

2023 ANNUAL CONFERENCE & EXPOSITION

June 27 – 30, 2023 • Hilton Orlando Bonnet Creek • Orange County



@flcounties
#FLCounties



State of the Wetlands: Orange County



@flcounties
#FLCounties



Dan Levy

Vice President

AECOM

New Threat Facing Florida

“The Algae Problem”

Florida Association of Counties (FAC)
Annual Conference – Orlando
June 29, 2023

Presented By:
Dan Levy, P.G.
National Director - Algae

Agenda

- 1 The Algae Problem
- 2 Need for Mitigation
- 3 Next Steps (Public Private Partnership – P3)

1

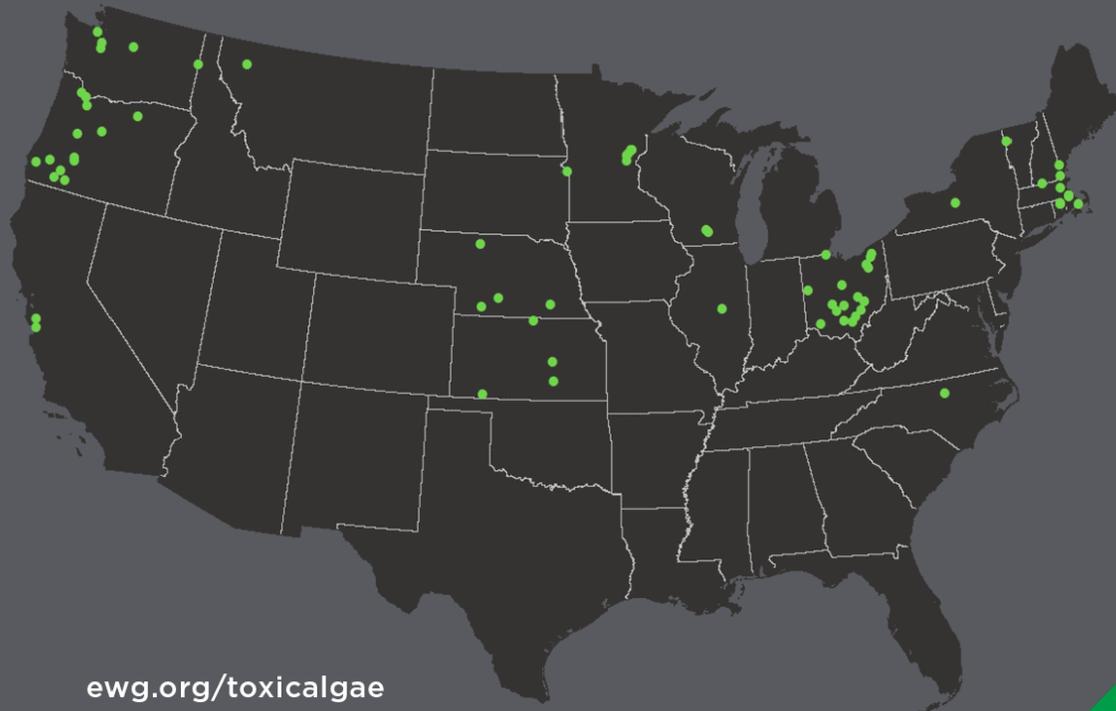
The Algae Problem

Harmful Algal Blooms

Increasing in Intensity, Lasting Longer, Becoming More Toxic

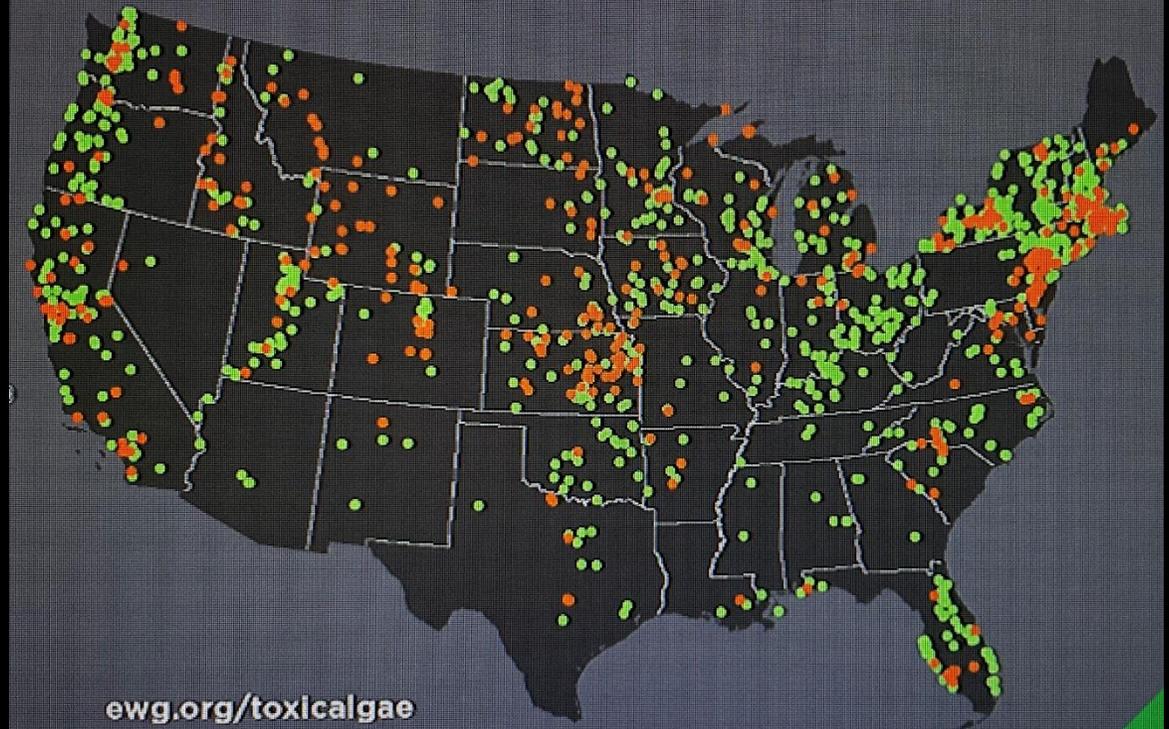
2010

ALGAE BLOOMS IN THE U.S. HAVE SURGED BETWEEN 2010 AND 2020



2020

ALGAE BLOOMS IN THE U.S. HAVE SURGED BETWEEN 2010 AND 2020



■ Locations of Algae Blooms 2010-2019

■ Locations of 2020 Algae Blooms (through October 9th)

Source: Environmental Working Group. Updated through October 9th, 2020.



More Challenges Ahead

UF scientists show how long toxins produced by HABs of blue-green algae remain in the air- October 2020

“...Residential areas within about 10 miles from a Harmful Algae Bloom (HAB) source could be impacted by the harmful algal aerosols even under a gentle breeze traveling four to seven miles per hour.”

Existing Technologies

1. Sonic
2. Aeration Bubbles
3. Peroxide
4. Algaecides
5. Dredging

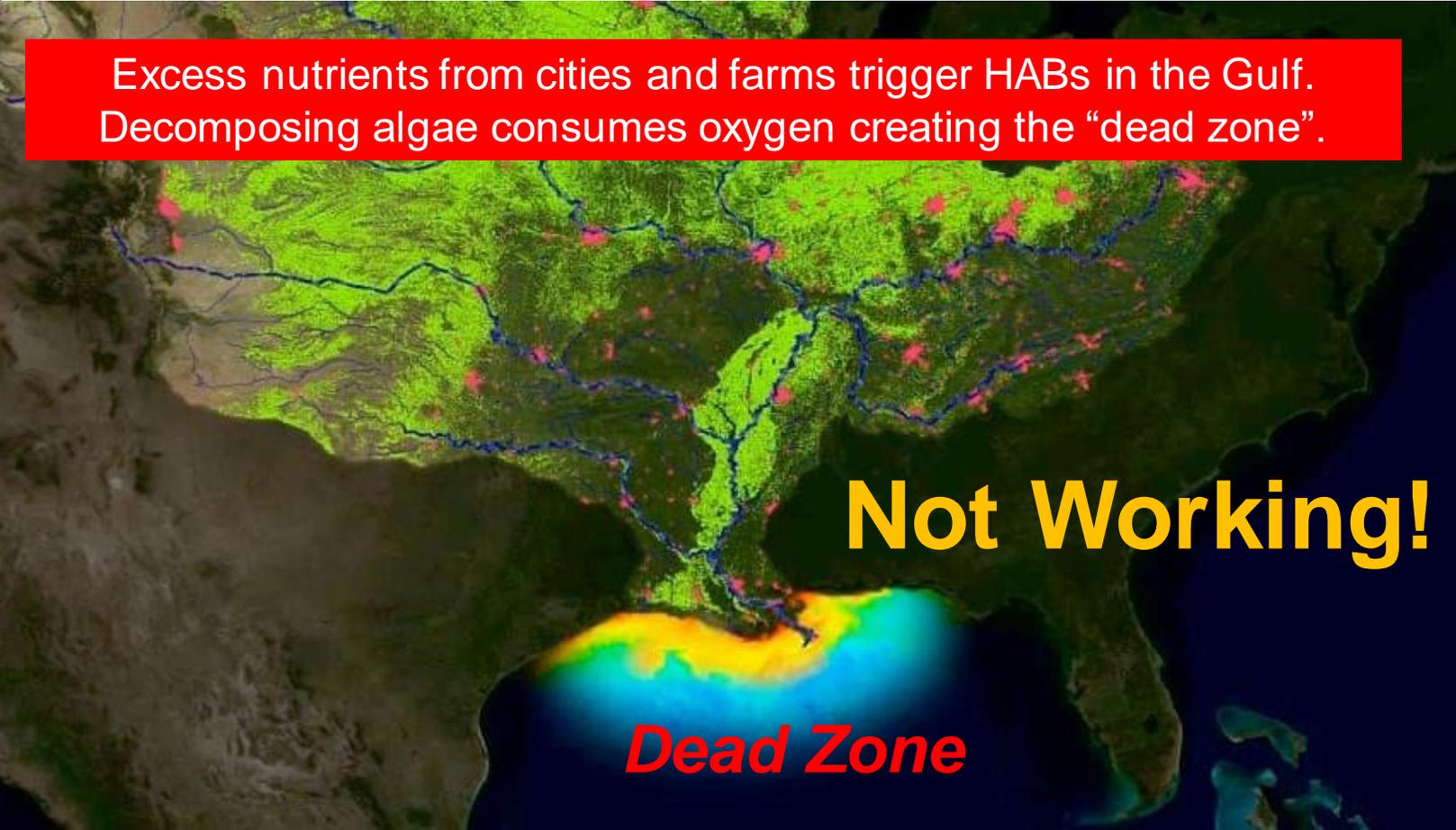


Current process of managing stormwater

Gulf 'Dead Zone' Chokes Marine Life

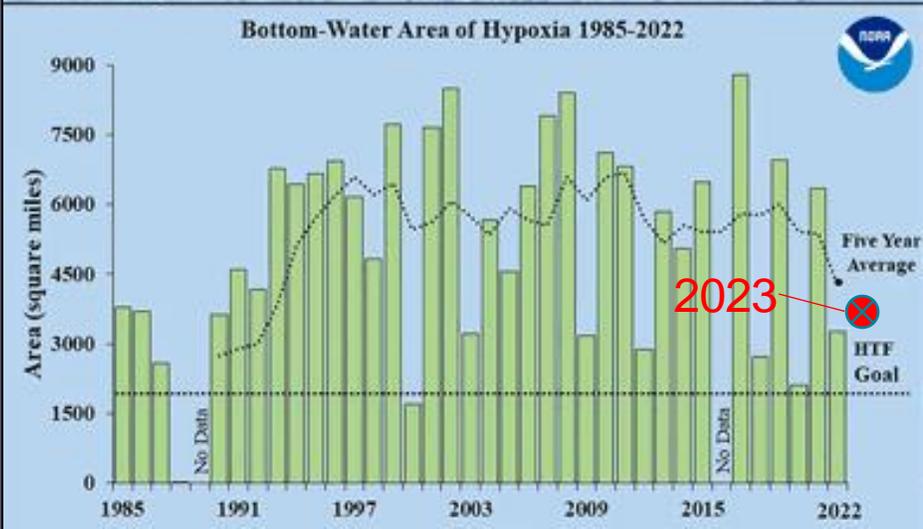
The Gulf of Mexico at the Mississippi River Delta experiences a seasonal *hypoxia*, or "dead zone," where there is not enough oxygen in the water to sustain marine life.

Excess nutrients from cities and farms trigger HABs in the Gulf. Decomposing algae consumes oxygen creating the "dead zone".

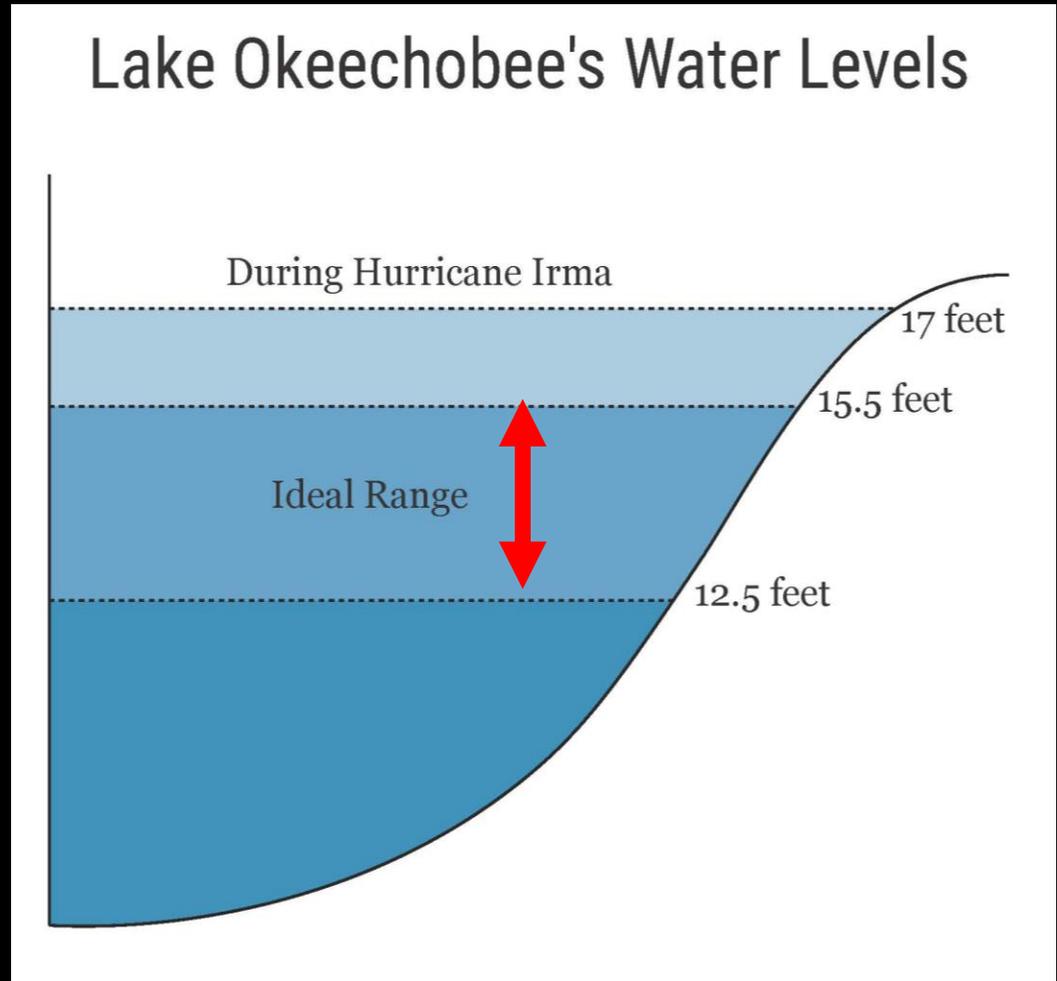
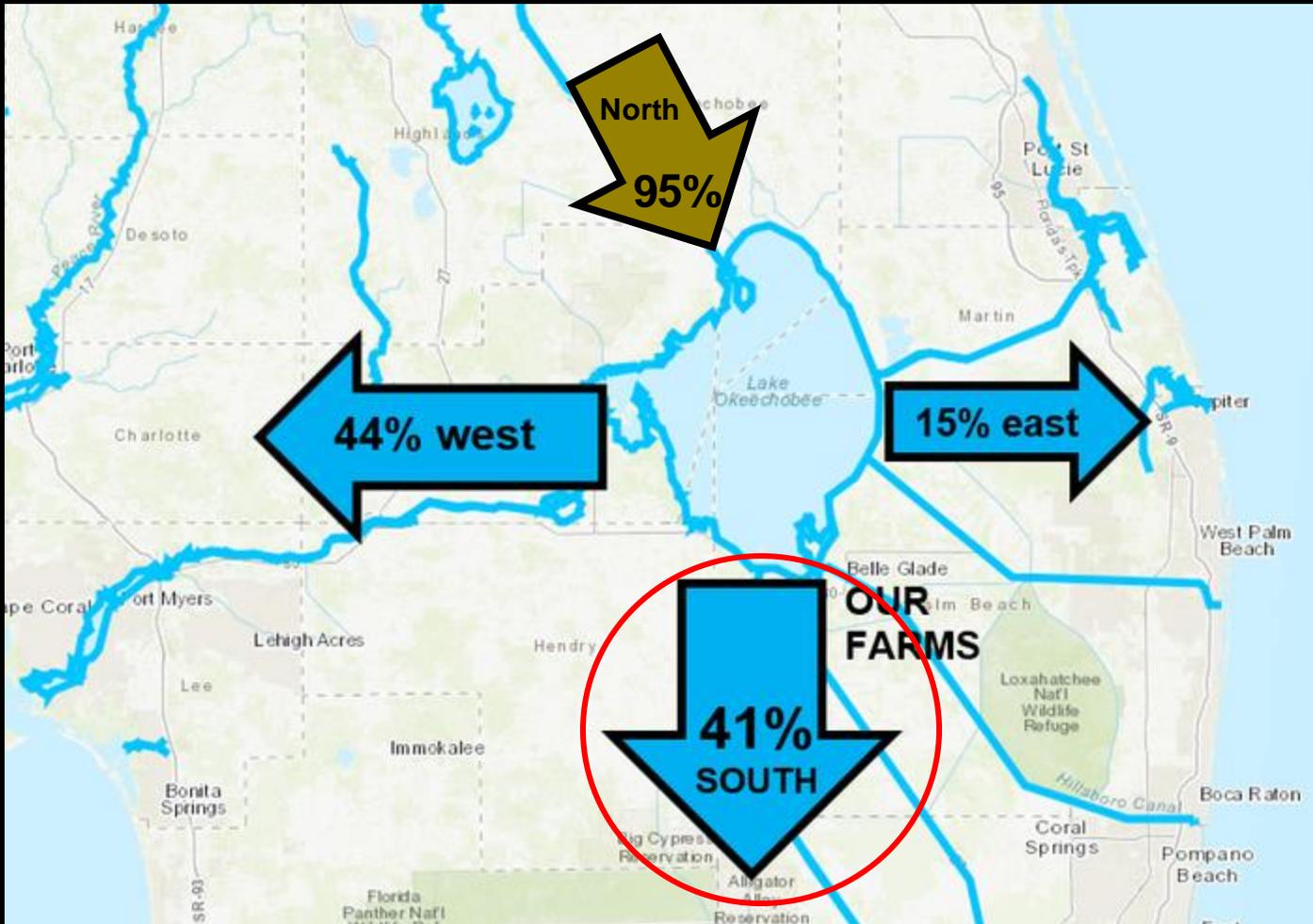


