# Corkscrew Swamp Sanctuary Modeling Update

Akin Owosina

## Big Cypress Basin Board Meeting
## February 25, 2021

Akin Owosina, P.E.,
Chief, H&H Bureau

# Background

- Issue
  - Corkscrew Swamp Sanctuary's hydrology shows a drying, dry season trend evidenced by a reduced hydroperiod at Lettuce Lake in the last 20 years of a 60-year period of record

- History of BCB Board Action
  - A team from Corkscrew Audubon presented to the Big Cypress Basin Board (Oct 2018) and requested Basin support to identify in the possible causes of the observed hydrologic change
  - Board asked staff to conduct preliminary modeling and review canal improvements/operations
  - Board allocated cost share funds in the FY19/20 budget ($100k)
  - Board committed technical staff review

# Background

- Related Modeling Studies
  - Staff evaluated changes to the BCB stormwater system since 2000
  - Completed modeling to identify the potential effect of improvements on Corkscrew Sanctuary Hydrology
  - Investigated the improvements from new structures
  - Worked with Audubon Corkscrew to plan a more robust modeling effort undertaken by Corkscrew to investigate the various potential causes raised in presentation to the board
  - Required collaboration/coordination with Coastal and Heartland National Estuary Program (CHNEP) South Lee model

# Background

- Status
  - Audubon Corkscrew entered into a cost share agreement with BCB/SFWMD in FY20
  - Initiated a project in 2020 (Kicked off in Feb 2020)
  - Completed model development and application, documented in a final report
  - Last deliverable of the project is a presentation of the findings to the Board - Today
- Project Completed
  - Presentation from Audubon Corkscrew team satisfying the final contract deliverable

# Corkscrew Swamp Sanctuary Hydrologic Modeling Project


**SHAWN CLEM, PH.D.**

**RESEARCH DIRECTOR**


**FEBRUARY 25, 2021**

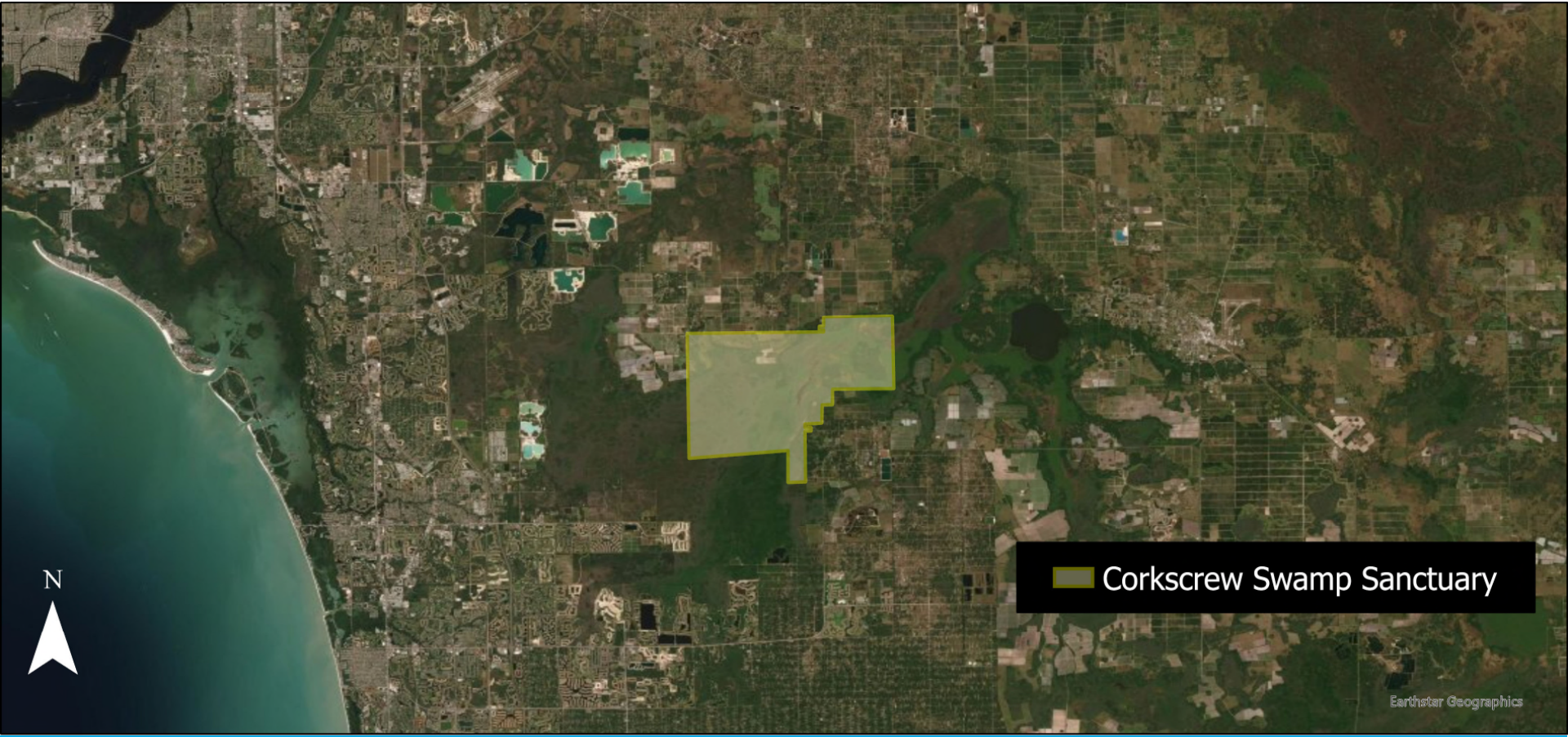
Audubon

Corkscrew Swamp Sanctuary

*Photo: RJ Wiley*

# CORKSCREW HYDROLOGIC MODELING PROJECT

Audubon



# CORKSCREW HYDROLOGIC MODELING PROJECT

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Background:

- Wood Stork
- Large, colonially-nesting wading bird
- Protect Threatened species

Photo: Lorraine Minns/Audubon Photography Awards

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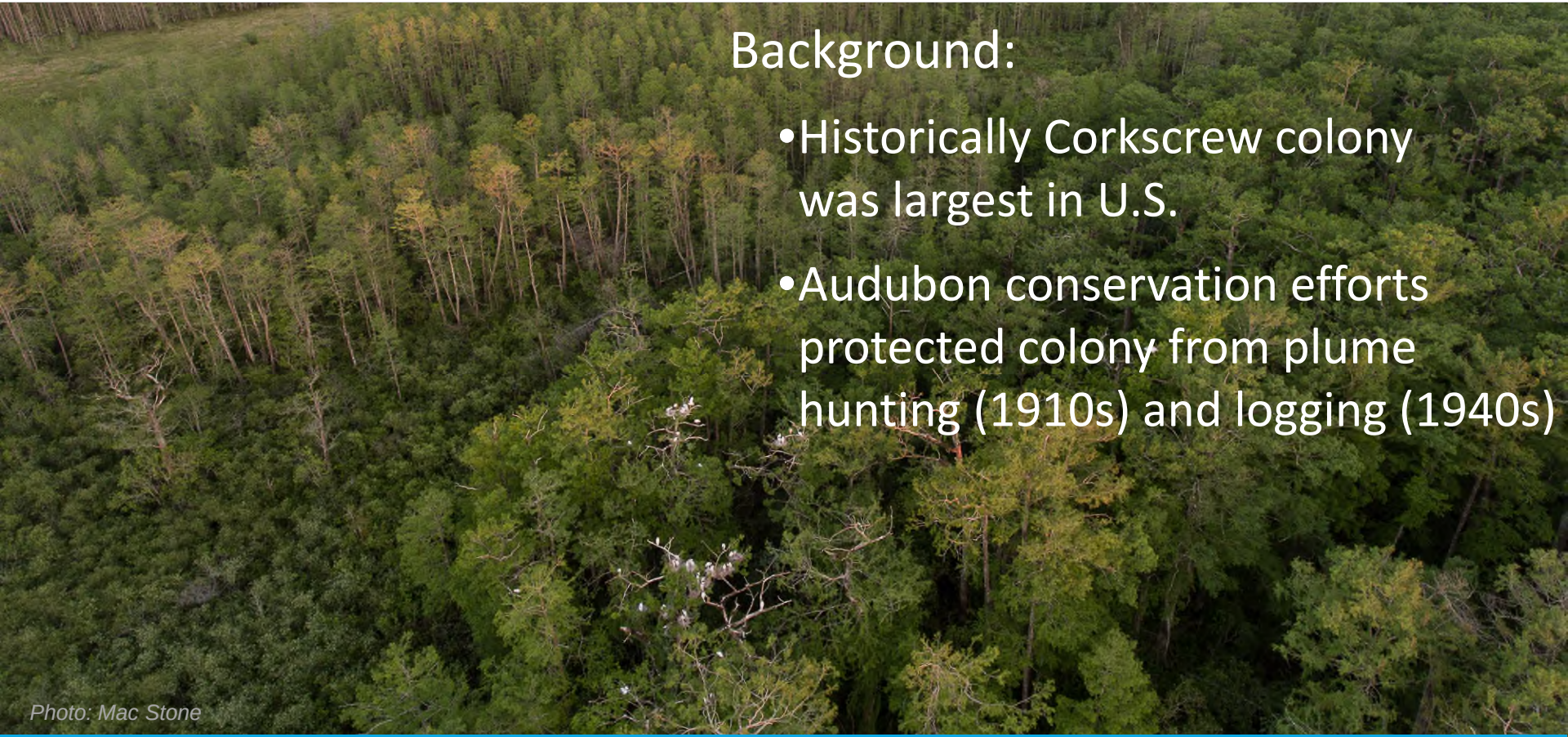

Background:

- Historically Corkscrew colony was largest in U.S.
- Audubon conservation efforts protected colony from plume hunting (1910s) and logging (1940s)

