

Investigating Phytoplankton, Hydrilla and Epiphytic Algal Dynamics within Chattahoochee Reservoirs

Wesley Gerrin, Duncan Elkins
and Susan Wilde



Warnell School of Forestry
& Natural Resources
UNIVERSITY OF GEORGIA

Background

- “Blue-green algae”
- Can photosynthesize but more similar to bacteria than true algae, existing as prokaryotic cells, reclassified as cyanobacteria
- These bacteria have chlorophyll *a* and use two photosystems that split water and yield oxygen gas
- fix nitrogen, survive in extreme environments



Hepatotoxins

“liver toxins”

Neurotoxins

“nerve toxins”



Chronic health effects at lower concentrations,
Acute at high concentration



A satellite view of a large reservoir, likely the Chattahoochee Reservoir, surrounded by a dense forest of green trees. The reservoir is a dark blue color, and there are some buildings and roads visible in the lower right corner. The text 'Project Objectives' is overlaid in a semi-transparent white box in the upper left.

Project Objectives

- Investigate the dynamics of planktonic harmful algal blooms in Chattahoochee reservoirs
- Monitor for toxic epiphytic cyanobacteria *Aetokthonos hydrillicola* on submerged aquatic vegetation

Sampling Locations

Lake Harding

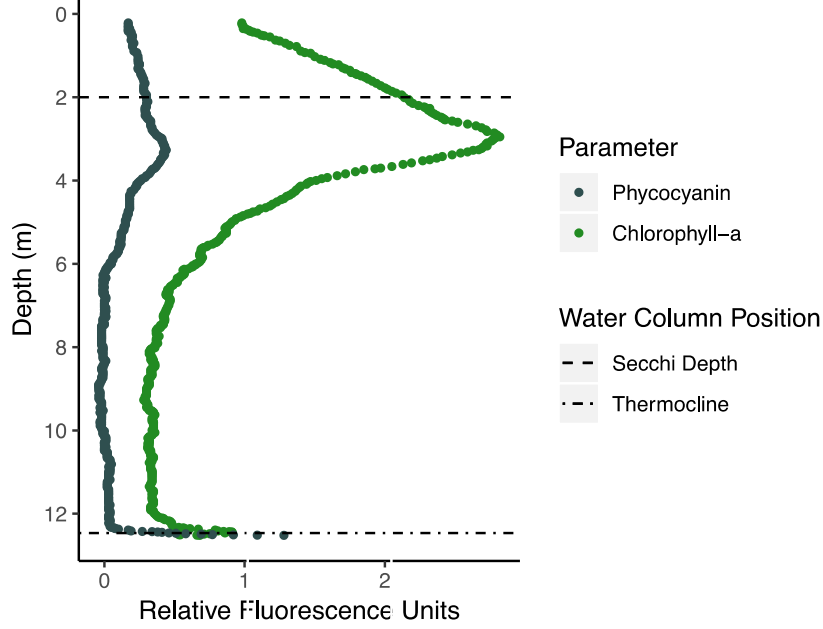


0 1.75 3.5 Km

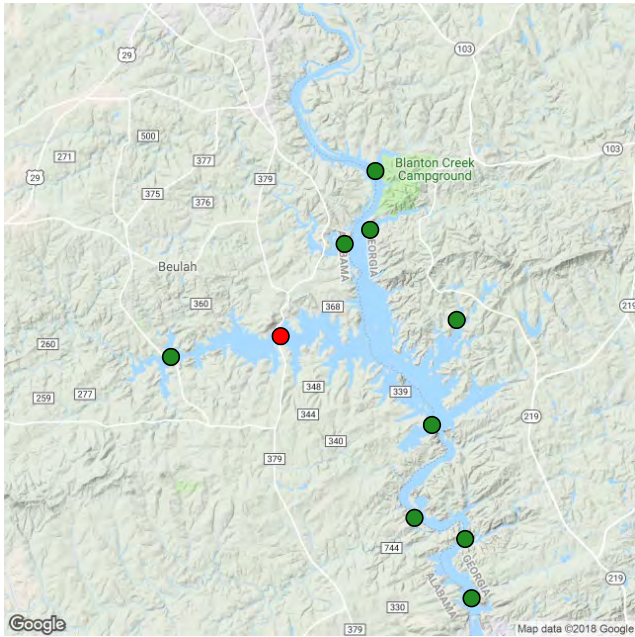
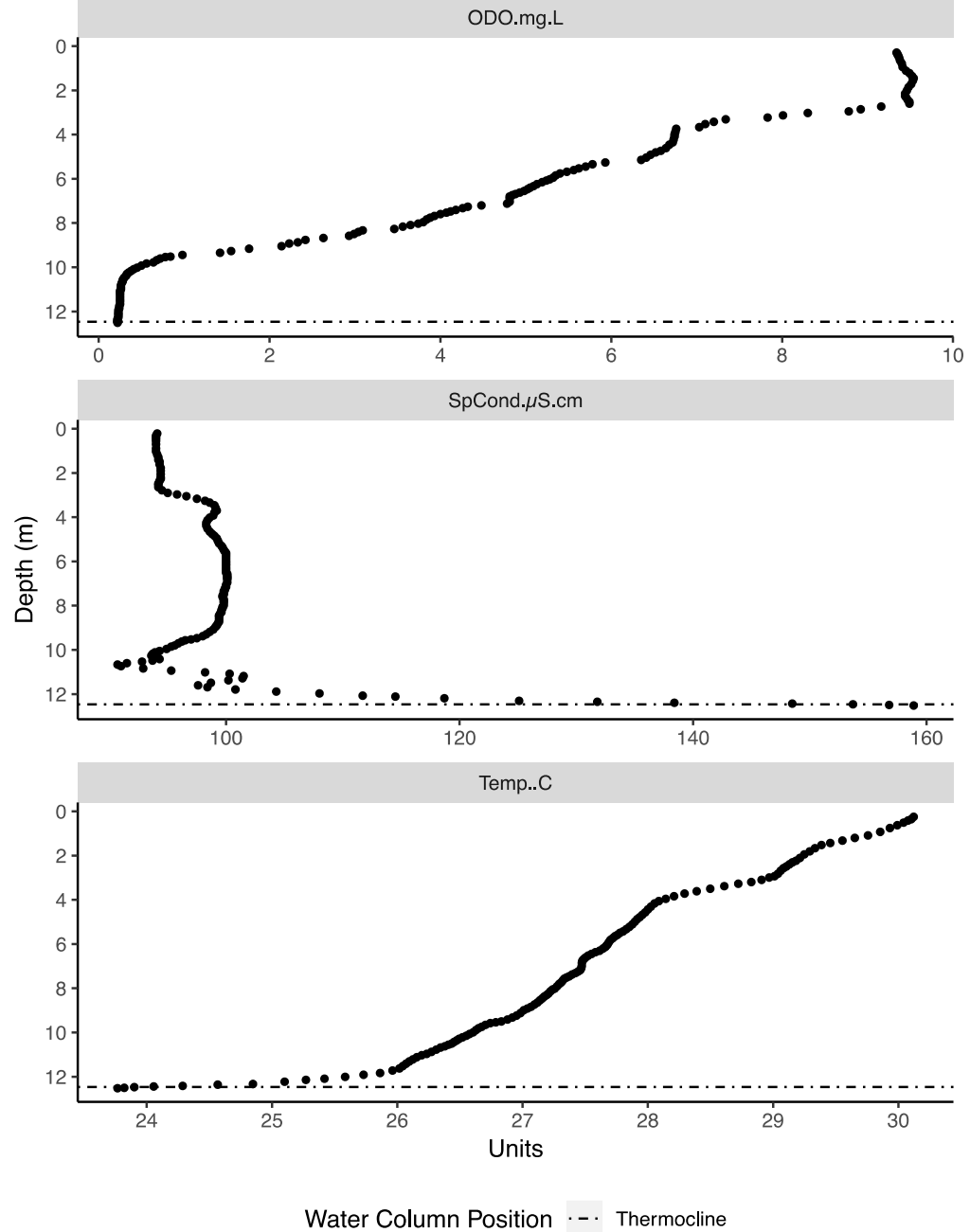
- Hydrilla Sample Locations (September)
- Water Sample Locations