2023 Prediction

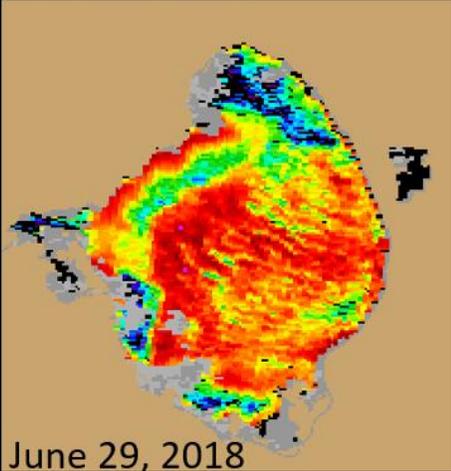
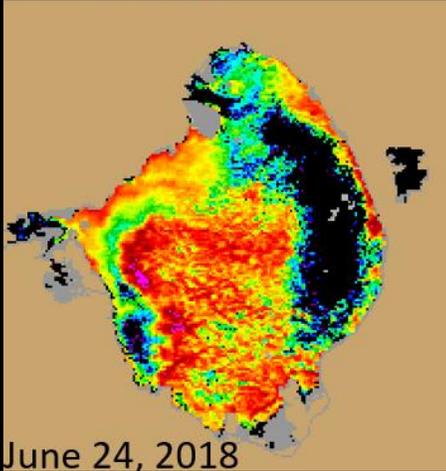
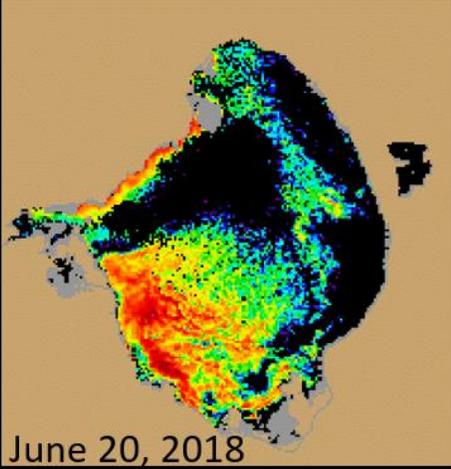
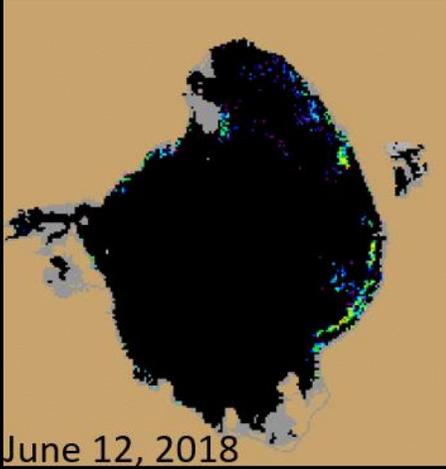
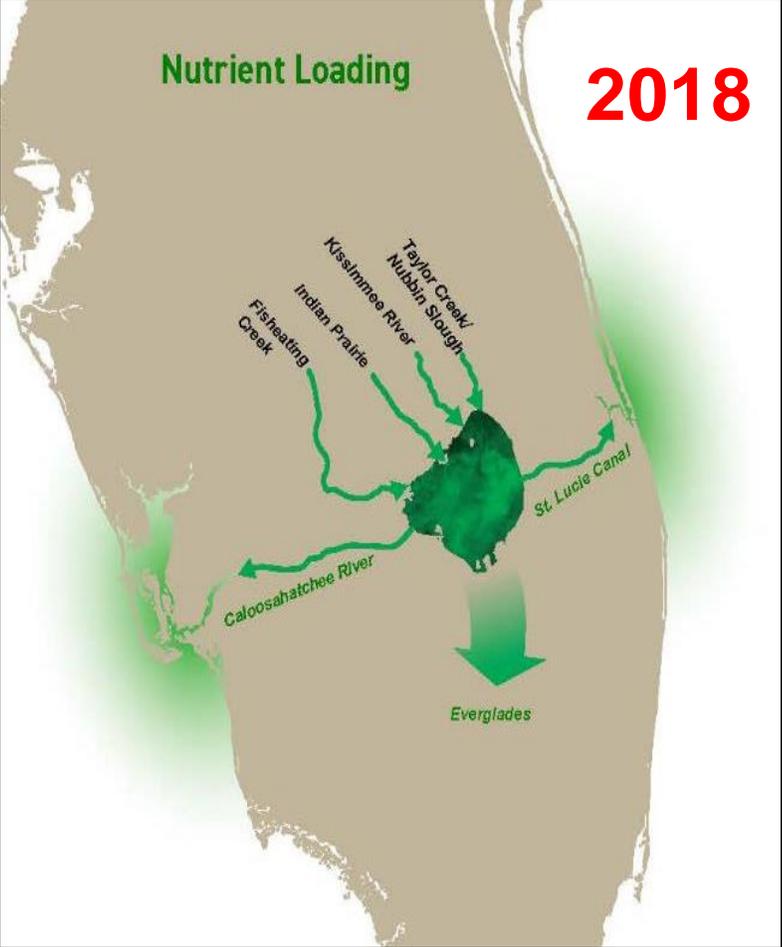
- 4,100 square miles, 20% larger than 2022
- >50% larger than the federal Hypoxia Task Force goal (1,900 square miles by 2035)



The current process



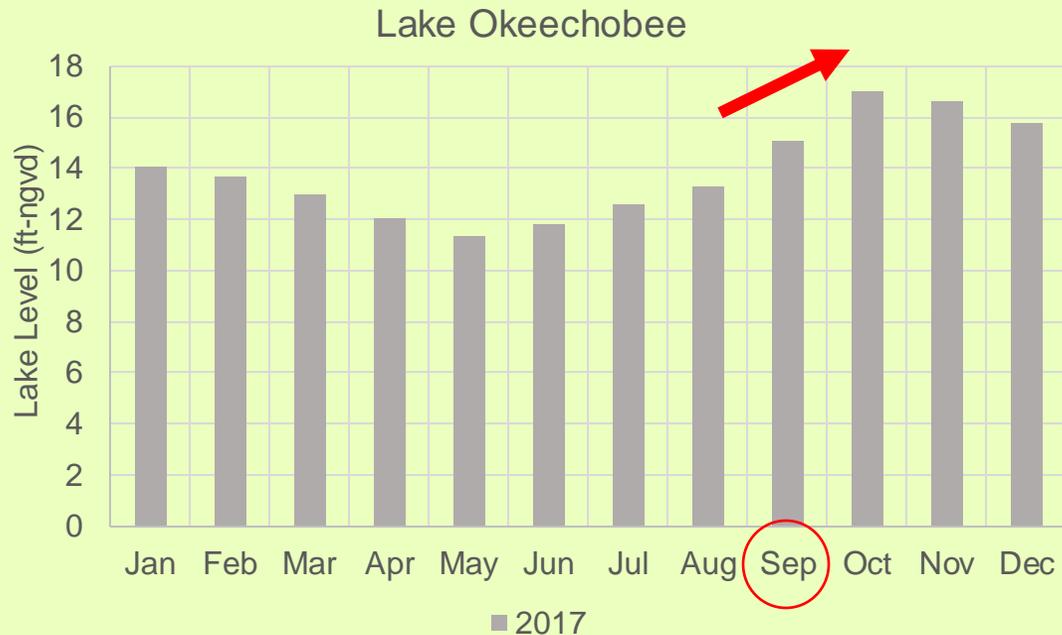
Not Working!



Hurricanes – more problems

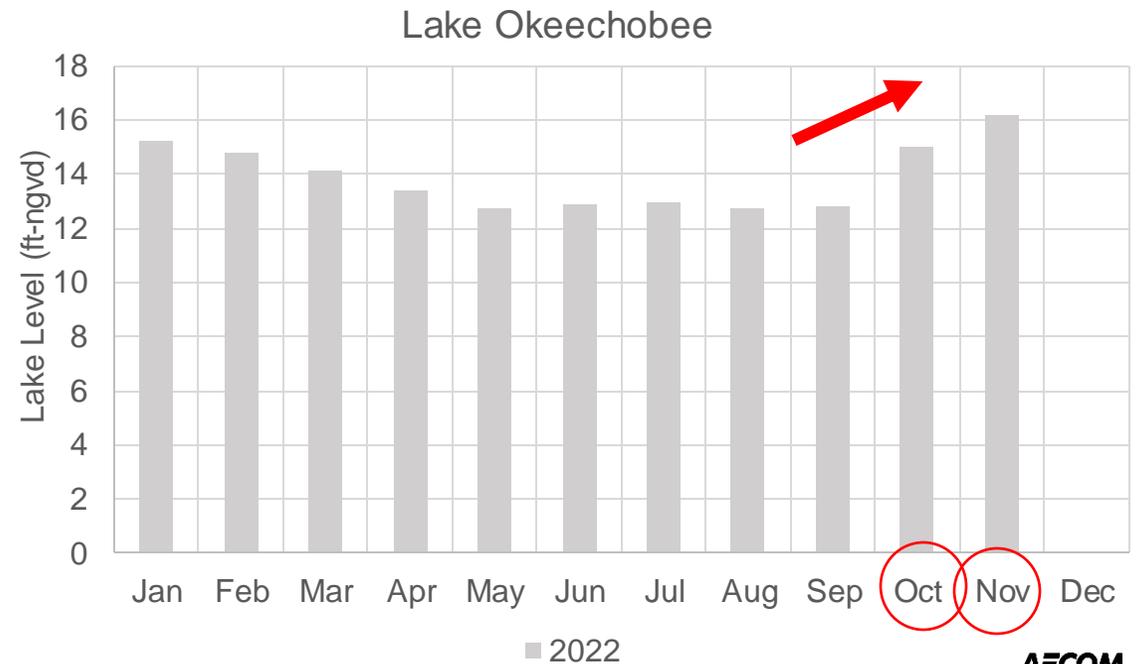
2017 Hurricane IRMA

12 inches rainfall – Lake increased 2-ft

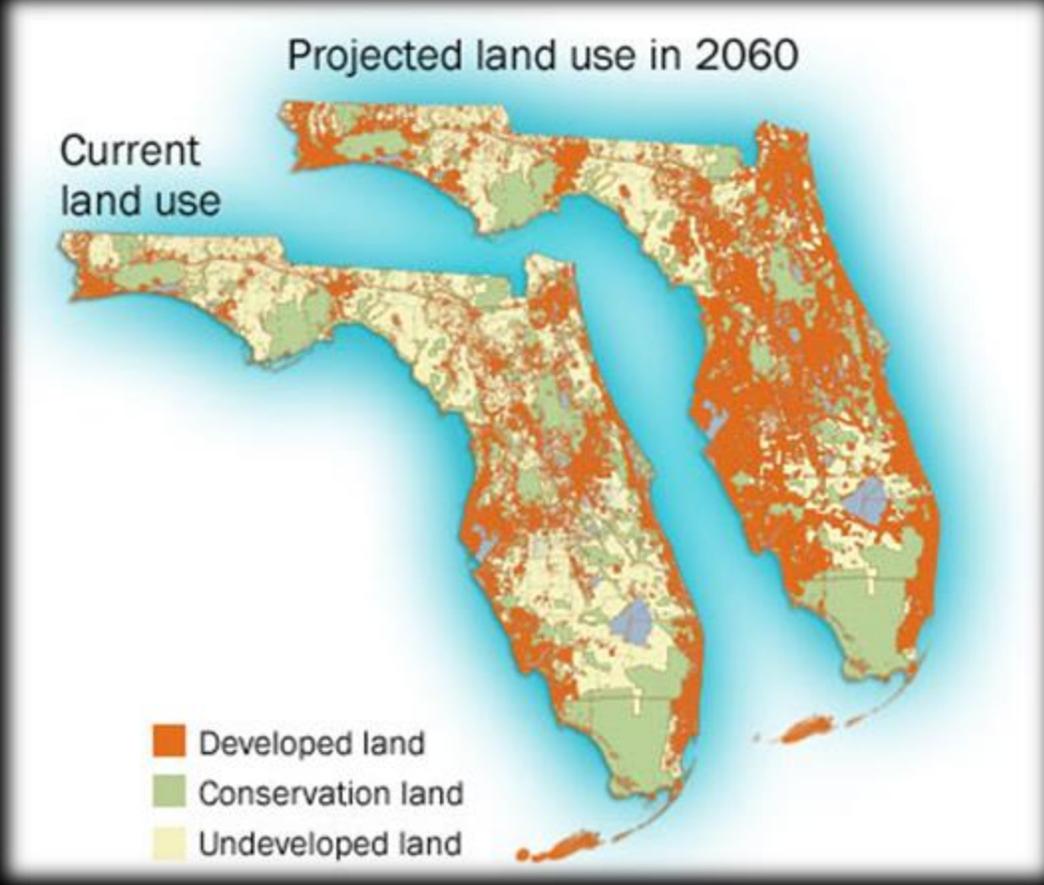
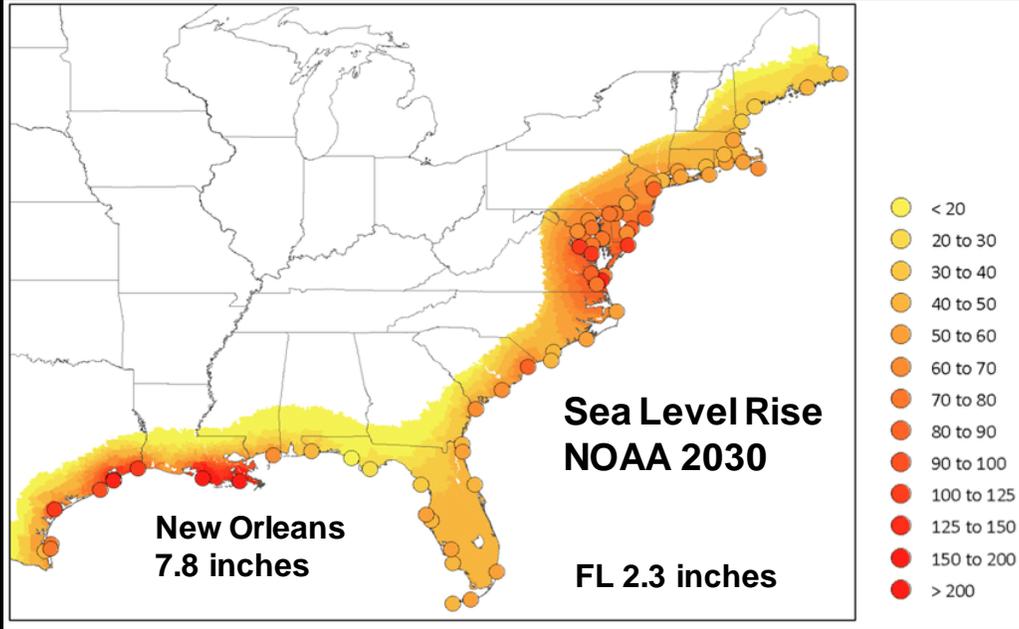
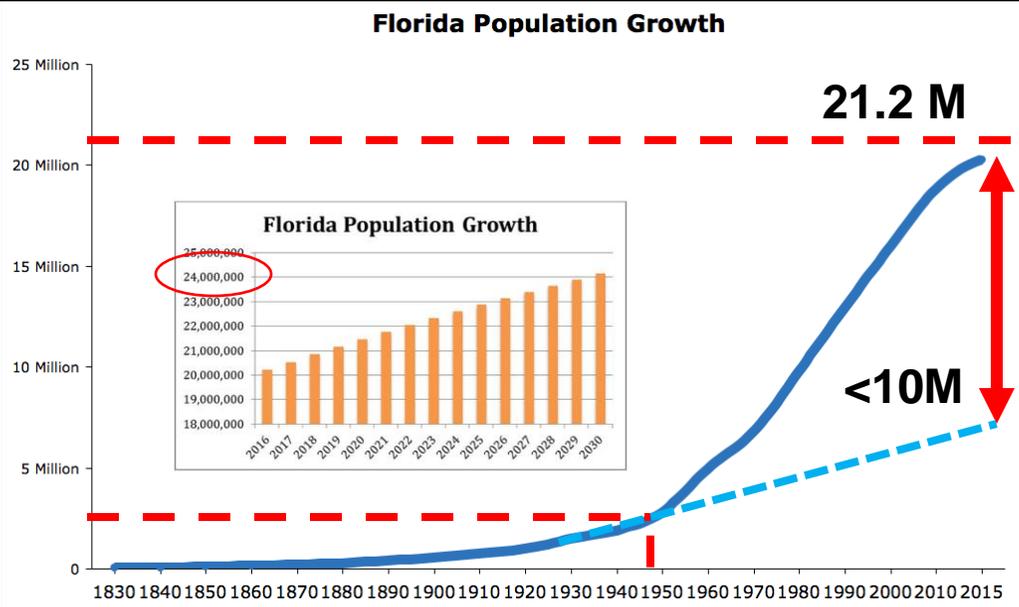


2022 Hurricanes Ian / Nicole

13.5 inches / 3 inches - Lake Increase 3.5ft



Florida's Future?



