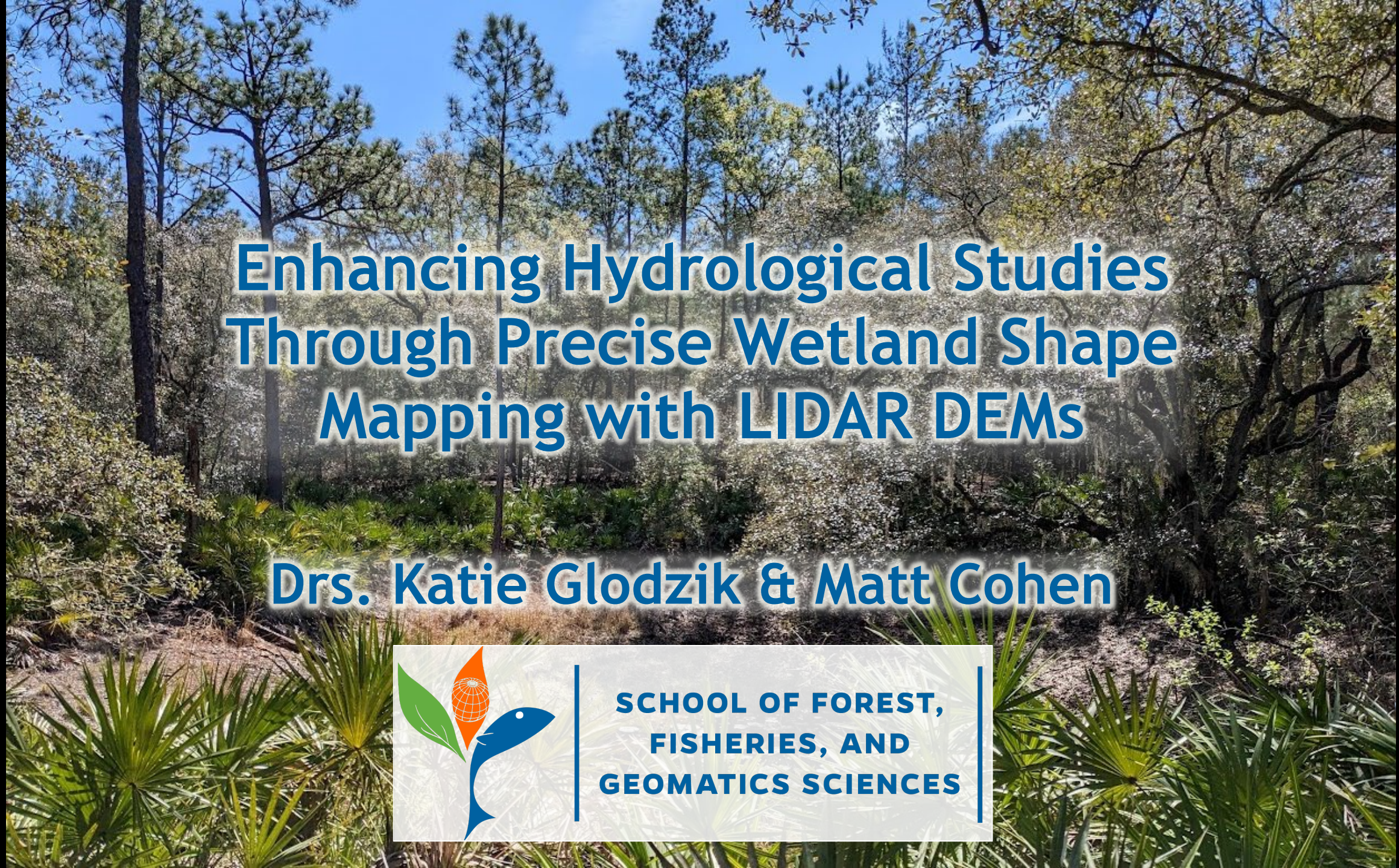


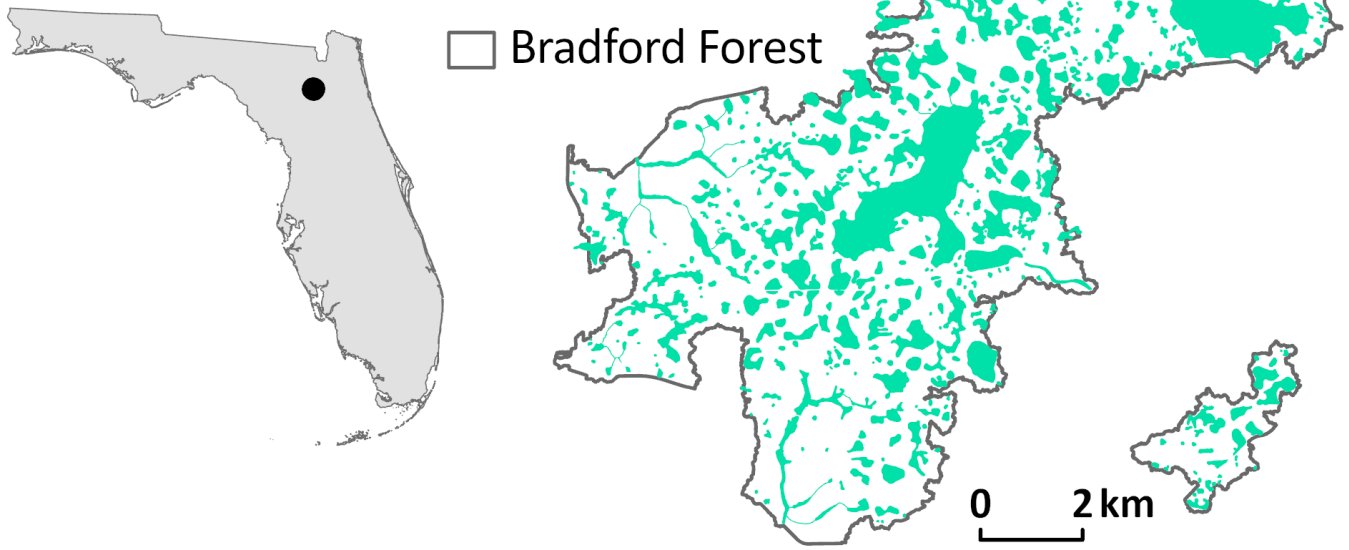
# Enhancing Hydrological Studies Through Precise Wetland Shape Mapping with LIDAR DEMs