Lake Harding Site 4

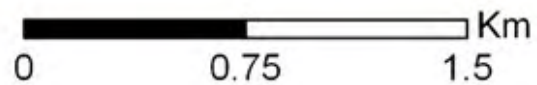
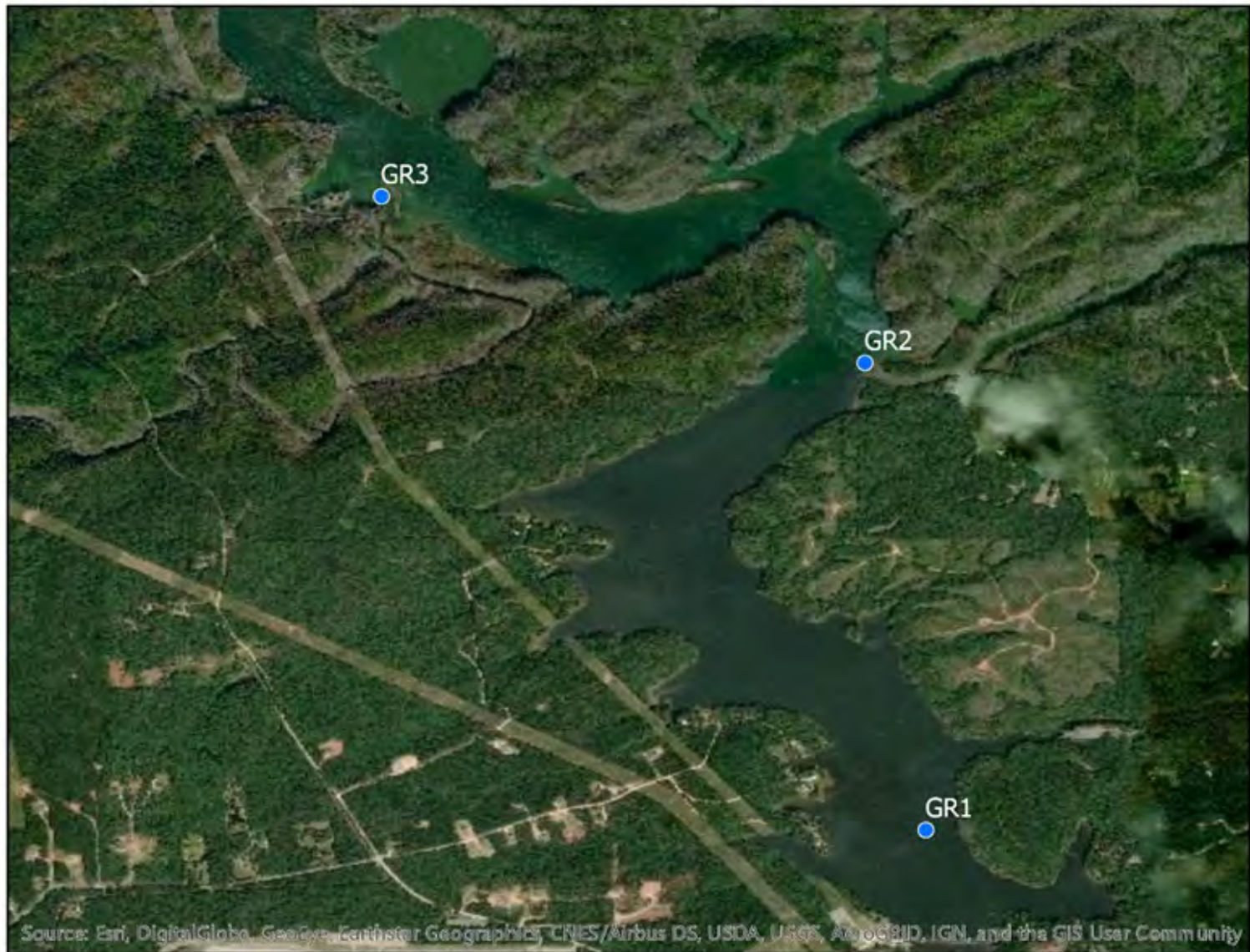
Phycocyanin and Chlorophyll-a