Address the Discharge (Protect the public)



Ft. Myers

WP Franklin Lock

Ortona Lock

Moore Haven Lock

Lake Okeechobee

2018 USACE discharges water from Lake Okeechobee to prevent flooding. Discharge resulted in Governor declaring a "State of Emergency" for 7 Counties



Options - Strategically place algae harvesters at the locks to removed HABS before discharge

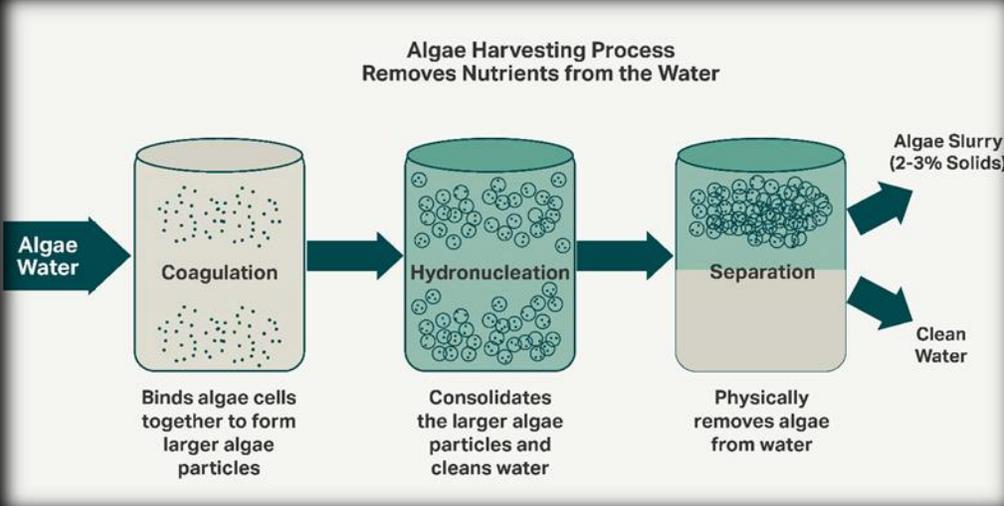
Flow Direction

2

Need for Mitigation



Algae Harvesting

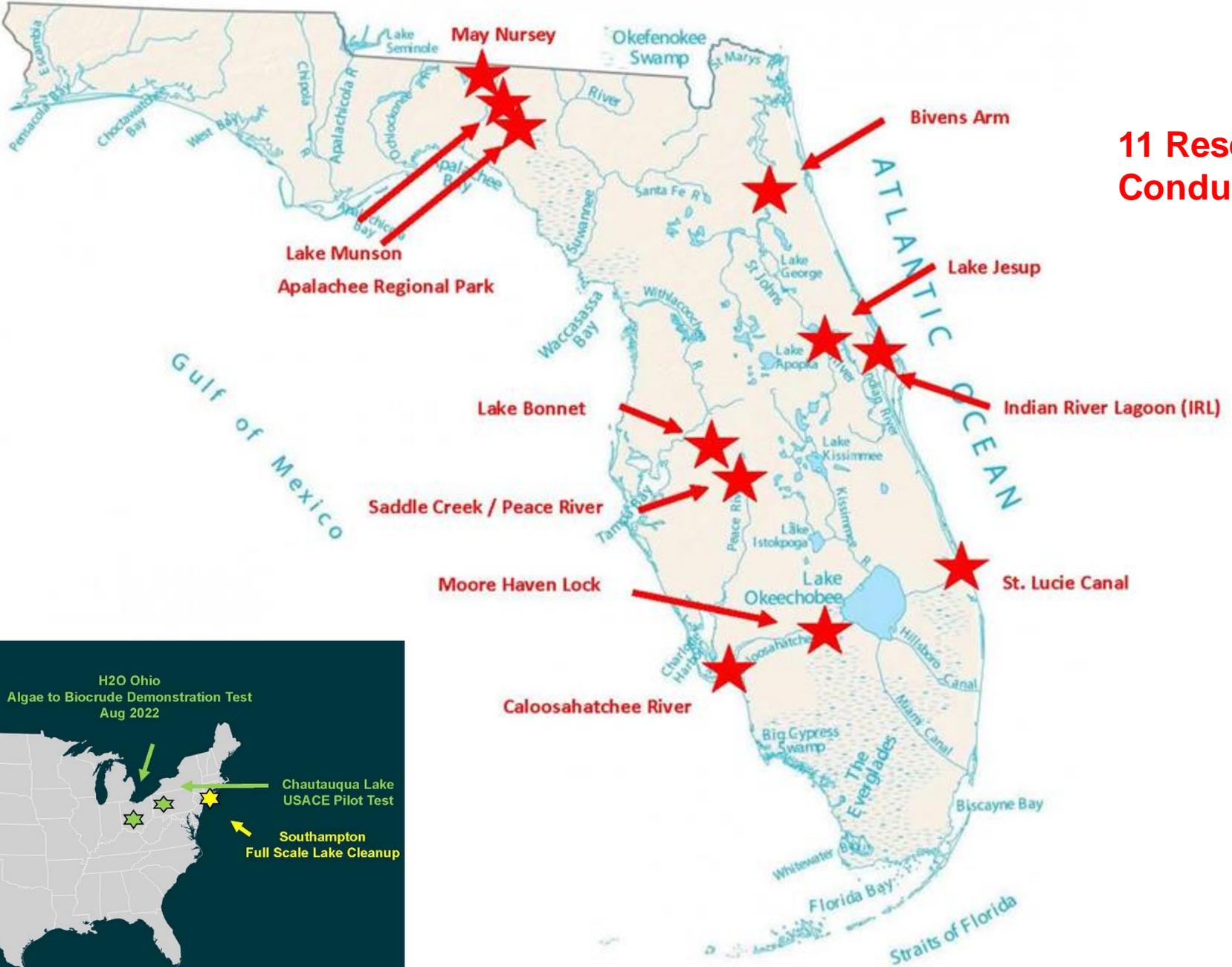


Senator Brodeur



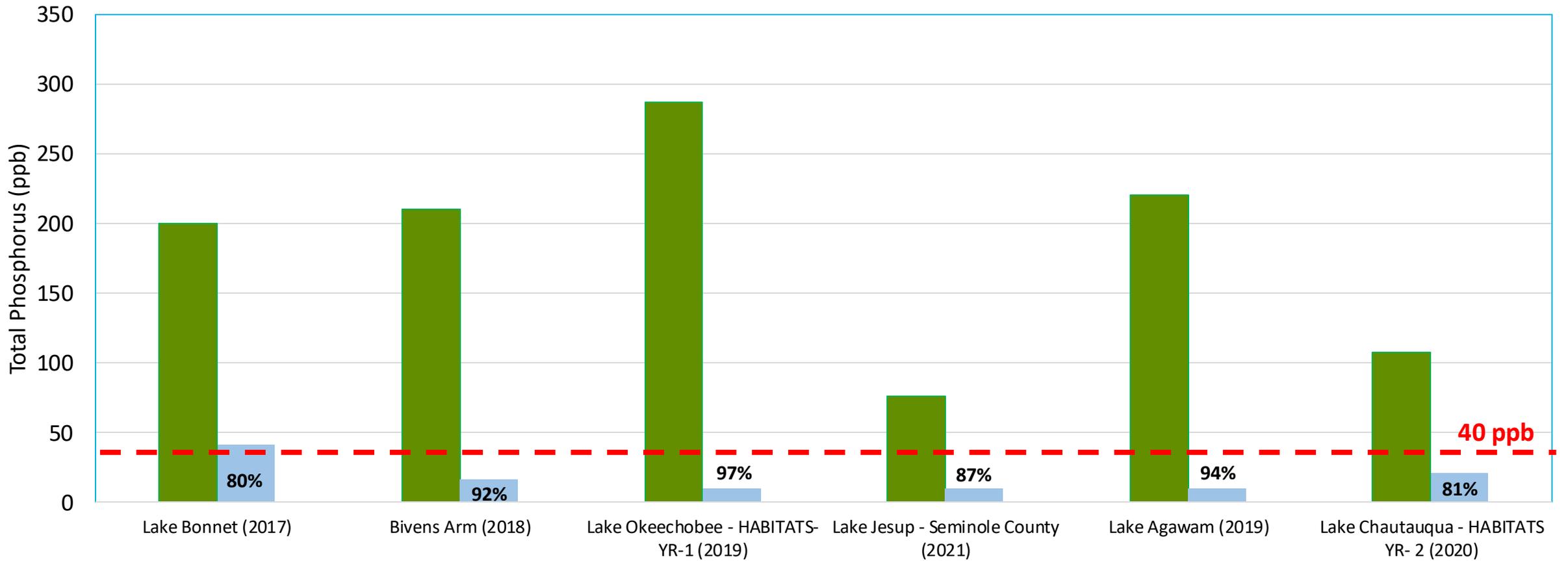
Rep. Smith

11 Research Projects Conducted in FL



Removal of Total Phosphorus

■ Influent Concentrations ■ Effluent Concentrations





**Algae
Biofoam**



**Algae
Biofertilizer**



**Algae
Biocrude**

Transforming Algae into Valuable Products

Algae Fertilizer



3

Next Steps (Public Private Partnership – P3)

Approach for Funding HAB Mitigation

1. FEMA requires local governments to develop and adopt Local Mitigation Strategy (LMS) plans as a precondition for receiving funding for mitigation projects.
2. HABs are now considered a “hazard” for purposes of FDEM’ State Hazard Mitigation Plan (SHMP) and having HABs identified in an LMS represents a potential funding opportunity.
3. Counties that have the potential to be impacted by HABs are recommended to update their LMS to included HAB mitigation.

FDEP HAB Mitigation Contract

CONTRACT NUMBER:

ES013, DEP Solicitation No. 2022018

**CONTRACT
TIMEFRAME:**

July 2022 – July 2025, with a 3 year renewal period

**CONTRACTING
AGENCY:**

Florida Department of Environmental
3900 Commonwealth Blvd, MS#24
Tallahassee, FL 32399

**AECOM CONTACT
INFORMATION**

Dan Levy, PG

Vice President, Environment National Director, Algae
305.519.1194 dan.levy@aecom.com

Marcia Warfel

Senior Business Development Manager
850.322.1622 marcia.warfel@aecom.com

Questions





State of the Wetlands: Orange County



@flcounties
#FLCounties

Tim Hull MS,PWS

Environmental Programs
Administrator

Orange County
Environmental Protection
Division



Lee Mullon

PE, CFM, D.WRE, PMP

**Principal at
Drummond Carpenter**



Dr. Leesa Souto Ph.D

**Director of Operations
and Sr. Project Manager**

Applied Ecology, Inc



STATE OF THE WETLANDS STUDY

FAC 2023 Annual Conference

Tim Hull, MS, PWS, *Orange County*

Lee Mullon, PE, *Drummond Carpenter, PLLC*

Leesa Souto, Ph.D., *Applied Ecology, Inc.*



PRESENTATION OUTLINE

- **Background**
- **Regulatory Review Study**
- **State of the Wetlands Study**
 - **Wetland Mapping**
 - **Wetland Fragmentation**
 - **Wetland Functional Changes**
 - **Additional Analyses**
- **Policy Recommendations**

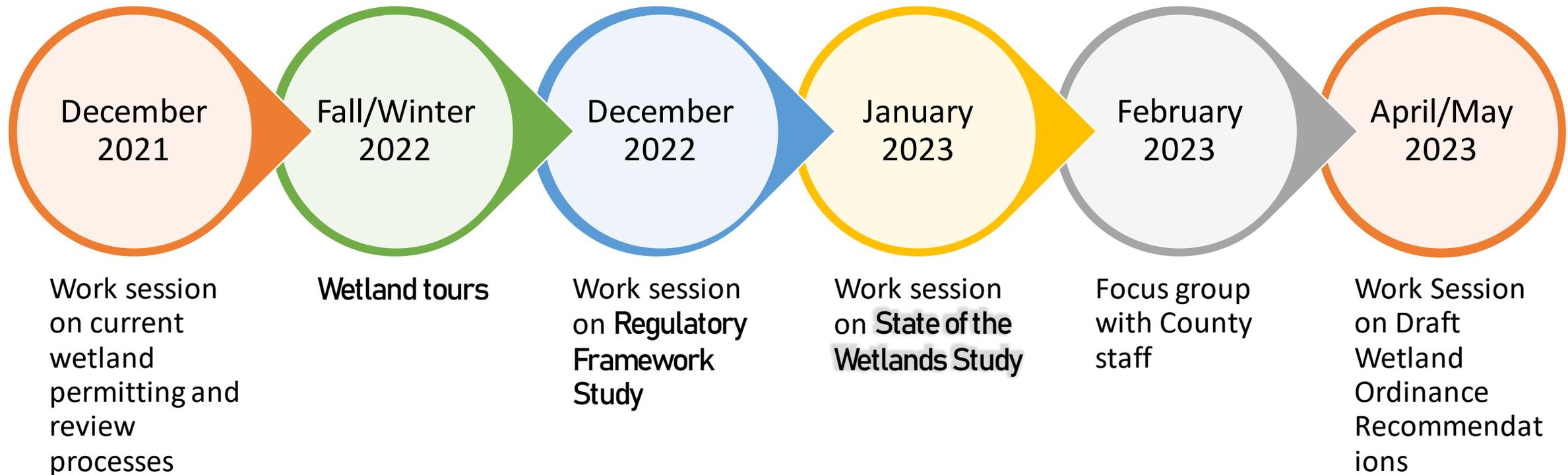


WHY UPDATE THE WETLAND ORDINANCE?

- Better reflect Board-directed policy and current regulatory climate
- Make permit process and outcomes more streamlined, predictable, and consistent
- Balance natural resource protection while promoting sustainable growth within Orange County
- Preserve wetland functionality within the County



BACKGROUND



WETLAND ORDINANCE PROCESS

- **Regulatory Review Study**

- Wetland regulations have not been updated since 1987
- Assess the current status and function of Orange County's regulations and compare to six other counties
- Interview 6 counties, NGOs, and developers to solicit feedback on how the ordinance and permitting processes should be updated

- **Technical Study**

- Compare historic inventory and condition of the County's wetland resources with present day
- Assess functional changes and trends in wetland loss and fragmentation
- Analyze ecosystem services associated with loss of wetland function

Why conduct the State of the Wetlands Study?

- Provides the scientific foundation to guide the Orange County ordinance update
- Changes in wetland coverage, type & function from ordinance implementation to current
- Highlights successes and challenges associated with mitigation
- Shapes specific recommendations for the draft ordinance: buffers, vulnerable systems, maintenance/monitoring requirements, etc.



PRESENTATION OUTLINE

- **Background**
- Regulatory Review Study
- State of the Wetlands Study
 - Wetland Mapping
 - Wetland Fragmentation
 - Wetland Functional Changes
 - Additional Analyses
- Policy Recommendations



REGULATORY REVIEW STUDY



Federal / State Review

- Federal and State Regulations and Procedures
- Comparison with Current County Regulations & Procedures

Internal Document Review

- Wetland Ordinance
- Comprehensive Plan
- Applicant's Handbook

County Reviews

- Volusia
- Osceola
- Seminole
- Leon
- Alachua
- Hillsborough

Interviews

- Orange County EPD Staff
- Other County Staff
- Consultants
- NGOs

Summarize Findings

- Technical Report
- Recommend Updates to Orange County's regulations and procedures

Interview Topics:

- Wetland definitions, ordinance language, wetland classification system, exemptions, mitigation, upland buffers, enforcement, permitting processes, lessons learned

REGULATORY REVIEW STUDY



COUNTIES

- Exemptions or a General Permit for minimal impact activities
- All combine CAD/CAI process
- Staff issues most permits
- Reasonable Use Criteria and avoidance/minimization
- Use state approved functional assessment (UMAM)
- Buffers 25-50 ft, greater along wetland/riverine systems
- Most include requirements for env. sensitive zones, connectivity

CONSULTANT

- Exemptions or streamlined process recommended
- Consolidated application CAD/CAI
- Remove classification system
- Allow for/prioritize urban in-fill
- Remove cumulative wetland impact review criteria
- Recommend similar upland buffers as State (min. 15 feet, avg. 25 feet)
- Adopt additional upland buffers to protect rare habitat

NGOS

- All wetlands should be protected
- Allow EPD staff to authorize most applications
- Include avoidance/minimization
- Strengthen listed plant species protections
- Do not assume State permitting authority
- Minimal amendments to existing conservation easements (some)
- Adopt additional buffers

