

Hydrology of Seasonal Ponds in the Apalachicola National Forest

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Acknowledgement:

Thanks to the USDA Forest Service for supporting this project

Disney short from 1943, "The Winged Scourge"



Doc "cutting weeds where the mosquito lays her eggs"



Happy spraying oil in a wetland to kill mosquito larvae



Doc and Bashful filling in some troublesome puddles

Functions:

Geographically isolated wetlands often encompass a wide range of hydrologic conditions (e.g., from shallow temporary ponds to deeper permanent waters).

This leads to a diversity of habitat types and quality, both within and among wetlands.

They support an amazing diversity of biota

They provide ecosystem services: e.g., aquifer storage/recharge, flooding mitigation, water quality

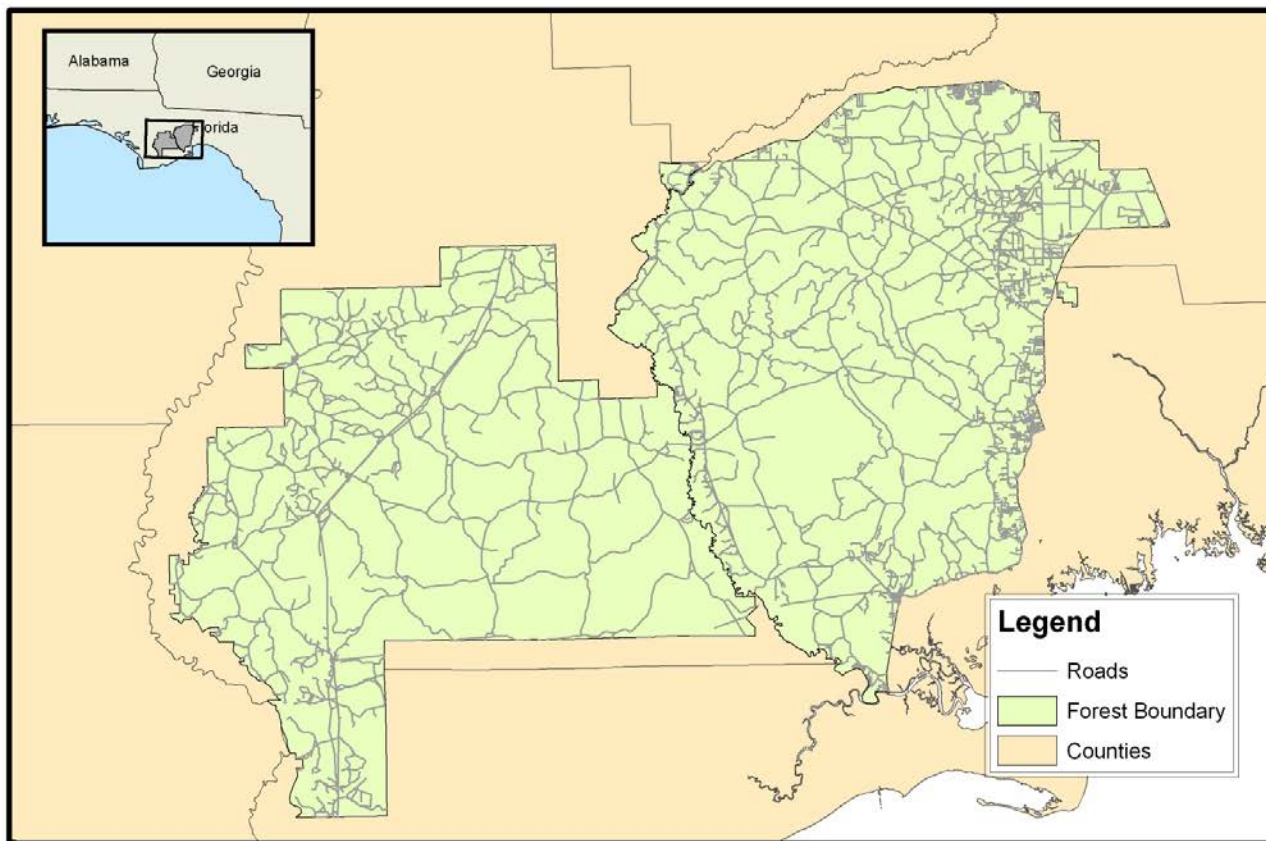


One aspect of this project examines the hydrology of temporary isolated ponds in the Apalachicola National Forest. The ponds fill with water during the rainy season and then generally dry out. Many types of amphibians are dependent on the ponds for breeding. The seasonal disappearance of the ponds precludes the presence of fish predators.



Seasonal ponds in the ANF host a diverse assemblage of species, several of which (striped newt and ornate chorus frog) are threatened or endangered. In recent years some of these species have been disappearing from seasonal ponds in the ANF.