Photo: Mac Stone

# CORKSCREW HYDROLOGIC MODELING PROJECT

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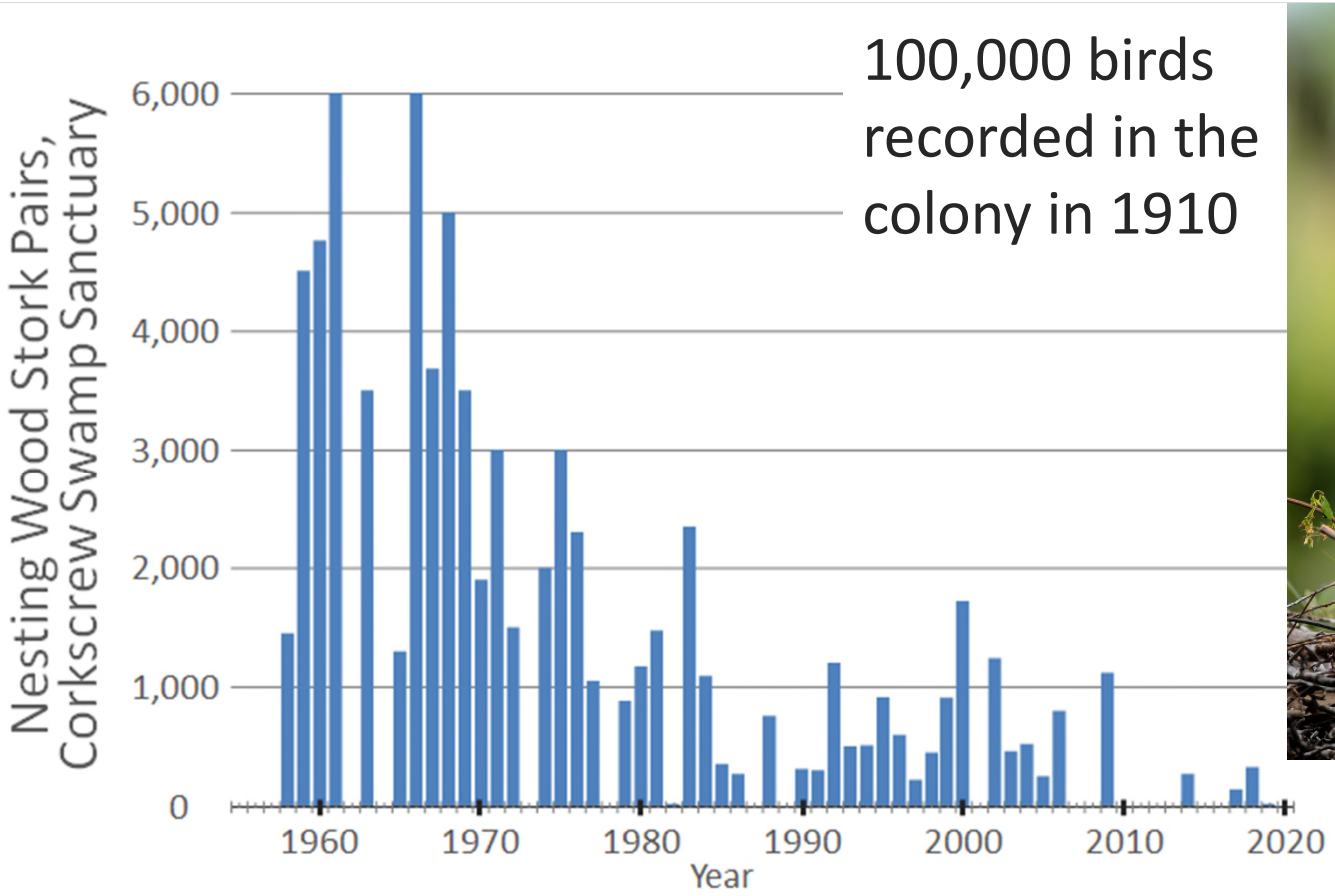


100,000 birds recorded in the colony in 1910

*Photo: Jeffrey Karnes/ Audubon Photography Awards*

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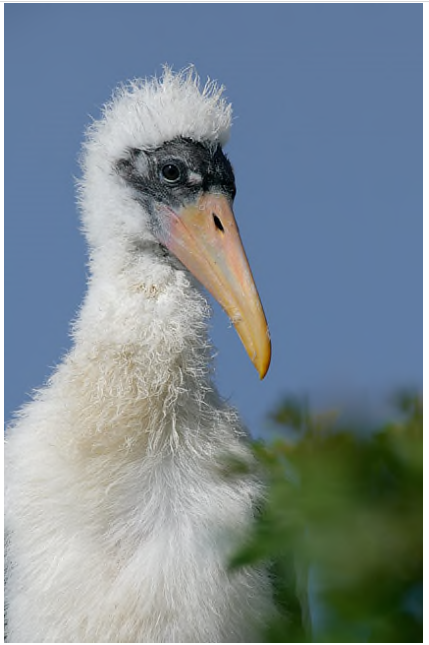

Hydrology drives aquatic prey production

Food availability limits wading bird populations

# CORKSCREW HYDROLOGIC MODELING PROJECT

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**SURFACE WATER**
Staff Gauges
1959-

**RAINFALL**
1959-

**GROUNDWATER**
Well (C-492)
1973-

N

0 0.05 0.1 0.2 0.3 0.4 0.5
Miles

# CORKSCREW HYDROLOGIC MODELING PROJECT

Audubon

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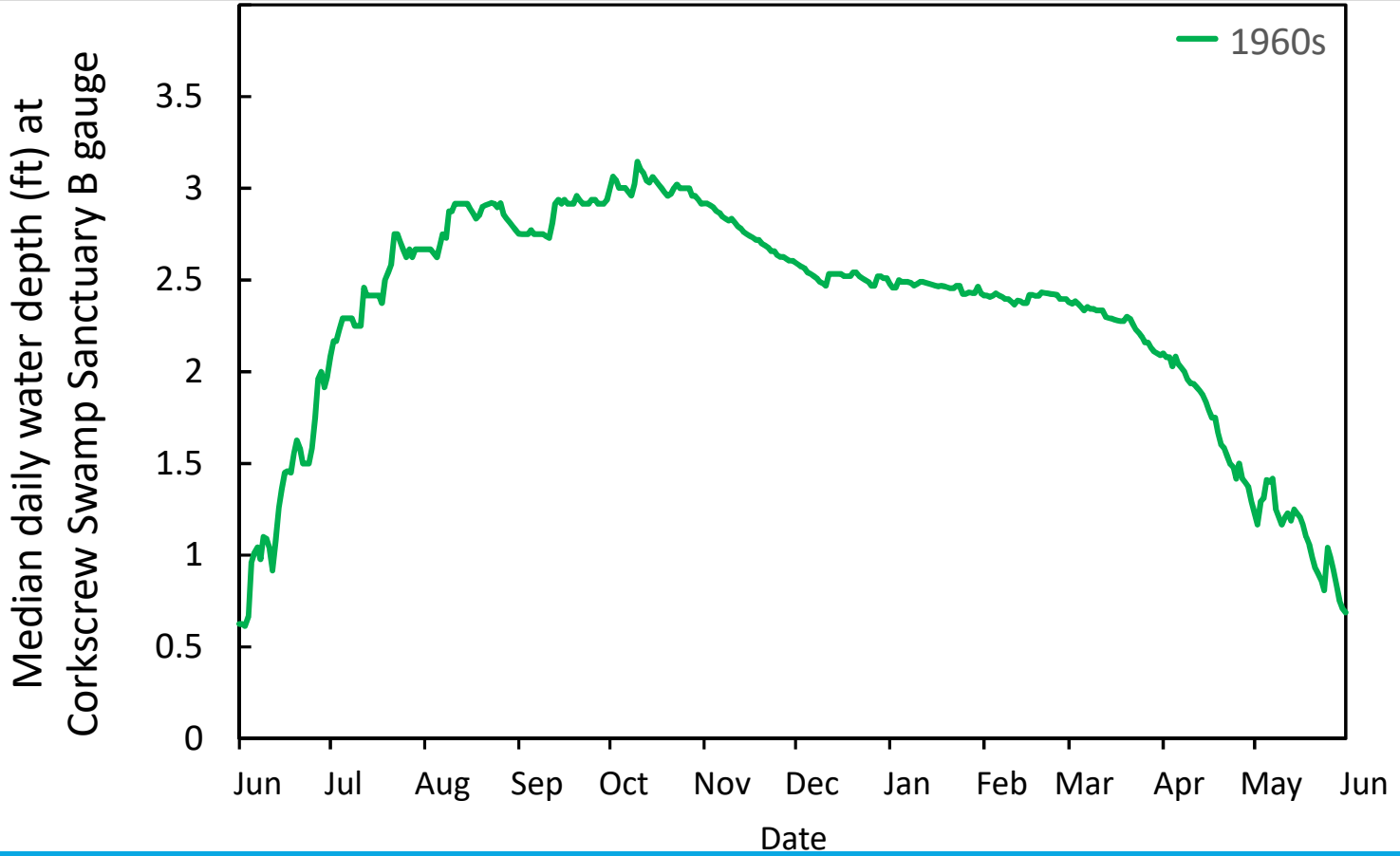