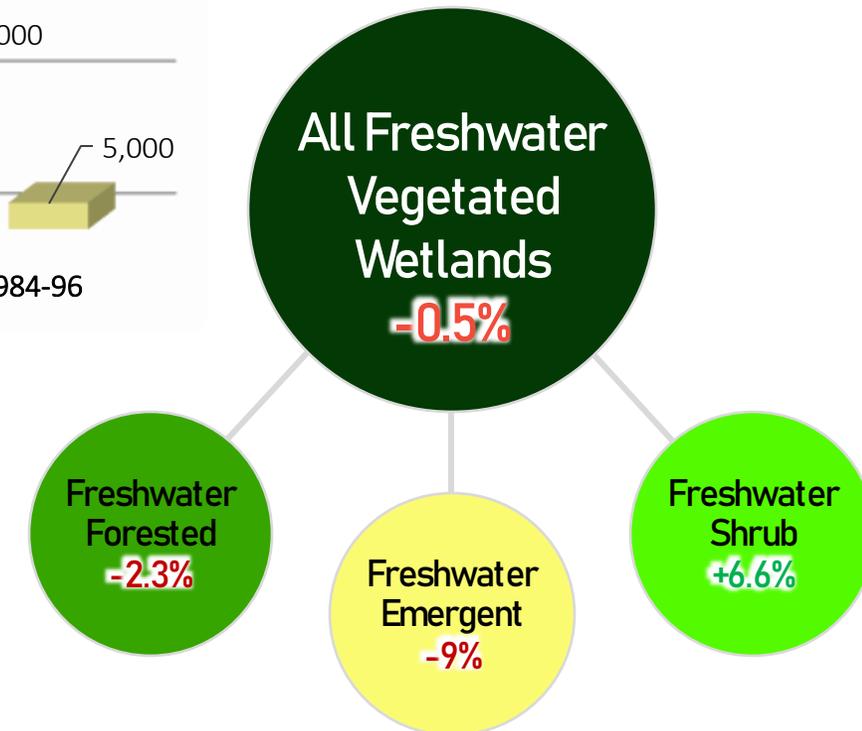
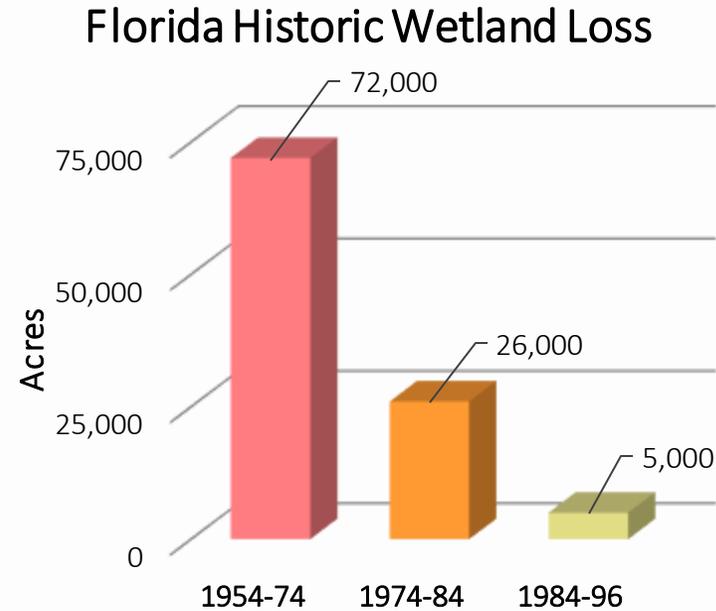
PRESENTATION OUTLINE

- Background
- **Regulatory Review Study**
- State of the Wetlands Study
 - Wetland Mapping
 - Wetland Fragmentation
 - Wetland Functional Changes
 - Additional Analyses
- Policy Recommendations



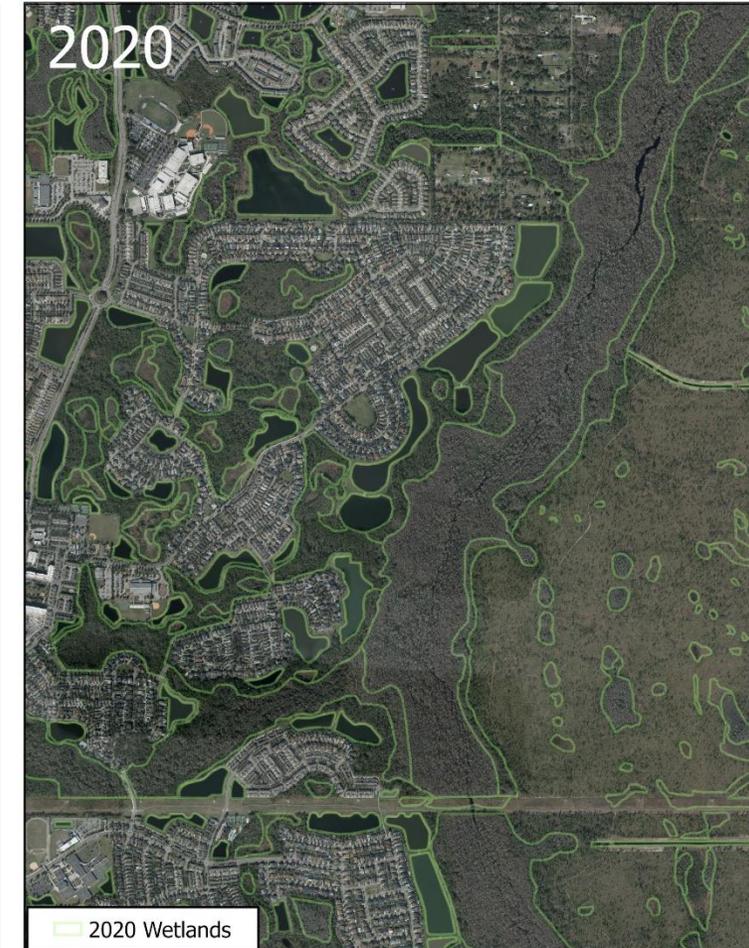
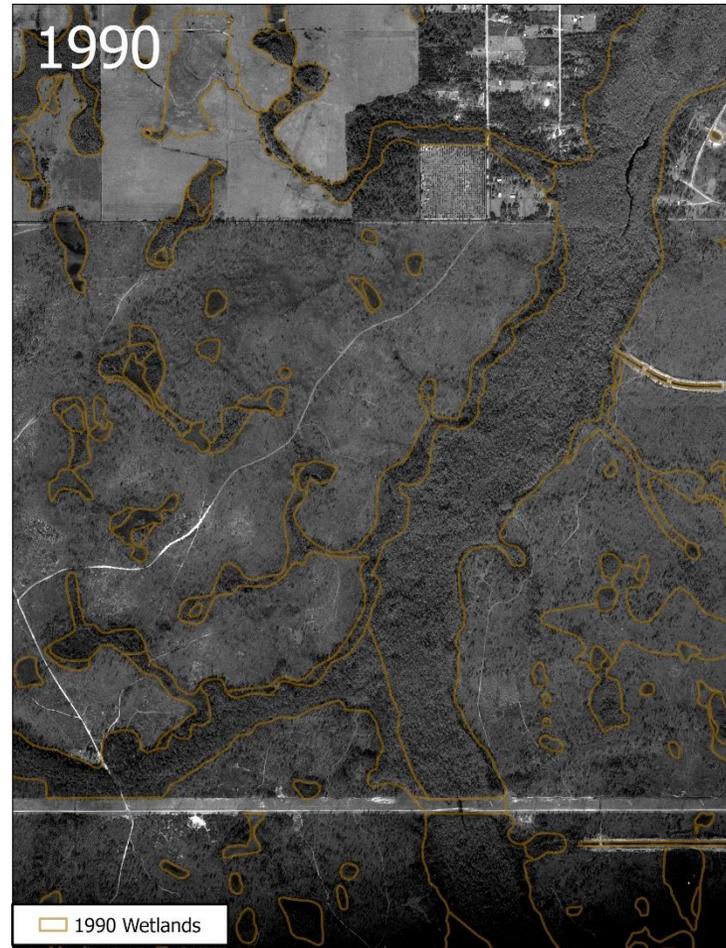
STATE OF THE WETLANDS STUDY

- 1954-1996: Florida-wide studies have indicated significant loss of wetlands
- Rate of loss declined after implementation of wetland regulations such as:
 - 1972 - Clean Water Act
 - 1987 - No Net Loss Rule
 - 1989 - Orange County Wetland Ordinance
- 1984-2004: Central FL study of isolated cypress systems showed 26% loss
- Impact is unequal by wetland type, leading to loss in diversity
- The SOTW provides a wetland inventory for Orange County from 1990-2020



STATE OF THE WETLANDS STUDY

- Aerial Photointerpretation (API) was utilized to map wetlands
- API is standard acceptable method used to create Land-Use/Land-Cover (LULC) datasets and maps from remotely sensed data
- API has been used extensively since the 1970s by local, state, and federal agencies to classify land cover, vegetation and soils.
- Wetland signatures include vegetation, texture, soil hydration
- Decadal mapping: 1990-2020



STATE OF THE WETLANDS STUDY



Mixed Hardwoods



Cypress Domes



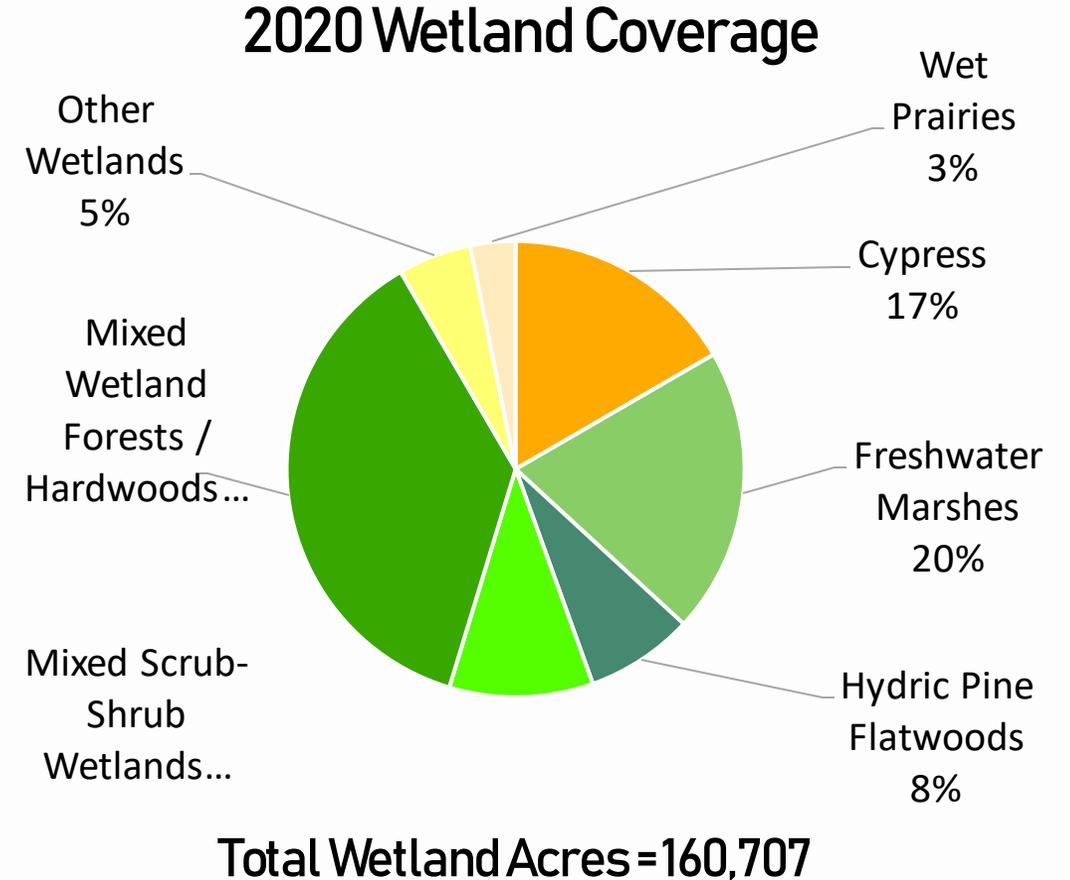
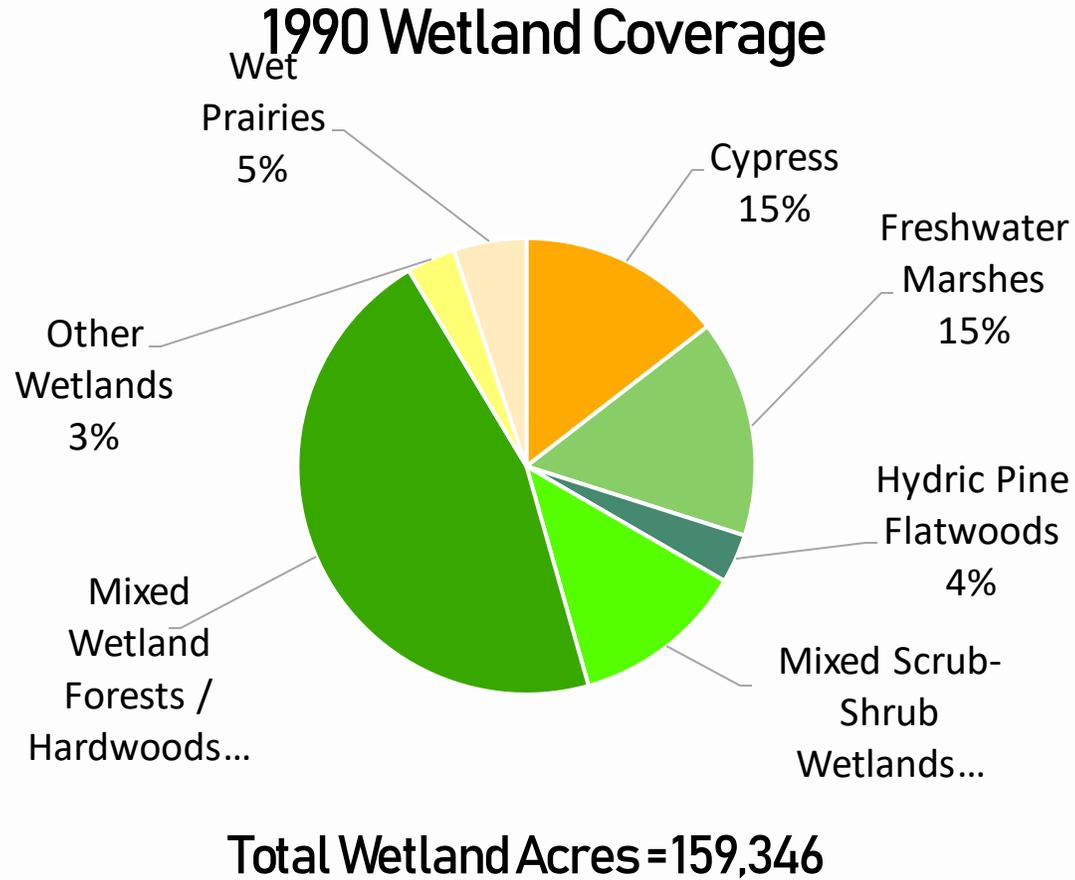
Hydric Pine Flatwoods



Freshwater Marshes

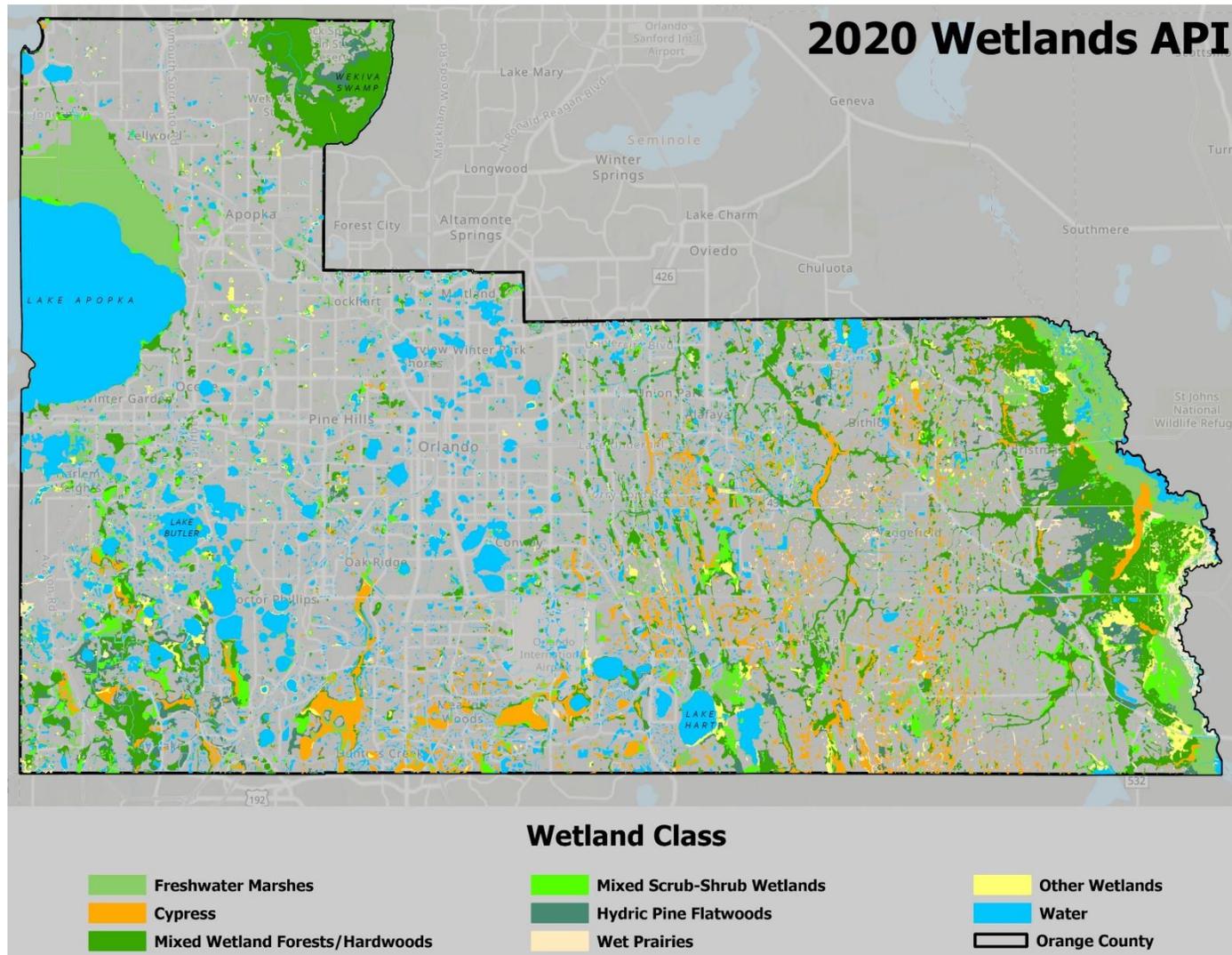
WETLAND MAPPING – SELECTED WETLAND TYPES

