business, and policy and bridging these disciplines. We aim to identify and close the gap between knowledge producers (i.e. universities, research infrastructures, national laboratories) and knowledge consumers (i.e. corporations, governments, NGO's). By closing this gap, we hope to increase the relevancy of science and research in developing new, actionable innovation to benefit society.

Canion, Andy

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Lori McCloud, St. Johns River Water Management District
Ed Carter, St. Johns River Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 1

Geospatial Modeling Approaches to Support Springs Protection Projects at SJRWMD

Identifying optimal locations for projects to reduce nitrogen loads in springsheds is critical to successful spring restoration. The St. Johns River Water Management District has developed geospatial tools to 1) predict occurrence of elevated aquifer nitrate concentrations and 2) estimate spatial variation in septic tank loads to groundwater. The first tool produces interpolated surfaces of elevated nitrate concentration and was developed using random forest models to predict the probability of exceeding nitrate concentration thresholds. Training data for the model were nitrate concentrations from public water system (PWS) wells, private drinking wells, and water management district wells. Predictor variables included soil drainage, karst features, land use, and subsurface geology. The second tool utilizes the STUMOD-FL vadose zone nitrogen fate and transport model developed by FDOH to predict loading from septic tanks. Although it is a highly parameterized model, the STUMOD-FL model can be run with default parameters for classes of soil specific to Florida, thus simplifying its implementation. Using pre-defined model output, basin-scale maps of septic tank loading were created using soil class and water table depth as input. These two geospatial tools have been implemented for the springsheds of Silver Springs, Wekiwa Spring, and Blue Spring (Volusia Co.). The tools provide a promising approach for describing karst areas, particularly where the Upper Floridan aquifer is minimally confined and there is a tight spatial and temporal link between land surface activities and aquifer contamination. From a management perspective, these tools can be used to evaluate spatial variation in aquifer vulnerability to nitrogen, can be integrated into evaluations of project effectiveness, and can be used to prioritize conservation land or easement acquisition.

Cardenas, Bernardo

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Session Title: Urban Water and Nutrient Management 2

Testing Smart Irrigation Controllers in the Real World

It has been determined that groundwater resources of Orange County, FL, are not suitable at the current rate of growth. Moreover, is estimated that more than half of its residential potable water is used for landscape irrigation. The objective of this project was to estimate the water conservation potential of smart irrigation controllers in residences that were high water users, across the Orange County Utilities service area. A total of 167 residential cooperators were recruited in nine location clusters. Each location cluster had the following treatments: ET controller only (ET), soil moisture sensor only (SMS), ET controller with optimized programming (ET+OPT), soil moisture sensor with optimized programming (SMS+OPT), and a comparison group that was monitored only (MO). Phase I of data collection encompassed November 2011 through October 2014. On average, the ET treatment reduced irrigation by 19%, and the ET+EDU group by 32%, compared to MO. The SMS reduced irrigation 30% and SMS+EDU 43%. The optimized groups applied less irrigation than their non-educational counterparts. During Phase II, up to October 2017, a tendency for the water savings to decline has been detected, mainly due to some homeowners disconnecting their smart irrigation controllers. Those who have kept them have maintained the results obtained during Phase I.

Cassani, John

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Session Title: Estuarine Ecology and Water Quality

In Support of Re-instating the Florida Harmful Algal Bloom Task Force: Establishing New Strategies for Monitoring, Prediction and Public Notification

In 2016, the massive South Florida algal bloom that resulted in a state of emergency for St. Lucie, Martin and Lee Counties was for many, the culmination of ineffective water policy in Florida that has led to widespread nutrient over-enrichment and water quality impairment. Harmful Algal Blooms (HABs) are an important symptom of declining water quality. The risks of recreational and drinking water exposure to algal cyanotoxins and other HABs has escalated over many years in Florida due to the increasing occurrence of HABs. The issue has now transcended ecological damage to one of major public health importance. Some analysts now consider HABs as the greatest inland water quality threat to public health in the U.S.

Furthermore, recent peer reviewed studies have identified links between HABs in Florida and an increased incidence of liver cancer. HAB toxins also present a significant threat to wildlife and domestic animals especially dogs. These are startling findings and now is the time to increase attention to this growing crisis in Florida.

Reinstating the Florida HAB Task Force is a meaningful step toward science based monitoring, prediction and notification of HABs. Twenty-two other states now have “actionable” guidelines codified in policy for addressing the challenge of HAB threats to public health. Federal legislation on HABs, could bring considerable funding for HAB related public health issues nationally. Timely planning is necessary to take advantage of any opportunity to address this growing problem in Florida and worldwide.

The Florida HAB Task Force was initiated in 1999 and is still codified in Florida Statute 379.2271 despite being defunded in 2001. Renewed funding of the HAB Task Force through legislative appropriations during the 2018 Legislative Session is necessary for re-instating the valuable role the HAB Task Force was meant to address through enabling legislation in 1999.

Chang, Seungwoo

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Session Title: Poster Session - Climate Change/Hydrology

Comparison of dynamic versus statistical downscaling of the CCSM4 General Circulation Model predictions for simulating hydrologic response in the Tampa Bay Region.

The Coupled Model Intercomparison Project Phase 5 (CMIP5) General Circulation Models (GCMs) have been used to project future climate and assess future climate impacts in many studies. In spite of the fact that bias-corrected, statistically downscaled retrospective CMIP5 GCMs reproduce monthly means and standard deviations of precipitation (P) and reference evapotranspiration (ET0) over the Tampa Bay region perfectly, retrospective streamflow and groundwater predictions using regional hydrologic model (INTB) showed some errors (Chang et al., in progress). Due to important local to regional-scale impacts of Gulf of Mexico and Atlantic Ocean dynamics on Florida's climate, it is possible that the errors could be removed or reduced by using a coupled ocean-atmosphere Regional Climate Model to dynamically downscale GCMs over Florida rather than statistically downscaling the GCMs directly. This study examined how water supply reliability might be improved and risk might be reduced by using Florida State University's coupled ocean-atmosphere Regional Climate Model (RSM-ROMS) to downscale CMIP5 CCSM4 predictions and projections for use with Tampa Bay Water's INTB model. Two dynamically downscaled CCSM4 GCM (coupled and uncoupled ocean-atmosphere RCMs) and four statistically downscaled CCSM4 GCM (LOCA, MACA, BCCA, and BCSA) retrospective and future predictions of P, maximum and minimum temperature (Tmax and Tmin) and ET0 estimated by Hargreaves method were used to drive Tampa Bay Water's INTB model. Downscaled P, Tmax, Tmin, and ET0, and the resulting INTB predictions of actual ET, streamflows and groundwater levels were compared over the Tampa Bay Region to evaluate hydrologic implications of differences in the downscaling techniques.

Chen, Xuqi

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Session Title: Coastal Ecosystems

Public Preferences for Adaptation Strategies to Sea Level Rise: The Role of Perception, Knowledge, and Experience

Sea level is expected to rise slowly and steadily in the foreseeable future due to climate change. Sea level rise (SLR) poses significant threats to Florida, as most of its population is located within 60 miles from the coasts. A direct consequence of SLR is inundation and flooding, causing considerable economic loss and ecological damages. Given that there are no viable solutions to stop or even slow down SLR, policymakers are left with only a few options to mitigate the damages, named adaptation strategies for SLR.
Currently, SLR adaptations are undertaken primarily by local governments, e.g., New York City and Miami Beach City. However, local governments will have difficulty sustaining the projects if residents do not view the SLR as a serious issue and would not support these strategies. In this study, we elicit local residents' attitudes toward three adaptation strategies: seawall, beach nourishment, and pumping, implemented in Miami-Dade County. Additionally, we assess the impact of residents' knowledge, perceived risk of SLR, and experiences with flooding on their attitudes toward the adaptation strategies. We find that only 68.08% of the respondents agree upon the current policy of fee collecting to support SLR adaptation. Respondents are least familiar with pumping, with around 21.35% of them never heard nor seen it before. They have a higher willingness-to-pay (WTP) for elevating seawall and beach nourishment than installing pumping system. We also find that years of protection has a significant positive effect on the WTP for adaptation strategies. Also, respondents who had suffered from flooding and storm surge before have a significantly higher WTP for all the three adaptation strategies. The findings of this study would provide with essential policy insights and implications on the social welfare through the investigation on what adaptation strategies are most preferred and how the cost should be split.

Cohen, Matthew

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Session Title: Challenges & Opportunities for Spring System Restoration 3

Primary Production in Spring-Fed Rivers

Special Session– Fitzgerald/Reddy
This work investigates whether nitrate reduction in water flowing to Florida's Springs will be sufficient to restore primary producer community structure. The hypothesis implicit in this proposed link is that nitrogen (N) supply was historically the limiting factor for primary production, such that recent increases in N availability enabled rapid algal growth and the decline of submerged aquatic vegetation (SAV). We tested the hypothesis that nitrogen does, or at least did, limit primary production in these flowing water systems in 4 ways. First, we synthesized the recent and historical measurements of open channel metabolism in spring rivers to evaluate correlative and mass balance evidence for N limitation. Second, we compared metabolism between two rivers (Silver Springs and Alexander Springs Creek) that differ dramatically in their contemporary N availability. Third, we monitored SAV growth in both rivers in an effort to elucidate the controls on biomass accrual at the patch-scale. Finally, we used in-situ benthic chamber experiments in both rivers to test for nutrient enrichment effects on metabolism and algal accrual rates. Within the benthic chambers, we further explored the utilization of nitrate at well below ambient concentrations. Across all 4 tests, we observe overwhelming evidence for the primacy of light inputs on metabolism, and no direct evidence for nitrogen enrichment effects. While it is impossible to prove the absence of mechanisms connecting N concentrations to changing primary producer communities, the preponderance of evidence supports strongly considering alternative explanations.

Conlin, Matthew

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Session Title: Coastal Flooding, Storm Surge and Sea Level Rise

Investigating the drivers of coastal flooding hazards through observations of coastal landscape evolution: a case study at NASA-Kennedy Space Center, Cape Canaveral, Florida

Although water management efforts are typically focused on supply and quality issues within freshwater systems, coastal communities expend significant resources managing the threats to ecosystems and infrastructure posed by ocean-driven flooding and saltwater intrusion into shallow coastal aquifers. Along sandy coasts, landscape change evolves over a range of timescales (minutes to decades). Superimposed onto long-term (decadal) trends are short-lived (day-long) high energy changes, driven by hurricanes for example, which can rapidly alter the coastal landscape by moving large quantities of sediment offshore and potentially increasing water levels over critical thresholds (e.g. dune overtopping). When such events act to move the shoreline landward, closer to infrastructure and freshwater environments, flooding threats are amplified for coastal communities. Further, these threats will likely become more apparent as global climate change continues to alter patterns of storm frequency and magnitude and accelerate sea level rise. This study aims to identify the drivers of coastal morphologic change adjacent to NASA-Kennedy Space Center near Cape Canaveral, Florida. At this location, shoreline retreat threatens critical launch infrastructure, a hazard which could have costly economic consequences. Using Empirical Orthogonal Function analysis, the dominant modes of coastal landscape variability are extracted from a five-year record of landscape evolution along 11 km of coastal property at this location. By examining correlation between the dominant modes of variability and observations of oceanographic forcing, the principal drivers of coastal change, and therefore of hazard evolution, are inferred for this portion of the coast. The results of this work are shedding light on the temporal and spatial patterns of processes responsible for coastal evolution, as well as informing coastal managers on how they should focus protection efforts to minimize coastal flooding hazards.

Copeland, Rick

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Authors: **Rick Copeland**, Florida Department of Environmental Protection

Session Title: Water Quality Issues

Statewide Changes in Florida's Lake, Stream, and Aquifer Water Quality: 2000-2015

In 2000 the Florida Department of Environmental Protection (DEP) initiated a monitoring program to evaluate changes in its water resources. Sampling is from two networks: (a) a probabilistic network that obtains over 600 randomly-located samples per year from rivers, streams, large lakes, small lakes, canals, confined aquifers and unconfined aquifers, and (b) a trend network consisting of fixed-stations at 78 river sites and 49 wells. All sampling is conducted under the guidance of DEP and laboratory analyses are conducted by its central laboratory in Tallahassee.
To date, network reporting has not addressed the inter-relationship of each resource category. Fortunately, the ability to evaluate inter-connections is aided by a stratified random network design, along with hundreds of samples from each resource category.
Several types of analyses were used to test for significant ($p < 0.05$) statewide changes for greater than 30 indicators. Using probabilistic network data, step trends (Lindsey and Rupert 2012) were used to evaluate changes between the early and late periods of the study. Regarding the trend network, the Seasonal-Kendall test (Hirsch et al. 1984) was used to evaluate for trends at each site for each parameter. The Regional-Kendall test (Helsel and Frans 2006) was used to test for statewide changes for each parameter in each resource category. Comparisons of changes among the resource categories were conducted and are discussed. Investigations such as this are needed to better understand the complex relationships among Florida's water-resource categories and the drivers that cause these relationships.

Court, Christa

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Dale Keairns, Deloitte Consulting Inc.
Christa Court, University of Florida, Food and Resource Economics

Session Title: Poster Session - Human Water Needs/Use

Water-Energy Prototype Model for the NEMS Platform: Thermoelectric Water Demand and its Implications for Regional Electricity Markets

A simplified energy water prototype model has been developed at the National Energy Technology Laboratory (NETL) as a part of a larger effort to comprehensively model energy-water interactions. The NETL energy water prototype model (NWEM) passively couples a variety of data on water supply, water availability, and power plant water use with the National Energy Modeling System (NEMS) power generation forecasts. NWEM operates at a watershed level and its efficacy in resolving local water supply and water-use trade-offs was demonstrated using data from Sandia National Laboratory along with a water supply scenario projected by the World Resources Institute. Since the prototype only passively utilized a forecast of power generation from an existing forecast, the model's choices were limited to purchases or retrofitting to meet future water supply constraints. In the next phase, NETL will integrate the water sub-module into the NEMS framework, which will allow active interaction between the water market and power markets extending the industry's ability to re-dispatch its generating units with the price of water as one of the variable costs.

Court, Christa

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Authors: **Christa Court**, Food and Resource Economics Department, University of Florida

Session Title: Water and Regional Science

Water and Regional Science

SPECIAL SESSION - CHRISTA COURT: Economic prosperity, quality of life, and the environment are all inextricably linked by water. Availability, quality, and use of water are regional by nature and though interregional trade in water is possible, regional variations in natural and historical resource allocations will continue to play roles in regional development and will likely become more important over time. Absent improvements in water management and efficiency improvements related to water use, additional stress on water resources might lead to reduced economic development potential (even the possibility of negative growth), poorer quality of life, and environmental hazards across regions within the U.S. and around the world. The interdisciplinary field of regional science – with its focus on the important roles of local and regional processes to socioeconomic performance and sustainability, its explicit treatment of spatial relationships, and its increasing attention devoted to modeling the linkages between the human system and the environment – is ideally suited to contribute high quality, policy relevant research on water. This paper details how methods and modeling frameworks that have been the core of regional science are uniquely suited for investigating the most pressing issues and questions related to water.

Crandall, Chelsey

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Session Title: Who are they? Understanding Audiences to Design or Improve programs

Community-involvement in watershed management: Surveying citizens along the Indian River Lagoon

he Indian River Lagoon, on the east coast of Florida, is one of the most biodiverse estuaries in the Northern Hemisphere. This shallow, tidal, narrow waterway stretches 156 miles and over 1 million people live in its watershed. Water quality in the lagoon has been a focus of planning and management activities since it became an Estuary of National Significance in 1990. In 2011 and 2012, extensive blooms of phytoplankton resulted in habitat decline and raised awareness of significant challenges to ecosystem health. While agriculture nutrient inputs are minimal in this watershed and wastewater inputs have been reduced through improvements to treatment facilities in urban areas, critical problems persist from residents, such as nitrogen and phosphorus runoff from excess lawn fertilizer and the failure of approximately 10% of the 300,000 septic tanks in the region. Education programs and awareness campaigns have been implemented along the lagoon to engage communities in reducing these threats. But whether these programs are successfully influencing attitudes and behaviors toward the lagoon has yet to be evaluated. With the Indian River Lagoon National Estuary Program (IRLNEP), we designed a survey for residents in the five counties along the lagoon to measure community members' beliefs, attitudes, and behaviors related to the health of the lagoon. This poster will present survey results describing current participation in lagoon-friendly behaviors. We will also report on some of the determinants of environmental behavior, such as the influences of environmental identity, personal experience at the lagoon and membership in conservation organizations. These results will form a baseline of knowledge and behaviors and suggest where additional educational investments might be useful. The survey instrument is intended to be used in the future by the IRLNEP to evaluate program success and continue to inform best practices for community involvement in watershed management.

Crouch, Trey

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Authors: **Trey Crouch**, University of Florida
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Session Title: Poster Session - Climate Change/Hydrology

Comparing Climate Change and Anthropogenic Activity effects on Madeira River Watershed Hydrosedimentology

Much like the rest of the Amazon basin, the Madeira River watershed is in a state of transition, driven by land-use change (LULCC), hydropower development, and a changing climate. Most standard engineering designs and environment impact assessments (EIAs) for hydroelectric dams rely on stationary assumptions for important environment variables (e.g. rainfall, flowrate, sediment flux, etc.), i.e. they do not take into account climate change or LULCC. Even without considering the myriad of socio-environmental impacts of dams, additional uncertainty about the viability of a dam is introduced if nonstationary climate change and LULCC scenarios are not considered. In this study, we quantified the sensitivity of Madeira River flow and sediment load to projected changes in climate using a synthesis of changes to potential evapotranspiration and precipitation from the literature. We quantified these changes at the site of two hydroelectric dam complexes, one in the lowlands that consists of two large run-of-the-river hydroelectric projects and another in the foothills of the Andes. Reservoir sedimentation and expected project life span were calculated for both stationary and non-stationary hydrological conditions to assess whether a nonstationary calculation is necessary as a factor of safety for dam viability and life-span calculations.

De Maria, Maite

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Mike Walsh, Aquatic Animal Health Program, University of Florida
Nancy Densolow, Center of Environmental and human toxicology, Department of Physiological Science, University of Florida

Session Title: Poster Session - Water Quality - Water Management

Nephrotoxic effects of glyphosate and Rodeo ® through water exposure on largemouth bass

Glyphosate is a component of herbicides with the largest use in the world and Florida is not an exception. It has been used extensively as a ripener for sugarcane and to control lake vegetation. Farmers chronically exposed to glyphosate have shown unusual kidney disease. In addition, after ingestion of large quantities, glyphosate produces nephrotoxicity among another organ failures. In the environment, fish can be exposed to runoff from agricultural areas or it can be sprayed directly into water bodies. Long-term exposure experiments with animal models, like fish, have shown reproductive impairments and kidney disease associated with glyphosate or its commercial version. Kidney injury can be related to the production of reactive oxygen species and it is the organ that may excrete glyphosate components. Our objective is to assess kidney damage and molecular changes in largemouth bass after chronic exposure to glyphosate or Rodeo, the commercial product. We exposed male individuals to 0.5 and 10mg/L concentrations of glyphosate and Rodeo® (chemically equivalent concentration) in water for 28 days. Our lowest concentration was similar to the EPA limit for drinking water. Glyphosate or its breakdown product (AMPA) will be determined in blood with mass spectrometry. We analyze changes in gene expression through RNA sequencing on trunk kidney and perform histopathology in this organ and others. We are going to correlate tissue damage with altered gene expression that will be validated by qPCR. Our genes of interest are kidney injury molecule (KIM-1), beta-2-microglobulin, neutrophil gelatinase-associated lipocalin (NGAL), corroborated with a housekeeping gene. Our research will contribute to identifying molecular markers for kidney damage as a consequence of exposure to glyphosate or Rodeo® in fish that can be extended to other species exposed through their environment.

de Rooij, Rob

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Session Title: Challenges & Opportunities for Spring System Restoration 1

Conduit and Fracture Flow Modeling

Special Session–Fitzgerald/Reddy
Physics-based distributed models for simulating flow and solute transport in karst aquifers are generally based on the discrete-continuum approach in which flow in the three-dimensional porous limestone matrix is coupled with flow in discrete one-dimensional conduits. In general, however, little is known about the geometry of conduit networks. To quantify and analyze the reliability of discrete-continuum models it is important to explore flow and transport behavior over an ensemble of possible karst conduit networks within a stochastic framework. This report documents a new methodology to generate a stochastic ensemble of possible karst conduit networks that honor what is known about the topography, geology, hydrology and climate of the system under study. The resulting hydrogeochemical model was used to simulate the widening of conduits over geological timescales, and subsequently to simulate flow and solute transport within an evolved karst aquifer representative of the Silver Springshed.
Morris Method Global Sensitivity Analysis showed that a limited combination of porous matrix properties and horizontal and vertical preferential flowpath (HPF and VPF) statistics produced karst conduit networks that generated first magnitude springflow rates (i.e., > 2.8 m3 s-1). Monte Carlo simulations of conduit generation, groundwater flow and conservative solute transport for conditions representative of the Silver Springshed showed that in addition to the statistics governing the distribution of VPFs and HPFs, the actual locations of VPFs and HPFs in relation to each other and the spring outlet determines whether a spring will develop. However, if a network developed, the uncertainty in the hydraulic and solute pulse response at the spring vent, and the locations of vulnerable regions within the springshed due to unknown locations of VPFs and HPFs, was minimal. The Monte Carlo simulation predicted large vulnerable regions of the idealized Silver Springshed (i.e., areas with peak solute travel times to the spring of less than 30 years) with low uncertainty. The spatial distribution of these vulnerable regions was quite different from that which would be identified using an equivalent porous media model. These results indicate that incorporating conduit flow processes that honor what is known about the topography, geology, hydrology and climate into the model is important, but that exact knowledge of conduit locations and orientations may be less important, for understanding springshed behavior. Further work to calibrate a Silver Springshed model that includes the ensemble of conduit geometries identified in this study is recommended.

Decker, Paul

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Authors: **Paul Decker**, University of Florida
Matt Cohen, SFRC, University of Florida

Session Title: Hydrologic Modeling and Water Management

Challenges to Rainfall-Runoff and Transit Time Distribution Modeling Within the Southeastern Coastal Plain, USA

Previous hydrologic studies primarily focus on processes related to montane catchments with significant runoff ratios (P-ET), low evapotranspiration rates, and reasonably short travel times. There is a significant lack of research for hydrologic processes occurring within the United States Southeastern Coastal Plain landscape where low-relief and high rates of evapotranspiration impact water fluxes. Hydrologic modeling efforts within this region may elucidate possible interactions and timescales of solute travel where much of the landscape is managed for agricultural crops, namely plantation forestry. A long-term paired watershed study carried out in north Florida monitored two second-order blackwater streams for five years. Rainfall-runoff models for both catchments were created using daily discharge, precipitation, and modeled evapotranspiration as input parameters. Model best-fit occurred when the catchments were modeled as storage-dependent reservoirs with discharge components separated as vadose, phreatic, and deep groundwater storage release. In addition, streamflow and rainfall chloride concentrations were used to model in-variable transit time distributions using spectral methods. In both catchments this transit time was unresolvable because output spectral power exceeded input spectral power, a result assumed to be driven by the evaporative demand of the region. A modeled chloride time series from input concentration as recharge and modeled output through the rainfall-runoff model was used to alleviate the unresolvable transit time. Results from the model framework illustrate a dampening in spectral power from rainfall to recharge chloride, and a further dampening from recharge to discharge chloride. This results indicates the importance to model the recharge process separately from rainfall in order to determine transit times of streamflow. Results illustrate significant effects from evaporation within the catchment – often exceeding the signal from the background catchment process itself. Regardless of modeling approach and methods, results from this study illustrate evapotranspiration as perhaps the most critical component to Southeastern Coastal Plain hydrology.

Desormeaux, Amanda

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Authors: **Amanda Desormeaux**, School of Natural Resources and Environment/Soil and Water Sciences, University of Florida
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Session Title: Challenges & Opportunities for Spring System Restoration 4

Balancing the Nitrogen Budget in Silver Springs: In Situ Measurements of Nitrate Fluxes and Attenuation

Additional Author: M. Yang, UF SWS, minjune@ufl.edu. Nitrate concentrations have been rising in Silver Springs over the past 50 years alongside increases in population and changes in land use. Understanding the main drivers of groundwater nitrate contamination first requires the quantification of the major stocks and fluxes of nitrogen at the springshed scale. This work enhances our understanding of the nitrogen (N) budget for the springshed by including direct measurements of nitrate leaching and attenuation. We deployed ion-exchange resin columns at nine sites in three dominant land uses with known N inputs across the springshed. Resin columns were deployed for four months to obtain integral measures of soil nitrate fluxes and attenuation. Additionally, we measured groundwater nitrate attenuation rates using push-pull tests in three wells characterized by conditions favorable for denitrification. We present these results and use them to calculate a springshed N budget for Silver Springs.

DeVito, Lauren

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Authors: **Lauren DeVito**, University of Florida
Robert Hensely, University of Florida
Matthew Cohen, University of Florida

Session Title: Poster Session - Stream/River Dynamics

Quantifying spatial and temporal variations in metabolism within and across stream order in a North Central Florida River network

The River Continuum Concept (RCC) posits that stream biota and ecological processing exhibit predictable change along a continuous gradient from the headwaters downstream to the mouth of a river. According to the RCC, longitudinal variation in stream metabolism (primary production and respiration) arises in response to channel widening and decreased canopy cover. However, the RCC does not consider variation in metabolic rates across streams of the same order within the network. It also does not consider temporal variation as a result of changing discharge, light and temperature, or make predictions regarding the relative magnitude of this variation across stream orders. The Suwannee River Watershed in Northern Florida is comprised of tannic blackwater, clear alluvial, and spring-fed streams where differing physical, chemical and biological features cause variations in in-stream metabolic rates within stream order. We deployed dissolved oxygen sensors in 12 headwater streams to measure metabolic rates over a period of several months. We also collected light, temperature, stage, flow, water quality samples in order to consider the effect of the differing physical, chemical and biological features on metabolic processing. Similar data was also collected in higher-ordered rivers downstream of these headwater locations. Preliminary results suggest that variations in metabolism within stream order may be equal or greater in magnitude to variation in means across orders. The results also suggest headwater to streams to be temporally more dynamic, and that this variation becomes dampened in larger order downstream reaches. These additional sources of variation are important to consider in conjunction with longitudinal variation when characterizing metabolic activity on the network level.

Donaghy, Kieran

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Authors: **Kieran Donaghy**, Cornell University
Arash Baheshtian, Department of City and Reigonal Planning, Cornell University
Jati Waluyo, Bank Indonesia

Session Title: Water and Regional Science

Integrated Assessment Modeling of Regional Water Infrastructure Problems

Integrated assessment modeling (IAM) is an interdisciplinary approach to the study of contemporary social and environmental problems whose complexity is such that models of social systems, infrastructure systems, and systems of the natural environment must be integrated to understand relationships between components and performance properties of the interdependent systems involved. The study of climate change and associated socioeconomic behavior is one area in which IAM has been conducted pervasively. Early efforts in IAM were criticized for the somewhat simplistic, back-of-the-envelope types of models they embodied—often in the service of obtaining a solution. Advances in problem formulation and model solution, however, have allowed more sophisticated and realistic characterizations of systems to be employed and broader ranges of scenarios and systems performance to be examined. The lessons learned from experience with IAM are not limited in application to global problems, however. In fact, we argue that they lend themselves to the study of contemporary problems encountered in many societies on a regional scale. In the research reported in this paper we demonstrate an approach to integrated assessment modeling of the problems affecting multiple communities in the Hudson River Valley of New York State: these communities must upgrade interdependent water infrastructure systems, in the face of climate change, budgetary constraints, and needs to accommodate growth and development in a manner consistent with legislated principles of 'smart growth.' This undertaking entails integrating models of regional hydrology, interdependent infrastructure systems, the regional economy and the financial positions of regional municipalities involved in a planning support system (PSS) for multiple (and not necessarily cooperative) stakeholders using Bohringer and Rutherford's (2008) top-down/bottom-up approach. We employ Ferris's set-up for solving multiple optimization problems with equilibrium constraints (MOPECs) to examine dynamic game outcomes and potential conflict management schemes (Britz et al., 2013).

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Britz, W., Ferris, M., and Kuhn, A. 2013, Modeling Water Allocating Institutions Based on Multiple Optimization Problems with Equilibrium Constraints. Environmental Modelling and Software, 46: 196-207.

Eisenstadt, William

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Authors: **William Eisenstadt**, Department of Electrical and Computer Engineering, University of Florida
Dr. Caroline Staub, IFAS and UF USAID AREA Project in Haiti
Dr. Lemâne Delva, IFAS and UF USAID AREA Project in Haiti
Dr. Wesly Jeune, IFAS and UF USAID AREA Project in Haiti
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Session Title: Use of technology to shape our water future

Wireless Weather Stations and Maintenance Training for Haitian Agriculture

This presentation shows the progress of Prof. Eisenstadt working under a UF USAID AREA project with IFAS researchers in building up the agricultural capability of Haitian farmers. In this work, Eisenstadt is providing solar powered wireless WiFi weather stations with modular designs that report weather data to the cloud (www.wunderground.com) automatically. The effort has installed 4 stations for agricultural research in Haiti in 2017 and continues to install new ones. These weather stations are constructed from inexpensive boards and open software so they can be cheaply repaired and maintained. The ultimate goal is educate technicians to cover Haiti with 100 or more weather stations and to provide farmers data for the country's varied climatic zones from sea level to 7000 ft. There are no good meteorological data records in Haiti so this effort provides an essential service to assist farmers in making productive planting decisions.

Prof. Eisenstadt has developed and delivered three training workshops in Haiti, 1) a weather station data usage, 2) a weather station IoT maker workshop and an 3) Internet of things programmer's workshop to Haitian agricultural engineers. These workshops transfer the hardware capability and software necessary for Haitians to build and repair their own weather stations. In the summer of 2018, Prof. Eisenstadt will provide a workshop in Haiti that discusses the use of weather data for agriculture and climate modeling.

In the next year, Professor Eisenstadt and UF students are creating a second generation solar power wireless weather station with additional features such as Bluetooth communications to cellphones and a weather data log. They are also looking at providing low cost soil moisture sensors in Haiti. In addition, Prof. Eisenstadt is developing additional capabilities for water monitoring and mosquito sensing and control devices with the help of volunteers at the University of Florida ECE department. Prof. Eisenstadt has placed weather measurement capability for mosquito and fly etymological studies at the USDA CMAVE facility in Gainesville, Florida and at the National Zoo in Washington, DC.

Epstein, Joshua

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Authors: **Joshua Epstein**, School of Forest Resources and Conservation, University of Florida
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Kaitlyn Mroczka, University of Florida, Soil and Water Sciences Department
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Session Title: Poster Session - Wetlands

Drivers of Community Composition and Water Quality in North Central Florida Freshwater Wetlands

Wetlands are ecosystems of high productivity and biodiversity that are threatened worldwide due to changes in land use and decreased water quality associated with anthropogenic influence. In Florida, a state having an abundance of wetlands, human development continues to exacerbate wetland losses and degradation. Understanding the factors driving differences in community composition and water quality in reference wetlands will provide baseline knowledge with which to assess the impacts associated with these threats. Fifteen freshwater wetlands (seven herbaceous and eight forested) in north central Florida were chosen with the intent to capture the reference standard wetland condition. Wetland vegetative communities could not cross hydrogeomorphic boundaries, and selected sites were sampled in summer 2016 or 2017. At each wetland sampling point, one 50m transect was laid out in each cardinal direction. Vegetation presence and frequency of occurrence identified to species were collected in 1m by 5m oblong quadrats sequentially placed along each transect. Macroinvertebrates were collected using standardized dip netting methods in which 20 sweeps were divided evenly amongst wetland habitats. Specimens were preserved on site in jars of formalin for later identification in the lab. Water quality (pH, specific conductance, temperature, and dissolved oxygen) was measured using a YSI probe, and water samples were collected to assess levels of nitrogen, phosphorus, turbidity, and chlorophyll in the lab. Landscape variables, such as land use, distance to nearest road, and distance to nearest waterbody, were measured in ArcGIS. To determine the landscape variables driving community dissimilarity and differences in water quality, we will use non-metric multi-dimensional scaling (NMDS). We hypothesize that (1) the suite of variables driving water quality and community composition will be similar within herbaceous and forested wetlands, and (2) sites that are more geographically isolated from development/agriculture will host a higher diversity of biological communities and have better water quality.

Erfanian, Elham

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Authors: **Elham Erfanian**, West Virginia University
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Session Title: Poster Session - Human Water Needs/Use

Long-term debt in water utilities: Does ownership matters? Evidence of West Virginian's Utilities

Special Session–Christa Court. Local governments provide a wide range of services and infrastructure such as water, sewer, and stormwater to their residents. In many jurisdictions, utilities are the most capital-intensive government function and the most visible one. Long-term debt is an indicator of utilities' financial health. Currently, local governments in the U.S. hold more than 1.7 trillion long-term debt. Particularly, due to population loss and population density, West Virginia water system is under financial constraints more than other states. By investigating important factors that explain long-term debt, we focus on the effects of different types of ownership on water utilities' long-term debt in West Virginia, where common types of water utility ownership include municipalities, public service districts, private utilities, and water associations. Results show the public service districts and municipalities have higher long-term debt.

Fitzgerald, Casey

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Authors: **Casey Fitzgerald**, St. Johns River Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 1

Restoration of Florida's Iconic Springs: Legislative, "Turn Dirt" and Scientific Solutions

Special session - Reddy/Fitzgerald
Florida's springs have been in the forefront of restoration efforts for the State of Florida for quite some time. The Department of Environmental Protection and water management districts have targeted these unique Florida resources for (1) multi-fold nutrient concentration decreases to meet Total Maximum Daily Load (TMDL) and Numeric Nutrient Criteria (NNC) standards and (2) flow protections and/or enhancements to meet established or anticipated Minimum Flows and Levels. Most recently, in 2016, the Florida legislature passed strategic springs legislation to create an enhanced framework and substantial funding for these efforts.
In order to provide context for this track's day-long springs focus, this presentation will summarize the key provisions of the 2016 Florida Springs and Aquifer Protection Act and provide an overview of the $150 million worth of restoration projects launched just in the St. Johns River Water Management District (SJRWMD) since 2013 via partnerships forged with the state, local governments, utilities and agricultural interests.
It will also set the particular stage for the next nine springs presentations to follow that stem from the recently concluded SJRWMD/University of Florida applied springs research effort as well as the final panel discussion. It will do so by reviewing the questions and objectives addressed and the approach employed in this comprehensive, three-year project entitled Collaborative Research Initiative on Sustainability and Protection of Springs (CRISPS). The findings will be revealed over the course of the day and will significantly contribute to the scientific foundation necessary to better identify, evaluate and strategically locate the most cost-effective, long-term springs restoration projects and to inform enlightened future management strategies.

Frazer, Thomas

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Session Title: Challenges & Opportunities for Spring System Restoration 3

From Algae to Alligators: Exploring Trophic Structure in Florida's Spring-Run Ecosystems

In recognition of the ecological and economic significance of the Floridan aquifer and its associated springs, the St. Johns River Water Management District (SJRWMD) developed a Springs Protection Initiative nearly five years ago. In support of the initiative's scientific research program, the University of Florida and the SJRWMD implemented the Collaborative Research Initiative on Springs Protection and Sustainability (CRISPS). As part of the CRISPS effort, we focused on trophic interactions and the consequences of those interactions on the structure and function of the Silver River ecosystem. We identified primary producers, grazers and consumers; analyzed stable isotopes in the collected material to delineate food webs; assessed grazing rates relative to growth rates in laboratory experiments, and evaluated the potential for top-down (consumer) control of key grazers in a manipulative field experiment. Our findings suggest that native macrophytes and their epiphytes provide much of the energy that is transferred to higher trophic levels. Benthic filamentous algae (one form of nuisance algae) do not contribute substantially to production at higher levels in the aquatic food web. Herbivorous insect larvae, however, do appear to use these benthic algae as food. Because benthic nuisance algae are consumed primarily by these emergent insects, it is likely that much of this productivity is exported to the surrounding terrestrial environment. In essence, nuisance algal mats in Silver River, and likely other spring systems, may be largely decoupled from the in situ food web. Although a number of grazers are capable of consuming nuisance algal taxa, our experimental work provided little evidence that predators mediate the impacts of grazing on plant and algal dynamics in Silver River, i.e., strong top-down influences were not apparent. The absence of strong top-down influences on the primary producer community suggests that manipulation of higher-level organisms, e.g., fish and turtles, is not likely to lead to more abundant grazers or a subsequent reduction in nuisance algae.

Frederick, Peter

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Authors: **Peter Frederick**, Department of Wildlife Ecology and Conservation, University of Florida
Bill Pine, University of Florida
Leslie Sturmer, University of Florida
David Kaplan, University of Florida
Maitane Olabarietta, University of Florida

Session Title: Estuarine Ecology and Water Quality

Introducing resilience to estuaries through restoration of oyster habitat in Florida's Big Bend

Oyster reefs provide a myriad of high value, large scale ecosystem services including water filtration, fish and wildlife habitat, coastal protection, and nutrient sequestration. On the Gulf Coast of Florida's Big Bend, reefs form parallel to the coast and may perform many of the functions of barrier islands, including embayment and detention of freshwater, leading to estuarine conditions. Over the past 30 yr 88% of these offshore reefs have disappeared, despite a 3,000 yr history of existence. The primary driver appears to be reductions in freshwater flow, leading to physiological stress and increased mortality from disease and predation. Although oysters grow rapidly and are not limited by larval supply in this area, high mortality over time leads to a negative shell budget, with eventual reversion to sand and shell hash habitat. This novel substrate does not support recruitment by oysters and is a dead end for reefs. There also appears to be a negative feedback loop - the more elevation is eroded on ghost reefs, there is less freshwater retention and increased probabilities of high salinity events. Through pilot studies and modeling we have established that 1) the addition of suitable substrate leads to a 9X increase in oyster recruitment, 2) the substrate (limerock boulders) is resilient to even heavy wave action (Hurricane Hermine) and thus is relatively permanent, 3) restored substrate tends to trap sediments and increase elevation, and 4) increased elevation will lead to reduced salinities in adjacent nearshore coastal waters. We are now embarking on a full scale restoration of a 5 km section of reef, with predictions that a) oysters will recruit to the site, b) oyster populations will be more persistent and resilient to freshwater flow fluctuations than in the recent past, c) elevation on the reef will be increased through growth of oysters, d) nearshore salinities will be reduced over a broad range of conditions, and e) bird, fish and plant communities will be affected in ways that are consistent with buffered and generally decreased salinities.

Freitas, Andressa

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Authors: **Andressa Freitas**, Soil and Water Sciences Department, University of Florida
Vimala Nair, University of Florida - Soil and Water Sciences Department
Willie Harris, University of Florida - Soil and Water Sciences Department

Session Title: Poster Session - Water Quality - Water Management

Variable Consequences of Converting Biosolids to Biochar: Implications for Water Quality

Biosolids, byproducts of wastewater treatment, can serve as an alternative source of nutrients in crop production. When applied to the soil, these materials enable nutrient recycling while providing a solution for waste management. However, the nutrients could be detrimental if their release exceeded the soil's capacity to retain them. Biosolids conversion to biochar, a material obtained by heating in the absence (or low concentration) of oxygen, could convert nutrients to more stable forms that are less readily transported to water bodies where they could foster eutrophication. Our objective was to identify phosphorus (P) release and associations in biosolids from various places (Florida & Chicago in USA, Spain and Brazil) as well as their corresponding biochars. Materials were assessed using solid-state and solution chemistry techniques along with desorption experiments to identify the mechanisms of P retention and release. X-ray diffraction (XRD) and scanning electron microscopy (SEM) analyses indicated contrasting compositions among biosolids, with variations that related to processing and origin. Most of the biochar samples showed Ca- and Mg- P associations. The conversion of biosolids into biochar modified the mineralogy of some materials due to the presence of thermally unstable minerals (e.g., struvite). Chemical analyses such as water soluble P, pH, Mehlich 3-extractable P and other elements, total carbon, and total Kjeldahl nitrogen confirmed differences between biosolids and their corresponding biochars. Data suggest that biosolids from different locations, as well as their corresponding biochars, would differ markedly in nutrient release behavior and in the level of water quality risk they would pose when land applied. Therefore, in addition to soil property considerations, the rate of biosolids or biochar applications should take into account the properties of the amendments that vary geographically base on source and processing differences.

Fu, Xiangju

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Authors: **Xiangju Fu**, University of Florida

Session Title: Poster Session - Agricultural/Silvicultural Water

Using sprinkler irrigation to save water for Florida`s potato production

Seepage irrigation is the predominant irrigation method adopted by potato growers in Florida, involving pumping a large volume of groundwater to maintain a high water table for the root zone. Seepage irrigation has low water-use efficiency (20%-50%). Thus, large volume of water is needed. Sprinkler irrigation, however, has much greater water-use efficiency (>85%). A three years project was completed to explore the feasibility of using sprinkler irrigation (overhead) to replace seepage irrigation for Florida`s potato production. The project was conducted on four sub-farms of Jones Potato Farm with a total acreage of 2,800 acres, Parrish, Florida, from 2012 to 2015. Two irrigation systems, overhead and seepage, were randomly arranged and compared side by side with four replications by using 14 center pivots. Both chipping potato ('Atlantic') and tablestock potato ('Red LaSoda') were used. Water usage and tuber yields were measured., Seepage irrigation used 20.0 inches of irrigation water on average, while overhead irrigation used only 8.5 inches. Approximately 1 billion gallons of irrigation water (57.5%) was saved using overhead irrigation during the three growing seasons. However, after converting seepage into overhead irrigation, tuber yield was dropped by 10%, which meant that the traditional fertilizer program was not suitable for overhead irrigated potato production.. To fix the problem of yield reduction, a new project has been proceeding with fertigation on the same farm and on the UF/IFAS Hastings Agricultural Extension Center. Overhead irrigation with fertigation will probably the future for Florida's potato production.

Fujimoto, Masanori

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Authors: **Masanori Fujimoto**, University of Florida
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Rupesh Bhomia, Soil & Water Sciences Department, University of Florida
Ramesh Reddy, Soil & Water Sciences Department, University of Florida

Session Title: Challenges & Opportunities for Everglades System Restoration

Microbe-mediated nutrient transformation in the Everglades Stormwater Treatment Areas (STAs)

Water quality and quantity are global issues we now face with increasing urgency. Freshwater serves as a source of drinking water and is used for irrigation, a vital resource for food production. Non-point source nutrients from agriculture, specifically phosphorus, have caused myriad issues in aquatic ecosystems, including the Everglades. Everglades Stormwater Treatment Areas (STAs) are large-scale constructed wetlands designed to remove nutrients from water. Ongoing research has demonstrated that total phosphorus concentration in water has been reduced from approximately 100 μg/L in the influent to 20 μg/L in the effluent, which still exceeds the current EPA recommendation of 13 μg /L in the effluent. Accumulation of phosphorus has been observed in the STAs sediments, specifically Floc and recently accreted sediment (RAS) fractions. The sediment deposited total phosphorus concentration declines from the inlet to outlet, creating a phosphorus concentration gradient along the flow in the wetlands. Vegetation type, submerged aquatic vegetation (SAV), and emergent aquatic vegetation (EAV) have also been found to affect phosphorus sequestration. Microbes play fundamental roles in biogeochemical cycles in aquatic ecosystems by mediating transformation of nutrients. In this study, we examined microbial community compositions (MCC) in the sediment core and the water column along transects of STA-II cell 1 (EAV) and cell 3 (SAV) using 16S rRNA amplicon sequencing. Principal coordinate analysis of MCC suggests that aquatic MCC differ from those in sediments. Within sediment MCC, both vegetation types and sediment fractions had effects on MCC. Phosphate accumulating organisms (PAO) were detected in the sediments, and had a distinct spatial distribution pattern across the cells and along the transects. The findings from this study help us to elucidate mechanistic processes that take place in the wetlands. This study also has implications for water resource management that seeks to balance food production and ecosystem conservation.

Gatson, Grant

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Authors: **Grant Gatson**, Wood plc, formerly Amec Foster Wheeler
Suzy Baird, Wood plc, formerly Amec Foster Wheeler

Session Title: Challenges & Opportunities for Spring System Restoration 4

Ichetucknee Springshed Water Quality Improvement Project Infiltration Treatment Wetland Creation and Denitrification Wall Implementation

The project objective was to convert Lake City's Wastewater Treatment Facility (WWTF) sprayfields (SFs) into constructed treatment wetlands to reduce nitrogen loading and provide beneficial recharge into the upper Floridan aquifer (UFA) in this area of high recharge to the Ichetucknee Springs Group. Total Maximum Daily Loads (TMDLS) established for the Santa Fe River Basin are not to exceed a monthly average of 0.35 milligrams per liter (mg/L). However, historic water quality data for St. Margaret WWTF effluent indicates concentrations of 1.86 mg/L nitrate-nitrogen (NO3-N) and average groundwater concentrations collected from deep wells within the SFs ranging from 0.35 to 3.20 mg NO3-N/L. As a result, the St. Margaret WWTF Sprayfield, located in Lake City, Florida, was converted into a more effective nitrogen removal treatment wetland. This project reduced loading of NO3-N to the UFA, a source of the Ichetucknee Springs flow, and contributes to achievement of the objectives of the Basin Management Action Plan for the Implementation of TMDLs for Nutrients adopted by the Florida Department of Environmental Protection in the Santa Fe River Basin.

Amec Foster Wheeler converted SF1 into a continuous free surface flow treatment wetland system. Following nitrogen removal, the treated effluent recharges into the UFA through existing infiltration features on the sprayfield property. Converting SF1 into an infiltration treatment wetland (1) facilitated enhancement of nitrate uptake, (2) reduced loading of nitrogen from the WWTF to the Ichetucknee Springshed and the Santa Fe River, (3) slightly increased beneficial recharge to the UFA, (4) reduced offsite impacts due to effluent runoff during flood events (5) and protected karst features and creeks. SF2 design included the addition of innovative denitrification walls to intercept subsurface flow of the effluent before it reached the recharge zone. The denitrification walls increase nitrate uptake, providing water for recharge of the UFA.

Gillin, Matlack

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Authors: **Matlack Gillin**, University of Florida

Session Title: Coastal Flooding, Storm Surge and Sea Level Rise

Meteotsunami Occurrence and Propagation in the Northeastern Gulf of Mexico

Meteotsunamis occur globally but have only recently gained attention in the Gulf of Mexico. Records from NOAA sensors and additional instruments were used to examine water levels and atmospheric pressure forcing in the northeastern Gulf of Mexico from December 2015 to February 2016. This analysis identified two meteotsunami events, both of which were produced by an oscillatory pressure signal. Continuous Wavelet Transform analysis of water level and atmospheric forcing showed a remarkably similar structure in the frequency domain during both meteotsunamis. This qualitatively suggested a dependence of water level on atmospheric pressure. Additionally, wavelet coherence analysis showed that coherency existed between wind oscillations associated with convective cells and the meteotsunami water level. This indicated that both atmospheric pressure and wind played a role in meteotsunami generation. Vector addition using atmospheric pressure peaks and troughs yielded the speed and direction of these atmospheric disturbances. The velocity of these disturbances was used, along with the shallow water wave approximation, to identify the location of atmosphere-ocean resonance and the approximate position where these meteotsunamis became free waves. This technique can be complemented with numerical modeling to quantify the required wave conditions to reproduce the coastline signals. This will allow future research to determine the required meteotsunami amplification in the resonance region.

Glodzik, Katie

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Authors: **Katie Glodzik**, University of Florida

Session Title: Coastal Ecosystems

Geographic drivers of coastal forest die-off and change since 1984 in the Lower Suwannee NWR

Sea level rise and reduced freshwater discharge are causing higher coastal salinity along the Florida Big Bend, causing coastal forest die-off and replacement by salt marsh. Coastal forest is dominated by cabbage palm (Sabal palmetto) and red cedar (Juniperus virginiana), which can tolerate low-to-moderate salinity (<10-15 ppt) but become significantly stressed from sustained higher salinities. Previous monitoring studies revealed that islands with die-off experienced more frequent tidal flooding and were at lower elevations, though there were instances of low-elevation islands supporting healthy vegetation. Higher die-off rates occurred during drought years, suggesting the importance of freshwater influence. This study contributes to sea level rise impact research by investigating effects of geographic variables besides elevation (part 1) and by considering effects of both saltwater and freshwater influence (part 2). Using Google Earth Engine (GEE) to interpret Landsat 5 and 8 images, we created annual composite images of the Normalized Difference Vegetation Index (NDVI) for coastal forest in the Lower Suwannee National Wildlife Refuge. For part 1, we built an ArcGIS geospatial model to examine how forest geographic characteristics (elevation; distances to coast, tidal creek, forest edge; distance and orientation to Suwannee River mouth; and island shape) affect recent NDVI. For part 2, we constructed four time series of forest NDVI, aggregated by island versus continuous forest, and north versus south of the Suwannee River. We analyzed these time series in comparison to time series of local rainfall and evapotranspiration, river discharge, and sea level measured at Cedar Key, to investigate how changes in freshwater and seawater influence NDVI. Early results from part 1 suggest that in addition to having low elevation, other variables that contribute to salinity stress are closeness to tidal creeks, being north of the Suwannee River, and for islands, having a high perimeter-to-area ratio (i.e., having a more irregular shape). Proximity to the Suwannee River mouth and distance from the coast were not significant.

Greco, Stacie

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Authors: **Stacie Greco**, Alachua County Environmental Protection Department

Session Title: Urban Water and Nutrient Management 2

Reducing Residential Landscape Irrigation with Regulatory and Social Marketing Tools

The Alachua County Environmental Protection Department (ACEPD) employs various methods to influence behaviors that impact local water resources. Regulation in the form of ordinances and land use rules can prove effective when there is the political will to adopt and the staff to implement such. Social marketing is the science of applying traditional marketing tools to create specific and measurable behavior changes, and is proving to be an effective tool to meet water protection goals.

Public supply is the largest use of water in Alachua County, with landscape irrigation representing much of the residential water budget. Alachua County recently adopted a Landscape Irrigation Design Code which applies design standards, approval fees, and inspection requirements to all new landscape irrigation systems in unincorporated Alachua County. With over a year of implementation of this regulatory program, challenges and successes are surfacing.

While the Irrigation Design Code addresses new construction, there are over 14,000 existing landscape irrigation systems in the County. Staff designed and pilot tested the Turf SWAP (Save Water, Add Plants) program in 2013-2015 to help property owners replace irrigated turf with Florida Friendly LandscapingTM. The greatest barriers for homeowner participation included costs and lack of time. To overcome such, ACEPD secured cost share funding in 2016 to offer a 50% cash rebate to participating property owners. This presentation will explore the use of social marketing, social media, and regulatory tools to influence landscaping related behaviors.

Guerra, Gisselle

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Arnoldo Valle-Levinson, Department of Civil and Coastal Engineering, University of Florida.

Session Title: Estuarine Ecology and Water Quality

Statistical assessment of saltwater intrusion in a subtropical estuary

Water level and salinity measurements were used to investigate saltwater intrusion along a subtropical estuary from November 2014 to November 2015. River discharge, precipitation, and wind velocity were also obtained along the Suwannee River, at the Florida's Big Bend. The limit of saltwater intrusion was defined by the tidally averaged position of 2 g/kg isohaline (X2) in each tidal cycle. Observations were used to construct a first-order autoregressive Markov-chain model, with Monte Carlo simulations; and a two-step hyperbolic tangent fit, to predict X2. The Markov-chain model related X2 of a previous tidal cycle to the tidally averaged river discharge, water level, precipitation and wind velocity. In order to capture the seasonality of the Suwannee River discharge, the analysis was done separately for high and low river discharge regimes. As expected, saltwater intrusion was inversely related to river discharge. Values of X2 were 0.4 km for a discharge of 383 m3/s during the cold season, and 6 km for a discharge of 168 m3/s for the warm season. Along-estuary distributions of salinity were fitted to a two-step hyperbolic tangent function. First, the hyperbolic tangent function was used to calculate the observed coefficient β that corresponds to the distributions of salinity at each tidal cycle. Second, using a linear regression model the β coefficient was related to the forcings—river discharge, water level, precipitation, and wind velocity at each tidal cycle. Modeled β coefficients agreed with observed β coefficients, suggesting that both approaches, the autoregressive model and the hyperbolic tangent fit followed the trend of the salinity distribution in space and time.

Gustafson, Tom

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Authors: **Tom Gustafson**, Florida International University

Session Title: Coastal Flooding, Storm Surge and Sea Level Rise

Islands of South Florida

While there are different predictions, models, and estimates to suggest that sea level rise will flood part or all South Florida communities over the next 40 or more years, what is consistently understood by experts in the field is that this global process that that warms the planet, melts ice, produces stronger storm systems, and raises the sea level will be continuing for hundreds of years and more likely will be continuing for thousands of years. The permanent flooding of South Florida and other coastal communities can no longer be discussed in terms of "if"; these flood conditions must now be discussed in terms of "when".

Given current South Florida elevations, GHGs already in the atmosphere, the likely acceleration of such GHG emissions for the next twenty years and more, and expected sea level rise feedback mechanisms, there is little likelihood that South Florida, as we know it today, will not be habitable by the year 2100 AD unless we are willing to start very soon to build something that creates communities elevated about current conditions.

While there are several possible ways to make such changes in topography and structures, these Islands of South Florida will need to be planned and implemented to integrate the following:

A very different multimodal transportation system

Very different systems to collect and store freshwater water and dispose of solid waste and waste water

New methods and systems to: grow locally most or all our food; manufacture locally most or all our goods and building materials in daily use; and, secure the raw materials/durable goods we might need

Innovative structures and optimized natural environments resilient and resistant to the more severe storm systems that will be visiting us (i.e., with torrential rains, higher winds, and stronger storm surge); inclusive of the planting and mature growth of mangrove forests in the spaces between the "Islands of South Florida" and the planting of other useful trees and foliage on the "Islands of South Florida"

Renewable energy generation systems (e.g., solar and wind) that provide all the power the South Florida region might need when combined with fourth generation nuclear reactor facilities

An expanded capacity to educate children (especially girls and the at-risk children) through their graduate school studies along with providing them high tech and advanced job skills

Expansion of information technology, software, and systems, data, and written works such that they can be maintained as the electronic equivalent of a modern day Royal Library of Alexander to store, retrieve and expand upon knowledge

A seed bank appropriate for the conditions expected to be experienced by the "Islands of South Florida" over the long term

Cutting-edge medicine to deal with new and evolving diseases and health care focused on well-being

What lies ahead is limited only by our will to survive, commitment to long term planning, desire to establish a just and egalitarian society, and efforts to continuously expand the horizon of human endeavor.

Guzmán, Sandra

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Session Title: Poster Session - Agricultural/Silvicultural Water

Modeling Nutrient Leaching at Farm Scale: A Comparison of Hydrological and Crop Models

The Upper Floridian Aquifer (UFA) is the main source of water for irrigation in the states of Florida and Georgia. Changing land use, crop management practices, increasing water demands for irrigation, and nutrient leaching can potentially affect the sustainability of agricultural production across the states. A wide variety of models can be used to determine loads of nutrients both in surface and groundwater as a result of crop management practices and irrigation. However, selection of a particular model depends on the level of detail required, the user needs and familiarity with the model, the model efficiency, and how intuitive is the calibration process. In this study, we summarize the main components and characteristics of three of the most widely used models for the prediction of nutrient leaching and crop yield. The Soil and Water Assessment Tool (SWAT), the Decision Support System for Agrotecnology Transfer (DSSAT), and the Agricultural Policy Environmental Extender (APEX) will be evaluated based on their effectiveness in predicting crop yield and soil water variables, such as, runoff, infiltration, potential evapotranspiration, soil and plant evaporation, and root water uptake. For the prediction of nutrients we will evaluate mineralization, immobilization, nutrient leaching, nitrification and denitrification variables. Preliminary results show that although all models have similar theoretical basis to calculate crop yield, soil water, and nutrient transport, DSSAT is more detailed in the representation of the plant physiological processes, SWAT emphasizes soil-atmosphere hydrological processes, and APEX is more detailed for the estimation of erosion processes and movement of nutrients from livestock. We expect the results of this preliminary study to be the baseline for watershed modelers and stakeholders to select the most appropriate model for nutrient leaching prediction at farm and watershed scale.

Hahus, Ian

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Session Title: Wetland Ecosystems

Exploring the space-time continuum: the influence of model resolution and timestep on the performance of a landscape-scale wetland model

Improving the understanding and management of the hydrology of the Everglades will have great economic benefits for the state of Florida. In addition to hydrologic services such as groundwater filtration and recharge, benefits from the hydrology-driven ecology of the system include revenues from National Park visitation, hunting, and fishing. Due to its position within the watershed, the management of Water Conservation Area 1 (WCA 1) can influence the hydrology of downstream portions of the Everglades system through the timings and amounts of controlled surface water releases. Informed management of vast wetland systems such as WCA 1 requires data collection and modelling at a large scale. A flexible gridded hydrologic model of the system was developed to determine the effects of spatial resolution on predictive ability. Two simplified flow models were developed to predict grid exchange flows based on water depth: a depth-dependent Manning's formulation and a simplified power law model. The model was tested at grid sizes of 400, 800, 1600, 3200, and 6400 meters. A global sensitivity analysis was performed to quantify the degree to which model resolution, timestep, flow equation, and model parameters affect the performance of the model. In general, the Manning's flow equation yielded better results than the simple power law. The optimum timestep depended on the resolution of the model. The covariation of these two variables suggested a "representative speed" of approximately 3 km/day within WCA 1. The results of these analyses can help managers prioritize data collection based on model sensitivity to related inputs. In addition, knowledge of the impact of spatial and temporal resolution will enable decision makers to strike a balance between predictive ability and model efficiency when predicting hydrological impacts of potential management changes.

Hansen, Kira

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Session Title: Poster Session - Agricultural/Silvicultural Water

Compact Bed Geometries for Fresh Produce: Environmental Footprint, Disease, and Economics

Raised-bed plastic covered beds are used globally to produce fresh-market crops (e.g. tomato, peppers, and strawberries) and returns higher yields, earlier, and better fruit, but requires high inputs. The conventional bed geometries used for drip-irrigated plasticulture system, is between 90-76 cm wide and 10-20 cm tall, and is not wetted with a single drip tape. To better fit the wetted area of a single drip tape, compact beds were designed (61-41 cm wide and 23- 30 cm tall) and evaluated at commercial vegetable farms on the east coast. Thinner beds reduced the amount of inputs needed to construct the bed with preliminary results showing sustained yield with a reduction of up to 50% in irrigation volume, 20% in fertilizer, 10% in carbon footprint (reduced plastic, fuel, fertilizer, and pesticides), and between $125 – 600/ha in input costs. Taller beds also reduced the leaching volume due to an increased residence time of the water within the bed before moving below the root zone. Taller beds also reduced the runoff volume by 15-20% due to reduction in impervious (plastic covered) areas. The effect of flooding was further reduced due to greater bed heights which decrease the root zone soil moisture and associated waterborne diseases (Phytophthora capsici). Preliminary results also showed resiliency of compact beds during Hurricane Irma; compact beds did not loose the plastic compared to compact beds which showed almost two-thirds of the plastic loss due to hurricane force winds and sustained flooding. Ultimately, compact bed geometries offer a way for growers to gain more crop per drop of inputs. Currently several producers in multiple states (FL, SC, and GA) have adopted the compact beds with an estimated impact of 1 million in cost savings and large scale reductions in water and chemical use with a potential national impact of more than 60 million per year.

He, Fei

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Session Title: Poster Session - Agricultural/Silvicultural Water

Economic Analysis of Nitrogen Fertilizer Application Rates for North Florida Carrot

Acknowledgements: Robert Hochmuth, Charles Barrett, and Benjamin Broughton

As a part of the multi-state project “Agricultural Water Security through Sustainable Use of the Floridan Aquifer” led by UF Water Institute and funded by USDA, this study focuses on the costs of implementing more environmentally sustainable agricultural production practices in the Suwannee River Basin. The study examines producers’ decisions to introduce a new crop – carrot – into agricultural crop rotations in north Florida; and evaluates carrot production costs and revenues given alternative nitrogen (N) fertilizer application rates. Discussions with UF/IFAS Extension faculty were used to identify carrot production practices relevant to north Florida. This information was combined with the data from agricultural suppliers and published reports. Data from 2016-2017 field trials conducted in UF/IFAS Suwannee Valley Agricultural Extension Center were examined using one-way ANOVA and multiple comparisons Tukey's test. The study found that yield responses to N application rate differed among carrot varieties. Overall, this study suggests that the cost of N rate can depend on carrot varieties and targeted markets, and this difference should be accounted for in the development of pollution reduction strategies.

Hendrickson, John

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Authors: **John Hendrickson**, St. Johns River Water Management District
Vickie Hoge, St. Johns River Water Management District
Lanie Meridth, St. Johns River Water Management District

Session Title: Water Quality Issues

Patterns in Surface Water Phosphorus Concentrations and Biosolids Utilization in the Upper St. Johns River

The headwaters of the upper St. Johns River (USJR) is an integrated aquatic ecosystem of restored herbaceous marsh and run-of-the-river lakes. The SJRWMD owns and manages over 166,000 acres, a significant portion of the area within the 100-year floodplain, striving to optimize essential flood protection while also restoring normal ecosystem function by minimizing the adverse effects of over-drainage. Despite restoration progress, many of the headwater lakes and streams exhibit significant increasing trends in phosphorus and increasing incidences of harmful cyanobacterial blooms, an ominous manifestation in this Class I water. This upward trend is coincident with an increase in the application of wastewater biosolids on cattle pastures in the basins' western watersheds, and water quality sampling data indicate significant correlations between the cumulative biosolid phosphorus applied within watersheds and runoff phosphorus concentrations. The intensification in application is encouraged in part by a prohibition in the adjacent Okeechobee watershed, elevating the USJR as the next most cost-effective destination for class B biosolids generated in central and south Florida. Current regulations base class B biosolids application rates on crop nitrogen requirements. Phosphorus limits are recommended based on Mehlich-3 extractable P from intermittent soil test result results, a less definitive threshold which, in an environment of biosolids oversupply, could encourage overfertilization with phosphorus and ultimately increased export to surface waters. Regulations or economic incentives should be considered that favor utilization of biosolids for a broader array of agronomic, horticultural and residential landscape applications, drive production to class A quality, extract phosphorus during treatment, and ultimately encourage more parsimonious utilization. Additional research should be undertaken to better describe plant available phosphorus from various soil types and biosolids sources, and the modes of phosphorus migration to surface waters.

Hensley, Robert

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Authors: **Robert Hensley**, University of Florida
Matthew Cohen, University of Florida

Session Title: Challenges & Opportunities for Spring System Restoration 2

Flow declines and reversals as a driver of algal proliferation in springs

The spring ecosystems of north Florida have become markedly degraded, with widespread proliferation of filamentous algal mats. Restoration efforts have primarily focused on nitrate load reductions. Reduced recharge and increased groundwater withdrawal have resulted in widespread flow declines, and in the case of springs which discharge directly into the Suwannee or Santa Fe Rivers, increased frequency of flow reversals. Declining flows in general have been associated with increased apparent water age and reduced dissolved oxygen (DO) concentrations. During reversal events, springs are inundated with tannic, high DOC water. Respiration of this organic material produces DO sags which may persist even after outward flow conditions are restored. This hypoxic stress on grazers may produce a trophic cascade which allows algae to proliferate. Analysis shows a strong correlations between DO, potential for reversal, and algal abundance. Results suggest maintaining flows and levels which enable higher DO conditions and which reduce reversal potential, may be an important strategy for springs restoration.

Henson, Kevin

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Authors: **Kevin Henson**, University of Florida
David Kaplan, University of Florida

Session Title: Poster Session - Wetlands

The Effects Of Forest Management On The Hydrology Of Isolated Wetlands In North Central Florida Pine Flatwoods.

Many of the pine flatwoods in Southeast United States have a mosaic of isolated ephemeral wetlands that can comprise of up to 30% of the total land area. These wetlands are important for flora and fauna that depend on the storage for water use, breeding, and larval development. The hydrology of these wetlands can impact groundwater hydrology and affect fires by providing islands of unburnable area for wildlife to retreat to. This project investigates the effects of two types of commonly used forest management (prescribed burning and selective thinning) on the hydroperiod of isolated wetlands in pine flatwoods (three wetlands per treatment type). We measure pine tree basal area, leaf area index, duff layer thickness, and ground cover percentage before and after the burning and thinning to quantify how much plant material is removed during management. Depth of water and bathymetry of each wetland are used to determine stage and volume measurements before and after the treatments. We use the depth measurement to calculate actual evapotranspiration using White's Method and compare it to potential evaporation from the Penmen-Montieth equation using available Florida Automated Weather Network (FAWN) weather data. We compare these differences in ET between prescribed burning and selective thinning. The results of this study have implications on water conservation, endangered amphibian protection, and future management of pine flatwoods forests.

Her, Younggu

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Authors: **Younggu Her**, Tropical Research and Education Center/Agricultural & Biological Engineering, University of Florida

Session Title: Challenges & Opportunities for Everglades System Restoration

Lake Okeechobee inflow projection using an agricultural watershed model

Lake Okeechobee is intensively managed to prevent flooding and provide water in southeast Florida. The regulation schedule for the lake is largely influenced by the amount of inflow, which frequently exceeds its outflow capacity. Climate variability poses additional challenges for regulating the inflow and outflow of water. Several studies estimated and predicted the inflow with different methods and models including global climate indices, South Florida Water Management Model (SFWMM), neural network models, and Watershed Assessment Model (WAM). However, agricultural fields and management activities that dominate the landscape in the drainage areas of the lake have not been explicitly considered in the previous studies. Such limitations will prevent us getting the detailed understandings of hydrological processes occurring in the areas and identifying critical areas and seasons on which to focus our watershed management efforts under projected climate variability. We prepared an agricultural watershed model and future hydrological projection ensemble to help better comprehend the spatiotemporal variations of the inflow and its generation and assess the impact of climate variability on the watershed processes. The Soil and Water Assessment Tool (SWAT) was used to represent the landscape of the drainage areas mathematically, and its parameters were calibrated at multiple locations where flow measurements are available. Then, multi-model climate ensembles made for weather gages associated were incorporated in the calibrated SWAT model. We discussed challenges we faced in setting up the model and calibrating the model parameters due to the unique features of the study areas. The hydrological projections made in this study are expected to provide information useful to catchment-scale water resources management and decision-making for Lake Okeechobee and its basin.

Higgins, Tiffany

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Authors: **Tiffany Higgins**, Independent Researcher & Journalist

Session Title: Impacts of Dams and Socioecological Systems 1

Munduruku Responses to Sao Manoel and Teles Pires Hydroelectric Dams in Brazil's Amazon: Indigenous Observations of and Resistance to Hydrologic River Changes due to Dams, Mining, and Soy Production

This paper is based mostly on primary sources, interviews with Munduruku women reporting changes in the Tapajós River basin due to gold mining (thus mercury production), agrotoxics in water due to increased soy production, soy ports, land cleared for soy and corn, and increased trucking transport of corn and soy. These changes are both biological (reports of dead fish, turtles wasting away), cultural (demands for restitution from dam companies for injuries to Munduruku culture), and spiritual (demand for return of sacred urns removed by companies in the process of construction of dams, insistence on use of Munduruku language terms to describe spiritual losses suffered). It is the viewpoint of this paper that these three levels—biological, cultural, and spiritual—are intrinsically interwoven, and should be considered together when understanding sociocultural and socioenvironmental threats to the river system and its creatures. Rather than honoring the Cartesian split between matter and spirit, to be an ally to environmentally threatened riverine humans and non-humans, we should understand the material bases of lifeways as interpenetrated with cultural concepts of spirit, and conversely, understand the spiritual as interpenetrated by biological webs of forest, river, and creatures. This paper listens to Munduruku and other indigenous groups self-report on observations of a changing, threatened river, as well as depiction of spirits such as the mãe do peixe (mother of the fish), each represented by an ancestral, ceremonial urn, which, if damaged, will damage the river itself and its sustenance, spiritual, cultural, and biological. I draw upon anthropologist Marisol de la Cadena's study of how indigenous Andeans conceptualize "earth beings" such as mountains as political actors (de la Cadena 2015), as well as Abigail Perez Aguilera on how the Mexican Wirikuta redefined "territory" as not property (for mining) but a spiritual-biological category (Aguilera 2016).

Hoge, Victoria

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Session Title: Poster Session - Water Quality - Water Management

Developing a Biosolids Database for Watershed Modeling Efforts

The St. Johns River Water Management District (SJRWMD) is currently in the process of completing a districtwide inventory of biosolids application for incorporation into watershed modeling efforts for evaluation of Total Maximum Daily Loads (TMDLs). Biosolids are the stabilized solids or slurries that are removed from municipal wastewater treatment processes or domestic septage and applied to pasture or other agricultural lands as a disposal method. Currently, there is no existing database of biosolids applications within the SJRWMD and there have been no extensive studies that evaluate biosolids as a potential source of excess nutrients. Thus, this work will help to improve our understanding of the effects of biosolids application on water quality within the St. John's River and its tributaries. The Department of Environmental Protection (DEP) permits generating treatment facilities and residual application sites that receive and land apply biosolids. Biosolids land applied in Florida are generally Class B, or minimum quality for beneficial use through land application. Application rates of biosolids are determined by crop nitrogen demand, which can often result in an over application of phosphorus to the soil and increase the risk of nutrient runoff into nearby surface waters. The biosolids inventory includes yearly total nitrogen (TN) and total phosphorus (TP) biosolids application rates (lb/ac) for residual application sites districtwide between the years of 2000-2016. Within this period of record, the district has identified over 190 application sites and over 200 generating facilities that produce biosolids that are applied districtwide. Biosolids application data within the Upper St. Johns River basin (USJRB) was incorporated into the USJRB water quality model as a point source load. Currently, biosolids application data are being used to evaluate connections with water quality issues in surface water bodies proximal to application zones.

Holian, Lauren

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Authors: **Lauren Holian**, University of Florida
Jamie Gillooly, Research Professor

Session Title: Poster Session - Water Quality - Water Management

Viruses Can't Take the Heat

Viruses are the most diverse and abundant "forms of life" on Earth. They significantly impact human health and are integral to the functioning of aquatic ecosystems, steering the cycle of microbiotic communities. Developing an understanding of virus impacts on aquatic systems requires general knowledge of the basic life history features which govern their persistence (i.e., survival, growth and reproduction). We examine the effect of temperature on virus mortality (i.e., decay) rate across a diverse range of environments for all major virus types (dsDNA, ssDNA, etc.). Temperature is a proven determinant of virus decay rate, establishing a general relationship between temperature and virus decay rate provides a basis for examining the importance of other factors that may play a role in decay. We find that across all species, virus survival decreases about 2-fold for every 10 degree increase in temperature and explains about 67% of the variation. There are three hypothesis for the temperature-decay relationship: decay rate is proportional to DNA decay, decay rate is proportional to virus multiplication rate or that it is proportional to host decay rate (1/lifespan). In this broad-scale analysis, the viral decay trend across temperatures is established and the possible mechanistic processes responsible for the observed pattern are compared. The slope of the observed temperature-lifespan virus relationship (-.084 ln(Days)/˚C) was significantly shallower than that of DNA decay (-0.19 ln(DNA Half-life, 100bp/˚C), but very similar to that of host cell lifespan (-0.091 ln(body-mass corrected lifespan of host cells/˚C). This suggests that DNA decay may be an unlikely explanation for the observed pattern but the pattern could result from co-evolutionary processes pairing viral decay rate with that of their host's.

Hundemer, Sadie

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Authors: **Sadie Hundemer**, University of Florida
Martha Monroe, University of Florida

Session Title: Who are they? Understanding Audiences to Design or Improve programs

Into the minds of stakeholders: Using mental models to enhance communication and collaboration in water policy

The Upper Floridan Aquifer (UFA) supports an annual $7.5 billion in agricultural activities across Florida, Georgia, and Alabama; supplies drinking water for 10 million people; and provides habitat in the springs and rivers it feeds. However, the UFA faces major risks to water quantity and quality due to increased pressure on the resource from population growth, intensification of agriculture and silviculture, and climate change.
The UF Water Institute is coordinating a project to develop and evaluate scenarios representing tradeoffs for achieving regional water security. Success in this endeavor will require the collaboration of stakeholders from agriculture, forestry, tourism, government, and science, as well as representatives from communities across the region. Each of these stakeholders likely has different perspectives on the water system, water issues, and potential remedies. Policy discussions and evaluations of alternatives are being facilitated, in part, through a collective understanding of stakeholder mental models, captured and evaluated using conceptual content cognitive mapping (3CM).
3CM is a research tool that allows stakeholders to explain how they think by selecting and organizing cards that represent elements of the system. Capturing mental models in this way allows project members to view the system through the eyes of their collaborators, which can facilitate relationship building and communication. Metal models play an additional role in external communication. Stakeholders come to the project team as representatives of larger communities that are not privy to project discussion, but may be impacted by the outcomes. Mental models allow for the development of communication about the project mission and outcomes using frames that resonate with various communities.
This poster session will compare stakeholder mental models and discuss how the models are helping the project team learn about stakeholders and advance water security.

Inglett, Patrick

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Dean Dobberfuhl, St. Johns River Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 1

Identifying N Sources and Transformations in the Silver Spring Springshed, USA

Special Session–Fitzgerald/Reddy Silver Springs is the largest of Florida's first magnitude springs and also likely the largest limestone spring in the United States. Land use in the springshed has shifted to more urban/agricultural over the past 50 years, and with this change, nitrate levels in ground and surface water have also increased. Biogeochemical transformations of N in the soil, vadose zone and shallow aquifer influence how much nitrate ultimately emerges at the spring so we conducted this project to trace N from sources within the springshed through the vadose zone and aquifer to discharge at the spring vent. Laboratory and field measurements were coupled in various ways to determine concentrations of nutrients, microbial composition, and denitrification rates in profiles through the soil and vadose zone, as well as concentrations of nutrients, ratios of stable isotopes for nitrate, and concentrations of dissolved gases in groundwater. Geochemical properties showed that the West and East spring vent reflected the land use of forests/wetlands, and agriculture/urban, respectively. Nitrate concentrations in soils varied among land uses, ranked in the order of agriculture>urban>forest≥wetlands. Direct measurements confirm low rates of denitrification in samples of aquifer limestone, but estimates based dissolved gases from the spring vents indicate denitrification losses of approximately 17- 43% of the nitrate load to the aquifer. Excess N2 and changes in isotopic ratios for nitrate δ15N and δ18O in well and vent samples indicate that most of the nitrate in the unconfined, western springshed originates from a common N source, with δ15N and δ18O signatures of approximately 6-7‰. These signatures likely represent more organic N sources, such as wastewater, manure, or soil N, but caution should be used until additional analyses can better establish this end member.

Jackson, Jennifer

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Katrina Indarawis, University of Florida

Session Title: Poster Session - Human Water Needs/Use

Coagulation of Proteins Using Chitosan for Drinking Water Treatment Applications

Reverse Osmosis (RO) filtration will be crucial for drinking water treatment in the future due to its ability to remove emerging contaminants such as pharmaceuticals, however RO filtration still faces issues with membrane fouling. Ion exchange has been shown to aide in the pretreatment of water for RO filtration by removing charged constituents in water. However, neutral, hydrophilic portions of organic matter such as proteins remain after ion exchange and are a critical foulant for RO membranes. Removing dissolved protein via coagulation with chitosan would increase the life-span of RO membranes and drive down energy costs associated with fouled membranes. Chitosan is a natural biopolymer derived from the shells of crustaceans and has been shown to bind to proteins. Chitosan is a desirable coagulant for water treatment because it is naturally derived and can be land-applied after use unlike other water treatment coagulants such as alum and ferric chloride. Therefore, the primary goal of this research is to coagulate bovine serum albumin (BSA), a model protein, from solution using chitosan. To achieve this goal the point of zero charge for chitosan will be determined via salt titration, the coagulation process will be seeded using quartz sand and kaolinite clay to encourage larger floc-size, and the effectiveness of chitosan derivatives such as chitosan alginate will be tested. Preliminary results have shown that undissolved chitosan at a dose of 10 mg/L is superior to a more concentrated dissolved dose. Based upon literature review, the point of zero charge of chitosan should occur at a pH of approximately 5, kaolinite clay should perform better than sand when seeding, and chitosan-alginate may be more effective than chitosan alone.

Jawitz, James

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Authors: **James Jawitz**, Soil and Water Sciences Department, University of Florida
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Session Title: Challenges & Opportunities for Spring System Restoration 1

Through the hidden veins of the earth: How do water and solutes get to Silver Springs?

Special Session–Fitzgerald/Reddy

How long does it take for a rainfall signal to appear at Silver Springs? What flow paths do anthropogenic contaminants take to get to the Spring? This presentation describes our recent work on these questions in the Silver Springs basin. This work was part of a large cooperative initiative between UF and the St Johns River Water Management District.

Johnson, Hailey

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Authors: **Hailey Johnson**, University of Florida
Peter Adams, University of Florida

Session Title: Poster Session - Coastal Waters

A Numerical Study to Quantify the Stability of Cuspate Features on Sandy Coastlines in Response to Evolving Wave and Storm Climates

Sandy coasts are dynamic environments that respond to changes in wave climate and storm events. Coastal changes effect widespread impacts due to the density of human populations and diverse ecosystems characteristic to coastal zones. Accordingly, understanding the influence of wave and storm climates on coastal morphology is critical to the management of natural resources and municipal interests, one of which being freshwater supply to coastal communities. This study employs the Coastline Evolution Model, a one-contour-line, two-dimensional numerical coastal evolution model, to explore the morphologic response of sandy coasts to various wave climates at annual, decadal, and centennial timescales. In our model, coastline evolution is driven by gradients in longshore sediment transport, which produce regions of erosion and regions of deposition. The volume and direction of sediment transport in this model is parameterized by wave heights and direction. Recent studies indicate that regional trends in wave height and approach direction are shifting, perhaps, as a result of global climate change. Numerical simulations presented here utilize predicted wave conditions to demonstrate how the stability of a coastal planform may be impacted by persistent changes in nearshore wave conditions. In addition to decadal wave-driven morphologic trends, sandy coasts responds to energetic storms such as hurricanes and nor'easters; analyses indicated that observed shifts in global climate may lead to an increase in frequency and intensity of storm events. This study quantifies variability in the magnitude of shoreline change as a result of recurrent high-intensity storms and analyzes the influence of storm-related offshore sediment transport on the propensity of a coastline to form cuspate features. The growth or loss of these features influences the distribution of coastal biota and is an important consideration in coastal engineering and development.

Jones, Gregg

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Authors: **Gregg Jones**, Cardno

Session Title: Water Quality Issues

Aquifer Recharge with Minimally Treated Stormwater to Augment Groundwater Supplies - Regulatory Framework, Research, and Pilot Projects

New groundwater withdrawals for water supply from the Upper Floridan aquifer have been restricted in many parts of the state due to environmental impacts such as reduced spring flow, reduced baseflow to rivers, and lowered water levels in lakes and wetlands. An important tool to augment aquifers to increase the availability of groundwater is aquifer recharge using river water. An impediment to aquifer recharge in the past has been the requirement that any water introduced artificially into the Floridan aquifer must meet all primary and secondary drinking water standards. The high cost of treating river water to this degree has limited the use of aquifer recharge technology. This presentation will explain recent decisions by the U.S. Environmental Protection Agency that have provided a path forward for aquifer recharge projects that propose minimal treatment of source water. Pilot projects that are now in progress across the state will also be discussed and preliminary results of testing will be highlighted.

Juarez, Braulio

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Authors: **Braulio Juarez**, Civil and Coastal Engineering Department, University of Florida
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Session Title: Coastal Ecosystems

Tidal and residual circulation in a multiple-inlet deltaic system

A week-long campaign of towed ADCP transects and CTD casts was performed at Barataria Bay, an estuary in the Mississippi river delta, to investigate the circulation and connection between its 8 inlets. Results from the westernmost inlet, inlet 1, showed the diurnal tidal currents were up to 50 cm/s in the channel and with a slight deflection to the right side of the channel. The semidiurnal harmonic showed the same distribution but with a smaller amplitude, up to 40 cm/s. At inlet 2, to the east of Grand Isle, the amplitude of the diurnal currents was up to 25 cm/s while semidiurnal currents reached 20 cm/s in the channel at 10 m depth. The residual circulation was stronger at inlet 2 than at inlet 1, and with different spatial distributions. At inlet 1, the residual flow was vertically sheared, with seaward flow at the surface and landward flow underneath. At inlet 2, the residual circulation was laterally sheared, with seaward flow on the left side (looking landward) and landward flow on the right side of the channel. Both residual flows at inlet 2 had a maximum magnitude centered at 20 m depth. Toward the eastern portion of Barataria Bay, closer to the Mississippi River discharge, increased density gradients reinforce the role of baroclinicity on exchange. Because of this river-derived forcing, the residual currents are expected to be stronger in the eastern inlets than in the western inlets.

Jumani, Suman

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Authors: **Suman Jumani**, Soil and Water Sciences Department, University of Florida
Matthew Deitch, Assistant Professor, West Florida Research and Education Center, University of Florida

Session Title: Poster Session - Human Water Needs/Use

Reach and catchment-scale impacts of small hydropower projects in a tropical biodiversity hotspot

The search for cleaner and greener sources of energy has led to the proliferation of small hydropower projects (SHPs), especially in tropical developing countries. These projects are widely propagated as environmentally benign due to the assumption that they have no emissions, negligible impacts on river flows, and smaller areas of submergence compared to those created behind large hydropower dams. However, there is a paucity of research examining the ecological impacts of SHPs, especially on tropical river systems.
This study assessed the reach- and catchment-scale impacts of SHPs in the Western Ghats landscape of India - a global biodiversity hotspot and a distinct freshwater ecoregion. For this study, we collected data from three streams - two dammed and one undammed - in a hierarchical framework to examine the effects of SHPs on water quality, channel geometry, and fish assemblages.
Subsequently, we assessed the catchment-scale impacts of SHPs in the Western Ghats of Karnataka State, where 81 SHPs have been commissioned, and over 350 more have been planned for further development. The spatial clustering and extent of SHP-related dewatering on the drainage network across the study site was estimated. This scenario was compared with the expected scenario of when all proposed SHPs would be commissioned to predict the full extent of impact to the drainage network.
Reach-level impacts were highly significant. SHP related operations reduced habitat availability by altering stream geometry and longitudinal connectivity, affected habitat quality by altering water quality parameters and thereby affected fish species richness. At the catchment-scale, the extent of dewatering was found to be substantial and spatially clustered. Based on existing and proposed scenarios, priority catchments were identified. In light of our findings, we suggest suitable changes to SHP operations and policies.

Kakarla, Sri Charan

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Authors: **Yiannis Amaptzidis**, University of Florida - SWFREC
Sri Charan Kakarla, University of Florida - SWFREC

Session Title: Agricultural Water and Nutrient Management 2

Automated and Voice-Controlled Irrigation System for Specialty Crops

Issues of sustainable water use are at the forefront of agricultural management agencies across the United States. Supplies of good-quality water for agriculture is expected to decrease in several regions, including the Southwest Florida, due to climate change. Growers in Florida are consequently looking towards new approaches for protecting, conserving, and restoring water resources while simultaneously meeting demands for urban, agricultural, and other needs. The overall goal of this research project is to design, develop and implement a smart, automated, and voice-controlled irrigation system to help growers make irrigation decisions and improve water management. The proposed system includes: (i) a smart controller (Arduino mega microcontroller); (ii) wireless sensor network (e.g. ambient temperature and humidity sensors, soil moisture sensors etc.); (iii) a server (raspberry pi 3); (iv) voice control using the Alexa system (by amazon); (v) solenoid valves; (vi) electrical pumps; (vii) flow sensors. The voice control allows the user to check the status of the plants/system (e.g. soil moisture and temperature) and wirelessly control the valves/pumps. This system irrigates each section based on plant needs; it can maximize yield with minimum use of water. Additionally, it is economical, portable and user friendly. The proposed system has the ability to apply water directly where it is needed, therefore saving water and energy and preventing excessive water runoff and leaching.

Kaplan, David

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Authors: **David Kaplan**, Environmental Engineering Sciences, ESSIE, University of Florida
Nathan Reaver, University of Florida
Peter Sucsy, St. Johns River Water Management Distrct

Session Title: Challenges & Opportunities for Spring System Restoration 2

Connecting Spring Run Hydraulics and Ecosystem Structure in the Silver River

Special Session–Fitzgerald/Reddy
Spring ecosystems are one of Florida's most important environmental and economic resources, however their ecological integrity is vulnerable to changes in water quantity and quality. In recent decades, many Florida springs have experienced reduced flow, increased nitrate concentrations, increased algae, and decreased native plant coverage. As part of the St. Johns River Water Management District-University of Florida Collaborative Research Initiative on Sustainability and Protection of Springs (CRISPS) project, our team sought to improve understanding of the effects of spring run hydraulics and hydrodynamics on primary producer community structure (PPCS), with a focus on algae and submerged aquatic vegetation. Here we present a synthesis of our group's observational and modeling studies. Most critically, we found that water velocity strongly influences PPCS. A velocity of ~0.22 m/s represents an important threshold for high vs. low epiphytic algal cover, though algae can be present above and below this threshold. Before 2000, velocities often exceeded this threshold in Silver River, however between 2000 and 2003, the stage-discharge relationship changed to yield higher stage and lower velocity for a given discharge. This transition may have reduced sloughing of epiphytic algae, leading to higher algal biomass, and we present several hypotheses for how this hydraulic shift may have occurred. Additionally, flow manipulation experiments revealed that colonization and removal of epiphytic algae was not hysteretic, so restoring higher velocities should reduce epiphytic algal cover.
Given these findings, velocity may be a manageable driver of algal abundance. Velocity can be managed via four interconnected interventions: 1) maintaining aquifer levels that promote high discharge rates; 2) managing non-native vegetation within Silver River to reduce channel hydraulic roughness; 3) reducing the downstream stage in the Ocklawaha River to increase the surface water slope; and 4) dredging sediment from the lower river to increase bed slope. Importantly, employing a single intervention may not yield meaningful increases in velocity. For example, higher spring discharge was not correlated with increased velocities, which also varied with channel hydraulic characteristics and downstream water level. As such, management actions that employ these mechanisms were analyzed using the Environmental Fluid Dynamics Code (EFDC) model to assess their relative influence on velocity and likely effect on PPCS. Evaluating the potential costs and environmental tradeoffs of these management activities - and implementing an adaptive monitoring and management plan to assess their effectiveness - will be an important step in meeting restoration goals, particularly in light of other management mandates (e.g., the Silver River MFL).

Kaplan, David

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Authors: **David Kaplan**, Environmental Engineering Sciences, ESSIE, University of Florida
Kelsie Timpe, University of Florida

Session Title: Impacts of Dams and Socioecological Systems 1

Quantifying the ecohydrological impact of dams in the Amazon

Developing countries around the world are expanding hydropower to meet growing energy demand. In the Brazilian Amazon, >200 dams are planned over the next 30 years, and questions about the impacts of current and future hydropower in this globally important watershed remain unanswered. In this context, we applied a hydrologic indicator method to quantify how existing Amazon dams have altered the natural flow regime and to identify predictors of alteration. The type and magnitude of hydrologic alteration varied widely by dam, but the largest changes were to critical characteristics of the flood pulse. Impacts were largest for low-elevation, large-reservoir dams, however small dams had enormous impacts relative to electricity production. Finally, the cumulative effect of multiple dams was significant, but only for some aspects of the flow regime. This analysis is a first step toward the development of environmental flows plans and policies relevant to the Amazon and other mega-diverse river basins.

Keller, Chris

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Authors: **Chris Keller**, Wetland Solutions, Inc.
Kristen Sealey, Gainesville Regional Utilities
Morgan Leger, Gainesville Regional Utilities

Session Title: Urban Water and Nutrient Management 1

Kanapaha hybrid stormwater/reclaimed water recharge wetland

Since 2008, Gainesville Regional Utilities (GRU) has been pioneering the use of infiltrating or recharge wetlands as an environmentally-sound technology for polishing reclaimed water and recharging the surficial and Floridan aquifers. Demonstration-scale projects at the Kanapaha Water Reclamation Facility (KWRF) and Kanapaha Middle School (KMS) have proven that infiltration rates up to several inches per day are sustainable and that nitrogen removal is better than what can be achieved with conventional land application methods such as spray irrigation and rapid infiltration basins. The key to maximizing the nutrient removal effectiveness is to maintain anaerobic subsurface conditions through consistent hydraulic loading. The wetland vegetation provides the carbon source and attachment sites for denitrifying microbes.

Much of GRU's service area is characterized by sandy, rapidly-draining soils, and dry retention is the favored method for residential and commercial stormwater management. These stormwater basins sit idle between runoff events and are not utilized to their full potential. The absence of biological treatment processes in dry retention basins limits their effectiveness for water quality improvement. The realization that infiltrated stormwater may still transport nutrient loads to sensitive receiving waters, such as springs, has led several municipalities to require design enhancements for new dry retention basins that increase pollutant removal efficiency. In neighborhoods and along rights-of-way near existing or planned reclaimed water distribution mains, dry retention systems can be designed or retro-fitted as infiltrating wetlands to serve multiple purposes: providing the necessary stormwater management function during rainfall events; recharging the aquifer with highly polished reclaimed water between rainfall events; replacing grass cover with aesthetically pleasing wetland vegetation; and maximizing ecological function and wildlife value.

In cooperation with the Alachua County School Board and the St. John's River Water Management District (SJRWMD), GRU has retrofitted an existing dry retention basin into the first combined stormwater/reclaimed water infiltrating wetland system. Full-scale infiltration tests were conducted to evaluate the sustainable infiltration rate, and drawdown modeling showed that the design storm requirements could still be met with the basin receiving a continuous supply of reclaimed water. The SJRWMD issued a permit authorizing the modification of the retention stormwater system to a stormwater/reclaimed water hybrid pond. The conversion from a dry, grassed basin to a functional wetland ecosystem was completed in August 2016. Operational hydrologic and water quality data collection began in July and September 2016, respectively.

The technical and regulatory feasibility of converting dry retention basins to infiltrating wetlands has been demonstrated and this strategy offers utilities the opportunity to maximize the use of existing or planned water resource infrastructure.

Khadka, Mitra

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Authors: **Mitra Khadka**, University of Florida
Jonathan Martin, Department of Geological Sciences, University of Florida

Session Title: Challenges & Opportunities for Spring System Restoration 2

Nutrient and Trace Metal Dynamics at the Sediment-Water Interface in Silver River, Florida

Stream benthic sediments are hot spots for biogeochemical reactions, and can act as sources and sinks of stream nutrients. These processes depend on accumulation rates of sedimentary organic carbon (OC), nitrogen (N) and phosphorous (P), and their delivery to streams. To evaluate sources and sinks, we estimated sediment accretion with 210Pb in the spring-fed Silver River in north-central Florida. Sedimentation rates range from 1.6 to 2.2 mm yr-1 and reflect accumulation rates for OC, TN and TP of 170-238, 13-16 and 2-8 g m-2 yr-1, respectively. Heavy δ13C and light δ15N values of OC and TN, respectively, suggest allochthonous organic matters from terrestrial C3 plants accumulate near the spring. In contrast, much organic matters at mid- and down-stream sites originate from autochthonous algae and plankton, reflecting a labile substrate that could enhance nutrient fluxes. Biogeochemical reactions are shown by increasing Fe, Mn, soluble reactive phosphorous (SRP), NH4-N, and H2S concentrations with depth in sediment pore water. In contrast, decreasing NO3-N concentrations with depth in the pore water reflect a sink for riverine NO3-N. High hydraulic conductivity (5.0 × 10-3 to 6.2 × 10-2 cm s-1) of the bottom sediment and hydraulic gradients continuously oriented towards the river show nutrients flow to the river. However, diffusion transports more solutes than advection from the sediments except for NO3-N which diffuses into the pore water at a faster rate than it flows to the river, reflecting a small loss (~0.02%) of the daily NO3-N spring load. However, total benthic fluxes of NH4-N, SRP, Fe, Mn and HS- contribute about 12%, 47%, 12%, 5% and 100% of the daily spring loads. Although smaller than spring loads, these fluxes can be important to benthic ecosystem function and management, particularly when they are delivered directly to stagnant areas within the subaquatic vegetation.

Khare, Yogesh

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Authors: **Yogesh Khare**, Everglades Foundation
Melodie Naja, Chief Scientist, Everglades Foundation
Andrew Stainback, Economist, Everglades Foundation

Session Title: Challenges & Opportunities for Everglades System Restoration

Heuristic assessment of restoration strategies to achieve phosphorus target in Lake Okeechobee

Several restoration plans have been developed to address high total phosphorus (TP) loads reaching Lake Okeechobee (LO) focusing on implementing different strategies, mainly Best Management Practices (BMPs), Dispersed Water Management (DWM) and Stormwater Treatment Areas (STAs). The aim of this study was to assess the economic viability and performance of these water quality management strategies (MS) with potentially large footprints to achieve TP goal of 40 ppb for the northern basins discharging into LO. The Watershed Assessment Model (WAM) was used as an evaluation tool for this heuristic assessment. The LO watershed was sub-divided into 10 basins and calibrated for the 'Base' period of 10 years (1998-2007). With 'acceptable' to 'good' WAM performance in individual basins, the simulated total average annual flows and TP loads were 2.65x109 m3 and 429 metric tons, respectively. The TP hotspot areas were also identified. The economic viability and performance of the MS was assessed considering three BMP levels and five DWM alternatives combining existing DWM projects and hypothetical water management levels. For each restoration scenario, the STA sizes were determined using the Dynamic Model for Stormwater Treatment Area (DMSTA) to achieve the TP goal of 40 ppb. Results showed that the TP load reduction (from Base) under BMP and DWM scenarios would range from 11-40%, substantially lower than the required four-fold reduction, indicating STA construction is imperative. The most cost effective scenario found in this study consisted of BMP Type I implementation throughout the LO watershed, continuation of existing DWM projects, along with the construction of ~200 km2 of STAs at strategic location/s north of LO. The preliminary resulting annual cost of implementing this scenario was assessed at $147 million.

King, Sean

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Authors: **Sean King**, Southwest Florida Water Management District
Sky Notestein, Southwest Florida Water Management District
Chris Anastasiou, Southwest Florida Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 3

Salinity pulses and manatee herbivory as drivers of submerged aquatic vegetation community changes in coastal Florida spring systems

The Springs Coast region of Florida is known for several first-magnitude spring systems including Crystal River/Kings Bay, Homosassa River, Chassahowitzka River, and Weeki Wachee River. The submerged aquatic vegetation (SAV) communities in these systems provide important ecosystem services that help maintain water clarity, reduce nutrient levels, and provide fish and wildlife habitat. In recent decades SAV abundance has declined substantially in some of these systems, which has spurred efforts to restore SAV communities and associated ecosystem services. The results of recent SAV monitoring and restoration efforts demonstrate the role of salinity pulses and manatee herbivory as primary drivers of SAV communities in coastal springs systems. Manatee populations are increasing in the Springs Coast region and grazing pressure on SAV is expected to continue to increase. Salinity pulses associated with tropical storm surges have been shown to dramatically decrease SAV abundance, with variable recovery. In addition to salinity pulses, average salinities appear to be increasing in portions of some coastal spring systems. Higher salinities may reduce the potential area suitable for freshwater SAV species, since average salinities › 3.5 ppt have been shown to limit the downstream extent of SAV in these systems. Sea-level rise in this region appears to be largely responsible for increasing salinities and longer water residence times, with corresponding effects on the SAV community and overall system status. Current trends in salinities, manatee herbivory, and SAV abundance have profound implications for management of these resources and the future of coastal Florida spring systems.

Kirk, Lily

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Authors: **Lily Kirk**, University of Florida
Matthew Cohen, School of Forest Resources and Conservation, University of Florida

Session Title: Poster Session - Stream/River Dynamics

Benthic Light Availability Improves Predictions of Riverine Primary Production

Light is a fundamental control on photosynthesis, and often the only control strongly correlated with gross primary production (GPP) in streams and rivers; yet it has received far less attention than nutrients. Because benthic light is difficult to measure in situ, surrogates such as open sky irradiance are often used. Several studies have now refined methods to quantify canopy and water column attenuation of open sky light in order to estimate the amount of light that actually reaches the benthos. Given the additional effort that measuring benthic light requires, we should ask if benthic light always improves our predictions of GPP compared to just open sky irradiance. We use long-term, high-resolution dissolved oxygen, turbidity, dissolved organic matter (fDOM), and irradiance data from streams and rivers in north-central Florida, US across gradients of size and color to build statistical models of benthic light that predict GPP. Preliminary results on a large, clear river show only modest model improvements over open sky irradiance, even in heavily canopied reaches with pulses of tannic water. However, in another spring-fed river with greater connectivity to adjacent wetlands – and hence larger, more frequent pulses of tannic water – the model improved dramatically with the inclusion of fDOM (model R2 improved from 0.28 to 0.68). River shade modeling efforts also suggest that knowing benthic light will greatly enhance our ability to predict GPP in narrower, forested streams flowing in particular directions. Our objective is to outline conditions where an assessment of benthic light conditions would be necessary for riverine metabolism studies or management strategies.

Koirala, Unmesh

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Authors: **Unmesh Koirala**, School of Forest Resources and Conservation, University of Florida
Kevin Athearn, Regional Specialized Extension Agent
Damian Adams, Associate Professor

Session Title: Agricultural Water and Nutrient Management 1

Enterprise-level Economic Impacts of Agricultural BMP adoption to Meet Florida Water Quality and Quantity Standards

This study was to investigate enterprise-level economic impacts of adopting agricultural Best Management Practices (BMPs) in the Upper Floridan Aquifer (UFA) region. Government agencies are encouraging farmers to adopt BMPs in order to reduce agricultural water use and improve water quality. Farmers seek information on the costs and returns associated with changing practices, and policy makers need information on factors affecting adoption decisions, as well as the economic implications for agriculture in the region. To address these needs enterprise-level economic impact analysis was done by creating crop budgets for two major agricultural land uses (corn and peanuts) in the Suwannee watershed area in Florida. These budgets were generated based on published statistics and interviews with producers, their suppliers, local businesses, area extension agents and specialists who work closely with producers. They provided the estimates for projected costs, revenue, and net returns for a single enterprise that is representative of the production system in the study area. These crop budgets were used to develop a farm scale financial analysis model for the associated production practices. Then using the estimates of BMP data (e.g., cost of installation, other costs involved in the adoption, impact on yield), predictions were made for enterprise level financial impacts under different adoption scenarios. Results of this study allowed us to compare the financial performance of operations under alternative BMPs. These results will help inform other associated studies on eliciting stakeholder's preferences, feasibility analysis and understanding the economic and environmental trade-offs for alternative BMPs.

Konstantis, Tatiana

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Authors: **Tatiana Kontantis**, University of Florida
Katrina Indarawis, University of Florida
David Silvey, Tyndale Air Force Base

Session Title: Poster Session - Human Water Needs/Use

Characterization of waste water samples from Mexico Beach Florida

Introduction
Tyndall Air Force Base, located in the Panhandle of Florida near the city of Mexico Beach, has experienced increased damage from an unknown fibrous substance present in their waste water distribution system. This substance is costing the base nearly $3,000 per week to remove. Characteristics of the solid include an oily appearance and unusual buoyancy, as well as continual growth when exposed to air. This has ruled out traditional forms of residential wastewater issues. Recent concerns in wastewater distribution systems include the use of flushable wipes which have led to major clogging within main sewer lines and caked substances on sewer filters. This research seeks to characterize waste samples from lift station #1722 at Tyndall Air Force Base and compare them to three commercially available products in order to determine if consumer product break down is present.
Methods
Scanning Electron Microscopy imaging along with Energy Dispersive X-Ray Spectroscopy will be used to identify surface characteristics, topography, and elements present within the samples. Fourier Transform Infrared Spectroscopy along with X-Ray Photoelectron Spectroscopy will be used to verify chemical constituents to supplement data. Three products on the market, Scrubbing Bubbles Antibacterial Bathroom Flushable Wipes, Cottonelle Flushable Cleansings Cloths, and Air Wick V.I. Poo Toilet Perfume, were chosen based on common ingredients found in similar consumer products, claims on industry standard technology, and breakdown ability. Experiments were run with the use of a shaker table and magnetic stir bar to simulate pipe water flow agitation. The samples produced from these three products will undergo the same characterization analysis and will be compared to that of the actual wastewater samples.
Results
Initial results indicate that the wastewater samples from the base are composed of fibrous substances that are less dense than water. Simulations indicated that one of the three products experienced breakdown.

Krimsky, Lisa

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Authors: **Lisa Krimsky**, UF/IFAS
Shelly Krueger, UF/IFAS Florida Sea Grant

Session Title: Poster Session - Water Quality - Water Management

Capitalizing on local capacity to develop a statewide volunteer water monitoring program.

The UF/IFAS Water Watch program is a community-based volunteer water quality monitoring program that was created in 2014 by UF/IFAS Sea Grant extension agents in Miami-Dade and Monroe counties to promote awareness of the importance of water quality and the connections between land-use and aquatic health. Volunteer “boots on the ground” provide an effective means to leverage limited funding and foster stakeholder support, and these models have expanded to a statewide Water Watch program. Successful expansion is contingent on volunteer participation and ensuring volunteer data could be used for resource management. Since the real value of volunteer-generated data depends on consistency, it is imperative to begin program development by defining standard operating procedures (SOPs) for reliable, verifiable data collection. Working with the Environmental Protection Agency, we developed a quality assurance project plan to ensure quality-assured/quality-controlled (QA/QC) volunteer data. Currently, these programs are undergoing further validation SOPs with the Florida Department of Environmental Protection in order for these volunteer data to be used by natural resource managers in coastal Florida. Designed as a Train-the-Trainer program, each Extension Agent Coordinator trains volunteers using the same Water Watch Standard Operating Procedures (SOPs). Water quality parameters are chosen to meet data needs and funding availability of local entities and include analysis for pathogens, nutrients and other physical and chemical parameters to track ambient water quality conditions over time. To date, these two pilot programs have expanded statewide to 11 counties, collecting data from more than 90 unique sites. Although Water Watch focuses on water quality, its development can provide examples of lessons learned for other applications and best practices for citizen science initiatives.

Langston, Amy

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Authors: **Amy Langston**, University of Florida
David Kaplan, Engineering School of Sustainable Infrastructure and Environment, University of Florida

Session Title: Poster Session - Climate Change/Hydrology

Modeling the Effects of Climate Change and Predation on Northward Expansion of Black Mangroves (Avicennia germinans) into Temperate Salt Marsh

Altered temperature and precipitation regimes driven by climate change are affecting the global distribution of mangroves, particularly at poleward range limits, where fewer freeze events allow mangrove migration into temperate climates. Along the west coast of Florida, black mangroves (Avicennia germinans) reach their northern range limit in the Big Bend region, where sea level rise and fewer freeze events create favorable environmental conditions for their survival. However, as black mangroves expand into temperate salt marsh, they face intense predation pressure by purple marsh crabs (Sesarma reticulatum). We conducted a field experiment investigating the relationship between crab predation and propagule density. Results showed that propagule consumption decreased with increased propagule density. On average, 27% of propagules in a 100/m2 density treatment were consumed, 55% of propagules in a 25/m2 density treatment were consumed, and 100% of propagules in a 1/m2 density treatment were consumed. We are incorporating field results into an individual-based model to quantify the relative effects of propagule predation on mangrove colonization, in concert with storm-driven dispersal and freeze events. We hypothesize that predation affects regional mangrove expansion into salt marsh by reducing overall encroachment success and that the combined effects of regional abiotic controls and local predation depend on the magnitude and frequency of abiotic disturbance, propagule density, and crab density. The individual-based model will be a useful tool for simulating spatial and temporal changes in mangrove populations on a 1-year time step under different environmental and predation scenarios. We expect the combination of field data and predictive modeling will offer new insights on patterns of mangrove coverage along a dynamic coastal region.

Lee, Duhui

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Authors: **Duhui Lee**, The Department of Tourism, Recreation and Sports Management, University of Florida
Jinwon Kim, Assistant Professor

Session Title: Poster Session - Coastal Waters

Measuring the equity of beach access for people with disabilities: A case study of Duval county

Beaches are a unique type of recreation setting offering significant physiological, psychological, and social benefits to people with disabilities. Providing and improving adequate access to recreation amenities such as beaches for people with disabilities have been recognized as essential responsibilities of public leisure agencies in their response to the Americans with Disabilities Act (ADA) of 1990. However, not all people with disabilities have adequate access to beaches. Concern continues that those with disabilities tend to be disproportionately denied the multiple benefits of access to beaches. Disparities in levels of access to beaches for people with disabilities represent an example of environmental injustice. Assessing the degree of environmental justice inherent in the distribution of access to beaches for people with ambulatory difficulty is, thus, an essential prerequisite to effective community recreation planning and management in the creation of active, health and sustainable communities. Despite the importance of equitable beach access for people with disabilities, and though some studies have focused on legal issues in the context of the public trust doctrine or ADA, no known empirical study has evaluated whether the level of beach access for people with disabilities is indeed equitable. So, the purpose of this study is to measure the degree of equity inherent in the distribution of beach access for people with disabilities in the Jacksonville Metropolitan Area. Geographic Information System in combination with spatial statistical techniques such as geographically weighted regression will be employed to account for spatial effects, phenomena rarely considered in prior equity analyses in the parks and recreation literature. The findings of this study can help parks and recreation agencies better understand local patterns of equity with regard to beach access for people with ambulatory difficulty, an important first step in facilitating the formulation of more effective water-based community recreation planning and management.

Leitman, Steve

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Authors: **Steve Leitman**, Waters Without Borders
Greg Kiker, University of Florida

Session Title: Impacts of Dams and Socioecological Systems 1

Performance Metrics: The link between hydrology, engineering and ecology in the Apalachicola/Chattahoochee/Flint Basin

In river basin management, defining and analyzing performance metrics to discern acceptable, marginal and unacceptable alternatives is a significant challenge given the complex social, ecological and technical uncertainties. While significant professional attention and financial resources are devoted to legal issues, limited regulatory monitoring and occasional modeling, little effort is devoted to defining and testing performance criteria to define acceptable outcomes and attain system objectives. As an example, we review the recent criteria used to select the preferred alternative for the Water Control Manual (WCM) for the Apalachicola-Chattahoochee-Flint (ACF) basin by the U.S. Army Corps of Engineers, Mobile District (USACE) in 2016-2017; the official guideline for how all federal reservoirs will be managed into the post-2017 future. We will show that many of the WCM performance metrics are ill-suited to discerning water system performance towards the stated USACE objectives. Additionally, we propose revised criteria that better capture system states, performance and transparency for greater clarity and progress in this disputed water basin.

Li, Xinhu

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Authors: **Xinhu Li**, Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences
Gary Feng, USDA-Agricultural Research Service

Session Title: Poster Session - Wetlands

Comparison of characteristic salt crust soils and no crust soils: implications for the effect of flooding on salinization in hyper-arid floodplains

Soil salt crusts have been shown to restrict wind erosion and influence water and salt movement in soil, and they are therefore of great concern worldwide. However, there is little available information for the comparison of characteristic salt crust soils and soils without a salt crust (located near salt crust soils) in hyper-arid floodplains. The objective of this study was to investigate paired samples from salt crusts and surface soils without a salt crust in the floodplain of the Tarim River in China. The results revealed that the salt crust soils were mainly distributed in shrublands dominated by Tarimax species, which accounted for 73.33%, followed by wetlands, with a shallower groundwater table (<2.4 m). The salt crust thickness showed positive correlations with salt content (R^2=0.610) and crust strength (R^2=0.639). Compared with soils without a salt crust, the salt crusts exhibited higher clay ($p<0.05$), silt ($p<0.01$) and soil organic matter ($p<0.01$) contents, were located in low-lying areas, and experienced high flood overflow relatively frequently. Therefore, flooding did not decrease the salt content in top soils but may have increased the intensity of salt accumulation and caused salt crust formation in soils with shallower groundwater (e.g., <2.4 m).

Lotero, Laura

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Authors: **Laura Lotero**, University of South Florida
Mark Rains, University of South Florida
Kai Rains, University of South Florida

Session Title: Wetland Ecosystems

The Role of High-Elevation Parámo Wetlands in Generation of Streamflow and Water Supply in the Northern Andes, Colombia

Water security requires that sufficient quantities of water be available at appropriate times. This is particularly challenging for high-intensity urban and agricultural settings. In underdeveloped nations, streamflow is commonly the preferred source of water, as it is readily available and delivered cost-free to users. Yet, the sources of these critical streamflows are often unknown. This issue is salient in the Northern Andes, where basic knowledge of the controls on the quantity, quality, and timing of runoff is lacking. High-elevation headwaters have been considered primary catchment areas in the Northern Andes, but the extent of water providing to municipalities in the Northern Andes is unknown. In this study, we quantify the contribution of water derived from the upper watershed to the streamflow in the Tulúa River which supplies water to 200,000 people in the city of Tulúa. The river runs 72 km along urban, agricultural, and industrial communities on the Central Cordillera of the Colombian Andes. We collected 32 and 34 water samples in August and November, respectively. The water samples were representative of high-elevation headwaters runoff and shallow groundwater discharge throughout the watershed. We analyzed samples for dissolved constituents and stable isotopes and used mass-balance mixing models to identify the source of streamflow in the lower watershed of the Tuluá River, where it supports a large municipality. Results indicate that surface runoff largely originates in extreme upper headwater settings, where parámos dominate the land cover. These findings underscore the need for source-water protection efforts in the upper watershed, including the páramos. This project serves as a model for other páramo derived watersheds, where source-water protection is a critical challenge.

Ludgate, Nargiza

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Authors: **Nargiza Ludgate**, University of Florida

Session Title: Poster Session - Human Water Needs/Use

Gender roles in household water resource management in water-scarce countries: Does greywater treatment technology empower rural women in Jordan

Hashemite Kingdom of Jordan is one of the driest countries in the world that struggles to cope with the limited freshwater resources to meet the growing demand from the economy and the domestic sector. To cope with water shortage, Jordan is considering all possible alternatives of water supply and demand management including the reuse of treated greywater in the households. A number of international organizations, including the International Center for Agricultural Research in the Dry Areas and International Fund for Agricultural Development, in collaboration with Jordan's National Center for Agricultural Research and Extension, have implemented the community-based interventions that tested 27 and installed more than 400 constructed wetland systems to treat greywater within household compound in eight governorates in Jordan. This research fills the gap of examining how the introduction of greywater technology impacts the bargaining power and gender relations within the households and whether women's economic power, defined as access to and control over productive resources, income and assets, is impacted. This research evaluated the impact of greywater treatment technology on intra-household water demand management and resource allocation, and by looking at changes in the bargaining power between men and women in the household, using sex-disaggregated data. The fieldwork compared data between technology users and non-users, males and females, and assessed the impact of greywater reuse on men and women's roles in relation to resource management and allocation for home garden production, and whether benefits received from greywater treatment technology adoption and use lead to greater women's bargaining power within the household This research contributes to the understanding of how interventions promoting water saving technologies affects intra-household bargaining dynamics in Jordan.

Lusk, Mary

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Authors: **Mary Lusk**, UF/IFAS
Andrea Albertin, UF/IFAS

Session Title: Challenges & Opportunities for Spring System Restoration 4

Onsite Wastewater Treatment and Disposal Systems in Florida's Springsheds: Managing the Interrelations between Spring Water Quality and Physical Infrastructure Needs

The 2016 Florida Water Bill established the Florida Springs and Aquifer Protection Act, which designated a new class of protected waters in the state: the Outstanding Florida Springs (OFS). The Outstanding Florida Springs are the state's first-magnitude springs, or those with discharge of at least 100 cubic feet per second (cfs), as well as 6 second-magnitude springs. An important part of the Florida Springs and Aquifer Protection Act is a set of provisions for addressing potential nitrate pollution from onsite wastewater treatment and disposal systems (OSTDS), commonly called septic systems. As long as these systems are properly sited and maintained, they offer public health benefits, including reduced risk of human exposure to wastewater pathogens. However, conventional OSTDS systems are not designed to meet the nutrient removal capacities often needed to protect vulnerable waterbodies such as springs. This presentation discusses a case study from Florida, USA, where new legislative action is requiring the remediation, and sometimes the removal, of select OSTDS's in the state's springsheds. The presentation will provide (1) an overview of how OSTDS's work and the pollutants they treat, (2) the current state of the science on the fate and OSTDS contaminants, (3) data and a case study from Florida on nitrogen and pathogen levels attributable to OSTDS's in various waterbodies, and (4) a discussion of possible educational and technological solutions needed to address the inherently linked environmental and human health ramifications of aging, improperly sited, and poorly maintained OSTDS's in Florida springsheds.

Mattson, Robert

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Authors: **Robert Mattson**, St. Johns River Water Management District
Dianne Hall, St. Johns River Water Management District
Mary Szafraniec, Amec Foster Wheeler
Margaret Guyette, St. Johns River Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 3

Synoptic Survey of Algal Communities in 14 Florida Spring-Run Streams

Spring-run stream ecosystems in Florida have exhibited changes in plant community structure over the past 30-40 years, shifting from a submerged aquatic macrophyte-dominated community, to one dominated by benthic filamentous algal species. Drivers behind these shifts have been identified as elevated concentrations of nitrate (measured as nitrate-nitrite N or NOx), reduced spring flows (lower current velocities), changes in algal grazer populations, and changes in micronutrient concentration or availability. Evidence exists which supports all of these hypotheses. To supplement the CRISPS research conducted by UF, SJRWMD and Amec Foster Wheeler conducted a synoptic (short-term) biological survey in 14 spring-run streams in north and central Florida in 2015. Multivariate analysis of the algal data with the PRIMER software indicated that spring-run streams along the St. Johns River (SJR) had lower coverage of epiphytic algae compared to non-SJR streams in the Fall of 2015, but no differences were seen among all streams in Spring 2015. No significant differences in macroalgal cover were seen among all 14 streams in both seasons. Bio-Env analysis showed weak-to-moderate correlations between algal cover and current velocity, conductivity, turbidity, and macrophyte biomass. Epiphyte communities in SJR spring-run streams had a different species composition than non-SJR systems based on relative abundance of certain diatom, chlorophyte, and cyanobacteria species. In macroalgal communities, SJR systems were characterized by higher relative abundance of the xanthophyte Vaucheria and the cyanobacterium Microseira (formerly Lyngbya) wollei, while non-SJR systems had higher relative abundance of the chlorophyte Dichotomosiphon tuberosus. Bio-Env analysis indicated that multiple physical and chemical factors produced these differences, with conductivity being the one consistent factor. Analysis of quantitative epiphyte data (µg/m2 chlorophyll a and g dry weight/m2) will also be presented and results of this study will be compared to prior studies of Florida spring algal communities.

McCurley, Kathryn

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Authors: **Kathryn McCurley**, University of Florida
James Jawitz, University of Florida

Session Title: Forest Ecohydrology

Impacts of decreasing tropical forest cover on local hydrologic regimes

Land cover is a primary determinant of how rainfall is partitioned between runoff and evapotranspiration. Therefore, shifts in land cover type influence water availability. In this study, long-term water budgets were constructed for 23 tropical watersheds, which were selected based on data availability between 1960-2007. Annual evapotranspiration was computed for each basin using the Budyko framework with spatially-averaged gridded annual precipitation and potential evapotranspiration data as well as annual runoff time series. Land cover type data were aggregated as forest, agriculture, and grasslands and were also spatially averaged at annual timesteps. The Budyko catchment parameter, which integrates the effects of vegetative features on the landscape, was linked to dominant land cover type. Furthermore, observed changes in runoff and evapotranspiration over time were decomposed for attribution as human- or climate-induced. Human-induced changes were found to be significantly correlated with land cover changes. Ultimately, long-term changes in evapotranspiration further impact local water availability through precipitation recycling. Deforestation was found to be correlated to increases in mean annual runoff as well as with corresponding decreases in evapotranspiration. The decrease in evapotranspiration was computed to yield a decrease in rainfall that is contingent on spatially- and scale-dependent precipitation recycling rates. These findings fundamentally provide a basis for how human-induced land cover change influences water availability at the watershed and larger regional scale.

McLamore, Eric

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Authors: **Eric McLamore**, Department of Agricultural and Biological Engineering, University of Florida
Victoria Morgan, Agricultural & Biological Engineering, University of Florida
Diana Vanegas, Food Engineering Department, Universidad del Valle, Colombia
Irene Velez-Torres, School of Environmental and Natural Resource Engineering, Universidad del Valle, Colombia

Session Title: Use of technology to shape our water future

Mobile phone-based nanosensor diagnostics for planetary health

Planetary health deals with the inseparable connection between human health and the health of environmental and agricultural systems. The Lancet commission on planetary health recently called for improved integration of interdisciplinary knowledge and new technologies for improving systems governance related to environmental and agricultural systems. A wide range of mobile health tools have been developed for point of need medical applications over the last few decades, and new technologies are currently being developed for agroenvironmental applications. However, the portfolio of sensors available for field monitoring in agricultural and environmental applications are limited. This limited success has been due to the use of: i) highly specialized chip/biochip devices that cannot withstand challenging field conditions, ii) cost prohibitive sensing schemes for large scale monitoring campaigns, iii) protocols that require extensive user training, and/or iv) excessive power consumption for large datasets. To extend the portfolio of planetary health technologies, our lab is developing a suite of handheld (mobile phone-based) nanosensors for measuring small molecules, viruses, and bacteria in water samples. The low cost nanosensors can be fabricated on site with commercially available equipment, require no exogenous reagents, are self-powered or use 9V batteries, and data is downloaded to cloud based decision support systems for ad hoc analysis by machine learning algorithms. Specific case studies of electrochemical and plasmonic nanosensors will be discussed for measuring mercury or pathogenic bacteria in drinking water. Our strategy is to use a combination of low cost, rapid sensors for supporting regional monitoring campaigns. We are currently developing apps and machine learning algorithms to support rapid post hoc data analysis. The sensors and data analytics are incorporated into a participatory monitoring program in post-conflict Colombia for monitoring drinking and contact water quality in rural impoverished communities.

Medina, Miles

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Authors: **Miles Medina**, Department of Agricultural and Biological Engineering, University of Florida
Ray Huffaker, UF ABE
James Jawitz, UF SWS

Session Title: Poster Session - Wetlands

Diagnosing drivers of environmental noncompliance in constructed treatment wetlands: A nonlinear dynamics approach

Treatment wetlands remove contaminants from surface runoff to sustain or improve downstream water uses. In southern Florida USA, the Everglades Stormwater Treatment Areas (STAs) remove phosphorus from agricultural drainage before it is discharged to the ecologically degraded Everglades Protection Area. However, total phosphorus concentrations in STA outflows (cOUT) consistently exceed the regulatory limit (10 ppb), and the drivers of this noncompliance are not clearly understood. Moreover, the current management model (DMSTA), and alternative models proposed in the literature, do not skillfully simulate cOUT dynamics to support effective intervention: The conventional paradigm, which relies on theory-based linear approximations, fails to adequately explain complex treatment behavior. Using nonlinear time series methods, we empirically diagnose the dynamical structure underlying observed cOUT volatility and identify drivers amenable to management intervention. Results indicate that cOUT volatility at STA-3/4 is predominantly systematic due to low-dimensional nonlinear deterministic dynamics. Further, we identify the wetland stage at the STA-3/4 inlet as a strong driver of noncompliance (stronger than the TP concentration at the inlet), suggesting that management of the hydraulic loading rate should be prioritized. Finally, based on these insights we successfully develop an ensemble of parsimonious nonlinear deterministic models that skillfully reproduce long-term dynamics at STA-3/4.

Meeder, John

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Authors: **John Meeder**, Florida International University
Mike Ross, Department of Earth and Environment and Southeast Environmental Research Center
Randall Parkinson, Institute of Water and Environment
Santiago Castaneda, Florida Internation University

Session Title: Coastal Ecosystems

Enhancing coastal wetland resilience to sea level rise; just add water?

Geological data indicate that for more than three millennia, southeast Florida hosted extensive fresh water wetland habitat, extending to within 50 m of the shore of Biscayne Bay. In marked contrast, over the last 70+ years, the region has been subject to salt water intrusion and mangrove encroachment triggered by acceleration in the rate of sea level rise. A 1994 study to determine if increasing fresh water delivery would reverse or minimize salt water encroachment determined that water levels in the delivery canal were too low to deliver sufficient water to the wetland. The Army Corps of Engineers and the South Florida Water management District initiated measures to increase delivery canal head and placed breaches in a coastal levee to increase water delivery. Results of an ongoing study based on profiles of mollusk composition in sediments of the Biscayne Bay Coastal Wetlands indicated that even at increased levels of fresh water delivery, present rates of sea level rise prevent mitigation of salt water encroachment, which has actually increased in some treated areas. Under the existing rate of sea level rise, our data indicate that the open waters of Biscayne Bay will extend as far as the coastal levees within 50 to 100 yr. Increasing freshwater delivery will not reverse this trend, but is likely accelerate wetland inundation.

Middleton, Beth

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Authors: **Beth Middleton**, US Geological Survey

Session Title: Coastal Ecosystems

Wind and salt: coastal wetland resilience to hurricanes

After hurricanes, coastal wetlands affected by saltwater surge, flooding and wind may have different recovery trajectories. For example, four North American hurricanes have differed in their effects on tidal Taxodium distichum swamps. In 2017, Hurricane Harvey flooded Big Thicket National Preserve (Texas) with copious amounts of freshwater while Hurricane Irma subjected St. Marks National Wildlife Refuge (Florida) to wind damage. Earlier storms such as Hurricanes Katrina and Sandy had different storm signatures because of high winds and salinity intrusion, respectively. One set of vegetation structure studies compared salt water, freshwater flooding and wind-driven impacts of these hurricanes along coastal wetland gradients along the Gulf and Atlantic Coasts. In these studies, T. distichum was resilient to wind and prolonged freshwater inundation, but not to salinity. Seed bank studies of various vegetation and gradient types examined the responses of multiple species to various water regimes (unflooded but saturated vs. flooded to 8 cm) and salinity levels (0, 1, and 5 ppt). In these seedbank studies, simulated conditions of post-hurricane flooding and salinity mostly suppressed regeneration of these coastal wetland species, even at low salinity levels (1 and 5 ppt). Overall, these studies indicate that hurricanes differ in their ability to drive long term changes in coastal wetland vegetation depending on the levels of structural damage and subsequent regeneration. The resulting recovery trajectories of wetland species composition will depend on the individualistic responses of species to post-hurricane environments and the frequency and intensity of these disturbances.

Migliaccio, Kati

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Authors: **Kati Migliaccio**, Department of Agricultural and Biological Engineering, University of Florida
Kelly Morgan, University of Florida
George Vellidis, University of Georga
Clyde Fraisse, University of Florida
Michael Dukes, University of Florida

Session Title: Use of technology to shape our water future

Using smartphone apps to make water management decisions

Technology provides a means to place science-based decision making into the hands of those making water decisions in an easy, functional way. One approach is to connect information to users through their smart devices – tablets or phones. Smartirrigation apps were previously developed by the UF/IFAS and UGA to link irrigators to data for making water management decisions (smartirrigationapps.org). These tools show the ability to incorporate data and simple models to provide irrigators with current information. While first version apps provided information using weather stations and recorded data, future apps will likely use gridded weather products and forecast data. The availability and access to large spatial databases provides this increased ability. Examples include FRET, PRISM, and RTMA data. In addition, knowledge and technical capabilities exist to further expand these tools to include fertilizer management, pest management, and record keeping. Apps can be further improved by integrating simple additional tools to help users provide more accurate input for driving the model used. Collaborative research and extension efforts with social scientist will help with developing more user friendly app products and will help target additional features to increase their viability.

Miller, Raymond

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Authors: **Raymond Miller**, Dewberry
Amar Nayegandhi, Dewberry
Al Karlin, Southwest Florida Water Management District

Session Title: Challenges & Opportunities for Spring System Restoration 4

Topobathy Lidar Mapping in Kings Bay

Kings Bay located in Crystal River, Florida is the second largest springs group in Florida, with more than 70 springs scattered within the 600-acre bay. It is the largest winter refuge for manatees on the Florida Gulf Coast and is a National Wildlife Refuge. Since the 1960s, extensive dredge-and-fill projects along with the construction of sea walls and canals have altered the bathymetry and shoreline of Kings Bay. These activities have also reduced the number of natural wetlands and impacted water quality. To mitigate these impacts, the Southwest Florida Water Management District has designated Kings Bay as a priority water body in its Surface Water Improvement and Management (SWIM) program and is performing a series of projects to restore the bay. To support these efforts, the District intends to develop a high resolution Digital Elevation Model to help District scientists and engineers better understand the topography and bathymetry of Kings Bay.

As part of a pilot study, the District received topographic/bathymetric lidar data acquired by the Joint Airborne Lidar Bathymetric Technical Center of Expertise (JABLTCX) using the Coastal Zone Mapping and Imaging Lidar (CZMIL). These data were acquired to evaluate this technology's effectiveness for mapping the bathymetry of Kings Bay. The District partnered with Dewberry to process the lidar data and produce a high-resolution Digital Elevation Model (DEM) for this pilot study.

This presentation will provide an overview of topographic/bathymetric lidar data, the application of this technology to springs mapping, challenges encountered, along with the results of the Kings Bay pilot study.

Milligan, Lara

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Authors: **Lara Milligan**, UF/IFAS Extension Pinellas County
Abbey Tyrna, UF/IFAS Extension Sarasota County

Session Title: Sharing Information: Effective Communication Strategies

The Florida Waters Stewardship Program: A New Extension Program Driving Social Change

I am applying for an Extension Scholarship.

People play a significant role in water resource management. People demand water, supply water, and impact water every day. Yet, all too often people also take the quality and quantity of water that they come in contact with for granted. Frequently it takes a water quality disaster, such as a destructive algae bloom, to increase awareness among Floridians. A multi-session Extension program focused on water resources was created to raise awareness and increase the public's sense of responsibility. Through the Florida Waters Stewardship Program (FWSP), cohorts of the concerned public become drivers of change, impacting water resources through local actions. The FWSP was modeled after other "Master" Extension programs and piloted in 2016. Results from the two-county pilot programs showed significant gains in knowledge and measurable benefits to the community. Pre-post surveys, written reflections, 6-month follow-up surveys, and unstructured participant interviews were used to gauge potential changes in knowledge and behavior. Results from pre-post surveys (n=32) showed average knowledge of all participants increased in the thirteen water topics evaluated. Written reflections recorded during the last session point to the network of like-minded people as one of the most influential aspects of the programs (69%, n=19). Follow-up surveys from one pilot showed 67% (n=12) of participants are being more conscious consumers, using less water and reducing plastic consumption. Some success stories that came from the unstructured interviews included program graduates taking on leading roles within the community to author and distribute a children's book on the water cycle, write and co-host a local environmental radio show, and write and perform rap songs about Florida waters. Results show FWSP successfully trained and educated interested Floridians to become stewards of their local water resources through expert presentations, field tours, at-home online explorations, and hands-on activities including class stewardship projects.

Mills, Brenda

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Authors: **Brenda Mills**, South Florida Water Management District

Session Title: Engaging Stakeholders in Developing Solutions to Water Issues

Solutions Found Together: Getting Water Off Farms and into Nature

South Miami-Dade County has been transformed over the years by people, roads and canals effectively cordoning it from the Everglades. Except that continuing to operate canals just like yesterday is no longer enough. Torrential rains on farms during the 2013 Thanksgiving holiday weekend followed by a localized drought depriving Taylor Slough and Florida Bay of freshwater set in motion the need to make changes.

The South Florida Water Management District's Governing Board directed staff to organize public workshops and work with stakeholders to identify solutions to these two separate yet connected problems. Agriculture and environmental stakeholders had voiced their concerns and their ideal solutions and were primed for action. But these two issues, and their respective representatives, had historically never identified mutually agreeable solutions.

The problems to be solved, the stakeholders, and the range of options considered had not changed. Everything and everyone was extremely familiar. The key difference for the South Dade Study was soliciting stakeholders to leave past assumptions behind and openly consider how known solutions could work under today's conditions. Limiting the duration of the study to six months ensured stakeholders that a long, time consuming process would be avoided and the investment of theiir time would be worth it. By focusing on a narrow scope, moving water away farms and towards Taylor Slough, it was possible to educate and inform people. By creating an open, respective exchange of information the solution could be found and implemented. Today, eight of the ten solutions identified have been implemented and planning initiated on the ninth.

Minogue, Patrick

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Authors: **Richard Cristan**, University of Florida
Patrick Minogue, University of Florida
Anna Osiecka, University of Florida

Session Title: Forest Ecohydrology

Effect of harvesting pine straw on ammonia volatilization following polymer-coated and non-coated urea fertilizer applications on a North Florida slash pine plantation

Slash pine plantations that utilize pine straw are often raked annually between stand ages of 10 to 22 years. Annual pine straw raking can have a negative effect on pine nutrient availability. To offset nutrient removals, nitrogen fertilization is a common management practice. Typically urea fertilizer is used due to its high nitrogen concentration and lower price; however, it is subject to ammonia volatile losses. Polymer- and sulfur-coated urea products have been developed to mitigate this issue. This study examined the effect of pine straw raking on ammonia volatilization following fertilization using controlled release polymer coated urea (PCU) and non-coated conventional urea (NCU) in slash pine plantations. The study utilized 30 half-acre plots to test five fertilizer treatments with and without pine straw raking. Fertilizer treatments consisted of three PCU treatments (25, 50, and 125 lb elemental N/ac), NCU treatment (50 lb N/ac), and an untreated control. Each treatment was applied to three raked and non-raked plots. Ammonia volatilization was assessed weekly for 12 weeks using two methods: open chamber (6 gallon bucket) and semi-open chamber (2 liter bottle). Preliminary results indicated that ammonia volatilization was higher for non-raked plots when compared to raked plots for weeks 1-4 for all PCU treatments. For the same weeks, the NCU treatment resulted in higher volatilization for non-raked plots in weeks 1-2 and higher volatilization for raked plots in weeks 3-4. Overall volatile losses were greatest for PCU 125 followed by the NCU, PCU 50, PCU 25, and control.

Mohd Jani, Siti Jariani

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Authors: **Siti Jariani Mohd Jani**, University of Florida

Session Title: Poster Session - Water Quality - Water Management

Rainy Season Nitrogen Transport in Urban Residential Stormwater Runoff

Nitrogen (N) input from residential stormwater runoff causes nutrient enrichment in coastal water which leads to eutrophication. Our objectives were to measure N composition in runoff for residential catchments and compare the composition to different storm event patterns and investigate the processes that might influence N forms composition thus alter the nitrogen (N) cycle in urban waters. Runoff water samples (n=220) were collected during wet season (May to September 2016) from an inlet of stormwater wet pond that has been installed with autosampler. Samples were analysed for various N forms [ammonium (NH3–N), nitrate (NO3–N), dissolved organic nitrogen (DON), and particulate organic nitrogen (PON)]. A total of 22 storm events were captured during the wet season. Total rainfall recorded in 22 events were 37 cm or 38% of total rainfall throughout the study period (91 cm). Duration of rainfall for all collected stormwater events were ranged 10 min to 597 min with rainfall intensity ranged at 0.152 cm/hr to 4.686 cm/hr. Flow weighted mean concentrations of total N (TN) for all collected storm event was 1.2±0.6 mg/L. Total flow of stormwater runoff throughout the 22 storm events was 6.82 million L (32%) of total flow over wet season (21.47 million L) and carried 15.1 kg of TN with DON as the dominant form (47%). Total N was positively correlated with DON throughout the season (R^2=0.62, $p<0.05$) suggesting than TN amounts in the runoff are strongly influence by DON. Runoff volume was positively correlated with rainfall volume (R^2=0.97, $p<0.05$) throughout the 22 storm events. This urban stormwater generated about 1 to 69% of runoff in the watershed. Our results also showed that different storm characteristics will results in different patterns in N composition in the runoff. Finding from this study helps to identify the event that might contribute to high N loadings and provide an information for better stormwater management designs and practices in urban watersheds.

Mora, Nesmar

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Authors: **Nesmar Mora**, Royal Consulting Services, Inc.

Session Title: Poster Session - Coastal Waters

Green Remediation Alternative

Due to an increasing world demand to create a sustainable environment, Operative Recovery Solutions has been developing an innovative, environmentally-friendly solution for recovering oil from spills. Not only does this ground-breaking technology, named ORS-SORB®, remove the oil from contaminated water, but the oil is recovered and can be reused and the by-product can be used as fertilizer. ORS-SORB® comes in the form of a powder, solid block, pillow, special collectors, and barrier containers. It works via capillary action, collecting liquids less dense than water, such as: oils, gasolines, solvents, organic acids, others). Applied to the surface of the water, ORS-SORB® absorbs the target liquid until it is fully saturated. ORS-SORB® is then simply removed, skimmed, or filtered from the water source. The absorption capacity of the product is 1 liter of product (56 g) can absorb 0.9 liters of spilled liquid. ORS-SORB® is completely recyclable and suitable for all oils and liquids. The production process for this product does not produce any hazardous waste and the recovered oil can be compressed from the absorbent (99%) for reuse. The remaining waste can be recycled after a simple bacterial treatment and can be used as an efficient fertilizer (26% nitrogen). Further, ORS-SORB® is biodegradable, non-toxic, non-flammable, and non-leaking. ORS-SORB® has been implemented, tested, and certified worldwide. ORS-SORB® was used in Ogoni, Nigeria by the Ministry of Environment to cleanup a site at Yorla Oil Field with excellent results. The ORS-SORB® is distributed in the US. By Florida Equipment And Restoration, Inc.

Morera, Maria

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Authors: **Maria Morera**, University of Florida
Paul Monaghan, University of Florida
Michael Dukes, University of Florida

Session Title: Who are they? Understanding Audiences to Design or Improve programs

Targeting audience segments for outdoor water conservation: A comparison of high and low irrigators in central and southwest Florida

Successful promotion of urban outdoor water conservation requires understanding key drivers of yard care practices among residential homeowners. This study compared landscaping and irrigation practices among high irrigators participating in a smart irrigation pilot project and low irrigators recognized for their Florida-Friendly Yards. The purpose of the research was to assess factors linked to their contrasting outdoor water usage. The study collected self-reported behavioral, attitudinal, and demographic data through mail and electronic surveys distributed in central and southwest Florida. Results indicated significant differences in water conservation attitudes, levels of familiarity with components of the landscape, membership in homeowner's associations, and household income between the two groups. Results suggest residential audience segments can be defined in terms of these factors to build on existing support for irrigation efficiency improvements and curtailment behaviors. The findings of the study provide a broader understanding of homeowner preferences and point to opportunities for strategic promotion of water-saving devices and practices.

Mossa, Joann

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Authors: **Joann Mossa**, Geography, University of Florida
Yin-Hsuen Chen, Univ. of Florida, Geography

Session Title: Wetland Ecosystems

Decreased Floodplain Inundation and Lateral Connectivity of the mid-Apalachicola River following Dredging-Related Channel Changes

Prior studies found that water levels for a given discharge have decreased by varying amounts along the Apalachicola River and its floodplain from the 1950s to 2004. The causes of lower water levels include dam-related degradation, widening due to dredging and snag removal, and channel adjustments caused by artificial cutoffs. These alterations were caused by river engineering for a Navigation Project during the 1950s through 2002. Furthermore, the river receives less flow from upstream than historically due to irrigation and other water demands. Combined, lower water levels from degradation and widening, and decreased flows has resulted in reduced lateral connectivity between sloughs and the main-stem river, less floodplain inundation, and drier forest composition.
This study models the connectivity of the river and slough system during different water levels in mid-Apalachicola floodplain between river mile 40 and 64, where lower water levels are primarily due to dredging and snag removal. Primary sonar data of sloughs collected during boat trips during high flows are coupled with secondary LiDAR, National Hydrological Dataset, stage and discharge data and analyzed in ArcGIS. We converted raw LiDAR data into a shapefile and built a TIN terrain model based on the LiDAR points and then exported it into high-resolution 1.5 by 1.5 meter grid DEM. LiDAR data were collected at a discharge of ~ 10,000 cfs, thus sonar measures channel and floodplain features below that level. Floodplain inundation was examined for different water levels, including past water levels prior to impact interpreted from Light et al. (2006). Findings give management insight regarding river-floodplain interactions to better assess nutrient exchange, potential fisheries movements and botanical changes associated with drying of the floodplain.

Oliveira Fiorini, Ana Carolina

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Authors: **Ana Carolina Fiorini**, University of Florida

Session Title: Forest Ecohydrology

Participation in a Payment for Environment Service: "Produtores de Água e Floresta" case study

Payments to conserve or recover functionality of green infrastructure in watersheds have been increasing globally. Private landowners have been the main target of this type of payment, they earned at least $ 9.8B in 2015 (Forest Trend 2016). "Produtores de Agua e Floresta" (PAF) is a payment for water services (PWS) in one of the most beleaguered ecosystems in the world, the Atlantic Forests of Brazil. The program aims to restore and maintain riparian forest to reduce soil erosion and sustain water availability. The incentive approach adopts a "provider receiver" principle, i.e., land-owners provide environment services and therefore should be compensated. Nevertheless, like many payments for ecosystems services in the world, PAF pays to increase compliance levels of a law that demands protection of riparian forests. The success of a voluntary program partially depends of characteristics of people and properties that enroll in the program. Because participating properties were not randomly selected, their characteristics can also affect the outcome of the intervention. To investigate the self-selection bias of PAF participants, we interviewed participants and non-participants of PAF and gathered information about their land. We unraveled landowners' motivations to enroll or not in the program, and gained insight into factors that shape compliance of environmental regulations. Most landowners stated that the protection and restoration of forest are important for water quantity, and that environment regulations are crucial to maintain minimum provision of services. Interestingly, the mix of incentives and command-and-control policies was commonly both a reason to enroll and not to enroll in PAF. Participants tended to be elderly with high levels of off-farm income. Yet, the poorest participants had higher dependence levels on farming activities, what potentially has implications for equity outcomes. We give suggestions for PWS policy design, and the forth coming scale up of the program.

Olsen, Eric

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Authors: **Eric Olsen**, Hopping Green & Sams

Session Title: Water Policy, Planning and Management

Water Supply Planning - Road map to Florida's water supply and growth future

This presentation will focus on the regional water supply planning undertaken by the water management districts and the links those plans have to water resource constraints such as minimum flows and levels and water reservations as well as the connections to the water supply concurrency requirements of local government comprehensive plans. The presentation will demonstrate how these various water supply planning connections serve to create a road map of Florida's water supply future. The presentation will describe enhancements to the regional water supply planning process created by springs protection legislation enacted in 2016. Finally, the presentation will outline how regional water supply plans provide a foundation for multiple entities to come together to jointly work on developing sustainable alternative water supplies.

Onofre, Thiago

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Authors: **Clyde W. Fraisse**, University of Florida
Thiago B. Onofre, University of Florida

Session Title: Use of technology to shape our water future

AgroClimate Wireless Sensor Networks to Improve Resource Use Efficiency in Agriculture

Climate variability and change creates risks to all sectors of the economy, including the food and fiber enterprises in the Southeast USA. Climate is already a prime factor in 9 out of 10 disasters, many of which cost billions of dollars and thousands of lives. The potentially increased production and environmental risks from a changing climate are expected to make the challenge of providing sufficient food for a global population that is expected to top 9.5 billion by 2050 even more difficult. Increases in human populations and demand for food, energy, and water combined with an uncertain future climate that is very likely to have higher temperatures and increased frequencies of extreme events are certain to lead to increased food shortages unless cropping systems become more resilient to those changes. Facing these challenges requires developing smart technologies to monitor, predict, and analyze environmental conditions while providing growers with readily available tools to help them make more informed decisions. The AgroClimate group at the University of Florida has been improving its ability to monitor and analyze site-specific weather variables by developing smart wireless sensor networks (WSNs). Advances in sensor and wireless network technologies and their convergence to the Internet offer significant opportunities for the development and application of smart sensor networks to enhance the monitoring of environmental conditions affecting water and other inputs user efficiency. Recent developed WSNs to monitor rainfall, air temperature, relative humidity, and leaf wetness spatial and temporal variability are presented and discussed.

Orozco-Lopez, Enrique

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Authors: **Enrique Orozco-Lopez**, University of Florida
Rafael Muñoz-Carpena, Professor
Bin Gao, Professor
Garey Fox, Proffessor

Session Title: Poster Session - Stream/River Dynamics

Concepts, Theories and Models of Macropore Flow Through Riparian Vadose Zone.

The design of water pollution control practices such as vegetative filter strips and riparian buffers typically focuses on surface runoff with subsurface flow and transport usually assumed to be negligible. Field evidence suggests a prevalence of preferential flow in riparian areas due to increase biological activities (roots, worms, etc.) and large hydraulic gradients from adjacent streams. Since subsurface transport of contaminants can be significant with preferential flow, the prevalence of macropores in riparian buffers can negate the intended benefits of this widely-adopted control practice. To limit degradation of aquatic ecosystem services, we review different approaches to simulate macropore flow and transport through the riparian vadose zone. In addition, and due to the especial characteristics of these areas, we also account for the influence that a seasonal shallow water table will have on the subsurface and overland flow and transport processes. The objective of this work is to identify those theories describing macropore flow that may be applied in the riparian buffer scales. Critical need is to characterize the morphology of macropore networks in the field. Yet, we find that this relationship between micro-, meso-, and macro-scale is still deficient and must be further explored. It is anticipated that the holistic knowledge of hydrodynamics through riparian vadose zone can benefit from this work. This understanding provides foundational knowledge towards the improvement of prediction of riparian buffers performance.

Osborne, Todd

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Session Title: Challenges & Opportunities for Spring System Restoration 2

Relationships between submerged aquatic vegetation, increased nitrate, and the proliferation of algae in Florida springs: lessons learned from mesocosm experiments

Special Session/Reddy. Mesocosm studies utilizing Vallisneria americana and Sagittaria kurziana were conducted at the Whitney Laboratory for Marine Bioscience to determine relationships between submerged aquatic vegetation (SAV) and nitrate concentration, and top down / bottom up control of algal proliferation. Mesocosms allowed investigation of Silver Springs water and SAV with variable concentrations of nitrate, current velocities, and oxygen availability. While no negative effects of direct nitrate toxicity were observed, increased algal proliferation was noted in all increased nitrate treatments suggesting a direct link between algal growth and nitrate availability. Exposure of synthetic SAV blades to a range of current velocities resulted in reduced algal colonization and biomass accumulation at velocities greater than 25 cm s-1. This finding supports previous field observations of current velocity and associated shear stresses exerting bottom up control on algal biomass production in springs. No negative effect of hypoxia on growth of SAV was observed in mesocosm experiments, however, grazers such as gastropods and decapods were determined to be adversely affected by low oxygen availability. Results of mesocosm experiments suggest that while SAV is not directly affected by increased nitrate availability, algae were found to respond positively to increased nitrate concentration. Further, reduced flow and oxygen, trends currently observed in springs around the state, can both influence the proliferation of algae in spring systems.

Osiecka, Anna

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Session Title: Poster Session - Agricultural/Silvicultural Water

Effects of fertilization and pine straw removal from slash pine plantations on the concentration of ammonium and nitrate-nitrite nitrogen in soil solution

Pine straw producers tend to apply luxury consumption fertilization rates to increase yield, creating a risk of groundwater and surface water contamination. Controlled-release fertilizers reduce leaching risks, but have not been used in forestry due to high cost. The purpose of our study was to investigate the effects of applying controlled-release polymer-coated urea (ESN) compared to conventional urea in raked and non-raked slash pine plantations on the ammonium (NH4-N) and nitrate-nitrite (NOx-N) nitrogen concentration in the soil solution. Five June fertilization treatments (ESN at 0, 28, 56, or 140 kg N ha-1, urea at 56 kg N ha-1) and two February raking treatments (raked and non-raked) were tested in a randomized complete block design with three replications. These fertilization rates were applied annually in 2014, 2015, and 2016 and annual pine straw harvests were done in 2014-2017. Soil solution was collected by suction lysimeters at 30-cm depth for one year following each fertilization. All fertilization treatments increased NH4-N and NOx-N concentrations in soil solution compared to the non-fertilized control and to pre-fertilization levels. The period of elevated NH4-N concentrations occurred between one and four weeks after the second and third fertilization, and the period of elevated NOx-N concentrations from one to 13 or 26 weeks after each fertilization, with peaks at four or eight weeks. Secondary minor NOx-N concentration spikes were recorded almost a year after the first and second fertilization. NH4-N and NOx-N concentrations increased with increasing N application rate. Conventional urea resulted in greater NH4-N concentration increase than ESN applied at the same N rate, especially in the non-raked plots. Effects of pine straw harvesting were not consistent, but generally NH4-N concentrations were higher in non-raked plots, while NOx-N concentrations were higher in non-raked plots after ESN application, but in raked plots after urea application.

Ouyang, Ying

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Session Title: Hydrologic Modeling and Water Management

A Pond and Irrigation Model (PIM) for Simultaneously Predicting Crop Irrigation Demand and Pond Water Availability: A Case Study in Mississippi

Groundwater withdrawals in the United States have increased dramatically since last century and a consequence of such withdrawals is the depletion of water resources from subsurface aquifers. It has been reported that groundwater level in Mississippi Delta has declined more than 7m since 1970 due to agricultural pumpage for crop irrigation. Although more on-farm water storage ponds have been constructed in recent years to mitigate groundwater depletion in Mississippi, there is currently a lack of a tool to simultaneously estimate crop irrigation demand and pond water availability. In this study, a Pond-Irrigation Model (PIM) was developed to meet this need using STELLA (Structural Thinking, Experiential Learning Laboratory with Animation) software. PIM simulates crop land and farm pond hydrological processes such as rainfall, surface runoff, soil drainage, and evapotranspiration as well as crop irrigation demand and pond water availability. More importantly, PIM is able to determine the optimal ratio of farm pond size to crop land area with sufficient pond water available for crop irrigation. As a case demonstration, the model was applied to concomitantly estimate row crops (i.e., corn, cotton, and soybeans) water irrigation demand and pond water availability in a farm located at East-central Mississippi. The ratio of farm pond size to crop land area used in this study was 1: 18 (i.e., a one-ha pond with an average depth of 2m to irrigate 18 ha crop land). Simulations showed that corn used more soil water for growth than soybeans, whereas soybeans needed more irrigation water than corn and occurred because of less rainwater available during the soybeans growth season. Simulations further revealed that over a 10-year simulation period from 2005 to 2014, there was one time for corn, zero time for cotton, and two times for soybeans when there was insufficient pond water available for irrigation. The PIM developed in this study is a useful tool for estimating crop irrigation demand and pond water availability simultaneously.

Papacek, Joshua

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Session Title: Estuarine Ecology and Water Quality

Bottom-up Controls of Recent Harmful Algal Blooms in the northern Indian River Lagoon, FL

Ecosystem-disruptive harmful algal blooms (HABs) are becoming increasingly more common in many estuaries. Multiple physical and chemical factors are known to contribute to HABs by increasing phytoplankton growth from the base of the ecosystem. We investigated the major 'bottom-up' factors including temperature, salinity, and available nutrients (nitrogen-N and phosphorus-P) in light of recent algal bloom events (since 2011) in the northern Indian River Lagoon (IRL). Of these factors, temperature and salinity have been implicated in other estuaries, but do not show a direct, conclusive correlation with recent HABs in the IRL. In contrast, long-term water quality monitoring data shows a disproportionate increase in total and dissolved P in the water-column since 2010. We hypothesized that increased available P levels, and in turn lower N:P ratios, explain elevated abundance of picocyanobacteria in the IRL and the significant N2 fixation rates measured prior to recent bloom events. Additionally, uptake experiments suggest that internal recycling of ammonium and dissolved organic forms of N may select for certain species of nano- and pico-planktonic eukaryotic algae that have recently dominated IRL blooms. Secondary effects and feedbacks from these major HABs include declines in seagrass abundance and health, leading to higher internal nutrient loads from senescent biomass, and reduced nutrient uptake and storage by the seagrasses and their epiphytes. This shift in nutrient pools from benthic communities to the water-column likely enhances the turnover of available nutrients via the microbial loop, and could lead to a 'new' ecosystem state favoring widespread and sustained blooms of nano- and picoplanktonic algae.

Paudel, Rajendra

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Session Title: Challenges & Opportunities for Everglades System Restoration

Water Quality and Ecological Responses to Hydrologic Restoration Options in the Everglades

The Everglades is a complex, highly managed ecosystem, and its natural hydrologic properties, water quality, soils, and flora and fauna have been altered by the Central & Southern Florida Project, decades of nutrient pollution, as well as invasive species, and climate change. Water storage capacity has also been diminished due to drainage and landscape modifications. Currently, the southern Everglades is deprived of freshwater during dry years and the Northern Estuaries receive excess regulatory discharges during wet years. A significant change in habitats including the degradation of ridge and slough pattern and loss of tree islands has been documented due to combined effects of altered hydrologic patterns, loss of sheetflow and diminished storage. Evaluating system-wide benefits of restoration scenarios is essential to understand tradeoffs in hydrological and ecological performance. We developed six restoration alternatives that represent variations in reservoir size, decompartmentalization, seepage control, and Lake Okeechobee regulation schedules. We used the South Florida Water Management Model (SFWMM), which has been used as a restoration planning tool for more than 25 years. Hydrologic output is then used to evaluate system-wide water quality changes and infrastructure needs, and ecological condition with a suite of tools specific to different components of the system (e.g., wading birds). Our results suggest that increased storage and hydrologic restoration generally improves ecological functionality in the Everglades landscape, although restoration did not produce benefits across all areas the Everglades landscape. There are clear trade-offs among different basins and regions. Most scenarios increase freshwater flows into Everglades National Park, particularly in dry periods, which is important to improve habitat condition. Increased decompartmentalization is essential to restoring the frequency and timing of water depth in some areas as well. These findings are relevant to Everglades restoration especially in light of recent and emerging science on storage feasibility and climate change.

Pazmiño-Hernandez, Marco

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Authors: **Marco Pazmiño-Hernandez**, Department of Agricultural and Biological Engineering, University of Florida
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Session Title: Poster Session - Wetlands

Design and evaluation of a link-node hydrological model to study the spatiotemporal impacts of an interbasin water transfer in the Tempisque-Bebedero watershed, Costa Rica

The rapid development in one of the most important watersheds in Central America has caused unintended and cascading consequences for the environment and ecosystem in the region. Located in the province of Guanacaste in the Northwest region of Costa Rica, the Tempisque-Bebedero watershed has faced severe ecological degradation during the past four decades due to water transfer for hydropower generation and irrigation infrastructure systems. The basin outlet forms Palo Verde's coastal wetland, part of the Palo Verde National Park, which is a critical protected area for North American migratory birds and has been identified under the Ramsar Convention as a wetland of international importance, especially as waterfowl habitat. A spatially explicit link-node hydrological model is developed and tested to study the spatial temporal dynamics and decouple the human and natural system interactions in the Tempisque-Bebedero watershed.
The model integrates and evaluates rainfall-runoff processes from gridded locations into daily summaries of water movement at 57 nodes, each with a temporally detailed set of hydrological processes, from the upper sections of the watershed to the Palo Verde National Park at the outlet. The findings serve to produce spatial maps series with detailed, 5-minute hydrograph time series (extent, depth and duration of flooding) used to understand the role of water and its different sources, the impact of human disturbances, and inform management alternatives.

Phelps, Sara

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Session Title: Water Quality Issues

A closer look at nutrient source identification: accelerated dissolution of geologic phosphate deposition in humic lakes

Since the establishment of the CWA, managers have sought to reduce pollutant loads to impaired lakes to reach TMDLs. However, NPS pollution continues to challenge pollutant management. One potential source of NPS pollution is erosion and sediment transport from urban areas with large amounts of concentrated runoff. While erosion and sediment transport is not typically a major NPS pollutant for nutrients, Florida's geology indicates a closer look. The USGS suggests that geological units with notable amounts of phosphate can be found at or near land surface across 19% of Florida. This estimate does not account for further exposure by erosion, channelization, and earth moving activities. Therefore, erosion and sediment transport in this geologic setting may be a significant source of phosphorus loading to drainage lakes. Furthermore, changes in the intensity of storm events are likely to further exacerbate this issue. In this study, we examined the factors that dictate geologic phosphate dissolution in humic lakes. Geologic phosphate is often considered stable and relatively innocuous despite high TP concentrations. However, in humic drainage lakes, biogeochemical conditions may create an environment conducive to accelerated geologic phosphate dissolution, thereby increasing concentrations of biologically available phosphorus. Our findings from dissolution experiments in several humic lakes underlain by the phosphate-rich Hawthorn Group help to understand whether erosion and sediment transport of geologic phosphorus is meaningful to phosphorus loads in such lakes. These findings may indicate a new approach to phosphorus management, load estimates, and prioritization for humic drainage lakes found in this geologic setting.

Prince, Kimberly

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Session Title: Poster Session - Coastal Waters

Red drum ontogenetic shifts in prey network structure drives persistent organic pollutant accumulation.

Once widely used as a dielectric or coolant, polychlorinated biphenyls (PCBs) are now known as one of the most pervasive persistent organic pollutants to contaminate our aquatic environment, particularly in coastal regions where a majority of chemical plants were located. Although PCBs were banned domestically in 1979 and internationally in 2001, high PCB levels in top predators and adverse effects on reproduction are still observed today, emphasizing the need to identify the mechanisms by which PCBs continue to accumulate in coastal food webs. To advance knowledge and inform coastal management, we test how life stage, trophic position, and prey network structure of a high profile coastal predator, red drum (Sciaenops ocellatus) influences PCB accumulation. Preliminary results demonstrate a strong linear relationship between size and total PCB concentration, and variances in total concentration levels among males within the mature size class. Homolog and congener profiles differed among the ontogenetic classes as well. After analyzing stable isotope, gut content, and age (otolith) data, this study will reveal how red drum trophic level (δ15N), prey network structure, and relative PCB concentration shift as individuals mature, and whether or not the strongest trophic links are key pathways for PCB accumulation. Results will inform management strategies by identifying the life stage at which red drum accumulate PCBs the fastest, the prey species that are essential to PCB accumulation, and indicate population and ecosystem health of red drum that inhabit Altamaha fed estuaries along the Georgia coast.

Prouty, Christine

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Session Title: Water Policy, Planning and Management

Context-Sensitive Approaches to Water/Wastewater Management in a Coastal Environment: A Case Study from Southern Belize

This presentation describes the results of five seasons of NSF-funded social science research on the Placencia Peninsula in southern Belize designed to understand the complex relationships between water, wastewater, tourism, and infrastructure development. After a massive hurricane devastated Belize's south coast in 2001, the national government has supported various "sustainable tourism" projects to stimulate economic redevelopment throughout the country. As part of this effort, the government recently received funding from the Inter-American Development Bank to implement a centralized water and wastewater management system in the popular coastal tourist destination of Placencia Peninsula. At the same time, local communities have been collecting and managing their water and wastewater using various decentralized approaches including rainwater harvesting systems and on-site wastewater treatment technologies. Tensions have emerged among some stakeholder groups regarding the resilience of a centralized system in the face of increasing impacts from severe weather. Further adding to this friction is a loss of autonomy in decision making at the local and household level regarding community water and wastewater management. Our research brings together diverse perspectives and fields of expertise to determine the ways and extent to which coastal communities undergoing rapid tourism and related development may design, implement, and sustain new wastewater technologies that recover water, nutrients, and energy. This presentation provides a summary of our emerging results, focusing on the complex role that geography, history, and politics play in the negotiation of water and wastewater management systems in this region.

Qiu, Gary

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Authors: **Gary Qiu**, Department of Environmental Engineering Sciences

Session Title: Poster Session - Water Quality - Water Management

Reduction of Adverse Effects of Tritium in Water

As innovative human activities continue to grow, so does the introduction of man-made radioisotopes. These elements are common among various research and power supplies in reactor technology. They are also found as byproducts of common medical procedures. Though often times mislooked, the growth of these potential detriments will often proliferate tritium levels in both air and water. As a radioactive form of hydrogen, tritium is a naturally and anthropogenically occurring isotope that has adhesive properties to anything with hydrogen, especially common water sources. Tritium has no evidence of a threshold exposure damage, implying human health complications in even the smallest of doses. The purpose of this research is to establish and understand sources of the isotope and methods of prevention and neutralization.

Qiu, Jiangxiao

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Authors: **Jiangxiao Qiu**, University of Florida

Session Title: Hydrologic Modeling and Water Management

Nonlinear response of ecosystem services to groundwater availability under climate extremes

Depletion of groundwater has been accelerating at regional to global scales. Besides serving domestic, industrial and agricultural needs, in situ groundwater is also a key control on biological, physical and chemical processes across the critical zone, all of which underpin the supply of ecosystem services essential for humanity. While there is a rich history of research on groundwater effects on subsurface and surface processes, understanding interactions, nonlinearity and feedbacks between groundwater and ecosystem services remain limited, and almost absent in the ecosystem service literature. Moreover, how climate extremes may alter groundwater effects on services is underexplored. In this research, we used a process-based ecosystem model (Agro-IBIS) to quantify groundwater effects on eight ecosystem services related to food, water and biogeochemical processes in an urbanizing agricultural watershed in the Midwest, USA. We asked: (1) Which ecosystem services are more susceptible to shallow groundwater influences? (2) Do effects of groundwater on ecosystem services vary under contrasting climate conditions (i.e., dry, wet and average)? (3) Where on the landscape are groundwater effects on ecosystem services most pronounced? (4) How do groundwater effects depend on water table depth? Overall, groundwater significantly impacted all services studied, with the largest effects on food production, water quality and quantity, and flood regulation services. Climate also mediated groundwater effects with the strongest effects occurring under dry climatic conditions. There was substantial spatial heterogeneity in groundwater effects across the landscape that is driven in part by spatial variations in water table depth. Most ecosystem services responded nonlinearly to groundwater availability, with most apparent groundwater effects occurring when the water table is shallower than a critical depth of ~2.5-m. Our findings provide compelling evidence that groundwater plays a vital role in sustaining ecosystem services. Our research highlights the pressing need to consider groundwater during the assessment and management of ecosystem services, and suggests that protecting groundwater resources may enhance ecosystem service resilience to future climate extremes and increased climate variability.

Quintero, Carlos

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Session Title: Poster Session - Wetlands

Seasonal Carbon Fluxes in a Patterned Karst Wetland and Implications of Hydrology on Basin Expansion in Big Cypress National Preserve

Patterned Wetland Depressions are ubiquitous in the sub-tropical low relief limestone landscape of South West Florida. These bowl shaped wetland depressions are typically home to dense cypress communities that thrive on the prolonged hydroperiods and deep carbon rich soils near their centers with Saw Palmetto and South Florida Slash Pine populating the adjacent uplands. The underlying limestone bedrock is highly susceptible to chemical weathering by carbonic acid, which forms when CO2 and H20 interact. To test the hypothesis that scale dependent feedbacks operate in this environment to regulate basin expansion and to evaluate the effects of hydroperiod on soil respiration and storage we studied 3 separate wetland depressions within the preserve. First we outfitted our wetlands of interest with water level loggers which informed us of hydrologic conditions within our sites. Some depression centers remain inundated throughout the year while others dry out completely. Second we coupled our hydrologic data with DEMs obtained from LiDAR surveys of our domes. Hydroperiods in depression centers are much longer than those of the adjacent uplands. Finally we sampled soil respiration rates using a LICOR LI-6400 outfitted with a soil respiration chamber periodically throughout the year and collected measures of carbon content and soil depth within our domes. Efflux rates are typically higher near the centers of depression features and vary as a function of stage and distance from feature center. We found evidence to support the hypothesis that scale dependent feedbacks operate on this landscape to grow wetland landscape features. The presence of scale dependent feedbacks acting upon this landscape add to the growing body of work on patterned landscapes and biotically mediated karst formation.

Rath, Sagarika

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Session Title: Poster Session - Agricultural/Silvicultural Water

Comparison of SWAT and DSSAT at Field scale evaluation of BMPs on reduction of N leaching as a tool to identify high N load critical areas in a watershed scale BMP evaluation at field scale to reduce nitrogen leaching without impact on yield

Nitrogen (N) pollution into waterbodies is one of the major issues in north-central Florida, which has been attributed mainly to agricultural lands. Therefore, the implementation of Best Management Practices (BMPs) such as proper irrigation, N management, and crop rotations is required to avoid N leaching from the soil profile. Nevertheless, the success of these BMPs and their potential reduction on N leaching loads needs to be quantified in order to identify critical high Nitrogen areas in the watershed. Results from a field scale model may provide more accurate N leaching simulations that further can be up scaled into a watershed scale model to identify these critical areas. The main objectives of this study are: (i) to evaluate the nutrient and water dynamics at field scale using SWAT and DSSAT prior to a watershed evaluation (ii) Simulate water and nitrogen (N) dynamics for different irrigation and N fertility rates applied at field experiment in order to quantify nitrogen leaching. Simulation results from field scale was used to build confidence on the performance of the crop-hydrological model on various scenarios. Field data was obtained from research experimental field performed at Live Oak, Florida. Preliminary results show the University Florida recommended fertilizer (246kg/ha) dose for corn shows similar yield at high fertilizer application of 336 kg/ha with less leaching. Both SWAT and DSSAT estimation show similar trend of nitrogen leaching for different fertilizer application.

Reaver, Nathan

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Authors: **Nathan Reaver**, University of Florida
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Session Title: Poster Session - Stream/River Dynamics

Swept Away: Interactions between hydrology and primary producers in Florida Springs

In many of Florida's spring-fed rivers, cover of benthic and periphytic algae is increasing and in some cases are replacing submerged aquatic vegetation (SAV). A potential driver of these shifts in primary producer community structure is hydraulic control of algal abundance. Flow velocity drives the drag force on submerged algae and is a significant control on algal colonization and sloughing rates. This study investigated the relationship between flow velocity and algal and SAV abundance in spring-rivers, and consisted of three components: 1) Analysis of observational algal abundance and flow velocity data from multiple spring systems to determine a critical threshold velocity for algal presence; 2) A flow suppression experiment to determine the intrinsic algal growth rate and hysteretic behavior of algal establishment; 3) Development of an ecohydrological SAV growth model with feedbacks to reach-scale flow velocity. The analysis of observational algal abundance and flow velocity data was comprised of the application of a Bayesian statistical model to data from each of the multiple spring system datasets. This model determined if there was a critical threshold present in the data, and what its value was. Results from all the spring systems studied suggest a critical threshold velocity of 0.215 m/s with 95% CI (0.160 m/s-0.270 m/s). The flow suppression experiment was comprised of multiple deployments of flow blocking structures, which reduced flow velocity to near zero. Algal cover was monitored daily following the flow reduction. After substantial algal growth, flow was restored and the algal cover was monitored daily. Results from all deployments suggest an intrinsic algal growth rate of 1.14 1/day (95% CI: 0.70/day-1.60/day), and suggests that algal establishment is not strongly hysteretic. Results from the ecohydrological SAV growth model suggest that the model can reproduce the behavior observed in actual spring run stage, discharge, and velocity relationships.

Reaver, Nathan

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Session Title: Poster Session - Stream/River Dynamics

Quantifying and Predicting Three-Dimensional Heterogeneity in Transient Storage Using Roving Profiling

Hydraulic transport is an important component of nutrient spiraling in streams. Quantifying conservative solute transport is a prerequisite for understanding the cycling and fate of reactive solutes, such as nutrients. Numerous studies have modeled solute transport within streams using the one-dimensional advection, dispersion and storage (ADS) equation calibrated to experimental data from tracer experiments. However, there are limitations to the information about in-stream transient storage that can be derived from calibrated ADS model parameters. Transient storage (TS) in the ADS model is most often modeled as a single process, and calibrated model parameters are "lumped" values that are the best-fit representation of multiple real-world TS processes. In this study, we developed a roving profiling method to assess and predict spatial heterogeneity of in-stream TS. We performed five tracer experiments on three spring-fed rivers in Florida (USA) using Rhodamine WT. For each experiment, stationary fluorometers were deployed to measure breakthrough curves for multiple reaches within the river. Teams of roving samplers moved along the rivers measuring tracer concentrations at various locations and depths within the reaches. A Bayesian statistical method was used to calibrate the ADS model to the stationary breakthrough curves, resulting in probability distributions for both the advective and TS zone. Rover samples were assigned a probability of being from either the advective or TS zone by comparing measured concentrations to the probability distributions of concentrations in the ADS advective and TS zones. A regression model was used to predict the probability of any in-stream position being located within the advective versus TS zone based on spatiotemporal predictors (time, river position, depth, and distance from bank) and eco-geomorphological feature (eddies, woody debris, benthic depressions, and aquatic vegetation). Results confirm that TS is spatially variable as a function of spatiotemporal and eco-geomorphological features.

Reisinger, Alexander

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Session Title: Urban Water and Nutrient Management 1

Development and validation of low-cost sensor platforms for monitoring urban water quality

The rapidly expanding urbanization of Florida has caused considerable strain on natural resources within urban environments. Most of Florida's urban waters are impaired for nutrients, low dissolved oxygen, and/or pathogens. Monitoring the spatial and temporal dynamics in water bodies has typically been limited to grab sampling that may not meaningfully capture the spatially and temporally dynamic nature of pollutants. While logging sensors can detect a variety of parameters at high frequency, they are generally cost prohibitive for capturing this variability. Growing popularity of low-cost, open-source micro controller platforms, such as Arduino, and recent development of similarly low-cost environmental sensors have reduced the cost of collecting high frequency water quality data distributed over significant spatial scales. Incorporating transceivers with these platforms offers the potential for real-time monitoring and possibility for incorporating controls. We are developing a low-cost, customizable, sensor platform that will allow local municipalities, utility companies, and developers to monitor a range of water quality metrics. Using commercially available CPU boards and sensors, we have been monitoring stream temperature, conductivity, pH, orthophosphate, and dissolved oxygen across multiple urban stream sites throughout Gainesville, FL. Additionally, we are using standard, established probes to compare our low-cost approach to a more traditional sensor approach, while also collecting grab samples over a routine monitoring schedule. By comparing the performance of our low-cost platform with higher cost alternatives, we can both establish the capability of our platform for detecting important water quality changes, while also performing a cost-benefit analysis. Development and implementation of this platform will expand the capabilities of various stakeholders to monitor water quality across a range of aquatic ecosystems, allowing them to adapt and manage water resources to changes in water quality with rapid response times.

Sanchez, Georgina

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Session Title: Urban Water and Nutrient Management 2

Water Use in Urbanized Areas: Effects of Urban Form and Socio-Ecological Drivers

Future water availability is becoming more uncertain as human populations grow, cities expand into rural regions and climate changes. In this study, we examine how water use in urbanized areas can be explained or predicted by the spatial configuration of urban form across the rapidly growing region of the southeastern U.S. We applied spatial pattern analysis techniques to quantitatively measure the structure of developed patches and characterize the spatial configuration of urban form at the census tract level. Through non-spatial and spatial regression approaches we examined the relationships and spatial dependencies between urban form metrics, socio-ecological variables and two water use variables: a) domestic water use, and b) total development-induced water use that combines estimates of public supply, domestic self-supply and industrial self-supply. We found that urban form had the highest measure of relative importance (53%) and explained significantly more variance in water use compared to other social, economic or environmental indicators commonly implemented to estimate and predict water use. We suggest that landscape-level urban form metrics in water use modeling can contribute to developing design-oriented conservation strategies and can inform water and land-use planning.

Searcy, Jennison

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Session Title: Engaging Stakeholders in Developing Solutions to Water Issues

The “Watery” Work of Community Engagement and the CIVIC Extension Program

Water, wind, or both? Choose your agent of change in shaping Florida’s water future. Decades, generations, even centuries from now, do we want communities to look back on the legacy of Cooperative Extension as a fundamental catalyst of positive community change, or simply as an intermittent force that has shaped the quality and character of communities only at the margins and at the most opportune times? A compelling case can be made that we ought to do both: just as water and wind shape the contours of canyons and riverbeds over geologic time, we (the Cooperative Extension system) have shaped both the fundamental “essence” as well as the nuanced character of U.S. communities for over 150 years, since the land-grant system was signed into law by President Lincoln. Yet as we’ve moved from a predominantly agrarian, rural society to an industrial, urbanized one, have we strayed from our identity as a fundamental community-shaping force? Are we offering a surplus of “windy” programs at the cost of investing in the “watery” ones that tackle our toughest challenges and speak to our basic needs and deepest-held values?
UF/IFAS is developing a new Extension program to address questions such as these, beginning with a focus on Florida’s complex and often contentious issues of water and poverty. The Community Voices, Informed Choices (or CIVIC) Program brings together partners with expertise in natural resources, community development, and citizen-driven democracy to provide training for county agents on nationally-recognized engagement processes and best practices. Our goal is to catalyze informed and inclusive action for healthier human, ecological, and economic systems. Among a suite of engagement tools, we are creating Florida-specific, science-based frameworks and developing activities that invite Floridians with competing perspectives to engage in conversation, informed decision-making, and action together.

Sharp, Misti

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Authors: **Misti Sharp**, IFAS, University of Florida

Session Title: Poster Session - Climate Change/Hydrology

Economic Damages Associated with Water Related Natural Disasters

In 2017, Texas and Florida experienced as much as $200 billion dollars in damage due to hurricanes Harvey and Irma. The damages associated with wildfires in the western United States this year has already been reported in the billions as these fires continue to rage in areas much less remote than typical, raining down damage to agricultural lands, wineries, and residences. The key question becomes: are water-related natural disasters becoming more prolific and more intense in terms economic damages and lives lost? This study uses the EM-DAT International Disaster Database and various other sources of data to put in context the natural disasters related to water. Data analyzed will compare disasters from recent years to the natural disasters of the past century on a global and regional basis. Econometrics will be used to determine which disasters tend to result in the most direct economic damages and will predict how these disasters and their associated damages are likely to play out into the future, should these trends continue. Furthermore, the study explores policy implications for those who bear the burden of the rising costs of natural disasters related to climate change. Three micro-case studies illuminate the social, physical and institutional factors that influence the costly nature of these types of natural disasters. The Texas Drought (beginning in 2011), the 2007 California Wildfires, and Hurricane Charley (2004) in Florida were chosen for these highlighted disasters as they all have had catastrophic impacts on their respective states and the changing institutions that deal with natural disaster response.

Shrestha, Maryada

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Timothy Martin, Professor
Jason Vogel, Assistant Professor

Session Title: Poster Session - Agricultural/Silvicultural Water

Contrasting water use efficiency and export for two different pine management systems

Forests in the southeastern US cover about one third of the forested land areas in the conterminous USA. Forests provide clean water and carbon sequestration and forest management can greatly affect the dynamics of these ecosystem services. We examined tradeoffs in water use, water yield and biomass accumulation (water use efficiency, WUE) for two types of managed pine: A naturally regenerated mixed stand of longleaf pine (Pinus palustris Mill) and slash pine (Pinus elliottii) managed to resemble natural forests (age ~60 years), and plantations of slash pine managed for fiber (age 5-25 years). The older forest was burned in the spring at approximately 2-year intervals. We measured evapotranspiration (ET) and carbon fluxes (net ecosystem production, NEP) using the eddy covariance approach along with biometric estimations of woody biomass increment (IW). Measurements covered 21-years of the plantation forest, and 17-years in the natural forest, capturing a broad range in climatic variability from extreme droughts to tropical storms. Mean annual ET was 724 ± 118 mm for the natural forest and 958 ± 108 mm for the plantations. The ET to precipitation (P) ratios was 0.67 ± 0.13 for the natural forest and 0.85 ± 0.15 for the plantations. Water use efficiency was estimated as the amount of biomass (C) accumulated (NEP) per Kg of water used (ET) and woody biomass (IW) produced per Kg of water used. We found that WUE for plantations as NEP/ET (1.28 ± 0.36 gC KgH2O-1) or IW/ET (0.67 ± 0.11 gC KgH2O-1) was higher than WUE for natural forest as NEP/ET (0.77 ± 0.40 gC KgH2O-1) or IW/ET (0.26 ± 0.10 gC KgH2O-1). These results suggest that relative to pine plantations, management for natural forests results in greater water yield to the local hydrologic system but lower rates of ecosystem carbon sequestration.

Shukla, Sanjay

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Authors: **SANJAY SHUKLA**, Department of Agricultural and Biological Engineering, University of Florida
ASMITA SHUKLA, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
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Session Title: Urban Water and Nutrient Management 1

Hydraulically Circumventing Phosphorus Release from Aged Stormwater Detention Systems

Phosphorus (P) treatment through stormwater detention areas (SDAs) in agricultural and urban landscapes comes with an impending risk of P saturation and release as they mature. Given their high cost, it is imperative that the issue of P saturation of the SDAs be addressed. Water and nutrient fluxes from a 15-year old SDA located in a vegetable farm in the Everglades basin were monitored for four years to quantify P treatment efficiency, identify retention mechanisms, and design management alternatives to alleviate the P saturation issue. The SDA was monitored for two years before it was modified and then monitoring resumed for two years to evaluate the effectiveness of the alternatives. Analysis of Pre-modification period (2009-2011) results showed that water retention outweighs biogeochemical mechanisms as a P treatment avenue because of soil P saturation owing to continued P input for more than a decade. The SDA was hydraulically altered by constructing a berm to compartmentalize it and increasing the storage by raising the discharge level. Preliminary results showed that the hydraulic retrofits increased the surface water retention from 49% during the pre-modification period to 95% in the first-year post-modification (2014-2015). The P treatment increased from 52% to 95%. Similar water and P retentions during both pre- and post-modification period showed the inconsequential impact of biogeochemical processes in retaining P. The main reason for the large increase in P retention was the increase in pre-discharge storage. Increasing volumetric retention is an effective alternative and can help maintain or increase the treatment efficiency of SDAs. With the aging stormwater infrastructure and potential for future increase in extreme rainfall events, a payment for water treatment services can be explored in cooperation with the stakeholders to improve water quality.

Sims, Roger

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Authors: **Roger Sims**, Holland & Knight

Session Title: Water Policy, Planning and Management

Protecting and restoring Florida's water resources: a legal perspective

This presentation will explore legal initiatives and existing law regarding the balance between responsible use, and impacts to Florida's water resources. Discussion topics include ground water and surface water regulation, setting minimum flows and levels, basin management action plans, water use planning, the Central Florida Water Initiative (CFWI). and recent case law. The presentation will focus on state and local legal programs.

Sishodia, Rajendra

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Authors: **Rajendra Sishodia**, University of Florida
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Session Title: Poster Session - Agricultural/Silvicultural Water

Ranchland Water Retention Effects on Flows and Nutrient Loads in the Northern Everglades

A nine-year study was conducted to evaluate the effects of on-ranch water retention (WR) on surface flows and nutrient loads at two study sites in the Lake Okeechobee (LO) watershed, Florida. The study sites (Site 1 and Site 2) are comprised of wetland-upland hydrologic units. To implement the WR, a flashboard riser structure was installed in the drainage ditch. Measured surface flow and nutrient concentration data for four pre-WR and five post- WR years for Site 1, and three pre- and six post-WR years for Site 2 were used. Although annual surface flows decreased by 60% and 54% at Site 1 and Site 2, respectively these reductions were not statistically significant due to variability in rainfall. To reduce the effects of variable rainfall, the flows and nutrient data were compared for similar rainfall events (difference <10%). The event-based comparisons showed statistically significant ($p < 0.05$) reductions in surface flow at both sites. Relatively less evapotranspiration and groundwater fluxes during the short span of rainfall events combined with reduced rainfall variability helped unmask the effects of WR with significant flow reductions shown during the post-WR period. Statically significant reduction ($p<0.05$) in both total phosphorus (TP) and total nitrogen (TN) loads were observed for Site 2, while Site 1 showed moderate evidence ($p=0.051$) for TP load reduction. Statistically significant reduction in TP load at Site 2 was likely due to its higher elevation and higher P adsorption capacity of the soils than Site 1. Better connectivity of landscape to flow channel combined with the presence of hot-spots (cattle feeding areas) resulted in higher P transport from Site 1, compared to Site 2. Overall, both sites were effective in reducing surface flows with Site 2 performing better than Site 1 in reducing TP load. Selection of sites similar to Site 2 was recommended for Payment for Environmental Services Programs (PES) in Florida.

So, Sangdon

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Arnoldo Valle-Levinson, Department of Civil and Coastal Engineering, University of Florida

Session Title: Coastal Flooding, Storm Surge and Sea Level Rise

Storm surge from Hurricane Irma along the Florida Peninsula

Hurricane Irma impacted the entire Florida peninsula in September 2017. The combination of Irma's strength, size, and track provided a unique opportunity to study hurricane effects on storm surge at both sides of a peninsula. These effects were analyzed with water level and atmospheric forcing records from 11 stations on Florida's west coast and 8 stations on Florida's east coast. Storm surge was defined as the difference between predicted tides and observed water levels. Storm surge characteristics on the west coast of Florida were markedly different from those on the east coast. On the west coast, the maximum positive storm surge was 2.2m at Naples, to the south of the peninsula, corresponding to onshore winds and 970mb atmospheric pressure. A stunning negative surge of -1.7m appeared at Cedar Key, in the peninsula's northwestern quarter, after ~10hr of oblique offshore winds. On the east coast, the maximum surge was 3.1m at Fernandina Beach, where wind velocity displayed horizontal convergence. Barometric pressure played a secondary, but non-negligible role. Additionally, semi-diurnal perturbations to the storm surge appeared on both northern coasts of Florida, within bights. Similar surge characteristics should appear during storms that track along other peninsulas throughout the world.

Sobczak, Robert

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Authors: **Robert V. Sobczak**, Big Cypress National Preserve
Michael J. Duever, Natural Ecosystems
Kelly J. Keefe, U.S. Army Corps of Engineers
Antonio J Pernas, Big Cypress National Preserve
John F Meeder, Florida International University

Session Title: Wetland Ecosystems

The Hydrology of the Big Cypress Before Canals (and the Myth of the Rain-Driven Swamp)

Big Cypress National Preserve is often celebrated in modern times as a "rain-driven" ecosystem in which rainfall – not upstream flows – provides the primary source of water for filling its swamp forested expanse. Under this conceptualization, the preserve is envisioned as a hydrologic Brigadoon of sorts in which progressive planning in the early 1970s – namely, the decision to carve the preserve's parochial bounds to coincide with the catchment that delivers freshwater flow to the western estuarine arm of Everglades National park – saved the swamp and, in one fell swoop, achieved what has become a decades-long and quite arduous restoration of the Kissimmee-Okeechobee-Everglades (KOE) flow way to the east. Central to this widespread line of reasoning is the assumption that the some 35 miles of Central and South Florida (C&SF) Project drainage works that forms the preserve's eastern boundary – commonly called the L-28 – was placed along a physiographic boundary, and therefore has had little to no effect. While a paucity of hydrologic data in this mysterious "swamp-meets-glades" confluence (aka the Western Everglades) has helped perpetuate this notion into the modern era, it is ultimately history (not hydrologic models) that unravels the profound ecological impact of the levee and, in the process, punctures a hole in the sophistry of the swamp's "rain-driven" myth.

Spellman, Patricia

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Authors: **Patricia Spellman**, University of Florida
David Kaplan, University of Florida

Session Title: Poster Session - Agricultural/Silvicultural Water

The efficacy of different gridded climate datasets in simulating hydrological output the Santa Fe River basin, northern Florida

The use of gridded climate data is often necessary to capture the spatial and temporal variability in weather patterns when forcing hydrologic models. Several gridded climate datasets exist and differ based on the interpolation method used to grid the data, grid resolution and climate parameters available to the end user. The variability in the interpolation methods can create different values across datasets even when the same weather station data is used, which can vary in how accurately weather is reproduced on a local or regional scale. Thus, the selection of a gridded climate dataset for hydrologic modeling would depend upon the area of study, forcing an assessment of different gridded climate data's ability to produce meaningful hydrologic output. We assess the efficacy of 3 gridded climate datasets, Maurer, Livneh and NLDAS-2, to yield reliable weather data and streamflow in the Santa Fe River basin via the Soil and Water Assessment Tool (SWAT). The Maurer and Livneh datasets have been shown to more often match observed precipitation and temperature with greater accuracy than NLDAS-2. However, the Maurer and Livneh datasets do not provide all the parameters necessary to calculate potential evapotranspiration (PET) using Penman-Monteith or Priestley-Taylor; which are the recommended PET estimation methods in Florida. Accurately estimating PET is essential for reliable hydrologic simulations. We therefore also compare the efficacy of different PET methods within SWAT, and assess the utility of the SWAT weather generator to produce reliable estimates of variables used to calculate PET when the model is forced with climate data where variables necessary to calculate PET are missing. We compare generated streamflow and weather data to observed values and assess which dataset would be more reliable for use in the Santa Fe River basin. Our results can then be used to guide gridded climate data selections for other watersheds in the region.

Spellman, Patricia

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Authors: **Patricia Spellman**, University of Florida
David Kaplan, University of Florida
Veronica Webster, Michigan Technological University

Session Title: Poster Session - Agricultural/Silvicultural Water

Developing a new regional skew for the Suwannee River basin, northern Florida.

Challenges in reliably estimating peak flows for water resource management and planning are many, however, one impediment is the estimation of flood skew. In the US, the three-parameter Log-Pearson Type III (LP3) distribution is recommended to relate the probability of exceedance to a specified design flood discharge, e.g. the 100-year flood. Estimation of all three parameters requires flood skew which is typically biased and subject to large sampling errors because of short streamflow records. Thus, use of a regional flood skew is recommended to reduce bias and improve estimates of selected return period discharge. The most common source from which regional flood skew is obtained comes from the Hardison map published in 1979. However, efforts to update regional skew values have been ongoing, whereby regional regression analysis is used with geomorphic data from several sites to develop a more informed regional skew. Because recent studies have shown flood skew is significantly affected by surface and groundwater interactions, updates to regional skew values should consider this process where appropriate. The Suwannee River Basin in northern Florida is one such watershed where extreme surface and groundwater interaction occurs and regional flood skew values have not been updated since publication of the Hardison map in 1979. Therefore, we developed a new regional skew for the Suwannee River Basin using Bayesian regression analysis that accounts for surface and groundwater interactions. A regional skew value of -0.349 is proposed as a new value for regional flood skew the Suwannee River Basin, which reduces RMSE, particularly at higher return period flows, compared with the commonly used map value of regional skew, -0.100.

Stahlhut, Katherine

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Authors: **Katherine Stahlhut**, US Geological Survey
Barry Rosen, US Geological Survey
John Hall, Academy of Natural Sciences of Philadelphia

Session Title: Poster Session - Wetlands

The Desmids of the Arthur R. Marshall Loxahatchee National Wildlife Refuge

The Arthur R. Marshall Loxahatchee National Wildlife Refuge, Boynton Beach, Florida, contains approximately 144,000 acres southeast of Lake Okeechobee. The interior portion of the refuge is rainfall driven, resulting in waters with low dissolved ions and slightly acidic. Desmids, a unique, ornate group of green algae loosely associated with submerged vascular plants, were photo-documented for the first time from this location. The canal system surrounding the refuge contains a high level of ions from agricultural runoff, and intrusion of this water into the refuge interior during high canal water levels may have suppressed some of the desmid population. A transect from the canal to the ombrotrophic interior was sampled every three months and the species present were identified and catalogued. More than 200 species from 31 genera were found. The interior of the refuge had the greatest diversity; however, the areas of the refuge most affected by canal water intrusion, such as the western perimeter, still contained a population of desmids. We postulate that the diversity of desmids in the Arthur R. Marshall Loxahatchee National Wildlife Refuge may be an important refuge for desmids and other freshwater algae in North America, particularly for those species restricted to the subtropical portions of the United States.

Sucsy, Peter

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Authors: **Peter Sucsy**, St. Johns River Water Management District
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Session Title: Poster Session - Stream/River Dynamics

Mechanistic Modeling for Water Resources Management of the St. Johns River, FL

The St. Johns River (SJR) extends 500 km from its headwaters in the marshes of Indian River County to its exit into the Atlantic Ocean east of Jacksonville. The river drains an area of over 22,000 km2. Annual average rainfall across the region averages 117 to 145 cm of which approximately 24% is realized as discharge at the mouth.
The SJR Basin's water supply needs are primarily met by groundwater withdrawal along with water conservation and reuse. The St. Johns River Water Management District (SJRWMD), through its water supply planning function, has determined that future water supply demands will require alternative water supply sources as groundwater supplies reach sustainable limits. Alternative water sources considered are seawater, brackish (slightly salty) groundwater, reclaimed water and surface water as well as increased conservation.
In 2012, SJRWMD completed a comprehensive study of the potential environmental effects of surface water withdrawals from the St. Johns River on the plants, animals and water resources of the system. Following review of this study, the National Review Council (NRC) recommended that the District (i) periodically update the models as part of an adaptive management strategy and (ii) add water quality components to assess the effects of urbanization on water quality.
In October 2017, the District developed a three-year project plan to meet the NRC recommendations. Our poster presentation provides details on the scope of this work, identifies recent literature used for model improvement, and suggests the benefits of this work as a starting point for further in-depth analyses and scientific studies by academic research groups.

Sukop, Michael

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Authors: **Michael C Sukop**, Florida International University
Adam Douglas Henry, University of Arizona
Jessica Bolson, Florida International University
Nancy Schneider, Institute for Sustainable Communities
Timothy Kirby, Florida International University

Session Title: Sharing Information: Effective Communication Strategies

Using Social Network Analysis to Identify and Understand Linkages Between Climate-related Organizations in Southeast Florida

Additional Author: Karina French, Institute for Sustainable Communities, kfrench@iscvt.org. A Social Network Analysis (SNA) was undertaken to identify organizations engaged in climate-related work in Southeast Florida and to begin to understand linkages between them, with an aim of identifying gaps and enhancing communication. Beyond government, academia, and known NGOs working in this arena, it is not known what groups are also communicating about climate change, what messages they are delivering, and to whom. Understanding the gaps and overlaps in climate communication in Southeast Florida would increase efficiency in outreach, engagement, and implementation of climate change action.
A small group of 27 organizational representatives was selected for the first round of data collection. This panel consisted of federal, state, and local governmental agency staff, media personnel, real estate developers, academics, and representatives of chambers of commerce, foundations, and religious groups. A 'snowball' scheme in which additional survey respondents were identified by the first cohort was employed.

The survey consisted of a series of questions regarding the organization's climate-related activities, the extent of the organization's focus on climate, the nature of the organization's work (e.g., planning, data collection, research, communication, advocacy), and its sources of climate information. The survey then probed connections with other organizations.
Initial data processing was needed to make organization names consistent to the extent possible. Respondent's ability to "fill in the blanks" led to numerous overlapping categories such as "local governments in general" and "other local municipalities" that presented some ambiguity. Data were analysed in Visone SNA software.
The first cohort's responses provided a large number of additional organizations that could be included in a snowball expansion of the survey. Preliminary results showed that the large counties, the Southeast Florida Regional Climate Change Compact, the South Florida Regional Planning Council, some climate education and advocacy groups, and local and state universities play central roles in the network.

Szafraniec, Mary

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Authors: **Mary Szafraniec**, Amec Foster Wheeler
John Kiefer, Amec Foster Wheeler
Erik Oij, Amec Foster Wheeler

Session Title: Water Quality Issues

Sediment Nutrient Flux to Assess Nutrient Management Alternatives

There is a general lack of data tracking improvements from sediment nutrient management. Prior to conducting a large scale and costly restoration project that may include sediment removal or chemical inactivation to improve water quality in a waterbody, it is important to understand how the action may affect the overlying water column after implementation. Results from a few alternatives analysis case studies that used Amec Foster Wheeler field and laboratory Standard Operating Procedures to collect and incubate intact sediment cores will be presented. The case studies determined flux rates from a variety of highly eutrophic lakes and treatment wetlands in Central Florida. Sediment cores were incubated in the laboratory under existing conditions to evaluate several alternatives such as sediment capping by applying chemical or biological treatments to the cores to answer the question as to what extent the alternatives would reduce the rate of nutrients (orthophosphate and ammonia-nitrogen) releasing into the water column. The magnitude and variability of internal nutrient flux rates and loads from the sediments to the water column were compared across a multitude of alternatives that included capping with clean fill, Phoslock ©, instituting aeration, and adding various biological amendments. In addition to the laboratory bench scale assessments, the case studies assessed each alternative to compare the technical feasibility, costs, potential water quality improvement and regulatory compliance. The results of these case studies can be used to assist with watershed restoration planning as sediment nutrient removal or chemical/biological amendments can be compared against other aquatic system restoration BMPs along with costs to develop long-term plans. More specifically, the results can be used in the prioritization of removal or chemical inactivation of sediment types, and to quantify the potential beneficial impacts of sediment nutrient management on water quality.

Taylor, Nicholas

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Michael Sweeney, Toho Water Authority
Bradley Spatz, University of Florida - IFAS
Pierce Jones, University of Florida - IFAS

Session Title: Urban Water and Nutrient Management 2

H2OSAV: A Water Conservation Program Data Hub

The Central Florida Water Initiative (CFWI) planning area is approaching its current capacity for groundwater withdrawal at about 800 million gallons per day (mgd). By 2035, regional water use is projected to increase to 1,100 mgd. If management activities are optimized on a regional basis, approximately 50 mgd of additional groundwater could be available. The remaining 250 mgd will have to be met through increased water conservation and development of alternative sources.

The CFWI Conservation Planning Sub-team was tasked with evaluating conservation potential through the implementation of additional conservation in the public supply and agricultural sectors. For purposes of the 2015 Final CFWI Regional Water Supply Plan report, they estimated a minimum potential water savings of 37 mgd. However, the Sub-team's evaluation process revealed a general lack of shared knowledge about existing conservation programs and virtually no rigorous analytics on the program's impacts.

To address this issue, several CFWI water utilities, FDEP and FDACS are working with the UF/IFAS Program for Resource Efficient Communities (PREC) to develop and manage an interactive data hub, called H2OSAV, which will allow dynamic updating of conservation program metrics and evaluation of program impacts. At a minimum the data hub is expected to enhance water conservation through more transparent information exchange and program benchmarking. However, H2OSAV will also serve as a repository of measured and verified (M&V) conservation program water savings that will extend over multi-year timeframes. This information will be the basis for increasingly accurate calculations of return on investment (ROI), allowing for more tangible, direct comparisons to the costs and yields from alternative water supply infrastructure projects.

This presentation will demonstrate and describe the H2OSAV data hub project and present initial analytics for Toho Water Authority conservation programs and others.

Teegarden, Robert D.

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Authors: **Robert D. Teegarden**, OUC - The Reliable One

Session Title: Water Policy, Planning and Management

Carbon Utilization - Florida's potential pathway and processes for converting to the bioeconomy--Research and the prospects for collaborating across the energy, water and agriculture sectors

Producing transportation bio- fuels can be among the ways OUC and Florida innovate and adapt to a future carbon managed world. Recycling waste nutrients and partnering with agriculture offers a surprisingly wide range to produce valuable renewable bio products, from chemicals and fuels to animal feeds and bio fertilizers. New businesses founded on the recycling of carbon/ nutrients as inputs for creating large scale biomass feedstocks will make such renewable bio products more affordable in Florida.

Already a variety of biomass feedstocks can be used to produce energy (including transportation fuels) and bio-based products. The US Dept. of Energy Bioenergy Technologies Office (DOE-BETO) has focused on the development of cellulosic feedstocks derived from non-food-based feedstocks, such as agricultural residues, woody biomass from forest thinnings, municipal solid wastes and even energy crops (energycane, switchgrass, etc.) DOE-BETO is also developing microalgae as a source of feedstocks for biorefineries – able to produce biofuels, chemicals and animal feeds. Microalgae are a diverse group of primarily aquatic microscopic plants. OUC has partnered with the MicroBio Engineering Inc., the University of Florida and others to tackle one of the world's most pressing and difficult problems – carbon capture and utilization with microalgae. Research over the past 2 years by the OUC and partners, assisted by a grant from DOE National Energy Technology Laboratory (NETL), has been investigating methods to capture and utilize SEC coal - fired flue gas to grow and process algal biomass into renewable biofuels and higher value animal feeds. Developments in process technology, gas separation, materials science requires increase of the current scales of innovative and multi-disciplinary approaches across the water, energy and food sectors for utilizing carbon. Investments in the bio economy - US federal agencies have invested billions of dollars into such research - proves that biomass grown on marginal nonfood farm lands and blended with nutrients from surrounding communities may be successfully developed and play a significant role as feedstock for new industries and agri - businesses of the future. The State of Florida is well positioned with ideal location and climate for algal biomass production and develop a commercially viable bio economy.

Tootoonchi, Mohsen

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Authors: **Mohsen Tootoonchi**, University of Florida
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Session Title: Poster Session - Climate Change/Hydrology

Evaluating proxies for seawater in sea level rise and climate change research

Climate change and sea level rise have the potential to alter the vegetation composition of our aquatic ecosystems. In order to achieve resilience and stability in our ecosystems, we need a better understanding of future changes based on sound scientific projections. Using actual sea water for implementing sea level salinities in laboratory and greenhouse experiments is not always feasible, hence commercial aquarium mixes might be a good substitute to mimic natural saltwater-freshwater systems. In this study, we compared the growth of Vallisneria americana (Eel-grass) and Hydrilla verticillata (Hydrilla) under 4 salinity levels (0.5, 1.0, 2.5 and 5.0 ppt) induced by 4 different salt types (Sea Water, Instant Ocean Aquarium Mix, NaCl and Morton Sea Salt). Aquatic plants were grown in separate pots filled with Sand or Peat and were submersed in 60 L mesocosms. Salinity levels were increased gradually and water level, salinity and pH were monitored every week. After 10 weeks exposure to increased salinity levels, plants were visually evaluated on a 0-10 scale and destructively harvested to record wet and dry weights. Results showed that Peat and Sand did not substantially impact plant's biomass. Mesocosms which were treated with Morton or NaCl had severe Hydrilla damage at 2.5 ppt and all Hydrilla were eradicated at 5 ppt. While Instant Ocean Aquarium Mix or Sea Water treated mesocosms had less Hydrilla damage at both 2.5 and 5 ppt levels and no eradication was observed. Vallisneria was not affected by different salt types in various salinity levels except at 0.5 ppt level where NaCl had smaller biomass than all other salt types. Overall, our results suggest that Instant Ocean Aquarium Mix is a strong candidate for increasing salinity levels in sea level rise experiments, as it showed a similar effect on plant's biomass as Sea Water.

Valle-Levinson, Arnoldo

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Authors: **Arnoldo Valle-Levinson**, Civil and Coastal Engineering, ESSIE, University of Florida
Andrea Dutton, UF
Jon Martin, UF

Session Title: Coastal Flooding, Storm Surge and Sea Level Rise

Linkage between sea-level rise hot-spots in the Southeastern United States and the Gulf of Mexico

The southeastern coast of the US was affected by rates of sea-level rise (SLR) of nearly 2 cm/yr, a SLR hot-spot, in the period 2011-2015. The SLR hot-spot in the southeastern United States has apparently stabilized after 2015. This study explored whether SLR hot-spots have also appeared in the Gulf of Mexico. Water level data during the past century were first detrended and then filtered with a one-year window to identify timing and location of SLR hot-spots. Water level variations throughout the US coast of the Gulf of Mexico have mostly been in the same direction. The most prominent SLR hot-spots in the Gulf of Mexico coincided with those in the southeastern US. However, a westward lag in the SLR signal signified a recent stabilization of the SLR hot-spot in Florida's coast but a trending toward a hot-spot peak in Louisiana and Texas. The presence of a SLR hot-spot in the Gulf of Mexico in 2017 has established a higher reference level on which storm surges from Harvey, Irma and Nate have been more damaging than only 5-10 years ago.

Vazquez, Kathleen

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Authors: **Kathleen Vazquez**, University of Florida
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Rafael Muñoz-Carpena, Department of Agricultural and Biological Engineering, University of Florida

Session Title: Poster Session - Agricultural/Silvicultural Water

A Mechanistic Bacterial Transport Model to Inform Food Safety Management of Agricultural Pond Water

Irrigation water is considered a major pathway to fresh produce for food-borne illness related pathogens. The Food Safety Modernization Act (FSMA) specifies sampling-based methods using Escherichia coli as an indicator organism and microbial criteria, geometric mean (GM) and statistical threshold value (STV), to regulate agricultural water. These regulations lack preventive measures, important to controlling the processes that introduce bacterial contamination into water sources. To inform FSMA regulations concerning agricultural water, this study develops a simple mechanistic model to predict the microbial quality of agricultural water. This model proved useful to simulate data from a highly variable surface water irrigation pond in West Central Florida. The performance of the model was similar or superior to existing pathogen transport models, with a Nash-Sutcliffe efficiency of 0.574 when incorporating observed values uncertainty. Global sensitivity analysis is then used to reveal the most important processes controlling bacterial water quality criteria: aquatic removal rate of bacteria for GM, and bacterial source and transport dynamics STV. It was also found that large peaks E. coli concentration events were mechanistically driven by rainfall/runoff processes. From these findings, we suggest preventative measures enhancing die-off rates through treatment after large runoff-producing rainfall events. Bacterial source characteristics such as wildlife population should be controlled in instances where STV exceeds regulatory limits. Vegetative filter strips, when properly designed and maintained, also provide an opportunity to mitigate bacterial transfer into the agricultural waters by reducing runoff flow and settling particulated pollutants.

Vrachioli, Maria

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Authors: **Maria Vrachioli**, University of Florida
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Session Title: Agricultural Water and Nutrient Management 2

Impact Evaluation of New Irrigation Technology in Crete: Correcting for Selectivity Bias

The interest in promoting food and water security through development projects has evolved to the need for tools that can evaluate the impact of these projects, and to ensure that the projects reach the most vulnerable and achieve the least well-off for the members of the community (Gertler et al., 2011). This study brings together the stochastic frontier model with impact evaluation methodology to measure the impact on farmers' technical efficiency (TE) within a modern irrigation technology transition framework. Deciding to adopt or not the new irrigation technology is not necessarily a random determination. Unobserved heterogeneity across the farms in the sample can have an impact on the farmer's decision to adopt the new technology. Therefore, when selection bias is present and the model is not correcting for it, this leads to biased frontier measures and therefore generates biased efficiency scores. In this study, we apply the Heckman (1979) and Greene (2010) models to correct for selectivity bias that arises from unobserved variables, and then we measure and compare technical efficiency scores (TE) resulting from these models. The empirical application will use data covering 56 small-scale greenhouse farms, mainly cultivating vegetables, from the Ierapetra Valley in the Southeast part of the island of Crete (Greece) for the cropping years from 2009 to 2013. This data set contains information on output quantities and four inputs along with irrigation water. The results reveal that the average technical efficiency for farmers who adopted sprinklers is lower than the group of non-adopters when the presence of selectivity bias cannot be rejected. This outcome can be explained by the fact that after the adoption of new technologies, adopters may need more time to learn how to use the technology efficiently.

Vrachioli, Maria

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Authors: **Maria Vrachioli**, University of Florida
Spiro Stefanou, University of Florida

Session Title: Poster Session - Agricultural/Silvicultural Water

Water' s Contribution to Agricultural Productivity under Spatial Adjustments

Population growth, in combination with increasing incomes, is leading to a more nutrient-dense food demand that has driven the agricultural sector to expand the use of water for irrigation, bringing the water crisis to the center of global debate (UnitedNations, 2015). With agricultural sector being the largest user of water at a global level accounting for 70 percent of fresh water withdrawals (Molden, 2007), work focusing on projects related to sustainable agricultural water management practices has shown that shifting to more productive, water-saving technologies is the cornerstone to achieve effective use of agricultural water (FAO, 2017; IFPRI, 2017; United Nations, 2015; World Bank, 2017). The improved effectiveness of water conveyance, the efficiency in its use, and the associated impact on non-water input and output choices have the potential to impact the economic well-being of the farming community and promote the sustainability of agricultural production. The objective of this study is to contribute toward productivity-enhancing policies by estimating the magnitude of gains from the more effective use of water in agriculture. The effectiveness of these policies depends on the proper measurement of water's contribution to agricultural efficiency and productivity. This study develops a measure of water's contribution to total factor productivity (TFP) change that accounts for spatial water quantity and quality adjustments. This spatial model is a first attempt to estimate the contribution of agricultural water's use to productivity of a project and to capture differences in farm-level productivity due to head versus tail disparities in water allocation. As measurement of the terms in the water balance on a spatial case can be challenging, hydrological simulation modeling will be used in this study to estimate the contribution of water to total factor productivity change over space.

Wakhungu, Mathews

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Christian Wells, University of south Florida
Qing Lu, University of South Florida
Qiong Zhang, University of South Florida

Session Title: Hydrologic Modeling and Water Management

Managing Interdependent Infrastructures: Water, Stormwater, and Transportation

Critical urban infrastructures, such as those designed to manage water, stormwater, and transportation, do not exist and operate in isolation, but are interdependent at different levels, are often physically co-located, and can affect overall infrastructure performance. Cascading failures, such as those witnessed during recent events associated with Hurricanes Harvey, Irma, and Maria, remind us about the importance of understanding critical infrastructure interconnections and their impact on the resilience of infrastructure organizations. As part of a larger multidisciplinary project funded by the National Science Foundation's CRIISP (critical resilient interdependent infrastructure systems and processes) program, this presentation considers the social, economic and political contingencies of public utilities in the City of Tampa, Florida. Based on baseline interviews with utility managers, current infrastructural challenges vary from inadequate funding that limits organizations to reactionary management approaches, aging infrastructures vulnerable to acute failures, and network interdependencies that complicate decision making and often results in inefficiencies in operations and management. We also find that, while the utilities have prioritization models to guide capital projects and maintenance operations, priorities are sometimes restructured unexpectedly and actions taken are sometimes in reaction to projects by other utilities. We argue that resilient water, stormwater, and transportation infrastructures are those that are able to anticipate the type and degree of interdependencies and forecast the impacts of decisions made by other actors in
the networks on their infrastructure. Ultimately, identifying the socioeconomic interdependencies builds knowledge and awareness of the most influential factors and points vulnerability points in interlinked water infrastructures. Based on the assessment of the organizational capacity to identify and forecast the challenges emanating from the interconnection, we can model operational, technological, and policy strategies that will enable decision making to consider the interdependencies and their impacts.

Wessel, Mike

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Authors: **Mike Wessel**, Janicki Environmental
Jay Leverone, Sarasota Bay Estuary Program

Session Title: Estuarine Ecology and Water Quality

Developing an innovative nutrient management strategy for Southwest Florida Tidal Creeks by Linking Source Water Concentrations, Instream Processes, and Estuarine Dynamics

Southwest Florida tidal creeks are integral to the ecological function of their larger coastal estuaries, serving as a site of nutrient cycling and a critical nursery area for many juvenile fish species of recreational and commercial importance. However, the estuarine portion of these creeks is currently underrepresented in routine monitoring efforts and governed by narrative standards that were developed for other systems. This study focused on developing quantitative, defensible, and protective numeric targets and thresholds for nutrients in southwest Florida tidal creeks as part of a larger nutrient management strategy for southwest Florida tidal creeks. The study involved a one year bimonthly sampling effort of 16 of the more than 300 tidal creeks identified during the study. Biological response endpoints including water column chlorophyll, sediment chlorophyll, and fisheries data were collected and combined with existing remote sensing and in situ data describing landscape level effects at varying spatial scales. Importantly, three National Estuary Programs and six county governments contributed in kind services to the sampling effort for this study. Water quality conditions were found to be characteristic of wetland environments with the potential for low dissolved oxygen concentrations and periodic high chlorophyll concentrations. Despite this artifact, many of these creeks supported high fish species diversity and an abundance of important estuarine dependent fish species including the important sportfish, the Common Snook (Centropomus undecimalis). Nutrient concentrations did not follow a linear decay curve indicating the potential for nutrient addition in the estuarine portion of these systems. This presentation will discuss how outcomes from this study have led to an efficient and effective management strategy for identifying creeks with a high likelihood of impairment, and providing creek-specific targets and thresholds that allow for the proactive management of these creeks in an effort to fully protect attributes related to their designated use.

White Jr., Elliott

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Authors: **Elliott White Jr.**, University of Florida
David Kaplan, University of Florida

Session Title: Poster Session - Wetlands

Hurricane Impacts on Coastal Baldcypress Swamps are Storm Dependent and Temporally and Spatially Variable

Hurricanes are typically seen as harmful to both human and natural systems. This is particularly true when considering coastal freshwater wetlands (CFW). Due to the saltwater intolerance of many CFW plant species, hurricane induced storm surges have the potential to cause considerable damage if they reach CFWs. Coastal baldcypress swamps are a type of CFW where the canopy is dominated by baldcypress trees (Taxodium distichum). With a saltwater tolerance of 2 ppt (seawater is 35 ppt) there is considerable concern when hurricanes are expected to make landfall near baldcypress swamps. The assumption that groundwater salinity in these systems will always increase as the result of a hurricane is not well supported. Data from 22 conductivity-temperature-depth (CTD) groundwater wells located in coastal baldcypress swamps in east Texas and the Florida Big Bend region indicate the impacts of hurricanes on these systems are not easily predictable or uniform. This observation is best realized when looking at the groundwater salinity of the swamps. Hurricanes Hermine (2016) and Irma (2017) both made landfall on Florida impacting the Big Bend coast. Hurricane Hermine increased groundwater salinity in the swamps along the Suwannee River, whereas Hurricane Irma decreased groundwater salinity for those same swamps. However, these trends were not uniform across all sites; there existed a range of increased salinization and freshening that varied spatially. In addition, the acute impact of hurricanes varied temporally for each site. Hurricanes can act as drivers of salinization or freshening to these systems, but they can also do neither. Hurricane Harvey (2017) made landfall in coastal southwest Texas and shifted to east Texas. Beaumont, TX saw historic levels of flooding along the Neches River and its surrounding coastal baldcypress swamp floodplain. Groundwater sensors in the area showed no immediate response to nearly 5 m of additional freshwater. Hurricanes have the potential to wreck CFWs via storm surge induced salinization, relieve them of existing salinization, or have no impact at all. Knowing and understanding the system at homeostasis can give better insight into how hurricanes impact CFW groundwater.

Wu, Qianyan

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Authors: **Qianyan WU**, University of Florida
XIANG BI, UNIVERSITY OF FLORIDA

Session Title: Poster Session - Stream/River Dynamics

Valuing the Recreation Benefits of Springs in Florida

In North Central Florida, there are over 300 documented springs with 19 first magnitude springs. The springs are a vital part of the Suwannee River Basin and important to the riverine ecosystem. However, increasing water use from agricultural production and urbanization has resulted in a reduction in water flows and water quality in the springs. Our study aims to determine the economic value of springs for recreation and environmental services and examine the feasibility of a market-based payment program to achieve water conservation and water quality improvement.
We randomly sampled 500 visitors to four springs in North Central Florida from May 2016 to August 2016, the peak season for spring visitors in the region. We elicited information on visitors' characteristics and perception for springs. We estimated the consumer surplus at the springs using the travel cost method. The mean consumer surplus per person per trip is $154.40 generated from truncated negative binomial regression with endogenous stratification. We further analyzed the visitors' responses to the hypothetical price increase using the contingent valuation method. Without reducing the number of trips to the springs, the average entrance fee increase a visitor would be willing to accept is $12.57 per adult, with confidence intervals of [$8.61, $14.89]. It should be noted that the entrance fees provide one way to generate funds for conservation. Relative to respondents' willingness to pay, the current entrance fee for springs is very low at only $4 per six-person vehicle. Thus, there is substantial potential to use entrance fees to generate funds for water conservation and ecosystem payment program. We hope to generate discussion about policy options to improve water quality and water levels and receive feedback at the 6th biennial UF Water Institute Symposium.

Yang, Wei

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Authors: **Wei Yang**, China Agricultural University
Gary Feng, USDA-ARS, Genetics and Sustainable Agricultural Research Unit
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Session Title: Poster Session - Agricultural/Silvicultural Water

Simulating longer-term performance of cover crops on water drainage and nitrogen cycling in corn and soybean rotation with RZWQM2

Planting winter cover crops in soybean and maize rotations is a potential approach for reducing subsurface drainage and nitrate-nitrogen loss. However, the longer-term (2005-2009) impact of this practice needs to be further investigated. The RZWQM2 model was used to simulate the longer-term effects of the practice on water drainage and nitrogen cycling by using a winter cover crop within a corn-soybean rotation. The RZWQM2 model was calibrated satisfactory in terms of crop yield, biomass, and N uptake, with percent error (PE) was within ±15% and relative root mean square error (RRMSE) <20% except for biomass and rye N uptake. Simulated daily and annual drainage and annual NO3-N loss were also satisfactorily, with efficiency of model (EF) >0.60, d-index <0.85, and percent bias within ±22%. The simulation in soil water storage was unsatisfactory but comparable to other studies. Longer-term simulations showed that applying a winter cover was effective to reduce annual NO3-N loss by 14.6 kg N ha-1 (17%) and subsurface drainage by 3.2 cm (15%), respectively, and increased annual ET by 5% (2.9 cm).

Zamora Re, Maria

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Authors: **Maria Isabel Zamora Re**, University of Florida
Michael Dukes, Professor Agricultural and Biological Engineering

Session Title: Agricultural Water and Nutrient Management 1

BMPs evaluation at field scale to reduce nitrogen leaching without impact on corn yield

Nitrogen (N) pollution into waterbodies is one of the major issues in north-central Florida, which has been attributed mainly to agricultural lands. Therefore, the implementation of Best Management Practices (BMPs) such as proper irrigation and N management is required to avoid N leaching from the soil profile. Nevertheless, the success of these BMPs and their potential reduction on N leaching loads needs to be quantified. The main objective of this study is to evaluate water and nitrogen (N) dynamics for different irrigation and N fertility rates applied in a corn field experiment in order to quantify their impact on nitrogen leaching and yield. This study was performed at an experimental field located in Live Oak, Florida. Irrigation treatments consisted of: (i) GROW, calendar based irrigation mimicking grower's practices, (ii) SMS, soil moisture sensors used to monitor volumetric water content and trigger irrigation using field capacity (FC) and maximum allowable depletion (50% MAD) as thresholds, (iii) rainfed or non-irrigated plots. Three N fertility rates were evaluated: 336, 247 and 157 kg N/ha. The experimental design consisted of a randomized complete block arranged in a split plot with four replicates. Soil samples were taken at four depths (0-15 cm, 15-30 cm, 30-60 cm and 60-90 cm) biweekly during the crop season and monthly after harvest and were analyzed for NO3-N and NH4-N; whereas tissue samples were taken during key growth stages during the crop season and were analyzed for TKN. DSSAT was used in the estimation of N leaching. In 2015 and 2016, no significant differences in yield were found among GROW (average yield=13.0 and 13.6 ton/ha, respectively) and SMS (12.9 and 12.7 ton/ha; respectively); however the NO showed significantly lower yield on both years (9.6 and 8.5 ton/ha, respectively. In 2015, significant difference in yield was not found between fertility rates 336 and 247 kg N/ha, or 247 and 157 kg N/ha, however the 336 kg N/ha yield was significantly higher than 157 kg N/ha. In 2016, no significant differences in yield were found across the N fertility rates. Leaching simulations in 2015 across the 336, 247 and 157 kg N/ha fertility rates for the GROW treatment resulted in: 146, 70, 21 kg N/ha; 116, 43 and 14 kg N/ha, respectively for the SMS treatment and 138, 67 and 14 kg n/ha for the NON treatment, respectively. In 2015, the use of SMS with a 247 kg N/ha fertility rate reduced 39% N leaching compared to a calendar based irrigation (GROW) at the same rate. Furthermore, this combined practice can potentially reduce N leaching by 70% compared to high N rates (336 kg N/ha).

Zare, Alina

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Authors: **Alina Zare**, University of Florida
Nicholas Young, University of Florida
Daniel Suen, University of Florida
James Keller, University of Missouri

Session Title: Use of technology to shape our water future

Synthetic Aperture SONAR Soft Segmentation using Possibilistic Fuzzy Local Information C-Means

Special Session–Migliaccio:
Side-look synthetic aperture sonar (SAS) can produce very high quality images of the sea-floor. When viewing this imagery, a human observer can often easily identify various sea-floor textures such as sand ripple, hard-packed sand, sea grass and rock. In this presentation, we will present the Possibilistic Fuzzy Local Information C-Means (PFLICM) approach to segment SAS imagery into sea-floor regions that exhibit these various natural textures while accounting for regions of transition, smooth gradients, and outliers. The proposed PFLICM method incorporates fuzzy and possibilistic clustering methods and leverages local spatial information to perform soft segmentation. Results are shown on several SAS scenes and compared to alternative segmentation approaches.

Ziolkowska, Jad

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Authors: **Jad Ziolkowska**, University of Oklahoma

Session Title: Water and Regional Science

Desalination for Future Water Supply in the US - Economic, Environmental and Social Issues

Special Session – Christa Court
In the United States (US), the daily desalination capacity reached 2 BGD (billion gallons per day) in 2013. While the desalination technology provides an additional water supply and can lessen pressure on groundwater and surface water resources, especially in times of drought, desalination costs are still relatively high and prohibitive in many regions of the country. Furthermore, research on long-term desalination trends, socio-economic impacts and potentials is scarce, mainly due to limited data and regional variability in desalination production capacities across the US.
This paper presents: 1) SWOT analysis for desalination in the US to evaluate strengths, weaknesses, opportunities and challenges for this technology based on case study examples from California, Florida, and Texas, and 2) interactive geospatial models with a multi-dimensional analysis of desalination trends in the time span 1950-2013 in different regions of the country.
The analysis shows that more than 90% of all desalination plants in the US are small-scale plants with the capacity below 4.31 MGD (million gallons per day). They are mainly located on the US East Coast, as well as in California, Texas, Oklahoma, and Florida. Most of the plants use brackish groundwater, despite their geographical proximity to the sea, which can be explained by economic factors related to brine disposal.
The SWOT analysis and geospatial models can be used both for educational and interdisciplinary research purposes. They are presented as a first step towards a broader socio-economic analysis to determine optimal locations and the largest demand for desalination plants in different regions in the future. The models can also be applied in solving emergency questions related to water shortages.

Zotarelli, Lincoln

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Michael Dukes, Agricultural and Biological Eng. University of Florida
Senthold Asseng, Agricultural and Biological Eng. University of Florida
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Session Title: Agricultural Water and Nutrient Management 1

Nitrogen fertilizer management for potatoes under different irrigation systems

Splitting nitrogen (N) fertilizer application on potato is key to increase tuber yield and nitrogen use efficiency, however, the use of more efficient irrigation systems to replace the conventional seepage system in sandy soil might affect the N rates applied. The study objective was to determine the optimum N fertilizer rates and timing of application to maximize tuber yield and plant growth under seepage, tile drainage, subsurface drip (SDI) and sprinkler irrigation in Florida. A factorial of three N rates applied at planting (Npl) 0, 56 and 112 kg.ha-1 followed by two N rates applied at plant emergence (Neme) and at tuber initiation (Nti) 56 and 112 kg.ha-1 were randomized in a complete block design with four replicates in each irrigation systems in 2015 and 2016. There was no interaction between N fertilizer treatments and irrigation systems. The average volume of irrigation water applied was 292, 169, 145 and 93 mm for seepage, tile drainage, SDI and sprinkler, respectively. The whole plant N uptake efficiency (NUpE) from total N applied was the lowest for seepage (48%) compared to alternative irrigation systems that averaged 60%. Total tuber yield was 32.2, 37.2 34.7 and 33.3 Mg.ha-1 respectively for seepage, tile drainage, SDI and sprinkler irrigation. The application of 56, 112 and 56 kg.ha-1 at Npl, Neme and Nti yielded 29.1 Mg.ha-1 which was similar to higher N fertilizer rate treatments. Alternative irrigation systems reduced the irrigation requirement compared to seepage.

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