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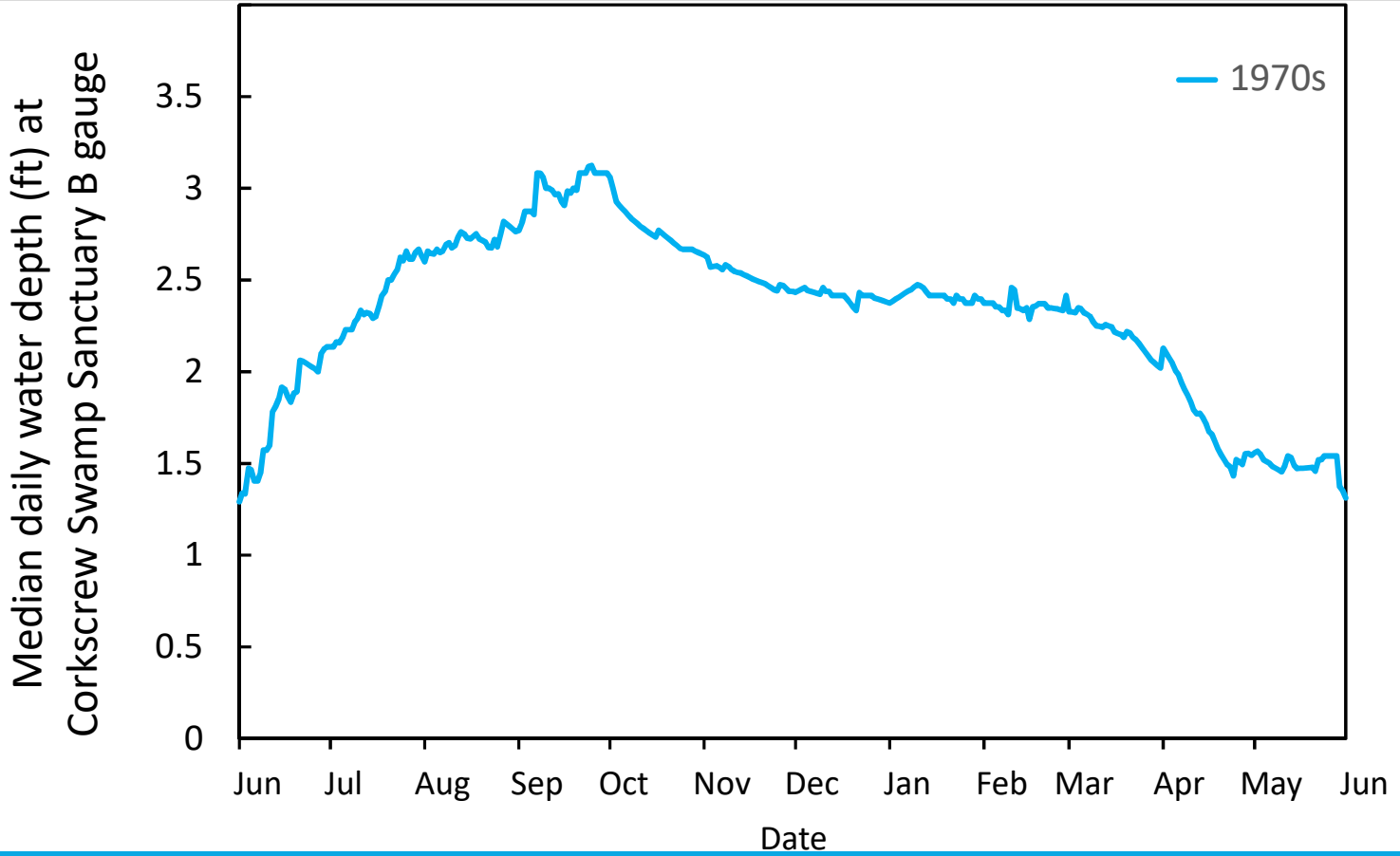

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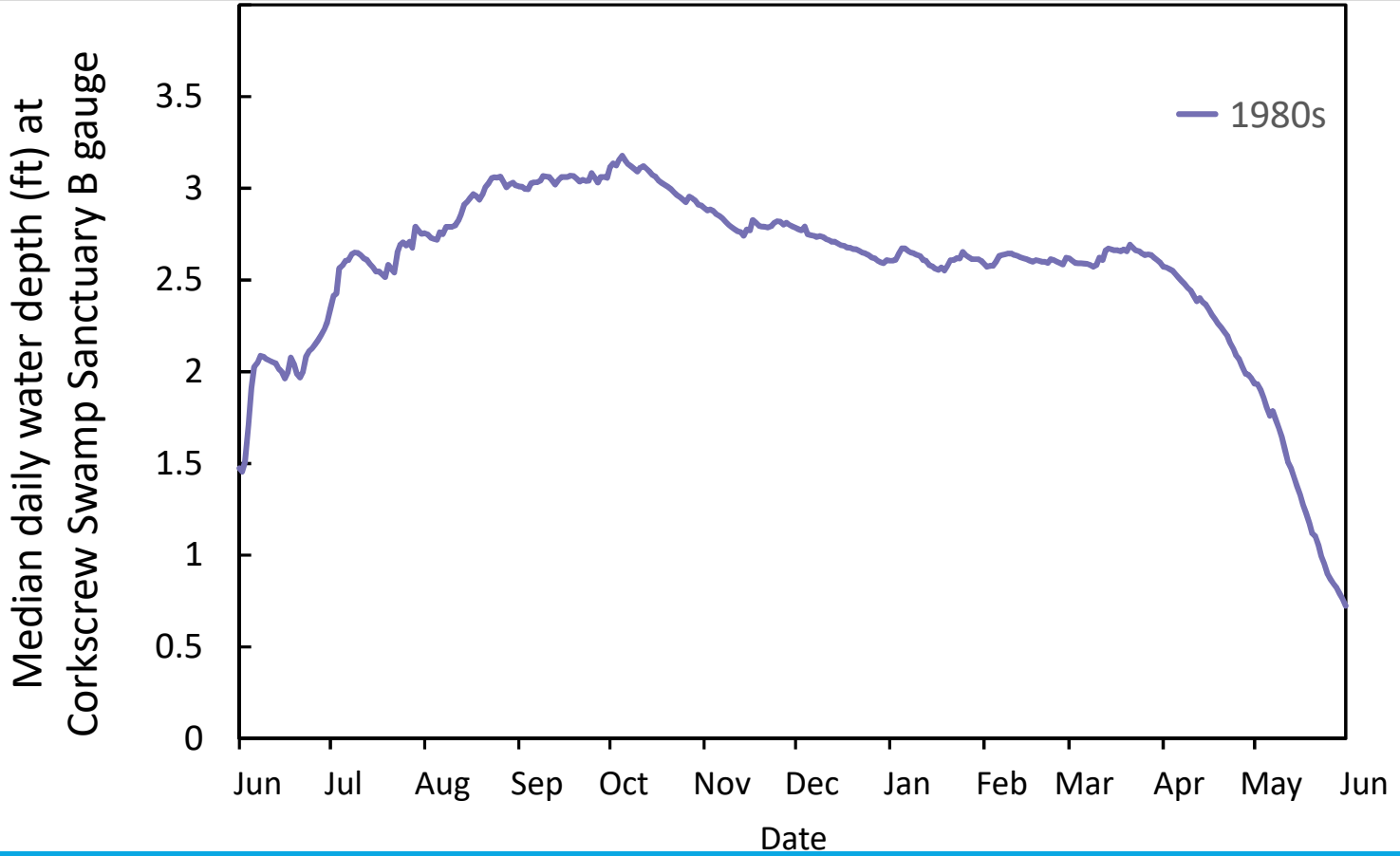

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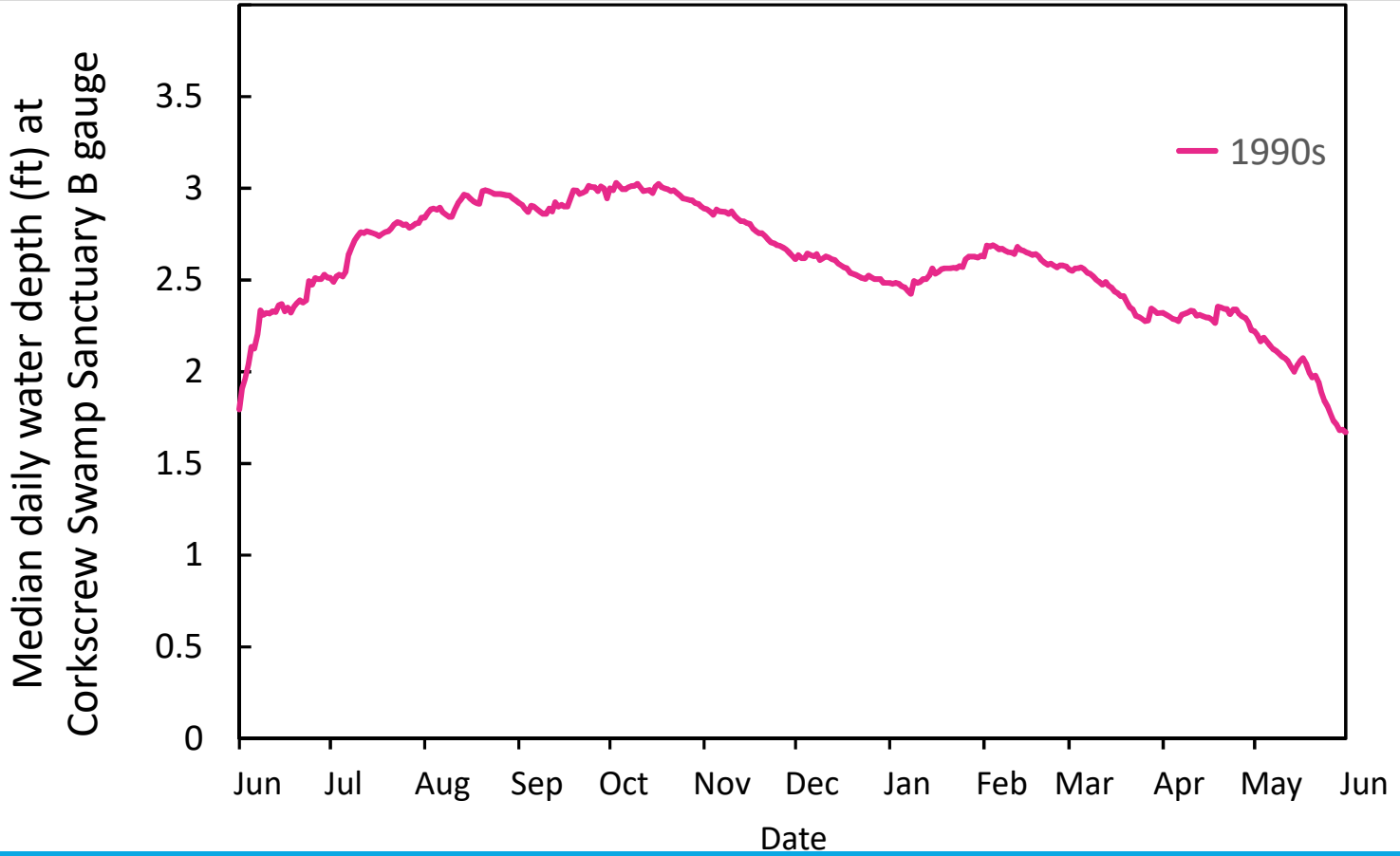