STATE OF THE WETLANDS STUDY



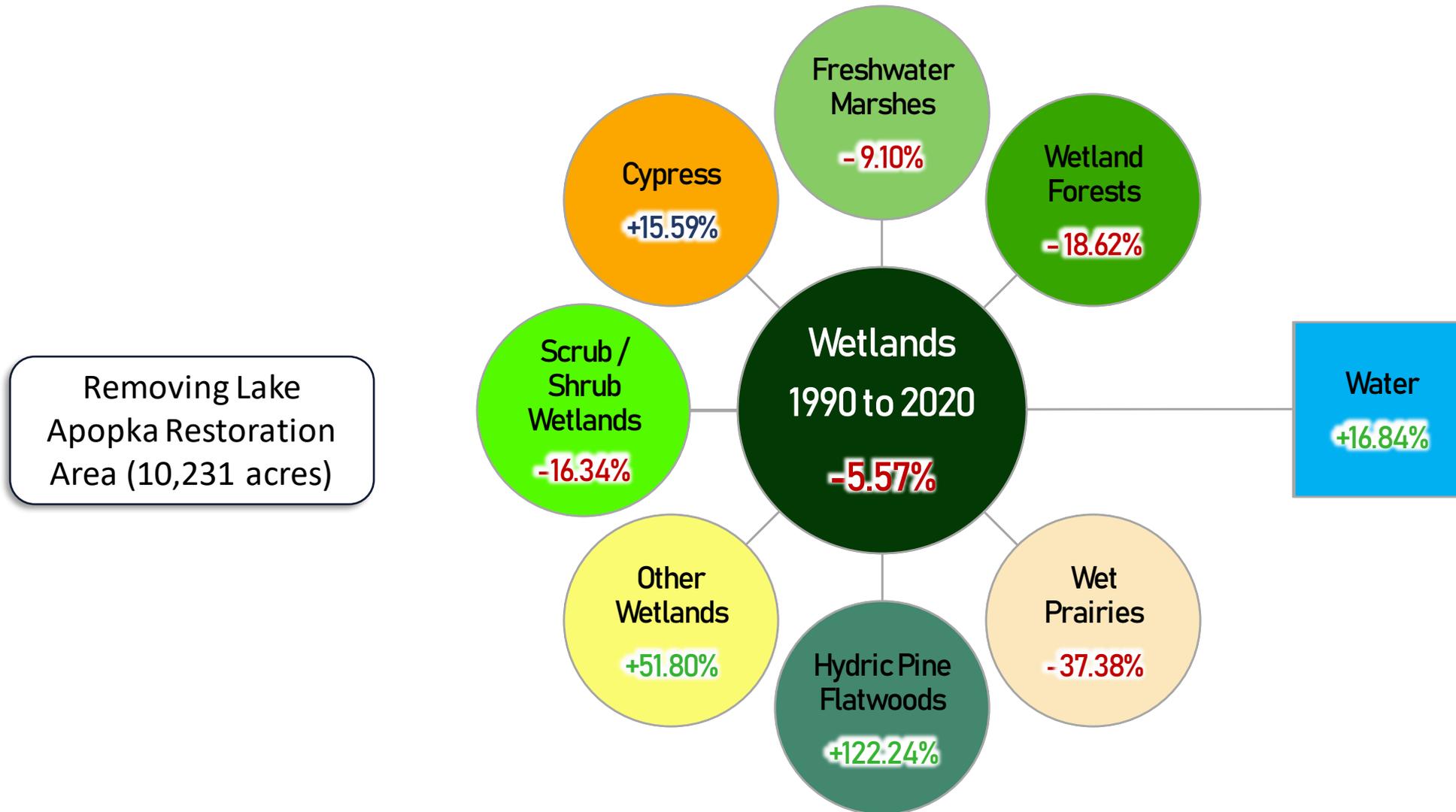
WETLAND MAPPING – CHANGES IN COVERAGE

STATE OF THE WETLANDS STUDY



WETLAND MAPPING – CHANGES IN COVERAGE

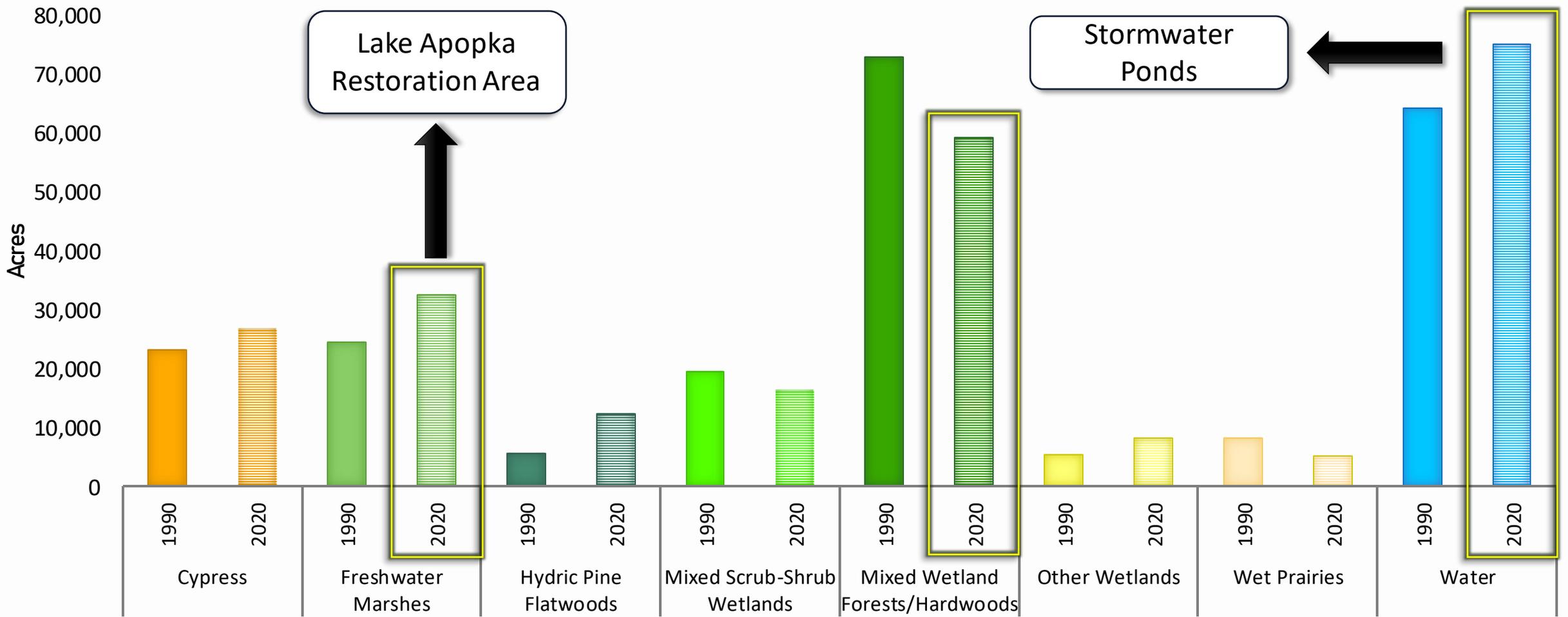
STATE OF THE WETLANDS STUDY



WETLAND MAPPING – CHANGES IN COVERAGE

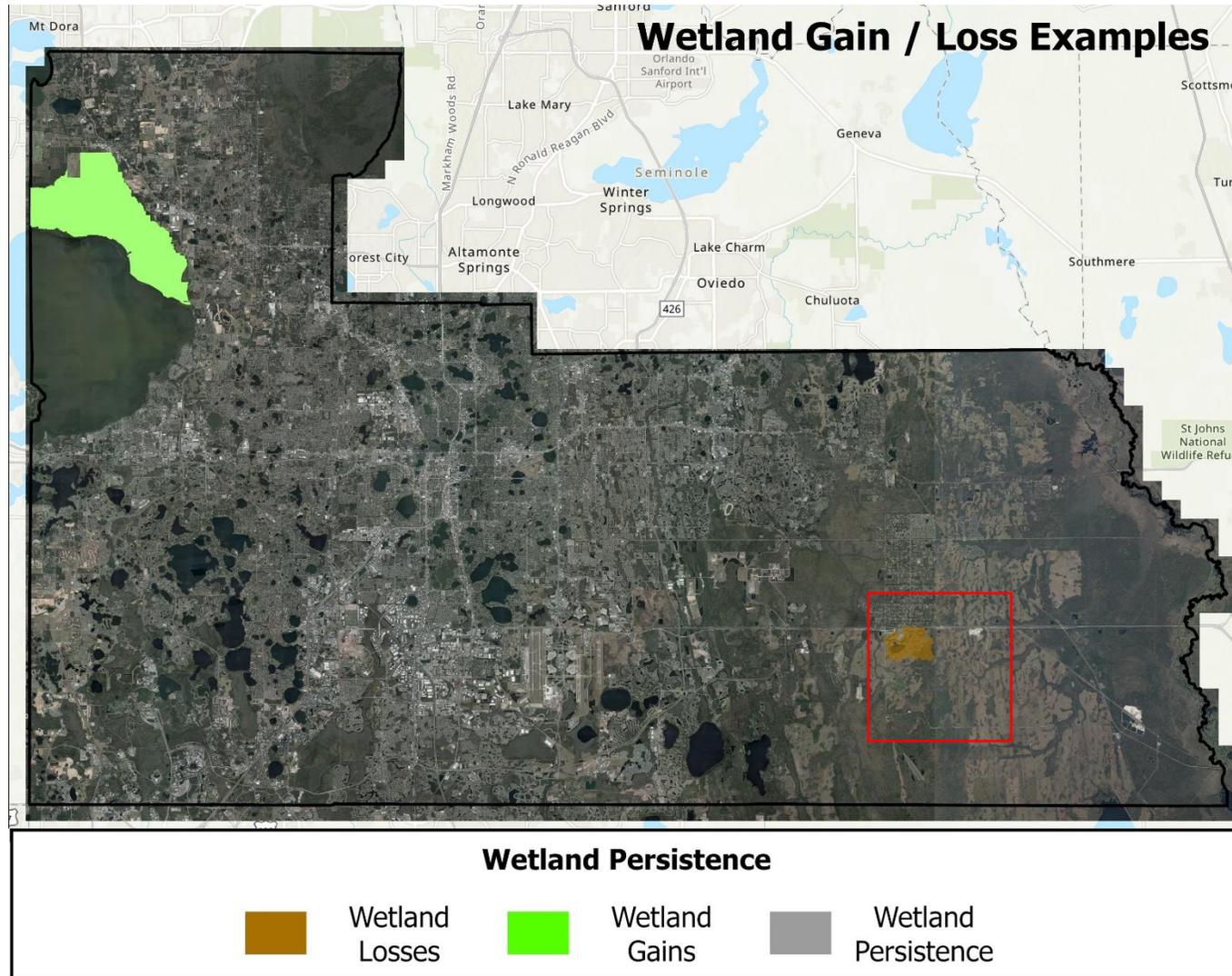
STATE OF THE WETLANDS STUDY

TOTAL ACREAGE BY WETLAND TYPE FOR 1990 AND 2020



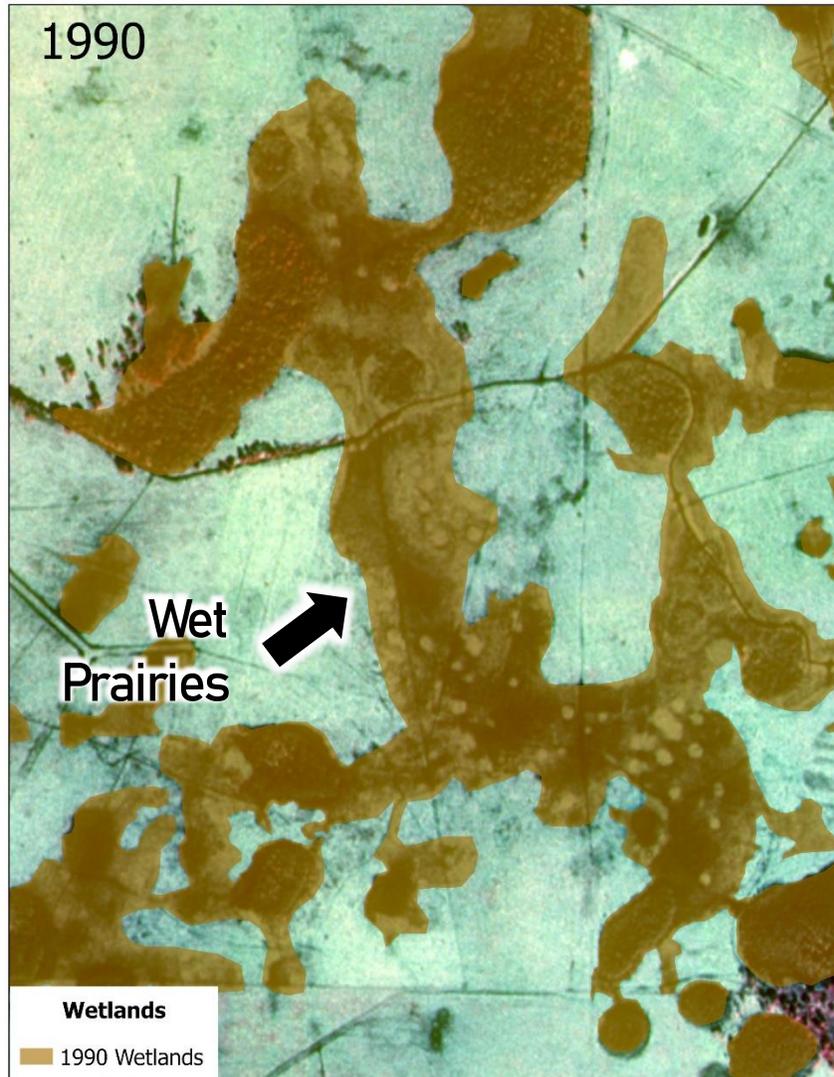
WETLAND MAPPING – CHANGES IN COVERAGE

STATE OF THE WETLANDS STUDY



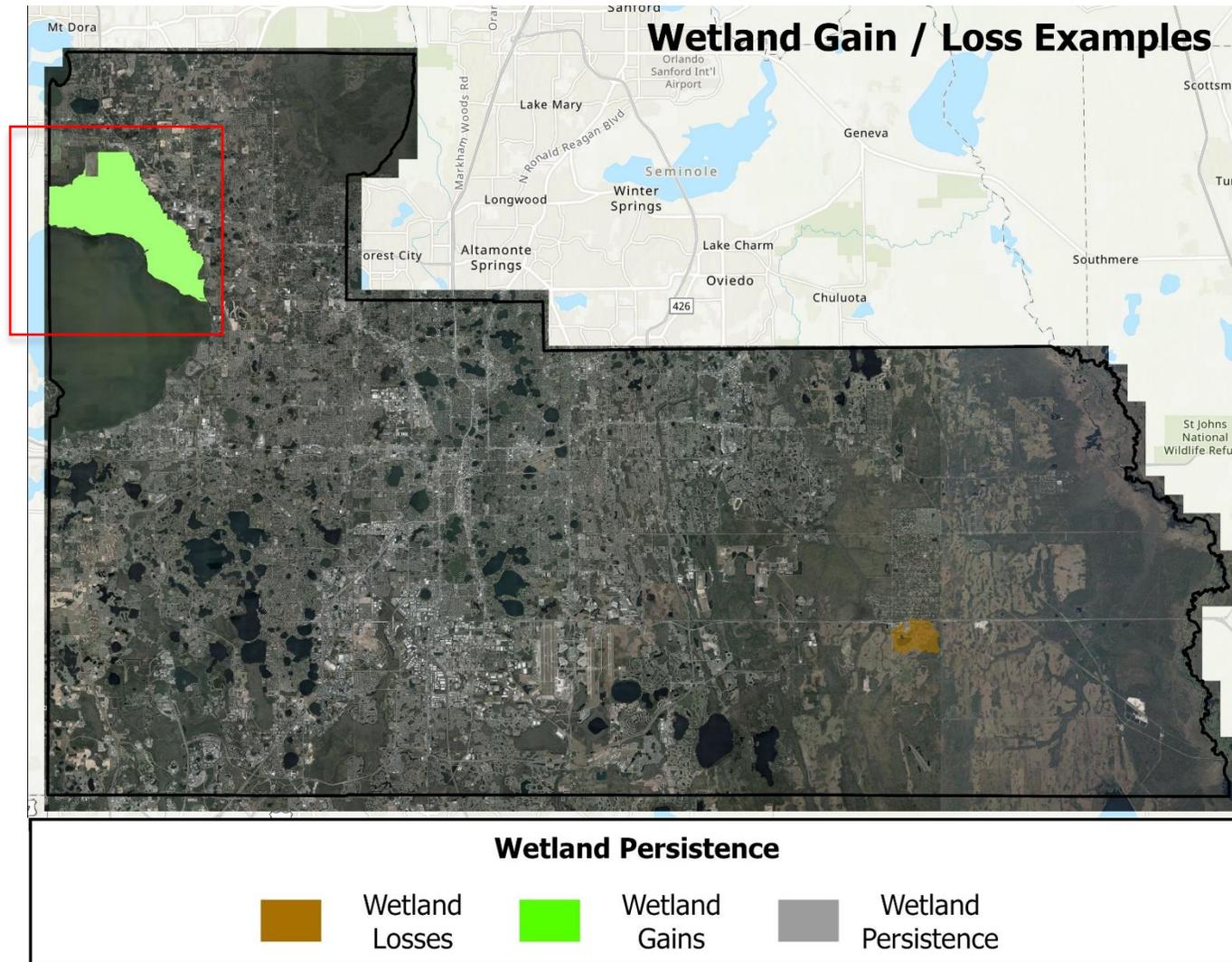
WETLAND MAPPING – PERSISTENCE / CHANGE DETECTION