DO, SpC, & Temp



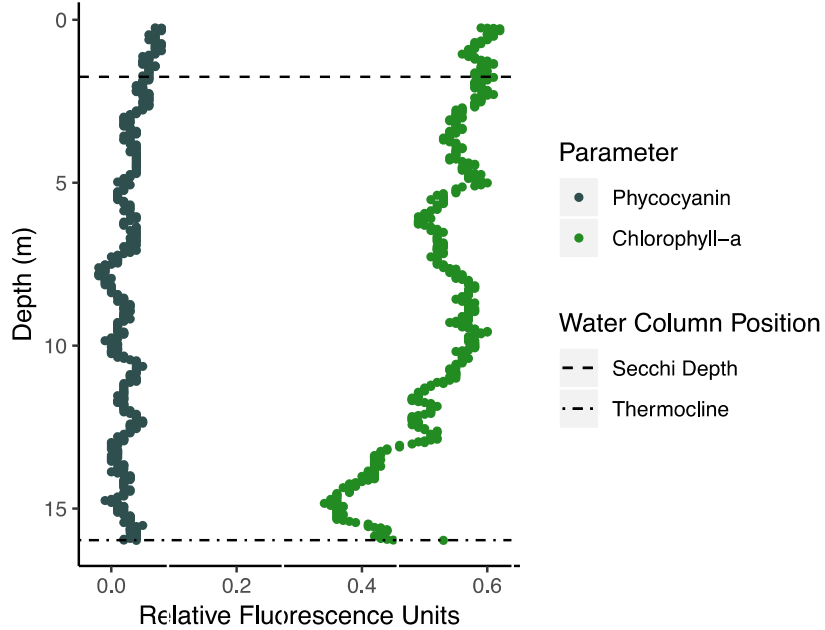
Lake Goat Rock