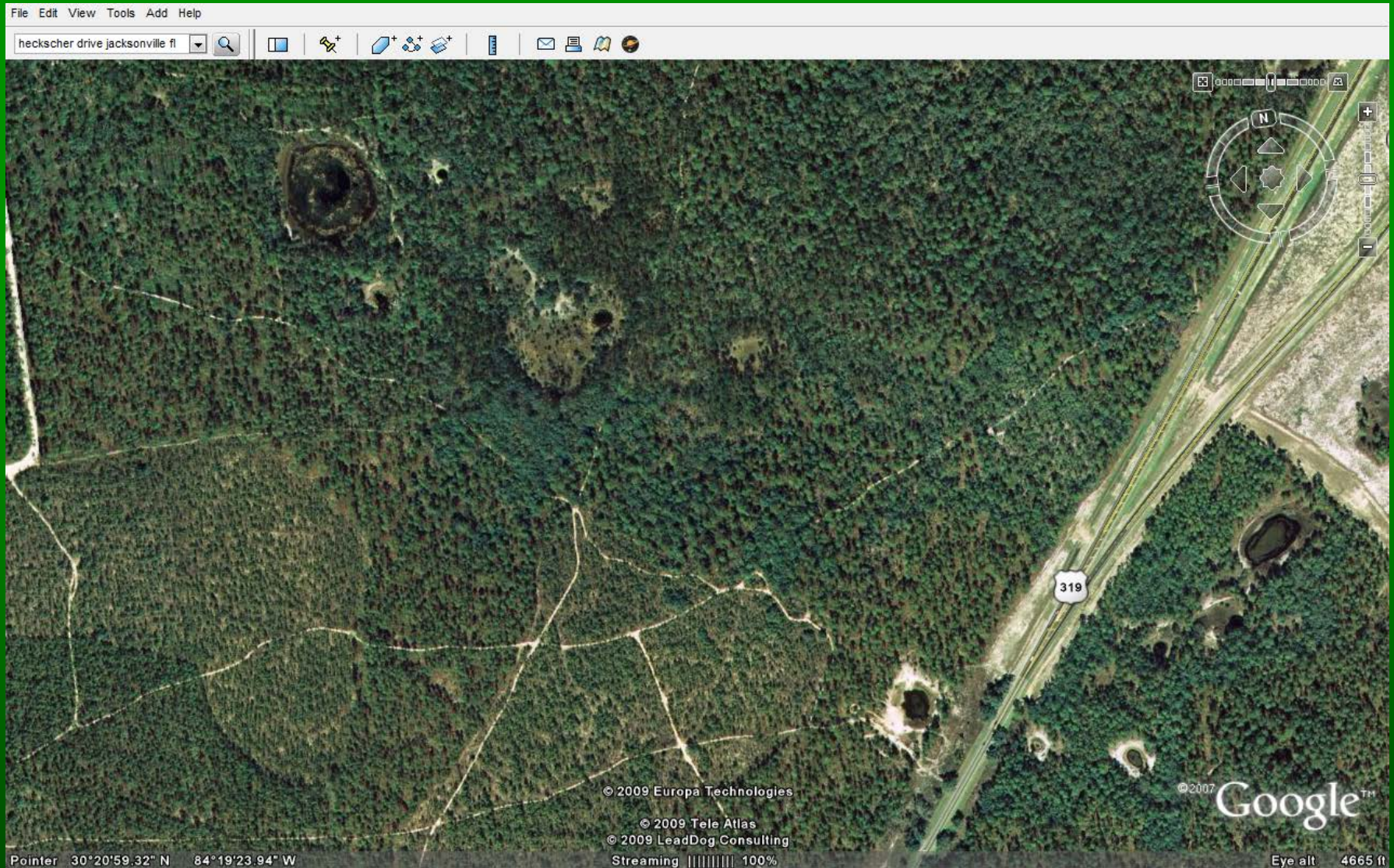
Apalachicola National Forest

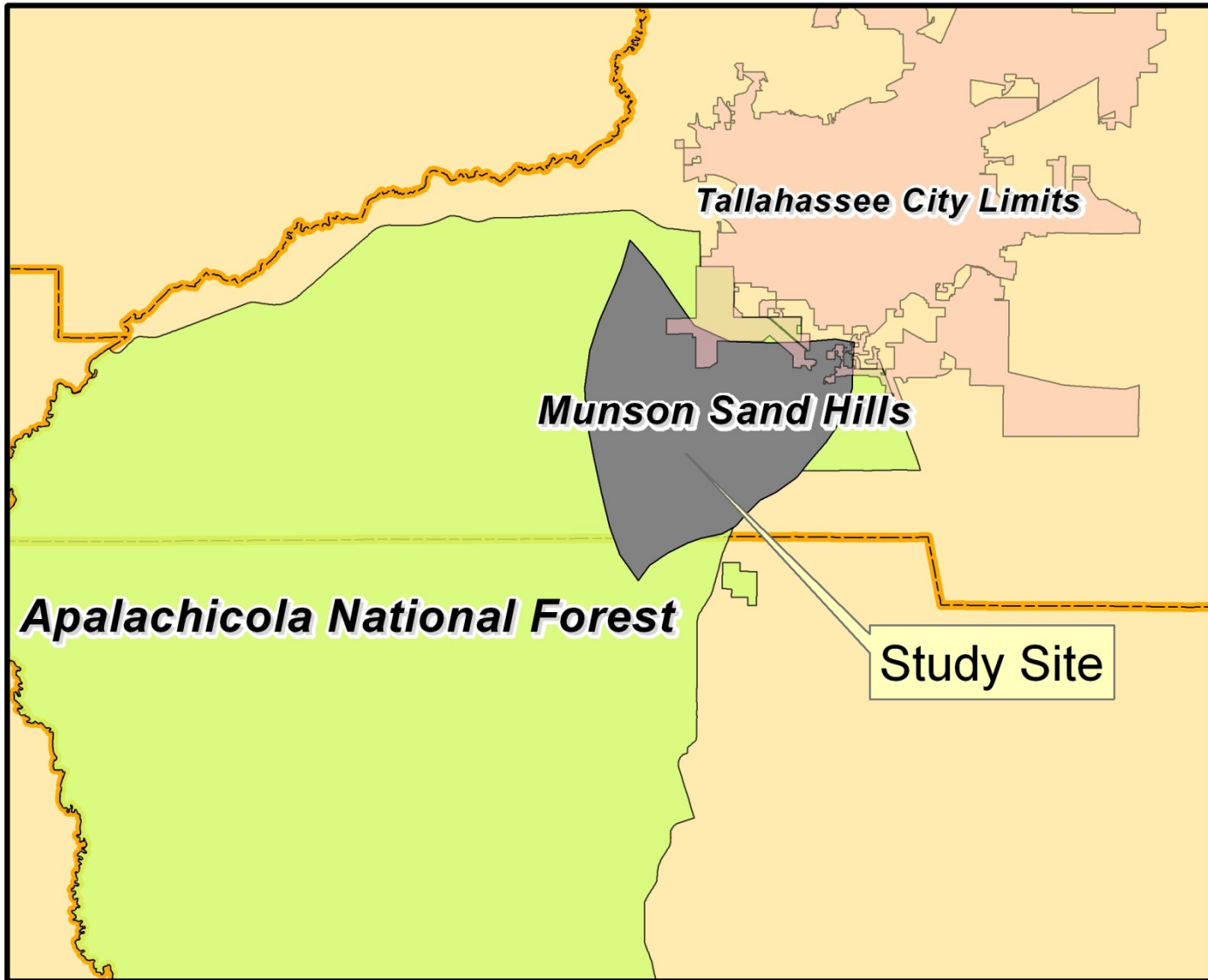


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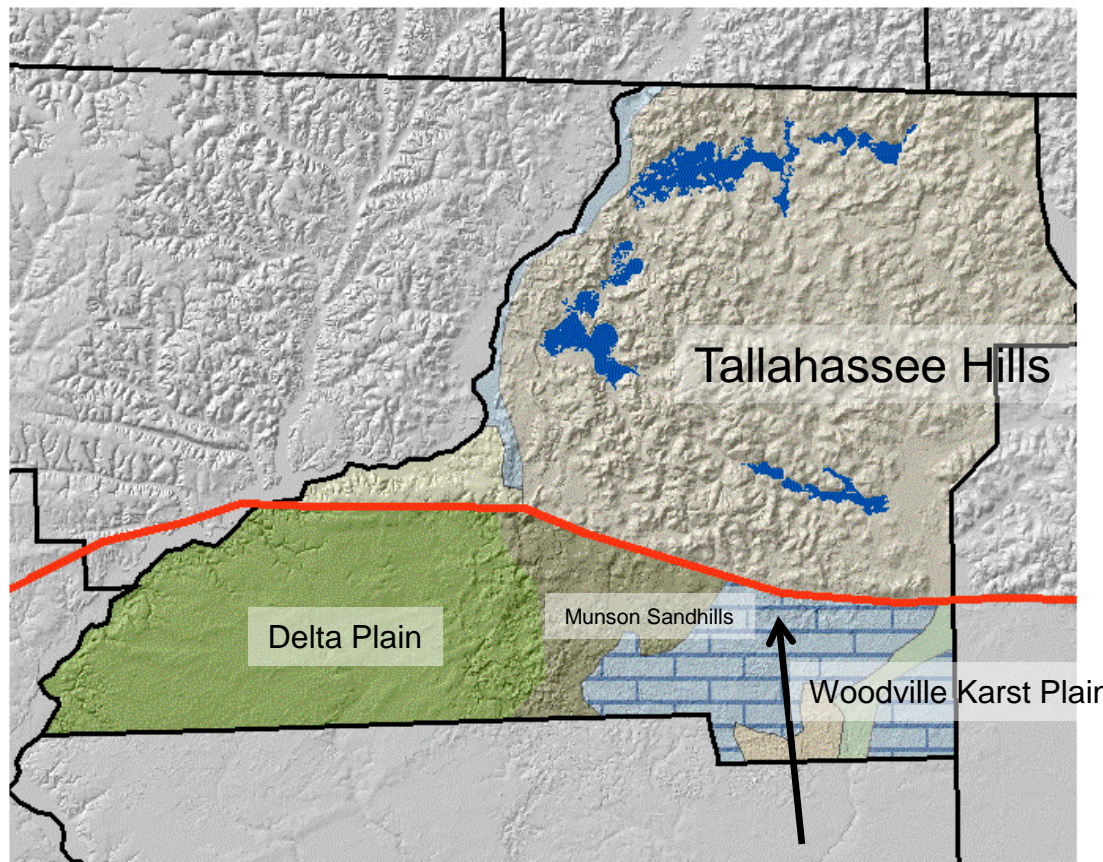
0 10 20 30 Kilometers

Seasonal ponds in the Apalachicola National Forest are relatively small (15 – 200 m diameter) circular depressions