STATE OF THE WETLANDS STUDY



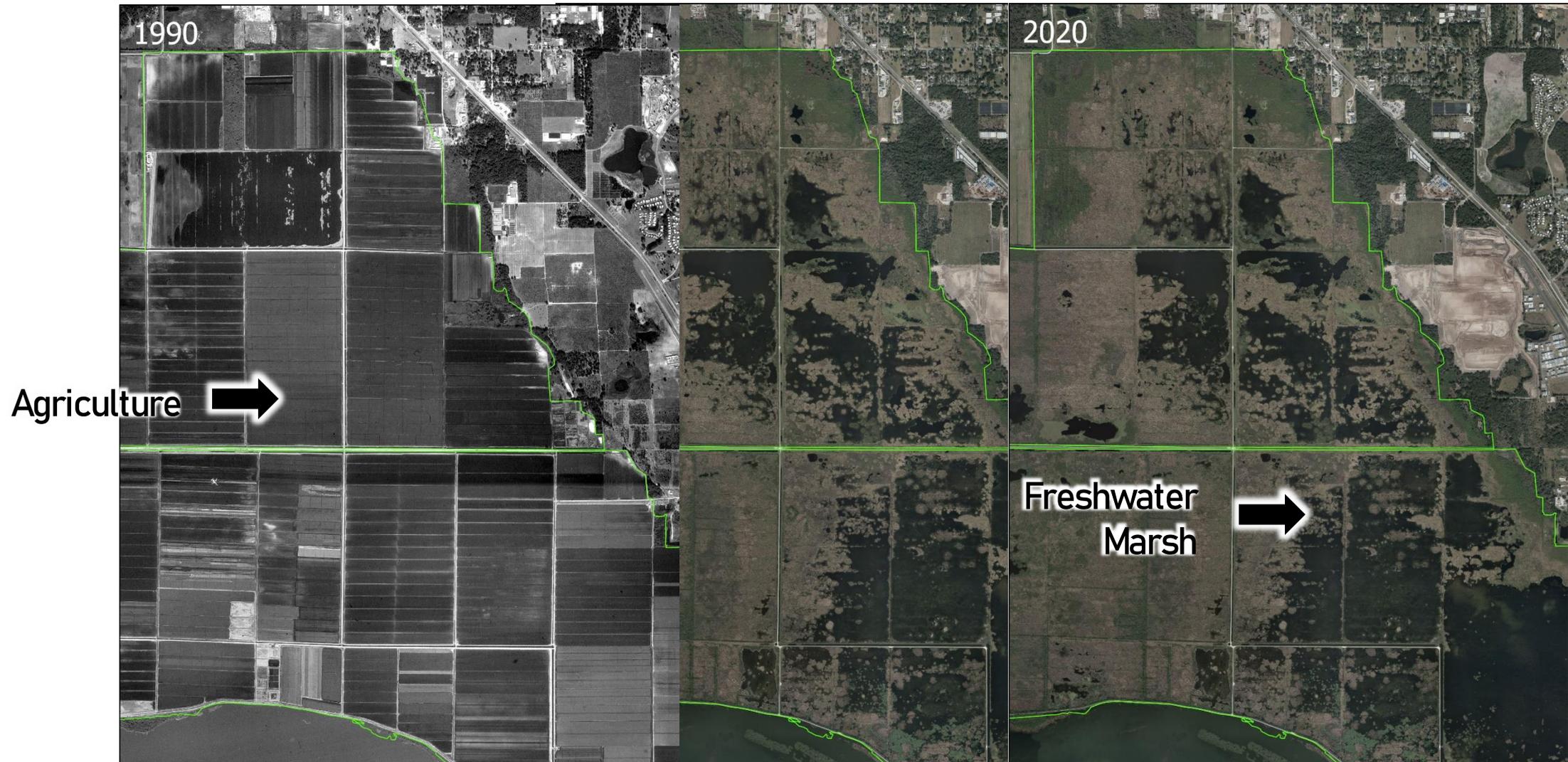
WETLAND MAPPING – PERSISTENCE MAP (WETLANDS LOST)

STATE OF THE WETLANDS STUDY



WETLAND MAPPING – PERSISTENCE / CHANGE DETECTION

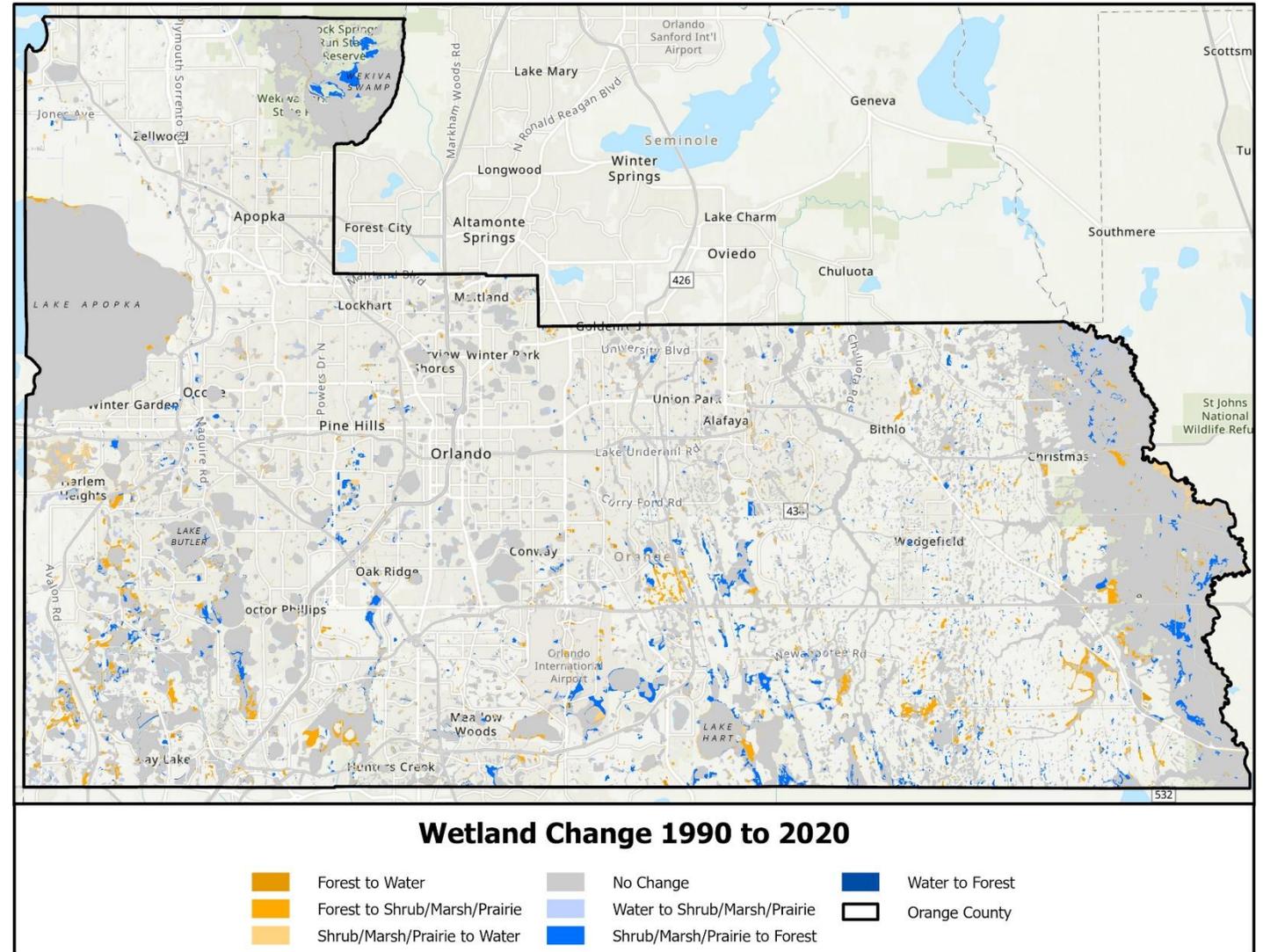
STATE OF THE WETLANDS STUDY



WETLAND MAPPING – PERSISTENCE MAP (WETLANDS GAINED)

STATE OF THE WETLANDS STUDY

- Many of the surface water and wetlands do not appear to change in 30 years
- Succession is occurring in some wetlands (shrub to forested system)
- Changes equally occurring with losses of forested systems to shrub/herb systems (canopy removed)
- Changes in wetland type impact biodiversity



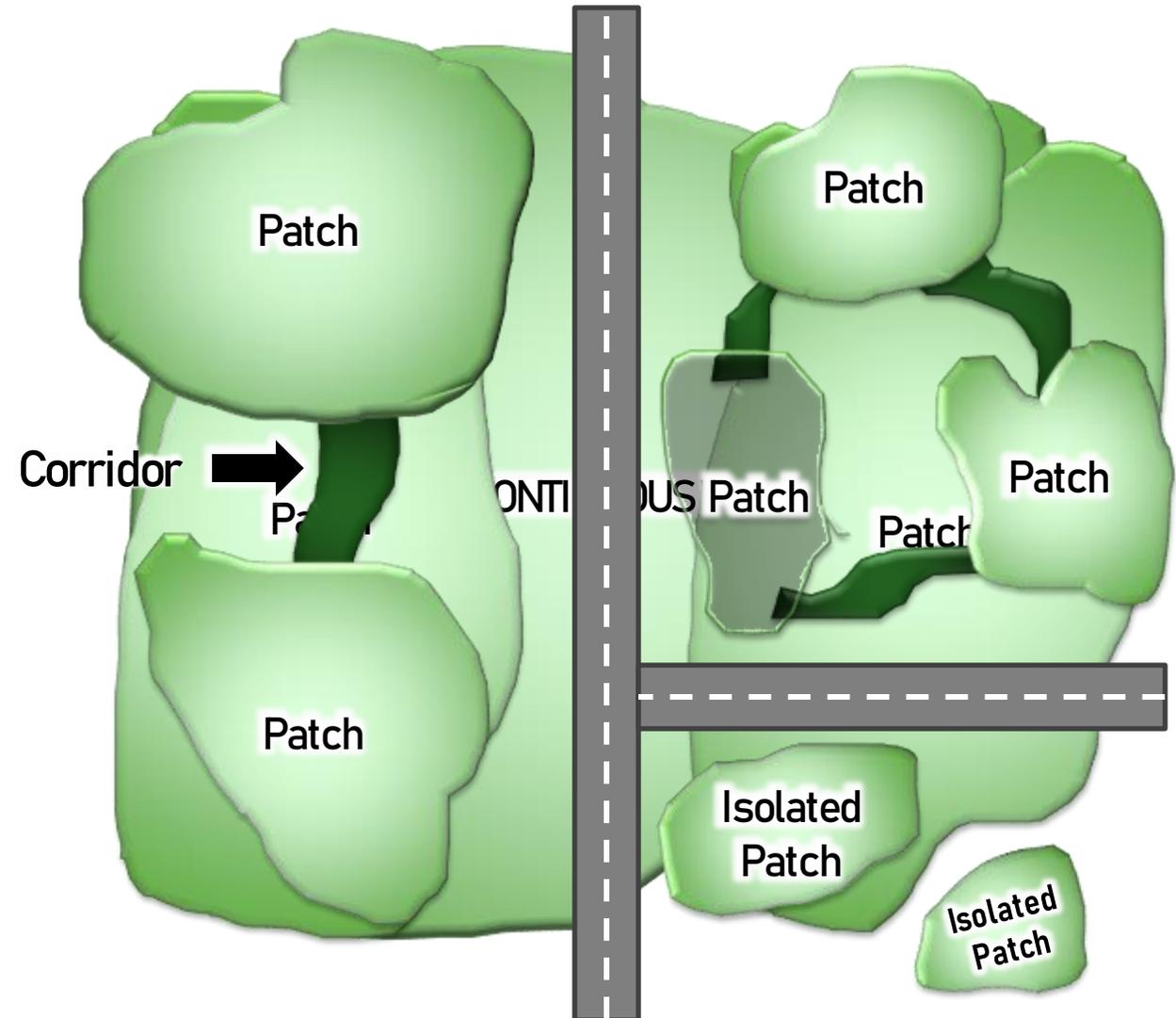
PRESENTATION OUTLINE

- Background
- Regulatory Review Study
- **State of the Wetlands Study**
 - Wetland Mapping
 - Wetland Fragmentation
 - Wetland Functional Changes
 - Additional Analyses
- Policy Recommendations



STATE OF THE WETLANDS STUDY

- Habitat destruction typically leads to fragmentation
- Division of habitat into smaller and more isolated fragments, separated by human-transformed land cover.
- Fragmentation impacts ecosystem function, hydrology, habitat, and species composition (i.e., invasive cover)
- Selected metrics compared:
 - Edge: perimeter of wetland
 - Shape Index: perimeter/ $\sqrt{\text{patch area}}$
 - Contiguity: spatial connectiveness



STATE OF THE WETLANDS STUDY



WETLANDTYPE	Total Edge (mi)		
	1990	2020	Trend
Cypress	564.74	754.90	↑
Freshwater Marshes	1,008.19	1,194.72	↑
Hydric Pine Flatwoods	129.44	371.21	↑
Mixed Scrub-Shrub Wetlands	697.80	815.60	↑
Mixed Wetland Forests / Hardwoods	1,083.09	1,189.78	↑
Other Wetlands	278.45	297.17	█
Wet Prairies	279.89	619.44	↑
Water	739.19	995.91	↑

WETLAND FRAGMENTATION – CHANGES FROM 1990 TO 2020

STATE OF THE WETLANDS STUDY



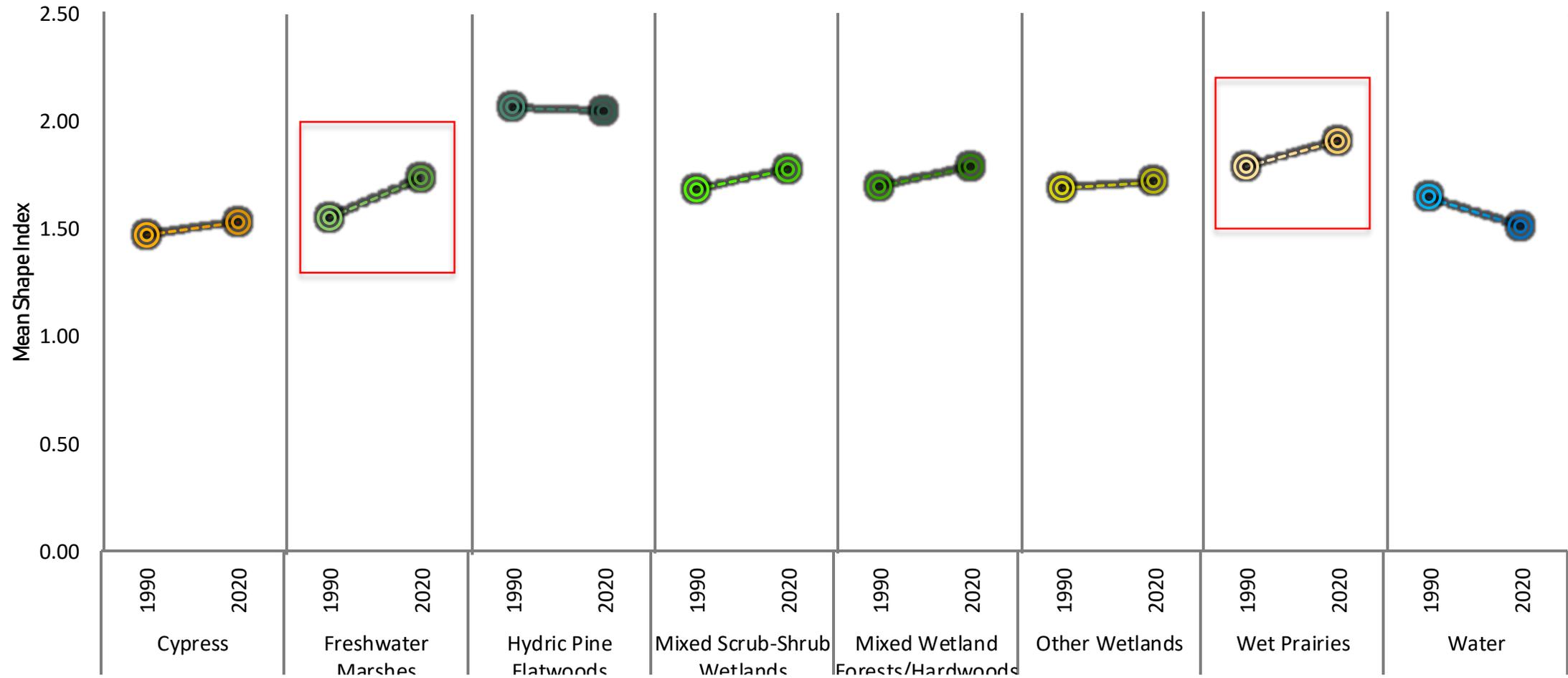
WETLANDTYPE	Mean Contiguity Index		
	1990	2020	Trend
Cypress	0.90	0.89	↓
Freshwater Marshes	0.83	0.77	↓
Hydric Pine Flatwoods	0.92	0.89	↓
Mixed Scrub-Shrub Wetlands	0.88	0.86	↓
Mixed Wetland Forests / Hardwoods	0.89	0.88	↓
Other Wetlands	0.85	0.81	↓
Wet Prairies	0.82	0.78	↓
Water	0.84	0.84	↓

WETLAND FRAGMENTATION – CHANGES FROM 1990 TO 2020

STATE OF THE WETLANDS STUDY

FRAGMENTATION BY WETLAND TYPE FOR 1990 AND 2020

Most Fragmented
↑
↓
Least Fragmented



WETLAND FRAGMENTATION – CHANGES FROM 1990 TO 2020

- Between 1990-2020:
 - Overall loss of acreage ~5.6% or ~8500 acres
 - Losses most dramatic for wet prairies (37%); mixed wetland forested/hardwoods systems (19%); all system types are important in order to achieve diversity
 - Gains in hydric pine flatwoods (>100%)
 - Composition of the wetland types is changing over time, with succession evident in some cases, and anthropogenic impacts in others
- Fragmentation impact on wetlands varies significantly by wetland type:
 - Moderate decline in contiguity and increased fragmentation for freshwater marshes and wet prairies
 - Cypress and hydric pine appear to be more robust and present less fragmentation impacts
- Loss in acreage is not equivalent to change in wetland function

PRESENTATION OUTLINE

- Background
- Regulatory Review Study
- **State of the Wetlands Study**
 - Wetland Mapping
 - **Wetland Fragmentation**
 - Wetland Functional Changes
 - Additional Analyses
- Policy Recommendations



STATE OF THE WETLANDS STUDY



- Selected 51 onsite mitigation sites using CAI permit data
- Used a ranking mechanism for site selection
 - CAI permits issued >10 years ago
 - Prior to UMAM (or equivalent)
 - One of the five types: wetland forested mixed/wetland hardwoods, cypress, hydric pine, wet prairies, and freshwater marshes
- Objective:
 - Used for mapping product quality assurance
 - Use as surrogate for functional change, looking beyond acreage loss
- Metrics collected: functional data (UMAM), % invasive cover class
- Selected sites (15): using hyperspectral imaging using an UAS

STATE OF THE WETLANDS STUDY



Threatened - State

Sarracenia minor
(Hooded Pitcherplant)