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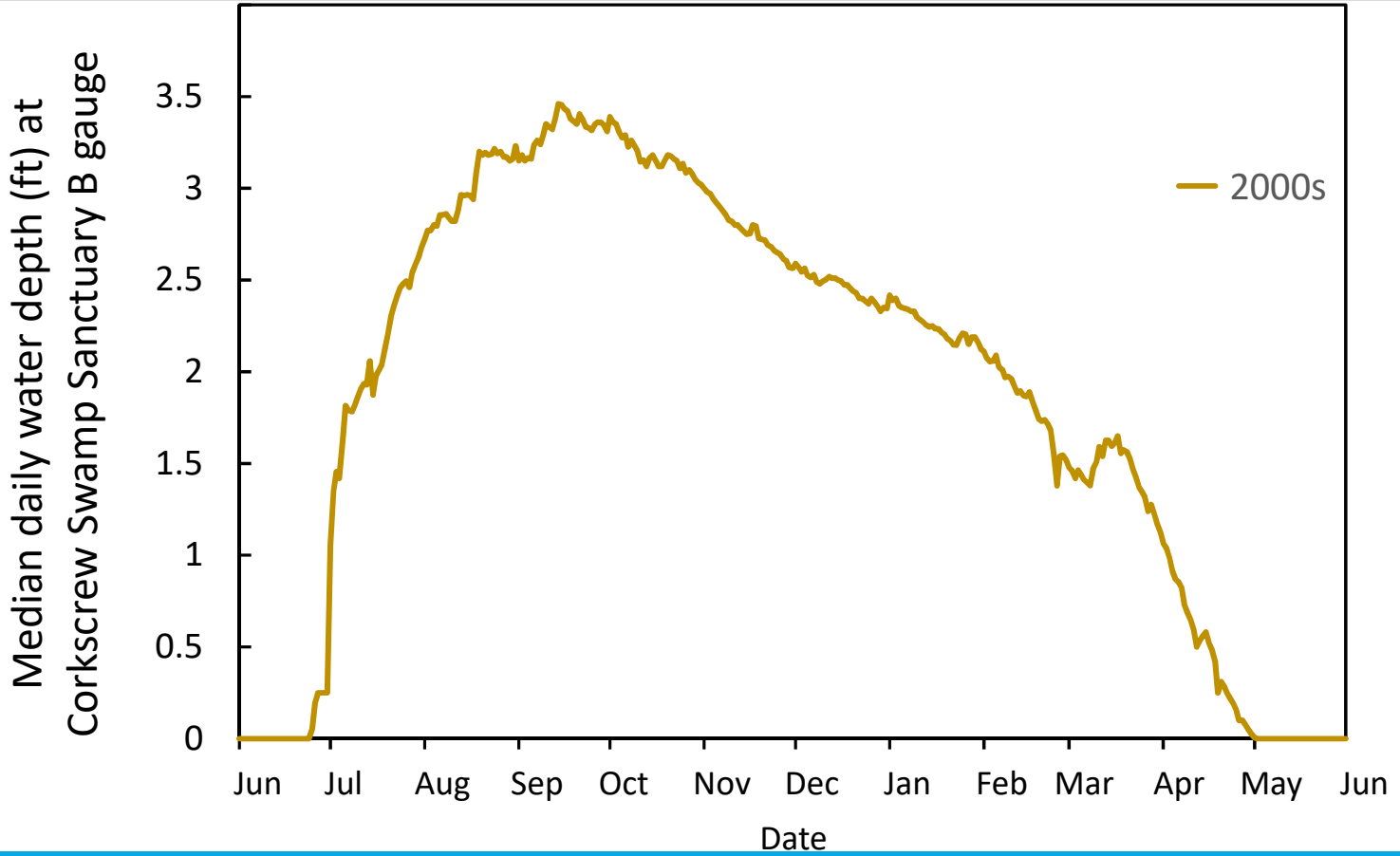

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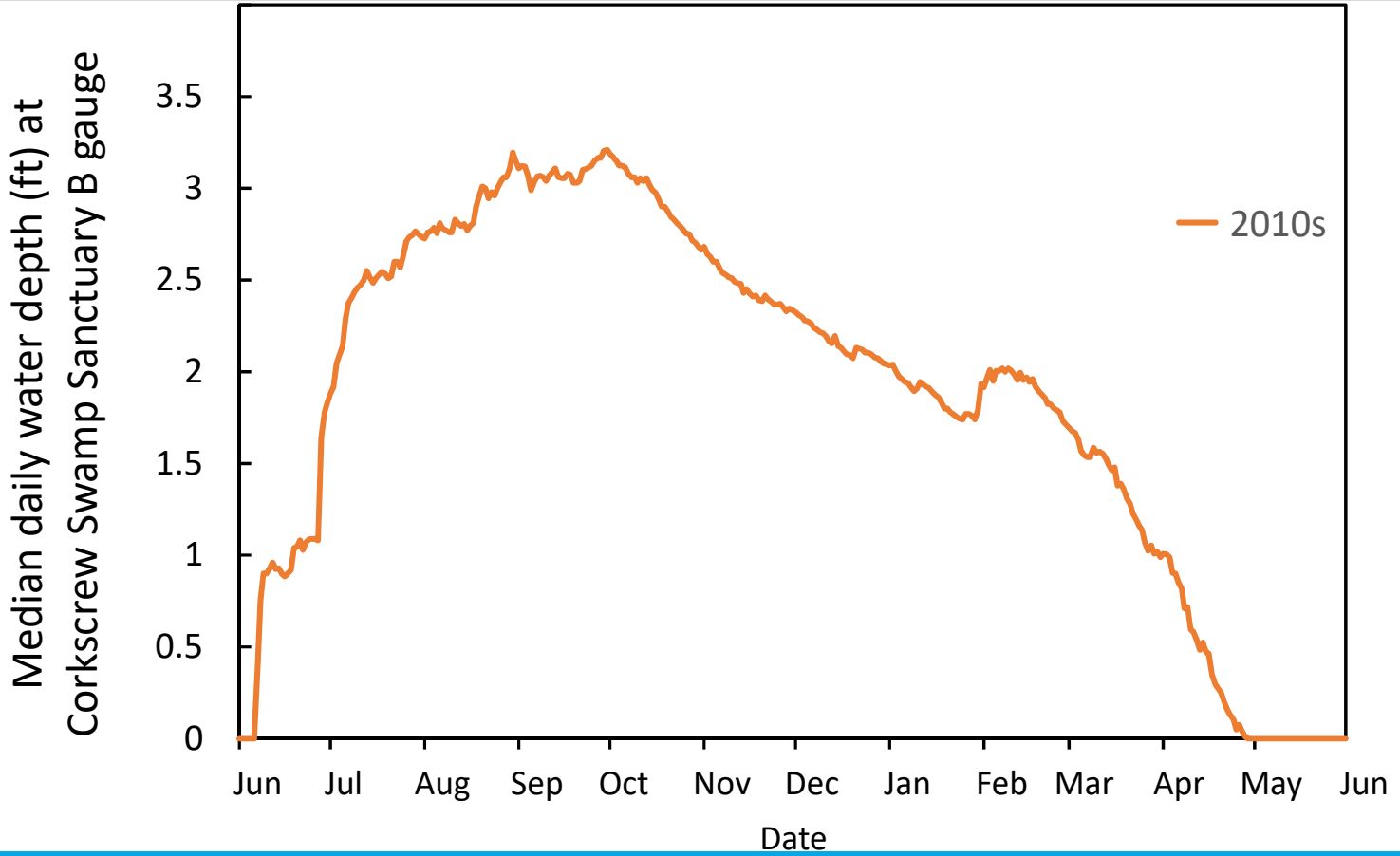

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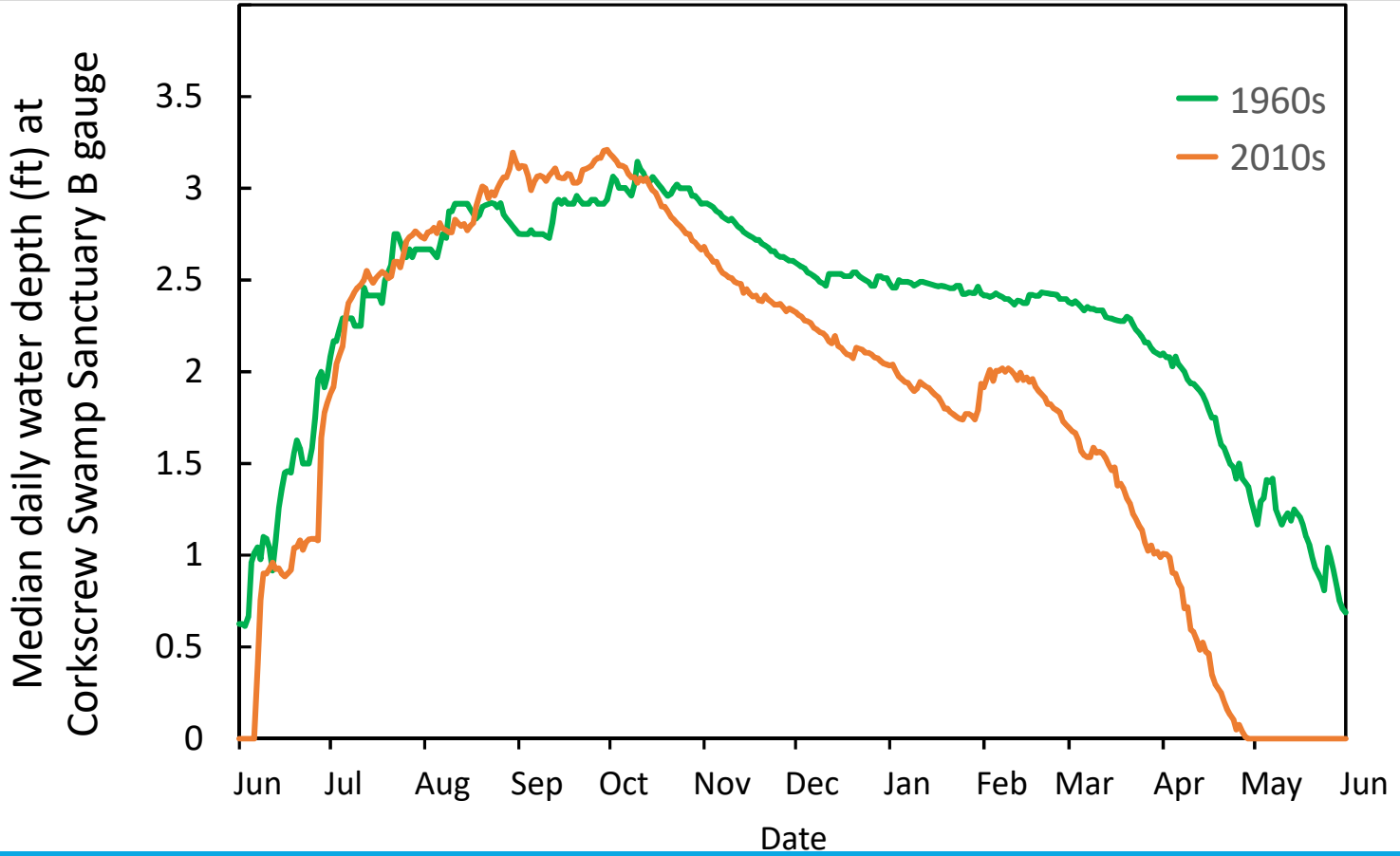

# CORKSCREW HYDROLOGIC MODELING PROJECT

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## Reduction in hydroperiod 1960s to 2010s:

| Freshwater Marsh | Bald Cypress | Pond |
|---|---|---|
|  |  |  |
| ↓ 29% | ↓ 18% | ↓ 17% |
| 2.6 months shorter | 1.9 months shorter | 2.0 months shorter |

# CORKSCREW HYDROLOGIC MODELING PROJECT

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## Implications for wildlife

- Reduced aquatic prey base
- Direct impacts on Wood Stork nest success

*Photo: James Robellard/Audubon Photography Awards*

# CORKSCREW HYDROLOGIC MODELING PROJECT

Audubon


## Implications for plants

- Succession of plant communities & habitats
- Altered understory microclimate

# CORKSCREW HYDROLOGIC MODELING PROJECT

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**Increased fire risk**

- Managing land with fire is more challenging
- Cypress forest vulnerable to catastrophic fire

# CORKSCREW HYDROLOGIC MODELING PROJECT

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**Reduced freshwater storage**

- Shortened period of inundation reduces aquifer recharge

# CORKSCREW HYDROLOGIC MODELING PROJECT

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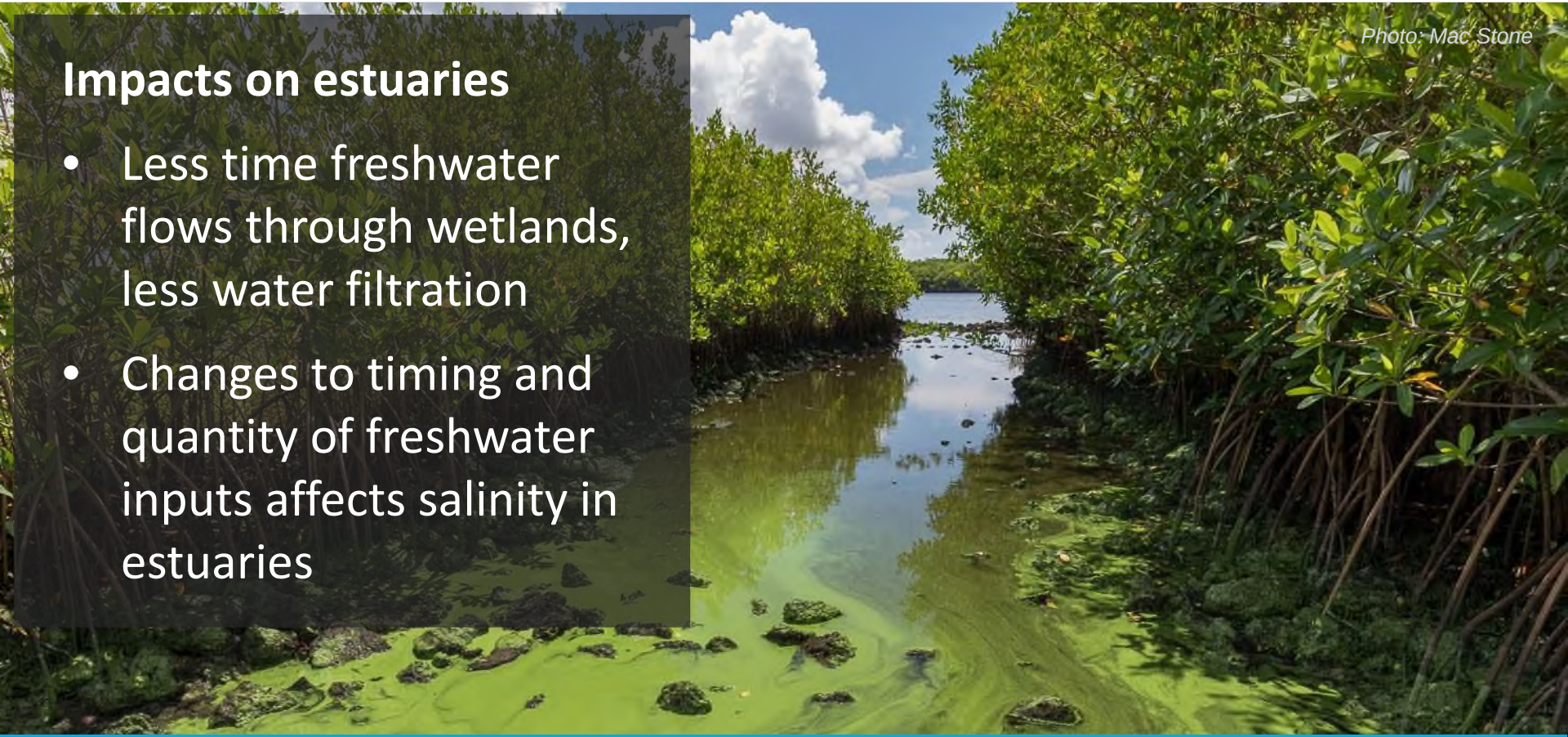


## Impacts on estuaries

- Less time freshwater flows through wetlands, less water filtration
- Changes to timing and quantity of freshwater inputs affects salinity in estuaries

# CORKSCREW HYDROLOGIC MODELING PROJECT

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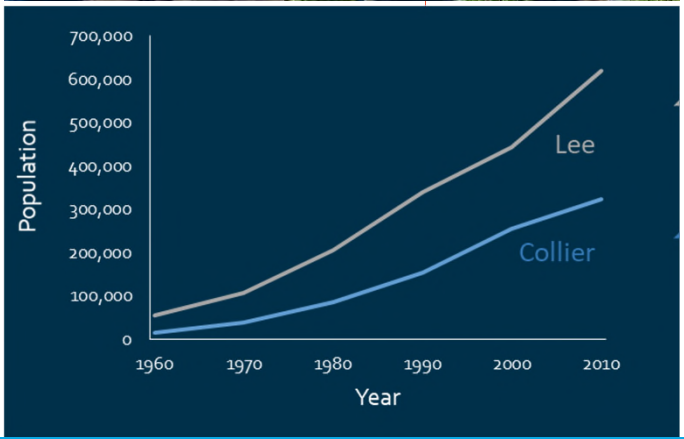
## Where could our water be going?

- Agriculture
- Residential
- Increased evapotranspiration
- Water management

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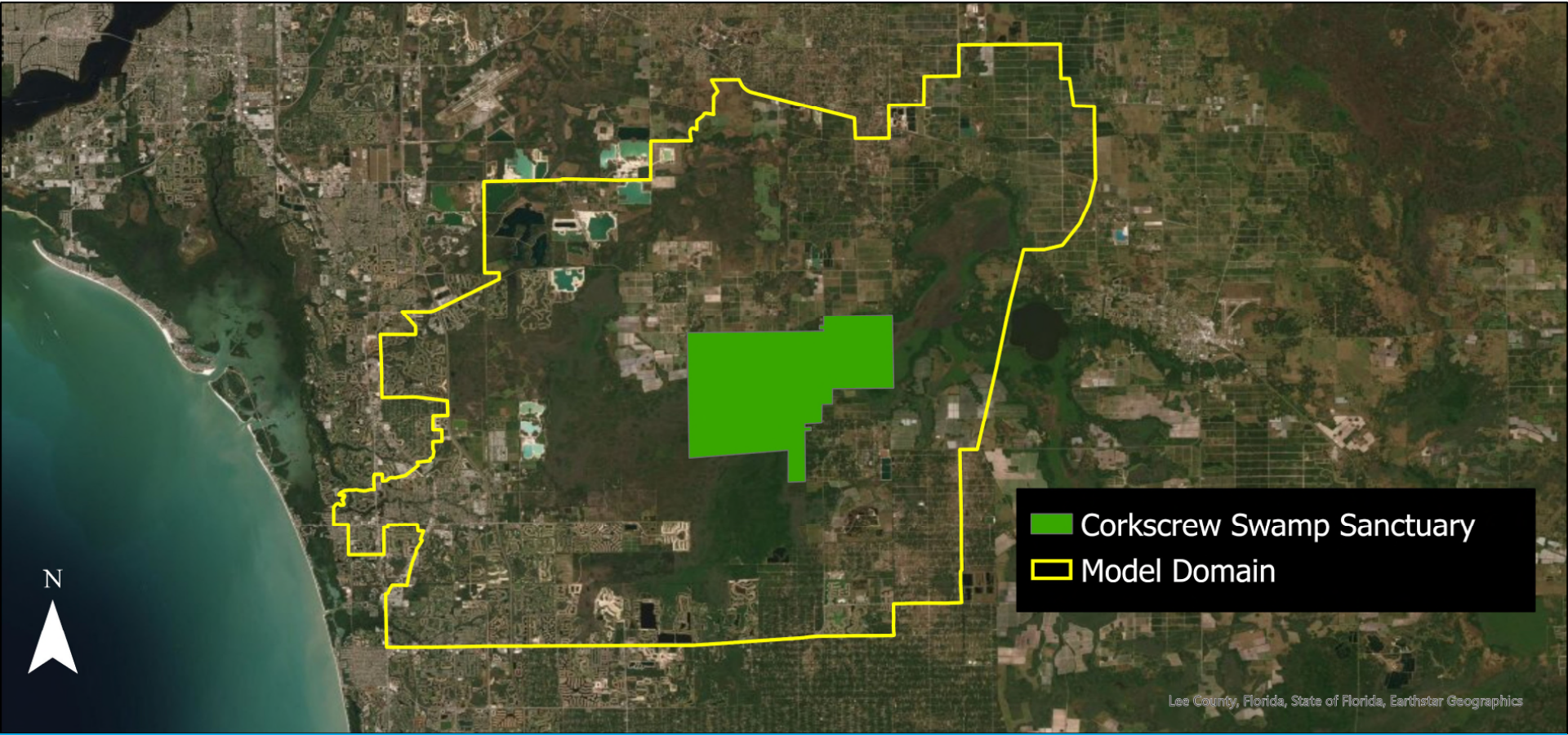

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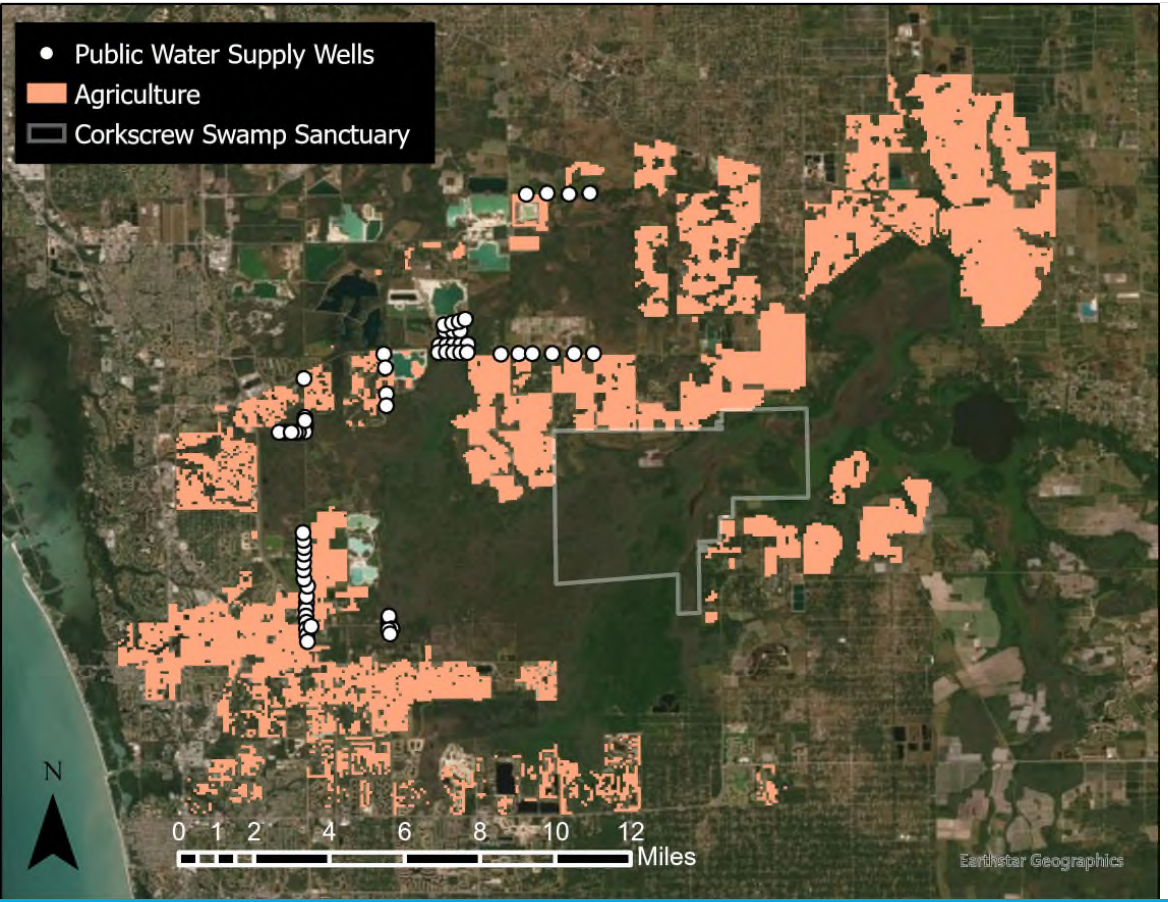


## Scenario 1

- **Eliminate agriculture**
  **One area becomes drier**
- **Eliminate public water supply wellfields**
  **No hydroperiod change in the Sanctuary**
- **Eliminate BOTH**
  **Modest hydroperiod increase along boardwalk (+6 inches, + few weeks)**

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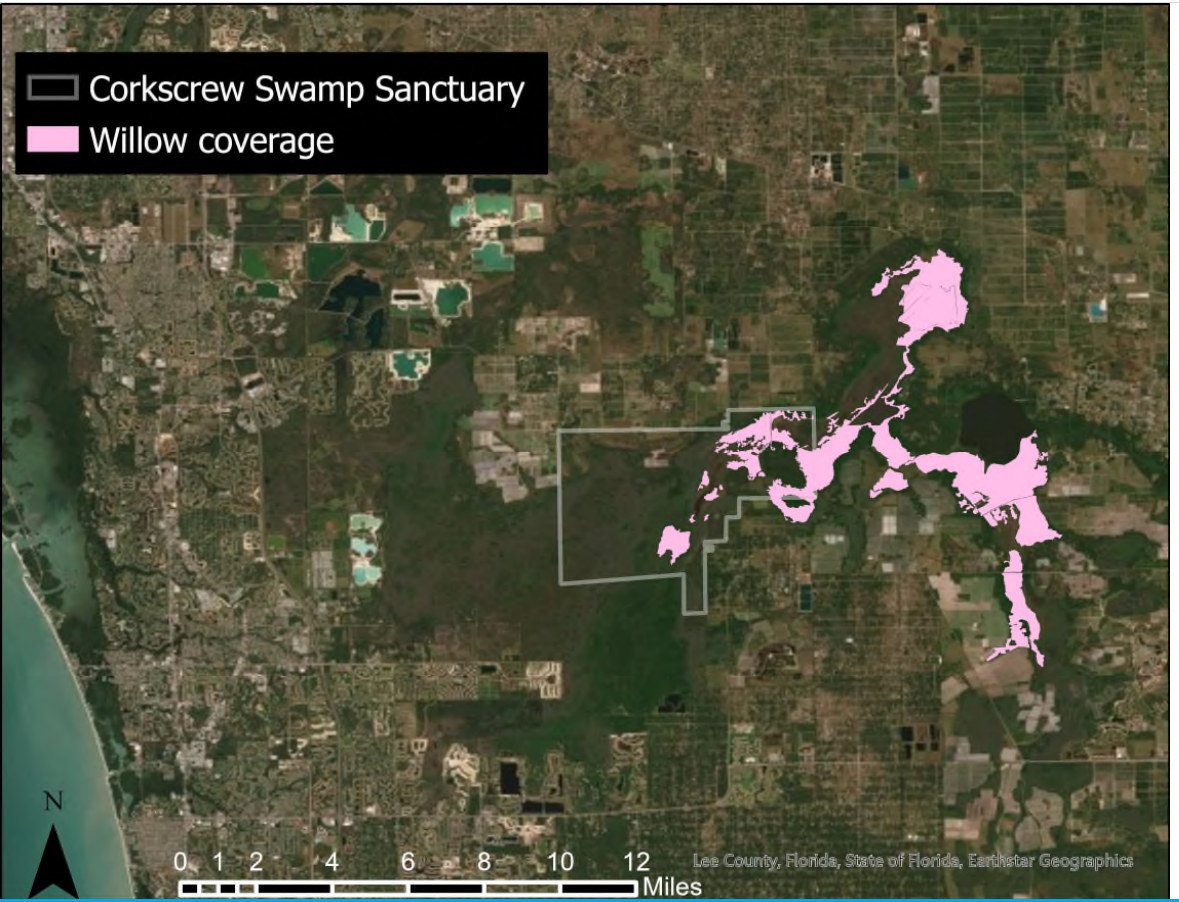


## Scenario 2

- **Eliminate willow & thin pines**

**No significant change to Sanctuary hydrology**

**…but evapotranspiration reduced by >1,500 acre feet per year in restoration area**

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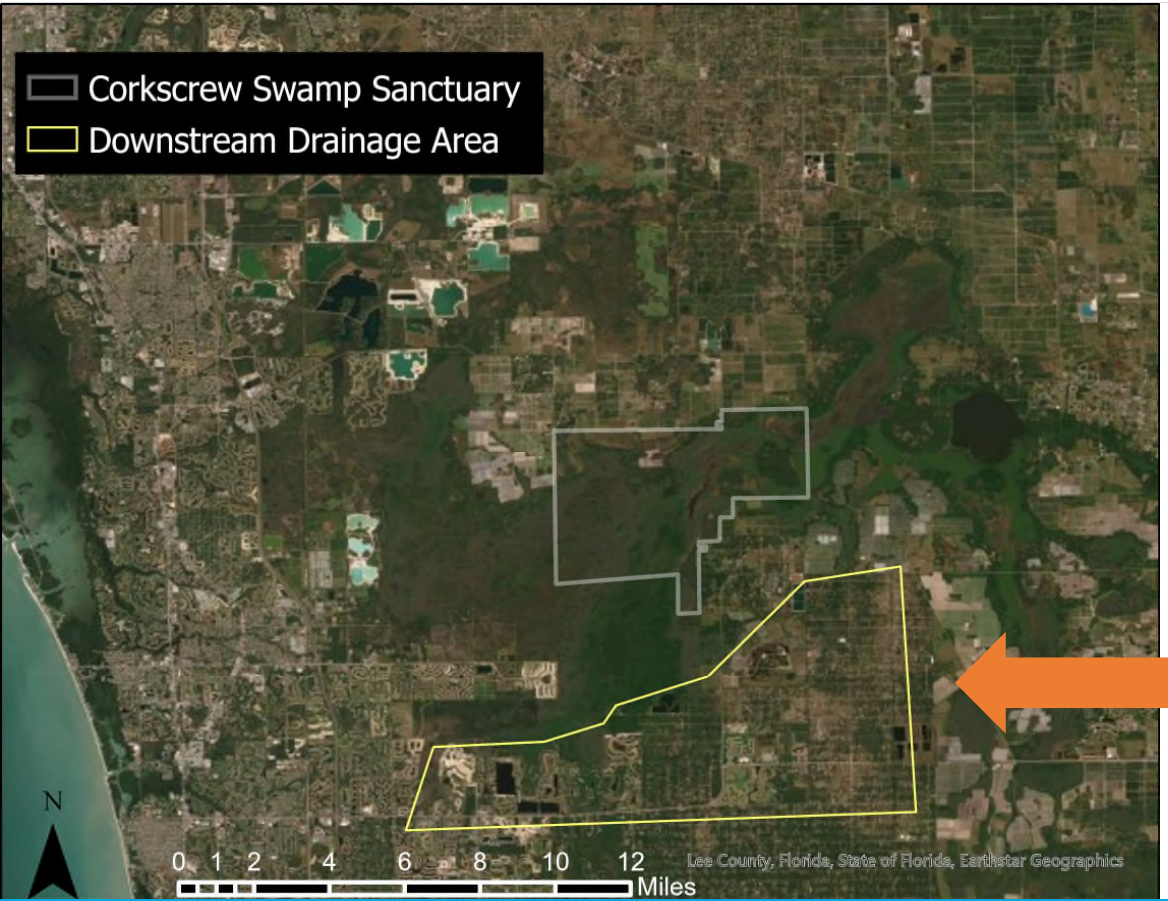


## Scenario 3

- **Eliminate downstream drainage**

area where canals and structures were removed in the model

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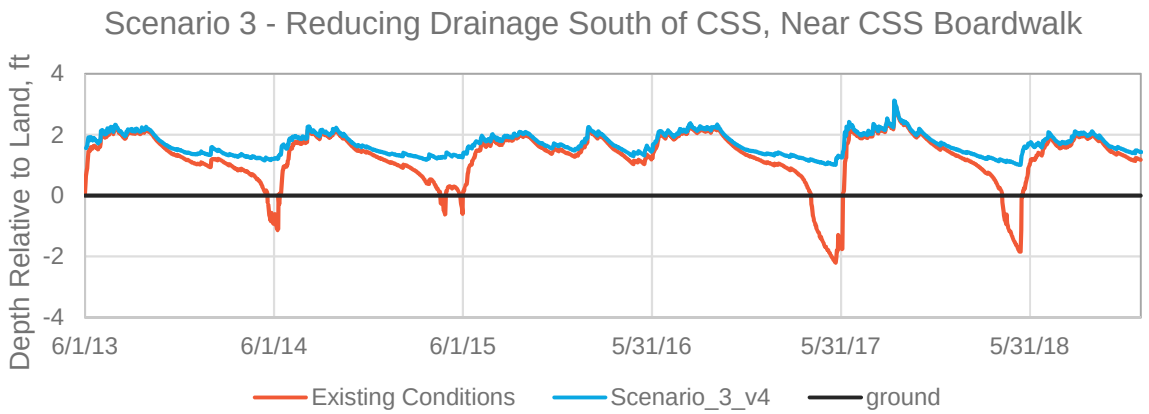
## Scenario 3




- **Eliminate downstream drainage**

**Significant increase in Sanctuary water levels & hydroperiod**

**Conditions similar to those seen in 1960s & 1970s**

**Downstream conveyance improved in mid-2000s**

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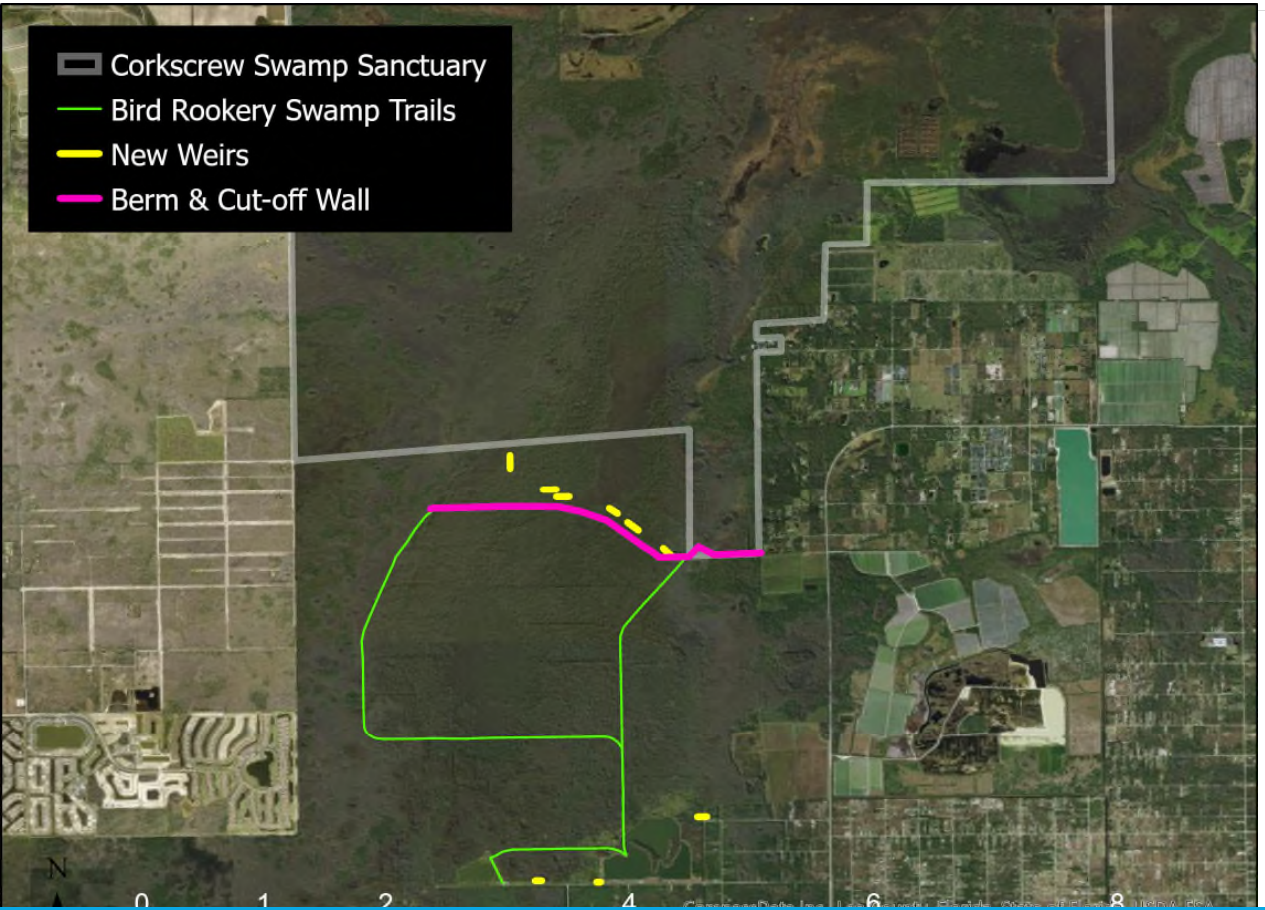


## Scenario 4

- **Reduce outflows from Sanctuary while maintaining flood protection**

**Demonstrated retaining groundwater is possible with engineering**

**Need further modelling for greater hydrologic improvement**

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## Conclusions

- Two driving factors significantly impacted Sanctuary hydrology: drainage and agriculture
- Downstream drainage clearly had the greatest effect
- Some drainage can be captured through downstream engineering and operations changes; need a mitigation plan

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## Conclusions

- Groundwater pumping had a negative impact on Sanctuary hydrology; fosters spread of willow & inhibits prescribed fire
- Water loss from invasive woody vegetation has site-level impacts; overall impact on Sanctuary hydrology is negligible (but clear benefits for wildlife)

# Corkscrew Swamp Sanctuary Hydrologic Modeling Project

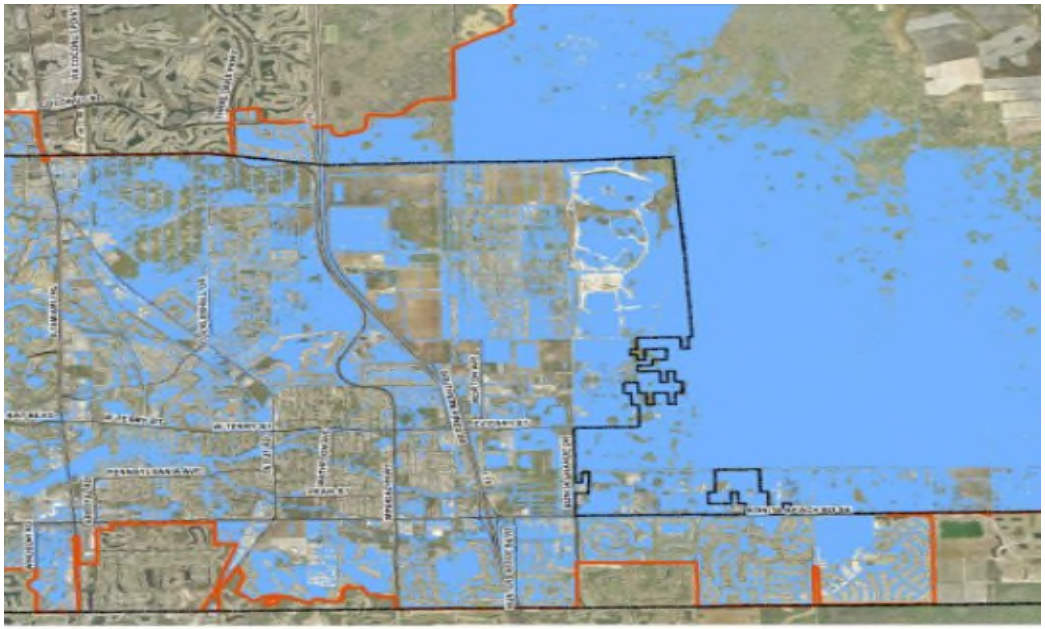
**BRAD CORNELL**
**SWFL POLICY ASSOCIATE**

**FEBRUARY 25, 2021**

Audubon
Corkscrew Swamp Sanctuary

## Policy Recommendations

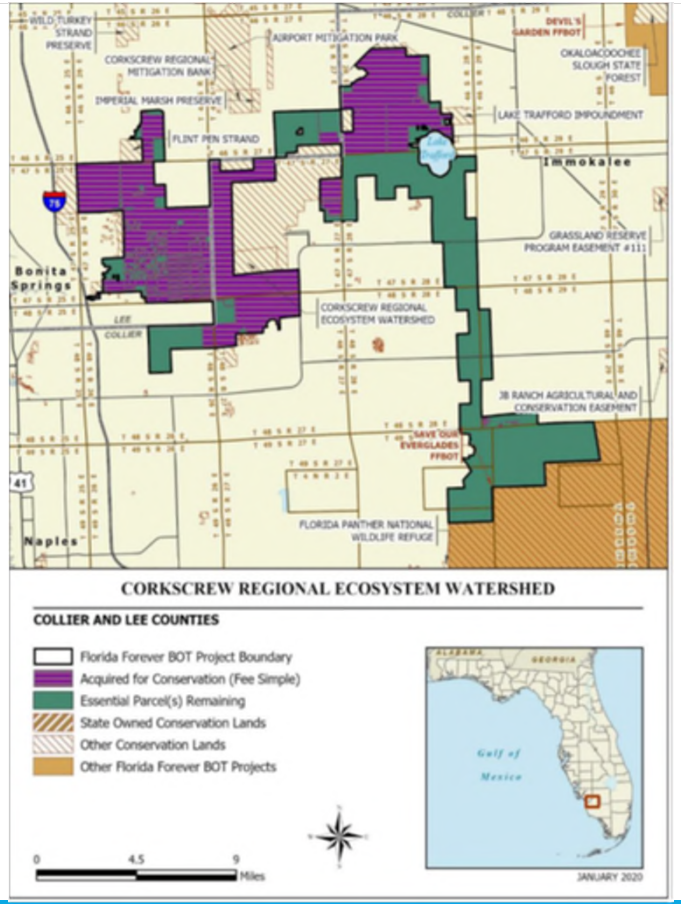
- Address properties with excessive flooding vulnerability.
- Reduce stormwater runoff with innovative strategies, such as Low Impact Development.



**Bonita Springs 5-Year Floodplain**

## Policy Recommendations

- Collaborate on wider hydrologic models, restoration plans, and flood mitigation plans.
- Support land acquisition and restoration of strategic water resources parcels in region.



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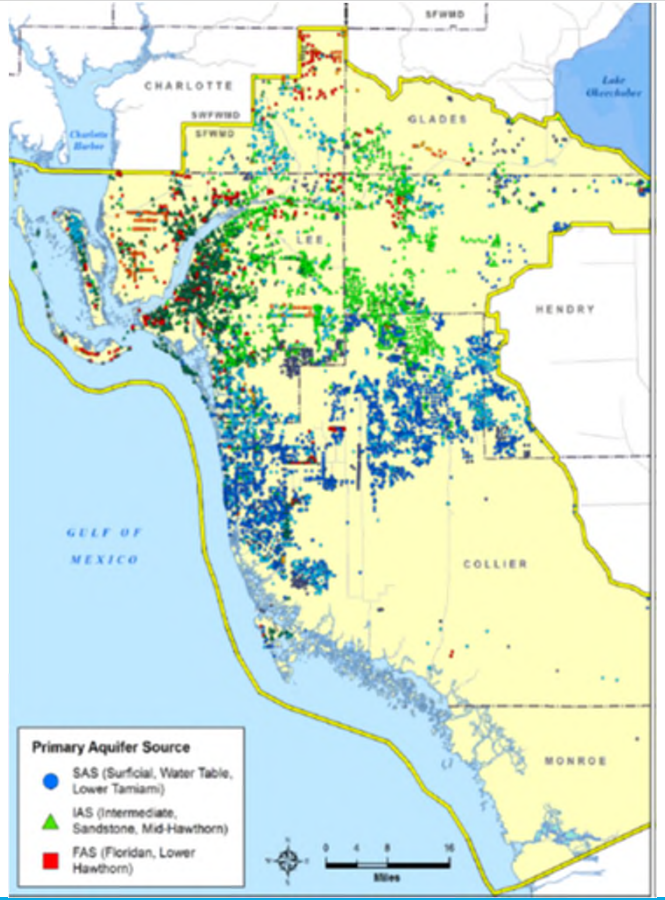
## Policy Recommendations

- Rule change to avoid development in indefensible flood plains.
- Rule change to prohibit discharges which harm downstream conservation lands.

## Policy Recommendations

- Retrofit existing agricultural, urban and industrial water management systems to stop demonstrated harm to downstream lands, using public investments & partnerships.
- Prohibit Public Water Supply and private wells within 5 miles of conservation lands; reduce surficial water supply sources and reduce turfgrass to conserve water.



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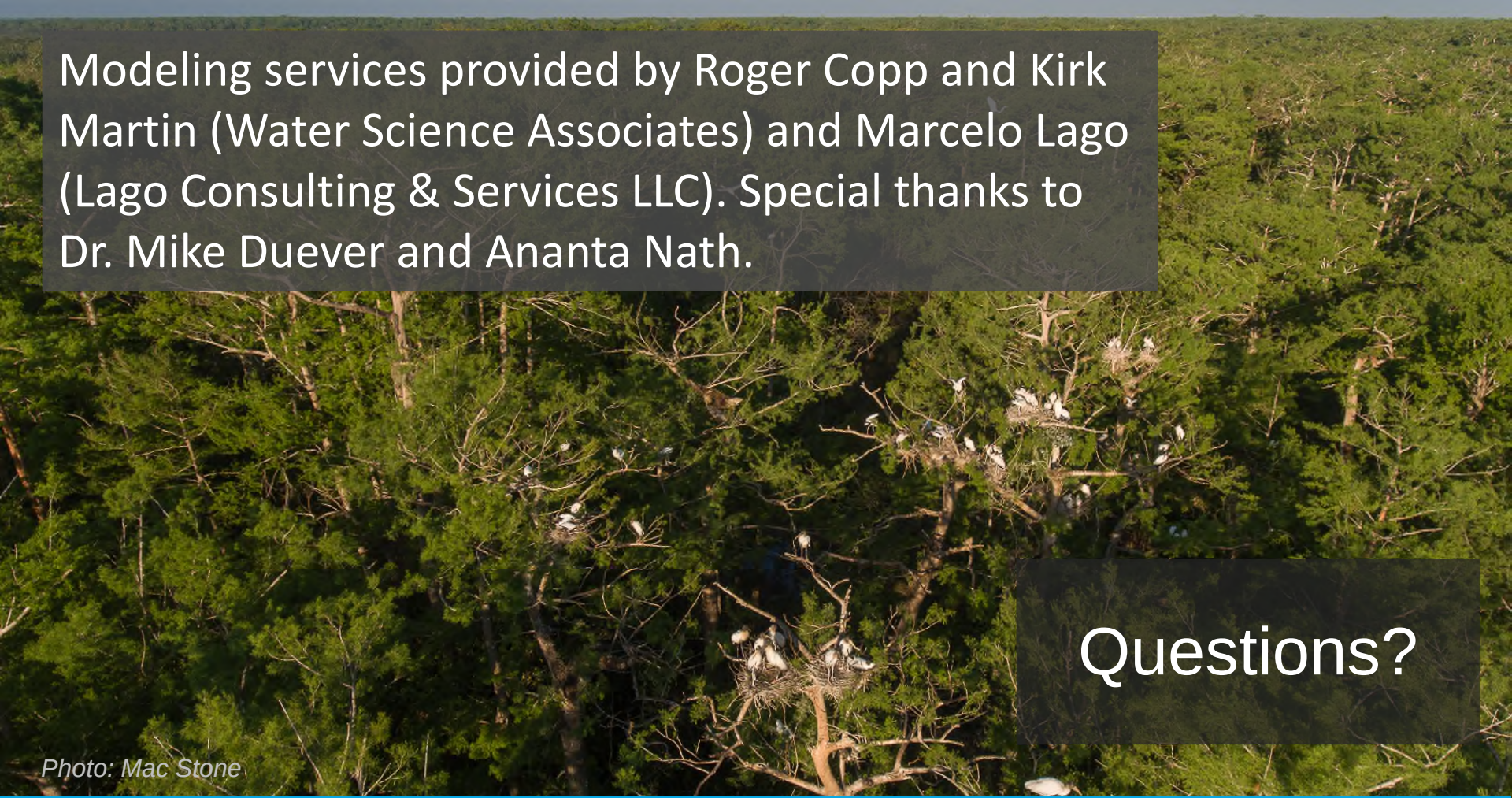
## Next steps

- Improved hydrologic monitoring
- Improvements to topographic data
- Additional modeling of mitigation options

Modeling services provided by Roger Copp and Kirk Martin (Water Science Associates) and Marcelo Lago (Lago Consulting & Services LLC). Special thanks to Dr. Mike Duever and Ananta Nath.



# Questions?

*Photo: Mac Stone*