Geologic Features In The Study Region

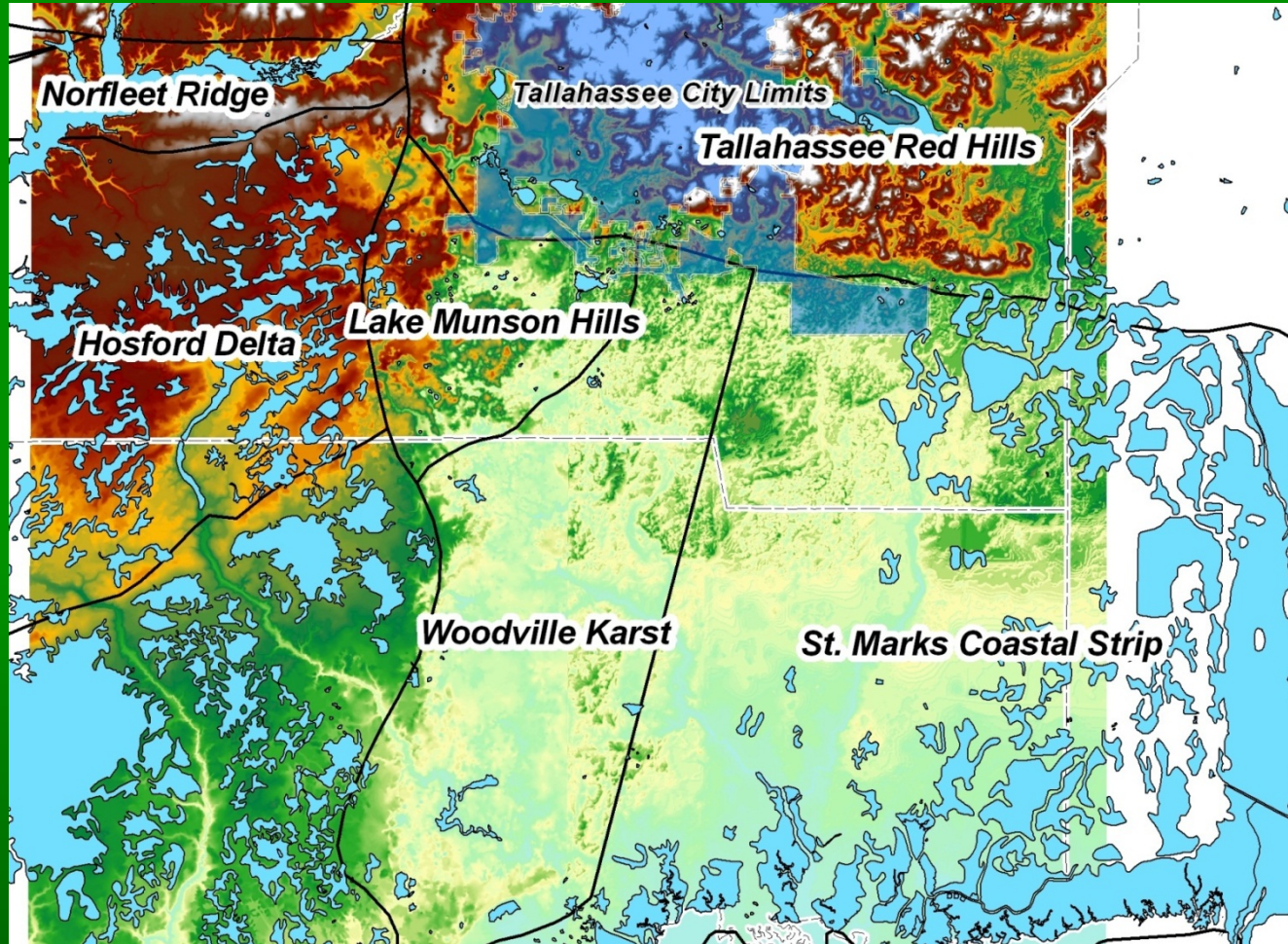


Explanation

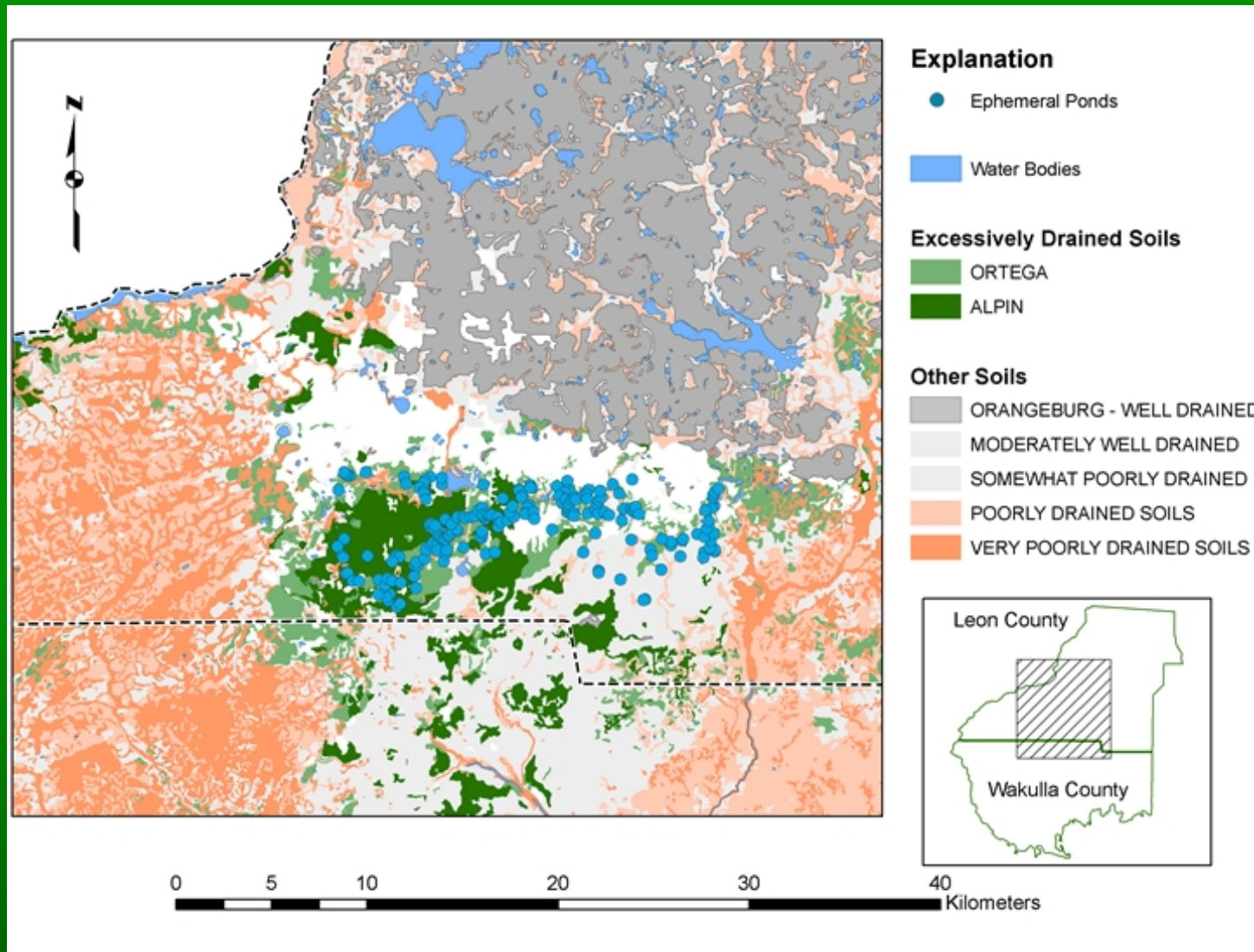
- Cody_Scarp**
- Major Lakes
- Appalachicola Coastal Lowlands
- Ochockonee River Valley Lowlands
- Saint Marks River Valley Lowland
- Okefenokee Dunes
- Tallahassee Hills
- Lake Munson Hills
- Wakulla Sand Hills
- Woodville Karst Plain

A physiographic feature called the Cody Scarp marks the topographic transition. The Cody Scarp is believed to represent a Pleistocene shoreline representing a previous sea level stand. The receding ocean stripped away sediments overlying the Woodville Karst Plain to the east, exposing the limestone aquifer beneath.

Physiographic Features In The Study Region



The ponds in the Munson Sand Hills are scattered across a region that represents a topographic transition from the Tallahassee Red Hills region to the north, to the Woodville Karst Plain to the south. To the west of the Sand Hills are remnant deltaic sediments.



The ponds occur in the excessively drained Ortega and Alpin soil. Drainage is internal and very little drainage pattern exists. Surrounding soils are clay rich and poorly to very poorly drained, resulting in a landscape characterized by wetlands.

Vegetation around the ponds occurs in distinct concentric zones dominated by different species



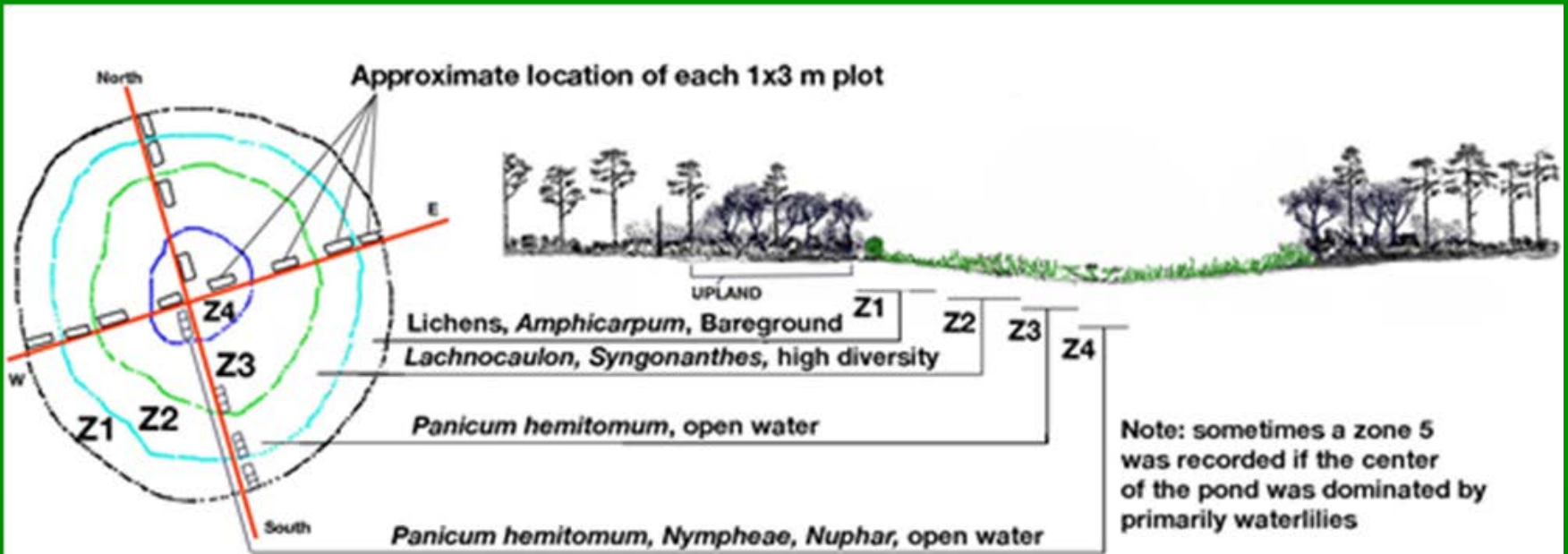


Diagram courtesy of John Tobe.

Vegetative zonation is controlled by pond hydroperiods. Fluctuating water levels result in different degrees of soil inundation, and thus give rise to different assemblages of wetland plants.

Many of the ephemeral ponds in the ANF have been disturbed by illegal recreational use of off-highway vehicles



The sandy ecotones between “upland” dry soil vegetation and wetland vegetation becomes an attractive “racetrack” for OHV traffic.



Natural conditions



Moderate impact by OHV

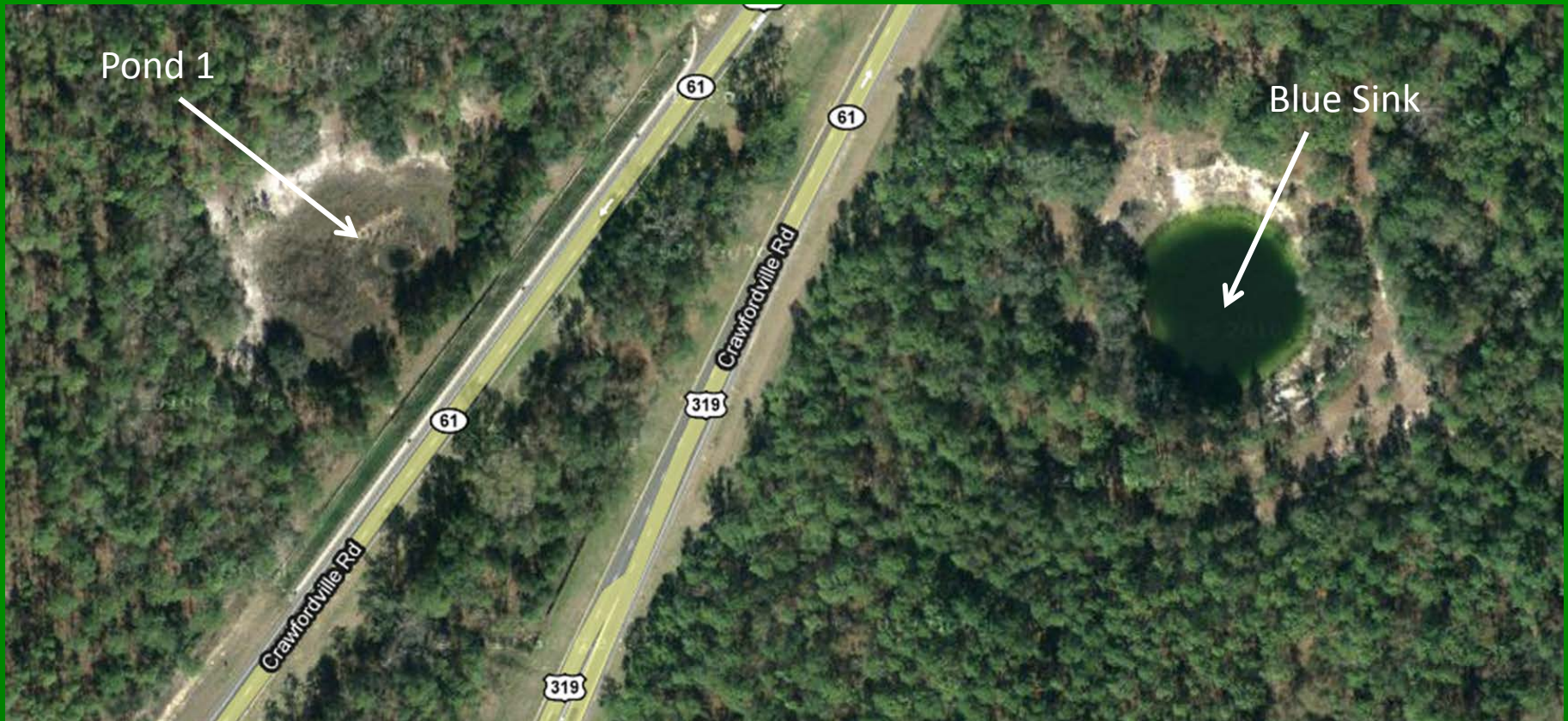


Severe impact by OHV



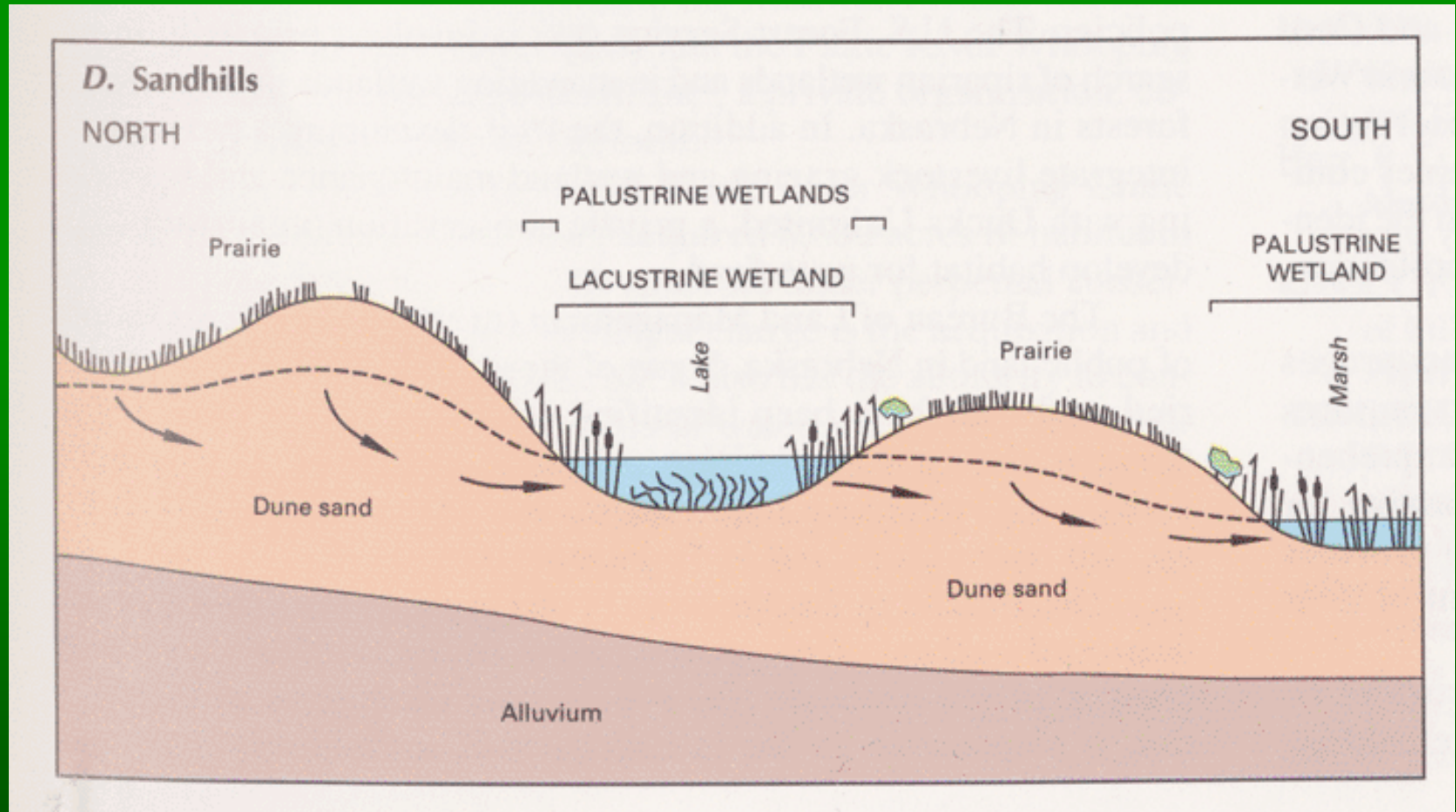
For this project the Forest Service wanted some recommendations for pond restoration and management. We are studying various aspects of the ponds to gain a better understanding of the system and assess indicators of pond “health”.

- Soil: Compaction? Degradation?
- Vegetation: Degree of disturbance. Indicator of pond quality
- Bioindicators: Aquatic macroinvertebrate assemblages as water quality indicators
- Water chemistry: Water quality
- Hydrology: Timing of hydroperiod is crucial to successful breeding of amphibians and other pond-obligate species. Water needs to be in the ponds at the right time. We wanted to understand what controls pond hydroperiods.

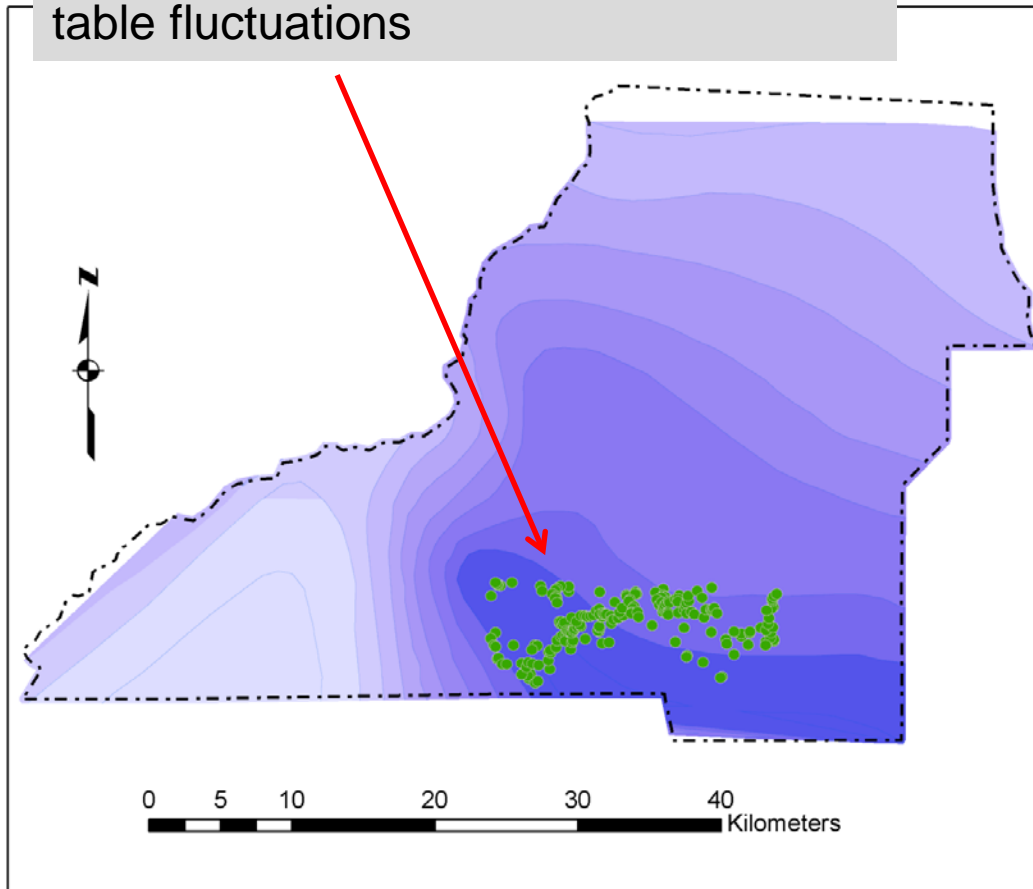


We wanted to investigate the potential role that ground water plays in pond hydroperiods. In the Munson Sand Hills the water table can occur very near the surface elevation, as indicated by the presence of numerous water-filled sinkholes in the region. To study this, we selected a pond (Pond 1) located near a sinkhole (Blue Sink) that is permanently filled.

Tiner, 2002, model of sand hills hydrodynamics



Many pond bottom elevations are very close to the elevation range of water table fluctuations

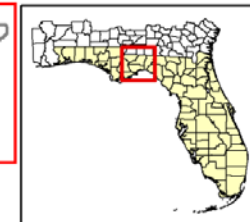
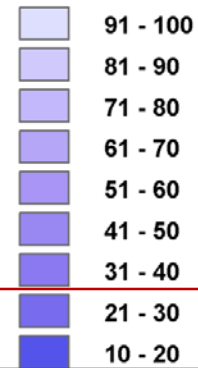


Explanation

● Ephemeral Ponds

Water Table Elevation

Feet



Water Elevation - NGVD 29
Modified from Davis et al, 2010

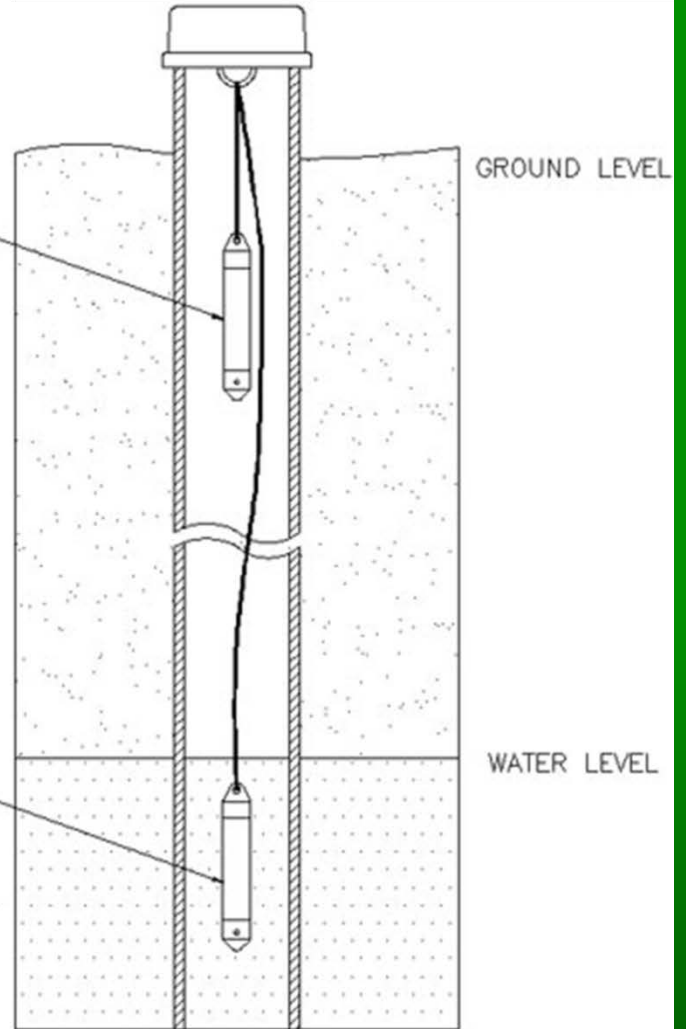


We selected a pond and a nearby sinkhole for our investigation



OPTIONAL BAROMETRIC
PRESSURE LOGGER

WATER LEVEL
LOGGER

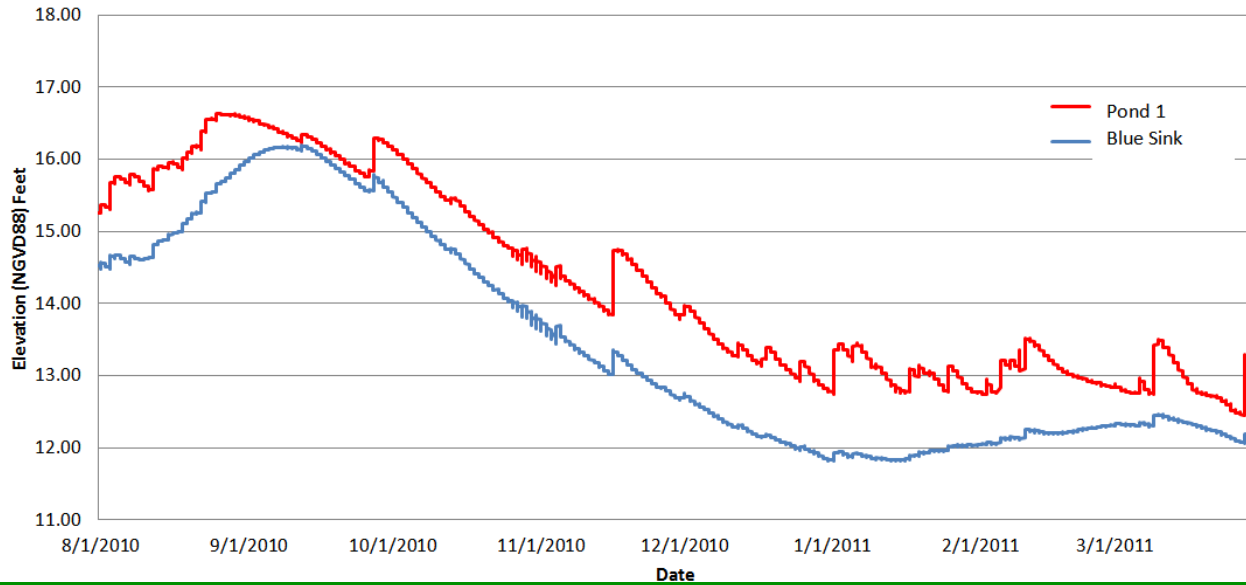


9. Instrumentation installed at Pond 1 and Blue Sink.

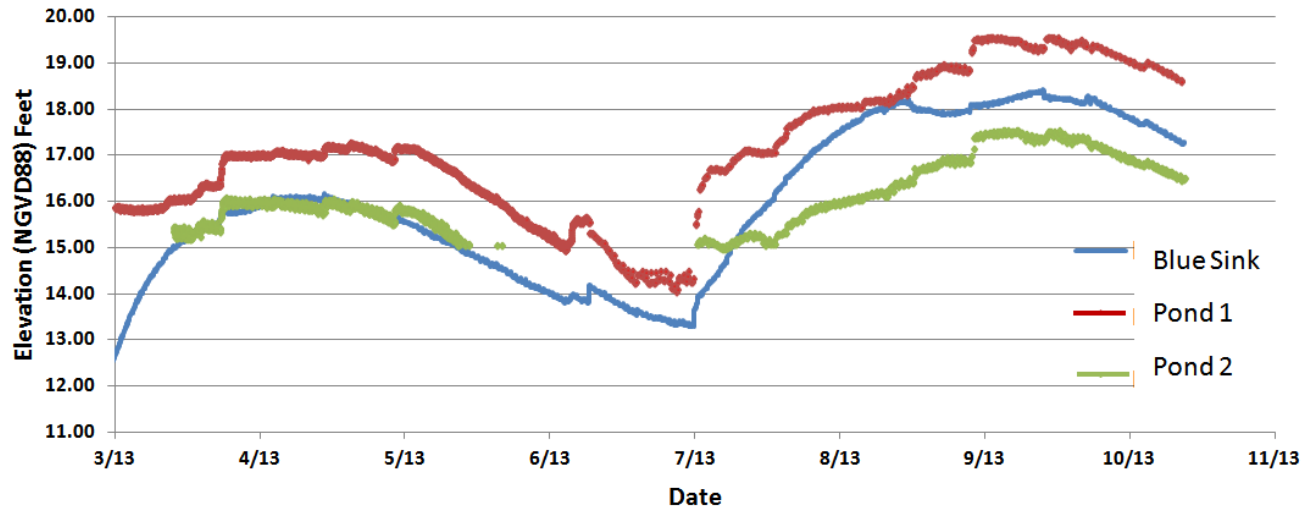


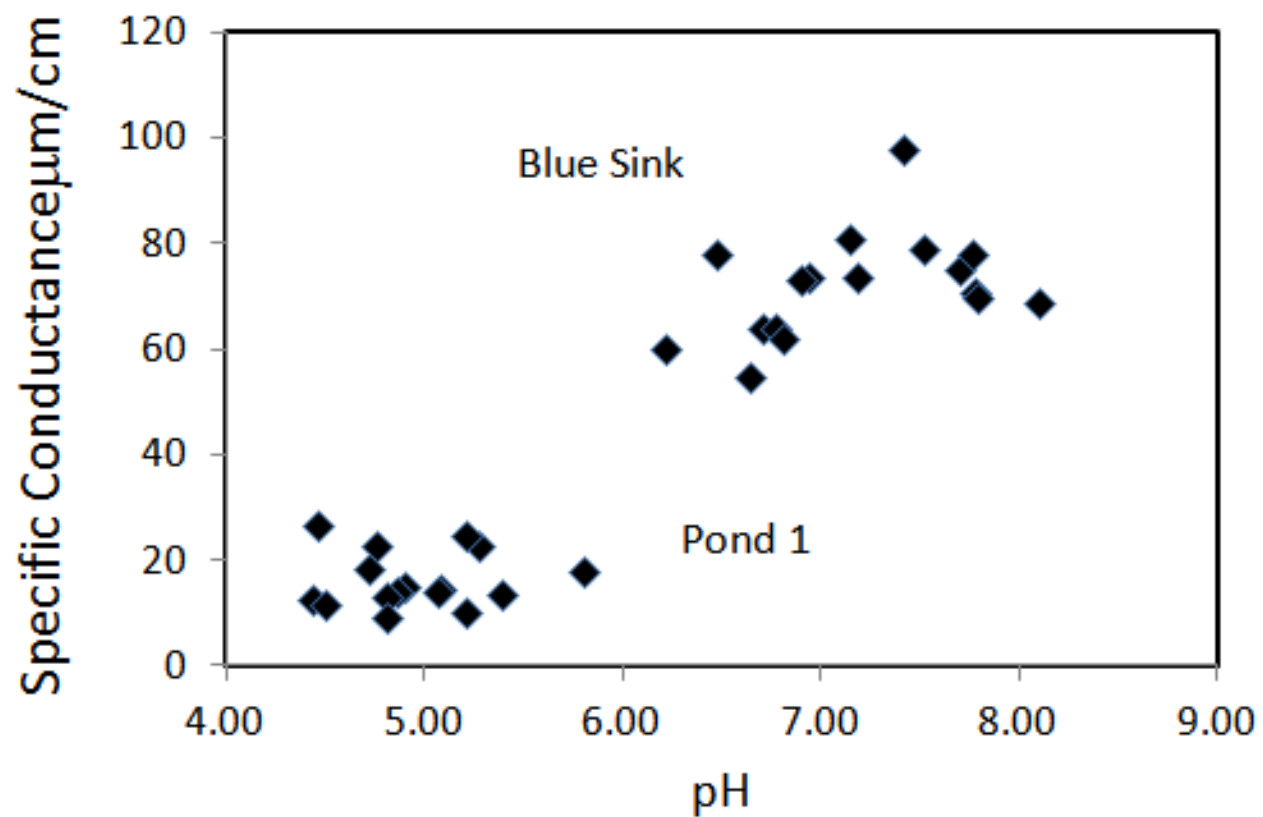
Atmospheric corrected pressure-sensing data loggers were installed in Blue Sink (shown here) and Pond 1. Water depth was collected at 15 minute intervals. A rain-gage was installed at Pond 1 and set to collect rainfall in half-hour increments.

Pond 1 and Blue Sink Water Elevations



Pond 1, Pond 2 and Blue Sink Water Elevations





Hypothesis: Pond hydroperiods are not directly controlled by ground water, but may be indirectly controlled by the proximity of ground water to the surface. When ground water levels are high, rainfall fills the pond and “floats” on top of the ground water. When the ground water table falls during dry seasons, rainfall filling the pond drains out quickly and the pond does not hold water.

Next Steps: investigate other ponds in relation to water table; more detailed chemical analysis; install piezometers to analyze hydraulic gradients