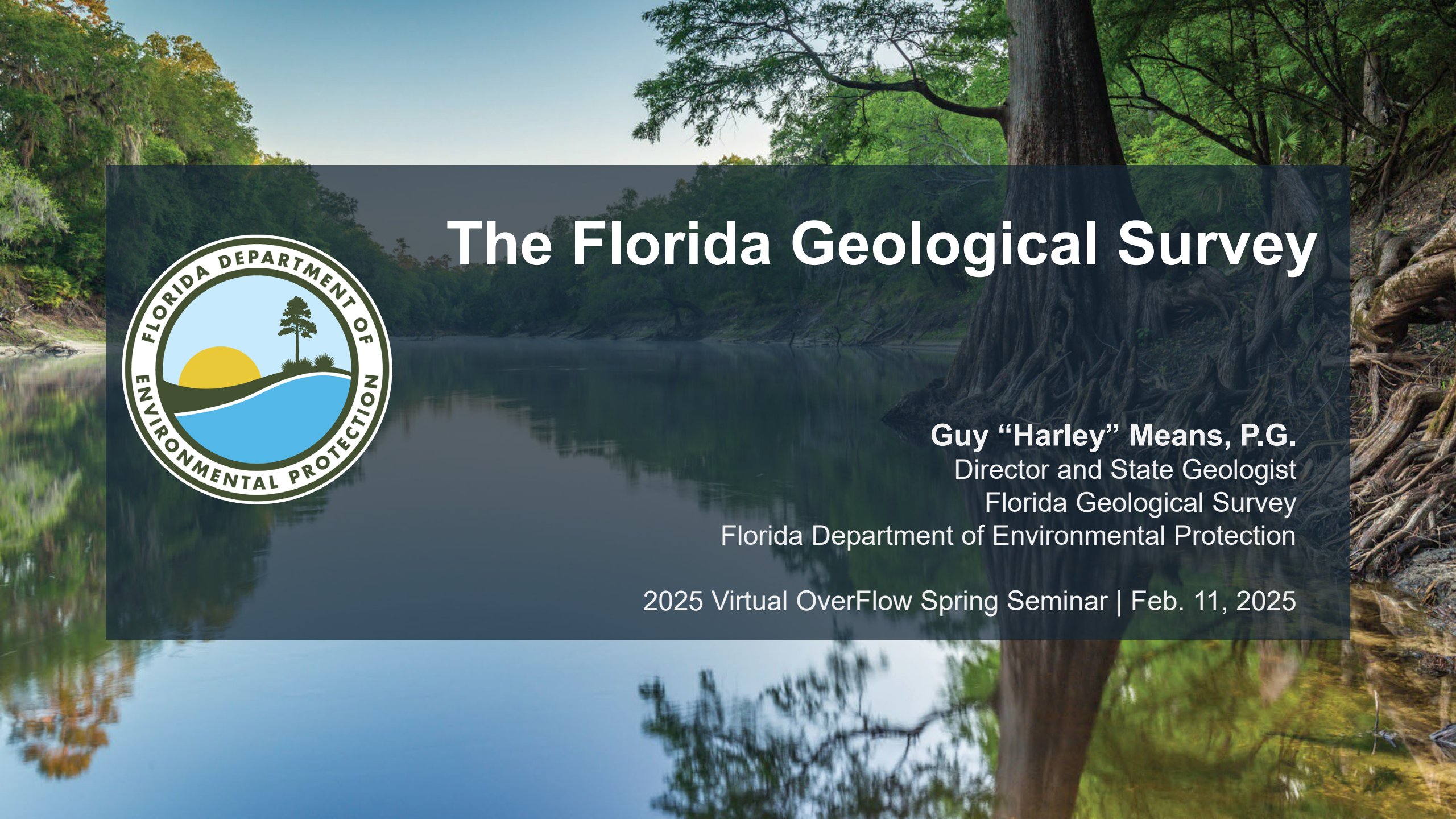


The Florida Geological Survey

Guy “Harley” Means, P.G.
Director and State Geologist
Florida Geological Survey
Florida Department of Environmental Protection

2025 Virtual OverFlow Spring Seminar | Feb. 11, 2025

FLORIDA GEOLOGICAL SURVEY (Established in 1907)

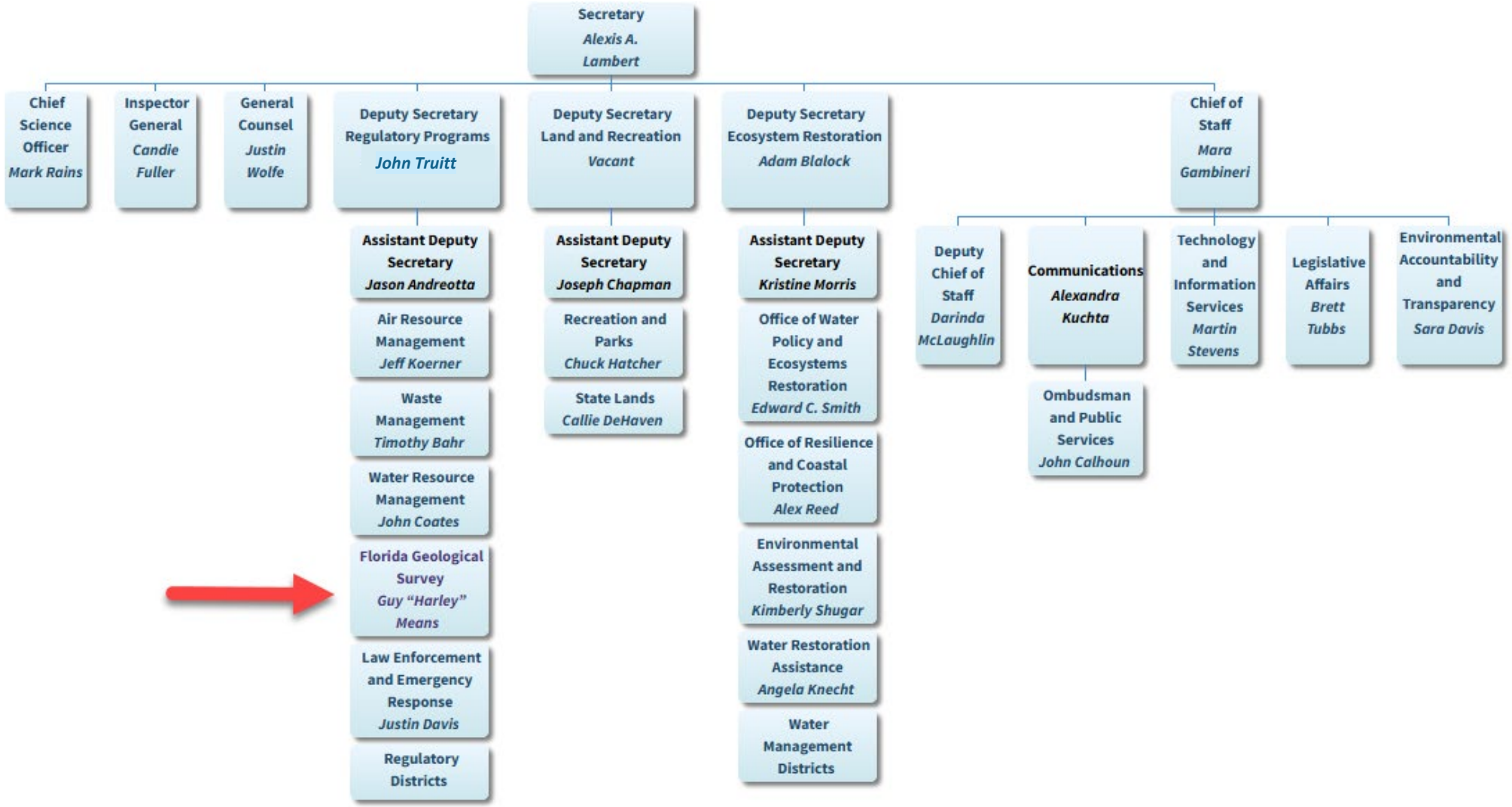
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Lake Jackson, Leon County

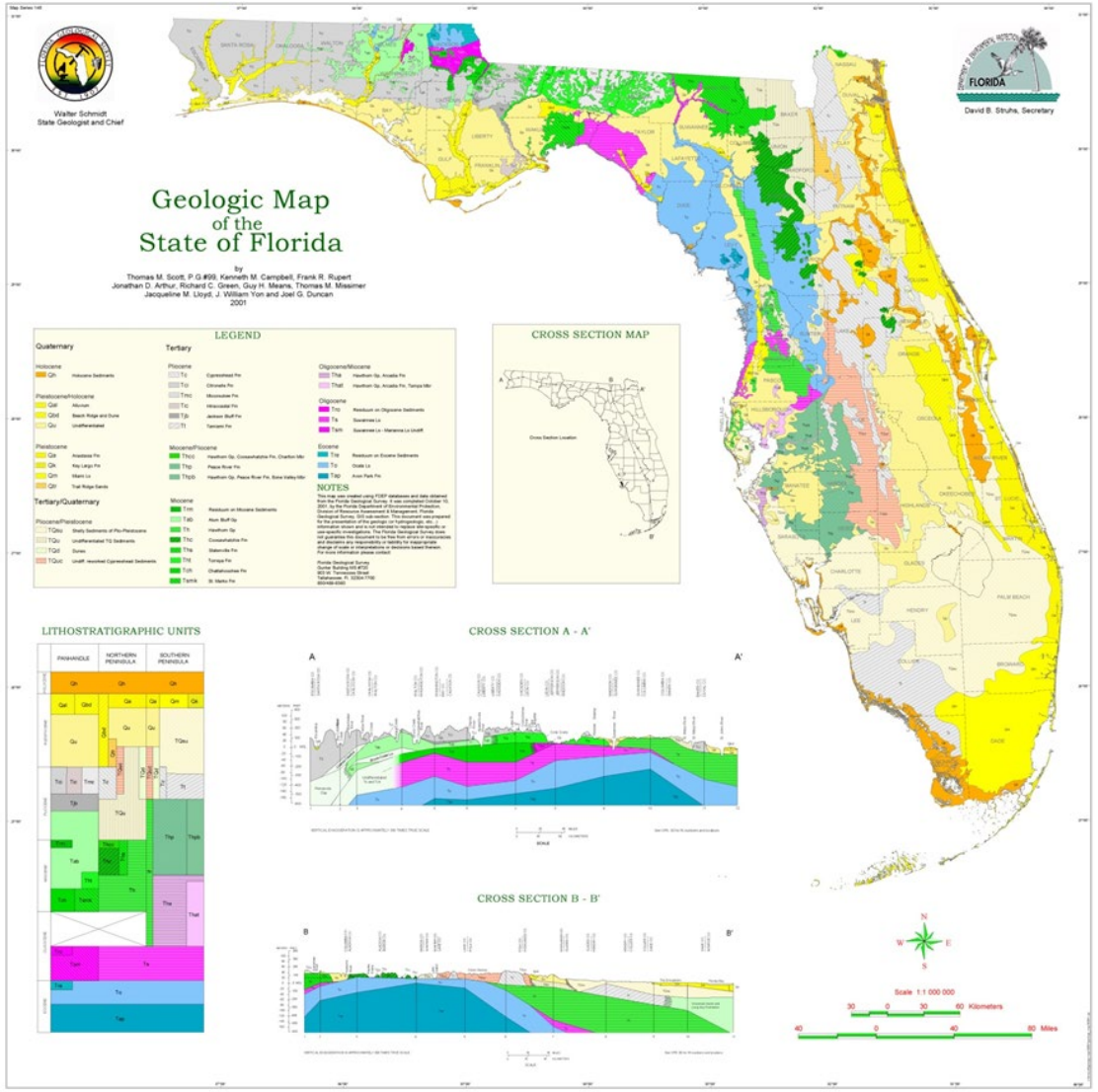
Chapter 377.075 Florida Statutes directs FGS to:

- Improve our understanding of the geology of Florida.
- Conduct field and laboratory investigations of the geology and hydrology of the state.
- Make and maintain collections and exhibits of geologic specimens.
- Engage in interagency collaboration.
- Act as a clearinghouse of geologic information and interpretations; maintain a research library.
- Conduct geologic and physiographic mapping, mineral, sediment, and water analyses.