Threatened - State

Tillandsia balbisiana
(Northern Needleleaf)



Threatened - State

Dendrophylax porrectus
(Jingle Bell Orchid)



Endangered - State

Tillandsia fasciculata
(Cardinal Airplant)

STATE OF THE WETLANDS STUDY



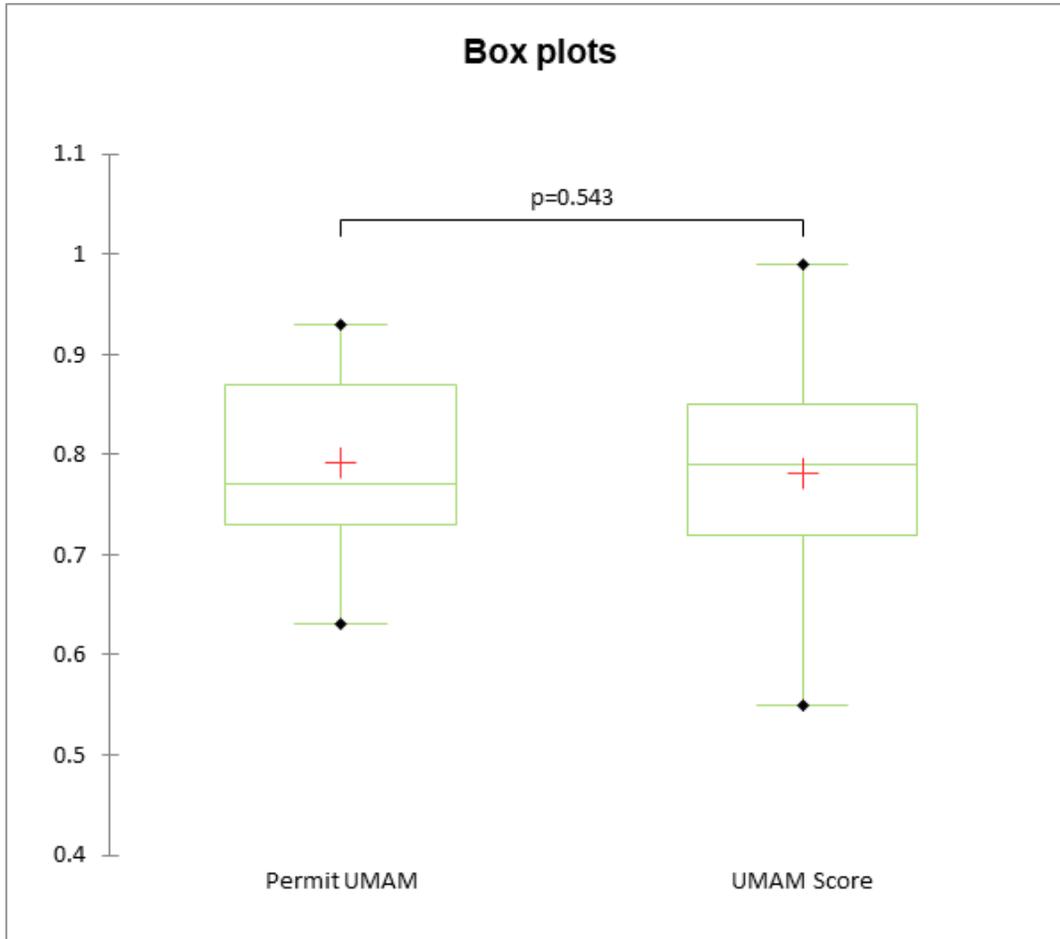
Wetland Type	Number of Sites	Permit UMAM	Current UMAM	% UMAM Change (Avg)	Number Sites Gained Function	Number Sites Lost Function	% Exotic Category (Avg)
Cypress	10	0.77	0.77	1%	6	4	2.70
Mixed Forested	20	0.77	0.71	-7%	6	14	2.70
Freshwater Marsh	12	0.83	0.74	-10%	1	11	2.60
Wet Prairie	2	0.70	0.83	19%	2	0	1.00
Hydric Pine	4	0.79	0.85	8%	3	1	1.25
Mixed Shrub	3	0.74	0.64	-12%	0	3	3.30
All Sites	51	0.78	0.74	-4%	18	33	2.51

Exotic % Category	Exotic % Present
1	< 1%
2	1% to 5%
3	5% to 25%
4	25% to 50%
5	> 50%

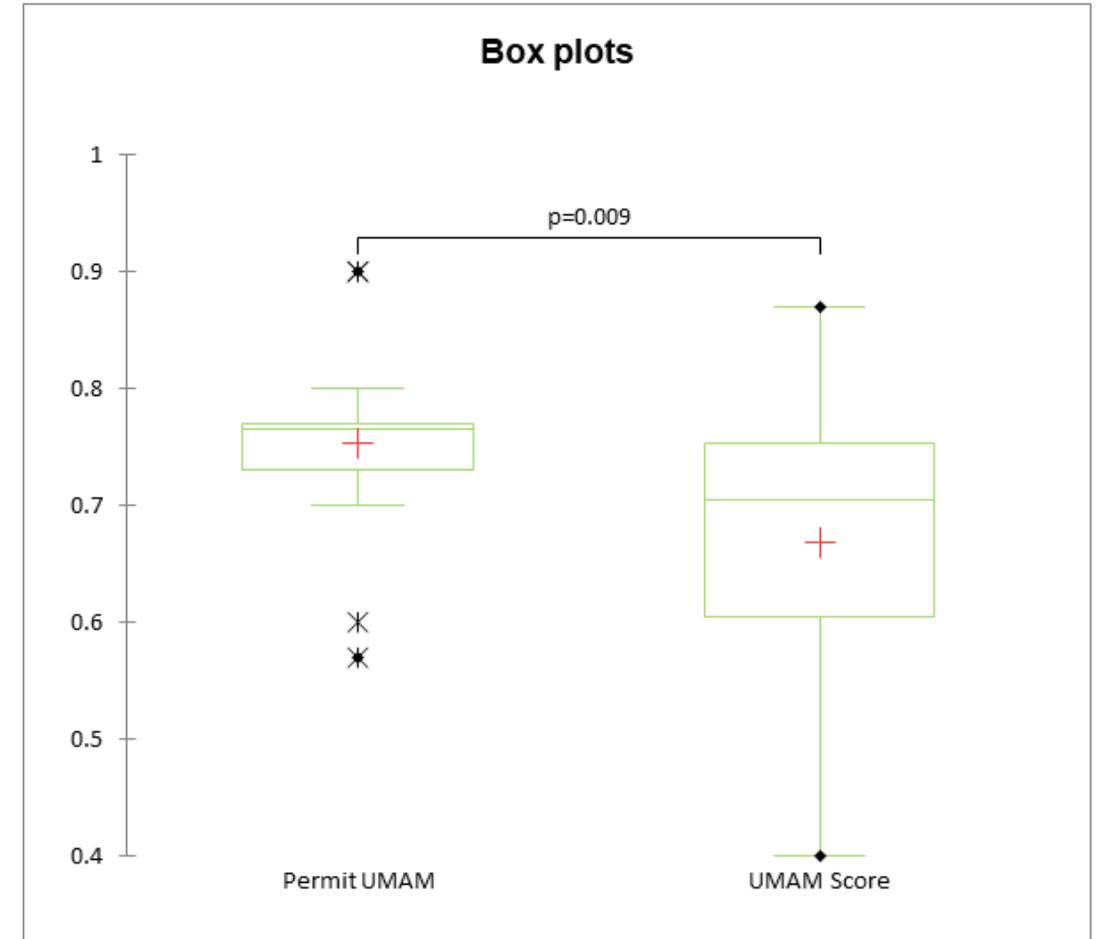
WETLAND FUNCTIONAL CHANGES – SUMMARY RESULTS

STATE OF THE WETLANDS STUDY

SITES WITH BUFFERS



SITES WITH NO OR LIMITED BUFFERS



WETLAND FUNCTIONAL CHANGES – BUFFER IMPORTANCE

STATE OF THE WETLANDS STUDY



- Some sites surrounded by development were of very high quality.
- Remote/rural sites maintained or gained wetland function over time.
- Wetland functional loss highest for shrub systems, followed by freshwater marshes and mixed hardwoods.
- Functional gains for wet prairies and hydric pine flatwood systems.
- Many freshwater marshes are transitioning to a scrub-shrub or forested system.
- Hydrology impacts often lead to increased exotic presence, with exotic vegetation often observed in the edges of the systems (initial 25').
- Sites with no or limited buffers had statistically significant loss of function over time.
- Preserving/planting an upland buffer with appropriate species is critical to avoid woody species from migrating into herbaceous systems.
- A robust maintenance program helps ensure long term health of a system.

WETLAND FUNCTIONAL CHANGES – KEY TAKEAWAYS

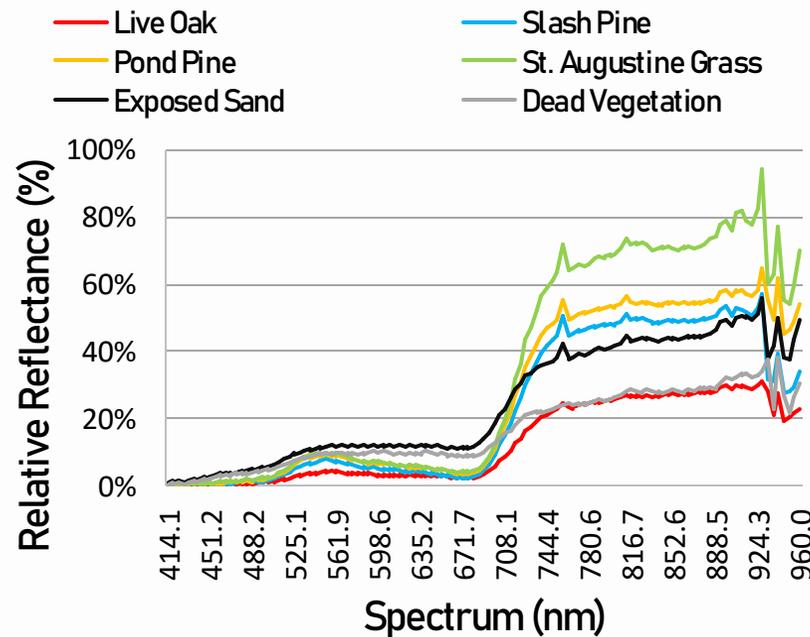
PRESENTATION OUTLINE

- Background
- Regulatory Review Study
- **State of the Wetlands Study**
 - Wetland Mapping
 - Wetland Fragmentation
 - **Wetland Functional Changes**
 - Additional Analyses
- Policy Recommendations



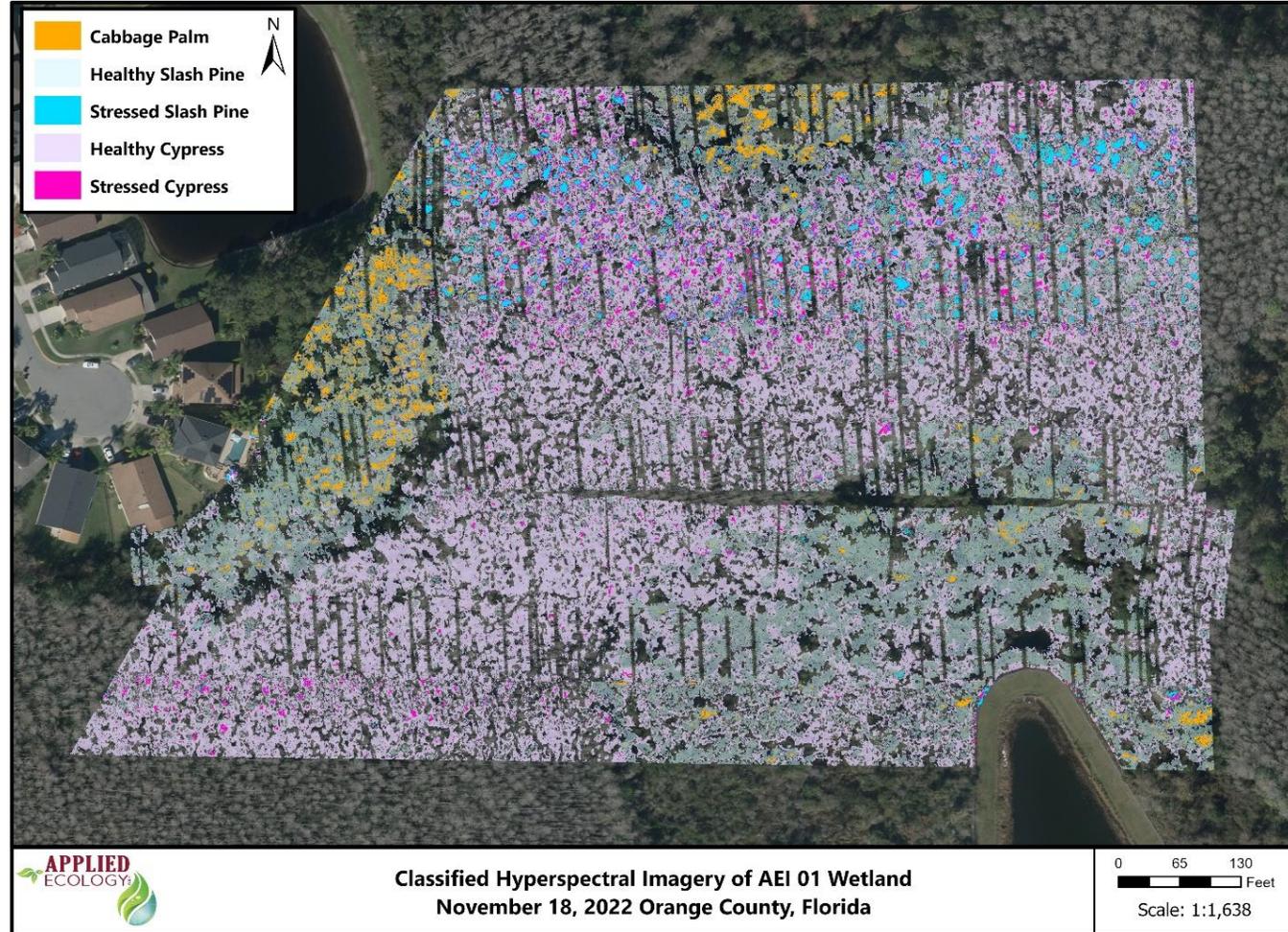
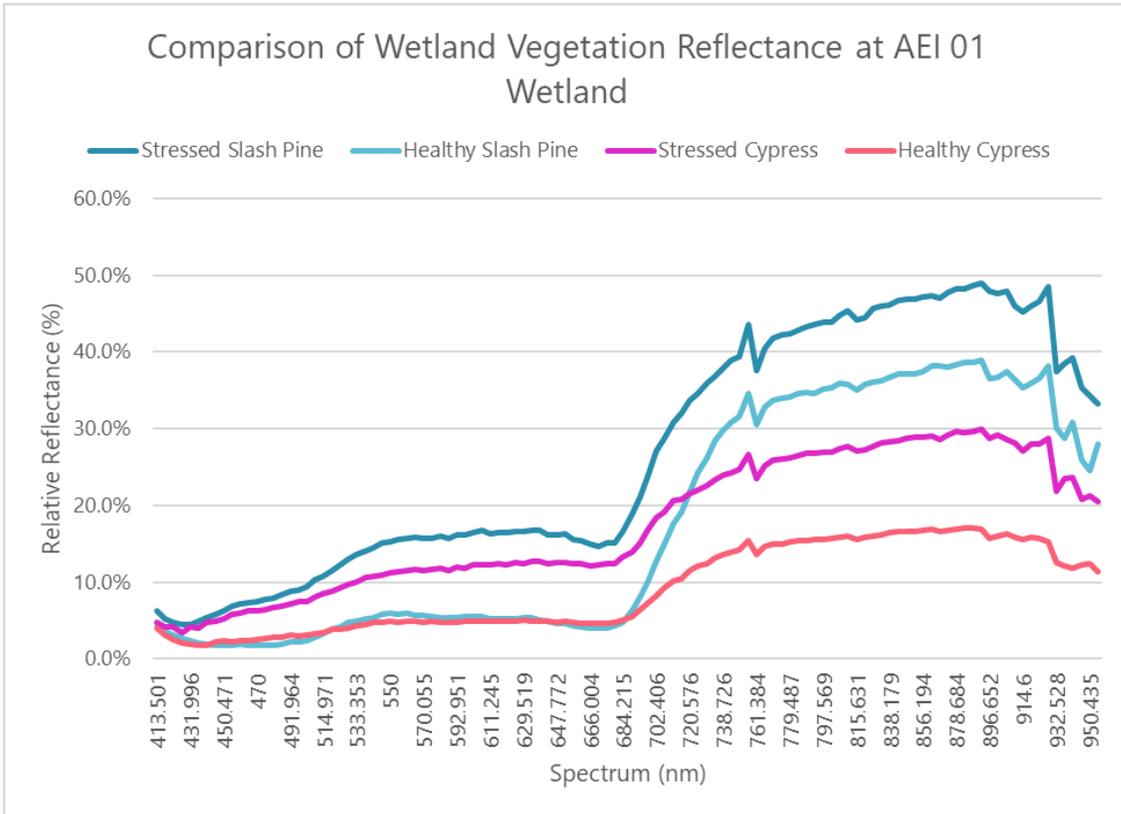
STATE OF THE WETLANDS STUDY

- Correlations of population change with wetland coverage change and fragmentation metrics
- Correlations of wetland losses with impaired systems
- Examining functional loss in context with other variables: land use change, population growth and others
- Development of wetland health indices based on remote sensing (UAS analysis)
- Conceptual scenario estimate of wetland loss by 2050