Drs. Katie Glodzik & Matt Cohen

SCHOOL OF FOREST, FISHERIES, AND GEOMATICS SCIENCES

# Depression wetlands are prevalent in North Florida

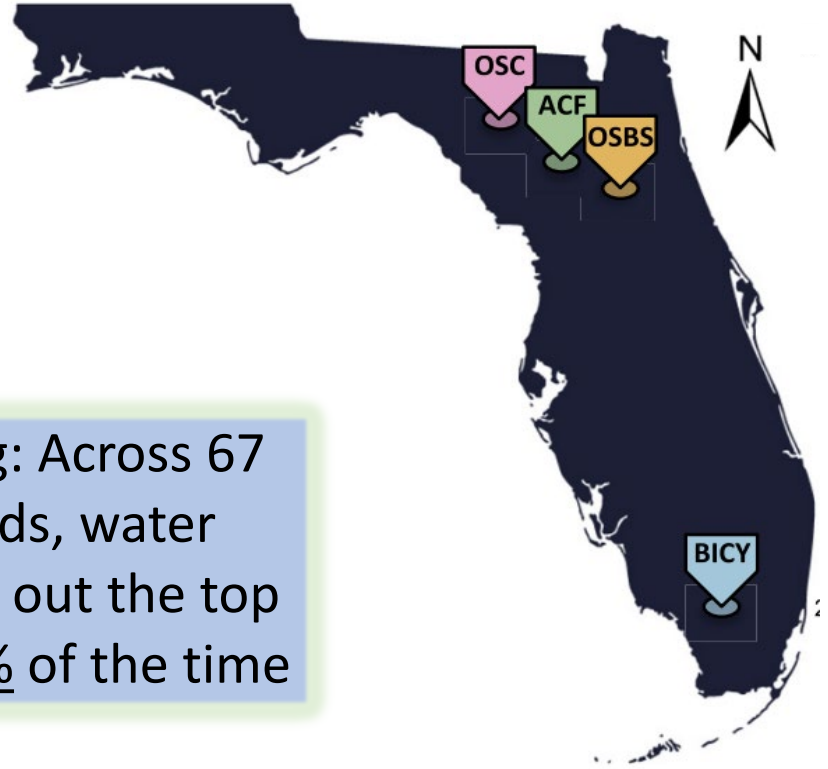
- They provide amphibian habitat, clean water, are C storage hotspots
- NWI and FL Land Cover data poorly capture them

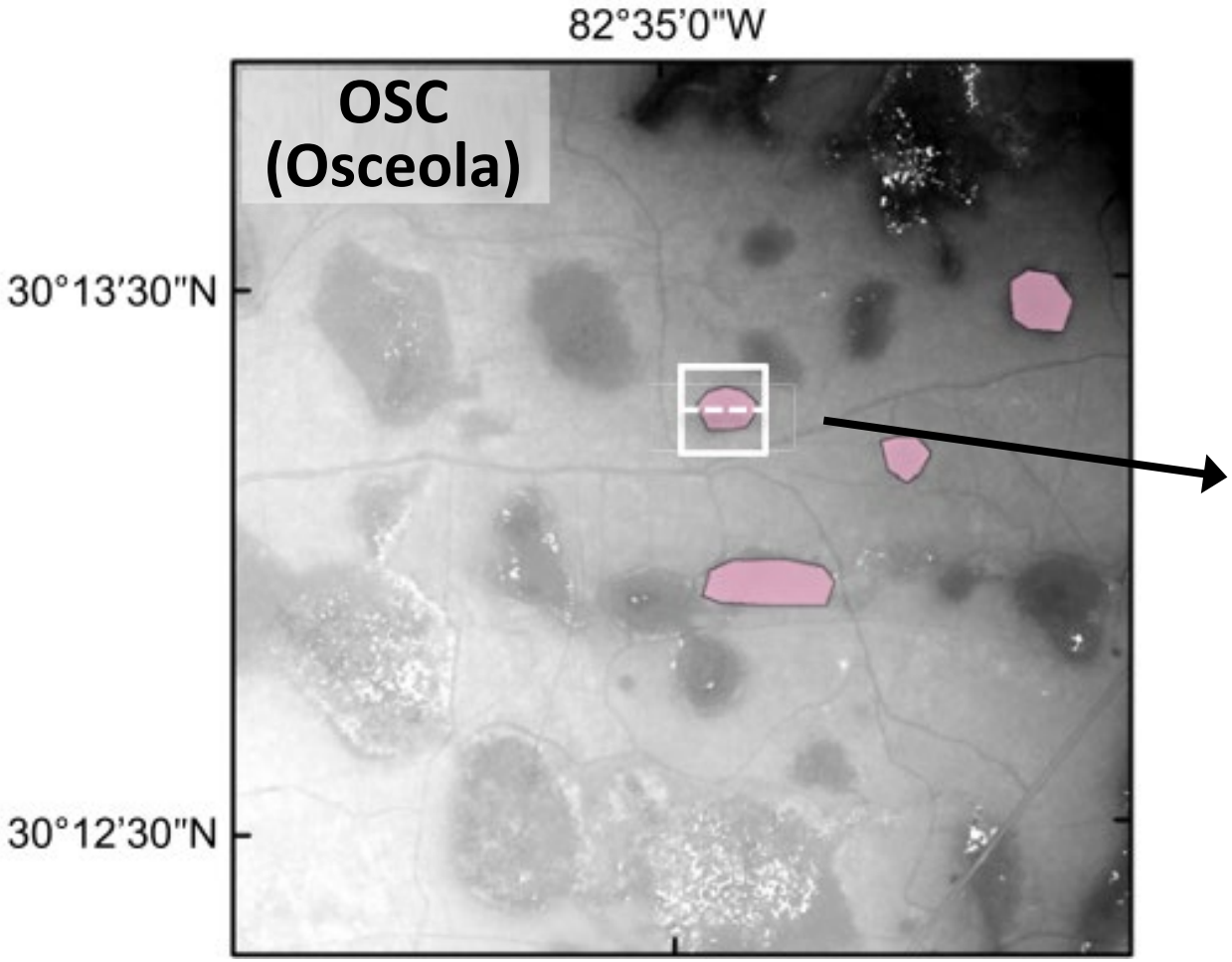




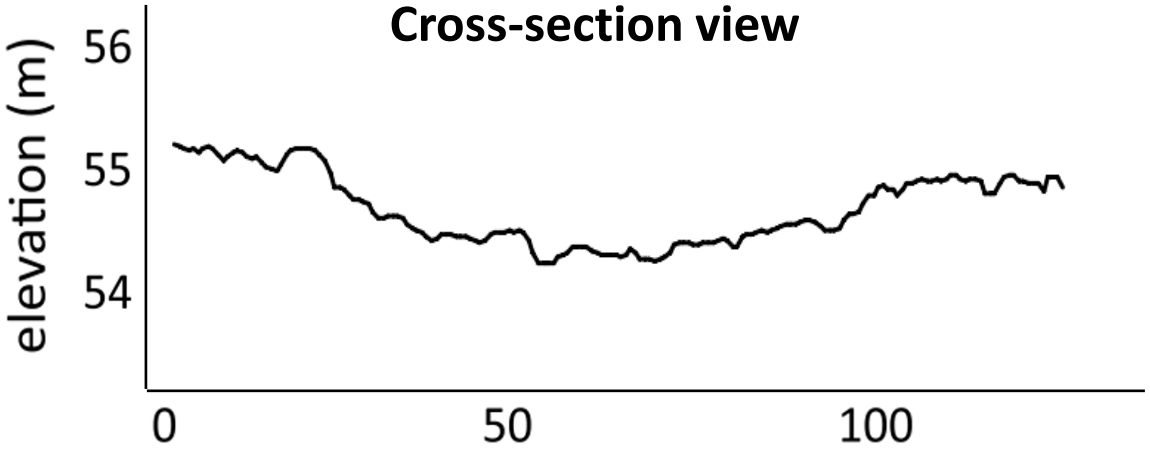
Water intermittently flows via surface flow
Water percolates to groundwater
Katie Glodzik

# *Patterns of Wetland Hydrologic Connectivity Across Coastal-Plain Wetlandscapes* (Lee et al., 2023)



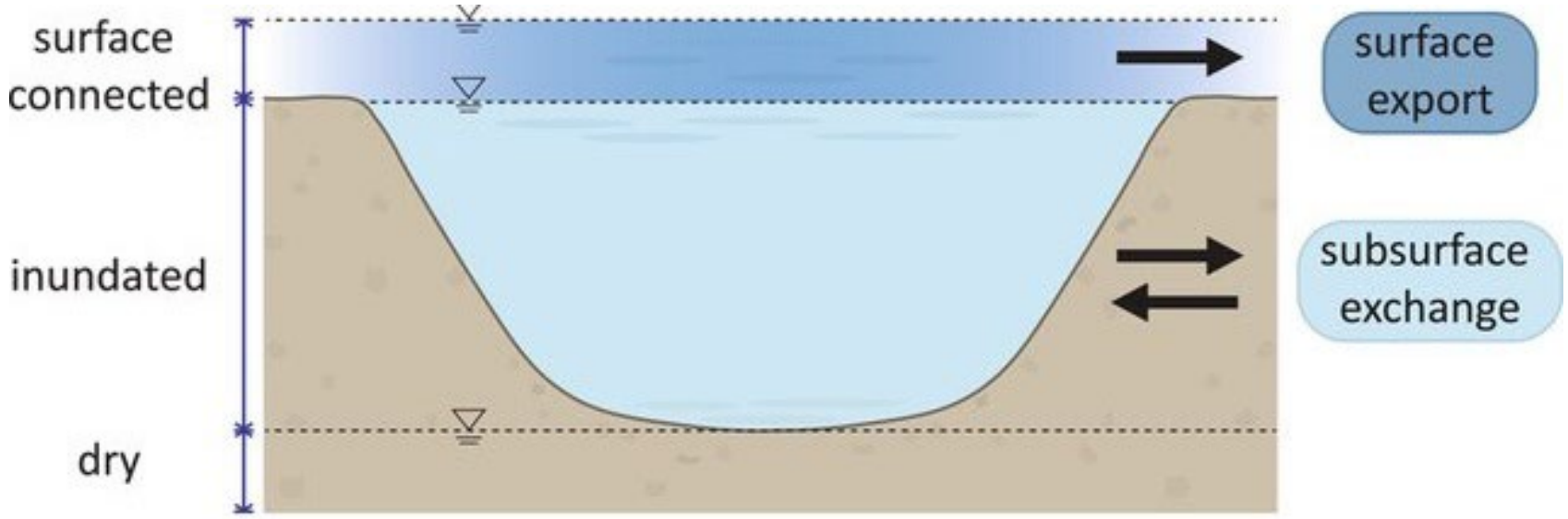




Finding: Across 67 wetlands, water flowed out the top <u>10-40%</u> of the time



# Water held in depressional wetlands has implications both small and regional

- *Surface Depression and Wetland Water Storage Improves Major River Basin Hydrologic Predictions* (Rajib et al. 2020)
- Helps us model how forest management affect regional water yield




Lee et al., 2023

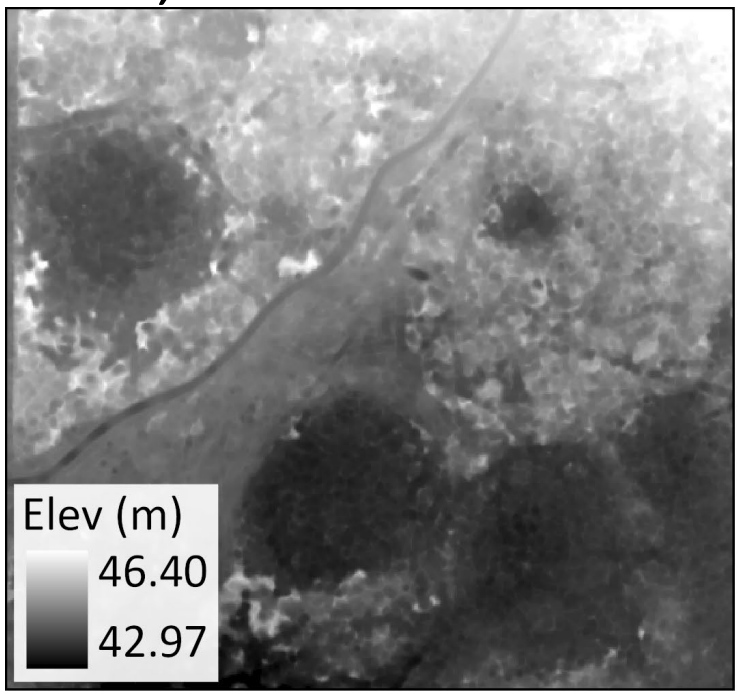
# Research on depressional wetland shapes has focused on prairie pothole wetlands



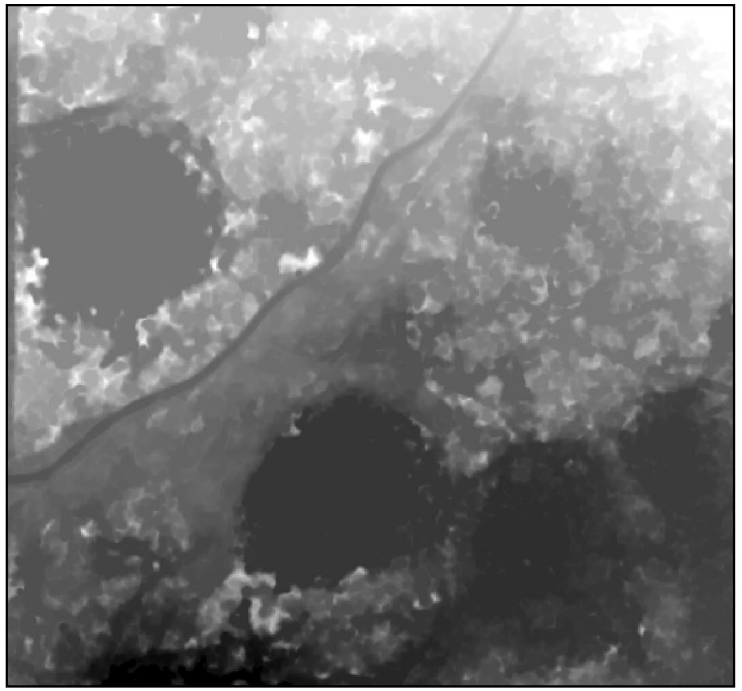
These have predictable depth-to-area ratios (Vanderhoof et al., 2015, 2016)

# The foundation of DEM-based mapping of depression wetlands: the Fill tool

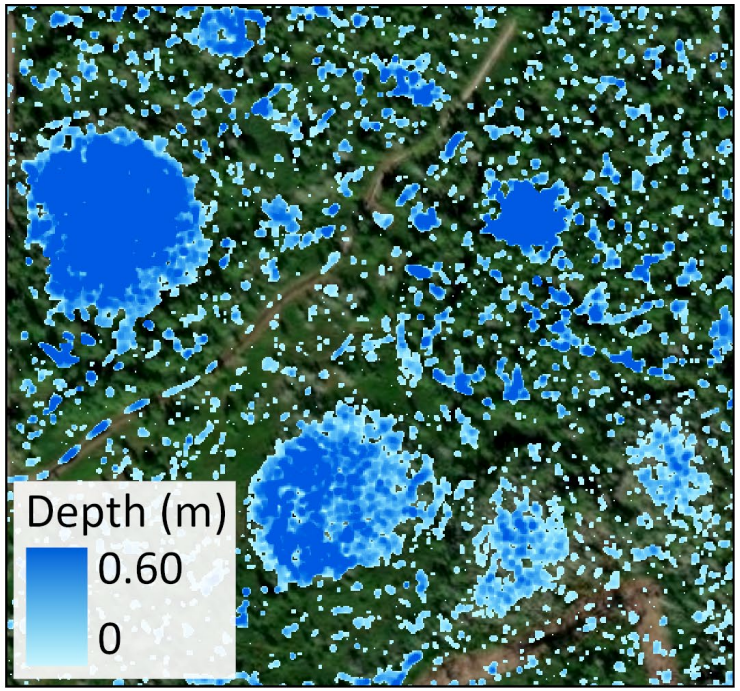
DEM, smoothed




DEM filled



Filled – DEM = Spill Depth




DEM = Digital Elevation Model

Despite consistent depth-area ratios in prairie potholes, we suspect that does not occur in Florida

# Project goals in Bradford Forest

- Improved maps of depression wetland presence and boundaries
- Depth-to-area patterns: is there a predictable relationship?

# Unique challenges

- Extremely flat elevation → lots of depressions are *not* wetlands
- Dense, tall vegetation → vegetation artifacts in DEM
- Bradford Forest is cut up with dirt roads → but DEM can't "see" culverts

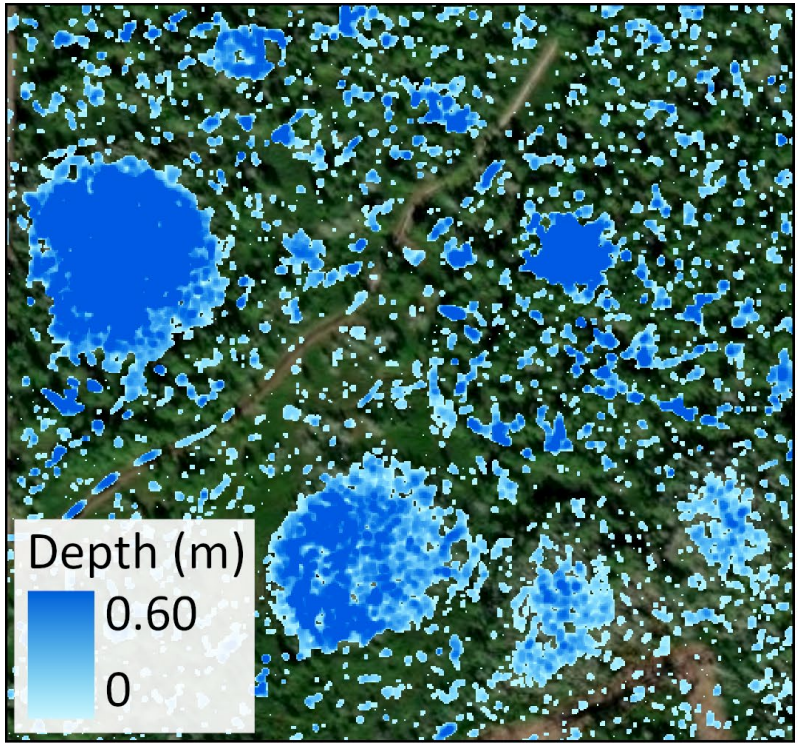
# Vegetation-dense wetlands


Etoniah Creek State Forest


Osceola National Forest

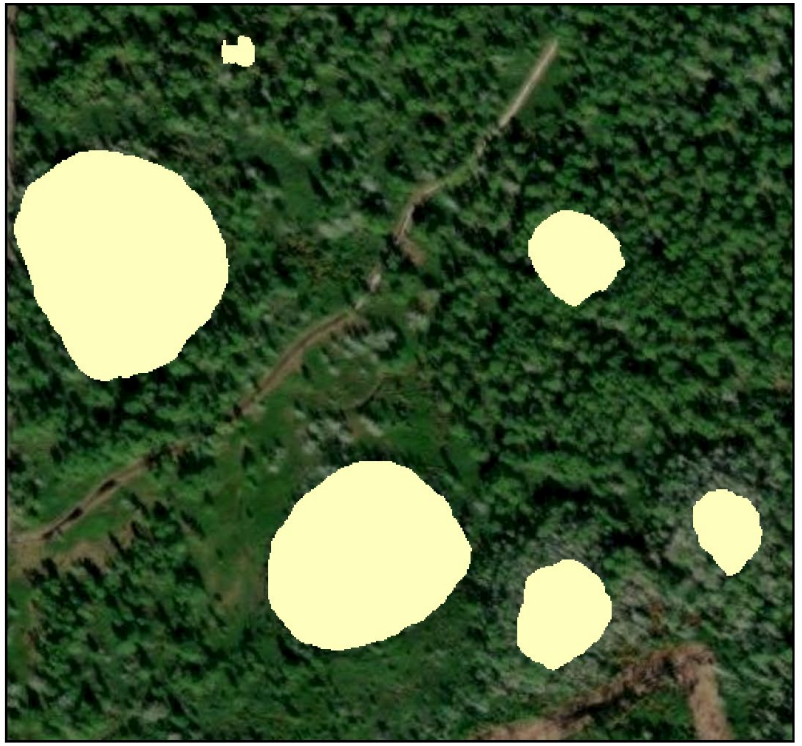
# Processing steps, starting with spill depths

Filled – DEM = Spill Depth

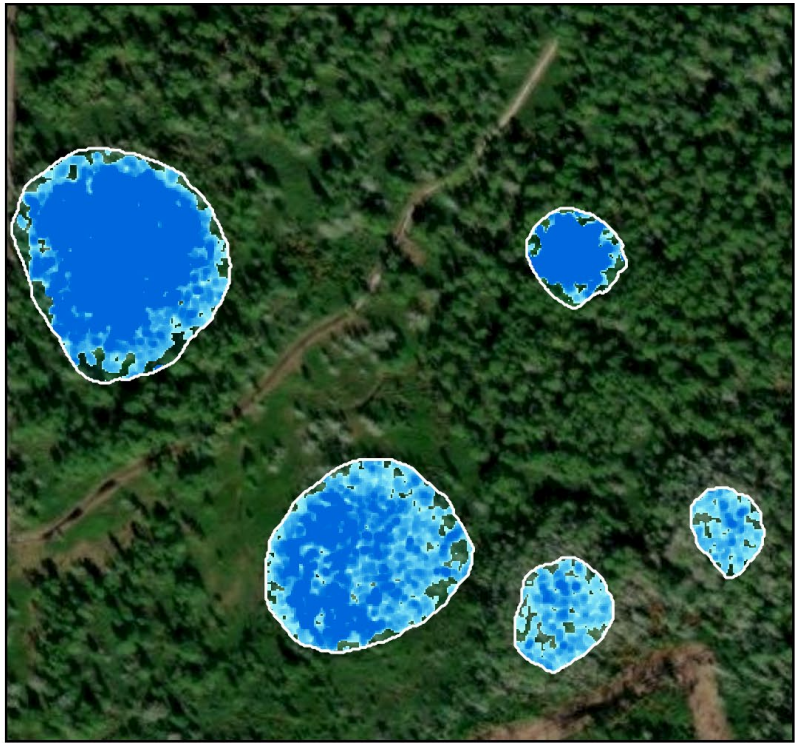



50x50 cell majority filter of cells requiring fill

(Dana Wilson Master Project, 2023)

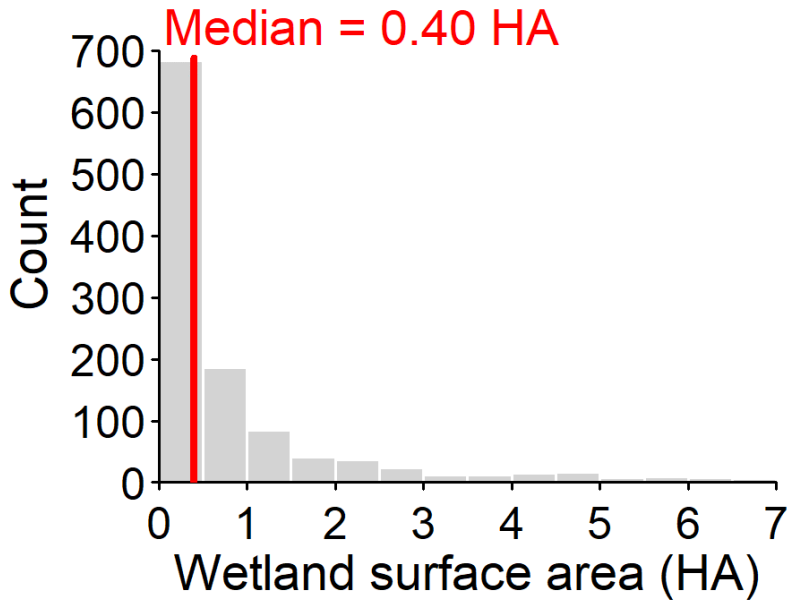


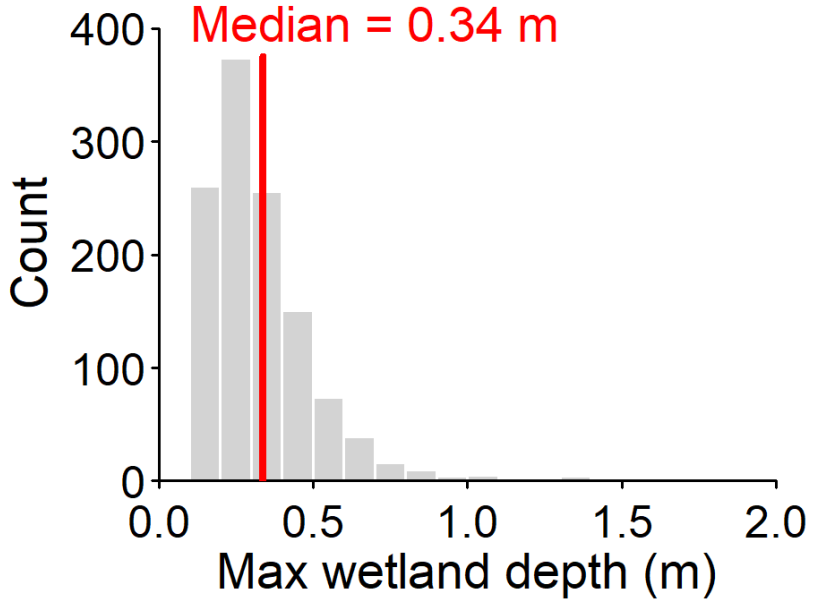
Retain depressions meeting size, mean and max depth thresholds



# DEM method offers more detail than NWI

| | NWI | DEM-based |
|---|---|---|
| Number of wetlands | 453 | 1,198 |
| Median wetland size | 1.24 HA | 0.40 HA |
| Summed area | 29.9 $km^2$ | 21.9 $km^2$ |
| Wetlands missing from the *other* dataset | 40/453 | 484/1,198 |

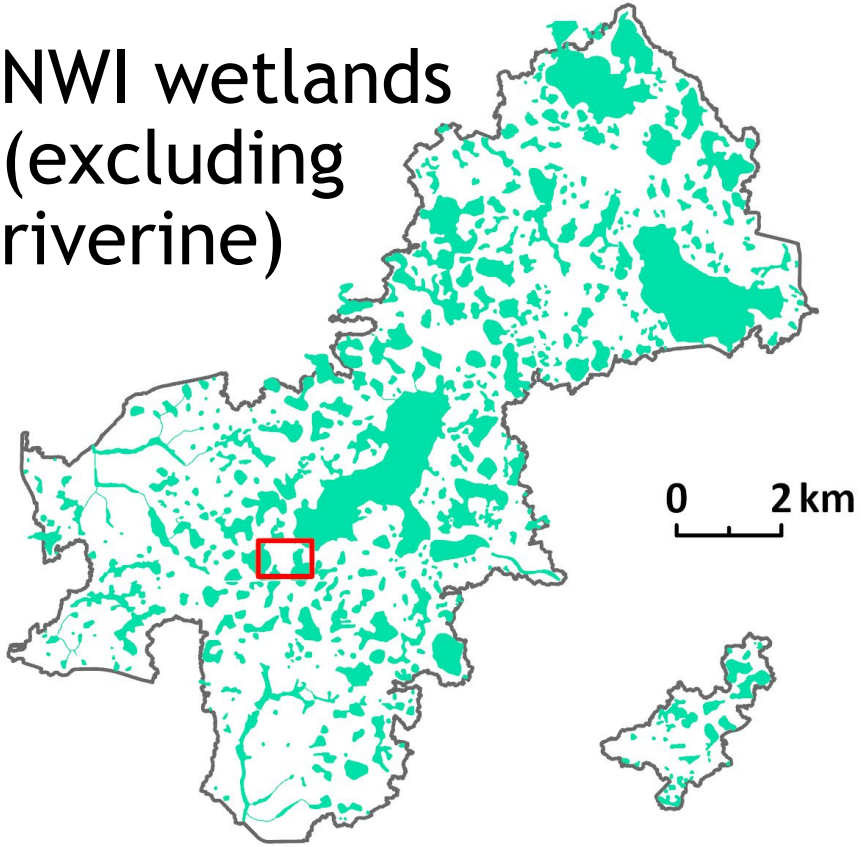


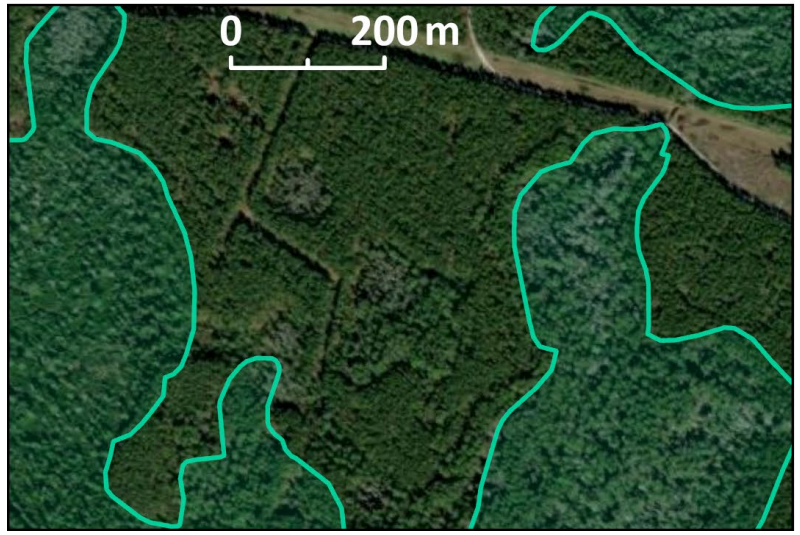




1. NWI often identifies large, rough wetland
2. DEM-based method identifies new wetlands, often small (mean=3,899 $m^2$)

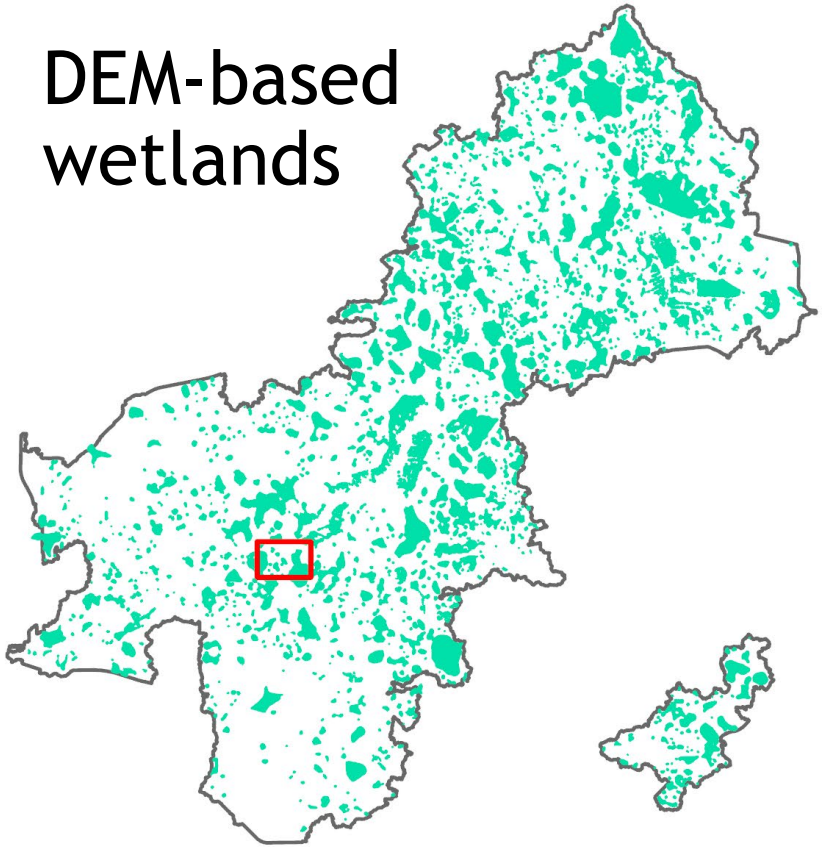
Tends to identify large, rough boundaries

## NWI wetlands (excluding riverine)



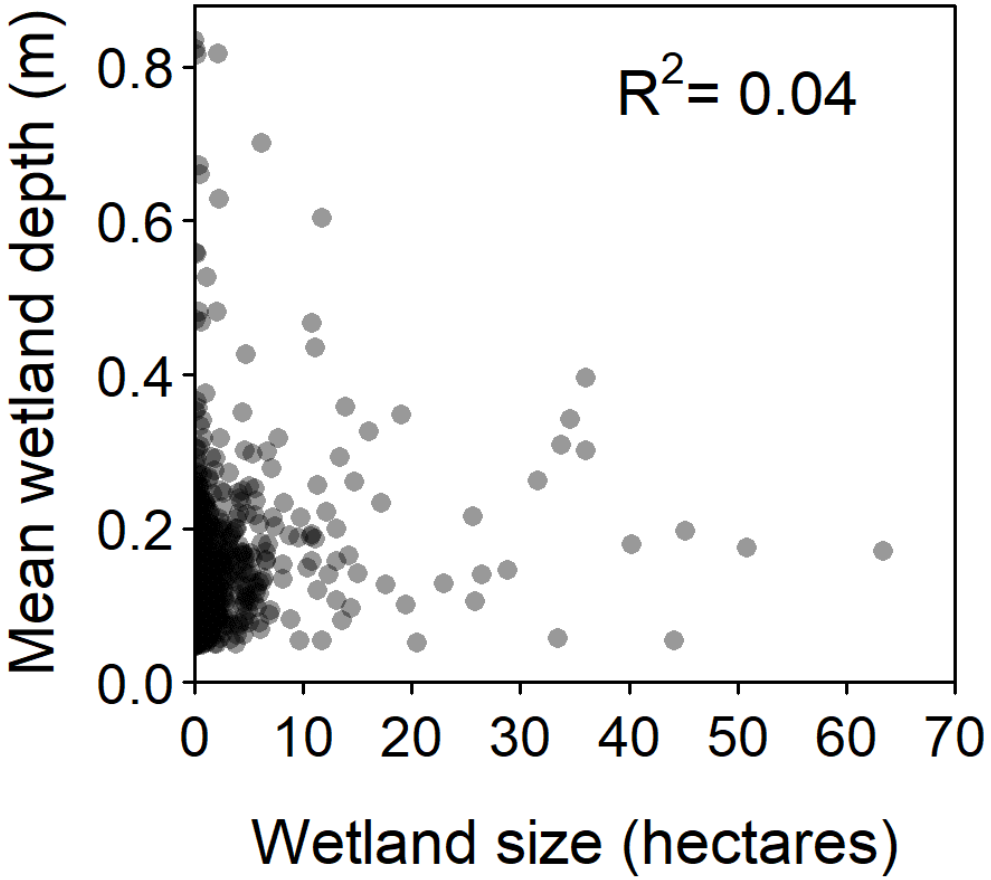

## DEM-based wetlands

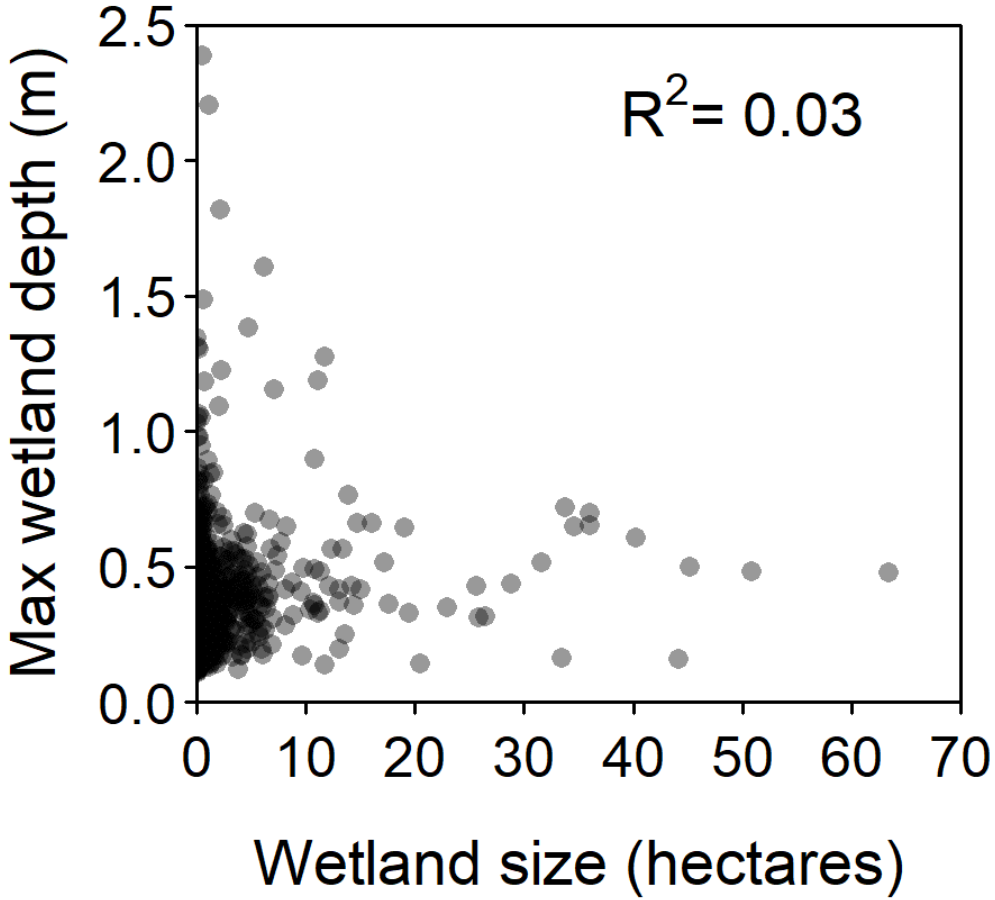


Better at finding small wetlands.

Boundaries are more fine-tuned

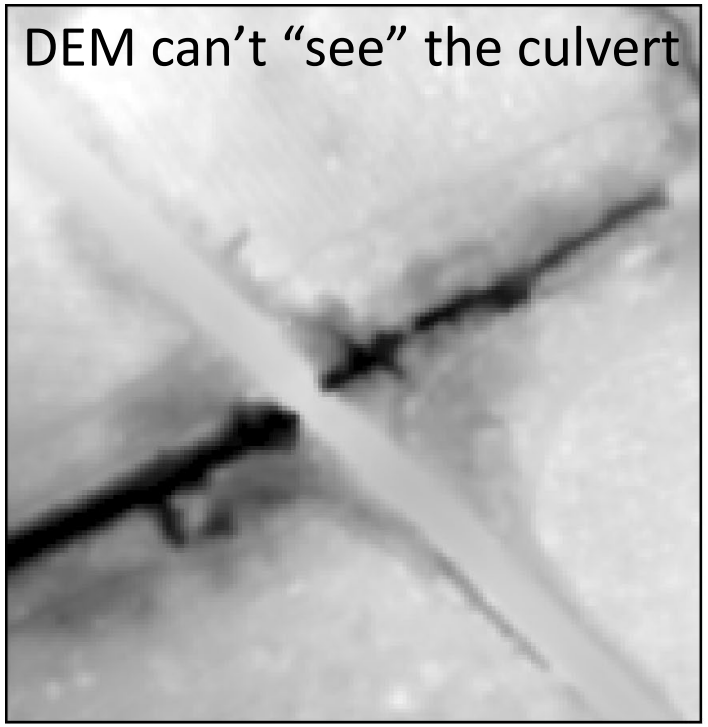
# Can we predict wetland depth from area? **No**



# In-progress: adjusting for culverts and roads

- Arc-Python script finds telltale signs of culvert and cut a line across the road

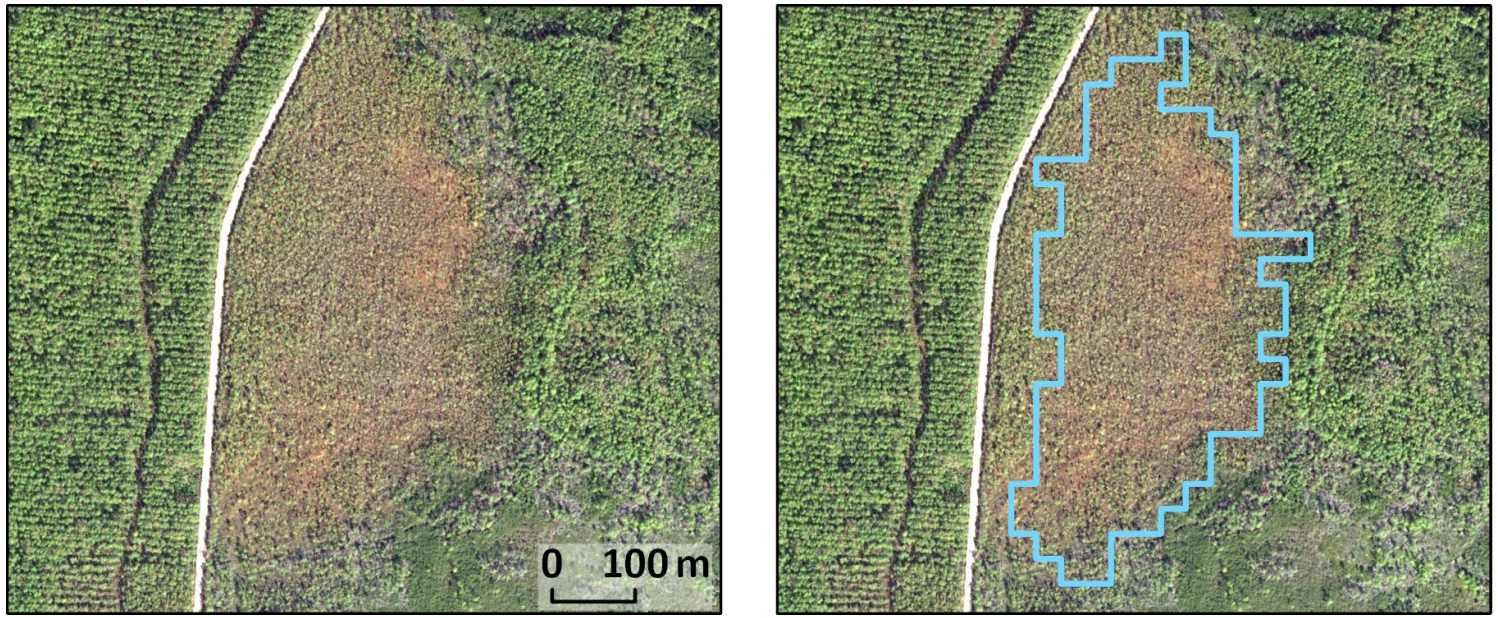




# In-progress: Remote sensing water index to validate wetlands and exclude non-wetlands

- Water in Wetlands (WiW) method to find standing water, even among vegetation (Lefebvre et al., 2019)

Using annual-averaged Landsat infrared, WiW identified frequently saturated area




# Implications

- In North FL, we cannot assume consistent depth-to-area relationship for estimating volume
- DEM-based depths are required to estimate volumes held by depressional wetlands
- Using DEM uncovers more wetlands than NWI and more precise boundaries


Thank you!