FLORIDA GEOLOGICAL SURVEY
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



FLORIDA GEOLOGICAL SURVEY
MISSION STATEMENT



Statewide Surficial Geologic Map (Scott et al., 2001)

"Collect, interpret, maintain and distribute objective quality geologic information to benefit Florida"

FGS accomplishes its mission through:

- Collection of geologic samples, data and other geoscience information.
- Research and mapping.
- Maintaining the state geologic sample collection facility.
- Communication, outreach and customer service.
- FGS has 33 FTE staff organized into five sections.

FLORIDA GEOLOGICAL SURVEY

GEOLOGIC SAMPLE ACQUISITION & MANAGEMENT SECTION (collects geologic data)

Mobile Drill B37X
Wireline Coring Drill Rig

AMS 9120-RAP
Direct-Push Rig

FGS has two drill rigs that allows the Geologic Sample Acquisitions & Management Section to:

- Collect borehole samples (core and cuttings).
- Drill and install monitor wells.
- Collect borehole geophysical data.

Additional sample collection tools include:

- Truck mounted direct-push core rig.
- Vibra-core unit.
- Grab samplers.
- 21’ Carolina Skiff.
- 24’ pontoon boat.
- 18’ Weldbilt aluminum hull.
- 15’ Tracker Grizzly aluminum.
- 12’ Carolina Skiff.

Section Administrator:
David Paul, P.G.

FLORIDA GEOLOGICAL SURVEY

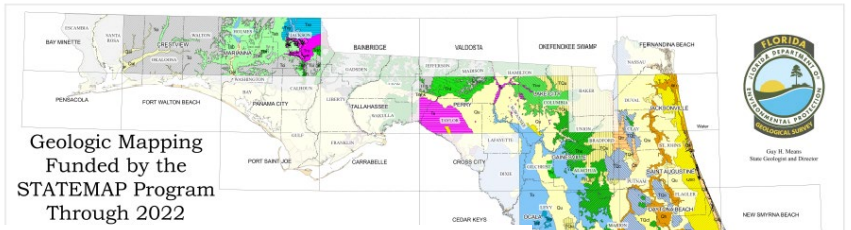
GEOLOGIC SAMPLE ACQUISITION & MANAGEMENT SECTION (collects geologic data)

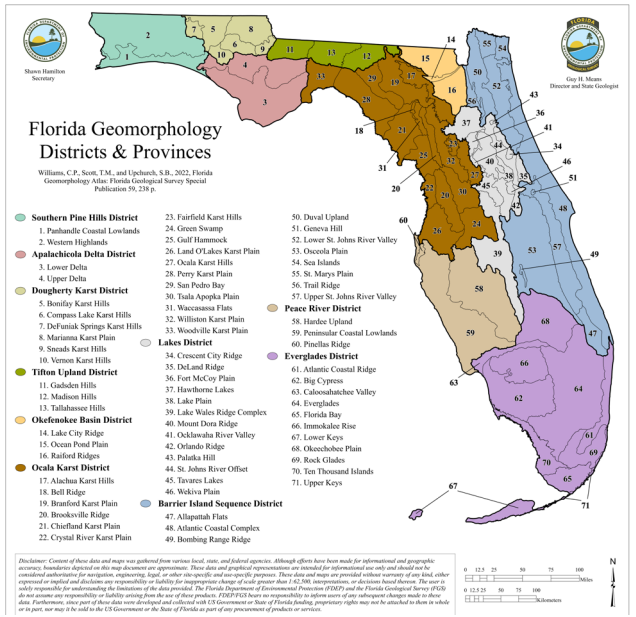
Geologic Sample Collections Facility:

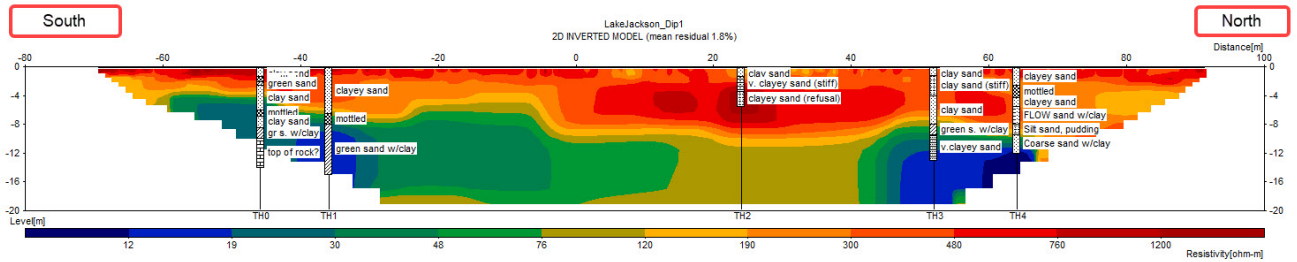
- Contains samples from more than 20,000 boreholes around the state.
- 9,552 surface samples (M-series).
- Facility is more than 22,000 square feet.
- Samples have been valued at more than $ 1.6 billion dollars.

FLORIDA GEOLOGICAL SURVEY

GEOLOGIC INVESTIGATIONS SECTION (collects & interprets geologic data)







- Conducts geologic mapping at various scales and publishes results.
- Conducts geomorphic mapping.
- Conducts mineral resource mapping.
- Updates statewide stratigraphic nomenclature.
- Conducts near-surface geophysical surveys.
  - Geohazards.
  - Sediment characterization.
  - Groundwater.
- Capabilities
  - Ground penetrating radar (GPR).
  - Seismic - Multichannel analysis of surface waves (MASW), Refraction.
  - Electrical Resistivity Tomography (ERT).

Assistant State Geologist and Section Administrator: Clint Kromhout, P.G.

FLORIDA GEOLOGICAL SURVEY

APPLIED GEOSCIENCE SERVICES SECTION (collects & interprets geologic data)

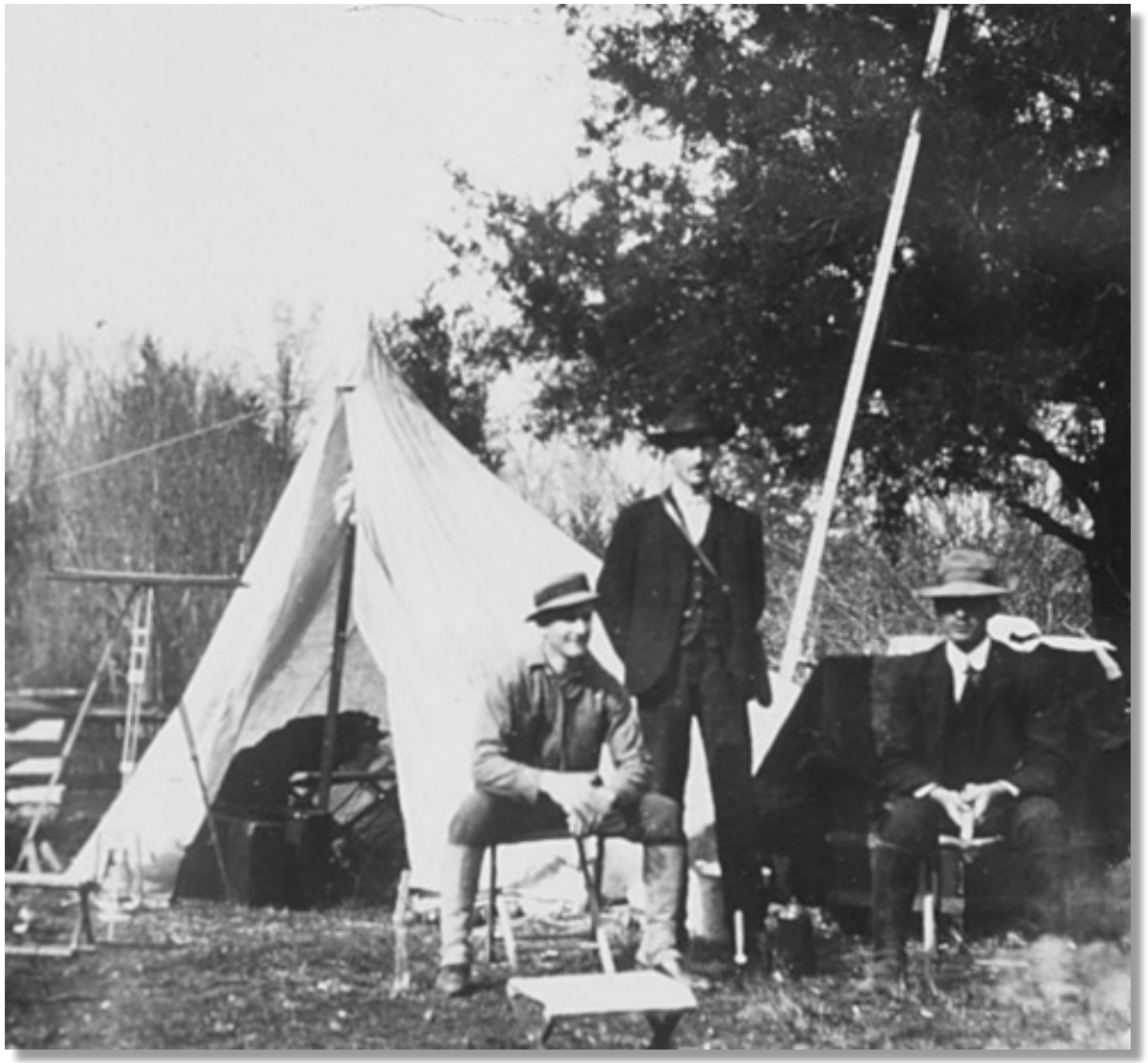
Lake Jackson – Porter Hole Sink

- Conducts surface water – groundwater interaction studies (dye tracing).
- Delineates springshed boundaries and assesses related water quality issues.
- Collects spring and stream flow data.
- Maintains the state's springs and subsidence incident reports datasets.
- Creates statewide potentiometric surface maps for the Upper Floridan aquifer.
- Creates and assesses hydrogeological flow and contaminate transport models for regulatory and land use applications.
- Provides DEP, WMDs, and other agencies with geoscience research and analyses as requested.