Impacts of wetland loss modeling

STATE OF THE WETLANDS STUDY



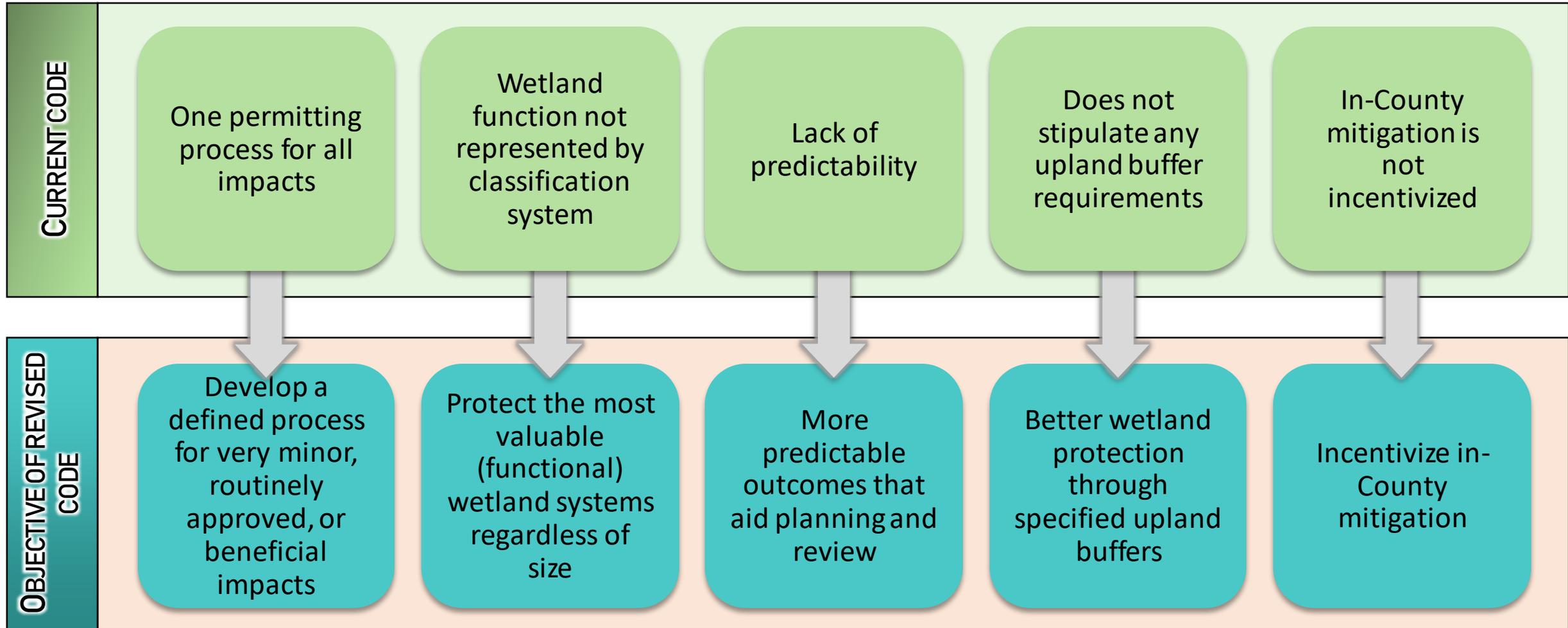
ADDITIONAL ANALYSES – USING UAV FOR WETLAND HEALTH

PRESENTATION OUTLINE

- Background
- Regulatory Review Study
- **State of the Wetlands Study**
 - Wetland Mapping
 - Wetland Fragmentation
 - Wetland Functional Changes
 - **Additional Analyses**
- Policy Recommendations



POLICY RECOMMENDATIONS

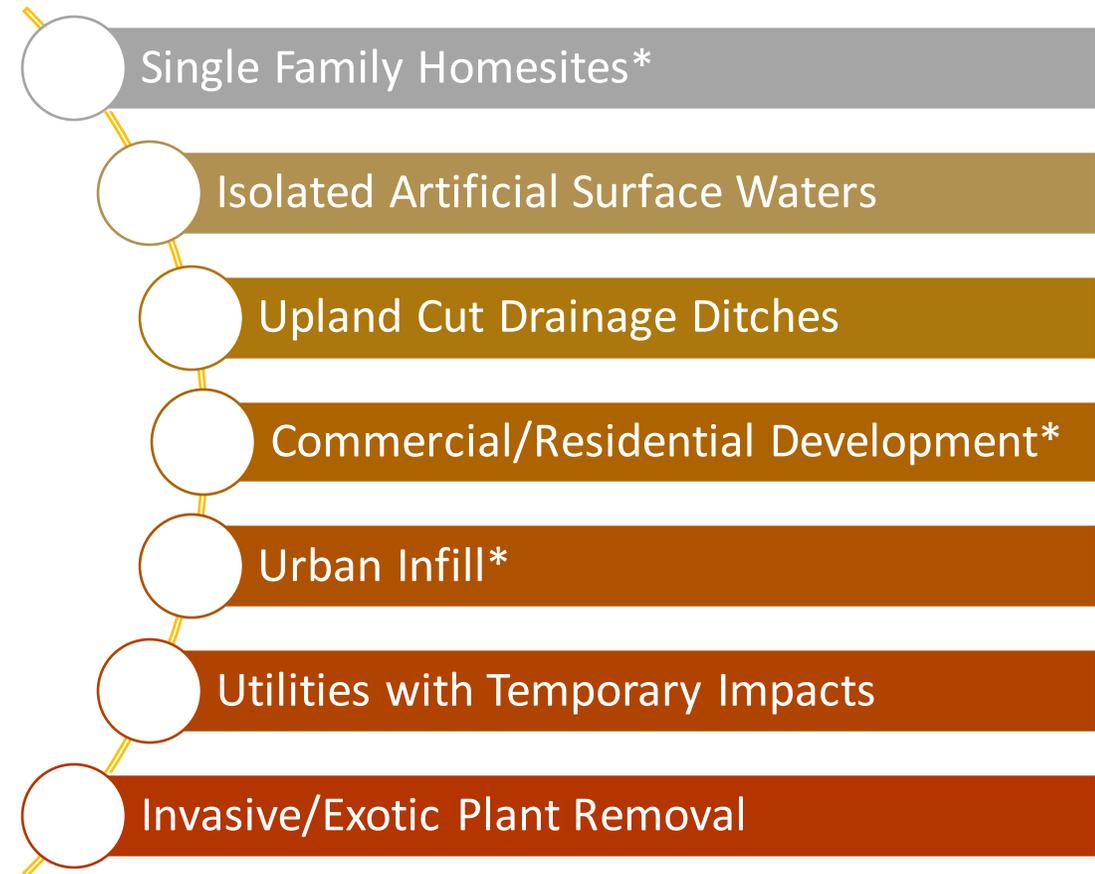


WETLAND ORDINANCE UPDATES – KEY FOCUS AREAS

BENEFITS OF NOTICED GENERAL PERMITS (NGP)

- Very clear and transparent guidelines enhance the process and build trust with customers
- Captures common activities typically approved by the County; facilitates reduction of time and costs to customers and staff
- Simplified application process using a checklist
 - Reduces Requests for Additional Information (RAIs)
- Allows for appropriate allocation of staff resources to those projects with more significant impact on natural resources

DRAFT NGP CATEGORIES



POLICY RECOMMENDATIONS



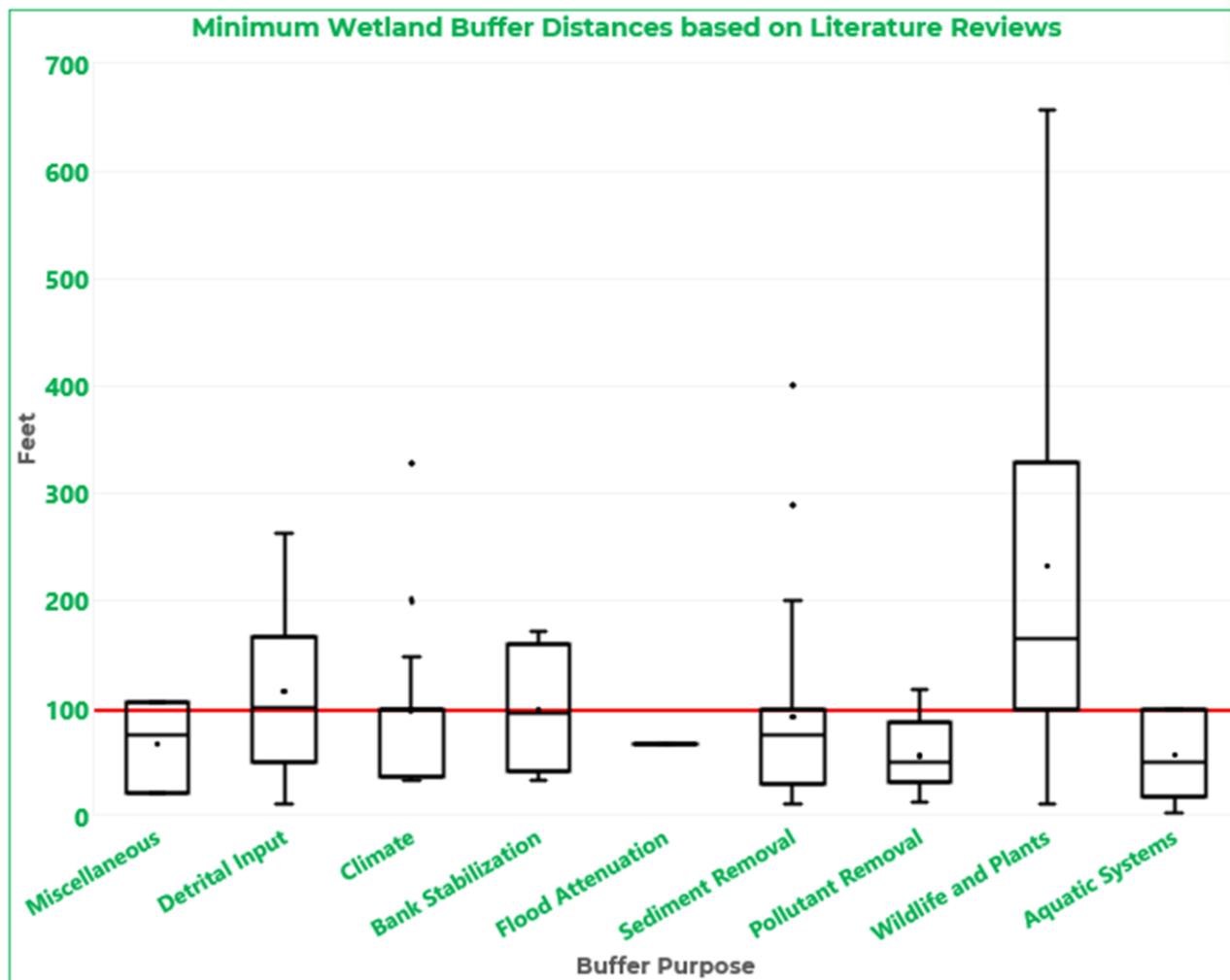
DRAFT STANDARD PERMIT (SP) MATRIX

- Size of impact and wetland functionality determine level of review, type and depth of impact analyses, and approval requirements
- Other factors (modifiers) impact the permit level

Permit Levels
SP Level 1
SP Level 2
SP Level 3

		Wetland Impact (Acres)			
		≤ 2.0	>2.0-10.00	>10.00-25.0	>25.00
UMAM Score	10	Yellow	Yellow	Red	Red
	9	Yellow	Yellow	Red	Red
	8	Yellow	Yellow	Red	Red
	7	Green	Yellow	Red	Red
	6	Green	Yellow	Red	Red
	5	Green	Yellow	Yellow	Red
	4	Green	Yellow	Yellow	Red
	3	Green	Green	Yellow	Red
	2	Green	Green	Yellow	Red
	1	Green	Green	Yellow	Red

POLICY RECOMMENDATIONS



Environmental Law Institute (2003). Conservation Thresholds for Land Use Planners.

RESEARCH ON BUFFER DISTANCES

- Metanalysis with over 130 studies
- Focus on Florida wetlands
- Data plotted based on minimum buffer distance

DRAFT RECOMMENDATIONS

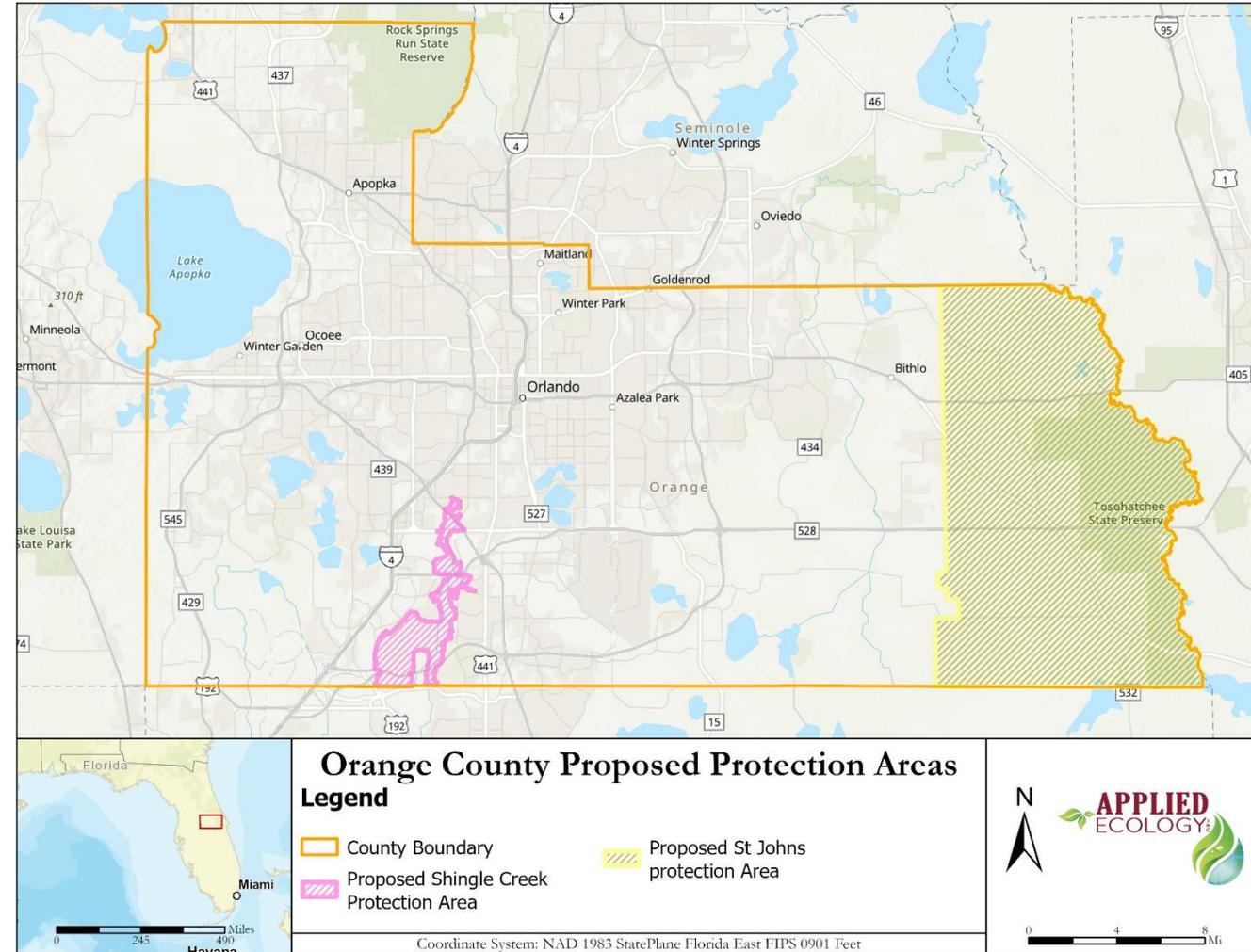
- A minimum of 100-ft natural and undisturbed buffer for all sites except:
 - NGPs and SP Level 1 projects on small lots
 - All cases: minimum 25-ft, average 50-ft
- If required buffer cannot be provided, mitigation and other measures (e.g., wildlife-friendly fencing, signage) are required
- Additional buffer sizes based on modifiers such as OFW, location (SPAs), habitat, and protected species nesting onsite



POLICY RECOMMENDATIONS

DEVELOPMENT OF NEW SPECIAL PROTECTION AREAS (SPAs)

- Potential additional areas to consider as SPAs
 - Shingle Creek
 - St. Johns River
- Potential use as permitting modifier
- Increased upland buffer requirements
- Other requirements to be defined



POLICY RECOMMENDATIONS

NEW MAINTENANCE & MONITORING REQUIREMENTS

- All on-site and off-site mitigation will require perpetual maintenance and monitoring
 - Monitoring:
 - Maintain <5% invasive/exotic species
 - Periodic trash removal
 - Reporting:
 - Annual Reports for first 5 years
 - After 5 years, reports every 2-3 years
- Wildlife-friendly fencing/signage
 - Prevent encroachment
 - Clearly indicate maintenance requirements



Perpetual Maintenance = Wetland Longevity

- Healthy vegetation community
- Minimal invasive species (< 5%)
- Native species recruitment
- Maintains ecological function

POLICY RECOMMENDATIONS

Tiered Permitting Approach

Noticed General Permit and Standard Permit processes in lieu of a single permit type (CAI)

Eliminate Class I, II, III wetland classification system. Assess wetlands based on quality and functionality using UMAM, not just size and connectivity

Base the level of review, type and level of impact analyses, and approval level (i.e., EPD staff, EPO, BCC) on size of impact, wetland functionality, and modifiers

SPAs for Shingle Creek and St. Johns

Sensitive areas with increasing development pressure

Increased upland buffer widths

Other criteria to be defined

Upland Buffers

Minimum 100' buffer with exceptions for small parcels

Larger or smaller buffers may be appropriate in some cases

Mitigation

Incentivize in-County mitigation

Accept only larger CEs as mitigation

Require monitoring and maintenance in perpetuity

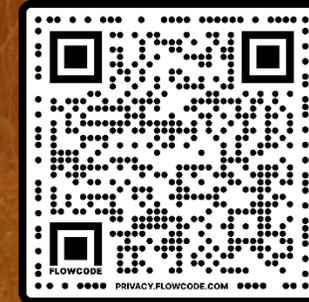
QUESTIONS & DISCUSSION

FAC 2023 Annual Conference

Tim Hull, MS, PWS, *Orange County*

Lee Mullon, PE, *Drummond Carpenter, PLLC*

Leesa Souto, Ph.D., *Applied Ecology, Inc.*





STATE OF THE WETLANDS STUDY: ORANGE COUNTY

SIGN IN / SURVEY:

