GEER 2015

Greater Everglades Ecosystem Restoration

Science in Support of Everglades Restoration

April 21-23, 2015

Coral Springs, Florida USA

www.conference.ifas.ufl.edu/GEER2015

About GEER

Restoration of the Greater Everglades has advanced significantly since the last GEER conference held in conjunction with INTECOL in 2012, and science in support of restoration has become even more important to achieving restoration results. Significant challenges face society's vision for restoration – altered hydrology, degraded water quality, invasions by non-native plants and animals, human development placing pressure on our remaining natural systems, and climate change. Despite these challenges, major restoration projects are planned and/or underway, including increased water storage, bridges on Tamiami Trail to restore flow, water quality improvement, and others. High-quality science relevant to these challenges and restoration efforts are required to provide resource managers and policy-makers with the best information possible. GEER 2015 will provide a valuable forum for scientists and engineers to showcase and communicate the latest scientific developments, and to facilitate information exchange that builds shared understanding among federal, state, local, and tribal scientists and decision-makers, academia, non-governmental organizations, the private sector, and private citizens.

The conference organizers have worked hard to provide an excellent location and conference venue, three full days of plenary and contributed sessions, and opportunities for valuable interaction – all while minimizing travel, lodging, and meeting costs. Thank you for joining us and participating in GEER 2015's dialogue to better understand and inform Everglades restoration!

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Welcome to GEER 2015, the Greater Everglades Ecosystem Restoration (GEER) Science Conference – the premier Everglades science conference since 2000.

Coral Springs, the "city with everything under the sun," provides a convenient and accessible location for this year's event, encouraging wide participation from the south Florida and national Everglades science community.

Restoration of the Greater Everglades has advanced significantly since the last GEER Conference held in conjunction with INTECOL in 2012. Science in support of Everglades restoration – this year's conference theme – has become even more important to achieve and measure. Significant challenges face our vision for restoration: altered hydrology, degraded water quality, invasions by non-native plants and animals, human development placing pressure on our remaining natural systems, climate change, and sea level rise.

Despite these challenges, major restoration projects are planned and/or underway, including increased water storage, bridges on Tamiami Trail to restore flow, expanded water quality projects to clean Everglades water, and others. High-quality science relevant to these challenges and the restoration efforts are required to provide resource managers and policy-makers with the best information possible. GEER 2015 provides a valuable forum for scientists, engineers, managers, and regulators to showcase and communicate the latest scientific developments, and to facilitate information exchange that builds shared understanding among federal, state, local, and tribal scientists, as well as decision-makers, academia, non-governmental organizations, the private sector, and private citizens.

Initiated by the University of Florida-IFAS and the U.S. Geological Survey, GEER has become the preeminent Everglades science conference, bringing together scientists, engineers, natural resource managers, planners, and policy-makers from federal, state, and local government, tribes, academia, non-governmental organizations, industry groups, and the private sector.

GEER 2015 presents a full program over three days – five concurrent sessions of oral presentations, three plenary sessions, and a poster session, all on aspects of Everglades science, representing many disciplines and sectors. The 90-minute plenary sessions begin each day of the conference and focus on three different topics. The first plenary session consists of viewpoints from policy-makers who will highlight the role of science in Everglades restoration and the challenges of communicating that science to decision-makers. The second plenary session occurs on Earth Day, and it encompasses a multi-faceted series of presentations from high-school students enrolled in South Plantation High School's Environmental Science and Everglades Restoration Magnet Program. Expect an inspiring and invigorating session, with demonstrations on solar/engineering topics and precision agriculture, a panel discussion about current Everglades topics, an award-winning BioBlitz rap, and closing with a musical entertainment piece by the school's drama program. The third plenary session provides perspectives from two eminent scientists, discussing institutional lessons learned from large-scale ecosystem restoration and sustainability science dimensions of ecosystem restoration.

We wish to thank the members of the Program Committee, who spent considerable time developing the scientific program, seeking individuals to coordinate dedicated sessions, organizing individually submitted abstracts, and providing overall guidance to the conference.

We also would like to thank our conference sponsors including our Primary Sponsoring Organizations, the United States Geological Survey and the National Park Service; our Premier Level Sponsors, U.S. Fish & Wildlife Service and the South Florida Water Management District; and our Supporting Level Sponsors, Dewberry, the "Ding" Darling Wildlife Society, Eureka Water Probes, Florida International University Southeast Environmental Research Center, and OTT Hydromet. It would not be possible to have a conference of this caliber without their support.

And last, but not least, we also thank Beth Miller-Tipton, Tamar Ditzian, and the skilled staff at the University of Florida's Office of Conferences & Institutes for their work in organizing this year's GEER Conference, as they have all previous years. The exceptional quality of their work is a key reason why GEER has become a much-anticipated and valuable feature of South Florida's science community.

We trust you will take advantage of every opportunity GEER 2015 provides to view posters, visit with exhibiting sponsors, attend program sessions, and make new connections. As Conference Co-Chairs and on behalf of the Program Committee and the Executive Committee, we welcome you to GEER 2015. We're glad you could join us!

Sincerely,

Nick Aumen

Regional Science Advisor,
Southeast Region,
United States Geological Survey

Ramesh Reddy

Graduate Research Professor and Chair,
Soil and Water Science Department,
Institute of Food and Agricultural Sciences (IFAS),
University of Florida

A Tribute to Dr. G. Ronnie "The Very" Best

With deep appreciation for your many years of visionary guidance
and contributions to wetland science and the Everglades,
and for creating the Greater Everglades Ecosystem Restoration Conference.

A prolific researcher and passionate Everglades restoration visionary, Dr. Ronnie Best conceived of the first Greater Everglades Ecosystem Restoration (GEER) Conference over fifteen years ago. As we all gather together again in 2015, it is fitting—if not long overdue—for us to dedicate this conference to him.

Ronnie grew up in Augusta, GA and attended Richmond Academy. He received his BS from Augusta College, and his MS and Ph.D. degrees from University of Georgia. At the time, he was a staunch fan of the Georgia Bulldogs. But everything changed when he accepted a faculty position at the University of Florida, and became a Gator fan. He spent almost two decades at UF, serving as a member of the faculty of the Environmental Engineering Sciences Department and the Director of the Center for Wetlands and Water Resources. Ronnie now has a dual love for The Gators and The Dawgs, and he has lived with this happy contradiction over three decades. Unwilling to have his passion for either school wane, he became a Gator-Dawg to appease his love for both schools, regularly attending football games in a special shirt that showed his equal devotion to both schools.

Dr. Best joined the federal service in 1995 as Branch Chief for the Wetlands Ecology Branch of the USGS National Wetlands Research Center (NWRC) in Lafayette, LA. In 1997, he moved to South Florida to become the Coordinator of the USGS Greater Everglades Priority Ecosystems Science Program.

Still maintaining his connections with the University of Florida, Dr. Best conceived of and initiated the first Greater Everglades Ecosystem Restoration (GEER) Conference in 2000, and served as Organizing Committee Chair of the past 6 GEERs (2000, 2004, 2006, 2008, 2010, and 2012). The primary theme of these conferences was "Planning, Policy and Science," emphasizing the need for cooperation among all groups engaged in Everglades restoration.

Ronnie strongly believed that success of sustainable ecosystem restoration—whether it's for the Everglades, coastal Louisiana, the CALFED Bay Delta, or any other large system—must integrate all three principal components. He expanded his vision on a national level and went on to create NCER – the National Conference on Ecosystem Restoration, bringing restoration professionals together from across all large-scale ecosystems for multidisciplinary discussion and collaboration.

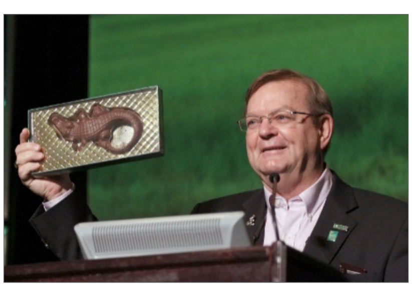
Dr. Best has over three decades of research and teaching experience in the area of ecology, ecological engineering, and wetlands restoration and management, most of which has been in Florida. He has 100+ publications including book chapters, technical reports, and journal publications; he co-edited a book on the Okefenokee Swamp and also co-edited a special issue publication on Biogeochemistry of the Greater Everglades. While at UF, he taught and conducted research on wetlands ecology and ecological engineering, and served as major advisor to over 45 graduate students and on committees for over 120 graduate students. Dr. Best had Courtesy Professor appointments with the University of Florida and the Florida Atlantic University where he served on graduate student committees and occasionally lectured in classes. Ronnie was one of the founding members of the Society for Wetland Scientists and served as President of this professional society.

Ronnie has been married to his lovely bride Sam for almost 49 years, and she has been by his side throughout his career, starting early on in graduate school when they waded together through chest-high water collecting vegetation samples in the Okefenokee Swamp. When Ronnie retired from USGS in 2014, they exchanged their sea level residence in Fort Lauderdale for a mountain view elevation in Hiawassee, GA where they live with their spoiled and fuzzy Yorkipoo babies, Bella & Zoe.

Retirement has not dulled his enthusiasm for the things he holds dear. A proud connoisseur of barbecue, Ronnie still keeps that little black book in his pocket to record his dining experiences at the best BBQ restaurants across the country. And his passion for chocolate? Well, some things never change.

While Ronnie continues to celebrate his retirement with family, football, chocolate and good barbecue, he remains steadfast in his commitment to the planning, policy and science of restoration, and he continues to share his wisdom and experience with large-scale systems restoration professionals. Ronnie has always demonstrated a strong passion for everything he does, and as beneficiaries of his lifelong dedication, we thank him.

Ronnie can be reached at: GatorDawg11@yahoo.com



"We must save the Earth; it is the only planet with chocolate!"

- Dr. G. Ronnie Best

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Gainesville, FL

Dedicated Session Organizer Recognition

Everglades science community professionals were invited to organize sessions on topics relevant to their restoration activities. This process took several months and hundreds of volunteer hours. We would like to thank the following session organizers for their time, efforts, and expertise on behalf of the conference.

1 - **Glenn Landers**, Planning and Policy Division, US Army Corps of Engineers, Jacksonville District, Jacksonville, FL and **David Rudnick**, South Florida Natural Resources Center, Everglades National Park, Homestead, FL

2 - **David Krabbenhoft**, U.S. Geological Survey, Wisconsin Water Science Center, Middleton, WI, **George Aiken**, U.S. Geological Survey, USGS National Research Program, Boulder, CO and **William Orem**, U.S. Geological Survey, Energy and Minerals Program, Reston VA

3 - **Patrick A. Pitts**, U.S. Fish and Wildlife Service, Vero Beach, FL

4 - **James P. Cuda**, University of Florida, Institute of Food and Agricultural Sciences, Gainesville, FL

5 - **Stephanie S. Romañach**, U.S. Geological Survey, Fort Lauderdale FL

6 - **David Rudnick**, South Florida Natural Resources Center, Everglades National Park, Homestead, FL and **Todd Osborne**, The Whitney Laboratory for Marine Bioscience, University of Florida, St. Augustine, FL

7 - **Joel Trexler**, Department of Biological Science, Florida International University, Miami, FL and **Dale Gawlik**, Environmental Science Program, Department of Biological Sciences, Florida Atlantic University, Boca Raton, FL

8 - **Sarah Bellmund**, Biscayne National Park, Homestead, FL and **Sharon Ewe**, Ecology and Environment Inc., Wellington, FL

9 - **Andrew J. LoSchiavo**, U.S. Army Corps of Engineers - Jacksonville District, Jacksonville, FL

10 - **Christa L. Zweig**, South Florida Water Management District, West Palm Beach, FL

13- **Xavier Comas**, Department of Geosciences, Florida Atlantic University, Davie, FL, **Matthew Warren,** USDA Forest Service, Durham, NH and **Brian Benscoter,** Department of Biology, Florida Atlantic University, Davie, FL

14 - **Frank E. Marshall**, Cetacean Logic Foundation, New Smyrna Beach, FL

15 - **Andrew J. LoSchiavo**, U.S. Army Corps of Engineers - Jacksonville District, Jacksonville, FL

16 - **Delia Ivanoff**, South Florida Water Management District, West Palm Beach, FL

17 - **Colin Saunders** and **Fred Sklar**, South Florida Water Management District, West Palm Beach, FL; **Jay Choi and Jud Harvey**, U.S. Geological Survey, Reston, VA

18 - **Mike Duever**, Natural Ecosystems LLC, Naples, FL and **Kim Dryden**, U.S. Fish and Wildlife Service, Naples, FL

20 - **Stephanie S. Romañach**, U.S. Geological Survey, Fort Lauderdale FL

22 - **Thomas Dreschel**, South Florida Water Management District, West Palm Beach, FL and **Leonard Scinto**, Florida International University, Dept. of Earth and Environment and Southeast Environmental Research Center, Miami, FL

23 - **Kelly Keefe**, U.S. Army Corps of Engineers, Jacksonville, FL

24 - **Rebekah E. Gibble**, U.S. Fish and Wildlife Service, A.R.M. Loxahatchee National Wildlife Service, Boynton Beach, FL

25 - **Stephanie S. Romañach**, U.S. Geological Survey, Fort Lauderdale, FL

26 - **Robert Johnson** and **David Rudnick**, South Florida Natural Resources Center, Everglades National Park, Homestead, FL

27 - **Michael S. Ross**, SERC, Department of Earth & Environment, Florida International University, Miami, FL and **Carlos Coronado-Molina,** South Florida Water Management District, West Palm Beach, FL

28 - **Forrest Dierberg**, DB Environmental, Inc., Rockledge, FL, **Paul Julian**, Florida Department of Environmental Protection, Office of Ecosystem Projects, Fort Myers Beach, FL and **Andrew Ogram**, Soil and Water Science Department, University of Florida, Gainesville, FL

30 - **George Aiken**, U.S. Geological Survey, USGS National Research Program, Boulder, CO

31 - **William Orem**, U.S. Geological Survey, Energy and Minerals Program, Reston VA, **David Krabbenhoft**, U.S. Geological Survey, Wisconsin Water Science Center, Middleton, WI, **George Aiken**, U.S. Geological Survey, USGS National Research Program, Boulder, CO and **G. Melodie Naja**, Everglades Foundation, Palmetto Bay, FL

32 - **Jud Harvey**, U.S. Geological Survey, Reston, VA and **Fred Sklar**, South Florida Water Management District, West Palm Beach, FL

33 - **Tony Pernas**, National Park Service, Florida/Caribbean Exotic Plant Management Team, Palmetto Bay, FL

34 - **Stacie Auvenshine**, U.S. Army Corps of Engineers, Jacksonville, FL and **David Rudnick**, South Florida Natural Resources Center, Everglades National Park, Homestead, FL

36 - **Christopher Bernhardt** and **G. Lynn Wingard**, U.S. Geological Survey, Reston, VA

38 - **Patrick W. Inglett**, University of Florida/IFAS, Gainesville, FL and **Alan L. Wright**, University of Florida/IFAS Everglades Research & Education Center, Belle Glade, FL

A Special Thank You to our Sponsors

Without their generous support, this conference would not be possible.

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OTT Hydromet

Pre-Conference Workshop on Invasive Species:

Advances in Research and Management of Invasive Exotic Species in the Greater Everglades Ecosystem

Conducted Monday, April 20, 2015

Nearly 100 participants learned about the latest developments in research and management of invasive exotic species in the Greater Everglades ecosystem.

Background

The Greater Everglades Ecosystem is vulnerable to introduction, establishment, and spread of non-native species because of its subtropical climate, major ports of entry, and the pet, aquarium, and ornamental plant industries. Invasive exotic plants and animals are causing increasing environmental and economic problems in south Florida. The Greater Everglades Ecosystem is imperiled by numerous threats, and is the location of the largest scale ecosystem restoration program in the world. Invasive exotic species may diminish the return on ecosystem restoration investment and threaten ecosystem functions and services, cultural values, recreational opportunities, and economic interests vital to the health of the entire state of Florida. Progress has been made in defining the problem with invasive wildlife, and lessons have been learned from the longer battle with invasive plants.

Workshop Benefits

This workshop provided a forum for the exchange of ideas among researchers and between researchers and managers. At the conclusion of the workshop, attendees gained a better understanding of current issues and emerging trends in invasive exotic species research and management.

Proceedings

Workshop speakers' manuscripts will be submitted for publication in a special, dedicated issue on Everglades Invasive Species in *Southeastern Naturalist* journal.

Workshop Organizers

Frank J. Mazzotti
University of Florida

Michael S. Cherkiss
US Geological Survey

LeRoy Rodgers
South Florida Water Management District

Session Descriptions

Sessions 1 - 40

Please refer to page 8 in this book for information on Session Organizers.

Tuesday, April 21 | Sessions 1-5 | 10:20am – 12noon

1 Sea-Level Rise and Restoration Part I: Understanding and Projections of a Changing Landscape and Seascape

GREAT CYPRESS

The purpose of this session is to synthesize information concerning sea-level rise rates and potential patterns and effects of seawater inundation of the Greater Everglades. The session will present and discuss recent findings that provide insight of how rising sea-levels, concurrent with Everglades restoration efforts, will influence the Greater Everglades in coming decades. The session will focus on physical and geomorphological attributes and dynamics, with considerations of geochemical changes driven by saltwater intrusion. Results from global models of sea level rise and local models of Everglades hydrology that evaluate the interactions of sea level rise and changing hydrology will be explored.

2 Linking Everglades Restoration and Mercury Cycling, Bioaccumulation and Toxicity

ROYAL POINCIANA

Mercury contamination of the Everglades is an ecosystem-wide problem that results from both natural and man-related factors that are both external and internal to the ecosystem, including: climate and extreme events (e.g., droughts and hurricanes), water use and distribution, water quality, agricultural practices, exotic species introduction, and variability in atmospheric mercury loading. This session will summarize the roles of these factors in regulating mercury and methylmercury levels across the Everglades and provide a status update on mercury contamination conditions across the Greater Everglades Ecosystem, with particular emphasis on ties to the restoration program.

3 Biscayne Bay Part I: Assessment of Current and Recent Ecosystem Conditions in Western Biscayne Bay

IBIS

The session will present new information on salinity, submerged aquatic vegetation, epifauna, and mangrove fishes along western Biscayne Bay with a geographic focus in the BBCW Project area. Presentations will include the latest trends on floral and faunal distribution and abundance. Also, an in-depth look at the large macroalgae bloom occurring in northwestern Biscayne Bay will be described.

4 Contribution of Weed Biological Control in Support of Everglades Restoration

EGRET

The explosive growth of invasive weeds in the Everglades has been due in part to the state's unique environment and also the absence of natural enemies that limit the reproduction and spread of these plants. There is general agreement among public and private land managers that biological control is needed to provide an environmentally sustainable and cost effective solution to this problem. The purpose of this session is to showcase several biological control projects and how they are playing a key role in addressing the invasive weeds impacting the Everglades. Presenters will address topics related to biological control of air potato, Brazilian peppertree, cogongrass, lygodium, melaleuca, and tropical soda apple.

5 Snail Kites & Apple Snails

SANDPIPER

The purpose this session is to learn the latest science on the endangered Everglades snail kite, an obligate wetland species which is used as an ecological indicator species to measure the success of Greater Everglades restoration. Snail kite populations declined precipitously before 2010 but have slowly increased since. Theories for the decline included extreme low and high water events, regulation schedule limitations, decline in prey, and low juvenile survival. Recent increases appear associated with an invasion of exotic apple snails. This session will provide the latest scientific findings on this indicator species throughout the Greater Everglades.

Tuesday, April 21 | Sessions 6-10 | 1:20pm – 3pm

6 Sea-Level Rise and Restoration Part II: Ecological Responses and Influences on a Changing Landscape and Seascape

GREAT CYPRESS

This session will present and discuss recent findings that provide insight on how rising sea-levels, concurrent with Everglades restoration efforts, will influence the Greater Everglades in coming decades. In particular, we will examine how salinity and inundation patterns affect plant communities and soils and consequently influence land elevation dynamics and rates of marine transgression. This includes the responses of plant communities and soils, which can influence whether land elevations subside or rise, and consequently alter spatial patterns and rates of saltwater intrusion. The session will explore understanding of such feedbacks, identifying opportunities for adaptive actions to maximize restoration efficacy and slow climate change impacts.

7 Advances in Use of the Trophic Hypothesis to Guide Monitoring and Management of the Everglades

ROYAL POINCIANA

Recovery of historical trophic relationships sustaining apex predators such as wading birds is a fundamental goal of the Comprehensive Everglades Restoration Plan (CERP). The Trophic Hypothesis captures the concept that wading bird nesting success is currently limited by the availability of appropriate prey at densities, water depths, and times when needed for reproduction. The hypothesis identifies key links from the action of managers affecting hydrological variation to primary production which affects production of small fish and crustaceans, to prey concentration, and ultimately to wading bird foraging and nesting success. This session will include talks addressing our increasing understanding of the ecological processes that link management actions to aquatic animals, and ultimately wading bird nesting.

8 Biscayne Bay Part II: Coastal Restoration and Management of Biscayne Bay

IBIS

The purpose of this session is to synthesize the findings from researchers who have been working in Biscayne Bay over the last decade, to identify the state of restoration of the Bay from a hydrological and ecological perspective and to discuss how management practices are shaping our science and understanding. The session also aims to bring to light new issues that are now facing the Bay. Presenters will address topics related to restoration, hydrologic impacts, water quality, management and control of invasive species (e.g. lionfish, coral disease), and factors that contributed to the algal bloom in 2013. These presentations will offer insight into how sea level rise and climate change will affect restoration and management of the Bay and how this work is used in Biscayne Bay management.

9 From Start to Finish: How Hydrology is Linked to Ecology to Plan, Design, Implement, and Operate Restoration Projects to Achieve Success.

EGRET

This session will cover how scientific and technical information is incorporated into each step of the USACE project lifecycle per new SMART (Specific, Measureable, Attainable, Risk Informed, and Timely) planning and adaptive management guidance, using the CEPP (Central Everglades Planning Project) project as the example. It will also cover how hydrological and ecological information is likely to be used to inform detailed design, operations, and reporting of monitoring information to improve implementation.

10 Advanced Technologies in Everglades Ecosystem Restoration

SANDPIPER

A unique system like the Everglades calls for new methods and technologies to monitor and assess restoration possibilities and progress. This session will expose scientists and managers to advanced technologies being used to investigate Everglades ecosystem properties and to monitor restoration. Presenters will address topics within a broad scope of cutting-edge methods and technologies, from molecular to ecosystem-level, and their application to Everglades restoration. These technologies are early in their implementation, and they provide a setting to encourage future collaborative opportunities.

Tuesday, April 21 | Sessions 11-15 | 3:20pm – 5pm

11 Climate Change, Sea Level Rise, and Natural Hazards

GREAT CYPRESS

The purpose of this session is to present the latest information on modeling, monitoring and hindcasting the effects of climate change, sea level rise, and pulsed events such as hurricanes and the associated storm surge on the Greater Everglades Ecosystem. The session will include presentations on hindcasting of historic hurricanes, and the effects of the interaction of sea level and storm events on the coastal zone, coastal forests, and the islands within Florida Bay. The use of satellite data to enhance resolution of water level monitoring within the wetlands and the use of models to reduce uncertainty in groundwater levels as sea level rises will also be highlighted.

12 Aquatic Animals in Restoration

ROYAL POINCIANA

The session examines biotic responses to hydrological modification and to restoration efforts. The session will cover responses by amphibians, fishes and insects. An area of interest is understanding the mechanistic relationships between hydrological drivers and biological responses, in order to better forecast responses to restoration efforts. For example, in the coastal Everglades, research focuses in closely examining how upstream water levels affect fishes across multiple ecological scales, from the behavior of individuals to the ability of the mangrove region to provide recreational fisheries.

13 Carbon Storage and Release in Low Latitude Peatlands

IBIS

The purpose of this session is to highlight research advances in carbon dynamics in low latitude peatland systems, particularly related to carbon storage and release. In their natural state, low latitude peatlands are persistent Carbon sinks and store large amounts of Carbon in soil organic matter. Large uncertainties exist related to Carbon flux rates and processes driving Carbon accumulation and release in low latitude peat soils, particularly linked to spatial and temporal variability in subtropical and tropical peatland systems. Emphasis is given to low latitude systems around the world, including the Florida Everglades.

14 Advances in Hydrology and Salinity Models for Greater Everglades Ecosystem Restoration

EGRET

This session will discuss the formulation and application of forecasting models for hydrology and salinity currently in use for Greater Everglades Ecosystem restoration and the roles that a particular model may serve. Estuarine salinity and the relationships to the variable nature of hydrology, climate, and tide conditions are primary ecosystem drivers in most conceptual ecological models for the coastal Everglades. Hydrology and salinity models are important tools used by ecologists, hydrologists, and water managers to evaluate the expected benefits and impacts of restoration activities. When hydrology/salinity models are coupled with ecological models, the potential future changes in wetland community composition, estuarine water quality, and coastal fisheries can be simulated to evaluate the larger-scale regional effects on the biota of water management activities or alternative management scenarios.

15 Establish Hydrological and Ecological Thresholds to Inform CEPP Adaptive Management Implementation

SANDPIPER

Performance measures exist for many South Florida Ecosystem restoration indicators to support evaluation of end restoration goals. However, incremental ecological thresholds are needed to support adaptive management specific to performance expected from subsets of restoration projects, such as the Central Everglades Planning Project (CEPP). In many cases, predictive models may not be available to help set discriminate thresholds. Other options for establishing thresholds involve applying statistical methods to baseline data (i.e., means for the indicator and associated quartiles or standard error, indices, and aggregations of indices), or use of best professional judgment. Methods and examples of ecological thresholds specific to restoration indicators that will be improved by CEPP will be presented for: 1. Hydrology, 2. Prey, 3. Predators, 4. Soil, and 5. Vegetation and Landscape.

Wednesday, April 22 | Sessions 16-20 | 10:20am – 12noon

16

Everglades Stormwater Treatment Areas: New Scientific Findings and Restoration Strategies Implementation Progress

GREAT CYPRESS

The purpose of this session is to facilitate discussions about the Everglades Stormwater Treatment Areas (STAs), including design and configuration, hydraulics, treatment performance, vegetation management, and latest research. While the STAs have historically been successfully in reducing total phosphorus concentrations and load, new regulatory limits drive the need to further lower the outflow concentrations and sustain the required performance. Presentations will focus on new findings and efforts toward achieving and sustaining lower concentrations at the STA outflows.

17

Flow-Pulse Drivers of Aquatic Ecosystem Restoration - Findings from the Decomp Physical Model

ROYAL POINCIANA

This session will highlight the effects of sheetflow and canal-backfilling on hydrology, water quality, sediment transport, and fish populations in the ridge and slough landscape, as documented in the Decomp Physical Model (DPM). It will also discuss the extent to which restoring historic levels of sheetflow has so far restarted the critical process of sediment redistribution (i.e., scouring sloughs and building ridges) and potentially altered water quality and nutrient cycling. The effects of flow and backfilling on fish populations as well as hydrologic and sediment dynamics in canal treatments and surrounding marshes will also be highlighted.

18

Construction Management Challenges of a Landscape-Scale Restoration Project (Picayune Strand Restoration Project)

IBIS

The purpose of this session is to describe the resource, habitat management, landscape, and organizational challenges that have occurred during the ongoing construction of the 55,000-acre Picayune Strand Restoration Project (PSRP). It will present "lessons learned" from 11 years of ongoing construction of the Picayune Strand Restoration Project that affected fish and wildlife resources, hydrology, planning and operations, exotic and nuisance plant control, and site habitat management. The session will demonstrate how planning and persistent implementation of resource protection strategies reduces construction and operational costs, delays, and conflicts. It will also be informative for construction planning of new CERP projects.

19

Wetland Birds

EGRET

This session provides recent findings on the ecology and conservation of wetland birds in the Greater Everglades Ecosystem. Talks in this session examine the direct response of birds to restoration activities, as well as their response to hydrologic processes affected by restoration. In addition, this session will present large scale movement patterns of wood storks and nesting patterns of bald eagles and ospreys in the coastal Everglades.

20

Ecological Models and Tools for Everglades Restoration Planning, Parts I & II

SANDPIPER

Many ecological models have been developed in the Everglades to help forecast potential species and habitat impacts as a result of proposed restoration plans. The purpose of this session is to learn about ecological models and tools that have been developed for Everglades restoration planning. Ecological models are needed for the evaluation and assessment of alternative plans to restore the Greater Everglades ecosystem. These sessions will showcase ecological models for several species and habitats of concern in the Everglades as well as modeling tools developed for use during restoration planning. A number of desktop and web-based tools have been developed, working alongside users and decision makers, to make these models and their outputs more accessible to end-users.

Wednesday, April 22 | Sessions 21-25 | 1:20pm – 3pm

21 STAs and EAA Water Quality

GREAT CYPRESS

Since the last GEER conference, several state and federal projects have been implemented or are under consideration. Challenges will be presented while examining the sources of phosphorus reaching the Stormwater Treatment Areas (STAs). Phosphorus loadings from the Everglades Agricultural Area (EAA) farms, the role of aquatic vegetation in EAA canals, and canals acting as phosphorus sink or source will be discussed. Once the challenges are highlighted, the rest of the session will mainly focus on investigating opportunities and current projects to improve the performance of the STAs. The two major plans that will be discussed throughout the session are the State Restoration Strategies and the Federal Central Everglades Planning Project (CEPP).

22 Everglades Hydrology, Peat Accretion and Loss: Effects on Carbon Exchange and Water Retention

ROYAL POINCIANA

The purpose of this session is to highlight peat/soil processes in the Everglades ecosystem. The session will focus on the impacts of various environmental factors, especially regarding variations in hydrology, on the soils of the Everglades. The properties and processes of Everglades soils will be examined using various tools ranging from mechanistic determination to landscape-scale geospatial analysis. An overview of methods used and the results of these investigations will be described. The focus will largely be on carbon dynamics and other soil characteristics critical to landscape restoration.

23 Ecosystem Services and Everglades Restoration: Moving Forward with Case Studies and Tools that Integrate Ecosystem Services into Decision Making

IBIS

The purpose of this session is to provide current examples of ecosystem services assessments and tools that have or could influence decision making in restoration of the greater Everglades ecosystem. The session will focus on successful examples, tools/methods, and progress in strategically prioritizing an integrative ecosystem services approach to restoration. Case studies and emerging tools will be shown, with study results of a cross-comparison of agencies' progress in incorporating ecosystem services.

24 Science and Habitat Management in the A.R.M. Loxahatchee National Wildlife Refuge: 13th Annual Loxahatchee Science Workshop

EGRET

This session will consist of presentations by invited speakers and Arthur R. Marshall Loxahatchee National Wildlife Refuge (ARMLNWR) staff. Specific topics will include management of the refuge's ridge and slough habitat, exotic species control and status within ARMLNWR and surrounding areas, and ongoing research as it relates to local and system-wide management issues (e.g., water quality, hydrology, multi-species management).

25 Ecological Models and Tools for Everglades Restoration Planning, Parts I & II

SANDPIPER

Many ecological models have been developed in the Everglades to help forecast potential species and habitat impacts as a result of proposed restoration plans. The purpose of this session is to learn about ecological models and tools that have been developed for Everglades restoration planning. Ecological models are needed for the evaluation and assessment of alternative plans to restore the Greater Everglades ecosystem. These sessions will showcase ecological models for several species and habitats of concern in the Everglades as well as modeling tools developed for use during restoration planning. A number of desktop and web-based tools have been developed, working alongside users and decision makers, to make these models and their outputs more accessible to end-users.

Thursday, April 23 | Sessions 26-30 | 10:20am – 12noon

26 Everglades Restoration Progress: Assessing the Effects of Modified Water Deliveries on Northern Shark River Slough

GREAT CYPRESS

The purpose of this session is to consider the challenges and prospects for restoration success associated with the Modified Water Deliveries Project. The Modified Water Deliveries (MWD) Project is a crucial precursor of CERP, and especially for its Central Everglades project. With completion of the MWD structures, including a one-mile bridge on Tamiami Trail, operational testing is about to begin. This session will summarize the history, goals, and status of this project and synthesize the ecological status and trends of the Everglades system downstream of Tamiami Canal structures. The session will also present plans for assessing ecological responses to MWD implementation.

27 Tree Island Ecology: Advances on Ecological Restoration

ROYAL POINCIANA

The purpose of this session is to synthesize our current understanding of the physical and biochemical processes contributing to tree island dynamics within the Greater Everglades Ecosystem. Specifically, this session will focus on talks discussing topics such as plant responses to hydrology variability, anthropogenic hydrologic manipulations, stochastic disturbances (i.e. hurricanes, frost, etc.), and climate change in the context of ecosystem restoration. Data integration and synthesis will be presented to provide managers and stakeholders information on the long-term trajectory of tree islands within the greater Everglades ecosystem. Panel discussions at the end of the scientific presentation will address the challenges of integrating tree island restoration and management in view of global climate change.

28 Mercury Cycling, Transport, and Effect in the Everglades

IBIS

The purpose of this session is to focus on one of the most critical issues facing the successful implementation of an Everglades restoration program: high concentrations of methylmercury (MeHg) in fish and wildlife. Recent research on the sources, transformations, and bioaccumulation of MeHg in the Everglades will be presented. Source controls for sulfate (a required electron acceptor for sulfate reducing bacteria, one of the dominant groups of methylating bacteria) and inorganic mercury (the precursor substrate for MeHg) have been proposed as a means of mitigating net mercury methylation. Presenters will address topics related to the complex and interwoven biogeochemical factors that influence the methylation of Hg, and which makes the implementation of effective regulator measures particularly challenging.

29 Coastal Marine Ecology

EGRET

This session provides models, characterizations, and comparisons of the ecology and water quality of coastal lakes, wetlands and bays in the Greater Everglades Ecosystem. Talks in this session will examine the variability of phytoplankton, oysters, submerged aquatic vegetation and nutrients as a function of anthropogenic change, water management, restoration and sea level rise. Models to identify times of greatest change in Florida Bay and to understand the water quality processes for a constructed wetland will be presented. In addition, this session will describe the development and utility of a coastal drought index for sites along the Gulf of Mexico and Florida Bay.

30 Organic Matter, Carbon Cycling and Water Quality in the Greater Everglades Ecosystem

SANDPIPER

Organic matter and carbon cycling are master variables controlling many processes of interest in the Greater Florida Everglades. At the most basic level, the carbon cycle is at the center of all life-sustaining processes and tightly related to hydrology and the cycles controlling phosphorous, nitrogen, and sulfur. The chemical and biological processes driving carbon cycling in the Everglades are critical for water quality, and the fates of pollutants and greenhouse gases (e.g. carbon dioxide and methane). This session addresses all aspects of carbon cycling and the chemistry and fate of both dissolved and solid phase organic matter in the Everglades ecosystem.

Thursday, April 23 | Sessions 31-35 | 1:20pm – 3pm

31 Sulfur in the Greater Everglades Ecosystem – Sources, Cycling, Fate, Biogeochemistry, and Impacts

GREAT CYPRESS

Sulfur is a key contaminant in the Greater Everglades, fundamentally altering ecosystem biogeochemistry through stimulation of microbial sulfate reduction. Perhaps the biggest impact of sulfur loading (mostly as sulfate) on the Everglades is as a major control on mercury methylation in the ecosystem, but other impacts include: increased carbon cycling in organic soils, sulfide control on metal ion solubility, sulfide toxicity, and internal eutrophication. The session will focus on all aspects of sulfur biogeochemistry in the Everglades, including sources, cycling, fate, transport, and impacts. The effects of climate change and ecosystem restoration on sulfur loading and ecosystem impacts of sulfur are also of interest in this session.

32 Modeling the Incremental Value of Restored Flow to Everglades Ecology

ROYAL POINCIANA

The Everglades is valued for freshwater and ecological resources that support a highly valued combination of densely vegetated marsh and tree islands habitats interspersed with well-connected deepwater sloughs that maintain pathways for fish migration and feeding areas for wading birds. A century of water management has substantially threatened water quality, and changed hydroperiods, water flow, vegetation community composition, and ground surface (due to peat subsidence). This session examines the latest results from integrated analyses of flow restoration and predicted ecological outcomes of restoration. Presentations emphasize predictions of the level of Everglades ecosystem functionality achieved for a given investment in restoration across a spectrum of scenarios ranging from no plan to full decompartmentalization.

33 Invasive Species Monitoring in the Florida Everglades

IBIS

The purpose of this session is to provide an overview of current monitoring and mapping programs for invasive plant and animal species in the Florida Everglades and to explore opportunities to expand and integrate these programs with restoration and land management efforts. Presentations will discuss a wide range of taxonomic groups, including plants, fish, and reptiles, that cover monitoring strategies at different stages of the invasion process—newly detected through widely established populations. Presenters will address topics related to monitoring design for difficult to detect species and large landscapes, rapid response monitoring to facilitate potential eradication of newly established species, and utilization of monitoring data to predict invasion patterns.

34 Florida Bay Restoration: Ecosystem Status, Trends, and Responses

EGRET

The purpose of this session is to describe recent research and monitoring findings in Florida Bay and adjacent saline wetlands, with a focus on initial responses to Comprehensive Everglades Restoration Plan's C-111 Spreader Canal Western Project (C-111 SCWP) implementation. The session will present the latest information on freshwater flow, water quality, seagrasses, juvenile sportfish, and roseate spoonbills and their prey-base in and adjacent to Florida Bay. Long-term and short-term trends in Florida Bay flora and fauna will also be highlighted.

35 Biogeochemistry

SANDPIPER

This session will provide an update on the most recent research, monitoring, and synthesis of biogeochemical processes that have important ramifications for ecosystem status and restoration. These biogeochemical processes are often overlooked when focusing on hydrologic restoration of the Everglades, but can affect important ecosystem attributes such as primary productivity (plants and diatoms) and trophic interactions (fish, birds, and alligators). This session will cover both the mechanisms of phosphate regulation in groundwater and phosphorus distribution in surface water as it relates to modeling. Mercury (Hg) and other toxic metals will also be discussed to understand sources, controlling factors, and implications on risk of exposure in the Everglades. An example ecological risk assessment of multiple nutrient and contaminant effects related to regional Aquifer Storage and Recovery will also be presented. Finally, details on environmental variation will be presented to explain benthic diatom spatial and temporal diversity.

Thursday, April 23 | Sessions 36-40 | 3:20pm – 5pm

36 Multi-Decadal to Millennial-Scale Proxy Records of Sea-Level Rise and Climate Change in the Everglades: How Past Variability Informs Restoration Management

GREAT CYPRESS

Long-term proxy records reconstructing past climate and sea level are the primary means of understanding the physical drivers that have influenced the Everglades over the past centuries to millennia. Because these records capture past intervals of drought and rapid sea level rise, they provide the context to evaluate forecasted ecosystem responses to a range of future climate scenarios and current anthropogenic stressors. Integration of proxy records into restoration planning increases the likelihood of achieving sustainable ecosystem function. The session will focus on contributions from research documenting the rate and magnitude of past climate and sea-level changes and their ecological impacts.

37 Restoration Planning and Decision-Making

ROYAL POINCIANA

The purpose of this session is to describe recent research and monitoring findings for restoration planning and decision making. The session will present information discussing the new natural system model, carbon sequestration in mangroves, natural resource conditions in the NPS in south Florida, 15 years of National Academies of Science reviews, and bridging science and technology with various tools. Some of the policy discussion will involve a digital visualization tool depicting long term effects of phosphorus on the ridge and slough landscape.

38 Enzymes: Functions and Use as Indicators of Change in Everglades Systems

IBIS

The purpose of this session is to discuss the findings from available studies on various enzymes related to carbon, nitrogen, phosphorus, and sulfur cycling in Everglades systems, and to highlight the past lessons and potential future role of enzymes as sensitive indicators of biogeochemical changes. This session will feature talks from leading experts with past and current research dealing with measurement of enzyme activities and their interpretation in Everglades systems. Enzymes related to the major elemental cycles in the Everglades (C, N, P, S) will be presented, as well as studies from a range of Everglades systems (northern agricultural systems, storm water treatment areas, water conservation areas, and Everglades National Park).

39 Invasive Species

EGRET

This session covers recent findings on the biology of invasive select animals and plants in South Florida. The species examined include the black and white tegu, Burmese python, purple swamphen, apple snail, and redbay and laurel wilt. The session focuses on questions related to behavior, habitat use, and diet, as well as disease resistance in trees.

40 Hydrology

SANDPIPER

This session on hydrology provides models and data that describe flows, hydroperiods, water quality, and microtopography in the ridge-slough landscapes of the Greater Everglades Ecosystem. Talks in this session will examine the influence of ridge heights, roads, water management, and proposed bridges on the hydrological variability of the landscape. In addition, this session provides flow monitoring data along U.S. 41, a discussion of the historical patterns of water movement in Northeast Shark River Slough, and a quantification of evaporation rates from Lake Okeechobee using the Bowen ration method.

Biographies

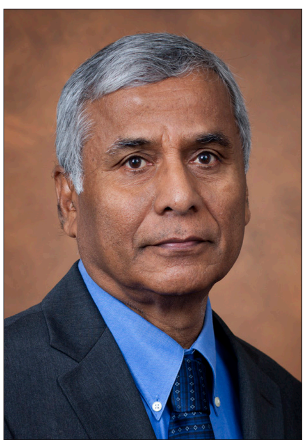
Conference Chairs & Plenary Speakers

CONFERENCE CHAIRS

Nick Aumen, GEER 2015 Conference Co-Chair

Regional Science Advisor - South Florida, United States Geological Survey

Nick Aumen is Regional Science Advisor for the US Geological Survey (Southeast Region), overseeing the Greater Everglades Priority Ecosystem Sciences program. This program, involving USGS scientists nationwide, provides high quality science in support of Everglades restoration. Nick was an aquatic ecologist for 15 years with Everglades National Park, leading an interagency team of scientists tracking restoration progress. Prior to his National Park Service position, Nick was the Research Director at the South Florida Water Management District, directing a team of 120-plus scientists conducting research in support of ecosystem restoration. Nick received his B.S. and M.S. in biology at the University of West Florida, and his Ph.D. in microbial ecology at Oregon State University. He was a faculty member in the Biology Department at the University of Mississippi, and was a tenured Associate Professor of Biology when he returned to Florida. Nick presently is an affiliate faculty member at Florida Atlantic University (Department of Geosciences), and at the University of Florida (Soil and Water Science Department). He also served 5 years on the national Board of Directors of the Sierra Club, a 120-yr-old environmental organization with more than 750,000 members, and served two terms as its Vice-President and one as Treasurer.



K. Ramesh Reddy, GEER 2015 Conference Co-Chair

Chair, University of Florida/IFAS Soil and Water Science Department

Dr. K. Ramesh Reddy is graduate research professor and chair of the Soil and Water Science Department at the University of Florida. He holds a Ph.D. in soil science with specialization in biogeochemistry from Louisiana State University. He conducts research on coupled biogeochemical cycling of nutrients and other contaminants in wetlands and aquatic systems, as related to water quality, carbon sequestration, ecosystem productivity, and restoration. He has worked on Florida's wetlands and aquatic systems for more than 35 years. Dr. Reddy established an interdisciplinary program on biogeochemistry of wetlands and aquatic systems, through the Wetland Biogeochemistry Laboratory (WBL) established within the SWSD. Since its establishment in 1987, the WBL has provided a home for graduate students from various disciplines, postdoctoral associates and visiting scientists. Examples of teaching, research, and extension activities of the WBL can be seen at the web site: www.soils.ifas.ufl.edu/wetlands. He has served on numerous advisory committees at state, national, and international levels. He has served on the National Research Council Committee on Soil Science and the Committee on Independent Scientific Review of Everglades Restoration Progress. He also served on several U.S. Environmental Protection Agency committees including the Science Advisory Board Ecological Effects Committee, Wetland Connectivity Panel, and Lake Erie Phosphorus Objective Panel.

PLENARY SPEAKERS

Don Boesch

President, University of Maryland Center for Environmental Science

Donald F. Boesch is a Professor of Marine Science and President of the University of Maryland Center for Environmental Science and University System of Maryland's Vice Chancellor for Environmental Sustainability. He earned his B.S. in biology at Tulane University and Ph.D. in oceanography at the College of William and Mary. Don has conducted ecological and oceanographic research on coastal and continental shelf ecosystems along the Atlantic Coast, and in the Gulf of Mexico, eastern Australia, and the East China Sea. He is a past-chairman of the Ocean Studies Board of the National Research Council was appointed by President Obama to the National Commission on the BP Deepwater Oil Spill and the Offshore Drilling. Don has forty years of experience in the application of science in ecosystem restoration, including in the Chesapeake Bay, the Florida Everglades and Coastal Louisiana.

Shannon A. Estenoz

Director, Office of Everglades Restoration Initiatives, U.S. Department of the Interior

As the Director of Everglades Restoration Initiatives for the US Department of the Interior, Shannon Estenoz is the Interior Secretary's representative in Florida on Everglades restoration issues. Shannon coordinates the Department's restoration efforts and is the Executive Director of the South Florida Ecosystem Restoration Task Force. Shannon's Everglades career spans seventeen years including roles as Executive Director of the Environmental & Land Use Law Center, Everglades Program Director of the World Wildlife Fund, three terms as National Co-Chair of the Everglades Coalition, and Sun Coast Regional Director of the National Parks Conservation Association. Shannon served on Governor Chiles' Commission for a Sustainable South Florida and Governor Bush's Commission for the Everglades. Governor Crist appointed Shannon to the Governing Board of the South Florida Water Management District where she served as Vice Chair of the Governing Board, Chair of both the Water Resources Advisory Commission and the Broward Water Resources Task Force, and as a member of the Broward Board of County Commissioners Water Advisory Board.

Shannon received a 2001 National Wetland Award from the Environmental Protection Agency; Conservationist of the Year awards in 2002, 2003, and 2009 from the Florida Wildlife Federation, the Arthur R. Marshall Foundation, and Everglades Coalition respectively; the 2010 Marjory Stoneman Douglas Environmental Award from Friends of the Everglades; and the 2010 Champion of the Everglades Award from Audubon of Florida. Shannon is a fifth generation native of Key West and holds degrees in international affairs and civil engineering from Florida State University.

Jennifer Gimbel

Principal Deputy Assistant Secretary for Water & Science,
U.S. Department of the Interior

Jennifer Gimbel was named Water & Science's Principal Deputy on October 1, 2014. In this capacity, Gimbel oversees water and science policy for the Department and has responsibility for the U.S. Bureau of Reclamation and the U.S. Geological Survey. She administers the National Land Imaging Program, the nation's longest sequential moderate-resolution satellite imaging program provided by the Landsat series of satellites, now hosted by USGS. Gimble also provides hands-on leadership on Colorado River issues and is the Secretary's designee to, and Chair of, the Glen Canyon Dam Adaptive Management Work Group.

Gimble was Deputy Commissioner for the Bureau of Reclamation and managed Reclamation's congressional, legislative and public affairs activities. She was also the executive responsible for Reclamation's national relationships with federal, state and local governments, as well as citizen organizations and other nongovernmental groups.

Gimbel returned to Reclamation after serving as Counselor to the Assistant Secretary for Water and Science at the Department of the Interior where she focused on legislative and legal matters, concentrating on issues regarding the Rio Grande, Salton Sea, California Bay Delta, and the Clean Water Act.

She came to Interior in 2013 after serving five years as Director of the Colorado Water Conservation Board which is the water policy agency for the State of Colorado. As Director, she carried out policies and directives of a citizen board and the administration relating to the conservation, development and utilization of the state's water resources. She represented Colorado in several interstate activities, including being the Governor's representative on the Colorado River and as one of his appointees to the Western States Water Council.

Gimbel previously worked at Reclamation from 2001 until 2008 on a variety of policy and program issues including serving as Chair of the Secretary's Indian Water Rights Working Group. Program areas included operation and maintenance, deferred maintenance, the Water Conservation Field Services Program, drought, hazardous waste, invasive species, water management and planning, and other issues.

Gimbel's career also includes experience with the Colorado Attorney General's office and the Wyoming Attorney General office, where she advised and represented the Attorney General and other state officials regarding interstate water matters, water law and administrative law.

She has a Bachelor of Science and Juris Doctorate from the University of Wyoming and a Master of Science from the University of Delaware.

Suzette Kimball

Director, Acting, Office of the Director, United States Geological Survey

Dr. Kimball is responsible for leading the Nation's largest water, earth, and biological science, and civilian mapping agency. Prior to becoming the Acting Director, Dr. Kimball was the USGS Deputy Director. In 2008, she became the Acting Associate Director for Geology, and prior to that was the Director of the USGS Eastern Region, starting in 2004. She joined the USGS as Eastern Regional Executive for Biology. In that position, she built many partnerships, helped shape programs, and led the establishment of the USGS Florida Integrated Science Center. She came to the USGS from the National Park Service in Atlanta, where she was Associate Regional Director.

She entered the National Park Service as a research coordinator in the Global Climate Change Program, became Southeast Regional Chief Scientist, and then Associate Regional Director. She was assistant professor of environmental sciences at the University of Virginia, co-director of the Center for Coastal Management and Policy and marine scientist at the Virginia Institute of Marine Science, and managed coastal morphology and barrier island studies in the U.S. Army Corps of Engineers.

She serves on executive boards and many State and national committees, including the Consortium for Coastal Restoration through Science & Technology, the Council of Examiners of the National Association of State Boards of Geology, and the DOI Senior Executive Service Advisory Council. She was on the board of directors of the Coastal Society and has served as secretary of the American Geophysical Union's Ocean Sciences Section.

She has authored numerous publications on barrier island dynamics, coastal ecosystem science, coastal zone management and policy, and natural resource exploration, evaluation, and management. She has received the Presidential Rank Award and the Secretary of the Interior's Meritorious Service Award.

Dr. Kimball has a doctorate in environmental sciences with a specialty in coastal processes from the University of Virginia, a master's in geology and geophysics from Ball State University, and a bachelor's in English and geology from the College of William & Mary.

Jack M. Payne

Senior Vice President for Agriculture and Natural Resources,
University of Florida, Institute of Food and Agricultural Sciences (IFAS)

Jack Payne is the Senior Vice President for Agriculture and Natural Resources at the University of Florida and the Administrative Head for the Institute of Food and Agricultural Sciences. Prior to his current position he served as a Vice President at Iowa State University, and, previous to Iowa State, he was a Vice President and Dean at Utah State University. Jack also has experience at two other land-grant institutions: Pennsylvania State University, where he served on the faculty of the School of Forest Resources, and, later, at Texas A&M University, where he served as a faculty member in the Fisheries and Wildlife Department.

After leaving Texas A&M University, Payne had a long career with Ducks Unlimited (DU), as their National Director of Conservation. While at Ducks Unlimited, some of his successes included the development of DU's private lands program with agriculture, the development of a national conservation easement program and the expansion of their Mexican program to Central and South America.

Payne received his M.S. in Aquatic Ecology and his Ph.D. in Wildlife Ecology from Utah State University and is a graduate of the Institute for Educational Management at Harvard University. He is a tenured professor in the Department of Wildlife Ecology and Conservation at the University of Florida.

Colin Polsky

Director, Florida Atlantic University (FAU), Center for Environmental Studies

Dr. Colin Polsky joined the Florida Atlantic University faculty as Professor of Geosciences in August 2014. His primary responsibility is to Direct the Florida Center for Environmental Studies. Under Dr. Polsky's leadership, CES has embraced a new vision that builds on past successes while expanding into new domains.

Dr. Polsky is an environmental social scientist, specializing in the Human Dimensions of Global Environmental Change. His research examines U.S. climate vulnerabilities, in both methodological and applied terms. He has completed four degrees in four disciplines, plus a two-year postdoctoral training in a fifth field: mathematics, humanities, French, geography, and Science & International Affairs. Polsky's NSF grants total close to $18M of which $1.7M has been directed to his stewardship. His publications include 27 peer-reviewed articles, 2 co-authored books, 18 book chapters, and 12 other reports. Polsky has served as co-Convening Lead Author for a chapter in the 2013 National Climate Assessment, served on NRC, NSF, and USGCRP committees, and prepared reviews for several IPCC reports.

Polsky's administrative experience includes 8 years as Director of a University undergraduate research program, 1.5 years as Associate Dean, and 1 year on an elected governance board. These experiences have led to significant experience with university leadership and program-building; fund-raising from public and private foundations; staffing of diverse and multi-generational teams; and communicating with varied audiences, for both persuasive and reporting purposes.

Plenary Session Overviews

Tuesday, April 21, 2015 | 8:30am - 10:00am | *Opening Plenary*

Science, Policy, and Decision-Making for Everglades Restoration

Plenary Speakers:

- ***Welcome***
  K. Ramesh Reddy, Chair, IFAS Soil and Water Science Department, University of Florida; GEER 2015 Co-Chair
- ***Introduction***
  Jack Payne, Senior Vice President for Agriculture and Natural Resources, University of Florida, Institute of Food and Agricultural Sciences (IFAS)
- ***A Federal Policy Perspective***
  Jennifer Gimbel, Assistant Secretary for Water and Science, Department of the Interior
- ***USGS Science in Support of Everglades Restoration***
  Suzette Kimball, Acting Director, United States Geological Survey
- ***Science Communication to Managers: Harmony, Cacophony, and Everything in Between***
  Shannon Estenoz, Director of Everglades Restoration Initiatives, Department of the Interior

Session Moderator:

- **Nick Aumen**, Regional Science Advisor – South Florida, United States Geological Survey; GEER 2015 Chair

Wednesday, April 22, 2015 | 8:30am - 10:00am | *Earth Day Plenary*

Future Environmentalists from South Plantation High School Pay It Forward

South Plantation High School's Environmental Science and Everglades Restoration Magnet Program has allowed students to discover academic and real-world environmental issues on an accessible scientific level. With a foundation in science and research, the Magnet program encourages students to engage in the community through technological advancement, environmental education, and service learning, offering students new ways of learning and understanding these matters. Continuous exposure to the pristine Everglades provides a strong catalyst for our students' development into life-long earthly stewards.

During this Earth Day plenary session, witness how South Plantation High School connects to the Everglades through a real-time experience. The session's program will include the following student presentations:

- The **Solar/Engineering** Division will demonstrate how a high school student has the opportunity to live the "Green Life" with a focus on alternative energy, which connects to South Plantation High School's Environmental Science culture.
- We will also show how **Precision Agriculture** in the form of drone technology, infrared mapping and Arduino moisture sensors may save Florida's water systems.
- The **ER (Everglades Restoration) Ambassadors** will be featured in a Panel Discussion. The ER is a service learning educational outreach club that informs the community about the importance of preserving the Everglades, the impacts of climate change and invasive species, the importance of conserving water, and other environmental issues that plague South Florida.
- The **Fairchild Challenge** competition team will bring to light the advantages and disadvantages of pesticides through short skits, and the topic of biodiversity will be presented through an award-winning BioBlitz rap.
- South Plantation High School's extraordinary **Drama Program** will close the plenary session with a musical entertainment piece.

We encourage you to join us for this unique opportunity to engage on today's Everglades issues with tomorrow's environmentalists.

Thursday, April 23, 2015 | 8:30am - 10:00am | *Closing Plenary*

Science in Support of Everglades Restoration

Plenary Speakers:

- ***Institutional Scientific Challenges in Large-Scale Ecosystem Restoration***
  Don Boesch, President, Center for Environmental Science, University of Maryland
- ***Using a Sustainability Science Frame to Advance Ecosystem Restoration***
  Colin Polsky, Director, Center for Environmental Studies, Florida Atlantic University

Session Moderator:

- **Nick Aumen**, Regional Science Advisor – South Florida, United States Geological Survey, GEER 2015 Chair

GEER 2015

Program Agenda and Schedule of Oral Presentations

MONDAY	***Monday, April 20, 2015***
10:00am-5:00pm	**OPTIONAL: Invasive Species Workshop in Ibis & Egret**
3:00pm-6:00pm	Conference Registration Opens and Poster Presenters Install Displays
5:30pm- 7:00pm	Networking Social on Breeze's Terrace
TUESDAY	***Tuesday, April 21, 2015***
7:00am-8:30am	**Morning Refreshments in Poster Hall**
8:30am-10:00am	**Opening Plenary Session in Great Cypress & Royal Poinciana**
8:30am-10:00am	***Science, Policy, and Decision-Making for Everglades Restoration*** **Moderator: Nick Aumen, Regional Science Advisor - South Florida, United States Geological Survey** **<u>Welcome and Introductions</u>** **K. Ramesh Reddy**, Graduate Research Professor and Department Chair of University of Florida Soil and Water Science Department **Jack Payne**, Senior Vice President for Agriculture and Natural Resources, University of Florida, Institute of Food and Agricultural Sciences (IFAS) **<u>Presentations</u>** **Jennifer Gimbel**, Assistant Secretary for Water and Science, Department of the Interior ***A Federal Policy Perspective*** **Suzette Kimball**, Acting Director, United States Geological Survey (USGS) ***USGS Science in Support of Everglades Restoration*** **Shannon Estenoz**, Director of Everglades Restoration Initiatives, Department of the Interior ***Science Communication to Managers: Harmony, Cacophony, and Everything in Between***
10:00am-10:20am	**AM Break in Poster Hall**

TUESDAY	Tuesday, April 21, 2015				
10:20am-12noon	Concurrent Sessions				
Location	**Great Cypress**	**Royal Poinciana**	**Ibis**	**Egret**	**Sandpiper**
	Session 1	**Session 2**	**Session 3**	**Session 4**	**Session 5**
	Sea-Level Rise and Restoration Part I: Understanding and Projections of a Changing Landscape and Seascape	**Linking Everglades Restoration and Mercury Cycling, Bioaccumulation and Toxicity**	**Biscayne Bay Part I: Assessment of Current and Recent Ecosystem Conditions in Western Biscayne Bay**	**Contribution of Weed Biological Control in Support of Everglades Restoration**	**Snail Kites & Apple Snails**
Moderator	**Glenn Landers**	**David Krabbenhoft**	**Patrick Pitts**	**James Cuda**	**Stephanie Romañach**
10:20am	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
10:30am	**Jayantha Obeysekera** An Overview of Global and Regional Sea-Level Rise Projections	**George Aiken** The Influences of Dissolved Organic Matter on Mercury Cycling in the Florida Everglades	**Sarah Bellmund** Salinity Patterns and Trends in Western Biscayne Bay	**Min Rayamajhi** Biological Control of *Melaleuca quinquenervia* in Southern Florida	**Kenneth Meyer** Snail Kite Satellite Telemetry Reveals Large-Scale Movements and Concentrated Use of “Peripheral” Wetlands for Habitat Management, Population Monitoring, and Exposure to Toxins
10:45am	**Frank Marshall** Sea-Level Rise and Climate Change at the Coastal Boundary: Observations, Projections, and Issues of Concern for Resource Management	**Michael Tate** An Examination of the Net Methylmercury Production in the Florida Everglades using a Eulerian Approach	**Diego Lirman** SAV Communities of Western Biscayne Bay, Miami, Florida, USA: Human and Natural Drivers of Seagrass and Macroalgal Abundance and Distribution	**Julio Medal** Biological Control of Tropical Soda Apple, *Solanum viarum* (Solanaceae) in Florida: A Successful Project	**Robert Fletcher** The Demographic Causes of Population Growth and Decline in the Snail Kite
11:00am	**Jack Cosby** Analysis of Sea-Level Rise and Climate Change Scenarios for Florida Bay using the Fathom Model	**Morgan Maglio** Drivers of Geospatial and Temporal Variability in the Distribution of Mercury and Methylmercury in the Everglades National Park	**Gladys Liehr and Joan Browder** Biscayne Bay Alongshore Epifauna- Indicators of Ecosystem Change	**Ellen Lake** Biological Control of *Lygodium microphyllum*	**Tyler Beck** Managing Habitat for the Everglade Snail Kites (*Rostrhamus sociabilis plumbeus*) on Central Florida Lakes
11:15am	**Eric Swain** Effects of Sea-Level Rise and Water Management on the Hydrologic Impact of Historic Storms	**Darren Rumbold** Trophic Transfer of Mercury Along Salinity Gradients in Shark River and Caloosahatchee River Estuaries	**Joseph Serafy** CERP and Killifish Habitat in Biscayne Bay’s Littoral Zone	**Eric Rohrig** Biological Control of Air Potato, *Dioscorea bulbifera,*in Florida	**Philip Darby** Evaluating Snail Kite Prey Availability Benchmarks in the Kite Habitat Network
11:30am	**René Price** Phosphorus Release from the Biscayne Aquifer with Sea-Level Rise	**Kristen Hart** Mercury Bioaccumulation in Pythons from the Greater Everglades	**Ligia Collado-Vides** Nutrients as a Potential Source to Sustain a Persistent Bloom of Anadyomene J.V. Lamaroux *(Anadyomenaceae, Chorophya)* in Biscayne Bay Florida	**William Overholt** Prospects for Classical Biological Control of Cogongrass	**Christopher Cattau** Effects of the Exotic Apple Snail (*Pomacea maculata*) on Snail Kite Behavior and Demography
11:45am	**Glenn Landers** Potential Sea Level Change Impacts within the Shark River Slough Basin Area	**Ted Lange** Fish Mercury in the Florida Everglades: Management Implications for Everglades Restoration	**Christian Avila** Spatial and Temporal Trends of a Multi-Year Macroalgal Bloom	**James Cuda** Recent Advances in Biological Control of Brazilian peppertree, *Schinus terebinthifolia*	**Steffan Pierre** The Relative Contributions of Landscape and Local Conditions to Invasion Success of the Non-Native Apple Snail in Ranchland Wetlands
12noon-1:00pm	**Lunch Provided on Breeze’s Terrace**				

TUESDAY	Tuesday, April 21, 2015				
1:20pm-3:00pm	**Concurrent Sessions**				
Location	**Great Cypress**	**Royal Poinciana**	**Ibis**	**Egret**	**Sandpiper**
	Session 6	**Session 7**	**Session 8**	**Session 9**	**Session 10**
	Sea-Level Rise and Restoration Part II: Ecological Responses and Influences on a Changing Landscape and Seascape	**Advances in Use of the Trophic Hypothesis to Guide Monitoring and Management of the Everglades**	**Biscayne Bay Part II: Coastal Restoration and Management of Biscayne Bay**	**Linking Hydrology to Ecology in Restoration Planning, Design, and Implementation**	**Advanced Technologies in Everglades Ecosystem Restoration**
Moderator	**David Rudnick (Todd Osborne, co-chair)**	**Dale Gawlik**	**Sarah Bellmund & Sharon Ewe**	**Andrew LoSchiavo**	**Christa Zweig**
1:20pm	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
1:30pm	**Todd Osborne** Forecast Effects of Sea-Level Rise on Coastal Wetland Structure and Function	**Peter Frederick** Potential Effects of Nest Predation, Contamination, and Distant Wetland Attractors on Reproductive Responses of Wading Birds to CERP	**Bahram Charkhian** Biscayne Bay Coastal Wetland Restoration Benefits	**Brad Foster** SMART Planning for the Central Everglades Planning Project	**Kristin Seitz** Use of Molecular Techniques to Identify Everglades' Aquatic Fungal Community Associated with Cattail Decomposition
1:45pm	**Joseph M. Smoak** Mangrove Forest Soil Accretion Rates and the Relationship with Sea Level and Storms Over the Past Century	**Jerry Lorenz** Adapting the Everglades Trophic Hypothesis to Roseate Spoonbills in an Estuarine Environment	**Stephen Blair** Biscayne Bay- A Jewel in Jeopardy	**Melissa Nasuti** Evaluating the Effects of Central Everglades Planning Project Alternative Plans Using Performance Measures and Ecological Planning	**Peter Regier** Use of Biomarkers in Everglades Restoration
2:00pm	**Thomas J. Smith III** Patterns of Sediment Surface Elevation Change in the Southwest Coastal Everglades	**Lori Oberhofer** Monitoring Mercury Exposure in Nesting Wading Birds: Considerations for the Everglades Trophic Hypothesis	**Vanessa McDonough** Management of the Invasive Indo-Pacific Lionfish in Biscayne National Park	**Murika Davis** How Hydrologic Modeling and Ecological Criteria Inform Engineering Design of Restoration Project Features	**Joe Stachelek** Resolving Fine-Scale Patterning and Restoration Outcomes in the Coastal Everglades
2:15pm	**Stephen E. Davis** Effects of Increased Salinity and Inundation on Wetland Soil Carbon Dynamics at the Everglades Freshwater-Saltwater Ecotone	**Mark Cook** Movement and Habitat Use of Aquatic Fauna in Relation to Seasonal Hydrologic Variation: Implications for Wading Bird Prey Availability	**Caroline Herman** Methods for Detecting Patterns in Groundwater Flow into Biscayne Bay, FL	**James Vearil** How Modeling and Design Criteria Inform Operations Planning and Water Management Implementation	**Elise Morrison** The Use of Molecular Techniques to Assess Microbial Nutrient Status in the Everglades
2:30pm	**Martha Nungesser** How to Build a Bigger Florida Bay	**Jessica Klassen** Bridging the Gap Between Everglades Prey Production and Wading Bird Prey Selection	**Henry Briceño** Nutrient Thresholds Drive Phytoplankton Biomass Responses in South Florida Coastal and Estuarine Waters	**Gretchen Ehlinger** How Monitoring for Restoration Success Informs Water Management and Project Implementation	**Erik Tate-Boldt** Application of Synthetic Floc to Evaluate Sediment Transport in the Decompartmentalization Physical Model Project
2:45pm	**Marguerite Koch** Climate Change Projected Effects on Coastal Foundation Communities of the Greater Everglades using a 2060 Scenario: Need for a New Management Paradigm	**Joel Trexler** The Trophic Hypothesis: Long-Term Trends in Wading Bird Prey Species in the Freshwater Everglades	**Brian Carlstrom** Ecosystem Restoration and Management in Biscayne National Park	**Gina Paduano Ralph** How Monitoring for Endangered Species Informs Water Management and Project Implementation	**Matt Burgess** Applications of High-Resolution Aerial Imagery and a Small Unmanned Aircraft System in Everglades Science
3:00pm-3:20pm	**PM Break in Poster Hall**				

TUESDAY	Tuesday, April 21, 2015				
3:20pm-5:00pm	Concurrent Sessions				
Location	**Great Cypress**	**Royal Poinciana**	**Ibis**	**Egret**	**Sandpiper**
	Session 11	**Session 12**	**Session 13**	**Session 14**	**Session 15**
	Climate Change, Sea Level Rise, and Natural Hazards	**Aquatic Animals in Restoration**	**Carbon Storage and Release in Low Latitude Peatlands**	**Advances in Hydrology and Salinity Models for Greater Everglades Ecosystem Restoration**	**Performance Measures for Central Everglades Adaptive Management**
Moderator	**G. Lynn Wingard**	**Jennifer Rehage**	**Xavier Comas, Matthew Warren & Brian Benscoter**	**Frank Marshall**	**Andrew LoSchiavo**
3:20pm	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
3:30pm	**Dennis Krohn** Progress in a Hindcast Simulation of the 1926 Great Miami Hurricane	**Ross Boucek** Photoperiod vs. Hydrology: Which Best Predicts Migrations of Temperate Freshwater Forage Species and Their Tropical Estuarine Predator in the Oligohaline Reaches of the Shark River?	**Steve Frolking** Modelling the Impacts of Land Use Change on Carbon Dynamics in Tropical Peatlands Using the Tropical Holocene Peat Model (HPMTROP)	**Jenifer Barnes** Calibration Activities for the South Florida Water Management Model (SFWMM a.k.a. 2x2 Model)	**Eric Bush** The Role of Ecological Thresholds in Adaptive Management
3:45pm	**Danielle Ogurcak** The Interaction of Pulse and Press Disturbances: Discerning the Effects of Sea Level Rise from Those of Storm Surge Flooding in Coastal Forests of the Lower Florida Keys, FL	**Jessica Lee** Drying Times: Survival of a Freshwater Mesoconsumer in a Coastal Refuge Habitat During Seasonal Drying	**Jorge Ramirez** Modeling Methane Ebullition from Peat Soils of the Florida Everglades	**Jordan Barr** Recent Progress in the MIKE Marsh Model of Everglades National Park	**Paul Conrads** Real-time Evaluation of Hydrologic Performance Measures Specific to Central Everglades Planning Project (CEPP) Restoration Success
4:00pm	**Shimon Wdowinski** Mangrove Colonization Patterns and Rates Along the Coastal Everglades	**Durland Fish** Potential Response of Mosquito-Borne Viruses to Ecosystem Restoration in the Greater Everglades	**Barclay Shoemaker** Water, Energy and Carbon Cycling in Greater Everglades Forested Wetlands	**Yongshan Wan** Rapid Prediction of Estuarine Salinity for Everglades Ecosystem Restoration	**Andrew LoSchiavo** Soil Restoration Thresholds Specific to Central Everglades Planning Project Success
4:15pm	**G. Lynn Wingard** Interior Mud Flats of Florida Bay Islands: Records of Sea Level Rise, Storm History, and Island Formation	**Brent Anderson** The Distribution of Anurans in a Hydrologically Modified River Floodplain	**Frank Anderson** Net Ecosystem Exchanges of Carbon Dioxide and Methane from Sub-Tropical and Temperate Peatlands: A Comparison of Natural and Restored Wetland Systems	**Melinda Lohmann** BISECT Model Simulations for Evaluating Present, Past, and Future Conditions and Providing Input to Emerging Ecological Models	**James Herrin** Identifying Thresholds in Fish Community Dynamics and Composition in Response to Altered Hydroperiods in Everglades Marshes
4:30pm	**Hannah Cooper** Incorporating Uncertainty of Groundwater Modeling in Sea-Level Rise Assessment: A Case Study in South Florida	**Jennifer Rehage** Fish Dynamics at the Everglades Marsh-Mangrove Ecotone: Drydowns, Subsidies, Coldsnaps & the Link to Recreational Fisheries	**Michelle Budny** Impact of Willow Invasion on Water and Carbon Exchange in the Vegetation of a Subtropical Wetland	**Detong Sun** Three Dimensional Model Evaluation of Physical Alterations of the Caloosahatchee River Estuary: Impact on Salt Transport	**Laura Brandt** Crocodilian Ecological Thresholds Specific to Central Everglades Planning Project (CEPP)
4:45pm	**Jeremy May** Influence of Varying Environmental Conditions on Canopy Species Recruits from Four Everglades Plant Communities	**Discussion**	**Paul Glaser** Holocene Dynamics of the Florida Everglades with Respect to Climate, Dustfall, and Tropical Storms	**Erik Stabenau** An Improved Biscayne Bay Hydrodynamic Model for Evaluation of Restoration Efforts and the Effects of Groundwater on Salinity	**David Kaplan** Pattern and Process in the Everglades Ridge-Slough Landscape
5:00pm	**EVENING ON OWN**				

WEDNESDAY	***Wednesday, April 22, 2015***				
7:30am-8:30am	**Morning Refreshments in Poster Hall**				
8:30am-10:00am	**Earth Day Plenary Session in Great Cypress & Royal Poinciana**				
8:30am-10:00am	***Future Environmentalists from South Plantation High School Pay It Forward*** **Introduction: Nick Aumen, Regional Science Advisor - South Florida, United States Geological Survey** *Students from South Plantation High School's Environmental Science and Everglades Restoration Magnet Program will offer presentations, a Q & A Panel Discussion, skits, a rap, and a musical entertainment piece, to demonstrate what Everglades restoration and environmental stewardship mean to them.*				
10:00am-10:20am	**AM Break in Poster Hall**				
10:20am-12noon	**Concurrent Sessions**				
Location	Great Cypress	Royal Poinciana	Ibis	Egret	Sandpiper
	Session 16	**Session 17**	**Session 18**	**Session 19**	**Session 20**
	Everglades Stormwater Treatment Areas	**Flow-Pulse Drivers of Aquatic Ecosystem Restoration - Findings From the Decomp Physical Model**	**Construction Management Challenges of a Landscape-Scale Restoration Project (Picayune Strand Restoration Project)**	**Wetland Birds**	**Ecological Models & Tools Part I**
Moderator	**Larry Gerry**	**Fred H. Sklar**	**Kim Dryden**	**Mathieu Basille**	**Stephanie Romañach**
10:20am	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
10:30am	**Delia Ivanoff** Historical Performance of the Stormwater Treatment Areas	**David T. Ho** Landscape-Scale Hydrologic Responses to a Flow Pulse Experiment	**Janet Starnes** Project Management Challenges on a Restoration Project Under Multiple Jurisdictions	**Michael Cheek** Interim Response of Wading Birds (*pelecaniformes* and *ciconiformes*) and Waterfowl (*anseriformes*) to the Kissimmee River Restoration Project	**James Beerens** Multi-species and Landscape Scenario Planning Using Hydrologic Simulation Modeling
10:45am	**Tom DeBusk** Effects of Limerock and Non-Farmed Muck Substrates on Stormwater Treatment Area Performance	**Jud Harvey** The Decompartmentalization Physical Model (DPM) Experiments: Testing the Restoration of Historic High Flows in a Disconnected Everglades	**Michael J. Duever** Restoring the Pre-Development Hydrologic Regime in the Picayune Strand Restoration Project Area	**Jennifer Chastant** Water Level Fluctuations Influence Wading Bird Prey Availability and Nesting in a Managed Lake Ecosystem	**Leonard Pearlstine** Ecological Position Analysis: An Online Tool for Spatial Habitat Forecasts
11:00am	**Rupesh Bhomia** Stability of Sequestered Phosphorus in Stormwater Treatment Areas: Role of Dominant Wetland Vegetation	**Sue Newman** To Move or Not to Move-Water Quality and Sediment Entrainment Responses to Two Flow Events	**Maureen S. Bonness** Following the Bulldozers. Invasive Plant Control for the Picayune Strand Restoration Project	**Dale Gawlik** Factors Affecting the Abundance of Wading Birds in Intertidal Habitat: Are Freshwater Models Applicable?	**Craig Conzelmann** EverVIEW *lite*: The Next Generation of Modeling Visualization From the Joint Ecosystem Modeling Community
11:15am	**Jeremy McBryan** Everglades Restoration Strategies: Optimizing the Performance of Stormwater Treatment Areas	**Laurel Larsen** Shear Stress Variability and Floc Redistribution During a Flow Release	**Dexter Sowell** State Forest Management on a Federal Habitat Restoration Project	**Anna Vecchione** Significance of Human Interaction and Interference on Osprey Populations in the Everglades	**Mark McKelvy** Supporting Decision-Making in the Greater Everglades and Beyond with the Everview Platform
11:30am	**Larry Schwartz** Science Plan in Support of Everglades Restoration Strategies	**Colin Saunders** Restoring Sheetflow in a Ridge-Slough-Canal-and-Levee Landscape- A Synthesis of Tracers, Traps and Transport	**Daniel H. Slone** Manatees and the Picayune Strand Restoration Project	**Jason Bosley** Developing a Spatio-Temporal Occupancy Model for a Declining Nesting Population of Bald Eagles in Florida Bay, Everglades National Park	**Kevin Suir** Dynamic Web Tools for Modeling and Monitoring Data Visualization
11:45am	**Walter Wilcox** Evolving Strategies for Stormwater Treatment Area (STA) Operational Management	**Mike Bush** Effects of Flow and Connectivity on Everglades Aquatic Consumers: Evaluating Three Hypotheses	**Grady H. Caulk** Protecting Cultural Resources on a Restoration Project and Adjacent Public Lands	**Mathieu Basille** Using Wood Stork Movement to Enhance Conservation Efforts	**Bo Zhang** Modeling the Dynamics of the Invasive Tree, *Melaleuca Quinquenervia,* in the Everglades, With and Without Biological Control
12noon-1:00pm	**Lunch Provided on Breeze's Terrace**				

WEDNESDAY	Wednesday, April 22, 2015				
1:20pm-3:00pm	**Concurrent Sessions**				
Location	Great Cypress	Royal Poinciana	Ibis	Egret	Sandpiper
	Session 21	**Session 22**	**Session 23**	**Session 24**	**Session 25**
	STAs & EAA Water Quality	**Everglades Hydrology, Peat Accretion and Loss: Effects on Carbon Exchange and Water Retention**	**Ecosystem Services and Everglades Restoration: Moving Forward with Case Studies and Tools that Integrate Ecosystem Services into Decision Making**	**Science and Habitat Management in the A.R.M. Loxahatchee National Wildlife Refuge: 13th Annual Loxahatchee Refuge Science Workshop**	**Ecological Models & Tools Part II**
Moderator	**Melodie Naja**	**Thomas Dreschel & Leonard Scinto**	**Kelly Keefe**	**Rebekah Gibble**	**Stephanie Romañach**
1:20pm	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
1:30pm	**Sayena Faradmarandi** Phosphorus Loadings from the Everglades Agricultural Area	**Leonard Scinto** Soil Accretion on Constructed Everglades Tree Islands: Production and Decomposition Affected by Water Levels	**Annet Forkink** The Use of Ecosystem Services in Florida: A Cross-Perspective of Agencies	**Jeff Beauchamp** Trends in Relative Density and Body Condition of Alligators in the Everglades	**Brian Reichert** Network Modularity Reveals Critical Scales for Connectivity Conservation
1:45pm	**Jehangir Bhadha** Aquatic Vegetation and Its Role on Phosphorus Dynamics in the Everglades Agricultural Area	**Xavier Comas** Carbon Flux Variability in the Everglades Using Hydrogeophysical Methods	**Pallab Mozumder** Valuation of Ecosystem Services for Environmental Decision Making in South Florida	**Kyle Douglas-Mankin** Measurement and Modeling of Airboat Flow-Cut Hydraulics in the A.R.M. Loxahatchee National Wildlife Refuge	**Michelle Petersen** Gaining Insight From Restoration Scenario Evaluations With Wading Bird Nest Effort Models
2:00pm	**Hongying Zhao** STA-3/4 Periphyton-based Stormwater Treatment Area (PSTA) Cell Water and Total Phosphorus Budget Analyses	**Alan Wright** Soil Organic Matter Cycling in Everglades Peatlands	**Michael Sukop** Ecosystem Service Valuation and Hydro-Economic Optimization of South Florida Water Resources	**Margaret Hunter** Efficacy of eDNA as an Early Detection and Rapid Response Indicator for Burmese Pythons in the Northern Greater Everglades Ecosystem and A.R.M. Loxahatchee National Wildlife Refuge	**Hardin Waddle** Modeling the Occurrence of Everglades Amphibians as a Function of Hydrology and Habitat Type
2:15pm	**Maria Loinaz** Innovative Hydraulic Modeling Approaches Used During the Design of an Everglades Treatment Wetland	**Daniel Scheidt** Decadal Variation in Everglades Peat Soil at the Landscape Scale: Results of R-EMAP 1995-2014	**Kelly Keefe** Assessing the Value of the Central Everglades Planning Project (CEPP) in Everglades Restoration: An Ecosystem Services Approach	**James Lange** Effects of Aerial Herbicide Treatment of Melaleuca on Native Habitat Recovery in the Northern Everglades	**Simeon Yurek** Integrated Eco-Hydrological Modeling of Forage Fish Aimed at Supporting Management Decisions
2:30pm	**Patrick Keith** Design and Construction of a Flow Equalization Basin to Optimize Performance of Everglades Stormwater Treatment Areas	**Brian Benscoter** Understanding the Vulnerability of Everglades Peat Soils to Smoldering Combustion	**Christopher Kelble** NOAA's Integrated Ecosystem Assessments: Using Ecosystem Services to Improve Decision Making	**Robert McCleery** Meso-Mammal Communities of A.R.M. Loxahatchee National Wildlife Refuge as a Reference for the Greater Everglades Ecosystem	**Don DeAngelis** Modeling the Effects of Sea Level Rise and Storm Surge on Coastal Everglades Vegetation
2:45pm	**Larry Fink** Scoping-Level Evaluation of Everglades Water Quality Compliance Using a Central Flow-Way Hydrated With Lake Okeechobee Water	**Thomas Dreschel** Determining Historical and Recent Everglades Peat Quantities Using Geospatial Techniques	**Geoffrey Cook** Ecosystem Service Sustainability Across an Urbanization Gradient in Coastal South Florida	**Donatto Surratt** Spatial and Temporal Trends in Water Quality at the A.R.M. Loxahatchee National Wildlife Refuge: An Assessment of Long-Term Restoration	**Discussion**
3:00pm-5:00pm	**FORMAL POSTER NETWORKING SESSION IN POSTER HALL**				
5:00pm	**EVENING ON OWN**				

THURSDAY	*Thursday, April 23, 2015*				
7:30am-8:30am	**Morning Refreshments in Poster Hall**				
8:30am-10:00am	**Closing Plenary Session in Great Cypress & Royal Poinciana**				
8:30am-10:00am	***Science in Support of Everglades Restoration*** **Moderator: Nick Aumen, Regional Science Advisor - South Florida, United States Geological Survey** **Don Boesch**, President, Center for Environmental Science, University of Maryland ***Institutional Scientific Challenges in Large-Scale Ecosystem Restoration*** **Colin Polsky**, Director, Center for Environmental Studies, Florida Atlantic University ***Using a Sustainability Science Fram to Advance Ecosystem Restoration***				
10:00am-10:20am	**AM Break in Poster Hall**				
10:20am-12noon	**Concurrent Sessions**				
Location	Great Cypress	Royal Poinciana	Ibis	Egret	Sandpiper
10:20am-12noon	**Session 26**	**Session 27**	**Session 28**	**Session 29**	**Session 30**
	Everglades Restoration Progress: Assessing Effects of Modified Water Deliveries on Northern Shark River Slough	**Tree Island Ecology: Advances on Ecological Restoration**	**Mercury Cycling, Transport, and Effects in the Everglades**	**Coastal Marine Ecology**	**Organic Matter, Carbon Cycling, and Water Quality in the Greater Everglades Ecosystem**
Moderator	**David Rudnick & Robert Johnson**	**Carlos Coronado-Molina & Michael Ross**	**Forrest Dierberg, Andy Ogram & Paul Julian II**	**Paul Conrads**	**George Aiken**
10:20am	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
10:30am	**Robert Johnson** Restoring Flows to Northeast Shark River Slough, Everglades vis the Modified Water Deliveries Project, A 30 Year Odyssey	**Daniel Hughes** Tree Islands and the Last 5000 Years of Human Occupation	**Paul Julian II** An Overview of Everglades Mercury Issues: Critical Questions Remain	**Michael Kline** Variability in the Submerged Aquatic Vegetation Community Within the Northeastern Florida Bay Mangrove Ecotone Over Two Decades	**Rudolf Jaffe** Detailed Molecular Characterization of Dissolved Organic Matter From the Everglades: A Comparative Study Through the Analysis of Optical Properties, NMR and FTICR/MS
10:45am	**Jennifer Richards** Assessment of the Ecological Status and Trends of Northeastern Shark River Slough	**Carlos Coronado-Molina** Litterfall and Tree Growth Dynamics in a Pristine Tree Island and a Degraded Tree Island in WCA-3A: The Importance of Ecological Functions on Tree Islands	**David Krabbenhoft** Mercury Contamination of the Everglades: Revelations from the Long-Term ACME Project and Future Considerations	**Yini Shangguan** Phytoplankton Response to Changing Nutrients from Comprehensive Everglades Restoration Plan: Comparison of Two Coastal Lagoon Systems	**Brian Bergamaschi** Export of Dissolved Organic Carbon from the Everglades to Coastal Waters
11:00am	**Joffre Castro** Spatial Patterns of Phosphorus Enrichment in Northern Shark River Slough	**Susana Stoffella** Did Flooding Kill the Ghost Tree Islands? Evidence From Healthy Everglades Tree Islands and the LILA Experiment Platform	**Guangliang Liu** Distribution of Mercury in Ecosystem Components in the Everglades: A Mass Budget Perspective	**Hongqing Wang** Predicting the Responses of Eastern Oyster Population to River Diversion and Sea-Level Rise	**Brett Poulin** The Influences of Sulfate Reduction on the Chemistry of Organic Matter in the Everglades
11:15am	**Daniel Gann** Mapping Vegetation and Vegetation Change Patterns in Northern Shark River Slough from Remotely Sensed Data	**Tiffany Troxler** Integrating Tree Island Metrics to Understand Potential Mechanisms for Past Degradation and Future Restoration	**Andy Ogram** Molecular Microbial Ecology of Mercury Methylation in the Everglades Soil Ecosystem	**Kang-Ren Jin** An Integrated Environmental Model for a Constructed Wetland: Water Quality Processes	**Brendan Buskirk** Fire and Flood: Response of Organic Matter to Extreme Events in the DPM Footprint
11:30am	**Eric Sokol** Influences of Changing Hydrologic Conditions on Food Web Patterns Near the Boundaries of Everglades National Park	**Pamela Sullivan** Hydrogeochemical Processes in Man-Made Tree Islands	**Binhe Gu** Spatial and Temporal Variations of Total Mercury in Mosquitofish from Everglades Marshes	**Laurel Collins** Mathematical Analysis of the Influence of Naturally Occurring vs. Anthropogenic Events on WQ in Florida Bay	**Joshua Breithaupt** Quantifying the Relative Contributions Made by Organic Matter and Mineral Sediment to Accretion Rates in the Coastal Everglades
11:45am	**Tylan Dean** Cape Sable Seaside Sparrow Habitat Suitability and Subpopulation Viability with Modified Water Deliveries	**Michael Ross** Meta-Community Structure of South Florida Hardwood Hammocks: Implications for Species Responses to Climate Change	**Forrest Dierberg** Community-Related Trophic Variability Contributes to Variations in Mosquitofish Mercury Concentrations in WCA-2A	**Paul Conrads** Development of a Coastal Drought Index Using Salinity Data	**Bob Sobczak** Restoration Rally Cry for the Big Cypress Swamp
12noon-1:00pm	**Lunch Provided on Breeze's Terrace**				

THURSDAY	Thursday, April 23, 2015				
1:20pm-3:00pm	**Concurrent Sessions**				
Location	Great Cypress	Royal Poinciana	Ibis	Egret	Sandpiper
	Session 31	**Session 32**	**Session 33**	**Session 34**	**Session 35**
	Sulfur in the Greater Everglades Ecosystem – Sources, Cycling, Fate, Biogeochemistry, and Impacts	**Modeling the Incremental Value of Restored Flow to Everglades Ecology**	**Invasive Species Monitoring**	**Florida Bay Restoration: Ecosystem Status, Trends, and Responses**	**Biogeochemistry**
Moderator	**William Orem**	**Jud Harvey**	**Tony Pernas**	**Stacie Auvenshine**	**Mark Shafer**
1:20pm	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
1:30pm	**William Orem** Sulfur in the Everglades - An Overview	**Thomas Van Lent** Restoration Directions: Science Informing the Process	**Michael Rochford** Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP)	**Margaret Hall** Long Term Changes in Seagrass Distribution and Abundance in Florida Bay	**Hilary Flower** Control of Phosphate Concentration Through Adsorption and Desorption Processes in Shallow Groundwater of Coastal Everglades
1:45pm	**Curt Pollman** The Role of Sulfate as a Driver of Mercury Methylation in the Everglades - What Does Statistics Really Have to Say?	**Fred Sklar** Back To The Future: A Landscape-Scale Response to Restoration	**Jennifer Ketterlin Eckles** Interagency Monitoring and Assessment Efforts for the Argentine Black and White Tegu in the Southeastern Everglades	**Lindsey Visser** Juvenile Sportfish Monitoring in Florida Bay, Everglades National Park	**Mark Shafer** Ecological Risk Assessment of CERP Aquifer Storage and Recovery
2:00pm	**Mike Jerauld** Geochemical Response to Aqueous Sulfate Additions in an Oligotrophic Everglades Marsh	**Evelyn Gaiser** Periphyton Responses to Flow Restoration: Distribution, Community Composition, and Edibility	**Michael Avery** Applying Wildlife Genetics to Invasive Wildlife Management in the Florida Everglades	**Tom Frankovich** Predicting Changes in Estuarine SAV Distribution from Increased Freshwater Delivery	**Michael Waldon** Frequency Distribution of Surface Water Total Phosphorus in the Loxahatchee Refuge: Similarity and Implications for Dynamic Models
2:15pm	**Peter Kalla** Everglades REMAP 2013/2014: Sulfur and Related Findings for Mercury	**Jay Choi** Modeling Restoration Outcomes for the Everglades Ridge-Slough Landscape	**Joseph Parkos** Implications of Movement Behavior and Local Density on Nonnative Fish Detection in Everglades Restoration Assessments	**Theresa Strazisar** A Population Approach to Understanding Mechanisms Controlling the Submerged Aquatic Vegetation Species *Ruppia maritima L.*(widgeongrass) at the Everglades-Florida Bay Ecotone	**Nicholas Schulte** Environmental Variance and Dispersal Explain Benthic Diatom Spatial and Temporal Beta Diversity in the Florida Everglades
2:30pm	**Matthew Varonka** Sulfur and Mercury Modeling in the Everglades	**Carl Fitz** Soil Oxidation and Phosphorus Storage Changes Resulting from a Range of Restoration Options	**Melissa Smith** Biological Control Releases on *Lygodium microphyllum* in Cape Sable Wilderness Area, Everglades National Park: CERP Implementation and Monitoring for Success	**David Rudnick** An Overview of C-111 Spreader Canal Western Project Implementation and Restoration Progress	**Yong Cai** Evaluation of the Possible Sources and Controlling Factors of Toxic Metals in the Florida Everglades and Their Potential Risk of Exposure
2:45pm	**Eduardo Patino** Continuous Monitoring of Mercury in Everglades National Park	**Christa Zweig** Deviations From a Theme: Peat Patterning In Sub-Tropical Landscapes	**Tony Pernas** Balancing Accuracy and Precision for Monitoring Exotic Plant Management at the Landscape Scale	**Michelle Robinson** Initial Monitoring Results of Ecosystem Response to the C-111 Spreader Canal Western Phase in Northeastern Florida Bay	**Ping Jiang** Geochemical Modeling of Hg Speciation and the Implications on Mercury Cycling in the Everglades
3:00pm-3:20pm	**PM Break in Poster Hall** *(Poster presenters are to remove displays by 5pm.)*				

THURSDAY	*Thursday, April 23, 2015*				
3:20pm-5:00pm	**Concurrent Sessions**				
Location	Great Cypress	Royal Poinciana	Ibis	Egret	Sandpiper
	Session 36	**Session 37**	**Session 38**	**Session 39**	**Session 40**
	Multi-Decadal to Millennial-Scale Proxy Records of Sea-Level Rise and Climate Change	**Restoration Planning and Decision-Making**	**Enzymes: Functions and Use as Indicators of Change in Everglades Systems**	**Invasive Species**	**Hydrology**
Moderator	**Christopher Bernhardt & G. Lynn Wingard**	**John Volin**	**Patrick Inglett**	**Dean Monette**	**David Sumner**
3:20pm	**Introduction**	**Introduction**	**Introduction**	**Introduction**	**Introduction**
3:30pm	**Miriam Jones** Impact of Sea-Level Rise on Everglades Carbon Storage Capacity: Shift From Terrestrial to Blue Carbon Sink	**Agnes McLean** Testing a New Natural System Model for Use in South Florida Ecosystem Restoration	**Xiaolin Liao** Multiple Enzyme Systems and Their Effectiveness as Indicators of Everglades Restoration	**Lindsey Garner** Seasonal and Daily Activity Patterns of Argentine Black and White Tegus	**Subodh Acharya** Simulating the Effects of Ridge Elevation and Geometry on Ridge-Slough Landscape Hydrology: How Much Water Do We Need?
3:45pm	**Lauren Toth** Development and Demise of Florida's Coral Reefs: the Roles of Climate, Sea Level, and Regional Hydrology	**Mahadev Bhat** Pricing the Carbon Right: The Case of the Everglades Mangroves	**Krish Jayachandran** Phosphatases Enzymes Activity in Phosphorus Rich Everglades Tree Islands Ecosystem	**Michelle McEachern** Brumation of Black and White Tegus (*Tupinambis merianae*) in Southern Florida	**Kevin Kotun** Water Management and Hydrology of Northeast Shark River Slough from 1940 to 2015
4:00pm	**Peter Swart** Large Corals in Florida Bay: Faithful Recorders of the Environmental Conditions Over the Past 200 Years	**Jed Redwine** The Natural Resource Condition Assessments of Everglades National Park and Big Cypress National Preserve	**Patrick Inglett** Nitrogenase Activity as an Indicator of Everglades Impact and Restoration	**Bryan Falk** Are Burmese Pythons in Florida Getting Skinnier?	**Stephanie Long** Modeling the Hydrodynamic and Water Quality Impacts of Proposed Tamiami Trail Bridge Construction Using the M3ENP Numerical Model
4:15pm	**Anna Wachnicka** Responses of the South Florida Coastal and Estuarine Ecosystems to Climate Variability, Sea Level Rise and Extreme Weather Events over the Last 4600 Years	**Stephanie Johnson** Reflections on 15 Years of NRC Independent Scientific Review of Everglades Restoration	**Christine VanZomeren** Soil Organic Nitrogen Mineralization and Enzyme Activities as Indicators of Nutrient Impacts in the Florida Everglades	**Corey Callaghan** Diet and Selectivity of the Purple Swamphen in South Florida	**Amanda Booth** Flow Monitoring Along U.S. 41 between County Road 92 and State Road 29, in Southwest Florida, 2007–2010
4:30pm	**Christopher Smith** Using Recent Hurricanes and Associated Event Layers to Evaluate Regional Storm Impacts on Estuarine-Wetland Systems	**Paul Wetzel** Connecting Science and Policy in Ecosystem Restoration	**Kanika Inglett** Temperature Sensitivity of Hydrolytic Enzymes: Application to Decomposition and Greenhouse Gas Emissions	**Marc Hughes** Redbay and Laurel Wilt: The Search for Resistant Trees	**Michael Wacker** Quantifying Evaporation Rates from Lake Okeechobee, Florida
4:45pm	**Terrence McCloskey** Using OGPs to Establish Long-Term Tropical Cyclone Landfall Records and Elucidate the Mid-to-Late Holocene Climatic History of the Northern Gulf Coast	**John Volin** Digital Visualization as a Tool to Bridge Science and Policy: Examining the Long-Term Effects of Phosphorus on the Everglades Ridge Slough Landscape	**Shelby Servais** Effects of Increased Salinity and Inundation on Microbial Processing of Carbon and Nutrients in Oligohaline Wetland Soils	**Dean Monette** Vegetation Community Relationships with *Pomacea paludosa* and *Pomacea maculata* in Lake Okeechobee, Florida, United States	**David Sumner** Hydroperiod Approach for a Non-Flat World
5:00pm	**Conference Concludes**				

Poster Display Information

Poster presentations play a key role in the success of GEER 2015. Much time will be dedicated for viewing posters, allowing scientists, policy makers, planners, practitioners and managers to interact and use these opportunities to share details of their work, successes and lessons learned.

- Early morning, mid-day and afternoon refreshments will be served in the poster session room each day. In addition, there will be a formal Poster Session on Wednesday. (See detailed schedule below.)
- NOTE: **All posters are on display the entire conference.** Poster presenters will be asked to stand at their poster during the Poster Session on Wednesday.

Events to be held in the Poster Hall

POSTER SET-UP	**Monday, April 20, 4:00pm - 7:00pm***
NETWORKING POSTER SESSION	**Wednesday, April 22, 3:00pm - 5:00pm** Presenters are asked to please be stationed at their poster to answer questions about their work.
POSTER REMOVAL	**Thursday, April 23, 5:00pm - 5:30pm****

**Posters may be set-up upon arrival at the hotel any time during these hours, but no later than 10:30am Tuesday, April 21*

***Poster display boards will be dismantled by the vendor promptly, so please remove your poster during the requested time slot. Conference organizers are not responsible for lost or damaged posters removed by the display board vendor. Posters left behind will be discarded.*

Poster Directory & Full Author Recognition

Directory of Poster Presentations

Listed Alphabetically by Presenting Author
Presenting author names are in **bold**.

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8 **BIOCHAR AND MILL ASH USE AS SOIL AMENDMENTS TO GROW SUGARCANE ON SANDY SOILS IN SOUTH FLORIDA -- Odiney Alvarez[1]**, Timothy A. Lang[2], Jehangir H. Bhadha[1], Mabry McCray[2], Bin Gao[3], Barry Glaz[4], and Samira H. Daroub[1]; [1]Soil and Water Science Department, University of Florida, Belle Glade, Florida, USA; [2] Agronomy Department, University of Florida, Belle Glade, Florida, USA; [3] Agricultural and Biological Engineering, University of Florida, Gainesville, Florida, USA; [4] Former USDA-ARS Research Agronomist, Sugarcane Field Station, Canal Point, Florida, USA

37 **COMPARING THE SEASONAL AND SPATIAL VARIABILITY OF SURFACE WATER AND GROUNDWATER SALINITY IN THE EASTERN PANHANDLE, EVERGLADES NATIONAL PARK, FL, USA -- Gordon H. Anderson[1]**, Erik Stabenau[2] and Peter Frezza[3]; [1]U.S. Geological Survey, Southeast Ecological Science Center, Gainesville, FL, USA; [2] Everglades National Park, South Florida Natural Resources Center, Homestead, FL, USA; [3] Audubon Everglades Science Center, Estuarine and Marine Research Group, Tavernier, FL, USA

49 **APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS IN THE HYDRAULIC DESIGN OF AN EVERGLADES RESTORATION STRATEGIES PROJECT --** Jie Zeng, **Matahel Ansar**, and Emile Damisse; South Florida Water Management District, West Palm Beach, FL, USA

50 **CLIMATE SENSITIVITY RUNS USING THE SOUTH FLORIDA WATER MANAGEMENT MODEL --** Jayantha Obeysekera and **Jenifer Barnes**; South Florida Water Management District, West Palm Beach, FL, USA

25 **CARBON CYCLING IN COASTAL MANGROVE FORESTS: WHERE HAS THE "MISSING" SINK GONE? -- Jordan G. Barr[1]**, Jose D. Fuentes[2], David Ho[3], Sara Ferrón[3], Tiffany G. Troxler[4], Paulo Olivas[4], and Vic Engel[5]; [1]Everglades National Park, Homestead, FL, USA; [2]The Pennsylvania State University, University Park, PA, USA; [3]University of Hawaii, Manoa, HI, USA; [4]Florida International University, Miami, FL, USA; [5]United States Geological Survey, Gainesville, FL, USA

61 **PARASITE GAIN AND ENEMY RELEASE: COMPARING THE PARASITE ASSEMBLAGES OF EVERGLADES INTRODUCED CICHLIDS AND NATIVE SUNFISHES -- C. P. Beck[1]** and J. S. Rehage[1]; [1]Florida International University, Miami, FL, USA

57 **INVASIVE EXOTIC SPECIES STRATEGIC ACTION FRAMEWORK -- Carrie Beeler**; South Florida Ecosystem Restoration Task Force, Davie, FL, USA; Homestead, FL, USA

63 **SHIFTED ASSEMBLY RULES: HOW DO NON-NATIVE FISHES AFFECT METACOMMUNITY ASSEMBLY IN EPHEMERAL WETLAND HABITATS? -- Jesse R. Blanchard** and Jennifer S. Rehage; Florida International University, Miami, FL, USA

51 **FOREST PRODUCTIVITY ALONG AN ELEVATIONAL GRADIENT IN THE UPPER FLORIDA KEYS -- Jesus Blanco**, Junnio Freixa; Southeast Environmental Research Center, Florida International University, Miami, FL, USA

90 **SPATIAL DISTRIBUTION OF NITRATE+NITRITE CONCENTRATIONS IN THE TIDAL CALOOSAHATCHEE RIVER DURING 2014 -- Amanda Booth**; United States Geological Survey, Fort Myers, FL, USA

6 **ASSESSING TRADE-OFFS AMONG ECOSYSTEM SERVICES IN A PAYMENT-FOR-WATER SERVICES PROGRAM ON FLORIDA RANCHLANDS -- E. Boughton[1]**, Sanjay Shukla[2], Patrick Bohlen[3], Angelica Engel[2], John Fauth[3], Greg Hendricks[2], David Jenkins[3], Greg Kiker[2], Pedro Quintana-Ascencio[3], and Hilary Swain[1]; [1]Archbold Biological Station, Lake Placid, FL, USA; [2] University of Florida, Gainesville, FL, USA; [3] University of Central Florida, Orlando, FL, USA

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53 **A SPATIAL AND TEMPORAL ANALYSIS OF MANGROVE COVERAGE IN CHARLOTTE HARBOR -- Lindsay M. Brendis[1]**, Thomas J. Smith III[2], Joseph M. Smoak[1], Ryan P. Moyer[3]; [1]University of South Florida Saint Petersburg, Department of Environmental Science, Policy and Geography, St. Petersburg, FL, USA; [2]U.S. Geological Survey, Southeast Ecological Science Center, St. Petersburg, FL, USA; [3]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St.Petersburg, FL, USA

87 **VALUATION OF FISHERY ECOSYSTEM SERVICES OF THE EVERGLADES WATER MANAGEMENT -- Christina E. Brown[1]**, Mahadev Bhat[1], Jennifer Rehage,[1]Pallab Mozumder[1], Victor C. Engel[2], Michael C. Sukop[1], Jessica Lee[1], Ross Boucek[1], Nadia Seeteram[1] and Jessica Bolson[3]; [1]Florida International University, Earth and Environment Department, Miami, FL USA; [2]U.S. Geological Survey, Southeast Ecological Science Center, Gainesville, FL USA; [3] University of Pennsylvania, Wharton Center for Risk Management and Decision Processes, Philadelphia, PA, USA

27 **CARBON SEQUESTRATION IN THE MANGROVE FORESTS OF CHARLOTTE HARBOR AND IMPLICATIONS FOR CONSERVATION AND RESTORATION -- Megan P. Burford[1]**, Joseph M. Smoak[1], Ryan P. Moyer[2], Richard Mbatu[1]; [1]Department of Environmental Science, Policy and Geography, University of South Florida, St. Petersburg, FL, USA; [2]Florida Fish & Wildlife Conservation Commission, St. Petersburg, FL, USA

13 **TRANSPORT OF PHOSPHORUS WITH SUSPENDED SEDIMENT DURING EXPERIMENTAL RESTORATION OF EVERGLADES HIGH FLOWS -- Brendan Buskirk[1]**, Jud Harvey[1], Laurel Larsen[2], Jay Choi[1], Allison Swartz[1], Jesus Gomez-Velez[1], Sue Newman[3], and Colin Saunders[3]; [1]U.S. Geological Survey - National Research Program, Reston, VA, USA; [2]University of California, Berkeley, CA, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA

92 **DROPLET DIGITAL PCR (DDPCR): A NEW APPROACH TO ENVIRONMENTAL DNA (EDNA) DETECTION OF RARE AND CRYPTIC SPECIES -- John S. S. Butterfield**, Gaia Meigs-Friend, Margaret E. Hunter; U.S. Geological Survey, Gainesville, FL, USA

19 **MACROINVERTEBRATES OF WETLANDS, CANALS, AND STREAMS IN SW FLORIDA: A RAPID FIELD ASSESSMENT AND MULTIVARIATE APPROACH FOR COMMUNITY ANALYSIS AND IDENTIFYING INDICATOR TAXA -- David W. Ceilley[1]** and Edwin M. Everham, III[2]; [1]Johnson Engineering, Fort Myers, FL, USA; [2]Florida Gulf Coast University, Fort Myers, FL, USA

20 **TAPE GRASS, VALLISNERIA AMERICANA RESTORATION IN SW FLORIDA USING EXCLOSURE CAGES TO REDUCE HERBIVORY AND PROMOTE SEED PRODUCTION -- David W. Ceilley[1]**, Edwin M Everham III[2], John A. Ferlita[2], Kory M. Ross[2], Carter E. Henne[3], and James F. Anderson[3]; [1]Johnson Engineering, Fort Myers, FL, USA; [2]Florida Gulf Coast University, Fort Myers, FL, USA; [3]Sea and Shoreline, Ruskin, FL, USA

60 **ASSESSMENT OF SMALL MAMMAL DEMOGRAPHICS AND COMMUNITIES IN THE GREATER EVERGLADES ECOSYSTEM --** Stephanie S. Romañach[1], Kristen M. Hart[1], James M. Beerens[1], Robert A. McCleery[2], **Julia P. Chapman[3]**, and Matthew R. Hanson[3]; [1]U.S. Geological Survey, Fort Lauderdale, FL, USA; [2] University of Florida, Gainesville, FL, USA; [3] Cherokee Nation Technology Solutions, contractor to U.S. Geological Survey, Fort Lauderdale, FL, USA

26 **ORGANIC CARBON BURIAL RATES IN AN AREA TRANSITIONING FROM SAWGRASS MARSH TO MANGROVE ADJACENT TO THE HARNEY RIVER IN EVERGLADES NATIONAL PARK -- Kailey R. Comparetto[1],** Joseph M. Smoak[1], Joshua L. Breithaupt[2], Thomas J. Smith III[3], Christian J. Sanders[4]; [1]University of South Florida, Department of Environmental Science, Policy, and Geography, St. Petersburg, FL, USA; [2]University of South Florida, College of Marine Science, St. Petersburg, FL, USA; [3]U.S Geological Survey, Southeast Ecological Science Center, St. Petersburg, FL, USA; [4]Centre for Coastal Biogeochemistry, School of Environment, Science and Engineering, Southern Cross University, Lismore, NSW, Australia

47 **AUTOMATED ONLINE ECOLOGICAL MODELING AND EVALUATION FOR EVERGLADES MANAGEMENT AND RESTORATION --** Leonard Pearlstine[1], Suresh Golconda[2], Kevin Suir[3], Alicia LoGalbo[1], Craig Conzelmann[3], Janice Parsons[1], Pamela Telis[4], and **Paul Conrads[5];** [1]National Park Service, Homestead, FL USA; [2] University of Louisiana at Lafayette, Lafayette, LA USA; [3] U.S. Geological Survey, Lafayette, LA USA; [4] U.S. Geological Survey, Jacksonville, FL USA; [5] U.S. Geological Survey, Columbia, SC, USA

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74 **QUANTIFYING HABITAT AND APPLE SNAIL DENSITY EFFECTS ON PREY AVAILABILITY TO SNAIL KITES -- Philip M. Coppola** and Philip C. Darby; University of West Florida, Pensacola, FL, USA

88 **ENVIRONMENTAL AND ECONOMIC BENEFITS OF A WATER QUALITY TRADING PROGRAM IN A NORTHERN LAKE OKEECHOBEE BASIN -- Juliana Corrales[1,2]**, G. Melodie Naja[2], Mahadev G. Bhat[1], and Fernando Miralles-Wilhelm[1]; [1]Department of Earth and Environment, Florida International University, Miami, FL, USA; [2]Science Department, Everglades Foundation, Palmetto Bay, FL, USA

34 **METHYLMERCURY IN FOOD WEBS IN THE EVERGLADES: TEMPORAL VARIATIONS OVER THE LAST TWO DECADES -- Wenbin Cui[1]**, Guangliang Liu[1], Ping Jiang[1], Daniel Scheidt[2], Peter Kalla[2], Yong Cai[1]; [1]Florida International University, Miami, FL, USA; [2]U.S. Environmental Protection Agency, Region 4, Athens, GA, USA

67 **DIET AND FORAGING ECOLOGY OF DIAMONDBACK TERRAPINS (MALACLEMYS TERRAPIN) IN SOUTH FLORIDA, INCLUDING EVERGLADES NATIONAL PARK -- Mathew J. Denton[1]**, Kristen M. Hart[1], Amanda W.J. Demopoulos[2], Anton E. Oleinik[3], John D. Baldwin[4]; [1]U.S. Geological Survey, Southeast Ecological Science Center, Davie, FL, USA; [2]U.S. Geological Survey, Southeast Ecological Science Center, Gainesville, FL, USA; [3]Florida Atlantic University, Boca Raton, FL, USA; [4]Florida Atlantic University, Davie, FL, USA

48 **HYDROLOGIC MONITORING AT S-152 FOR THE DECOMPARTMENTILIZATION PHYSICAL MODEL (DPM) FLOW-RELEASE TEST -- Mark Dickman**; United States Geological Survey, Davie, FL, USA

78 **PREDATION BY CRAYFISH FAVORS NATIVE OVER INVASIVE APPLE SNAILS -- Nathan J. Dorn[1]** and M. Hafsadi; [1]Department of Biological Sciences, Florida Atlantic University, Davie, FL, USA

72 **HABITAT SUITABILITY FOR AN ENDANGERED BUTTERFLY, BARTRAM'S SCRUB HAIRSTREAK, AND IMPLICATIONS FOR MANAGEMENT -- Alana Edwards[1]** and Scott Markwith[1]; [1]Florida Atlantic University, Boca Raton, FL, USA

97 **GUIDING LAKE TRAFFORD'S RESTORATION: LAKE TRAFFORD MANAGEMENT TEAM AND MANAGEMENT ACTION PLAN -- Edwin M. Everham III**[1], Serge Thomas[1], John Ferlita[1], Mark Lucius[1], and David W. Ceilley[2]; 1Florida Gulf Coast University, Ft. Myers, FL, USA; [2]Johnson Engineering Inc. Ft Myers, FL, USA

98 **HERPETOFAUNAL COMMUNITY CHANGES IN MULTIPLE HABITATS OVER FIFTEEN YEARS IN THE CORKSCREW REGIONAL ECOSYTEM WATERSHED** -- Dean A. Croshaw[2], John R. Cassani[1], Joseph Bozzo[3], Brenda Brooks[4], **Edwin M. Everham III**[1], David W. Ceilley[1], Deborah Hanson[4]; [1]Florida Gulf Coast University, Department of Marine and Ecological Sciences, Fort Myers, Florida, USA; [2]Florida Gulf Coast University, Department of Biological Sciences, Fort Myers, Florida, USA; [3]South Florida Water Management District, Estero, Florida, USA; [4]Corkscrew Regional Ecosystem Watershed Land & Water Trust, Estero, Florida, USA

69 **THE ROLE OF THE AMERICAN ALLIGATOR (ALLIGATOR MISSISSIPPIENSIS) AND AMERICAN CROCODILE (CROCODYLUS ACUTUS) AS INDICATORS OF ECOLOGICAL CHANGE IN EVERGLADES ECOSYSTEMS --** Frank J. Mazzotti[1], **Seth Farris[1]**, Michael S. Cherkiss[2], Laura A. Brandt[3], Caitlin Hackett[1], Michiko Squires[1], Venetia Briggs[1], Jeff Beauchamp[1], and Kristen M. Hart[2]; [1]University of Florida, Fort Lauderdale Research and Education Center, Davie, FL, USA; [2]U.S. Geological Survey, Southeast Ecological Science Center, Davie, FL, USA; [3]U.S. Fish and Wildlife Service, Davie, FL, USA

32 **DERIVATION OF A WATER QUALITY CRITERION TO PROTECT THE FLORIDA PANTHER (PUMA CONCOLOR CORYI) -- Larry E. Fink**; [1]Owner and Principal, Waterwise Consulting™, LLC, Hollywood, FL, USA

24 **DOES FIRE HAVE A ROLE IN THE TRANSITION FROM A HEALTHY TREE ISLAND TO A GHOST ISLAND? A FIRE HISTORY ANALYSIS -- Junnio Freixa**, Michael Ross, Jay Sah, Jesus Blanco, and Susana Stoffella; [1]Southeast Environmental Research Center, Florida International University, Miami, FL, USA

70 **HOME RANGE AND MOVEMENTS OF AMERICAN ALLIGATORS IN AN ESTUARY HABITAT -- Ikuko Fujisaki[1]**, Kristen Hart[2], Frank Mazzotti[1], Michael Cherkiss[2], Autumn Sartain[3], Brian Jeffery[4], Jeffrey Beauchamp[1], and Mathew Denton[2]; [1]University of Florida, Davie, FL, USA; [2]U.S. Geological Survey, Davie, FL, USA; [3]CNTS, Davie, FL, USA; [4]University of Florida, Gainesville, FL, USA

65 **DESCRIBING LARGEMOUTH BASS BIOMETRIC AND DISTRIBUTIONAL CHARACTERISTICS IN ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE, FLORIDA, USA --** Jeffrey Herod[1], **John Galvez[2]**, Thomas Sinclair[3], Allan Brown[1], Andy Jackson[4], Theresa Thom[5]; [1]U.S. Fish & Wildlife Service, Atlanta, GA, USA; [2]U.S. Fish & Wildlife Service, Vero Beach, FL, USA; [3]U.S. Fish & Wildlife Service, Albuquerque, NM, USA; [4]U.S. Fish & Wildlife Service, Welaka, FL, USA; [5]U.S. Fish & Wildlife Service, Hardeeville, SC, USA

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66 **DESCRIBING THE FISH COMMUNITY IN THE ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE, FLORIDA, USA --** Jeffrey Herod[1], **John Galvez[2]**, Thomas Sinclair[3], Allan Brown[1], Andy Jackson[4], Edgardo Diaz-Ferguson[5], Gregory R. Moyer[5], Theresa Thom[6]; [1]U.S. Fish & Wildlife Service, Atlanta, GA, USA ; [2]U.S. Fish & Wildlife Service, Vero Beach, FL USA; [3]U.S. Fish & Wildlife Service, Albuquerque, NM, USA; [4]U.S. Fish & Wildlife Service, Welaka, FL, USA; [5]U.S. Fish & Wildlife Service, Warm Springs, GA, USA; [6]U.S. Fish & Wildlife Service, Hardeeville, SC, USA

94 **THE EVERGLADES NATIONAL PARK AND BIG CYPRESS NATIONAL PRESERVE VEGETATION MAPPING PROJECT --** Kevin R. T. Whelan[1], Pablo L. Ruiz[2], Theodore Schall[3], and **Helena Giannini[4];** [1]National Park Service, Palmetto Bay, FL, USA; [2]National Park Service, Palmetto Bay, FL, USA; [3]United States Army Corps of Engineers, Jacksonville, FL, USA; [4]National Park Service, Palmetto Bay, FL, USA

38 **USING HEAT AS A TRACER TO QUANTIFY EFFECTS OF RESTORED HIGH FLOWS ON GROUNDWATER-SURFACE WATER INTERACTIONS IN THE EVERGLADES -- Jesus D. Gomez-Velez**, Jud Harvey, Jay Choi, Brendan Buskirk, and Allison Swartz; U.S. Geological Survey, Reston, VA, USA

89 **ASSESSING IMPACTS OF AN ACTIVE WATER SCHEDULE ON VEGETATION AND MAMMAL COMMUNITIES IN HOLEY LAND WILDLIFE MANAGEMENT AREA -- Sergio C. Gonzalez**; [1]Florida Fish & Wildlife Conservation Commission, Sunrise, FL, USA

68 **SMALL MAMMAL COMMUNITIES AS INDICATORS OF RESTORATION SUCCESS IN THE GREATER EVERGLADES --** Stephanie S. Romañach[1], **Matthew R. Hanson[2]**, Julia P. Chapman[2], and James M. Beerens[1]; [1]U.S. Geological Survey, Fort Lauderdale, FL, USA; [2]Cherokee Nation Technology Solutions, contractor to U.S. Geological Survey, Fort Lauderdale, FL, USA

81 **EFFECTIVENESS OF AERIAL HERBICIDE TREATMENT OF MELALEUCA FOR HABITAT RECOVERY IN THE NORTHERN EVERGLADES -- Diane Harshbarger[1]**, Brian W. Benscoter[1], and Rebecca Gibble[2]; [1]Florida Atlantic University, Davie, FL, USA; [2]Arthur R. Marshall Loxahatchee National Wildlife Refuge, Boynton Beach, FL, USA

58 **CONCERN FOR INVASIVE BURMESE PYTHONS (PYTHON MOLURUS BIVITTATUS) AMONG PARTICIPANTS AND NON-PARTICIPANTS IN THE 2013 PYTHON CHALLENGE -- Rebecca G. Harvey[1]**, Larry Perez[2], and Frank J. Mazzotti[1]; [1]University of Florida, Fort Lauderdale Research and Education Center, Davie, FL, USA; [2]Everglades National Park, Homestead, FL, USA

79 **HOME RANGE SIZE AND HABITAT USE BY THE EASTERN INDIGO SNAKE (DRYMARCHON COUPERI) IN SOUTH FLORIDA: C-44 RESERVOIR SITE, ALLAPATTAH FLATS, AND BABCOCK RANCH --** David W. Ceilley[1], **John E. Herman[2]**, S. Brent Jackson[2], Daniel Dickinson[2], Chelsie F. Houston[2], Jon Webb[2], and Edwin M. Everham III[2]; [1]Johnson Engineering Inc. Ft Myers, FL USA; [2]Florida Gulf Coast University, Ft. Myers, FL, USA

64 **QUANTIFYING THE MOVEMENT AND HABITAT USE OF NATIVE SUNFISHES IN RESPONSE TO SEASONAL HYDROLOGICAL VARIATION IN THE EVERGLADES -- Gregory J. Hill[1]**, Amartya K. Saha[2], Eric Cline[3], Mark Cook[4] and Jennifer S. Rehage[2]; [1]Florida International University, Miami, FL, USA; [2]Florida International University, Miami, FL, USA; [3]South Florida Water Management District, FL, USA; [4]South Florida Water Management District, FL, USA

59 **ENVIRONMENTAL DNA (EDNA) OCCURRENCE AND DETECTION ESTIMATES FOR INVASIVE BURMESE PYTHONS IN SOUTHERN FLORIDA -- Margaret E. Hunter[1]**, Sara J. Oyler-McCance[2], Robert M. Dorazio[1], Jennifer A. Fike[2], Brian J. Smith[3], Robert N. Reed[2] and Kristen M. Hart[4]; [1]US Geological Survey, Southeast Ecological Science Center, Gainesville, FL, USA; [2]US Geological Survey, Fort Collins Science Center, Fort Collins, CO, USA; [3]University of Florida, Department of Wildlife Ecology and Conservation, Newins-Ziegler Hall, Gainesville, FL, USA; [4]US Geological Survey, Southeast Ecological Science Center, Davie, FL, USA

11 **CARBON FUNCTIONAL GROUPS INFLUENCE METHANOGENESIS PATHWAYS: FLORIDA EVERGLADES AS A CASE STUDY --** Lucy Ngatia[1], Anna E. Normand[1], Francisca Hinz[1], Patrick. Inglett[1], Jeff Chanton[2] K. Ramesh Reddy[1], and **Kanika S. Inglett[1]**; [1]University of Florida, Department of Soil and Water Science, Gainesville, FL, USA; [2]FSU Department of Oceanography, Tallahassee, FL, USA

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12 **MICROBIAL METHANE OXIDATION IN FRESHWATER WETLAND SOILS: KINETICS AND SENSITIVITY TO NUTRIENT CONDITIONS --** Francisca Hinz, Lucy Ngatia, Patrick W. Inglett, K. Ramesh Reddy, and. **Kanika S. Inglett**; Soil and Water Science Department, University of Florida, Gainesville, FL, USA

7 **DEVELOPING SUSTAINABLE SOIL MANAGEMENT PRACTICES FOR ORGANIC SOILS OF THE EVERGLADES AGRICULTURAL AREA -- Stephen Jennewein**, Samira Daroub, Jehangir Bhadha, Maninder Singh, Mabry McCray, Timothy Lang; University of Florida, Everglades Research Education Center, Belle Glade, FL, USA

39 **AN INTEGRATED ENVIRONMENT MODEL FOR A CONSTRUCTED WETLAND - HYDRODYNAMICS AND TRANSPORT PROCESSES -- KangRen Jin**[1] and Zhen-Gang Ji[2]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Catholic University of America, Washington, DC, USA

40 **MONITORING WATER STAGE AND VEGETATION IN THE EVERGLADES USING SINGLE POLARIMETRIC RADARSAT-2 IMAGERY -- Anupama John** and Hector R. Fuentes; Florida International University, Miami, FL, USA

16 **BIOGEOCHEMICAL FLUXES FROM ESTUARINE MANGROVE LAKE SEDIMENTS ADJACENT TO FLORIDA BAY --** Michael S. Owens[1], **Stephen P. Kelly**[2], Thomas A. Frankovich[3], David T. Rudnick[4], James W. Fourqurean[3], and Jeffrey C. Cornwell[1]; [1]Horn Point Laboratory, University of Maryland Center for Environmental Science, Cambridge, MD, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA; [3]Department of Biological Sciences, Marine Science Program and Southeast Environmental Research Center, Florida International University, North Miami, FL, USA; [4]Everglades National Park, Homestead, FL, USA

95 **VEGETATION REGENERATION IN THE HOLE-IN-THE-DONUT, EVERGLADES NATIONAL PARK, MEETS SUCCESS TARGETS -- Suzanne M. Kennedy**[1], Jill E. Meyer[2], Jonathan E. Taylor[3], Steven W. Woodmansee[4], and Chris Haddad[1]; [1]Floravista, Inc., Merritt Island, FL, USA; [2]CSS-Dynamac, Fairfax, VA, USA; [3]National Park Service, Everglades National Park, Homestead, FL, USA; [4]Pro Native Consulting, Miami, FL, USA

62 **WHERE ARE ALL THE BONEFISH? INTEGRATING ANGLER PERSPECTIVES AND ECOLOGICAL CHANGES INFLUENCING BONEFISH DECLINES IN THE FLORIDA BAY -- Emily Kroloff** [1], Jennifer Rehage [1], Joel Heinen [1], Rolando Santos [1], Ross Boucek [1]; [1]Florida International University, Miami, FL, USA

35 **BIODIVERSITY OF FUNCTIONAL GENES ACROSS MIAMI-DADE COUNTY SOILS -- Priyanka Kushwaha**[1], Jacqueline Zayas[2], Yanie Oliva[2], Maria Mendoza[2,3], Beatrice Kallifatidis[2,3], and DeEtta Mills[2,3]; [1]Department of Chemistry and Biochemistry, Florida International University, Miami, FL, USA; [2]Department of Biological Sciences, Florida International University, Miami, FL, USA; [3]International Forensic Research Institute, Florida International University, Miami, FL, USA

85 **IBBEAM – AN INTEBRATED BISCAYNE BAY ECOLOGICAL ASSESSMENT AND MONITORING PROJECT -- Gladys A. Liehr**[1], Diego Lirman[1], Joe Serafy[2], Joan Browder[2], Sarah Bellmund[3]; [1]University of Miami, Miami, FL, USA; [2]National Marine Fisheries Service, Miami, FL, USA; [3]Biscayne National Park, Homestead, FL, USA

41 **HYDROLOGIC CONTROLS OF COASTAL GROUNDWATER DISCHARGE IN TAYLOR SLOUGH, EVERGLADES NATIONAL PARK, FL, USA -- Edward I. Linden**[1] and René M. Price[1,2]; [1]Department of Earth and Environment, Florida International University, Miami, FL, USA; [2]Southeast Environmental Research Center, Florida International University, Miami, FL, USA

15 **THE RRELATIONSHIP BETWEEN RAINFALL AND NUTRIENT CONCENTRATIONS IN THE COASTAL EVERGLADES -- Mario Londono**[1], Henry Briceno[2], Jeff Onsted[1] and Nick Jaffe[2]; [1]Florida International University, Department of Earth and Environment, Miami, FL, USA; [2]Florida International University, Southeast Environmental Research Center, Miami, FL, USA

75 **ALGAL BIODIVERSITY IN SUBTROPICAL WETLANDS: AN OPPORTUNITY FOR COMPARATIVE RESEARCH -- Luca Marazzi**[1], Evelyn Gaiser[1]; Southeast Environmental Research Center, Florida International University, Miami, FL, USA

1 **THE PINE ROCKLANDS OF THE MIAMI ROCK RIDGE: AN EVERGLADES ECOSYSTEM IN PERIL -- Sarah Martin**[1] and Craig van der Heiden[2]; [1]The Institute For Regional Conservation, Miami, FL, USA; [2]The Institute For Regional Conservation, Delray Beach, FL, USA

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96 **RESPONSE OF THE DIATOM ENCYONEMA EVERGLADIANUM TO ENVIRONMENTAL CHANGES ASSOCIATED WITH SEA LEVEL RISE IN THE CARIBBEAN BASIN -- Viviana Mazzei**[1] and Evelyn Gaiser[1]; [1]Department of Biological Sciences, Florida International University, Miami, FL, USA

30 **SPATIAL VARIABILITY IN BIOGENIC GAS RELEASES FROM SUBTROPICAL PEAT MONOLITHS IS REVEALED FROM HIGH FREQUENCY GROUND PENETRATING RADAR (GPR) -- Matthew D. McClellan**[1], William J. Wright[1], Thomas Shahan[1], Nathaniel Sharpe[1], Gregory J. Mount[2], Xavier Comas[1]; [1]Florida Atlantic University, Davie, FL, USA; [2]Indiana University of Pennsylvania, Indiana, PA, USA

46 **NESTING HABITAT AVAILABILITY FOR CAPE SABLE SEASIDE SPARROWS AS A FUNCTION OF EVERGLADES WATER DEPTH --** Pamela Telis[1] and **Bryan McCloskey**[2]**;** [1]U.S. Geological Survey, Caribbean-Florida Water Science Center, Jacksonville, FL, USA; [2]Cherokee Nation Technology Solutions, contractor to U.S. Geological Survey, St. Petersburg, FL, USA

44 **USING EXPLORE AND VIEW EDEN (EVE) TO ACCESS EVERGLADES DEPTH ESTIMATION NETWORK (EDEN) DATA -- Bryan McCloskey**[1], Pamela Telis[2], and Matthew Petkewich[3]; [1]U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center, St. Petersburg, FL, USA; [2]U.S. Geological Survey, Caribbean-Florida Water Science Center, Jacksonville, FL, USA; [3]U.S. Geological Survey, South Atlantic Water Science Center, Columbia, SC, USA

45 **USING THE EVERGLADES DEPTH ESTIMATION NETWORK (EDEN) FOR REAL-TIME EVALUATION OF THE EVERGLADES RESTORATION TRANSITION PLAN (ERTP) AND ITS IMPACTS ON TREE ISLANDS IN THE FLORIDA EVERGLADES --** Pamela Telis[1] and **Bryan McCloskey**[2]; [1]U.S. Geological Survey, Caribbean-Florida Water Science Center, Jacksonville, FL, USA; [2]Cherokee Nation Technology Solutions, contractor to U.S. Geological Survey, St. Petersburg, FL, USA

33 **SNAIL KITE (ROSTRHAMUS SOCIABILIS) EXPOSURE TO MERCURY IN FLORIDA: SUB-LETHAL CONCENTRATIONS IN THE SOUTHERN EVERGLADES MAY HINDER REPRODUCTION AND CURTAIL RECOVERY -- Kenneth D. Meyer**[1], Gina M. Kent[1], and David C. Evers[2]; [1]Avian Research and Conservation Institute, Gainesville, FL, USA; [2]Biodiversity Research Institute, Portland, ME, USA

5 **DISEASE, DOGS AND DRONES: AN INTEGRATED APPROACH FOR TRACKING FUNGAL PATHOGENS IN THE ENVIRONMENT -- DeEtta Mills**[1], Kenneth Furton[1], Jennifer Gebelein[1], Julian Mendel[1], Beatrice Kallifatidis[1], and Alison Simon[1]; [1]Florida International University, Miami, FL, USA

9 **EXAMINING BIOGENIC GAS DYNAMICS IN PEAT SOILS OF THE FLORIDA EVERGLADES USING CAPACITANCE MOISTURE PROBES -- Cali Munzenrieder**, Alex Garcia, and Xavier Comas; Florida Atlantic University, Boca Raton, FL, USA; Davie, FL, USA

86 **THE FLORIDA PANTHER PAYMENT FOR ECOSYSTEM SERVICES PILOT PROJECT --** Kevin Godsea[1] and **Erin P. Myers**[1]**;** [1]US Fish and Wildlife Service Southwest Florida Gulf Coast Refuge Complex, Immokalee, FL, USA

36 **FLORISTIC DATA – THEORY, APPLICATION, AND IMPACT -- Lindsey Roland Nieratka, M.S.**[1], George D. Gann[1], and Craig van der Heiden, Ph.D[1]**;** [1]The Institute for Regional Conservation, Delray Beach, FL, USA

22 **USE OF FLUORESCENT DISSOLVED ORGANIC MATTER (FDOM) SENSOR DATA TO CALCULATE DISSOLVED ORGANIC CARBON CONCENTRATIONS IN EVERGLADES NATIONAL PARK -- Eduardo Patino**[1] and Travis Knight[1]; [1]United States Geological Survey, Fort Myers, FL, USA

52 **EG REVITALIZATION: MANAGE THE UNAVOIDABLE OF SEA-LEVEL RISE -- Thomas L. Poulson**[1]; University of Illinois-Chicago (Retired), Chicago, IL, USA; Florida Atlantic University, Jupiter, FL, USA

23 **POST-FIRE SUCCESSION AND CARBON STORAGE IN THE NORTHERN EVERGLADES -- Lisa M. Reger** and Brian W. Benscoter; Environmental Science Program, Florida Atlantic University, Davie, FL, USA

31 **CYANOBACTERIAL MEDIATED MINERALIZATION OF A RARE FORM OF CALCIUM CARBONATE IN THE EVERGLADES: VATERITE -- Barry H. Rosen**[1], Nicholas Schulte[2], Evelyn Gaiser[2] and Colin Saunders[3]; [1]US Geological Survey, Orlando, FL, USA; [2]Florida International University, Miami, FL, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA

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54 **THE BOTANY OF SHELL MOUNDS IN SOUTHWESTERN EVERGLADES NATIONAL PARK, FLORIDA -- Jimi Sadle[1];** [1]National Park Service, Everglades National Park, Homestead, FL, USA

84 **HYDROLOGIC DRIVEN SHORT-TERM VEGETATION SUCCESSIONAL DYNAMICS IN SHARK RIVER SLOUGH, EVERGLADES NATIONAL PARK, FLORIDA -- Jay Sah**[1], Michael Ross[1, 2], and Pablo Ruiz[3]; Southeast Environmental Research Center, Florida International University, Miami, FL, USA; Department of Earth & Environment, Florida International University, Miami, FL, USA; South Florida/Caribbean I&M Network, National Park Service, Palmetto Bay, FL, USA

77 **THE TROJAN Y METHOD FOR CONTROLLING ESTABLISHED INVASIVE SPECIES -- Pamela J. Schofield[1]**, Margaret Hunter[1] and John Teem[2]; [1]US Geological Survey, Gainesville, FL, USA; [2]Florida Department of Agriculture and Consumer Services, Tallahassee, FL, USA

3 **REDUCING LABILE PHOSPHORUS IN AGRICULTURAL CANAL SEDIMENT BY CONTROLLING FLOATING AND SUBMERGED AQUATIC VEGETATION -- Anne E. Sexton[1]**, Jehangir H. Bhadha[1], Timothy A. Lang[1], and Samira H. Daroub[1]; [1]University of Florida, IFAS, Everglades Research and Education Center, Belle Glade, FL, USA

28 **UTILIZING GROUND PENETRATING RADAR (GPR) TO INVESTIGATE THE TEMPORAL AND SPATIAL DISTRIBUTION OF BIOGENIC GASES FROM PEAT SOILS AT THE LOXAHATCHEE IMPOUNDMENT LANDSCAPE ASSESSMENT (LILA) --** Nathan Sharp, **Thomas Shahan**, William Wright, and Xavier Comas; Department of Geosciences, Florida Atlantic University, Davie, FL, USA

71 **ALLIGATOR PRODUCTION SUITABILITY INDEX MODEL FOR RESTORATION PLANNING AND ASSESSMENT -- Dilip Shinde[1]**, Leonard Pearlstine[1], Laura A. Brandt[2], Frank J. Mazzotti[3], Mark W. Parry[1], Brian Jeffery[3], and Alicia Lo Galbo[4]; [1]South Florida Natural Resources Center, Everglades National Park, Homestead, FL, USA; [2]U.S. Fish and Wildlife Service, Davie, FL, USA; [3]Fort Lauderdale Research and Education Center, University of Florida, Davie, FL, USA; [4]U.S. Army Corps of Engineers, Norfolk, VA, USA

55 **APPLICATION OF VOC ANALYSIS FOR CANINE TRAINING AND THE DETECTION OF THE FATAL LAUREL WILT DISEASE -- Alison G. Simon**[1], Julian Mendel[1], Kenneth G. Furton[1], and DeEtta Mills[1]; [1]Florida International University, Miami, FL, USA

29 **INVESTIGATING THE EFFECTS OF INCREASED SALINITY AND TEMPERATURE ON CARBON GAS DYNAMICS OF SUBTROPICAL PEAT SOILS -- Matthew Sirianni[1]** and Xavier Comas[1]; [1]Florida Atlantic University, Boca Raton, FL, USA

56 **MITIGATING THE CULTURAL AND ECOLOGICAL LOSSES FROM LAUREL WILT ON SWAMP BAY ON TRIBAL LANDS IN FLORIDA -- Lanette Sobel**; University of Florida, IFAS, Gainesville, FL, USA

42 **VISUALIZATION OF WATER VELOCITY FIELDS ENTERING AND EXITING STRUCTURE-152 IN SUPPORT OF THE DECOMPARTMENTALIZATION PHYSICAL MODEL (DPM), WATER CONSERVATION AREA 3, MIAMI-DADE COUNTY, FLORIDA -- Lars Soderqvist[1];** [1]U.S. Geological Survey, Fort Myers, FL, USA

10 **INFLUENCE OF SOIL BIOGEOCHEMICAL PROPERTIES ON EXOTIC INVASIVE LYGODIUM MICROPHYLLUM: A CROSS CONTINENT COMPARISON OF SOIL CHARACTERISTICS TO INVASION SUCCESS -- Pushpa Gautam Soti[1],** Krish Jayachandran[1], Matthew Purcell[2]; [1]Department of Earth and Environment, Florida International University, Miami, FL, USA; [2]USDA-ARS Australian Biological Control Laboratory, Brisbane, Queensland, Australia

76 **MOLLUSCAN SURVIVAL IN EXTREME ENVIRONMENTS OF FLORIDA BAY -- Bethany Stackhouse[1]**, G. Lynn Wingard[1]; [1]U.S. Geological Survey, Reston, VA, USA

73 **INSIGHTS INTO FEEDING ECOLOGY, TIMING OF EGG FORMATION, AND GEOGRAPHIC RANGE OF WATERBIRDS FROM SOUTH FLORIDA USING THE STABLE ISOTOPIC COMPOSITION OF CARBONATE (C & O) AND THE ORGANIC MATRIX (C & N) --** Greta Mackenzie [1], Fred Schaffner[2], and **Peter K. Swart[1]**; [1]Department of Marine Geological Sciences, RSMAS, University of Miami, Miami, FL, USA; [2]Universidad del Turabo, School of Science and Technology, Gurabo, PR

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14 **MEASURING HIGH-FLOW SEDIMENT DYNAMICS TO DETERMINE A HYDRAULIC THRESHOLD FOR RESTORING THE RIDGE AND SLOUGH LANDSCAPE -- Allison Swartz[1]**, Jud Harvey[1], Laurel Larsen[2,1], Jay Choi[1], Jesus Gomez-Velez[1]and Brendan Buskirk[1]; [1]U.S. Geological Survey-National Research Program, Reston, VA, USA; [2]University of California, Berkeley, CA, USA

18 **HYDROLOGIC MODELING OF PROPOSED RESERVOIR IN WEST MIAMI DADE TO SUPPLY FRESH WATER FOR ENVIRONMENTAL RESTORATION OF BISCAYNE NATIONAL PARK -- Georgio Tachiev[1]**, Amy Cook[1], Ken Ammon[2], Humberto Alonso[3], Jose Lopez [3], Sam Poole[4]; [1]GIT Consulting LLC, Coral Gables, FL, USA; [2]Ammon Water Resource Engineering LLC, FL, USA; [3]Atkins Global Inc, Fort Lauderdale, FL, USA; [4] Berger Singerman, Fort Lauderale FL, USA

2 **STORMWATER PONDS OF SW FLORIDA COULD DEAL A BLOW TO GEER -- Serge Thomas;** Florida Gulf Coast University (FGCU), FL, USA

21 **USING FOSSILIZED CHARCOAL AND 210PB TO TEST THE EVERGLADES FIRE HISTORY GEODATABASE -- Ginger Tiling-Range[1]**, Thomas J. Smith III[2], A. M. Foster[3], J. M. Smoak[4], and J. L. Breithaupt[5]; [1]Cherokee Nations Business Solutions, St. Petersburg, FL, USA; [2]Southeast Ecological Science Center, U.S. Geological Survey, St. Petersburg, FL, USA; [3]Southeast Ecological Science Center, U.S. Geological Survey, Gainesville, FL, USA; [4]Department of Environmental Science, University of South Florida, St. Petersburg, FL, USA; [5]College of Marine Science, University of South Florida, St. Petersburg, FL, USA

4 **IMPACT OF WATER MANAGEMENT ON RICE YIELDS, RICE WATER WEEVIL INFESTATION AND RAINAGE WATER QUALITY IN THE EVERGLADES AGRICULTURAL AREA -- Mohsen Tootoonchi**, Timothy Lang, Jehangir Bhadha and Samira Daroub; Everglades Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida, Belle Glade, FL, USA

17 **NUTRIENTS IN LEAVES OF POND APPLES (ANNONA GLABRA) AND SURROUNDING SOIL AND WATER IN A CYPRESS-POND APPLE SWAMP IN THE NORTHERN EVERGLADES --** Peggy VanArman[1] and **Joel VanArman[2];** [1]Palm Beach Atlantic Univ., West Palm Beach, FL, USA; [2]Arthur R. Marshall Foundation. Lake Worth, FL, USA

43 **INSAR FOR WATER LEVEL MONITORING IN THE EVERGLADES WETLANDS -- Shimon Wdowinski[1]**, Sang-Hoon Hong[1,2] and Brian Brisco[3]; [1]University of Miami, Miami, FL, USA; [2]Korea Polar Research Institute, Incheon, Republic of Korea; [3]Canada Centre for Mapping and Earth Observation, Ottawa, Canada

91 **AVAILABILITY OF GEODETIC SURVEYS BY THE U.S. GEOLOGICAL SURVEY IN SOUTH FLORIDA -- Corey Whittaker [1]**, Eric Carlson[1]; [1]U.S. Geological Survey, Davie, FL, USA

80 **DIET ANALYSIS OF OUSTALET'S CHAMELEONS (FURCIFER OUSTALETI), AN ESTABLISHED EXOTIC IN SOUTHERN FLORIDA, USA -- Sara E. Williams[1]**, Joy J. Vinci[1], Edward F. Metzger III[1], Michael R. Rochford[1], Dustin Smith[2], Frank J. Mazzotti[1]; [1]University of Florida, Davie, FL, USA; [2]Miami-Dade Zoological Parks and Gardens, Miami, FL, USA

82 **SEASONAL BIOGENIC GAS DYNAMICS IN THE FLORIDA EVERGLADES ARE REVEALED USING HYDROGEOPHYSICAL METHODS -- William Wright[1]**, Greg Mount[2], Matthew McClellan[1], Xavier Comas[1]; [1]Florida Atlantic University, Davie, FL, USA; [2]Indiana University of Pennsylvania, Indiana, PA, USA

83 **USING GROUND PENETRATING RADAR (GPR) TO IMAGE SPATIAL VARIABILITY IN POROSITY IN THE MIAMI LIMESTONE --** Gregory J. Mount[1], Xavier Comas[2], Matthew McClellan[2], **William Wright[2]**; [1]Department of Geosciences, Indiana University of Pennsylvania, Indiana, PA, USA; [2]Department of Geosciences, Florida Atlantic University, Davie, FL, USA

93 **PATTERN METRICS AND THE EARLY DETECTION OF ECOSYSTEM DEGRADATION IN THE RIDGE-SLOUGH LANDSCAPE -- Jing Yuan**, Matthew J Cohen; Ecohydrology Lab, University of Florida, Gainesville, FL, USA

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Full Author Recognition

(Oral Presentations)

Tuesday, April 21, 2015 | 10:20am - 12noon

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Session #1: Sea-Level Rise and Restoration Part I: Understanding and Projections of a Changing Landscape and Seascape

[Great Cypress]

Moderator: Glenn Landers, U.S. Army Corps of Engineers, Jacksonville, FL

10:20 Introduction

10:30 **AN OVERVIEW OF GLOBAL AND REGIONAL SEA-LEVEL RISE PROJECTIONS -- Jayantha Obeysekera**; South Florida Water Management District, West Palm Beach, FL, USA

10:45 SEA-LEVEL RISE AND CLIMATE CHANGE AT THE COASTAL BOUNDARY: OBSERVATIONS, PROJECTIONS, AND ISSUES OF CONCERN FOR RESOURCE MANAGEMENT **-- Frank Marshall[1]** and Erik Stabenau[2]; [1]Cetacean Logic Foundation, New Smyrna Beach, FL, USA; [2] South Florida Natural Resources Center, National Park Service, Homestead, FL, USA

11:00 ANALYSIS OF SEA LEVEL RISE AND CLIMATE CHANGE SCENARIOS FOR FLORIDA BAY USING THE FATHOM MODEL -- **Bernard Cosby[1]**, Frank Marshall[2] and William Nuttle[3]; [1]Centre for Ecology and Hydrology, Bangor, Wales, UK, and Department of Environmental Sciences, University of Virginia, Charlottesville, VA; [2]Cetacean Logic Foundation, New Smyrna Beach, FL, USA; [3]Eco-hydrology, Ottawa, Ontario, Canada

11:15 **EFFECTS OF SEA-LEVEL RISE AND WATER MANAGEMENT ON THE HYDROLOGIC IMPACT OF HISTORIC STORMS -- Swain, Eric[1]**, Krohn, M. Dennis[2], Lohmann, Melinda[1], Langtimm, Catherine[3], and Obeysekera, Jayantha[4]; [1]U.S. Geological Survey, Fort Lauderdale, FL USA; [2]U.S. Geological Survey, St. Petersburg, FL, USA; [3]U.S. Geological Survey, Gainesville, FL, USA; [4]South Florida Water Management District, West Palm Beach, FL, USA

11:30 **PHOSPHOROUS RELEASE FROM THE BISCAYNE AQUIFER WITH SEA-LEVEL RISE -- René M. Price**; Department of Earth and Environment and SERC, Florida International University, Miami, FL, USA

11:45 **POTENTIAL SEA LEVEL CHANGE IMPACTS WITHIN THE SHARK RIVER SLOUGH BASIN AREA -- Glenn B. Landers**; U.S. Army Corps of Engineers, Jacksonville, FL, USA

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Session #2: Linking Everglades Restoration and Mercury Cycling, Bioaccumulation and Toxicity

[Royal Poinciana]

Moderator: David Krabbenhoft, U.S. Geological Survey, Middleton, WI

10:20 Introduction

10:30 **THE INFLUENCES OF DISSOLVED ORGANIC MATTER ON MERCURY CYCLING IN THE FLORIDA EVERGLADES -- George Aiken[1]**, David P. Krabbenhoft[2], William H. Orem[3]; [1]U.S. Geological Survey, Water Resources Discipline, Boulder, CO, USA; [2]U.S. Geological Survey, Water Resources Discipline, Middleton, WI, USA; [3]U.S. Geological Survey, National Center, Reston, VA, USA

10:45 **AN EXAMINATION OF THE NET METHYLMERCURY PRODUCTION IN THE FLORIDA EVERGLADES USING A EULERIAN APPROACH -- Michael Tate[1]**, Dave Krabbenhoft[1], Morgan Maglio[1], John DeWild[1], Jacob Ogorek[1], Charlie Thompson[1], Bill Orem[2], and George Aiken[3]; [1]U.S. Geological Survey, Middleton, WI, USA; [2]U.S. Geological Survey, Reston, VA, USA; [3]U.S. Geological Survey, Boulder, CO, USA

11:00 **DRIVERS OF GEOSPATIAL AND TEMPORAL VARIABILITY IN THE DISTRIBUTION OF MERCURY AND METHYLMERCURY IN THE EVERGLADES NATIONAL PARK -- Morgan Maglio[1]**, David Krabbenhoft[1], Michael Tate[1], John DeWild[1], Jacob Ogorek[1], Charlie Thompson[1], George Aiken[2], William Orem[3], Jeffrey Kline[4], Joffre Castro[4], Cynthia Gilmour[5]; [1] U.S. Geological Survey, Middleton, WI, USA; [2] U.S. Geological Survey, Boulder, CO, USA; [3] U.S. Geological Survey, Reston, VA, USA; [4] National Park Service, Everglades National Park, Homestead, FL, USA; [5] Smithsonian Estuarine Research Center, Edgewater, MD, USA

11:15 **TROPHIC TRANSFER OF MERCURY ALONG SALINITY GRADIENTS IN SHARK RIVER AND CALOOSAHATCHEE RIVER ESTUARIES -- Darren G. Rumbold[1]**, Ted R. Lange[2], Doug Richards[2], Gina DelPizzo[2], and Nicole Fronczkowski[1]; [1]Florida Gulf Coast University, Fort Myers, FL USA; [2]Florida Fish and Wildlife Conservation Commission, Eustis, FL. USAShaye Sable, Erol Karadogan, and Chris Wallen; Dynamic Solutions, LLC, Baton Rouge, LA, USA

11:30 **MERCURY BIOACCUMULATION IN PYTHONS FROM THE GREATER EVERGLADES -- Kristen M. Hart[1]**, David Krabbenhoft[2], Amanda Demopoulos[3], Michael Tate[2], Jacob Ogorek[2], John DeWild[2], Charlie Thompson[2], Jennifer McClain-Counts[3], and Skip Snow[4]; [1]U. S. Geological Survey, Davie, FL, USA; [2]U.S. Geological Survey, Middleton, WI, USA; [3]U.S. Geological Survey, Gainesville, FL, USA; [4]National Park Service, Everglades National Park, Homestead, FL, USA

11:45 **FISH MERCURY IN THE FLORIDA EVERGLADES: MANAGEMENT IMPLICATIONS FOR EVERGLADES RESTORATION -- Ted R. Lange**; Florida Fish and Wildlife Conservation Commission, Eustis, FL, USA

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Session #3: Biscayne Bay Part I: Assessment of Current and Recent Ecosystem Conditions in Western Biscayne Bay

[Ibis]

Moderator: Patrick Pitts, U.S. Fish & Wildlife Service, Vero Beach, FL

10:20 Introduction

10:30 **SALINITY PATTERNS AND TRENDS IN WESTERN BISCAYNE BAY -- Sarah A. Bellmund[1]**, Gladys Liehr[2], Joseph Serafy[2,], Diego Lirman[2], and Joan Browder[3]; [1]National Park Service, BNP, Homestead, FL; [2]University of Miami, RSMAS, Miami FL; [3]NOAA Fisheries, SEFSC, Miami FL

10:45 **SAV COMMUNITIES OF WESTERN BISCAYNE BAY, MIAMI, FLORIDA, USA: HUMAN AND NATURAL DRIVERS OF SEAGRASS AND MACROALGAL ABUNDANCE AND DISTRIBUTION -- D. Lirman[1]**, S. Schopmeyer[1], R. Santos[1], L. Collado-Vides[2], S. Bellmund[3], G. Liehr[1], J. Serafy[1,4], J. Browder[4]; [1]University of Miami, Miami, FL 33149, USA; [2]Florida International University, Miami, FL 33199, USA; [3]Biscayne National Park, Homestead, FL 33033, USA; [4]NOAA/NMFS/SEFSC, Miami, FL 33149, USA

11:00 **BISCAYNE BAY ALONGSHORE EPIFAUNA - INDICATORS OF ECOSYSTEM CHANGE -- Joan A Browder[1], Gladys A Liehr[2],** Diego Lirman[2], Sarah Bellmund[3] and Joseph E Serafy[1]; [1]National Marine Fisheries Service, Miami, FL, USA; [2]University of Miami, Miami, FL, USA; [3]Biscayne National Park, Homestead, FL, USA

11:15 **CERP AND KILLIFISH HABITAT IN BISCAYNE BAY'S LITTORAL ZONE-- Joseph E Serafy**; National Marine Fisheries Service, Miami, FL, USA

11:30 **NUTRIENTS AS A POTENTIAL SOURCE TO SUSTAIN A PERSISTENT BLOOM OF ANADYOMENE J.V. LAMAROUX (*ANADYOMENACEAE, CHOROPHYA*) IN BISCAYNE BAY FLORIDA -- Ligia Collado-Vides[1]**, Christian Avila[2], Steve Blair[2], Pamela Sweeney[3], Diego Lirman[4]; [1]Florida International University, Miami, FL, USA; [2]Miami-Dade Division of Environmental Resources Management (DERM), FL, USA; [3]Florida Department of Environmental Protection, FL, USA; [4] University of Miami, FL, USA

11:45 **SPATIAL AND TEMPORAL TRENDS OF A MULTI-YEAR MACROALGAL BLOOM--** Galia Varona[1], **Christian Avila[1]**, Stephen Blair[1], Ligia Collado-Vides[2]; [1] Miami-Dade Division of Environmental Resources Management (DERM), Miami, FL, USA; [2] Florida International University, Miami, FL, USA

Tuesday, April 21, 2015 | 10:20am - 12noon

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Session #4: Contribution of Weed Biological Control in Support of Everglades Restoration

[Egret]

Moderator: James Cuda, Universtiy of Florida, Gainesville, FL

10:20 Introduction

10:30 **BIOLOGICAL CONTROL OF MELALEUCA QUINQUENERVIA IN SOUTHERN FLORIDA-- Min B. Rayamajhi[1]**, Paul D. Pratt[2], Philip. W. Tipping[1] and Ted D. Center[3] ;[1]USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL, USA; [2]USDA/ARS, Exotic & Invasive Weeds Research Albany CA, USA; [3]Retired, Fort Lauderdale, FL USA

10:45 **BIOLOGICAL CONTROL OF TROPICAL SODA APPLE, SOLANUM VIARUM (SOLANACEAE) IN FLORIDA: A SUCCESSFUL PROJECT-- Julio Medal[1],** William Overholt[2], Rodrigo Díaz[2], Amy Roda[3], Kenneth Hibbard[1],Raghavan Charudattan[2], Nikary Bustamante[2], Stephen Higth[4], James Cuda[2]; [1]Florida Department of Agriculture and Consumer Services – Division of Plant Industry, Gainesville, FL, USA; [2]University of Florida, FL, USA; [3]USDA-APHIS, Kendall, FL, USA; [4]USDA-ARS, Tallahassee, FL, USA

11:00 **BIOLOGICAL CONTROL OF LYGODIUM MICROPHYLLUM -- Ellen C. Lake[1]**, Melissa C. Smith[1], Gregory S.Wheeler[1], Paul D. Pratt[2]; [1]USDA Agricultural Research Service, Invasive Plant Research Laboratory, Fort Lauderdale, FL, USA; [2]USDA Agricultural Research Service, Western Regional Research Center, Albany, CA, USA

11:15 **BIOLOGICAL CONTROL OF AIR POTATO, DIOSCOREA BULBIFERA, IN FLORIDA -- Eric Rohrig[1]**, Ken Hibbard[1], Trevor Smith[1], Min Rayamajhi[2], Ellen Lake[2], Melissa Smith[2], Allen Dray[2], Bill Overholt[3], Rodrigo Diaz[3], Veronica Manrique[3], Stephen Hight[4]; [1] FDACS, Division of Plant Industry, Gainesville, FL, USA; [2] UF, Indian River Research & Education Center, Ft. Pierce, FL, USA; [3] USDA ARS, Invasive Plant Research Laboratory, Ft. Lauderdale, FL, USA; [4] USDA ARS, Center for Medical, Agricultural, and Veterinary Entomology, Tallahassee, FL, USA

11:30 **PROSPECTS FOR CLASSICAL BIOLOGICAL CONTROL OF COGONGRASS-- William A. Overholt[1]**, James P. Cuda[2], John A. Goolsby[3], A. Millie Burrell[4], Bruno Le Ru[5], Keiji Takasu[6], Patricia E. Klein[4] and Alexis Racelis[7]; [1]University of Florida, Fort Pierce, FL, USA; [2]University of Florida, Gainesville, FL, USA; [3]USDA/ARS, Edinburg, TX, USA; [4]Texas A&M University, College Station, TX, USA; [5]International Centre of Insect Physiology and Ecology, Nairobi, Kenya; [6]Kyushu University, Fukuoka, Japan; [7]University of Texas–Pan American, Edinburg, TX, USA

11:45 **RECENT ADVANCES IN BIOLOGICAL CONTROL OF BRAZILIAN PEPPERTREE, *SCHINUS TEREBINTHIFOLIA*-- James P. Cuda[1]**, William A. Overholt[2], Rodrigo Diaz[2], Veronica Manrique[2], Alissa M. Berro[1],Patricia Prade[2], and Julio Medal[3]; [1]Universtiy of Florida, Gainesville, FL, USA; [2]Indian River Research & Education Center, Ft. Pierce, FL, USA; [3]FDACS Division of Plant Industry, Gainesville, FL, USA

5

Session #5: Snail Kites & Apple Snails

[Sandpiper]

Moderator: Stephanie Romañach, U.S. Geological Survey, Davie, FL

10:20 Introduction

10:30 **SNAIL KITE (*ROSTRHAMUS SOCIABILIS*) SATELLITE TELEMETRY REVEALS LARGE-SCALE MOVEMENTS AND CONCENTRATED USE OF "PERIPHERAL" WETLANDS: IMPLICATIONS FOR HABITAT MANAGEMENT AND POPULATION MONITORING -- Kenneth D. Meyer[1]**, Gina M. Kent[1], Kristen M. Hart[2], Ikuko Fujisaki[3], and Autumn R. Sartain[4]; [1]Avian Research and Conservation Institute, Gainesville, FL, USA; [2]U.S. Geological Survey, Davie, FL, USA; [3]University of Florida, Gainesville, FL, USA; [4]CN Management and Consulting, contracted to U.S. Geological Survey, Davie, FL, USA

10:45 **THE DEMOGRAPHIC CAUSES OF POPULATION GROWTH AND DECLINE IN THE SNAIL KITE -- Robert J. Fletcher, Jr**, Brian E. Reichert, Chris E. Cattau, and Ellen P. Robertson; University of Florida, Gainesville, FL, USA

11:00 **MANAGING HABITAT FOR THE EVERGLADE SNAIL KITES (*ROSTRHAMUS SOCIABILIS PLUMBEUS*) ON CENTRAL FLORIDA LAKES -- Tyler J. Beck;** Florida Fish and Wildlife Conservation Commission, Tequesta, FL, USA

11:15 **EVALUATING SNAIL KITE PREY AVAILABILITY BENCHMARKS IN THE KITE HABITAT NETWORK -- Philip C. Darby[1]**, Ikuko Fujisaki[2], and Erin H. Leone[3]; [1]University of West Florida, Pensacola, FL, USA; [2]University of Florida, Davie, FL, USA; [3]Florida Fish and Wildlife Conservation Commission, Gainesville, FL, USA

11:30 **EFFECTS OF THE EXOTIC APPLE SNAIL (*POMACEA MACULATA*) ON SNAIL KITE BEHAVIOR AND DEMOGRAPHY -- Christopher E. Cattau[1],** Robert J. Fletcher Jr.[1], and Wiley M. Kitchens[1]; [1]University of Florida, Gainesville, FL, USA

11:45 **THE RELATIVE CONTRIBUTIONS OF LANDSCAPE AND LOCAL CONDITIONS TO INVASION SUCCESS OF THE NON-NATIVE APPLE SNAIL IN RANCHLAND WETLANDS -- Steffan M. Pierre [1]**, Elizabeth H. Boughton [2], and Pedro F. Quintana Ascencio [1]; [1]University of Central Florida, Orlando, Florida, USA; [2]Archbold Biological Station, Lake Placid, Florida, USA

Tuesday, April 21, 2015 | 1:20pm - 3pm

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Session #6: Sea-Level Rise and Restoration Part II: Ecological Responses and Influences on a Changing Landscape and Seascape

[Great Cypress]

Moderator: David Rudnick[1] & Todd Osborne[2]; [1]Everglades National Park - SFNRC, Homestead, FL; [2]University of Florida, Gainesville, FL

1:20 Introduction

1:30 **FORECAST EFFECTS OF SEA-LEVEL RISE ON COASTAL WETLAND STRUCTURE AND FUNCTION -- Todd Z. Osborne**[1,2], Lisa G. Chambers[3], Lorae T. Simpson[1,4]; [1]Whitney Laboratory for Marine Bioscience, University of Florida, St. Augustine, FL, USA; [2]Wetland Biogeochemistry Laboratory, University of Florida, Gainesville, FL, USA; [3]Soil and Water Research Laboratory, St. Louis University, St. Louis, MS,USA; [4]Smithsonian Environmental Research Center, Ft. Pierce, FL, USA

1:45 **MANGROVE FOREST SOIL ACCRETION RATES AND THE RELATIONSHIP WITH SEA LEVEL AND STORMS OVER THE PAST CENTURY -- Joseph M. Smoak[1]**, Joshua L. Breithaupt[2], Thomas J. Smith III[3], Ryan P. Moyer[4], Christian J. Sanders[5] and Larry C. Peterson[6]; [1]University of South Florida, Department of Environmental Science, Policy and Geography, St. Petersburg, FL, USA; [2]University of South Florida, College of Marine Science, St. Petersburg, FL, USA; [3]U.S. Geological Survey, Southeast Ecological Science Center, St. Petersburg, FL, USA; [4]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Saint Petersburg, FL, USA; [5]Centre for Coastal Biogeochemistry, School of Environment, Science and Engineering, Southern Cross University, Lismore, NSW, Australia; [6]Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, USA

2:00 **PATTERNS OF SEDIMENT SURFACE ELEVATION CHANGE IN THE SOUTHWEST COASTAL EVERGLADES -- Thomas J. Smith III[1]**, Gordon H. Anderson[2], Ginger Tiling-Range[3], Karen M. Balentine[4]; [1]U.S. Geological Survey, Southeast Ecological Science Center, St. Petersburg, FL, USA; [2]U.S. Geological Survey, Southeast Ecological Science Center, Gainesville, FL, USA; [3]Cherokee Nations Business Solutions, St. Petersburg, FL, USA; [4]U.S. Fish & Wildlife Service, Great Dismal Swamp NWR, Suffolk, VA USA

2:15 **EFFECTS OF INCREASED SALINITY AND INUNDATION ON WETLAND SOIL CARBON DYNAMICS AT THE EVERGLADES FRESHWATER-SALTWATER ECOTONE -- Stephen E. Davis[1]**, Tiffany Troxler[2], Fred Sklar[3], Carlos Coronado-Molina[3], Evelyn Gaiser[2], Steve Kelly[3], John S. Kominoski[2], Christopher Madden[3], David Rudnick[4], Joe Stachelek[3]; [1]Everglades Foundation, Palmetto Bay, FL USA; [2]Florida International University, Miami, FL, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA; [4]Everglades National Park, Homestead, FL, USA

2:30 **HOW TO BUILD A BIGGER FLORIDA BAY -- Martha K. Nungesser**; South Florida Water Management District, West Palm Beach, FL, US

2:45 **CLIMATE CHANGE PROJECTED EFFECTS ON COASTAL FOUNDATION COMMUNITIES OF THE GREATER EVERGLADES USING A 2060 SCENARIO: NEED FOR A NEW MANAGEMENT PARADIGM -- Marguerite S. Koch[1]**, Carlos Coronado[2], Margaret W. Miller[3], Dave T. Rudnick[4], Erik Stabenau[4], Robert Halley[5], Fred H. Sklar[2]; [1]Biological Sciences Department, Florida Atlantic University, Boca Raton, FL, USA; [2]Everglades Systems Assessment, South Florida Water Management District, West Palm Beach, FL, USA; [3]Protected Resources Division, Benthic Ecosystem Assessment and Research, National Marine Fisheries Service, NOAA, Miami, FL, USA; [4]South Florida Natural Resources Center, Everglades National Park, Homestead, FL, USA; [5]U.S. Geological Survey (retired), St. Petersburg, FL, USA

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Session #7: Advances in Use of the Trophic Hypothesis to Guide Monitoring and Management of the Everglades

[Royal Poinciana]

Moderator: Dale Gawlik, Florida Atlantic University, Boca Raton, FL

1:20 Introduction

1:30 **POTENTIAL EFFECTS OF NEST PREDATION, CONTAMINATION, AND DISTANT WETLAND ATTRACTORS ON REPRODUCTIVE RESPONSES OF WADING BIRDS TO CERP -- Peter C. Frederick**; Department of Wildlife Ecology and Conservation, University of Florida, Gainesville FL. USA

1:45 **ADAPTING THE EVERGLADES TROPHIC HYPOTHESIS TO ROSEATE SPOONBILLS IN AN ESTUARINE ENVIRONMENT -- Jerome J. Lorenz;** Audubon Florida Everglades Science Center, Tavernier, FL, USA

2:00 **MONITORING MERCURY EXPOSURE IN NESTING WADING BIRDS: CONSIDERATIONS FOR THE EVERGLADES TROPHIC HYPOTHESIS** -- Ignacio Rodríguez-Jorquera[1], Peter Frederick[2], and **Lori Oberhofer[3]**; [1]University of Florida, Gainesville, FL, USA; [2]University of Florida, Gainesville, FL, USA; [3]Everglades National Park, Homestead, FL, USA

2:15 **MOVEMENT AND HABITAT USE OF AQUATIC FAUNA IN RELATION TO SEASONAL HYDROLOGIC VARIATION: IMPLICATIONS FOR WADING BIRD PREY AVAILABILITY --** Jennifer S. Rehage[1], Greg Hill[1], **Mark I. Cook[2]** and Eric A. Cline[2]; [1]Florida International University, Miami, FL, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA

2:30 **BRIDGING THE GAP BETWEEN EVERGLADES PREY PRODUCTION AND WADING BIRD PREY SELECTION -- Jessica A. Klassen** and Dale E. Gawlik; Florida Atlantic University, Boca Raton, FL USA

2:45 **THE TROPHIC HYPOTHESIS: LONG-TERM TRENDS IN WADING BIRD PREY SPECIES IN THE FRESHWATER EVERGLADES -- Joel Trexler [1]**, Jeff Kline[2], Joseph Parkos[1], and William Loftus[3]; [1]Florida International University, Miami, FL, USA; [2]Everglades National Park, Homestead, FL, USA; [3]USGS, Gainesville, FL, USA

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Session #8: Biscayne Bay Part II: Coastal Restoration and Management of Biscayne Bay

[Ibis]

Moderator: Sarah Bellmund[1] & Sharon Ewe Pitts[2]; [1]National Park Service, Biscayne National Park, Homestead, FL; [2]Ecology and Environment, Inc., Washinton, DC

10:20 Introduction

1:30 **BISCAYNE BAY COASTAL WETLAND RESTORATION BENEFITS -- Bahram Charkhian**; South Florida Water Management District, West Palm Beach, FL, USA

1:45 **BISCAYNE BAY - A JEWEL IN JEOPARDY -- Stephen Blair[1]**, Sara Bellmund[2]; [1]Miami-Dade County Environmental Resources Management (DERM), Miami, FL, USA; [2]National Park Service, Biscayne National Park, Homestead, FL, USA

2:00 **MANAGEMENT OF THE INVASIVE INDO-PACIFIC LIONFISH IN BISCAYNE NATIONAL PARK -- Vanessa McDonough**, Shelby Moneysmith, Caitlin Johnson, Christina Vilmar, Ryan Fura, Ana Zangroniz, Kristian Rogers, Michael Hoffman and Megan Davenport; Biscayne National Park, Homestead, FL, USA

2:15 **METHODS FOR DETECTING PATTERNS IN GROUNDWATER FLOW INTO BISCAYNE BAY, FL -- Caroline Herman**[1], Sarah A. Bellmund[2], Diego Lirman[1]; [1]University of Miami, RSMAS, Miami, FL, USA; [2]National Park Service, BNP, Homestead, FL, USA

2:30 **NUTRIENT THRESHOLDS OF PHYTOPLANKTON BIOMASS RESPONSES IN SOUTH FLORIDA COASTAL AND ESTUARINE WATERS -- Henry O. Briceño[1]** and Joseph M. Boyer[2]; [1]Florida International University, Miami, FL, USA; [2]Plymouth State University, Plymouth, NH, USA

2:45 **ECOSYSTEM RESTORATION AND MANAGEMENT IN BISCAYNE NATIONAL PARK -- Brian Carlstrom** and Sarah A. Bellmund; National Park Service, Biscayne National Park, Homestead, FL, USA

Tuesday, April 21, 2015 | 1:20pm - 3pm

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Session #9: Linking Hydrology to Ecology in Restoration Planning, Design, and Implementation

[Egret]

Moderator: Andrew LoSchiavo, U.S. Army Corps of Engineers, Jacksonville, FL

10:20 Introduction

1:30 **SMART PLANNING FOR THE CENTRAL EVERGLADES PLANNING PROJECT --** Bradley A. Foster; U.S. Army Corps of Engineers, Jacksonville, Florida, USA

1:45 **EVALUATING THE EFFECTS OF CENTRAL EVERGLADES PLANNING PROJECT ALTERNATIVE PLANS USING PERFORMANCE MEASURES AND ECOLOGICAL PLANNING -- Melissa Nasuti**; U.S. Army Corps of Engineers, Jacksonville, Florida, USA

2:00 **HOW HYDROLOGIC MODELING AND ECOLOGICAL CRITERIA INFORM ENGINEERING DESIGN OF RESTORATION PROJECT FEATURES -- Murika Davis**; U.S. Army Corps of Engineers, Jacksonville, Florida, USA

2:15 **HOW MODELING AND DESIGN CRITERIA INFORM OPERATIONS PLANNING AND WATER MANAGEMENT IMPLEMENTATION -- James Vearil[1]**, Jonathan Jenkins[2], and Andrew LoSchiavo[2]; [1] University of North Florida, Jacksonville, FL, USA; [2] U.S. Army Corps of Engineers, Jacksonville, FL, USA

2:30 **HOW MONITORING FOR RESTORATION SUCCESS INFORMS WATER MANAGEMENT AND PROJECT IMPLEMENTATION -- Gretchen Ehlinger**, Kelly Keefe and Andrew LoSchiavo; U.S. Army Corps of Engineers, Jacksonville, Florida, USA

2:45 **HOW MONITORING FOR ENDANGERED SPECIES INFORMS WATER MANAGEMENT AND PROJECT IMPLEMENTATION -- Gina Paduano Ralph**; U.S. Army Corps of Engineers, Jacksonville, Florida, USA

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Session #10: Advanced Technologies in Everglades Ecosystem Restoration

[Sandpiper]

Moderator: Christa Zweig, South Florida Water Management District, West Palm Beach, FL

1:20 Introduction

1:30 **USE OF MOLECULAR TECHNIQUES TO IDENTIFY EVERGLADES' AQUATIC FUNGAL COMMUNITY ASSOCIATED WITH CATTAIL DECOMPOSITION -- K. Seitz[1]**, S. Newman[1], C. R. Penton[2]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Arizona State University, Tempe, Arizona, USA

1:45 **USE OF BIOMARKERS IN EVERGLADES RESTORATION --** Colin Saunders[1], Carlos Coronado-Molina[1], Rudolf Jaffé[2], Ding He[2], **Peter Regier[2]**, Blanca Jara[2]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Southeast Environmental Research Center, and Department of Chemistry and Biochemistry, Florida International University, Miami, USA

2:00 **RESOLVING FINE-SCALE PATTERNING AND RESTORATION OUTCOMES IN THE COASTAL EVERGLADES -- Joseph Stachelek** and Christopher J. Madden; South Florida Water Management District, West Palm Beach, FL, USA

2:15 **THE USE OF MOLECULAR TECHNIQUES TO ASSESS MICROBIAL NUTRIENT STATUS IN THE EVERGLADES -- E. Morrison[1]**, S. Newman[2], K. Reddy[1], Z. He[3], J. Zhou[3], A. Ogram[1]; [1]Soil and Water Science, University of Florida, Gainesville, FL, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA; [3]Institute for Environmental Genomics, University of Oklahoma, Norman, OK, USA

2:30 **APPLICATION OF SYNTHETIC FLOC TO EVALUATE SEDIMENT TRANSPORT IN THE DECOMPARTMENTALIZATION PHYSICAL MODEL PROJECT -- E. Tate-Boldt**[1], C. J. Saunders[1], S. Newman[1], F. Sklar[1], Christopher Hansen[1,2], C. Zweig[1]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Florida International Univ., Miami, FL, USA

2:45 **APPLICATIONS OF HIGH-RESOLUTION AERIAL IMAGERY AND A SMALL UNMANNED AIRCRAFT SYSTEM IN EVERGLADES SCIENCE -- Matthew A. Burgess[1]**, Christa L. Zweig[2], Susan Newman[2], Mark I. Cook[2], H. LeRoy Rodgers[2], Raymond R. Carthy[1], Benjamin E. Wilkinson[1], Travis J. Whitley[1], Tyler S. Ward[1], Joseph G. DiRodio[1], Peter C. Frederick[1], Peter G. Ifju[1], Scot E. Smith[1], and H. Franklin Percival[1]; [1]University of Florida, Gainesville, FL, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA

Tuesday, April 21, 2015 | 3:20pm - 5pm

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Session #11: Climate Change, Sea Level Rise, and Natural Hazards

[Great Cypress]

Moderator: G. Lynn Wingard, U.S. Geological Survey, Reston, VA

3:20 Introduction

3:30 **PROGRESS IN A HINDCAST SIMULATION OF THE 1926 GREAT MIAMI HURRICANE -- Krohn, M. Dennis**[1], Eric Swain[2], Catherine Langtimm[3], and Jayantha Obeysekera[4];[1]U.S. Geological Survey, St. Petersburg, FL USA; [2]U.S. Geological Survey, Davie, FL, USA; [3]U.S. Geological Survey, Gainesville, FL, USA; [4]South Florida Water Management District, West Palm Beach, FL, USA

3:45 **THE INTERACTION OF PULSE AND PRESS DISTURBANCES: DISCERNING THE EFFECTS OF SEA LEVEL RISE FROM THOSE OF STORM SURGE FLOODING IN COASTAL FORESTS OF THE LOWER FLORIDA KEYS, FL -- Danielle E. Ogurcak**[1], Jay P. Sah[2], and Michael S. Ross[1,2]; [1] Florida International University, Department of Earth and Environment, Miami, FL, USA; [2] Florida International University, Southeast Environmental Research Center, Miami, FL, USA

4:00 **MANGROVE COLONIZATION PATTERNS AND RATES ALONG THE COASTAL EVERGLADES -- Shimon Wdowinski**[1], Amanda Brioche[1], Emanuelle Feliciano[1], Sang-Hoon Hong[1,2]; [1]University of Miami, Miami, FL, USA; [2]Korea Polar Research Institute, Incheon, Republic of Korea

4:15 **INTERIOR MUD FLATS OF FLORIDA BAY ISLANDS: RECORDS OF SEA LEVEL RISE, STORM HISTORY, AND ISLAND FORMATION -- G. Lynn Wingard**[1], Christopher Bernhardt[1], Miriam Jones[1], Anna Wachnicka[2], Marci Marot[3], and Bethany Stackhouse[1]; [1] U.S. Geological Survey, Reston, VA, USA; [2] Florida International University, Miami, FL, USA; [3] U.S. Geological Survey, St. Petersburg, FL, USA

4:30 **INCORPORATING UNCERTAINTY OF GROUNDWATER MODELING IN SEA-LEVEL RISE ASSESSMENT: A CASE STUDY IN SOUTH FLORIDA -- Hannah M Cooper**, Caiyun Zhang and Donna Selch; Florida Atlantic University, Boca Raton, FL, USA

4:45 **INFLUENCE OF VARYING ENVIRONMENTAL CONDITIONS ON CANOPY SPECIES RECRUITS FROM FOUR EVERGLADES PLANT COMMUNITIES -- Jeremy L May** and Steven Oberbauer; Florida International University, Miami, Florida, USA

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Session #12: Aquatic Animals in Restoration

[Royal Poinciana]

Moderator: Jennifer Rehage, Florida International University, Miami, FL

3:20 Introduction

3:30 **PHOTOPERIOD VS. HYDROLOGY: WHICH BEST PREDICTS MIGRATIONS OF TEMPERATE FRESHWATER FORAGE SPECIES AND THEIR TROPICAL ESTUARINE PREDATOR IN THE OLIGOHALINE REACHES OF THE SHARK RIVER? – R.E. Boucek,** G. Hill, J.S. Rehage; Florida International University, Miami, FL USA

3:45 **DRYING TIMES: SURVIVAL OF A FRESHWATER MESOCONSUMER IN A COASTAL REFUGE HABITAT DURING SEASONAL DRYING -- Jessica A. Lee** and Jennifer S. Rehage; Florida International University, Earth and Environment Department, Miami, FL USA

4:00 **POTENTIAL RESPONSE OF MOSQUITOES AND MOSQUITO-BORNE VIRUSES TO ECOSYSTEM RESTORATION IN THE GREATER EVERGLADES -- Durland Fish**[1,] Robert B. Tesh[2,] Qiong Zhang[1,] and David Wong[3]; [1]Yale School of Public Health, New Haven, CT, USA; [2]University of Texas Medical Branch, Galveston, TX, USA; [3]National Park Service, Albuquerque, NM, USA

4:15 **THE DISTRIBUTION OF ANURANS IN A HYDROLOGICALLY MODIFIED RIVER FLOODPLAIN -- Brent Anderson**; South Florida Water Management District, West Palm Beach, Florida, USA

4:30 **FISH DYNAMICS AT THE EVERGLADES MARSH-MANGROVE ECOTONE: DRYDOWNS, SUBSIDIES, COLDSNAPS & THE LINK TO RECREATIONAL FISHERIES -- Jennifer S. Rehage**; Earth & Environment Department, Southeast Environmental Research Center, Florida International University, Miami, FL, USA

4:45 **DISCUSSION**

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Session #13: Carbon Storage and Release in Low Latitude Peatlands

[Ibis]

Moderator: Xavier Comas[1]**, Matthew Warren**[2] **& Brian Benscoter**[1]; [1]Florida Atlantic University, Davie, FL; [2]USDA Forest Service, Durham, NH

3:20 Introduction

3:30 **MODELLING THE IMPACTS OF LAND USE CHANGE ON CARBON DYNAMICS IN TROPICAL PEATLANDS USING THE TROPICAL HOLOCENE PEAT MODEL (HPMTROP) -- Steve Frolking**[1], Zhaohua Dai[2], Sofyan Kurnianto[3] and Matthew Warren[4]; [1]University of New Hampshire, Durham, NH, USA; [2]USDA Forest Service, Newtown, PA, USA; [3]Oregon State University, Corvallis, OR, USA; [4]USDA Forest Service, Durham, NH, USA

3:45 **MODELING METHANE EBULLITION FROM PEAT SOILS OF THE FLORIDA EVERGLADES -- Jorge A Ramirez,** William Wright and Xavier Comas; Department of Geosciences, Florida Atlantic University, Davie, FL, USA

4:00 **WATER, ENERGY AND CARBON CYCLING IN GREATER EVERGLADES FORESTED WETLANDS -- W. Barclay Shoemaker**[1] and Frank Anderson[2]; [1]U.S. Geological Survey, Florida Water Science Center, Davie, FL, USA; [2]U.S. Geological Survey, California Water Science Center, Sacramento, CA, USA

4:15 **NET ECOSYSTEM EXCHANGES OF CARBON DIOXIDE AND METHANE FROM SUB-TROPICAL AND TEMPERATE PEATLANDS: A COMPARISON OF NATURAL AND RESTORED WETLAND SYSTEMS -- Frank Anderson**[1], W. Barclay Shoemaker[2], Brian Bergamaschi[1], L. Windham-Myers[3], and R. Fujii[1]; [1]U.S. Geological Survey, California Water Science Center, Sacramento, CA, USA; [2]U.S. Geological Survey, Florida Water Science Center, Davie, FL, USA; [3]U.S. Geological Survey, NRP, Menlo Park, CA, USA

4:30 **IMPACT OF WILLOW INVASION ON WATER AND CARBON EXCHANGE IN THE VEGETATION OF A SUBTROPICAL WETLAND -- Michelle L. Budny** and Brian W. Benscoter; Florida Atlantic University, Davie, FL, USA

4:45 **HOLOCENE DYNAMICS OF THE FLORIDA EVERGLADES WITH RESPECT TO CLIMATE, DUSTFALL, AND TROPICAL STORMS -- Paul H. Glaser**[1], Barbara C. S. Hansen[1], Joseph J. Donovan[2], Thomas J. Givnish[3], Craig A. Stricker[4], and John C. Volin[5]; [1]Department of Earth Sciences, University of Minnesota, Minneapolis, MN, USA; [2]Department of Geology and Geography, West Virginia University, Morgantown WV, USA; [3]Department of Botany, Birge Hall, University of Wisconsin-Madison, Madison, WI, USA; [4]U. S. Geological Survey Fort Collins Science Center, Denver, CO, USA; [5]Department of Natural Resources and the Environment, University of Connecticut, Storrs, CT, USA

Tuesday, April 21, 2015 | 3:20pm - 5pm

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Session #14: Advances in Hydrology and Salinity Models for Greater Everglades Ecosystem Restoration

[Egret]

Moderator: Frank Marshall, Cetacean Logic Foundation, New Smyrna Beach, FL

3:20 Introduction

3:30 **CALIBRATION ACTIVITIES FOR THE SOUTH FLORIDA WATER MANAGEMENT MODEL (SFWMM A.K.A. 2x2 MODEL) -- Jenifer Barnes**; South Florida Water Management District, West Palm Beach, FL, USA

3:45 **RECENT PROGRESS IN THE MIKE MARSH MODEL OF EVERGLADES NATIONAL PARK -- Jordan G. Barr[1]**, Robert Fennema[1], Georgio Tachiev[2], Amy Cook[2]; [1]South Florida Natural Resource Center, Everglades National Park, Homestead, FL, USA; [2]GIT Consulting, Coral Gables, FL, USA

4:00 **RAPID PREDICTION OF ESTUARINE SALINITY FOR EVERGLADES ECOSYSTEM RESTORATION -- Yongshan Wan**, Peter Doering, Christopher Buzzelli, Patricia Gorman, Zhiqiang Chen; South Florida Water Management District

4:15 **BISECT MODEL SIMULATIONS FOR EVALUATING PRESENT, PAST, AND FUTURE CONDITIONS AND PROVIDING INPUT TO EMERGING ECOLOGICAL MODELS -- Melinda A Lohmann**[1], Eric D Swain[1], Brad Stith[2], Catherine Langtimm[2], and Ann Foster[2]; [1]U.S. Geological Survey, Caribbean-Florida Water Science Center, Davie, FL, USA; [2] U.S. Geological Survey Biological Resources Division, Gainesville, FL, USA

4:30 **THREE DIMENSIONAL MODEL EVALUATION OF PHYSICAL ALTERATIONS OF THE CALOOSAHATCHEE RIVER ESTUARY: IMPACT ON SALT TRANSPORT -- Detong Sun** and Yongshan Wan; South Florida Water Management District, West Palm Beach, Florida, USA

4:45 **AN IMPROVED BISCAYNE BAY HYDRODYNAMIC MODEL FOR EVALUATION OF RESTORATION EFFORTS AND THE EFFECTS OF GROUNDWATER ON SALINITY -- Erik Stabenau** and Amy Renshaw; National Park Service, Homestead, FL, USA

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Session #15: Performance Measures for Central Everglades Adaptive Management

[Sandpiper]

Moderator: Andrew LoSchiavo, U.S. Army Corps of Engineers, Jacksonville, FL

3:20 Introduction

3:30 **THE ROLE OF ECOLOGICAL THRESHOLDS IN ADAPTIVE MANAGEMENT --** Kelly Keefe and Andy LoSchiavo; U.S. Army Corps of Engineers, Jacksonville, FL, USA; ***Eric Bush presenting***

3:45 **REAL-TIME EVALUATION OF HYDROLOGIC PERFORMANCE MEASURES SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT (CEPP) RESTORATION SUCCESS --** Pamela Telis[1], **Paul Conrads[2]**, and Bryan McCloskey[3]; [1]U.S. Geological Survey, Caribbean-Florida Water Science Center, Jacksonville, FL, USA; [2]U.S. Geological Survey, South Atlantic Water Science Center, Columbia, SC, USA; [3]Cherokee Nation Technology Solutions, contractor to U.S. Geological Survey, St. Petersburg, FL, USA

4:00 **SOIL RESTORATION THRESHOLDS SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT SUCCESS -- Andrew LoSchiavo**[1], Tom Dreschel, Chris McVoy, Todd Osborne, David Rudnick, and Fred Sklar; [1]U.S. Army Corps of Engineers, Jacksonville, FL, USA

4:15 **IDENTIFYING THRESHOLDS IN FISH COMMUNITY DYNAMICS AND COMPOSITION IN RESPONSE TO ALTERED HYDROPERIODS IN EVERGLADES MARSHES --** Christopher P. Catano[1], **James Herrin[2]**, Joel C. Trexler[2]; [1]Washington University in St. Louis, St. Louis, MO, USA; [2]Florida International University, Miami, FL, USA

4:30 **CROCODILIAN ECOLOGICAL THRESHOLDS SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT (CEPP) -- Laura A. Brandt[1]** and Frank J. Mazzotti[2]; [1]U.S. Fish and Wildlife Service, Davie, FL, USA; [2] University of Florida, Davie, FL, USA

4:45 **PATTERN AND PROCESS IN THE EVERGLADES RIDGE-SLOUGH LANDSCAPE --** Matthew J. Cohen[1], **David A. Kaplan[2]**, Subodh Acharya[1,2], Stephen Casey[1], James B. Heffernan[3], James W. Jawitz[4], Jing Yuan[1], and Danielle Watts[5]; [1]University of Florida, School of Forest Resources and Conservation, Gainesville, FL, USA; [2]University of Florida, Engineering School of Sustainable Infrastructure and Environment, Environmental Engineering Sciences Department, Gainesville, FL, USA; [3]Duke University, Nicholas School of the Environment, Durham, NC, USA; [4]University of Florida, Soil and Water Science Department, Gainesville, FL, USA; [5]University of California, Berkeley, Department of Geography, Berkeley, CA, USA

Wednesday, April 22, 2015 | 10:20am - 12noon

16

Session #16: Everglades Stormwater Treatment Areas

[Great Cypress]

Moderator: Larry Gerry, South Florida Water Management District, West Palm Beach, FL

10:20 Introduction

10:30 **HISTORICAL PERFORMANCE OF THE STORMWATER TREATMENT AREAS -- Delia Ivanoff**, Kathy Pietro, and Hongjun Chen; South Florida Water Management District, West Palm Beach, FL, USA

10:45 **EFFECTS OF LIMEROCK AND NON-FARMED MUCK SUBSTRATES ON STORMWATER TREATMENT AREA PERFORMANCE -- Thomas A. DeBusk[1]**, Kevin Grace[1], Mike Jerauld[1] Dawn Sierer-Finn[1], Manuel Zamorano[2] and Michelle Kharbanda[1]; [1]DB Environmental, Inc., Rockledge, FL, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA

11:00 **STABILITY OF SEQUESTERED PHOSPHORUS IN STORMWATER TREATMENT AREAS: ROLE OF DOMINANT WETLAND VEGETATION -- Rupesh K. Bhomia[1]** and K. R. Reddy[2]; [1]Oregon State University, Corvallis, OR, USA; [2]University of Florida, Gainesville, FL, USA

11:15 **EVERGLADES RESTORATION STRATEGIES: OPTIMIZING THE PERFORMANCE OF STORMWATER TREATMENT AREAS -- Jeremy C. McBryan**; South Florida Water Management District, West Palm Beach, FL, USA

11:30 **SCIENCE PLAN IN SUPPORT OF EVERGLADES RESTORATION STRATEGIES -- Larry Schwartz**; South Florida Water Management District, West Palm Beach, FL, USA

11:45 **EVOLVING STRATEGIES FOR STORMWATER TREATMENT AREA (STA) OPERATIONAL MANAGEMENT -- Walter M. Wilcox**, Alaa Ali, Wasantha A. Lal, Mohammed Z. Moustafa and Raul Novoa; South Florida Water Management District, West Palm Beach, FL, USA

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Session #17: Flow-Pulse Drivers of Aquatic Ecosystem Restoration - Findings From the Decomp Physical Model

[Royal Poinciana]

Moderator: Fred H. Sklar, South Florida Water Management District, West Palm Beach, FL

10:20 Introduction

10:30 **LANDSCAPE-SCALE HYDROLOGIC RESPONSES TO A FLOW PULSE EXPERIMENT -- David T. Ho[1]**, Benjamin Hickman[1], Sara Ferrón[1], Victor C. Engel[2]; [1]University of Hawaii, Honolulu, HI, USA; [2]US Geological Survey, Gainesville, FL, USA

10:45 **THE DECOMPARTMENTALIZATION PHYSICAL MODEL (DPM) EXPERIMENTS: TESTING THE RESTORATION OF HISTORIC HIGH FLOWS IN A DISCONNECTED EVERGLADES -- Jud Harvey[1]**, Laurel Larsen[2,1], Jay Choi[1], Jesus Gomez-Velez[1], Brendan Buskirk[1], Allison Swartz[1], Colin Saunders[3], Sue Newman[3], Fred Sklar[3], Barry Rosen[4], and David Ho[5]; [1]U.S. Geological Survey - National Research Program, Reston, VA, USA; [2]University of California, Berkeley, CA, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA; [4]U.S. Geological Survey, Orlando, FL, USA; [5]University of Hawaii, Honolulu, HI, USA

11:00 **TO MOVE OR NOT TO MOVE - WATER QUALITY AND SEDIMENT ENTRAINMENT RESPONSES TO TWO FLOW EVENTS -- Sue Newman** [1], Michael Manna[1], Kristin Seitz[1], Erik Tate-Boldt[1], Chris Hansen[2], and Colin Saunders[1]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Florida International Univ., Miami, FL, USA

11:15 **SHEAR STRESS VARIABILITY AND FLOC REDISTRIBUTION DURING A FLOW RELEASE -- Laurel Larsen[1,2]**, Rachel Allen[1], Rosanna Neuhausler[1], Jud Harvey[2], Jay Choi[2], Sue Newman[3], Colin Saunders[3], Erik Tate-Bold[3]; [1]University of California, Berkeley, CA, USA; [2]US Geological Survey, Reston, VA, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA

11:30 **RESTORING SHEETFLOW IN A RIDGE-SLOUGH-CANAL-AND-LEVEE LANDSCAPE - A SYNTHESIS OF TRACERS, TRAPS AND TRANSPORT -- Colin J. Saunders**[1], Erik Tate-Boldt[1], Carlos Coronado-Molina[1], Sue Newman[1], Fred Sklar[1], Eric Cline[1], Christopher Hansen[2], Fabioloa Santamaria[3], Christa Zweig[1], Jud Harvey[4], Laurel Larsen[5,4], Jay Choi[4], Peter Regier[2], Ding He[2], Rudolf Jaffé[2], David T. Ho[6]; [1] South Florida Water Management District, West Palm Beach, FL, USA; [2] Florida International Univ., Miami, FL, USA; [3] Scheda Ecological Associates, Inc., West Palm Beach, FL, USA; [4] US Geological Survey, Gainesville, FL, USA; [5] University of California, Berkeley, CA, USA; [6] University of Hawaii, Honolulu, HI, USA

11:45 **EFFECTS OF FLOW AND CONNECTIVITY ON EVERGLADES AQUATIC CONSUMERS: EVALUATING THREE HYPOTHESES -- Michael R. Bush**, Sarah Bornhoeft, John Gatto, and Joel C. Trexler; Florida International University, Miami, FL, USA

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Session #18: Construction Management Challenges of a Landscape-Scale Restoration Project (Picayune Strand Restoration Project)

[Ibis]

Moderator: Kim Dryden, U.S. Fish & Wildlife Service, Naples, FL

10:20 Introduction

10:30 **PROJECT MANAGEMENT CHALLENGES ON A RESTORATION PROJECT UNDER MULTIPLE JURISDICTIONS -- Janet Starnes[1]**, and Lacy Shaw[2]; [1]South Florida Water Management District, FL, USA; [2]US Army Corps of Engineers, Jacksonville, FL, USA

10:45 **RESTORING THE PRE-DEVELOPMENT HYDROLOGIC REGIME IN THE PICAYUNE STRAND RESTORATION PROJECT AREA -- Michael J. Duever**; Natural Ecosystems, Naples, FL, USA

11:00 **FOLLOWING THE BULLDOZERS. INVASIVE PLANT CONTROL FOR THE PICAYUNE STRAND RESTORATION PROJECT --** Michael J. Barry, **Maureen S. Bonness** and Craig van der Heiden; Institute for Regional Conservation, Delray Beach, FL, USA

11:15 **STATE FOREST MANAGEMENT ON A FEDERAL HABITAT RESTORATION PROJECT -- Dexter Sowell**; Florida Forest Service, Fort Myers, FL, USA

11:30 **MANATEES AND THE PICAYUNE STRAND RESTORATION PROJECT -- Daniel H Slone**; United States Geological Survey, Gainesville, FL, USA

11:45 **PROTECTING CULTURAL RESOURCES ON A RESTORATION PROJECT AND ADJACENT PUBLIC LANDS -- Grady H. Caulk**; U.S. Army Corps of Engineers, Jacksonville, FL, USA

Wednesday, April 22, 2015 | 10:20am - 12noon

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Session #19: Wetland Birds

[Egret]

Moderator: Mathieu Basille, University of Florida – FLREC, Fort Lauderdale, FL

10:20 Introduction

10:30 **INTERIM RESPONSE OF WADING BIRDS (PELECANIFORMES AND CICONIFORMES) AND WATERFOWL (ANSERIFORMES) TO THE KISSIMMEE RIVER RESTORATION PROJECT, FLORIDA, U.S.A. -- Michael D. Cheek[1]**, Gary Williams[2], Stephen Bousquin[3], Stefani Melvin[4,] and James Colee[5]; [1]South Florida Water Management District, West Palm Beach, FL, USA; [2]Southwest Florida Water Management District, Brooksville, FL, USA; [3]South Florida Water Management District, West Palm Beach, FL, USA; [4]Salmon-Challis National Forest, Salmon, Idaho, USA; [5]University of Florida, Gainesville, FL, USA

10:45 **WATER LEVEL FLUCTUATIONS INFLUENCE WADING BIRD PREY AVAILABILITY AND NESTING IN A MANAGED LAKE ECOSYSTEM --** Alico Inc., Fort Myers, FL, USA

11:00 **FACTORS AFFECTING THE ABUNDANCE OF WADING BIRDS IN INTERTIDAL HABITAT: ARE FRESHWATER MODELS APPLICABLE? -- Dale E. Gawlik** and Leonardo Calle; Florida Atlantic University, Boca Raton, FL, USA

11:15 **SIGNIFICANCE OF HUMAN INTERACTION AND INTERFERENCE ON OSPREY POPULATIONS IN THE EVERGLADES -- Anna Vecchione[1]**, Renata Schneider[2], Antonia Gardner[2]**,** Debbie Mauney[3]; [1]Sea Life Conservation and Arts, Charleston, SC, USA; [2]South Florida Wildlife Center, Fort Lauderdale, FL, USA; [3]Avian Conservation Center & The Center for Birds of Prey, Awendaw, SC, USA

11:30 **DEVELOPING A SPATIO-TEMPORAL OCCUPANCY MODEL FOR A DECLINING NESTING POPULATION OF BALD EAGLES HALIAEETUS LEUCOCEPHALUS IN FLORIDA BAY, EVERGLADES NATIONAL PARK -- Jason W. Bosley[1]**, John D. Baldwin[1], and Erik G. Noonburg[1]; [1]Florida Atlantic University, Davie, FL, USA

11:45 **USING WOOD STORK MOVEMENT TO ENHANCE CONSERVATION EFFORTS -- Mathieu Basille[1]**, Allison Benscoter[1], Rena Borkhataria[2], David Bucklin[1], Laura Brandt[3], Frank Mazzotti[1], Stephanie Romañach[4], Carolina Speroterra[1], James Watling[1]; [1]University of Florida, Fort Lauderdale, FL, USA; [2]University of Florida, Belle Glade, FL, USA; [3]U.S. Fish & Wildlife Service, Fort Lauderdale, FL, USA; [4]U.S. Geological Survey, Fort Lauderdale, FL, USA

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Session #20: Ecological Models & Tools, Part I

[Sandpiper]

Moderator: Stephanie Romañach, U.S. Geological Survey, Davie, FL

10:20 Introduction

10:30 **MULTI-SPECIES AND LANDSCAPE SCENARIO PLANNING USING HYDROLOGIC SIMULATION MODELING -- James M. Beerens[1]**, Mark McKelvy[1], Leonard Pearlstine[2], Heather Tipton[3], Stephanie S. Romañach[1], Craig Conzelmann[4]; [1]US Geological Survey, Fort Lauderdale, FL, USA; [2]Everglades National Park, Homestead, FL, USA; [3]U.S. Fish & Wildlife Service, Vero Beach, FL, USA; [4]U.S. Geological Survey, Lafayette, LA, USA

10:45 **ECOLOGICAL POSITION ANALYSIS: AN ONLINE TOOL FOR SPATIAL HABITAT FORECASTS -- Leonard Pearlstine[1]**, Gregg Reynolds[1], James Beerens[2], Kevin Suir[3], Mark McKelvy[3]; [1] National Park Service, Homestead, FL, USA; [2] U.S. Geological Survey, Davie, FL, USA; [3] U.S. Geological Survey, Lafayette, LA, USA

11:00 **EverVIEW lite: THE NEXT GENERATION OF MODELING VISUALIZATION FROM THE JOINT ECOSYSTEM MODELING COMMUNITY-- Craig P. Conzelmann[1],** Stephanie S. Romañach[2], Kevin Suir[1], and Mark McKelvy[2]; [1]U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, USA; [2]U.S. Geological Survey, Fort Lauderdale Research and Education Center, Davie, FL, USA

11:15 **SUPPORTING DECISION-MAKING IN THE GREATER EVERGLADES AND BEYOND WITH THE EVERVIEW PLATFORM -- Mark McKelvy**[1], Stephanie S. Romañach[1], Craig P. Conzelmann[2], Kevin Suir[2], James Darcey[3], and Sumani Chimmula[4]; [1]U.S. Geological Survey, Gainesville, FL, USA; [2]U.S. Geological Survey, Lafayette, LA, USA; [3]Five Rivers Services, LLC, Colorado Springs, CO, USA; [4]University of Louisiana, Lafayette, LA, USA

11:30 **DYNAMIC WEB TOOLS FOR MODELING AND MONITORING DATA VISUALIZATION -- Kevin J. Suir[1]**, Suresh Golconda[2], Craig Conzelmann[1], Stephanie Roma**ñach**[3], Leonard Pearlstine[4], Mark McKelvy[3], Janice Parsons[4], and Heather Smith[1]; [1]U.S. Geological Survey, Lafayette, LA, USA; [2]University of Louisiana at Lafayette, Lafayette, LA, USA; [3]U.S. Geological Survey, Gainesville, FL, USA; [4]National Park Service, Homestead, FL, USA

11:45 **MODELING THE DYNAMICS OF THE INVASIVE TREE, MELALEUCA QUINQUENERVIA, IN THE EVERGLADES, WITH AND WITHOUT BIOLOGICAL CONTROL -- Bo Zhang**[1], Don DeAngelis[2], Min Rayamajhi[3]; [1]University of Miami, Coral Gables, FL, USA; [2]U. S. Geological Survey, University of Miami, Coral Gables, FL, USA; [3]Invasive Plant Research Laboratory, USDA, Fort Lauderdale, FL, USA

Wednesday, April 22, 2015 | 1:20pm - 3pm

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Session #21: STAs & EAA Water Quality

[Great Cypress]

Moderator: Melodie Naja, Everglades Foundation, Palmetto Bay, FL

1:20 Introduction

1:30 **PHOSPHORUS LOADINGS FROM THE EVERGLADES AGRICULTURAL AREA -- Sayena Faridmarandi[1]** and Ghinwa Melodie Naja[2];[1]Texas A&M University, College Station, TX, USA; [2]Everglades Foundation, Palmetto Bay, FL, USA

1:45 **AQUATIC VEGETATION AND ITS ROLE ON PHOSPHORUS DYNAMICS IN THE EVERGLADES AGRICULTURAL AREA -- Jehangir H. Bhadha[1]**, Timothy A. Lang[1], and Samira H. Daroub[1];[1]University of Florida-Everglades Research and Education Center, Belle Glade, FL, USA

2:00 **STA-3/4 PERIPHYTON-BASED STORMWATER TREATMENT AREA (PSTA) CELL WATER AND TOTAL PHOSPHORUS BUDGET ANALYSES -- Hongying Zhao, Ph.D., P.E.1**, Tracey Piccone, P.E.2, and Manuel Felipe Zamorano3; 1South Florida Water Management District, West Palm Beach, FL, USA; 2South Florida Water Management District, West Palm Beach, FL, USA; 3South Florida Water Management District, West Palm Beach, FL, USA

2:15 **INNOVATIVE HYDRAULIC MODELING APPROACHES USED DURING THE DESIGN OF AN EVERGLADES TREATMENT WETLAND -- Maria Loinaz[1]**, Brent Whitfield[2], John Visconti[3], Alexis San Miguel[4], Jeremy C. McBryan[4], and Ken Konya[4];[1]ADA Engineering, Inc., Tampa, FL, USA;[2]ADA Engineering, Inc., West Palm Beach, FL, USA;[3]M-WH, West Palm Beach, FL, USA;[4]South Florida Water Management District, West Palm Beach, FL, USA

2:30 **DESIGN AND CONSTRUCTION OF A FLOW EQUALIZATION BASIN TO OPTIMIZE PERFORMANCE OF EVERGLADES STORMWATER TREATMENT AREAS** -- **Patrick Keith[1]**, Brent Anderson[2], Anthony Rosato[3], and Jeremy C. McBryan[3];[1]NorthStar Contracting Group, Inc., West Palm Beach, FL, USA;[2]NorthStar Contracting Group, Inc., Tampa, FL, USA;[3]South Florida Water Management District, West Palm Beach, FL, USA

2:45 **SCOPING-LEVEL EVALUATION OF EVERGLADES WATER QUALITY COMPLIANCE USING A CENTRAL FLOW-WAY HYDRATED WITH LAKE OKEECHOBEE WATER** -- **Larry E. Fink**; Waterwise Consulting™, LLC, Hollywood, FL, USA

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Session #22: Everglades Hydrology, Peat Accretion and Loss: Effects on Carbon Exchange and Water Retention

[Royal Poinciana]

Moderator: Thomas Dreschel[1] & Leonard Scinto[2]; [1]South Florida Water Management District, West Palm Beach, FL; [2]Florida International University, Miami, FL

1:20 Introduction

1:30 **SOIL ACCRETION ON CONSTRUCTED EVERGLADES TREE ISLANDS: PRODUCTION AND DECOMPOSTION AFFECTED BY WATER LEVELS** -- **Leonard J. Scinto[1]**, Alexandra Serna[1], Diana Johnson[1], Andres F. Rodriguez[2], Fred H. Sklar[3], Eric Cline[3], and Thomas Dreschel[3];-[1]Florida International University, Miami, FL, USA;[2]University of Florida, Gainesville, FL, USA;[3]South Florida Water Management District, West Palm Beach, FL, USA

1:45 **CARBON FLUX VARIABILITY IN THE EVERGLADES USING HYDROGEOPHYSICAL METHODS -- Xavier Comas**, and William Wright; Department of Geosciences, Florida Atlantic University, Davie, FL, USA

2:00 **SOIL ORGANIC MATTER CYCLING IN EVERGLADES PEATLANDS -- Alan L. Wright[1]**, Jing Hu[2], Rupesh Bhomia[2], Rongzhong Ye[3], and K. Ramesh Reddy[2];[1]University of Florida, Everglades REC, Belle Glade, FL, USA;[2]University of Florida, Soil & Water Science Dept., Gainesville, FL, USA;[3]University of California-Davis, Department of Land, Air and Water Resources, Davis, CA, USA

2:15 **DECADAL VARIATION IN EVERGLADES PEAT SOIL AT THE LANDSCAPE SCALE: RESULTS OF R-EMAP 1995-2014 -- Daniel J. Scheidt[1]**, Diana Johnson[2], Leonard J. Scinto[2] and Peter Kalla[1];[1]United States Environmental Protection Agency, Athens, Georgia, USA;[2]Florida International University, Miami, Florida, USA

2:30 **UNDERSTANDING THE VULNERABILITY OF EVERGLADES PEAT SOILS TO SMOLDERING COMBUSTION -- Brian W.** Benscoter[1] and James Johnson[1,2];[1]Florida Atlantic University, Davie, FL, USA;[2]University of Georgia, Athens, GA, USA

2:45 **DETERMINING HISTORICAL AND RECENT EVERGLADES PEAT QUANTITIES USING GEOSPATIAL TECHNIQUES** -- **Thomas W. Dreschel** and Susan M. Hohner;South Florida Water Management District, West Palm Beach, FL, USA

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Session #23: Ecosystem Services and Everglades Restoration: Moving Forward with Case Studies and Tools that Integrate Ecosystem Services into Decision Making

[Ibis]

Moderator: Kelly Keefe, U.S. Army Corp of Engineers, Jacksonville, FL

1:20 Introduction

1:30 **THE USE OF ECOSYSTEM SERVICES IN FLORIDA: A CROSS-PERSPECTIVE OF AGENCIES -- Annet Forkink**; Floria State University, Tallahassee, FL, USA

1:45 **VALUATION OF ECOSYSTEM SERVICES FOR ENVIRONMENTAL DECISION MAKING IN SOUTH FLORIDA** -- Nadia A. Seeteram[1] and **Pallab Mozumder[2]**;[1]Department of Earth and Environment, Florida International University, Miami, FL, USA;[2]Department of Earth and Environment, Department of Economics and Social Science Research Lab, International Hurricane Research Center, Florida International University, Miami, FL, USA

2:00 **ECOSYSTEM SERVICE VALUATION AND HYDRO-ECONOMIC OPTIMIZATION OF SOUTH FLORIDA WATER RESOURCES -- Michael C. Sukop[1]**, Victor C. Engel[2], Mahadev Bhat[1], Jessica Bolson[3], Jeffrey Czajowski[3], Michael Flaxman[4], Jose D. Fuentes[5], Ali Mirchi[6], Pallab Mozumder[1], Huong Nguyen[7], Jennifer Rehage[1], Joseph Smoak[8], Yuki Takatsuka[9], David Watkins[6], Richard Weisskoff[7];[1]Florida International University, Miami, FL, USA;[2]U. S. Geological Survey, Gainesville, FL, USA;[3]University of Pennsylvania, Philadelphia, PA, USA;[4]GeoDesign Technologies, Inc. San Francisco, CA, USA;[5]Pennsylvania State University, State College, PA, USA;[6]Michigan Technological University, Houghton, MI;[7]University of Miami, Coral Gables, FL, USA;[8]University of South Florida, St. Petersburg, FL, USA;[9]Florida State University, Tallahassee, FL, USA

2:15 **ASSESSING THE VALUE OF THE CENTRAL EVERGLADES PLANNING PROJECT (CEPP) IN EVERGLADES RESTORATION: AN ECOSYSTEM SERVICES APPROACH** -- Leslie Richardson[1], **Kelly Keefe[2]**, Christopher Huber[1], Laila Racevskis[3], Gregg Reynolds[4], Scott Thourot[5], Ian Miller[5];[1] U.S. Geological Survey Fort Collins Science Center, Fort Collins, Colorado, USA;[2] U.S. Army Corps of Engineers Everglades Restoration, Jacksonville, Florida, USA;[3] University of Florida Food and Resource Economics Department, Gainesville, Florida, USA;[4] National Park Service, Everglades National Park, Homestead, Florida, USA;[5] South Florida Water Management District, West Palm Beach, Florida, USA

2:30 **NOAA'S INTEGRATED ECOSYSTEM ASSESSMENTS: USING ECOSYSTEM SERVICES TO IMPROVE DECISION MAKING** -- **Christopher Kelble**; NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami, FL, USA

2:45 **ECOSYSTEM SERVICE SUSTAINABILITY ACROSS AN URBANIZATION GRADIENT IN COASTAL SOUTH FLORIDA** -- **Geoffrey S. Cook[1,2]**, Pamela J. Fletcher[2,3], and Christopher R. Kelble[2];[1] Cooperative Institute for Marine and Atmospheric Studies, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, FL, USA;[2] NOAA, Atlantic Oceanographic and Meteorological Laboratory, Ocean Chemistry and Ecosystems Division, Miami, FL, USA;[3] Florida Sea Grant, University of Florida, Gainesville, FL, USA

Wednesday, April 22, 2015 | 1:20pm - 3pm

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Session #24: Science and Habitat Management in the A.R.M. Loxahatchee National Wildlife Refuge: 13th Annual Loxahatchee Refuge Science Workshop

[Egret]

Moderator: Rebekah Gibble, U.S. Fish and Wildlife Service, Boynton Beach, FL

1:20 Introduction

1:30 **TRENDS IN RELATIVE DENSITY AND BODY CONDITION OF ALLIGATORS IN THE EVERGLADES --** Laura A. Brandt [1], **Jeff Beauchamp[2]**, Frank J. Mazzotti[2], Brian M. Jeffery[2], J. Hardin Waddle[3], Michael S. Cherkiss[4], Kristen M. Hart[4], Kenneth G. Rice[5];[1]U.S. Fish and Wildlife Service, Davie, FL;[2] University of Florida, Davie, FL;[3]U.S. Geological Survey, Lafayette, LA;[4]U.S. Geological Survey, Davie, FL;[5]U.S. Geological Survey, Gainesville, FL

1:45 **MEASUREMENT AND MODELING OF AIRBOAT FLOW-CUT HYDRAULICS IN THE A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE** -- **Kyle R. Douglas-Mankin[1]**, Donatto D. Surratt[2];[1]US Fish & Wildlife Service, Boynton Beach, FL, USA;[2]Everglades National Park, Homestead, FL, USA

2:00 **EFFICACY OF EDNA AS AN EARLY DETECTION AND RAPID RESPONSE INDICATOR FOR BURMESE PYTHONS IN THE NORTHERN GREATER EVERGLADES ECOSYSTEM AND ARM LOXAHATCHEE NATIONAL WILDLIFE REFUGE** -- **Margaret E. Hunter[1]**, Robert M. Dorazio[1], and Kristen M. Hart[2];[1]US Geological Survey, Southeast Ecological Science Center, Gainesville, FL, USA;[2]US Geological Survey, Southeast Ecological Science Center, Davie, FL, USA

2:15 **EFFECTS OF AERIAL HERBICIDE TREATMENT OF MELALEUCA ON NATIVE HABITAT RECOVERY IN THE NORTHERN EVERGLADES --** Brian W. Benscoter[1], **James J. Lange[1,3]**, Diane Harshberger[1], and Rebekah E. Gibble[2];[1]Florida Atlantic University, Davie, FL, USA;[2]Arthur R. Marshall Loxahatchee National Wildlife Refuge, Boynton Beach, FL, USA;[3]Fairchild Tropical Botanic Garden, Coral Gables, FL, USA

2:30 **MESO-MAMMAL COMMUNITIES OF A.R.M. LOXAHATCHEE NATION WILDLIFE REFUGE AS A REFERENCE FOR THE GREATER EVERGLADES ECOSYSTEM** -- **Robert McCleery[1]**, Adia Sovie[2], Rena Borkateria[3] and Kristen Hart[4];[1] University of Florida, Department of Wildlife Ecology and Conservation, Gainesville, FL;[2] University of Florida, Department of Wildlife Ecology and Conservation, Gainesville, FL;[3] University of Florida, Department of Wildlife Ecology and Conservation, Belle Glad, FL;[4] USGS, Southeast Ecological Science Center, Davie, FL

2:45 **SPATIAL AND TEMPORAL TRENDS IN WATER QUALITY AT THE A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE: AN ASSESSMENT OF LONG-TERM RESTORATION** -- **Donatto D. Surratt[1]**, Rebekah E. Gibble[2];[1]Everglades National Park, Homestead, FL, USA;[2]U.S. Fish and Wildlife Service, Boynton Beach, FL, USA

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Session #25: Ecological Models & Tools, Part II

[Sandpiper]

Moderator: Stephanie Romañach, U.S. Geological Survey, Davie, FL

1:20 Introduction

1:30 **NETWORK MODULARITY REVEALS CRITICAL SCALES FOR CONNECTIVITY CONSERVATION -- Brian E. Reichert [1]**, Robert J. Fletcher Jr. [1], Andre Revell [1], Wiley M. Kitchens [2], Jeremy D. Dixon [3], and James D. Austin [1]; [1]Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL, USA; [2]U.S. Geological Survey, Florida Cooperative Fish and Wildlife Research Unit, University of Florida, Gainesville, FL, USA; [3]Crocodile Lake National Wildlife Refuge, Key Largo, FL, USA

1:45 **GAINING INSIGHT FROM RESTORATION SCENARIO EVALUATIONS WITH WADING BIRD NEST EFFORT MODELS** -- **Michelle L. Petersen** and Dale E. Gawlik; Florida Atlantic University, Boca Raton, FL, USA

2:00 **MODELING THE OCCURRENCE OF EVERGLADES AMPHIBIANS AS A FUNCTION OF HYDROLOGY AND HABITAT TYPE -- Hardin Waddle[1]**, Susan Walls[2], Stephanie Romañach[2], Sumani Chimmula[3], and Kevin Suir[1];[1]U.S. Geological Survey, Lafayette, LA, USA;[2]U.S. Geological Survey, Gainesville, FL, USA;[3]University of Louisiana at Lafayette, Lafayette, LA 70504

2:15 **INTEGRATED ECO-HYDROLOGICAL MODELLING OF FORAGE FISH AIMED AT SUPPORTING MANAGEMENT DECISIONS -- Simeon Yurek[1]**, Donald L. DeAngelis[1,2], Joel C. Trexler[3], Laurel G. Larsen[4];[1]University of Miami, Miami, FL, USA;[2]Southeast Ecological Science Center, U. S. Geological Survey, Gainesville, FL, USA;[3]Florida International University, Miami, FL, USA;[4]University of California, Berkeley, Berkeley, CA, USA

2:30 **MODELING THE EFFECTS OF SEA LEVEL RISE AND STORM SURGE ON COASTAL EVERGLADES VEGETATION --** Su Yean Teh[1], **Donald L. DeAngelis[2],** Michael Turtora[3], Jiang Jiang[4], Leonard Pearlstine[5], Thomas J. Smith[6] and Hock Lye Koh[7];[1]Universiti Sains Malaysia, 11800 Penang, Malaysia;[2]U. S. Geological Survey, University of Miami, Coral Gables, FL, USA;[3]U. S. Geological Survey, Lutz, FL, USA;[4] University of Tennessee, Knoxville, TN, USA;[5]Everglades National Park, South Florida Natural Resources Center, Homestead, FL, USA;[6]U.S. Geological Survey, St. Petersburg, FL, USA;[7] UCSI University, Kuala Lumpur, Malaysia

2:45 **DISCUSSION**

Thursday April 23, 2015 | 10:20am - 12noon

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Session #26: Everglades Restoration Progress: Assessing Effects of Modified Water Deliveries on Northern Shark River Slough

[Great Cypress]

Moderator: David Rudnick & Robert Johnson, Everglades National Park, Homestead, FL

10:20 Introduction

10:30 **RESTORING FLOWS TO NORTHEAST SHARK RIVER SLOUGH, EVERGLADES VIA THE MODIFIED WATER DELIVERIES PROJECT, A 30 YEAR ODYSSEY** -- **Robert Johnson**, Kevin Kotun, and David Rudnick; National Park Service, Everglades National Park, Homestead, FL, USA

10:45 **ASSESSMENT OF THE ECOLOGICAL STATUS AND TRENDS OF NORTHEASTERN SHARK RIVER SLOUGH -- Jennifer Richards[1]**, Evelyn Gaiser[1], Daniel Gann[1], Leonard Scinto[1], and Joel Trexler[1];[1]Florida International University, Miami, FL, USA

11:00 **SPATIAL PATTERNS OF PHOSPHORUS ENRICHMENT IN NORTHERN SHARK RIVER SLOUGH** -- **Joffre Castro;** Everglades National Park, Homestead, FL, USA

11:15 **MAPPING VEGETATION AND VEGETATION CHANGE PATTERNS IN NORTHERN SHARK RIVER SLOUGH FROM REMOTELY SENSED DATA** -- **Daniel Gann[1]**, and Jennifer Richards[1];[1]Florida International University, Miami, FL, USA

11:30 **INFLUENCES OF CHANGING HYDROLOGIC CONDITIONS ON FOOD WEB PATTERNS NEAR THE BOUNDARIES OF EVERGLADES NATIONAL PARK** -- **Eric R. Sokol**[1] and Joel C. Trexler[2];[1]Virginia Tech, Blacksburg, VA, USA;-[2]Florida International University, FL, USA

11:45 **EXPECTATIONS FOR CAPE SABLE SEASIDE SPARROW HABITAT SUITABILITY AND SUBPOPULATION VIABILITY WITH MODIFIED WATER DELIVERIES** -- **Tylan F. Dean[1]** and Leonard Pearlstine[1];[1]South Florida Natural Resources Center, Everglades National Park, Homestead, FL, USA

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Session #27: Tree Island Ecology: Advances on Ecological Restoration

[Royal Poinciana]

Moderator: Carlos Coronado-Molina[1] & Michael Ross[2]; [1]South Florida Water Management District, West Palm Beach, FL; [2]Florida International University, Miami, FL

10:20 Introduction

10:30 **TREE ISLANDS AND THE LAST 5000 YEARS OF HUMAN OCCUPATION -- Daniel Hughes;**US Army Corps of Engineers, Jacksonville, FL, USA

10:45 **LITTERFALL AND TREE GROWTH DYNAMICS IN A PRISTINE TREE ISLAND AND A DEGRADED TREE ISLAND IN WCA-3A: THE IMPORTANCE OF ECOLOGICAL FUNCTIONS ON TREE ISLANDS** -- **Carlos Coronado-Molina[1]**, Fred Sklar[1], Darlene Marley[1], Fabiola Santamaria[2] and Michelle Blaha[2];[1]South Florida Water Management District, West Palm Beach, FL, USA;[2]Scheda Ecological Associates, Inc., West Palm Beach, FL, USA

11:00 **DID FLOODING KILL THE GHOST TREE ISLANDS? EVIDENCE FROM HEALTHY EVERGLADES TREE ISLANDS AND THE LILA EXPERIMENTAL PLATFORM** -- **Susana Stoffella[1],** Michael Ross[1], Jay Sah[1], Jesus Blanco[1], Junnio Freixa[1]and Eric Cline[2];-[1]Southeast Environmental Research Center, Florida International University, Miami, FL, USA;[2]South Florida Water Management District

11:15 **INTEGRATING TREE ISLAND METRICS TO UNDERSTAND POTENTIAL MECHANISMS FOR PAST DEGRADATION AND FUTURE RESTORATION** -- **Tiffany G. Troxler[1]**, Carlos Coronado[2], Fred Sklar[2];[1] Southeastern Environmental Research Center and Department of Biological Sciences, Florida International University, Miami, FL;[2] Everglades Systems Assessment Section, South Florida Water Management District, West Palm Beach, FL

11:30 **HYDROGEOCHEMICAL RESPONSE OF EXPERIMENTAL EVERGLADES TREE ISLANDS (FLORIDA, USA): IDENTIFYING FEEDBACK MECHANISMS ASSOCIATED WITH EARLY TREE GROWTH AND DIFFERING GEOLOGIC MATERIALS** -- **Pamela L. Sullivan** [1], René M. Price[2], Leonel Sternberg[3], Jay Sah[2], Leonard Scinto[2], Michael S. Ross[2], Eric Cline[4], Thomas Dreschel[4], and Fred Sklar[4];[1] University of Kanas, Lawrence, KS, USA;[2] Florida International University, Miami, FL, USA;[3] Department of Biology, University of Miami, Miami, FL, USA;[4] South Florida Water Management District, West Palm Beach, FL, USA

11:45 **METACOMMUNITY STRUCTURE OF HARDWOOD HAMMOCKS OF THE EVERGLADES AND FLORIDA KEYS** -- **Michael Ross;**Department of Earth and Environment, Florida International University

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Session #28: Mercury Cycling, Transport, and Effects in the Everglades

[Ibis]

Moderator: Forrest Dierberg[1], Andy Ogram[2] & Paul Julian II[3]; [1]DB Environmental, Inc., Rockledge, F; [2]University of Florida, Gainesville, FL; [3]Florida Department of Environmental Protection, Ft. Myers, FL

10:20 Introduction

10:30 **AN OVERVIEW OF EVERGLADES MERCURY ISSUES: CRITICAL QUESTIONS REMAIN -- Paul Julian II[1]**, Binhe Gu[2], Garth Redfield[2], and Ken Weaver[3];[1]Florida Department of Environmental Protection, Office of Ecosystem Projects, Ft. Myers, FL, USA;[2]South Florida Water Management District, Water Quality Bureau, West Palm Beach FL, USA;[3]Florida Department of Environmental Protection, Division of Ecosystem Assessment and Restoration, Tallahassee, FL, USA

10:45 **MERCURY CONTAMINATION OF THE EVERGLADES: REVELATIONS FROM THE LONG-TERM ACME PROJECT AND FUTURE CONSIDERATIONS** -- **David Krabbenhoft[1]**, John DeWild[1], Morgan Maglio[1], Jacob Ogorek[1], Michael Tate[1], Charlie Thompson[1], George Aiken[2], William Orem[3], Jeffrey Kline[4], Joffre Castro[4], Cynthia Gilmour[5], James Hurley[6],Darren Rumbold[7], Ted Lange[8], and Carl Fitz[9];[1] U.S. Geological Survey, Middleton, WI, USA;[2] U.S. Geological Survey, Boulder, CO, USA;[3] U.S. Geological Survey, Reston, VA, USA;[4] National Park Service, Everglades National Park, Homestead, FL, USA;[5] Smithsonian Estuarine Research Center, Edgewater, MD, USA;[6] University of Wisconsin-Madison, Madison, WI USA;[7] Florida Gulf Coast University, Fort Myers, FL, USA;[8] Florida Fish and Wildlife Conservation Commission, Eustis, FL, USA;[9] University of Florida, Gainesville, FL, USA

11:00 **DISTRIBUTION OF MERCURY IN ECOSYSTEM COMPONENTS IN THE EVERGLADES: A MASS BUDGET PERSPECTIVE** -- **Guangliang Liu[1]**, Yong Cai[1], Ping Jiang[1], Wenbin Cui[1], Peter Kalla[2] and Dan Scheidt[2];[1]Florida International University, Miami, FL, USA;[2]U.S. Environmental Protection Agency, Region 4, Athens, GA, USA

11:15 **MOLECULAR MICROBIAL ECOLOGY OF MERCURY METHYLATION IN THE EVERGLADES SOIL ECOSYSTEM** -- Hee-Sung Bae[1], F.E. Dierberg[2], and **Andrew Ogram**[1];[1]University of Florida, Gainesville, FL, USA;[2]DB Environmental, Inc., Rockledge, FL, USA

11:30 **SPATIAL AND TEMPORAL VARIATIONS OF TOTAL MERCURY IN MOSQUITOFISH FROM EVERGLADES MARSHES** -- **Binhe Gu[1]**, Paul Julian[2], and Garth Redfield[1];[1]South Florida Water Management District, West Palm Beach FL, USA;[2]Florida Department of Environmental Protection, Fort Myers, FL, USA

11:45 **COMMUNITY-RELATED TROPHIC VARIABILITY CONTRIBUTES TO VARIATIONS IN MOSQUITOFISH (GAMBUSIA HOLBROOKI) MERCURY CONCENTRATIONS IN WATER CONSERVATION AREA 2A** -- **Forrest Dierberg[1]** , M. Jerauld[1], T. DeBusk[1], D. Sierer-Finn[1], J. Potts[1], N. Larson[1], and B. Gu[2];[1]DB Environmental, Inc., Rockledge, FL, USA;[2]South Florida Water Management District, West Palm Beach, FL, USA

Thursday April 23, 2015 | 10:20am - 12noon

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Session #29: Coastal Marine Ecology

[Egret]

Moderator: Paul Conrads, U.S. Geological Survey, Columbia, SC

10:20 Introduction

10:30 **VARIABILITY IN THE SUBMERGED AQUATIC VEGETATION COMMUNITY WITHIN THE NORTHEASTERN FLORIDA BAY MANGROVE ECOTONE OVER TWO DECADES** -- **Michael Kline**[1], Peter Frezza[1] and Jerome Lorenz[1];Audubon of Florida, Everglades Science Center, Tavernier, FL, USA

10:45 **PHYTOPLANKTON RESPONSE TO CHANGING NUTRIENTS FROM COMPREHENSIVE EVERGLADES RESTORATION PLAN: COMPARISON OF TWO COASTAL LAGOON SYSTEMS IN NORTHERN FLORIDA BAY, USA** -- **Yini Shangguan**[1], Patricia M. Glibert[1], Jeff Alexander[1], Christopher J. Madden[2], and Sue Murasko[1];[1]University of Maryland Center for Environmental Science, Cambridge, MD, USA;[2]South Florida Water Management District, West Palm Beach, FL, USA

11:00 **PREDICTING THE RESPONSES OF EASTERN OYSTER POPULATION TO RIVER DIVERSION AND SEA-LEVEL RISE** -- **Hongqing Wang**[1], Qin Chen[2], Megan La Peyre[1, 3], Kelin Hu[2], Jerome La Peyre[3], Julie Anderson Lively[3];[1]U.S. Geological Survey, Baton Rouge, LA, USA;[2]Louisiana State University, Baton Rouge, LA, USA;[3]Louisiana State University Agricultural Center, Baton Rouge, LA, USA

11:15 **AN INTEGRATED ENVIRONMENTAL MODEL FOR A CONSTRUCTED WETLAND: WATER QUALITY PROCESSES** -- **KangRen Jin**[1] and Zhen-Gang Ji[2];[1]South Florida Water Management District, West Palm Beach, FL, USA;[2]Catholic University of America, Washington, DC 20064, USA

11:30 **MATHEMATICAL ANALYSIS OF THE INFLUENCE OF NATURALLY OCCURRING VS. ANTHROPOGENIC EVENTS ON WATER QUALITY IN FLORIDA BAY** -- **Laurel S. Collins**[1], Lee-Ann C. Hayek[2] and Anna Wachnicka[1];[1]Florida International University, Miami, FL, USA;[2]Smithsonian Institution, Museum of Natural History, Washington, DC, USA

11:45 **DEVELOPMENT OF A COASTAL DROUGHT INDEX USING SALINITY DATA** -- **Paul Conrads**[1] and Lisa Darby[2];[1]U.S. Geological Survey, S.C. Water Science Center, Columbia, SC, USA; [2]National Integrated Drought Information System, Boulder, CO, USA

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Session #30: Organic Matter, Carbon Cycling, and Water Quality in the Greater Everglades Ecosystem

[Sandpiper]

Moderator: George Aiken, U.S. Geological Survey, S.C. Water Science Center, Boulder, CO

10:20 Introduction

10:30 **DETAILED MOLECULAR CHARACTERIZATION OF DISSOLVED ORGANIC MATTER FROM THE EVERGLADES: A COMPARATIVE STUDY THROUGH THE ANALYSIS OF OPTICAL PROPERTIES, NMR AND FTICR/MS** -- **R. Jaffé**[1], N. Hertkorn[2], M. Harir[2], K. M. Cawley[1], P. Schmitt-Kopplin[2];[1]Southeast Environmental Research Center, and Department of Chemistry and Biochemistry, Florida International University, Miami, FL, USA;[2]Helmholtz Zentrum Muenchen, German Research Center for Environmental Health, Research Unit Analytical Biogeochemistry (BGC), Neuherberg, Germany

10:45 **EXPORT OF DISSOLVED ORGANIC CARBON FROM THE EVERGLADES TO COASTAL WATERS** -- **Brian A. Bergamaschi**[1], George R. Aiken[2], David P. Krabbenhoft[3], Eduardo Patino[4], Darren G. Rumbold[5], William H. Orem[6];[1] United States Geological Survey California Water Science Center, Sacramento, CA, USA;[2] United States Geological Survey National Research Program, Boulder, CO, USA;[3] United States Geological Survey Wisconsin Water Science Center, Madison, WI, USA;[4] United States Geological Survey Florida Water Science Center, St. Petersburg, FL, USA;[5] Florida Gulf Coast University, Ft. Myers, FL, USA;[6] United States Geological Survey, Reston, VA, USA

11:00 **THE INFLUENCES OF SULFATE REDUCTION ON THE CHEMISTRY OF ORGANIC MATTER IN THE EVERGLADES** -- George R. Aiken[1], Joseph N. Ryan[2], Aron Stubbins[3], Cole Anthony[2], and **Brett A. Poulin**[1,2];[1]U.S. Geological Survey, Boulder, CO, USA;[2]University of Colorado Boulder, USA;[3]Skidaway Institute of Oceanography, University of Georgia, USA

11:15 **FIRE AND FLOOD: RESPONSE OF ORGANIC MATTER TO EXTREME EVENTS IN THE DPM FOOTPRINT** -- Laurel Larsen[1,2], **Brendan Buskirk**[2], Jud Harvey[2], Kenna Butler[3], George Aiken[3], Sue Newman[4], and Jay Choi[2];[1]University of California, Berkeley, CA, USA;[2]US Geological Survey, Reston, VA, USA;[3]US Geological Survey, Boulder, CO, USA;[4]South Florida Water Management District, West Palm Beach, FL, USA

11:30 **QUANTIFYING THE RELATIVE CONTRIBUTIONS MADE BY ORGANIC MATTER AND MINERAL SEDIMENT TO ACCRETION RATES IN THE COASTAL EVERGLADES** -- **Joshua L. Breithaupt**[1], Joseph M. Smoak[2], Thomas J. Smith III[3]; [1]University of South Florida, College of Marine Science, St. Petersburg, FL; [2]University of South Florida, Department of Environmental Science, Policy, and Geography, St. Petersburg, FL, USA; [3]U.S Geological Survey, Southeast Ecological Science Center, St. Petersburg, FL, USA

11:45 **RESTORATION RALLY CRY FOR THE BIG CYPRESS SWAMP** -- **Robert V. Sobczak**[1], Jim Burch[1], Denesia Cheek[2], Ron Clark[1], Michael Duever[3], Kim Dryden[4], Kevin Godsea[5], Eduardo Patino[6], Renee Rau[7] and Greg Suszek[5]; [1]Big Cypress National Preserve, Ochopee, FL, USA; [2]National Park Service – Southeast Regional Office, Atlanta, FL, USA; [3]Natural Ecosystems, LLC, Corkscrew, FL, USA; [4]Fish and Wildlife Service, Vero Beach, FL; [5]Florida Panther National Wildlife Refuge, Immakolee, FL; [6]U.S Geological Survey, Ft Myers, FL; [7]Fakahatchee Strand Preserve, Copeland, FL, USA

Thursday April 23, 2015 | 1:20pm - 3pm

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Session #31: Sulfur in the Greater Everglades Ecosystem – Sources, Cycling, Fate, Biogeochemistry, and Impacts

[Great Cypress]

Moderator: William Orem, U.S. Geological Survey, Reston, VA

1:20 Introduction

1:30 **SULFUR AND MERCURY MODELING IN THE EVERGLADES** -- Matthew Varonka[1], David Krabbenhoft[2], George Aiken[3], Carl Fitz[4], Mark Shafer[5], and **William Orem[1];**[1]U.S. Geological Survey, Reston, VA, USA; [2]U.S. Geological Survey, Middletown, WI;[3]U.S. Geological Survey, Boulder, CO, USA; [4]University of Florida, Gainesville, FL, USA; [5]U.S. Army Corps of Engineers, Jacksonville, FL, USA

1:45 **THE ROLE OF SULFATE AS A DRIVER FOR MERCURY METHYLATION IN THE EVERGLADES – WHAT DOES STATISTICS REALLY HAVE TO SAY?-- Curtis D. Pollman;**University of Florida, Gainesville, FL, USA

2:00 **GEOCHEMICAL RESPONSE TO AQUEOUS SULFATE ADDITIONS IN AN OLIGOTROPHIC EVERGLADES MARSH** -- Tom DeBusk[1], **M. Jerauld[1]**, F. Dierberg[1], D. Sierer-Finn[1], B. Gu[2];[1]DB Environmental, Inc., Rockledge, FL, USA;[2]South Florida Water Management District, West Palm Beach, FL, USA

2:15 **EVERGLADES REMAP 2013/2014: SULFUR AND RELATED FINDINGS FOR MERCURY-- Peter Kalla[1]**, Daniel Scheidt[2], Pamela Betts[1], Louis Pounds[3], Guangliang Lui[4], and Yong Cai[4];[1]U.S. Environmental Protection Agency, Region 4 laboratory, Athens, GA, USA; [2]U.S. Environmental Protection Agency, Water Protection Division, Athens, GA, USA; [3]Alion Science and Technology, Inc., Athens, GA, USA; [4]Florida International University, Miami, FL, USA

2:30 **SULFUR AND MERCURY MODELING IN THE EVERGLADES -- Matthew Varonka[1]**, David Krabbenhoft[2], George Aiken[3], Carl Fitz[4], Mark Shafer[5], and William Orem[1];[1]U.S. Geological Survey, Reston, VA, USA; [2]U.S. Geological Survey, Middletown, WI; [3]U.S. Geological Survey, Boulder, CO, USA; [4]University of Florida, Gainesville, FL, USA; [5]U.S. Army Corps of Engineers, Jacksonville, FL, USA

2:45 **CONTINUOUS MONITORING OF MERCURY IN EVERGLADES NATIONAL PARK**. -- **Eduardo Patino[1]** and Travis Knight[1];[1]United States Geological Survey, Fort Myers, FL, USA

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Session #32: Modeling the Incremental Value of Restored Flow to Everglades Ecology

[Royal Poinciana]

Moderator: Jud Harvey, U.S. Geological Survey, Reston, VA

1:20 Introduction

1:30 **RESTORATION DIRECTIONS: SCIENCE INFORMING THE PROCESS --** James Beerens[1], Rena Bokrkhataria[2], Daniel L. Childers[3], Jay Choi[4], Stephen E. Davis III[5], Steven M. Davis[6], Carl Fitz[7], Evelyn E. Gaiser[8], Judson W. Harvey[4], Thomas Lodge[9], Frank Marshall[10], Bobby McCormick[11], G. Melodie Naja[4], Todd Z. Osborne[2], Michael S. Ross[8], Jay Sah[8], Joel C. Trexler[8], **Thomas Van Lent**[5], and Paul R. Wetzel[12];[1]U.S. Geological Survey, Davie, FL, USA;[2]The University of Florida, Gainesville, FL, USA;[3]Arizona State University, Phoenix, AZ, USA;[4]U.S. Geological Survey, Reston, VA, USA;[5]The Everglades Foundation, Palmetto Bay, FL, USA;[6]Ibis Ecosystem Associates, Inc, Ft. Myers, FL, USA;[7]EcoLandMod, Inc., Ft. Pierce, FL, USA;[8]Florida International University, Miami, FL, USA;[9]Thomas Lodge Associates, Miami, FL, USA;[10]Cetaeean Logic, New Symrna Beach, FL, USA;[11]Clemson University, Clemson, SC, USA;[12]Smith College, Northampton, MA, USA

1:45 **BACK TO THE FUTURE: A LANDSCAPE-SCALE RESPONSE TO RESTORATION** -- Kate Shepard Watkins, Shaye Sable, Erol Karadogan, and Chris Wallen; Dynamic Solutions, LLC, Baton Rouge, LA, USA **Fred Sklar[1]**, J. Beerens[2], L. Brandt[3], T. Frankovich[4], C. Madden[1], J. Trexler[5], A, McLean[6], S. Davis[7] and W. Wilcox[1];[1]South Florida Water Management District, West Palm Beach, FL, USA;[2]USGS, Davie, FL, USA;[3]U.S. Fish and Wildlife Service, Davie, FL, USA;[4]University of Virginia;[5]Florida International University, Miami, FL, USA;[6]Everglades National Park, Homestead, FL, USA;[7]Steve Davis, Everglades Foundation, Miami, FL, USA

2:00 **PERIPHYTON RESPONSES TO FLOW RESTORATION: DISTRIBUTION, COMMUNITY COMPOSITION, AND EDIBILITY -- Evelyn Gaiser;** Florida International University, Miami, FL, USA

2:15 **MODELING RESTORATION OUTCOMES FOR THE EVERGLADES RIDGE-SLOUGH LANDSCAPE -- Jay Choi [1]** and Jud Harvey[1];[1]U.S. Geological Survey, Reston, VA, USA

2:30 **SOIL OXIDATION AND PHOSPHORUS STORAGE CHANGES RESULTING FROM A RANGE OF RESTORATION OPTIONS -- H. Carl Fitz[1]**, Todd Z. Osborne[2], and Stephen E. Davis, III[3];[1]EcoLandMod, Inc., Fort Pierce, FL, USA;[2]University of Florida, St. Augustine, FL, USA;[3]Everglades Foundation, Palmetto Bay, FL, USA

2:45 **DEVIATIONS FROM A THEME: PEAT PATTERNING IN SUB-TROPICAL LANDSCAPES -- Christa L. Zweig[1]**, Susan Newman[1], Fred H. Sklar[1], and Wiley M. Kitchens[2];[1] South Florida Water Management District, West Palm Beach, FL USA;[2] University of Florida, Gainesville, FL USA

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Session #33: Invasive Species Monitoring

[Ibis]

Moderator: Tony Pernas, National Park Service, Palmetto Bay, FL

1:20 Introduction

1:30 **EVERGLADES INVASIVE REPTILE AND AMPHIBIAN MONITORING PROGRAM (EIRAMP)-- Michel R. Rochford[1]** and Frank J. Mazzotti[1];[1]University of Florida, Fort Lauderdale, FL, USA

1:45 **INTERAGENCY MONITORING AND ASSESSMENT EFFORTS FOR THE ARGENTINE BLACK AND WHITE TEGU IN THE SOUTHEASTERN EVERGLADES -- Jenny Ketterlin Eckles[1]**, Tylan F. Dean[2], Frank J. Mazzotti[3], Robert N. Reed[4], and H. LeRoy Rodgers[5];[1]Florida Fish and Wildlife Conservation Commission, Davie, FL, USA;[2]National Park Service, Homestead, FL, USA;[3]University of Florida, Davie, FL, USA;[4]United States Geological Survey, Fort Collins, CO, USA;[5]South Florida Water Management District, West Palm Beach, FL, USA

2:00 **APPLYING WILDLIFE GENETICS TO INVASIVE SPECIES MANAGEMENT IN THE FLORIDA EVERGLADES -- Michael L. Avery[1]** and Antoinette J. Piaggio[2];[1]USDA/APHIS National Wildlife Research Center, Gainesville, FL, USA;[2]USDA/APHIS National Wildlife Research Center, Fort Collins, CO, USA

2:15 **IMPLICATIONS OF MOVEMENT BEHAVIOR AND LOCAL DENSITY ON NONNATIVE FISH DETECTION IN EVERGLADES RESTORATION ASSESSMENTS -- Joseph J. Parkos III[1]**, Jeffrey L. Kline[2], and Joel C. Trexler[1];[1]Florida International University, North Miami, FL USA;[2]Everglades National Park, Homestead, FL USA

2:30 **BIOLOGICAL CONTROL RELEASES ON *LYGODIUM MICROPHYLLUM* IN CAPE SABLE WILDERNESS AREA, EVERGLADES NATIONAL PARK: CERP IMPLEMENTATION AND MONITORING FOR SUCCESS -- Melissa C. Smith[1]**, Ellen C. Lake[1], Hillary Cooley[2], and LeRoy Rodgers;[1]USDA-ARS Invasive Plant Research Lab, Fort Lauderdale, FL, USA;[2]National Park Service, Everglades National Park, Homestead, FL, USA;[3]South Florida Water Management District, West Palm Beach, FL, USA

2:45 **BALANCING ACCURACY AND PRECISION FOR MONITORING EXOTIC PLANT MANAGEMENT AT THE LANDSCAPE SCALE -- Tony Pernas[1]**, Jed Redwine[1], LeRoy Rodgers[2], and Shea Bruscia[1];[1]National Park Service, Palmetto Bay, FL, USA;[2]South Florida Water Management District, West Palm Beach, FL, USA

Thursday April 23, 2015 | 1:20pm - 3pm

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Session #34: Florida Bay Restoration: Ecosystem Status, Trends, and Responses

[Egret]

Moderator: Stacie Auvenshine, U.S. Army Corps of Engineers, Jacksonville, FL

1:20 Introduction

1:30 **LONG-TERM CHANGES IN SEAGRASS DISTRIBUTION AND ABUNDANCE IN FLORIDA BAY** -- **Margaret O. Hall**[1], Michael J. Durako[2], Manuel Merello[1], and Juliet Christian[1];[1]Florida Fish and Wildlife Research Institute, St. Petersburg, FL, USA;[2]University of North Carolina at Wilmington, Wilmington, NC, USA

1:45 **JUVENILE SPORTFISH MONITORING IN FLORIDA BAY, EVERGLADES NATIONAL PARK**-- **Lindsey Visser[1],** Chris Kelble[2], Joan Browder[3], Joseph Contillo[4], and Timothy Cook[5]; [1]University of Miami CIMAS, Miami, FL, USA;[2]NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami, FL, USA; [3]NOAA National Marine Fisheries Service, Miami, FL, USA; [4]NOAA National Marine Fisheries Service, Miami, FL, USA; [5]University of Miami CIMAS, Miami, FL, USA

2:00 **PREDICTING CHANGES IN ESTUARINE SAV DISTRIBUTION FROM INCREASED FRESHWATER DELIVERY** -- **Thomas A. Frankovich**[1], Frank Marshall[2], Mark Zucker[3], Steve Kelly[4] and James Warren Fourqurean[1];[1]Florida International University, Miami, FL, USA;[2]Cetacean Logic Foundation, New Smyrna Beach, FL, USA;[3]U.S. Geological Survey, Davie, FL, USA;[4]South Florida Water Management District, West Palm Beach, FL, USA

2:15 **A POPULATION APPROACH TO UNDERSTANDING MECHANISMS CONTROLLING THE SUBMERGED AQUATIC VEGETATION SPECIES *RUPPIA MARITIMA L.* (WIDGEONGRASS) AT THE EVERGLADES-FLORIDA BAY ECOTONE** -- **Theresa Strazisar** [1], Marguerite S. Koch[1], and Christopher J. Madden[2];[1]Dept. Biological Sciences, Florida Atlantic University, Boca Raton, FL, USA;[2]South Florida Water Management District, Everglades Division, West Palm Beach, FL, USA

2:30 **AN OVERVIEW OF C-111 SPREADER CANAL WESTERN PROJECT IMPLEMENTATION AND RESTORATION PROGRESS** -- **David Rudnick** [1], Kevin Kotun[1], Tiffany Troxler[2], Jerry Lorenz[3], Christopher Madden[4], Amanda McDonald[4], Stephen Kelly[4], Joseph Stachelek[4], and Carlos Coronado[4];[1] South Florida Natural Resources Center, Everglades National Park, Homestead, FL, USA;[2] Southeast Environmental Research Center, Florida International University, Miami, FL, USA;[3] Everglades Science Center, Audubon Florida, Tavernier, FL, USA;[4] Everglades Systems Assessment Section, South Florida Water Management District, West Palm Beach, FL, USA

2:45 **INITIAL MONITORING RESULTS OF ECOSYSTEM RESPONSE TO THE C-111 SPREADER CANAL WESTERN PHASE IN NORTHEASTERN FLORIDA BAY** -- Jerome Lorenz[1], Peter Frezza[1], Michael Kline[1] and **Michelle Robinson[1];**[1]Audubon Florida, Everglades Science Center, Tavernier, FL, USA

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Session #35: Biogeochemistry

[Sandpiper]

Moderator: Mark Shafer, U.S. Army Corps of Engineers, Jacksonville, FL

1:20 Introduction

1:30 **CONTROL OF PHOSPHATE CONCENTRATION THROUGH ADSORPTION AND DESORPTION PROCESSES IN SHALLOW GROUNDWATER OF COASTAL EVERGLADES -- Hilary D. Flower** [1], Mark Rains[1], David Lewis[1], Jia-Zhong Zhang[2], and Rene Price[3];[1]University of South Florida, Tampa, FL, USA;[2]National Oceanic and Atmospheric Administration, Miami, FL, USA;[3]Florida International University, Miami, FL, USA

1:45 **ECOLOGICAL RISK ASSESSMENT OF CERP AQUIFER STORAGE AND RECOVERY** -- **Mark D. Shafer**[1], Steven Schubert[2], Isabel Johnson[3];[1]U.S. Army Corps of Engineers, Jacksonville, FL, USA;[2]U.S. Fish & Wildlife Service, Vero Beach, FL, USA;[3]Golder Associates, Inc., Gainesville, FL, USA

2:00 **FREQUENCY DISTRIBUTIONS OF SURFACE WATER TOTAL PHOSPHORUS IN THE LOXAHATCHEE REFUGE: SIMILARITY AND IMPLICATIONS FOR DYNAMIC MODELS** -- **Michael G. Waldon**[1], Donatto Surratt[2];[1] unaffiliated, Lafayette, LA, USA;[2] Everglades Program Team, National Park Service, Boynton Beach, FL, USA

2:15 **ENVIRONMENTAL VARIANCE AND DISPERSAL EXPLAIN BENTHIC DIATOM SPATIAL AND TEMPORAL BETA DIVERSITY IN THE FLORIDA EVERGLADES** -- **Nicholas O. Schulte**[1] and Evelyn E. Gaiser[1];[1]Florida International University, Miami, FL, USA

2:30 **EVALUATION OF THE POSSIBLE SOURCES AND CONTROLLING FACTORS OF TOXIC METALS IN THE FLORIDA EVERGLADES AND THEIR POTENTIAL RISK OF EXPOSURE** -- Yanbin Li[1,2,3], Zhiwei Duan[1,4], Guangliang Liu[1,4], Peter Kalla[5], Daniel Scheidt[5], Yong Cai[1,4]; [1]Department of Chemistry & Biochemistry, Florida International University, Miami, FL, USA;[2] Key Laboratory of Marine Chemistry Theory and Technology, Ministry of Education/ Qingdao Collaborative Innovation Center of Marine Science and Technology, Ocean University of China, Qingdao, China; [3]College of Chemistry and Chemical Engineering, Ocean University of China, Qingdao 266100, China; [4]Southeast Environmental Research Center, Florida International University, Miami, FL, USA; [5]US Environmental Protection Agency, Region 4, Science and Ecosystem Support Division, Athens, GA , 30605, USA

2:45 **GEOCHEMICAL MODELING OF HG SPECIATION AND THE IMPLICATIONS ON MERCURY CYCLING IN THE EVERGLADES** -- **Ping Jiang**[1], Guangliang Liu[1], Wenbin Cui[1], Daniel Scheidt[2], Peter Kalla[2], and Yong Cai[1];[1] Florida International University, Miami, FL, USA;[2]U.S. Environmental Protection Agency, Region 4, Athens, GA, USA

Thursday April 23, 2015 | 3:20pm - 5pm

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Session #36: Multi-Decadal to Millennial-Scale Proxy Records of Sea-Level Rise and Climate Change

[Great Cypress]

Moderator: Christopher Bernhardt & G. Lynn Wingard, U.S. Geological Survey, Reston, VA

3:20 Introduction

3:30 **IMPACT OF SEA-LEVEL RISE ON EVERGLADES CARBON STORAGE CAPACITY: SHIFT FROM TERRESTRIAL TO BLUE CARBON SINK -- Miriam C. Jones**, Christopher Bernhardt, G. Lynn Wingard, Marci Marot, Bethany Stackhouse; U.S. Geological Survey, National Center, Reston, VA, USA

3:45 **DEVELOPMENT AND DEMISE OF FLORIDA'S CORAL REEFS: THE ROLES OF CLIMATE, SEA LEVEL, AND REGIONAL HYDROLOGY-- Lauren T. Toth** and Ilsa B. Kuffner; USGS Coastal and Marine Science Center, Saint Petersburg, FL, USA

4:00 **LARGE CORALS IN FLORIDA BAY: FAITHFUL RECORDERS OF THE ENVIRONMENTAL CONDITIONS OVER THE PAST 200 YEARS -- Peter K. Swart** [1], Remy Okazaki[2] and Chris Langdon[2]; [1]Department of Marine Geological Sciences, RSMAS, University of Miami, FL, USA; [2]Department of Marine Biology and Ecology, RSMAS, University of Miami, FL, USA

4:15 **RESPONSES OF THE SOUTH FLORIDA COASTAL AND ESTUARINE ECOSYSTEMS TO CLIMATE VARIABILITY, SEA LEVEL RISE AND EXTREME WEATHER EVENTS OVER THE LAST 4600 YEARS -- Anna Wachnicka[1]**, Lynn Wingard[2]; [1]Southeast Environmental Research Center, Florida International University, Miami, FL, USA; [2] U.S. Geological Survey, Reston, VA, USA

4:30 **USING RECENT HURRICANES AND ASSOCIATED EVENT LAYERS TO EVALUATE REGIONAL STORM IMPACTS ON ESTUARINE-WETLAND SYSTEMS --** Christopher G. Smith[1], Lisa E. Osterman[1], Marci Marot[1], C. Scott Adams[1], Miriam C. Jones[2]; [1]U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center, St. Petersburg, FL, USA; [2]U.S. Geological Survey, Eastern Geology and Paleoclimate Science Center, Reston, VA, USA

4:45 **USING OGPS TO ESTABLISH LONG-TERM TROPICAL CYCLONE LANDFALL RECORDS AND ELUCIDATE THE MID-TO-LATE HOLOCENE CLIMATIC HISTORY OF THE NORTHERN GULF COAST -- Terrence A. McCloskey[1]**, Christopher G. Smith[1], Christian Haller[2], C. Scott Adams[1]; [1] USGS Coastal and Marine Science Center, St. Petersburg, FL, USA; [2] Department of Coastal Marine Sciences, University of South Florida, St. Petersburg, FL, USA

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Session #37: Restoration Planning and Decision-Making

[Royal Poinciana]

Moderator: John Volin, University of Connecticut, Storrs, CT

3:20 Introduction

3:30 **TESTING A NEW NATURAL SYSTEM MODEL FOR USE IN SOUTH FLORIDA ECOSYSTEM RESTORATION -- Agnes R. McLean[1]**, Melissa A. Nasuti[2]; [1]National Park Service, Homestead FL, USA; [2]US Army Corps of Engineers, Jacksonville FL, USA

3:45 **PRICING THE CARBON RIGHT: THE CASE OF THE EVERGLADES MANGROVES --** Meenakshi Jerath[1], **Mahadev Bhat[1]**, Victor H. Rivera-Monroy[2], Edward Castañeda-Moya[2], Marc Simard[3], Robert R.Twilley[2]; [1]Earth and Environment Department, Florida International University, Miami, FL USA; [2]Department of Oceanography and Coastal Sciences, School of the Coast and Environment, Louisiana State University, Baton Rouge, LA, USA; [3] Radar and Engineering Section, Caltech-Jet Propulsion Laboratory, Pasadena, CA, USA

4:00 **THE NATURAL RESOURCE CONDITION ASSESSMENTS OF EVERGLADES NATIONAL PARK AND BIG CYPRESS NATIONAL PRESERVE-- Jed Redwine[1]**, Matt Patterson[1], Andrea Atkinson[1], and John Kellam[3]; [1]National Park Service, Palmetto Bay, FL, USA; [2]Everglades National Park, Homestead, FL, USA; [3]Big Cypress National Preserve, Ochopee, FL, USA

4:15 **REFLECTIONS ON 15 YEARS OF NRC INDEPENDENT SCIENTIFIC REVIEW OF EVERGLADES RESTORATION -- Stephanie Johnson** and David Policansky; National Research Council, Washington, DC, USA

4:30 **CONNECTING SCIENCE AND POLICY IN ECOSYSTEM RESTORATION -- Paul R. Wetzel**; Smith College, Northampton, MA, USA

4:45 **DIGITAL VISUALIZATION AS A TOOL TO BRIDGE SCIENCE AND POLICY: EXAMINING THE LONG-TERM EFFECTS OF PHOSPHORUS ON THE EVERGLADES RIDGE SLOUGH LANDSCAPE -- John C. Volin[1]**, Sue Newman[2], Dan Pejril[1], Lindsay Dreiss[1]; [1]University of Connecticut, Storrs, CT, USA; [2]South Florida Water Management District, West Palm Beach, FL, USA

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Session #38: Enzymes: Functions and Use as Indicators of Change in Everglades Systems

[Ibis]

Moderator: Patrick Inglett, Soil and Water Science Department, University of Florida, Gainesville, FL

3:20 Introduction

3:30 **MULTIPLE ENZYME SYSTEMS AND THEIR EFFECTIVENESS AS INDICATORS OF EVERGLADES RESTORATION --** Patrick W. Inglett, Kanika S. Inglett and **Xiaolin Liao**; Soil and Water Science Department, University of Florida, Gainesville, FL, USA

3:45 **PHOSPHATASES ENZYMES ACTIVITY IN PHOSPHORUS RICH EVERGLADES TREE ISLANDS ECOSYSTEM -- Krish Jayachandran**, Len Scinto, and Mike Ross; Department of Earth and Environment, Florida International University, Miami, Florida, USA

4:00 **NITROGENASE ACTIVITY AS AN INDICATOR OF EVERGLADES IMPACT AND RESTORATION -- Patrick W. Inglett** and Xiaolin Liao; Wetland Biogeochemistry Laboratory, Department of Soil and Water Science, University of Florida, Gainesville, FL, USA

4:15 **SOIL ORGANIC NITROGEN MINERALIZATION AND ENZYME ACTIVITIES AS INDICATORS OF NUTRIENT IMPACTS IN THE FLORIDA EVERGLADES -- Christine M. VanZomeren** and K. Ramesh Reddy; University of Florida, Gainesville, FL, USA

4:30 **TEMPERATURE SENSITIVITY OF HYDROLYTIC ENZYMES: APPLICATION TO DECOMPOSITION AND GREENHOUSE GAS EMISSIONS -- Kanika S Inglett**, Swati Goswami, Debjani Sihi, and Patrick W. Inglett; Soil and Water Science Department, University of Florida, Gainesville, USA

4:45 **EFFECTS OF INCREASED SALINITY AND INUNDATION ON MICROBIAL PROCESSING OF CARBON AND NUTRIENTS IN OLIGOHALINE WETLAND SOILS -- Shelby M. Servais[1]**, John S. Kominoski[1,4], Benjamin J. Wilson[1], Viviana Mazzei[1], Carlos Coronado-Molina[2], Stephen E. Davis[3], Evelyn E. Gaiser[1,4], Steve Kelly[2], Chris Madden[2], Joseph Stachelek[2], Fred Sklar[2] , Tiffany Troxler[1,4], and Laura Bauman[1]; [1]Florida International University, Miami, Florida, USA; [2]South Florida Water Management District, West Palm Beach, Florida, USA; [3]Everglades Foundation, Palmetto Bay, Florida, USA; [4]Southeast Environmental Research Center, Miami, Florida, USA

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Session #39: Invasive Species

[Egret]

Moderator: Dean Monette, Ecology and Environment, Inc., Wellington, FL

3:20 Introduction

3:30 **SEASONAL AND DAILY ACTIVITY PATTERNS OF ARGENTINE BLACK AND WHITE TEGUS -- Lindsey Garner**, Frank J. Mazzotti, Joy Vinci; University of Florida, Davie, FL, USA

3:45 **BRUMATION OF BLACK AND WHITE TEGUS (TUPINAMBIS MERIANAE) IN SOUTHERN FLORIDA -- Michelle A. McEachern**, Emma B. Hanslowe, Amy A. Yackel Adams, Page E. Klug, Bryan G. Falk and Robert N. Reed; [1]U.S. Geological Survey, Fort Collins Science Center, Ft. Collins, CO, USA

4:00 **ARE BURMESE PYTHONS IN FLORIDA GETTING SKINNIER? -- Bryan Falk**; U.S. Geological Survey, Homestead, FL, USA

4:15 **DIET AND SELECTIVITY OF THE PURPLE SWAMPHEN IN SOUTH FLORIDA -- Corey T. Callaghan** and Dale E. Gawlik; Florida Atlantic University, Boca Raton, FL, USA

4:30 **REDBAY AND LAUREL WILT: THE SEARCH FOR RESISTANT TREES -- Marc A. Hughes** and Jason A. Smith; University of Florida, Gainesville, FL, USA

4:45 **VEGETATION COMMUNITY RELATIONSHIPS WITH POMACEA PALUDOSA AND POMACEA MACULATA IN LAKE OKEECHOBEE, FLORIDA, UNITED STATES -- Dean Monette, PhD[1,2]**, Scott Markwith, PhD[2] and Sharon Ewe, PhD[1,2]; [1]Ecology and Environment, Inc., Wellington, Florida, USA; [2]Florida Atlantic University, Boca Raton, Florida, USA

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Session #40: Hydrology

[Sandpiper]

Moderator: David Sumner, US Geological Survey Caribbean-Florida Water Science Center, Lutz, FL

3:20 Introduction

3:30 **SIMULATING THE EFFECTS OF RIDGE ELEVATION AND GEOMETRY ON RIDGE-SLOUGH LANDSCAPE HYDROLOGY: HOW MUCH WATER DO WE NEED? -- Subodh Acharya[1]**, David A. Kaplan[2], Matthew J. Cohen[1], James W. Jawitz[3]; [1]School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA; [2]Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL, USA; [3]Soil and Water Science Department, University of Florida, Gainesville, FL, USA

3:45 **WATER MANAGEMENT AND HYDROLOGY OF NORTHEAST SHARK RIVER SLOUGH FROM 1940 TO 2015 -- Kevin Kotun**; South Florida Natural Resources Center, Everglades National Park, Homestead, FL, USA

4:00 **MODELING THE HYDRODYNAMIC AND WATER QUALITY IMPACTS OF PROPOSED TAMIAMI TRAIL BRIDGE CONSTRUCTION USING THE M3ENP NUMERICAL MODEL -- Stephanie Long[1]**, Georgio Tachiev[2], Amy Cook[1,2], Robert Fenema[3], Jordan Barr[3]; [1]A.D.A. Engineering, Tampa, FL, USA; [2]GIT Consulting LLC, Coral Gables, FL, USA; [3]South Florida Natural Resource Center, Everglades National Park, Homestead, FL, USA

4:15 **FLOW MONITORING ALONG U.S. 41 BETWEEN COUNTY ROAD 92 AND STATE ROAD 29, IN SOUTHWEST FLORIDA, 2007–2010 -- Amanda Booth** and Lars Soderqvist; United States Geological Survey, Fort Myers, FL, USA

4:30 **QUANTIFYING EVAPORATION RATES FROM LAKE OKEECHOBEE, FLORIDA -- Michael A. Wacker** and W. Barclay Shoemaker; U.S. Geological Survey, Caribbean-Florida Water Science Center, Davie, FL, USA

4:45 **HYDROPERIOD APPROACH FOR A NON-FLAT WORLD -- David M. Sumner**; US Geological Survey Caribbean-Florida Water Science Center, Lutz, FL, USA

Conference Abstracts

Listed alphabetically by presenting author last name.
Presenting author names appear in **bold**.

SIMULATING THE EFFECTS OF RIDGE ELEVATION AND GEOMETRY ON RIDGE-SLOUGH LANDSCAPE HYDROLOGY: HOW MUCH WATER DO WE NEED?

***Subodh Acharya*[1]**, *David A. Kaplan*[2], *Matthew J. Cohen*[1], *and James W. Jawitz*[3]
[1]School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA
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The Everglades ridge-slough landscape is a self-organized, patterned peatland with two distinct vegetation patches characterized by differences in peat elevation and vegetation type. Hydrologic modification has led to degradation of flow-parallel patterning in large portions of the Everglades. Even in the best-conserved portions of the Everglades, where historic landscape patterning remains largely unchanged, a drastic loss of elevation differences between ridges and sloughs (from 60-90 cm historically to ca. 25 cm today) has been observed. Flow regime has been hypothesized to be the key driver of peat accretion dynamics, which in turn drives the evolution and maintenance of the ridge-slough patterned landscape. The objectives of this study were to: 1) model hydrologic conditions under a variety of ridge heights, ranging from those found in severely degraded contemporary landscapes (<10 cm) though proposed historic values; 2) use the model to determine the maximum ridge height that could be supported (via appropriate inundation regime, i.e., hydroperiod) given contemporary hydrology; and 3) use the model to back-calculate how much additional water would be required to support higher ridges. To meet these objectives, we used a hydrodynamic model to simulate landscape-scale discharge competence and hydroperiod in synthetic ridge-slough landscapes with varying ridge height (10, 25, 50, and 75 cm) and four levels of anisotropy (a metric of patch elongation in the direction of flow) under the contemporary flow regime. Relationships derived from this model were then used to estimate the increase in flow over contemporary conditions that would be required to support 75-cm ridges. Model results showed that hydroperiod decreased non-linearly with increasing ridge height. At the current level of anisotropy observed in the best-conserved landscapes the number of dry ridge days nearly doubled (from 50 to 93) when ridge height increased from 25 to 75 cm. Notably, this is a substantially drier condition than observed in the contemporary conserved landscapes (where ridges are dry ca. 53 days per year), suggesting that the current flow regime would be insufficient to consistently maintain high-enough inundation frequencies to be conducive to peat accretion and the evolution and sustenance of anisotropic ridge-slough patterning. In landscapes with 75-cm ridges, sustaining average hydroperiods similar to those observed in the contemporary conserved landscapes (ca. 310 days per year) would require >3 times the current discharge volume. This study therefore suggests either that a large increase in flow will be required to maintain tall ridges and/or that ridge heights in the historic Everglades might not have been as large as reported in previous studies.

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THE INFLUENCES OF DISSOLVED ORGANIC MATTER ON MERCURY CYCLING IN THE FLORIDA EVERGLADES

***George Aiken*[1]*, David P. Krabbenhoft*[2]*, and William H. Orem*[3]

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Dissolved organic matter (DOM) in the Florida Everglades controls a number of environmental processes important for ecosystem function including the absorption of light, mineral dissolution/precipitation, transport of hydrophobic compounds (such as pesticides), and the transport and reactivity of metals. Of particular interest are the interactions of mercury (Hg) with DOM, which control the chemical speciation and geochemistry of Hg in surface waters, wetland soils, and porewaters; the partitioning of Hg and methylmercury (MeHg) between dissolved and particulate phases and biota in the water column; and the photoreactivity of Hg and MeHg. The chemistry and reactivity of DOM in a given location in the Everglades are dependent on the dominant vegetation types, biogeochemical processes, hydroperiod, interactions of surface water with peat pore waters, and amounts of canal water. Most of the DOM in the Everglades originates from the degradation and leaching of organic detritus derived from the algae, bacteria and macrophytes living within the wetland environment. In addition, organic matter is also transported to the Water Conservation Areas of the Everglades in the canals that drain the Everglades Agricultural Area (EAA), and to coastal waters from mangrove forests. The strength of DOM interactions is influenced both by dissolved organic carbon concentrations and the chemical nature of the DOM (i.e. its chemical composition).

DOM exerts controls on mercury biogeochemistry in two important ways. First, it acts as a strong ligand that, in the absence of sulfide, controls the mercury speciation in aquatic systems. The strength of DOM-mercury binding interactions is dependent on low-abundance reduced S groups (i.e., thiols, organic sulfides). Second, in the presence of sulfide, DOM interacts strongly with nanocolloidal HgS to stabilize HgS clusters and slow particle growth kinetics. Nanocolloidal metacinnabar-like species become smaller and less ordered with decreasing Hg: DOM ratio, decreasing sulfide concentrations, and increasing DOM aromaticity. Nanocolloidal HgS, the form of Hg anticipated to be found in the pore waters of sediments containing sulfide resulting from microbial sulfate reduction, enhances Hg methylation, whereas larger HgS particles do not. These DOM-Hg interactions therefore are critical for providing a better understanding of the methylation process. For instance, while sulfate is a master variable controlling both sulfate reduction and the methylation of Hg, DOM-HgS interactions modulate the methylation process, thereby influencing the formation of methylmercury (MeHg). Therefore, efforts to model and anticipate the effects of sulfate on the formation of MeHg in both natural and managed wetland systems need to address the potential influences of DOM.

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BIOCHAR AND MILL ASH USE AS SOIL AMENDMENTS TO GROW SUGARCANE ON SANDY SOILS IN SOUTH FLORIDA

***Odiney Alvarez*[1]**, *Timothy A. Lang*[2], *Jehangir H. Bhadha*[1], *Mabry McCray*[2], *Bin Gao*[3], *Barry Glaz*[4], *and Samira H. Daroub*[1]

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[3] Agricultural and Biological Engineering, University of Florida, Gainesville, Florida, USA
[4] Former USDA-ARS Research Agronomist, Sugarcane Field Station, Canal Point, Florida, USA

Sugarcane production on sandy soils of South Florida has been gaining interest due to the need to expand sugar and bioenergy production, and to gradually alleviate production in organic soils. The application of organic residues has the potential to improve physiochemical properties of sandy soils with low organic matter (OM) by increasing carbon content, water holding capacity (WHC), nutrient retention and cycling. Moreover, the recycling of agricultural and urban local organic residues into cultivated land provides an option to make products that can enhance soil properties and improve crop growth, while also reducing wastes and minimizing harmful effects of agricultural production on the environment. This study was conducted to evaluate biochar and mill ash effects on soil properties, drainage water nutrient composition, and sugarcane crop growth and yield. Mill ash and three biochars produced from local hardwood yard waste (HY), horse barn shavings with manure (HM), and rice hulls (RH) were incorporated at 1% and 2% (by weight) to sandy soils in 70 gallon lysimeters. The experimental design consisted of a randomized block set-up including eight treatments and two controls simulating standard field practices (fertilizer only and 12% mill ash), with four replications each. Results showed that biochar treatments lowered bulk density, increased WHC, and increased OM compared to the control. Soil pH shifted from slightly acidic to neutral or basic with treatment incorporation at the beginning of the experiment. Monthly drainage water samples showed mill ash 2% treatment and mill ash 12% control had lower total phosphorus, total dissolved phosphorus, and ortho-phosphate in comparison to RH 2% treatment at the beginning of the experiment; however, phosphorus concentrations stabilized towards the end of the experiment. RH 2% treatment showed greater top visible dewlap height compared to HY 1%, HY 2%, HM 1%, mill ash 1%, and mill ash 12%. In addition, RH 2% treatment and mill ash 12% had greater cane weight and sucrose content per lysimeter compared to the control with fertilizer only. Mill ash and biochar improved sandy soil properties, but only RH 2% treatment and mill ash 12% application resulted in greater yield of plant cane harvest. Future research will evaluate long-term effects of the amendments on soil properties and ratoon cane harvest.

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THE DISTRIBUTION OF ANURANS IN A HYDROLOGICALLY MODIFIED RIVER FLOODPLAIN

Brent Anderson
South Florida Water Management District, West Palm Beach, Florida, USA

Channelization of the Kissimmee River in the 1960s converted the river's floodplain wetlands into upland cattle pasture, decreasing the area of available anuran breeding habitat. Throughout the past 20 years efforts to backfill the canal and reestablish the historic hydrology of the river/floodplain system have converted more than 2,000 ha of cattle pasture back into seasonal wetlands. Anuran-vocalization surveys were conducted along the Kissimmee River/floodplain system in channelized areas and in a partially restored section to which intermittent floodplain inundation was reestablished in 2001. Vocalization data were used to assess the response of anuran breeding populations to partial restoration of the river/floodplain system. Both the channelized and the restoration area supported similar levels of species richness, but overall detection of anuran choruses was significantly greater in the restoration area. Data from channelized sections of the river/floodplain system suggest that all ten native anuran species that typically breed in wetland habitat in central Florida were able to persist in the channelized system, but in limited numbers for most species. Remaining temporary wetlands in the pastures, permanent canals and ditches, and an intact forested upland adjacent to the floodplain are most likely contributing factors in the persistence of these species throughout the channelized period.

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NET ECOSYSTEM EXCHANGES OF CARBON DIOXIDE AND METHANE FROM SUB-TROPICAL AND TEMPERATE PEATLANDS: A COMPARISON OF NATURAL AND RESTORED WETLAND SYSTEMS

Frank Anderson[1], *W. Barclay Shoemaker*[2], *Brian Bergamaschi*[1], *L. Windham-Myers*[3], *and R. Fujii*[1]

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Peatlands occupy a small percentage of the earth's terrestrial land mass (1-3%), but store a large portion of the world's soil organic carbon (21-29%). Due to soil drainage for flood control and agriculture, nutrient loading from urban and agricultural runoff, or inter-annual variability in weather patterns, peatlands can become destabilized and have the potential to emit large fluxes of carbon dioxide and methane gases to the atmosphere as well as dissolved carbon to rivers. Currently, there are efforts to mitigate soil organic carbon loss through programs such as the Comprehensive Everglades Restoration Plan in Florida and, in California, the preservation of peat soils and restoration of wetlands has recently received interest as a potential source of credits in emissions offset and trading programs. The transition of land management to a restorative plan affects both the atmospheric exchange of surface energy and carbon fluxes. Here we compare fluxes from natural and "restored" wetland systems, specifically, the Blue Cypress and Dwarf Cypress eddy-covariance flux stations in Florida and three sites in the California's Sacramento San Joaquin Delta – a restored wetland on Twitchell Island, an agricultural managed peatland on Sherman Island, and a natural brackish system in Suisun Marsh. We will present results indicating some of the largest global rates of net ecosystem carbon exchange (-39 gC-CO_2 m^{-2} day^{-1}) with some of the highest global rates of methane emissions (175 mg C-CH_4 m^{-2} day^{-1}). These results represent a synthesis of data collected by federal, state and academic scientists in an effort to build collaboration and to expand U.S. Geological Survey scientific observation networks.

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COMPARING THE SEASONAL AND SPATIAL VARIABILITY OF SURFACE WATER AND GROUNDWATER SALINITY IN THE EASTERN PANHANDLE, EVERGLADES NATIONAL PARK, FL, USA

***Gordon H. Anderson*[1]*, Erik Stabenau*[2] *and Peter Frezza*[3]

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The Eastern panhandle (EP) region of Everglades National Park (ENP) is a watershed bounded by C-111 canal on the north, Florida Bay on the south, and highway US 1 on the east. EP land consists of carbonate marl sediment with sparse freshwater vegetation near the C-111 canal that transition into a patchwork of scrub Red Mangrove with short, ephemeral creeks that drain east into Long Sound (LS) and west into Joe Bay (JB).

The C-111 canal dredged in the mid-1960s for NASA rocket transport had the unintended consequence of dewatering the EP marsh. Quantifying the seasonal and temporal salinity patterns in the EP is important to understand the marsh hydrology and water flow into Florida Bay and can be useful in evaluating Everglades restoration success, including the ongoing C-111 spreader canal project.

We used daily salinity data from four USGS surface (SW)/groundwater (GW) paired gages for water years 2001-2006 to determine the seasonal and spatial salinity variability in the EP marsh. Two gages represent the upper freshwater marsh (UHC and UJB) and two gages represent the lower coastal marsh (LHC and LJB). The daily residual (GW-SW) salinity frequency distribution was plotted. All distributions were skewed left, toward low salinity values, a non-normal distribution. Daily residuals show GW salinity was 70-91% greater than SW salinity. UJB, UHC and LJB histogram showed GW-SW residual difference with the greatest frequency at 20-25 PSU. Upper EP gage UHC had greatest residual difference frequency at 3 PSU and had the lowest overall GW or SW salinity values. We used surface water salinity data from National Audubon Society (NAS) adjacent coastal creeks gages and ENP Florida Bay salinity gage data for comparison.

Monthly mean salinity data were analyzed for seasonal GW and SW salinity patterns in the EP watershed. We observed both surface and groundwater salinity maximum occurred in May, while minimum salinities occurred from September to November. Surface water salinity data showed a sinusoid pattern with salinity peaking during April to May, followed by sharp declines to near freshwater condition as a response to early summer rainfall and overland flows. Groundwater salinity showed less seasonal variability than surface salinity.

These salinity data, including the only long-term GW salinity data for EP, provide an important baseline of the seasonal and spatial salinity patterns. Additional salinity monitoring is feasible from these sites, if timely data is needed to evaluate current restoration impacts on the Eastern Panhandle and Florida Bay.

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APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS IN THE HYDRAULIC DESIGN OF AN EVERGLADES RESTORATION STRATEGIES PROJECT

Jie Zeng, ***Matahel Ansar****, and Emile Damisse*
South Florida Water Management District, West Palm Beach, FL, USA

The “Restoration Strategies” program is a State of Florida initiative that will expand upon existing water quality improvement projects to achieve the phosphorus water quality standard established for the Everglades. This program will create additional hundreds of acres of new Stormwater Treatment Areas (STAs) and over hundred thousand acre-feet of additional water storage through construction of upstream shallow reservoirs known as Flow Equalization Basins (FEBs). The FEBs will operate as surge attenuation basins to better modulate inflows to the STAs and help maintain target water levels needed to achieve optimal water quality treatment performance. Because of the proposed operational and structural changes, there is a need to assess the hydraulic performance of existing and proposed structures under various operational conditions. Traditionally, designing and constructing a small–scale laboratory physical model is the most reliable way of testing and evaluating the performance of water control and conveyance structures prior to construction. However, this approach can be very expensive, time consuming, and limited in all flow ranges that can be tested.

This paper describes a novel approach in the application of Computational Fluid Dynamics (CFD) to the hydraulic design of water control structures. CFD is a very powerful numerical tool based on solving second-order nonlinear partial differential equations known as Reynolds-Averaged Navier-Stokes equations. Its results are detailed three-dimensional flow fields, pressures, and water surface elevations, which are essential for assessing the performance of water control structures under various operational scenarios. This paper describes two CFD case studies focusing on the hydraulic design of flow conveyance features upstream of L8 FEB. The first case is the optimization of local scour mitigation measures at a sharp channel bend in the Inflow and Distribution work of STA1E&W. The second application is flow simulations to evaluate the hydraulic performance of energy dissipation and erosion control measures downstream of S5AS spillway. Both examples show how CFD can iteratively be used to optimize the design of water control and conveyance structures, and predict their behavior under various operational conditions in a very cost effective manner.

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APPLYING WILDLIFE GENETICS TO INVASIVE SPECIES MANAGEMENT IN THE FLORIDA EVERGLADES

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The Greater Everglades ecosystem is being assaulted by invasive taxa from viruses and bacteria to feral swine and pythons. Combating the impacts of invasive species requires methods and technology from a variety of disciplines. We are applying wildlife genetics in a number of ways to define, understand, and manage the problems caused by invasive wildlife species. Environmental DNA (eDNA) is cellular material shed by animals as they move through their environment. We recently developed and published an eDNA method for detecting Burmese pythons (*Python bivittatus*) in water. The Burmese python is a semiaquatic species, and its elusive nature and cryptic coloration make detection difficult. Development of a detection method that eliminates the need for direct observations or handling greatly enhances management options for this invasive species. We are implementing our python eDNA methodology along 25-km sections of two canals in south Florida to try to understand the limits of the distribution of this species in FL. An eDNA assay for Nile monitors (*Varanus niloticus*) is under development. Broad-scale application of eDNA will help delineate species distribution, identify incipient populations before they become established, and verify outcomes of eradication efforts. Metagenomics uses next-generation genome sequencing to identify all DNA fragments in a single environmental sample. We evaluated this method using water samples collected in and near Everglades National Park. Our analyses revealed dozens of taxa, although we were limited in making species-specific identifications because sufficient genomic reference materials are not available. This is a potentially powerful tool for monitoring diversity and for detecting rare species within specific taxonomic groups such as fishes in conjunction with traditional methods. Invasion pathways and origins are important in the development of prevention and management strategies to limit invasive species impacts. In collaboration with the University of Florida, we analyzed individuals from populations of black spiny-tailed iguanas (*Ctenosaura similis*) collected throughout south Florida. The results revealed four distinct haplotypes, suggesting four separate invasion events. Comparisons to haplotypes from the native range of this Central American lizard are in progress to identify the sources of the invasive animals.

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SPATIAL AND TEMPORAL TRENDS OF A MULTI-YEAR MACROALGAL BLOOM

Galia Varona[1], ***Christian Avila***[1], *Stephen Blair*[1], *Ligia Collado-Vides*[2]
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A macroalgal bloom composed by two species of the genus *Anadyomene* (Chlorophyta) has persisted in the North-Central-Inshore (NCI) region of Biscayne Bay for ten years. The bloom developed during 2004-2005, grew to extraordinary cover and abundance by 2008-2010, and persists today. The bloom is in an area of the Bay where water quality characteristics are affected by canal and potential groundwater discharges. The efforts of the DERM's seagrass monitoring program have been to understand the status, spatio-temporal dynamics, and the extent of benthic impact of this unprecedented bloom.

At the peak of the bloom in the NCI region (2008-2010), *Anadyomene* spp. were found throughout approximately 60 km^2 and in blooming proportions (>5% cover) for 34 km^2. Evaluations of the cubic volume of macroalgae in 2012 indicated a pattern of greatest biomass just offshore of the two canals in the region, Coral Gables Waterway and Snapper Creek. These findings support the results of a parallel study on the *Anadyomene* tissue nutrient concentration which found higher levels of Nitrogen and indications of anthropogenic sources of Nitrogen in areas where salinity is predominantly marine. Prior to the bloom, the NCI region was a *Thalassia testudinum* dominated seagrass community, with varying abundances of *Syringodium filiforme* and *Halodule wrigthii.* Impacts to seagrass were evaluated using the monitoring data from this region. During 1999-2004 (pre-bloom period) green algae (as a monitoring category) had a low % cover, with most sites showing a <5% cover and the opposite pattern was detected for *T. testudinum*, (> 50% cover at the majority of the sites). During the 2010-2014, over half of the sites within the area were found to have less than <5% *T. testudinum*, while at the same time the majority of sites had green algae at > 50%. Throughout the period of the bloom (2005-present), the bloom area has not expanded beyond the NCI region. Recent monitoring efforts in 2014 indicate the bloom area has shown some reduction in the southern and western areas, while the eastern boundary has persisted. Additionally, an overall decrease in the percent cover and average volume of *Anadyomene* spp. was measured throughout the bloom area.

The water quality and ecosystem vitality of Biscayne Bay are likely linked to economic activity supported by the Bay. While this bloom, along with two unprecedented phytoplankton blooms that have occurred since 2005, may indicate a decreased resilience of the Bay to nutrient inputs and perturbations. These events emphasize the importance of maintaining monitoring programs, such as this one, to identify changes in the Bay and understand how these changes may affect the Bay's long-term health, and its environmental and economic sustainability.

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CALIBRATION ACTIVITIES FOR THE SOUTH FLORIDA WATER MANAGEMENT MODEL (SFWMM A.K.A. 2X2 MODEL)

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The South Florida Water Management Model (SFWMM) is a regional-scale computer model that simulates the hydrology and management of the water resources system from Lake Okeechobee to Florida Bay, covering an area of 7,600 square miles. The model currently simulates the major components of the hydrologic cycle in south Florida on a daily basis using climatic data for the 1965-2005 period. Efforts are underway to calibrate the SFWMM to the year 2010 with a data extension to the year 2012. This presentation will highlight the state of the calibration effort to date and provide information regarding the model to the scientific community and the public. Projects which use the SFWMM will be highlighted and any pertinent model results will be presented.

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CLIMATE SENSITIVITY RUNS USING THE SOUTH FLORIDA WATER MANAGEMENT MODEL

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The South Florida Water Management Model is used for regional modeling within the southeast Florida region. This model includes Lake Okeechobee and its operational protocols. Sensitivity runs have been performed using the Natural System Model (NSM) and the South Florida Water Management Model (SFWMM) to analyze the effects of wholesale increases and decreases within the climate regime. These results have been shared with multiple agencies and a recommendation from this effort is the enhancement of the climate datasets with more realistic possible futures. The SFWMM climate team is moving forward with development of dataset production and the incorporation of this data into sensitivity runs. These runs will satisfy the needs of multi-agency projects currently underway which are analyzing the effects of changes in climate and sea level. Further detailed modeling could include operational studies to optimize water supply and flood control performance under different climate regimes.

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CARBON CYCLING IN COASTAL MANGROVE FORESTS: WHERE HAS THE "MISSING" SINK GONE?

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Though considerable progress has been made in quantifying individual fluxes of carbon in mangrove forests, closing carbon budgets in these systems continues to present a challenge. Recent global mangrove budgets suggest that ~ 50% of carbon fixed through photosynthesis does not accumulate in the plants or soils in these systems. Few attempts have been made to assess the major carbon fluxes in these forests at the landscape scale. At the Florida Coastal Everglades Long Term Ecological Research site, SRS6 in the Everglades National Park, we have made progress in quantifying the carbon budget of a tall ~18 m riverine mangrove forest, with independent validation of lateral carbon fluxes into the estuary-coastal ocean. Average annual net ecosystem carbon exchange (atmosphere-to-surface) was 1016±65 g C m^{-2} yr^{-1} during 2004 to 2013. These fluxes represent some of the largest carbon exchanges of any ecosystem, yet long-term (100-year) records of soil carbon burial in this forest are only 12% of this value, or 123±19 g C m^{-2} yr^{-1}. Over time scales of years to decades, the net ecosystem carbon balance may include both soil carbon accretion plus some fraction of net primary productivity (average of 762±129 g C m^{-2} yr^{-1}). These values suggest the total lateral carbon efflux (including dissolved inorganic and organic carbon and particulate carbon) ranges from 254±194 g C m^{-2} yr^{-1} to 791±126 g C m^{-2} yr^{-1}. These large and uncertain values suggest that mangrove forests represent a substantial carbon source to the adjacent estuary and coastal ocean, and that establishing direct and independent measures of lateral forest-to-estuary fluxes are imperative. To this end, in this presentation we report *in situ* measures of dissolved inorganic and organic carbon in Shark River to independently verify lateral fluxes entering the estuary and coastal ocean. Quantifying these lateral carbon fluxes serves two purposes. The effort will represent the first attempt to assemble a total carbon budget in mangrove forests. The budget includes atmosphere-forest exchange, forest-water-estuary exchange, and internal processing (e.g. partitioning of carbon into biomass, soil, coarse woody debris, etc.). Second, our findings will help validate our initial results suggesting that up to 75% of the carbon assimilated from the atmosphere is eventually delivered to the coastal ocean.

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RECENT PROGRESS IN THE MIKE MARSH MODEL OF EVERGLADES NATIONAL PARK

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Everglades National Park (ENP) is a large wetland surrounded on the north and east side by developed areas of Dade County which are protected from flooding by levees and drainage canals bordering the Park. The high transmissivity of the underlying aquifer coupled with the operations of the regional drainage and conveyance canals result in large quantities of groundwater flowing from the wetland areas to the east, raising potential flood control issues during periods of high regional water levels and/or heavy localized rainfall.

To assess the impacts of existing and potential water control strategies, ENP has developed a hydrologic model simulating both surface water and groundwater which covers approximately 1050 square miles of Park and adjacent lands, as well as a companion model of 110 miles of canals and associated structural components. These components include the detention areas adjacent to the South Dade Conveyance System (SDCS). The developed model is a combination of the MIKE SHE/MIKE 11 packages developed by DHI (Danish Hydrological Institute), named the MIKE Marsh Model of ENP (M3ENP). The current version of M3ENP is capable of simulating hydrological impacts of proposed structural and operational alternatives and provides a modeled historical overview of local hydrology since 1987.

The M3ENP allows input of complex canal architecture and structure operational strategies. Along the northern and eastern boundaries of ENP the relevant canals, structures, and pumps are fully modeled and interact with both the surface water and groundwater regimes. The model grid contains 155 rows and 158 columns with a resolution of 400 meter square cells. Current simulations cover the time period from 1987 to 2010 using rainfall, potential evapotranspiration, and groundwater head boundary condition (except for a southern flux boundary) inputs at a daily resolution. The model outputs data of stage and flow in the canal system, as well as overland, unsaturated and saturated flows and levels. In addition to flows and water levels, other key results will be highlighted such as evapotranspiration rates and canal-groundwater exchange. To date, structural and operational strategies considered along Tamiami Trail and the SDCS have been readily incorporated into the M3ENP. In this update and review, we present the significant progress that has been made in M3ENP.

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USING WOOD STORK MOVEMENT TO ENHANCE CONSERVATION EFFORTS

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Wood storks are iconic wading birds found in South Florida during wintertime. The distinct breeding population occurring in Florida and its neighboring states is currently classified as threatened under the Endangered Species Act, and as such, is of conservation concern. Wood storks are partially migratory, and individuals can migrate distances longer than 1000 km from South Florida in winter up to Mississippi and North Carolina during summertime. The objective of this project was to investigate detailed movement dynamics of wood stork, monitored using fine-scale GPS telemetry, and relate them to landscape features, such as urbanization and climate, to understand wood stork migrations at multiple spatio-temporal scales.

At the individual level, we identified movement modes within individual GPS trajectories, to be able to disentangle between potential behaviors. We trained a classification algorithm to recognize four typical movement modes, including migration, and be able to predict the movement mode of any movement step. The algorithm was able to classify movement modes correctly 90 % of the time, and identified migration steps as less than 1 % of movements. This small portion of movements is however critical, as it is responsible for the rapid switch of wood storks from Northern summer areas to Southern nesting ranges.

We then used migration data only to understand what shapes migration, and the environmental factors that affect it. We identified two main migration routes along the Eastern and Western coastlines of Florida, with the Eastern coastline being strongly used during the spring migration going northwards, while the Western coastline is more strongly used during the fall migration going southwards. We thus evaluated habitat selection along each migration path, which revealed that wood storks clearly selected for lower temperatures along their northwards migration in spring, while they preferred higher temperatures along their southwards migration in fall. In both seasons, wood storks strongly preferred wetlands, and cultivated areas, while they strongly avoided developed areas.

By decomposing the mechanisms of movement during wood stork migration, we were able to identify migration corridors, and suitable conditions along migration paths. This work provides relevant information for wood stork conservation across the landscape, highlighting how current land use and climatic conditions influence wood stork movements, as a basis to integrate future climate projections and urbanization into a comprehensive conservation plan.

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TRENDS IN RELATIVE DENSITY AND BODY CONDITION OF ALLIGATORS IN THE EVERGLADES

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Alligators (*Alligator mississippiensis*) are one of the system-wide ecological indicators of ecologic change in the Greater Everglades because of their linkage to hydrologic conditions at various spatial and temporal scales. Their reproduction and survival is dependent upon suitable hydrologic patterns and current populations in Everglades marshes are suppressed because of altered hydrology. Restoration of hydrological patterns with multi-year hydoperiods and more natural frequency of intense dry-downs are expected to result in increases in relative density and body condition of alligators. We have systematically sampled alligator relative density and body condition in various wetland management units within the Greater Everglades since the early 2000s. This allowed us to compare trends in these measures over time and examine how different hydrologic conditions affect these trends. Here we compare trends in alligator relative density and alligator body condition between sites that have longer hydroperiods and experience less frequent dry-downs with sites with shorter hydroperiods and more frequent dry-downs. Relative density of alligators at the longer hydroperiod sites did not show declining trends over the sample period while those at shorter hydroperiod sites did. At Arthur R. Marshall Loxahatchee National Wildlife Refuge (a longer hydroperiod site) alligators showed population response to hydrologic conditions with declines in abundance after dry years followed by increases in abundance in subsequent years. There is evidence that intensity as well as frequency of dry events affected population dynamics with greater declines after drier conditions and greater increases after successive years without dry conditions.

Alligator body condition is used as a non-destructive measure of an animal's condition based on the relationship between body mass and length (snout-vent length). It can reflect both seasonal and long-term suitability of a wetland and we hypothesize that it is affected by seasonal water depths, longer term hydroperiod, and yearly fluctuations in water level (amplitude). Over our sampling period, alligator body condition varied by wetland and water year (WY) and overall showed a decline from WY 2000-2014. Annual variability of water depth (amplitude) was positively related to body condition. Within Arthur R. Marshall Loxahatchee National Wildlife Refuge, average yearly body condition was higher and less variable from 1999 - 2003 when average time between marsh drying was longer and amplitude higher than from 2003 - 2010 when average time since marsh drying and amplitude was lower. Results from both of these studies are consistent with our hypothesis that marsh drying patterns affect alligator relative density and body condition and allow us to better understand the appropriate ranges of hydropatterns for alligators in the Everglades.

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PARASITE GAIN AND ENEMY RELEASE: COMPARING THE PARASITE ASSEMBLAGES OF EVERGLADES INTRODUCED CICHLIDS AND NATIVE SUNFISHES.

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The "enemy release hypothesis" posits a net release from population-regulating predators or parasites as an important mechanism for the success of invasive species. Many introduced species, including fishes, lose the majority of their home-range parasites and gain fewer in their new habitats, but continue gaining parasites over time. Gain of parasites by nonnative hosts can lead an increased disease burden on native hosts by supporting larger populations of native parasites, termed parasite spillback. Nonnative freshwater fish have heavily invaded the Everglades, and due to their high abundance may be causing changes to native parasite communities. The freshwater fish parasite community of the Everglades is largely unexamined; however, it is likely that the low native freshwater fish diversity has led to a similarly reduced freshwater fish parasite diversity, giving the habitat a lower biotic resistance to invasion.

This study tests the hypothesis that introduced fishes in the Everglades benefit from escape from parasites but are gaining parasites over time. We hypothesize that species with a longer time since invasion will have higher metazoan parasite diversity and prevalence. We are comparing parasite assemblages between three nonnative cichlids: Black Acara *Cichlasoma bimaculatum,* Mayan Cichlid *C. urophthalmus,* and African Jewelfish *Hemichromis letourneuxi,* with 3 native centrarchids: Warmouth *Lepomis gulosus,* Spotted Sunfish *L. punctatus,* and Dollar Sunfish *L. marginatus*. Centrarchids are important mesoconsumers in the Everglades which, because they co-occur and have similar dietary breadth and morphologies, are likely to compete and interact with nonnative cichlids. Preliminary results indicate a lower prevalence of parasites in nonnative cichlids than in native centrarchids.

In the Comprehensive Everglades Restoration Plan, additional metrics that evaluate restoration success are continuously being considered, and parasite assemblages have been shown to be useful indicators of restoration success. The proposed work will reveal the parasite assemblages of several ubiquitous Everglades fishes, allowing comparison with assemblages from artificial and restored habitats. This study is well positioned to also detect nonnative parasites introduced with nonnative fishes, and determine whether these have infected native fishes. Additionally by identifying trophically-transmitted parasites, this study may provide novel insight on the position of nonnative cichlids in the food web.

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MANAGING HABITAT FOR THE EVERGLADE SNAIL KITES (*ROSTRHAMUS SOCIABILIS PLUMBEUS*) ON CENTRAL FLORIDA LAKES

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The Lakes that form the headwaters to the Everglades watershed suffer from considerable hydrologic and nutrient impairment which have altered vegetation structure and composition. Many of these lakes are also considered critical foraging and breeding habitat for the Federally Endangered Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*). Issues that arise from these impairments include overgrowth of invasive plants, unnatural dry-season recession rates, and loss of habitat diversity. Until the natural hydrologic and nutrient regimes are restored to these systems, tasks that in all likelihood will never fully happen, habitat conditions in important Snail Kite areas will require constant monitoring and management. Management methods include the use of chemical herbicides, managed recessions and drawdowns, mechanical harvesting and organic sediment removal projects. Because many of these techniques have perceived or actual tradeoffs, wetland managers coordinate closely with other agencies, organizations and the general public to ensure that management actions are necessary, appropriate and supported. Carefully planning the timing, extent, locations and other details of these management actions can also greatly shape their efficacy and perception.

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INVASIVE EXOTIC SPECIES STRATEGIC ACTION FRAMEWORK

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The South Florida Ecosystem Restoration Task Force (SFERTF) consists of members who are top level policy makers, representing tribal, federal, state, and local government, working together on the largest ecosystem restoration project in the world: the greater Everglades ecosystem. The SFERTF has been concerned about invasive exotic species and their impacts on South Florida's ecosystem for more than a decade. In November 2014, the SFERTF approved the Invasive Exotic Species Strategic Action Framework. This Framework was developed to enhance our collective ability to combat invasive exotics.

The Framework initiative has developed four goals organized around the Invasion Curve (to view go to: http://www.evergladesrestoration.gov/content/ies/ies.html). The Invasion Curve is broadly accepted and applied, and organizes the battle against exotics into four phases: 1) Prevention, 2) Eradication through Early Detection and Rapid Response (EDRR), 3) Containment, and 4) Resource Protection and Long-Term Management. It also shows the relationship of each of these phases to the duration and extent of the invasion, and the costs of addressing it. It points out that the longer we wait to address a particular invasion, and the more widespread that invasion becomes, and the more expensive it is to address. The Invasion Curve also tells us that, in general, the most cost effective approach to controlling invasive exotic species is to prevent the introduction of the species in the first place. If prevention is not possible, EDRR is the next most cost effective strategy to employ. If both opportunities to prevent or swiftly eradicate are missed, costs of addressing the invasion begin to rise very quickly.

The four goals of the Framework are supported by strategies and objectives. The strategies went through a prioritization process and identified the development of an EDRR system as a high priority. Tool development in all four goal areas and continued coordination was also identified as a priority.

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MULTI-SPECIES AND LANDSCAPE SCENARIO PLANNING USING HYDROLOGICAL SIMULATION MODELING

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Water management actions can have direct and indirect effects on a wide range of ecological communities in the Greater Everglades. Therefore, management recommendations rely upon an understanding of landscape processes, individual species biology, and community responses at the landscape scale. Fortunately, for many landscape processes and species, robust ecological data are available to allow detailed modeling of responses to hydrological change. To directly compare output from these models, quantitative applications are needed to identify management strategies that can benefit a suite of ecological communities, while explicitly quantifying the potential costs to others (e.g., wading birds, Cape Sable Seaside Sparrow, prey fishes, seagrasses, and landscape responses).

We developed an objective, quantitative, and spatially-explicit framework that ranks species and landscape responses to hydrologic forecast simulations, selects the best simulation, and compares the best outcomes among the responses. In this process, multi-annual forecast simulations of Everglades Depth Estimation Network (EDEN) depths are created using cell-based Monte Carlo simulations of historical bi-weekly water depth changes in the Greater Everglades.

These simulations are then input into a suite of ecological models to determine the scenario that most benefits the species or landscape response. Using wading birds as an example, we evaluated simulated nest effort and success responses of Great Egrets, White Ibises, and Wood Storks. The endpoints of the 'optimal' scenario for each species were then plotted to determine the rate of water depth change, given the real-time depths, required to meet the species endpoints. When this process is repeated for all modeled responses, rates within the 95% confidence intervals of forecast rates can then identify the subset of species or landscape responses most likely to benefit from the anticipated future environment. Within this subset, recommendations can be made to meet target water depths for a selected species or community. Further, recommendations (within operational flexibility) can be continually updated based on a narrowing window of likely outcomes.

Finally, simulations and ecological model evaluations will be updated bi-weekly and provided to users via an automated, dynamic online platform with maps of modeling output, 'best' scenarios, and multi-species endpoints within the context of probabilistic hydrological outcomes. This framework can inform decision making to facilitate the persistence of biodiversity in the Everglades.

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SALINITY PATTERNS AND TRENDS IN WESTERN BISCAYNE BAY

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Biscayne Bay was predominantly an estuarine system that has become a marine lagoonal system over time due to freshwater diversion as well as altered timing and delivery of freshwater flow. Biscayne National Park has been monitoring salinity throughout south Biscayne Bay, Card Sound and Barns Sound for ten years. This project is part of the Monitoring and Assessment Plan (MAP) of the Comprehensive Everglades Restoration Plan (CERP). Altered water management operations upstream of Biscayne Bay appear to have improved the downstream receiving waters of Biscayne Bay and Biscayne National Park. Salinity along the western shoreline improved during and after the period of test water deliveries that were implemented by the South Florida Water Management District (SFWMD). Improvements in downstream salinity occurred after changes to the water shed including culverts allowing water flow under U. S. Highway One into the Florida Keys and altered structure configuration at the S-197 structure. Water delivery from the new structures as part of the Deering Estate component of the CERP Biscayne Bay Coastal Wetland (BBCW) also have improved to salinity distribution in the downstream receiving portions of Biscayne Bay. Generally salinity patterns show hypersaline conditions and salinity variability along the western shoreline reflect the distribution of canals and seasonal water management. Salinity in Biscayne Bay generally follows a gradient from the west with average or median salinity increasing to the east. Highest salinity values occur in the early wet season while highest salinity averages occur in the late dry season. Salinity is most variable in the areas with canals, however salinity in this area is also the lowest. Salinity is affected by groundwater, rainfall, surface water runoff, and canal discharge. Salinity metrics reflecting habitat suitability criteria also reflect this pattern.

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UNDERSTANDING THE VULNERABILITY OF EVERGLADES PEAT SOILS TO SMOLDERING COMBUSTION

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Natural fire regimes help maintain ecosystem functions and services and disruptions of natural disturbance regimes can have detrimental impacts, jeopardizing ecosystem health. Peatland wildfires worldwide have increased in severity and temporal frequency due to both natural and anthropogenic alteration to the environment, yet the vulnerability of peat to combustion during wildfires based on changing patterns in hydrology is not well understood. Severe peat combustion can disrupt native vegetation succession, alter microtopography, and release large amounts of soil and biomass carbon into the atmosphere, resulting in persistent changes to ecosystem structure and function. Fire occurrences in the Everglades are no exception to this exacerbated trend and have increased in severity since hydrologic alterations began. While natural fire regimes can maintain the wetland ecosystems of the Everglades, severe burning due to high fuel accumulation or drier soil conditions resulting from altered hydrology can have negative feedbacks to vegetation recovery, soil stability, and water quality. Additionally, the smoldering combustion of organic soils typical of peatland fires has consequences for climate forcing, wildfire management, and human health. Smoldering in organic soils occurs at low temperatures and high fuel moistures and can persist for periods of weeks to months following ignition. This incomplete form of combustion produces high emissions of particulate matter and pyrogenic (black) carbon that have substantial radiative forcing potential. The colder temperatures of smoldering fires also results in smoke plumes that remain near the ground. This thick, high particulate matter smoke can result in hazardous reduction in visibility and has been shown to cause increased risk of heart attack and respiratory illness in nearby communities. Therefore, understanding the drivers of peat smoldering and the implications of climate, hydrology, or management alterations on peatland vulnerability to severe burning are critical for the restoration and maintenance of Everglades wetlands. In this study, we used a thermodynamic model to estimate the potential depth of burning and regional vulnerability of Everglades peat soils to combustion across a range of soil fuel conditions. While projected depth of burning was relatively minimal, the primary factors limiting combustion varied across the Everglades, with fuel moisture being more important in the south and mineral content more important in the north. As combustion concentrates inorganic material in post-fire residues, this may cause a negative feedback to repeat burning, helping to preserve organic soils over multiple fire return intervals. Additionally, due to regional tradeoffs between hydroperiod and soil mineral content, specialized water management strategies may not be necessary for minimizing soil combustion vulnerability.

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EXPORT OF DISSOLVED ORGANIC CARBON FROM THE EVERGLADES TO COASTAL WATERS

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Coastal wetlands are globally important sinks for carbon, amounting to a third or more of oceanic carbon storage, with mangroves comprising the majority of this repository. Export of dissolved organic carbon (DOC) from mangrove systems can represent the largest global source of terrestrial material to the oceans, with DOC export reportedly accounting for up to 50% of net primary production. Constraining DOC export is important for assessing the role of mangroves in global, coastal and regional carbon budgets. Also, the export of DOC from mangroves is also directly related to export of nutrients, mercury and methylmercury to coastal environments.

We examined the export of DOC from the tidal zone of the Shark River estuary, an area of predominantly freshwater sawgrass marsh in its headwaters, and expansive mangrove swamp in the lower reaches. Tides are semidiurnal with a mean amplitude of approximately 1 m. Discrete samples were collected from immediately below the surface across the salinity gradient. Samples were analyzed for DOC concentration, UV absorbance, fluorescence, humic content and dissolved lignin phenols. We estimated the mass of DOC exported from Shark River estuary using continuous acoustic measurements of discharge combined with continuous in-situ measurements of fluorescent dissolved organic material (FDOM) as a proxy for DOC. We established the relationship of FDOM to DOC by measuring FDOM in situ while collecting discrete water samples throughout the estuary over a range of salinities.

Estimating mass fluxes of dissolved organic carbon in estuarine environments is challenging because of bidirectional flows, rapidly changing concentrations, and the physical dynamics that affect tidal interactions with wetlands. We found that most Shark River DOC export was driven by tidal pumping as opposed to flow from fresh water regions. For the periods measured, DOC export due to net freshwater flow accounted for less than 5% of the total flux. The magnitude of the flux was strongly affected by water height and precipitation–even though fluxes were tidally driven. The composition of the DOC exported as well as the position within the estuary where this carbon is added indicates the exported DOC is almost entirely derived from mangroves.

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AQUATIC VEGETATION AND ITS ROLE ON PHOSPHORUS DYNAMICS IN THE EVERGLADES AGRICULTURAL AREA

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Farm canals in the Everglades Agricultural Area (EAA) contain an abundance of floating and submerged aquatic vegetation (FAV, SAV). These species flourish in waters with high phosphorus (P) concentrations preventing the co-precipitation of P with the underlying limestone bedrock. Although these aquatic weeds are recognized as nuisance due to their ability to multiply and spread rapidly in open waters, they can also serve as a P sink. To test the effects of FAV and SAV on water quality, a lysimeter experiment was stocked with water lettuce and filamentous algae. Results helped quantify the uptake of various P fractions from the water column by these two aquatic species. The P concentration in all treatments reduced significantly after each water exchange. Treatments without sediments showed a higher efficiency for P removal, implying that the accumulation of sediments in farm canals could have a negative effect on exiting P loads. The presence of vegetation resulted in a reduction in water column P concentration; however this will only serve as a short-term sink because of their high turn-over rate. The buildup of highly labile, organic, P-enriched sediments in farms canals has been associated with the production of FAV. During drainage events, particularly those associated with storm events these particulates are susceptible to transport and contribute significantly to the overall P loads.

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PRICING THE CARBON RIGHT: THE CASE OF THE EVERGLADES MANGROVES

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Mangroves are highly productive ecosystems, next only to tropical forests, with a global primary production of 218 ± 72 Tg C yr -1. Mangroves have the potential to act as highly efficient sinks of carbon as they sequester atmospheric carbon in their aboveground and belowground biomass, and in sediments. Carbon sequestration and storage service by mangroves provides global benefits by removing the harmful greenhouse gas carbon dioxide from the atmosphere. The undervaluation of this ecosystem service by society further exacerbates the rapid loss of mangroves through extensive degradation and over exploitation. The failure to link this significant ecosystem service to societal benefits leads to inefficient decision making regarding mangrove ecosystems. Unlike the tangible benefits of provisioning ecosystem services that carry market prices, benefits of regulating ecosystem services like carbon sequestration are less obvious. An economic valuation of this ecosystem service that makes a cogent case for the utilitarian benefits of carbon sequestration by mangroves resulting in real economic benefits to society is urgently needed. A robust valuation of this ecosystem service must be first supported by reliable, scientific methods that can estimate the total carbon stored in the mangrove ecosystem. The variability in mangrove production and carbon accumulation through space and time must be accounted for as it greatly influences the economic valuation of the sequestration service. As no single valuation method can encompass the value of carbon sequestration and storage to society and human welfare, this paper analyzes three different methodologies appropriate for carbon sequestration: market price analysis, social cost method, and damage avoidance method.

Each of the valuation method is applied to total organic carbon (TOC) storage in mangrove forests of the Everglades National Park (ENP), Florida. The TOC storage estimated for this forest ranged from 34–456 Mg/ha and was higher than values reported for tropical, boreal and temperate forests. The TOC value ranged from $306 million ($162 – 450 million) to $2 billion ($1.06 – 2.94 billion). Unit area values were estimated at $2,415/ha ($1,281 – 3,549/ha) and $15,800/ha ($8,381 – 23,221/ha) based on the U.S. market price and average abatement cost of C, respectively. The information about C storage and its economic value has the ability to change public perception about how the C sequestration service by ENP mangroves supports their well-being and the associated benefits. This information can also assist in future policy changes such that the extensive mangrove area in the ENP, the largest mangrove area in the continental USA, can be included in climate change mitigation strategies at the national and international level.

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STABILITY OF SEQUESTERED PHOSPHORUS IN STORMWATER TREATMENT AREAS: ROLE OF DOMINANT WETLAND VEGETATION

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Sustained treatment performance of STAs is underpinned by the stability of sequestered phosphorus (P) in recently accreted soils (RAS). Therefore, quantification of reactive and non-reactive (stable) P pools in STA soils can indicate potential P flux into overlying water in response to a biogeochemical and/or hydrological perturbation. We assessed the stability of P pools in soil samples from two STAs and evaluated the influence of dominant wetland vegetation (Emergent Aquatic Vegetation, EAV and Submerged Aquatic Vegetation, SAV) on the reactivity of soil P pools.

Intact soil cores were collected from STA-1W and STA-2 and were divided into three layers - floc, RAS and pre-STA soil. Floc and RAS accumulated after STA became operational, whereas underlying peat represented pre-STA soils. Utilizing operationally defined P fractionation scheme, we determined relative proportions of reactive and stable P fractions in STA soils. Reactive P fraction comprised of 65-70% of all P stored in STA soils. Floc and RAS contained greater amount of reactive P than pre-STA soils but the relative proportion of reactive P pools in floc, RAS and pre-STA soils were similar (ranging from 63 to 77%). There was no significant difference in relative proportion of reactive and stable P pools between EAV and SAV dominant sections of STAs (cells). In STA-1W, reactive P constituted 77% of total P in floc of EAV cells and 72% of total P in SAV cells, however EAV floc had higher proportion (50%) as organic P while SAV floc had larger proportion as inorganic P (40%). In STA-2, EAV floc contained 76% of total P in reactive pool and SAV floc contained 70% of total P in stable forms. Greater proportion of reactive P was stored as organic P in EAV floc and RAS (51% and 46% of total P, respectively) compared to SAV floc and RAS where organic P was 20% and 35% of total P, respectively. Pre-STA soils were similar for both EAV and SAV cells, with higher proportion of reactive P pools located as organic P.

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BISCAYNE BAY: A JEWEL IN JEOPARDY?

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Although Biscayne Bay remains relatively healthy in terms of water quality and nutrient content, natural and man-induced events have negatively impact water quality and bay bottom resources. Three events have occurred in Biscayne Bay since 2005 that reflect the change in water quality conditions within the Bay which have resulted in algal blooms, unprecedented in their scale or duration that impacted over 10,000 acres of bay bottom habitat. These events signal a diminished ability of the Bay to handle these previously tolerable insults. The events were: A micro-algal bloom initiated in 2005 in Barnes and Card Sounds and Manatee Bay (in the southern end of Biscayne Bay) that persisted for 3 years, and resulted in a loss of up to 51% of sea grasses in portions of the affected regions of the Bay

A macro-algal bloom of two species of *Anadyomene* that initiated in 2008 and continues (in a diminished state) today. The impacted area is in the central-western region of the Bay, from south of Rickenbacker Causeway to south of Coral Gables and the western shore out to mid-bay. This bloom has impacted over 7500 acres of bay bottom, including the loss of sea grass and degraded bay bottom habitat.
A phytoplankton (diatom) bloom began in June of 2013, and lasted 3 months in some areas. The bloom occurred in a large portion of Central Biscayne Bay, including Biscayne National Park. The striking elements of this bloom was that it occurred throughout the open portions of the Bay that has significant and open exchange with the ocean. An algal bloom (macro-algal or phytoplankton) event had never been recorded in this portion of the Bay before.

The exact causes of these blooms remain undetermined; however, nutrient loading due to a combination of natural and anthropogenic sources and forces are believed to be responsible. The microalgal blooms seemed to occur following periods of heavy nutrient loading from weather events, associated storm-water discharges, as well as coastal construction activities and water management actions. While the Bay's fast recovery after the 2013 micro-algal bloom could be considered an indication of the Bay's ability to withstand 'event-driven' imbalances, the other events appear to indicate the Bay presently has less capacity to tolerate levels of disturbance than it has been able to handle in the past.

These events indicate that Biscayne Bay is showing a decreased resilience, as its response to episodic imbalances is changing. These activities have occurred in the Bay without significant changes noted in the multi-decadal water quality monitoring data. Thus, minor changes in water quality and habitat conditions can go undetected until irreversible alternations in the Bay's ecological health and environmental and economic sustainability have occurred. These warning signs emphasize the importance of maintaining vigilance in assessment and monitoring of conditions in the Bay. Continued long-term water quality and ecological monitoring are required to identify changes in the Bay and understand how these changes may affect the Bay's long-term health and its environmental and economic sustainability.

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SHIFTED ASSEMBLY RULES: HOW DO NON-NATIVE FISHES AFFECT METACOMMUNITY ASSEMBLY IN EPHEMERAL WETLAND HABITATS?

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Many ecological questions can be simplified to 'why do organisms live where they do, with what community they live with, and how did they get there?' In recent decades metacommunity theory has provided ecologists with a framework to begin understanding the importance of local and regional processes. A metacommunity is defined as a group of discrete local communities that interact via dispersal, thus providing the framework needed to improve our understanding of fish distributions across the highly heterogeneous Everglades marsh landscape.

In the southern Everglades' marl prairies, solution holes serve as longer hydroperiod patches in the short hydroperiod Rocky Glades (RG) marsh, where fishes congregate to avoid desiccation. However, due to the increased length and severity of dry down in this area, as well as intense predation pressure, few fishes survive to the end of the dry season in these holes. As these sites are effectively extirpated and re-assembled annually, they provide a unique opportunity to study re-assembly of a metacommunity without the need for anthropogenic manipulations. Additionally, this region is among the most invaded fish habitats of the Everglades with nearly 50% of the species being non-native (NN) and new species arriving as recently as 2010. The few studies that address the influence of NN species on metacommunity assembly suggest that new invaders can have drastic effects on the outcome of any given assembly event, thus changing the distribution of member species. Have recent fish invasions had a notable effect on the RG fish metacommunity assembly process?

Previous work in the RG has shown fish metacommunity assembly was a random process, with no significant deviation from a null distribution, in 1999 and 2000. We analyzed a subsequent data set, with comparable trapping methods, and found that this pattern held in 2002, but shifted toward aggregation in 2003 and 2004. To account for potential trapping biases, we also sampled solution holes via paired depletion electrofishing and visual surveys in 2013 and 2014. We find RG fish metacommunity assembly was aggregative in both years. Backwards stepwise linear regressions suggest that, in these years, regional diversity was determined by dispersal distances; however, adjusted local diversity showed close association with the density of African Jewelfish (*Hemichromis letourneuxi*). This NN micropiscivore first spread through the RG in 2003, concurrent with the apparent shift of metacommunity assembly rules.
While additional data are needed to determine if Jewelfish were the cause of this shift, our data suggest that the introduction of this new species has altered local scale assembly patterns of fishes in the RG. As these communities represent important foraging sites for a multitude of Everglades fauna, this change may have as of yet unknown consequences for the marsh food web.

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FOREST PRODUCTIVITY ALONG AN ELEVATIONAL GRADIENT IN THE UPPER FLORIDA KEYS

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The hardwood hammocks of the Florida Keys are freshwater dependent forests of West Indian origin. In the Upper (northernmost) Keys, however, freshwater availability is scarce and replenished by seasonal rains from June to October. Soils in the forest are thin above limestone bedrock, and the groundwater table is brackish. The forests are a mixture of different aged stands due to anthropogenic disturbances within the last 90+ years. Previous ecological work in Keys forests suggests that hammocks are arranged along an elevational gradient in which productivity, as indicated by tree height, increases with ground elevation.

One might therefore infer that with a warming climate and rising sea levels, hammock productivity will decline and hammock species will be displaced as conditions shift towards more saline environment, resulting in filtering out freshwater dependent species. The objective of this study is to explore in greater detail the relationship between canopy height, a proxy for productivity, and ground elevation at a landscape level.

Using LiDAR, a digital elevation model and a digital forest canopy surface model was generated. I found a positive correlation across all forests between canopy height and ground elevation, though the relationship differed between young and old forests.

Overall, young forests had shorter canopies across all elevations, perhaps because not enough time had elapsed to reach maximum height. Intermediate aged forests had slightly taller canopies than older forests at highest elevations, possibly due to the presence of fast growing, early successional, emergent species that may not survive to the oldest age classes. The increase in tree height with elevation at all ages suggests that forests at high elevations may exploit freshwater stored in thicker bedrock profile above the saline water table, thus being more productive than forests at lower elevations.

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FOLLOWING THE BULLDOZERS: INVASIVE PLANT CONTROL FOR THE PICAYUNE STRAND RESTORATION PROJECTE

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Prior human manipulation of the Picayune landscape not only altered hydrologic and fire regimes, but also encouraged invasive native and exotic plants to become pervasive. Restoration of historical hydrologic regimes is critical groundwork for re-establishing ecological functions, but restoration of native biodiversity must consider long-term control of invasive plants.

In addition to filling canals, a primary mechanism for restoring sheet-flow to the Picayune is the degradation of a grid of hundreds of miles of roads, as well as logging trams, ditches and spoil piles. Unfortunately, this very act of soil disturbance and mixing road material into the substrate creates conditions in which invasive plants thrive. Rehydration may eventually control some invasive species. However, slower than anticipated implementation of multiple components of this restoration project has translated to a protracted time period between road removal and rehydration, and during that time invasive plants readily got established, spread, and are evermore challenging to control. There is no doubt that minimizing the extent of soil disturbance is preferential for reducing long-term needs for controlling invasive plants.

The Institute for Regional Conservation has been mapping Picayune invasive plants and coordinating herbicide contractors since 2008. Funding for controlling invasive plants has been limited and unpredictable. Hence, effective management of invasives requires a coordinator that adapts to weekly changes in availability of funding, availability of trained crews, conditions that restrict herbicide application (flooding, precipitation, frosts, fires), and seasonal conditions of target species. From lessons learned during this project, we modified our strategy to target select species within the construction footprints under these guidelines: a) pre-emptive strikes on aggressive wetland invasive species with repeated follow-up treatment, b) treating several species that are readily extinguished, c) holding back on treatment of most upland species until post-rehydration, and d) treating problematic upland areas that will not be rehydrated (former home-sites, nurseries, ranches). Through vigilant monitoring and re-treatments, we have had success at controlling infamous invaders such as torpedograss, cogongrass, melaleuca, and several giant grass species. Simultaneously, several untargeted species are becoming dominant in construction footprints as we await hydrologic restoration and/or increased funding.

The sector north of the pump stations will not be rehydrated and remains an area of concern since it is an important Florida panther corridor, yet is currently heavily invaded by Brazilian pepper. The task of controlling invasive plants in the zones betwixt the degraded roads has been evaluated, but has been put on hold until we witness the effects of rehydration. The need for adaptive management of invasive plants will linger long after cessation of the construction phase.

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FLOW MONITORING ALONG U.S. 41 BETWEEN COUNTY ROAD 92 AND STATE ROAD 29, IN SOUTHWEST FLORIDA, 2007–2010

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Freshwater flow to the Ten Thousand Islands estuary of Southwest Florida has been altered by the construction of U.S. Highway 41 (Tamiami Trail) near the Southern Golden Gate Estates planned development, and the Barron River Canal. The Picayune Strand Restoration Project and the Tamiami Trail Culverts Project, both associated with the Comprehensive Everglades Restoration Plan, have been initiated to restore flow to a more natural regime. Quantifying the flow to the estuary pre- and post-construction is crucial to evaluating the success of these projects.

The U.S. Geological Survey conducted a study between March 2006 and September 2010 to calculate the flow under the Tamiami Trail between County Road 92 and State Road 29 in southwest Florida. The Faka Union Canal was excluded from this study because it is monitored by the South Florida Water Management District. The study period occurred after the completion of the Tamiami Trail Culverts Project and before major construction related to the Picayune Strand Restoration Project. The section of the Tamiami Trail that was studied contains 35 bridges and 16 culverts. Measuring each individual bridge or culvert on a continuous basis was not cost-effective; therefore the area was divided into seven subbasins. The index velocity method was used to compute discharge at one instrumented bridge per subbasin. Periodic discharge measurements were made at all bridges and culverts. Daily mean values of discharge for the uninstrumented structures were calculated on the basis of relations between the measured discharge at the uninstrumented stations and the continuous discharge and stage at the instrumented bridge.

The study quantified the spatial and temporal distribution of freshwater flow to the estuary. During water years 2008 to 2010 (October 2007 to September 2010) more than half of the flow under the Tamiami Trail, between State Road 29 and County Road 92, can be attributed to the Faka Union Canal. Over the same period, 9 percent of the flow through the study area came from west of the Faka Union Canal and 31 percent came from east of the Faka Union Canal. Results of this study can serve as a baseline with which ongoing restoration of Picayune Stand can be evaluated.

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SPATIAL DISTRIBUTION OF NITRATE+NITRITE CONCENTRATIONS IN THE TIDAL CALOOSAHATCHEE RIVER DURING 2014

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Eutrophication is a concern for many coastal systems, including the tidal Caloosahatchee River. The Caloosahatchee River, which flows into San Carlos Bay, is typically nitrogen limited. It has been estimated by the South Florida Water Management District that discharge at the Franklin Locks (S-79) accounts for 90 percent of the total nitrogen load to the estuary. Nitrate+nitrite has been monitored continuously (at 15-minute intervals) by USGS since April 2014 upstream of S-79 using an optical sensor. USGS moving boat surveys of water quality have been expanded recently to include nitrate+nitrite. Water quality maps are created 6 times a year within the tidal Caloosahatchee River, San Carlos Bay, Matlacha Pass, Pine Island Sound, Charlotte Harbor and the Gulf of Mexico.

During moving boat surveys, water-quality data are collected using an onboard pump system while the boat travels at approximately 20 mph. In-line sensors analyze water-quality, including nitrate+nitrite. Location data and water-quality data are imported into an Environmental Systems Research Institute ArcMap Geographical Information System program to create water-quality maps. Discrete nitrate+nitrite samples were collected during 2014 at several locations during the moving boat water-quality surveys and also at the fixed monitoring location. These water samples were sent to the USGS National Water Quality Lab for analysis. Initial results indicate that nitrate+nitrite concentrations measured in the field during moving-boat surveys are higher than concentrations measured in the lab for discrete water samples; the high values for color in the water likely contribute to this discrepancy. The sensor data are therefore corrected based upon the relation between sensor data and lab data.
Preliminary results from the upstream optical sensor at S-79 indicate that nitrate+nitrite concentrations peak in early November. The lowest values upstream of S-79 were observed in late May 2014. The highest values observed during a moving boat water-quality survey occurred on August 19, 2014 near S-79 and at the mouth of the Orange River. Nitrate+nitrite data were not available for the moving boat water-quality survey in October and no surveys occurred in November 2014.

Data from moving boat surveys can assist in evaluating nitrate+nitrite concentrations and provide spatially intensive coverage that can be used to identify sources of these nutrients and additional areas of concern in the tidal Caloosahatchee River and downstream estuaries. Continuous water quality sensor data can increase the accuracy of load calculations from S-79.

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DEVELOPING A SPATIO-TEMPORAL OCCUPANCY MODEL FOR A DECLINING NESTING POPULATION OF BALD EAGLES *HALIAEETUS LEUCOCEPHALUS* IN FLORIDA BAY, EVERGLADES NATIONAL PARK

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Bald Eagle territory use in Florida Bay, Everglades National Park has declined by as much as 43% with a significant increase in year-to-year variation despite a historically stable population. We describe these changes in territory dynamics using Markov chain models based on observed frequencies of territory use collected from a long-term monitoring program beginning in 1958. Over the monitoring period, a total of 49 annual transition matrices were constructed, considering four possible fates (unoccupied, occupied, active, or successful). Using loglinear analysis to detect and quantify spatio-temporal variation we explore the ecological importance of time and location on transient dynamics for this population. Changes in territory patchiness and more frequent territory abandonment coincide with changes in hydrology and the prey availability for Florida Bay. Compounding effects of time and location manifest most significantly over the last 15 years along an east-west gradient with effects most severe at the eastern portion of the bay. Our Markov chain models predict similar equilibrium composition and rates of convergence, as measured by the damping ratio, supporting evidence for an increasingly unstable population with greater sensitivity to changes impacting overall productivity. The proposed model establishes relative importance to transition probabilities that increase the number of successful territories and maximize productivity, provides useful insight into the effects of stochastic and anthropogenic changes, and can be used as a resource to help direct ongoing management actions related to the recovery of other territorially breeding wildlife and their respective habitats.

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PHOTOPERIOD VS. HYDROLOGY: WHICH BEST PREDICTS MIGRATIONS OF TEMPERATE FRESHWATER FORAGE SPECIES AND THEIR TROPICAL ESTUARINE PREDATOR IN THE OLIGOHALINE REACHES OF THE SHARK RIVER?

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Forecasted changes in global climate are expected to have profound impacts on trophic interactions. One such climate mediated change to foodweb dynamics may emerge from alterations in trophic synchrony between predators and their prey. These novel asynchronies can result from changes in the phenology of predators or prey, as well as from functional replacements of a predator or prey species vulnerable to a climate stressor by one that is resistant to the disturbance. This functional replacement may be quite pronounced in the sub-tropics where tropical species are advancing poleward rapidly, through species introductions and unassisted migrations, and are now interacting with temperate species at the equatorial extent of their range.

In the oligohaline reaches of the Shark River, fish communities are composed of tropical euryhaline piscivores (namely common snook) originating from the Caribbean, and temperate freshwater forage fishes (spotted and dollar sunfishes) that colonized South Florida from more northern regions of the United States. In the dry season, both guilds increase in abundance, with temperate species moving downstream into the estuary to escape receding water levels on upstream marshes, and tropical estuarine piscivores moving upstream to feed on increased concentrations of temperate forage fishes moving off marshes. Given the distinct evolutionary histories of these temperate prey and tropical predators, it is possible that they use different environmental information as cues to migrate to the oligohaline zone. For instance, in more temperate regions, seasonal variation in photoperiod and temperature are the predominant migration and reproductive environmental cues for fishes. However, in the tropics where photo-period and temperature do not vary seasonally, fishes often use seasonal changes in rainfall as it relates to freshwater flows as migration and spawning cues. Thus, we hypothesize that changes in photo-period would better predict when temperate forage fishes migrate into estuaries, while changes in freshwater flows and receding water levels would better predict migrations of tropical piscivores to the headwater creeks.

We tested these hypotheses by sampling fish abundances monthly from 2010-2014 via electrofishing. We determined whether annual changes in photo-period (as expressed as the number of days after January 1st), or annual receding water levels (marsh stage at MO31), was a better predictor of dry season increases in the abundance of temperate forage fishes, and tropical piscivores using information theoretic approaches. Our results show that photo-period was a better predictor of dry season increases in temperate fish abundance, while receding water levels better predicted dry season increases in tropical piscivore abundance.

To conclude, though not climate change mediated, this trophic asynchrony between tropical predators and temperate prey results in the predators only exploiting this subsidy when receding water levels match up with the specific photoperiod cue. Further in years where they do not coincide, snook almost completely miss this prey subsidy.

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ASSESSING TRADE-OFFS AMONG ECOSYSTEM SERVICES IN A PAYMENT-FOR-WATER SERVICES PROGRAM ON FLORIDA RANCHLANDS

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We evaluated trade-offs among ecosystem services in a payment for ecosystem services (PES) pilot program in the Northern Everglades that is paying ranchers to retain water on their lands. In addition to water storage, ranchlands offer multiple ecosystem services, including forage production, a mosaic of wetland and upland habitats, and associated biodiversity. We examined the effect of water retention on biodiversity, forage production, and invasive/pest species. The data were used to refine decision tools that help evaluate trade-offs among multiple ecosystem services at scales relevant to ranchers and decision makers.

Hydrologic modeling and scenario analysis comparing different water levels set by riser board water control structures (baseline, maximum board height, and PES program board height) showed that installing these structures in ranchland ditches, increased inundation area in nearby wetlands by 28%, and reduced flow leaving the ranch by 22%, due to increased subsurface storage. Wetlands that were farther away from ditches with water control structures showed no response to board management.

We examined whether managing for water retention resulted in other beneficial services or ecosystem disservices, such as increasing aquatic biodiversity versus forage loss. Abundance of most animal groups was favored by increased water availability, which simultaneously increased the amount of favorable wetland habitat and the amount of time suitable habitat was present. Water retention therefore provided a positive ecosystem service for desired wildlife but could create a problem due to increased mosquito abundances. There was a negative linear relationship between water availability and both plant diversity and planted forage grass cover, suggesting that retaining more water in ranchland wetlands resulted in lost wetland plant diversity and planted upland forage grasses. However, increased cover of wetland forage species could potentially make up for lost planted forages, and loss of wetland plant diversity would only occur if wetland footprints do not expand. Exotic plant abundance and richness were variable among ranches and were not strongly linked to water availability. The strong site effects on many factors indicate that responses to increased water retention depended on existing site conditions; therefore it is difficult to project ecosystem services among sites.

An existing Decision Support System was modified to include ecological predictions of biodiversity, forage production, invasive/pest species, water retention, and economic data for two ranches. Results from three different analytical techniques that used different value weights highlighted greater water retention levels as giving larger economic and ecological effects. Local results vary significantly and more work is needed to scale up several ranches into regional estimates.

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CROCODILIAN ECOLOGICAL THRESHOLDS SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT (CEPP)

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Within the context of the Central Everglades Planning Project (CEPP) threshold/trigger is defined as a point or limit that signifies when restoration performance is veering away from expectations and is trending toward an unintended outcome or that the desired performance is being achieved. Expected responses for a range of hydrological and ecological attributes have been developed for overall implementation of the Comprehensive Everglades Restoration Plan (CERP). These targets represent what should be achieved with full system-wide restoration. A challenge in the interim is to evaluate incremental progress toward these targets with incremental implementation of restoration plans such as CEPP.

Crocodilians are one of the system-wide ecological indicators of ecological change in the Greater Everglades because of their linkage to hydrologic conditions at various spatial and temporal scales. Changes in relative abundance, body condition, growth and survival reflect changing ecosystem characteristics and we have hypotheses on expected responses to hydropatterns and salinity. We will discuss how targets that we have developed for overall restoration can be scaled for use specifically with CEPP. The framework involves defining what hydrologic responses are expected to CEPP and linking those crocodilian responses through the use of habitat suitability and statistical models based on past monitoring data. This will provide expected responses. So for example with the CEPP tentatively selected plan there is an expectation that suitability for alligators in northern WCA3A will improve greatly, while conditions in southern WCA3A will remain about the same. Based on this information we would expect that relative abundance and body condition in northern WCA3A would increase while that in southern WCA3A would remain about the same. The magnitude of increase can be calculated based on statistical models relating hydrology (hydroperiod, amplitude, frequency and intensity of dry downs) and other parameters (prey base) to body condition and relative density. This can be done for both expected (modeled) hydrology and field measurements of actual hydrology. Those responses are then added to current status of relative abundance and body condition determined through pre-project monitoring to provide estimated or actual improvements of CEPP. Progress toward those targets can then be tracked through continued monitoring of alligators, their prey, and hydrology. The CEPP targets can also be compared to the overall CERP targets to gauge how much more improvement is necessary to achieve overall restoration targets. Additionally, this information can be used to determine if appropriate progress is being made or if additional measures are needed.

Keys to being able to predict and assess responses of crocodilians to CEPP include having appropriate predictions of hydrology and salinity in targeted areas and adequate hydrologic, salinity, aquatic fauna, and crocodilian monitoring to track actual responses.

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QUANTIFYING THE RELATIVE CONTRIBUTIONS MADE BY ORGANIC MATTER AND MINERAL SEDIMENT TO ACCRETION RATES IN THE COASTAL EVERGLADES

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Soils in the southwestern coastal Everglades are composed largely of mangrove organic matter and mineral sediments that are delivered by storm surge deposition and longshore transport/ tidal redistribution of marine sediments. This subsidy of marine mineral sediments has been hypothesized to boost accretion rates and increase the likelihood of these locations keeping pace with sea level rise. The purpose of this research was to quantify the relative contributions of organic matter and mineral sediments to mangrove soil accretion rates in the coastal Everglades. These contributions have been evaluated in salty, brackish, and freshwater marsh systems but such research is lacking in mangroves.

We examined accretion rates at thirteen sites along the Shark, Harney, & Broad Rivers in the southwestern Everglades using radiometric dating (^{210}Pb & ^{137}Cs). Literature values for particle densities of 1.14 and 2.61 g cm^{-3} for organic and mineral sediments were used for the present analysis. Sites were classified according to a combination of up-river distance and soil dry bulk density as follows: Upstream-Organic, Intermediate-Mixed, and Downstream-Mineral. In addition to testing for differences between these three classes, we examined whether the addition of mineral storm sediment has a positive or negative influence on accretion rates.

The percentage of soil OM decreases from upstream (85%) to downstream (25%) locations. The mass of OM in the top 40 cm of soil is not significantly different for any sites on the three rivers, however the mass of mineral matter increases by a factor of 10-30 between the upstream and downstream locations. Accretion rates are highest in the middle of the estuary where OM accumulation rates are highest, but mineral accumulation rates are only a fourth of those found in the downstream locations. Rather than increasing long-term accretion rates, the addition of mineral mass primarily increases soil bulk density (in addition to indirect secondary effects such as fertilizing mangrove productivity). Organic matter is the strongest indicator of accretion rates at all locations over the past century.

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A SPATIAL AND TEMPORAL ANALYSIS OF MANGROVE COVERAGE IN CHARLOTTE HARBOR

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Mangrove habitats may undergo spatial changes over time in response to alterations in climate, sea-level rise, urbanization, and policy implementations. While land use for tidal wetlands surrounding the Charlotte Harbor Estuary (FL) has been evaluated, a long-term time-series of mangrove forest coverage has not previously been examined in this basin. This study examines contemporary and historical aerial images in order to quantify changes in mangrove coverage. Mangrove forests were delineated and digitized using standard elements of image interpretation (growth patterns, color and texture, shape, etc.). We hypothesize that the combined effects of natural and anthropogenic drivers have resulted in an overall loss of mangrove coverage within the study area. This project is part of a larger study using sediment cores to examine historical changes in mangrove and marsh coverage by linking the images to sediment accretion and carbon accumulation rates for the same sites.

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NUTRIENT THRESHOLDS DRIVE PHYTOPLANKTON BIOMASS RESPONSES IN SOUTH FLORIDA COASTAL AND ESTUARINE WATERS

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South Florida (SF) coastal and estuarine waters have experienced the impact of anthropogenic interventions since the early 1900's, including major disruptions of its hydrology and sustained urban and agricultural development, and even impacts from far-field sources, such as the Gulf of Mexico and the Mississippi River. Hence, despite their oligotrophic nature, SF aquatic ecosystems bear the heritage and signals of such a long and sustained influence.

Six basins have been previously defined for SF, namely Biscayne Bay, Florida Bay, Whitewater Bay-Ten Thousand Islands, Pine Island Sound-Rookery Bay, Florida Keys and the Gulf Shelf. These are complex systems where no cause-and-effect relationships between nutrient enrichment and ecosystem responses have been clearly understood. Adding to these difficulties is the lack/scarcity of nutrient dose-response experimental work on key plant/animal species. Fortunately, water-quality monitoring has been in place for about 20 years in SF and analysis of these historical records may supply the information required to assess the status of waterbodies and to gain an adequate insight into biogeochemical processes, like eutrophication. We selected FIU's database as the reference dataset because of its spatial-temporal coverage at fixed 350 stations, completeness of measured variables, its sustained field and analytical protocols along the period of record and for being the basis to subdivide SF waters into biogeochemical sub-basins. Those datasets, especially phosphorus and nitrogen data are critical for defining the nutrient levels at which potential system shifts are triggered at each sub-basin.

We have developed a method to calculate P and N thresholds separating Chlorophyll-a baseline conditions, supportive of a waterbody's designated use, from those altered states driven by eutrophication. Chlorophyll-a is of special interest for our purpose because its value as an index of productivity and trophic status of coastal and estuarine waters. These ecological thresholds are the critical values of an environmental driver for which small changes can produce an abrupt shift in ecosystem conditions, where core ecosystem functions, structures and processes are essentially changed between alternative states. We derived the TN and TP concentration thresholds for South Florida estuaries and coastal waters using Z-scored cumulative CHL-a charts, which measure the departure from the average CHL-a concentration along a nutrient gradient. When comparisons are expanded to basin and even across South Florida waters as a whole, it is possible to outline a series of common breaks in a stepwise fashion, which transcend salinity regimes, from the most oligotrophic systems (Florida Keys) to the eutrophic end members (Pine Island-Rookery Bay, Whitewater Bay-Ten Thousand Islands).

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BISCAYNE BAY ALONGSHORE EPIFAUNA – INDICATORS OF ECOSYSTEM CHANGE

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The Biscayne Bay epifauna, consisting of small fish and large invertebrates, is an important component of the bay ecosystem, forming key links in food webs leading from microalgae and detritus to large consumers such as sport fish, bottlenose dolphin, water birds, and crocodiles. Salinity is a major factor that will be altered by change in freshwater inflow under the Comprehensive Everglades Restoration Plan (CERP), and so analyses in IBBEAM are being conducted to determine the distribution of epifaunal species in relation to salinity in order to identify species and community characterizations for use as ecological indicators in assessment and adaptive management for CERP. The alongshore epifauna of Biscayne Bay includes pink shrimp, an important commercial fishery species that has its nursery ground in the shallow nearshore bay. Shrimp and other epifauna support snapper, grouper, and other reef fish species that shelter in the mangrove prop-roots. Recent analytical work includes 1) developing a scale of salinity affinity, based on species distributions in relation to salinity, for species presently found in the community, to better visualize; 2) developing habitat suitability models that can be used to predict species probability of occurrence and density based on salinity and seagrass composition and cover; 3) defining shoreline segments with commonality of epifaunal community structure for making spatial comparisons before and after CERP projects potentially affecting different parts of the shoreline are implemented; and 4) scoring the last two years (by season), against a previous set of years, for status of pink shrimp, an indicator species in the South Florida Ecosystem Restoration Task Force Annual Ecological Indicators Assessment process. Epifaunal fish species near the lower end of the salinity scale include the crested goby, flagfin mojarra, southern sennet, bandtail puffer, and sheepshead minnow. Species near the higher end of the salinity scale include the spotted whiff, gray snapper, spotted dragonet, and dusky and fringed pipefish. IBBEAM Habitat Suitability Models show a significant correlation of pink shrimp density with salinity (peak ~22 psu) and Halodule cover (peak ~50%). ANOSIM analysis showed significant spatial differentiation in species composition along the shoreline. The stop-light status of pink shrimp in its alongshore nursery ground was poor for the dry season (January-February) and neutral for the wet season (July-August) of 2012 and 2013, compared to previous years (2007-2011).

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VALUATION OF FISHERY ECOSYSTEM SERVICES OF THE EVERGLADES WATER MANAGEMENT

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Economic valuation of ecosystem services (ES) is gaining importance in the context of natural resources management, policies and research. For instance, the flow of freshwater through the Everglades and down into the Florida Bay serves to maintain low salinity conditions that are essential to maintaining good habitat for certain fish and wildlife populations. Thus, the recreational fishing industry in the Everglades is a direct beneficiary of improved and sustained fishery habitat. Recreational experience is therefore gaining attention from resource managers as one of the key ES of the hydro-ecological system of the Everglades.

This research develops a conceptual methodology to determine the economic value to stakeholders of recreational fishery ES in the Everglades and Florida Bay. These services are not directly market-valued, so they will be valued using a discrete choice experiment, which is based on the utility-theoretic framework. Choices presented to anglers will consist of various restoration and climate scenarios, each representing varying levels of attributes important to anglers. The method recognizes that anglers not only care for fishery-related attributes (e.g., fish abundance, target fish catch, fishing area, etc.), but also the overall health of the Everglades and Florida Bay. Each choice may entail additional monetary cost per fishing trip. Anglers will then be asked to pick their preferred scenario. In order to help respondents make an objective decision with regard to their most preferred choice, the online survey will use a combination of written explanation, animation and visual presentations (maps and videos) of the alternative water management and fishery scenarios. Clear definition of ecological scenarios and attendant attributes will allow anglers to objectively evaluate the economic trade-off inherent in each scenario. With the help of a statistical model, the survey data will help us estimate the monetary values of various fishery and ecological attributes. This paper hopes to present preliminary findings of the survey during the conference. The paper will also demonstrate how the economic values of the fisheries ES can be incorporated into the broader hydro-economic model that is being currently developed for evaluating regional water management decisions in South Florida.

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IMPACT OF WILLOW INVASION ON WATER AND CARBON EXCHANGE IN THE VEGETATION OF A SUBTROPICAL WETLAND

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Southern coastal willow (*Salix caroliniana*) is native to the Florida wetlands, commonly found on drier landforms like levees and tree islands. Shortened periods of inundation due to water management have led to the encroachment and expansion of these shrubs in sawgrass (*Cladium jamaicense*) marsh communities. The broadleaf willow is morphologically and physiologically different from the graminoid sedge sawgrass, with possible consequence for microhabitat conditions and ecosystem function. Shrub encroachment in wetlands can shade the understory potentially leading to decreased temperatures and light availability and changes in primary productivity. Additionally, dense vegetation can slow airflow, decreasing the rate at which leaf gas exchange occurs. Willow is often assumed to have greater rates of transpiration, thereby affecting wetland water management, and may have concurrent differences in photosynthesis and carbon exchange. However, the ecophysiological impact of the willow invasion has not been quantified.

We assessed differences in plant water and carbon exchange between willow and sawgrass at Blue Cypress Conservation Area, an impounded sawgrass peatland within the St. John's River Water Management District (SJRWMD). Stomatal conductance (g_s) and net CO_2 exchange (A_{net}; photosynthesis and autotrophic respiration) were measured on fully expanded, non-damaged leaves of sawgrass and willow using a portable infrared gas analyzer (LI-6400XT, LI-COR, Lincoln, NE, U.S.A.). Willow had higher rates of g_s and A_{net} than sawgrass. However, sawgrass had greater intrinsic water use efficiency (WUE) than willow. This suggests that willow is capable of greater gas exchange and carbon assimilation that sawgrass but requires more water for each unit of carbon gained. As willow cover expands and replaces sawgrass, this could lead to greater water loss from the marsh affecting water management and ecosystem processes. The results obtained from this study will provide a better understanding of ecophysiological changes that occur within marsh communities with shrub expansion, which will have cascading impacts on soil carbon storage, microclimate, and water quality. Understanding the implications of willow expansion will improve landscape models of wetland water and carbon exchange as well as inform water management decisions.

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CARBON SEQUESTRATION IN THE MANGROVE FORESTS OF CHARLOTTE HARBOR AND IMPLICATIONS FOR CONSERVATION AND RESTORATION

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The Charlotte Harbor Estuary on Florida's gulf coast is the second largest open water estuary in Florida. Managed by the Charlotte Harbor National Estuary Program, it covers 700 square kilometers and encompasses an 11,572 square kilometer watershed. Close to 157 square kilometers of undeveloped property surrounding the estuary has been acquired as the Charlotte Harbor Preserve State Park. Mangroves will be directly impacted by rising sea level resulting from changing climate. Resilience of mangrove forests to sea-level rise is inhibited by development and upland land-use changes, which alters the sediment and water flow and impedes potential landward migration of forests.

Mangrove forests are extremely productive, averaging 2500 mg C m^{-2} per day and playing an important role in the biogeochemical cycling of organic carbon and peat accretion. A large amount of organic carbon is sequestered as peat in mangrove forests, burying an average of 26.1 Tg C yr^{-1} globally and thus acting as an important carbon sink. Habitat degradation and destruction result in the loss of carbon burial and long-term carbon storage, which could force these forests that currently act as carbon sinks to become atmospheric carbon sources.

This project aims to develop a better understanding of how the Charlotte Harbor mangrove system will respond to sea-level rise as well as its role in carbon sequestration via burial and storage by answering the following questions:
What is the historic change in organic carbon burial on a centennial time scale?
What are the peat accretion rates over the past century?
Will the mangroves of this system keep pace with sea-level rise?
What is the outlook for implementing policies designed to protect and conserve mangrove forests in Charlotte Harbor?

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APPLICATIONS OF HIGH-RESOLUTION AERIAL IMAGERY AND A SMALL UNMANNED AIRCRAFT SYSTEM IN EVERGLADES SCIENCE

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Personnel from a multitude of Departments at the University of Florida (UF) have worked for over 15 years as part of an interdisciplinary project to develop small unmanned aircraft systems (sUAS) as photographic platforms specifically designed to provide wildlife and natural resource professionals with an additional tool for collecting low-altitude, high-resolution aerial imagery. From its inception, the University of Florida Unmanned Aircraft Systems Research Program (UFUASRP) has worked extensively to develop low-cost, high-accuracy, aerial platforms and optical payloads to capture digital imagery over remote areas that contain targets of interest to wildlife scientists, hydrologists, and other researchers to aid in answering scientific questions.

Wading bird nesting surveys in tree islands, migratory waterfowl and avifauna surveys, phenology transects of vegetation, and hydrology changes in the Greater Florida Everglades are just a few of the activities that have been surveyed or monitored by biologists/scientists from UF, the South Florida Water Management District (SFWMD), the State of Florida, and Federal agencies for decades. Existing techniques consist primarily of levee- or boat-based visual surveys, or double-observer low-altitude manned aircraft aerial surveys. As the UFUASRP has gained experience and exposure, there has been tremendous interest in testing the utility of flying its sUAS (which are considered aircraft) over various types of targets in the Everglades to collect georeferenced aerial imagery. Unfortunately, due to Federal Aviation Administration (FAA) regulations regarding special flight requirements for any aircraft operating within a 30 nautical miles radius of Miami International Airport, the UFUASRP has only been able to secure FAA permission to fly its sUAS over portions of the Everglades to date.

Despite being currently unable to obtain FAA permission to fly the UF sUAS over several prime areas of the Everglades, the UFUASRP developed a way to utilize manned aircraft capabilities in collaboration with its low-cost, high-resolution, georeferenced imaging payload. Working in conjunction with the FAA, the Program constructed a small aluminum box containing its sUAS imaging payload, which can be rigidly affixed to specific manned aircraft. Through a cooperative effort with the SFWMD, the UFUASRP has been able to assess and integrate newer, faster, and higher-resolution optical payloads for collecting aerial imagery aboard Bell® 407 helicopters in areas containing targets where sUAS are not currently permitted. Test applications using the box have included censusing of avifauna, spatial delineation and quantification of vegetation, and evaluation of sheetflow restoration efforts. Preliminary results highlight the potential utility of this suite of tools in high-resolution natural resource assessment.

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THE ROLE OF ECOLOGICAL THRESHOLDS IN ADAPTIVE MANAGEMENT

Kelly Keefe and Andy LoSchiavo **Presented by: Eric Bush**
U.S. Army Corps of Engineers, Jacksonville, FL, USA

Performance measures for south Florida ecosystem restoration indicators support evaluation of progress toward restoration goals envisioned for the Comprehensive Everglades Restoration Plan. Incremental ecological thresholds are needed to support adaptive management specific to performance expected from subsets of restoration projects, such as the Central Everglades Planning Project (CEPP). Due to funding limitations, project dependencies, and constraints, not all of the CEPP components will be implemented at once. Because of uncertainty inherent with ecosystem responses to restoration actions, incremental ecological thresholds provide a benchmark to compare monitoring of actual restoration results to determine whether the initial restoration actions are performing as hypothesized or not. This information can inform adjustments to the next set of CEPP restoration actions and/or future CERP projects and operations to improve restoration performance, as part of an adaptive management approach. Thresholds are part of a continuum of methods to evaluate restoration performance. This presentation will introduce the concept of ecological thresholds specific to informing adaptive management of the CEPP.

Ecological thresholds are often characterized to represent a point, range, or distribution beyond which an important change occurs in an ecosystem condition, such as a state, pattern, or process. Thresholds confirm progress toward restoration goals and objectives or, conversely, they can indicate performance issues that need attention. Thresholds are most useful if they are known early in the planning process for a restoration project, if a restoration project's objectives and constraints/considerations are in alignment with the thresholds, if they are explicit in the project's adaptive management plan, and if the project's monitoring will produce data on the status or progress of the restoration project in terms of the thresholds.

This presentation will help audience members of diverse backgrounds gain a mutual understanding of the terms and concepts that will be used throughout this session.

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EFFECTS OF FLOW AND CONNECTIVITY ON EVERGLADES AQUATIC CONSUMERS: EVALUATING THREE HYPOTHESES

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The DECOMP Physical Model (DPM) uses experimental manipulation of water flow to evaluate hypothesized benefits of re-connecting regions of the Everglades and re-creating historical velocities of sheetflow. The goal of the project is to reduce uncertainties around future restoration projects involving sheetflow restoration and decompartmentalization. We have examined three hypotheses related to the effects of sheetflow on aquatic consumers: (H_1) historical flows were too low to have direct effects on fish movement and distribution; (H_2) removal of levees changes habitat connectivity and facilitates consumer recovery from droughts; and (H_3) flowing water increases phosphorus loading, changes P dynamics, and stimulates consumer productivity.

We have evaluated H_1 by field sampling with throw traps and airboat-mounted electrofisher in DPM to determine if experimental flows have altered the density or species composition of fishes in the study area. We also used drift fence sampling to evaluate fish movement activity. This work has been complemented by laboratory studies of the swimming performance of Everglades fish species exposed to experimental flows spanning velocities believed to be historically relevant. We evaluated swimming performance for the range of size classes most likely affected. These studies indicated few changes in species composition, density, or behavior during or immediately following experimental flow increases. Further monitoring is needed to determine if nutrient impacts (H_3) will cause cumulative changes over time. We found that flow velocities at or below the highest ones created in the DPM flowpath exceed the maximum flows in which juveniles of some species can maintain their position. Electrofishing large fishes yielded greater CPUE from transects in the canal-fill area compared to marsh transects, indicating habitat quality for large fishes in the DPM footprint has not been negatively impacted. The high vascular plant density in the partial fill area has created high-quality fish habitat for the first year post-fill.
H_2 was evaluated through use of radio-tracking of two fish species, largemouth bass and bowfin, tagged in DPM. We tracked their movement activities before and after canal modification and removal of the levee (L67C) separating the Pocket and WCA 3B. We found that members of both species moved from the L67C into WCA 3B through the degraded area during 2013 and 2014, with 11 of 80 tagged individuals (13.8%) moving into WCA 3B through the degraded levee in DPM or a section of degraded levee ~8 km to the north. Six of these fish (7.5%) did so during the experimental flow periods. No fish were recorded moving through the northern degraded levee prior to 2013. Drift fences were used to determine the impacts of levee removal and canal fill on directional movement. Activity patterns were largely unchanged during the flow event, though the structure of the small fish communities in the Pocket and WCA 3B became more similar after levee removal, suggesting dispersal across the two previously separate regions.

Finally, we experimentally tested the hypothesis (H_3) that increased water flow would lead to increased nutrient loading to biofilms and change algal species composition, with implications for consumers that cascade up the food web. In October 2014, before the DPM flow experiment was begun, and again in November during an elevated flow event, we placed cages containing selected consumers (grass shrimp, sailfin mollies, and eastern mosquitofish) in the DPM flowpath with baffles to accelerate or block water flow. Samples from this study are currently being analyzed.

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FIRE AND FLOOD: RESPONSE OF ORGANIC MATTER TO EXTREME EVENTS IN THE DPM FOOTPRINT

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Dissolved organic matter (DOM) quality and quantity varies over seasonal and diurnal timescales, affected by light, temperature, and seasonal changes in hydrology. Less well understood is how it responds to extreme events such as fire and flood. DOM quantity and quality in the Everglades play an important role in mercury methylation and drive ecosystem metabolism, so it is important to understand how fire and flood—proposed management tools—will impact these characteristics. As part of the Decompartmentalization Physical Model (DPM) experiment, DOM samples were collected between 2011 and 2014 at nine sites between the L67A and L67C canals (the area commonly referred to as "the Pocket," within the L67A, and downstream of the L67C. Samples were obtained monthly during the wet season (roughly July through March) and analyzed for dissolved organic carbon (DOC) concentrations and specific UV absorbance (SUVA). The sampling period included a fire in July 2011 and a managed flow release in November 2013.

Fire had the largest impact on DOM quantity, producing the highest DOC concentrations observed at most sites, outside the range of seasonal variability and with impacts lasting for about one year. Seasonal variability during the post-fire water years was characterized by relatively high DOC values in winter, typically peaking between December and March, with a secondary peak during the rewetting period, July-August. The relative magnitude of the two peaks was spatially variable, related to periphyton coverage and extent of inundation. The flood did not elevate DOC concentrations beyond the range of seasonal variability at most sites, but it did shift the winter peak earlier in time, and, perhaps more importantly, substantially reduced the across-study-area variability in DOC.

Unlike DOC, SUVA did not exhibit consistent seasonality, but all sites exhibited a local minimum in SUVA immediately after the fire in July 2011, followed but a local maximum the next month. SUVA declined but remained high for the remainder of the 2011-2012 water year. Immediately following the flow release, SUVA increased at most sites, and, like DOC concentrations, achieved its lowest spatial variability. The increase in SUVA was comparable to that after the fire, and, for some sites, outside the range of seasonal variability. Notably, though, for the sites both immediately upstream and downstream of the L67C, the November flow release was on the tail end of a much broader peak that appeared triggered by the breaching of that levee, which occurred months before the culverts in the L67A levee were opened.

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TRANSPORT OF PHOSPHORUS WITH SUSPENDED SEDIMENT DURING EXPERIMENTAL RESTORATION OF EVERGLADES HIGH FLOWS

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The mobility of phosphorus associated with suspended particulates presents a challenge to the restoration of the Everglades due to the potential for downstream contamination. The operation of the Decompartmentalization Physical Model (DPM) in fall 2013 and 2014 to establish historic-level high flows in an impounded area of the Everglades provided the opportunity to examine how phosphorus transport could be affected by restoration. We measured changes in suspended sediment concentration (SSC), suspended particle size distributions, and total phosphorus and organic phosphorus fractions that were transported during experimental flow releases in the late fall of November 2013 and 2014, a time when total phosphorus concentrations in the water column are generally lowest. Water flow velocity measurements and water-column sample collection methods to determine suspended sediment concentration are described in a companion abstract by Swartz and others. The average size of suspended particles was determined from water sample splits by running multiple aliquots of each sample through a LISST-Portable particle size analyzer as soon as possible after sample collection to avoid the effect of flocculation. Additional samples of epiphyton and floc were also analyzed for particle size. The size of suspended particles also was measured in situ in the water column continuously for several days prior and following the high-flow release using two laser diffraction particle size analyzers (LISST-100X and LISST-FLOC). Volumetric based measurements of particle size were converted to mass-based values using laboratory settling column data for Everglades particulates. Water column samples and epiphyton and floc particles were stored out of light and on ice and returned to the laboratory for analysis of total nitrogen (TN), total phosphorus (TP), dry weight of water-column particles, loss on ignition of all particle samples (LOI), and digestion and analysis of $NaHCO_3$ extractable P from all particle samples.

Comparison of pre-flow release and high-flow data indicated an increase in suspended sediment concentrations during high flow for which the median diameter of suspended particles in the water column decreased from approximately 150 to 50 µm. Total phosphorus increased from approximately 4 µg/L during the pre-flow period to 9 µg/L at high flow, reflecting greater concentration of P in finer particles. When combined with higher flow speeds and greater depths of water during high flows, the transported P load was elevated for days. Notably, enhanced phosphorus transport was spatially limited due to gradual attenuation of water flow velocity and flow depths with distance from the gated culverts, and also as a result of filtration of suspended particles on stems of aquatic and emergent vegetation.

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DROPLET DIGITAL PCR (DDPCR): A NEW APPROACH TO ENVIRONMENTAL DNA (EDNA) DETECTION OF RARE AND CRYPTIC SPECIES

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Environmental DNA (eDNA) is a powerful tool used to inform conservation and management of rare and cryptic invasive and imperiled species. Environmental DNA uses water samples to detect and quantify single-species DNA molecules shed into the environment. Further, eDNA can provide improved occurrence and detection probabilities for difficult to detect species. A new technology, droplet digital PCR (ddPCR), provides an opportunity to enhance eDNA detection through reduced inhibition, improved efficiency, and greater precision. To test the viability of ddPCR for eDNA experimentation and compare to previous methodology, we evaluated previously developed assays using traditional and quantitative PCR (qPCR) methods. Grass Carp (*Ctenopharyngodon idella*) were assessed using laboratory experiments and field trials in artificial ponds. Both ddPCR and qPCR produced a minimum detection threshold for Grass Carp at a DNA concentration of 10^{-3} ng/µL, resulting in 1.68 (0.00-3.00) copies of eDNA for the ddPCR and a mean cycle number of 36.14 for qPCR. In five ponds, with and without fish, ddPCR found a mean of 6.59 (0.00-26.25) DNA copies in two inhabited ponds and no detection in three uninhabited ponds. Our results indicate that ddPCR is a viable eDNA alternative to qPCR and conventional PCR. Droplet digital PCR allows for reliable absolute quantification based on Poisson distribution rather than having to estimate concentrations from a standard curve calculation that can be subjective when defining the threshold cycle. Work will continue in optimizing previously developed qPCR assays for the novel ddPCR platform. The assays include the manatee genus (*Trichechus)* and five species of invasive giant constrictors, including Burmese pythons.

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EVALUATION OF THE POSSIBLE SOURCES AND CONTROLLING FACTORS OF TOXIC METALS IN THE FLORIDA EVERGLADES AND THEIR POTENTIAL RISK OF EXPOSURE

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The Florida Everglades is an environmentally sensitive wetland ecosystem with a number of threatened and endangered fauna species susceptible to the deterioration of water quality. Several potential toxic metal sources exist in the Everglades, including farming, atmospheric deposition, and human activities in urban areas, causing the concern of potential metal exposure risks in this system. Although mercury has been identified as an important environmental stressor in the Everglades, little is known about the pollution status of other toxic metals of potential concern to this ecosystem. In this study, 8 toxic metals/metalloids (Cd, Cr, Pb, Ni, Cu, Zn, As, Hg) in Everglades soils were investigated in both dry and wet seasons. By using SQG (sediment quality guideline)-method, Pb, Cr, As, Cu, Cd and Ni were identified to be above Florida TEC (threshold effect concentration) at a number of sampling sites, particularly for Pb, which had a similar level of potential risk to organisms as Hg. In addition, a new method was developed for source identification and controlling factor elucidation of toxic metals by introducing an enrichment factor (EF) in the statistical analysis. The method includes two components: 1) identification of the possible sources of toxic metals by the distribution of their EFs, 2) estimation of the relative importance of anthropogenic loads and environmental parameters by including EFs index in multiple regression analysis. The distributions of metal EFs were observed to be consistent with the locations of possible anthropogenic sources for these toxic metals in the Everglades, indicating that the distribution of EFs could be used as an indicator of anthropogenic sources. Multiple regression analysis showed that Cr, Ni, Cu and Pb were mainly related to anthropogenic discharge in the Everglades, while soil characteristics (especially pH and organic matter) were more important compared to anthropogenic discharge for the spatial distribution of As, Cd, Zn, and Hg.

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DIET AND SELECTIVITY OF THE PURPLE SWAMPHEN IN SOUTH FLORIDA

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The goals of our project are to compare the diet of the Purple Swamphen (*Porphyrio porphyrio*) across three different areas of South Florida and investigate whether swamphens are selecting particular types of food. We analyzed the carcasses of 91 swamphens collected by The Florida Fish and Wildlife Commission from Stormwater Treatment Area 1W (STA1W), Water Conservation Area 2B (WCA2B), and Lake Okeechobee. We measured morphological characteristics of each bird and sorted and identified the contents of its proventriculus and gizzard. In addition, we quantified the vegetation community in WCA2B so that we could calculate diet selectivity. We found that the swamphens differed in size among the study sites with the larger birds originating from STA1W compared to the other two sites. The primary food item of the swamphen at all three sites was Gulf Coast spikerush (*Eleocharis cellulosa*), comprising 79%, 72%, and 49% mean dry weight for WCA2B, Lake Okeechobee, and STA1W, respectively. Accounting for food availability, swamphens were strongly selective for spikerush. Like many invasive species, swamphens are considered to have an opportunistic diet. However, the birds in South Florida heavily selected for spikerush. High selectively is not likely to limit the expansion of swamphens, because of the plant's prevalence throughout Florida and the southeastern U.S. Potential impacts to native species would likely depend on the degree to which they are dependent on spikerush and the amount that spikerush is reduced by swamphens.

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ECOSYSTEM RESTORATION AND MANAGEMENT IN BISCAYNE NATIONAL PARK

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Biscayne National Park faces uphill challenges in managing the Park's 172,000 acres. The watershed for the Park consists of the most developed urban area in Florida. This extensive development and large population has resulted in issues related to water quality, water quantity, fishery sustainability, exotic species, and resources damage. The data provided by science and monitoring have been used by management to work with local governments, state agencies, and federal partners to develop policies, rules, and procedures addressing these issues. We have used extensive science to partner on developing nutrient criteria, reservation of freshwater for the Bay, policies and restoration of areas experiencing destruction due to boat grounding, and fisheries management. Results from this flow of science and monitoring data have resulted in establishment of numeric nutrient criteria, water reservations, National Park Service seagrass grounding policy, and a robust fishery management plan for the Park. Science and monitoring are critical components of successful ecosystem and Park management.

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SPATIAL PATTERNS OF PHOSPHORUS ENRICHMENT IN NORTHERN SHARK RIVER SLOUGH

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Half a century of extensive, planned alterations of the hydrology and landuse patterns upstream of Everglades National Park have impacted the park's ecology. Eutrophication of the marsh has resulted from point discharges of nutrient-rich surface water. In Shark River Slough, total phosphorus (TP) concentration and loading varies with the quality and quantity of surface water discharges from the S12s structures, multiple culverts, and a 1-mile bridge along the L29 Canal. Historically, the discharges have greatly fluctuated depending on the particular water management plan implemented. Starting with the Central and Southern Florida Project (1948), inflows into Shark River Slough were severely curtailed and shifted from east to west. Numerous water delivery plans followed: from the Minimum Water Delivery Plan (1979—1983), to various plans in the 1990s and 2000s, to the current Everglades Restoration Transition Plan (ERTP). In the future, the ERTP plan will be replaced by those of the Modified Water Deliveries and the Central Everglades Planning Projects. However, before the latter two projects come on line, the existing conditions of the marsh must be evaluated to allow eventual assessment of the ecological benefits of the projects.

The ecological changes resulting from hydrologic alteration, including TP eutrophication, are often recorded and preserved in wetland soils. The soil properties reflect the accumulated response to environmental changes occurring over mid-to-long term time scales. These ecological changes can be quantified by evaluating the soil's biogechemical properties with depth or along nutrient gradient fronts. Soil studies in Shark River Slough provide a very informative but incomplete record of soil eutrophication. Some are large-scale studies, others are regional, and a few are site-specific projects. The large-sale studies confirm a general north-to-south nutrient gradient, with higher soil phosphorus levels south of Lake Okeechobee than in the Water Conservations Areas and the park. The regional studies reveal a heterogenic edaphic system, where ecoregions with characteristic TP levels commingle. The site-specific studies show that soil phosphorus contamination is not a concern for most areas in the park, except near inflow points. Importantly, two field experiments investigated the ecological response to low-level TP dosing of the marsh. These experiments document a dynamic response to phosphorus dosing with effects detected first in microbial communities, followed by sediments, macrophytes, and consumers. Notably, the changes occurred without detectable changes in water column TP.

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EFFECTS OF THE EXOTIC APPLE SNAIL (*POMACEA MACULATA*) ON SNAIL KITE BEHAVIOR AND DEMOGRAPHY

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The snail kite (*Rostrhamus sociabilis*) is a medium-sized raptor and an extreme dietary specialist of freshwater apple snails of the genus *Pomacea*. The endangered U.S. population of snail kites (*R. s. plumbeus*), which is confined to a network of freshwater wetlands in peninsular Florida, historically subsisted on a diet composed almost exclusively of the Florida apple snail (*P. paludosa*), the only species of this genus native North America. Over the last decade, a highly successful invasive exotic apple snail (*P. maculata*) spread rapidly among many Florida wetlands and is now commonly consumed by snail kites. Several studies have highlighted the negative effects of the larger-sized exotic snail on kite foraging behavior and success, but none have quantified kite demographic responses. Moreover, *P. maculata* and *P. paludosa* differ in several key aspects of life history, and because of these differences, exotic snail populations can alter not only prey size distributions but also prey densities and spatiotemporal patterns in prey availability, potentially having differential impacts to different kite vital rates. Understanding how such complex changes to the prey landscape influence snail kite population dynamics is critical to conservation and management.

Using data from a long-term snail kite monitoring program, we assessed spatial and temporal variation in a suite of parameters (including rates of movement, survival, and several aspects of breeding biology) with respect to the invasion history of the exotic snail. We found strong associations between the distribution of the exotic snail and several aspects of snail kite behavior and demography, and these patterns suggest that exotic snail populations provide a trophic subsidy to the kite population. The kite breeding distribution (as measured by interannual movement rates and by relative nest abundances) closely tracked the spread of exotic snail populations among wetlands throughout the kite's range, including the first documented nesting in the Stormwater Treatment Areas. The number of young fledged per successful nest and juvenile apparent survival were both positively correlated with exotic snail presence. In addition, the ratio of breeding to non-breeding kites and the maximum number of co-occurring nests increased sharply following colonization, which suggests that the presence of exotic snails may influence wetland-specific carrying capacities. Temporal dynamics of kite breeding were also affected. Average breeding season length increased by a factor of ≈2 in wetlands colonized by the exotic snail, and in these colonized wetlands, within-season patterns of nesting activity suggest increased incidence of double brooding or re-nesting following nest failure. Our demographic analyses refute the previous hypothesis (which was based on foraging observations and energetic analyses) that juveniles hatched in wetlands colonized by the exotic snail would experience lower survival rates. To the contrary, analysis of capture-mark-resight data indicates increased juvenile apparent survival in colonized wetlands, and matrix population modeling indicates that wetlands colonized by the exotic snail have helped to increase snail kite population growth rate. Despite the positive associations between exotic snail presence and many snail kite vital rates, there are many uncertainties regarding both short- and long-term effects of the exotic snail invasion that may present future challenges to snail kite conservation and Everglades restoration.

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PROTECTING CULTURAL RESOURCES ON A RESTORATION PROJECT AND ADJACENT PUBLIC LANDS

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The Picayune Strand Restoration Project (PSRP) is an extensive and complex ecosystem restoration project. In the late 1960's Gulf American Corporation began constructing what they called the "world's largest subdivision". Their "Golden Gate Estates" was intended to provide homes for close to a half million people. By the 1980's only the northern portion of the area had been significantly populated. By the mid 1980's plans to purchase the "Southern Golden Gates Estates" as conservation lands were being implemented, as such the lands became part of the Picayune State Forest. Restoration of the Southern Golden Gates Estates was one of the components of the Comprehensive Everglades Restoration Plan. The goal for this restoration was to restore the natural hydrology consisting of sheet flow to the Ten Thousand Islands. The plan included removal of over 200 miles of roads, plug 42 miles of canals to maintain flood protection and establish the sheet flow pattern pump stations and distribution systems were also components of the plan.

By 2004 with the issuance of the Southern Golden Gates Estates Ecosystem Restoration EIS (now PSRP) 13 prehistoric sites had been recorded in the project area. These sites were all recorded as part of incidental surveys conducted to document sites reported by Forest managers. Through the planning process a number of cultural resource surveys were conducted for both the Jacksonville Corps of Engineers and the South Florida Water Management District. Seven of the surveys were feature specific surveys. These surveys resulted in the identification of 70 prehistoric sites within the area of potential effects of the restoration project, monitoring during construction has resulted in the identification of an additional 16 prehistoric sites. In all total less than 7% of the area potentially affected by the restoration project.

The effects to cultural resources can be more than those caused by direct construction impacts. Impacts from construction are straight forward and easy to understand. Road removal even though some disturbance occurred during the original 1960/70's construction can result in additional impacts. The most difficult impacts to explain are the potential adverse effects from inundation. The argument has been "we are restoring to the original condition". However, the restoration is at a landscape level and the potential impacts are on a small location specific level. Additionally, impacts to archeological materials are determined by a change from the existing condition.

This paper presents the results of archeological investigations, and the issues and resolutions associated with protecting cultural resources during the large scale Picayune Strand Restoration Project.

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MACROINVERTEBRATES OF WETLANDS, CANALS, AND STREAMS IN SW FLORIDA: A RAPID FIELD ASSESSMENT AND MULTIVARIATE APPROACH FOR COMMUNITY ANALYSIS AND IDENTIFYING INDICATOR TAXA.

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Monitoring change in ecological systems, particularly in response to restoration efforts is a critical issue. Ecologists and land managers strive for the most effective and efficient way to document degradation or recovery. Between 2002 and 2013 macroinvertebrate communities of wetlands, canals, and stream habitats of southwest Florida were collected using standardized techniques with D-frame dip nets from all major habitats for a period of one hour, which was found to approximate the asymptote of the species accumulation curve. Samples were field sorted using a white sorting tray, forceps, and an eyedropper and preserved in 80% ethanol and returned for laboratory identification to the lowest practical taxonomic level using taxonomic keys for Florida and a 10x-60x stereo-zoom microscope. For most organisms we confirmed identification to genus or species and entered into to Excel and PRIMERv6 for univariate diversity metrics and multivariate analysis based on Bray-Curtis similarity, using hierarchical cluster analysis, SIMPROF, MDS, SIMPER, ANOSIM tools in PRIMERv6. We evaluated communities at canals and streams at Babcock Ranch in Charlotte and Lee Counties, the tributaries of Estero Bay in Lee County, and wetlands and canals of Picayune Strand, Fakahatchee Strand, and Florida Panther NWR in Collier County, FL. Macroinvertebrate communities from impacted wetlands were significantly different than reference wetlands based on random permutation tests in SIMPROF and ANOSIM. Reference sites showed high Bray-Curtis similarity and grouped tightly in the cluster analyses and MDS ordinations while impacted sites (wetlands and streams) showed high dissimilarity to reference sites and low similarity to other impacted sites. Restored wetlands exhibited macroinvertebrate community structure that were more similar to reference sites with trajectories in MDS ordination space indicating recovery of wetland functions. SIMPER analysis was used to identify species contributions to dissimilarity between groups and to identify indicator taxa for hydrologic restoration projects at both Picayune Strand and Babcock Ranch. Macroinvertebrate communities were found to respond very quickly to hydrologic restoration activities and therefore serve as performance measures of wetland restoration success. Macroinvertebrate communities were found to be significantly different between natural streams and canals in Lee and Charlotte Counties which was attributed to differences in habitat structure, water quality, and topography. Range extensions for several aquatic insects were documented from the aquatic faunal surveys between 2002 and 2013 at Babcock Ranch, Picayune Strand, Fakahatchee Strand and Florida Panther NWR. In the Estero Bay tributaries assessments, macroinvertebrate communities were associated with water quality and habitat structure. In the canals of Picayune Strand, macroinvertebrates were very similar to those found in borrow pit ponds with good water quality and significantly different from those collected from the various wetland habitats in adjacent lands. The use of rapid field assessment methods together with lab identification and multivariate analysis are proposed as a cost-effective approach for biological monitoring of aquatic habitats, identification of indicator taxa, and documenting changes in community structure over time in response to disturbance, water quality and restoration activities. Together these studies are believed to have implications for the development of wetland restoration performance measures and bio-criteria for canals and streams of the western Everglades ecoregion.

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TAPE GRASS, *VALLISNERIA AMERICANA* RESTORATION IN SW FLORIDA USING EXCLOSURE CAGES TO REDUCE HERBIVORY AND PROMOTE SEED PRODUCTION

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Water quality degradation, algae blooms, drought conditions, water management practices, invasive species, and excessive herbivory have all contributed to the decimation of native submerged aquatic vegetation (SAV) coverage in aquatic ecosystems. For example, over two thousand acres of the freshwater tape grass (or eel grass), *Vallisneria americana* in the C-43 and upper Caloosahatchee Estuary have been lost since 2001. Tape grass is considered as a valued ecosystem component (VEC) for Everglades Restoration but has been nearly eliminated from many freshwater ecosystems from north Florida springs to the Caloosahatchee River and Lake Trafford. SAV recovery is hindered in many areas by excessive herbivory. Herbivores include turtles, manatees, waterfowl, grass carp, crayfish and other invertebrates including the invasive non-native apple snail, *Pomacea maculata* (syn. *insularum*). Herbivore exclosure cage designs have been tested in the Caloosahatchee River since 2002 with mixed results. Other researchers have also used herbivore exclosures to protect *V. americana* plantings in the Crystal River, Florida and in the Chesapeake Bay. Several exclosure cage designs were tested for protecting planted *V. americana* from herbivores in the Caloosahatchee River. Low profile cages (30 cm) were used to successfully establish plots of tape grass but flower production was not possible due to grazing on female flowers and shoots that grew through the top mesh of exclosures. In 2011 *V. americana* was replanted upstream of structure S-79 in order to establish a potential seed source for future populations in the upper estuary. Higher profile cages (1.0 m high) constructed of PVC and plastic mesh and anchored with bricks and rebar were deployed to allow for vertical growth and seed production. Flowering and seed pod production was successful in both small (1m^2) and large exclosures (2m x 6m) cages Wave action from C-43 boat traffic caused damage that required routine maintenance that became cost prohibitive. Vandalism and manatees occasionally contributed to large cage damage. The non-native apple snail, *P. maculata w*as discovered grazing inside both cage designs and had negative effects on growth and seed production. The snails entered through the 1.2 cm mesh as juveniles and then grew to adulthood and produced egg masses on interior of the PVC frames. Removal of the non-native snails and eggs became necessary. Exclosure cages were successfully used for establishing a seed source of *V. americana* for the Caloosahatchee Estuary, and at Lake Trafford where 73± acres of *V. americana* were established by 2013 from a small planting effort in 2008. Beginning in March 2015 we began replanting *V. americana* at the same locations in the Caloosahatchee River protected by a much sturdier Grow-SAV™ exclosure to withstand boat wakes and manatees. This three-year project also includes quantifying fish and invertebrate communities inside and outside exclosures, assessment of seed production and biomass, genetic analyses to monitor spread downstream, and maintenance to remove non-native snails and epiphytes as needed. A much larger scale *V. americana* restoration project for the tidal Caloosahatchee River is currently under consideration for RESTORE Act and NFWF Gulf of Mexico Benefit Funding.

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ASSESSMENT OF SMALL MAMMAL DEMOGRAPHICS AND COMMUNITIES IN THE GREATER EVERGLADES ECOSYSTEM

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The decline of mammal populations in Everglades National Park (ENP) over the last 20 years is likely to influence the ecology of the Greater Everglades (GE) ecosystem. Published and unpublished accounts suggest that populations of mammals including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opposums (*Didelphis virginiana*), round-tailed muskrat (*Neofiber alleni*), Everglades mink (*Neovison vison evergladensis*), and bobcat (*Lynx rufus*) have declined in ENP. There is mounting evidence that predation by the non-native, invasive Burmese python (*Python molurus bivittatus*) has contributed to these population declines in the GE. A recent study (by KMH and RAM) in the GE found that pythons were the dominant predator (77%) of released rabbits in ENP. Using marsh rabbits (*Sylvilagus palustris*) as a model, the probability of finding marsh rabbits decreased to near 0% with increased proximity to one site, Flamingo at ENP. This area is considered to be “ground zero” for python invasion from unwanted pet releases in the mid-1980’s. However, marsh rabbit occurrence was near 100% in all wetland habitat types >120km from Flamingo.

To understand why and how mammals in the GE are declining it is critical to understand the underlying dynamics that drive these populations and how community structure responds to changes within the environment. Rodents make up a large portion of the diet of pythons in the GEE, but unlike other many larger mammals in the system they still appear to be prevalent throughout the GE landscape. Nonetheless, it is likely that the survival and reproduction of mammals are drastically affected by pythons and that small mammal communities will respond to the increased sensitivity of each species to python predation.

Our current study uses live-trapping to capture and mark small mammals on tree islands near Rock Reef Pass and Chekika at ENP. Results from August and December 2014 show both spatial and temporal variability in species abundance caught between ENP sites as well as species composition throughout the tree islands. Environmental factors such as season and water levels as well as species specific ecology will be taken into account when analyses are finalized. Sampling will be ongoing throughout 2015.

Future analyses will include comparing species composition and abundance to data from Dr. Mike Gaines at the University of Miami who trapped on these same tree islands near Rock Reef Pass in the 1990s, prior to the python expansion. We will also examine capture data along a broader spatial gradient to include additional trapping being conducted this year at the Arthur R. Marshall Loxahatchee National Wildlife, Refuge where pythons have not yet been detected.

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BISCAYNE BAY COASTAL WETLANDS RESTORATION BENEFITS

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The purpose of the Biscayne Bay Coastal Wetlands (BBCW) project is to contribute to the restoration of Biscayne Bay and adjacent coastal wetlands as part of a comprehensive plan for restoring the south Florida ecosystem. The project intends to redistribute freshwater from existing point source canal discharges to coastal wetlands adjacent to Biscayne Bay providing more natural and historic overland flow to remnant tidal creeks. The project will improve the ecological function of saltwater wetlands and the nearshore bay environment by improving salinity concentrations for fish and shellfish nursery habitat.

BBCW Phase 1 is composed of three components: Deering Estate, Cutler Wetlands and L-31E Flow Way. In advance of congressional authorization, the South Florida Water Management District (SFWMD) constructed the Deering Estate Flow Way and installed culverts for the L31E Flow Way. By expediting the completion of these project features hydrologic environmental improvements and project benefits are already being realized.

Water quality and ecological monitoring is currently tracking project performance and being utilized for adaptive management purposes. Monitoring results have indicated initial success in ecosystem restoration. Enhanced freshwater delivery and hydrologic connectivity through implementation of the Biscayne Bay Coastal Wetland Project has resulted in significant improvement in the integrity and health of the coastal wetland ecosystem.

This presentation will focus on recent restoration benefits in the Biscayne Bay Coastal Wetland Project.

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WATER LEVEL FLUCTUATIONS INFLUENCE WADING BIRD PREY AVAILABILITY AND NESTING IN A MANAGED LAKE ECOSYSTEM

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The restoration of wetlands in south Florida is largely based on the premise that hydrologic patterns, fish populations, and wading bird nesting are tightly linked. Quantifying the response of the wading bird prey community to different environmental conditions will improve our understanding of how wading birds will be affected by hydrologic regimes as well as how long-term habitat conditions may regulate reproduction and nesting patterns. Our study was conducted Jan-Jun from 2011 – 2013 at Lake Okeechobee, a highly managed, eutrophic lake located in central south Florida. Our goal was to determine the effects of varying levels of wading bird prey availability in the lake's littoral zone on wading bird nesting. We quantified the prey community using length and weight measurements from 40,676 aquatic animals captured in throw-traps throughout each season. Maximum pooled nest effort for the Great Blue Heron (*Ardea herodias*), Great Egret (*Ardea alba*), Snowy Egret (*Egretta thula*), and White Ibis (*Eudocimus albus*), was 4,236 nests in 2011, 2,029 nests in 2012, and 6,919 nests in 2013. Correspondingly, mean prey density was 165 ± 168 prey/m^2 in 2011, 87 ± 55 prey/m^2 in 2012, and 104 ± 61 prey/m^2 in 2013. A habitat suitability model (HSM) previously developed for the littoral zone of Lake Okeechobee, based on water levels and vegetation, was used to predict annual estimates of foraging habitat available to wading birds. The percent of foraging habitat that became available to wading birds was 33.54%, 36.34%, and 77.23% in 2011, 2012, and 2013, respectively.

We constructed a generalized linear mixed model to quantify the relationship between wading bird fledging rate, prey density, and foraging habitat availability around each active colony in the lake. Annual fledging rate was calculated for each species present within the colony. Prey density was calculated as the mean density of fish, crayfish, and shrimp pooled, from throw-trap sites within a 10-km buffer of each colony. We treated 'colony' as a random variable in the analysis because we were interested in general patterns for colonies within Lake Okeechobee.

Terms for prey density, foraging habitat availability and their interaction were significant (Prey: $F_{1, 13}$ = 14.45, P = 0.0022; HSM: $F_{1, 13}$ = 9.54, P = 0.0086; Prey*HSM: $F_{1, 13}$ = 5.16, P = 0.0407). The interaction was positive, indicating that predicted fledging rate increased with increasing prey density and foraging habitat. However, fledging rate increased more rapidly with increases in prey density when foraging habitat availability was low than when availability was high. The interaction plot suggests a key tipping point in prey density at 125 prey/m^2. In 2011, 4 of the 6 colonies we monitored had prey densities over 125 prey/m^2, whereas in 2012 and 2013 no colonies had prey densities that high. Thus, our data suggests that in 2011 fledging rate was driven by high prey density whereas in 2012 and 2013 fledging rate was driven by habitat availability.

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INTERIM RESPONSE OF WADING BIRDS (PELECANIFORMES AND CICONIIFORMES) AND WATERFOWL (ANSERIFORMES) TO THE KISSIMMEE RIVER RESTORATION PROJECT, FLORIDA, USA

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Success of the Kissimmee River Restoration Project will be evaluated in part by monitoring response of populations of wading birds (Pelecaniformes and Ciconiiformes) and waterfowl (Anseriformes) to hydrologic and subsequent habitat restoration. These two waterbird guilds were integral components of the pre-channelization river-floodplain ecosystem, and both declined substantially following channelization. Restoration is expected to attract wading birds and waterfowl by reintroducing naturally fluctuating water levels, seasonal hydroperiods, and historic vegetation communities. Post-construction aerial surveys (Nov 2001-May 2008) within the Phase I restoration area indicate that the abundance and species richness of both wading birds and waterfowl have shown a positive restoration response thus far. Since completion of restoration Phases I, IVa, and IVb in 2001, 2007, and 2009, respectively, the dry season abundance of aquatic wading birds and waterfowl (evaluated as a three-year running average) has exceeded restoration expectations (≥30.6 birds/km² and ≥3.9 birds/km², respectively) except during 2007-2009 and 2009-2011 for wading birds, and 2007-2009 for waterfowl. While there has been a significant positive restoration effect on waterfowl abundance, waterfowl species richness (*n*=6) has not yet reached the restoration expectation of ≥13 species. Abundance of the terrestrial cattle egret (*Bubulcus ibis*), which increased dramatically after the majority of floodplain wetlands were converted to cattle pastures in the channelized system, has shown a significant negative response to restoration. It is anticipated that completion of the remaining phases of restoration (II/III), and implementation of the Kissimmee River Headwaters Revitalization water regulation schedule by 2018, will further increase and improve habitat for wading birds and waterfowl by reestablishing floodplain hydrology that more closely mimics historical conditions.

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MODELING RESTORATION OUTCOMES FOR THE EVERGLADES RIDGE-SLOUGH LANDSCAPE

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The Everglades in 1870 was dominantly comprised of a ridge and slough wetland landscape named for the striking pattern of arranged linearly between topographically higher and more densely vegetated sawgrass ridges. The well-connected deep-water sloughs supported high aquatic productivity and maintained pathways for animal dispersal. The surrounding sawgrass ridges provided edges for feeding and nursery habitats that helped support a diverse assemblage of fish and wildlife. The topographic variation of the ridge and slough landscape also slows the period of winter water-level dry down that concentrates prey in sloughs during a crucial stage of nesting for wading birds. Over the last century much of the ridge and slough landscape has been lost or degraded, either as a result of wetland conversion to agricultural, industrial and residential uses, or as a result of unintended side effects of water management to control floods and conserve water. Over-drainage decreased water levels and slowed the flow, which permitted peat oxidation and prevented natural processes of sediment redistribution from sloughs to ridges. Microtopographic variation that is essential to co-existence of deep-water sloughs between ridges has substantially decreased. At present only 18% of the ridge and slough landscape from 1870 remains in a high-functioning state.

Our study objective was to use hydrologic modeling and ecological analysis to predict restoration outcomes in the Everglades ridge and slough landscape. For each scenario we evaluated six metrics of ridge and slough landscape functionality in five sub-basins of the Everglades including northern WCA 3A, central WCA 3A, southern WCA 3A, WCA 3B, and ENP. We developed ridge-slough functionality ratings in all sub-basins for each of the five restoration scenarios. This was accomplished by combining hydrologic model outcomes with topographic and ecological data to quantify metrics and compare them with reference values representing a "well-functioning" landscape. Modeling results from the South Florida Water Management Model (SFWMM) were used to simulate present-day hydrology and four possible restoration scenarios. We developed rating criteria for ridge-slough landscape metrics based on historic information about Everglades landscape patterns, microtopography, water levels, and hydroperiods. These comparisons guided the selection of ranges for each metric that reflected loss of functional values and potential for restoration. We found that target water levels needed to support a functioning ridge-slough landscape in central and southern WCA 3A and ENP can be achieved by all of the restoration options that we examined. In contrast, none of the options improved water levels and hydroperiods enough to restore a functional ridge-slough landscape in northern WCA-3A or WCA 3B. Selecting between options is affected by costs and benefits of increased water storage and flow. The most important reason to expand water storage may be the added flexibility that increased flow provides in adaptively managing water levels to face challenges such as drier conditions in the central Everglades that are likely to be caused by increased temperatures and evapotranspiration during the coming decades.

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NUTRIENTS AS POTENTIAL SOURCE TO SUSTAIN A PERSISTENT BLOOM OF *ANADYOMENE* J.V. LAMOUROUX (ANADYOMENACEAE, CHLOROPHYTA) IN BISCAYNE BAY, FLORIDA

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Green macroalgal blooms are becoming a common problem in coastal waters and estuaries. A persistent macroalgal bloom of the genus *Anadyomene* J.V. Lamouroux (Cladophorales, Anadyomenaceae) in Biscayne Bay, Florida, USA was detected and studied since 2002. Here we present the taxonomic identification and nutrient interactions in order to understand the species and the potential sources that support its blooming persistence.

The morphological-based identification of species was verified by a molecular analysis that sequenced the variable C1D2 region of the large subunit (LSU) nrDNA. Results indicate that the bloom is composed of two species: *Anadyomene stellata*, reported previously for Florida, and a diminutive perforate undetermined species, *Anadyomene* sp. potentially representing an introduction in the area.

Water samples show that sucralose, an anthropogenic indicator, was detected in all samples with a recovery above 66%, meaning that there is a clear signature of anthropogenic discharge to the bay. Sucralose values and TN and NH_4 were higher in the Coral Gables canal area compared with other sites. The tissue nutrient content of macroalgae and seagrass show high availability of P and N. Values for N and ∂15N are in general high, with interesting very high values of ∂15N in Coral Gables and Deering Estate indicating that these sites are receiving large amounts of potential anthropogenic origin nutrients.

Spatial variability might be explained by the different sources and water mix in the bay, so far highest values of nutrients and sucralose were detected at the Coral Gables Canal, and Deering Estate area, which correspond with the highest abundance of the bloom. We conclude that nutrient availability might come from different anthropogenic sources demonstrated by the presence of sucralose in all samples, such as canals, sheath and underground water providing enough nutrients, and corroborated by the tissue values found in the algae and seagrasses sustaining this particular persistent bloom. We suggest that an annual monitoring should be kept in place as well as the search of anthropogenic sources particularly at Deering Estate and Coral Gables canal.

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MATHEMATICAL ANALYSIS OF THE INFLUENCE OF NATURALLY OCCURRING VS. ANTHROPOGENIC EVENTS ON WATER QUALITY IN FLORIDA BAY

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Environmental research on Florida Bay, Everglades National Park, has focused on the degradation of coastal water quality and environmental change that has occurred since permanent human occupation in the late 1800s. The relative extent of perturbations to the Everglades ecosystem by human activities (e.g., beginning of agriculture, canal construction) versus natural events (e.g., hurricanes, droughts) has been debated. This study compares the timing of perturbations in the Florida Bay record of the preserved microbiota and physical conditions to known human and natural events over the past 120 years to infer their relative strengths.

Six sediment cores were collected from four areas of Florida Bay near the mainland (1 site), the central bay (2 sites) and near the Gulf of Mexico (1 site). Ages for the sediments were determined with ^{210}Pb, and the sediments were analyzed for proxy variables of water quality and other environmental properties. For each variable, the number of sediment samples and the cores sampled ranged from <100 to >300. We adapted a procedure from signal processing, or impulse-response functions, to track the responses of the variables to the impulses of the time-dependent shocks or occurrences of disruptive events, both anthropogenic and natural. We identified where larger breaks and smaller perturbations occurred in time within the dated sediment cores.

The physical variables did not produce definitive responses but the foraminiferal and diatom assemblages did. We used the biotic variables alone to identify six times of major breaks and perturbations (taxonomic turnovers) that correspond in timing to the following historically recorded events: 1) 1906-1910 construction of the Flagler Railroad; 2) 1926-1935 hurricanes; 3) 1954-1959 strongly negative phases of the El Niño/Southern Oscillation and Pacific Decadal Oscillation, and associated extensive drought events; 4) 1977-1980 negative Atlantic Multidecadal Oscillation and ENSO, strong drought and institution of a Monthly Allocation Plan for controlling water release; 5) 1987-1994 seagrass die-off that began with hot, still conditions; and 6) 1997-1999 seagrass recovery and increased water flow.

Most of the six taxonomic turnovers were associated with naturally occurring rather than anthropogenic events.We examined in detail the first event, construction of a railroad connecting the Florida Keys and mainland, to test predicted causes with ecologically meaningful taxa. The data generally indicate a decrease in salinity; results are equivocal for a nutrient change due to decreased Atlantic inflow; and the prediction of increased retention of organic matter from decreased circulation is rejected. In general, our analyses identify microbiotas as the most successful approach to identifying past times of environmental change and their potential causes.

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CARBON FLUX VARIABILITY IN THE EVERGLADES USING HYDROGEOPHYSICAL METHODS

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Peatlands are well recognized carbon reservoirs that account for about 33% of the global soil carbon pool, however the spatial and temporal variability in accumulation and release of greenhouse gases (mainly methane and carbon dioxide) to the atmosphere from peat soils remains very uncertain. The use of near-surface geophysical methods such as ground penetrating radar (GPR) or electrical resistivity imaging (ERI) has proven useful during the last decade to better understand the spatial and temporal distribution of in situ biogenic gas within the peat matrix that goes beyond traditional methods (i.e., gas chambers). The approach however has focused exclusively on boreal peatlands, while no studies in subtropical systems like the Everglades using these techniques have been reported.

In this paper GPR is combined with gas traps, time-lapse cameras, gas chromatography, and surface deformation measurements to explore biogenic gas dynamics (mainly gas buildup and release) in two locations in the Everglades. Several gas releasing events reaching maximum values that exceeded 700 mg CH_4 m^{-2} d^{-1} were detected as corresponded by decreasing gas contents from the GPR and surface deformation measurements and increases in gas entrapment, and were correlated to periods of high atmospheric pressure. Furthermore, average flux events measured at hourly scales were up to threefold larger when compared to daily fluxes, therefore questioning what the appropriate spatial and temporal scale of measurement is necessary to properly capture the dynamics of biogenic gas release in subtropical peat soils.

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ORGANIC CARBON BURIAL RATES IN AN AREA TRANSITIONING FROM SAWGRASS MARSH TO MANGROVE ADJACENT TO THE HARNEY RIVER IN EVERGLADES NATIONAL PARK

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Wetlands provide a range of valuable ecosystem services including sequestering large quantities of organic carbon in their soils. Mangrove and freshwater marsh soils within the coastal region of Everglades National Park form through the accumulation of organic matter. As sea level rises, some freshwater marsh systems could be replaced by mangrove systems. This process will lead to a change in the type of organic matter accumulating in the soil, as well as the biogeochemical processes involved in the degradation of organic matter. We hypothesize that these changes will influence the rate of carbon burial within the system. To examine this hypothesis we selected a site ~10 km upstream from the Gulf of Mexico along the Harney River where the encroachment of mangroves into a freshwater sawgrass marsh has been observed over the last 70 years. Six cores were collected in a transect spanning the mangrove to marsh transition area. We use ^{210}Pb dating and measurements of soil organic carbon to estimate burial over the last 100 years in the fringe mangrove and sawgrass marsh systems. Preliminary results suggest the mangrove forest buries organic carbon at a rate greater than sawgrass marsh.

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AUTOMATED ONLINE ECOLOGICAL MODELING AND EVALUATION FOR EVERGLADES MANAGEMENT AND RESTORATION

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An automated ecological decision support system has been developed for real-time data acquisition, model simulation, display of spatiotemporal model results, and generation of summary evaluation graphics and reports. The pilot tool implementation integrates a module for wading bird population evaluation that serves the immediate needs of resource management in the Everglades. The web-based tool is designed with flexibility that encourages its use as a standard framework for future addition of evaluation modules for other species. The framework acquires and preprocesses monitoring data from multiple external sources to perform weekly ecological model simulations and evaluations. Modeling products, data, and related information delivery occurs online via dynamic web pages that offer users the ability to view and compare past generated maps, as well as access the underlying numeric data, along with explanatory text about the model evaluation method and the generated maps. Each web page will be constructed in a way that allows the inclusion of its content on multiple web sites, facilitating wider availability and ease of access across the user community.

Wading birds are a high priority indicator with a well-established and analyzed dataset that is linked tightly to surface-water hydrology. Surface-water hydrologic data are readily available online from the Everglades Depth Estimation Network (EDEN) as daily real-time, interpolated water-level gaging station data for the entire freshwater portion of the Greater Everglades from 1991 to present (2014) and is updated and available online daily. Synthesis of model evaluations of spatial trends for wading birds and other indicators of ecological health in easily accessible and understandable formats increases the likelihood it will be included in water-management operations and other decision-making, thus completing the monitoring-management-action feedback loop. The weekly wading bird reports provide valuable information for multi-agency meetings to evaluate water operations in the Everglades and contribute to the adaptive management goals of the Comprehensive Everglades Restoration Plan. The technology to accomplish this decision support tool should be of interest to other monitoring programs across the country where there is interest in making data and analysis results available more quickly via the web. The results should be of use to planners, modelers, operations managers, researchers, park interpretive staff, and all stakeholders interested in the effectiveness of the Everglades Restoration.

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DEVELOPMENT OF A CO ASTAL DROUGHT INDEX USING SALINITY DATA

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The location of the freshwater-saltwater interface in surface-water bodies is an important factor in the ecological and socio-economic dynamics of coastal communities. It influences community composition in freshwater and saltwater ecosystems, determines fisheries spawning habitat, and controls freshwater availability for municipal and industrial water intakes. These dynamics may be affected by coastal drought through changes in Vibrio bacteria impacts on shellfish harvesting and occurrence of wound infection, fish kills, harmful algal blooms, hypoxia, and beach closures.

Many definitions of drought exist, with most describing a decline in precipitation having negative impacts on water supply and agriculture. Four general types of drought are currently recognized: hydrological, agricultural, meteorological, and socio-economic. Indices have been developed for these drought types incorporating data such as rainfall, streamflow, soil moisture, groundwater levels, and snow pack. However, these drought indices were developed for upland areas and may not be appropriate indices for characterizing drought in coastal areas. Because of the uniqueness of drought impacts on coastal ecosystems, a need exists to develop a coastal drought index (CDI). The availability of many real-time and historical salinity datasets provides an opportunity to develop a salinity-based coastal drought index.

The challenge of characterizing salinity dynamics in response to drought is excluding responses attributable to occasional saltwater intrusion events. Various statistical and numerical techniques were applied to evaluate the most appropriate approach to develop salinity drought indices. An approach similar to the Standardized Precipitation Index was modified and applied to salinity data obtained from sites in South Carolina, Georgia, and Florida, USA. Coastal drought indices characterizing 1-, 3-, 6-, 9-, and 12-month drought conditions were developed. Evaluation of the CDI indicates that it can be used for different estuary types (for example, brackish, olioghaline, or mesohaline estuaries), for regional comparison between estuaries, and as an index for wet conditions (high freshwater inflow) in addition to drought conditions. The development of the various drought characteristic intervals (1, 3, 6, 9, and 12-month) allow for the CDI to be correlated with environmental response variables that occur on different time intervals. The CDI computed for Florida Bay shows a strong visual correlation with the occurrence of harmful algal blooms along the coast. The presentation will describe the development of the CDI and its application to sites along the Gulf of Mexico and Florida Bay.

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REAL-TIME EVALUATION OF HYDROLOGIC PERFORMANCE MEASURES SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT (CEPP) RESTORATION SUCCESS

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Fundamental objectives of the Central Everglades Planning Project (CEPP) include increasing quantity, improving quality, and returning rain-driven timing and distribution of flows to the St. Lucie and Caloosahatchee River estuaries, the central Everglades and eastern parts of Everglades National Park (ENP), and Florida Bay. Hydrologic performance measures evaluate incremental progress towards achieving the CEPP restoration goals or indicate potential obstacles that would require an adjustment. Adaptive management will refine CEPP implementation by monitoring designated areas, evaluating results, and making adjustments to the restoration implementation, if needed. Hydrologic performance measures for CEPP have been established for four specific areas of the Everglades; northern Water Conservation Area 3A (WCA), southern WCA3B, northeast Shark River Slough (SRS) in ENP, and coastal Florida Bay.

Real-time evaluation of hydrologic performance measures of CEPP restoration changes is proposed, and includes: (1) measurement of flow direction in WCA3A; (2) evaluation of hydroperiod in WCA3A and SRS; and (3) salinity targets in northeast Florida Bay. One CEPP performance measure is to return the historic north-to-south flow direction in WCA3A. For the marshes of the WCA3A, flow direction maps based on surface-water gradients from the daily EDEN water-level surfaces can be generated to show flow direction. Hydrologic change can be evaluated against the CEPP performance measure for north-to-south flow direction when compared to current west-to-east flow direction data. The second CEPP performance measure is to reduce the number of dry days when the water level is below land surface in northern WCA3A and SRS. Change in hydroperiod in WCA3A and SRS can be computed annually, or averaged over several years from EDEN daily water-level surfaces and compared to the CEPP pre-implementation period. Another performance measure for CEPP is salinity in Florida Bay. To evaluate salinity in Florida Bay, a curve defining maximum target salinity as a function of flow and/or water level can be generated from historic data. Real-time salinity data can be graphed to determine if salinity changes are expected as a result of CEPP implementation. These and other approaches show how applications of EDEN real-time data can be used to quickly assess hydrologic performance measures and evaluate the effectiveness of the CEPP implementation in reaching its restoration goals.

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EVERVIEW *LITE*: THE NEXT GENERATION OF MODELING VISUALIZATION FROM THE JOINT ECOSYSTEM MODELING COMMUNITY

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Natural resource managers have repeatedly expressed the challenges of interacting with complex model outputs and their need to view, manipulate, and assess ecological modeling data on their desktop computers. For the past five years as the EverView user-base has expanded, so has its functionality. User-interaction with the EverVIEW development team has identified a need for a lightweight, web-based interface to view and interact with their Network Common Data Form (netCDF) datasets. In an effort to address this need, we have developed the next generation of ecological model viewer: EverVIEW *lite*.

This new web application will implement some key functions users are already familiar with in EverVIEW, such as the ability to spatially and temporally inspect and interact with modeling outputs individually or in a side-by-side comparison view. The first version of the software will support identify point objects provided through user “click” events and polygon identify objects through reference GIS layers. These identify objects combined with time stepping controls will allow the user to drill into the cell-based modeling output values and also perform on-the-fly summarizations and plotting of time series data. EverVIEW lite will also expose the user to several common reference GIS data layers such as water management units or restoration project boundaries which help bring management context to their visualizations along with tools allowing scenario comparisons and print outputs.

Unlike desktop EverVIEW where the user is the primary provider of data, EverVIEW *lite* will be paired with a USGS effort to expose a modeling data library. The library will be built upon an open source Thematic Real-Time Environmental Distributed Data Services (THREDDS) platform and will expose data through standards compliant protocols including Open-source Project for a Network Data Access Protocol (OPeNDAP) and Network Common Web Mapping Services (ncWMS). Users of EverVIEW *lite* will have access to numerous scenarios of popular models outputs pre-configured for consumption. The modeling data library will also allow a user to login and upload their own standards-compliant modeling outputs to be visualized with EverVIEW *lite* and shared with other users.

Through this new platform we hope to further advance one of the earliest Joint Ecosystem Modeling principles: “get data into the hands of users to help inform their decision process”.

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ECOSYSTEM SERVICE SUSTAINABILITY ACROSS AN URBANIZATION GRADIENT IN COASTAL SOUTH FLORIDA

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One of the challenges facing scientists today is synthesizing results from a multitude of disparate studies to develop cohesive and synthetic understanding of how coastal ecosystems are structured, how they function, and how these in turn impact the sustainability of ecosystem services. The sustainability of coastal ecosystem services is predicated on the continued production and resilience of the ecosystem components responsible for producing services derived by coastal ecosystems while being simultaneously impacted by natural and anthropogenic sources of perturbation and change. Here we use integrated conceptual ecosystem models developed as part of the Marine and Estuarine Goal-Setting for South Florida (MARES) project in conjunction with expert opinion and matrix-based analyses to quantify the relative impact of near and far-field pressures on ecosystem states and ecosystem services in coastal south Florida. We present results from a relatively pristine (with respect to urbanization) region of coastal south Florida and preliminary results from adjacent suburban and urban coastal regions in southwest and southeast Florida. Within the relatively pristine central study region the greatest relative threats were adequate freshwater delivery to coastal estuaries and climate change related impacts to temperature and weather. The most at-risk ecosystem states were protected species, fish and shellfish, and coral and hardbottom; the most at-risk ecosystem services were existence of a natural system, pristine wilderness experience, and non-extractive recreation. When comparing the relative magnitude of near- and far-field pressures, far-field pressures (e.g. climate change) had greater impacts on the provisioning of ecosystem services than local pressures (e.g. recreational fishing). This finding underscores a primary challenge associated with the successful management of coastal ecosystems, namely, how can local management strategies mitigate and address regional and global-scale stressors who origin is outside of defined resource management domains?

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MOVEMENT AND HABITAT USE OF AQUATIC FAUNA IN RELATION TO SEASONAL HYDROLOGIC VARIATION: IMPLICATIONS FOR WADING BIRD PREY AVAILABILITY

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An important goal of current restoration efforts is to determine the factors that contribute to the formation of high-quality foraging habitat for wading birds. This has been formalized in the Trophic Hypothesis conceptual model, which identifies key linkages among hydrologic conditions, aquatic faunal prey availability, and wading bird foraging and reproduction. An important knowledge gap is how fish become concentrated at high densities and available to birds during dry-season water recessions. Understanding this requires a detailed examination of fish movements and distributions across habitats in response to hydrologic variation at fine spatiotemporal scales.

Here, we use a novel combination of field enclosures and passive integrated transponder (PIT) systems within the Loxahatchee Impoundment Landscape Assessment (LILA) experimental complex to track detailed fish behaviors in an experimental context. In six large in situ enclosures (12 m x 4 m) we continuously tracked the movement and habitat use of PIT-tagged centrachids across three habitats of varying depth and complexity using multiple flatbed antennas during the dry seasons (January to July) of 2014 and 2015. The approach allows us to examine fine-scale responses by prey fish in real-time to natural and experimental variation in water levels, covering the transition from high to low and back to high water. Specifically, we ask how are patterns of fish movement and distribution across Everglades marsh habitats influenced by 1) seasonal variation in hydrology (dry season water-level recession), 2) manipulated variation in hydrology (mid dry-season water-level reversal), and 3) the presence of predators (avian and aquatic), competitors and non-native species.

Preliminary results show that fish distributions are strongly responsive to changes in water depth, and these responses are nonlinear, and habitat- and species-specific. We observed rapid threshold-dependent shifts in fish distribution in response to both water recession and rewetting, whether natural or induced experimentally. Use of habitats that dry (i.e., the ridge and slough) was highest when these habitats first flooded, suggesting that recently-flooded habitats may be most profitable to fish. Fish immediately shifted to using these habitats upon first reflooding, resulting in a loss in previous fish concentration from the deeper habitat. Overall, these results suggest that alterations to natural hydrological patterns might affect fish distribution rapidly, resulting in loses in prey concentration in deeper habitats and a redistribution of fish to shallower habitats, affecting prey availability for wading bird foraging.

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INCORPORATING UNCERTAINTY OF GROUNDWATER MODELING IN SEA-LEVEL RISE ASSESSMENT: A CASE STUDY IN SOUTH FLORIDA

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Researchers can assist in effective decision making by reducing uncertainty in marine and groundwater inundation due to Sea-level Rise (SLR). A majority of studies considered marine inundation, and only recently, groundwater inundation is being incorporated into the SLR mapping. However, the effect of including uncertainty in groundwater modeling is still not well understood. In this study, we evaluated the effect of considering groundwater modeling uncertainty in assessing land area vulnerable to marine and groundwater inundation in South Florida. Six Water Table Elevation Model (WTEM) techniques (Multiple Linear Regression (MLR), Geographic Weighted Regression (GWR), Global Polynomial Interpolation (GPI), Inverse Distance Weighted (IDW), Ordinary Kriging (OK), and Empirical Bayesian Kriging (EBK)) were tested to identify the best approach. Simple inundation models excluding uncertainty with and without WTEM were examined. Refined inundation models using Monte Carlo simulation that include uncertainty in future SLR estimates, LiDAR elevation, vertical datums and the transformations made between them with and without WTEM uncertainty were evaluated. GPI and EBK were recognized as the best for producing WTEMs in two primary physiographic regions (the Southern Slope and Atlantic Coastal Ridge). Excluding uncertainty without WTEM underestimated total land area by 14%, while including uncertainty without WTEM overestimated total vulnerable land area by 16% at the 95% probability threshold. It is significant to include WTEM uncertainty in SLR vulnerability analysis for more effective adaptation decisions.

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QUANTIFYING HABITAT AND APPLE SNAIL DENSITY EFFECTS ON PREY AVAILABILITY TO SNAIL KITES

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The endangered snail kite (*Rostrhamus sociabilis plumbeus*) is a dietary specialist which feeds exclusively on freshwater snails; historically kites foraged only for native Florida apple snails (*Pomacea paludosa*), but increasingly they forage on exotic snails (*P. maculata*). Snails become vulnerable to kites when the snails surface to breathe air, or are otherwise near the surface. Although snail density has been associated with particular aspects of kite ecology, little data exist on the proportion of snails available, and no studies have quantified how environmental factors and snail density influence the proportion of snails available from a foraging kite's perspective. We will present quantitative data (collected in 2014 and 2015) on snail availability to foraging snail kites under targeted environmental conditions in the Everglades.

Data on snail surfacing behavior were generated from visual counts of live apple snails in mesocosms placed within Everglades wetland habitats typical of those targeted by foraging kites. Mesocosms were placed in different locations to capture gradients of water depth and plant community type. Water temperature and dissolved oxygen, factors known to influence snail surfacing behavior, were recorded in each mesocosm. The proportion of snails at or near the water surface (to a depth of 16cm) was recorded for 30 minutes. In another series of observations, we recorded snail detectability as the time it takes an elevated human searcher to detect surfaced snails. Empty apple snail shells were placed at randomly generated coordinates and depths within a search plot and the observer recorded the time until detection of the first snail shell. Snail depth, snail density, dominant emergent vegetation type, and vegetation stem density were independent variables.

Preliminary data collected in 2014 show that time until first detection is positively correlated with emergent stem density, negatively correlated with snail density, and significantly different between emergent vegetation species. Shell placement depth (0-16 cm) was eliminated as a factor influencing detection time. Data will be added in 2015 to complete analyses of seasonal/temperature effects on snail surfacing behavior and to increase the sample size.

These data contribute to our understanding of basic predator-prey relationships for a dietary specialist dependent on Florida wetlands. Our observations can be incorporated into on-going modelling efforts for kites and snails being used for evaluating alternative Everglades restoration plans. A simulation model, Everkite, is being used to project kite population responses under varying hydrologic conditions; a similar model, Eversnail, is under development for apple snails. These two models are thus far independent, but they could eventually be linked once appropriate information gaps are filled. The most relevant metric to link these two models together is snail availability.

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LITTERFALL AND TREE GROWTH DYNAMICS IN A PRISTINE TREE ISLAND AND A DEGRADED TREE ISLAND IN WCA-3A: THE IMPORTANCE OF ECOLOGICAL FUNCTIONS ON TREE ISLANDS

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In wetland forests, leaf tissue and tree biomass production are a major source of nutrients. Therefore, production of litterfall to the soil surface, especially in a low nutrient system like the Everglades, may be critical to tree island sustainability. Additionally, litterfall and tree growth dynamics will help us understand temporal and spatial patterns of aboveground primary production, the effects of hydroperiod fluctuations on primary production, peat accumulation rates, and nutrient cycling dynamics. This study compares forest structure, growth rate, species contribution to leaf fall, and litterfall between a pristine (3AS3) and a degraded (3AS17-6) tree island. It is hypothesized that long-term soil saturation and poor soil nutrient conditions have a negative effect on the structure and function of tree islands.

At Tree Island 3AS3, average litterfall ranged from 0.56 to 4.4 g m^{-2} day^{-1} on the head, from 4.5 to 0.94 g m^{-2} day^{-1} on the wet head, and from 0.63 to 2.4 g m^{-2} day^{-1} on the near tail. At Tree Island 3AS17-6, average litterfall ranged from 0.52 to 4.0 g m^{-2} day^{-1} on the head and from 0.34 to 2.8 g m^{-2} day^{-1} on the wet head. Litterfall pattern showed a strong seasonality on the head with high litterfall production occurring at the onset of the wet season (July-August) and the lowest during the onset of the dry season (December-February).

On both 3AS3 and 3AS17-6 tree islands *S. caroliniana* individuals growing on the head had higher growth rates (mean 0.014 and 0.025 mm day^{-1}, respectively) than *A. glabra* tree individuals (mean 0.007 and 0.006 mm day^{-1}, respectively). Similarly, growth rates on the head were highly seasonal with the highest growth rates of *S. caroliniana* occurring during the dry months (March–May) while the highest growth rates of *A. glabra* occurring at the beginning of the rainy season (June–July).
Results suggest that hydropatterns and soil properties played an important role in determining forest structure and species composition, which in turn may be driving both tree growth and litterfall spatial patterns observed on those tree islands. Poor nutrients conditions associated with low soil TP, high water depth and long periods of inundation can led to low litterfall values and low growth rates on the degraded tree island. In contrast, rich nutrient conditions and short period of inundation may play an important role in determining the high litterfall values and relatively high tree growth rates on pristine tree islands.

Comparing environmental conditions on pristine and degraded tree islands emphasized the importance of soil fertility and more natural wet and dry cycles. Current hydrological conditions of high water level, low water flow, and impounded conditions will not restore the structure and function of degraded tree islands. The preservation of the plant community dynamics on tree islands, including the natural shifts in species composition, forest structure and function (i.e., litterfall production, tree growth, nutrient cycling) is directly dependent on the existence of a mosaic of hydrological conditions, which requires water management policies that promote natural wet and dry cycles through the Everglades ecosystem.

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ENVIRONMENTAL AND ECONOMIC BENEFITS OF A WATER QUALITY TRADING PROGRAM IN A NORTHERN LAKE OKEECHOBEE BASIN

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Lake Okeechobee is the largest lake in the southeastern United States and is a central hydraulic component of the Everglades ecosystem in South Florida. Excessive phosphorus loading from agricultural and urban activities have been identified as the leading cause of the lake's impairment. Reducing phosphorus loading in the watershed is necessary to restore and enhance the lake's ecosystem services. However, this generally involves the implementation of phosphorus loading control programs requiring economic resources and investments. Water quality trading programs have emerged over the past decades as a mechanism to cost-effectively achieve water quality objectives in impaired watersheds. The main objective of this research was to assess the environmental and economic benefits of implementing a water quality trading program in a basin of Lake Okeechobee watershed (S191 basin), as compared to a command-and-control approach, while achieving a specific phosphorus reduction goal.

A comprehensive methodology coupling a hydrologic and water quality model to an economic model was developed, to estimate the Total Phosphorus (TP) loading generated at the farm level, reaching the streams, and attenuated to the basin outlet from all sources within the basin. Once the TP loading were assessed, the optimal combination of Best Management Practices (BMPs) was determined while minimizing the cost of attaining a TP reduction target. Moreover, a complete trading scenario was developed in order to 1) determine the optimal credit price, 2) identify potential buyers and sellers of credits, 3) estimate the amount and cost of credits to be traded while considering features, such as trading ratios and transactions fees, and 4) estimate the potential cost savings of a phosphorus credit trading program. The cost savings of the trading program was quantified considering two phosphorus abatement scenarios: a command-and-control approach and a least-cost abatement approach.

The hydrologic and water quality modeling yield TP loading of 106.4, 91, and 85 mtons yr^{-1} at the farm level, reaching the streams, and attenuated to the basin outlet, respectively. Almost 95% of the TP loading reaching the nearby streams were attributed to agriculture sources, and only 1.2% originated from urban areas. A 30% load reduction was estimated as the most cost-effective TP target for the two abatement scenarios, and the individual allocation was set at a TP load target of 1.6 kg ha^{-1} yr^{-1} (at the nearby stream level). The least-cost abatement scenario generated a potential cost savings of 27% ($1.3 million per year), based on an optimal credit price of $179. Dairies, ornamentals, row crops, and sod farms were identified as potential credit buyers, whereas improved pastures, citrus, and urban areas were identified as potential credit sellers. The methodology developed in this study has been also applied to other areas of the Northern Lake Okeechobee watershed.

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ANALYSIS OF SEA LEVEL RISE AND CLIMATE CHANGE SCENARIOS FOR FLORIDA BAY USING THE FATHOM MODEL

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The coastal ecosystems in South Florida are among the most vulnerable areas of the United States to the effects of climate change and accelerating sea level rise. In Florida Bay within Everglades National Park (ENP), the most obvious direct effects of sea level rise (SLR) will be higher water levels and the potential for increased mixing with the Gulf and Florida Straits leading to lowered residence times and increased salinity within the Bay. Effects of climate change (CC) will likely include increased air and water temperatures leading to higher evaporation and the potential for hyper-saline conditions in some locations, while altered precipitation and runoff regimes may exacerbate or mitigate the salinity changes in other locations. The possibility of even higher salinities and temperatures in waters where high salinity and temperatures already pose a stress on organisms presents a severe threat to the Bay.

The FATHOM model was used to analyze the effects of several scenarios of SLR and CC on salinities and residence times across Florida Bay and in the adjacent near-shore embayments of ENP. SLR scenarios included increases of mean annual sea surface elevation of 1 and 2 feet. For each sea level increase the potential effects of accretion of shoals and/or in-fill of basins within the Bay were examined. For the 2 foot SLR, an additional scenario was run to include inundation of wetlands along the NE boundary the Bay. CC scenarios included variations in precipitation (+/- 20%), evaporation (+15%), freshwater runoff (+/- 20%) and boundary salinity (+/- 5%).

For SLR, changes in Bay-wide average salinity varied from +4% to +14% across the scenarios, with the largest change noted for a 2 foot SLR with no accretion or infill and inundation of upstream wetlands. Spatially, the largest salinity changes were in the North and Northeast regions. In general, SLR reduced residence times throughout most of the Bay. The Bay-wide average residence times declined by 30% to 70% across all scenarios. SLR affected residence times not only by lowering the average values but also by compressing the annual range (i.e. lower variance) with larger reductions in peak residence times than in minimum residence times.

For CC scenarios, decreases in Bay-wide average salinity (-4% to -7%) were seen for increased precipitation and runoff and decreased boundary salinity. Increased average salinity (+5% to +8%) occurred for all other CC scenarios. Similar to the SLR scenarios, the greatest changes were seen for the North and Northeast regions. CC scenarios did not affect residence times very strongly, producing +2% to -6% changes in the Bay-wide average residence times.

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RECENT ADVANCES IN BIOLOGICAL CONTROL OF BRAZILIAN PEPPERTREE, *SCHINUS TEREBINTHIFOLIA*

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Brazilian peppertree, *Schinus terebinthifolia* Raddi (Anacardiaceae), is an invasive, rapidly colonizing woody shrub of disturbed habitats, natural communities and conservation areas predominantly in central and south Florida, particularly the Everglades. The state of Florida spends millions of dollars annually controlling large infestations of Brazilian peppertree on public lands primarily by burning, physical extraction and herbicides. Biological control with host specific natural enemies is a more environmentally sustainable management tactic because no native relatives of the genus *Schinus* (the taxonomic group to which Brazilian peppertree belongs) occur in the US, and this control method can be integrated with conventional control practices. One of the objectives of our research program is to examine the host specificity/ impact of candidate biological control agents on Brazilian peppertree. We are currently studying several potential biological control agents: a stem boring weevil *Apocnemidophorus pipitzi* (Faust) (Coleoptera: Curculionidae) from Paraguay, and three species of leaflet galling psyllids of the genus *Calophya* Löw (Hemiptera: Calophyidae) from Brazil.

Adults of the weevil *A. pipitzi* are defoliators and feed mainly on the upper surface of subterminal leaflets. Females deposit eggs singly inside the stems and larvae feed under the bark where they damage the vascular cambium. There are five instars, pupation also occurs inside the stem, and a new generation is produced in 3-4 months. Host specificity tests were conducted with 77 plant species in 39 families and 7 orders. The results of multiple choice tests showed that *A. pipitzi* can reproduce only on Brazilian peppertree and the congeneric Hardee peppertree, *Schinus polygamus* (Cav.) Cabrera, which is invasive in California. A petition to release this insect in Florida for classical biological control of Brazilian peppertree was submitted in October 2012.

Calophya latiforceps Burckhardt lays its eggs along leaflet margins and veins, and nymphs complete their development in open pit galls in ~ 40 days. The developing psyllids damage plants by reducing leaflet performance and survival, which inhibits plant growth. Laboratory host range studies showed *C. latiforceps* was only able to reproduce on Brazilian peppertree. Eggs laid on non-target plants eclosed, but nymphs rapidly died due to an inability to induce gall formation. Molecular methods and plant exposures were used to assay for the presence of plant pathogenic bacteria and viruses in *C. latiforceps*, and all results were negative. Because of the host specificity of *C. latiforceps*, a petition was prepared requesting approval for its release in Florida. Similar studies are in progress with two congeners of *C. latiforceps*-*Calophya terebinthifolii* Burckhardt & Basset and a newly discovered undescribed *Calophya* sp.

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METHYLMERCURY IN FOOD WEBS IN THE EVERGLADES: TEMPORAL VARIATIONS OVER THE LAST TWO DECADES

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The finding of elevated methylmercury (MeHg) in wildlife in the Florida Everglades about 1990 resulted in concern about the impact of this highly toxic mercury (Hg) species to this ecosystem. Since then, great efforts have been made to identify the source, fate, transport of Hg, as well as the production and transformation of MeHg. The Everglades Regional Environmental Monitoring and Assessment Program (R-EMAP), a comprehensive monitoring and research project led by the United States Environmental Protection Agency, was initiated in 1993 to study the source and biogeochemical cycling of Hg in the Everglades. Up to date, four phases have been completed (1993-1995, 1999, 2005, 2013-2014), involving approximately 1000 marsh sampling sites. In addition to R-EMAP, several agencies have also conducted studies dealing with atmospheric mercury deposition, and Hg concentration in gamefish, wading birds and other large predators. These studies provide timely and critical information needed for a better understanding of the cycling of Hg in the Everglades.

The National Atmospheric Deposition Program's data indicate a decline of Hg concentration in the air over the Everglades by approximately 60% over last two decades. Meanwhile, the data from South Florida Water Management District's database have shown the total Hg concentrations in mosquitofish, sunfish and largemouth bass have dropped significantly in some areas of the Everglades, while a similar trend has not been observed in other areas.

A comprehensive analysis utilizing these databases has not been conducted. The purpose of this study is to examine the temporal trends of Hg contamination in the food web across different trophic levels over recent years, by integrating all these data into a comprehensive dataset and using unified statistical techniques to analyze the data. The data analyses are carried out on mosquitofish, gamefish, wading birds, and alligators to determine the temporal trends of Hg levels in these major biological species representing different trophic levels. The temporal trends of Hg in different species are related to examine the potential relationship between adjacent trophic levels. The biota Hg temporal patterns are then correlated to Hg data in environmental matrices including air, surface water, and periphyton, in order to understand how changes in Hg deposition and environmental conditions affect Hg bioaccumulation.

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EVALUATING SNAIL KITE PREY AVAILABILITY BENCHMARKS IN THE KITE HABITAT NETWORK

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Florida's endangered snail kite (*Rostrhamus sociabilis plumbeus*) occupies a network of over 20 discrete wetland units. Kites forage for apple snails (genus *Pomacea*) that are accessible (flooded wetlands with suitable vegetation) and at a sufficient abundance to support all their dietary needs. Kite distribution shifts annually based on fluctuations in resource availability (e.g. kites move when a wetland dries out). Nearly all reports on 30^{+} years of kite monitoring data equate resource availability with hydrologic metrics (e.g., seasonal water stage, drought indices). However, we have data indicating snail availability correlates poorly with these hydrologic metrics. Although the kite population is monitored range wide, kite food availability has received little attention at the appropriate spatio-temporal scales; this hinders our ability to define what constitutes a sufficient forage base, which, in turn, makes it difficult to quantify habitat suitability metrics in support of kite population recovery. Here we present 1) snail density benchmarks critical to kite foraging and demography, 2) data on snails sampled since 1995 compared to these benchmarks, and 3) analyses of existing field data to identify opportunities to stream-line a snail sampling protocol for potential application to large scale monitoring.

Published data indicate that snail densities $< 0.15/m^2$ support few foraging kites, frequent failed foraging bouts, and no nesting. Conversely, densities $> 1.0/m^2$ support 100% foraging success, high concentrations of kite nests, and ≥ 2 fledglings/nest. Intermediate snail density benchmarks will be presented. We will report snail density estimates from ≈300 sites (some sampled multiple times) from 1995-2014 from 15 wetlands. Snail declines and low densities are consistent with kite abandonment of historically critical wetland units and overall kite population decline. In recent years kites have increasingly consumed exotic snails (*P. maculata*).

We bootstrapped existing field data to look for opportunities to streamline our 1-m^2 throw trap sampling approach to estimating snail density, with emphasis on identifying 'low' ($<0.15/m^2$) vs. 'abundant' ($>1.0/m^2$) prey densities. We found 15 traps sufficient to identify low prey density sites. Power analyses indicated that statistical comparisons of low and abundant sites may be supported by 10-15 traps per site. Comparisons between intermediate snail density sites would require more sampling to achieve Power ≥ 0.8. We also identified ways to reduce sample effort per trap without loss of accuracy, allowing a fixed sampling effort to be spread over a larger area. Egg clusters can also be incorporated into surveys for presence / absence data. Our results could be extended to design large-scale snail surveys and develop habitat suitability indices to monitor kite habitat quality.

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HOW HYDROLOGIC MODELING AND ECOLOGICAL CRITERIA INFORM ENGINEERING DESIGN OF RESTORATION PROJECT FEATURES

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The Central Everglades Planning Project (CEPP) was an expedited planning effort undertaken as part of the overall Comprehensive Everglades Restoration Plan (CERP). The Project Implementation Report (PIR) combined planning and design activities for three primary areas of interest as follows: 1) Storage & water treatment facilities in the Everglades Agricultural Area (EAA), 2) Decompartmentalization of levees within the Everglades Protection Area (EPA) and 3) Levee seepage management features along the Everglades / urban boundary in southeastern Florida. A team of modelers from USACE, SFWMD, and DOI completed the modeling for CEPP. South Florida is a unique environment requiring specialized models to simulate regional operations. South Florida has a complex regional hydrologic system that includes miles of primary and secondary networked canals, nearly 300 man-made flow regulation structures, square miles of flat terrain much of which are wetlands, and permeable surficial soils that enhance groundwater-surface water interactions. Because of the region's highly variable hydrology, it is imperative that models be capable of running regional simulations of decades covering wet, dry and average rainfall condition. The primary application of models in the CEPP was for assessment of regional-level hydrologic planning. CEPP modeling tools were jointly selected based on their collective capability to provide adequate hydrologic information to conduct evaluations of the entire south Florida system.

CEPP modeling used a three-tier approach and centered around use of a decoupled link-node model Regional Simulation Model for Basins (RSM-BN) for the EAA, stormwater treatment areas (STAs) and the northern estuaries, in combination with a detailed meshed Regional Simulation Model for the Glades and Lower East Coast Service Areas (RSM-GL) for the Water Conservation areas (WCAs), Everglades National Park (ENP) and the Lower East Coast. New hydrologic models (Regional Simulation Models, iModel, RESOPS) and modeling approaches were applied to support screening, evaluation, and analysis of water supply and flood control effects. Hydrologic and ecological criteria from modeling output, scientific and engineering reports were used to inform the design (capacity and function) of project features that were then modeled, and will be further incorporated into the detailed design of project features, once the project is authorized. The presentation will focus on this unique modeling strategy, how it can be utilized in future projects and how input from modeling tools and scientific reports can be implemented in the detailed design of project features.

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EFFECTS OF INCREASED SALINITY AND INUNDATION ON WETLAND SOIL CARBON DYNAMICS AT THE EVERGLADES FRESHWATER-SALTWATER ECOTONE

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Peat soils are critical to the Greater Everglades Ecosystem because peat accretion is a large and important carbon (C) reservoir that contributes to landscape pattern and maintains wetland elevation relative to rising sea level. With sea level rising at ~3 mm y^{-1}, coastal freshwater and oligohaline Everglades wetlands are being exposed to increased duration and spatial extent of inundation and salinity from seawater, which can affect soil C balance through soil redox potential, soil respiration, and the intensity of osmotic stress to vegetation. The term "peat collapse" has been used to describe a relatively dramatic shift in soil C balance, leading to a rapid loss of soil elevation, and culminating in a conversion of vegetated freshwater marsh to open water. The process has been documented to varying degrees across the U.S. and contributes to instability of coastal marshes that are important for fisheries habitat, shoreline stabilization, and C sequestration.

In the pre-drainage Everglades, peat collapse has been speculated as contributing to the formation of noteworthy coastal features such as Whitewater Bay. More recently, Wanless and Vlaswinkel, in a 2005 report to Everglades National Park, described significant peat collapse in Cape Sable as a result of sea level rise and the impacts from canals dug in the 1920s that pierced a marl berm barrier protecting interior freshwater marsh from saltwater intrusion and tidal forces. Visible loss of marsh and conversion to open water on Cape Sable was evident in aerial photos taken from as early as 1935, suggesting that significant areas of marsh can collapse over a decade or less. More recently, evidence of freshwater peat collapse has been observed in lower Shark River Slough suggesting that this process is ongoing and may be affected by a reduction in freshwater head, recent storm surges (e.g., Hurricane Wilma), sea level rise, and possibly fire.

In late 2014, we initiated parallel field and mesocosm experiments to investigate potential mechanisms of peat collapse attributed to increased seawater salinity and inundation in freshwater and oligohaline wetland ecosystems of the southern coastal Everglades. Evidence from our previous experiments with mangrove peats showed predicted shifts in soil redox and enhanced C loss from soils exposed to increased salinity. Our present, long-term study will elucidate mechanistic responses of increased seawater salinity and inundation on soil C loss and de-stabilization in freshwater and oligohaline wetlands of the coastal Everglades. Our work addresses one of the key climate change research priorities identified by the CISRERP Committee in its most recent biennial report and will contribute to an improved understanding of freshwater and oligohaline peat vulnerability across the coastal Everglades. Support for this collaborative research comes from Florida Sea Grant, Florida Coastal Everglades Long-Term Ecological Research Program, South Florida Water Management District, Everglades National Park, and the Everglades Foundation.

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EXPECTATIONS FOR CAPE SABLE SEASIDE SPARROW HABITAT SUITABILITY AND SUBPOPULATION VIABILITY WITH MODIFIED WATER DELIVERIES

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The endangered Cape Sable seaside sparrow is an endemic subspecies that now occurs only within Everglades National Park and the adjacent conservation lands. In the early 1990s, the sparrow population declined by approximately 50% as a result of unfavorable hydrologic conditions within a large portion of its range, and since then, the population has not recovered. For years, water managers have worked to limit flows into the sparrow's short-hydroperiod *Muhlenbergia* prairie habitat to maintain conditions that will allow the sparrows to persist. Despite these efforts, sparrows have not thrived, and in fact have declined further in some areas.

For over a decade, the Modified Water Deliveries project has been considered a necessary step to restore sparrow habitat by reducing flows into the area of sparrow subpopulation A and instead returning flows along the historic flowpath of Shark Slough. Modified Water Deliveries will be one of the first projects that has the potential to significantly change the hydropattern in and around sparrow habitat. The habitat suitability is expected to change in two sparrow subpopulations: subpopulation E, which is the second largest remaining, and subpopulation A, which experienced the greatest decline in the past. The project may reduce habitat suitability within portions of subpopulation E, where sparrows regularly occur today, as that area becomes wetter, while improving habitat suitability within portions of subpopulation A where it is expected to become drier.

We have developed habitat suitability indicators that will help evaluate the potential consequences and consider whether the tradeoff in habitat suitability for sparrows among the two areas will be detrimental or beneficial to the viability of each subpopulation and for the overall sparrow population. A water operations plan for Modified Water Deliveries is necessary for accurate determination of future sparrow habitat suitability. However, as the implementation of the project progresses, the indicator tool, will aid in predicting trends, identifying where monitoring may be most effective over time, and where there may be opportunities to manage habitat to improve its future suitability.

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MODELING THE EFFECTS OF SEA LEVEL RISE AND STORM SURGE ON COASTAL EVERGLADES VEGETATION

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Global climate change poses challenges to the low-lying Florida Everglades, where sea level rise (SLR) and storm-surge overwash events will have both acute and long-term effects on vegetation and on soil and groundwater salinities, posing risks of habitat loss critical to native species. An early warning system is urgently needed to understand, predict, and prepare for the consequences of these climate-related impacts on both the short-term dynamics of salinity in the soil and groundwater, and the long-term effects on vegetation. For this purpose, the USGS spatially explicit models of vegetation community dynamics along coastal salinity gradients (MANHAM) is integrated into the USGS groundwater models (SUTRA) to create a coupled hydrology-salinity-vegetation model, MANTRA. In MANTRA, the uptake of water by plant is modeled by a fluid mass sink term. Groundwater salinity, water saturation and vegetation biomass determine the fluid mass available for plant transpiration. The formulations and assumptions used in the coupled model will be presented. The MANTRA model is calibrated with salinity data and vegetation pattern for Rowdy Bend area of Florida Everglades. Possible regime shift at Rowdy Bend is investigated by simulating the vegetation responses to climate variability and disturbances, including SLR and storm surges. It is envisaged that MANTRA will help in projecting the effects of overwash and climate change events on groundwater salinity as well as potential changes in vegetation composition. Further, potential countermeasures and strategies for ecosystem preservation can be further explored via MANTRA simulations. Some ideas for model improvement and application will also be presented.

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EFFECTS OF LIMEROCK AND NON-FARMED MUCK SUBSTRATES ON STORMWATER TREATMENT AREA PERFORMANCE

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Phosphorus (P) removal performance within the Everglades Stormwater Treatment Areas (STA) is related to a number of factors, including the vegetation community type and the inflow phosphorus loading rate (PLR). Additionally, internal P loading from enriched sediments, either via diffusive flux or macrophyte mining, may constrain the minimum achievable outflow TP levels of these treatment wetlands.

This presentation focuses on field-scale STA vegetation communities established on limerock and on non-farmed muck soils, both of which are substrates that appear to minimize internal P loading rates. Spatial gradients in surface water phosphorus and other constituents are evident from surveys conducted along transects between inflow and outflow regions. On muck soils colonized by emergent vegetation (*Typha* spp. and *Cladium jamaicense*), STA 2 Cell 1 exhibits declining P concentrations along the flow path, and an increase in alkaline phosphatase activity (APA, an indicator of biological P-limitation) in the outflow region of the cell. Similarly, a limerock-based treatment cell (Periphyton-based STA, or PSTA Cell) dominated by heavily-epiphytized submerged aquatic vegetation exhibits increases in APA with distance through the cell. Like STA 2 Cell 1, the PSTA Cell surface waters typically continue to decrease in TP concentration to ultra-low levels (often < 10 µg/L) in the outflow regions. The TP concentration reductions observed on both these substrates are a departure from the pattern observed for STAs on previously-farmed muck soils that exhibit higher "minimum achievable" outflow TP concentrations of ~14 - 16 µg/L.

Vegetation and soil differences between the limerock-based PSTA Cell and muck-based STA 2 Cell 1 are pronounced, yet both achieve comparably low outflow TP concentrations. The role of internal P flux, therefore, remains a topic of investigation in these and other STA flow paths.

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DIET AND FORAGING ECOLOGY OF DIAMONDBACK TERRAPINS (*MALACLEMYS TERRAPIN*) IN SOUTH FLORIDA, INCLUDING EVERGLADES NATIONAL PARK

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Coastal species continue to face environmental changes as the density of humans and their impacts on coastlines increase. The diamondback terrapin (*Malaclemys terrapin*) is no exception, with its life history predisposing it to impacts from humans both on land and in the near shore environment. Diamondback terrapins are found in salt marshes and mangroves along the Atlantic and Gulf coasts from Massachusetts to Texas. Unique amongst turtles as the only estuarine species, they face many threats that impact coastal landscapes including habitat loss, climate change, and pollution. These stressors could also potentially affect the distribution and abundance of their prey species; thus it is important to understand their foraging ecology. Whereas previous diet studies have elucidated terrapins' role in temperate salt marsh food webs, food resources for subtropical mangrove terrapins had not been studied.

We examined dietary resource use for diamondback terrapins in subtropical mangrove creek and island habitats in south Florida, including in the southwest coastal Everglades, to determine individual foraging strategies. Fecal analysis revealed seven categories of food items with gastropods, crabs, and bivalves being the most dominant food items respectively. Non-metric multidimensional scaling revealed differences in habitat, but not by terrapin size class. Stable isotope analysis confirmed the findings, identifying habitat and site differences in $\delta^{13}C$ and $\delta^{15}N$ values for both terrapins and their prey. Bi-plots of terrapin and potential prey $\delta^{13}C$ and $\delta^{15}N$ values revealed potential dietary sources previously undetermined by fecal analysis. Comparisons of scute and blood isotope data revealed significant differences in $\delta^{13}C$ indicating potential shifts in either food resources and/or habitat use through the time period recorded in the scute tissue. These tissue comparisons represent a powerful tool for estimating long term foraging strategies for a key estuarine species.

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HYDROLOGIC MONITORING AT S-152 FOR THE DECOMPARTMENTILIZATION PHYSICAL MODEL (DPM) FLOW-RELEASE TEST

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The natural hydrology for much of the Everglades has been altered and surface-water flow patterns have been obstructed by a system of levees and canals. This levee and canal system was constructed to protect nearby urban and agricultural areas from flooding and to store water for municipal and agricultural use. The DECOMP element of the Comprehensive Everglades Restoration Plan (CERP) is intended to reestablish natural flow patterns through the Everglades by decompartmentalization, which is the removal of flow obstructions such as roads, levees, and canals.

The DECOMP Physical Model (DPM) flow-release test was designed to determine the effects of decompartmentalization on the landscape and ecology within Water Conservation Area 3 (WCA 3), a section of the Everglades located north of the Everglades National Park. WCA 3, which is divided into WCA 3-A and WCA 3-B by Levee-67A (L-67A) and Levee-67C (L-67C), was reconnected by installing water control structure S-152 in the L-67A levee, degrading the L-67C levee, and filling in a section of the L-67C canal.

The U.S. Geological Survey (USGS) monitored continuous water levels on either side of S-152 and measured flows through the structure. Techniques and methods used for data collection and computation of continuous discharge record for the first and second flow test periods, occurring in 2013 and 2014, respectively, are presented. Preliminary results demonstrate the ability to develop accurate ratings for the computation of discharge at this location.

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COMMUNITY-RELATED TROPHIC VARIABILITY CONTRIBUTES TO VARIATIONS IN MOSQUITOFISH (*GAMBUSIA HOLBROOKI*) MERCURY CONCENTRATIONS IN WATER CONSERVATION AREA 2A

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External loads of inorganic mercury (as Hg^{2+}) and surface water sulfate are thought to be primary determinants of mercury concentrations in mosquitofish (*Gambusia holbrooki*) in the Everglades. However, mosquitofish total Hg (THg) concentrations are not correlated to surface water THg or methylmercury (MeHg) concentrations, and are only modestly correlated with sulfate concentrations. Further, substantial scatter exists within the relationship between mosquitofish THg and surface water sulfate, particularly at moderate sulfate concentrations. Distinct distribution patterns emerge within these data when they are grouped by vegetation community (cattail vs. sawgrass vs. slough [wet prairie]), suggesting an active ecological mechanism influencing the accumulation of Hg by Everglades mosquitofish.

We identified the taxonomic composition of the food items, and measured stable isotope (^{13}C and ^{15}N) content and THg and MeHg concentrations in the guts and whole bodies of mosquitofish from two locations within Water Conservation Area (WCA)-2A. Site F2 (P-enriched) and site U3 (P-limited) represented low and high, respectively, historical mosquitofish Hg body burdens. As typically observed for these two sites, THg concentrations in the tissues of mosquitofish were higher by 50% to 100% at U3 than F2. Mosquitofish THg concentrations were not correlated to any measured surface or pore water analyte (i.e., dissolved THg or MeHg, sulfate, sulfide, dissolved organic carbon (DOC), and dissolved iron concentrations), except surface water total phosphorus concentration (TP). Based on ^{15}N analysis, we found that mosquitofish from U3 and F2 occupied similar trophic levels (as secondary consumers). Interestingly, gut content taxonomy did not indicate markedly different prey selection between fish from the two sites, yet gut content MeHg concentration was also higher at U3 than F2, indicating greater dietary Hg exposure at U3 relative to F2.We also found that relative enrichments of gut content and mosquitofish tissue ^{13}C were similar to the green algae found at F2, and distinctly different than at U3, which represented more of the blue-green algae found at that location, indicating different C sources supplying the food chain.

We hypothesize that different primary producers (calcareous periphyton at U3 and green algae at F2), contribute differentially to trophic transfers of Hg. This alteration in food web structure may account for some of the variability in the Hg body burdens within high sulfate areas of WCA-2A. Therefore, variation in the MeHg content of mosquitofish diet, which is regulated in part by habitat structure that reflects nutrient conditions (e.g., high green algal total organic carbon (TOC) and TP at F2; low periphyton TOC and TP at U3), may be an important determinant in mosquitofish THg levels not only within WCA-2A, but across the entire Everglades landscape.

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PREDATION BY CRAYFISH FAVORS NATIVE OVER INVASIVE APPLE SNAILS

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Consideration of predator and prey life histories may provide clues to important predator-prey interactions and distributions or abundances of invasive species in Everglades wetlands. The invasive apple snail, *Pomacea maculata* is spreading in freshwaters of Florida and appears to be a strong competitor of native Florida apple snails (*P. paludosa*). We quantified the limits of an expanding local *P. maculata* with egg mass surveys in southern Water Conservation Area 3A (WCA 3A) and experimentally examined the predatory effects of a native crayfish (*Procambarus fallax*) on hatchling survival of both species of apple snails in mesocosm and lab studies. Because crayfish feed size-selectively, the smaller hatchlings of exotic apple snails were predicted to be more vulnerable than the hatchlings of native Florida apple snails.

No comprehensive distribution data on *P. maculata* are available, but the spatial distributions of *P. maculata* egg masses in 2013 and 2014 suggested a slow invasion northward into southern WCA 3A. In the experimental wetland mesocosms crayfish reduced survival of both species, but exotic apple snail hatchlings experienced > 8X greater vulnerability to crayfish than native hatchlings; none of the 2,268 stocked exotic hatchlings survived the 44 d exposure. In the lab crayfish fed selectively on the smaller *P. maculata* hatchlings when both snails were exposed simultaneously. We are currently investigating defensive traits of juvenile snails in the lab. Combining the survival rates with published life history data the results suggest that differential mortality caused by crayfish at the hatchling stage could selectively favor native apple snail assemblages. Whether or not crayfish can ultimately limit the invasive *P. maculata* populations in wetlands, the results suggest that environmental conditions favoring populations of crayfish should also favor assemblages of the relatively predator-resistant *P. paludosa* in the Everglades.

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MEASUREMENT AND MODELING OF AIRBOAT FLOW-CUT HYDRAULICS IN THE A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE

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Hydrologic conditions are central to achieving healthy ecological function and clean water in the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) in the northern Everglades (Florida, USA). The Refuge originally had a largely rainfall driven ecohydrological system with seasonal runoff inflows from the upstream watershed. However, current hydrology is influenced by interaction between a 56,000 ha (138,000 ac) inner marsh and a 92 km (57 mi) rim canal, with 13 discrete inflow/ outflow structures connecting the Refuge to the surrounding area. Surface water moves between the marsh and canal through two very different hydraulic processes: (i) via shallow surface flow through marsh vegetation, which includes a zone of dense emergent wetland plants at the intersection of the marsh and canal, and (ii) via distinct flow paths that cut through the dense rim vegetation and allow preferential water flow between the canal and the interior marsh. The objectives of this study were to determine the most appropriate friction equation parameters to describe hydraulics of flow-path cuts through dense emergent wetland vegetation in a low-gradient northern-Everglades wetland, and apply the results to demonstrate the impacts of airboat trails on interior Refuge marsh hydrology.

Field data were collected at seven locations on four flow-path cuts in the Refuge. Flow velocity at each site was measured using a side-facing acoustic Doppler velocity meter. Data were fit to various forms of the friction equation, including Manning's, which predicts velocity as a function of water depth and water surface slope using an equation with friction (a), water depth (b), and water surface slope (c) parameters. Results were analyzed to determine the most appropriate set of parameters to represent average velocity of airboat cuts with shallow open channels and a canoe trail having a deeper channel and moderately dense submerged aquatic vegetation. Manning's form of the friction equation (b = 1.67, c = 0.5) was inappropriate to simulate shallow, low-gradient flow cuts. The best parameter set, based on consistency of b and c parameters with prior literature and near-optimal performance statistics, was $a = 3.11 \times 10^7$ $m^{0.74}$ d^{-1}, b = 1.26, c = 1.00. Using the same parameters for b and c, the canoe trail was well represented by modifying only the friction parameter: $a = 1.27 \times 10^7$ $m^{0.74}$ d^{-1}.

These results indicate airboat cuts may contribute an order of magnitude (or more) greater flow per unit width than through dense rim vegetation, with major impacts on water exchange between the perimeter canal and Refuge interior marsh. This study may inform simulation of hydraulics through similar flow-cuts throughout the Everglades and other shallow marsh settings.

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DETERMINING HISTORICAL AND RECENT EVERGLADES PEAT QUANTITIES USING GEOSPATIAL TECHNIQUES

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The Florida Everglades is a patterned peatland formed from sawgrass and other aquatic plant remains that have accumulated over thousands of years. The region was drained in the late 1800s for agricultural and urban development and has been altered by the construction of canals and levees. The drainage in particular has caused the loss of much of the peat of the Everglades by peat fires and microbial oxidation.

Plans for Everglades restoration, such as the Central Everglades Planning Project (CEPP), are designed to enable Everglades restoration by providing additional water to flow through the remaining Everglades. A quote from the CEPP Fact Sheet (USACE & SFWMD 2014) indicates that this will be accomplished by: "Increasing storage, treatment and conveyance of water south of Lake Okeechobee; Removing and/or plugging canals and levees within the central Everglades; and Retaining water within Everglades National Park and protect urban and agricultural areas to the east from flooding". Additional water into the Everglades would prevent further peat loss by oxidation and encourage the accretion of peat that has been lost with a result of the sequestration of atmospheric carbon. But how much peat was there originally and how much has been lost? We know that approximately 50% of the original surface area is gone; what about the foundation, the key driver of ecological processes? What has happened to the soil?

The purpose of this study was to determine the volume and mass of peat and the mass of carbon for each of the predrainage landscapes as well as the current Everglades regions. Historical and current surveys within the Everglades were used to create contour maps. With these maps, along with a bedrock contour map of south Florida and soils data from the USEPA, we have estimated the Everglades peat characteristics using Geographic Information Systems technology. This information provides a rough, quantitative examination of the historical Everglades, its current condition, and the changes in the peat soil that have taken place over more than a century. Given the uncertainties in the hindcasting of some of these data sets, this analysis should be viewed as providing rough-order-of-magnitude values. Our calculations indicate that the current Everglades contains less than 24% of the original peat volume, 17% of its mass and 19% of its carbon.

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RESTORING THE PRE-DEVELOPMENT HYDROLOGIC REGIME IN THE PICAYUNE STRAND RESTORATION PROJECT AREA

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The primary strategy for restoring the Picayune hydrologic regime has been to remove all unnaturally elevated topographic material resulting from creation of the Southern Golden Gate Estates in the 1960s to restore a more natural overland flow through the area after the canals are filled. The earth-moving activities involved a seemingly simple process of first removing the vegetation along the roads, logging trams, and canals to expose the unnaturally elevated spoil. Secondly, the unnaturally elevated spoil was degraded and/or placed in canals to match natural elevations that currently exist along the edges of the construction footprints.

When setting up the planning documents, which are the basis for contractor bids, one tries to be as specific as possible to assure that the objectives will be met and also to allow for realistic cost estimates. However, one major complication is first finding the spoil under 40 years of vegetation growth. In some areas, the vegetation can be sparse and the spoil is clearly visible, while in others it can be very difficult to tell how much of a pile is vegetation and how much is spoil, which can significantly affect cost estimates for removing it. Another was the importance of reestablishing natural topographic variability that exists on a scale of inches within and between different Picayune plant communities. Many of these complications occur at local scales, such as natural mounds, bedrock outcrops, wetland depressions, sloughs crossing a construction footprint, or spoil associated with fire-breaks that are not part of the PSRP restoration effort, all of which cannot be easily addressed in the project planning documents.

With implementation of the planning documents, another whole new set of realities come into play that affect our ability to meet project objectives, including: equipment operators' experience and understanding of project objectives, how conscientious subcontractors are, substrate variability such as natural bedrock highs that should not be leveled, staff participation in construction kick-off meetings, weekly construction progress meetings, and regular cruising of the project site to be aware of activities that still need to be done, modified, or stopped.

A crucial aspect of dealing with these complications is the regular and consistent involvement of staff who are knowledgeable about the natural characteristics and processes of the ecosystems being restored, have been involved in development of the project goals and design, and enjoy working in the field in sometimes uncomfortable and remote natural areas.

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HABITAT SUITABILITY FOR AN ENDANGERED BUTTERFLY, BARTRAM'S SCRUB HAIRSTREAK, AND IMPLICATIONS FOR MANAGEMENT

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Bartram's Scrub Hairstreak (BSH), *Strymon acis bartrami*, are found exclusively in the pine rocklands ecosystem in extreme southern Florida and the keys. After decades of development and disturbance, this ecosystem has dwindled to a small fraction of its historic extent. These pine rocklands are severely fragmented and surrounded by development, creating a challenge for resource managers charged with preserving the biodiversity and integrity of these systems. As a result of fire suppression and habitat fragmentation, current populations of BSH are patchily distributed throughout the remaining pine rocklands and have declined drastically. As a result, the butterfly was federally listed as an endangered species in September 2014.

While prescribed fire has now become an essential tool for resource managers, they are increasingly concerned that without sufficient information about BSH's, they could unknowingly be contributing to the extirpation of this species from their lands. Thus, understanding the ecological needs and the distribution of BSH could be critical for the survival of this butterfly.

In this study, we are examining various environmental and ecological characteristics of BSH populations at both the patch and landscape scale to determine what factors may be affecting habitat suitability for all BSH life stages. First, we are investigating the patch-scale factors that may determine the suitability of habitat for BSH populations for all life stages. We are also analyzing remotely sensed data to determine if there are any strong relationships between these landscape scale and patch-scale factors so that habitat suitability can be reliably predicted at the landscape scale. Finally, we are analyzing the relationship between pine rocklands management, both prescribed burning and exotic plant removal, to determine if there is a relationship between pine rocklands management and suitable habitat for BSH. The results of these studies will be used to inform land management decisions and guide restoration efforts toward other suitable habitat patches so that the landscape can be managed to facilitate colonization of BSH populations in other areas.

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HOW MONITORING FOR RESTORATION SUCCESS INFORMS WATER MANAGEMENT AND PROJECT IMPLEMENTATION

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The Central Everglades Planning Project (CEPP) is based on extensive existing scientific knowledge of the Everglades and associated estuaries, understanding of the problems and opportunities, and the evaluation of alternatives and estimation of the potential project restoration performance. The CEPP Adaptive Management (AM) and Monitoring Plan identifies the monitoring information needed to inform CEPP implementation and to document restoration progress and includes an adaptive management plan, hydrometeorological monitoring plan, water quality monitoring plan, and an ecological monitoring plan. The overall objective of the AM and Monitoring Plans are to focus resources on refinement of CEPP to fine-tune performance due to inevitable project uncertainties, based on existing knowledge and knowledge that will be gained through monitoring and assessment.

AM plan monitoring is targeted to address hypotheses about expected CEPP restoration performance in specific areas of the south Florida ecosystem. The monitoring design and analysis will determine if restoration improvements are being made as expected. If performance issues are detected, then the information will be used to inform changes in the design of the next CEPP project components, adjustments in operations, and/or implementation of additional restoration actions identified in the AM plan. The primary purpose of the CEPP Ecological Monitoring Plan is to identify the monitoring necessary to inform decision-makers, CEPP partner agencies, and the public on CEPP's achievement of ecological restoration success. This plan will monitor ecosystem responses to changes in water depth, hydroperiod duration, and water flow velocity within the Central Everglades that are expected to provide ecological conditions suitable for expanded and intensified wildlife utilization through improvements in wetland habitat functional quality. This monitoring will be leveraged as much as possible to contribute to CEPP adaptive management, but is different from the adaptive management plan monitoring in that it focuses on restoration success at a larger scale and is not tied to addressing specific project uncertainties.

The CEPP monitoring plans are complete from a CEPP perspective by providing all monitoring required to address CEPP-specific needs, while leveraging existing monitoring and analysis efforts, knowledge, and information funded by Restoration, Coordination and Verification (RECOVER), CERP sponsors, and partner agencies. CEPP monitoring will be closely coordinated with the CERP RECOVER Monitoring and Assessment Plan (MAP) to avoid duplication of efforts. Furthermore, the monitoring plan will ensure temporal and spatial coverage of monitoring parameters that are appropriate to detect changes at the project level and will fill gaps in the MAP monitoring parameters to address CEPP-specific needs by adding additional project-level parameters not included in the MAP.

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GUIDING LAKE TRAFFORD'S RESTORATION: LAKE TRAFFORD MANAGEMENT TEAM AND MANAGEMENT ACTION PLAN

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Lake Trafford had been subjected to increasing anthropogenic nutrient loading over several decades. This resulted in a shift away from a clear, macrophyte-dominated system state to a turbid plankton-dominated one, resulting in algal blooms and fish kills. The Big Cypress Basin (BCB) implemented a restoration project that involved hydraulic dredging of the lake, resulting in the removal of over 6 million cubic yards of sediments. In an effort to coordinate the on-going restoration and post-dredging management activities, the BCB established the Lake Trafford Management Team (LTMT) including representatives from: Big Cypress Basin of the South Florida Water Management District; US Fish and Wildlife Service; Florida Fish and Wildlife Conservation Commission; Florida Department of Environmental Protection; Collier County Pollution Control; and Florida Gulf Coast University. The vision for Lake Trafford, as developed by the LTMT is to: *Return Lake Trafford to a popular and productive sportfishing, recreational, and tourist destination, and to a healthy lake ecosystem with diverse native plant and animal communities*. The LTMT collaboratively developed the Lake Trafford Management Action Plan, which includes categories of management activities that impact: water quality; fish and wildlife; vegetation; the lake ecosystem; and management coordination. For each of these categories of activities the plan includes objectives, identified management actions for next year and projected for the next five years, and stated specific performance measures associated with these objectives and management activities. The plan also identifies challenges to the achievement of the vision, including: unpredictable weather events; exotic species management; agency coordination; private partnerships and stakeholder involvement; continued dedicated funding; and the need to expand management to a holistic watershed perspective. Completing the restoration of Lake Trafford requires continued active management to restore native vegetation, on-going efforts to control invasive exotics, and management of the sport fish populations. In addition, long-term monitoring of water quality, vegetation dynamics, and fish and wildlife populations is necessary to track the evolving health of the lake and to guide the development and implementation of future management activities as we facilitate the full recovery of Lake Trafford. The LTMT provides a model of coordination of multi-agency management efforts that can be applied to a variety of restoration projects in the region.

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HERPETOFAUNAL COMMUNITY CHANGES IN MULTIPLE HABITATS OVER FIFTEEN YEARS IN THE CORKSCREW REGIONAL ECOSYTEM WATERSHED

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Herpetofaunal declines have been documented globally, and southern Florida is an especially vulnerable region because of high impacts from hydrological perturbations and nonindigenous species. The hydrological restoration associated with the Comprehensive Everglades Restoration Project may have profound impacts on herpetofaunal communities. To assess the extent of recent change in herpetofauna community composition, we established a baseline inventory during 1995-97 in the Corkscrew Regional Ecosystem Watershed preserve and repeated our sampling methods fifteen years later (2010-11). Nine drift fence arrays were placed in four habitat types: mesic flatwood, mesic hammock, depression marsh, and wet prairie. Trapping occurred daily for one week during 7-8 sampling runs in each period (57 and 49 total sampling days, respectively). Species richness was maintained in mesic hammock habitats but varied in the others. Catch rates of several native species (*Anaxyrus terrestris*, *Lithobates grylio*, *Anolis carolinensis*, *Nerodia fasciata*) declined significantly. Other native species (*Lithobates sphenocephalus*, *Siren lacertina*, and *Notophthalmus viridescens piaropicola*) that were abundant in 1995-97 declined by greater than 50%. Catch rate of only two species (the nonindigenous *Anolis sagrei* and the native *Diadophis punctatus*) increased significantly. Hierarchical cluster analysis indicated similarity within habitat types but significant dissimilarity between sampling periods, confirming shifts in community composition. Analysis of individual species' contributions to overall similarity across habitats shows a shift from dominance of native species in the 1990s to increased importance of nonindigenous species in 2010-11. These results document significant recent changes in the structure and composition of this southwest Florida herpetofaunal community. Although the causes are unknown, hydrological shifts and ecological impacts of nonindigenous species may have contributed.

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ARE BURMESE PYTHONS IN FLORIDA GETTING SKINNIER?

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The invasive population of Burmese pythons (*Python molurus bivittatus*) in Florida has been implicated in the population decline of several of its prey species. The impact of these population declines may affect the python population itself if prey availability is limiting. I predicted that a reduction in available prey will result in a reduction in average python body size (i.e., pythons will have gotten skinnier), and tested for a decline of average python body condition over time. Using necropsy data collected over several years, and a regression of python weight on mass as a metric of body condition, I estimated the average body condition of Burmese pythons in southern Florida for each year from 2000 to 2014. I observed a general decline of average annual body condition during this time period, which is consistent with the hypothesis that a decline in prey availability has resulted in skinnier snakes. I discuss these results in the context of Burmese python reproduction and the geographic distribution in Florida.

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PHOSPHORUS LOADINGS FROM THE EVERGLADES AGRICULTURAL AREA

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Water and phosphorus (P) budgets of a large agricultural basin located in South Florida (Everglades Agricultural Area, EAA) were computed from water years 2005 to 2012. The annual surface outflow P loading from the EAA averaged 157.2 mtons originating from Lake Okeechobee (16.4 mtons, 10.4%), farms (131.0 mtons, 83.4%), and surrounding basins (9.8 mtons, 6.2%) after attenuation. Farms, urban areas, and the adjacent C-139 basin contributed 186.1, 15.6, and 3.8 mtons/yr P to the canals, respectively. The average annual soil P retention was estimated at 412.5 mtons. Water and P budgets showed seasonal variations with high correlation between rainfall and P load in drainage and surface outflows.

Moreover, results indicated that the canals acted as a P sink storing 64.8 mtons/yr. To assess the P loading impact of farm drainage on the canals and on the outflow, dimensionless impact factors were developed. Sixty-two farms were identified with a high and a medium impact factor I1 level contributing 44.5% of the total drainage P load to the canals, while their collective area represented less than 23% of the EAA area (172 farms). Optimizing the best management practice (BMP) strategies on these farms could minimize the environmental impacts on the downstream sensitive wetlands areas.

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THE ROLE OF THE AMERICAN ALLIGATOR (*ALLIGATOR MISSISSIPPIENSIS*) AND AMERICAN CROCODILE (*CROCODYLUS ACUTUS*) AS INDICATORS OF ECOLOGICAL CHANGE IN EVERGLADES ECOSYSTEMS

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The system-wide Monitoring and Assessment Plan (MAP) for the Comprehensive Everglades Restoration Plan (CERP) identified indicators and targets for monitoring ecosystem responses and tracks progress toward meeting restoration goals. The health and population parameters of alligators and crocodiles respond directly to the suitability of environmental conditions including changes in water depth, periods of inundation, and salinities. Therefore, these species have been selected as indicators for the Greater Everglades module in the MAP and are one of the indicators used in the biennial report to Congress and the system-wide ecological indicators report for Everglades restoration. Here we present analyses on data collected from 2004-2014 throughout the Greater Everglades for both alligators and crocodiles. We examined relative density and body condition for alligators and crocodiles as well as survival, growth, and nesting occurrence and success for crocodiles.

For alligators we found that relative density (measured as encounter rates) and body condition fall below restoration targets across the Greater Everglades. Out of 10 areas (5 on state lands and 5 on federal lands) surveyed from 2004-2014 we found that encounter rates significantly declined in 6 areas. Three areas with a decline were on state lands where monitoring was suspended in 2012. Overall body condition indices of alligators have also shown significant declines. We also found a decrease in mean encounter rate of crocodiles across all years. However, the number of crocodile nests annually has increased over the past 25 years. Initiation of crocodile nesting along East Cape and Buttonwood canals coincided with the plugging of those canals as part of Everglades restoration in the 1980s. This has led to a faster increase in nesting effort in Buttonwood and East Cape Canals over nesting in northeastern Florida Bay.
By tracking the short term and long term responses of crocodilians we can develop and refine ecological tools to aid in project planning, species conservation, and effective resource management.

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DERIVATION OF A WATER QUALITY CRITERION TO PROTECT THE FLORIDA PANTHER (*PUMA CONCOLOR CORYI*)

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To address its statewide methylmercury (MeHg) in fish problem, in the early 1990s Florida led the nation with a moratorium on new waste incinerator permits and proactive rules mandating the diversion of mercury (Hg) out of solid waste combustion streams. This would buy Florida's most MeHg-susceptible fresh and salt water resources, the Everglades and Florida Bay, time until the emissions from all inorganic Hg (IHg) sources could be reduced to safe levels for humans and wildlife with an ample margin of safety, as mandated by the Total Maximum Load (TMDL) provision of the Clean Water Act. To implement the Hg TMDL under Federal Court Order, the Florida Dept. of Environmental Protection assumed the most exposed, most sensitive mammalian life stage was the human fetus and adopted EPA's Water Quality Criterion (WQC) of 0.3 ppm total mercury (THg) as MeHg in fish flesh as the Hg load reduction target.

In the late 1980s the high levels of MeHg in Florida panthers consuming prey linked to the aquatic food chain threatened the health of this highly endangered species. After a decade of decline in the 1990s and early 2000s in response to Florida's precautionary, proactive Hg emissions control efforts, the THg concentrations in Florida panther blood and fur began to increase in the 2000s. This is most likely a consequence of increasing contribution of elemental Hg emitted by coal-fired power plants in China and India that is converted to IHg in the upper troposphere by the action of sunlight on halogenated compounds of ocean origin. The affected areas include the Florida panther populations in the Big Cypress National Preserve and Fakahatchee Strand. Whether recent increases in lethal collisions with autos is a result of the depth-speed perception deficit from the highly neurotoxic MeHg accumulating in their brains suggests that FDEP should reconsider the Florida panther as the target mammalian species.

Development of a fish flesh WQC to protect the Florida panther requires the following steps:
(1) adapt the observed MeHg neurological no observable effect level (NOEL) in the domestic cat brain to the Florida panther brain with a margin of safety; (2) translate the brain NOEL into an equivalent diet NOEL using a steady-state bioaccumulation model and blood:organ ratios from data collected from necropsied animals; (3) use a representative worst-case diet to allocate to each prey species it's diet-weighted share of the diet NOEL; (4) translate the diet-weighted Florida panther NOEL in each prey species into its equivalent diet NOEL as per (2); (5) allocate to each prey species in the aquatic food chain its diet-weighted share of the Florida panther NOEL; (6) the lowest concentration of MeHg in fish is the Florida panther NOEL-based WQC.

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SCOPING-LEVEL EVALUATION OF EVERGLADES WATER QUALITY COMPLIANCE USING A CENTRAL FLOW-WAY HYDRATED WITH LAKE OKEECHOBEE WATER

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The Central Everglades Project Plan (CEPP) accelerated the planning of the Comprehensive Everglades Restoration Plan (CERP) projects required for restoring a more natural water quantity, quality, routing, and timing to the Central Everglades. On the one hand, this is a notable accomplishment that has already received official recognition and professional awards. On the other hand, this was achieved by taking shortcuts that omitted or gave short shrift to critical performance measures and constraints. The former included the time to project completion and time to resource recovery in response to project operation. The latter included nutrient and toxicant water quality constraints imposed by the Clean Water Act via the Water Resources Development Act (WRDA) of 1996 and 2000 on project design, operation, and maintenance options. This skewed the decision-making process to favor minor modifications to the status quo, where stormwater runoff from the Everglades Agricultural Area (EAA) treated by constructed wetlands is used to rehydrate the Everglades, over other potentially viable alternatives. These alternatives include a 150,000-acre Central Flow-Way (CFW) that conveys Lake Okeechobee water from the Herbert Hoover Dike through the Rotenberger and Holey Land tracts and the largest of the constructed wetlands to the northern border of the remnant impounded Everglades.

The constructed wetlands known as Stormwater Treatment Areas (STAs) presently treat about 1.5 million (M) acre-ft of EAA runoff annually. CEPP's preferred option will add another 220,000 acre-ft of treated Lake Okeechobee water circa 2030. The STAs are required to attain the 10 ppb Total Phosphorus (TP) Water Quality Standard (WQS) as a the flow-weighted annual average at the downstream boundary with the impounded Everglades when CEPP is complete and 13 ppb now. To evaluate the ability of the CFW to attain the TP WQS at the compliance boundary sooner than CEPP, I used the same steady-state water quality model that was used for STA design. Based on this scoping-level exercise, an annual average flow of 1.75M acre-ft per year will comply with the TP WQS if the roughly 150,000 acre flow-way footprint with annual average TP net settling rates of 10.2 m/yr, 13 m/yr, or 14.2 m/yr used in STA design or routinely achieved by the STAs. In fact, at those TP net annual average settling rates, the inflow could be increased to 2M acre-ft per year, 2.5M acre-ft per year, and 2.8 M acre-ft per year, respectively, without exceeding the TP WQS at the point of compliance. Based on these encouraging scoping results, the CFW's compliance sensitivity to flow surges associated with extreme rainfall events needs to be evaluated using an EPA-approved, time-dependent water quality model, e.g., WASP.

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POTENTIAL RESPONSE OF MOSQUITOES AND MOSQUITO-BORNE VIRUSES TO ECOSYSTEM RESTORATION IN THE GREATER EVERGLADES

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Mosquitoes and mosquito-borne viruses contribute to the biodiversity of wetland ecosystems and play important roles in ecosystem function, yet these organisms rarely receive adequate attention in wetlands restoration projects. More than 45 mosquito species occur in the Everglades Region of South Florida in addition to more than 20 species of virus transmitted by mosquitoes. Baseline data on the distribution and prevalence of mosquitoes and mosquito-borne viruses were obtained at 95 study sites located within Everglades National Park, Big Cypress National Preserve, Fakahatchee Strand Preserve State Park, and Picayune Strand State Forest during the summer months (June- August) of 2012 and 2013. The mosquito population at each location was sampled with a CDC light trap baited with carbon dioxide for one night between 1600 hr and 0800 hr. Captured mosquitoes were frozen, identified to species, pooled in 50 individuals/species, and inoculated into Vero and C6/36 cell lines for virus isolation and identification. Approximately 300,000 mosquitoes were captured comprising 31 species and 2,100 mosquito pools were processed. More than 100 virus isolations have been obtained and a total of 10 viruses have so far been identified, which include both vertebrate and invertebrate (mosquito-specific) viruses. Several of the vertebrate viruses are known to be pathogenic to humans and/or wildlife. The distribution of mosquito species was found to be dependent upon major plant communities and hydrology. The distribution of mosquito-borne viruses was found to be highly aggregated and dependent upon mosquito species composition and abundance. Preliminary results indicate that restoration efforts, particularly in Picayune Strand State Forest, are likely to increase the distribution and prevalence of mosquito-borne viruses due to changes in hydrology and floristics. Further work is needed to determine the impact of changes in the distribution and prevalence of mosquitoes and mosquito-borne viruses upon humans and wildlife in the Everglades Region resulting from restoration efforts.

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SOIL OXIDATION AND PHOSPHORUS STORAGE CHANGES RESULTING FROM A RANGE OF RESTORATION OPTIONS

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The Synthesis of Everglades Research and Ecosystem Services (SERES) project was a multi-disciplinary effort to evaluate a range of novel Everglades restoration options, building upon the CERP but using alternative storage and decompartmentalization options (see T. Van Lent presentation). We used the Everglades Landscape Model (ELM) to explore a variety of hydro-ecological responses to the SERES restoration options. The ELM explicitly integrates fully dynamic flux equations that integrate hydrology, nutrients, plants, and soils. The model incorporates both overland and subsurface groundwater flows. Managed flows transport water and nutrients through the network of canals and levees, explicitly simulated in ELM via interactions between raster grid cells and canal/levee vectors.

Water management for the SERES restoration options were simulated by the South Florida Water Management Model (SFWMM) v6.0, and the ELM v2.8.6 used SFWMM output of daily water control structure flow data for all of the (point) structures within the greater Everglades model domain. For each restoration option, all water inflows from external sources into the ELM domain were assigned either a constant phosphorus (P) concentration of 10 mg/L for each structure, or, in the case of STA-2 and STA-3/4, daily P concentrations were used from simulations of the DMSTA. Those daily total P concentrations generally had 36-year mean concentrations of <10 mg/L.

A variety of hydro-ecological Performance Measures were used to make relative comparisons among the 36-yr restoration OPTions and an Existing Condition Base. These included 1) peat accretion rates, 2) P accumulation rates, and six other water quality and hydrologic metrics (e.g., surface water P concentration, surface water flow velocities). Here we emphasize soils, which are excellent integrators of long term wetland ecosystem dynamics. Note that the restoration peat accretion target is to both a) minimize the marsh area that undergoes excessive dry-out and oxidation with low accretion rates, and to b) minimize the marsh area that has abnormally high peat accretion rates due to eutrophication and thus an altered ecosystem with abnormally high productivity/turnover rates. Thus, the target is the "sweet spot" of peat accretion for a healthy wetland that is between those values.

All restoration OPTions showed reduced P accumulation rates relative to the Existing Condition Base, which assumed higher P inflows based upon recent historical performance of the Stormwater Treatment Areas. All restoration options showed increased marsh area with "healthy wetland" peat accumulation rates, with different degrees of performance among OPTions that varied spatially. It was apparent from these analyses that components of the novel SERES options may improve soil conditions relative to the basic CERP0 water management. All model assumptions, input data, and results for the SERES OPT scenario are available at: http://www.ecolandmod.com/projects/ELMreg500SERES.

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THE DEMOGRAPHIC CAUSES OF POPULATION GROWTH AND DECLINE IN THE SNAIL KITE

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Understanding population biology is essential for management and conservation of species of interest, as well as interpreting effects of changing environments on the distribution and abundance of species. Because changes in population size of species are directly linked to changes in demographic rates, such as reproduction and survival, knowledge of how these rates change over time and what drives variation in these rates are necessary for effective conservation and management of imperiled species. The Everglade snail kite (*Rostrhamus sociabilis plumbeus*) is a highly endangered, wetland-dependent raptor confined to central and south Florida. Over the past twenty years, population monitoring suggests that the species has experienced an overall population decline, but trends highlight oscillating population growth rates, where declines are followed with more minor, population increases. We use a variety of approaches to interpret key demographic rates causing population declines and increases (life table response experiments, perturbation analyses, and trend analyses). We find that population declines are best explained by changes in adult fertility (the product of young fledged per adult and juvenile survival), whereas population increases are best explained by changes in juvenile survival. Vital rates most responsible to number of young fledged include nest survival and re-nesting rates, whereas prior research suggests juvenile survival is most important in the first 1-2 months post-fledging. We discuss the implications of these results for the conservation and recovery of the species and Everglades restoration, along with potential factors that may be driving these changes in these demographic rates.

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CONTROL OF PHOSPHATE CONCENTRATION THROUGH ADSORPTION AND DESORPTION PROCESSES IN SHALLOW GROUNDWATER OF COASTAL EVERGLADES

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The balance of fresh and marine water supplies in coastal mixing zones can affect P availability, one of the important drivers of primary productivity. This study focuses on an abiotic portion of the biogeochemical P cycle in the mangrove ecotone of Taylor Slough, of the coastal Everglades, Florida. We tested the soluble reactive phosphorus (P) sorption properties of the Taylor Slough mangrove ecotone sediment with three endmember water types in this region: fresh groundwater, high bicarbonate brackish water from the mangrove ecotone, and Florida Bay seawater.

Results showed that P exhibited markedly lower sorption efficiency in ecotone groundwater (K_d=0.2 L/g, compared to 11 L/g and 3.4 L/g in fresh groundwater and seawater respectively). The low buffering capacity of the sediment in ecotone groundwater would allow ambient water P concentration to be maintained at a higher concentration in ecotone groundwater than in the other two waters. Equilibrium P concentration (EPC_o) was highest in ecotone groundwater (0.094 +/- 0.003uM compared to 0.075 +/- 0.005uM and 0.058 +/- 0.004uM and for fresh groundwater and seawater respectively). EPC_o for all three waters fall within the range of natural variability in mangrove ecotone groundwater P concentrations as determined previously by longterm monitoring data by the Florida Coastal Everglades Longterm Ecological Research project. The sediment would be expected to act as a P buffer, with short term desorption of P occurring when the water is most depleted in P. Because the sediment exhibits the highest EPCo in ecotone groundwater, P would be expected to desorb from sediment sooner in ecotone groundwater than the other two water types.

These experiments suggest that mangrove ecotone groundwater would act as a “P source” compared to the upstream and downstream waters. This is consistent with the field observation that P concentrations is highest in the mangrove portion of the freshwater-marine water transect in Taylor Slough. If either fresh or marine water were to replace ecotone groundwater in this region, P availability would be expected to decline, particularly if freshwater were to become the dominant water type. Daily and seasonal variations in water quality in the Taylor Slough mixing zone could cause temporally and spatially variable P sorption behavior, with direct consequences for P availability.

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THE USE OF ECOSYSTEM SERVICES IN FLORIDA: A CROSS-PERSPECTIVE OF AGENCIES

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The Ecosystem Services Assessment (ESA) is a relatively new approach which is used to analyze the potential impacts of human actions and decisions on the natural and built environment. There is an increasing interest from policy and decision makers to use this approach to guide land-use planning. This research investigates the use of ESA, in land-use planning projects in Florida, using an online survey. The target group for the online survey includes respondents who have been involved in projects in which ecosystem services were valuated, quantified or described. Recruitment emails were sent to staff working for local, state, regional, federal and tribal government agencies, non-profit organizations, research institutes, universities and other relevant actors. The contact list was identified through prior in-depth interviews, document review and government websites. The link to the online survey was kept open from May 1 until July 29, 2014. The survey included questions about terms and concepts with respect to ESA methods. Other questions dealt with respondents' perceived strengths and barriers regarding the use of ESA. In addition, the survey obtained demographic and general background information such as gender, age, ethnicity, education, workplace, and experience with ESA. Out of 311 successfully contacted addresses, 136 respondents completed the survey and provided a wide range of responses. These responses were analyzed differentiating between agencies. Key findings will be presented considering the status quo and perceived strengths and barriers with respect to the use of ESA in Florida.

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SMART PLANNNING FOR THE CENTRAL EVERGLADES PLANNING PROJECT

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The Central Everglades Planning Project (CEPP) contains several components of the Comprehensive Everglades Restoration Plan, one of the largest ecosystem restoration projects in the world. CEPP began in 2011 as one of the studies in a pilot program to test new approaches to project planning within the U.S. Army Corps of Engineers (USACE). In response to concerns of stakeholders, USACE developed the SMART Planning methods to produce planning reports more quickly, at lower cost, and with more effective integration of regional and headquarters reviewers than before.

CEPP uses three sets of SMART Planning processes and products. The first is an explicit focus on incremental decisions. Five major intermediate decisions are part of all studies. They help focus the study team to reach decisions when they need to be decided. These major intermediate decisions are made by all levels of the Corps, together with the non-federal sponsor. The second is a new approach to managing risk. The study team asks whether the incremental decisions can be made with existing data and analyses, or whether and how much additional information is needed. All three levels of the Corps together assess the risk of relying on existing data to the schedule and cost risk to obtain more data. The goal is to save time and study cost by minimizing over-analysis and collecting data that are not necessary to make the decisions. The third is a group of tools – report synopsis, risk register, decision management plan, and decision log – that assist decision-making, document the decisions made throughout the study, and are building blocks of the planning report.

For CEPP, the SMART planning meant information was pulled from prior planning efforts (Everglades Agricultural Area, Decompartmentalization of Water Conservation Area 3A, and Everglades National Park Seepage Management) to develop the CEPP project goals and objectives. Ecological objectives include: restore seasonal hydroperiods and freshwater distribution; improve sheetflow patterns and surface water depths and durations in the Everglades system in order to reduce soil subsidence, the frequency of damaging peat fires, and the decline of tree islands; reduce high volume discharges from Lake Okeechobee to improve the quality of oyster and SAV habitat in the northern estuaries; restore appropriate dry season recession rates for wildlife utilization; and restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function. These objectives were matched with hydrologic performance measures that had already developed to evaluate alternative plans and identify the plan that provides the most performance lift at the best cost.

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PREDICTING CHANGES IN ESTUARINE SAV DISTRIBUTION FROM INCREASED FRESHWATER DELIVERY

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Humans have altered the delivery of freshwater to estuaries changing the salinity and the structure of SAV communities. The draining of the Florida Everglades to permit residential and agricultural development and the pumping of groundwater for human use during the twentieth century has reduced freshwater delivery to Florida Bay by an estimated 60%. Mean salinities in the mangrove transition zone between the freshwater Everglades and Florida Bay are estimated to have increased by 20-30 psu. It is within this zone, known locally as the "mangrove lakes", that SAV, waterfowl, and wading bird abundances have been greatly reduced from historical levels. Ecosystem managers aim to restore SAV to historical abundances within this region by increasing the delivery and retention of freshwater.

Statistical habitat requirement models provide the ability to predict changes in SAV community distributions and have been used to assess the potential success of water management practices towards achieving SAV restoration goals. This paper describes the construction of a habitat requirement model for the estuarine SAV communities in the southern Everglades based on water quality and sediment thickness characteristics and the use of modeled salinity versus freshwater flow relationships to predict changes in SAV community structure resulting from increased freshwater delivery. These predictions can be used to guide restoration efforts in the estuaries of the Everglades and in similar ecosystems.

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POTENTIAL EFFECTS OF NEST PREDATION, CONTAMINATION, AND DISTANT WETLAND ATTRACTORS ON REPRODUCTIVE RESPONSES OF WADING BIRDS TO CERP

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Several lines of evidence support the prediction that reproduction by long legged wading birds is generally and predominantly limited by availability of prey before and during the breeding season. This dynamic is at the core of the Trophic Hypothesis, which relates wading bird nesting to foraging success, fish population cycling, and hydrology. While evidence supporting connections between avian foraging, hydrology and aquatic prey standing stocks have grown much stronger and more specific during the last decade, there remain a number of current and future uncertainties about the assumption that avian population size and nesting success are driven by access to prey.

Mercury contamination in the Everglades has been related mechanistically to nest success, at high enough nest failure rates that effects are predicted at the population level. While exposure rates have subsided considerably in much of the ecosystem, recent work indicates that methylmercury availability remains persistently high in the coastal zone. This is a potential problem given that an important CERP goal is to restore estuarine conditions, and attract birds to nest specifically in the coastal zone. It remains unclear how exposure will interact with restored coastal hydrology and rising sea level, and whether those exposure rates would affect nesting success.

There is also growing evidence that wading bird populations move in response to hydropatterns within the southeastern U.S., and shifting patterns of aquaculture and surface water usage have the power to strongly affect the size of populations within the Everglades. Large scale changes in crawfish aquaculture acreage in Louisiana, for example, is at least temporally related to changes in wading bird populations both in Florida and Louisiana.

Lastly, although nest predation has historically been a negligible or at least episodic source of nest failure in the Everglades, predation on nest contents and incubating adults by Burmese Pythons (*Python molurus*) has strong potential to affect nest success, and thereby the prediction that nest success will improve with restoration of historical hydrological conditions. Although no nest predation events have been attributable to pythons to date, pythons have been found in nests, and have moved towards and inhabited colonies as birds begin breeding active during the spring.

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DOES FIRE HAVE A ROLE IN THE TRANSITION FROM A HEALTHY TREE ISLAND TO A GHOST ISLAND? A FIRE HISTORY ANALYSIS

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Sharp declines in the number and area of tree islands have been reported for some portions of the Everglades. Tree island loss has generally been attributed to management-related changes in hydrologic regime, either prolonged periods of high water, which can cause death in all but the most flood-tolerant woody species, or excessively dry conditions, which increase the likelihood of catastrophic peat fires. Less dramatic hydrologic influences, for instance impacts on stand composition or forest productivity are pervasive.

The term "ghost island" has been applied to tree islands that have recently lost all or most of their forest canopy. Despite the absence of trees, they remain evident as landforms on current aerials.

In the Everglades, tree island "loss" is one endpoint in a dynamic in which woody and herbaceous plants vie for dominance under the influence of stresses such as flooding or fire. Like flooding, fire is known to strongly favor graminoids over woody plants, and the size, stature, and even the presence of a tree island may be a product of its recent fire history. The complex relationships between fire, flooding, and vegetation in Everglades landscapes are not yet fully understood, and consequently have not been incorporated into system-wide restoration planning.

Our objective therefore was to determine whether the 'ghost islands' current structure is enforced by the recent water regime, by historical contingencies - fire or high water - whose effects have become fixed in the landforms, or both. Using Landsat to delineate and digitize fire scars, we reconstructed the recent fire history of ten tree islands in Water Conservation Area 2A at a 3 year interval from 1980 to 2013. Of the ten tree islands, eight are 'ghost islands,' one is a "live" island, and one is a "transitional" island. The fire history includes islands that were considered to be burned if any part fell within the fire boundary. Preliminary results based on the 33 year fire history revealed that fire frequency varied between 1 to 3 fires for most ghost islands, and was not much different from that for healthy islands. Additionally, there were 2 ghost islands that have not been affected by fire within the same time frame, suggesting that fire frequency might not be the only cause of the degradation of these ghost islands. Fire might have played an indirect role in conjunction with other factors such as flooding.

This information may aid in planning for tree island restoration, by providing insight on the elasticity of ecosystem recovery following mitigation of conditions responsible for degradation.

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MODELLING THE IMPACTS OF LAND USE CHANGE ON CARBON DYNAMICS IN TROPICAL PEATLANDS USING THE TROPICAL HOLOCENE PEAT MODEL (HPMTROP)

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Tropical peatlands store approximately 14-19% of the world's peat carbon, with estimates ranging from 50-90 GtC. Southeast Asia contains the largest proportion of tropical peatland with an estimated 56% of the tropical peatland area and 77% of the tropical peat C store. These peatlands have functioned as a globally significant carbon sink for millennia. However they are now being deforested, degraded and converted to other land uses at extremely high rates, switching their function from carbon sink to source. In addition, land use change causes losses of other critical ecosystem services, functions, and biodiversity.

The carbon dynamics of tropical peatlands are largely under-studied compared to temperate and boreal peatlands. Comprehensive field studies are scarce, particularly at the ecological time scales required to assess process rates and long-term trends. Therefore, it is informative to use modelling approaches to ascertain long-term carbon dynamics beyond scales of practical observation. Here we use the Tropical Holocene Peat Model (HPMTrop) to assess the impact of land use change on carbon storage in a hypothetical tropical peat system over decadal time scales. HPMTrop is a process-based dynamic carbon model parameterized and calibrated from existing field data from Southeast Asia. We present peat carbon losses caused by typical trajectories of peatland conversion, and the potential rebalance of the carbon cycle and restored carbon sequestration under possible peatland rewetting and rehabilitation scenarios. Results indicate that although emissions from converted peatlands can be reduced, or even reversed, restoration of carbon stocks lost due to conversion is impossible at practical time scales; for example steady C accumulation over hundreds to thousands of years would be necessary to replenish carbon stocks lost over just one rotation of industrial oil palm cultivation, a dominant driver of land use change in the region.

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HOME RANGE AND MOVEMENTS OF AMERICAN ALLIGATORS IN AN ESTUARY HABITAT

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Understanding movement patterns of free-ranging top predator in a heterogeneous ecosystem is important for gaining insight into trophic interactions. Using satellite telemetry, we tracked the movements of five adult American alligators (*Alligator mississippiensis*) in Shark River Slough estuary to delineate their habitat use and determine drivers of their activity patterns in a seasonally-fluctuating environment. We also compared VHF- and satellite-tracks of one of the alligators to examine tradeoffs in data quality and quantity.

All tracked alligators showed high site fidelity in the estuary, but estimated home range size and core-use areas were highly variable. Two alligators were relatively sedentary and remained in the upper stream zone. One alligator traveled to a transition zone between freshwater marsh and estuary habitat, but primarily remained in the upstream area. Two alligators traveled to the downstream zone into saline conditions and showed high salinity tolerance. Overall movement rates were highly influenced by salinity, temperature, and season. Both satellite and VHF radio telemetries resulted in similar home range, core-use area, and activity centers.

This study reveals consistent use of the Everglades estuary habitat by American alligators. Even though American alligators occupy estuarine habitat as only a small portion of their entire range, consistent use of such habitat by satellite-tracked alligators highlights its importance for this top predator and ecosystem engineer. The alligators showed variations in their movement pattern and seasonal habitat, with movement attributable to environmental factors. Although satellite-derived locations were more dispersed compared to locations collected using VHF radio-tags, data collected from VHF tracking omitted some habitat used for a short period of time, indicating the effectiveness of satellite telemetry to continuously track animals for ecosystem-scale studies.

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PERIPHYTON RESPONSES TO FLOW RESTORATION: DISTRIBUTION, COMMUNITY COMPOSITION, AND EDIBILITY

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The Synthesis of Everglades Research and Ecosystem Services (SERES) Project has evaluated Everglades restoration options provides to identify a plan that best achieves restoration of the remaining ecosystem. Five restoration scenarios were compared to evaluate the effects of incremental water storage and the removal of levees and canals on the restoration of hydrology and ecology of the Everglades. This presentation focuses on the outcomes of these scenarios on benthic microbial (periphyton) abundance, community structure and potential to support the food web (edibility). The five scenario options include existing conditions (A), full Comprehensive Everglades Restoration Plan (CERP) (B), scaled-back CERP (C), and CERP plus above-ground storage (D) and decompartmentalization (E). All restoration scenarios include estimates of Stormwater Treamtent Area (STA) expansions that would be needed to treat additional water flows to reach mandated water quality criteria before entering the Everglades.

The influence of these options on periphyton biomass, composition and edibility were explored using empirical models (PERIMOD) that derive periphtyon attributes from water depth and soil total phosphorus (TP) concentration. While these driver variables may not respond on timescales that capitalize on the ability of periphyton to serve as an early indicator of change, they are important outputs from the Everglades Landscape Model that has been adapted to run the five scenarios listed above.

All restoration models caused the same direction of change in the three variables. Periphyton biomass will be reduced with restoration due to increased water stage which is negatively correlated with calcareous mat development. This impact is greatest under Option B, particularly in eastern and western edges of Everglades National Park were periphyton biomass will be reduced by more than half. Periphyton TP concentration will increase, particularly under Option E, partly because increased water stage will reduce the inorganic portion of periphyton mats that typically confers low P concentrations, but also because of increased P loads due to decompartmentalization. Notably, predicted values for periphyton TP are below those considered “baseline” in all scenarios. Periphyton edibility is also positively correlated with water depth and soil TP, and is expected to increase in all scenarios. Native periphyton mats are typically dominated by unpalatable cyanobacteria, particularly in the marl prairie region along the ENP boundaries. Increased water depths in all scenarios will reduce mat biomass and cyanobacterial dominance, increasing palatability. These effects will be most noticable in the central Shark River drainage, where edibility will increase from <5 to >20%. We expect this change in periphyton edibility to cascade through the food web from small aquatic consumers to wading birds.

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DESCRIBING LARGEMOUTH BASS BIOMETRIC AND DISTRIBUTIONAL CHARACTERISTICS IN ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE, FLORIDA, USA

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Results of boat electrofishing were used to describe the largemouth bass population in the canals at the Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida. Surveys were conducted at 102 1-km randomly-selected canal sites between October 2011 and October 2012. Data was collected for biometrics and fish distribution, and compared against bank side (levee vs interior marsh) and seasons (dry vs wet). The study determined that individual largemouth bass ranged in total length (mm) 54 - 610 (mean= 268.3, std.=95.21) and standard length (mm) ranged from 53 - 530 (mean= 221.6, std.= 81.24). The total biomass for largemouth bass was 1183.05 kg. The mean catch per unit of effort was 47.38 LMB/ hour. Proportional Stock Density was balanced with a score of 43. Relative Stock Density was 14. Two trophy size individuals (e.g., >600 mm total length) were caught during the surveys. There were differences detected between banksides and seasons. This apex predator is an important ecological and recreational target species to track trends in the Everglades.

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DESCRIBING THE FISH COMMUNITY IN THE ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE, FLORIDA, USA

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The fish community in canals of the A. R. Marshall Loxahatchee National Wildlife Refuge was described based on the results of boat electrofishing, and taxa were verified by the use of molecular techniques. Between October 2011 and October 2012, surveys were conducted at 102 1-km sites in the three canals that form the internal perimeter of the refuge. These samples consisted of 15,440 individuals representing 34 species of fish. We found differences between seasons (i.e., October 2011, April 2012, and October 2012) and bank side sampled (i.e., Levee and Interior Marsh) for species, number of individuals, and biomass. The metrics used for species richness were consistent and all in the good range, but had a declining trend. Non-native fish species comprised 15 percent of the fish community (i.e., five non-native species of the total 34 species). Before beginning the study, we identified three non-native fish species, reported in other canals in South Florida, as target species: bullseye snakehead (n=1 individual collected) and Mayan cichlid (n=2 individuals collected) were confirmed within the refuge's canal waters. We did not collect African jewelfish, which was the third target non-native fish species. DNA barcoding using the mtDNA CO1 gene was used to confirm the identification of fish species. We based preliminary species identification on field morphological traits and then challenged these identifications. A total of 106 tissue samples were analyzed. Thirty one of 105 (30%) sequences were verified by Barcode of Life Data System (BOLD). While BOLD categorized the remaining 74 sequences as un-validated, they had a high (often >95%) sequence similarity to the field (morphological) species identification. We believe these techniques are important tools to consider for documenting the fish species present in waters of the Everglades ecosystem as well as in national wildlife refuges across the nation.

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MAPPING VEGETATION AND VEGETATION CHANGE PATTERNS IN NORTHERN SHARK RIVER SLOUGH FROM REMOTELY SENSED DATA

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Plant communities can change either by expansion and contraction of an existing community into adjacent communities, or by gradual change of one entire community into another. We do not know which of these processes will operate in the future under the northeastern Shark River Slough (NESRS) restoration efforts. Different processes may apply to different communities or community combinations. In order to monitor vegetation change, we have used WorldView-2 (WV2) satellite imagery (2m x 2m pixels and 8 spectral bands) to generate a detailed vegetation map of NESRS below the Tamiami Trail (TT) bridge. This map served as the baseline to detect vegetation changes between 1999 and 2009 using Landsat data, which required re-scaling vegetation from the 2m WV2 resolution to the 30m x 30m Landsat resolution.

Vegetation plot level data informed development of a classification scheme for the NESRS landscape suitable to a 2m spatial resolution. Training samples for vegetation classes were digitized using stereoscopic aerial photography from 2009. Training signatures for the classification algorithm were extracted for a bi-seasonal spectral dataset (November 2010 and May 2013) including local texture variables. The digitized samples were used to establish a random forest classifier, which was applied to all pixels of the stacked data layers to predict vegetation type across the entire landscape on a pixel by pixel basis. The resulting map captures landscape-scale features, such as a general northeast to southwest trend for vegetation patches through the central and southwestern parts of the study area; a northwest to southeast trend in some features, seen most clearly in the southeastern corner of the study area; and the zonation in the vegetation halos around the culverts under the TT. The map shows a very heterogeneous landscape with fine-scale details, such as clearly delineated small patches of sparse and dense short graminoids on peat (8% cover) and of cattail (*Typha domingensis,* 2.8%) interspersed in sawgrass (*Cladium jamaicense*, 78.1%). Willows (*Salix caroliniana*) covered 3.0% of the study area. Bayhead shrubs (2.0%) were abundant in the tree islands and inside the willow around the culverts; bayhead trees (0.3%) and hardwood hammock trees (0.2%) were found inside the culvert halos and in the heads of most tree islands. This map provides a spatially explicit pre-restoration snapshot of vegetation distribution in the NESRS region prior to restoration impacts.

For the change detection, co-occurring vegetation patterns aggregated to 30m x 30m pixels were established by applying k-means clustering algorithms to relative abundances of the WV2 data,. Changes for scaled vegetation classes were then assessed by comparing change in magnitude and direction of tasseled cap transformed Landsat reflectance data. This integrated vegetation detection and scaling method allowed us to identify areas with high probability of vegetation changes between 1999 and 2009, as well as the direction of change. Some changes indicated a shift from one community to another, while some areas changed density within the same vegetation class.

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SEASONAL AND DAILY ACTIVITY PATTERNS OF ARGENTINE BLACK AND WHITE TEGUS

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Argentine black and white tegus (*Tupinambis merianae*) are established in Miami-Dade, Hillsborough, and Polk counties, Florida. *Tupinambis merianae* are habitat generalists and are observed in coastal areas, clearings, edges, and disturbed areas. Argentine black and white tegus spend time in burrows including a winter brumation periods which starts in October and ends in February. While understanding behavior of tegus is important in developing management plans, relatively little is known about any aspect of tegu behavior. The purpose of this study was to elucidate patterns of activity of Argentine black and white tegus in southern Miami-Dade County. We asked the following questions; what are the seasonal patterns of activities in relation to size and sex, and what is the daily activity pattern of tegus?

Thirty-five live traps were set during the 2014 tegu active season. Two hundred sixty-nine tegus were trapped during 3399 trap days with an overall average catch-per-unit effort (CPUE) of 0.072. CPUE varied by trap and by month. Individual trap CPUE's ranged from a high of 0.29 to a low of 0. Trap success for tegus was highest in September, while trap success for the months of February and October were lowest. Males were caught more frequently than females in March, suggesting males emerge from brumation in March, while females emerge later in April. The average size of tegus caught in live traps generally decreased as the year progressed. Additionally, the occurrence of tegus too small to accurately sex suggests young-of-year tegus begin to reach trappable size or weight in August.

Twenty-nine camera traps were set during the 2014 tegu active season .Tegus were detected on 7 of the 29 camera traps, including the easternmost ORV trail camera trap, suggesting an eastern range expansion towards Card Sound Road. Tegus were also detected on the C110 canal, both north and south of 424th street. Two cameras placed on an alligator nest in an area of known high tegu density had a large number of tegu occurrences. We used the data from one of these camera traps to determine daily activity peaks of tegus. Most tegu activity occurs during 9 AM until 5 PM.

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FACTORS AFFECTING THE ABUNDANCE OF WADING BIRDS IN INTERTIDAL HABITAT: ARE FRESHWATER MODELS APPLICABLE?

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Seasonal water level fluctuations in the freshwater Everglades control habitat and food availability for wading birds, but these relationships may not be transferable to intertidal habitat, where water levels fluctuate at multiple periodicities and there are hourly shifts in the location of suitable foraging depths. Daily tidal cycles create a temporal window of foraging habitat availability that shifts an hour per day. Thus, available foraging habitat cycles through the day and night every few weeks, producing dramatic differences in availability for birds that are restricted to foraging in either day or night. In addition, biweekly differences in tidal amplitude, driven by moon phase, also affect the area of habitat available to birds.

We developed a tidal simulation model to provide dynamic estimates of habitat availability. We then used an information theoretic approach that combined the tidal model output with empirical measurements of wading bird foraging sites to test the relative effects of habitat variables on the foraging abundance of two species of wading birds that differ in the degree to which their foraging is constrained by time. In the Florida Keys, the Little Blue Heron (*Egretta caerulea*) forages diurnally whereas the Great White Heron (*Ardea herodias occidentalis*), can forage at any time. Quarterly wading bird distribution surveys (N = 38; 2011-2013) were conducted by boat on a 14-km transect adjacent to extensive intertidal flats in the lower Florida Keys.

Unlike freshwater models, hydrologic characteristics were not the primary determinant of wading bird abundance in the intertidal zone. Moon phase corresponded to a 7-fold change in foraging abundance from quarter (neap tide) to full/new (spring tides) moons for the Little Blue Heron versus a 3-fold change in abundance for the Great White Heron. Area of available foraging habitat, driven by tidal fluctuations, was positively correlated with the foraging abundance of both species and was the second most important factor in explaining changes in the daily foraging abundance. Area of foraging habitat produced a 5-fold increase in abundance over the data range for the Little Blue Heron, versus a 2-fold increase for Great White Heron.

Habitat availability for the Great White Heron (day and night feeder) was affected significantly by moon phase ($t = 4.87$, $df = 32$, $P < 0.01$). Surprisingly, there was not a significant relationship between habitat availability and moon phase for the Little Blue Heron, a diurnal-only forager ($t = 1.62$, $df = 32$, $P = 0.12$), suggesting that birds were responding to changes in the environment that are strongly linked to the moon phase but not to changes in habitat availability *per se*. Some marine species are known to exhibit synchronous movements in response to moon phase. We hypothesize that Little Blue Herons were responding to a proximate cue from their prey species, ultimately driven by moon phase. Future work will investigate the effects of moon phase on wading birds via biweekly cyclic changes in tidal amplitude as well as indirectly through the behavioral and numerical responses of their prey.

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THE EVERGLADES NATIONAL PARK AND BIG CYPRESS NATIONAL PRESERVE VEGETATION MAPPING PROJECT

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The Everglades National Park (EVER) and Big Cypress National Preserve (BICY) vegetation mapping project is a cooperative effort between the South Florida Water Management District (SFWMD), the United States Army Corps of Engineers (USACE), the South Florida Caribbean Inventory and Monitoring Network of the National Park Service (SFCN-NPS) and the National Vegetation Mapping program in the National Park Service (VIP-NPS). The project will map all of EVER and eastern BICY. Photointerpreters classify the dominant vegetation community in each 50m x 50m grid cell using aerial imagery on a three-dimensional photogrammetric work station. Photointerpreters spend considerable time botanizing and collecting vegetation information in the field for each region being mapped. A photointerpretation key is used to relate vegetation signature to field collected training point data. This landscape-level field data includes species-level relative abundance within a spatially explicit area and geo-referenced photographic documentation which is used for this and a number of other Everglades restoration projects. Variation in classification has been reduced by creating ecoregion keys that bifurcate the Rutchey et al. (2009) vegetation classification system. Quality control and quality assessment is accomplished by extensive cross-calibration between photo-interpreters, review of a minimum number of random cells per area mapped, and a review of vegetation classification codes unique to the area being mapped. Accuracy assessment is accomplished by field verification of 210 randomly selected grid cells per region. It is expected that this project will produce a highly accurate and spatially complete vegetation map with over 80% accuracy and 90% confidence.

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HOLOCENE DYNAMICS OF THE FLORIDA EVERGLADES WITH RESPECT TO CLIMATE, DUSTFALL, AND TROPICAL STORMS

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Aeolian dust Is rarely considered an important source for nutrients in large peatlands, which generally develop in moist regions far from the major centers of dust production. As a result past studies assumed that the Everglades provides a classic example of an originally oligotrophic, P-limited wetland that was subsequently degraded by anthropogenic activities. However, a multi-proxy sedimentary record indicates that changes in atmospheric circulation patterns produced an abrupt shift in the hydrology and dust deposition in the Everglades over the past 4600 years. A wet climatic period with high loadings of aeolian dust prevailed prior to 2800 cal BP when vegetation typical of a deep slough dominated the principal drainage outlet of the Everglades. This dust was apparently transported from distant source areas such as the Sahara by tropical storms according to its elemental chemistry and mineralogy. A drier climatic regime with a steep decline in dustfall persisted after 2800 cal BP maintaining sawgrass vegetation at the coring site as tree islands developed nearby (and pine forests covered adjacent uplands). The marked decline in dustfall was related to corresponding declines in sedimentary phosphorus, organic nitrogen, and organic carbon suggesting a close relationship existed among dustfall, primary production, and possibly vegetation patterning prior to the 20th century. The climatic change after 2800 BP was probably produced by a shift in the Bermuda High to the southeast, shunting tropical storms to the south of Florida into the Gulf of Mexico.

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USING HEAT AS A TRACER TO QUANTIFY EFFECTS OF RESTORED HIGH FLOWS ON GROUNDWATER-SURFACE WATER INTERACTIONS IN THE EVERGLADES

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Shallow aquifers continuously exchange mass and energy with surficial environments, influencing the spatial and temporal patterns of hydraulic head, temperature, and conservative and reactive solute concentrations. Any of these state variables can potentially be used to infer the extent and magnitude of groundwater-surface water interactions. Despite previous work there is little known about how Everglades restoration could affect groundwater surface-water interactions and related physicochemical processes. In this study, we evaluate the feasibility of using inexpensive temperature sensors to quantify wetland-aquifer interactions driven by water level variability during controlled water releases in the Decompartmentalization Physical Model (DPM) high flow experiments. Using heat as a tracer is a drastically cheaper method of monitoring of surface-subsurface water interactions compared with hydraulic-gradient based measures and solute tracer techniques.

We installed traditional piezometers with nearby temperature sensors in the DPM experimental footprint in the central Everglades. Temperature was collected every 10 minutes at the water-sediment interface (0 cm depth) and three additional depths within the peat sediment (5, 15, and 35 cm) which are expected to be sensitive to vertical exchange of surface water and subsurface water within the peat which is approximately 60 to 80 cm deep in the study area. Two modeling methods were used: (i) an established analytical method and (ii) a numerical simulation method. The analytical method uses spectral techniques to separate the diurnal temperature signal from the observations and analytical solutions of the 1-D mathematical model for conservation of energy to estimate the fluxes. Alternatively, the numerical simulation method fits water exchange fluxes using a numerical solution of the 1-D equations for conservation of energy combined with an optimization approach.

Exploratory analysis of the temperature time series highlights three characteristic time scales: 1, 18, and 365 days. Diurnal amplitudes were about 0.2 C (ten times the sensor resolution) during the observation period. A simple sensitivity analysis using thermal properties of peat showed that diurnal fluctuations would be attenuated to the sensor resolution within the first 10 cm of peat. In addition, uncertainties in peak and phase shift detection of the diurnal signals result in unreliable estimates of the exchange's magnitude and direction using the analytical method. The numerical simulation method, on the other hand, takes advantage of the information from signals with longer periodicities (i.e., 18 and 365 days). This method found that groundwater discharge occurred in the upstream area of DPM under pre-experimental conditions but during the experimental high flow release the pattern of groundwater-surface water interactions switched to alternating periods of discharge and recharge. In conclusion, heat can be used to characterize the exchange process in the DPM experimental footprint; however, numerical techniques are needed in order to acquire consistent estimates.

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ASSESSING IMPACTS OF AN ACTIVE WATER SCHEDULE ON VEGETATION AND MAMMAL COMMUNITIES IN HOLEY LAND WILDLIFE MANAGEMENT AREA

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The 35,350 acres of land that is Holey Land Wildlife Management Area (WMA) has been managed by the Florida Fish and Wildlife Conservation Commission (formerly the Game and Fresh Water Fish Commission) since 1968. Water management is coordinated with the South Florida Water Management District. As part of the restoration of the area, a pump station (G200A) in the northwest corner of Holey Land WMA began delivering water from the Miami Canal in 1991. In 2005, Hurricane Wilma damaged the G200A pump to where it was mostly non-functional until repairs were made in September 2014, when water (treated via Stormwater Treatment Areas) was again able to be pumped into the area. These events provide a unique opportunity to examine the impacts of an active water schedule and to assess how water management activities affect both vegetation and wildlife communities in the Holey Land WMA. Mammal encounter rates were calculated from opportunistic observations from various perimeter levee surveys over the last two decades. A small mammal trapping survey was replicated and compared to surveys conducted between 1995 and 1997. Results of linear regression models show that a drastic increase in cattail abundance during the period when the G200A pump was active and a decrease after its failure is attributable to increased nutrient inputs. Mammal encounter rates showed a strong declining trend during the time period after the pump failure, but not for the entire time period analyzed. This appears to be because of an observed spike in mammal encounters immediately after the pump failure. Active sampling for small mammals shows a decline in diversity along the Miami Canal since the mid 1990s, but this may be attributable to shifts in the spatial distribution of species as optimal habitat shifts in response to changes in hydrology.

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SPATIAL AND TEMPORAL VARIATIONS OF TOTAL MERCURY IN MOSQUITOFISH FROM EVERGLADES MARSHES

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Improvements in water quality, quantity and distribution from implementation of the 1994 Everglades Forever Act (EFA) might inadvertently worsen the Everglades mercury problem while reducing downstream eutrophication. In response, a mercury monitoring program was begun in water year (WY) 1999 to monitor the concentrations of total mercury (THg) and methylmercury (MeHg) in selected abiotic (e.g., water and sediment) and biotic (e.g., fish and bird tissues) media within the downstream receiving waters which include the Water Conservation Areas (WCAs), Rotenberger and Holey Land Wildlife Management Areas (WMA), and the Everglades National Park (ENP). The objective of this monitoring program, implemented under EFA permits, was to track changes in mercury concentrations over space and time in response to the changes in hydrology and water quality associated with EFA restoration efforts.

Mosquitofish (*Gambusia* spp.) are a good bio-indicator of short-term and localized changes in mercury accumulation because of their small size, short life span, and widespread occurrence in the Everglades. For the monitoring program, composite samples of between 100 and 250 mosquitofish are collected during each sampling event from representative monitoring stations within the Everglades system for each water year. The resulting data reflect large spatial and temporal variability of mosquitofish THg concentrations ranging from 3 to 373 ng g^{-1} (wet weight). The arithmetic average of THg concentrations from all stations for the entire period of record (WY1999-2014) was 65 ng g^{-1} (n=539 composite samples). While this mean concentration is below the United States Environmental Protection Agency (USEPA) Trophic Level 3 (TL3) fish criterion (77 ng g^{-1}) for protection of wildlife, 37% of the samples did in fact exceed the criterion which is a concern.

There are significant differences in mosquitofish THg concentrations across the 12 monitoring stations (ANOVA, $p<0.05$). Several stations consistently exhibited high THg concentrations, most occurring in the interior marsh stations of WCA-2A, WCA-3A and ENP. Additionally, several stations near the inflow canals in the Rotenberger WMA, WCA-2A and WCA-3A reveal consistently low Hg concentrations. There was no north-south gradient in mosquitofish THg concentrations. Although moderate sulfate concentrations are thought to promote mercury methylation by sulfate reducing bacteria and bioaccumulation, high THg concentrations in mosquitofish were found in stations with both low (<1 mg L^{-1}) or high sulfate concentrations (>30 mg L^{-1}).

There are typically large year-to-year fluctuations in THg concentration within each station. No significant trend of change in mosquitofish THg was found for any station (Spearman Rank Correlation, all $p>0.05$) and associations with surface water quality are not evident. However, low THg concentrations (i.e., less than 77 ng g^{-1}) in mosquitofish were often found in wet years (WY2000, WY2002–WY2007, WY2011 and WY2014), and THg concentrations exceeding the USEPA TL3 fish criterion were typically associated with dry years. This observation suggests that soil oxidation which may lead to the release of inorganic mercury and sulfate might have accounted for elevated mercury methylation and subsequent transfers to the upper trophic level.

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LONG-TERM CHANGES IN SEAGRASS DISTRIBUTION AND ABUNDANCE IN FLORIDA BAY

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Seagrasses form long-lived, ecologically-important communities near the land/sea interface in many coastal regions. Florida Bay supports one of the world's most extensive seagrass meadows, and is located at the base of the Everglades hydrological system. Because seagrasses integrate *net* changes in water quality parameters that tend to exhibit rapid and wide fluctuations when measured directly (e.g. salinity, light availability, and nutrient levels), Florida Bay seagrasses were chosen as a central performance measure for evaluating effects of the Comprehensive Everglades Restoration Plan (CERP) in the Southern Coastal System, and as a system-wide indicator for assessing Everglades restoration. The South Florida Fisheries Habitat Assessment Program (FHAP) has provided detailed information on community characteristics of submerged aquatic vegetation (SAV; which includes seagrass and macroalgae) in Florida Bay since 1995. South Florida FHAP conducts SAV surveys annually, at the end of the dry season (May-June) when salinity stress on seagrasses is typically highest. Monitoring stations are determined using a systematic-random sampling design. Each basin is divided into 30 tessellated hexagonal grid cells, and a single station position is randomly chosen from within each grid cell during each monitoring event. Cover of each species is visually estimated at each station using a modified Braun-Blanquet abundance scale. Analysis of long-term data (1995 to 2014) has revealed large changes in seagrass community structure in western and central Florida Bay that reflected recovery and secondary succession following a widespread die-off of *Thalassia testudinum* in the late 1980's and subsequent persistent turbidity from algal blooms and sediment resuspension from the early to mid-1990's. However, analysis of shorter-term or long-interval (i.e. multiple years between monitoring events) data may lead to very different conclusions regarding community change, depending on what time interval is analyzed. Thus, to establish ecosystem condition or to interpret landscape-scale changes that may occur in seagrass ecosystems in response to management actions or environmental perturbations requires long-term monitoring on at least an annual basis.

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SMALL MAMMAL COMMUNITIES AS INDICATORS OF RESTORATION SUCCESS IN THE GREATER EVERGLADES

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A major aim of the Picayune Strand Restoration Project (PSRP) is to fill drainage canals to restore hydrologic pattern and function to the southwest portion of the Greater Everglades ecosystem. The presence and population health of species that depend on more natural hydrologic patterns can serve as indicators of hydrologic and resulting ecosystem restoration. Returning Picayune Strand to a more natural hydrologic regime will not only provide increased habitat for important Everglades species but is also expected to restore hydrologic and faunal connectivity within and between natural areas adjacent to the project areas such as Fakahatchee Strand State Preserve and Panther National Wildlife Refuge.

The goal of this study is to determine whether small mammal community composition has responded to restoration project implementation. Focal species are: Marsh rice rats (Oryzomys palustris), Hispid cotton rats (Sigmodon hispidus), and Cotton mice (Peromyscus gossypinus). As Picayune Strand experiences longer hydroperiods with restoration, wildlife communities and populations are expected to recover in response. Marsh rice rats, for example, are semi-aquatic rodents known to forage in marshes and therefore should expand into areas that become wetter with restoration.

Our study uses live-trapping to capture and mark small mammals in the PSRP footprint. We selected areas to trap small mammals within the major vegetative types within PSRP: cypress, pine, hardwood hammock, and wetland (grassland). We are trapping in ‘restored’ and ‘not restored’ areas of each habitat type to examine impacts of restoration progress. Areas considered ‘restored’ are within 1.4 km of Prairie Canal which was plugged in 2004. Areas considered ‘not restored’ are at least 8.5 km from Prairie Canal and are therefore located in areas that are heavily drained by existing canals. Traps are set in a 6 x 6 grid for 36 traps in each replicate across four trap nights. We use three grid replicates in each of the four habitat types and two restoration conditions (restored vs not restored) for 864 traps per trapping session.

Results from the wet season (October/November2014) showed higher Cotton rat and Cotton mouse abundance in the ‘restored’ sites compared to the ‘not restored’ sites. Captures were made in all habitat types, but the majority were in cypress. Marsh rice rats were not captured in the wet season in any habitat type. Trapping will be repeated in the dry season (February 2015) to examine seasonal patterns.

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EFFECTIVENESS OF AERIAL HERBICIDE TREATMENT OF MELALEUCA FOR HABITAT RECOVERY IN THE NORTHERN EVERGLADES

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Melaleuca quinquenervia is an aggressive, exotic invasive tree in the Florida Everglades that displaces native vegetation, often forming dense, closed canopy stands with very little value for native wetland wildlife. Negative impacts of *Melaleuca* can increase with time through increased shading, altered hydrology, and substrate changes from massive litter production. Management of *Melaleuca* typically involves either aerial or ground spraying with herbicides. However, the impacts of management practices on non-target native vegetation and the recovery of native plant communities are not well quantified. To examine the impact of *Melaleuca* management practices on habitat restoration potential at A.R.M. Loxahatchee National Wildlife Refuge, twenty stands with evident invasion were chosen to receive an aerial herbicide application. Stands were selected to encompass the range of major vegetation types within the Refuge. Vegetation composition and a suite of environmental conditions were assessed prior to and following aerial treatment with herbicide to evaluate the recovery of microhabitat conditions and plant communities. This information will help develop management guidelines for the use of aerial herbicides in the maintenance of high quality habitat at the Refuge.

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MERCURY BIOACCUMULATION IN PYTHONS FROM THE GREATER EVERGLADES

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Wildlife exposure to environmental contaminants such as mercury (Hg) can have detrimental effects on survival and reproduction. In a collaborative project focused on Hg bioaccumulation in invasive pythons captured in the Greater Everglades, we analyzed 137 adult tail-tissue samples for their total Hg content, and a subset (24) of those for their methylmercury (MeHg) content. In addition, we analyzed tail tissue samples from 25 hatchlings and their mother. The USGS isotope lab has analyzed the same python tissues for stable nitrogen and carbon isotopes. The primary goals of the Hg sampling effort were to quantify the range of observed Hg and MeHg levels in adult and hatchling tissues from pythons captured in the Greater Everglades region, and to determine if there are controls (e.g., age, weight, length, sex, capture location, diet) on Hg and MeHg concentrations that can help us to understand their exposure and to inform resource managers and the public on the possible health threat from consuming python meat. The primary goals of the isotope sampling effort were to explore trophic position of pythons.

The mean observed Hg levels (4.3 ppm; micro grams per gram, dry weight) were surprisingly 3-4 times greater than previously observed concentrations in tail tissues of American alligator, the long held apical predator in the Everglades. Equally surprising was the observed range in concentrations (0.003 – 36.9 ppm) among the adult specimens compared to the mean hatchling Hg concentration of 0.001 ppm. In both adult and hatchling specimens, ~80% of the total Hg body burden was in the form of MeHg. We are unaware of any other species that show a similar MeHg:Hg ratio for adults and young. Further, there was a significant correlation between MeHg and total Hg and $d^{13}C$ and $d^{15}N$, indicating that mercury concentration is related to python carbon or energy sources and their associated trophic level. Although a distinct geospatial trend in the Hg results is not apparent, specimens from the Shark River Slough (SRS) are generally elevated compared to other areas. This observation is consistent with other recent research results from the Everglades, which show that MeHg in Gambusia (Mosquito Fish) and surface water are greatest in the SRS. We suggest that pythons are exposed to MeHg through their diet, which in turn is modulated by local environmental controls of MeHg production.

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THE DECOMPARTMENTALIZATION PHYSICAL MODEL (DPM) EXPERIMENTS: TESTING THE RESTORATION OF HISTORIC HIGH FLOWS IN A DISCONNECTED EVERGLADES

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How much water is needed to restore a self-sustaining Everglades ridge and slough system and its desirable ecosystem services? How large must the flow pulses be and how long should they last? Is there a flow threshold that must be exceeded in order to achieve the desired outcomes? Decades of field and modeling based research have provided a knowledge foundation to design restoration; however, restoration outcomes are debated and remain highly uncertain. The Decompartmentalization Physical Model (DPM) is a science experiment that operates at a scale never before attempted to resolve key uncertainties by directly observing the hydraulic, sedimentary, and ecological effectiveness of restoration. An important goal is to determine the how annual high-flow pulses function to preserve or restore deep-water sloughs. The experiment is taking place in an area typified by loss of sloughs after sixty years of isolation from historic high flows and expansion of sawgrass. The resulting loss in area and connectivity of sloughs at this location and many others has diminished the biodiversity that has earned the Everglades the distinction of a wetland of international significance.

Background conditions at the DPM were characterized prior to experimental flow releases between 2010 and 2012. The first high-flow release began in November 2013 and lasted two months and a second high-flow began in November 2014 and lasted three months. We measured the propagation of high-flow pulses through the degraded landscape to determine what the effects were on transporting sediment in sloughs, and whether the suspended sediment that had been entrained in the sloughs was deposited on sawgrass ridges. The flow release through the L67-A levee's gated culverts caused a gravity wave to propagate radially outward across the wetland. The resulting high flow had its greatest influence within a kilometer, causing a moderate increase in water level from approximately 40 to 55 cm (at a distance of 440 m from the culverts) and a large increase in water flow velocity, from 0.3 cm/s to as great as 6 cm/s. A high-concentration plume of suspended particles was transported during the first several hours (~8 mg/L); however, that easily entrainable source of large sediment particles was short-lived and was superseded by a lower concentration plume of finer suspended particles (1.5 mg/L) from a source area that was depleted over a period of days rather than hours. Transport of suspended particles through sawgrass was delayed and attenuated relative to transport through sloughs, consistent with the hypothesis that annual flow pulses redistribute sediment from sloughs to sawgrass ridges and may be instrumental in managing self-sustaining sloughs in the Everglades.

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CONCERN FOR INVASIVE BURMESE PYTHONS (*PYTHON MOLURUS BIVITTATUS*) AMONG PARTICIPANTS AND NON-PARTICIPANTS IN THE 2013 PYTHON CHALLENGE™

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Public engagement is important to invasive species management, and recreational harvest programs are one way agencies seek to involve the public and raise awareness. We surveyed participants (n = 660) and event attendees (n = 77) in the 2013 Python Challenge™ to understand whether this event achieved its primary goal of raising awareness of Burmese pythons' (*Python molurus bivittatus*) ecological impact in south Florida. Respondents indicated a high level of "concern" about the seriousness of the python problem and the need for management actions. Concern was affected positively by environmental motivations, experience of seeing pythons in the wild, older age, and female sex, but negatively by level of Python Challenge involvement. Results suggest that "proximate" experience of *not* seeing a python may reduce concern, whereas "ongoing" experience may temper concern without diminishing involvement. This research highlights the role of experience in shaping beliefs and advises caution in public participation programs.

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METHODS FOR DETECTING PATTERNS IN GROUNDWATER FLOW INTO BISCAYNE BAY, FL

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The Salinity Monitoring Project at Biscayne National Park maintains 47 salinity monitoring stations throughout Biscayne Bay. Of these sites, 11 have both a surface and benthic salinity monitoring station. This study used historical data from the 10 of the 11 paired sites to explore methods for detecting groundwater discharge patterns in Biscayne Bay. A variety of statistical methods were used to detect fresh water upwelling. The difference in salinity between the surface and benthic instrument, the daily variance, and submerged aquatic vegetation surveys are compared for their use in groundwater detection. Ultimately, no one method was definitive and they are best used in conjunction with one another. This study did not find any statistically significant trends in the salinity data that implied groundwater was present, nor were there statically significant seasonal patterns. However, this may have been due to necessary instrument removal and further studies are needed. The information collected for the Salinity Monitoring

Project and for this study will be used to provide information on the hydrology and salinity regimes of the Bay as a part of the Comprehensive Everglades Restoration.

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HOME RANGE SIZE AND HABITAT USE BY THE EASTERN INDIGO SNAKE (*DRYMARCHON COUPERI*) IN SOUTH FLORIDA: C-44 RESERVOIR SITE, ALLAPATTAH FLATS, AND BABCOCK RANCH

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The original purpose of this study was to quantify Eastern Indigo Snakes (*Drymarchon couperi*) movement patterns and survivability within a large-scale land conversion project during and immediately after construction. The construction of the C-44 reservoir project did not begin as anticipated and response to construction and land use change was not possible. However a total of twelve snakes were captured and seven snakes were surgically implanted with 13 gram Holohil Systems transmitters. Movement patterns were documented through twice weekly tracking of snakes. The average duration for tracking was seven months. Of six adult *D. couperi* tracked during the study period at the C-44 site we observed a high mortality rate. None of the mortalities appeared to be related to surgical implant, health issues, or the research study itself since all snakes were active and appeared healthy during routine visual inspections. The 4:1 sex ratio of males to females reported by Layne and Steiner (1996) for adult *D. couperi* does not appear to hold true for the C-44 site based on the capture ratio in our study (including all those captured, not just implanted). We captured a total of five adult male *D. couperi* and seven adult females, for a ratio of 0.71:1.0, male to female on the C-44 site. Home range and density estimates were calculated separately for each gender. The average home range for three females (including two tracked off the site) was 19.7 ha. The average home range size for the largest males was 55.38 ha. Within the adult male territories, we expect that there would also be one to several females at any given time. We attribute the small home range size to the high quality of the habitat, which consisted of wetland and upland ecotones with dense cover and permanent water, as well as high prey availability, , ample natural and artificial refugia, and lack of human activity such as hunting, farming, and vehicular traffic. A conservative population estimate of adult *D. couperi* on the 4,800 ha C-44 site would be 86 males and 240 females. This does not include juveniles which we know are present onsite as a result of at least four captures at various locations. These conservative estimates are based on a small sample size and an underlying assumption of homogeneity of habitat quality across the site. This study documented a thriving population of *D. couperi* on a previously highly disturbed site. This population was found to utilize artificial and small mammal burrows in the complete absence of gopher tortoise burrows and demonstrated important differences in habitat use patterns between more northern populations. These differences highlight the need for conservation biologists to consider ecological and behavioral differences across the biogeographic range of a species. In addition, in a world were landscape alteration is common, it is important to understand that altered habitat can substitute for more natural habitats for many organisms.

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IDENTIFYING THRESHOLDS IN FISH COMMUNITY DYNAMICS AND COMPOSITION IN RESPONSE TO ALTERED HYDROPERIODS IN EVERGLADES MARSHES

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The possibility of thresholds and other complex, non-linear dynamical properties of ecological systems is prompting a paradigm shift in ecosystem management practices. However, not all ecosystems exhibit threshold-like behavior and the dynamics associated with directional change in environmental drivers may well be ecosystem specific. Therefore, application of threshold models in restoration and management must be driven by empirical evidence for, and documentation of uncertainty associated with, threshold dynamics.

We used a multi-pronged approach to determine the presence of non-linear dynamics in Everglades fish community structure and process (biomass production). First, we modeled time-series dynamics of small fish (8 cm SL) biomass in freshwater marshes at 17 sites over periods ranging from 16 to 34 years. Then, we applied metric-based (changes in variance) and model-based (time-variation in autoregressive coefficients) indicators to detect possible non-linear changes in system state and stability. Second, we used distance-decay relationships to model long-term trends and turnover rates in composition. Third, we used Threshold Indicator Taxon Analysis (TITAN) to quantify species-level thresholds, their uncertainty, and community transitions in response to drought disturbance.

After accounting for hydrological and seasonal variation in time-series dynamics, many sites exhibited emergent and cumulative effects of disturbance on biomass. Long-term declines in biomass correlated roughly with regional hydroperiods (11.2%, 9.5%, and 6.8% declines in regions TSL, SRS, WCA-3A/3B, respectively). In addition, 22.2% of sites in TSL, 38.9% in SRS, and 20.8% in WCA-3A/3B exhibited potential non-linear dynamics represented by changes in variance, although uncertainty around thresholds was large. Significant directional compositional changes were observed in 67% of sites in TSL, 50% in SRS, and 63% in WCA-3A/3B, with regional mean turnover rates of -0.021, -0.014, and -0.010 yr^{-1}, respectively. However in shorter hydroperiod regions (SRS and TSL) composition shifted to smaller-bodied species that maintain lower biomass, while in a longer hydroperiod region (WCA-3A) composition shifted to larger-bodied fishes. Over a 34 year time-series (1978-2012) metric- and model-based leading indicators indicated a lack of state change despite declining biomass in Northwest SRS, while some evidence suggests that non-linear, threshold-like changes in biomass in response to restored hydroperiods are present in Northeast SRS. TITAN analysis confirms that most fish increased standing stock in response to reduced drought frequency (lengthened hydroperiods) and increased days since drying events, with many responding synchronously at approximately 250 days post-drought. Overall, the evidence for thresholds varied among species and localities, often accompanied by substantial uncertainty. These results indicate care must be taken in selecting performance measures for assessments based on threshold-based management action plans and that environmental change over the study period was not great enough at the study sites to yield ecosystem state change, but was great enough to decrease fish standing stocks by ecologically significant amounts.

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QUANTIFYING THE MOVEMENT AND HABITAT USE OF NATIVE SUNFISHES IN RESPONSE TO SEASONAL HYDROLOGICAL VARIATION IN THE EVERGLADES

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Understanding animal habitat selection and inter-habitat movements plays an important role in population and community ecology. Yet, obtaining a sufficiently high spatiotemporal resolution of the movement paths of organisms remains a major challenge in movement ecology. In this study, we use a combination of tagging and enclosure techniques to gain this high spatiotemporal resolution and examined the movement and habitat use of native centrarchid fishes (warmouth), in relation to seasonal variation in environmental conditions, notably hydrology.

We conducted our experiment in an experimental wetland facility at Loxahatchee National Wildlife Refuge in the Everglades. Low frequency Radio Frequency Identification (RFID) technology was used to track the movement and habitat use of fishes individually tagged with 21 mm Passive Integrated Transponder (PIT) tags. To overcome the sparse recapture rate inherent in tagging studies, we use six replicate 12m by 4 m field in situ enclosures, equipped with an antenna array. Each enclosure spans three key Everglades habitat types: ridge, slough and alligator holes, along an increasing water depth gradient.

Preliminary data collected from 2013 (March-July) shows variation in the use of the three habitats by warmouth across time and hydrological period. Overall, habitat partitioning by warmouth at decreasing and low water condition was alligator hole dominant with minor slough usage and minimal to no ridge use. This changed abruptly upon the start of the rainy season. As water levels began to increase, habitat usage shifted with a significant increase in ridge use and decrease in alligator hole use observed. Later when water levels stabilized, ridge use decreased slightly and partitioning between the alligator hole and slough was similarly equal. These data suggest a degree of temporal partitioning in habitat usage that may relate to foraging and may differentially influence the susceptibility of warmouth to avian predation.

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LANDSCAPE-SCALE HYDROLOGIC RESPONSES TO A FLOW PULSE EXPERIMENT

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Shallow, slow moving surface water called “sheet flow” plays a critical role in sediment transport and nutrient fluxes throughout the Everglades. Over the past several years, our group has used sulfur hexafluoride (SF_6) injected into the water column in tracer release experiments designed to measure these flow patterns at large ($>10^4$ m^2) spatial scales in an environmentally safe, inexpensive and robust manner.

The most recent tracer release experiments were conducted in an impounded zone approximately 1.6 km in width between the L67A and C levees/canals as part of the DECOMP Physical Model (DPM). The DPM is an on-going, large-scale field study that aims to address scientific, hydrologic, and water management issues related to restoring sheet flow in the Everglades.

The specific objective of these tracer release experiments is to determine the large-scale direction and speed of surface water flow between the L67A and C levees/canals before and after the opening of gated culverts installed in the L67A levee. These data will allow for the direct evaluation of the impacts of increased water flow on sheet flow patterns. Tracer measurements during pre-operation conditions have shown large spatial and temporal variability in the flow direction and speed throughout the DPM footprint, whereas measurements after the operation are relatively constant. The implications of these results for future large-scale sheet flow and habitat restoration efforts will be discussed.

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TREE ISLANDS AND THE LAST 5000 YEARS OF HUMAN OCCUPATION

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Since before the formation of the Everglades, people have been living in what is now south Florida. Native American populations were witness to the creation of the Everglades and lived through the last great environmental shift as sea level rose across the region during what is known in archaeological context as the Archaic Period which spans from 7500-500 B.C. The beginning of the Archaic coincides with the start of the Holocene epoch. During this time period, Florida experienced a rise in sea level and a consequent loss of many of the coastal areas and development of the Everglades proper. This climactic change occurred in starts and stops throughout the Archaic period before developing into what is recognized as the modern climate of south Florida at the end of the Archaic. The purpose of this presentation is to discuss what archaeology and information gathered from past inhabitants of the region can tell us about previous expressions of the Everglades and the tree islands that they came to live on.

This presentation will examine data on tree island elevations within Water Conservation Area 3 and Everglades National Park. It will discuss analyses conducted by the U.S. Army Corps of Engineers with regard to understanding the effects of increased water levels on archaeological sites through its examination of data provided by the Everglades Depth Estimation Network. The presentation will address potential next steps to assist in understanding the current and restored environment through the archaeology of people who lived across the landscape of the Everglades.

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REDBAY AND LAUREL WILT: THE SEARCH FOR RESISTANT TREES

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Redbays (*Persea borbonia*) and swamp bays (*P. palustris*) of the coastal plain of the United States have been significantly impacted by laurel wilt since its emergence in 2002. In 2011 aerial surveys detected laurel wilt among the tree islands of Everglades National Park, and the disease has rapidly spread westward to Big Cypress National Preserve and Water Conservation Area 3, causing mortality among the local swamp bay populations. The exotic fungal pathogen (*Raffaelea lauricola*) is disseminated by the redbay ambrosia beetle (*Xyleborus glabratus*) as it bores into the sapwood of healthy trees within the family Lauraceae, with redbay and swamp bay as preferred hosts. To assess the occurrence of putatively resistant survivors within areas of severe mortality, six natural areas with heavy laurel wilt disease pressure were chosen in the SE USA as study sites. Surviving, asymptomatic redbay individuals (3"+ DBH) within these sites were selected as candidate trees; vegetatively propagated, gps labeled, and revisited periodically to confirm their health status. Over 90 putatively resistant redbay selections were chosen, their propagated ramets planted, and included within the laurel wilt resistance screening trial at the UF research farm in Citra, Florida. A total of three field experiments were conducted since 2010. Several replicates of candidate trees were artificially inoculated with a liquid spore suspension of *R. lauricola* and rated weekly for disease development (wilt) and mortality. Results, confirm the extreme susceptibility of redbay to *R. lauricola*, with complete foliar wilt and tree death sometimes occurring within 3-5 weeks of inoculation. However, the propagules of select redbay individuals displayed a repeated tolerance to the disease, with mild to moderate symptoms occurring, yet no mortality.

Ongoing experiments to elucidate the mechanisms for survivorship include the analysis of sapwood anatomy and reactivity to *R. lauricola* infection via electron microscopy, genetic mapping to discover possible resistance-linked loci, as well as an assessment of host tissue volatiles that may affect their attractiveness to the vector (*X. glabratus*). Due to the remote and fragile nature of the everglades ecosystem, traditions control methods (chemical pesticides/fungicides and sanitation) are unfeasible, leaving resistant germplasm as the major viable method to reduce the effects of laurel wilt and establish durable breeding populations. The tolerant germplasm discovered within these trials is currently serving as stock for future breeding and restoration efforts.

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EFFICACY OF EDNA AS AN EARLY DETECTION AND RAPID RESPONSE INDICATOR FOR BURMESE PYTHONS IN THE NORTHERN GREATER EVERGLADES ECOSYSTEM AND ARM LOXAHATCHEE NATIONAL WILDLIFE REFUGE

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Detecting invasive species at low densities and prior to population establishment is critical for successful control and eradication. Burmese pythons occupy thousands of square kilometers of mostly inaccessible habitats and are detrimental to native species. Burmese python detection and occurrence probabilities have been extremely low using tools such as detector dogs, remote sensing, attractant traps, and “Judas snakes.” Environmental DNA (eDNA) is increasingly being used for detection of non-native species to inform management actions, especially when traditional field methods are inadequate. Genetic detection methods are time and cost effective in a number of systems and may be preferable to traditional methods for constrictor snakes. Environmental DNA originates from cellular material shed by organisms (via skin, excrement, etc.) into water or soil, and can be used for species identification. In a pilot study, eDNA assays were developed for five giant constrictor species and Burmese python eDNA was detected throughout southern Florida. From eDNA detection results, a three-level site occupancy model was developed to provide the first informative cumulative occurrence (ψ = 0. 39-0.80) and detection probabilities (p = 0.91-1.00). Detected eDNA also confirmed visual-sighting reports of Burmese pythons in Holey Land Wildlife Management Area and Stormwater Treatment Area 5 (ψ = 0.39 [CI = 0.07-0.83]; p = 0.95 [CI = 0.73-1.00]) indicating that Burmese pythons are moving further to the north and closer to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (ARM-LNWR) boundaries. From August 2014 to 2016, selected areas in and around ARM-LNWR will be surveyed. In addition to assistance with potential rapid response and removal efforts, detection probabilities will be calculated and range-boundaries will be estimated for Burmese pythons in the northern Greater Everglades Ecosystem. Critical habitat, such as wading bird colonies possibly at risk of predation, could also be targeted.

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ENVIRONMENTAL DNA (EDNA) OCCURRENCE AND DETECTION ESTIMATES FOR INVASIVE BURMESE PYTHONS IN SOUTHERN FLORIDA

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Invasive giant constrictors are challenging to detect using traditional tools due to their secretive behaviors, cryptic skin patterns, and occupation of thousands of square kilometers of largely inaccessible habitats. Occupancy and detection probabilities are needed for invasive species population management; however, estimates have only been obtainable for Burmese pythons (*Python molurus bivittatus)* and were extremely low using visual surveys and traps. Burmese pythons*, Northern African pythons* (*P. sebae*), and boa constrictors (Boa constrictor) are established and reproducing, threatening native species and the ecological restoration of the Florida Everglades. Additional species, including the green (Eunectes murinus) and yellow (E. notaeus) anaconda, are present and have the potential to become established in Florida. A potentially informative detection method, environmental DNA (eDNA), uses water samples to amplify DNA that is shed into the environment. To assist detection efforts, we developed species-specific quantitative PCR primers for the Burmese python, Northern African python, boa constrictor, and the green and yellow anaconda. We validated Burmese python, Northern African python, and boa constrictor assays using laboratory trials and we tested all species in 21 field locations within eight south Florida regions. In the field, Burmese python eDNA was detected in 37 of 63 field sampling events, however, the other species were not detected in the field. Although eDNA was heterogeneously distributed in the environment, occupancy models provided the first estimates of detection probabilities which were greater than 91%. Burmese python eDNA was also detected in two new areas near the northern edge of the known population in peninsular Florida.

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CARBON FUNCTIONAL GROUPS INFLUENCE METHANOGENESIS PATHWAYS: FLORIDA EVERGLADES AS A CASE STUDY

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In Florida freshwater Everglades, methane production varies spatially along the nutrient gradient from the eutrophic exterior of the wetland to the oligotrophic interior. Although both acetoclastic and hydrogenotrophic pathways of methane production have been reported, their drivers are not fully clear. We investigated the effects of organic matter quality on methanogenesis pathways using manipulated soil laboratory incubations using CH_3F. Soil samples were collected from three different sites in the Water Conservation Area 2A of the Everglades dominated by different plant species; *Typha domingensis Pers.*, *Nymphea odorata* and *Cladium jamaicense Crantz*. We used biogeochemical properties and solid-state ^{13}C-CPMAS-NMR spectroscopy to determine the organic matter quality. We found a decomposition gradient from upper to deeper soil depth as indicated by increasing alkyl, DOC and decreasing O-alkyl, MBC, MBN, and C:P ratio with increasing depth. The decomposition gradient was coupled with decreasing CH_4 and CO_2 production. Hydrogenotrophic methanogenesis dominated in all sites and depths apart from 5-10cm depth in F1 (63%) and U3S (57%) site. Methane ^{13}C ranged from -49 to -73. Acetoclastic methane production significantly decreased with increasing alkyl (P = 0.0117; R^2 = 0.697) and alkyl: O-alkyl ratio (P = 0.0051; R^2 = -0.749) but not significantly so for hydrogenotrophic methane production (P = 0.0892; R^2 = 0.511) and (P = 0.2215; R^2= - 0.381) respectively. Acetoclastic methanogenesis related positively with aromatic C in F1 site (P= 0.0058; R^2= 0.994) but negatively in U3S (P= 0.0232; R^2= -0.977) and U3R (P= 0.0744; R^2= -0.926). The depleted $^{13}C\text{-}CH_4$ signatures in 30-40cm depth in both F1 and U3R suggest a possibility of anaerobic methane oxidation, which needs further studies. Organic matter recalcitrance appears to facilitate hydrogenotrophic pathway over acetoclastic pathway. Changes in organic matter quality will shift the dominant methanogenesis pathways and influence CH_4 production.

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MICROBIAL METHANE OXIDATION IN FRESHWATER WETLAND SOILS: KINETICS AND SENSITIVITY TO NUTRIENT CONDITIONS

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Methane (CH_4) is the second most abundant greenhouse gas and is 25 times more efficient at trapping heat than carbon dioxide. With an approximate 10 year lifespan in the atmosphere, reductions in CH_4 emissions may significantly reduce the impact of climate change. Microbially mediated CH_4 oxidation is a significant determinant of the net CH_4 fluxed from wetland soils. With the potential to reduce the soil CH_4 emissions by up to 90%, an increased understanding of this process is essential to improve strategies to reduce CH_4 emissions from wetland systems.

The kinetics of CH_4 oxidation were determined in soils along the established nutrient gradient present in WCA-2A in Florida Everglades. A laboratory manipulation study was performed using microcosms containing soils which were collected from the eutrophic (F1) and oligotrophic ridge (U3R) and slough (U3S) sites. Rates of CH_4 oxidation were measured for each soil under the added 10% vol CH_4 concentrations along the depth profile at 0-5, 5-10, and 10-20 cm increments to determine the Michaelis-Menton kinetics. Significant differences were found in the maximum oxidation rate (*Vmax*) and substrate affinity (*Km*) among the sites and with soil depth. The *Vmax* (20.1±4.7 µg CH_4 g^{-1} h^{-1}) at 0-5 cm in F1 was significantly lower than deeper depths. The *Vmax* of F1 at 5-10 cm was significantly higher than U3R and U3S. The *Km* at 0-5 cm in F1 (684 ± 313 µg CH_4 g^{-1}) and U3R (1380 ± 230 µg CH_4 g^{-1}) showed significantly higher affinity for substrate relative to that observed in deeper soils. The *Km* values below 5 cm of U3S were significantly lower than both F1 and U3R. Significant positive correlations with total phosphorus (TP) suggest that TP may be influencing the oxidation activity. Correlations with nitrate (NO_3^-) suggest varying influence on CH_4 oxidation activity, with higher (NO_3^-) concentrations having an inhibitory effect on CH_4 oxidation rates. Results from another study that determined the influence of ammonium (NH_4^+) on the rate of CH_4 oxidation revealed significant negative correlations between the two variables in soils from F1 ($p = 0.0011$) and U3S ($p = 0.0078$) sites. In addition, phospholipid fatty acid analysis was performed to determine the fingerprint of the microbial community structure in different soils. Phospholipid fatty acid (PLFA) analysis revealed differences between bacterial and fungal ratios with soil depth. Correlations with soil nutrients revealed that overall among the sites, the ratio of gram negative to gram positive bacteria, as well as the ratio of all bacteria to fungi were negatively correlated ($p = <0.0001$) with soil total P concentrations.

Kinetic parameters of microbial CH_4 oxidation rates were determined at various soil depths along the established nutrient gradient present in WCA-2A in Florida Everglades and correlated with phospholipid based microbial community structure.

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TEMPERATURE SENSITIVITY OF HYDROLYTIC ENZYMES: APPLICATION TO DECOMPOSITION AND GREENHOUSE GAS EMISSIONS

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Extracellular enzyme activity is a rate limiting step of soil organic matter decomposition. These enzyme activities are direct responses of dominant soil microbial communities to nutrient availability, nutrient limitations and the existing external environmental conditions in soils. Therefore any change in the environment that affects the microbial biomass or the relative abundance of microbial communities can significantly influence the production and activities of extracellular enzymes. This presentation will include results of several studies that have investigated the effect of temperature on various enzyme activities (related to C, N, P cycling) in wetland soils. Some key results of these studies revealed differences in response of enzyme activities to altered temperature conditions under both aerobic and anaerobic conditions. Furthermore these patterns of response varied in soils from different trophic status (nutrient conditions). Enzyme kinetics were not only influenced by the temperature increase but also the rate at which the temperature was changing.

This presentation will address the potential impacts of variation in temperature sensitivity of enzymes kinetics in wetland soils of different trophic status and hydrologic status on decomposition and consequently the carbon losses from soils.

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NITROGENASE ACTIVITY AS AN INDICATOR OF EVERGLADES IMPACT AND RESTORATION

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The observation of high rates of nitrogenase activity in a P limited ecosystem like the Everglades remains somewhat of an enigma. Despite this, N fixing species and conditions abound in both the natural and impacted areas of the Everglades system. This presentation discusses what is known about N fixation in Everglades systems and the major controls on the process which allow it to indicate a variety of system impacts and change. N fixation in the Everglades occurs mostly in periphytic communities dominated by cyanobacteria with a smaller contribution from bacteria and archaea. To date, only two of the many Everglades systems (WCA2A and the marl prairies of the National Park) have received some attention, leaving several key Everglades habitats yet to be studied for their periphyton nitrogenase activity. Based on the few studies conducted thus far, N fixation by periphytic communities in the Everglades can be significant and an important contributor to the overall N cycle of the system. The sensitivity of periphyton (community structure and function) to both physical conditions and availability of N and P also allows nitrogenase activity to be a sensitive indicator of both nutrient dynamics (especially P) and hydrology.

The extreme diversity of conditions present in the Everglades system combined with the close tie between enzyme activity and environmental conditions suggests that more work is needed to accurately assess and quantify nitrogenase and N fixation within the system. Topics that warrant attention are the relative rates of N fixation between different ecosystem components (soil, detritus, and benthic, epiphytic, and floating periphyton) and their response to changing environmental conditions (i.e., light/water depth, temperature, nutrient levels). The exact contribution of N fixation to the N cycle of the Everglades also remains unknown, but through the use of novel techniques such as molecular characterization of nif expression combined with studies to capture the spatial and temporal dynamics of periphyton and microbial mats, we will gain a better understanding of this dynamic process and its importance within the sensitive Everglades system. Combined with future studies tracing fixed N through other system compartments (e.g., dissolved organic N, plant uptake, foodwebs, etc.), the role of the process may be established with larger scale implications for combined effects of P enrichment and hydrology on N cycling through the Everglades landscape.

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HISTORICAL PERFORMANCE OF THE STORMWATER TREATMENT AREAS

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The Everglades Stormwater Treatment Areas (STAs) have been constructed and are operated to remove excess P from agricultural and urban runoff before it goes into the Everglades Protection Area. There are currently five STAs providing a total of approximately 57,000 of effective treatment area. Over their combined operational histories, the STAs have treated 14.8 million acre-feet of water and retained over 1,874 metric tons of total phosphorus (75% TP load reduction). The annual flow-weighted mean (FWM) concentration of TP has been reduced from 137 to 34 ppb. The best performance to date has been achieved in STA-2 and STA-3/4, with a historical mean outflow FWM concentration of 22 and 17 ppb, respectively. In addition, a 100-acre cell within STA-3/4, known as the STA-3/4 Periphyton-based STA (PSTA) has achieved 8-13 ppb over its operational history.

The operation and management of these large-scale treatment wetlands pose many challenges. Short-term operational decisions are based on near-real time data and flow-ways are prioritized based on their condition or constraints. Long-term operational and management strategies are based on long-term evaluation of STA performance, condition, and scientific findings. High hydraulic and TP loading, as well as inflow concentrations are known to affect STAs' phosphorus uptake performance. The South Florida Water Management District has been taking steps to control these key factors, including the construction of Flow Equalization Basins and source control upstream of the STAs, through Best Management Practices. Recent data analyses suggest that when these factors are controlled at desirable levels, other factors, e.g. biogeochemical, could be the primary controllers of the STA's performance. Over years of operation, retained P is stored in the soil, floc, and vegetation biomass. The role of these storage components in short-term and long-term P reduction is the subject of a current research.

This presentation will provide a summary of STA performance, successes and challenges, and key mechanisms and factors affecting STA performance.

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DETAILED MOLECULAR CHARACTERIZATION OF DISSOLVED ORGANIC MATTER FROM THE EVERGLADES: A COMPARATIVE STUDY THROUGH THE ANALYSIS OF OPTICAL PROPERTIES, NMR AND FTICR/MS

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Dissolved organic matter (DOM) is a critical component of the carbon cycle in freshwater systems and its elemental composition and molecular features determine its reactivity and thus its stability in the environment. DOM is particularly prominent in wetland ecosystems and can be exported through drainage into streams and ultimately the ocean. While DOM has been characterized through a great variety of analytical techniques, much focus has been placed on characterizations in oceanic environments and large river systems. In addition, multi-analytical approaches using advanced analytical techniques for the characterization of DOM in wetlands have been sparse. Here we present a detailed characterization of DOM from the Everglades, and present a comparison with that of other sub-tropical wetlands, the Pantanal (Brazil) and the Okavango Delta (Botswana). Data is presented showing that the bulk molecular characteristics in freshwater DOM are shared by diverse aquatic ecosystems that can be very different in their environmental character. However, detailed analyses reveal significant variations in the molecular composition that can in most cases be controlled by site-specific ecological processes and watershed dynamics including fire regimes, external sources of sulphur, and hydrological drivers such as hydroperiod or degree of inundation.

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PHOSPHATASES ENZYMES ACTIVITY IN PHOSPHORUS RICH EVERGLADES TREE ISLANDS ECOSYSTEM

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The tree islands are considered key indicators of the health of the Everglades ecosystem because of their sensitivity to both flooding and drought conditions. Tree islands also act as sinks for nutrients in the ecosystem and may play an important role in regulating nutrient dynamics. Very little is known about the role of enzymes in particular phosphatases in the biogeochemical cycling of phosphorus in this ecosystem. Soil phosphatases play a major role in the mineralization processes of organic phosphorus substrates. Enzymes in soils originate from animal, plant and microbial sources and the resulting soil biological activity includes the metabolic processes of all these organisms. The activity of soil phosphatases can be influenced by numerous factors and soil properties and environmental factors play a key role among them. This study focuses on the characterization of the phosphatases enzymes and microbial communities in tree islands, marshes, and coastal wetlands of the Everglades. Soil samples were collected from marsh, hammock, bayhead, bayhead swamp, and other coastal wetland habitats, and were analyzed for physical, chemical and biological properties. Phosphatase enzyme activity were correlated with total, organic, and inorganic phosphorus. The significance of phosphatases enzymes in regulating phosphorus cycling in these ecosystems will be discussed.

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DEVELOPING SUSTAINABLE SOIL MANAGEMENT PRACTICES FOR ORGANIC SOILS OF THE EVERGLADES AGRICULTURAL AREA

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Water table management and cultivation of organic soils in fields in the Everglades Agricultural Area (EAA) with as little as 16 cm of soil above bedrock presents a problem for continued crop production. The effects of tillage, water-table, and fertilizer on soil microbial biomass, nutrient cycling, gaseous (CO_2, N_2O, and CH_4) flux, and sugarcane yield will be investigated. Changes in gaseous flux or microbial activity may signify altered subsidence rates and help determine which practices enhance soil sustainability. Two studies will be conducted to determine the effects of tillage, water-table, soil depth, and fertilizer on microbial biomass, nutrient cycling, and gaseous emissions. One study will be conducted in lysimeters while another will be conducted in the field. Lysimeters with regulated water-tables and fertilizer rates will be used to examine the effects of 2 water-tables, 2 soil depths, and 2 nitrogen fertilizer application rates. The field trial will examine the effect of 3 tillage treatments. A Gasmet DX4040 will be configured for soil flux measurements to measure soil gaseous flux. Increasingly shallow soil depth as a result of oxidation of organic matter in the EAA has led to challenges in managing these soils. These research trials will help achieve a better understanding on the role of tillage, water-table management, and fertilizer on soil oxidation of the organic soils in the EAA. Developing new practices for sustainable soil management has the potential to mitigate management issues and preserve remaining soil depth.

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GEOCHEMICAL RESPONSE TO AQUEOUS SULFATE ADDITIONS IN AN OLIGOTROPHIC EVERGLADES MARSH

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Attention recently has been focused on increased sulfate concentrations in the Everglades, which have been attributed to upstream anthropogenic activities. Sulfate enrichment in some freshwater wetlands has been shown to liberate sediment P and enhance mercury methylation. To investigate if these or other effects of sulfate enrichment occur in the Everglades, in situ mesocosms were established at a low-P (~4 µg/L), low-sulfate (<1.0 mg/L) site in Water Conservation Area 3A (WCA-3A). The enclosures were dosed with a range (0 [control] to 48 mg/L) of sulfate amendments continuously (bi-weekly) during three consecutive wet seasons.

Sulfate amendments prompted notable changes to the sulfur cycling and redox potential in dosed mesocosms. Sulfate was depleted from surface waters during each batch cycle, but accumulated in porewaters, up to 24 mg/L in the 48 mg/L-amended treatment (cf. 0.5 mg/L in the un-amended controls). Sulfide accumulated in surface and porewaters (porewater sulfide averaged 0.24 mg/L in all sulfate-dosed mesocosms, compared to 0.07 mg/L in un-amended controls). Sediment redox potential decreased with increasing sulfate dose. However, water column soluble reactive P (SRP) was consistently below detection limit (2 µg/L), regardless of sulfate treatment. Further, relative to control mesocosms (no sulfate amendment), sulfate-dosed enclosures showed no response by surface water alkalinity, ammonia, dissolved calcium, dissolved organic carbon, or P species; or by porewater alkalinity or P species.

Total and methylmercury (THg and MeHg) were measured on four select occasions. Following a regional seasonal dry-out in 2011, surface water MeHg concentrations were elevated compared to subsequent sample events, but there was no significant effect of sulfate dose. In 2012, an experimental spike of inorganic Hg(II) increased surface water THg concentrations, but did not increase the MeHg concentration in any matrix. Both before and after the addition of the Hg(II), the mesocosms that received sulfate at 12 and 48 mg/L had a combined higher aqueous MeHg concentrations (0.28 ng/L) than the combined low-sulfate treatments and controls (0.16 ng/L). However, in the final sampling event of the third dosing season (March 2013), surface water MeHg was not significantly related to the sulfate amendment concentration.

Based on study results, we suggest that the oligotrophic, carbon-limited nature of our research site, reflective of much of the remaining Everglades, incidentally precludes or minimizes many of the harmful effects of sulfate enrichment observed in other wetlands.

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GEOCHEMICAL MODELING OF HG SPECIATION AND THE IMPLICATIONS ON MERCURY CYCLING IN THE EVERGLADES

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The Florida Everglades, a subtropical wetland ecosystem located in South Florida, provides significant ecological, water storage, flood control and recreational benefits to the region and important habitat for wildlife including endangered species. However, elevated levels of mercury (Hg), especially methylmercury (MeHg), a potent neurotoxin, have been measured in fish and wildlife in the Everglades over the last few decades. This is not only an issue for human consumption of fish, but also threatens fish-eating wildlife species and the biological diversity of this ecosystem.

Efforts have been made to investigate source, transport, transformation (reduction/oxidation and in particular methylation/demethylation), and bioaccumulation of Hg in fish and wildlife in the Everglades. Spatial patterns in mercury cycling and bioaccumulation in the Everglades have been investigated. However, much remains unclear about how elevated levels of Hg in fish and wildlife are accumulated and the biogeochemical cycling of mercury in this system. Of particular concern is the lack of studies that deal with the speciation of inorganic Hg, whether being dissolved Hg ions (or neutral species) or bound to particles and organic matter, and the effect of these Hg species on Hg transformation (e.g., methylation and photochemical reactions) and bioaccumulation. The objective of this study is to understand how geochemical factors such as pH, dissolved ions, and organic matter affect inorganic Hg species and subsequently control Hg cycling and bioaccumulation.

In this work, geochemical models are used to model the distribution of inorganic Hg species. The data are from the Everglades Regional Environmental Monitoring and Assessment Program (R-EMAP). The United States Environmental Protection Agency began the probability-based R-EMAP survey in 1993, and has collected and analyzed samples, including surface water, soil, vegetation, and fish, throughout the Everglades at about 1000 different locations. This program generated massive datasets, including total mercury, methylmercury, and biogeochemical characteristics parameters, for the entire Everglades ecosystem, which provides an unprecedented data source for geochemical modeling. The distribution of inorganic Hg species in surface water throughout the entire Everglades is determined by applying geochemical models to different R-EMAP sampling sites. The patterns of inorganic Hg species distribution are related to MeHg levels in environmental matrices to examine how inorganic Hg species potentially affect the production and fate of MeHg, and then further related to fish Hg levels to explore the relationship between inorganic Hg speciation, MeHg production, and Hg bioaccumulation. The implications of the distribution of inorganic Hg species on important Hg transformation processes and the overall Hg cycling in this ecosystem are discussed.

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AN INTEGRATED ENVIRONMENT MODEL FOR A CONSTRUCTED WETLAND - HYDRODYNAMICS AND TRANSPORT PROCESSES

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Constructed wetlands (CW) are used by the South Florida Water Management District as the primary technology for treating agricultural stormwater runoff. In South Florida, Stormwater Treatment Areas (STAs) have been built to reduce phosphorus (P) concentrations from agricultural drainage and Lake Okeechobee discharges. The scale of these constructed wetlands is unprecedented in terms of size, cost, and scientific challenges. STA management needs models/tools to provide detailed spatial and temporal information to optimize the P removal efficiency and to predict the dynamic response of STAs under a variety of management conditions. The Lake Okeechobee Environment Model (LOEM) developed for Lake Okeechobee has been enhanced to simulate hydrodynamics and transport processes in the wetland environment. The vegetation resistance stresses caused by Submerged Aquatic Vegetation (SAV) and Emergent Aquatic Vegetation (EAV) are included in the LOEM-CW. The LOEM-CW is calibrated and validated with 6 years of measured data (2008 – 2013) at different locations in cells 3A and 3B of STA 3/4. Through graphical and statistical comparisons, it is shown that the model simulated stage, flow velocity, water temperature, and total Suspended Solid (TSS) in the study area reasonably well. The LOEM-CW is poised to serve as a powerful tool in wetland management and operation of STAs.

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AN INTEGRATED ENVIRONMENTAL MODEL FOR A CONSTRUCTED WETLAND: WATER QUALITY PROCESSES

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Constructed wetlands (CW) are used by the South Florida Water Management District as the primary technology for treating agricultural stormwater runoff. In south Florida, Stormwater Treatment Areas (STAs) have been built to reduce phosphorus (P) concentrations from agricultural drainage and Lake Okeechobee discharges. The scale of the constructed wetland is unprecedented in terms of size, cost, and scientific challenges. STA management needs models/tools to provide detailed spatial and temporal information to optimize the P removal efficiency and to predict the dynamic response of STAs under a variety of management conditions. The model in this study is based on the Lake Okeechobee Environment Model (LOEM) developed for the Lake Okeechobee in the past 15 years. In this study, the LOEM-CW water quality model is developed for simulating water quality processes, especially the P cycling, in constructed wetlands. The coupled interactions of submerged aquatic vegetation (SAV) and emergent aquatic vegetation (EAV) with P variables are included in the LOEM-CW to ensure that the P cycling processes are represented realistically. The LOEM-CW is calibrated and verified with 6 years of measured data (2008 – 2013) at 6 locations in cells 3A and 3B of STA 3/4. Through graphical and statistical comparisons, it is shown that the model simulated P, N, and DO processes in the STA reasonably well. Both EAV and SAV are important to reducing flow velocity, increasing sediment and nutrient settling, and consuming P. Scenario simulations from the LOEM-CW illustrate that increasing water depth, assuming the vegetation can sustain it, increases the retention time and decreases TP concentration in the STA. This manuscript demonstrates a first successful application of an integrated hydrodynamics, sediment, EAV/SAV, and water quality model in STAs or wetlands in the United States.

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MONITORING WATER STAGE AND VEGETATION IN THE EVERGLADES USING SINGLE POLARIMETRIC RADARSAT-2 IMAGERY

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Effective planning for ecosystem restoration requires periodic inventorying and monitoring of wetlands. The characteristic of radar imagery that makes it most suitable in monitoring wetlands is its ability to detect the presence of water. While satellites can provide seasonal data of the wetland systems through repeat coverage, they are prone to cloud cover and tend to have low spatial resolutions. The advantages of Synthetic Aperture Radar (SAR) systems like RADARSAT-2 operating in the microwave C band are that they are unaffected by cloud cover and precipitation, and can obtain images with high spatial resolution on the ground.

Each pixel in the RADARSAT-2 image represents the backscatter which is the intensity of the return signal measured in Decibels. This study attempted to find a correlation between the radar backscatter value obtained through the RADARSAT-2 images and the water stage and vegetation reported in the Everglades Depth Estimation Network (EDEN). Two satellite images acquired on May 4th, 2013 and May 7th, 2013, with a pixel size resolution of 3m were used. The study area was the result of overlapping areas of the two RADARSAT-2 images. The image acquired on the May 4th, 2013 has higher incident angles (46.51^{o}-49.83^{o}) compared to the one acquired on May 7th, 2013 (29.31^{o}-34.1^{o}). A 3x3 mean filter was applied across both images to reduce speckle, and the backscatter was normalized using a cosine law. EDEN ground stations which were located within the study area were chosen. Stations that fell in urban developed lands and stations with misclassified vegetation types were neglected resulting in 41 ground stations. All the stage data was converted to NAVD88 with the local conversions that were provided with the data. The depth of standing water at each station was then calculated by subtracting the water stage from the ground elevations.

The ANOVA test performed on the data shows that the RADARSAT-2 image with higher incidence angles (May 4th, 2013) is more sensitive to the overall hydrologic state of the stations ($p=0.0442$ at $\alpha=0.05$), while at lower incidence angle (May 7th, 2013) there is a significant difference in radar backscatter between different vegetation types ($p=0.0021$ at $\alpha=0.05$). Post hoc analysis determined that stations with vegetation type sawgrass, canal and other (wetland shrubs) had similar backscatter values while wet prairie and slough had similar backscatter. For the stations with wet prairie vegetation type, there is a strong correlation between radar backscatter and depth of water on May 7th, 2013 ($R^2=0.9223$), and a significant correlation between the two on May 4th, 2013 ($R^2=0.5563$). Since radar backscatter is highly dependent on vegetation biomass, additional work will use Normalized Difference Vegetation Index (NDVI) in the algorithm development process.

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RESTORING FLOWS TO NORTHEAST SHARK RIVER SLOUGH, EVERGLADES VIA THE MODIFIED WATER DELIVERIES PROJECT, A 30 YEAR ODYSSEY

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Historically, surface water flows entered Everglades National Park (ENP) from the north, via a shallow eastern flow-way referred to as Northeast Shark River Slough (NESRS). In the late 1920's the Tamiami Trail roadway was constructed across the northern boundary of Shark River Slough. By the 1960's, the Army Corps of Engineers' constructed the Central and Southern Florida (C&SF) Project and levees were built to enclose the central Everglades, forming a series of Water Conservation Areas. These combined actions eliminated the natural marsh sheetflow into ENP, redirected surface water flows into the higher-elevated wetlands of Western Shark River Slough, and caused the NESRS wetlands to drydown and loose much of their peat soils. In 1970 the U.S. Congress directed the Army Corps to provide a Minimum Water Delivery Schedule to ENP, and in 1983 an Experimental Water Delivery Program began restoring surface water flows into Northeast Shark River Slough, but the flows were limited due to flooding concerns on private lands in the East Everglades.

In 1989 Congress declared that Everglades National Park had been adversely affected by external factors which had altered the ecosystem including the natural hydrologic conditions within the park. Congress expanded the boundaries of Everglades National Park to include the contiguous lands and waters of the Northeast Shark River Slough that are vital to the long-term protection of the park and restoration of natural hydrologic conditions within the park (Everglades National Park Protection and Expansion Act, 1989). The 1989 Act directed the National Park Service to acquire 109,000 acres of lands in Northeast Shark River Slough and the broader East Everglades. The Act further directed the Secretary of the Army, to construct modifications to the C&SF Project to improve water deliveries into the park, and take steps to restore the natural hydrological conditions within the park. These C&SF Project modifications were set forth in a 1992 Army Corps of Engineers General Design Memorandum, referred to as the *Modified Water Deliveries to Everglades National Park Project*.

In 2007 construction was completed on the upstream conveyance and seepage management components of the Modified Water Deliveries (MWD) project. In 2013 the eastern Tamiami Trail roadway was raised to accommodate higher water levels in the upstream L-29 canal, and a 1-mile bridge was added to improve conveyance under the roadway. The final feature in the 8.5 Square-Mile Area flood mitigation component is slated to be complete later in 2015, and the first of two incremental field tests will begin to raise water levels in the NESRS marsh in mid 2015. The last phase is the completion of a combined operational plan that will revise water management activities in WCA-3A, NESRS, and the adjacent C-111 canal system. All of these actions will increase marsh water depths and flooding durations, and begin to restore the ecological conditions in these over-drained wetlands.

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REFLECTIONS ON 15 YEARS OF NRC INDEPENDENT SCIENTIFIC REVIEW OF EVERGLADES RESTORATION

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Since 1999, the National Research Council (NRC) has provided independent scientific advice to CERP agencies. The NRC is an independent, non-governmental organization chartered by the government to provide advice on issues of science and policy. In recent decades, the NRC has conducted many studies on large ecosystem restorations, including on the Chesapeake Bay, California Bay-Delta, Platte River, Glen Canyon, and coastal Louisiana, but the Everglades studies represent the NRC's longest continuous engagement on a single ecosystem restoration program.

Since 1999, the NRC has conducted three separate studies focused on Everglades restoration, each with a different study scope and driver, and produced twelve reports. The Committee on the Restoration of the Greater Everglades Ecosystem (CROGEE, 1999-2005) was formed to advise the South Florida Ecosystem Restoration Task Force on specific scientific issues impacting restoration planning. The CROGEE issued six reports on topics including aquifer storage and recovery, monitoring and assessment, and water storage. In 2003, a panel was formed under a congressional mandate to review a National Park Service Everglades research program. In 2004, the Committee on Independent Scientific Review of Everglades Restoration Progress (CISRERP) was formed in response to a Water Resources Development Act of 2000 mandate to provide biennial reviews of Everglades restoration progress. The biennial reviews have offered an opportunity to look broadly at the restoration program and identify the most pressing scientific and engineering issues that may impact progress in any given biennial cycle.

This presentation will reflect on the evolution of the independent review process in the Everglades, major contributions, recurring themes, and lessons learned for other restoration programs.

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IMPACT OF SEA-LEVEL RISE ON EVERGLADES CARBON STORAGE CAPACITY: SHIFT FROM TERRESTRIAL TO BLUE CARBON SINK

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Florida Bay is a shallow carbonate bay located between the southernmost land on the Florida Peninsula and the Florida Keys within Everglades National Park. Numerous islands and carbonate banks, often rimmed by mangroves are scattered throughout the bay and provide important habitat and physical barriers to storm surge, tidal flux, and wave development on the southern coast of Florida. The centers of many of these islands are situated mostly below sea level and are open mudflats with little or no vegetation. These mudflats occasionally flood with rain or seawater and the environment is highly evaporative.

In order to understand the formation and development of these islands, U.S. Geological Survey researchers took 18 sediment cores from 10 sites on 4 islands. These cores will be used to improve the understanding of Holocene patterns and impacts of sea level rise and storm history and to understand the capacity of Florida Bay sediments to store carbon. Each core, ranging from 220-250 cm, bottomed out in limestone bedrock. Several cores contain freshwater peat at their base, suggesting they were initially part of the freshwater Everglades-like wetland habitats. A gradual transition from peat to carbonate mud occurred, followed by a second layer of mangrove peat, as carbonate mud built up enough for mangroves to colonize higher ridges. The amount of organic carbon and inorganic carbon varies throughout these cores, depending on the presence or absence of organic peat. The inorganic carbon is highest immediately following the inundation of the basal freshwater peat and lowest in shell hash layers. Despite the high organic matter content of the peat units, a significant amount of inorganic carbon is still present throughout. The results of this project will contribute to our understanding of the timing of sea-level rise over this shallow bay and how carbon accumulation rates change as the system transitions from organic to inorganic carbon sources.

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AN OVERVIEW OF EVERGLADES MERCURY ISSUES: CRITICAL QUESTIONS REMAIN

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Mercury (Hg) methylation and bioaccumulation is a major environmental issue in the Greater Everglades Ecosystem. Hg has been recognized as a major ecological concern since the late 1970s when elevated concentrations were repeatedly observed in fish and other biota. During the late 1980s, Hg became a major human-health concern with elevated concentrations of Hg being reported in Everglades's sport fish, which lead to a consumption advisory by the Florida Department of Health. In response to these concerns as well as Hg impairments throughout the state, the Florida Department of Environmental Protection (FDEP) developed and adopted the statewide Hg Total Maximum Daily Load.

Each year for the Everglades Ecosystem, FDEP along with the South Florida Water Management District, Florida Fish and Wildlife Conservation Commission, University of Florida and contracted consultants evaluates and investigates Hg conditions, trends and mechanisms specific to the Everglades Protection Area. This presentation will discuss general trends and patterns of Hg concentrations observed in biotia, atmospheric wet deposition and surface water within the Everglades Protection Area (EPA). It will also provide an overview of the statewide Hg TMDL and discuss priority issues revolving around biota-Hg interactions, predictability of the proposed sulfur-Hg relationship, Hg trophic dynamics, and microbial ecology.

Since Florida Water Year (WY; May 1 – April 30) 1989 to present, Hg tissue concentrations in Largemouth Bass (*Micropterus salmoides* L.) sampled across the EPA have declined. Meanwhile, lower trophic level species including sunfish (*Lepomis* spp.) and mosquitofish (*Gambusia* spp.) Hg tissue concentrations remain relatively high with no temporal trends apparent for sunfish and decreasing trends seen in mosquitofish. Similar declines have been observed in avian-fauna with Great Egret (*Ardea alba* L.) Hg feather concentrations declining in recent years. Meanwhile, wet deposition of Hg has remained relatively constant through the period of record (based on areal loading rates). Furthermore, wet deposition of Hg to the Everglades ecosystem is the dominate delivery mechanism of Hg accounting for approximately 95% of the Hg entering the region when compared to surface water inputs.

Although the state of Florida has adopted a statewide Hg TMDL, more work is needed to better understand and predict Hg dynamics, especially in the context of water quality conditions within the Everglades ecosystem. However, without a quantum step in our ability to link surface water conditions (i.e. sulfate/sulfide, iron, dissolved organic carbon, etc.), ambient methyl-Hg and biota Hg levels, there is no way to justify any complimentary ecosystem-wide, parameter specific management strategy to reduce Hg risks.

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EVERGLADES REMAP 2013/2014: SULFUR AND RELATED FINDINGS FOR MERCURY

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The Everglades Regional Monitoring and Assessment Program (REMAP) is a probability-based, multi-media survey that the U.S. Environmental Protection Agency (EPA) has conducted to describe, explain, and predict conditions throughout the public Everglades freshwater flow-way since 1995. In the latest Phase (IV) of the Program, we sampled 51 locations in 2013 and 119 locations in 2014. Sulfur has been a constituent of concern in REMAP because of its relationship to mercury toxicity and because of its adverse effect on the native sawgrass (*Cladium jamaicense*) marsh community.

Sulfate in surface water in Everglades National Park (ENP) in the wet season of 2013 was generally lower than in the previous REMAP survey of 2005. The proportion of ENP with values $\leq$ 1 mg/l (the Comprehensive Everglades Restoration Plan goal) appeared to be slightly greater than in 2005, though only a fourth of the Park remained at background level (0.02 mg/l, the analytical method detection limit). Preliminary data from the 2014 survey of the entire greater Everglades study area indicate far less sulfate in the system than previously.

In 2013 a sampling method was developed to test bottom-water sulfide as a rapid surrogate for pore-water sulfide. The target medium is the nephloid layer, the centimeter of water just above the soil surface. Preliminary data from the 2014 survey show that bottom-water sulfide correlated with surface-water sulfate ($R = 0.33$, $p < .001$), but not as well as pore-water sulfide did in 2005 ($R = 0.77$, $p < .001$).

Methylated mercury in surface water in the Park in 2013 appeared to be down by about an order of magnitude overall (2013 ENP median = 0.061 ng/l, 2005 = 0.125). This decline may be related to generally lower sulfate levels. Preliminary data from the 2014 survey of the entire system show that there was about half as much methyl mercury in surface water as in 2005. As in the Park in 2013, there was also less total mercury, but not enough to explain the difference in methyl mercury.

The mosquitofish (*Gambusia affinis*), a forage fish ubiquitous in the Everglades, is used in REMAP to monitor mercury levels in consumers. Limited data obtained in 2013 suggested a decline in the Park from 2005. Nevertheless, about one-fifth of the data distribution in 2013 was above EPA's predator protection level of 77 ng/g. Preliminary data from 2014 corroborate the 2013 results. All descriptive statistics show about one-third as much mercury in mosquitofish system-wide. This finding is probably reflective of the lower sulfate levels in the system.

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PATTERN AND PROCESS IN THE EVERGLADES RIDGE-SLOUGH LANDSCAPE

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The ridge-slough patterned landscape is one of the sentinel features of the historical Everglades and a focal point for restoration. This talk synthesizes five years of research on pattern and process in this evocative and important landscape, with an emphasis on our emerging understanding of the features, origins and resilience of ridge-slough patterning. We begin by exploring patterns of soil elevation across a gradient of hydrologic modification in the Everglades. These results yield the inference that elevation bimodality is a core indicator of landscape condition and that the loss of bimodality precedes spatial pattern changes observable via classical remote sensing methods. We then expand to the landscape scale to document reciprocal feedbacks between pattern geometry and hydrology through the use of hydrodynamic modeling, illustrating how ridge density, shape, and orientation combine to control hydroperiod. That work forms the basis for recent and ongoing work, which focuses on the mechanisms of landform development. We present two models (one analytical, one numerical) that explore the plausibility of hydroperiod as the primary feedback that controls ridge density and patch elongation, a concept we refer to as the self-organizing canal hypothesis. Our results lend support to that general framework, but also suggest important limitations. Next, we summarize recent work that rigorously describes the extant ridge-slough pattern over a range of spatial scales and proposes a novel set of spatial metrics that can be used to evaluate the performance of spatial models. These results provide the critical observation that landscape pattern is not regular (that is, there is no characteristic wavelength), suggesting global, rather than intermediate-scale, controls on pattern development. This finding helps identify a subset of plausible negative feedback mechanisms that influence ridge-slough patterning, while potentially eliminating other hypothesized drivers. Finally, we explore the explicit coupling of hydraulics and pattern geometry to test the efficacy of landscape change metrics that can be useful for documenting landscape pattern response to restoration activities.

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ASSESSING THE VALUE OF THE CENTRAL EVERGLADES PLANNING PROJECT (CEPP) IN EVERGLADES RESTORATION: AN ECOSYSTEM SERVICES APPROACH

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This study identifies ecosystem services that could be affected by a restoration project in the central Everglades and monetizes the economic value of a subset of these services using existing data. Findings suggest that the project will potentially increase many ecosystem services that have considerable economic value to society. The ecosystem services monetized within the scope of this study are a subset of the difference between the future-with the Central Everglades Planning Project (CEPP) and the future-without CEPP, and they totaled ~$1.8 billion USD at a 2.5% discount rate. Findings suggest that the use of ecosystem services in project planning and communications may require acknowledgement of the difficulty of monetizing important services and the limitations associated with using only existing data and models. Results of this study highlight the need for additional valuation efforts in this region, focused on those services that are likely to be impacted by restoration activities but were notably challenging to value in this assessment due to shortages of data.

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DESIGN AND CONSTRUCTION OF A FLOW EQUALIZATION BASIN TO OPTIMIZE PERFORMANCE OF EVERGLADES STORMWATER TREATMENT AREAS

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In order to reduce phosphorus concentrations in waters that are received by the Everglades, the South Florida Water Management District (SFWMD) has constructed and is currently operating roughly 57,000 acres of Stormwater Treatment Areas (STAs). Since 1994, Everglades STAs have reduced average annual total phosphorus concentrations from approximately 170 parts per billion (ppb) to 19 ppb, with some individual STAs as low as 12 ppb. This has had a significant impact in achieving overall restoration goals for the Everglades. However, Florida's wet season storm events result in peak stormwater runoff flows that can result in undesirable STA water depths, damage to treatment vegetation, and reduced phosphorus removal performance. To address these and other issues, SFWMD is implementing the Restoration Strategies initiative, where the performance of existing water quality infrastructure continues to be optimized and a suite of additional water quality projects are being constructed in order to further reduce phosphorus concentrations. The suite of projects will add an additional 6,500 acres of STA and add almost 120,000 acre-feet of storage in three reservoirs, also known as flow equalization basins (FEBs).

The A-1 FEB project is specifically designed to support the operations of STA-3/4, the world's largest STA, and STA-2. The approximately 60,000 acre-foot A-1 FEB (15,000 acres x 4 feet deep) will attenuate peak flows and temporarily store stormwater runoff from approximately 275,000 acres of land in the central Everglades Agricultural Area collected by the North New River (NNR) and Miami Canals. The A-1 FEB will then release water to STA-3/4 and STA-2 at a controlled rate, therefore improving water depths, vegetation conditions and phosphorus removal performance within the STAs.

A-1 FEB inflows are directed from south to north along its perimeter via two above-ground channels. Water then flows south through the FEB's interior for release to the STAs. This configuration ensures that stormwater will travel completely through the FEB before being released, which allows sufficient time for suspended solids to settle out. This increased travel time will also allow for ancillary water quality improvement from contact time with emergent aquatic vegetation that will naturally propagate within the FEB over time. The design of the A-1 FEB effectively utilizes existing STA canal and pump station infrastructure for its inflow and outflow operations which reduces construction, operation, and maintenance costs while also providing necessary operational flexibility. The A-1 FEB design further reduces operation and construction costs by utilizing solar-powered slide gates for a large portion of the A-1 FEB discharge structures while also improving operational performance.

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NOAA'S INTEGRATED ECOSYSTEM ASSESSMENTS: USING ECOSYSTEM SERVICES TO IMPROVE DECISION MAKING

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Federal resource management agencies in the U.S. have been mandated to adopt the principles of Ecosystem Based Management (EBM) to protect their trust resources. The two primary goals of CERP are to enhance ecological values and enhance economic values and social well-being. These goals are, in essence, equivalent to EBM. To make scientifically sound EBM a reality requires the development of a transparent process for summarizing the status of the ecosystem, including humans; analyzing risks to the ecosystem; and evaluating tradeoffs amongst alternative management scenarios. This process must be able to quantify these tradeoffs among the various ecosystem services society wants and needs. NOAA has developed the Integrated Ecosystem Assessment (IEA) process to be the analytical engine informing EBM decisions.

IEAs are currently being implemented in five large marine ecosystems throughout the U.S., including the Gulf of Mexico. The Gulf of Mexico IEA leverages a vast amount of IEA work that has already been completed in south Florida's coastal ecosystem. The south Florida marine ecosystem has a few established indicators for ecosystem health through Everglades Restoration. The MARine and EStuarine Goal-Setting for South Florida (MARES) expanded these indicators to include a comprehensive suite of indicators and indices for both ecology and socioeconomic components of the ecosystem. The MARES approach focused upon indicators that were directly connected to the delivery of ecosystem services. In addition to developing comprehensive indicators for summarizing the status of the ecosystem, the IEA program in conjunction with MARES developed a new risk assessment methodology focused on examining risk not just to the natural components of the ecosystem, but also to the delivery of ecosystem services. Planned IEA activities in south Florida for the coming year are aimed at investigating and quantifying the linkages between ecosystem status, ecosystem services and human well-being via ecosystem service production functions and correlative linkages between ecosystem services and Human Well-Being indices that already exist for the Gulf of Mexico.

In addition to efforts in south Florida, IEAs are being used across the U.S. to aid in decision-making for marine activities ranging from fisheries, to the siting of wind farms, to comprehensive ecosystem restoration of Puget Sound. Results from these initial stages of IEA development in south Florida will be presented along with other relevant examples of ecosystem service analyses in other regions of the country and the proposed next stages for the IEA in south Florida. The presentation will close with ideas regarding how IEAs provide ecosystem service information in a format that could be used to inform decision-making for Everglades restoration.

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BIOGEOCHEMICAL FLUXES FROM ESTUARINE MANGRGOVE LAKE SEDIMENTS ADJACENT TO FLORIDA BAY

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Using core incubations, we estimated the net exchange of nitrogen and phosphorus species under light and dark conditions in estuarine lakes that are the aquatic interface between the freshwater Everglades and marine Florida Bay. These lakes and adjacent shallow water Florida Bay environments are sites where restoration of hydrological flows will likely have the largest impact on salinity. Sediment respiration, measured by oxygen uptake, averaged 2400±1300, -300±1000 and 1900±1400 mmol m^{-2} h^{-1} for dark incubations, light incubations, and gross photosynthesis estimates respectively, with dark incubations consistent with oxygen uptake measured by microelectrode profiles. Although most fluxes of soluble reactive phosphorus, nitrate, and N_2-N were low under both light and dark incubation conditions, we observed a number of very high effluxes of ammonium during dark incubations. A significant decrease of ammonium flux was observed in the light. The largest differences in the efflux of NH_4^+ occurred in lakes during periods of low coverage of the aquatic macrophyte *Chara hornemannii* Wallmam, with NH_4^+ effluxes > 200 mmol m^{-2} h^{-1}. Increasing freshwater flow from the Everglades will expand lower salinity environments suitable for *Chara* abundance, and therefore, may diminish sediment NH_4^+ effluxes.

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VEGETATION REGENERATION IN THE HOLE-IN-THE-DONUT, EVERGLADES NATIONAL PARK, MEETS SUCCESS TARGETS

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The Hole-in-the-Donut (HID) is a tract of land located in the southern Everglades National Park (ENP), encompassing 6,300 acres of former freshwater glades marsh, hydric marl prairie, and mesic pine rockland, which was farmed starting in the early 1900s. Farming activities ceased in the mid-1970s, and subsequently the HID developed into a monotypic, Brazilian pepper (*Schinus terebinthifolius*) stand. In 1989, a pilot project identified a promising treatment. The treatment method involves complete removal of vegetation and disturbed substrate down to bare limestone. The soil removal method establishes native plant species colonization conditions that successfully regenerate naturally occurring vegetation communities.

In the 1990s, the Army Corp of Engineers (ACOE) and Florida Department of Environmental Protection (FDEP) authorized an In-lieu Fee (ILF) mitigation project, and mitigation funds have driven yearly efforts to restore additional HID areas and continually assess success. Across 26 years, ENP has restored approximately 4,895 acres of disturbed, non-native Brazilian pepper monocultures to natural wetlands and annually evaluated restoration area performance.

We applied rigorous analyses on the extensive HID vegetation monitoring dataset, satellite imagery, and hydroperiod models, to quantify compliance with performance standard targets and identify natural community distribution. Performance standard targets include re-colonization with appropriate native species, limiting non-native, nuisance vegetation to 1% cover, and restoring freshwater wetland function. Analysis taps into an extensive vegetation monitoring dataset spanning 26 monitoring years. Annual reports describe native species recruitment, emigration, and colonization across temporal and spatial gradients. Detrended Correspondence Analysis (DCA), Canonical Correspondence Analysis (CCA), and remote sensing identify emerging, succeeding, and persisting natural communities.

Analyses indicate restored HID areas rapidly attain performance targets with minimal land management. The areas contain high native species diversity, low Brazilian pepper cover, low non-native, nuisance species cover, and high wetland functions. NPS land management comprises prescribed burns and herbicide-treating nuisance plant species. Restored areas trend towards herbaceous and graminoid dominated freshwater marsh and prairie communities.

In the next 10 years, ENP will remove the remaining 1,405 acres Brazilian pepper monoculture stands and restore natural wetland functions to the HID. Future vegetation monitoring and analysis will continue to discover more about the on-going and future trends in the HID.

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INTERAGENCY MONITORING AND ASSESSMENT EFFORTS FOR THE ARGENTINE BLACK AND WHITE TEGU IN THE SOUTHEASTERN EVERGLADES

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Argentine black and white tegus (*Tupinambis merianae*) are large-bodied teiids native to South America. This species is now established in the southeastern Everglades in Miami-Dade County. In 2008, members of the Everglades Cooperative Invasive Species Management Area discovered this population and cooperating agencies began an interagency monitoring and assessment effort in 2009. The effort emphasizes assessment by removal with goals of containing and controlling the population.

More recently, the Florida Fish and Wildlife Commission (FWC), University of Florida, National Park Service, United States Geological Survey, Miami-Dade County, and South Florida Water Management District are coordinating monitoring live traps and remote cameras, determining reproductive status and diet, and tracking tegus using radio telemetry. These activities occur primarily in natural areas. In agricultural and suburban areas, FWC is monitoring reports of the species made by the public through web- and phone-based exotic species reporting tools. Live traps are delivered to citizens willing to monitor them in cooperation with the Miami-Dade County Venom One unit.

Results of these efforts indicate that tegus are highly adaptable and well-suited to wetland and ruderal habitats in southeastern Miami-Dade County. The population appears to be growing and spreading quickly from the initial core area. The ability of tegus to overwinter has allowed them to persist as far north as Hillsborough County (site of a separate population). Tegus are omnivorous and stomach content analyses from tegus collected in 2012 and 2013 revealed consumption of both native and nonnative plants and animals, including protected species. If the population is allowed to go unchecked, tegus may pose a threat to local populations of native wildlife, including the American Crocodile (*Crocodylus acutus*) and Key Largo Wood Rat (*Neotoma floridana smalli*), two federally-designated endangered species. Long-term management will be needed to control the population and coordinating agencies continue to improve on detection and control efforts as we work to understand the long-term impacts of this new invader.

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BRIDGING THE GAP BETWEEN EVERGLADES PREY PRODUCTION AND WADING BIRD PREY SELECTION

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The Tropic Hypothesis relies on the interaction of landscape and hydrological processes that convert aquatic fauna produced in the wet season into available prey for wading birds during the dry season. Since wading birds are food limited in the Everglades, processes that increase aquatic fauna concentrations, and their availability to wading birds, are essential to increase wading bird populations in South Florida. First generation predictive models using a combination of field measurements and remotely gathered hydrological data from the Everglades Depth Estimation Network (EDEN) have shown that water level recession rate, wet-season prey biomass, microtopography, and submerged vegetation all play key roles in generating high concentrations of aquatic fauna that are available to wading birds. However, wading birds do not forage randomly throughout the landscape, so we must make the key link between prey availability and wading bird prey selection in order to understand the processes that generate prey communities more likely to support wading bird populations.

We conducted a three year study on wading bird prey selection by collecting food boluses from Wood Stork (*Mycteria americana*), Tricolored Heron (*Egretta tricolor*), Snowy Egret (*Egretta thula*), and Little Blue Heron (*Egretta caerulea*) nestlings. We found that wading birds actively selected prey larger than generally available in the environment. This selection limits Wood Stork prey to < 1% of that produced in the natural Everglades landscape, and small heron prey to ~30% of that produced in the landscape. To account for this selection, we are generating second generation models to determine the processes that generate high concentrations of consumed wading bird prey types. We are limiting our model terms to hydrological variables that we can remotely derive from EDEN. Preliminary analyses suggest that water level recession rate and water level amplitude (the extent of dry-down throughout the dry season) are the major factors producing concentrations of the large prey selected by wading birds. Our final models will be used to create predictive maps of prey densities based on real-time hydrologic data to better assess the effects of water management practices on wading bird populations.

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VARIABILITY IN THE SUBMERGED AQUATIC VEGETATION COMMUNITY WITHIN THE NORTHEASTERN FLORIDA BAY MANGROVE ECOTONE OVER TWO DECADES

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Audubon's Everglades Science Center has been monitoring hydrologic conditions in the coastal mangrove zone of northeastern Florida Bay since 1990. The emphasis of this research is how these hydrologic conditions affect submerged aquatic vegetation (SAV) and fish populations in the watershed. Since 1996, surveying of SAV has been conducted bi-monthly at 4 sites: Taylor River (TR), Joe Bay (JB), Highway Creek (HC) and Barnes Sound (BS). At each site, 6 fixed stations (4 at BS) are surveyed along a salinity gradient; beginning at a hydrologic monitoring station upstream and ending at Florida Bay. Abundance estimates of SAV are assessed using a point intercept percent coverage method. Salinity, temperature, water depth and water clarity of surface water are measured at each station on the day of the survey. SAV communities consisted of euryhaline seagrasses, algae, and freshwater marsh plants. Stations of similar annual mean salinity had similar assemblages of vegetation. Upstream stations exhibiting annual mean salinities ranging from 6.5-9.8 psu consisted primarily of a mixed assemblage of *Chara hornemannii* and *Ruppia maritima*; as well as freshwater plants. Downstream stations exhibiting annual mean salinities ranging from 19.0-28.4 psu were dominated by *Halodule wrightii*, or *Thalassia testudinum*. Since 1996, annual mean salinity at all stations has steadily increased; yet, only at the downstream HC sites was this salinity increase significant ($p<.001$). Over the same time period, water depth at all four of the downstream stations increased as well as at upstream HC, ($p<.01$). SAV abundance changed in concurrence with these shifts in the physical parameters, most notably at the upstream stations. Total SAV abundance decreased with increasing salinity ($p<.001$) at all upstream stations except BS and increased with increasing water level ($p=.04$) at the upstream JB and TR sites. The salinity at upstream BS is twice that of the other upstream stations due to its' close proximity to the marine environment. Years that were less saline resulted in increased abundance and higher species diversity of SAV. SAV at upstream stations were also prone to seasonal die-off and re-growth coincident with rapid increases in salinity at the onset of the dry season. Most recently, the seasonal die-off at the upstream sites of TR and JB has been severe and prolonged since the onset of the 2013-14 dry season. Recolonization and continued growth occurs with lowered salinities throughout the wet season. Only at the downstream HC sites has the increase in total SAV abundance been significant ($p<.01$) across the entire 2 decades of the study. However, since May 2007, total SAV abundance across the BS transect, upstream HC, and downstream JB, displayed a significant increasing trend ($p<.01$). All of these sites with the exception of the upstream HC site have annual mean salinities greater than 20 psu; but, the entire HC transect has been subject to increased marine influence since completion of construction of bridging and new culverts under US-1 in 2008 allowing greater connectivity between the ocean and Long Sound.

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CLIMATE CHANGE PROJECTED EFFECTS ON COASTAL FOUNDATION COMMUNITIES OF THE GREATER EVERGLADES USING A 2060 SCENARIO: NEED FOR A NEW MANAGEMENT PARADIGM

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Rising sea levels and temperature will be dominant drivers of coastal Everglades' foundation communities (i.e., mangrove forests, seagrass/macroalgae and coral reefs) by 2060 based on a climate change scenario of +1.5 ^{o}C temperature, +1.5 foot (46 cm) in sea level, +/- 10% in precipitation and 490 ppm CO_2. Current mangrove forest soil elevation change in South Florida ranges from 0.9-2.5 mm y^{-1} and would have to increase 2 to 4-fold in order to accommodate a 2060 sea level rise rate. No evidence is available to indicate that coastal mangroves from South Florida and the wider Caribbean can keep pace with a rapid rate of sea level rise. Thus, particles and nutrients from destabilized coastlines could be mobilized and impact benthic habitats of southern Florida. Uncertainties in regional geomorphology and coastal current changes under higher sea levels make this prediction tentative without further research. The 2060 higher temperature scenario would compromise Florida's coral reefs that are already degraded. We suggest a new paradigm is needed for resource management under climate change that manages coastlines for resilience to marine transgression and promotes active ecosystem management. In the case of the Everglades, greater freshwater flows could maximize mangrove peat accumulation, stabilize coastlines and limit saltwater intrusion, while specific coral species may require propagation. Further, it is suggested that regional climate drivers and oceanographic processes be incorporated into Everglades and South Florida management plans, as they are likely to impact coastal ecosystems, interior freshwater wetlands and urban coastlines over the next few decades.

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WATER MANAGEMENT AND HYDROLOGY OF NORTHEAST SHARK RIVER SLOUGH, 1940 TO 2015

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Monitoring flow under Tamiami Trail (US41) began in 1940 and comprises one of the longest records of hydrologic data in South Florida. The United States Geological Survey, in cooperation with the National Park Service and United States Army Corps of Engineers, measures the flow through each bridge or culvert on a semi-monthly basis and computes the total discharge for 4 separate sections along US41, including the section from L30 to L67 representing Northeast Shark River Slough (NESRS).

This analysis focuses on the evolution of flows into NESRS from 1940 to present and how they have changed with each major structural or operational change. In those years, there were several significant changes in water management, including rain driven hydrology in the early years, the construction of the east coast protective levee, the impoundment of the conservation areas, the experimental program, and most recently the construction of a one-mile bridge.

To evaluate changes in the spatial distribution of flow we needed measurements of the individual culverts. The USGS only reports the total flow through all of the culverts, but the individual measurements were recorded on the field sheets. Consequently, we compiled all of the field sheets from the USGS to get the flow through each individual culvert into a database.

This analysis evaluates changes in the quantity, quality, timing and spatial distribution of water flowing across US41 into NESRS for each of the time periods and uses available data in the marsh to evaluate the downstream response.

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MERCURY CONTAMINATION OF THE EVERGLADES: REVELATIONS FROM THE LONG-TERM ACME PROJECT AND FUTURE CONSIDERATIONS

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Globally, mercury (Hg) Mercury contamination of the environment remains an important topic due to propensity for methylmercury (MeHg) to bioaccumulate beyond safe thresholds in fish, wildlife and humans. The study of Hg biogeochemistry is challenging due to its low concentrations (parts per trillion) in most environmental settings, and a high susceptibility to phase, redox, and chemical speciation changes. In addition, water and land management approaches can have profound effects on the distribution, chemical speciation, and toxicity of Hg. Such is the case of the Florida Everglades, home to one of the largest ecosystem restoration effort ever attempted. Many years of research by the USGS-led Aquatic Cycling of Mercury in the Everglades (ACME) project has helped to resolve how man's past and present actions have affected fundamental biogeochemical processes that are important to ecosystem health, and profoundly affect Hg cycling. The overall goal of the ACME project is to provide science that supports resource management decisions by providing information that can anticipate how current and future restoration actions will affect Hg cycling in the Everglades.

This presentation will serve as a synthesis of the ACME project since Hg was discovered as an issue in south Florida in the 1980's. At that time, ubiquitously high Hg levels in sport fish and reported lethal exposure to the Florida Panther was the impetus for initiating the multi-disciplinary ACME project. Scientific opinion at that time held that conditions in subtropical wetlands, like the Everglades, would universally promote the formation of MeHg. However, the ACME team revealed that very large gradients in MeHg existed across the ecosystem, from some of the highest ever reported to undetectable, and were driven by both man-related and natural factors, which range from water quality to climate variability. Recently, the ACME team has collaborated on the development of a spatially discrete MeHg prediction model that relates sulfate releases from canal discharge points and flow across the surface of the marsh. Suggestions on the application of new mercury research tools that will continue to inform Hg science in the Everglades will be offered.

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PROGRESS IN A HINDCAST SIMULATION OF THE 1926 GREAT MIAMI HURRICANE

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Simulations of the 1926 Great Miami Hurricane were originally included as part of an investigation into long-term sources of vegetation regime change in the Everglades. Using the 1996-2004 USGS BISECT hydrodynamic model, a hindcast for the Everglades was conducted from 1926-1932. The hindcast included most major storms during that time frame, but the 1926 Great Miami Hurricane was omitted because the model input gages had been destroyed by the storm. The missing data was estimated for rainfall from anecdotal evidence and empirical storm relationships and for wind data from modern gridded wind fields taken from Hurricane Wilma. Our experience shows that the hindcast provided valuable lessons in adapting to the uncertainties and limitation of historic data sets, which can then function as a bridge to even larger uncertainties associated with forecast simulations.

A reanalysis of the hindcast of the Great Miami storm was funded to test alternate scenarios for modern hurricane impacts. Ranking of damage estimates for U.S. hurricanes shows that damage from the Great Miami storm accounting for inflation far exceeds damage for all but one other modern hurricane, Hurricane Katrina. Our storm-focused hindcast shows both strengths and weaknesses. The model was able to represent the effects of historic sea-level rise and contrast that with canal development over the last 70 years. This work is presented by Swain et. al. in this conference. The hindcast was not as capable at representing storm surge conditions. Historic aerial photographs of Haulover Inlet after the 1926 storm clearly show multiple episodes and directions of storm surge flow. The current version of BISECT estimates storm surge by a stationery boundary condition. The model is unable to reliably represent the temporal variation of boundary conditions needed to portray the Great Miami surge.

Future work will focus on adapting the USGS hydrodynamic model to better represent these temporal surge variations. This gap between onshore flow models and offshore surge models has been highlighted by local emergency managers as a major obstacle to improving storm response forecasting. In response, the USGS is part of a cooperative proposal with NOAA and Miami-Dade County to conduct continuous current real-time monitoring for flows, water levels, and salinity from a hardened gage capable of measuring storm surge. Efforts to involve the international community to help improve the representation of major storms are also being pursued. Given our previous success with hindcasts, we could foster cooperation with modeling efforts in other countries of comparable historic storms.

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WHERE ARE ALL THE BONEFISH? INTEGRATING ANGLER PERSPECTIVES AND ECOLOGICAL CHANGES INFLUENCING BONEFISH DECLINES IN THE FLORIDA BAY

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In south Florida and throughout the west-central Atlantic Basin, bonefish *Albula vulpes* are the backbone of recreational fisheries (Larkin et. al, 2010). Recreational bonefish fisheries in Florida contribute almost $1.5 billion yearly to the economy (Vasquez-Yeomans et.al. 2009), supporting livelihoods for professional fishing guides year-around. Bonefish are the preferred fish species among anglers in the Florida Keys because of their large sizes and their great strength and endurance thereby challenging anglers during capture (Crabtree et. al., 1996). Recreational fishing and evidence of bonefish decline have both increased with human population growth (Cooke and Phillip, 2004). In the last century, Florida bay has changed from a natural to a highly managed system due to the construction of large networks of canals that have diverted freshwater away from the Bay, as well as other notable changes (Stabenau and Kotun, 2012).

This project aims to account for the change in distribution and abundance of bonefish throughout Florida bay. We ask what has caused bonefish decline, how has bonefish decline changed over space and time, and how has the decline in bonefish changed overall angler perceptions and behaviors? We aim to answer these questions by analyzing trends in previously and on-going collected data on prey abundance, sea-grass distribution, and hydrological changes in Florida bay. A mix of semi-structured surveys and key informant interviews will also be conducted to complement and strengthen the patterns and changes we find in the biological data sets. By establishing data through these methods we should be able to derive a baseline not currently known due to a lack of data on bonefish catches.

The recreational fishing industry is a very important in many parts of the world. Specifically, in South Florida, it contributes a substantial amount to the economy. Without this industry, the broader economy as well as the people whose livelihoods depend on it will experience severe losses. Unlike commercial fisheries, once a recreational fishery such as bonefish has declined to economic extinction, there is no substitute and the fishery will close. The importance of understanding bonefish movement and why they have experienced declines is not only a benefit to the conservation and maintenance of the species, but also to the maintenance of livelihoods that recreational bonefish fisheries provide. By involving anglers and guides in the main data collection process we can increase both outreach and education on the importance of sustainable fishing practices and increase overall support for conservation.

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BIODIVERSITY OF FUNCTIONAL GENES ACROSS MIAMI-DADE COUNTY SOILS

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Soil microbial community plays an important role in maintaining the fertility and stability of soils by cycling the biochemical nutrients such as carbon, phosphorus, nitrogen, sulfur, iron. Soil bacterial community profiles have been categorized using 16S rRNA hypervariable domains. These domains are effective in determining the taxa present in soils. However, 16S rRNA profile is not adequate to establish the functional diversity of these microbes. These functions are carried out by the enzymes produced by soil microorganisms. Thus, investigation of these functional enzymes can provide a better understanding of the function of the soils and the relationship between biodiversity and ecosystem stability. The objective of the study was to compare the functional diversity of microbial communities amongst different soil types: Lauderhill Dania-Pahokee (Soil type 2) and Perrine-Biscayne-Pennsuco (Soil type 4) of Miami-Dade County, Florida.

DNA was extracted from samples (n = 36) collected from one transect belonging to each soil type. Degenerate primers for *mcrA, cel48,* and *dsrA* were used to amplify the gene using polymerase chain reaction followed by cloning and sequencing. Sequences were analyzed by BLAST and subsequently aligned to construct phylogenetic trees in Mega 6.0. On comparison of sequences of *mcrA* gene obtained from KNT and CS transect with reference sequences from other Florida studies resulted in close alignment with *Methanothermobacter thermautotrophicus*. However, many were not associated with any known reference samples. Reference sequences for *cel48* gene aligned with different transects but also sub-grouped together. The two transects for *dsrA* gene for most part grouped within their respective soil type. Although some of the clones from the two soil types examined in Miami-Dade County grouped together with a particular soil type, there was overlap in the clones from the different soil types. These overlaps for these genes are indicative of saturated anoxic soils which are also useful for discrimination of environmental ecosystems. Thus, the study of these overlaps is important as it can also provide useful information. The assessment of phylogenetic and functional abilities of microbial communities will clarify the importance of microbes for soil function and hence define its structure.

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BIOLOGICAL CONTROL OF LYGODIUM MICROPHYLLUM

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Old World climbing fern, *Lygodium microphyllum* (Cav.) R. Br. (Polypodiales: Lygodiaceae), was first reported as naturalized in Florida in 1968. It is now widespread and expanding its range throughout wetland and mesic habitats in south and central Florida, with isolated populations further north. *Lygodium microphyllum* invades ecologically sensitive areas where it degrades habitats and reduces ecosystem services. It forms persistent rhizomes and is a prolific producer of self-compatible windborne spores, which facilitates its spread into remote areas. Old World climbing fern is difficult to manage using herbicide and other traditional control techniques, and can act as a fuel ladder, carrying fires to areas that do not normally burn.

Three biological control agents have been approved for release against *L. microphyllum*: the white Lygodium moth, *Austromusotima camptozonale* Yen (Lepidoptera: Crambidae), the brown Lygodium moth, *Neomusotima conspurcatalis* Warren (Lepidoptera: Crambidae), and a mite, *Floracarus perrepae* Knihinicki & Boczek (Acariformes: Eriophyidae). The white Lygodium moth failed to establish in Florida despite extensive release efforts. All releases of *N. conspurcatalis* that consisted of 4,000 or more larvae established persistent populations and dispersing moths are colonizing new sites. Extensive feeding by large numbers of *N. conspurcatalis* larvae can cause entire *L. microphyllum* tree skirts to "brown out." Feeding by *F. perrepae* causes leaf roll galls, which can reduce the above and belowground biomass of *L. microphyllum* and destroy apical meristems. The mite is dispersing at a rate of approximately 3.5 km per year. Ongoing research is evaluating the impact of these agents and how to integrate biological and chemical control. Both *N. conspurcatalis* and *F. perrepae* are being massed reared and released as part of the Comprehensive Everglades Restoration Plan (CERP).

Two additional potential biological control agents are undergoing host-range testing at the IPRL quarantine facility. *Lygomusotima stria* Solis & Yen (Lepidoptera: Crambidae) is a leaf-defoliating moth related to *A. camptozonale* and *N. conspurcatalis*. The sawfly *Neostrombocerus albicomus* Konow (Hymenoptera: Tenthredinidae) causes large defoliation events in the native range of *L. microphyllum*. Foreign exploration for additional potential agents is ongoing, with particular emphasis on stem-boring moths, which cause extensive damage but are extremely difficult to colonize.

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POTENTIAL SEA LEVEL CHANGE IMPACTS WITHIN THE SHARK RIVER SLOUGH BASIN AREA

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Over the period from 1900 to 2000, sea level rise at Key West, Florida was roughly +9 inches, and this rate is expected to accelerate in coming years. U.S. Army Corps of Engineers (USACE) guidance requires consideration of three future sea level change (SLC) scenarios based on historic, intermediate and high rates of relative SLC developed per National Research Council guidance and info from nearby long term tide station records. Use of these future scenarios is intended to help project teams identify potential SLC impacts on existing or potential civil works projects, and then make risk-informed decisions on appropriate adaptation strategies, if needed.

This presentation will focus on potential sea level change impacts on landscape elevations in the Shark River Slough Basin Area from the Gulf Coast to Water Conservation Area 3B, and related concerns for adjacent natural and developed areas. A range of SLC scenarios based on USACE and National Oceanic and Atmospheric Agency (NOAA) guidance will be identified. Potential SLC impacts to be discussed include: anticipated landscape elevation changes resulting from loss of freshwater peat soils subject to increasingly frequent saltwater inundation, and related saltwater intrusion and flooding risks for adjacent natural and developed areas as Shark River Slough gradually transforms into a shallow saltwater bay.

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EFFECTS OF AERIAL HERBICIDE TREATMENT OF *MELALEUCA* ON NATIVE HABITAT RECOVERY IN THE NORTHERN EVERGLADES

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Melaleuca quinquenervia is an aggressive, exotic invasive tree in the greater Florida Everglades region that displaces native vegetation, often forming dense, closed canopy stands with very little value for native wetland wildlife. Broadcast aerial herbicides have proven an effective method for treating large and difficult to access areas. However, the impacts of management practices on non-target native vegetation as well as post-treatment recovery of native plant communities are not well quantified. To examine the impact of *Melaleuca* management practices on habitat restoration potential at A.R.M. Loxahatchee National Wildlife Refuge, we initially conducted vegetation surveys of ten previously treated (>6 yrs.) *Melaleuca* stands from the stand center into the surrounding marsh to assess community composition across a gradient of herbicide application and invasion severity. NMDS results show communities in previously dense *Melaleuca* to be more similar to intact marsh than sparsely invaded areas, although reinvasion was positively correlated with density. Alternately, treated areas previously with little or no *Melaleuca* show little similarity to intact marsh, with conversion toward wet prairie/ slough vegetation and a decrease in total cover. Additionally, we conducted a manipulative **Sa**wgrass **B**iomass **R**emoval **E**xperiment (SaBRE), establishing ten 4m^2 plots for each of three treatments (control, aboveground biomass clipping, and herbicide application) to quantify the recovery trajectory of sawgrass communities under scenarios of non-target herbicide treatment. While clipped plots demonstrated substantial progress toward recovery to pretreatment composition after 36 weeks, herbicide treated plots had little live cover and remained highly dissimilar to the native marsh, with vegetation and structure more similar to that of a slough habitat. Lastly, to compare recovery trajectories of treated *Melaleuca* stands located in different hydrologic and vegetation settings, twenty stands with evident invasion were chosen to receive an aerial herbicide application. Vegetation composition and a suite of environmental conditions were assessed prior to and following aerial treatment with herbicide to evaluate the recovery of microhabitat conditions and plant communities. Our findings suggest that impacts of herbicide treatment are long-lived and largely mediated by invasion severity which should be taken into consideration when developing invasive species management strategies. Canopy density influences interception of the aerial herbicide, with faster understory recovery in dense canopies compared to more open canopies, albeit with greater reinvasion. Additionally, extended periods may be required for recovery of treated non-target vegetation. This information will help develop management guidelines for the use of aerial herbicides in the maintenance of high-quality habitat at the Refuge.

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FISH MERCURY IN THE FLORIDA EVERGLADES: MANAGEMENT IMPLICATIONS FOR EVERGLADES RESTORATION

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Mercury (Hg) bioaccumulation in fish and wildlife from the Everglades has been a concern since the mid 70's when first identified as an issue within Everglades National Park. Concerns expanded during the 80's as sport fish with Hg concentrations well in excess of 1 mg/kg (ppm) were found within the Everglades Protection Area (EPA). Mercury continues to be a significant water quality problem within the EPA and downstream in Florida Bay and the Gulf of Mexico (GOM). Elevated Hg concentrations in biota are an important endpoint within the Everglades mercury cycle and reflect relatively high rates of atmospheric deposition of inorganic mercury coupled with a wetland ecosystem that efficiently produces methylmercury (MeHg). MeHg, the more toxic form of mercury, bioaccumulates efficiently in aquatic food webs, and comprises nearly all of the Hg in top predators. In spite of declines in fish mercury levels during the late 90's, Hg concentrations in fish remain elevated at levels of concern. In response, the Florida Department of Health (FDOH) issues fish consumption advisories for Florida Bay, the GOM, and the fresh waters of the EPA and adjacent Everglades (FDOH, 2014). These advisories encourage limited, and in some instances, no consumption of 8 fresh water, 3 exotic, and 2 estuarine transient species within the EPA. Similarly, within the EPA limited consumption is recommended for pig frogs (Rana grylio) harvested from Water Conservation Areas (WCA) 2 and 3 and the Florida Fish and Wildlife Conservation Commission has banned the sale of alligator meat harvested from WCAs 2 and 3. Ecological risk assessments indicate that piscivorous wildlife continues to be at risk from foraging within the EPA.

Monitoring of mercury within the fresh water fisheries of the EPA began in earnest during the mid-80s to 1) assess human and wildlife risks from consumption of mercury-contaminated fish, 2) describe spatial and temporal trends, and 3) better understand the ecological significance of mercury bioaccumulation in fish and wildlife. Linking results of this research to well-informed management strategies becomes complicated but must be intimately linked with research on how various restoration strategies influence MeHg production and biological exposure through the aquatic food web.

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SHEAR STRESS VARIABILITY AND FLOC REDISTRIBUTION DURING A FLOW RELEASE

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Degradation of the Everglades' ridge and slough patterned landscape structure has been attributed to widespread changes in water depths and the curtailment of flow pulses that redistribute organic sediment from sloughs to ridges. The Decompartmentalization Physical Model (DPM) was established in part to test the hypothesis that historic flow pulses could have induced a slough-to-ridge redistribution of sediment and evaluate the extent to which managed flow releases can restore sediment redistribution events. Two experimental flow releases have taken place to date, in November 2013 and November 2014. During each release, gated culverts on the L67A canal were opened, releasing a flood wave into the area commonly known as the Pocket. A 3000' gap breached in the L67C levee downstream permitted the flood to exit the Pocket. Before and during each flow pulse, we monitored bed shear stress across a ridge-slough transect oriented perpendicular to flow 440 m from the culverts. At six stations along the transect, we used a profiling acoustic Doppler velocimeter to characterize mean flow velocities and near-bed turbulence at a vertical increment of 1.5 mm. Bed shear stress was computed from profiles of turbulent kinetic energy. Spatial variability of suspended sediment concentrations along the transect and transport of a synthetic floc tracer released upstream were both monitored.

The flow releases increased velocities by an order of magnitude at all stations across the transect, from <1 cm/s to 5.9 cm/s at the far slough station. Far ridge water column velocities, however, remained <2 cm/s. Bed shear stresses similarly increased by an order of magnitude at almost all stations, except for the far ridge and a transition zone station. Prior to the 2013 flow release, bed shear stresses were fairly uniform across the transect, averaging 0.003 Pa, an order of magnitude lower than the 0.01 Pa threshold point of entrainment of Everglades bed floc. During the flow release, bed shear stress exceeded that threshold at the two slough stations, equaled the threshold in one of the transition zone stations, and remained below the threshold for the far ridge station. Correspondingly, floc transport was observed primarily in the sloughs, and suspended sediment transport through the ridge was delayed and attenuated relative to the slough. Mid water column velocities were only loosely correlated to bed shear stress but ranged from 2.0 to 5.9 cm/s for the stations at or above the threshold and from 1.4 to 1.9 cm/s for the stations below the threshold. A significant decay in flow velocity and bed shear stress occurred within one day of the flow release, with a corresponding decrease in suspended sediment concentrations.

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DRYING TIMES: SURVIVAL OF A FRESHWATER MESOCONSUMER IN A COASTAL REFUGE HABITAT DURING SEASONAL DRYING

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Persistence in the face of disturbance can be largely influenced by the availability and quality of refuge habitat. Refuges for aquatic species become increasingly important under reduced water flows and, as the scarcity of the world's freshwater resources grows, so will our need to understand the ability of refuge habitat to buffer populations under altered flow regimes. In the seasonally-pulsing Everglades, natural marsh flooding and drying patterns have been highly modified, resulting in decreased hydroperiods, coupled with an increased magnitude and frequency of marsh drying. This overall reduction in flow has likely increased the importance of deep water refuge habitats in maintaining fish populations, but at the same time these same alterations have also negatively influenced the available refuges. Coastal mangrove creeks of the Everglades are vulnerable to changes in freshwater inflows and hydrological reductions have altered the characteristic salinity gradients of this region. Understanding these changes is crucial, as ecotonal estuarine habitats function as important refuge for large-bodied mesoconsumers, such as the Florida Largemouth Bass, *Micropterus salmoides floridanus,* (LMB).

Linking vital rates (i.e., survival) to environmental factors provides a powerful tool to investigate how populations respond to disturbance. Thus, we employed a unique combination of mark-recapture techniques and citizen science to investigate the ability of mangrove creeks to buffer LMB populations from seasonally occurring periods of marsh drying, i.e., serve as refuge. We hypothesized that survival would decrease in times when marshes are drying down and in periods when marshes functionally dry. However, we found that survival in the refuge remained high as marshes dried, but consistently decreased when they had effectively completely dried. Under current reductions of hydrological flow, complete drying of the marshes occurs regularly, drying in 3 out of the 4 years of this study. By comparing the year marshes did not fully dry, we observed that there were critical water levels at which the capacity of refuge habitat to buffer from disturbance fails. We also expected survival in these periods to vary across years as a result of annual variation in marsh inundation patterns. Instead, time and year varying models ranked lowest, indicating that there is a consistency in the monthly rates of survival within each period, despite variation in drying patterns. Overall, the length of time marshes remained dry influenced total dry season mortality. These findings suggest, under current reduced water availability, ecotonal refuge habitat cannot fully buffer LMB populations, resulting in frequent pressure from seasonal drying events. Understanding survival during disturbance events will further our knowledge of how populations may respond from future changes in flow regimes driven by Everglades restoration and climate change.

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MULTIPLE ENZYME SYSTEMS AND THEIR EFFECTIVENESS AS INDICATORS OF NUTRIENT ENRICHMENT IN EVERGLADES

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Over the last century, the oligotrophic Florida Everglades has been severely impacted by human activities, resulting in nutrient enrichment and invasion of exotic species. Various indicators have been used to diagnose the nutrient status and evaluate the restoration. Compared to vegetation and soil physical properties, microbial indicators, in particular extracellular enzyme activities (EAs), can respond to environmental stress more rapidly and have been considered as sensitive indicators. Here, two well-studied locations in Florida Everglades were selected to investigate the effectiveness of enzyme activities as indicators of nutrient enrichment. Both of the two locations presented a phosphorus (P) gradient. One was located in the Water Conservation Area 2A (WCA-2A) in the northern Everglades, and the other was in the Hole-in-the-Donut (HID) in the southern Everglades. The total nutrients and EAs related to C, N, and P cycling of soil and peripyton from the literature were compared along the P gradient in both locations. Microbial allocation of resources among community indicator enzymes (MARCIE) model was applied to show the needs and demands by the microbial communities. We found that in the two different systems, phosphatase activities in soil decreased, and periphyton nitrogenase activities increased with the increase of P levels, indicating N limitation for periphyton. Only in the HID area, the soil leucine aminopepetidase showed an increasing trend with the increase of P levels, suggesting N limitation for soil microbes. The MARCIE further showed that the microbial environment shifts from a primarily P-limited system to a possibly N-limited system in the two degraded systems. The indicators of EAs effectively demonstrate the nutrient status under environmental stress in different systems but can also reveal the related nutrient cycling. Different components in the same systems are likely to present different nutrient limitations.

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IBBEAM – AN INTEGRATED BISCAYNE BAY ECOLOGICAL ASSESSMENT AND MONITORING PROJECT

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IBBEAM combines four previously independent efforts involved in the Comprehensive Everglades Restoration Plan (CERP) for greater uniformity, consistency, and efficiency in data collection, management, and presentation, while also enabling new, cross-component analyses to be performed. The components include: (1) water quality (temperature and salinity); (2) submerged aquatic vegetation (SAV); (3) epifaunal fishes and invertebrates; and (4) mangrove-associated fishes.

Spatial patterns and temporal trajectories of key metrics stemming from each IBBEAM component were combined, and a cohesive data analysis approach was implemented that allows side-by-side comparisons of metrics at the same spatiotemporal resolution. Habitat Suitability Models, Indicator species identification and Salinity Indices (e.g. Mesohaline Index: proportion of salinity observation ≥ 5 and <18), were developed to fill knowledge gaps about southwestern Biscayne Bay's nearshore biota that may be affected by CERP implementation and to provide a scientific basis for the development of a suite of ecological performance measures for assessment and use in adaptive management.

IBBEAM results identified a subset of species whose distribution and abundance respond quantitatively to change in salinity. Further, results indicate that Biscayne Bay's nearshore environment does not constitute the consistent, expansive mesohaline habitat (≥ 5 and <18psu) that CERP seeks to reestablish.

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HYDROLOGIC CONTROLS OF COASTAL GROUNDWATER DISCHARGE IN TAYLOR SLOUGH, EVERGLADES NATIONAL PARK, FL, USA

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The drivers of groundwater discharge in South Florida's mangrove ecotone along coastal Taylor Slough are poorly understood. Groundwater discharge has been observed, but a forcing mechanism has not been determined. The objective of this project is to determine the relationships between groundwater discharge and its potential hydrologic drivers as well as the changes to surface water chemistry as a result of that discharge. Timing of groundwater discharge will be determined by comparing groundwater and surface water head levels at three sites within the estuarine zone of Taylor Slough. Potential drivers of groundwater discharge include precipitation, evapotranspiration, upstream surface water and canal water levels, upstream water management controlled inflows, and downstream surface water levels in Florida Bay. Correlations between the timing of groundwater discharge with each of the potential drivers will be determined. In addition, the concentrations of major ions and nutrients of surface water at each site will be regressed against the timing of groundwater discharge.

Initial results indicate strong correlations between estuarine water levels in Taylor Slough with downstream surface water levels, generally decreasing in strength with distance from the sites. The timing of groundwater discharge does not seem to correlate with the potential drivers tested at the site located closest to the coastline. Further water level analyses will involve time-series statistics including use of a spectral density function and autocorrelation followed by subsequent comparison of these time-series results among the different potential drivers and groundwater discharge in the ecotone. The results of this research will help in determining the effects of water management practices and sea level on coastal groundwater discharge in Taylor Slough and the effects of discharge on surface water's chemistry.

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SAV COMMUNITIES OF WESTERN BISCAYNE BAY, MIAMI, FLORIDA, USA: HUMAN AND NATURAL DRIVERS OF SEAGRASS AND MACROALGAE ABUNDANCE AND DISTRIBUTION

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Nearshore benthic habitats of Biscayne Bay are being influenced by changes in hydrology through the activities of the Comprehensive Everglades Restoration Plan (CERP). We examine whether the proposed programmatic expansion of mesohaline salinities through the introduction of additional fresh water would result in: 1) seascape fragmentation, 2) increases in seagrass cover; 3) expansion in the cover of *Halodule*; and 4) a reduction in the dominance of *Thalassia*. Salinity patterns and proximity to freshwater canals were correlated with significant fragmentation of seagrass habitats over the past 70 years. Salinity was the only physical variable with a significant relationship to the occurrence of all SAV taxa. Occurrence of *Thalassia*, *Halimeda*, and *Penicillus* increased significantly with increasing salinity, but *Halodule, Syringodium*, *Laurencia, Udotea, Batophora, Caulerpa,* and *Acetabularia* showed a significant negative relationship with salinity. The salinity range in which both *Thalassia* and *Halodule* had similar frequency of occurrence was 15-25 psu. The combined cover of *Thalassia* and *Halodule* when both species are present (23%) is higher than the cover when only one of the species is present (17.4 % for *Thalassia* and 19.7 % for *Halodule*). The low abundance of *Thalassia* along the shoreline is not only due to its exclusion from low-salinity environments but also by higher nutrient availability that favors *Halodule*. Percent N, P, and N:P ratios in seagrass tissue suggest that Biscayne Bay receives high N inputs and is P limited. Thus, increased P availability may facilitate an expansion of *Halodule*. The data collected suggest that increased mesohaline salinities will increase seagrass abundance and support co-dominance by *Halodule* and *Thalassia* as hypothesized, but raise concerns that current high N availability and the potential for increases in P may prompt a shift away from seagrass-dominated to algal-dominated communities under scenarios of enhanced fresh water inputs.

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DISTRIBUTION OF MERCURY IN ECOSYSTEM COMPONENTS IN THE EVERGLADES: A MASS BUDGET PERSPECTIVE

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The accumulation of elevated levels of mercury (Hg) in fishes and wildlife is of concern for the Florida Everglades, and continuous efforts have been made to investigate the source, transport, transformation, and bioaccumulation of Hg in this ecosystem. As the Everglades is a large ecosystem with subareas connected by water flows, it is important to investigate the distribution of Hg at the whole ecosystem level. This study utilized a mass budget method, by calculating mass storage of Hg (including total Hg, THg, and methylmercury, MeHg) in each ecosystem component, to determine the relative distribution of Hg mass across ecosystem components. The ecosystem components include surface water, soil, flocculent detrital material (floc), periphyton, macrophyte, and mosquitofish in this study. The calculations were based primarily on the datasets generated in the U.S. Environmental Protection Agency (EPA) Everglades Regional Environmental Monitoring and Assessment Program (R-EMAP). R-EMAP adopted a probability-based, ecosystem-wide sampling design to collect samples throughout the Everglades. The probability of a sample being included in the sampling event is known (expressed as inclusion probability density function), and thus the area that each sample point represents is predetermined, which is particularly useful for calculations of Hg mass at the ecosystem scale. The distribution patterns of Hg mass among ecosystem components were determined for different phases of R-EMAP, which were further analyzed to investigate the temporal changes of Hg contamination in the Everglades during the past years. In addition, Hg transport across different subareas of the Everglades through water flow was examined to complement the mass budget of Hg in this ecosystem. This mass budget information is important for adaptive management of Hg contamination in the Everglades and ongoing restoration efforts.

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BISECT MODEL SIMULATIONS FOR EVALUATING PRESENT, PAST, AND FUTURE CONDITIONS AND PROVIDING INPUT TO EMERGING ECOLOGICAL MODELS.

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Everglades National Park, a diverse natural ecosystem, and Miami-Dade County, a highly urbanized area, in south Florida, are comprised of a complex hydrological management system. Water management requirements for urban development along the east coast, have at times, conflicted with the water needs of the Everglades ecosystem, and have made it difficult to preserve this ecosystem. Climatic changes that affect sea level, precipitation, and temperature create additional challenges. The BISECT model is an integrated hydrodynamic surface water and groundwater model that calculates surface water hydro-periods, depths, flows, and salinity, and groundwater levels and salinities for the southern Florida peninsula. It was developed to estimate historical conditions, and to evaluate the impacts of changes to the system resulting from the improvements of Comprehensive Everglades Restoration Plan (CERP), modifications to the water management system, and future sea-level rise.

The BISECT model uses hydrologic data, including wind, rain, tidal amplitude, and surface-water and groundwater boundary levels and fluxes, to provide information on potential changes in surface-water levels, surface-water flow patterns and quantities, hydro-periods, groundwater levels, and salinity. The model simulated conditions during 1996-2004 along with scenarios based upon the relative and combined effects of aquifer barriers, CERP improvements, and sea-level rise. The BISECT model was also used to hind cast historical hydrologic conditions (1926-1940) to examine long-term effects of hydro-patterns, salinity, and elevation on the distribution of mangrove, marsh, and submerged aquatic vegetation that cannot be determined using only the modern record. The mangrove-marsh distributions were evaluated by comparing percentages of mangrove predicted with an ecological potential growth equation (driven with BISECT hydrologic output) to percentages observed from geo-referenced aerial photographs.

The BISECT model output is currently being used to support the modeling of aquatic ecosystems and organisms in Everglades National Park. Habitat suitability models for different submerged aquatic vegetation (SAV) species are used as indicators of how hydrology may influence the distribution of these SAV species. SAV provide habitat and resources for endangered species such as manatees and crocodiles, and are important for fisheries, wading birds, and waterfowl. Salinity is important to the survival and reproduction of many aquatic organisms that occur in the riverine-estuarine zones, where freshwater inflows and Gulf tidal waters mix. Changes in the patterns and quantities of salinity and other hydrologic variables can be estimated by using the BISECT tool to evaluate the projected impacts of climate change, sea level rise, and restoration efforts.

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INNOVATIVE HYDRAULIC MODELING APPROACHES USED DURING THE DESIGN OF AN EVERGLADES TREATMENT WETLAND

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In 2012, the State of Florida and the U.S. Environmental Protection Agency reached consensus on Restoration Strategies to improve water quality in America's Everglades – a plan that is expanding water quality improvement projects and is anticipated to achieve compliance with the State of Florida's numeric phosphorus criterion for the Everglades. On behalf of the State of Florida, the South Florida Water Management District is implementing six key projects within the Everglades tributary basins, one of which is the expansion of a 7,000-acre treatment wetland, known as Stormwater Treatment Area 1 West (STA-1W).

The initial STA-1W expansion project hydraulic study included an evaluation of a series of expansion alternatives simulated by one-dimensional (1D) and two-dimensional (2D) hydraulic models of the existing STA-1W facility and the proposed expansion area. The evaluation considered the projected construction cost and hydraulic performance of preferred alternative configurations for the expansion. The preferred alternative was further evaluated, which included a revised calibration of the existing STA-1W 1D model. The calibration considered various parameters and metrics, but the focus was on optimizing depth-dependent Manning's roughness coefficients (Manning's n) to provide an accurate representation of measured stages under various flow conditions within a two-year simulation period. A combination of manual and automatic calibration techniques was implemented to obtain representative Manning's n curves for wetlands dominated by submerged aquatic vegetation and emergent aquatic vegetation.

The detailed design of the expansion area utilized a 1D interim condition model developed using the calibrated parameters of the existing STA-1W model to determine size and number of the proposed hydraulic facilities. The 24-hour, 100-year design storm was applied to ensure that the maximum allowed depths in the cells were met and a 41-year simulation was run to evaluate the treatment potential under historical long-term climate conditions. Finally, a high resolution 2D model for the expansion area was developed to identify the preferential pathways, low flow areas, and the distribution of flow velocities in the cells, which determined the size and extent of the canals and the spacing of structures. Tests were performed to verify that the calibrated parameters of the 1D model could be implemented in the 2D model with matching results. A dynamic equilibrium approach was implemented for steady-state runs to generate spatially varying Manning's n maps for various flow conditions. Maps of velocities and residence times were generated, which provided insight into the performance of the expansion area and were used to refine the design.

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THE RELATIONSHIP BETWEEN RAINFALL AND NUTRIENT CONCENTRATIONS IN THE COASTAL EVERGLADES

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The FCE LTER Legacies working group is focused on identifying the factors that affect the movement and location of the ecotone in the coastal Everglades. One of the ways to address such an objective is to test whether a relationship exists between nutrient concentrations and rainfall in the near-shore waters off of Florida Bay, Whitewater Bay, and the Ten Thousand Islands. A test of this relationship was conducted at seventy-five long-term monitoring sites located among the three regions. Rainfall data was gathered from the SFWMD DBHydro database while nutrient data was obtained from FIU's SERC water quality monitoring site network. ArcGIS is used to interpolate rainfall surfaces for the study area. This allows for determining rainfall amounts for each of the water quality sites for the time period from 1991 through 2008. Once the rainfall and nutrient data is tabulated for each water quality site, cumulative sum plots are graphed showing nutrient concentrations versus monthly rainfall amounts. The cumulative sum plots are intended to illustrate possible thresholds of rainfall amounts that result in detectable changes in nutrient concentrations. Lastly, the cumulative sum plots are compared with each other in order to observe similarities and differences between sites that may correspond to potential geographic delineations. The results of these tests indicate that the rainfall thresholds vary among the various water quality sites across the three regions of the study area.

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MODELING THE HYDRODYNAMIC AND WATER QUALITY IMPACTS OF PROPOSED TAMIAMI TRAIL BRIDGE CONSTRUCTION USING THE M3ENP NUMERICAL MODEL

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Since the construction of Tamiami Trail in the 1920's, overland flow to the Florida Everglades has decreased significantly, impacting ecosystems from the wetlands to the estuary. As part of the effort to return flows to the historical levels, several changes to the existing water management infrastructure have been implemented or are in the design phase. These changes include the construction of two bridges (a 1- mile and a 2.6 mile bridge) and the removal of Tamiami Trail roadway as well as increasing canal water levels to increase head elevations north of Everglades National Park (ENP). A numerical model of ENP hydrology (M3ENP) was developed using MIKE SHE/MIKE 11 software to analyze the effect of these structure changes and evaluate the potential impact of bridge construction. Model simulations show that the newly constructed 1-mile bridge along Tamiami Trail could increase water delivery to Northeast Shark Slough (NESS) by about 5.6%. The 1-mile bridge plus the proposed 2.6-mile bridge could increase flows by 10.4% from the baseline flow. These simulations also showed that bridge implementation along Tamiami Trail will have a minimal impact on eastern canal operations and flood management. Hydroperiod analysis demonstrated that bridge construction alone can increase water levels in large areas of ENP by an additional 0.3 m above Baseline conditions for an additional 7 days annually. Additional simulations were conducted to simulate the effect of proposed water level increases for canals north of the Park. Raising water levels in the canal by up to one foot (0.3 meters) increased overland water levels up to 21 cm in some areas within ENP. These simulations demonstrate that a general increase in water levels and hydroperiods within ENP will be achieved by adding bridges to the Tamiami Trail roadway and by increasing water levels in the canal.

Using the hydrodynamic results from the Baseline and bridge construction scenarios, the advection-dispersion-reaction equation (ADRE) was coupled with the model and an analysis of phosphorus transport through the Everglades was performed using the M3ENP-AD model. The addition of bridges has shown to increase water flows to the Everglades, and the M3ENP-AD model has shown that over the entire model domain there is a general decrease in TP concentration when these bridges are added. However, the model results showed that Northeast Shark Slough (NESS), a target ecosystem for many recent restoration efforts, experienced an increase in cumulative TP load of about 30% over the simulation period with the inclusion of the 1.6 km bridge and raised canal stages.

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ADAPTING THE EVERGLADES TROPHIC HYPOTHESIS TO ROSEATE SPOONBILLS IN AN ESTUARINE ENVIRONMENT

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Audubon's Everglades Science Center began monitoring prey base fish and hydrology in the coastal mangrove habitats of northeastern Florida Bay since 1990 as part of an ecological study of roseate spoonbills that nest in Florida Bay but forage in these coastal habitats. Since then, new sites were added to include coastal wetlands of southern Biscayne Bay and monitoring of Submerged Aquatic Vegetation (SAV) were added to get a more complete understanding of the tropic structure of these roseate spoonbills. We created a Conceptual Ecological Model (CEM) for spoonbills based on the Trophic Hypotheses of the mainland Everglades. The CEM hypothesizes that freshwater inputs (rainfall and sheet flow from upstream) influences water levels and salinity in the coastal habitats. Salinity determines SAV cover and has direct effects on the fish community structure at each sight. Water levels affect prey abundance through length of hydroperiod allowing greater production with greater hydroperiod length by providing longer periods for fish reproduction times. Water levels also determine fish availability to predators by concentrating fish into smaller areas as water levels recede. The size of these concentration events are determined by the amount of prey production that occurred during higher water periods. Spoonbills time nesting with these concentration events so as to have an ample food supply to satisfgy the high energetic demads of their rapidly growing young. Nest production (chicks produced per nesting attempt or c/n) is determined by how much food can be rapidly transported from the foraging grounds to nesting colonies located in Florida Bay. High nesting success leads to increases in the number of spoonbills nesting in Florida Bay. Since developing the CEM, we have analyzed our data to reduce the uncertainties postulated in the CEM. These analytic results will be presented for each trophic step in the CEM beginning with freshwater inputs to the wetlands through the number of spoonbill nests found in Florida. Time permitting, we will also discuss how recent sea level is influencing these ecosystem responses.

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SOIL RESTORATION THRESHOLDS SPECIFIC TO CENTRAL EVERGLADES PLANNING PROJECT SUCCESS

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A Central Everglades Planning Project (CEPP) key objective is to reduce soil subsidence and damaging peat fires in the Greater Everglades system through hydrologic restoration. Everglades wetlands have been initially drained and the hydrological patterns continued to be altered by canals and levees constructed for flood control and water supply. The northern parts of each Everglades compartment (water conservation area 3A, 3B, and Everglades National Park) have experienced high rates of soil loss due to soil oxidation and combustion of organic peatland soils. In addition to restoring hydrology, peatland soils are the basis of restoring the unique Everglades ridge and slough landscape structure and function, maintaining and restoring tree islands, and mitigating the effects of future sea-level rise. CEPP will be capturing water previously lost to tide and redistributing the water to follow historic patterns of sheetflow timing and distribution into Northern Water Conservation Area 3A, 3B, and into Shark River Slough in Everglades National Park. Uncertainty remains as to whether enough water will be sent south at the right times to conserve and begin to restore the soil characteristics needed for a healthy functioning Everglades system.

This paper addresses how soil restoration thresholds might be set to measure expected positive changes due to restoration actions implemented by CEPP. Thresholds are based on hypothesized changes in restoration indicator values and can be associated with specific points in time after restoration actions are implemented to provide feedback that restoration is working or whether adaptive management adjustments are needed to improve performance. Measurements of key soil characteristics (soil moisture content, organic and inorganic carbon volumes and concentrations, pH, bulk density, nutrients, cations [Mg^{2+}, Ca^{2+}], and peat accretion) of reference ecosystem areas where structure and function is conserved should be compared to areas that are being restored (treated areas) and degraded areas that are not expected to be restored (controls). Expert opinion will be solicited to review and improve both quantitative and qualitative hypotheses identified in the CEPP adaptive management plan: 1) Statistically significant increases in soil moisture content; 2) Organic soil characteristics increase towards reference conditions; 3) Peat elevation increases in ridges and tree islands; 4) and soil porewater and non-extractive nutrient contents will not increase and will move towards reference conditions.

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DRIVERS OF GEOSPATIAL AND TEMPORAL VARIABILITY IN THE DISTRIBUTION OF MERCURY AND METHYLMERCURY IN EVERGLADES NATIONAL PARK

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Elevated mercury (Hg) in the food web has been a public concern in the Florida Everglades since the late 1980s and has been a persistent issue confronting ecosystem restoration. Several ecosystem-scale factors influence Hg bioaccumulation in the Everglades, such as elevated atmospheric Hg deposition; land use and water management; and environmental disturbances (e.g. fire and drought). In the Everglades, the production of methylmercury (MeHg), the most toxic and bioaccumulative form of environmental Hg, is driven by the bioavailability of inorganic Hg(II) and the metabolic activity of sulfate reducing bacteria. These factors rely on the abundance and composition of dissolved organic carbon (DOC) and sulfate loading, respectively.

To assess the distribution of Hg and MeHg within Everglades National Park (ENP), the U.S. Geological Survey and the National Park Service conducted annual surveys of surface water and mosquitofish (*Gambusia spp*.) at 76 sites from 2008 to 2013. Water and fish were analyzed for total mercury (HgT) and MeHg. In addition, water samples were analyzed for DOC, SUVA (specific UV absorbance at 254 nm), and major ions. Annual climatic variability (the number of days a site was dry preceding sampling) was also analyzed as a driver of MeHg production.

MeHg concentrations in water and fish exhibited distinct regional patterns, peaking within the Shark River Slough (SRS), the receiving area for canal water with relatively high DOC and sulfate concentrations. HgT was a strong predictor of MeHg concentrations for SRS sites (R^2=0.70, filtered water), but not for marsh sites unaffected by canals (R^2=0.15). Fish Hg trends generally followed those of surface water, with the exception of marsh fish during extremely wet or dry years. An El Niño event (2010) resulted in lower HgT and MeHg concentrations in surface water and SRS fish, while these concentrations were highest during a La Niña event (2011). A gradient boosting regression revealed the importance of other drivers for MeHg production (number of dry days preceding sampling, sulfate, and SUVA), relative to HgT concentrations, was greatly enhanced in the marsh, relative to SRS.

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ALGAL BIODIVERSITY IN SUBTROPICAL WETLANDS: AN OPPORTUNITY FOR COMPARATIVE RESEARCH

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The biodiversity and ecology of microorganisms is often overlooked despite the critical importance of algae, invertebrates and bacteria for the life and health of other species, including humans. Species (and trait) diversity increase the resilience of aquatic ecosystems to environmental pressures such as habitat degradation and climate change; thus it is fundamental to enhance the knowledge of the base levels of aquatic food webs.

Various studies have been conducted on the distribution and biodiversity of algae (phytoplankton, periphyton and/or phytobenthos) in internationally important subtropical wetlands such as the Everglades, Pantanal (Brazil), Okavango Delta (Botswana) and Kakadu (Australia). Wetlands in semiarid regions such as the Okavango Delta and highly impacted sites, e.g. the Everglades, face different present and future ecological pressures; for example, climate change and water pollution likely modify algal distribution and diversity patterns.

This talk investigates the relationships between algal diversity and biomass in relation to nutrient availability and habitat types using data already available for the Everglades and the Okavango Delta; diversity-productivity curves of vascular plants and animals have been studied much more extensively than those of algae. Therefore, we aim to develop comparative studies of algal biodiversity and biomass patterns in globally important Ramsar-protected sites as a means to inform conservation of key microscopic primary producers on which charismatic wildlife relies.

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SEA-LEVEL RISE AND CLIMATE CHANGE AT THE COASTAL BOUNDARY: OBSERVATIONS, PROJECTIONS, AND ISSUES OF CONCERN FOR RESOURCE MANAGEMENT

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Southeast Florida is the tip of the Florida peninsula and is highly affected by the strong connection to the surrounding oceanic waters. The topography of the land mass is dominated by low elevations and world-class wetland ecosystems, though most have been degraded by development activities. Because of the exceptionally flat landscape, coastal ecosystems in South Florida are among the most vulnerable areas of the United States to the effects of sea level rise (SLR) and climate change (CC). Approximately 80% of the lands in South Florida that will be affected by a one foot rise in ocean elevation are conservation lands, mostly coastal wetlands.

In Florida Bay within Everglades National Park (ENP), the effects of SLR have already been documented. The SLR rate reported by ENP at the Little Madeira Bay monitoring station is 0.26 cm/yr +/- 0.05 cm/yr (0.00846 +/- 0.00154 ft/yr), which is equivalent to about 2.5 cm per decade, a rate that is slightly greater than has been measured at the Key West tide station. By 2030, due to anticipated accelerated sea level rise, the elevation increase in the surrounding South Florida waters has been variously estimated at 6.5 to 17 cm over the 2010 elevations. By 2100, this water level increase is anticipated to be between 61 and 95 cm. Examples of natural Southeast Florida flora that will be affected include seagrass and macroalgae, coral reefs, buttonwood, mangrove, scrub mangrove, and herbaceous salt and freshwater wetlands. In addition to coastal vegetation, recreational fisheries in the estuaries and near-shore waters are also expected to be impacted. Given these base-line condition alterations, further change in coastal ecosystems driven by climate change and sea level rise can be expected. Can we estimate the probable future trajectory for the evolution of coastal ecosystems in the coming decades?

A conceptual evaluation of the effects of SLR and CC on Florida Bay using the FATHOM mass-balance model indicates that the salinity may increase by 4-14% and residence times may decrease by 30-70%, depending upon geologic adaptations in the Bay. In addition to higher water levels, more extreme weather events and changes to patterns of rainfall and evaporation, coastal ecosystems may experience reduced pH, increased salinity, and increased air and water temperatures in waters where high salinity and temperature already pose a stress on organisms. The expected response includes a change in the extent of coastal nurseries for important marine fish species. Some estuarine fishes are accustomed to a highly variable environment providing some resilience due to life cycles in highly variable environments. In one study the changes in Florida Bay habitat suitability were relatively small, on average. Nonetheless, community composition may be affected by species range shifts and displacement.

A number of studies have shown that greater freshwater flows maximize mangrove peat accumulation, stabilize coastlines, and limit salinity increases. For the benefit of the coastal ecosystem a new paradigm is needed whereby regional climate drivers and oceanographic processes are better incorporated into South Florida water and ecosystem management plans.

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THE PINE ROCKLANDS OF THE MIAMI ROCK RIDGE: AN EVERGLADES ECOSYSTEM IN PERIL

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Pine rockland is one of the most critically-imperiled ecosystems in the world. The habitat occurs in a narrow swath in South Florida and the Caribbean. In Florida pine rocklands are confined to Miami-Dade and Monroe counties. In Miami-Dade County, pine rockland occurs along the Miami Rock Ridge, which is a Pleistocene deposit of oolitic limestone. The southern quarter of the Miami Rock Ridge is protected in Everglades National Park and the northern three quarters extends from the Park boundary some 45 miles north into the Miami-Dade County. The northern portion of the Miami Rock Ridge has been almost completely developed. Less than 2% of the original extent remains, and pine rockland persists on less than 680 acres in private ownership and less than 2,267 acres in public ownership in small, isolated fragments.

Pine rockland in Miami-Dade County is an incredibly biodiverse natural community, containing dozens of species found nowhere else on earth. It is habitat for a diversity of Caribbean and temperate plant species at the northern and southern ends of their ranges. There are well over 500 species of flora alone occurring in South Florida's pine rocklands; many of which are considered endemic, rare, critically-imperiled, extirpated, threatened and endangered. Pine rocklands are also home to rare and endangered animals, such as the Bartram's hairstreak, Florida leafwing, Florida bonneted bat, Miami tiger beetle and rimrock crowned snake.

Many species occurring in pine rockland are becoming increasingly rare and even extinct. Previous and continuing loss of pine rockland habitat and consequential species decline occurring along the Miami Rock Ridge is due to a combination of factors, including: inadequate protection mechanisms, insufficient regional planning, lack of commitment to management and improper management. Human population growth and development pressures in Miami-Dade County continue to cause removal and degradation of persisting pine rockland fragments, which are subject to varying degrees of protection and management by both public and private landowners. Without further commitments to protection and management for the remaining pine rockland fragments occurring along the Miami Rock Ridge, this important component of the greater Everglades ecosystem will continue to decline and species will be lost.

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INFLUENCE OF VARYING ENVIRONMENTAL CONDITIONS ON CANOPY SPECIES RECRUITS FROM FOUR EVERGLADES PLANT COMMUNITIES

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The regular occurrence of hurricanes has been an important factor in shaping the structure and composition of forest ecosystems in the Florida Everglades. These storms often quickly and drastically change the environmental conditions within these forest communities. These communities are adapted to hurricane disturbances, but increased frequency and/or intensity of hurricanes or increases in the length of time to fully recover from storm damage may threaten these communities. The objective of this study was to determine the growth and physiological responses of juveniles of the dominant canopy species (*Bursera simaruba*, *Quercus virginiana*, *Taxodium distichum*, and *Pinus elliottii*) present in the four Everglades communities to differences and changes in the light environment and nutrient availability. A shadehouse experiment was conducted on the campus of Florida International University using differences in light and nutrients to simulate opening of the forest canopy and nutrient release associated with hurricane winds. .In addition, a hurricane simulation treatment was conducted to determine the speed of responses within each species to changing conditions. Overall, soil nutrient levels had a larger influence on growth rates and resource allocation in all species compared to light level manipulation. Alterations in the allocation of tissue specific biomass to varying conditions were species specific with *P. elliottii* and *Q. virginiana* showing the highest plasticity. The two broad leaf species were the most adaptable in response to the simulated hurricane treatment. Understanding the resource requirements and plasticity of response in the recruits of these dominant tree species is crucial to understanding their future roles in the structure and function of the Everglades forests.

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RESPONSE OF THE DIATOM *ENCYONEMA EVERGLADIANUM* TO ENVIRONMENTAL CHANGES ASSOCIATED WITH SEA LEVEL RISE IN THE CARIBBEAN BASIN

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The karstic, freshwater wetlands of the Everglades and Caribbean are threatened by saltwater intrusion due to sea level rise. Saltwater intrusion not only elevates conductivity in these environments but has been shown to elevate phosphorus (P) levels as well. Exposure to elevated salinity and P into these naturally low phosphorus, freshwater wetlands is expected to result in biogeochemical and compositional modifications.

The diatom *Encyonema evergladianum* is one of two dominant diatom species found in the calcareous periphyton mats characteristic of freshwater, karstic wetlands with low nutrient availability. We propose that this species is a potentially powerful indicator of water quality changes associated with saltwater intrusion into these wetlands. In this study, we explore the response of *E. evergladianum* abundance to periphyton mat TP, mat mineral content, and conductivity in the Florida Everglades and similar Caribbean wetlands.

We found that in both the Everglades and the Caribbean, *E. evergladianum* is highly sensitive to changes in the mineral content (calcareousness) of the periphyton mats in which they live and decreases in mat mineral weight are strongly correlated to TP concentration. Furthermore conductivity was positively correlated with TP and negatively correlated to the mineral content of the mats in the Everglades, but these relationships were not seen in the Caribbean. These results suggest that calcareous periphyton mats are the preferred niche of *E. evergladianum* and that loss of this mat structure is correlated to elevated TP which, in the Everglades, is coupled with elevated conductivity.

This study provides preliminary support for the use of *E. evergladianum* as an indicator species in karstic, freshwater wetlands threatened by elevated salinity and phosphorus associated with saltwater intrusion. Mesocosm experiments are underway to test the individual and synergistic effects of increased salinity and phosphorus on *E. evergladianum* abundance and periphyton mat calcareousness in order to disentangle the direct and indirect drivers of changes in *E. evergladianum* abundance.

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EVERGLADES RESTORATION STRATEGIES: OPTIMIZING THE PERFORMANCE OF STORMWATER TREATMENT AREAS

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The Everglades Forever Act, which was passed by the Florida Legislature in 1994, required the South Florida Water Management District to implement the Everglades Construction Project consisting of large constructed wetlands, or stormwater treatment areas (STAs), and the Everglades Agricultural Area Best Management Practices regulatory program. Since that time, substantial progress toward reducing phosphorus levels discharging to the Everglades has been achieved. Since 1994, the network of five STAs south of Lake Okeechobee — currently with 57,000 acres of effective treatment area — have treated 14.8 million acre-feet of water and retained approximately 1,874 metric tons of phosphorus that would have otherwise entered the Everglades. In Water Year 2014, the STAs treated approximately 1.3 million acre-feet of water, retaining 81 percent of phosphorus from water flowing through the treatment cells. Overall, Florida has invested more than $1.8 billion to improve Everglades water quality since 1994.

Additional improvements in Everglades water quality are currently being achieved through the Restoration Strategies initiative, where the performance of the existing water quality infrastructure continues to be optimized and a suite of additional water quality projects are being constructed in order to further reduce phosphorus concentrations that are consistent with water quality standards. The suite of projects will add an additional 6,500 acres of STA and add almost 120,000 acre-feet of storage in three reservoirs, also known as flow equalization basins (FEBs). The implementation of this large public works effort over two decades is an excellent case study on how science and engineering are integrated in the design, engineering, and construction of water quality features. Considerable advancements have been made on how water quality features are sized and designed to achieve water quality standards. Integrating water management features such as FEBs into the water quality treatment process and optimizing STA and FEB operational protocols can significantly improve project performance and reduce project costs.

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MESO-MAMMAL COMMUNITIES OF A.R.M. LOXAHATCHEE NATION WILDLIFE REFUGE AS A REFERENCE FOR THE GREATER EVERGLADES ECOSYSTEM

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The decline of mammal populations in Everglades National Park (ENP) over the last 20 years is likely to have a profound influence on the ecology of the Everglades system and the likelihood of successful Everglades restoration. There is mounting evidence that predation by the invasive Burmese python (*Python molurus bivittatus*) has contributed to these declines. However, Loxahatchee Nation Wildlife Refuge (NWR), located in Palm Beach County, encompasses ≈ 60,000 ha of remnant wetlands in the northern portion of the Greater Everglades Ecosystem (GEE), may have mammal communities yet to be altered by pythons. Accordingly, there was an urgent need to rigorously quantify the mammal communities within Loxahatchee NWR. After conducting intensive camera surveys from throughout the GEE and within Loxahatchee NWR, Loxahatchee NWR appeared to have a diverse and healthy meso-mammal populations. The only exception to this finding was the southern portion of the refuge. This area has deep standing water > 2m and appears to support marsh rabbit and rodent populations on floating mats of vegetation but not much more. Meso-mammal communities in Loxahatchee NWR differed considerably from most areas to south of the refuge. Preliminary data analysis suggests that there was a clear pattern of increasing mammal occurrence with increased distance from ENP. This pattern appeared to be particular strong with common species such as white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), bobcat (*Lynx rufus*) and marsh rabbit (*Sylvilagus palustris*). Our analysis suggests that mammal distributions throughout south Florida are consistent with previous work suggesting invasive pythons have greatly reduced mammal communities in and around ENP.

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SPATIAL VARIABILITY IN BIOGENIC GAS RELEASES FROM SUBTROPICAL PEAT MONOLITHS IS REVEALED FROM HIGH FREQUENCY GROUND PENETRATING RADAR (GPR)

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Peatlands are key contributors of greenhouse gases into the atmosphere that are capable of producing and releasing significant amounts of free-phase biogenic gases (CO_2 ,CH_4). Although many studies have investigated gas flux dynamics in peat soils over the last two decades the spatial distribution of these gases (particularly for tropical and subtropical systems) is still highly uncertain. In this study we used an array of hydrogeophysical methods to investigate the spatial variability in biogenic gas accumulation and release in three 0.027 m^3 peat monoliths from three different wetland ecosystems in central Florida, including a sawgrass peatland, a wet prairie, and a depressional wetland within a pine flatwood. High frequency (1.2 GHz) ground penetrating radar (GPR) surveys were collected along each sample about three times per week and over a period of five months in order to estimate gas content variability (i.e. build-up and release) within the peat matrix. GPR measurements were constrained with an array of gas traps (eight per sample) fitted with time-lapse cameras in order to capture gas releases at 15 minute intervals. Gas collected at the gas traps was analyzed with a gas chromatograph in order to determine CH_4 and CO_2 content. A grid of surface deformation points was also collected concurrently to monitor changes in the peat surface associated with gas build up and release. The aim of this study is to investigate the spatial variability in gas accumulation and release of biogenic gases for samples from different wetland ecosystems as well as variability within individual samples as potentially related to structural changes within the peat matrix. This work has implications for better understanding carbon dynamics in subtropical freshwater peatlands and how climate change may alter such dynamics.

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NESTING HABITAT AVAILABILITY FOR CAPE SABLE SEASIDE SPARROWS AS A FUNCTION OF EVERGLADES WATER DEPTH

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The endangered Cape Sable seaside sparrow (CSSS) (*Ammodramus maritima mirabilis*) is one of eight remaining subspecies of seaside sparrow. The CSSS once ranged throughout freshwater and brackish marsh habitats in southern Florida and the current known distribution is restricted to six separate subpopulation areas in Everglades National Park. Changes in habitat and hydrology threaten the CSSS with extinction, and efforts by regulatory and water-management agencies to protect and increase populations have been of limited success. The sparrows build their nests on the ground and up to six inches above the ground in mixed marl prairies. To increase nesting success, these short-hydroperiod prairies must remain mostly dry during the nesting season (March through July). Previously, a single water-level gage was used to estimate water depths in one or more subpopulation areas. Recently, several water-level gages used to estimate water depths in CSSS habitats were discontinued following a reduction in funding. An alternative and improved method for estimating and evaluating water depths was needed.

The Everglades Depth Estimation Network (EDEN) provides daily water-level and water-depth surfaces for the freshwater Everglades for the period 1991 to current (2014). An EDEN application was developed to use these surfaces to estimate and evaluate water levels and water depths in CSSS habitat on a real-time basis. An animated viewer shows flooded areas, calculates the percent of dry area, and estimates average water depth by subpopulation domain. Wildlife-resource scientists and managers can use this EDEN application to assess impacts on nesting success and develop management strategies for the future. Water-control managers can use these results to manage movement of water through water-control structures and, when possible, reduce flooding in these areas during the nesting season. This application of the EDEN water-level and water-depth data demonstrates how scientists and resource managers can use EDEN to analyze the effects of water management practices on vulnerable species in the Everglades.

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USING EXPLORE AND VIEW EDEN (EVE) TO ACCESS EVERGLADES DEPTH ESTIMATION NETWORK (EDEN) DATA

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The Everglades Depth Estimation Network (EDEN) provides water-level and water-depth data for the freshwater part of the greater Everglades. Initiated in 2006, EDEN is an integrated network of real-time water-level gages, interpolation models, and web-accessible applications that generate daily water-level maps and derived hydrologic data. Users of EDEN data include biologists and wildlife-resource scientists managing habitat requirements for endangered species, ecologists assessing restoration impacts, and water-resource managers monitoring water levels and depths to meet mandated regulation schedules.

The U.S. Geological Survey recently developed a graphical interface, Explore and View EDEN (EVE), to allow easy access to data stored in the EDEN database. EVE allows users to display and download water level (hourly and daily), rainfall, and evapotranspiration data for over 300 water-level gages in the Everglades.

Users can plot water-level data simultaneously for up to five gages with daily local rainfall and evapotranspiration for user-specified periods. Data for selected gages can be downloaded for use in spreadsheets or other plotting programs. Users can easily distinguish measured data from estimated and hindcasted data. The ground elevation at the gage is included to allow users to determine when conditions are dry at the gage. Water-level hydrographs are displayed in both vertical datums used in the Everglades (North American Vertical Datum of 1988 and National Geodetic Vertical Datum of 1929).

The EVE graphical interface, which is a part of the EDEN website, integrates monitoring data from gages operated by multiple agencies and provides model results to scientists and managers. This website provides “one-stop shopping” for consistent and well-documented data for use in the restoration of the Everglades.

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USING THE EVERGLADES DEPTH ESTIMATION NETWORK (EDEN) FOR REAL-TIME EVALUATION OF THE EVERGLADES RESTORATION TRANSITION PLAN (ERTP) AND ITS IMPACTS ON TREE ISLANDS IN THE FLORIDA EVERGLADES

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In 2012, the Everglades Restoration Transition Plan (ERTP), a new water-control plan for the Central and South Florida Project, replaced the Interim Operational Plan (IOP). These water-control plans primarily regulate water levels in the Everglades for wildlife resource management and flood management in the surrounding urban areas. Local Indian tribes have expressed strong objection to unnatural, such as flooding caused by humans, inundation of trees islands under the ERTP, because they use the tree islands as cultural and sacred burial sites. An Everglades Depth Estimation Network (EDEN) application was developed to allow real-time evaluations of ERTP water levels at and near tree islands within the impact area.

The EDEN, initiated in 2006, integrates data collected from a network of real-time water-level gages, interpolation models, and web-accessible applications, to generate daily water-level and water-depth maps and derived hydrologic data for the freshwater part of the greater Everglades. The EDEN is used to monitor water levels during the ERTP period and to compare those water levels with the water levels that occurred during the IOP period (2002 through 2012) in Water Conservation Areas 3A and 3B and in Everglades National Park.

Two approaches are used to compare water levels in the Everglades from the ERTP and the IOP periods; one approach is for measured water levels at marsh gages, and the other approach is for modeled water levels at tree islands. For each month, non-exceedance probabilities for specified percentiles are graphed for daily water levels. For example, the 90th percentile water level for May indicates that 90 percent of all days in May during the IOP period had water levels that were equal to or less than a specified water level. When current ERTP water levels are plotted on the monthly probability graphs, the user can compare current water levels with the water levels during the IOP period. For tree islands, the current water level also can be compared with the maximum ground-surface elevation to monitor when overtopping conditions occur.

A daily email notification informs stakeholders when current water levels reach specified elevations at gages or tree islands. An alert is triggered for a specific gage or tree island when the water level equals or exceeds the 90th percentile water level for the IOP period. An additional alert is triggered for tree islands when the water level equals or exceeds the maximum tree-island ground elevation. Water managers can use these plots to document the anticipated changes in water levels under the ERTP and make operational changes when necessary.

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USING OGPS TO ESTABLISH LONG-TERM TROPICAL CYCLONE LANDFALL RECORDS AND ELUCIDATE THE MID-TO-LATE HOLOCENE CLIMATIC HISTORY OF THE NORTHERN GULF COAST.

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The Gulf Coast is currently experiencing rapid shoreline degradation and retreat due to a large number of factors, both anthropogenic and natural. Because coastal degradation commonly occurs in pulses, associated with the passage of tropical cyclones, determining the frequency of tropical cyclones, identifying the temporal variability in their activity levels and correlating activity levels with climatic conditions is of great importance. Due to the brevity of the instrumental record, low-frequency changes in activity regimes can only be determined through the use of sedimentary proxies.

Although a number of millennial-scale landfall histories, based on sediment cores from coastal wetlands, have been established for the northern Gulf coast over the past two decades, standard methodologies have typically only recorded major hurricanes (categories III-V). However, recent methodological advances, especially the use of organic geochemical proxies (OGPs), have increased the resolution of event detection to include minor hurricanes (categories I-II). This is of special interest as recent studies have suggested that landfall frequency is much less variable for minor than major hurricanes. Given the spatial and temporal heterogeneity of tropical cyclone landfall, adequate spatial coverage is an essential requirement for developing accurate regional histories.

In this project we extend the use of OGP-based landfall histories to the Alabama/Mississippi coast. In order to quantify the sedimentary chemical signatures along the salinity gradient a number of marsh and estuarine surface samples and sediments cores were collected along three transects in Grand Bay, AL and the Pascagoula River, MS. Preliminary analyses including standard sedimentary procedures (LOI, bulk density, grain size analysis, and microfossil identification) and simple isotopic analysis ($\delta 13C$, $\delta 15N$ and C/N ratios) will be conducted on all marsh and estuarine surface samples and at regularly-spaced intervals throughout the cores to constrain environmental parameters and identify candidate intervals for more intensive OGP analysis (lignin phenols, biomarkers). Evidence of marine signatures in marsh environments will be used to identify possible tropical cyclone-generated marine intrusions.

At all sites, the surface sediments (20-400 cm depth) are a high-organic peat, overlying mineral intervals up to 200 cm thick. This is the reverse of the expected stratigraphy for a transgressive coast. In several cores the thick mineral layers do not extend to the core bottoms, but sit above thick peat layers, suggesting that these sandwiched mineral layers were deposited during extended periods of significantly altered boundary conditions. Likely candidate processes include large changes in sea level, storminess or coastal configuration. Accurate interpretation of these cores should elucidate the paleoclimatic history of the Gulf and help identify important processes driving regional geomorphic change.

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MANAGEMENT OF THE INVASIVE INDO-PACIFIC LIONFISH IN BISCAYNE NATIONAL PARK

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In 2009, Biscayne National Park divers documented the occurrence of the Indo-Pacific lionfish (*Pterois volitans/miles*) in Park waters. Because of its voracious appetite, lack of predators, venomous spines, rapid growth, and high fecundity, the lionfish has successfully adapted to life in the Atlantic Ocean and it represents the first successful invasion of a marine fish in Atlantic waters. Lionfish in the invaded range demonstrate higher densities than in their native range. The lionfish invasion poses an additional threat to the resources of Biscayne National Park, which are already threatened by a myriad of stressors including overfishing, poaching, declining water quality, climate change, boat groundings, and marine pollution.

In response to this invasion, Biscayne National Park scientists have worked independently and collaboratively to manage this highly destructive invasive species. Management efforts have included routine removals at known hotspots, outreach efforts to educate park users and local citizens about the invasion, and numerous field research projects. Field research projects have targeted different aspects of lionfish biology and ecology (including habitat preferences, recruitment rates, feeding habits, and reproductive behaviors) and lionfish control (including testing a lionfish trap and determining the frequency of removal efforts needed to keep a site free of lionfish). This presentation will provide a brief overview of the different management efforts, including highlights of the different research studies completed and underway.

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BRUMATION OF BLACK AND WHITE TEGUS (*TUPINAMBIS MERIANAE*) IN SOUTHERN FLORIDA

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Black and white tegus, *Tupinambis merianae*, have established two known invasive populations in Florida, including an expanding population east of Everglades National Park. These large lizards are habitat and diet generalists that inhabit climates ranging from tropical to temperate in their native South American distribution. Black and white tegus brumate – a term describing cold season inactivity in reptiles – in thermal refugia during winter months, but there is little available information on the behavior of black and white tegus during brumation in the wild. Knowledge of thermal refugia characteristics and locations, timing of brumation, and differences in behaviors between sexes and size classes during brumation will inform restoration initiatives and control efforts. We conducted a preliminary study on the behavior of adult male black and white tegus during the inactive season in 2012 – 2013 in the Southern Glades Wildlife Environmental Area east of Everglades National Park and a more comprehensive study of sub-adult and adult black and white tegus of both sexes in the same region is underway. In the inactive season of 2012 – 2013, black and white tegus commenced and ended brumation between September and October and January and February, respectively. The average length of brumation was 137 days (range 116 – 160 days). One of five black and white tegus emerged to bask regularly during brumation while the other four remained in the thermal refugia until the end of the inactive season. We discuss these findings in the context of our on-going study on black and white tegu brumation behavior.

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SUPPORTING DECISION-MAKING IN THE GREATER EVERGLADES AND BEYOND WITH THE EVERVIEW PLATFORM

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The Joint Ecosystem Modeling (JEM) community created the EverVIEW Data Viewer application over five years ago to help scientists and decision-makers involved in Everglades restoration planning. EverVIEW allows decision makers to compare and evaluate restoration plans and to examine their impacts on species habitats within the region. Since its inception, EverVIEW has gone through several successive updates to bring new capabilities requested, guided, and in many cases, funded by organizations within its user community. EverVIEW has been used to visualize Comprehensive Everglades Restoration Plan (CERP) NetCDF conventions-compliant datasets for projects such as the 2012 Louisiana Coastal Master Plan, the Natural Resource Conservation Service's Lower Mississippi Valley regional assessment, and the Central Everglades Planning Project.

As EverVIEW has matured, computational and analysis capabilities have been added as extensions not present in the base application, with some extensions leveraging the EverVIEW platform for a customized visualization experience. The Everglades Depth Estimation Network (EDEN) Data Viewer is the first example of the extension-plus-EverVIEW-platform concept, and enables visualization of EDEN ground and water surfaces, while producing daily depths and days since drydown datasets that are familiar to the EDEN user community. The Peninsular Florida Landscape Conservation Cooperative (PFLCC) has supported the development of the PFLCC Scenarios Viewer, the latest example of an extension built on top of EverVIEW. The Scenarios Viewer combines outputs of future scenarios involving human population trends and climate change with inundation scenarios of 100-year events with sea level rise, niche models of Florida's threatened and endangered species, and Critical Lands and Waters Identification Project datasets into a single package for easy comparison by decision-makers and planners. Planning has already begun for the next tool to bring customized visualization capabilities to aid in the upcoming 2017 Louisiana Coastal Master Plan.

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TESTING A NEW NATURAL SYSTEM MODEL FOR USE IN SOUTH FLORIDA ECOSYSTEM RESTORATION

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For well over a decade, restoration practitioners involved in ecosystem restoration activities in South Florida used the "Natural System Model" (NSM), a hydrologic model that simulates natural system response to relatively recent climatic conditions, to help set quantitative targets of what a "restored" ecosystem may look like. The NSM was also used in the development of performance measures used to evaluate progress towards restoration for various restoration planning scenarios, most notably the Comprehensive Everglades Restoration Plan, or CERP.
A new generation of natural system modeling, developed by the South Florida Water Management District, is the Natural System Regional Simulation Model (NSRSM). Model developers from the District requested that RECOVER do a collaborative test application of this new model and to assess its potential for use in the broad arena of restoration planning.

For this test application, RECOVER chose to use ecological models to evaluate the NSRSM. These models (*e.g.,* freshwater fish densities, wood stork foraging index, alligator production index) were run using NSRSM hydrology, and were compared back to the NSM, as well as more recent planning scenarios from the Central Everglades Planning Project (CEPP). Model results will be presented, as well as suggestions for the appropriate use of the NSRSM in restoration planning in South Florida.

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BIOLOGICAL CONTROL OF TROPICAL SODA APPLE, *SOLANUM VIARUM* (SOLANACEAE) IN FLORIDA: A SUCCESSFUL PROJECT

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Tropical soda apple, *Solanum viarum* (Solanaceae) is an invasive plant native to South America that was first reported in Florida, USA, in 1988. It rapidly invaded over 400,000 ha of improved pastures and natural ecosystems throughout Florida and spread to Alabama, Georgia, South Carolina, Texas, and Puerto Rico due to favorable environmental conditions and lack of natural enemies (herbivores and pathogens). Tropical soda apple reduces biodiversity in natural areas including the Everglades by displacing native vegetation. The plant also is a reservoir host for at least six crop viruses and major insect pests utilize the plant as an alternate host. Control costs for Florida ranchers were estimated at \$6.5 to 16 million annually. Because of its environmental and agricultural impacts, tropical soda apple was placed on the Florida and Federal Noxious Weeds Lists in 1995. Management practices in Florida pastures primarily involved herbicide applications and mowing which provided temporary weed suppression at an estimated cost of \$61 and \$47 per ha, respectively. However, application of these control methods is not always feasible in rough terrain or inaccessible areas such as cypress bayheads. In June 1994, the first exploration for natural enemies in South America was conducted by University of Florida and Brazilian researchers. Host-specificity tests with potential biocontrol candidates were initiated in 1997. The South American leaf-feeder beetle *Gratiana boliviana* (Chrysomelidae) was approved for field release in Florida in 2003. More than 250,000 beetles were mass reared and released from 2003 to 2011 by the Biocontrol Implementation Team that included local, state and federal researchers/land managers as well as cattle ranchers. Post-release monitoring through Florida indicated the beetle is causing significant defoliation of tropical soda apple, which is reducing stand density and decreasing fruit production in Central and South Florida with no-negative effects on non-target species. This was the first successful classical biocontrol project of a *Solanum* weds in North America.

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SNAIL KITE (*ROSTRHAMUS SOCIABILIS*) EXPOSURE TO MERCURY IN FLORIDA: SUB-LETHAL CONCENTRATIONS IN THE SOUTHERN EVERGLADES MAY HINDER REPRODUCTON AND CURTAIL RECOVERY

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The U.S. population of Snail Kites, limited to Florida, declined substantially and became federally listed as Endangered in 1967 following massive hydrologic and agricultural changes to the Greater Everglades and its headwaters. These changes to the large, naturally-functioning wetlands on which this species relies apparently had unfavorable effects on the kite's Apple Snail prey. Efforts to reestablish natural ecological functions in the Everglades entail monitoring the responses of key wetland species, including those that are listed or reflect the health of the greater system. This requires identifying meaningful metrics (e.g., bird nesting success) as well as anthropogenic factors that might confound the monitoring results (e.g., contaminants that depress nesting success independent of prey and hydrologic conditions). Mercury from industrial sources is a persistent environmental contaminant that bioaccumulates in wetlands worldwide. Most studies of mercury toxicity in birds have focused on fish-eating species. However, some birds that feed on invertebrates are known to have concentrations of mercury high enough to reduce nesting success. We measured mercury concentrations in Snail Kite feather samples collected in 2011 and 2012 from 22 adults captured from Lake Istokpoga (Highlands County) to eastern Everglades National Park (Miami-Dade County). Concentrations generally increased from northwest to southeast, reaching 3.3 to 4.8 ppm in the southern Everglades (southern Water Conservation Area 3A and the Frog Pond area of Everglades National Park). Similar concentrations have been associated with high rates of nest abandonment, embryo mortality, and reductions of >30% in nesting success for other species of invertivorous birds. The steady decline of the Snail Kite in WCA 3A has been attributed to the measured low density of Apple Snails in the region. Our results suggest that depressed nesting success due to sub-lethal effects of mercury could be aggravating the Snail Kite's decline, particularly given indications that physiologic stressors, such as poor feeding conditions, may exacerbate the toxic effects of mercury in birds. Stable isotope analyses now make it possible to link mercury loads in individual animals with industrial point sources, thus supporting remedial action. Because mercury's effects vary across taxa, we recommend a study of the behavioral and physiological impacts of mercury on Snail Kite reproduction in the Everglades to gauge its influence on the species' population growth and recovery.

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SNAIL KITE (*ROSTRHAMUS SOCIABILIS*) SATELLITE TELEMETRY REVEALS LARGE-SCALE MOVEMENTS AND CONCENTRATED USE OF "PERIPHERAL" WETLANDS: IMPLICATIONS FOR HABITAT MANAGEMENT AND POPULATION MONITORING

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The U.S. population of Snail Kites, limited to Florida, declined substantially and became federally listed as Endangered in 1967 following massive hydrologic and agricultural changes to the Greater Everglades and its headwaters. These changes to the large, naturally-functioning wetlands on which this species relies apparently had unfavorable effects on the kite's apple snail prey. Previous research and monitoring that used VHF telemetry and color-banding showed limited movement within sampled sites. Since 2007, we have collected >50,500 satellite-derived locations for 22 adult Snail Kites tagged throughout the species' Florida range. Of these locations, 54% were outside the natural wetlands that comprise the altered remnants of the Snail Kite's historic range. These "peripheral wetlands" include large water-management canals, agricultural drainage ditches, neighborhood retention ponds, and storm-water treatment areas (STAs, designed to use native vegetation to reduce pollutants from agricultural run-off). None of these areas are managed specifically for Snail Kites or have been regulated as suitable habitat, and most have not been incorporated into the large and expensive monitoring effort devoted to this species. Our results indicate that the created wetlands in which Snail Kites spend much of their time pose challenges for the management and conservation of this imperiled species.

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DISEASE, DOGS AND DRONES: AN INTEGRATED APPROACH FOR TRACKING FUNGAL PATHOGENS IN THE ENVIRONMENT

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Most invasive pest species are foreign to the US and enter through our ports of entry. Many are discovered by USDA's detector canines trained to sniff out illegally imported fruits, vegetables and animal products at the ports. However, those that evade detection become imminent threats to our US food supplies and natural resources. Using "high tech" drones and "low tech" canines can be an effective strategy to mitigate the spread of diseases once it enters the environment. Originally from Southeast Asia, the invasive wood boring beetle, *Xyleborus glabratus* was first discovered in 2002 in Georgia. Its fungal symbiont, *Raffaelea lauricola*, is a phytopathogen, the causative agent of the laurel wilt disease. The disease has completely decimated the wild laurel forests in the southeastern US, Florida's Everglades and is now invading the commercially important avocado groves. Avocado represents an important commercial crop and the loss of avocado groves could incur replacement costs in excess of $400M US dollars. The spread of the disease is very rapid, with lethality often within eight weeks. A single inoculation event can lead to laurel wilt and the death of the tree. Detection at the present time is to visually identify infected trees using helicopters followed by grove owner ground-truth and then complete eradication of the infected tree plus ≈10 surrounding trees to curb the spread of the fungus via root grafting. Combining volatile organic chemistry (the "smell" of the infection), fungal and plant biology (the interaction between pathogen and host) and spectral imaging (changes in tree canopy spectral output) can provide an earlier detection system that will help stop the spread of the disease before root grafting and nascent beetle emergence. This integrated and innovative approach uses drones (unmanned aerial systems, UASs) mounted with spectral and thermal cameras combined with detector canines trained to the odor of the infected tree for earlier disease detection-before visual symptoms appear and root grafting can take place. Once the UAS has flown over the groves and images have pinpointed stressed trees, ground-truth of the groves is done using the canines trained on the scent of the fungus/infection. To date, three canines have been trained on the scent of the infection, have been deploy into groves and have successfully identified non-symptomatic but infected trees that did not show any outward signs of the diseasewilting of the leaves at the crown of the tree. Molecular confirmation of the fungal pathogen's presence in non-symptomatic trees confirms the ability of the canines to detect the disease at its earliest stage. Spectral and thermal imaging can help correlate the vegetation indices to the positive alerts of the canines. Rapid DNA tests are being developed that will provide confirmation of the fungal pathogen in the field. This multi-disciplinary and integrated approach can enhance US food safety and security, protect our natural resources and help mitigate the spread of deadly phytopathogen.

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VEGETATION COMMUNITY RELATIONSHIPS WITH POMACEA *PALUDOSA* AND *POMACEA MACULATA* IN LAKE OKEECHOBEE, FLORIDA, UNITED STATES

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Invasion of exotic species is a global threat to native species, biological diversity, and ecological restoration projects. This is particularly true in aquatic environments where introductions can occur unnoticed, allowing exotic breeding populations to become established. *Pomacea maculata* is a problematic macrophyte herbivore often misidentified with one of the world's most invasive and destructive exotic snail, *Pomacea canaliculata*. In comparison, *P. maculata* potentially could cause a greater environmental impact by exhibiting a broader geographical distribution, increased climate tolerance, and greater egg production. This research addresses whether the exotic *P. maculata* and native *Pomacea paludosa* compete for similar resources by occupying identical vegetation communities in Lake Okeechobee. A non-parametric multidimensional scaling analysis in 3D showed visually and statistically strong separation of vegetation communities based on snail species presence, with few sites exhibiting species overlap. An ANOSIM analysis returned a significant difference in vegetation communities between the three groups: native, exotic, and mixed populations. The exotic floating plant *Hydrilla verticillata* contributed the most to plant community similarities between sites supporting *P. maculate*, whereas *Eleocharis cellulosa*, *Nymphaea odorata*, and *Schoenoplectus americanus* were the greatest contributors to similarities among plant communities supporting *P. paludosa*. Resource competition may exist in *V. americana* communities and populations of this important plant may be severely impacted due to the coupled top down herbivory pressure. *V. americana* is a highly desirable plant species for the 8 billion dollar Comprehensive Everglades Restoration Plan in South Florida.

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THE USE OF MOLECULAR TECHNIQUES TO ASSESS MICROBIAL NUTRIENT STATUS IN THE EVERGLADES

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The Everglades is a historically oligotrophic peatland that has been subject to phosphorus (P) enrichment from the adjoining Everglades Agricultural Area. Numerous studies have documented changes in vegetation communities, enzymatic activities, and biogeochemical cycles resulting from decades of P enrichment. This enrichment is particularly evident in the Everglades Water Conservation Area-2A (WCA-2A), which exhibits a gradient of P enrichment, ranging from impacted sites to unimpacted sites. Through our work, we investigate the impacts of P enrichment on the function and structure of microbial communities within WCA-2A. Microbial communities, and their ability to access nutrient and carbon sources, can be key drivers of soil biogeochemical cycles. Through use molecular techniques, such as quantitative-PCR (q-PCR), functional microarrays, and metagenomic sequencing, we have begun to assess microbial community response to P enrichment, and how they may alter nutrient cycling within WCA-2A. We have quantified key functional genes (via q-PCR) for P and nitrogen (N) cycling along the WCA-2A transect. Additional work was conducted via Geochip 3.0 functional microarray analysis, which found a suite of functional genes responsible for P and N cycling along the gradient. The ratio of gene abundances, particularly those of alkaline phosphatase (*phoX* and *phoD*) and dinitrogenase reductase (*nifH*), were found to change along the transect, suggesting that microbial communities are exhibiting a functional response to P enrichment. Further investigation via molecular techniques, including community characterization via 16S rRNA metagenomic sequencing, is currently being undertaken. By studying the dynamics microbial communities within oligotrophic peatlands, such as the Everglades, we can better understand the interlinked dynamics of microbial nutrient cycling, and assess how these technologies can be used to evaluate restoration goals.

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VALUATION OF ECOSYSTEM SERVICES FOR ENVIRONMENTAL DECISION MAKING IN SOUTH FLORIDA

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The Greater Everglades system imparts numerous, vital ecosystem services (ES) to South Florida residents including high quality drinking water supplies, a habitat for threatened and endangered species, opportunities for recreation and much more. The system is currently undergoing restoration on which the provision of these ES is highly dependent. As a result of the altered Everglades system and regional ecological and socioeconomic dynamics, restoration may either improve the provision of these services or impose a tradeoff between enhanced environmental goods and services and competing societal demands.

The current study aims at understanding public preferences for restoration and generating willingness to pay (WTP) values for restored ES through the implementation of a discrete choice experiment. We have collected data from 2,905 respondents based on two samples (n= 2,032 within the general public and n= 873 amongst licensed saltwater anglers in Florida) who participated in an online survey designed to elicit the WTP values for selected ecological and social attributes. In order to accommodate for the low-levels of scientific knowledge regarding the Everglades, the survey contained informational videos to provide key information on the past, present, and proposed flow within the Everglades and set up a broader context for the choice experiments. Preliminary analyses based on logit and mixed logit models indicate that income and price of restoration plans significantly affected choice for each plan.

We estimate that the Florida general public is willing to pay up to $854.1- $954.1 million over 10 years to avoid restrictions on their outdoor and indoor water usage and up to $90.8- $183.7 million over 10 years to restore the hydrological flow within the Water Conservation Areas. We also estimate that the Florida general public is willing to pay between $11.4 -$ 22.9 million for wetland species restoration, $21.4 - $22.9 million for dry land species restoration, and $21.2- $22.2 million for Florida Bay species restoration over 10 years. Considering that South Florida depends significantly on the services provided by the Everglades Ecosystems, assessing public preferences is necessary for a comprehensive view of the social dynamics of Everglades Restoration. The analysis from this study can provide some tangible estimates of economic values of these ES for policy analysts and decision makers.

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EXAMINING BIOGENIC GAS DYNAMICS IN PEAT SOILS OF THE FLORIDA EVERGLADES USING CAPACITANCE MOISTURE PROBES

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Peatlands are known to act as carbon sinks while representing major sources of biogenic gases such as methane (CH_4) and carbon dioxide (CO_2), two potent greenhouse gases. The overall warm temperatures (when compared to boreal systems) of the Florida Everglades have resulted in conditions conducive to biogenic gas releases throughout the entire year. Such releases are however not well understood and the temporal distribution and dynamics of biogenic gas release from peat soils of the Florida Everglades is uncertain. The majority of methods for estimating biogenic gas accumulation and release in peat soils tend to show limitations in terms of temporal resolution, which can be problematic for capturing rapid gas releases (i.e. ebullition events). The objective of our work is to test the use of capacitance moisture probes to better constrain temporal changes in biogenic gas accumulation and release at the laboratory scale from several peat monoliths from the Florida Everglades. Moisture probes are coupled with data loggers that allow measuring moisture content variability at minute to subminute sampling intervals. Probe measurements to estimate changes in moisture content over time within the peat matrix are also coupled with gas traps in order to compare gas dynamics with direct gas releases. As a result, moisture probes are used to infer gas content variability and estimate gas fluxes at a temporal resolution previously unreported (to our knowledge) for peat soils in the Everglades that can be ultimately incorporated into current models of carbon flux. Furthermore, this work has implications for better understanding patterns of gas release from peat soils in the Everglades and how climate change may affect gas dynamics.

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THE FLORIDA PANTHER PAYMENT FOR ECOSYSTEM SERVICES PILOT PROJECT

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Over the past 20 years, the Florida panther population has increased significantly in southwest Florida from an estimated 30 panthers in 1995 to approximately 100 - 180 today. This success is due to many factors, including habitat protection/management, and genetic restoration. With this success, panthers have been expanding their range on public and private lands. At the same time, conversion of agricultural lands to more intensive uses continues to contribute to the loss of Florida panther habitat that could inhibit recovery.

South and central Florida ranchlands are critical to successful panther survival, with over 29% of occupied panther range under private ownership within the Florida Panther Focus Area (Focus Area). The US Fish and Wildlife Service (USFWS) believes that the continued management of native habitats on private lands in this landscape is essential to the recovery of the Florida panther. Yet, the economic and environmental pressures facing ranchers is great. The unpredictable profitability of ranching operations from year to year in Florida is one of the factors that contributes to land use change and represents a threat to Florida's natural landscapes and the collective societal benefits these lands provide. Some landowners have converted native habitats and pasture into more intensive agriculture uses such as row crops, and others have sold their land because the encroachment of urban development drives up the surrounding property values, creating an incentive to sell. Though they may not want to sell the land or cancel lease agreements, many ranchers may be forced to if ranching becomes economically unviable.

Many landowners and ranchers in the Focus Area recognize that maintaining wildlife habitats on their lands that support panthers can be a liability if the panthers prey on their calves or cattle. Therefore, incentivizing the management of native habitats is crucial and may alleviate concerns of revenue lost due to panther depredations. Although there are many incentive and easement programs available to landowners in the Focus Area, these may not provide sufficient funds to keep larger ranchlands working in the face of current economic pressures. The USFWS developed the Florida Panther Payment for Ecosystem Services (PES) program for ranchers who have large acreages, diverse habitat types, varied land uses that provide quality habitat for the endangered Florida panther and its prey, and need additional financial assistance. Achieving Florida panther recovery goals may be augmented through this PES Program by itself or in combination with other financial assistance programs.

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EVALUATING THE EFFECTS OF CENTRAL EVERGLADES PLANNING PROJECT ALTERNATIVE PLANS USING PERFORMANCE MEASURES AND ECOLOGICAL PLANNING TOOLS

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The Central Everglades Planning Project (CEPP) is encompassed in the Comprehensive Everglades Restoration Plan (CERP), which was approved by Congress as a framework for the restoration of the natural system in south Florida under Section 601 of the Water Resources Development Act of 2000. The purpose of the CEPP is to improve the quantity, quality, timing and distribution of water flows to the Northern Estuaries, central Everglades (Water Conservation Area 3 and Everglades National Park), and Florida Bay while increasing water supply for municipal, industrial and agricultural users. The U.S. Army Corps of Engineers (USACE) requires that ecosystem restoration planning contribute to national ecosystem restoration, which is measured in terms of increases in the net quantity and/or quality of desired ecosystem resources. The CEPP planning model was developed by the Jacksonville District with support from multiple Federal and State agencies to quantify ecological benefits (*i.e.* Habitat Units [HUs]) and support plan evaluation, comparison, and selection of the recommended plan.

Performance measures were used to make the correlation between hydrologic output and ecosystem functions and evaluate the degree to which proposed alternative plans met restoration objectives. Each of the project performance measures for the CEPP planning effort were derived from those performance measures developed for CERP by REstoration, COordination, and VErification (RECOVER); an interagency and interdisciplinary scientific and technical team that provides system-wide scientific and technical support of the CERP. Performance measures were developed from Conceptual Ecological Models (CEMs) which are used in the Everglades restoration program as a framework for the planning and assessment of CERP. Performance measure scores were generated from regional hydrologic models and were aggregated within pre-defined project zones to generate HUs. Species specific ecological planning tools were also used within the CEPP planning effort to evaluate potential environmental effects of the recommended plan. An overview of the planning model used to justify the recommended plan and examples of ecological planning tools will be provided.

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TO MOVE OR NOT TO MOVE- WATER QUALITY AND SEDIMENT ENTRAINMENT RESPONSES TO TWO FLOW EVENTS

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The importance of sediment movement in response to flow is a key hypothesis in the maintenance and restoration of Everglades ridge and slough communities, and is a focus of the Decompartmentalization Physical Model (DPM) project. We used a combination of water quality and critical entrainment threshold (CET) velocities to assess the effect of flow on sediment suspension from different sediment types throughout the DPM footprint. CET was measured using a benthic annular flume, which provides controlled conditions to assess velocity: entrainment relationships. The DPM is a before-after-controlled-impact design, thus sampling is concentrated into pre, during, and post flow conditions.

In 2013, the year of the inaugural flow event, total phosphorus (TP) concentrations throughout the southerly flow field remained low, ≤ 10 ugL^{-1} pre, during and post flow, suggesting a limited effect of flow on TP concentrations. However, with increased flow, the rate of supply was higher and was reflected in reduced biomass-specific activity of phosphorus acquiring enzymes. In 2014 we conducted more frequent and directional water quality sampling allowing us to capture the southern flow path, as well as the predominant easterly flow path observed in both 2013 and 2014. These data revealed short-term increased TP concentrations at sites closest to the structure, particularly along the eastern-flow path. A similar response was observed for turbidity, though slightly offset in time to TP, suggesting either a change in P content and/or particulate material after the initial sediment pulse.

Previous studies have shown sediment re-suspension is influenced by both velocity and sediment characteristics. CET values measured post-flow in 2013 were generally lower than those measured pre-flow. Preliminary examination of the sedimentary materials collected during these benthic flume deployments suggested that sites closest to inflow were affected by construction materials in 2013. This was not surprising given the short time period between completion of construction and subsequent operation of the inflow structure. Interestingly, CET values observed in the pre-flow sampling of Oct 2014 were similar to those assessed in the 2013 post-flow sampling. CET data collected prior to 2013 suggest there may be seasonality in CET values. Thus, longer-term data collection is necessary to assess whether the lower CET values observed in 2014 demonstrate a change in sediment mobility due to the prior flow, or are a reflection of hydrologic/seasonal conditions.

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FLORISTIC DATA – THEORY, APPLICATION, AND IMPACT

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The Institute for Regional Conservation (IRC) is dedicated to the protection, restoration, and long-term management of biodiversity on a regional basis, and to the prevention of regional extinctions of rare plants, animals and ecosystems. For over two decades, IRC has been applying this mission to the conservation of plants and ecosystems in South Florida and within the Greater Everglades Ecosystem. Florida is one of the most floristically diverse states in the US with over 2,800 species of native plants. South Florida alone has over 1,400 native species, about half of the total in the state. The biodiversity in South Florida is not surprising given its location in the southern range of many temperate species and the northern range of many tropical species. With unique ecosystems and environmental characteristics, South Florida is also the host of many rare, endangered, and endemic species. Seventeen plants in South Florida are federally endangered or threatened and IRC recognizes 274 as "critically imperiled." Nearly 100 taxa may be extirpated in the region. With high biodiversity and a high occurrence of species which are threatened by limited ranges, habitat destruction, and improper management, it is essential that the best data possible are used to implement successful conservation and management strategies. These data should be utilized at all levels of management from individuals to agencies and land managers.

The Institute for Regional Conservation, realizing the need for collecting data on the occurrence and conservation status of South Florida flora, took on the task of inventorying all conservation areas in South Florida and creating the Floristic Inventory of South Florida (FISF) and publishing its results online. Since the publication of the book Rare Plants of South Florida: Their History, Conservation, and Restoration in 2002 and the creation of an online program titled Natives for Your Neighborhood, IRC's data have become invaluable to conservation planning and action in South Florida. These data have been accessed by tens of thousands of users and utilized by universities, conservation organizations, state and federal agencies, as well as the general public. By providing the data online for free IRC aims to ensure that the best information is available to make data driven and informed decisions on conservation in South Florida. Because the FISF clearly demonstrates that existing protected areas are not enough to protect all species IRC's online resources aim to aid the conservation of species not only by informing formal management decisions but by also engaging the general public in species conservation through native landscaping and small scale private habitat restoration.

The two online databases are accessed by thousands of individuals each month ranging from land managers and biologists to nurseries and casual enthusiasts. Using website usage data, citations, and testimonials IRC has assessed the impact and use of the FISF and Natives for your Neighborhood. What we have found is a strong contribution to conservation and educational efforts in South Florida as a result of the databases. IRC plans to continue assessing the impact of the FISF through formal surveys of land managers and agency biologist in the region.

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HOW TO BUILD A BIGGER FLORIDA BAY

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One target of Everglades restoration efforts in south Florida's Everglades includes increasing freshwater inflow into Everglades National Park (ENP) and Florida Bay. An assumption underlying Everglades restoration has been that surplus water from farther north in the Everglades can be redirected southward. However, changing climate may eliminate surpluses through higher temperatures and evapotranspiration and uncertain rainfall patterns. While sea level rise has received much attention, the high probability of reduced rainfall and increased evapotranspiration may be equally problematic for coastal regions.

Most of the Everglades is a freshwater peatland. For creation and maintenance, freshwater peat soils require a surplus of water over evapotranspiration. If this surplus disappears as climate changes, resulting droughts will challenge the long-term survival of Everglades ecosystems. Because the southernmost Everglades and Florida Bay rely heavily upon fresh water inflows, reduced inflow would alter ecosystems, increase salinities in Florida Bay, and change the southern Everglades landscape.
Both climate change and sea level rise are expected to cause major changes to Florida Bay and ENP. First, the effect of climate change on these areas is likely to result from both reduced rainfall and reduced freshwater inflow into ENP. A regional hydrological model was used to simulate a relatively moderate climate change scenario by the year 2060. Relative to base conditions, the scenario of increased temperature and decreased rainfall produced a 72% decrease in annual average inflow into ENP and a 64% decrease of flows into the Bay.

Second, sea level rise is expected to increase salinity both at the ground surface and from below. As sea levels rise, powerful storms and higher storm surge will push saltwater much farther inland than rising sea level alone. Because the highly porous south Florida karst facilitates saltwater movement, near-surface peat also may be damaged from subsurface saltwater intrusion. In the shorter term, the combined surface and subsurface intrusion of saltwater into the freshwater wetlands is expected to cause peat degradation and collapse, alter plant and microbial communities, release carbon as CO_2 with feedbacks to climate, and release nutrients and dissolved organic carbon into the Bay. Rising salinity already is altering vegetation in Shark River Slough tree islands and appears to be facilitating inland movement of mangrove forest communities.

Rising sea levels, increased storm surges, and saltwater intrusion along the coast are expected to change the Everglades landscape eventually from a freshwater wetland to a shallow marine ecosystem. Sea level is predicted to rise as much as 2 m by the end of the 21st century. With land elevations at the northern boundary of ENP between 2 and 2.4 m, most of ENP would then become a shallow bay, and southern Water Conservation Area 3 is likely to also be affected. Future landscapes of ENP and Florida Bay will differ significantly from those of today under anticipated sea level rise and altered hydrology resulting from climate change. Expansion of Florida Bay and loss of the freshwater ecosystems of ENP are likely.

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MONITORING MERCURY EXPOSURE IN NESTING WADING BIRDS: CONSIDERATIONS FOR THE EVERGLADES TROPHIC HYPOTHESIS

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Mercury is a natural, non-essential, bio-accumulative, and highly toxic global pollutant with known deleterious effects on fundamental physiological systems and processes in wildlife. Reproduction is one of the most sensitive processes to be affected by mercury exposure, and predators naturally exposed to high levels of mercury through bio-accumulative effects tend to be more at risk. Nevertheless, these alterations (including strong developmental impairment and endocrine disruption) may be very subtle and difficult to assess in the context of highly complex natural ecosystems with multiple stressors. The coastal estuarine zone of the Everglades is one of the most over drained areas, and historically the location of the majority of breeding by wading birds. A restoration plan is designed to re-hydrate this zone, with a clear prediction that wading birds will move back to the coast to nest in large numbers. Nevertheless, mercury levels on the coast can double those from the inland areas of Everglades, so the estimation of the risk of mercury exposure in the coastal zone of the Everglades becomes key information for the success and efficiency of restoration efforts. We present the initial results of mercury sampling from Wood Storks (*Mycteria americana*) and Great Egrets (*Ardea alba*) and discuss ongoing monitoring efforts to estimate reproductive effects of mercury exposure in Everglades populations of Great Egrets.

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AN OVERVIEW OF GLOBAL AND REGIONAL SEA LEVEL RISE PROJECTIONS

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The protection of investments in Everglades Restoration and the coastal infrastructure is important and will require projections of sea level rise for future planning. While data from tide gauges and satellite altimetry provide valuable information on historical rates of sea level rise, recent work clearly indicates that these rates are dynamic and likely to change in the future due to a variety of factors. Coupled with expectations of an accelerated increase of global temperature suggested by climate models, a significant acceleration of global sea level rise cannot be excluded from consideration in the future planning of coastal infrastructure. Future sea levels in regions such as South Florida will be further modified by regional and local factors such as vertical land movement, dynamic effects of ocean circulation and wind patterns, and the changes in gravitational effects of melting ice from Greenland and Antarctica. Numerous entities have attempted to project sea levels both globally and regionally. Considering the societal and fiscal implications from changes in sea level and its extremes, planners and engineers need a strategy to deal with the uncertainties in sea level change projections. The general lack of an acceptable practice for incorporating uncertainties in projections of SLR have led to "scenario based" guidance for considering future changes in sea level in infrastructure projects. This presentation will provide an overview of numerous global and regional sea level rise projections, modeling of extremes in the future and the potential implications of increasing sea levels on coastal projects located in both the natural and built environment.

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MOLECULAR MICROBIAL ECOLOGY OF MERCURY METHYLATION IN THE EVERGLADES SOIL ECOSYSTEM

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The fate of mercury in the Florida Everglades is of great concern because of potential adverse impacts on human and wildlife health through mercury accumulation in aquatic food webs. The major source of Hg(II) is deposition from the atmosphere associated with rainfall, which may be biologically reduced to Hg(0) or transformed to the more toxic methylmercury (MeHg), that may be transformed to Hg(II) via demethylation process. Considerable recent research has been devoted to identification of the complex geochemical interactions that control the fate of Hg(II); however, limited work has been conducted to characterize the distribution of microbes associated with the Hg cycle in the Everglades. The ultimate aim of this research was to explore the response of microbes involved in the Hg cycle in the Water Conservation Area (WCAs). This study investigated the distribution of Hg-methylating prokaryotes that harbor hgcA. hgcA encodes a corrinoid protein essential for Hg methylation and can be used as a biomarker for the potential for mercury methylation across broad phylogenetic boundaries. Using culture-independent PCR approach with a newly designed primer set, *hgcA* sequences were obtained from soils collected from three sites along a gradient in sulfate and nutrient concentrations in WCA 2A and 3A. The sequences obtained were distributed among diverse phyla, including *Deltaproteobacteria, Chloroflexi*, *Firmicutes* and *Methanomicrobia*; however, *hgcA* clone libraries from all sites were dominated by sequences clustering within the order *Syntrophobacterales* of the *Deltaproteobacteria* (49 to 65% of total sequences). Using *dsrB* mRNA assay, it was demonstrated that *Syntrophobacterales* dominated those study sites (75 to 89% of *dsrB* mRNA sequences). Laboratory incubations with soils taken from the site low in sulfate concentrations also suggested that Hg methylation activities were primarily mediated by members of the order *Syntrophobacterales*, with some contribution by methanogens, *Chloroflexi*, iron-reducing *Geobacter*, and non-sulfate reducing *Firmicutes* inhabiting the sites. These results strongly suggest that prokaryotes distributed within clades defined by syntrophs are the predominant group controlling methylation of Hg in low sulfate areas of the Everglades. Mercury methylation in the Everglades does not appear to be limited to sulfate reduction, such that additional processes should be a consideration in strategies for managing mercury methylation.

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THE INTERACTION OF PULSE AND PRESS DISTURBANCES: DISCERNING THE EFFECTS OF SEA LEVEL RISE FROM THOSE OF STORM SURGE FLOODING IN COASTAL FORESTS OF THE LOWER FLORIDA KEYS, FL

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Given the projected 21st century increases in sea level rise, the composition and structure of coastal forests in south Florida are likely to change in the near future. In low elevation terrestrial forests, increases in sea level serve as a press disturbance that lead to increasing groundwater salinity as salt water intrudes into coastal aquifers. Forests in the western Atlantic are also frequently impacted by pulse disturbances like hurricanes accompanied by both strong winds and storm surge flooding. The combined impacts of both press and pulse disturbances will lead to different ecological outcomes than either impact individually, possibly changing successional trajectories. Over the past several decades, disturbances of both types have resulted in forest retreat and changes in composition in a variety of locales in both hammock and pine rockland communities, including those located on islands of the lower Florida Keys.

This research investigates the impact that 5 cm of sea level rise has had on the freshwater resources and vegetation of pine rockland and hardwood hammock forests on two islands in the lower Florida Keys over a 22-year period (1990 to 2012). Within this time period, these sites were also impacted by storm surges from Hurricanes Georges (1998) and Wilma (2005). Based on a combination of vegetation and groundwater monitoring results from seven 60 m x 10 m permanent plots in the 1990s and 2010s, we ask whether changes in groundwater salinity, forest structure, and species composition measured within three strata are correlated. We hypothesized that sites located outside the boundaries of previously mapped freshwater lenses will have increased groundwater salinity over the time period and shifts in composition will be correlated with this increase. Percent cover was estimated in low and high shrub strata and basal area per hectare was calculated for each plot in the tree stratum. Changes in groundwater salinity were examined in relation to plot location (height above mean sea level and coastal proximity) and recent precipitation. Vegetation response to a change in groundwater salinity was assessed by calculating the shift in position of sites along the salinity vector fitted in a non-metric multidimensional ordination.

Increases in groundwater salinity over the time period were observed at locations outside the freshwater lens, while groundwater salinity remained stable at locations inside the lens boundary. Decreases in basal area per hectare were observed across all plots and were attributed to the effects of hurricane storm surge. Changes in composition correlated with sea level rise were only observed in the shrub strata. Our understanding of the effects of these interacting disturbances on coastal forests should aid in the management of coastal ecosystems of the Greater Everglades.

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SULFUR IN THE EVERGLADES – AN OVERVIEW

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Sulfur is a water quality issue of significance for the freshwater Florida Everglades. Roughly 60% of surface water in the Everglades is enriched in sulfate over 1 mg/L (a restoration performance measure). Highly enriched marshes in the northern Everglades have average sulfate levels of about 60 mg/L. The highest concentrations of sulfate (average 60-70 mg/L) occur in canal water within the Everglades Agricultural Area (EAA). Potential sulfur sources are many, but major sources may include: sulfur in agricultural applications, sulfur released by oxidation of organic EAA soils (legacy agricultural applications and natural sulfur), and groundwater. Rainfall contributes a comparably small amount of sulfate to the ecosystem. Lake Okeechobee delivers sulfate to canals, but primarily serves to act as a reservoir of sulfate sourced from the EAA and elsewhere into the lake than a source of sulfate itself.

Sulfate loading to the Everglades increases microbial sulfate reduction in soils, and leading to more reducing conditions, greater cycling of nutrients in soils, and production of hydrogen sulfide. The combination of high atmospheric mercury deposition rates, elevated sulfate loading, and high dissolved organic matter in the Everglades leads to increased methylmercury (MeHg) production and bioaccumulation in fish - exposing piscivorous wildlife and human consumers to the toxic effects of MeHg.

Sulfate from the EAA drainage canals penetrates far into the Everglades Water Conservation Areas and may extend into Everglades National Park. Current plans to restore sheet flow and to deliver more water to the Everglades may increase overall sulfur loads to the ecosystem and extend sulfate-enriched zone further south. However, water management practices that minimize soil drying and rewetting cycles can mitigate sulfate release during soil oxidation. A comprehensive Everglades restoration strategy should include reduction of sulfur loads as a goal because of the many detrimental impacts of sulfate on the ecosystem. Monitoring data show that the ecosystem response to changes in sulfate levels is rapid, and strategies for reducing sulfate loading may be effective in the near-term. A multifaceted approach employing best management practices for sulfur in agriculture, agricultural practices that minimize soil oxidation, and changes to stormwater treatment areas that increase sulfate retention could help achieve reduced sulfate loads to the Everglades, and the accompanying benefits.

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FORECAST EFFECTS OF SEA-LEVEL RISE ON COASTAL WETLAND STRUCTURE AND FUNCTION

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Sea-level rise is an ongoing process and its potential effects on the southern Everglades are a source of concern for ecosystem managers and scientists involved in restoration. This concern is born out of the high degree of uncertainty associated with future sea-level rise rates and the ecological impacts of salt water transgression into freshwater marshes. In this talk we explore some of the potential alterations to the wetland landscape in terms of vegetation community structure, soil stability and biogeochemical cycling. Ecosystem services such as carbon, nitrogen, and phosphorus storage will also addressed. Based upon our current understanding of freshwater wetland responses to saltwater transgression events, we evaluate potential wetland responses to both moderate and extreme sea-level rise scenarios.

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PROSPECTS FOR CLASSICAL BIOLOGICAL CONTROL OF COGONGRASS

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Cogongrass (*Imperata cylindrica* (L.) Beauv. (Poaceae)) ranks among the world's most noxious weeds because of its ability to colonize, spread, displace desirable vegetation, and disrupt ecosystems. It is considered native to the Old World where it is widely distributed. Historical records indicate that cogongrass was introduced into the southeastern USA from Japan and the Philippines in the early 1900s. In addition, an ornamental variety, Japanese blood grass, was introduced from Japan. Since its arrival, cogongrass has spread throughout the southeastern USA where it causes significant economic losses in pine plantations, alters fire regimes, and endangers wildlife habitat and ecological diversity. Recent molecular characterization of cogongrass in the USA indicates that four clonal lineages are present; one dominant in Mississippi, Alabama and the Florida panhandle, a second that dominates in penninsular Florida, a cultivated ornamental type, and an ornamental type that has escaped cultivation in South Carolina.

Current control methods for cogongrass rely on mowing and the application of herbicides. What has not been exploited is the introduction of host specific natural enemies from the native range that may impact the plant's competitiveness and reproductive output. In the past three years, we have surveyed for natural enemies of cogongrass in East Africa, Japan and the Philippines. Particularly promising is a group of stemboring noctuids belonging to the genus *Acrapex*, several of which have been identified in Africa and Japan. Three *Acrapex* spp. have been brought into a quarantine laboratory in Florida for further study; *A. yakoba* Le Ru from Tanzania, *A. syscia* Fletcher from Uganda, and *A. azumi* Sugi from Japan. Unfortunately, efforts to establish colonies of these species failed.

Future efforts will focus on laboratory colonization of African *Acrapex* spp. at a laboratory in Nairobi, Kenya, and in Japan, we plan to investigate the population dynamics of *A. azumai* and import a second collection into quarantine. In addition, a trip will be made to Java to collect *Orseolia javanica* Kieffer & van Leeuwen-Reijinvaan (Cecidomyiidae), a stem-galling midge which previous research suggests is a specialized herbivore of cogongrass.

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HOW MONITORING FOR ENDANGERED SPECIES INFORMS WATER MANAGEMENT AND PROJECT IMPLEMENTATION

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The Comprehensive Everglades Restoration Plan (CERP) is one of the largest ecosystem restoration projects in the world. It encompasses several distinct habitat types, from upland and wetland habitats to the estuaries of South Florida. Throughout this vast ecosystem, approximately 58 federally threatened and endangered species reside. CERP's main goal is to "Get the water right – quantity, quality, timing and distribution" to support ecologic functions that represent a restored Everglades landscape. One of the main challenges in Everglades restoration is predicting how these changes in water flow will affect threatened and endangered species and how to balance the needs of these species with the multiple purposes of CERP. One way to address this uncertainty is through development of comprehensive conservation plans that outline a stepwise approach to assist endangered species to adapt to hydrologic changes predicted under CERP.

The Central Everglades Planning Project (CEPP) is one component of CERP designed to improve quantity, quality, timing and distribution of water flows to the Northern Estuaries, Water Conservation Area 3, Everglades National Park and Florida Bay while increasing water supply for municipal, industrial and agricultural users. Using lessons learned from CEPP, this presentation will focus on identifying actions that can be taken to improve environmental baseline conditions for listed species in anticipation of future changes in hydrology; and how integration of endangered species monitoring into an adaptive management framework can be used to inform water management and balance competing project purposes.

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IMPLICATIONS OF MOVEMENT BEHAVIOR AND LOCAL DENSITY ON NONNATIVE FISH DETECTION IN EVERGLADES RESTORATION ASSESSMENTS

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Deriving spatiotemporal patterns of nonnative species abundance and occupancy from a monitoring program that uses both passive and active sampling gear is complicated by how movement behavior and local density interact to affect detection probabilities. Movement rate varies among individuals, species, seasons, and locations, affecting encounter rates with passive samplers and abundance estimates from active samplers. We sought to resolve the effects of movement and density on data from encounter and enclosure samples and formulate a synthetic interpretation of the data for detection probability of nonnative fishes. We simultaneously collected fish with two types of passive samplers and one active-sampler at 20-35 fixed sampling plots (depending on season) encompassing five different regions of the Florida Everglades every two months over a six-month period. One passive sampling technique consisted of three wire-mesh minnow traps, open on both ends, set without bait for 24 hours. The other passive sampling method was unbaited, wire-mesh minnow traps embedded in three drift-fence arrays. Each array consisted of a central square, four wings extending from the center at 45-degree angles, and four minnow traps arranged on each side of the square such that wings directed fish into traps facing each of the cardinal directions. Minnow traps in drift-fence arrays were set for 24 hours and only open on the end facing outward from the array's central square. The active sampling method consisted of 5-7 replicate collections with a 1-m^2 throw-trap. We used these data to estimate the relationship between encounter rate and local density to draw inferences about the relative impact of density and movement speed on collections. We used an encounter model to isolate movement dynamics from density, allowing us to characterize seasonal and interspecific differences in movement. We then reversed our focus to quantify how different movement patterns affected local density estimates. For each specific gear, detection probability was regressed on sampling effort and density. Occupancy models were developed for selected nonnative fishes by combining detection probabilities quantified for each gear effort-fish density relationship. We illustrated the implications of these results for spatial estimates of nonnative fish prevalence used in the biannual report of System-Wide Ecological Indicators for Everglades Restoration.

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CONTINUOUS MONITORING OF MERCURY IN EVERGLADES NATIONAL PARK

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The USGS has used data from fluorescent dissolved organic matter (FDOM) sensors to calculate time-series of mercury concentrations in surface waters of Everglades National Park (ENP). The objective of this study is to evaluate similar techniques and methods to calculate a continuous time-series of mercury concentrations and loads at control structure S-12D. S-12D is located along the Tamiami Trail (US Highway 41) and is one of many inflow points into ENP.

The USGS has been collecting continuous temperature, specific conductance, turbidity, and FDOM data since 2012, in an effort to develop and test site-specific relations that can be used to determine mercury concentrations at S-12D. In addition, monthly depth-integrated samples along a cross-section of the S-12D inflow and point water samples near the in-situ sensors were collected and analyzed for filtered total mercury (FTHg), filtered methyl-mercury (FMHg), particulate total mercury (PTHg), and particulate methyl-mercury (PMHg) by the USGS Wisconsin mercury lab. The water samples collected along a cross-section of the inflow were assumed to represent the mean concentration of mercury at S-12D.

Preliminary results indicate a strong correlation between the point water samples and water samples collected along the cross-section. Two methods were evaluated for calculating particulate and filtered mercury from surrogate parameters. One method used turbidity as the surrogate variable for calculating PTHg and PMHg, whereas the other method used FDOM, temperature, turbidity, and ultraviolet absorbance at 254 nanometers (A_{254}) as the surrogate variables for calculating FTHg and FMHg.

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USE OF FLUORESCENT DISSOLVED ORGANIC MATTER (FDOM) SENSOR DATA TO CALCULATE DISSOLVED ORGANIC CARBON CONCENTRATIONS IN EVERGLADES NATIONAL PARK.

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Fluorescent dissolved organic matter (FDOM) sensor data has been used by previous studies as a surrogate for dissolved organic carbon (DOC) concentrations in Everglades National Park. The objective of this study is to evaluate various techniques and methods to calculate a continuous time-series record of DOC concentrations and loads at control structure S-12D. Control structure S-12D is located along the Tamiami Trail (US Highway 41) and is one of many inflow points to Everglades National Park.

Since 2012, the USGS has been collecting continuous in-situ temperature, specific conductance, turbidity, and FDOM data at S-12D. Monthly discrete samples were collected near the in-situ sensors and analyzed for DOC and ultraviolet absorbance at 254 nanometers (A_{254}) by the USGS carbon research laboratory in Boulder, Colorado. During monthly sampling events, a field meter was used to collect data for the same properties and constituents monitored in-situ along a cross-section of S-12D inflow.

Preliminary analyses indicate a strong correlation between the data collected with a field meter along the cross-sectional and the in-situ sensor data. Previous USGS research has shown the importance of correcting FDOM data for temperature, turbidity, and inner filter effects; A_{254} is used to correct FDOM for inner filter effects. Several methods were evaluated for calculating DOC from surrogate data. A site-specific relation using surrogate data and laboratory results was determined with multivariate regression analysis to calculate DOC concentrations.

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ECOLOGICAL POSITION ANALYSIS: AN ONLINE TOOL FOR SPATIAL HABITAT FORECASTS

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The South Florida Water Management District (SFWMD) has long employed a risk-analysis technique known as position analysis to evaluate the seasonal and multi-seasonal performance of the water management system. Position analysis forecasts hydrologic conditions associated with a specific operating plan for a basin over a period of many months. The forecast is conditioned on the current state of the system, as well as generated water stage traces from initial conditions, which, in turn, are based on a range of meteorological conditions that may occur. For near real-time evaluation of Everglades ecological models, we have developed a spatially-continuous position analysis to create daily forecasts of water stage and depth over a period of up to a year beyond current conditions. Operation of regional water management systems is spatially modeled with SFWMD Regional Simulation Model (RSM) hydrologic scenarios. Best fit near-future conditions are constrained by National Oceanic and Atmospheric Administration (NOAA) 3-month precipitation forecasts as well as Everglades Depth Estimation Network (EDEN) past water stage variances and rates of change.

The resulting hydrologic position analysis provides a range of possible hydrologic futures that are the primary input to ecological models including wading birds, Cape Sable Seaside Sparrow, forage fishes, seagrasses, landscape indices, and others. An automated web server-based decision support framework has been developed to acquire and preprocess modeling input data from multiple external sources to perform the ecological model evaluations monthly. Data delivery occurs online via dynamic web pages that offer users the ability to view and compare past generated maps as well as access the underlying numeric data, along with explanatory text about the model evaluation method and the generated maps.

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BALANCING ACCURACY AND PRECISION FOR MONITORING EXOTIC PLANT MANAGEMENT AT THE LANDSCAPE SCALE

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Non-native plants were formally identified to the superintendent of Everglades National Park as an emerging threat to the Everglades Ecosystem by Craighead (1961). Specifically, Craighead stated: "Four of these plants, Australian pine, Brazilian holly, cajuput [synonym for Melaleuca], and Ardisia, will no doubt prove to be troublesome invaders, crowding out extensive areas of native vegetation." Fifty four years later, it is clear that Craighead's warning was prescient, as the most current estimates identify roughly 53,000 acres infested with exotics in Everglades National Park, and over 142,000 infested acres across the Everglades CISMA (Cooperative Invasive Species Management Area) (Rodgers & Pernas 2014) – a 2.8 million acre collection of lands managed to support natural resources.

Those who are familiar with exotic plant management in the Everglades ecosystem and the Comprehensive Everglades Restoration Plan have long recognized the concordance between soil disturbance, boundary effects, distorted hydrology, and the proliferation of invasive exotic pest plants. There is also growing concern about recently arrived invasive species that seem to establish in otherwise undisturbed areas. As this awareness permeates through to the political dialogue in the region, the challenges of effectively managing exotic plant species become paramount. A series of complex considerations emerge: what are our priority species; which species pose the greatest risk to the functional and biological integrity of the system; where are exotic plants spreading most rapidly; what is the relationship between ecological restoration and exotic plant species management?

While opinions on these questions abound, an objective process for determining management priorities is an effective way to slice through conceptual dialogue with science-based evidence. No one monitoring process can answer all concerns, but the Generalized Random Tessellated Stratified (GRTS) monitoring design presented here is an effective strategy for balancing the need to estimate the scale of the challenge across the landscape at 5-10 year intervals, and simultaneously estimate the rate of change among over 100,000 - fifteen acre patches. This exotic plant monitoring effort is designed to be synchronized with monitoring of the effects of the Comprehensive Everglades Restoration Plan. We will present both the history of this monitoring design as well as what we've learned from the first few years of sampling. Initial results indicate that low-level infestations are nearly twice as common as previously estimated and are spatially compact. A few exotic-free areas still occur, and these seem to be located in the least disturbed, most remote, and best hydrated regions in the ECISMA.

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GAINING INSIGHT FROM RESTORATION SCENARIO EVALUATIONS WITH WADING BIRD NEST EFFORT MODELS

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The health and function of the Everglades ecosystem can be evaluated through the breeding success of its wading bird population because the key hypothesis underlying its restoration effort, the "*Trophic Hypothesis*" states that hydrologic patterns, fish populations and wading birds are tightly linked. It has been demonstrated that wading birds in the Everglades are food limited in some years and the pronounced seasonal wet and dry cycles produce levels of food availability that can vary by orders of magnitude among seasons and years. In addition, the water fluctuations that control food availability in the Everglades are highly managed, thus, wading birds' ability to successfully fledge offspring can be controlled to some degree through local and landscape-level management efforts.

We constructed hierarchical nest effort models to aid in ecosystem-level conservation and management of Great Egret (*Ardea alba*), White Ibis (*Eudocimus albus*), and Wood Stork (*Mycteria americana*) populations in the Everglades. To test for environmental conditions that were most important for generating high wading bird nesting effort in the Everglades, we developed six *a priori* hypotheses; hypotheses arranged along a gradient of globalized to localized representations of food availability. Each model was represented as a function of environmental parameters using generalized linear models with fixed and random effects. An information-theoretic approach was conducted using Akaike Information Criterion (AIC) to investigate competing models.

The Wood Stork nest effort model was assessed using hydrologic data from the Natural Systems Regional Simulation Model (NSRSM) to predicted Wood Stork nest effort for 1991-2005. A regression analysis was then conducted using the predicted and observed nest effort regionally for the Everglades ecosystem.

High nest effort for Great Egrets and White Ibis was positively associated with high foraging density in the month of April. This pattern supports the *Foraging Distribution Hypothesis*, which suggests that nest effort is related to factors that produce large foraging aggregations of birds rather than being a simple function of hydrologic conditions. Wood Stork nest effort was negatively associated with the number of days water rises during the dry season. This supports the *Progressive Drydown* Hypothesis, which predicts nesting effort is highest when water levels continuously drop throughout the breeding season exposing a large amount of foraging habitat.

The ability of the NSRSM hydrological model to predict observed Wood Stork nest numbers varied regionally with the model performing better in the Northern Everglades than in the Southern Everglades (R^2 = 0.40 and 0.26 respectively). Predicted nest effort in the Northern Everglades did not differ from observed nest effort (t_{14} = 1.05, P = 0.15) whereas predicted nest effort in the southern everglades was always higher than observed (t_{14} = 1.71, P = 0.05). The regional difference in model performance was likely due to the NSRSM predicting fewer days of rising water for the southern part of the system than what was observed (t_{14} = 1.94, P = 0.03).

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THE RELATIVE CONTRIBUTIONS OF LANDSCAPE AND LOCAL CONDITIONS TO INVASION SUCCESS OF THE NON-NATIVE APPLE SNAIL (*POMACEA MACULATA* (AMPULLARIIDAE)) IN RANCHLAND WETLANDS

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Local attributes of wetlands are often used to delimit the range of aquatic invaders occurrence and predict probability of population establishment. However geospatial characteristics such as relative isolation and connectedness also influence an invader's pattern of dispersal and distribution. We investigated the relationship of local environmental variables and geospatial characteristics on the distribution of the invasive Island Apple snails, *Pomacea maculata,* across seasonal wetlands at Buck Island Ranch (BIR) Lake Placid, Florida.

We surveyed over 100 wetlands for snail presence and examined if probability of presence was associated with measures of wetland isolation/connectedness from original propagule sources and local wetland characteristics (pH, temperature, vegetation structure, water hardness, permanence, "shoreline" complexity).We also conducted an enclosure field experiment to determine if local characteristics may provide greater explanatory power for localized snail absence, than wetland connectivity and isolation. The enclosure experiment will highlight which environmental characteristics may influence non-native apple snail survivability and population establishment in *ephemeral ranchland wetlands* and *ditches.*

Monitoring of local wetland characteristics and the enclosure experiment is currently ongoing. Wetland survey data suggests that spatial distribution of snail presence is associated with distance from the primary propagule sources via ditches. Topographical variation appears relatively minimal at the BIR and many wetlands can merge during flood events. However the inter-wetland ditch distance was a better predictor of non-native snail presence than Euclidean distance proximity. Given the broader environmental tolerances and supra-annual longevity of the non-native apple snail, ranchland wetlands and ditches may sustain permanent populations of invasive snails. Although ecological impacts of these non-native snails are still largely undocumented in Florida, they are possibly affecting the endangered Everglades snail kite. In the past, seasonal wetlands were less utilized by snail kites hunting for the endemic Florida apple snail. However, multiple observations suggest snail kites are actively utilizing these habitats at BIR, possibly in response to high densities of non-native apple snails. Understanding the conditions that facilitate or preclude the expansion of this non-native mollusk can inform management decisions aimed at snail kite recovery and help identify potential impacts on native floral diversity.

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THE ROLE OF SULFATE AS A DRIVER FOR MERCURY METHYLATION IN THE EVERGLADES – WHAT DOES STATISTICS REALLY HAVE TO SAY?

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Elucidating the role of sulfate as a driver of mercury methylation in the Everglades has a rich and contentious history. The traditional and most widely accepted model of the relationship between sulfate concentrations and mercury methylation rates is non-linear and unimodal, with an optimum sulfate concentration that results in maximal net mercury methylation. According to this paradigm, which was first developed by Gilmour and Henry (1991), sulfate availability at concentrations below the optimal concentration limits the activity of sulfate reducing bacteria, which in turn limits rates of mercury methylation. At concentrations above the optimum, sulfate reduction produces sulfide at levels inhibitory to sulfate reduction, primarily through the sequestration of labile Hg^{2+}, which is a necessary substrate to support mercury methylation.

This conceptual model, which was also first referred to as the “Goldilocks” hypothesis by Orem (2001), has been both embraced and rejected by different researchers working in the Everglades, often on the basis of statistical analysis and interpretations of the same fundamental data sets. From a management perspective this dichotomy is problematic as the matter of developing a clear and quantitative understanding of the role of sulfate driving mercury methylation is critical with regards to restoring ecosystem health – potentially via reducing sulfate inputs to the ecosystem. Moreover, because sulfate concentrations have been greatly perturbed throughout much of the Everglades Protection Area, the sulfate-mercury question has potentially profound hydrologic and land use implications for the Everglades.

This paper examines several of the most recent publications that attempt to either support or refute the Goldilocks hypothesis through plotting and/or statistically modeling the relationship between sulfate and fish tissue mercury concentrations. Careful inspection of the analyses conducted indicate a number of inherent problems from a statistical perspective, including model mis-specification, inappropriate data aggregation that obscures underlying relationships, violations of underlying assumptions inherent in regression analysis, and imprecise and ambiguous analyses with respect to the sulfate-mercury methylation question. An alternative approach – structural equation modeling (SEM) – that is more rigorously applied to the USEPA Regional Environmental Monitoring Assessment Program (R-EMAP) data is presented to provide a quantitative assessment of the role of sulfate in driving methyl mercury production in the Everglades and its subsequent bioaccumulation in *Gambusia* (mosquito fish). Unlike more traditional regression modeling, SEM can incorporate complex variable relationships that include both direct and indirect pathways. SEM is thus a particularly attractive statistical modeling framework for the Everglades and the results from this SEM exercise are shown to both support the unimodal Goldilocks hypothesis, and demonstrate that sulfate dynamics play a significant and important role in the bioaccumulation of methyl mercury in *Gambusia.*

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THE INFLUENCES OF SULFATE REDUCTION ON THE CHEMISTRY OF ORGANIC MATTER IN THE EVERGLADES

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Sulfate inputs to the Everglades has significant implications for the cycling of sulfur and trace metals (e.g., mercury). Organic matter, present in soils and dissolved in surface and porewaters, plays important roles in controlling the chemical speciation and geochemistry of trace metals in surface waters and is influenced by sulfate reduction. Under sulfate reducing conditions, the abiotic addition of sulfide (S^{2-}) to dissolved organic matter (DOM) is recognized as the principal mechanism responsible for the elevated concentrations and high relative abundance of thiol groups (i.e., RS^-) in DOM. Thiol functional groups in soil organic matter (SOM) and DOM are responsible for exceptionally strong binding constants between DOM and soft metals (e.g. mercury). In addition, the incorporation of sulfide into organic matter may represent an important sink for sulfur in wetland environments. However, there is little experimental information on the rates of sulfide incorporation into organic matter, the organic molecules that sulfur incorporates into, or the stability of newly-incorporated organic sulfur to oxidation. In order to better predict the effects of land and water use changes on mercury and sulfur cycling in the Everglades, an improved quantitative understanding of sulfide incorporation to organic matter is needed.

We present preliminary results from field and laboratory efforts that quantifies sulfide addition to DOM at environmentally-relevant sulfide-to-DOM concentrations ratios (0.06 mol S^{2-} (mol C)$^{-1}$). In the laboratory, kinetics experiments with Suwannee River hydrophobic acid (HPOA) (pH 7, N_2 atmosphere) showed that pseudo-equilibrium was reached for the reaction between sulfide and DOM after 30-48 hours. After 48 hours, remaining sulfide was purged off with high-purity argon and DOM was isolated by solid-phase extraction on XAD-8 resin under a N_2 atmosphere. DOM samples before and after sulfide addition were characterized for total organic sulfur content and by Fourier transform ion cyclotron resonance mass spectrometry (FTICR-MS). Detailed DOM structural information obtained by FTICR-MS analyses enabled us to identify DOM molecules in which sulfur addition occurred and classes of molecules altered by sulfur incorporation (e.g., lignin, tannin). This information informed us about the long-term fate of sulfur in DOM based on known degradation pathways of these molecules. The stability of newly-incorporated organic sulfur to oxidation by molecular oxygen was evaluated by purging solutions for 24 hours with high-purity air. Sulfur incorporation in DOM was also evaluated in the field across a sulfate gradient in Water Conservation Area 2A of the Everglades. We isolated pore water DOM from 5 reduced sediments across a sulfide gradient and quantified changes in total organic sulfur and tracked molecular-scale changes by FTICR-MS.

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EG REVITALIZATION: MANAGE THE UNAVOIDABLE OF SEA-LEVEL RISE

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I use the “Dirty D’s” to describe how the EG was progressively damned. Ditching drained wetlands and damming by dikes and roads interrupted flow and dissected habitats. Art Marshall lamented that “Its head, heart, and body have been sliced, diced, and bled dry; no wonder its feet have stopped dancing.” Fred Sklar’s animated 2010 power-point emphasized the importance of flow with his title “Why is the Decompartmentalization Project the Heart of CERP?”

The interruption of flow, coupled with nutrient eutrophication, may have made it impossible for the southern EG to recover. Hagerthey et al. (2008) suggest that the landscape regime shift from slough to cattail and sawgrass to cattail may have passed a tipping point. Sklar (2010) uses a health crisis analogy of not enough exercise (flow) to explain the progressive loss of macro-topography (quasi linearity of ridges, sloughs, and tree islands) and micro-topography (bottom of soughs to top of ridges).

With sea-level rise I suggest that we bite the bullet of trying to restore both quantity and quality of water flowing south. The combination of partial Kissimmee restoration, inadequate BMPs, beginnings of dispersed storage, and increased number and efficiency of STAs has not avoided the unmanageable of excess P and N. But we can manage the unavoidable of sea-level rise by finally finishing those CERP projects that increase flow to the southern EG and Florida Bay. I hypothesize that this will give time for plant communities, especially sea-grasses and mangroves, to move north and will restore the high productivity at the freshwater seawater interface that may have explained the historic super-colonies of white ibis and other wading birds. So the present southern EG could become the world’s largest and most productive estuary with fisheries and sports fishing like historic Florida Bay.

We should certainly decrease nutrient input in all parts of the greater EG but not at the expense of inadequate flow south. For Lake Okeechobee and the east and west estuaries to avoid periodic collapse of ecosystems all individuals, municipalities, farmers, ranchers, and government entities must use all possible BMPs including state-of-the art septic systems and wastewater treatment. LaPointe (2012) shows that N and P pollution in the St Lucie watershed accounts for 60 to 80 percent of nutrient and bacterial pathogen pollution. Certainly excess freshwater releases from Lake Okeechobee contribute to the death of sea-grasses and oysters.

It is critical to augment flow south even if we cannot reduce P to 10 ppB. The means include plan 6 in the EAA, increasing canal capacity, reducing nutrient input using all BMPs and improved STAs, and especially decompartmentalization. We should again and finally reject ASRs as a way to augment flow during droughts. John Marshall (2007) presented to the SFWMD Board a full life cycle cost analysis that showed that replacing the then planned ASRS with sheet flow would save $6 B. And there still have not been tests to show that a freshwater lens can be recovered after more than a year of injection; the geology would seem to preclude it.

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PHOSPHORUS RELEASE FROM THE BISCAYNE AQUIFER WITH SEA LEVEL RISE

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Dissolution of calcium carbonate minerals (e.g. calcite, aragonite) has been shown to occur in limestone aquifers affected by seawater intrusion. Any phosphorus associated with the carbonate minerals, either adsorbed onto the mineral surface or absorbed within the crystal structure, would be expected to be released into the seawater intrusion zone upon mineral dissolution. The additional phosphorus in the groundwater can be available to plants (e.g. mangroves) utilizing groundwater from the seawater intrusion zone, or be transported to surface water with coastal groundwater discharge. The objective of this research was to quantify the amount of loosely adsorbed and total phosphate (P) in limestone from the Biscayne Aquifer. Phosphorus is an important and limiting nutrient in the Everglades ecosystem, and determining all of its sources is imperative. The results of this investigation indicate how much phosphate can be released from the Biscayne Aquifer as seawater intrusion increases with sea level rise.

Rock core collected from 7 core holes drilled from 20 to 44 m deep into the Biscayne Aquifer by the USGS was used in this investigation. Two cores were located in the fresh water portion of the Biscayne Aquifer, while the other 5 were located in brackish to saline groundwater. Sub-samples were collected from each of the rock cores at approximately 5 ft (1.46 m) intervals from the surface. Six replicates, weighing approximately 0.5 g each, of the sub-samples were processed and analyzed. The amounts of loosely adsorbed and total P were determined using the Ruttenberg sequential extraction procedure. Solutions of MgCl and HCl were used to extract the loosely adsorbed and total fractions of P, respectively. The concentration of P in each of the extracts was determined on a spectrophotometer. Geologic description of the core was made from visual inspection and from thin sections.

The average amount of loosely adsorbed P in the samples was about 2 µg of P/g of rock. Total P increased with depth in the core samples. In most cores, total P from the ground surface to 6 m depth was less than 50 µg of P/g of rock. At greater depths, the total P increased up to 2500 µg of P/g of rock. In general, shallow cores from the brackish groundwater zone had lower concentrations of total P compared to the cores from the freshwater portion of the aquifer. Higher total P was found to occur in core samples characterized as sandy limestone. Inspection of those samples under thin section identified sand size grains of detrital apatite averaging between 1 and 10% of the thin section. The apatite grains were rounded and most likely from the nearby Hawthorn formation sediments that occur below the Biscayne Aquifer, but also outcrop at the land surface just to the northwest of the Biscayne Aquifer. The apatite grains were either resuspended from the underlying Hawthorn formation sediments or transported to south Florida and then deposited with the Biscayne Aquifer limestone during its formation. The results of this research indicate there is significant amounts of P in the form of detrital apatite in the Biscayne Aquifer located between 10 and 44 m depth. The P may be released from the Biscayne Aquifer into the groundwater by dissolution within the seawater intrusion zone. As sea level continues to rise, seawater would be expected to intrude farther inland, particularly along the bottom of the Biscayne Aquifer, continually dissolving the aquifer matrix and releasing P into the intruding groundwater. That P may then be utilized by the Everglades ecosystem when transported with the groundwater flow towards the ground surface.

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MODELING METHANE EBULLITION FROM PEAT SOILS OF THE FLORIDA EVERGLADES

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Methane (CH_4) is a greenhouse gas with a global warming potential much greater than carbon dioxide, and one of the major sources of naturally occurring CH_4 are peatlands. Large amounts of CH_4 can be transported from peat to the atmosphere through bubbles (ebullition). Although wetland distribution is roughly bimodal with approximately 50% located in boreal and arctic regions and about 35% located in tropical/subtropical regions, most studies investigating ebullition from peat soils are based on boreal peatlands while low-latitude systems have traditionally been less studied. Nevertheless sources of CH_4 from tropical/subtropical peats may have an important role in mediating the Earth's climate and predicting present and future bubble emissions from these peat soils is necessary. Numerical modeling offers the possibility to quantitatively investigate ebullition, and much progress has been made in predicting bubble dynamics using modeling approaches with various levels of physical rigour, process complexity, and spatial scales. Here in this study we present a model that is able to re-produce the process of CH_4 bubble loss from peat. The model includes a spatially-explicit representation of the peat pore structure and replicates bubble accumulation, storage, and release within peat. Furthermore, the spatial heterogeneity of peat pore sizes at various depths is represented in the model to replicate variable amounts of gas storage at depth and bubble movement through peats. By including this level of detail in the model, different rates of ebullition from peats with different pore structures can be investigated. In this study the computer model of ebullition was setup to replicate CH_4 ebullition from Loxahatchee and Everglades peats and tested against observed ebullition collected from the Florida Everglades over a period of two years using hydrogeophysical methods. The results generated with the model demonstrate how peat structure and subsequent gas storage controls ebullition.

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BIOLOGICAL CONTROL OF *MELALEUCA QUINQUENERVIA* IN SOUTHERN FLORIDA

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Melaleuca quinquenervia (melaleuca) is an invasive tree species of Australian origin. Since its introduction to Florida over a century ago, it has colonized various ecologically sensitive habitats including the Florida Everglades, displaced native vegetation and created monotypic melaleuca tree stands. Biological, chemical, mechanical, cultural, and legislative approaches have been deployed to manage this invasive tree since mid 1990s. These management approaches have resulted in dramatic decline of melaleuca infestations and facilitated the return of non-melaleuca plants to the sites previously completely dominated this exotic tree. Under the biological control approach, a suite of four herbivorous insects: Oxyops vitiosa (weevil), Boreioglycaspis melaleucae (psyllid) and Lophodiplosis trifida (stem-galling cecid), Fergusonina turneri (gall-fly) have been imported from Australia and released in Florida. About 3.5 million of these herbivorous insects agents have been released in and around the Florida Everglades alone and numerous additional releases have been made to other parts of Florida as well. The first three species of the biological control insects and an adventive rust fungus Puccinia psidii (myrtle rust) of South American origin have established in most melaleuca infested areas of southern Florida. Currently, various levels of biological control impact can be seen throughout melaleuca infested landscapes of Florida.

In an effort to quantify biological control impact on melaleuca and native vegetation, three insect and three control plots measuring 25-100 m^2 each were established (during 1996-97) in four sites representing permanently flooded, seasonally flooded, and occasionally flooded melaleuca infestations in Florida. Weevils and psyllids were released into the insect plots and the sites were monitored for densities of the insects, melaleuca, and non-melaleuca plants. By 2004, three of the four original sites were lost to wild-fires and herbicide applications, leaving only the occasionally flooded site in Broward county where the study continued for 17 years before concluding in 2014.
During the study period, densities of biological control agents fluctuated from year to year while the plant community changed from a melaleuca monotypic stand to a more diverse plant community with 85% fewer melaleuca trees. Species richness increased from 10 plant species representing 9 families in 1997 to over 50 plant species representing 38 families in 2011. The majority of plant species that established in melaleuca tree gaps were comprised of native plants. The decline of existing mature melaleuca trees as well as seedling recruitment and establishment continues due to sustained attack by the biological control agents. These research findings have documented the steady negative impact of biological control on melaleuca's invasive attributes, leading to the gradual recovery and rehabilitation of melaleuca degraded plant communities.

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THE NATURAL RESOURCE CONDITION ASSESSMENTS OF EVERGLADES NATIONAL PARK AND BIG CYPRESS NATIONAL PRESERVE

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Natural Resource Condition Assessments (NRCAs) are being prepared for a large number of the over 280 National Park units with significant natural resources by 2016, in preparation for the centennial celebration of the National Park Service. NRCAs are focused on developing a comprehensive assessment of the status and trends of important natural resources that are found in each NPS unit, and are shaped by the legal framework, foundational intention, and management history of each unique property. The NRCAs for Big Cypress National Preserve and Everglades National Park are nearly complete, and these reports complement existing system-wide reporting that has been a hallmark of the Everglades restoration community.

To conduct the assessments, each park was divided into ecological zones and focal natural resources were identified. While many of the indicators overlap with Everglades restoration,
the NRCAs go beyond the water management related indicators to look more deeply at the history of fire management, the status of small mammals, distribution of invasive species, challenges with managing deer populations, and to identify fundamental threats to the biodiversity of the region. Although clean water is a top priority, so too is clean air, healthy soils, big trees, diverse habitats, and wild-caught animals that can be eaten without fear of mercury poisoning. Assessments drew on existing data, reports, and papers. New spatially explicit analyses were conducted for fire management, invasive species, and overall patterns of biological diversity. Dozens of natural resource managers and scientists contributed to writing sections of the reports. Stoplight indicators are used to communicate the status, trend, and degree of confidence associated with each natural resource category within and across ecological zones. Ecological zones are likewise evaluated based upon the status of the natural resources within them and stoplight symbols are used to communicate the areas of the parks under greatest stress. Analyzing the system in this fashion made it possible to leverage large quantities of information to identify resource management challenges and to identify gaps in the assessment.

The NRCAs provide an extensive assessment of many of these subjects and hopefully serves as a milestone in communicating the status of these resources in a way that is repeatable, scientifically sound, and easily understandable to both managers and the public.

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POST-FIRE SUCCESSION AND CARBON STORAGE IN THE NORTHERN EVERGLADES

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Fire plays a key role in the ecology of Everglades ecosystems and is a ubiquitous tool for managing the structure, function, and ecosystem services of the Greater Everglades watershed. Decades of water management, nutrient enrichment, and alteration of the natural fire regime has led to increased plant biomass fuel loads and altered vegetation composition in much of the Everglades. Since fire historically shaped the Everglades' landscape, successful restoration relies on the implementation of fire management practices. However, there is little quantitative understanding of the process of vegetation recovery post-fire or the implications for biomass and soil carbon storage during succession, particularly for sawgrass (*Cladium jamaicense*) dominated communities of the Everglades marshes. This research will provide documentation of the trajectory of plant community succession as well as carbon storage post-fire in sawgrass marshes of the northern Everglades. This study takes place in the A.R.M Loxahatchee National Wildlife Refuge. Historical fire records are being used to select sites along a chronosequence of time since the most recent prescribed fire, as well as assess the influence of relative phosphorus loading and hydrology on successional trajectories. Vegetation surveys are performed at each site to assess the pattern of plant community compositional and structural change through succession. Aboveground plant biomass and leaf area are estimated at each site non-destructively with additional destructively harvested samples for validation and to analyze total foliar C and N. Soil cores are used to quantify post-fire soil accretion as well as the organic matter, C, N, and P content of surface soils across the chronosequence. Ordination (Non-metric Multidimensional Scaling), cluster analysis, and indicator species analysis techniques will be used to evaluate patterns of community composition as well as potential environmental drivers of community change across the post-fire chronosequence. Results of this study will provide a greater understanding of the post-fire successional sequence and aboveground carbon storage by Everglades sawgrass communities as well as quantification of the effectiveness of fire management practices in the maintenance and restoration of quality habitat in the northern Everglades.

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USE OF BIOMARKERS IN EVERGLADES RESTORATION

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It is believed that historic freshwater sheetflow in the Florida Everglades was instrumental in distributing sediment to form a ridge-and-slough landscape. However, drainage of wetlands along with reduction and obstruction of flow has degraded this topography. The Decompartmentalization Physical Model is a landscape-scale test project to assess options for re-establishing sheetflow and re-engineering barriers to flow in order to restore natural freshwater delivery levels to the Everglades. To validate proof of concept that increased flow will restore ridge-slough microtopography, biomarker proxies were established for ridge and slough organic matter sources and monitored in flocculent particulate organic matter (floc) before, during and after high-flow conditions along a path of increased sheetflow. In addition, sediment traps were collected from partial and complete canal backfill sites. Four molecular organic biomarkers were evaluated: the aquatic proxy (P_{aq}), C_{20} highly-branched isoprenoids (C_{20} HBI), kaurenes and botyrococcenes. These biomarkers were able to successfully differentiate ridge and slough organic matter sources with Paq being most effective. Our preliminary data indicates that under increased flow conditions, flocculent matter from sloughs is preferentially mobilized. This suggests that increasing sheetflow velocity in degraded ridge and slough landscapes may be a viable restoration tool. While results from 2013-2014 sediment traps are inconclusive regarding effectiveness of canal backfilling, additional data will be collected during 2015-2016 including two periods of increased flow to enhance this dataset.

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FISH DYNAMICS AT THE EVERGLADES MARSH-MANGROVE ECOTONE: DRYDOWNS, SUBSIDIES, COLDSNAPS & THE LINK TO RECREATIONAL FISHERIES

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In the southwestern Everglades, mangrove-lined creeks link freshwater marshes draining Shark Slough to estuarine habitats downstream. Historically, this region was an important wading bird foraging and nesting habitat. Today, the region provides a number of important ecosystem services, including economically-valuable recreational fisheries. As elsewhere in the system, the ecotone has been impacted by reduced freshwater inflows that result in lower water levels and a higher frequency of marsh drying upstream, and a contraction of the oligohaline zone and higher salinities downstream.

The key objective of this research is to understand how hydroclimatic variation affects fresh and estuarine fish communities inhabiting the ecotone. Sampling involves boat electrofishing conducted along oligohaline to mesohaline reaches of the Shark River since 2004. We track responses to spatiotemporal variation in hydrology and climate across scales of interest, ranging from effects on individual fish (diets and movements), fish community patterns (fish abundance, composition and distribution), and ecosystem services (recreational anglers catches).

Results indicate that ecotonal creeks serve as important dry-down refuges for freshwater taxa, and that pulses of freshwater prey into ecotonal creeks trophically link estuarine and marsh ecosystems. Marsh prey production is displaced to the upper estuary during the dry season, and is readily consumed by mesoconsumers (and important fisheries) such as largemouth bass and common snook in creeks. Fish dynamics in the ecotone are closely tied to the timing and intensity of seasonal drying. The strength of this linkage is also affected by extreme climate events such as severe cold snaps and droughts.

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NETWORK MODULARITY REVEALS CRITICAL SCALES FOR CONNECTIVITY CONSERVATION

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Understanding responses of wildlife populations to restoration efforts requires knowledge of the spatial scales that are relevant for movement and demography. Recent developments in network analysis provide the ability to reliably and objectively identify these scales. Network modularity represents an otherwise ignored meso-scale at which individuals interact with each other and their environment. Estimating modularity in landscape or population networks can help assess spatial population structure by identifying aggregations of resource patches (e.g. wetlands) that are highly connected to each other through the movement of individuals yet only weakly linked to the remaining patches in the landscape. The spatial scales of these aggregations identified via network modularity can then be incorporated directly into demographic models to help guide restoration and planning efforts.

Using four species that vary widely in dispersal ability and include both mark-recapture and population genetic data, we provide examples in which we estimate modularity on networks to identify critical scales for both movement and gene flow in animals. We identify significant modularity in three of the species including the endangered Everglades Snail Kite. Through these examples, we provide evidence that this emergent structure can arise from both distance and behavioral-related limitations in movement (e.g. natal philopatry). Importantly, the inclusion of modularity in connectivity and population viability assessments alters conclusions regarding patch importance to connectivity and suggests higher metapopulation viability than when ignoring this hidden spatial scale. We argue that network modularity reveals critical meso-scales that are probably common in populations, providing a powerful means of identifying fundamental scales for biology and for conservation strategies aimed at recovering imperiled species.

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ASSESSMENT OF THE ECOLOGICAL STATUS AND TRENDS OF NORTHEASTERN SHARK RIVER SLOUGH

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Northeastern Shark River Slough (NESRS) is thought to have been a major flow way in the historical Everglades. Construction of the Tamiami Trail (TT) in the 1920s altered sheet flow to the area by reducing overall flow and channelizing the remaining through culverts. In the 1989 Everglades National Park Protection and Expansion Act, NESRS was acquired by Everglades National Park (ENP) in order to help restore hydrologic conditions in ENP. Thus, NESRS is integral to current restoration planning and is the subject of multiple restoration modifications, including the TT bridge (completed in spring 2013) and a seepage barrier extending south of TT along the eastern boundary of ENP, as well as planned modifications associated with the Central Everglades Planning Project and Modified Water Deliveries Control Plan. Ecological studies in this area are thus necessary to provide baseline information on ecological status and to monitor the effects of restoration.

In the initial year of planned monitoring in NESRS, 30 census and 10 intensive “bridge” sites were sampled during the dry (April) and wet (September) seasons of 2012, prior to completion of the TT bridge. Census sites were selected from a prior 2006-08 survey throughout the NESRS region, while intensive sites were located along three 4 km transects downstream of the TT bridge. We examined water and soil quality and depth, periphyton abundance and distribution, aquatic consumer composition and abundance, and vegetation community structure at several scales; here we describe soil, water and periphyton characteristics.

The sampled sites in NESRS are representative of short-hydroperiod marl prairie. Water depth during the wet season averaged 27 cm at the census sites, while intensive sites were deeper (52 cm). These differences reflect a general trend of deeper water in the remnant Shark Slough flow-path from northeast to southwest. Hydroperiod was calculated using the Everglades Depth Estimation Network adjusted by measured water depths. Hydroperiods ranged from 128-256 days (excluding five sites with 0 or 365 days) and generally were lowest on the northern and eastern edges of the region. Water total phosphorus (TP) concentrations during the wet season were near or below 10 µg L^{-1}. Soil TP concentrations ranged from 100-300 µg L^{-1}, and organic content ranged from 20-40%, typical of marl soils. Periphyton was abundant and widely distributed throughout the NESRS region. Variability in periphyton characteristics was primarily explained by proximity to the TT. While periphyton at sites near the boundary appeared enriched in TP relative to the central marl prairie, values were low relative to locations downstream of canal or culvert influences along the TT. This baseline data indicate that the NESRS is functioning as a short-hydroperiod marl prairie with little evidence of nutrient enrichment, except near the northern culverts and along the eastern boundary. Future monitoring will show whether restoration produces change toward a ridge and slough landscape.

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INITIAL MONITORING RESULTS OF ECOSYSTEM RESPONSE TO THE C-111 SPREADER CANAL WESTERN PHASE IN NORTHEASTERN FLORIDA BAY

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The implications of the C-111Spreader Canal Western Phase (C-111SCWP) project on Everglades and Florida Bay restoration efforts are not fully understood. Salinity and water levels are the most influencing variables to the ecosystem. Desirable conditions to promote a healthy ecosystem with productive submerged aquatic vegetation (SAV) and prey base fish populations have been identified as having low salinity levels and high water levels during the wet season, and low salinities and low water levels during the dry season. These conditions have been found to be advantageous for SAV growth and prey fish reproduction. The two main sources of freshwater flow into Florida Bay are sheetflow from Taylor Slough and discharge through the C-111 canal. The goal of the C-111SCWP project is to redirect freshwater flow into Taylor Slough by preventing seepage into the C-111 canal by creating a hydrologic ridge on the eastern boundary of Everglades National Park, providing the needed freshwater to prevent high salinity levels. Audubon Florida has been monitoring hydrologic conditions and prey base fishes in the coastal mangrove zone of northeastern Florida Bay since 1990. Currently, 9 independent research sites are being monitored for hydrology, SAV and prey base fish to document the effects of the C-111SCWP project. A year with a similar rainfall pattern prior to the C-111SCWP project was selected for comparison to each subject year following the initiation of the new water management practices. On-site hydrologic data were collected along with bimonthly SAV surveys which were conducted using a point intercept coverage method utilizing a 0.25m2 quadrat at several fixed locations. Prey base fish samples were collected using a 9m2 drop trap during June, September and monthly from November to April. Initial monitoring results indicate that flows through the C-111 canal are being minimized while flows through Taylor Slough are increasing. Results of comparison to subject years indicate higher water levels and lower salinities at our monitoring sites post C-111SCWP operation. Longer hydroperiods and reduced salinity corresponded with increased abundance of SAV. Although fish were expected to increase with longer hydroperiods and lower salinity, it was projected that these increases would have a longer response time, potentially up to 3 years. Although no increases in fish abundance were observed, results did show an increase in the percentage of freshwater species. The initial results of the C-111SCWP project seem very promising but some hesitation is advised as it is still early to make concrete conclusions. We expect that as climate change becomes more severe and sea level rise increases, the amount of fresh water flow will also need to increase to maintain lower salinity levels and a healthy ecosystem.

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EVERGLADES INVASIVE REPTILE AND AMPHIBIAN MONITORING PROGRAM (EIRAMP)

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The Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) responds to needs for research to develop effective control methods for exotic aquatic vertebrates, to determine impacts of exotic species on conservation lands, and to monitoring populations of invasive species. Florida is particularly prone to invasion by nonnative species and currently hosts more established alien reptiles than any other state or nation. Over 160 nonnative species of reptiles and amphibians are introduced to Florida and at least 56 are established.

We sampled amphibians, reptiles, and mammals using road cruising, visual encounter surveys, and anuran vocalization surveys along standardized routes across southern Florida to identify native and non-native species and update their distribution. Our primary method of detection was road cruising surveys. Most surveys began within 30 minutes of sunset but some routes were surveyed by day. Headlights from vehicles were used to detect reptiles, amphibians, and mammals. Surveys were conducted by a two or three person crew on roads or levees. Observations for amphibians, reptiles, and mammals on driving surveys were recorded to species, if possible, along with time, cloud cover percentage, location by global positioning system (GPS) in world geographic system (WGS) 1984 datum, habitat, adjacent habitat, and call/count index. Nonnative species were removed when possible.

At point locations we sampled via a standard visual encounter survey (VES) conducted for five minutes at all start, end, and check points. Each VES was conducted by at least one experienced observer using headlamps. Our VES samples were within a 20 m radius of the point (1256 m^2). We thoroughly searched each circular plot to find as many target species as possible. All animals were identified to species and we recorded time, cloud cover percentage, location, habitat, adjacent habitat, and count.

At each sampling point location where a VES was conducted we noted all species of vocalizing frogs and toads. Vocalization surveys spanned a five minute period in conjunction with the VES survey. Anurans heard were included regardless of position relative to the 20 m radius plot. Including all anurans heard eliminated the need to locate vocalizing individuals. The abundance of vocalizing anurans was estimated as one of three categories; individuals, group, and chorus.

Early detection and rapid response are critical to successful containment and eradication of nonnative species. Our data inform managers when new nonnative species are detected in southern Florida and when previously established nonnative species expand their range via dispersal or new introductions, providing the most effective strategy for extirpation or containment.

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BIOLOGICAL CONTROL OF AIR POTATO, *DIOSCOREA BULBIFERA*, IN FLORIDA

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Air potato is an invasive, high climbing vine capable of out-competing native vegetation and displacing other organisms. It forms dense blankets which smother native trees and understory plant species. The vines primary means of spread is through the production of aerial bulbils, known as “air potatoes”. Florida establishment was noted in 1905 once vines began forming thick coverings. Since then, it has spread throughout Florida as well as Hawaii, and other southern states. Previous air potato management methods have proven temporary and ineffective. Chemical control is costly and requires repeated basal and foliar sprays over several years. Damage or death to non target plants often occurs during these treatments. Additionally, new vines may continue to sprout from underground tubers when herbicide treatments cease. Mechanical control of air potato is labor intensive and time consuming. Temporary removal is possible when vines and bulbils are hand collected and destroyed. Eradication however, requires the removal of underground tubers which can be difficult to access and completely remove.

A biological control program against air potato was initiated by the USDA-ARS-Invasive Plant Research Laboratory in Ft. Lauderdale following the 2002 discovery of a beetle, *Lilioceris cheni* (Coleoptera: Chrysomelidae), in Nepal and later in China. Beetles where imported into quarantine where they were extensively studied and proved host specific to *Disocorea bulbifera*. Permission for release was granted from USDA Animal and Plant Health Inspection Services.

The air potato biological control program is a collaborative multi agency project between FDACS DPI, USDA ARS IPRL, and UF IRREC. The program involves beetle and plant research and mass rearing and release of the beetles throughout Florida. Several hundred thousand adult beetles and larvae have been released in over 40 counties to date and results have been promising. Reduced vine height, spread, and bulbil production has been observed at numerous sites.

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CYANOBACTERIAL MEDIATED MINERALIZATION OF A RARE FORM OF CALCIUM CARBONATE IN THE EVERGLADES: VATERITE

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Calcium carbonate mineralization is a well-known process of ecological and geological importance that can be mediated by cyanobacteria in freshwater and marine habitats. The milieu outside the cyanobacteria cell wall, commonly called mucilage and consisting mainly of extracellular polymeric substances, is the site of nucleation for mineralization. Cyanobacterial mediated mineralization of calcium carbonate occurs in settings with proper environmental conditions of high alkalinities, pH, bicarbonate ion concentrations, and dissolved calcium. In the oligotrophic regions of the Everglades, such as the marl prairies, sediments characteristically have abundant amounts of calcium carbonate that likely originate from cyanobacteria-dominated benthic microbial communities. Several species of cyanobacteria thrive in these habitats; however, only a few of these species are directly involved in calcium carbonate mineralization.

Cyanobacteria from the central part of the Everglades were examined using compound light and epifluorescent microscopy to identify species that mediate calcium carbonate mineralization. Cyanobacteria genera such as *Johannesbaptista pellucida,* previously reported to not mediate the mineralization of calcium carbonate were identified with calcitic encrustations. As previously described, the two cyanobacterial species responsible for the majority of the biologically mediated calcium carbonate mineralization in the Everglades are *Scytonema hofmannii* and *Schizothrix calcicola*. Microscopic examination of these filaments indicated that these two species formed distinct types of calcium carbonate. *Scytonema* filaments were up to 20 µm in diameter, and calcium carbonate was deposited outside the sheath as orthorhombic blocks. The active sites of filament growth lacked crystals; older portions of the filament generally were surrounded completely by calcium carbonate crystals. *Schizothrix* filaments ranged up to 2 µm in diameter and the crystals appeared needle-like.

To determine the elemental composition of these two distinct forms of calcium carbonate, energy-dispersive X-ray spectroscopy was performed on the crystals associated with the two dominant species of cyanobacteria. The *Scytonema*-associated crystals had a $CaCO_3$ composition consistent with aragonite. In contrast, the crystals of *Schizothrix* were found to be Ca_2CO_2, consistent with vaterite, a rare form of calcium carbonate from biological systems. No evidence of phosphorus was found in either type of crystal. Both cyanobacteria species are important to calcium carbonate mineralization in the Everglades, but the mineralization of vaterite by *Schizothrix* reveals unreported complexity of calcitic soils that may lead to a better understanding of carbon storage in the Everglades.

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METACOMMUNITY STRUCTURE OF HARDWOOD HAMMOCKS OF THE EVERGLADES AND FLORIDA KEYS

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Dry tropical forests in the continental United States reach their best development in South Florida, in locations where flooding and freezing temperatures are rare. These include the Florida Keys and the southeastern mainland coast, as well as climatically-buffered "tree islands" in the interior Everglades, surrounded by an extensive marsh or pine forest matrix. In this study, we examined spatial variation in tree composition within this network of forest fragments, with an eye toward how the poleward movement of tree species along the Florida peninsula in response to climatic warming may be affected by metacommunity processes. We analyzed metacommunity structure among 145 south Florida forests, tested for associations with selected climatic and topologic variables, and characterized parallel community-aggregated functional traits. Forest patch size was the strongest single correlate with composition and species richness, but mean January temperature and a neighborhood index denoting degree of isolation from other patches contributed significantly to regression models. The species data exhibited strong spatial autocorrelation structure, suggestive of loosely integrated sub-regional assemblages. Notably, the species-by-site matrix was highly nested, with tree species common to small upland fragments in the interior of the Everglades representing a distinct subset of the richer assemblages found in sites closer to the coast. Interior forests were smaller, more isolated, and subject to colder minimum temperatures than more coastal forests, and were comprised primarily of early-successional, animal dispersed species. While warming winter temperatures may relax some constraints on the northward migration of tropical species through the region, their movement will likely continue to be limited by the size and distribution of appropriate mesic habitat.

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AN OVERVIEW OF C-111 SPREADER CANAL WESTERN PROJECT IMPLEMENTATION AND RESTORATION PROGRESS

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The C-111 Spreader Canal Western Project (C-111SCW) is the first project of the Comprehensive Everglades Restoration Plan (CERP) that directly targets Florida Bay's restoration. While Congressional authorization was not received until June 2014, the South Florida Water Management District expedited construction of the project's features and began project operation in June 2012. These features and operations are designed to build a hydrologic ridge between Taylor Slough and the C-111 Canal as a means to minimize eastward seepage from the Slough, sustaining more natural hydropatterns in the slough with more natural patterns of water delivery to Florida Bay. This is expected to improve habitat and food webs in southeastern Everglades National Park's (ENP) wetland and estuarine ecosystems.

The C-111SCW project's hydrologic ridge is an extension of the managed hydrologic ridge that is now maintained along most of ENP's eastern boundary via operation of the C-111 South-Dade Project's water detention areas. Prior to C-111SCW operation, hydrologic monitoring and analysis demonstrated the efficacy of this approach to minimize seepage from ENP wetlands north of the ENP road. However in the absence of such a ridge south of the ENP road, inputs to Taylor Slough's headwaters still seeped toward the C-111 Canal. Preliminary analysis of hydrologic conditions following C-111SCW operation indicates that the C-111 SCWP features are working as designed, with the likelihood of improved stages and flows in Taylor Slough and resultant downstream salinity patterns in Florida Bay. However, with a relatively short period of operations plus climatic variability, it is premature to claim success regarding hydrologic improvements. Similarly, ecological indicators of project effects are initially promising, but strong inferences have yet to be derived from analyses.

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TROPHIC TRANSFER OF MERCURY ALONG SALINITY GRADIENTS IN SHARK RIVER AND CALOOSAHATCHEE RIVER ESTUARIES

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Mercury (Hg) levels have declined in biota in areas of the Everglades over the past 20 years; however, average levels remain a concern and Hg "hotspots" persist. One hotspot is the Shark River in Everglades National Park (ENP). Previous monitoring at North Prong Creek indicates Hg levels that exceed most other areas of Florida, with annual mean Hg levels ranging as high as 2.37 µg/g for largemouth bass (LMB; *Micropterus salmoides*), 1.73 µg/g for common snook (*Centropomus undecimalis*) and, 0.55 µg/g for grey snapper (*Lutjanus griseus*). Hg levels in bass at this site have shown no significant temporal trends (seasonal Kendall analyses; r = -0.018; P = 0.916) since monitoring began in 1994.

To better understand why Shark River remains a Hg "hotspot" and the processes influencing the landscape-scale Hg problem across South Florida, we initiated a study in 2010 in Shark River and Caloosahatchee estuaries, each with very different watershed characteristics and land use. Many factors influence Hg biomagnification including the natural variation in trophic structure among communities, degree of openness, and productivity as well and Hg loading and biogeochemistry. It is therefore essential that we use techniques that can isolate these factors. Accordingly, this study coupled Hg analyses of sediments, seston, and biota with stable isotope analysis (SIA) to examine trophic magnification factors (TMF) integrated across food webs at the headwater, mid-estuary and mouth of these two systems. The slope of the regression of tissue-Hg concentration (log-transformed) on $\delta^{15}N$ provides a metric for the trophic transfer efficiency. Equally important, $\delta^{15}N$ can be translated into trophic level (TL) after normalizing to the ^{15}N in a local primary consumer. The ultimate goal of this project is to generate the data needed to parameterize food web models that would allow use to make predictions about the efficacy of various corrective actions.

To date, we have collected 1,279 samples of biota representing 86 species of inverts and fishes along with sediments and seston; sampling will continue into the first quarter of 2015. Preliminary analysis of the data revealed TMF slopes, based on Total-Hg, ranged from 0.152 to 0.235 at 5 of the sites (r^2 as high as 0.62), which is within the range of TMFs reported for other ecosystems. Conversely, the site just downstream of S-79 in the Caloosahatchee had a negative slope (-0.025) with a very poor r^2 (0.01). We hope to improve the relationships by determining percent of Total-Hg as methylmercury (MeHg) in sediments, seston and inverts.

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THE BOTANY OF SHELL MOUNDS IN SOUTHWESTERN EVERGLADES NATIONAL PARK, FLORIDA

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Everglades National Park is a 1.5 million acre subtropical wetland located at the southern end of the Florida peninsula. Small isolated upland plant communities are found throughout these wetlands, many of which have been occupied and modified by humans over long periods of time. Extraordinary examples of the human influence on the landscape can be found in a series of massive shell mounds constructed by Calusa Indians beginning about 3000 years ago. Following the decline of the Calusa, these mounds were then briefly used by Seminole Indians and finally European settlers. The purpose of this paper is to present results of floristic inventories of 9 shell mounds in southern Everglades National Park. Emphasis will be given to the contribution of the flora of these human landscapes to the plant diversity in Everglades National Park. Potential links of the current flora to past occupational history will also be described.

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HYDROLOGIC DRIVEN SHORT-TERM VEGETATION SUCCESSIONAL DYNAMICS IN SHARK RIVER SLOUGH, EVERGLADES NATIONAL PARK, FLORIDA

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Plant communities arranged along a gradient are the results of ecological processes associated with underlying physico-chemical drivers that vary on both spatial and temporal scales. Temporal changes in those drivers, whether due to natural processes, anthropogenic disturbances or both, often result in a shift in community composition along the gradient, and through feedbacks between community and ecosystem processes, also determine the trajectories of community succession. In the Everglades, where plant communities are primarily arranged along a hydrologic gradient, with temporal change in hydrologic regime, a change in species composition may cause a shift in boundaries between self-organized entities present in the marl prairie and in ridge, slough and tree island landscapes. However, the direction and magnitude of such a change are determined by the extent of hydrologic alterations, with prolonged and extreme wet events even resulting in loss of upland woody vegetation. While persistent drying conditions set an opposite trend toward an expansion of sawgrass, and to the dominance of trees over herbaceous plants.

We examined the interaction between hydrology and vegetation over a 13-year period, between 1999/2000 and 2013 within the ridge-slough portion of marl prairie-slough gradient and seasonally flooded portions of tree islands in Shark River Slough, Everglades National Park. In the ridge-slough marsh, vegetation was sampled 4 times during that period, while vegetation along tree island transects and in permanent plots was sampled twice, once in the beginning and then in 2011 or 2012. Using a suite of multivariate techniques, including trajectory analysis, we examined the direction of vegetation change over time by quantifying the displacement of sites in relation to the hydrologic gradient in ordination space.

In Shark River Slough, drier conditions of the last decade or so have caused an apparent increase in spikerush and sawgrass cover at the expense of open water sloughs in the ridge-slough portion of marl-prairie-slough gradient. Moreover, within the complex tree island landforms, we have noted an expansion of woody plants across the full suite of communities, i.e., within Bayhead Forest, Bayhead Swamp, and Sawgrass Tail. In prolonged dry conditions, it is the progression towards sawgrass, and ultimately the establishment and growth of trees in the peat environment that drives successional processes towards the expansion of tree islands in the ridge and slough landscape. This study has implications for how the ridge and slough landscapes are managed in the Everglades.

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RESTORING SHEETFLOW IN A RIDGE-SLOUGH-CANAL-AND-LEVEE LANDSCAPE - A SYNTHESIS OF TRACERS, TRAPS AND TRANSPORT

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The Decomp Physical Model (DPM) is a landscape-scale experiment (~15-km^2) quantifying benefits of sheetflow and canal-backfilling on Everglades ridge-and-slough wetlands. Previous modeling and small-scale empirical studies suggest that predrainage water velocities were high enough (>2-3 cm s^{-1}) to entrain and redistribute sediments from sloughs to ridges. This process built the characteristic ridge and slough topography and patterning. Canals pose the potential to inhibit sediment redistribution and introduce high-nutrient sediment to downstream wetlands. To evaluate sheetflow and backfill hypotheses, the DPM uses 10 gated culverts on the L 67A levee to provide sheetflow into the "pocket" between the L-67A and L-67C levees. Other features include three 1,000-foot canal backfill treatments and 3,000-feet of removal of the L-67C levee. The DPM uses a "before-after-control-impact" (BACI) design, consisting of field monitoring under no flow (baseline) and high flow (impact) conditions. To date, two high flow events have occurred in Fall 2013 and 2014. An additional spatial design was implemented to quantify existing gradients in sediment characteristics and the overall spatial footprint of sheetflow generated by the culverts. Sediment movement was quantified using horizontal and vertical traps for transport and accumulation (respectively), and a paramagnetic, dual-use synthetic tracer (DST) was used to estimate directionality, velocity and preferential settling of sediment. Traditional water grab and velocity-based sediment budgets are presented earlier in this session.

In the 2013 flow event, horizontal traps indicated sediment transport in the impacted slough increased 20-fold under high flow, while the control slough changed little. Ridge transport increased subtly. DST moved at velocities ranging from 0.4 to 0.6 cm s^{-1}, lower than water velocities measured under high flow (2-5 cm s^{-1}). Sediment traps deployed across the study site showed that increased transport was limited to within ~500-m of the culverts. Partially and completely backfilled canal treatments exhibited a shift to more mineral-dominated sediments (reflecting fill material) in canal vertical traps and in horizontal traps in downstream marshes. Under high flow, the open canal treatment exhibited the greatest vertical accumulation and downstream transport of sediments. Additional years are needed to provide statistical power to confirm the repeatability of these initial results. Based on these findings, more active management approaches may help maximize the effectiveness of culverts and levee gaps in achieving sheetflow and sediment redistribution over a larger area, and in the intended direction.

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DECADAL VARIATION IN EVERGLADES PEAT SOIL AT THE LANDSCAPE SCALE: RESULTS OF R-EMAP 1995-2014

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Soil is a defining characteristic of a wetland ecosystem, and soil preservation is an important aspect of ecosystem protection. The perpetuation of Everglades peat and marl soils is dependent upon water depth, the duration of surface water inundation, and resulting wetland vegetative communities.

The Everglades Regional Monitoring and Assessment Program (R-EMAP) is a probability-based, multi-media survey that began documenting conditions throughout the public Everglades Protection Area in 1995. The Program sampled soil characteristics at 415 locations throughout the freshwater Everglades during 1995-1996, 226 locations in 1999, 229 locations in 2005, 51 locations in 2013 and 119 locations in 2014. Soil thickness, volume, bulk density, and percent organic matter are presented for the Everglades, and are related to water regime and plant communities. Soil thickness data are presented for 1946, 1995-1996, 2005 and 2013-2014. Preliminary analysis of 2013-2014 data do not indicate continuing subsidence of soil in the Everglades since 2005.

Mean soil thickness for 2014 was 3.1 feet (0.9 meters) at 119 sample stations, and ranged from 0 feet to over 12 feet (3.7 m). Water depths ranged from dry to 3.8 feet (1.2 m), and the average soil bulk density was 0.17 g cm^{-3}. The project previously reported that between 1946 and 1996 the shortened hydroperiod portion of WCA3 north of I-75 lost 39% to 65% of its soil. This area was reported to have 3 to 5 feet (0.9 - 1.5 m) of peat in 1946. In 1995-96, 2005 and 2014 we found only 1 to 3 feet (0.3 – 0.9 m) of soil, with less than 1 foot in some areas. Since the 1940s the Everglades Protection Area has lost from 11% to 28% of its soil (5.4 to 17 x 10^8 m^3). Among areas that were peat soil in 1946, northern WCA3 now has the lowest organic matter content, the highest bulk density, and the greatest soil loss. All are suggestive of formerly deeper peat soils being subjected to drier conditions due to water management changes. Surface water inundation has decreased, soils have subsided, and the remaining surface soil has become less organic.

If Everglades restoration efforts are to succeed, soil subsidence must be halted and water management must be improved to maintain marsh soils so that the plant communities and wildlife habitat of the Everglades are preserved. This is the focus of longstanding efforts to rehydrate the Northeast Shark Slough portion of Everglades National Park, such as the Modified Water Deliveries Project, and future efforts to restore the habitat of the Central Everglades such as the Central Everglades Planning Project.

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THE TROJAN Y METHOD FOR CONTROLLING ESTABLISHED INVASIVE SPECIES

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Once an invasive fish species has established a reproducing population and spread over large, interconnected waterways, it is nearly impossible to control the population with traditional methods (e.g., poisons, physical removal). Furthermore, most methods of fish control are costly and can have severe negative consequences for native species and habitats, making them impractical. A new technique for controlling established species relies on augmenting wild populations with individuals that are phenotypically sex-reversed from the expected genotype (i.e., carriers of Trojan Y chromosomes). In theory, the addition of YY chromosome females into a population with an XY sex-determination system should cause a disproportionate influx of Y chromosomes into subsequent generations and bias the overall sex ratio towards males. Computer models have shown that introducing a small proportion of Trojan Y carriers into an established population can lead to extinction in the wild as females become fewer and fewer.

While the Trojan Y concept is alluring, it has yet to be tested in a live-animal model. At the Southeast Ecological Science Center (Gainesville, FL), researchers are determining the feasibility of implementing the Trojan Y strategy with two fish species: African jewelfish (*Hemichromis letourneuxi*) and the common guppy (*Poecilia reticulata*). The research is broken down into roughly three stages: First, we will determine whether it is possible to create Trojan Y females for each species. This requires development of selective breeding techniques along with identifiable genetic markers. Second, we will document traits such as life-span, fecundity, aggressiveness and willingness to breed in the Trojan Y fish and whether these differ from wild fish. Third, we will perform population-level experiments by adding Trojan Y fish to a known population (in mesocosms or small experimental ponds) and following demographics over time to compare to results from statistical models. If the Trojan Y strategy is a viable one, it would be a break-through approach to dealing with invasive species control, and future research could evaluate its use in other animal groups (e.g., snails, crayfish, amphibians, etc.).

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ENVIRONMENTAL VARIANCE AND DISPERSAL EXPLAIN BENTHIC DIATOM SPATIAL AND TEMPORAL BETA DIVERSITY IN THE FLORIDA EVERGLADES

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Microbial communities drive ecosystem function and structure, but drivers of microbial community assembly remain largely unresolved. Microbial biogeography and community diversity have been traditionally attributed to niche-based environmental forces, but dispersal-based factors may have a greater role than previously considered, especially in aquatic ecosystems with physical heterogeneity and natural and anthropogenic disturbance. The metacommunity concept of communities linked by dispersal can therefore be used to uncover both environmental and spatial factors correlated with microbial beta diversity. Since metacommunity dynamics operate on both spatial and temporal scales, adequate resolution at each level is needed to understand fully community assembly. Coastal wetlands are generally spatially structured and characterized by environmental gradients, making them useful settings for understanding the variable effects of environmental and dispersal factors on community assembly. This study investigated the spatiotemporal diversity of a benthic diatom metacommunity at opposite ends of a subsidy-stress gradient in the Florida Everglades using data from 16 sites over 8 years.

The Everglades is characterized by two major drainages transitioning from oligotrophic freshwater marsh to an oligohaline ecotone enriched with marine-derived phosphorus and salt. Benthic microbial mats pervasive throughout the Everglades enable detailed investigation into microbial metacommunity diversity across a gradient of increasing nutrients and salinity vulnerable to both freshwater restoration and sea level rise. We sought to determine and contrast freshwater and oligohaline environmental variance, spatial and temporal diatom beta diversities, and niche- and dispersal-based factors associated with those diversities. We found that oligohaline communities were characterized by higher spatial but not temporal beta diversities than freshwater communities, which was explained by both environmental and dispersal factors. Of the environmental factors, freshwater diatom spatial beta diversity was correlated strongly with microbial abundance, oligohaline with hydrology, and the metacommunity by phosphorus and conductivity. Our findings challenge the idea that microbial distribution is regulated by predominantly local factors by uncovering diatom beta diversity variance explained by both environmental and dispersal factors. This research sheds light on microbial metacommunity diversity along a subsidy-stress gradient in the Florida Everglades with context of better understanding microbial community assembly in ecosystems at risk from anthropogenic and global climatic disturbances.

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SCIENCE PLAN IN SUPPORT OF EVERGLADES RESTORATION STRATEGIES

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In June 2012, the State of Florida and the U.S. Environmental Protection Agency reached consensus on new restoration strategies for further improving water quality in the Everglades. These strategies will expand water quality improvement projects, including the construction of Flow Equalization Basins (FEBs) to capture runoff during storm events and provide a more steady flow of water to the Stormwater Treatment Areas (STAs), to achieve the total phosphorus water quality based effluent limit (WQBEL) established in National Pollutant Discharge Elimination System and Everglades Forever Act permits. These permits and associated Consent Orders also require the District to develop and implement a Science Plan to enhance the understanding of mechanisms and factors that affect phosphorus reduction performance, particularly those that are key drivers at low TP concentrations (e.g. <20 micrograms per liter).

The *Science Plan for the Everglades Stormwater Treatment Areas* was structured and developed around six key questions, and related sub-questions, that were identified by the District's Science Plan Team. The effort involved reviewing existing knowledge, determining information gaps, and formulating questions regarding phosphorus removal mechanisms and the factors that influence these mechanisms, including physical, chemical, and biological processes. The Science Plan is a strategic, high-level document that will be revised and updated as needed. It includes eight initial studies aimed at gathering information for enhancement of the design and operations of water quality projects, enhancement of current management and operation, and development of new management strategies for the STAs. The development and implementation of the Science Plan and the initial studies will be presented.

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SOIL ACCRETION ON CONSTRUCTED EVERGLADES TREE ISLANDS: PRODUCTION AND DECOMPOSTION AFFECTED BY WATER LEVELS

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The Everglades are composed of several key ecosystem components that contribute to its diversity and sustainability. Tree islands provide a relatively dry habitat for flora and fauna, and are biogeochemical hotspots within the oligotrophic Everglades' marsh. Although tree islands comprise relatively little area, they are a numerous and vital elements of the landscape. Despite their importance, the number, size, and distribution of tree islands in the Everglades has been reduced due to hydrologic modifications since approximately the 1950s. The ability of tree islands to be maintained as topographic highs in a flooded landscape may largely be due to the balance between soil accretion and decomposition with greater rates of accretion leading to self-sustaining islands. This research was meant to evaluate response trajectories of mechanisms thought to lead to self-sustaining tree islands.

Changes in tree island litterfall, litter decomposition, and soil accretion rates relative to surface water levels and periods of inundation (hydroperiod) were determined over time. Sites were arranged based on two relative elevations at head highs and head lows (nominally 90 cm and 45 cm above slough soil surface, respectively) on constructed tree islands in the Loxahatchee Impoundment Landscape Assessment (LILA; ARM Loxahatchee National Wildlife Refuge, Boynton Beach, Florida, USA). We hypothesized that litterfall and decomposition rates would be greater at higher tree island elevations because of shallower water depth and shorter inundation time and the net balance in these factors would determine overall soil accretion.

Litter production varied between 263 and 732 g m^{-2} yr^{-1} and was greater at high elevation where trees were maximally productive. Decomposition rates were negatively correlated with inundation time, indicating higher decomposition at high elevations (2.37 and 2.19 % loss mo^{-1}, respectively) due to more favorable aerobic conditions. Soil accretion rates, using feldspar markers, averaged 0.70 cm yr^{-1} and maximized at high elevations. Newly accreted surface soils (0-3 cm) exhibited greater total phosphorus (TP, 374 µg g^{-1} dw), total nitrogen (TN, 14.4 mg g^{-1} dw), total carbon (TC, 190 mg g^{-1} dw), and organic matter (OM, 0.36 g g^{-1} dw) compared to 3-10 cm (older) soils (TP, 216 µg g^{-1} dw; TN, 10.2 mg g^{-1} dw; TC, 132 mg g^{-1} dw; OM, 0.25 g g^{-1} dw). Our findings indicate that plant growth and litter production influence tree island nutrient dynamics by increasing soil nutrient concentrations. Although rates of litterfall and decomposition where both greater at higher elevations, hydrology (period of inundation) exerted a greater influence on increasing production rather than reducing decomposition.

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USE OF MOLECULAR TECHNIQUES TO IDENTIFY EVERGLADES' AQUATIC FUNGAL COMMUNITY ASSOCIATED WITH CATTAIL DECOMPOSITION

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Understanding decomposition in terms of water management requires that we first understand the ecology of decomposition. Fungi have been accepted as the primary decomposers in terrestrial ecosystems but until recently the convention in aquatic systems has been to focus on bacterial decomposers. Recent studies have substantiated the notion that fungi are not only important decomposers in wetlands but may even be primary (Newell 1993; Newell and Porter 2000; Gessner and Van Ryckegem 2003; Bärlocher 2005; Gulis et al. 2006). Despite the fundamental role microorganisms play in overall ecosystem health and function little is understood about the community composition of bacteria and even less about fungi. To investigate the diversity and function of the aquatic fungal community in the Everglades, cattail litter was used as a substrate for fungal growth and placed in experimental plots along a nutrient gradient in Water Conservation Area 2A (WCA2A). The associated fungal communities were evaluated at specific time intervals over a three year period using 454 pyrosequencing targeting the fungal 28S LSU rRNA gene. Fungal DNA was extracted from the remaining plant material at each interval. Statistical analysis shows significant changes in fungal community structure as a function of decomposition duration, as well as, nutrient conditions. The results of the known genera reveal successional community changes as decomposition proceeds.

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CERP AND KILLIFISH HABITAT IN BISCAYNE BAY'S LITTORAL ZONE

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The goldspotted killifish (*Floridichthys carpio*) is a small, abundant forage fish that inhabits Biscayne Bay's mangrove-lined shorelines. Field observations and laboratory behavioral trials suggest that it prefers the intermediate salinity conditions that CERP targets for the Bay's littoral zone. Presented will be the rationale for: (1) continued monitoring of nearshore fish presence/abundance and accompanying abiotic/biotic habitat features; and (2) validation of fish-habitat relationships, derived strictly from field observations, with laboratory studies; and (3) assessment of different freshwater flow scenarios in terms of the quantity of suitable fish habitat that each scenario generates. Opportunities and challenges associated with improved conservation and management of Biscayne Bay's nearshore waters, habitats and fish assemblages will be identified.

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EFFECTS OF INCREASED SALINITY AND INUNDATION ON MICROBIAL PROCESSING OF CARBON AND NUTRIENTS IN OLIGOHALINE WETLAND SOILS

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Carbon (C) cycling in soils is fundamentally linked to the metabolism of microbial communities. Stressors like saltwater intrusion will affect coastal wetlands of the Florida Everglades by altering microbial activities and biogeochemical processes. Sea-level rise (SLR) will increase salinity, inundation regime, and marine-derived nutrients (phosphorus, P; sulfur S) in coastal wetlands, particularly in the oligohaline ecotone that is anticipated to have increased seawater exposure, with uncertain effects on soil microbial dynamics that affect soil C.

Our objective is to understand how soil microbial extracellular enzyme activities (EEAs) differentially respond to ambient and elevated water salinity (10 or 20 ppt) and inundation (soil surface exposed by 5 cm or completely submerged) to affect soil C balance and nutrient acquisition in oligohaline sawgrass peat soils. During initial increase (< 10 d) and longer-term exposure (> 90 d) to elevated salinity and inundation, we measured C- and nutrient-based EEAs and microbial respiration rates.

Exposure of soil to elevated salinity altered microbial C and P utilization that varied by depth and time. During initial salinity increase from 10 to 20 ppt, microbial communities showed increased alkaline phosphatase (AKP), decreased acid phosphatase (AP), and increased arylsulfatase (S) activities. After longer-term exposure to salinity and inundation treatments, changes in EEAs in the lowest soil depths (10-20 cm) were detected; AKP activities decreased ($P < 0.05$) with elevated salinity and cellulase (CEL) activities increased with elevated salinity and inundation ($P < 0.05$). Final soil microbial respiration rates were higher in submerged than exposed soils at mid- and low-depth sections of soil (2-10 cm, $P = 0.02$; 10-20 cm $P = 0.01$). Increases in seawater likely increased marine-derived P, decreasing microbial demand for P and subsequent AKP production. The interactive effect of salinity and inundation promoted the production of CEL to liberate C from more recalcitrant organic matter. Changes in microbial EEAs and heterotrophic processing of C may result from a shift in microbial community structure or a change in functional responses with increased salinity and inundation from added seawater. Changes in microbial processing of soil C and nutrients with SLR are likely to be greatest in freshwater and short hydroperiod coastal wetlands.

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REDUCING LABILE PHOSPHORUS IN AGRICULTURAL CANAL SEDIMENT BY CONTROLLING FLOATING AND SUBMERGED AQUATIC VEGETATION

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It is hypothesized that floating aquatic vegetation (FAV) has a significant impact on the ability of agricultural canal sediment to retain and release phosphorus (P) in the Everglades Agricultural Area (EAA). With FAV removal, more light penetrates the water column, possibly allowing for the co-precipitation of P with calcium and magnesium (Ca-Mg) into less labile minerals. Changes in redox conditions can also affect P-sorption capacity of iron and aluminum (Fe-Al) minerals in sediments. With FAV removal, more oxygen is present, increasing redox potential and P-sorption. No previous studies relate FAV removal from EAA canals to the speciation of P into more recalcitrant forms. P-fractionation was used to measure the concentration of labile and recalcitrant P in eight farms, with four treatment-control pairs. Treatment canals implement chemical FAV control, while control canals operate under normal management practices. Over time, it is expected that recalcitrant Ca-Mg and Fe-Al bound P will increase with a decrease in labile organic P in treatment canals compared to control canals. This generation of denser inorganic mineral P reduces P transport out of farm canals. In addition, x-ray diffraction (XRD) analysis is used to assess the spatial and temporal change in mineral composition of canal sediment. The first year P-fractionation data and initial XRD results are being analyzed to generate baseline control-treatment data. In the future, untested methods utilizing submerged aquatic vegetation (SAV) in tandem with Ca-saturated canal waters will be evaluated for P removal from the water column through plant uptake and co-precipitation with calcium carbonate.

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ECOLOGICAL RISK ASSESSMENT OF CERP AQUIFER STORAGE AND RECOVERY

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The U.S. Army Corps of Engineers in partnership with the South Florida Water Management District prepared an Ecological Risk Assessment (ERA) on the implementation Aquifer Storage and Recovery (ASR) as part of CERP (Comprehensive Everglades Restoration Plan). The ERA process used for this report followed United States Environmental Protection Agency (USEPA) guidelines for ERA studies.

The following risk assessment endpoints were selected: Reproducing populations of native fish; Survival of fish and aquatic invertebrates; periphyton and algae species diversity and abundance, and submerged aquatic vegetation (SAV); manatee protection, and Human health and wildlife protection. The ERA identified and evaluated chemical and physical stressors such as water temperature and impingement and entrainment of larval fish.

Risk assessment tasks included toxicological testing, in-situ bioaccumulation studies, stream condition index determinations, water quality monitoring, water quality modeling, and fisheries characterization. The overall finding of this ERA is that incremental implementation of CERP ASR is not likely to result in long-term ecological or water quality impacts to the Kissimmee River, Lake Okeechobee, or the Greater Everglades. Although this ERA did not identify substantial ecological risk from a water quality perspective, there is an acknowledgement that water quality conditions would need to be monitored under ASR implementation primarily to satisfy operating permit requirements but also to reduce the uncertainties identified in this ERA. In areas where ASR is proposed that have significant fisheries or high quality aquatic habitat, additional monitoring such as fishery surveys and stream condition index assessments are recommended. Given that this ERA acknowledges that the risk characterizations are uncertain, it is recommentded that CERP ASR implementation should be done in an incremental and geographically disperse manner in order to minimize the possibility of unforeseen ecological impacts. Implementation of ASR well cluster facilities with maximum capacity of 25 million gallons per day at one or more locations within the Lake Okeechobee Basin would present limited ecological risk. Implementation of similar ASR well clusters in other basins would present a similar risk that could be mitigated.

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UTILIZING GROUND PENETRATING RADAR (GPR) TO INVESTIGATE THE TEMPORAL AND SPATIAL DISTRIBUTION OF BIOGENIC GASES FROM PEAT SOILS AT THE LOXAHATCHEE IMPOUNDMENT LANDSCAPE ASSESSMENT (LILA)

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Peatlands are large terrestrial storages for carbon (C) and sources of greenhouse gases such as methane (CH_4) and carbon dioxide (CO_2). Although many studies over the last two decades have focused on estimating carbon fluxes from peatlands (particularly in boreal systems), the temporal and spatial distribution of biogenic gases within the peat soil is still not well understood. Furthermore, most of these previous studies were mainly conducted in high-latitude peatlands, while recent research suggests that gas production and emission rates from low-latitude peatlands in areas such as the Everglades may be larger than what was previously thought. This study investigates the spatial and temporal variability in accumulation and release of methane (CH_4) and carbon dioxide (CO_2) in low-latitude peatlands at the field scale (1-10m). The study was conducted in the Loxahatchee Impoundment Landscape Assessment (LILA), an 80 acre landscape scale, manually controlled and monitored model representing the four different environments found in the 1.7 million acre Everglades. Here a series of GPR transects in common offset mode (CO) were collected concurrently with gas chambers monitored with time-lapse photography, and surface deformation measurements to estimate how gas accumulation and release varies spatially and temporally over an approximate 100 m^2 area. This work has implications for better estimating carbon fluxes from peat soils in the Everglades.

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PHYTOPLANKTON RESPONSE TO CHANGING NUTRIENTS FROM COMPREHENSIVE EVERGLADES RESTORATION PLAN: COMPARISON OF TWO COASTAL LAGOON SYSTEMS IN NORTHERN FLORIDA BAY, USA

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The implementation of Comprehensive Everglades Restoration Plan (CERP) in South Florida is expected to alter the hydrology in the Everglades resulting in a change in the quality and quantity of nutrients in northern Florida Bay. Therefore, it is hypothesized that phytoplankton biomass and community composition will also change in response. The West Lake Chain (WLC) and Seven Palm Lake Chain (SPLC) are quasi-enclosed lake chains located in the southern Everglades/northern Florida Bay region that may be among the first systems to respond. They represent eutrophic and less nutrient-rich systems respectively. The quality and quantity of nutrients, and phytoplankton in WLC and SPLC were monitored over several seasons from 2010 to 2014, before and after CERP, to compare their regional difference.

There are large spatial differences in the nutrients and phytoplankton of these lake chains. Total dissolved nitrogen (TDN), total dissolved phosphorus (TDP), and total biomass (as chlorophyll a) were higher in WLC compared to those of SPLC, by much as 8-fold. DON, which contributed >90% to TDN in both lake chains, were significantly higher in WLC than that in SPLC, whereas the inorganic forms of N, NOx and NH_4^+ were not significantly different. In addition, while both chains had smaller- and larger-size phytoplankton each accounting for ~50%, WLC had significantly higher contribution of cyanobacteria, cryptophytes, photosynthetic dinoflagellates, and diatoms to phytoplankton biomass (indicated by HPLC data) than SPLC.

After CERP, nutrients showed similar trends in the two lake chains, but phytoplankton responded differently. TDN decreased by 4% in WLC and by 25% in SPLC while both TDP increased >30%. The proportion of DON and reduced form of N (DON and NH_4^+) were further elevated, reaching >95% and >99% respectively in both chains. Nevertheless, phytoplankton trends differed: the biomass declined by 50% in WLC, whereas it almost tripled in SPLC; smaller-size phytoplankton proportion increased by 13% in WLC but almost doubled in SPLC. Moreover, in WLC, the contribution of all four phytoplankton groups to biomass declined. In SPLC, the contribution of photosynthetic dinoflagellates and diatoms decreased, but cyanobacteria and cryptophytes, the small sized phytoplankton increased. These findings thus demonstrate the potential for similar changes in nutrients loads to systems with contrasting ambient conditions have the potential to alter phytoplankton communities in contrasting ways.

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ALLIGATOR PRODUCTION SUITABILITY INDEX MODEL FOR RESTORATION PLANNING AND ASSESSMENT

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The American alligator (*Alligator mississippiensis*) is a keystone species within the Everglades marsh systems whose activity structures the landscape. Alligators are dependent on spatial and temporal patterns of water fluctuations that affect courtship and mating, nesting, and habitat use. Alligator abundance, nesting effort, growth, survival, and body condition serve as indicators of the health of the Everglades marsh system. The Modified Water Deliveries Project and the Comprehensive Everglades Restoration Plan are two of the most significant Everglades restoration programs for reversing past environmental degradation and restore habitat for wildlife such as the alligator. Ecological modeling tools that can simulate the effects of restoration are of keen interest to natural resource managers, restoration, and conservation planners.

The Alligator Production Suitability Index (APSI) model incorporates concepts from existing alligator habitat suitability models, the literature, and data that have been collected in the last decade. This model uses new information to estimate an alligator production suitability index that includes components for habitat assessment and quality, breeding, courtship and mating, and nesting success (nest building and nest flooding). Examination of individual components of the index during a year provides insight to any limiting hydro-conditions that contribute to a poor overall index thus inhibiting successful hatchling production.

The APSI model can help in optimizing water management to stabilize and improve alligator populations and has been used to evaluate the effects of alternative Everglades restoration scenarios on habitat suitability for alligator production. Suitability scores can also be used as input to the U.S. Geological Survey alligator population model (APM) (Slone and Rice 2002). The Ecological and Design Documentation for details and User's Guide for instructions on how to install and run the model are available at http://www.simglades.org.

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WATER, ENERGY AND CARBON CYCLING IN GREATER EVERGLADES FORESTED WETLANDS

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Atmospheric-ecosystem exchange of water, energy and carbon (C) over cypress and pine forested wetlands in the Greater Everglades is currently being monitored as part of a long-term effort to create, expand and modernize U.S. Geological Survey monitoring networks using new technologies that are sensitive to climate change and promote collaborative science. This monitoring network allows identification of (1) processes, drivers, and disturbances (e.g., fire, drought, hurricanes, cold fronts) of wetland biogeochemical cycles; (2) interactions among these cycles (e.g., C water-use efficiency, photosynthesis, evapotranspiration); and (3) feedbacks with regional or global climate forcing (e.g., disturbance vulnerability, radiative forcing). For example, changes in net atmospheric-ecosystem C exchange (NEE) are a function of seasonality in solar insolation, air temperature, cypress and pine physiological activity, and water availability from rainfall during the humid, subtropical wet season. Cypress and pine forested wetlands in the Greater Everglades are net atmospheric C sinks on monthly and annual time scales. Atmospheric C is metabolized into organic C or particulates that accrete in the soil, are transported laterally to Florida Bay or the Gulf of Mexico via overland flow, or are oxidized during soil respiration. Soil respiration is apparently suppressed by flooding and inundation during the wet season. Continued collaborative data collection and analysis will improve understanding of historical, present and future Everglades forested wetland responses to regional (e.g., water-management modifications) and global (e.g., air temperature, sea-level) environmental change.

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APPLICATION OF VOC ANALYSIS FOR CANINE TRAINING AND THE DETECTION OF THE FATAL LAUREL WILT DISEASE

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Invasive species pose a huge threat to agriculture, environment, and economy in the United States. These threats can enter the US through ports-of-entry accidently, as in the case of the phytopathogenic fungus *Raffaelea lauricola*. The vector of *R. lauricola* is the invasive redbay ambrosia beetle (*Xyleborus glabratus*), which entered the United States on infected wood. The relationship between the beetle and the fungus is symbiotic: the beetle carries *R. lauricola* to a tree, inoculates the tree, and then farms the fungus as food. The result of this symbiosis is the fatal laurel wilt disease, whose symptoms include wilting of the leaves and discoloration of the bark due to the tree's reaction. An inoculated tree systematically shuts down its transpiration mechanism in order to stem the spread of the disease. This leads to the tree's death within four to six weeks. Laurel wilt is advancing through the Lauraceae forests in the southeastern US, and now is found in the Florida commercial avocado groves—the state's most important tropical fruit. It has the potential to eradicate the US avocado industry, causing billions of dollars in loss. The rapid rate of advancement of the laurel wilt disease demands the development of a method for detecting the disease before the development of physical symptoms. Canines—often used in law enforcement and in ports-of-entry to detect substances such as drugs, known biothreats, or banned agricultural items—will be deployed for this purpose. The current research identified the volatile organic compounds (VOCs) of avocado trees infected with the laurel wilt disease in order to create a canine training aid that mimics the target odor. A non-biological mimic is preferred over the actual substance to prevent the inadvertent spread of fungal spores. Using this aid, canines can be trained to detect infected trees before physical symptoms develop so that they can be removed from groves, thereby protecting healthy trees.

The VOCs of laurel wilt were identified using solid phase microextration-gas chromatography-mass spectrometry (SPME-GC-MS). Bipolar SPME fibers were used to sample compounds in the headspace above samples of infected wood and uninfected wood. The compounds were then desorbed and separated through GC-MS. Results show that when comparing four varieties of avocado, there are 13 compounds produced by infected trees that are not produced in uninfected trees. Additionally, there are 15 compounds categorized as sesquiterpenes that are present in uninfected varieties, but whose abundance increases dramatically in infected varieties. For example, in the Lula variety, production of sesquiterpenes increased by almost 92%. Each of these 28 compounds was considered for use in the canine training aids because of their novelty or abundance. The identification of these compounds will be incorporated into a training aid that will be used to combat the laurel wilt disease through rapid and early detection using canines.

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INVESTIGATING THE EFFECTS OF INCREASED SALINITY AND TEMPERATURE ON CARBON GAS DYNAMICS OF SUBTROPICAL PEAT SOILS

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Sea level rise (SLR) is an increasingly important topic for many low-lying coastal areas such as South Florida. The United States Army Corps of Engineers (USACE) projects that sea level change in South Florida, over the next 50 years, will increase between 5 and 24 inches based on historic and high rates of SLR respectively. SLR not only affects human populations and infrastructure in South Florida, but also may have many unrealized consequences on delicate ecosystems such as the Everglades. Globally, peatlands function as a net source of CH_4 (5-10% of total) flux to the atmosphere, as well as a net sink of atmospheric CO_2 with tropical and subtropical peatlands, like the Everglades, accounting for approximately 15% of the global C pool. Based on the USACE SLR projections it is conceivable that previously unexposed freshwater areas of the southern Everglades will become exposed to saline water. Previous studies investigating the effects of salt-water intrusion on freshwater peat soils in the Everglades are very limited, and to our knowledge none have intended to monitor the internal gas dynamics within the peat matrix using hydrogeophysical methods. In this study, we will focus on defining the effects of increasing salinity and temperature on the C dynamics of several peat soil monoliths at the laboratory scale. Two of the three monoliths will be subjected to changes in either salinity or temperature. As previously proposed by others, increases in salinity will result in dilation of pore spaces and thus hydraulic conductivity, while limiting methanogenesis. However, increases in temperature may induce the opposite effect, particularly in terms of methanogenic activity. By using an array of geophysical and hydrological methods we intend to better understand how such changes may affect biogenic gas dynamics and whether consistent thresholds to limit microbial activity conducive to biogenic gas formation exist in the peat soils of the Everglades. This work has implications for better understanding of how freshwater peatlands in the Everglades may be affected by SLR.

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BACK TO THE FUTURE: A LANDSCAPE-SCALE RESPONSE TO RESTORATION

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Since society values the landscapes that were once prevalent 50-200 years ago, there has been a concerted effort to look at the pristine past and develop plans to move the past into the future. However, bringing the past back is constrained by irrevocable damages and anthropogenic trends that cannot be easily reversed. The scale of the Everglades and its use for water supply and flood control is such that a full recovery is not possible. What is possible? The answer is the Central Everglades Planning Project (CEPP). CEPP is the "flux-capacitor" in this story of time travel.

The primary hydrological modeling outputs of CEPP were based on outputs from the Glades-LECSA version, of the Regional Simulation Model (RSM) developed at the South Florida Water Management District. The RSM is the DeLorean vehicle, designed to carry the bags of ecological restoration. Unfortunately, the capacity of this vehicle is limited, but is it significant? The simulated period between 1965 and 1985 without restoration had nine dry periods when there was no water in the sloughs in the most northern regions of SRS in Everglades National Park. With CEPP, all of these extreme dry conditions were eliminated. The impact of this was most apparent for fish, especially the size class used by wading birds. With our DeLorean we saw a 60-90% increase in fish density in northern SRS. As one might expect, the birds responded to the fish. Without CEPP, decreased water volume lowers landscape Days-Since-Drydown (DSD), such that prey densities are low even when depths are shallow and fish concentrations in pools should be high. Not so with CEPP. The increased volume, flow, and connectivity of the CEPP plan had a significant positive impact on the foraging response of all wading bird species, especially in WCA-3 and the ENP where foraging conditions for an average CEPP year (1978) improved by 25-100%. Further downstream, increased delivery of low nutrients to the coastal lakes and Florida Bay from the upstream freshwater Everglades with CEPP displaces the relatively P-rich marine water, increases water transparency and thus, decreases algal blooms. However, in a world of rising sea levels and lakes with legacy TP, will additional freshwater be needed to maintain existing SAV beds? We have reached a resource management milestone because CEPP provided a clear understanding of the models, the science and the concerns of society. What we have learned will guide future travelers back in time.

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MANATEES AND THE PICAYUNE STRAND RESTORATION PROJECT

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Florida manatees (*Trichechus manatus latirostris*) are susceptible to "cold stress syndrome" after prolonged exposure to water temperatures <20°C, *so* an accessible source of warm water is necessary for them to survive extended cold periods during the winter. The largest warm water refuge in the Ten Thousand Islands (TTI; Collier County FL) is found in the Port of the Islands (POI) basin. This basin retains heat when it receives freshwater flow over the FU-1 weir from the drainage canals of the Southern Golden Gate Estates (SGGE) that is now the Picayune Strand Restoration Project (PSRP). After restoration, this flow will be greatly reduced. Analysis of historical temperatures, flow rates over the FU-1 weir, and carcass recovery from the TTI suggested that the reduction of flow caused by the PSRP will negatively affect the warm water refuge, and the manatees that depend on it.

The multi-agency PSRP Manatee Working Group has examined several possible responses to future degradation of the warm water refuge at POI ranging from doing nothing to actively heating water onsite to maintain the refuge. Consistent with species conservation needs, restoration goals and fiscal responsibility, it was decided that the most effective response would be to replace the existing refuge with a new passive basin onsite.

Earlier research determined that the groundwater underlying POI was warm enough to support manatees through winter months, but hydraulic connection with the surface water in the POI basin was poor at best. A plan was formulated to create a connection to this groundwater to provide continued warm water. The first design, which proposed to create a refuge in the residential canals of POI, was abandoned after significant homeowner concerns were expressed at a public comment meeting. A second design was started using a spoil berm south of POI, on property owned by the state of Florida (Rookery Bay National Estuarine Research Reserve).

Construction timelines for restoration features (canal backfill and rehydration of wetlands) has been delayed by the need to mitigate for the presumed loss of the POI warm water refuge, and the scope of the project has been modified to accommodate manatee needs. This project is further along in construction than most other major Everglades restoration projects due to the cooperation and perseverance of the agencies involved, including USACE, SFWMD, USFWS, FFWCC, FDEP and USGS. Construction is due to begin soon on the new manatee refuge, and long-term monitoring will occur, including measurement of water quality and temperature, observation and photo-identification of manatees using the refuge, and monitoring of manatee movements in the surrounding landscape.

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USING RECENT HURRICANES AND ASSOCIATED EVENT LAYERS TO EVALUATE REGIONAL STORM IMPACTS ON ESTUARINE-WETLAND SYSTEMS

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Tropical cyclones are a major driver of change in coastal and estuarine environments. Heightened waves and sea level associated with tropical cyclones act to erode sediment from one environment and redistribute that sediment it to adjacent environments. The fate and transport of this redistributed material is of great importance to the long-term sediment budgets and vulnerability of these coastal systems. The spatial variance in both storm impacts and sediment redistribution is large. At the regional-scale, variance can often be attributed to natural variability in geologic parameters (sediment availability/erodibility), coastal geomorphology (including fetch, shoreline tortuosity, back-barrier versus estuarine shoreline, etc.), storm characteristics (intensity, duration, track/approach), and ecology (vegetation type, gradient, density).

To assess storm characteristics and coastal geomorphology on a regional-scale, cores were collected from seven *Juncus* marshes located in coastal regions of Alabama and Mississippi (i.e., Mobile Bay, Bon Secour Bay, Mississippi Sound, and Grand Bay) expected to be impacted by Hurricane Frederic in 1979. Cores were sectioned and processed for water content, organic matter (loss-on-ignition), and foraminiferal assemblages to identify storm events. Excess lead-210 and cesium-137 were used to develop chronologies for the cores and evaluate mass accumulation rates and sedimentation rates. Temporal variations in accumulation rates of inorganic and organic sediments were compared with shoreline and areal change rates derived from historic aerial imagery (in the vicinity of the core sites) to evaluate potential changes in sediment exchange prior to, during, and following the storm. Such regional assessment will improve our understanding of coastal change in estuarine marsh and/or mangrove environments as well help refine the role that storms play on regional sediment and carbon budgets.

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BIOLOGICAL CONTROL RELEASES ON *LYGODIUM MICROPHYLLUM* IN CAPE SABLE WILDERNESS AREA, EVERGLADES NATIONAL PARK: CERP IMPLEMENTATION AND MONITORING FOR SUCCESS

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Lygodium microphyllum invades the remotest areas in the Everglades ecosystem, including critical habitat and designated wilderness area in Cape Sable within Everglades National Park. Invasive plants in these areas have traditionally been managed with fire, other non-chemical methods and herbicide, but despite these control efforts, *L. microphyllum* continues to spread. *Lygodium microphyllum,* or Old World Climbing Fern (OWCF), reproduces through aerially borne spores that establish in a wide-range of wetland habitats including tree islands, cypress domes and sawgrass scrub. It persists despite top-kill from frost, fire or herbicide due to an extensive network of subterranean rhizomes.

Construction of the mass-rearing annex at the Invasive Plant Research Laboratory, United States Department of Agriculture, Agricultural Research Service (USDA-ARS) in Fort Lauderdale, FL was the first completed project of the expansive Comprehensive Everglades Restoration Plan (CERP). We inoculate invaded areas beginning with high-priority areas throughout the CERP region – an area that encompasses lands from the Kissimmee River Valley to the southern tip of Everglades National Park. We will then monitor release sites and the surrounding areas during follow-up surveys to determine establishment success and eventually the efficacy of the biological control agents on their target weeds.

Beginning in 2014, we identified Cape Sable as a high-priority area in which to conduct several innoculative releases of *Neomusotima conspurcatalis,* a defoliating moth and *Floracarus perrepae,* a leaf-galling mite. In April 2014, we released 20,000 moth larvae in four areas. The first releases of *N. conspurcatalis* did not establish in these areas, but we did locate a single thriving population of *F. perrepae* in the southern part of Cape Sable. Subsequent monitoring detected both agents, although in low densities. More releases are planned in February 2015, in areas that have recently been burned, with further monitoring of existing and new release sites.

Lygodium microphyllum has the potential to overtake many sensitive sites within this critical habitat. Established biological control agents would add significantly to an integrated weed management plan for OWCF that includes fire and herbicide. Ongoing collaborative efforts will continue to establish and monitor these populations within the larger CERP management plan.

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PATTERNS OF SEDIMENT SURFACE ELEVATION CHANGE IN THE SOUTHWEST COASTAL EVERGLADES

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The vegetation of the southwest coastal Everglades is dominated by mangrove forests and marshes. Both ecosystems are subjected to disturbances such as fire and hurricanes. They are also responding to sea-level rise (SLR). SLR at Key West, FL, has been occurring at approximately 2.24 mm•yr^{-1} since the record began in 1913. The mangrove forests are known to have moved upslope into adjacent marshes and also upstream along coastal river systems such as the Shark and Lostmans. Mangroves and marshes also accumulate organic matter and trap sediments washed in by storm surges. A major question is: Will these coastal wetlands keep pace with SLR by increasing their elevations vertically?

Beginning in 1998 Sediment Elevation Tables (SETs) where installed at a series of sites along the Shark and Lostmans River systems. The SETs have been measured at irregular intervals since their installation. The most upstream sites are in non-tidal, freshwater marsh systems with *Cladium jamaicense* and periphyton. The middle river reach sites are in low to brackish salinity areas with *Juncus roemarianus*, *Cladium* and mangroves. The downstream sites are typical riverine type mangrove forests with all three species present: *Avicennia germinans*, *Laguncularia racemosa* and *Rhizophora mangle*. At Big Sable Creek (BSC), on the northwest corner of Cape Sable, both mangrove forests and the extensive mudflats have been measured.

Patterns of surface elevation change are complex and very different between sites. The upstream sites along both river systems showed little or moderate increases in elevation. The downstream sites on both rivers had large increases due to sediment deposition from Hurricane Wilma's storm surge. At BSC, Wilma caused major erosion of the mudflats, which have slowly gained elevation since the storm's passage. Delayed mortality of mangrove trees following Wilma resulted in sediment elevation declines at several, but not all, of the downstream sites. After initial elevation declines due to delayed mortality, elevation began to rebound as trees recruited into the forest.

Continued measurement of sediment elevation in the coastal wetlands of the Everglades will provide needed and essential information for resource managers concerned with the health of the ecosystem in the face of climate change and sea-level rise.

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MANGROVE FOREST SOIL ACCRETION RATES AND THE RELATIONSHIP WITH SEA LEVEL AND STORMS OVER THE PAST CENTURY

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Mangrove forests provide a range of valuable ecosystem services including sequestering large quantities of organic carbon (OC) in their soils at rates higher than other forests. Whether or not mangrove soils continue to be a sink for OC will be determined by the mangrove ecosystems' response to climate change-induced stressors. The threats of rising sea level outpacing mangrove forest soil accretion and increased wave energy associated with this rise may become the primary climate change-induced stressors on mangrove ecosystems. Amplified wave energy associated with sea level rise could increasingly damage mangrove forests along the coastline. However, storms may enhance accretion rates at some sites due to delivery of storm surge material, which could increase the system's ability to keep pace with sea-level rise (SLR). To investigate these processes, we measured soil accretion rates over the last 100 years (via ^{210}Pb dating) within the mangrove forests of Everglades National Park and Ten Thousand Islands. We compare accretion rates with the sea level tide gauge record at Key West, FL over multiple time periods and scales. Accretion rates match (within error) the relatively modest average SLR over the most recent 50 and 100-year periods. Since SLR is expected to accelerate we use periods of relatively high SLR within the oscillations of the long-term record to examine how accretion rates respond during periods of higher SLR. Throughout the system organic matter accumulation is the most important source material contributing to accretion. Some of the more seaward sites also show an important contribution from carbonate material. Some soil cores from the most seaward sites exhibited visual laminations and Ca peaks (determined via x-ray fluorescence). These are indicators of storm surge deposits. While higher sea level might produce more damage and loss of mangrove forest along open water (e.g., Gulf of Mexico), our findings suggest some sites will have enhanced accretion rates due to supplementation with storm surge material.

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RESTORATION RALLY CRY FOR THE BIG CYPRESS SWAMP

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The Big Cypress Swamp of Southwest Florida has historically been perceived as a lower urgency subarea of the Greater Everglades Restoration effort. Factors contributing to this perception include its geographic separation from the highly-managed main Everglades flow way, its mosaic of smaller natural flow ways, an assumption that land conservation alone was enough to protect the area, and the widely held misconception that its hydrology has been less impacted than within the footprint of the Central and South Florida Project to the east.

A more accurate assessment reveals an area where conservation alone has fallen short of achieving and sustaining the ecological health of the swamp ecosystem. Instead, a network of legacy and now aging drainage infrastructure has caused widespread disruption of the swamp's characteristic sheet flow regime. Major impacts include severed inflows, interrupted overland flows, shallower surface water depths, seasonally shortened hydroperiods, degradation of wetland habitat, increased exposure to exotic biota, decreased freshwater contributions to estuaries in downstream Everglades National Park and Ten Thousand Islands National Wildlife Refuge, increased vulnerability to saltwater intrusion, and rising frequency and intensity of ecosystem-damaging and financially costly wildfires.

Restoring hydrologic regimes represents the next vital stewardship step for the Big Cypress Swamp. An overarching plan is needed to bring the area's legacy drainage infrastructure up-to-date with modern engineering and water conservation principles, to revitalize a hydrologic regime which achieves and sustains the swamp's ecological health, to unite resident watershed stewards under a common restoration umbrella, and to assimilate this renewed vision into Greater Everglades Restoration planning circles. Left unchecked, the current status quo will continue to imperil the swamp, increase its vulnerability to new threats and leave potential corrective actions unfulfilled.

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MITIGATING THE CULTURAL AND ECOLOGICAL LOSSES FROM LAUREL WILT ON TRIBAL LANDS IN FLORIDA

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Laurel wilt is an exotic and devastating disease which threatens trees in the Lauraceae family, including redbay, swamp bay and avocado, resulting in mortality rates of up to 100%. As a keystone canopy species in the tree islands of the Everglades and a culturally and medicinally important plant to the Seminole and Miccosukee Indian tribes of south and central Florida, swamp bay serves an important ecological and cultural role. The disease has spread rapidly since its introduction in the US in 2002, reaching south Florida in 2011. The purpose of this study is to determine viable swamp bay propagation techniques, propagate trees with putative resistance in an effort to create a germplasm bank that can be further tested for resistance, establish restoration plots, explore defensive management techniques and identify underlying factors which may be promoting the spread of this disease.

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VISUALIZATION OF WATER VELOCITY FIELDS ENTERING AND EXITING STRUCTURE-152 IN SUPPORT OF THE DECOMPARTMENTALIZATION PHYSICAL MODEL (DPM), WATER CONSERVATION AREA 3, MIAMI-DADE COUNTY, FLORIDA

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The primary goal of the Comprehensive Everglades Restoration Plan is to restore natural water flow through the Everglades. An approach known as decompartmentalization, which involves the removal of levees, canals, and other barriers to flow, has been suggested to aid in the restoration. In the region known as Water Conservation Area 3 (WCA-3), the L-67A and L-67C canals and levees, which bisect WCA-3 into WCA-3A to the north and WCA-3B to the south, are major barriers to natural flow.

A test project for the decompartmentalization of WCA-3 has been initiated through the WCA-3 Decompartmentalization and Sheetflow Enhancement Physical Model (DPM). This flow-release test involves reconnecting WCA-3A and WCA-3B through the construction of S-152, a structure comprised of ten gated five-foot diameter culverts in the L-67A levee. In addition, 3,000 feet of the "downstream" L-67C levee were removed to provide a pathway for flow; backfilling of the adjacent canal ranged in extent from no fill to partial fill to complete backfilling. Data collected during the DPM flow-release test will allow researchers to evaluate the effects of decompartmentalization on the hydrology and landscape within a small section of WCA-3 prior to implementing larger scale restoration efforts.

The U.S. Geological Survey (USGS), in cooperation with the U.S. Army Corp of Engineers, is monitoring discharge through S-152. To augment this data collection, velocity mapping surveys were performed to improve understanding of the movement of water from the L-67A canal, through S-152, and into the downstream wetlands. These mapping surveys use an acoustic Doppler current profiler (ADCP) interfaced with a differential global positioning system (DGPS) to measure the three-dimensional flow fields at various cross-sections immediately upstream and downstream of S-152. The data are processed using the USGS Velocity Mapping Toolbox (VMT) software package to provide detailed geo-referenced visualization of the flow.

The cross-section, plan view, and bathymetric images generated by the VMT software provide a better understanding of the movement of water from WCA-3A into the adjacent wetlands of WCA-3B. As ADCP and DGPS systems have become more widespread and user-friendly in recent years, software such as VMT provides a valuable tool for researchers in a variety of fields to generate useful imagery from their data.

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INFLUENCES OF CHANGING HYDROLOGIC CONDITIONS ON FOOD WEB PATTERNS NEAR THE BOUNDARIES OF EVERGLADES NATIONAL PARK

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A major goal of our work has been continued monitoring to evaluate how small fish populations along the eastern edge of Everglades National Park (ENP) have been affected by water management decisions associated with the S-332 water control structures. Dispersal and colonization dynamics play an important role in determining how fish populations respond to changing water levels. Here we describe the movement of small fishes with respect to changing water levels and deep water refugia, and how fish movement, in aggregate, affects community level responses to water management decisions.

Over the course of this monitoring project, we have used drift fences with minnow traps to collect moving fishes in marsh habitats in ENP between 2003 and 2013. Fish encounter rates in drift fences provide a sample of fish that were actively moving through marsh and wet-prairie habitats. Using this methodology, we assessed fish activity along the eastern edge of ENP near the L31W and C-111 features, in Taylor Slough (TS), and at reference sites located in Shark River Slough (SRS). We assessed inter-annual patterns in fish community composition separately for the early wet season, mid wet season, and late wet season using permutational MANOVA. For the 2013-2014 data set, we used a generalized linear model to assess whether fish encountered in drift fences near the eastern edge of the park were moving toward or away from deep water refugia (i.e., a canal). We conducted this analysis separately for Jewel Cichlids, Eastern Mosquitofish, Bluefin Killifish, Golden Topminnows, and Flagfish.

We found that species composition of the active fish was inextricably tied to local hydrologic characteristics. The fish community in SRS provided a reference to characterize long-hydroperiod assemblage composition, and the TS sites generally resembled SRS sites in that Flagfish and exotics were relatively rare. The prominence of exotics near the S-332 water control structures may be linked to direct surface flow pathways connecting canal habitats to the marsh. Species-level assessments of when and where fish disperse between canals and marsh habitat at the TS sites showed that changing water levels have the potential to influence when fishes move between the canals and the marsh at these sites. Moving forward, we will seek to better understand how fishes respond to hydrologic patterns in order to better predict how water management affects fish biodiversity in ENP. Because of plans to increase water levels in TS at sites near the C-111, Aerojet, and L-31W canals, future monitoring will be needed to track how the small fish community responds to both an increased hydroperiod and increased connectivity with deep water refuges in canals.

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INFLUENCE OF SOIL BIOGEOCHEMICAL PROPERTIES ON EXOTIC INVASIVE *LYGODIUM MICROPHYLLUM*: A CROSS CONTINENT COMPARISON OF SOIL CHARACTERISTICS TO INVASION SUCCESS

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With the influence in the plant's ability to extract water and nutrients, soil characteristics play an important role in the distribution of plant species. The objective of this research was to analyze the soil characteristics associated with exotic invasive, *Lygodium microphyllum,* in its native range in Australia and the recipient habitat in south Florida. Rhizosphere soil samples from both the continents were analyzed for the soil physical, chemical and biological characteristics.

The results from this study indicate that rhizosphere soil characteristics were very different in the two regions. Likewise, leaf nutrient status of this plant also varied in the two continents. The composition of mycorrhizal fungi, which is believed to aid this plant in the recipient habitat, was also very different with higher diversity in the disturbed sites compared to the undisturbed sites. The most important result was the Australian sites had a high concentration of aluminum and zinc which are phytotoxic in a highly acidic soil conditions compared to the Florida sites.

Overall, our results indicate that *L. microphyllum* could be growing poorly in its native range in Australia because of the soil toxic effects associated with strong soil acidity and low foliar nitrogen concentration which in turn could affect the photosynthetic capacity of the plant. On the other hand, Jonathan Dickinson Park, which has the worst case of *L. microphyllum* infestation in Florida, provides a more favorable growth environment for this plant with well drained sandy, slightly acidic soils with low concentration of soil elements. This study highlights that along with the characteristics of exotic plant species and native plant community, the understanding of invasive success of exotic plants needs the understanding of belowground community and ecology.

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STATE FOREST MANAGEMENT ON A FEDERAL HABITAT RESTORATION PROJECT

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The Florida Forest Service manages the Picayune Strand State Forest, of which the 55,000 acre Picayune Strand Restoration Project (PSRP) falls wholly within. There have been some impacts of the PSRP on forest management. The use of heavy equipment in building pump stations, removing hundreds of miles of roads and plugging canals, has necessitated the closure of large tracts of the state forest from the public for years at a time. Despite the public impact, the Florida Forest Service usually experiences only minor impacts in how it conducts forest management activities within the PSRP. There have been larger impacts on forest management, though, in four specific areas: reforestation, camping, endangered species and invasive species.

Reforestation of the native south Florida slash pine will not be initiated until all hydrologic restoration activities have been completed and at least one rainy season has passed. This will allow Florida Forest Service staff to gauge where sheet flow has returned to the forest, with the reforestation of pines to occur only in areas with appropriate hydrology. The T-canal campground on the south end of the forest was popular for many years. But restoration activities necessitated its closure, due to being within an active construction area with heavy equipment use, and not being suitable as a campground once the area has a longer hydroperiod and elevated water table. The installation of a replacement campground will not occur until all restoration activities are completed and areas outside of sheet flows can be mapped and surveyed.

The expansion of the red-cockaded woodpecker (RCW) population in the nearby Belle Meade tract has brought the RCW population directly adjacent to the PSRP. Given the RCWs foraging range and dispersal distance, recruitment clusters installed within the western edge of the PSRP would allow the RCW population to continue to grow. Yet, aided colonization within the PSRP would likely invalidate the US Fish and Wildlife Service's 2009 Biological Opinion 'not likely to adversely affect the red-cockaded woodpecker', due to the proximity of heavy equipment use within RCW recruitment clusters. Therefore, the Florida Forest Service will wait until all road removal and canal plugging activities are completed in the Miller phase of restoration before encouraging RCW expansion in the PSRP.

Lastly, and perhaps most challenging, will be the long-term management of invasive (plant) species. Invasive species management by contractors within the restoration footprint is integral to the restoration project. After PSRP completion, the Florida Forest Service will be the sole land manager responsible for invasive species. Invasive species treatment while the restoration footprint is still drained is much easier than after the hydrology is restored. Because invasive species impact most forest management activities, it is imperative that control efforts are enacted now before the hydrology is restored. Reduced coverage of invasive species, coupled with subsequent hydrologic restoration, will provide the greatest benefit to restoring habitat for the endangered fauna and flora of southwest Florida, and allow the Florida Forest Service the best opportunity to manage the PSRP for the long-term.

These impacts of the PSRP on forest management within the state forest will be discussed.

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AN IMPROVED BISCAYNE BAY HYDRODYNAMIC MODEL FOR EVALUATION OF RESTORATION EFFORTS AND THE EFFECTS OF GROUNDWATER ON SALINITY

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Biscayne Bay, a system of connected shallow basins that exchange water with the coastal ocean, is located on the southeast coast of Florida, USA at the northern end of the Florida Keys coral reef tract and adjacent to the densely populated City of Miami and Miami-Dade County. While historically a tidal estuary, the bay has become a marine lagoon, largely due to reduced freshwater input resulting from the installation of an extensive canal system designed to reduce flooding and allow habitation in the flat coastal region of South Florida. Restoration efforts within the greater Everglades system are intended to improve the quality, quantity, timing, and distribution of water flowing through the wetlands and into the coastal systems, including Biscayne Bay. Evaluating the likely impacts of these changes in freshwater flow along the shore requires a useful high-resolution model that is capable of predicting both the spatial and temporal distribution of salinity in the near shore areas and the bay at large.

The Biscayne Bay Simulation Model (BBSM) is a 2-dimensional finite-element model that has been used in the past for simulations of salinity and currents in Biscayne Bay. Since its most recent publication there have been several updates made to the model including; refining the grid to decrease element size along the shore line, changes in the depth dependent friction term, an expansion of the model's period of record from 1996 – 2006 to include data through 2011, and updates to existing canal discharge time series based on re-evaluation of the structure rating curves. These additions have greatly improved the quality of the model output in terms of its ability to reproduce observed salinity conditions in the near-shore region. Also, the relationship between discharge and salinity variation in the bay closely matches the relationship developed from observed data – providing further support of the usefulness of the model for evaluating restoration efforts.

In addition to calculating the impact from variation in canal or coastal discharge due to restoration, the effect of other natural features in the area can also be investigated. There have been several studies on the importance and magnitude of fresh groundwater discharge to the bay, ranging in approaches from direct flow measurements at seeps in the bay to hydrodynamic calculations or using sediment core data as a proxy to develop a paleo-salinity record. In all cases, the evidence points to a need for some fraction of groundwater to be included in the hydrodynamic model. However, the quantity, timing, and distribution of groundwater is uncertain. We will present estimates of the fresh groundwater component that appears to be necessary, strictly from a hydrodynamic modelling approach, to reproduce observed salinity patterns in the bay.

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RESOLVING FINE-SCALE PATTERNING AND RESTORATION OUTCOMES IN THE COASTAL EVERGLADES

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Evaluation of restoration outcomes depends on an accurate accounting of spatial patterning. In the coastal Everglades, the resolution of spatial features is limited both by the widely-spaced fixed-point design of monitoring programs and by the spatially complex layout of the mangrove transition zone and associated embayments. Usually each discrete area (basin) of Florida Bay is represented by a single monitoring station. When multiple stations are spatially interpolated using conventional methodologies, the results can be unreliable because interpolations extend through barriers in the landscape such as peninsulas and islands. We explored the capability of real-time onboard flow-through sampling of salinity, chlorophyll, and nutrients to resolve sub-basin scale water quality features when combined with a recently developed non-Euclidean interpolation method, Inverse Path Distance Weighting (IPDW). IPDW provided more accurate estimates of salinity patterning relative to its more commonly used Euclidean counterpart Inverse Distance Weighting (IDW).

The largest improvements were observed in the presence of the intense spatial gradients that occur at the transition between dry and wet seasons and on either side of narrow barriers separating hypersaline basins from brackish embayments. Strong gradients are ecologically important as they are often the site of high biological production and nutrient transformations. The restoration benefits of this methodology include a precise accounting of how freshwater inflows circulate through the Florida Bay ecosystem, and quantitative understanding of how inflows affect nutrient and phytoplankton dynamics.

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MOLLUSCAN SURVIVAL IN EXTREME ENVIRONMENTS OF FLORIDA BAY

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Many of the islands in Florida Bay exhibit unique environments that create extreme living conditions. These islands are typically fringed with mangroves, but have a non-vegetative barren interior that can be submersed in fresh to hypersaline water or completely dry, depending on the season. In April of 2014, fieldwork was conducted on four of these islands: western Bob Allen Key, Buttonwood Key # 7, Jim Foot Key, and Russell Key. Typically, the wet areas on the islands were shallow lakes (1-10 cm water depth) with a heavy load of flocculated material above a firm spongy reddish algal mat. A few species of mollusks were abundant in these lakes, scattered on top of the algal layer. Drier areas of the interior basins were characterized by deep mudcracks with mollusks congregating in the cracks on the sides of mud blocks.

On Buttonwood Key #7, we found the most diversity in mollusk species and the highest population densities dominated by *Polymesoda maritima* (=*Polymesoda floridana*) with 256- 5397 individuals per m^2 in collected samples. *P. maritima* were observed with soft tissue present in dry areas and shallow water with salinity ranging from 1.23 ppt to 96 ppt and temperature ranging from 28.3 ºC to 36.5 ºC on the four islands. *P. maritima* from a shallow lake with a salinity of 87.45 ppt and a temperature of 36.5 ºC on Buttonwood Key #7 were observed feeding. Other mollusks that were observed with soft tissue present on the islands are *Anomalocardia auberiana* (=*Anomalocardia cuneimeris*), *Angulus tampaensis*, *Cerithidea costata*, and *Cerithidea scalariformis*. In order to understand how these mollusks survive in this habitat, experiments were conducted in a controlled environment to attempt to revive *P. maritima* and *A. auberiana* that were collected from dry areas (soft tissue was present, but no active sign of life in the field) using water of varying salinities (0, 12, 30, and ~58 ppt). The specimens did not show any signs of life during the experiments, so the question remains whether these individuals would revive in the natural setting with introduced water or whether they were dead.

During the initial visit to Russell Key, a very dry hardpan surface with deep mudcracks was observed on the western side of the interior. Numerous very large adult *P. maritima* with soft tissue present were buried deep in the cracks. It appeared as though the mollusks burrowed down into the mudcracks as the water was drying up. The same site was revisited three days after the first visit and there was approximately 10 cm of water with a salinity of 1.23 ppt and a temperature of 28.3 ºC in the basin area with the mudcracks. The large *P. maritima* with tissue were still present and in life position. Additional studies need to be conducted to determine how these species survive these extreme conditions.

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PROJECT MANAGEMENT CHALLENGES ON A RESTORATION PROJECT UNDER MULITIPLE JURISDICTIONS (SESSION #22)

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The Picayune Strand Restoration Project (PSRP) was one of the first Project Implementation Reports completed and approved. The PSRP was authorized. in the Comprehensive Everglades Restoration Plan (CERP) under the Water Resources Development Act of 2007. The PSRP will restore overland flow to a 55,000 acre area that was overdrained by four large canals and crossed by a 260-mile network of roads. The canals and roads produced significant changes to the hydrology, vegetation and wildlife in the area. In addition, approximately 26,000 acres of adjacent public lands will have hydrology restored to a more natural hydroperiod resulting in significant restoration to those lands as well.

The planning, review, approval and construction of the PSRP has been an integrated partnership between federal, state, and local agencies that have worked jointly to move the project from the planning stage to a turn-dirt construction effort that has already begun to reap the benefits of restored hydrology. Prior to Congressional authorization the South Florida Water Management District (SFWMD), the non-federal sponsor, recognized the need to move forward with restoration since the ecosystem quality was continuing to decline. The SFWMD selected a subset of the features of the project alternatives that would provide immediate benefits. They performed detailed design, and then plugged the upper two miles of Prairie Canal in late 2003 through early 2004. Water levels returned almost immediately, desired vegetation sprouted, and wildlife and endangered species counts increased. In August of 2006 construction to plug the remaining five miles of Prairie Canal was begun and completed in late summer 2007. In addition the first phase of road removal was begun in October of 2006 and completed in October 2007 resulting in the removal of approximately 65 miles of roads in the same area of the project as Prairie Canal. In late 2007 the final design of the full project was completed by the SFWMD.

With Congressional authorization in late 2007 the US Army Corps of Engineers took the designs that had been completed by the SFWMD and moved forward with construction of the remaining features of the project – the Merritt, Faka Union, and Miller Pump Stations, road removal in Merritt and Faka Union construction footprints, and the east-west tie-back levee that connects the three pump stations together. In order to ensure that the ecological benefits are achieved and the project constructed as intended all of the state and federal agencies that were involved in the development of the plan participate in weekly construction calls, site visits and actively review all construction related providing input and guidance. The challenges of coordinating multiple agency perspectives and needs will be discussed and the affect those challenges have had on the construction of the Picayune Strand Restoration Project.

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DID FLOODING KILL THE GHOST TREE ISLANDS? EVIDENCE FROM HEALTHY EVERGLADES TREE ISLANDS AND THE LILA EXPERIMENTAL PLATFORM

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The Everglades is best known as an extensive grassy landscape shaped by slow-moving sheet flow, but much of its biodiversity is found in the forest fragments, or tree islands, that are embedded within the marsh. Recent water management has not adequately accounted for these forests, and in places has resulted in extensive tree island loss due to persistent flooding or to fire. The mechanisms underlying such losses are not completely known, but are likely to involve direct or indirect responses of trees to the local water regime. Better understanding of these responses is needed if water managers are to stay or reverse the ongoing decline in tree island condition, an important goal of the Comprehensive Everglades Restoration Plan.

The term "ghost island" has been applied to tree islands that have recently lost all or most of their forest canopy. Despite the absence of trees, they remain evident as landforms on current aerials. We examined the distribution of and water conditions experienced by woody plants in ghost islands surveyed in 2009 in WCA-2B. To provide a reference for comparison, we also conducted a parallel investigation of three intact tree islands in Everglades National Park (ENP). The probability of occurrence of trees decreased with increasing water depth in both intact and ghost islands. Though the likelihood of tree occurrence in ENP islands was higher than in ghost islands throughout the hydrologic range, trees became very infrequent once mean annual water depth (MAWD) approached 0.3 m in both island types. Finally, we compared the vegetation-hydrology relationships found in both data sets to flooding responses demonstrated by young trees in constructed tree islands at the Loxahatchee Impoundment Landscape Assessment (LILA) experimental site in Loxahatchee National Wildlife Refuge (LNWR). Survival for all eight species tested decreased with increasing water depth. Models for the four species normally found in well-drained Everglades's hardwood hammocks (*Bursera simaruba, Ficus aurea, Myrsine floridana*, and *Eugenia axillaris*) exhibited sharp decreases in survival as increased flooding pushed MAWD to -20 cm or more. Among the species more characteristic of swamp forests, only *Persea palustris* showed a similar level of sensitivity to high water conditions, while the survival functions of *C. icaco*, *M. cerifera*, and *Ilex cassine* declined much more gradually as water depth increased. Survival of two other swamp forest species, *Acer rubrum* and *A. glabra*, was uniformly high across the hydrologic gradient. These hydrologic relationships will aid in planning for tree island restoration, by providing insight on the elasticity of ecosystem recovery following mitigation of conditions responsible for degradation.

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A POPULATION APPROACH TO UNDERSTANDING MECHANISMS CONTROLLING THE SUBMERGED AQUATIC VEGETATION SPECIES *RUPPIA MARITIMA* L. (WIDGEONGRASS) AT THE EVERGLADES-FLORIDA BAY ECOTONE

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Ruppia maritima (widgeongrass) is a focal submerged aquatic vegetation (SAV) species for Everglades restoration in the southern estuaries and Florida Bay because of its importance in creating benthic habitat that supports high secondary productivity at the Everglades-Florida Bay ecotone. We are using a population-based approach to understand factors controlling *R. maritima* distribution and abundance, using recent in-situ experiments, laboratory and field data to quantify life history transitions and calculate population growth rates under conditions across the ecotone. In seasonal experiments, we quantified life history transitions from seed through sexually reproductive adult at field sites and followed germination, survival and clonal and sexual reproduction. We examined these transitions at two sites in the western and three sites in the eastern ecotone, ranging in abiotic and biotic conditions (salinity, temperature, light, nutrients [P], competitor SAV).

Seedling survival was low (<15% of seeds became adults), suggesting this life history stage is a "bottleneck" to population growth. However, survival of transplanted seedlings was 3x greater with phosphorus addition to sediments in the eastern ecotone along Joe Bay (JB), even with competitors present, indicating P-limitation also reduces seedling survival. Even with P addition, adult survival was similarly variable along the JB sites, exhibiting high within-site population stochasticity in the eastern ecotone. In contrast, adult survival was significantly greater in winter and spring under stable salinities in the western ecotone at West Lake (8-10 psu) in the absence of competitor SAV. Clonal reproduction rates were 2x greater, suggesting adult survival and clonal reproduction are important for the more robust populations in the western ecotone and perhaps a driver of reproductive meadows which are critical for new recruitment and maintenance of *R. maritima* at the Everglades Ecotone.

Sexual reproductive events have been connected to large meadows observed in the western ecotone (2011-present) at the onset of the wet season. These meadows have a markedly high density of total and short shoots (3232 and 2650 m^{-2}), linking clonal reproduction to *R. maritima* habitat and sexual reproduction. While the seed bank generally has low viable seed (~2%, <160 m^{-2}), greater total seed densities have been consistently found inside (>21,000 m^{-2}) than outside meadows where *R. maritima* is absent (<15,246 seeds m^{-2}; Strazisar et al. 2013, in prep), supporting a strong link between high seed densities and reproductive meadow development. Following dieback of a meadow in late summer, 21% of total seeds remaining in the seed bank were viable (3537 m^{-2}), indicating vegetation senescence did not occur because viable seed was exhausted, but perhaps due to seasonality in vegetation. Thus, viable seed production is likely required for *R. maritima* regeneration in subsequent years. In combination with low seedling survival and high population stochasticity in the east, our research indicates *R. maritima* populations at the ecotone are highly dependent upon seed production. Ongoing analyses will allow us to identify conditions under which populations increase or decline to better define minimum flows and levels to Florida Bay that promote *R. maritima* at the ecotone, reach restoration goals and predict this species' response to climate change and sea level rise.

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DYNAMIC WEB TOOLS FOR MODELING AND MONITORING DATA VISUALIZATION

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Online visualization of ecological model output and biological monitoring data can increase data utility and the efficacy of the data consumer. Although modeling and monitoring data are continually becoming more integrated into the Everglades restoration decision-making process, a long delay often exists between the collection or generation of data and the presentation of results. In many projects, this delay allows for the necessary analysis and synthesis of complex datasets into specific and meaningful recommendations. With some data, however, such as sightings of non-threatened and endangered species or outputs from a peer-reviewed forecasting model, delays may be unnecessary and exist only because of the lack of faster distribution mechanisms.

The Joint Ecosystem Modeling (JEM) group is engaged in two ongoing projects to present modeling output and monitoring data online without undue delay. The JEM Biological Data Viewer (JEM BDV) is a database-driven, online web map that displays data collected for various research projects in the Everglades and the southern Atlantic region. As data are entered into a project-specific database, the JEM BDV is automatically updated with these new data. Features in the system allow data to be spatially and/or temporally aggregated to obscure sensitive information. The potential also exists to detect and provide real-time alerts for biological events, such as the sighting of a species of interest or the initiation of a nesting period.

Additionally, a web-based framework has been developed to automate the preparation, execution, and display of ecological forecasting model output. The framework currently supports several models developed by the National Park Service and the U.S. Geological Survey, and is designed with flexibility to encourage future growth. Model output is typically generated weekly and presented online in several formats, including maps, tabular reports, and Network Common Data Form (NetCDF). A dynamic web page allows users to view and compare maps side-by-side, and can be deployed on multiple web sites for wider availability.

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ECOSYSTEM SERVICE VALUATION AND HYDRO-ECONOMIC OPTIMIZATION OF SOUTH FLORIDA WATER RESOURCES

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The South Florida Water Sustainability and Climate (SFWSC) project represents a multi-institution effort to develop a hydro-economic optimization model for the region's water resources over the next 50 years. The node-link network model will be used to investigate the economic dimensions of water resource allocations to the urban, agricultural and ecological systems of south Florida. In this scheme, socio-economic and ecological criteria (including criteria based on ecosystem services) developed for each of the major geographical units in south Florida will be employed in the network model to identify allocation strategies that meet specific management objectives. Minimizing the costs of not meeting urban, agricultural or ecological water demands, or maximizing the value of ecosystem services are some examples of the types of objectives explored using hydro-economic optimization models.

Draft optimization criteria have been developed from empirical relationships between: 1) consumption rates and price elasticity of residential drinking water, 2) the economic value of agricultural production and irrigation water supplies, and 3) flood damage and mean groundwater levels in urban areas. Willingness-to-pay surveys supplement literature-based estimates of the value of water-dependent Everglades ecosystem services. Special emphasis has been placed on the value of coastal fisheries and carbon cycling in the mangrove forests. New, data-driven relationships between the value of ecosystem services and Everglades hydrology will form the basis for additional criteria to be used in the regional model. Future efforts to refine the criteria for allocating water resources in south Florida will rely on stakeholder input. Plans to engage stakeholders in model testing and discussion of outcomes are underway.

The criteria used in regional management decisions play a key role in determining the sustainability of water resources. Hydro-economic optimization can provide key insights into the costs and trade-offs associated with various management objectives under a range of climate (IPCC AR5), sea-level rise and land use change scenarios. SFWSC efforts to employ these methods in south Florida will be discussed.

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HYDROGEOCHEMICAL RESPONSE OF EXPERIMENTAL EVERGLADES TREE ISLANDS (FLORIDA, USA): IDENTIFYING FEEDBACK MECHANISMS ASSOCIATED WITH EARLY TREE GROWTH AND DIFFERING GEOLOGIC MATERIALS

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Recent evidence suggests the interaction between biological and physical feedback mechanisms supports the spatial heterogeneity of wetlands, and thus helps maintain the biodiversity and function of the ecosystem. In the Everglades, one feedback mechanism that has been identified to maintain landscape heterogeneity by promoting tree island stability is the *transpiration-driven nutrient accumulation* mechanism. Here, transpiration by overlying trees draws groundwater into the islands, creating a hydrologic sink that traps and stores solutes and nutrients. While mounting evidence support this as a dominant mechanism in Everglades tree islands its now critical to: 1) quantify the conditions when the transpiration-driven nutrient accumulation mechanism initiates; and 2) determine if variations in underlying geologic materials and overlying forest structure at an island's inception governs the evolution of the groundwater geochemistry.

To elucidate the influence of early tree growth and geologic materials on tree island hydrodynamics and shallow groundwater chemistry, water chemistry was monitored biannually from 2007 through 2012 on eight recently planted experimental tree islands with different geologic materials. Groundwater, surface water, stem water and soil water chemistry were analyzed for oxygen and hydrogen stable isotopes to determine the source water for transpiration by the tree. Water isotopes coupled with year-round monitoring of water temperature was used to evaluate groundwater-surface water interaction. Groundwater and surface waters were also analyzed for major ions, and total and dissolved nutrient concentrations to determine influence on nutrient and mineral accumulation. Biannually measured tree heights were converted into aboveground biomass estimates (using allometric biomass equations) to determine the interaction between underlying groundwater geochemistry and aboveground biomass.

Results provided direct hydrologic evidence that transpiration of overlying trees led to the advective movement of water and associated ions toward the center of the tree islands. The observed increase in aboveground biomass was concurrent with the accumulation of ions and reduction in nutrient concentrations in the tree island groundwater. Here, limestone tree islands had an increased interaction with surrounding regional water compared to the peat tree islands, which led to geochemical conditions that favored the precipitation of calcium carbonate minerals in the center of the limestone islands. Forest structure and underlying geologic materials mediated the *transpiration-driven nutrient accumulation* mechanisms on these nascent islands.

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HYDROPERIOD APPROACH FOR A NON-FLAT WORLD

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Microtopography – small variations in land surface elevation over short distances – can have important hydrologic and ecologic impacts, particularly in wetland environments. For example, small areas of slightly higher and dry ground in an otherwise inundated wetland can provide critical bird nesting habitat; likewise, small areas of slightly lower and inundated ground in an otherwise ephemerally dry wetland can provide amphibian and fish habitat. Several measures of hydroperiod that acknowledge the effect of microtopography – as defined by a probability distribution function of land surface elevations - are introduced and shown to convey an enhanced description of the partial areal inundation and variable depth distribution. A time series of fractional inundation is proposed as more descriptive of inundation history than the traditional binary (wet or dry) time series. Statistical exceedance curves are presented to describe the probability of any given level of fractional inundation. These curves provide enhanced information on inundation beyond that of a single probability of inundation based on a “flat” wetland approach. Computation of the distribution of water depths in a microtopographic environment is suggested as a preferred measure of water depth over the single-valued depth approach frequently used when microtopography is ignored. Correlation of these enhanced hydroperiod measures with parallel measurement of ecologic form and function could provide improved understanding and predictive capability of the response of an ecosystem to hydrologic changes. Incorporation of microtopography considerations in the methods used by the USGS Everglades Depth Estimation Network (EDEN) could offer the opportunity to further enhance this already exceptionally useful tool.

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THREE DIMENSIONAL MODEL EVALUATION OF PHYSICAL ALTERATIONS OF THE CALOOSAHATCHEE RIVER ESTUARY: IMPACT ON SALT TRANSPORT

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Numerical hydrodynamic modeling provides quantitative understanding of how physical alterations of an estuary may alter the waterbody hydrodynamics and the rate of mixing with the ocean. In this study, a three dimensional hydrodynamic model (CH3D) was used to compare simulated salinities between the existing condition and five historical cases representing physical alterations of the Caloosahatchee Estuary including (1) removal of the headwater structure (S-79); (2) removal of the downstream causeway (Sanibel); (3) backfill of oyster bar near the estuary month; (4) backfill of the navigation channel; and (5) the pre-development bathymetric condition. The results suggested that some alterations including the Sanibel Causeway, removal of oyster bars and the S-79 structure may have some local effects but did not change estuarine salinity structure significantly. Filling in the navigation channel had a much more profound effect, resulting in a dry season salinity reduction of about 5 when compared with the existing condition. The reduced salt transport was more pronounced with the pre-development bathymetry because the estuary as a whole was much shallower than today. Theoretical analyses suggest that estuary depth and cross-sectional area have a significant effect on salt transport with increasing depth and larger cross-sectional areas leading to enhanced salt intrusion into the upper estuary. The significant system-wide increase in salt transport caused by the historic dredging of the navigation channels in the Caloosahatchee Estuary has significant implications in the development of realistic environmental flow targets for protection of the estuarine ecosystem.

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SPATIAL AND TEMPORAL TRENDS IN WATER QUALITY AT THE A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE: AN ASSESSMENT OF LONG-TERM RESTORATION

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The A.R.M. Loxahatchee National Wildlife Refuge (Refuge) developed as a soft-water, oligotrophic ecosystem and the ecology was driven by rainfall and surface water sheetflow as the system was historically connected to the Greater Everglades. Presently, the Refuge receives a large fraction of its annual water supply as nutrient and ion-enriched agricultural and urban runoff discharged to canals surrounding the Refuge. Intrusion of this canal water into the Refuge marsh has adversely impacted the ecology, causing ecosystem alterations such as reducing periphyton assemblage quality, decreasing growth rates of sensitive and desired vegetation species (e.g., *Xyris spp.*), and converting sawgrass to cattail. By 2004, two stormwater treatment areas (STA) were constructed and operated to reduce phosphorus levels delivered to the Refuge. To understand Refuge restoration as a result of the operation of these STAs, a network of water quality sampling stations (enhanced water quality monitoring network) were established in mid-2004. The monitoring network is mostly focused in the perimeter of the Refuge, where little characterization of water quality had occurred. Coupled with the historic water quality monitoring network, mostly focused in the interior of the Refuge, a broad spatial understanding of the Refuge water quality dynamics is possible. Here, we examine a decade of water quality data collected in the Refuge to understand how water management operations have influenced restoration.

To assess the progress of restoration on the Refuge, we examine several water quality parameters as they relate to federal, state, and/or ecological thresholds established for the Everglades and assess how they have responded to water management operations. Specifically, we examine time-series for total phosphorus, dissolved oxygen, specific conductance, and sulfate as they relate to their respective thresholds. We combine these parameters together to establish a water quality index that simply and quickly reveals areas of degrading, stable, or improving quality and we relate this metric to a vegetation metric recently designed for the Refuge. Our findings show that there have been long-term declines in total phosphorus levels delivered to the Refuge and in the canal surrounding the marsh, improvements in water quality at some locations in the Refuge marsh, but further degradation in other locations. Improvements in water quality are linked to improvements in STA discharges, and complex water management operations aimed at reducing canal water intrusion into the marsh, which is most evident along the eastern side of the Refuge. While improvements in water quality are evident, further work (i.e., STA expansion) is warranted to further Refuge restoration.

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EFFECTS OF SEA-LEVEL RISE AND WATER MANAGEMENT ON THE HYDROLOGIC IMPACT OF HISTORIC STORMS

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Large storm events have had significant impacts on the hydrologic system of South Florida, especially in terms of long-term coastal ecology and groundwater quality. Simulations of these historic storms focus on factors that affect inundation and long term salinity to evaluate past, present, and future impacts. With changes in water-management infrastructure, antecedent conditions and climatic forcings, two identical storms occurring at different historical periods will not have the same effect on hydrology. The only way to predict the effects of identical storms striking during different time periods is through hydrologic simulations that account for the relevant physics and conditions. The U.S. Geological Survey has developed a coupled hydrodynamic surface-water and groundwater simulator called FTLOADDS and applied it to the Miami-Dade County area. This model was calibrated to simulate the recent 1996-2004 period, and then modified to hindcast conditions for the 1926-1940 period based on available historical information. Hindcasts are useful to evaluate hydrologic changes; besides differences in surface-water inflow and sea-level, the network of water-management canals was far less developed during the hindcast period.

The hindcast period includes the Great Miami Hurricane of September 18, 1926, so representative rainfall, wind, and storm-surge data for the hurricane were developed from limited measurements, anecdotal information, and spatially-distributed wind approximation from known values for Hurricane Wilma in 2005. The effects on inundation are quite different than a simulation with a spatially-uniform wind. As much as one month after the hurricane, the simulation of spatially-uniform wind has 1.25 square kilometers more inundation than the simulation of spatially-variable wind. Further improvements in the storm-surge component of the simulation are planned by interfacing with the NOAA SLOSH model, which simulates the offshore buildup of the surge.

In order to compare effects of identical storms during different historical periods, the parameters developed for the 1926 Great Miami Hurricane were applied to the modern simulation for the date September 18, 1996. Results showed surface-water salinity intruding substantially further inland during the modern period than the hindcast period. A plausible cause for this increased storm-surge salinity deposition within the modern simulation is the 0.173 m increase in mean sea-level when compared to the hindcast simulation. Structural and management differences between the hindcast and recent periods must be considered as well, so an additional simulation was implemented that incorporated all canals and other historic features from the hindcast period with sea-level from the recent period. This simulation produced a similar post-storm salinity configuration as the recent simulation, except at locations near canals. These results indicate that the water-management canals may not be efficient in preventing inland salinity incursions when major storms occur at higher sea levels.

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INSIGHTS INTO FEEDING ECOLOGY, TIMING OF EGG FORMATION, AND GEOGRAPHIC RANGE OF WATERBIRDS FROM SOUTH FLORIDA USING THE STABLE ISOTOPIC COMPOSITION OF CARBONATE (C & O) AND THE ORGANIC MATRIX (C & N)

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The $d^{13}C$ and $d^{18}O$ have been measured in the carbonate portion of ~ 440 eggshells collected between 1988 and 1989 from the Everglades and Florida Bay representing nine different species of wading birds (Great Egret, Great White and Great Blue Heron, White Ibis, Roseate Spoonbill, Little Blue Heron, Snowy Egret, Tricolored Heron, and Reddish Egret). In addition shells from Ospreys also were measured for comparison and the $d^{13}C$ and $d^{15}N$ was measured in the organic matrix of the egg shells of 285 of the same samples. The $d^{13}C$ and $d^{15}N$ was also measured in the organic matrix. These analyses showed major differences between the Everglades and Florida Bay, with the samples from the Everglades having lower $d^{13}C$, but more positive $d^{18}O$ values, compared to Florida Bay. The difference in the $d^{13}C$ values represents a fundamental difference in the $d^{13}C$ of the organic material at the base of the food chains. In the Everglades the $d^{13}C$ is controlled by particulate organic material derived from terrestrial vegetation, while in Florida Bay the $d^{13}C$ is controlled by seagrasses and other marine plants. The positive $d^{18}O$ reflects enrichment in ^{18}O of the water as a result of evaporation in the Everglades compared to Florida Bay during the period of egg formation. All of the samples exhibited similar $d^{15}N$ values and the absence of positive correlation between $d^{13}C$ and $d^{15}N$ suggests that either the birds are feeding at generally similar trophic levels, or that the d ^{13}C and $d^{15}N$ of the organic material in the eggshell is not an effective trophic indicator in these environments.

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LARGE CORALS IN FLORIDA BAY: FAITHFUL RECORDERS OF THE ENVIRONMENTAL CONDITIONS OVER THE PAST 200 YEARS

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Two large specimens of the coral *Solenastrea bournoni,* located in Lignumvitae Basin within Florida Bay and with density banding extending back into the early 19th century, have since they were first discovered in the 1980s, provided information on the salinity, temperature, and general health of Florida Bay prior to the existence of actual measurements in the region. Some 20 years after the coral were cored in 1986, we drilled another core from one of the corals in 2008 and performed detailed geochemical analyses (d^{13}C, d^{18}O, Sr/Ca, Mg/Ca, and Ba/Ca) linking the new analyses to the previous records. This has allowed an assessment to be made of efforts to remediate hydrological conditions as recorded in the geochemistry of the coral skeletons and compare this to the actual water quality record over the same time period and reassess previous interpretation of conditions in Florida Bay over the past ~200 years.

Prior to 1986 a notable feature of the coral geochemistry was a decrease in the d^{13}C of the skeleton several times greater than that observed in atmospheric CO_2 and recorded by other corals in the region. This decline accelerated at the time of the railway construction and was ascribed to be a result of the increased oxidation of organic material delivered to Florida Bay and the lack of exchange of water between the Bay and the open ocean. Since 1986 the rate of decline has stabilized and in fact when the rate of decrease in d^{13}C is calculated between 1960 and 2008, it is comparable to the average decrease for the period. In essence there has been no further decrease in d^{13}C in Florida Bay since ~1990. This suggests that over this time period that the exchange between Florida Bay and the surrounding waters has increased, either as a result of natural variability in the environment or because of efforts designed to increase the water throughput into Florida Bay. An increase in throughout of freshwater is supported by a decrease in the d^{18}O values and a steep decline in the Sr/Ca ratio of the skeleton between 1990 and 1995. The decrease in Sr/Ca in the coral skeleton might normally be attributed to an increase in temperature, but in the case of Florida Bay, the Sr/Ca of the water is strongly correlated with salinity as Florida Bay receives mixtures of seawater with a normal Sr/Ca ratio, rainwater, with essential no Ca or Sr, and groundwater, which was a high concentration of Ca and very little Sr (hence a very low Sr/Ca ratio). Finally this decrease in salinity, while not evident in the mean salinity of Florida Bay is present if one examines only the salinity from Lignumvitae Basin over this time period. Such analyses confirm that the coral skeletons from Florida Bay are faithful recorders of conditions in the environment in which they are found.

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MEASURING HIGH-FLOW SEDIMENT DYNAMICS TO DETERMINE A HYDRAULIC THRESHOLD FOR RESTORING THE RIDGE AND SLOUGH LANDSCAPE

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The Everglades ridge and slough system plays a critical role in the function of the Everglades ecosystem by creating connectivity for organisms to disperse, thrive and create a diverse and productive food web. The Decompartmentalization Physical Model (DPM) aims to develop a flow benchmark necessary to create a self-sustaining ridge and slough ecosystem in the central Everglades. An overview and additional details of the DPM experiment are provided elsewhere in several companion abstracts for GEER2015 (e.g., see abstract by Harvey and others). Here we describe measurements of flow and sediment dynamics at the DPM.

Flow velocities were measured at approximately twenty stations within the DPM experimental area. Water flow velocity was measured continuously during the wet season at ten stations using continuously recording 10 megahertz (MHz) down-looking Acoustic Doppler Velocimeters (ADV). For shorter term deployments of hours up to one day we also used Vectrino ADVs. These instruments are deployed at fixed depths in the water column in cradles that attach to research docks. The instrument cradles are adjustable which allowed us to collect velocity profile data at selected times during the wet season. At sites not located near research docks we also sometimes used standard USGS Flow Tracker ADVs which have lower accuracy and a higher threshold for reliable flow detection (approximately 1 cm/s). Microtopography was characterized by measuring three replicate depths from the water surface to floc surface using a measuring tool constructed of CPVC pipe calibrated with a metric scale that was fitted with an I-shaped CPVC foot. These topographic measurements were made at selected ridge and slough sites over time during the study and more frequently during the time period before, during, and after the two to three months high-flow releases.

Suspended sediment concentrations (SSC) were paired with flow measurements and particle size measurements. Water samples were pumped slowly (60 ml/min) from the water column and pre-filtered through a 500 micron Nitex screen into one liter bottles that are stored cool and out of the light until analyzed for particle size in the field and SSC in the laboratory. Laboratory analysis included vacuum filtering through a 0.7 µm filter (Whatman GF/F) to obtain total suspended sediment dry mass at the site. Suspended sediment samples were pumped from fixed depths (usually mid depth) at all stations with flow measurements. Six locations were measured across one ridge to slough transect and two locations were measured at endpoints on another ridge to slough transect. At each location we measured SSC at a fixed depth of 5 cm above the flocculent sediment bed. Samples from three depths representing upper, mid-depth, and near bed sample depths were collected at the transect endpoints. Flow speed and SSC data were combined to calculate suspended sediment loads prior and during experimental high flows.

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HYDROLOGIC MODELING OF PROPOSED RESERVOIR IN WEST MIAMI DADE TO SUPPLY FRESH WATER FOR ENVIRONMENTAL RESTORATION OF BISCAYNE NATIONAL PARK

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An integrated surface and subsurface numerical model was used to provide regional hydrological analysis of proposed fresh water reservoir in West Miami-Dade County. The reservoir will be constructed using the existing rock mine just adjacent to L-31N canal west of Miami, which provides natural capture zone for the seepage east of L31N. The reservoir has a very favorable geology, with low conductivity at the bottom layer at elevation -43 feet. The facility will cover 1,800 acre and will provide 90,000 ac-ft of static storage of excess fresh water collected from runoff and seepage during the wet and dry seasons. Fresh water will be available for seasonal releases into the regional canal system for environmental restoration of Biscayne Bay, combat sea level rise and to provide water availability assurances for Biscayne National Park and Miami-Dade County as required by CERP. The operation of the reservoir is based on capturing the excess water from L-31N during the wet season and the natural groundwater seepage from ENP toward Biscayne Bay, and subsequent controlled release of the stored water as needed to improve year-round flows to the Biscayne National Park. This will add capacity to equalize seasonal hydrologic fluctuations and will provide a source of fresh water which will be available to improve the hydroperiods of regionally significant wetland systems. This reservoir will increase the regional availability of water along Biscayne Bay and will serve as natural source for recharging wellfields and is consistent with the below ground reservoir concepts as envisioned in CERP.

The numerical model was used to investigate the regional hydrology and the excess water which is available for the region, and demonstrated that the reservoir will provide annual capacity up to 338,000 ac-ft of dynamic storage without impacts on adjacent lands and ecosystems. During the dry season (November-May), the reservoir can provide continuous supply of freshwater up to 300 cfs. During the wet season, the reservoir can provide continuous supply of 550 cfs with peak flows up to 800 cfs during August and September without impacts to Everglades National Park, wellfelds or wetlands. The proposed releases to Biscayne National Park will create a freshwater head to maintain fresh/saltwater interface. Additionally, the reservoir will have significance for better management of stormwater drainage. The proximity of the reservoir to the West Well Field will ensure long-term water availability for the Miami-Dade County and the South Florida region under the uncertainties of Climate Change. The reservoir operation can provide significant support for the Central Everglades Plan and the Biscayne Bay Coastal Wetlands, Phase 2 project currently under development by the South Florida Water Management District (SFWMD) and the United States Corps of Engineers (USACE). Based on its strategic location, the reservoir can be used for potential public use opportunities and will be an important infrastructure component for long term adaptation of Miami-Dade County and the region for the impacts of Sea Level Rise and Climate Change.

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AN EXAMINATION OF THE NET METHYLMERUCRY PRODUCTION IN THE FLORIDA EVERGLADES USING A EULERIAN APPROACH

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Concerns over elevated Hg levels in fish and wildlife of the Florida Everglades, home to an extensive ecosystem restoration, are well documented. Canal waters draining to the Everglades from the north are enriched in sulfate (SO_4^{2-}) which originates within the Everglades Agricultural Area. Microbially-mediated SO_4^{2-} reduction is a key process leading to the formation of methylmercury (MeHg). Our research over the past 15 years has clearly demonstrated the link between SO_4^{2-} releases and MeHg production, but previous to this effort we had not revealed the systematic trends in total mercury (HgT) and MeHg along a flow path across the native marshes.

In an effort to better understand the inter-relations between SO_4^{2-} entrance points to the marshes and net MeHg production in surface waters, a Eulerian sampling strategy was employed. We collected surface water and porewater data along transects aligned with the general flow direction of Water Conservation Areas (WCA) 2A and 3A. The WCA-2A transect spans 14 km and runs from the midpoint on the L-6 canal to the center of the marsh. In WCA-3A, the transect follows the flow path from the terminus of the L-28 canal to the S-12 spillway (35km). Along both transects, SO_4^{2-} and dissolved organic carbon (DOC) concentrations are highest near the canal and decrease exponentially along the flow path. In WCA-2A, HgT and MeHg concentrations in surface water steadily increase with distance from the canal, reaching maximum levels about 3-4 km from the canal and then remain relatively constant. MeHg in the porewater were greatest at the sites furthest downstream. Near the canal, elevated sulfide levels resulting from the high SO_4^{2-} loading serves to suppress MeHg, but with dilution of SO_4^{2-} downstream from the canals, greater production of MeHg is evident. Where SO_4^{2-} concentrations are optimal for MeHg production and photo-demethylation rates are low due to relatively high DOC content, we observe the greatest MeHg accumulation levels. In regions where MeHg concentrations plateau, MeHg production and degradation rates are roughly equal.

Along the WCA-3A transect, maximum surface water HgT and MeHg concentrations were measured at the terminus of the L-28 canal. The Hg concentrations decrease toward the center of the marsh and then subtly increase near the S-12 canal. Porewater MeHg concentrations followed a similar longitudinal trend to the MeHg in surface water. Maximal MeHg concentrations near the L-28 canal terminus are the result of optimal SO_4^{2-} concentrations for MeHg production. Downstream, as surface water flows across the marsh and SO_4^{2-} and DOC decrease, MeHg levels likewise decline. The S-12 canal levee impedes water flow prior to entering Everglades National Park, allowing SO_4^{2-} enriched canal water to infiltrate the marsh, resulting in an increase in MeHg at the termination of WCA-3A.

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APPLICATION OF SYNTHETIC FLOC TO EVALUATE SEDIMENT TRANSPORT IN THE DECOMPARTMENTALIZATION PHYSICAL MODEL PROJECT

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Particle transport is essential for the development and maintenance of the Everglades ridge & slough landscape by redistributing entrained sediments. The Decompartmentalization Physical Model (DPM) is a landscape-level field test to reduce uncertainties associated with sheetflow, sediment redistribution and the resulting characteristic patterning and microtopography. The DPM utilizes a "Before-After-Control-Impact" (BACI) experimental design, consisting of field monitoring of hydrologic and biological parameters under low flow (baseline) and high flow (impact) conditions in both impacted and non-impacted sites. To evaluate scientific hypotheses associated with the sheetflow and canal backfilling uncertainties, the DPM uses an inflow structure (S-152) consisting of 10 gated culverts on the L67A to provide high sheetflow velocities into an area between the L67A and L67C levees known as the pocket.

To measure sediment movement and redistribution, we used a dual signature tracer (DST) hydraulically matched (i.e., representative) of the mean particle size and settling velocity of particles collected from the study region. The DST particle is an inert fluorescent material in which magnetite inclusions are imbedded. DST was deployed during the 2013 and 2014 DPM high flow events at impact and non-impact (control) sites within the DPM footprint. Two experiments were designed to assess particle transport: a spatial experiment to assess the direction of DST particle movement, and a temporal experiment to assess DST particle transport velocities. For both experiments, DST was deployed in a slough prior to the opening of the S152 structure. To measure spatial movement, 20-24 magnets were placed radially around the deployment location and retrieved the week after the initial flow. DST collected on each magnet was then dried and weighed. To measure DST velocities under high flow, sequential magnet deployment/retrievals were conducted at 15- to 30-minute intervals, at two boardwalks 20-m and 50-downstream of the DST deployment location, both spanning slough-to-ridge transects.

The spatial experiment demonstrated that DST was entrained under high flows created by the S152 structure and travelled in a southerly direction. At the low-flow site, DST travelled mainly east, consistent with baseline landscape flow. The temporal experiment demonstrated two distinct peaks in DST abundance at both downstream locations, but mainly in the slough. Based on the timing of these peaks, we estimated particle transport velocities of 0.6 (peak 1) and 0.4 cm/s (peak 2). These velocities were lower than water velocities measured with ADVs (2-6 cm/s), dye, and velocities estimated from the timing of turbidity peaks landscape-wide. These results indicate sediment movement may vary depending on different types of sediment considered.

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STORMWATER PONDS OF SW FLORIDA COULD DEAL A BLOW TO GEER

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The Greater Everglades Ecosystem (GEE) is characterized by a summer wet season with maximum precipitation occurring between May and September and relatively drier conditions the remainder of the year. Prior to extensive human development, rainfall making landfall during the dry season would fall on pervious surfaces which would recharge the aquifer, provide needed water for plant growth and would thus be constrained to land boundaries. Larger rainfall of the rainy season would not only cause these effects but would also yield runoff across the landscape thus bringing water diffusely to the coastal systems or, would provide flow to many hydrosystems including lotic systems reaching ultimately the coasts. Additionally, as water travelled horizontally and vertically across the landscape, water would be stripped of nutrients by the oligotrophic primary producers' characteristic of the region and thus supported a healthy food chain. The alteration of these hydro-patterns and oligonutrient dynamics post human development (circa 1920's) has been the focus of CERP with Everglades restoration being central. However, another aspect of the larger GEE hydrosystem that has largely been overlooked includes manmade stormwater retention/detention ponds south of Lake Okeechobee. The vast urban region bordering both sides of the River of Grass encompasses many small ponds which number about 10,000 in Lee and Collier Counties alone. Most of these ponds are about 2 acres in size and account for 1.8 and 0.8 percent of Lee and Collier County's surface area, respectively. In addition to their original function as borrow-pits, providing fill to elevate roads, houses and other structures, these ponds offer flood mitigation and water treatment benefits. Especially since 1982 an important design criteria in pond construction has been to retain/detain water and associated nutrient resulting from runoff of impervious surfaces. This is especially apparent during the dry season. Because of this pond-driven interception of flow, water deliveries to the coastal systems are delayed in as they were previous to the extensive human development with up to 80% of nutrients and other pollutants being retained. Detention ponds (ie. drainage pond as opposed to retention/seepage ponds) then release limnologically-treated water during the rainy season via overflow to nearby canals that ultimately empty downstream into natural freshwater and marine systems. Unfortunately, the ponds' aforementioned limnological (but not hydrological) functions have been altered because a large fraction of these systems are often surrounded by lush well-manicured, watered and fertilized monospecific turf. Some ponds are constructed with convoluted perimeters to maximize waterfront development enhancing the potential pollutant sources. Some ponds are also directly fed with reclaimed water to be treated in lieu of e.g. releasing such water in natural lotic systems. Because "unaesthetic" periphyton mats and macrophytes benefit from added nutrients, these ponds are heavily managed with algae-/herbicides thus negating the nutrient sequestration of the ponds. Ultimately, nutrients and the chemicals used are released downstream with documented disastrous effects. Since the number of constructed ponds closely tracks the exponentially-increasing coastal human population, pressures onto the natural downstream ecosystems of the GEE will increase.

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USING FOSSILIZED CHARCOAL AND ^{210}PB TO TEST THE EVERGLADES FIRE HISTORY GEODATABASE

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Fire in the south Florida landscape has historically been influential in shaping the Everglades ecosystem. Understanding the relationship among hydrology, soil formation, and fire is critical for maintaining the complex biotic components of the Everglades. As a result, the Everglades National Park (ENP) has documented fire events since 1948, and these data have been entered into an ESRI geodatabase for use in park planning, operational functions, fire management activities, and fire ecology studies. According to this geodatabase, 757,078 hectares of wetlands burned in the ENP from 1948 to 2011, some of which have burned numerous times. However, the records in the database also suggest that some wetland areas have not burned during this time. Consequently, we question whether the wetlands that are documented as unburned are correct. To test the accuracy of these data in the geodatabase, we sampled fossil charcoal and ^{210}Pb from sediment collected in areas with well-documented fire events and areas with no documented fire events. We examined these fossil charcoal samples to reconstruct local fire histories and to identify whether areas in the ENP have had fire events that were not documented in the geodatabase.

Fossil charcoal was first recognized for use in historic fire reconstruction in pollen slides in 1941. Since that discovery, fossil charcoal has been utilized in many studies as a means of establishing historic fire events. Charcoal is formed by incomplete combustion of plant material and can be deposited into sediment, washed into lakes, or transported via air to other locations downwind of the fire. Charcoal is inert and is well preserved in sediment, making its presence useful for fire history reconstruction.

By dating charcoal peaks with ^{210}Pb in agreement with ^{137}Cs fallout peaks, we were able to correlate historic fires down core with documented fires in the geodatabase at one of our sites. However, at this same site, two fire events happened in 2001 and 2005. Based on ^{210}Pb dates, there are no charcoal peaks during these time intervals. We hypothesize that these fire events may have been short-lived or too small to produce measureable fossil charcoal at this site. At another site with no documented fire events, we found a charcoal peak between 1950 to 1980 based on ^{210}Pb dates. We postulate that this represents gaps in the geodatabase. Therefore, we conclude that using fossil charcoal along with ^{210}Pb dating is a useful tool for fire history reconstruction.

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IMPACT OF WATER MANAGEMENT ON RICE YIELDS, RICE WATER WEEVIL INFESTATION AND DRAINAGE WATER QUALITY IN THE EVERGLADES AGRICULTURAL AREA

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Reducing the oxidation loss of organic matter and preserving the organic soils in the Everglades Agricultural Area in south Florida is important for agricultural production and the environment. Growing flooded rice can help mitigate losses by maintaining anaerobic conditions of flooded fields throughout the growing season. However, rice production requires more water than other crops. In addition, rice water weevil, *Lissorhoptrus oryzophilus* Kuschel, is the most destructive insect pest of rice in the United States. This study was conducted to see the effects of flood level and midseason drawdown on rice yields, rice water weevil infestation, water saving and drainage water quality. Four water level treatments: 15 cm continuous flood with midseason drawdown, 5 cm continuous flood with midseason drawdown, 15 cm continuous flood, and 5 cm continuous flood, and two rice cultivars: Cheniere and Taggart, were tested in a 2.4 ha split-plot experimental design with four replications. Phosphorus concentration was measured from water samples of inflows and outflows of each experimental plot. Rice grain yields were not significantly different between treatments and the average yield was 4.6 Mg. Phosphorus concentration reduction was highest in 15 cm continuous flood at 58% and lowest in 5 cm midseason drawdown, with an overall reduction of 46% on average. Rice water weevil larval density in the 15 cm flood was significantly higher (39%) than 5 cm flood. Shallow flood water level appears to be an effective cultural method for controlling rice water weevil infestation and also with practicing the single midseason drawdown, 3600of water per day can be conserved.

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DEVELOPMENT AND DEMISE OF FLORIDA'S CORAL REEFS: THE ROLES OF CLIMATE, SEA LEVEL, AND REGIONAL HYDROLOGY

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The coral reefs of the Florida Keys Reef Tract (FKRT) are a vital part of the greater Everglades ecosystem. The structure provided by these reefs not only contributes critical habitat for a variety of marine organisms, but is also crucial to protecting Florida's shorelines. Unfortunately, the progressive degradation of the FKRT in recent decades and the continuing impacts of global climate change are threatening the future of Florida's reefs and the key ecosystem services they provide. One way to gain insight into the future of this valuable ecosystem is to assess the response of Florida's reefs to environmental changes in the past. We used paleoecological records from cores of reef frameworks throughout the FKRT to evaluate the millennial-scale environmental drivers of development during the Holocene.

Although the decline in Florida's coral populations is a recent phenomenon, most reefs along the FKRT have grown (accreted) little over the last 4000 years and are, therefore, thought to be geologically senescent. Using our core-records, we have generated new records of Holocene sea-level changes, oceanography, reef accretion, and coral-reef paleoecology in the run-up to historic reef shutdown. We use these records in combination with existing records of regional climate to evaluate hypotheses about the environmental drivers of reef development and demise and the connections between the FKRT and the broader Everglades ecosystem. We demonstrate that the development of the FKRT has been tightly linked with that of the Everglades throughout the Holocene because the history of both ecosystems was strongly controlled by regional-scale changes in climate and sea-level. We also test the hypothesis that changes in regional hydrology associated with the expansion of the Everglades after the mid-Holocene may have contributed to the shutdown of reef development in the some parts of the FKRT during that time period. The paleological parallels between the FKRT and the Everglades suggest that these valuable ecosystems may share similar vulnerabilities to the impacts of climate change in the future.

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THE TROPHIC HYPOTHESIS: LONG-TERM TRENDS IN WADING BIRD PREY SPECIES IN THE FRESHWATER EVERGLADES

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The Trophic Hypothesis is a conceptual model linking human management actions to the production of wading birds through a food web that is shaped by hydrological variation. This model is an important element of assessing the Comprehensive Everglades Restoration Plan (CERP) because recovering historical patterns of wading bird production is an important goal of Everglades management, with strong support from the public. Small fish and crayfish are central elements of the trophic hypothesis because they are prey of wading birds and food availability during the nesting season is believed to be a limiting step to wading bird population dynamics. It is also hypothesized that the Everglades of today is not producing high quality foraging patches at the times and locations needed by wading birds compared to the historical ecosystem.

We report results from long-term monitoring of fish and macroinvertebrates in Water Conservation Areas 3A (6 sites), Shark River Slough (6 sites) and Taylor Slough (3 sites) using 1-m^2 throw-trap sampling and airboat-mounted electrofishing. Data were collected from 1996 to the present. Small fish biomass (species susceptible to throw trap collections, approximately 15mm to 8cm) declined monotonically at many sites over the study period, particularly in Shark River Slough and Taylor Slough. After statistically removing effects of short-term hydrological variation such as depth at the time of sampling, 4 of 6 sites in Shark River Slough, 2 of 3 sites in Taylor Slough, and 2 of 6 sites in WCA 3A revealed significant negative trends. The regional average decline in biomass over the 16 year period in Shark River Slough was 9.5%, in Taylor Slough was 11.2%, and in WCA 3A was 3.8% (two additional study sites north of Alligator Alley were excluded from this analysis, but showed marked decline in biomass). Fish species composition also changed directionally to increased frequency of rapidly colonizing species at 3 of 6 sites in Shark River Slough and 2 of 3 sites in Taylor Slough; 3 of 6 sites in WCA 3A displayed significant change in community composition over this period, but not reflecting life history differences associated with hydroperiod. Crayfish biomass displayed less marked directional change over the study period, but marked directional change in species composition. All three regions displayed marked decrease in relative biomass of the long-hydroperiod dominant species *Procambarus fallax* after the dry year of 2001 (as well as a marked biomass decline in Shark River Slough and WCA 3A); two regions (Shark River Slough and Taylor Slough) displayed a marked increase in biomass of the short-hydroperiod dominant species *P. alleni* after that year. Electrofishing targeting species over 8-cm standard length revealed a decline in catch-per-unit-effort over the 16-year study period in Shark River Slough and Taylor Slough, but not in WCA 3A. This pattern was present in statistical models with and without corrections for the effects of drying events (days since the site was last dry).

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INTEGRATING TREE ISLAND METRICS TO UNDERSTAND POTENTIAL MECHANISMS FOR PAST DEGRADATION AND FUTURE RESTORATION

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In the Everglades, tree islands are considered characteristic of the ecological "health" of the landscape. Phosphorus (P) levels in upland tree island soils are >100 times higher than P in adjacent marsh soils. Of primary concern is maintaining tree island soil P to prevent P enrichment of local marsh communities. Hydraulic and geochemical properties are key to understanding how the structure and function of tree islands can be maintained and restored and are critical parameters with which to monitor the "health" of tree islands. This project was developed to compare hydraulic and hydrogeochemical patterns at multiple temporal and spatial scales of four Everglades tree islands in the Water Conservation Areas (WCA): wet, intact (3AS3-WCA3A); wet, degraded (Ghost Island-WCA3A); dry, degraded (Twin Heads-WCA3B) and dry, degraded (3BS2-WCA3B).

The daily and seasonal pattern of plant water use and water quality parameters including P and chloride concentrations in soil water, groundwater and surface water have been measured for the last three years. We are also monitoring isotopic composition of dominant plant species and water sources (soil water, surface water/groundwater). The characteristic patterns associated with "healthy" and degraded islands will be discussed. Findings that illustrate mechanisms by which tree islands may become degraded and how they may be restored will also be discussed. For example, healthy tree islands exhibit strong spatial and temporal variability in plant water uptake (evapotranspirative drawdown) and clear evidence for ion accumulation, especially Cl, in soil water in the drier, high-head plant community. It appears that the extent, timing and variability of the regional hydrology, contributes to tree island hydrogeochemical patterns, the interrelationship between plant performance and soil mineral precipitation, and the balance between organic matter accumulation and decomposition.

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RESTORATION DIRECTIONS: SCIENCE INFORMING THE PROCESS

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In developing restoration plans for the Florida Everglades, the focus is often on infrastructure modifications to the Central and South Florida Project, the regional water management project that controls the hydrologic function in the remnant Everglades. This, however, puts restoration dialog primarily into the technical and scientific realm. Incorporating the views of managers and the public and synthesizing the technical and scientific information for those audiences was the goal of the Synthesis of Everglades Science and Ecosystem Services (SERES) project. The focus in SERES was not to develop a restoration plan, but informing decision leaders on their issues.

The primary questions from managers reflect concerns over costs, and economic and environmental benefits. Questions from the public focused on local environmental benefits and timelines. The SERES Team developed an array of options that attempted to provide insight to the managers' and public's questions; the options were not intended as implementable, "final" restoration alternatives. The options focused on varying in the amount, location, and types of water storage and on changes in decompartmentalization in the water conservation areas.

The scientific evaluations began with hydrologic modeling, which served as the basis for landscape modeling, water quality modeling, economics analyses, wading bird modeling, vegetation analyses, soils and periphyton simulations, and fire risk analyses. The SERES Team then worked collaboratively to synthesize the results of the in the context of the questions the managers asked. The essential elements of the scientific findings were then conveyed as answers to the management questions and summaries of the primary themes, such as amount of storage and degree of decompartmentalization.

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NUTRIENTS IN LEAVES OF POND APPLES (*ANNONA GLABRA*) AND SURROUNDING SOIL AND WATER IN A CYPRESS-POND APPLE SWAMP IN THE NORTHERN EVERGLADES

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Pond apple (*Annona glabra*) is an important species within the Everglades ecosystem. Historically, an extensive pond apple swamp occupied the transition zone at the northern boundary between Lake Okeechobee and Everglades. Today, pond apples primarily occur as an understory component of cypress heads and swamps, but also occur as the predominant species on some tree islands in southern Lake Okeechobee and the northern Everglades. Pond apples provide valuable wildlife habitat, food for a variety of species, anchor soil, and uptake nutrients such as nitrogen (N) and phosphorus (P) that may be considered to be contaminants in the Everglades ecosystem when their concentrations exceed background levels.

This study was conducted in the Arthur R. Marshall Loxahatchee National Wildlife Refuge, (LNWR), Boynton Beach, Florida to determine the concentrations of carbon (C), nitrogen (N), and phosphorus in soil, water and pond apple (*Annona glabra*) leaves in the LNWR. Measurement of organic carbon provides an estimate of total biomass. Nitrogen is an essential nutrient, but is not often limiting because it can be fixed from the atmosphere by bacteria in soil and plants. Phosphorus is a limiting factor for plant growth, especially in the Everglades, and is considered to be a contaminant in this ecosystem at levels above background, since even small changes in P concentrations influence entire communities. The growth of extensive stands of trees such as pond apples provides a significant mechanism to sequester nutrients in living tissue and thus reduce their concentrations in the substrate and water column. It was assumed that sites within the LNWR represent areas that are not nutrient enriched.

Samples of green leaves, senescent leaves, water and soil were collected in January, April, and November 2013 by researchers from Palm Peach Atlantic University and analyzed to determine concentrations of C, N and P. Results indicate that concentrations of C and N in green leaves varied seasonally and from site to site within each study area. P values almost double in April as plants emerge from winter dormancy. In soil, values for P were generally higher at the surface than at depth (to 30 cm**).** Results were compared to data from a similar study conducted on Torry Island (Belle Glade, Florida) in Lake Okeechobee in 2012 to determine whether differences in P concentration in soil and water between these two locations were related to differences in P concentrations in leaf tissues. Also, relative concentrations of C, N and P in leaf tissues were calculated to assess whether P was likely to be a limiting nutrient.

Future studies should focus on determining a) the effects of nutrients on the overall growth rate of pond apples, as an estimate of the rate at which P is removed from soil and water, and b) the total biomass per acre of pond apple communities in enriched vs unenriched conditions, to estimate how the rate of P removal by pond apples is likely to change over time.

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SOIL ORGANIC NITROGEN MINERALIZATION AND ENZYME ACTIVITIES AS INDICATORS OF NUTRIENT IMPACTS IN THE FLORIDA EVERGLADES

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Impacts of nutrient loading in wetlands may be expressed through changes in various biogeochemical processes associated with macroelemental cycling. This may include changes in organic matter decomposition rates along the decay continuum and associated enzyme activities. Nutrient loading, therefore, can change the microbial mediated mineralization of soil organic nitrogen (SON) by regulating the rate of extracellular N enzyme activities. A change in the rate of organic N mineralization is significant as 95% of the soil total N is in the form of organic N. In order to assess N availability, potentially mineralizable N (PMN) and associated extracellular enzyme activities can be used as proxies. Potentially mineralizable N determines the overall potential rate of organic N mineralization. Extracellular enzymes such as L-leucine-amino-peptidase and β,4-N-acetylglucosaminidase can provide information on the mineralization of specific soil organic N pools, such as amino acid N and amino sugar N pools, respectively. Consequently, PMN and extracellular potential enzyme activities can be used to link the role of enzymes in overall organic N mineralization and specific organic N pools. Nitrogen limitation, resulting from phosphorus loading, has previously been shown to increase PMN rates and enzyme activities in the Water Conservation Area 2A (WCA-2A) of the Everglades. The shift towards N limitation may result in the loss of labile amino acid N as this N pool is used to meet microbial N demands, leading to an increase in recalcitrant SON forms. The shift in SON pools could have significant effects, for example, on the Everglades restoration, as labile organic N is shifted to recalcitrant organic N as a result of N limitation.

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SULFUR AND MER. CURY MODELING IN THE EVERGLADES

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Mercury contamination impacts the entire Everglades ecosystem, and in its most bioaccumulative form methylmercury (MeHg), is a threat to wildlife and human health through neurotoxicity, endocrine effects, and other health impacts. The mercury contamination issue is complex, as mercury occurs in many forms in the environment. MeHg is produced within the Everglades by biogeochemical processes acting on inorganic mercury deposited primarily as rainfall. MeHg production results from microbial sulfate reduction in the surficial anoxic soils of the ecosystem. Sulfate reduction, in turn, is controlled by sulfate loading to the ecosystem from sources originating within the Everglades Agricultural Area (EAA). In addition to sulfate loading, other factors may impact both production and bioaccumulation of MeHg including dissolved sulfide, dissolved organic matter (DOM), and pH.

Mercury is arguably the most significant contamination issue facing Everglades restoration. Effective ecosystem management requires an understanding of these processes controlling production and distribution of MeHg, the impacts of ecosystem restoration strategies on these processes, and what approaches are available to mitigate MeHg production and biological impacts. We have developed conceptual models based on field and laboratory studies to explain the complex interplay between sulfur, DOM, and MeHg production. These models show how sulfate stimulates MeHg production up to a point where sulfide buildup inhibits further MeHg production. When used in combination with existing mathematical models for the distribution of sulfate within the ecosystem, the combined models allow prediction of how changes in sulfate loading impacts MeHg distribution within the ecosystem. Examples of increased and decreased sulfate loading and the predicted MeHg response will be discussed. We will also show how the models can be used to help land and water managers plan to address the sulfur/mercury issue in the Everglades.

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HOW MODELING AND DESIGN CRITERIA INFORM OPERATIONS PLANNING AND WATER MANAGEMENT IMPLEMENTATION

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C&SF Project Water Control Plans/CERP Operating Manuals include coordinated operating criteria and regulation schedules to guide how and when to operate water management structures to move water for project/system regulation. They include provisions for the collection, analysis, and dissemination of data to carry out regulation of projects in an appropriate manner. One main purpose of these Water Control Plans/Operating Manuals is day-to-day use in water management for essentially all foreseeable conditions affecting the project and to document how the project objectives were translated into operational rules. Policies are embodied in laws, regulations, and directives which guide the allocation of resources to achieve project goals over time. These water management policies are implemented by the design and construction of facilities, the design of operating rules for systems, and the use of operational flexibility and exercise of operator discretion. Operating rules generally guide shorter-term management decisions, and can include great uncertainty with respect to desired long-term hydrologic outcome (ACOE, Guidance Memorandum No. 5, 2007; EarthTech, Water Management ORI Report, 2005).

The general procedure in the planning process is to develop alternative plans that are intended to meet goals and objectives. Generally, hydrologic simulation models are used to help evaluate and compare alternative plans to see how well they meet the hydrologic criteria. Practical and realistic operating rules often depend upon simulation modeling that adequately represents the project features and operations. Water control plans/CERP Operating Manuals should provide “real world” operating criteria that are consistent with assumptions used in plan formulation and the simulation modeling process. One of the difficulties implementing policies in operations arises because many of the benefits to be balanced can only be evaluated over the long term while operator’s actions are limited by information available in the present. Thus, operators often need operating rules based on short-term surrogate objectives that will guide them in ways to achieve the long-term goals. The draft Project Operating Manual (POM) in the CEPP PIR includes operating criteria based on the Alt 4R2 modeling assumptions, however specific operational criteria will be developed prior to changes in the operations of new CEPP structures or existing C&SF/CERP structures. Adaptive management recommendations within the scope of approved plans and manuals may be implemented using existing operational flexibility; otherwise, additional analysis, agency coordination, public review, NEPA documentation, and temporary deviations or manual revisions may be required. The CEPP AM Plan specified RECOVER will work with water managers to identify the monitoring information, triggers, and process in the POM that will inform operational adjustments to better meet CEPP goals and objectives over the mid to longer term (ACOE, Guidance Memorandum No. 5, 2007; EarthTech, Water Management ORI Report, 2005; ACOE, CEPP Final PIR-EIS, 2014).

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SIGNIFICANCE OF HUMAN INTERACTION AND INTERFERENCE ON OSPREY POPULATIONS IN THE EVERGLADES

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The North American osprey (*Pandion haliaetus*; Pandionidae) is a territorial, stationary nesting, top predator bird of prey that lives close to bodies of water. Bio-monitoring this species provides insight into the effects of human disturbances and persistent pollutants on coastal fauna and ecosystems. The human interaction and interference on Everglades osprey populations is herewith evaluated for conservation strategies through the use of South Florida Wildlife Center admission data and eBird recorded sightings.

The South Florida Wildlife Center (SFWC) is involved in wildlife rescue, rehabilitation and release in tri-county area of Palm Beach, Broward, and Miami-Dade (Everglades conservation areas). We evaluated admission data for 140 ospreys between 2009 and 2014. Six percent (8/140) were dead at arrival, 24% (34/140) died after admission, 41% (57/140) had to be euthanized to avoid unnecessary suffering, 26% (36/140) were successfully treated and released, 3% (4/140) were transferred and one is still under care. The causes of admission were emaciation, fractures and trauma possibly due to collision with vehicles or man-made structures, gunshot wounds, methane burns or electrocution and injuries possibly due to interaction between species. Unknown causes and suspicious events were also recorded. Data demonstrated public and SFWC center positive interferences which are represented by rescue efforts, activities and care.

Data on osprey sightings reported by the public in Monroe, Miami-Dade and Collier was obtained from the eBird Basic Dataset database (Version: EBD_relMay-2014; Cornell Lab of Ornithology, Ithaca, New York). Annual sightings have gradually increased from 2010 to 2013, with an annual sighting frequency and average sighting frequency per week of 970.5 and 20.21 $\pm$ 7.0 in 2010 and 1218.4 and 25.3 $\pm$ 7.2 in 2013, and annual total sample size and average total per week of 890 and 18.5 $\pm$ 14.1 in 2010 and 2989 and 56.6 $\pm$ 42 in 2013.

Increased reported osprey sightings may represent a population increase or more public involvement in observing the natural habitats and inhabitants of the Everglades. Positive public intervention in reporting and/or transporting injured or orphaned osprey to rescue centers for care has increased the chances of such osprey surviving. Nonetheless, gunshot wounds in some osprey indicate that a few members of the public still need to be educated on the importance of preserving the animals inhabiting the Everglades. To conclude public positive interaction and support for non-profit centers like SFWC greatly contribute to the conservation efforts of a very significant bio-monitor bird of prey, the osprey.

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JUVENILE SPORTFISH MONITORING IN FLORIDA BAY, EVERGLADES NATIONAL PARK

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The spotted seatrout, *Cynoscion nebulosus*, is an important recreational sportfish in Florida Bay and spends its entire life history within the Bay. Salinity and freshwater influx affect spotted seatrout distribution both directly through physiology and indirectly by affecting habitat (i.e. seagrass), prey and predator distributions and species compositions. Therefore, juvenile spotted seatrout are a good indicator to assess the effect of the Comprehensive Everglades Restoration Project (CERP) on Florida Bay's recreational fishery.

Juvenile spotted seatrout populations have remained low throughout central Florida Bay, but not in the west sub-region from 2008 through 2013. There has been a statistically significant shift to lower juvenile spotted seatrout populations in the central bay since 2008. The cause of this shift is not certain, but 2008 had the highest salinities observed during the MAP sampling, which may have resulted in a shift in seatrout populations. Three sub-regions in Florida Bay showed juvenile spotted seatrout population inversely correlated with salinity, but the West did not. There was a significant positive linear relationship of spotted seatrout density, frequency of occurrence, and concentration, between seagrass percent cover throughout Florida Bay. The spatial distribution of seagrass and seatrout in Florida Bay varies by region, with a strong east (low percent cover, low frequency of occurrence) to west (high percent cover, higher frequency of occurrence) gradient.

A logistic regression was employed on the data collected from 2004 to 2010 to quantify the impact of salinity and temperature on juvenile spotted seatrout frequency of occurrence and again in 2014 to add seagrass effects. Juvenile spotted seatrout are unlikely to be observed at temperatures below 20°C, reflecting the seasonal spawning cycle. In hypersaline waters, juvenile spotted seatrout are only found in areas with moderate temperatures.

Perhaps most importantly, our analyses this year with our new water-quality-model-based HSI confirmed that simulated NSM conditions provided a sound restoration target for juvenile spotted seatrout abundance in each of our Florida Bay sampling sub-regions. Furthermore, the HSI model sufficiently discriminated between the alternatives of the Central Everglades Project design and future without CEPP, with regards to differences in juvenile spotted seatrout abundances.

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DIGITAL VISUALIZATION AS A TOOL TO BRIDGE SCIENCE AND POLICY: EXAMINING THE LONG-TERM EFFECTS OF PHOSPHORUS ON THE EVERGLADES RIDGE SLOUGH LANDSCAPE

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Everglades restoration remains one of the largest ecosystem-level restoration projects ever attempted. The underlying message to "Get the Water Right" was that both water quality and hydrology, including timing, flow and quantity, were being optimized to the extent possible to assure the best outcome for a naturally functioning Everglades ecosystem. Today, 15 years after the restoration was approved, some criticize it for its slow pace, while others applaud the successes. The former would like to increase the pace of restoration, which has inevitably resulted in debate among scientists regarding water quality and quantity tradeoffs. This technical discussion among scientists complicates the job of the decision makers, who ultimately are responsible for moving the restoration forward. This is further exacerbated by the mobile nature of senior managers' careers, which sometimes precludes the development of the necessary experience with the Everglades ecosystem. The central Everglades is dominated by the ridge slough ecosystem and is the focal area of much of today's debate. Based on peer-reviewed data, here we present a digital visualization of a cross-section of a representative ridge slough system through various stages of TP enrichment. The objective of the animation is to provide context of the complex interactions that occur in the ridge slough with increasing TP concentrations. Ultimately, we wish to facilitate a more holistic understanding of the system as one tool that could be used by decision-makers as well as synergistic communication among the scientific community.

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RESPONSES OF THE SOUTH FLORIDA COASTAL AND ESTUARINE ECOSYSTEMS TO CLIMATE VARIABILITY, SEA LEVEL RISE AND EXTREME WEATHER EVENTS OVER THE LAST 4600 YEARS

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Global climate change is affecting temperature and precipitation patterns, oceanic and atmospheric circulation, rate of rising sea level, and the frequency and magnitude of hurricanes and tropical storms. The magnitude of these changes and their subsequent effects on shallow marine and coastal ecosystems will vary regionally. Estuaries and coastal wetlands in south Florida have naturally evolved under a regime of rising sea level and specific patterns of hurricanes.

The decadal to centennial records of subfossil diatoms obtained from 13 sediment cores collected from Florida Bay, Biscayne Bay, and Shark River, were used to study the magnitude of environmental changes caused by natural and anthropogenic factors over the last 4,600 years. A definite trend of increasing salinity related to sea level rise over time have been observed in 4000-4600 year-old Bob Allen and Ninemile Bank cores collected in central and western Florida Bay, from sediments representing a freshwater environment (peat deposits) containing freshwater diatoms (e.g., *Mastogloia smithii, Encyonema evergladianum*) at the bottom of the cores to those representing an estuarine environment (calcareous mud deposits with numerous marine diatom taxa). Analysis of diatom assemblages in two ~2000 year-old cores collected at the mouth and central part of Shark River revealed that this region have persistently been a zone of mixed estuarine environment, with some pulses of freshwater occasionally reaching the mouth of the river. However, this analysis also revealed a progressively decreasing influence of freshwater and increasing abundance of marine diatom taxa toward the top of the cores, which suggest a slow development of more marine conditions in this region. This transition is most likely related to both, decreasing freshwater deliveries related to canal construction on the mainland and rising sea level. Additionally, presence of layers of sediments containing marine planktonic taxa sandwiched between sediments containing taxa typical for shallow, marine to brackish water environments implies presence of hurricane or tropical storm deposits in the cores. Analysis of all the cores collected in south Florida also showed smaller magnitude changes in the structure of diatom assemblages that often coincide with severe drought periods, which are typically associated with cold phases of El Nino Southern Oscillation, Atlantic Multidecadal Oscillation and Pacific Decadal Oscillation.

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QUANTIFYING EVAPORATION RATES FROM LAKE OKEECHOBEE, FLORIDA

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Lake Okeechobee in south-central Florida is the seventh largest freshwater Lake in the United States (US) and an important but controversial source of water for the Greater Everglades of south Florida. Prior to human modification, Lake Okeechobee routed water from the Kissimmee River Basin in the north to historic Everglade's wetlands in the south, predominantly during the humid, subtropical wet season. Completion of the Herbert Hoover Dike in 1937 allowed water managers to control water releases from the Lake for flood control and agricultural use. And more recently, ecosystem health is also considered in the timing of water releases. Water managers require accurate estimates of hydrologic inputs and outputs to Lake Okeechobee in order to manage water releases (and water levels). A poorly known hydrologic output is evaporation. Prior studies have estimated Lake Okeechobee evaporation rates ranging from 1,260 to 2,353 mm/year.

To quantify evaporation more accurately, the South Florida Water Management (SFWMD) and the U.S. Geological Survey (USGS) installed Bowen-ratio instrumentation on the SFWMD LZ40 platform in the center of Lake Okeechobee in November 2012. Based on over two years of data, annual evaporation is estimated to be about 1,700 mm/year using Bowen-ratio method. This value compares favorably with 2013 satellite (GOES) estimates of potential evapotranspiration (1,720 mm/year), but is greater than a value of 1,320 mm/year computed by the SFWMD using the "Simple" method.

The greatest daily evaporation rates occurred during the passage of cold fronts in the winter, as cold, dry air increased vapor pressure deficits, and energy stored in the Lake was made available for sensible and latent heat flux (the energy equivalent of evaporation). Thermistors suspended every two feet in the water column indicate the relatively shallow (15 feet deep, on average) lake is generally thermally well-mixed vertically, when compared to deeper lakes in the U.S. with similar surface area. Thermoclines gradually dissipated as wind velocities reached 10 meters per second.

Satellite images show relatively cloud-free skies (otherwise known as the "donut hole") over Lake Okeechobee compared with surrounding land areas. The "donut hole" is likely due to the large surface area of the lake (1,900 square kilometers) affecting local weather conditions, inducing increased solar insolation and lake evaporation. Continued data collection and analysis of evaporation will allow water managers to estimate water budgets more accurately for Lake Okeechobee under historical, present-day, and future conditions.

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MODELING THE OCCURRENCE OF EVERGLADES AMPHIBIANS AS A FUNCTION OF HYDROLOGY AND HABITAT TYPE

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Anuran amphibians (frogs and toads) are present throughout the Florida Everglades, but their distribution varies by species. Some amphibians require shallow, short-hydroperiod wetlands for breeding. Other species require long hydroperiods or even permanent water to accommodate long larval periods. Therefore the interaction of hydrology with other habitat features can be an important factor in determining which species of amphibians will be present at a site. By understanding the effect these interactions on the occurrence of amphibian species we can build a model to predict individual species presence and the overall species richness of amphibians at a site. This type of model can be used as a tool to help evaluate alternative restoration plans.

Using data from a number of USGS and University of Florida studies of amphibians throughout the Greater Everglades, we performed a multi-species (community) occupancy analysis using habitat type and hydroperiod as covariates. Habitat was categorized as Hammock, Pineland, Prairie, Slough, or Swamp, and hydroperiod was defined as the number of days a site was inundated within a hydrologic year. The resulting output from this model was used to build linear relationships with habitat and hydroperiod for 12 species of anurans in the Greater Everglades. The model output can be used to derive the estimate of probability of occurrence for each species for any given habitat and hydroperiod. For the purpose of this model, probability of occurrence is interpreted as a Habitat Suitability Index (HSI)).

To create a model-based tool to project amphibian HSI, we have created a base map of habitat for the Greater Everglades. The hydroperiod of the site is projected from related hydrologic models. The HSI of a cell is determined by first obtaining the habitat category of the cell and the hydroperiod for the year. Those numbers are then inserted into the equation for each species and a species-level probability of occurrence is produced. The resulting HSI can then be used to draw from a binomial distribution with probability of success (i.e. probability of value = 1) = HSI. Thus occurrence of a species at the site is modeled as a stochastic process that is based on empirical estimates of occurrence probability derived from our original sample data.

Species richness of amphibians at a cell and the HSI for each individual species are then easily viewed in the EverVIEW interface. This can be used by managers interested in understanding the potential impacts of water management or future climate conditions on amphibian distributions in the Everglades. Shifts in amphibian HSI are easily viewed by examining the difference in amphibian HSI between a reference condition and the proposed conditions.

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FREQUENCY DISTRIBUTIONS OF SURFACE WATER TOTAL PHOSPHORUS IN THE LOXAHATCHEE REFUGE: SIMILARITY AND IMPLICATIONS FOR DYNAMIC MODELS

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The Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) overlays a 58,000 ha area. Located in Palm Beach County, Florida, USA, the Refuge is a remnant of the historic Everglades. Sheetflow that naturally would flow across the Refuge wetlands was disrupted in the 1950s and early 1960s by construction of stormwater pumps, and levees with associated borrow canals which hydraulically isolated the Refuge from its watershed. Stormwater discharge into the Refuge contributed excessive loads of total phosphorus (TP) and other pollutants which impacted Refuge freshwater wetlands. Monitoring and modeling efforts have been implemented in the Refuge to improve hydrologic and nutrient dynamics understanding and to support management decisions.

Since mid-2004, the Refuge has operated an extended monitoring network composed of 37 surface water sampling sites within the Refuge. This network samples monthly a suite of physical and chemical properties at sites distributed across the Refuge marsh as well as in the perimeter canal. We observe that there is a similarity in the shape of scaled frequency distributions for TP among most of the marsh sites. This similarity suggests that the distributions may be generated by similar underlying mechanisms controlling phosphorus fluxes between available storage and surface water, and from available storage to permanent burial in the sediment.

To quantify these underlying mechanisms, we present alternative dynamic model structures representing P flux of uptake from surface water to available storage, return from storage to surface water, and from storage to permanent burial in sediments. We demonstrate through a technique of separation of timescales that specific alternative models make potentially testable predictions which can be related to the observed TP frequency distributions. Specifically, we examine the relationship between site mean TP, and the equilibrium TP-concentration approached when phosphorus loading and flow are near zero for a period of days.

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RAPID PREDICTION OF ESTUARINE SALINITY FOR EVERGLADES ECOSYSTEM RESTORATION

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Estuarine salinity envelope is an important performance measure for restoration of the Greater Everglades. The Central Everglades Planning Project (CEPP) focused on balancing the flow pattern between the southern Everglades and associated estuaries. Restoration alternatives were formulated with long-term model simulations (41 years from 1965 to 2005) of the regional hydrology with one of the primary project goals being to reduce deleterious inflows eastward to the St. Lucie Estuary (SLE) and westward to the Caloosahatchee River Estuary (CRE). To support the evaluation of CEEP alternatives, we developed a time series salinity model for rapid prediction of salinities at key locations in the SLE and CRE. The model consisted of an autoregressive term representing the system persistence and an exogenous term accounting for physical drivers including freshwater inflow, rainfall, and tidal water surface elevation that cause salinity to vary. Model calibration and validation using up to 20 years of measured data collected in the SLE and CRE indicate that the time series models offered comparable or superior performance compared with its 3-D counterparts. The model allowed for rapid assessment of estuarine salinities associated with each restoration alternative. The simulated salinity also provided inputs to ecological models for evaluation of potential impacts on the seagrasses and oysters inhabiting these estuaries.

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PREDICTING THE RESPONSES OF EASTERN OYSTER POPULATION TO RIVER DIVERSION AND SEA-LEVEL RISE

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Currently there is much debate and controversy regarding the perceived trade-offs with using freshwater diversions for coastal restoration: restoring wetlands over the long-run versus preserving eastern oyster (*Crassostrea virginica*) production from short-term impacts. Large-scale river diversions could dramatically change estuarine salinity, temperature, suspended sediment concentration, chlorophyll *a* concentration as well as water circulation and water level variability, thus affecting oyster spawning, recruitment, growth, and survival.

We developed a high-resolution and process-based numerical modeling system that couples hydrodynamic, water quality, and oyster population dynamics. We selected the Breton Sound Estuary (BSE) in the eastern Mississippi Deltaic Plain as the spatial domain for the modeling study. The coupled models were calibrated and validated against field observed physical and biological factors. We predicted the responses of oyster population in BSE to river diversions (i.e., Caernarvon Diversion) under different scenarios of relative sea-level rise (RSLR) compared to baseline condition (normal Mississippi River flow without diversion and RSLR). Preliminary model results indicate that large river diversions (>1,416 m^3 s^{-1}, or 50,000 ft^3 s^{-1} under RSLR scenarios tend to significantly affect the spatial and temporal patterns of salinity, temperature, suspended sediment concentration, chlorophyll a concentration , and current velocity, thereby affecting the size and location of the optimal zones for oyster growth and production.

The size and location of the zones for optimal oyster growth will change due to river diversion and RSLR. It is suggested that the tradeoffs between oyster production and land-building due to diversions should be considered in the implementation of future river diversion projects.

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INSAR FOR WATER LEVEL MONITORING IN THE EVERGLADES WETLANDS

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The south Florida Everglades is a unique wetland environment consisting of a very wide, shallow, and slow sheetflow. The Everglades also includes a wide coastal wetland area (mangrove forests) located along the southwestern coast of Florida. Over the past century human activity have significantly affected the drainage pattern in the wetlands, destroyed a significant part of vegetation, and reduced wildlife habitat. The northern most Everglades, just south of Lake Okeechobee was drained and proclaimed as an agricultural area. The northern and central Everglades were compartmentalized into several Water Conservations Areas (WCAs), which serve as large water reservoirs for the increasing population in south Florida. Only the southern section of the Everglades, about 30% of the original wetland area, was designated as a national park and has kept its natural wetland sheet flow.

Hydrological monitoring of the Everglades is conducted by a dense network of stage (water level) stations, which provide high temporal water level observations in a finite number of locations. In order to improve the spatial resolution of the water level observations, we use space-borne Interferometric Synthetic Aperture Radar (InSAR) measurements, which provide cm-level accuracy of water level changes with 1-50 m spatial resolution depending on the sensor type. We analyzed InSAR data acquired by X-band (TerraSAR-X, Cosmo-SkyMed), C-band (ERS- 1/2, Envisat, Radarsat-1/2), and L-band (JERS, ALOS) satellites. Our analysis shows that all data types can produce coherent interferograms, as long as the time span between the observations is short. The short wavelength, X- and C-band interferograms can maintain phase over periods of several weeks, whereas the longer wavelength L-band interferograms can maintain phase over months and even years.

The processed interferograms show different fringe patterns between freshwater wetland areas and the saltwater coastal wetland areas. The freshwater interferograms show an overall organized fringe pattern that follow boundaries of the WCAs, as well as discontinuous fringes across these boundaries, which reflect different water level changes across hydrological structures. The saltwater interferograms show a more complex fringe pattern with high fringe gradient along tidal channels, reflecting high water level changes in the tidal flushing zone. The InSAR-based observations of water level changes are useful for detecting flow patterns, flow discontinuities, and for constraining high spatial resolution wetland flow models.

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MANGROVE COLONIZATION PATTERNS AND RATES ALONG THE COASTAL EVERGLADES

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During the 20th century, sea level rose by 10-20 cm, which increased the salinity and altered other ecological parameters in the intertidal zone along coastal Everglades. The main beneficiaries of the altered conditions are mangroves, which thrive in intertidal brackish and saline environments. Consequently, mangroves expanded their territories on the account of freshwater vegetation, mainly sawgrass. However, the mangrove expansion, or colonization, process is slow and occurs in different forms, reflecting local effects, as land gradient, tidal channels, and freshwater supply.

Using satellite imagery, aerial photography, and a helicopter survey, we analyzed the patterns and rates of mangrove colonization along coastal Everglades. We identified the following three major colonization patterns:
Fingering pattern – Colonization occurs mainly along tidal channels in the western Everglades. The colonization extends mangrove forest distribution inland both perpendicular to channels and further east along channels.
Blanket-like pattern – Colonization occurs along a wide front in the southwest Everglades.
Sporadic colonization – Limited colonization occurs within the "white zone", which is a wide almost vegetation-free area located in the northern section of southern shore's intertidal zone.

In order to calculate colonization rate, we evaluated changes in mangrove distribution from 1940 to 2013 (73 years) using aerial photography and satellite imagery. The 1940 aerial photography of the Everglades were obtained from the SOFIA website (http://sofia.usgs.gov/exchange/aerial-photos/); the images are geo-referenced and resampled at 1 m pixel resolution. The 2013 imagery consists of a geo-referenced RapidEye satellite imagery with 6.6 m pixel resolution. Both resolutions are sufficient to identify individual mangrove trees and draw boundaries between mangrove and non-mangrove vegetation. We validated the results of the RapidEye classification analysis using geo-tagged photos taken during our 2014 helicopter survey. Preliminary results indicate a slow colonization rate in the western Everglades. We identified a maximum of 1.4 km eastward expansion of mangrove vegetation along some of the tidal channels in the western intertidal zone. These results indicate an average of roughly 20 m/yr colonization rate along some of the channels. Further analysis of the remote sensing data will allow us to quantify mangrove colonization rates along other sections of the coastal Everglades.

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CONNECTING SCIENCE AND POLICY IN ECOSYSTEM RESTORATION

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Synthesis of scientific information on the Everglades ecosystem for managers and policy makers is widely recognized as a critical component of Everglades restoration. However, communication between scientists and managers is difficult and managers claim that they do not have enough information to make informed decisions on where to spend their limited restoration dollars. Yet, the Everglades is one of the most studied ecosystems in the world, resulting in the accumulation of a rich and sophisticated ecological knowledge. How can this disconnect between policy makers and scientists be resolved? How can the restoration of the Everglades be moved forward?

One way is to answer the questions of policy makers in the context of broadly defined restoration scenarios that included major components of Everglades ecosystem functions and the economic valuation of the ecosystem services of restoration. The goal of the Synthesis of Everglades Research and Ecosystem Services (SERES) project was not to identify a new plan for Everglades restoration, but to evaluate the costs and benefits of different restoration trajectories and answer policy maker's questions in the context of the results of the scenario evaluations. Restoration scenarios evaluated considered a range of decompartmentalization and water storage options for the entire Everglades south of Lake Okeechobee. The scenarios were evaluated using *available* information and models as well as the expert knowledge of 15 scientists and an economist. Key areas of scenario evaluation focused on "things people care about" including water quality, wading birds, and fish as well as other important restoration parameters such as peat deposition, Florida Bay salinity, tree islands and landscape processes.
Across the restoration scenarios considered, decompartmentalization ranged from nothing (existing conditions) to removal of the L-67 levees and the L-38 levee. Water storage in the scenarios ranged from none to the storage proposed in the Central Everglades Restoration Plan (CERP) which included a mix of ASR, surface water storage, and Lake Belt storage, to up to 2,500,000 ac-ft/yr of surface water storage only.

All of the restoration scenarios evaluated improved the ecosystem conditions compared to the current conditions. Evaluation of SERES scenarios found that increasing surface storage, even beyond that proposed in the CERP and requisite decompartmentalization was necessary to more closely achieve pre-drainage conditions. However, ecosystem and economic benefits were not linear with water storage and the scenario with the maximum storage did not produce the maximum benefits. Technical information and results were summarized and graphically interpreted through an iterative, collaborative process between topical experts and a graphic artist with the objective of communicating project results to policy makers and the general public. The SERES project represents a unique process that can be adapted to the restoration of other ecosystems by considering both ecological and economic benefits and careful communication of technical information to all stakeholders.

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AVAILABILITY OF GEODETIC SURVEYS BY THE U.S. GEOLOGICAL SURVEY IN SOUTH FLORIDA

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Highly accurate topographic elevation data in south Florida, specifically the Florida Everglades, is vital for understanding the hydrologic, chemical, and physical complexities in the region, and for successfully modeling the system. In this low relief environment, accurate elevations are essential for the restoration efforts of the Everglades, and nearly all water level, water storage, and water budget data must be related to a common vertical datum. Unfortunately, the remote and difficult to access wetland terrain creates economic and logistic obstacles to obtaining accurate elevation surveys.

With the evolution of Geodetic surveys, centimeter-level accuracy may be achieved in remote and difficult-to-reach environments such as the Water Conservation Areas (WCA) of western Miami-Dade and Broward Counties and the nearby estuaries of Florida Bay. Standardized techniques and methods published by the U.S. Geological Survey present the use of Global Navigation Satellite System (GNSS) surveys. With GNSS technology, “Level 1” surveys (6 cm or less) are attainable in areas like the Florida Everglades.

GNSS surveys were used to establish a network of benchmarks in the coastal lakes (West, Cuthbert, Long, and Seven Palm Lakes) of Everglades National Park. The establishment of elevation benchmarks in the North American Vertical Datum of 1988 (NAVD 88) is essential for relating changes in surface-water and groundwater levels. GNSS surveys also were used to relate a network of sediment elevation tables to the NAVD 88 datum near the coast of Florida Bay (Taylor River, Joe Bay, and Highway Creek). In the WCA’s, GNSS surveys will be used to establish new benchmarks in NAVD 88 in order to ensure water-management operations use the best available water-level data to sustainably manage the limited freshwater resources for the increasing populous of south Florida.

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EVOLVING STRATEGIES FOR STORMWATER TREATMENT AREA OPERATIONAL MANAGEMENT

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In South Florida, large constructed wetlands, known as stormwater treatment areas (STAs) and proposed reservoirs known as flow equalization basins (FEB) are water management infrastructure features used for reducing phosphorus and storing agricultural runoff prior to discharging water into America's Everglades. These features can be considered as engineered systems that can provide quantifiable level of performance in terms of flood control, phosphorus (P) treatment, regulatory compliances and environmental sustainability. Information gathering, field testing and model hypothesis testing has been performed under the South Florida Water Management District's Restoration Strategies program in order to improve the understanding of FEB/STA system dynamics in terms of response times, attenuation rates, and numerous other relationships between control variables (gate openings and structure flows) and state variables (water level, P concentration). Development and implementation of analytic and computer models at varying temporal and spatial scales will help to incorporate improved understanding of the system dynamics into tools that can assist in analyzing infrastructure design and in optimizing operational control algorithms that increase the ability to maintain the system objectives including achievement of ultra-low outflow P concentrations and vegetation sustainability within the STA footprints.

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DIET ANALYSIS OF OUSTALET'S CHAMELEONS (*FURCIFER OUSTALETI*), AN ESTABLISHED EXOTIC IN SOUTHERN FLORIDA, USA

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Furcifer oustaleti (Oustalet's Chameleon) is an exotic species established in southern Florida for over a decade, but little of its natural history, including dietary habits, has been studied in its introduced range. Seventy fecal samples were collected and examined for diet contents between July 2011 and October 2014. Chameleons were captured and removed from a wild population residing in southern Florida. Samples were obtained from animals throughout the year to observe seasonal changes in diet. Diet items were minimally identified to order and a total of 53 prey items were identified. Prey items were predominantly insects, with the three most commonly identified as weevils (Family Curculionidae), followed by caterpillars (Saturniidae and unknown), and stinkbugs (Family Pentatomidae). Fourteen samples contained vertebrate remains from other reptile species including *Anolis* and *Hemidactylus*. Oustalet's Chameleon appears to be a generalist forager with a diet containing seasonally available food items.

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INTERIOR MUD FLATS OF FLORIDA BAY ISLANDS: RECORDS OF SEA LEVEL RISE, STORM HISTORY, AND ISLAND FORMATION

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The islands of Florida Bay form unique habitats within Everglades National Park and they are part of a complex network of mudbanks that delineate the distinct basins of the bay. The islands and mudbanks form important physical barriers to storm surge, tidal influx, and wave development that otherwise would impact the southern coast of peninsular Florida. An important resource management question is what is the fate of these islands and mudbanks as sea level rises? IPCC AR5 projections range from 0.26 to 0.98 m of sea level rise by 2100, depending on various scenarios for ice melting and greenhouse gas abatement. Loss of the islands and mudbanks would mean loss of distinct habitats and the character of Florida Bay would change from isolated basins to a more open water estuary, similar to Biscayne Bay.

In April 2014, USGS researchers collected 18 cores from 10 sites on 4 islands in Florida Bay: Jim Foot Key, Buttonwood Key #7, western Bob Allen Key, and Russell Key. The interiors of these islands are open mud flats, analogous to playas and playa lakes in desert regions. These island interiors are shallow basins that intermittently flood with rain or sea water, which later evaporates. Because they lie primarily below sea level and typically do not have external drainage, these basins provide an ideal setting for preserving a record of sea level, storm history, and island formation. As noted by previous researchers (Enos 1989; Swart and Kramer 1997), these islands preserve the most complete record within Florida Bay.

Significant sedimentological and hydrologic work has been done in the past to understand the formation of these islands (see Enos and Perkins, 1979; Enos, 1989; Wanless and Tagett, 1989; Swart and Kramer, 1997; and many others). We are building on this work by integrating paleoecologic, sedimentological, and geochemical records preserved in the island mud flats with elevation data and satellite imagery to develop an understanding of the integrated processes of changing sea level, storm history, sedimentation, and island development. These data will allow us to assess likely future scenarios for resource managers.

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SOIL ORGANIC MATTER CYCLING IN EVERGLADES PEATLANDS

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The soils in the Everglades ecosystem are primarily organic in nature and developed under flooded conditions. Changes to this ecosystem include nutrient loading, altered hydrologic conditions, and cultivation. These anthropogenic factors have significantly altered soil organic matter dynamics, especially within the cultivated lands of the Everglades Agricultural Area. Soil enzymes, which are responsible for the first step in organic matter decomposition, are often tightly coupled with nutrient concentrations in soil and water and their activity is enhanced by drainage. Stimulation of enzyme activity by these anthropogenic factors has accelerated organic matter cycling processes in the Everglades. Soil depths have decreased from several meters to a meter or less in many areas. Major factors controlling this soil subsidence include land-use patterns, water-table depth, and nutrient enrichment. The fate of the oxidized organic matter in the Everglades is of concern globally as various greenhouse gases (N_2O, CO_2, CH_4) exhibit different global warming potentials. It is necessary to better understand how anthropogenic factors influence organic matter cycling and decomposition, and the types and quantity of greenhouse gases produced and emitted to the atmosphere. Carbon dioxide is generally the most significant greenhouse gas produced under both flooded and drained conditions in Everglades cultivated soils, with less than 10% of total greenhouse gas production as N_2O and CH_4. However, flooding has the effect of decreasing total greenhouse gas emissions and slowing rates of organic matter cycling, allowing for soil accumulation.

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SEASONAL BIOGENIC GAS DYNAMICS IN THE FLORIDA EVERGLADES ARE REVEALED USING HYDROGEOPHYSICAL METHODS

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Peat soils in wetlands, including the Florida Everglades, are known to release significant amounts of methane (CH_4) and carbon dioxide (CO_2) to the atmosphere. However, uncertainties still remain regarding the spatio-temporal distribution and triggering mechanisms of gas releasing events from peat soils. Ground penetrating radar (GPR) is a geophysical tool that has successfully been used in the past to non-invasively investigate the *in-situ* gas dynamics of saturated peat soils. This study was conducted at a total of four field sites in the southern Florida Everglades (Water Conservation Areas 2a and 3a) over a period of two years, targeting the seasonal, temporal, and spatial distributions of gas dynamics and release. At each site, gas contents are monitored using an array of measurements, including the GPR method for monitoring interstitial gas content, flux chambers paired with time-lapse photography for directly capturing gas flux measurements at a high temporal resolution, and differential leveling for monitoring surface deformation measurements. This long-term study highlights both yearly cycles of biogenic gas production and release at a large temporal time scale (*i.e.,* annual patterns), while also capturing the rapidity of flux events on an hourly scale.

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USING GROUND PENETRATING RADAR (GPR) TO IMAGE SPATIAL VARIABILITY IN POROSITY IN THE MIAMI LIMESTONE

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Porosity of the eogenetic karst in the Miami Limestone of the Atlantic Coastal Ridge varies widely (i.e. typically between 17 and 67 %), representing a critical physical property that dictates groundwater flow and creates preferential flow paths. Better understanding the spatial variability in porosity in this formation is therefore crucial for the development of realistic groundwater flow models in South Florida, however its heterogeneous nature of makes characterization of porosities difficult to accomplish. This study uses ground penetrating radar (GPR) to identify lateral changes in porosity. Using the water table reflector as a proxy for a laterally continuous reflector allows for the quick estimation of electromagnetic wave velocity from which porosity can be estimated using well accepted petrophysical models. This research constrains the inherent water content and capillarity properties of the limestone in order to use the true water table reflector in the ground penetrating radar data for identifying any variation that may suggest a change in porosity above. The results show several areas where changes in EM wave velocity associated with contrasts in porosity exceeding 40 % cannot be explained by changes in volumetric water contents alone as typically exhibited in the Miami Limestone. This research can be potentially expanded to investigate water table elevations due to tidal signals and sea level rise, and could have potential applications for the estimation of evapotranspiration through the Miami Limestone.

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PATTERN METRICS AND THE EARLY DETECTION OF ECOSYSTEM DEGRADATION IN THE RIDGE-SLOUGH LANDSCAPE

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Indicators of landscape condition should be sensitive to environmental change, and provide early warning detection of incipient changes. Here, we assessed the performance of a suite of spatial metrics selected to quantify the condition of the ridge-slough patterned landscape in the Everglades .The assessment was performed versus direct measures of landscape condition obtained from regional surveys of soil elevation from which metrics of change between conserved and degraded have previously been observed. Metric performance was assessed based on the strength (sensitivity) and shape (leading vs. lagging) of the relationship between metrics and soil elevation properties. We measured vegetation patterning in twenty five 2×5 km primary sampling units (PSUs) that span a gradient of hydrologic and ecological condition across the greater Everglades ecosystem for which detailed soil elevation survey measurements were available. Building on previous research, we calculated 14 spatial pattern metrics that describe the composition, geometry and hydrologic connectivity from binary vegetation maps for each PSU. We related these metrics to soil elevation bi-modality (B), a previously proposed binary measure of landscape condition, and also to the standard deviation of soil elevation (SD_{SE}), a continuous measure of condition. We observed significant logistic regression slopes with B for only 4 metrics (slough width, ridge density, directional connectivity index, and least flow cost). More significant relationships (n = 8 metrics) were observed with SD_{SE}, with the strongest associations for slough density, mean ridge width, and the average length of straight flow, as well as for a suite of hydrologic connectivity metrics (directional connectivity index – DCI, least flow cost – LFC, and landscape discharge competence – LDC). We inferred leading vs. lagging performance from the exponent of fitted power functions. Only DCI exhibited the properties of a leading metric of the loss of soil elevation variation; all others were either significantly lagging or indeterminate. Our findings support previous work suggesting that soil elevation changes from altered peat accretion dynamics may precede changes in landscape pattern, and offer insights that will enable efficient monitoring of the ridge-slough landscape with the ongoing Everglades restoration effort.

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INTEGRATED ECO-HYDROLOGICAL MODELLING OF FORAGE FISH AIMED AT SUPPORTING MANAGEMENT DECISIONS

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Hydrologic data from the Everglades Depth Estimation Network (EDEN) was linked to empirical monitoring studies of forage fish populations in the Everglades using a model, GEFISH, that simulates complex food web interactions, population dynamics, and movement behaviors to produce spatiotemporally dynamic patterns of fish biomass growth and movement. Summary data from GEFISH are easily understood and suitable for Everglades management and decision support. The species represented in GEFISH have direct and supported relationships with hydrology, represent keystone components of Everglades food webs, and are good indicators of ecosystem restoration performance.

Small forage fish populations closely resemble seasonal hydrology because they gradually build up and disperse across the landscape through seasonally pulsed movements that depend upon the underlying topographic structure and annual rainfall dynamics. The spatial patterns of fish biomass growth, redistribution, and decline are relatively deterministic, and thus analogous to the hydrologic patterns that they respond to, though the timing and direction of movement is guided by biological imperatives of foraging and predator avoidance along hydrological flooding fronts.

GEFISH was used to compare biomass accumulation and concentration in natural and degraded Everglades ridge-and-slough habitats. A twelve-year time series of empirical water level data was applied to realistic topographies derived from georeferenced vegetation community maps using empirical vegetation patch elevations. Fish were assumed to disperse between shallow water habitats, seeking foraging opportunities and predator refuges. Spatiotemporal connectivity of these habitats depends upon persistent movement corridors in the topographic structure, and directional connectivity of hydrology (DCI) was measured. Three fish groups competed for the same resources with different parameters for movement speed, depth affinity, stranding and feeding. The ridge-and-slough landscape had interconnected, braided networks and seldom dried out completely, resulting in a high persistence of directional connectivity and net fish movement, while the degraded landscape had isolated pools and longer drought periods, resulting in low persistence of connectivity and fish movement.

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MODELING THE DYNAMICS OF THE INVASIVE TREE, *MELALUECA QUINQUENERVIA*, IN THE EVERGLADES, WITH AND WITHOUT BIOLOGICAL CONTROL

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Melaleuca quinquenervia (pine-bark tree) is an invasive non-native tree that has spread over wide areas of the freshwater ecosystems of southern Florida, displacing native vegetation. Suppression of Melaleuca appears to be progressing through the introduction of insect species, including the weevil, Melaleuca snout beetle (Oxyops vitiosa Pascoe) and the Melaleuca psyllid (Boreioglycaspis melaleucae). Because this is still the early phase of biocontrol, it is important to attempt to project the long-term effects of the biocontrol on the suppression of the Melaleuca and on the restoration of the native forest. The individual based forest simulation model, JABOWA, was used as a basis for developing a model to simulate successional processes occurring in areas of the Everglades occupied by Melaleuca, both in the absence and presence of the biological control agents. Our model assumes that the bio-control agents negatively influence both the growth and reproduction of Melaleuca, based on field data. Our simulation results show that the density and total basal area of Melaleuca decrease after the bio-control. On the contrary, the native species such as pond cypress and sawgrass tend to increase in density and total basal area. Therefore, it appears that the biocontrol will help in the reestablishment of the native community.

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STA-3/4 PERIPHYTON-BASED STORMWATER TREATMENT AREA (PSTA) CELL WATER AND TOTAL PHOSPHORUS BUDGET ANALYSES

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In accordance with the Everglades Water Quality Restoration Framework Agreement between the U.S. Environmental Protection Agency and Florida Department of Environmental Protection, a Science Plan was developed to investigate the critical factors that collectively influence the total phosphorus (TP) reduction in the STAs. Investigation of STA-3/4 PSTA Technology Performance, Design and Operational Factors is one of the initial studies in the Science Plan. The overall objective of the PSTA investigation is to assess the chemical and biological characteristics and design and operational factors that contribute to the superior performance of this cell.

The PSTA cell is a 100-acre wetland where much of the muck has been removed. The cell has achieved outflow concentrations of at or below 13 ppb. Water and TP Budget Analyses were conducted to further assess STA performance. The Water and TP Budgets were developed for the period of May 1, 2007 to April 30, 2014 using SFWMD's Water Budget Tool and Nutrient Load Program. This presentation summarizes improvements to structure flow estimates, seepage water quality and quantity estimates, updated annual water budgets and TP mass balances, as well as sensitivity analyses. Based on the water budget analysis, the inflow is comprised of 71, 23, and 6% surface flows, seepage, and rainfall, respectively, while the outflow is primarily comprised of structure flows. Based on the median value of the well sampling TP Concentration, 10 ppb, the estimated annual TP load reduction rate is 34%, while the annual concentration reduction rate is 31%. The estimated settling rate is 17.5 m yr^{-1}. The data collection efforts for the PSTA project are continuing and the results summarized in this presentation will be updated as new data becomes available.

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DEVIATIONS FROM A THEME: PEAT PATTERNING IN SUB-TROPICAL LANDSCAPES

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Patterned landscapes have long been a popular setting to test hypotheses about the effects of processes on ecosystem structure. The combination of scale-dependent and positive feedback theory is one of the most well-supported in current literature, each explaining separate aspects of patterned peatlands. These theories have been developed from dynamics in boreal peatlands and tested in boreal systems, but the mechanisms that control peat patterning in a sub-tropical system have yet to be acknowledged in theory. Statistical evidence for different mechanisms should be present in the biophysical features of sub-tropical patterned peatlands, such as the ridge and slough landscape (RSL) within Everglades. We tested whether features of the RSL, a sub-tropical, patterned peatland, conform to positive and scale-dependent feedback patterning theories developed in boreal peatlands and use dynamic simulation to explain our results. The analysis of surface elements and nutrient differences within the RSL and our dynamic simulations indicate that positive and scale-dependent feedback may not be appropriate theories for sub-tropical peat patterning. Decomposition, rather than production, appears to be more important for abrupt microtopographical elevation differences, and differential nutrient concentrations are due to vegetation types, rather than increased evapotranspiration from greater vascular plant growth. Our model expands on the current theories for RSL maintenance, incorporating vegetation types and life history traits into differential peat deposition, which create the signature microtopographical differences found in the Everglades, and demonstrates that the underlying ecological patterning processes in sub-tropical peatlands are likely very different from boreal peatlands and require further discussion and study.

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