Section Administrator:
Mary Beth Lupo, Ph.D, P.G.

FLORIDA GEOLOGICAL SURVEY

GEOSCIENCE INFORMATION & DATA MANAGEMEMT SECTION (maintains & provides geologic data)



E.H. Sellards, R. Harper and H. Gunter at Aspalaga Landing (1909).

- Provides support to all other programs with GIS expertise and data management.
- Publishes and maintains over 50 databases and maps through the FDEP Open Data Portal
- Maintains FGS research library.
- Maintains and distributes over 10,000 images, documents, maps and presentations on our Digital Asset Management software called ResourceSpace.
- Since 1907, FGS has produced more than 900 publications about the geology of Florida, and all are available online.

Section Administrator:
Alan Baker, P.G.

FLORIDA GEOLOGICAL SURVEY

ADMINISTRATIVE SECTION (staff support & outreach)

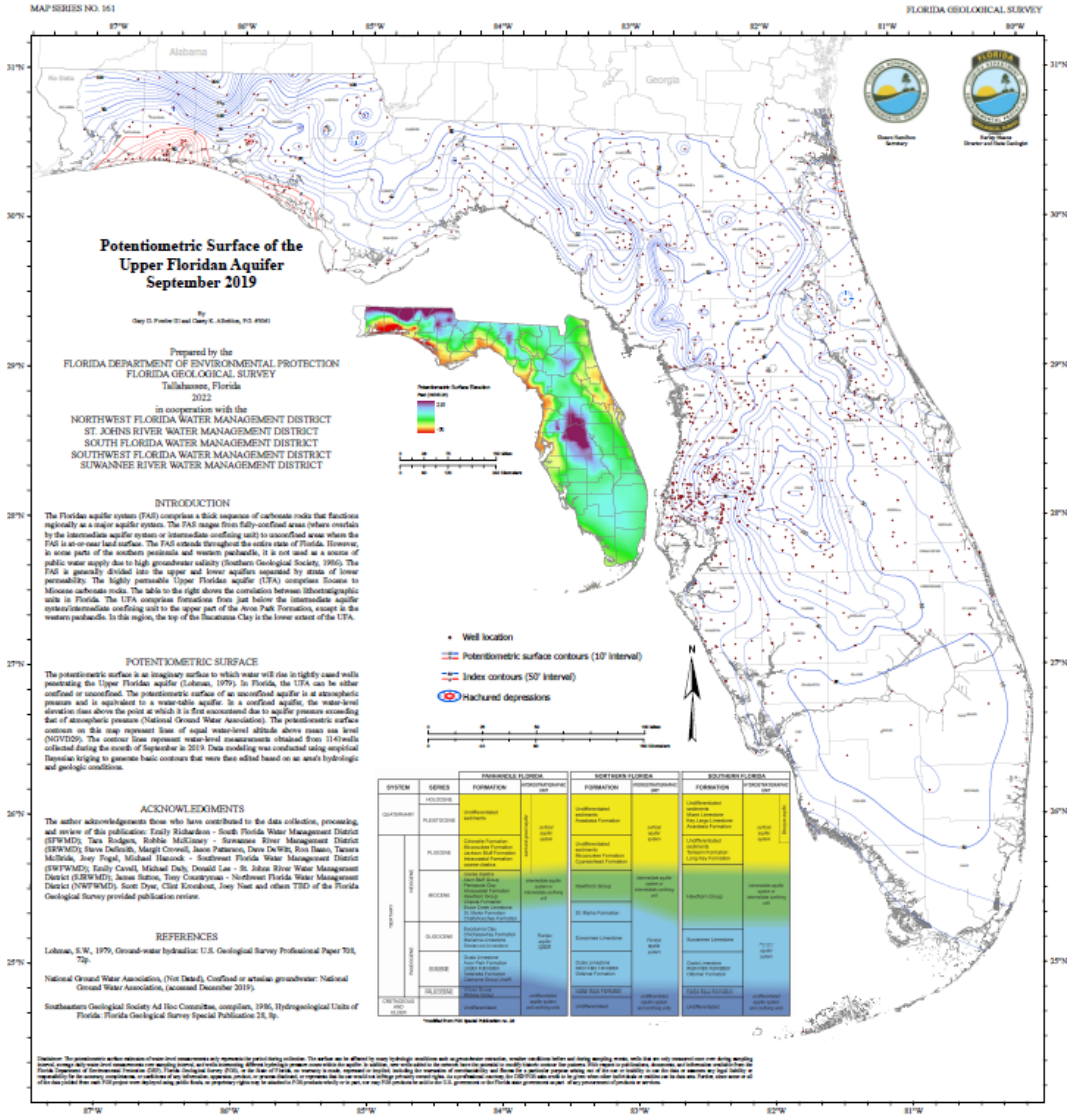
The Administrative Section provides:

- Business planning support.
- Performance and customer service tracking.
- Personnel management.
- Budget coordination (including grant tracking).
- Contracts and building management.
- Travel, training and speaking engagements.
- Legislative budget requests.
- Property management/inventory.
- Editing/writing assistance for publications and reports.
- Communications.
- Purchasing.

Section Administrator:
Traci Billingsley

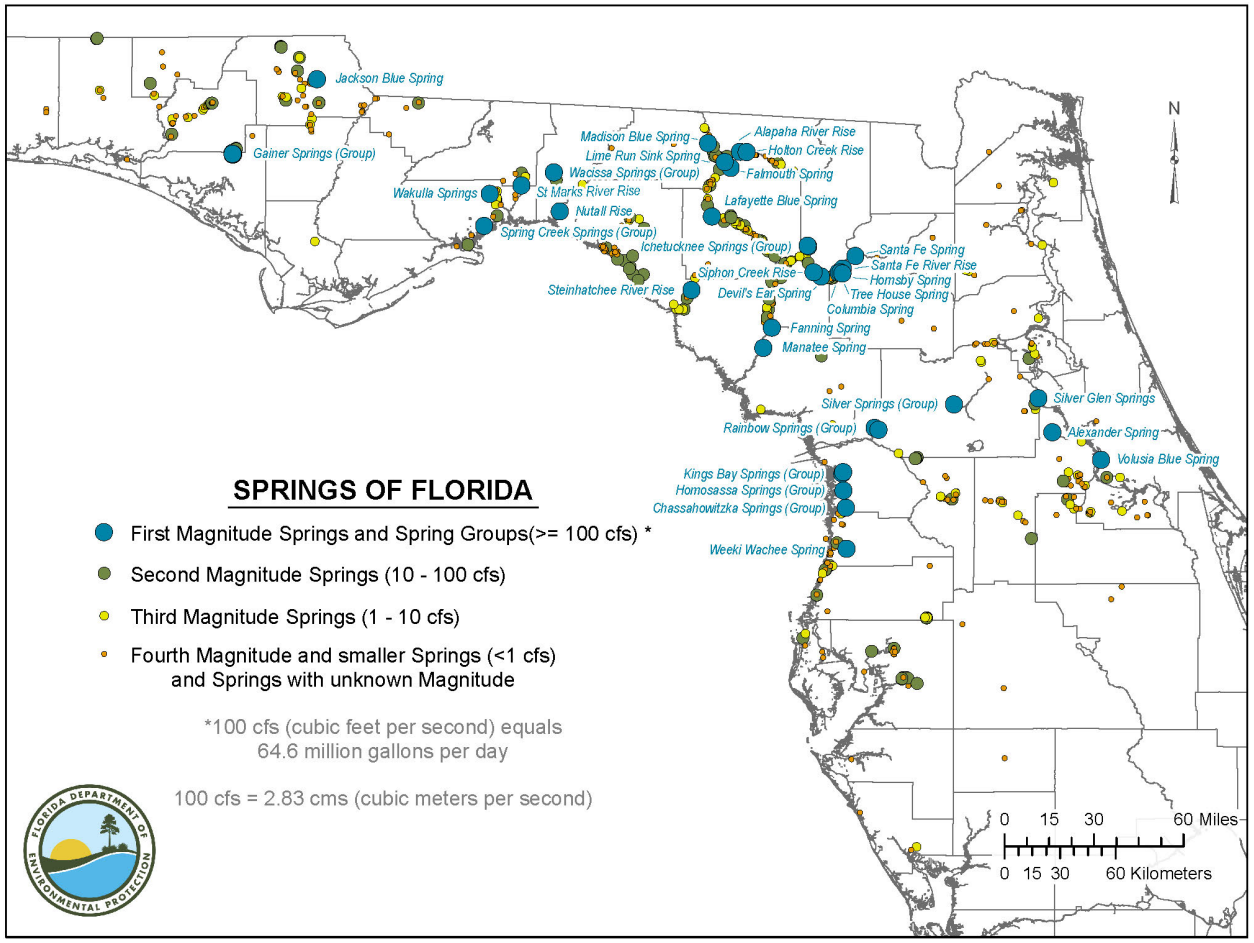
FLORIDA GEOLOGICAL SURVEY

PRODUCTS OF USE TO THIS GROUP – POTENTIOMETRIC SURFACE MAPS



- FGS produces potentiometric surface maps of the upper Florida aquifer twice a year in May and September.
- These maps are served through an interactive ArcGIS online platform accessible through the FGS website.

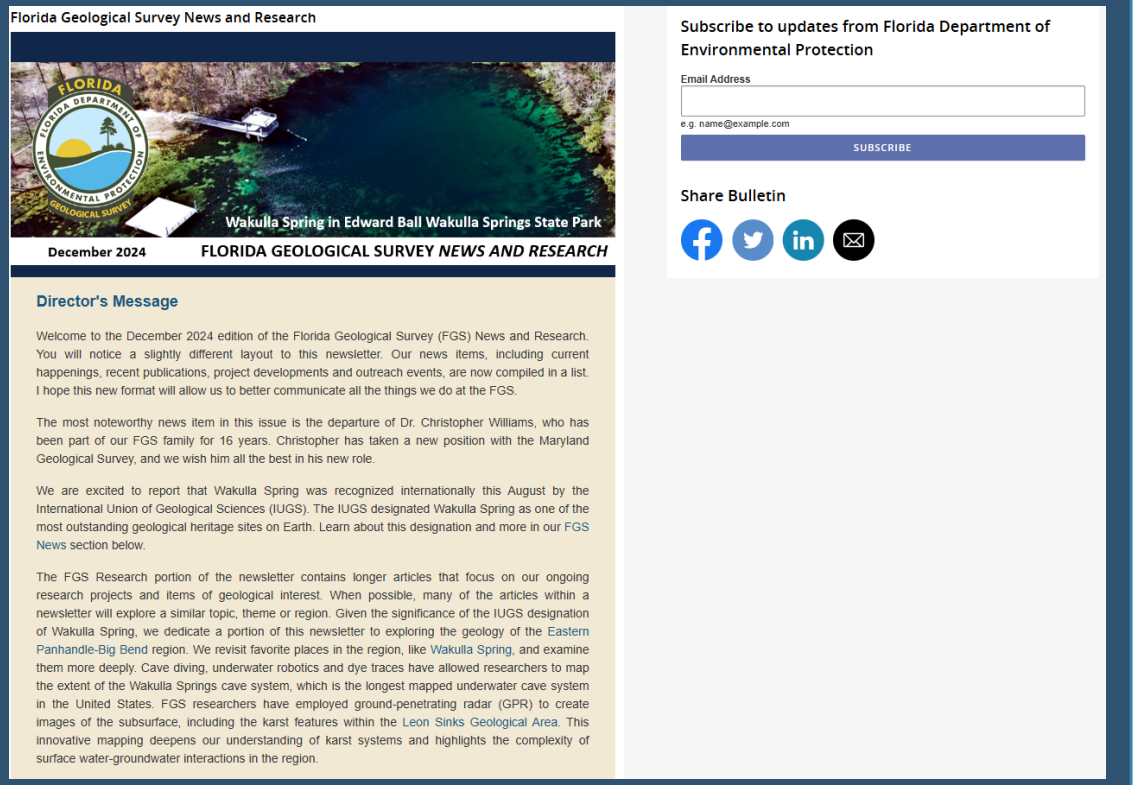
FLORIDA GEOLOGICAL SURVEY
SPRINGS OF FLORIDA



- FGS maintains and updates DEP's official list of artesian springs.
- The geospatial data is accessible through DEP's Map Direct platform.
- FGS also maintains a Springs webpage with links to FGS publications and other springs resources.

FLORIDA GEOLOGICAL SURVEY
ADDITIOONAL RESOURCES

- Geologic data (lithologic data).
- Geologic maps.
- Geomorphology atlas.
- GIS coverages.
- Publications (FGS and library resources).
- Sinkhole information.
- Groundwater vulnerability maps.
- Geologic expertise.
- Museum (rocks, minerals and fossils).
- Story maps.
- Newsletter twice a year.
- Learn more at FloridaDEP.gov/FGS.


Florida Geological Survey News and Research

Wakulla Spring in Edward Ball Wakulla Springs State Park

December 2024 FLORIDA GEOLOGICAL SURVEY *NEWS AND RESEARCH*

Director's Message

Welcome to the December 2024 edition of the Florida Geological Survey (FGS) News and Research. You will notice a slightly different layout to this newsletter. Our news items, including current happenings, recent publications, project developments and outreach events, are now compiled in a list. I hope this new format will allow us to better communicate all the things we do at the FGS.

The most noteworthy news item in this issue is the departure of Dr. Christopher Williams, who has been part of our FGS family for 16 years. Christopher has taken a new position with the Maryland Geological Survey, and we wish him all the best in his new role.

We are excited to report that Wakulla Spring was recognized internationally this August by the International Union of Geological Sciences (IUGS). The IUGS designated Wakulla Spring as one of the most outstanding geological heritage sites on Earth. Learn about this designation and more in our FGS News section below.

The FGS Research portion of the newsletter contains longer articles that focus on our ongoing research projects and items of geological interest. When possible, many of the articles within a newsletter will explore a similar topic, theme or region. Given the significance of the IUGS designation of Wakulla Spring, we dedicate a portion of this newsletter to exploring the geology of the Eastern Panhandle-Big Bend region. We revisit favorite places in the region, like Wakulla Spring, and examine them more deeply. Cave diving, underwater robotics and dye traces have allowed researchers to map the extent of the Wakulla Springs cave system, which is the longest mapped underwater cave system in the United States. FGS researchers have employed ground-penetrating radar (GPR) to create images of the subsurface, including the karst features within the Leon Sinks Geological Area. This innovative mapping deepens our understanding of karst systems and highlights the complexity of surface water-groundwater interactions in the region.

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Email Address

e.g. name@example.com

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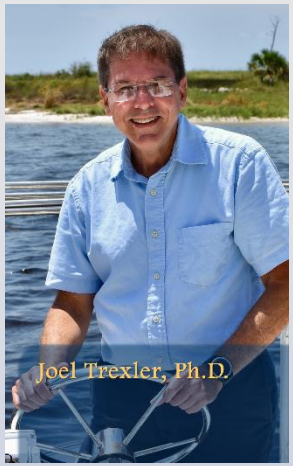
Share Bulletin

THANK YOU

Guy “Harley” Means, P.G.
Director and State Geologist
Florida Geological Survey
Florida Department of Environmental Protection

CONTACT INFORMATION:
850-617-0312
Guy.Means@FloridaDEP.gov


FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

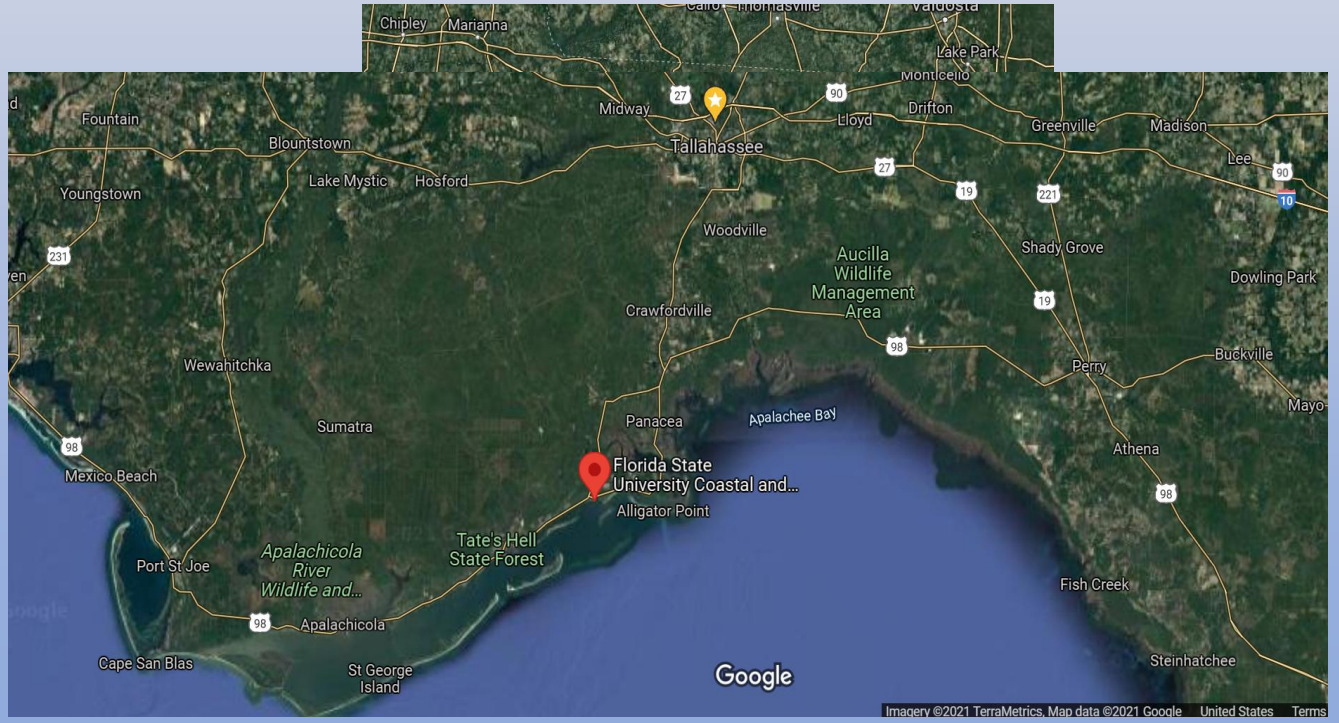


Coastal and Marine Laboratory
Florida State University

Joel Trexler
Director,
Professor of Biological Science

Coastal and Marine Laboratory
Florida State University

Joel Trexler
Director,
Professor of Biological Science



Coastal and Marine Laboratory
Florida State University

FSU CML Faculty

Dean Grubbs, Ph.D.

Sandra Brooke, Ph.D.

Josh Breithaupt, Ph.D.

Joel Trexler, Ph.D.

Postdoctoral Researchers

Alyssa Andres, Ph.D.

Betsy Mansfield, Ph.D.

Lauren Rice, Ph.D.

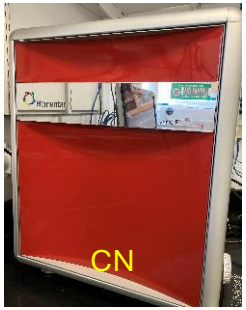
Breithaupt Lab: Biogeochemical measures of ecosystem health

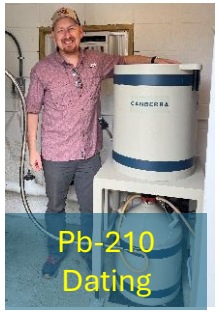
- Present and historical records of coastal ecosystem response to acute and chronic changes.
- The effect of nutrients added to shorelines by wrack deposition or eutrophication.
- Temporal and spatial variability of geomorphic and biogeochemical effects from large storms.
- Changing coastal foundational communities including oyster reefs, mangroves, salt and freshwater marshes, and seagrass meadows.

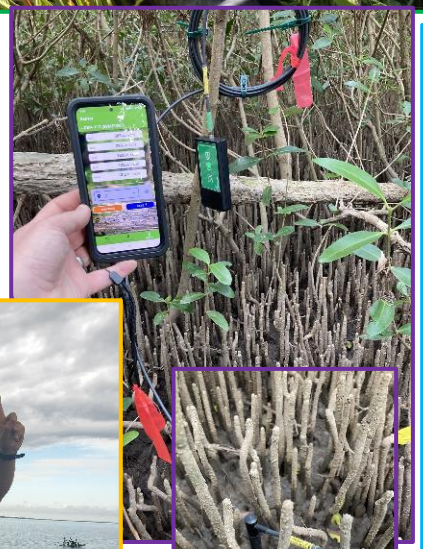
Using the LICOR trace gas analyzer to measure CO2 and CH4 released from wetland soils and sediments around Apalachicola Bay

Josh Breithaupt, PhD,
Research Faculty I

Coastal biogeochemistry & geomorphology







Grubbs Lab: Ichthyology and marine ecology of exploited fishes, especially elasmobranchs

- Management of fisheries and conservation of species of concern.
- Fishery-independent survey methods to study population dynamics, life histories, and distribution patterns of fishes.
- Mark-recapture studies and modern telemetry techniques to acquire data on movement patterns, habitat use, residency and philopatry.
- Major focus of my current research is providing data that will be used to designate Critical Habitat for Endangered smalltooth sawfish

A doctoral student tags a large tiger shark (*Galeocerdo cuvier*)

R. Dean Grubbs, PhD
Research Faculty III
Associate Director of Research
FSU Coastal & Marine Lab

Fish and Fisheries Ecology:

- Research addressing questions needed for fisheries management and conservation of marine fish populations.

- Drivers of community structure
- Food web dynamics
- Life histories
- Population dynamics
- Habitat use
- Movement and migration ecology
- Ecophysiology
- Bycatch mitigation
- Oil spill effects
- Climate change effects

- Most work is on sharks and rays but also teleosts, deep sea invertebrates.

Current Students:

Ashley Dawdy
(sawfish & cownose ray movement ecology)

Annais Muschett-Bonilla
(reproductive physiology in matrotrophic stingrays)

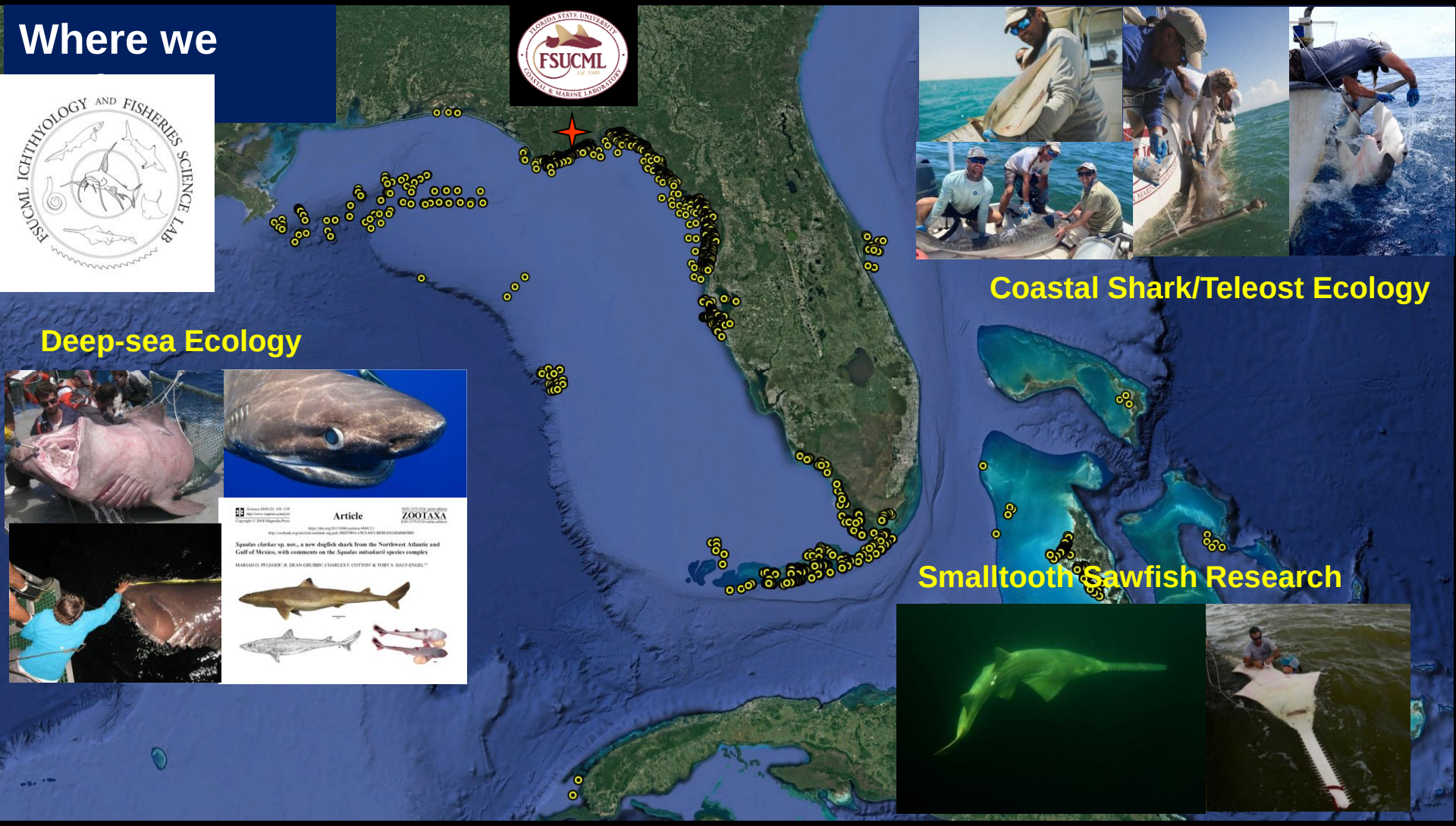
Jessica Dehn
(trophic ecology & population change in coastal sharks)

Emma Jackson
(community structure in deep sea sharks and teleosts)

Current Post-doc:

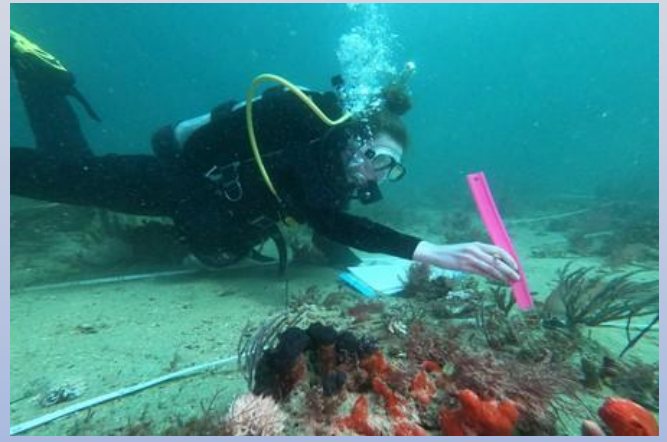
Alyssa Andres, PhD
(fish ecophysiology, stress physiology, climate change)

Where we


FSUCML ICHTHYOLOGY AND FISHERIES SCIENCE LAB
FLORIDA STATE UNIVERSITY
FSUCML
Est. 1949
COASTAL & MARINE LABORATORY
Deep-sea Ecology
Coastal Shark/Teleost Ecology
Smalltooth Sawfish Research
Article
ZOOTAXA
Squalus clarkae sp. nov., a new dogfish shark from the Northwest Atlantic and Gulf of Mexico, with comments on the Squalus mitsukurii species complex

Brooke Lab: Shallow to deep sea invertebrate ecology

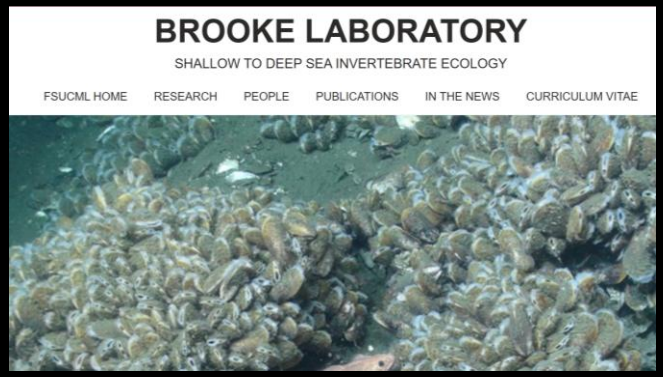
- Distribution, abundance, and physiology of corals, as well as how they are affected by anthropogenic impacts.
- Deep-water coral ecosystems in the Aleutian Islands of Alaska, Norwegian Fjords, South Atlantic Bight and Gulf of Mexico, including the conduct of post-Deepwater Horizon oil spill damage assessment.
- The Apalachicola Bay System Initiative (ABSI) seeks to gain insight into the root causes of decline of the bay's ecosystem and the deterioration of oyster reefs



A graduate student documents spatial variation in hard bottom coral communities of the coastal West Florida Shelf.

Sandra Brooke, PhD
Research Faculty III
FSU Coastal & Marine Lab

BENTHIC INVERTEBRATE ECOLOGY



RESEARCH TOPICS

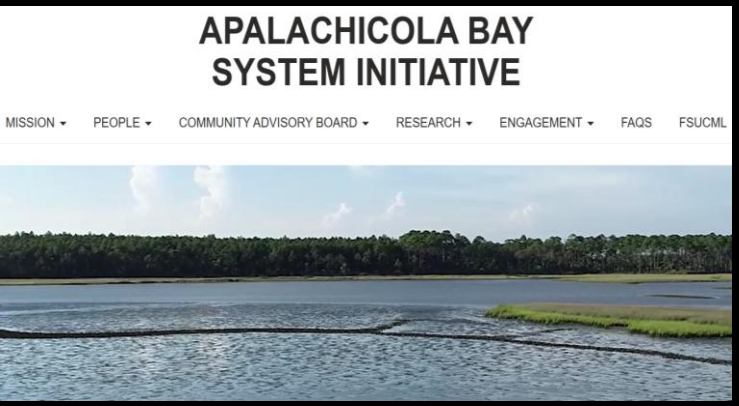
Deep Coral and Chemosynthetic Ecosystems

- Exploration and habitat characterization
- Drivers of species distributions
- Community structure
- Reproduction and larval ecology
- In situ growth and survival
- Physiological responses to stress
- Impacts of climate change

Coastal Marine Ecosystems

- Coral habitat characterization and species distribution
- Coral reproduction and growth
- Coral responses to thermal stress
- Coral habitat suitability modeling

WHERE WE WORK



Sandra Brooke, PhD,
Research Faculty III
FSU Coastal & Marine Lab

APALACHICOLA BAY SYSTEM INITIATIVE

https://marinelab.fsu.edu/absi/

RESEARCH TOPICS

- Oyster distribution, density & demograpics
- Oyster reef restoration experiments
- Bay scallop restoration experiments
- Oyster physiology & stress responses
- Reef associated invertebrates & fishes
- Oyster reproduction & larval ecology
- Oyster habitat suitability & larval dispersal models
- Oyster disease monitoring
- Drone surveys for intertidal monitoring
- Combined river flow & bio-physical model
- Apalachicola Bay food webs
- Pollutant levels in Apalachicola Bay
- Organic material dynamics in Apalachicola

COMMUNITY ENGAGEMENT

- Commmunity Advisory Board to develop Management and Restoration Plan for Apalachicola Bay
- Management plan released to public
- Plan Summary distributed to management agencies
- Oystermens workshops
- Community Workshops
- Presentations to local Government
- Public presentations and events
- Participation in local festivals
- Interviews with reporters and local media
- Participation in oyster documentary
- Distribution of bi-monthly newsletter

SHELLFISH HATCHERY

- Micro-algal culture
- Oyster conditioning
- Larval culture
- Oster spat on shell and seed production
- Bay scallop culture and juvenile production

PERSONNEL

- Faculty: 3-5
- Post-docs: 3
- Graduate students: >10
- Research Technicians: 6
- Hatchery Technicians: 5
- Interns: 6
- Undergraduates: >10
- Volunteers: >15

Apalachicola Bay System Initiative (ABSI)

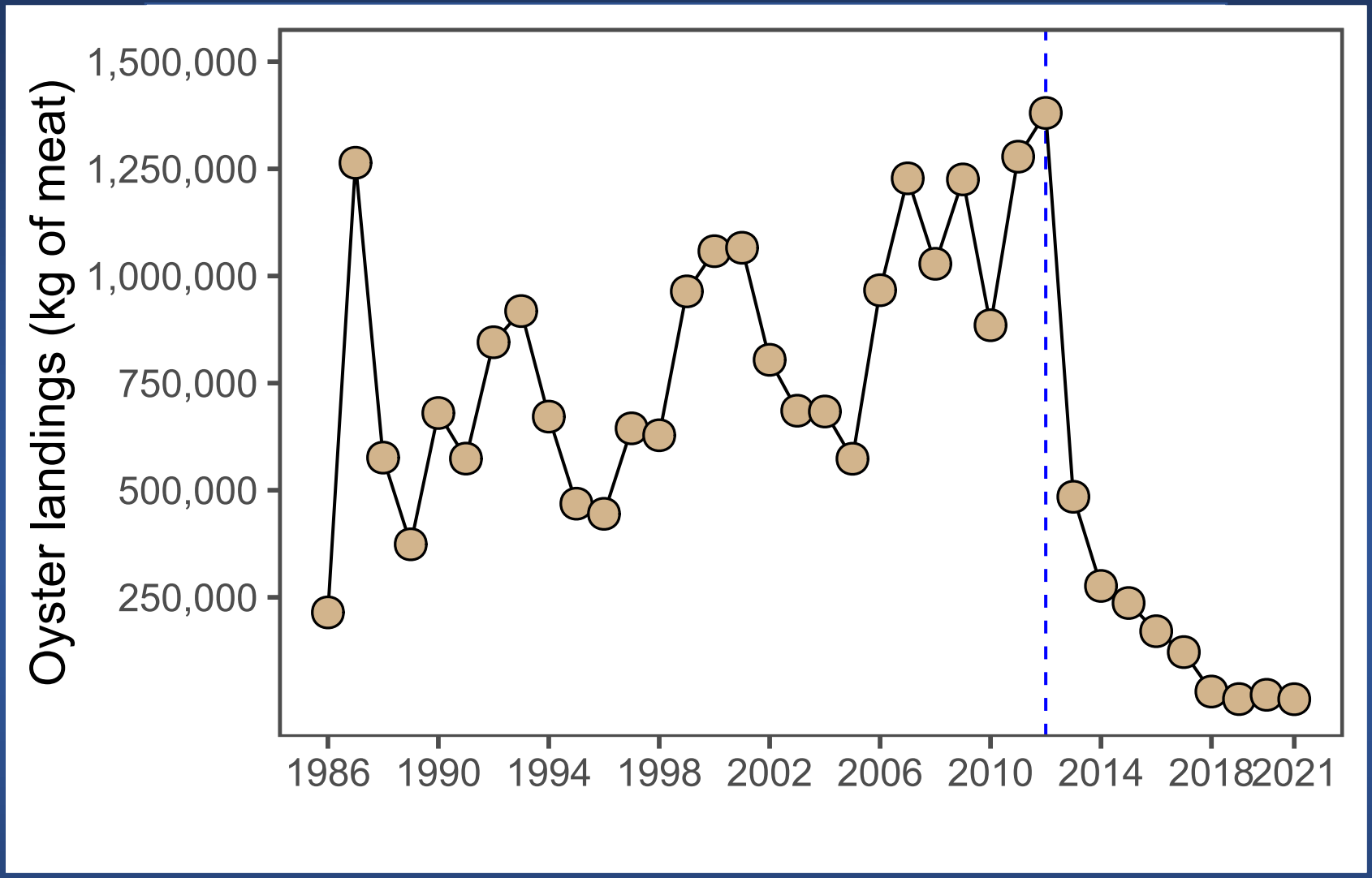
The Apalachicola river and bay system is among the most ecologically diverse and significant natural areas in the southeastern United States.

It serves as the central economic pillar of Franklin County, FL. It is now an imperiled ecosystem.

Florida State University is dedicated to reversing this trend through the **ABSI** funded in part by the Triumph Gulf Coast Inc.

ABSI Mission

The ABSI seeks to gain insight into the root causes of decline of the bay's ecosystem and the deterioration of oyster reefs. Ultimately, the ABSI will develop a management and restoration plan for the oyster reefs and the health of the bay.



2013: Apalachicola Bay Oyster fishery declared a federal fishery disaster

2020: FWC closed Apalachicola Bay Oyster Fishery for 5 years

Apalachicola Bay System Initiative (ABSI)

Development and implementation of Management and Restoration Plan

- Engagement with stakeholders, agencies, and university partners
- Community Advisory Board (CAB)

Research

- Causes of decline of the bay's ecosystem and the deterioration of oyster reefs
- Restoration strategies
- Hatchery to produce larvae for laboratory and field experiments related to restoration

ABSI Hatchery

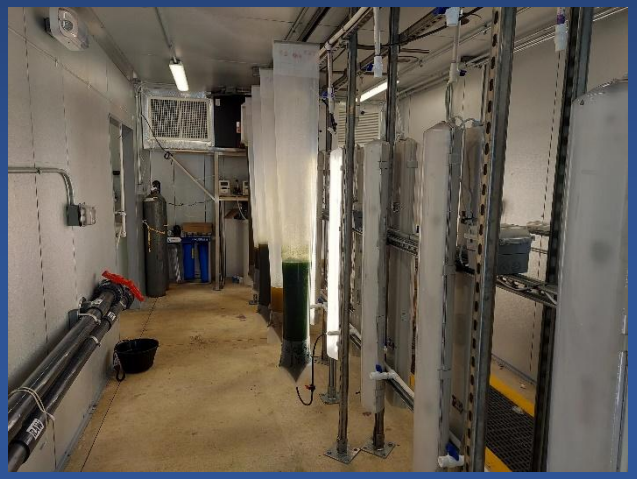
New 3,760 sqft hatchery operational summer 2022

- Temp-controlled algae room
- Temp-controlled brood stock room
- Spawning wrack 50 3-L tanks with recirculating system
- Larval holding tanks - six 1,000 gallon tanks; produce 3M larvae her tank (18M per spawn).
- Setting tank area

ABSI Hatchery

Algal stock cultures

Algal culture room



Spawning racks

Broodstock room

Larval tanks

Setting tanks

Community Engagement

Community Advisory Board

Oystermen's workshops

Public presentations

Annual open house

Shell recycling program

Hatchery Internships

Educational programs

Community Advisory Board (CAB)

Board Members

5 Non-profit organization
4 Seafood industry
4 Business
3 Local government
3 State Government
3 Federal government
2 Other

The CAB is tasked with developing recommendations - informed by science and stakeholder experiences - for the Apalachicola Bay System Management and Restoration Plan and to ensure there is a mechanism for the Plan implementation

23 CAB meetings since October 2019
4 in-person oystermen's workshops

Wakulla Springs: Tracing groundwater sources

Using chemical and molecular methods to create a “fingerprint” of groundwater sources believed to contribute to discharge from Wakulla Spring (WS).

Collaborative Team:

Joel Trexler, CML, Florida State University

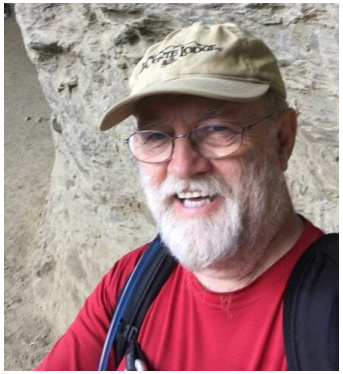
Josh Beithaupt, CML, Florida State University

Ming Ye, Department of Earth, Ocean, & Atmospheric Science, FSU

Chris Werner, Praeter Seape, LLC and Woodville Karst Plain Project

Gareth Davies, Cambrian Ground Water Co.

Schonna Manning, Florida International University



Objectives

This information permits us to:

- Evaluate the role of seawater intrusion from the Spring Creek and coastal areas as a possible source of high conductance events at WS,
- Improve our understanding of the subterranean plumbing of the WS conduit system and assess additional groundwater inputs that likely discharge at WS, and
- Add new information on the stoichiometry of nitrogen and phosphorus that control algal and plant growth in the Wakulla River and their impacts on the microbial community dynamics and ecosystem utilizing environmental DNA.

Wakulla Springs Lab—FSU School of Communication

Kellie Keys

Andy Opel

Goal #1: Educational Videos

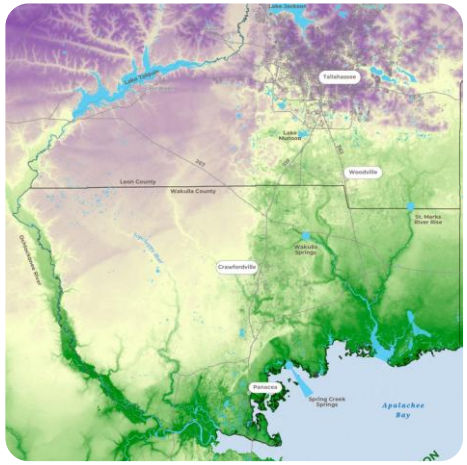
Year-one educational video for middle school students is filmed and in the editing process. The video will be offered free of charge for area teachers. The year-two goal is creating a high school-level video.

Goal #2: Research

Environmental communication research is a rapidly developing field of study. Our year-one research is examining the use of environmental values for message creation.

Goal #3: Watershed Tours

The tours are publicly available and highlight Tallahassee's direct connection to Wakulla Springs. The tours were originally established by renowned springs educator, Jim Stevenson.



Goal #4: Student Involvement

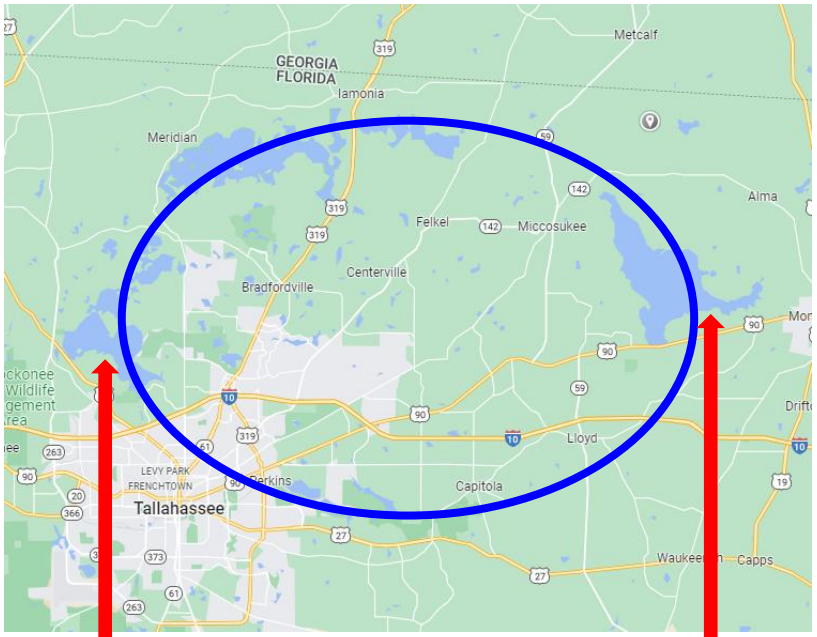
The lab prioritizes stuent involvement. To date, 13 students across five majors are interning or volunteering with the project. Five departments at FSU have collaborated.

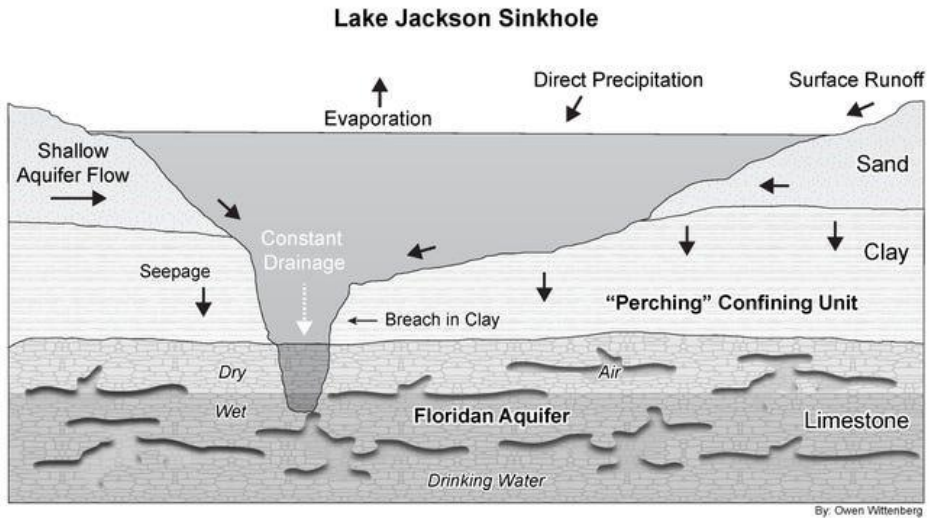
Groundwater reactive transport modeling

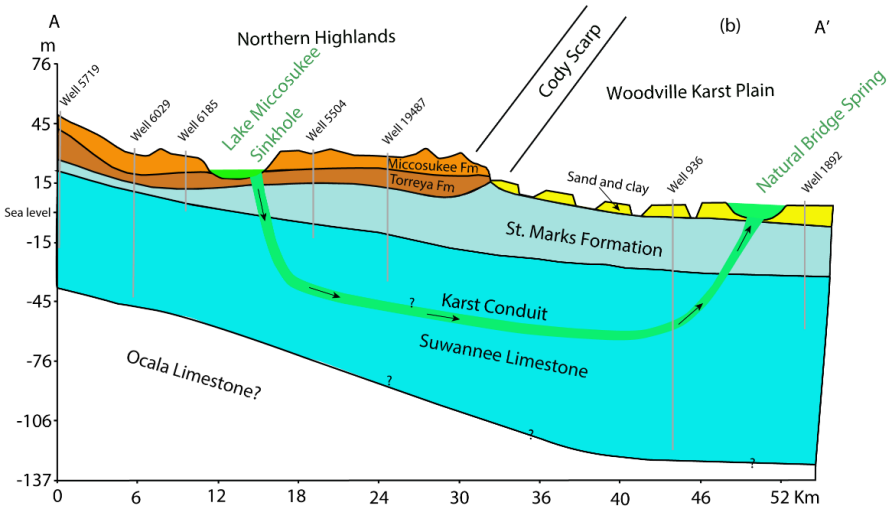
Ming Ye, Ph.D.
Department of Earth, Ocean, & Atmospheric Science

- Hydrogeology
- Groundwater reactive transport modeling
- Uncertainty quantification
- Geostatistics

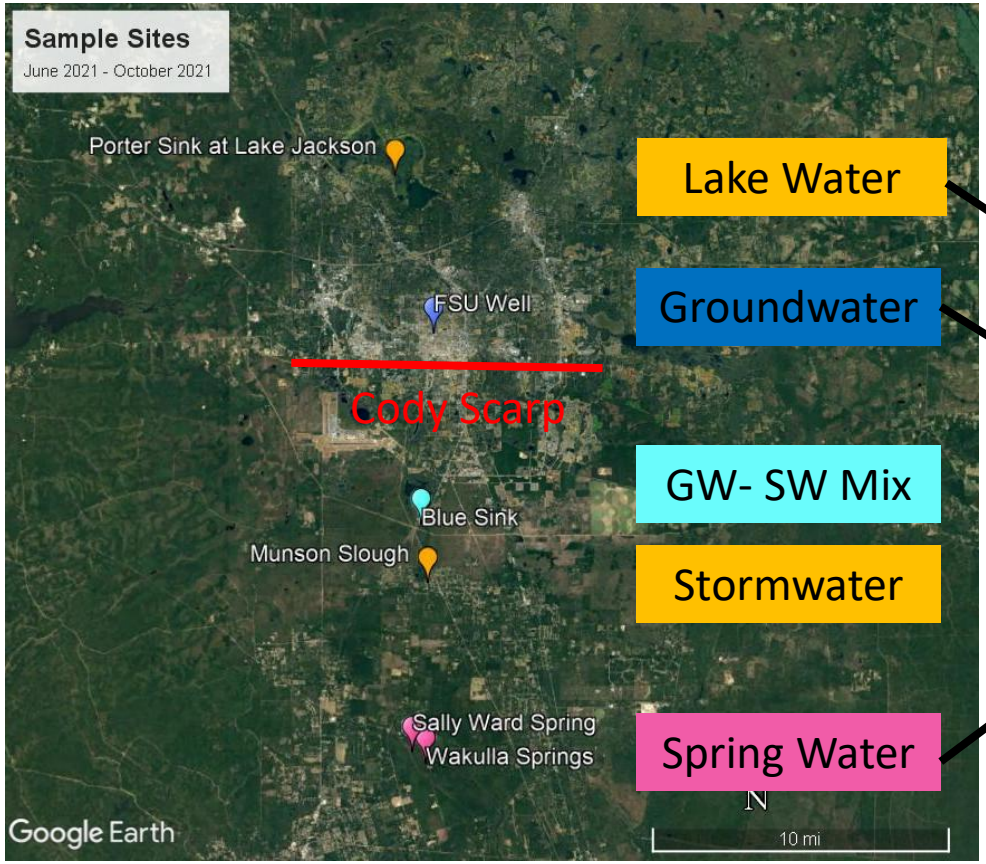
Four Sinkhole Lakes in Tallahassee, FL







Impacts on Groundwater Quality



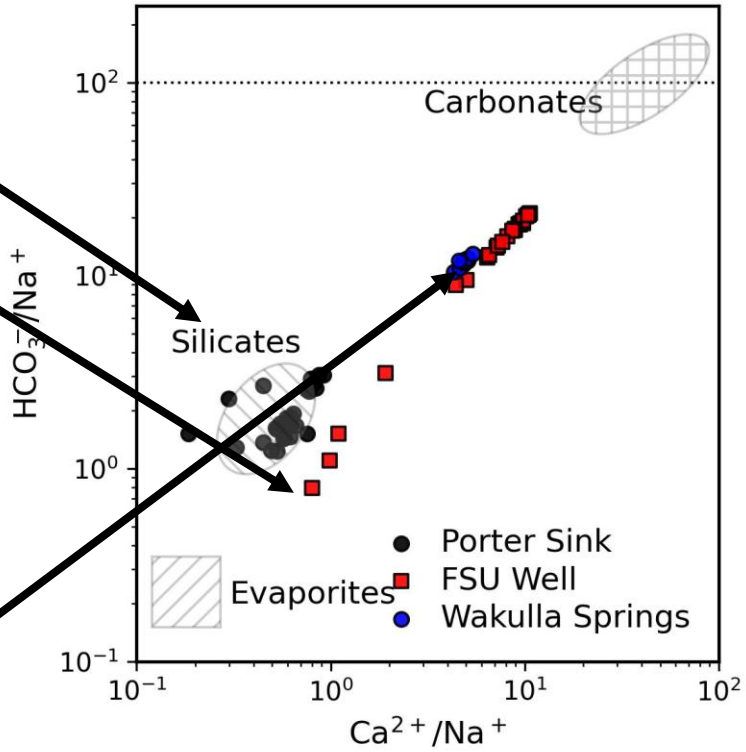
Lake Water

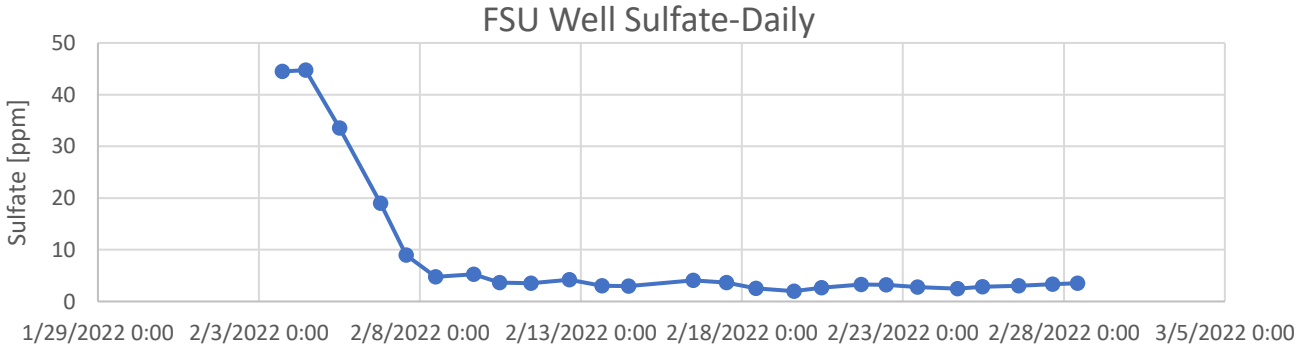
Groundwater

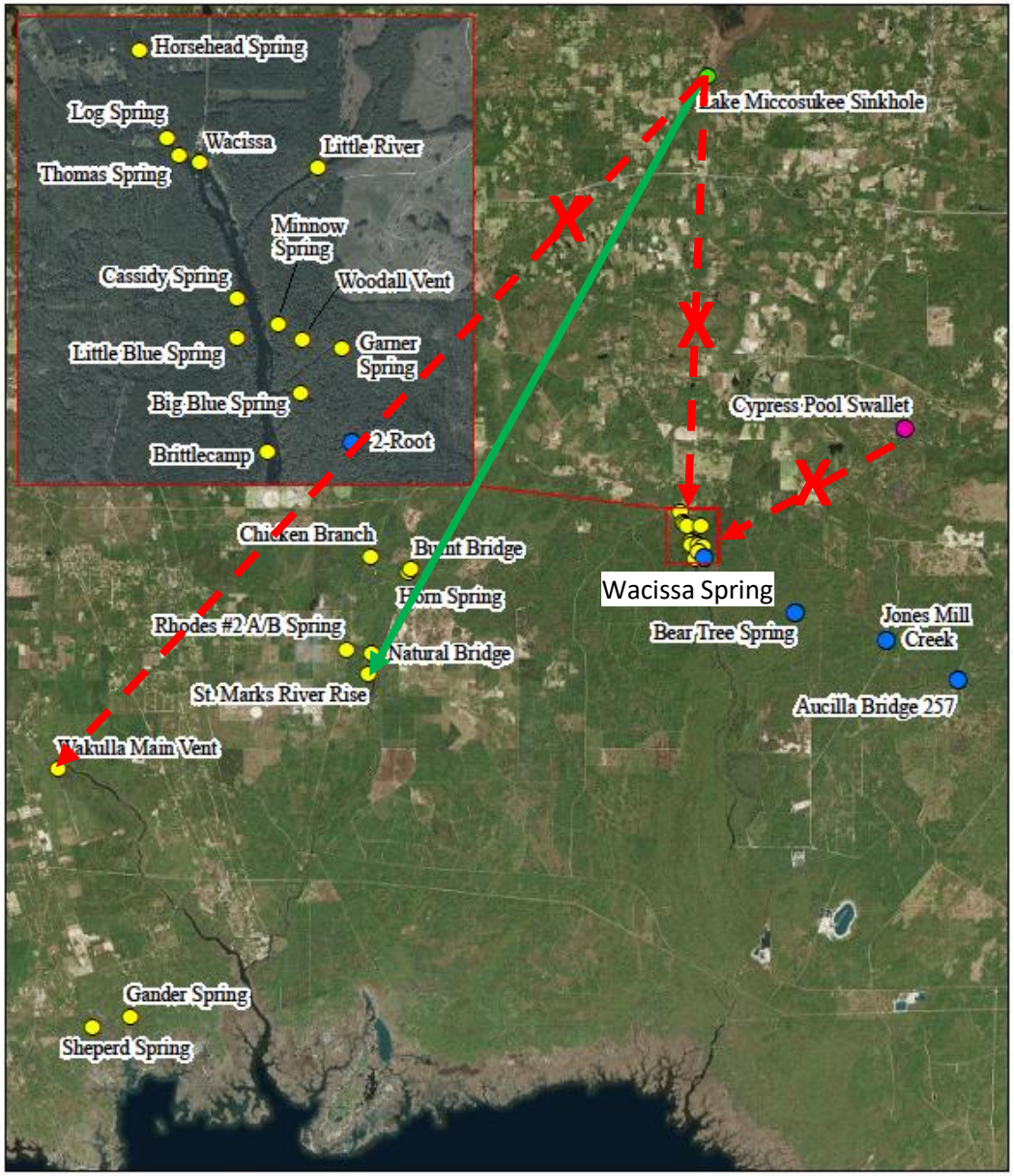
GW- SW Mix

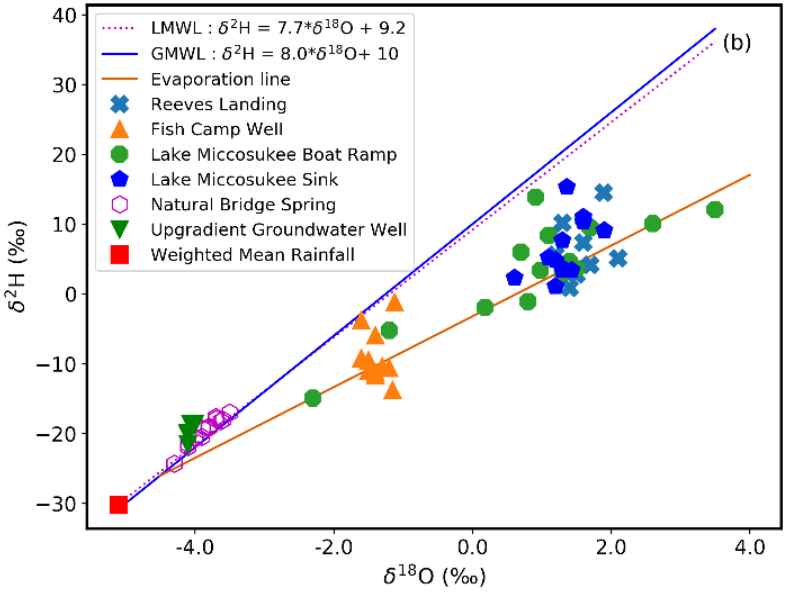
Stormwater

Spring Water





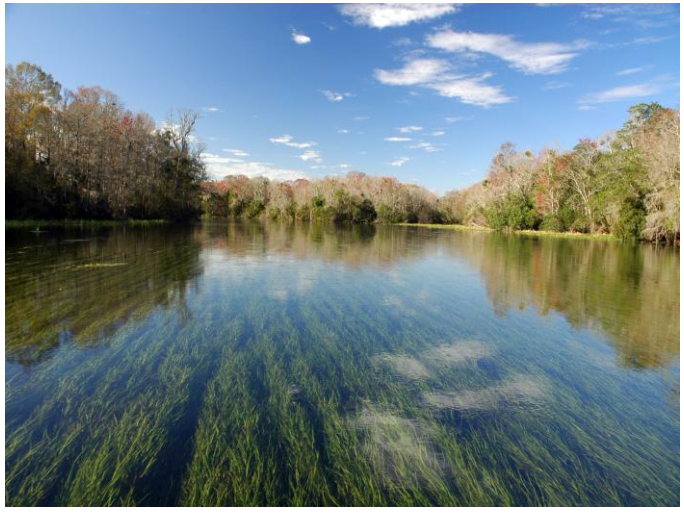

Horsehead Spring
Log Spring
Wacissa
Little River
Thomas Spring
Minnow Spring
Cassidy Spring
Woodall Vent
Little Blue Spring
Garner Spring
Big Blue Spring
Brittlecamp
2-Root
Lake Miccosukee Sinkhole
Cypress Pool Swallet
Chicken Branch
Burnt Bridge
Horn Spring
Wacissa Spring
Bear Tree Spring
Jones Mill Creek
Rhodes #2 A/B Spring
Natural Bridge
St. Marks River Rise
Aucilla Bridge 257
Wakulla Main Vent
Gander Spring
Sheperd Spring
Fluorescein Injection Site
Eosine Injection Site
Sample Sites
Additional Sample Sites
Lake Miccosukee Dye Trace
N
0
3
6
12 MI


LMWL : $\delta^2H = 7.7*\delta^{18}O + 9.2$
GMWL : $\delta^2H = 8.0*\delta^{18}O + 10$
Evaporation line
Reeves Landing
Fish Camp Well
Lake Miccosukee Boat Ramp
Lake Miccosukee Sink
Natural Bridge Spring
Upgradient Groundwater Well
Weighted Mean Rainfall
(b)
δ^2H (‰)
$\delta^{18}O$ (‰)
40
30
20
10
0
−10
−20
−30
-4.0
-2.0
0.0
2.0
4.0

Mixing Fraction of Lake Water

Time interval	Average $\delta^{18}O_{sp}$	Average $\delta^{18}O_{l}$	F_l ($\delta^{18}O$)	Average $\delta^{2}H_{sp}$	Average $\delta^{2}H_{l}$	F_l ($\delta^{2}H$)
21 days	-3.6‰	1.4‰	8.5%	-18‰	8‰	7.1%
28 days	-3.6‰	1.6‰	9.2%	-18‰	8‰	7.1%
35 days	-3.6‰	1.5‰	7.6%	-18‰	9‰	6.8%

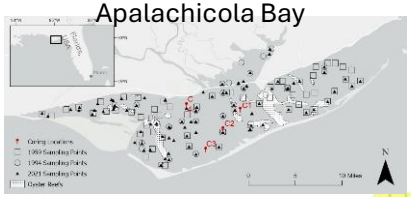
Wacissa River: before

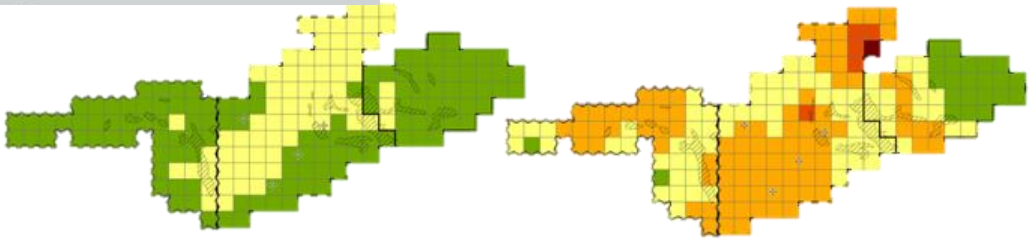


Wacissa River: now

Marine Sediments as Record of Eutrophication

Apalachicola Bay

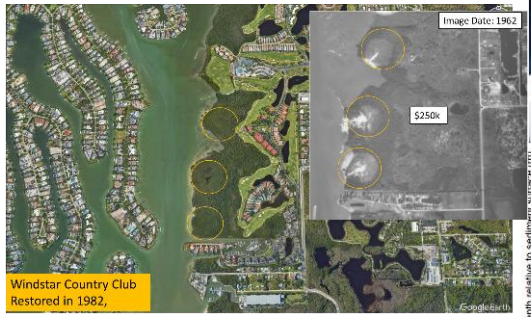


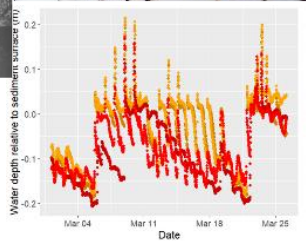


1959: median 6.6 mg g^{-1}

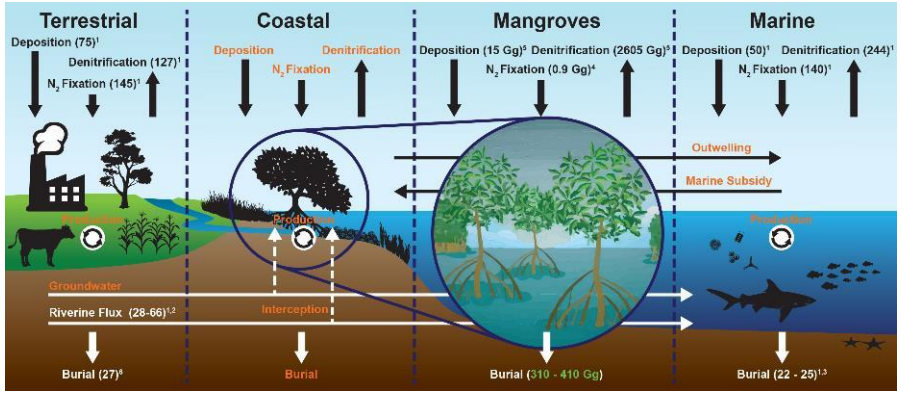
2021: median 22.1 mg g^{-1}

Influence of Hydrology and Elevation on Soil Building in Restored Wetlands





Capture of Terrestrial Nitrogen by Coastal Wetland Soils



Sea-level rise and coastal wetland loss