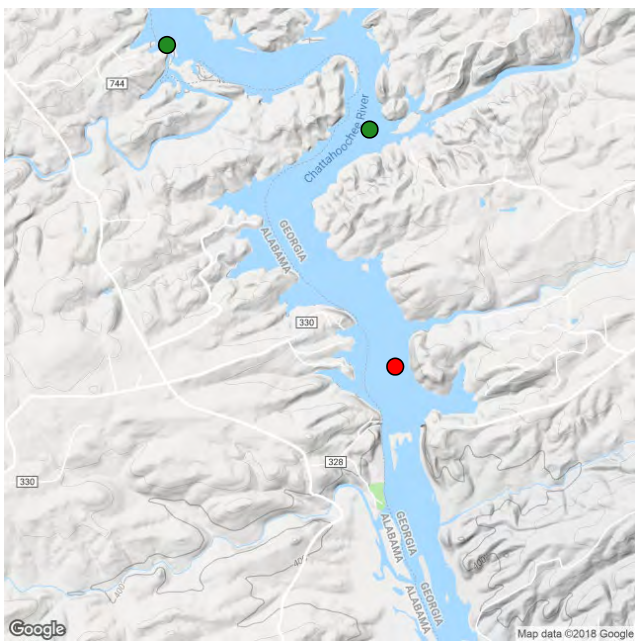
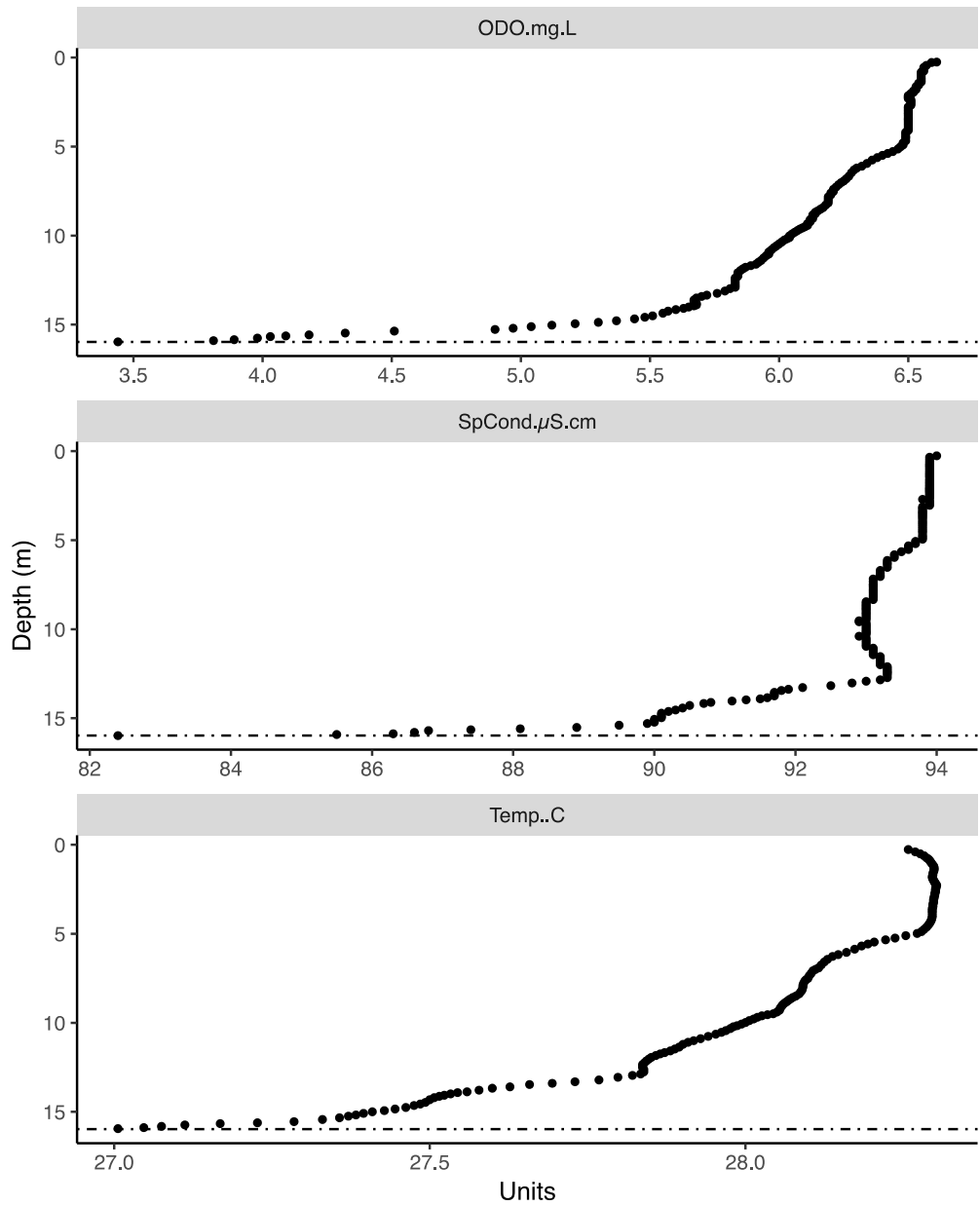
● Water Sample Locations

Lake Goat Rock Site 1

Phycocyanin and Chlorophyll-a

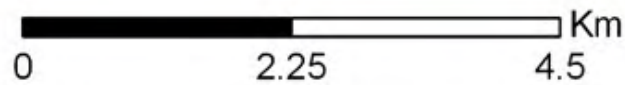
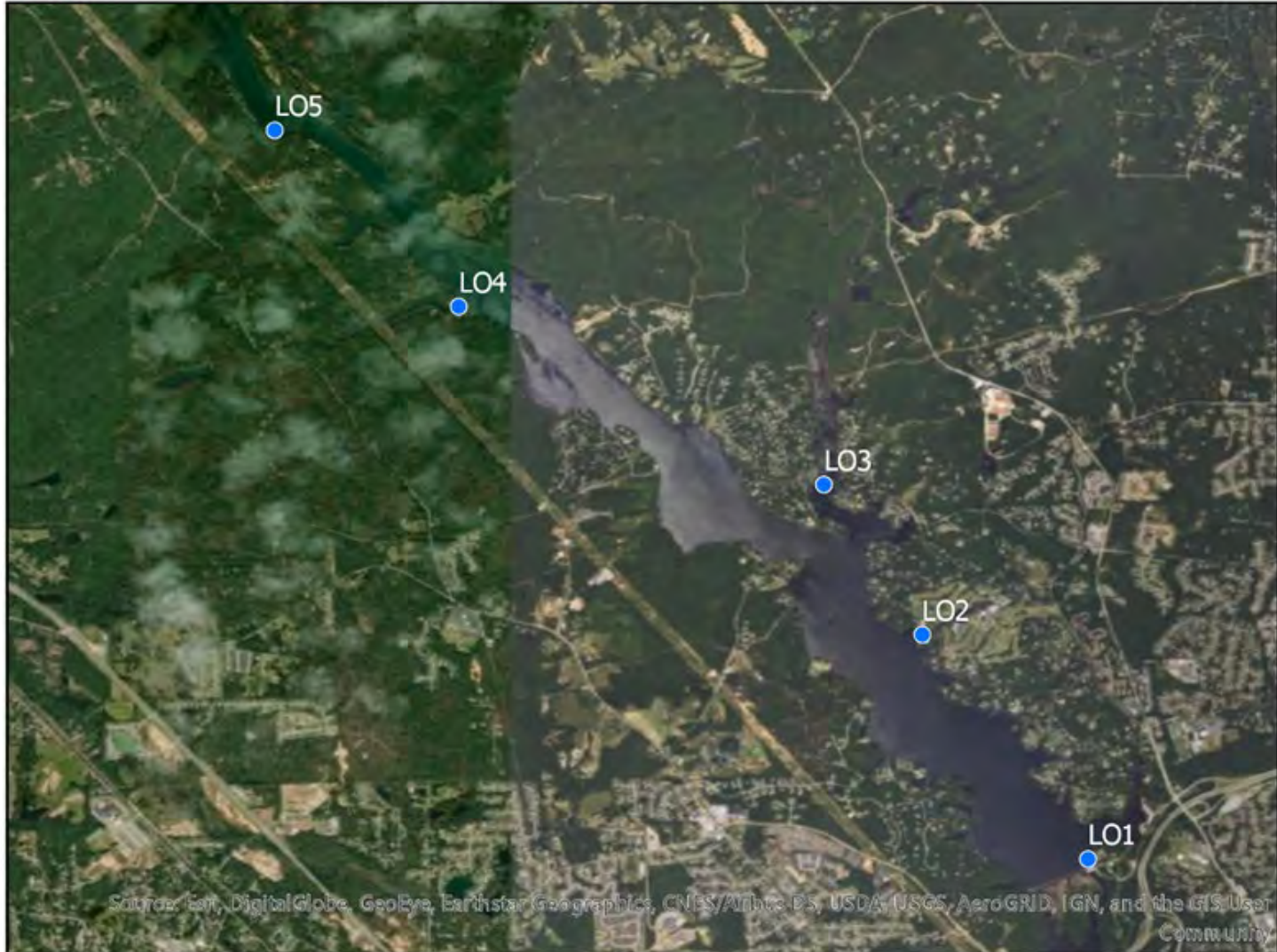


DO, SpC, & Temp



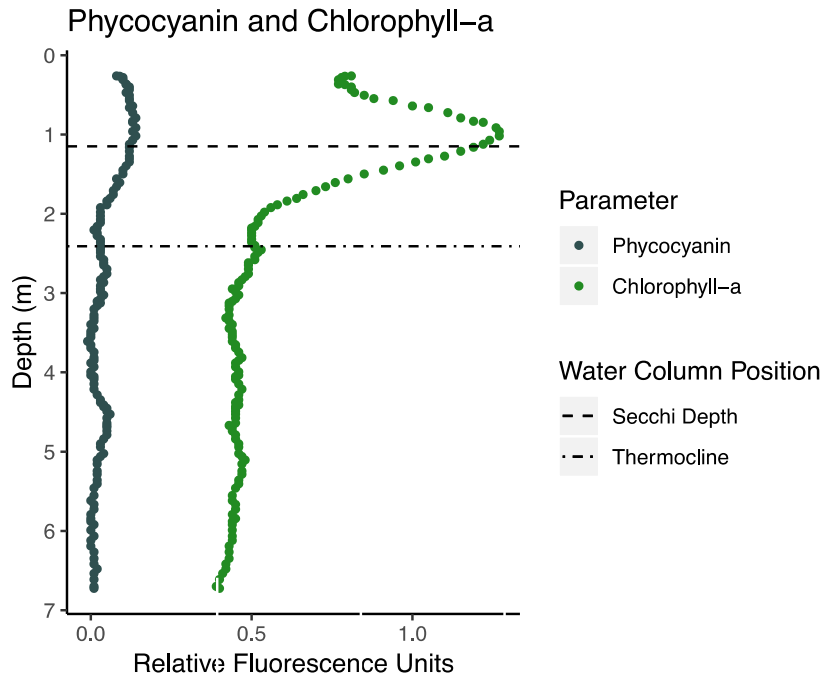
Water Column Position --- Thermocline

Lake Oliver

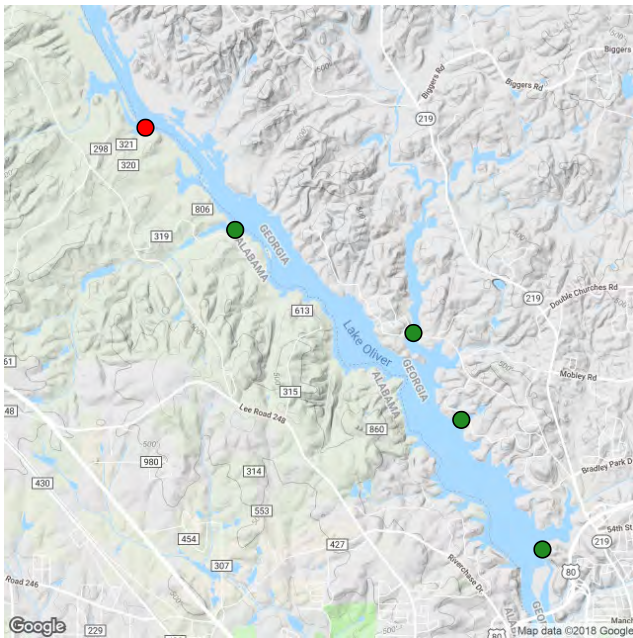
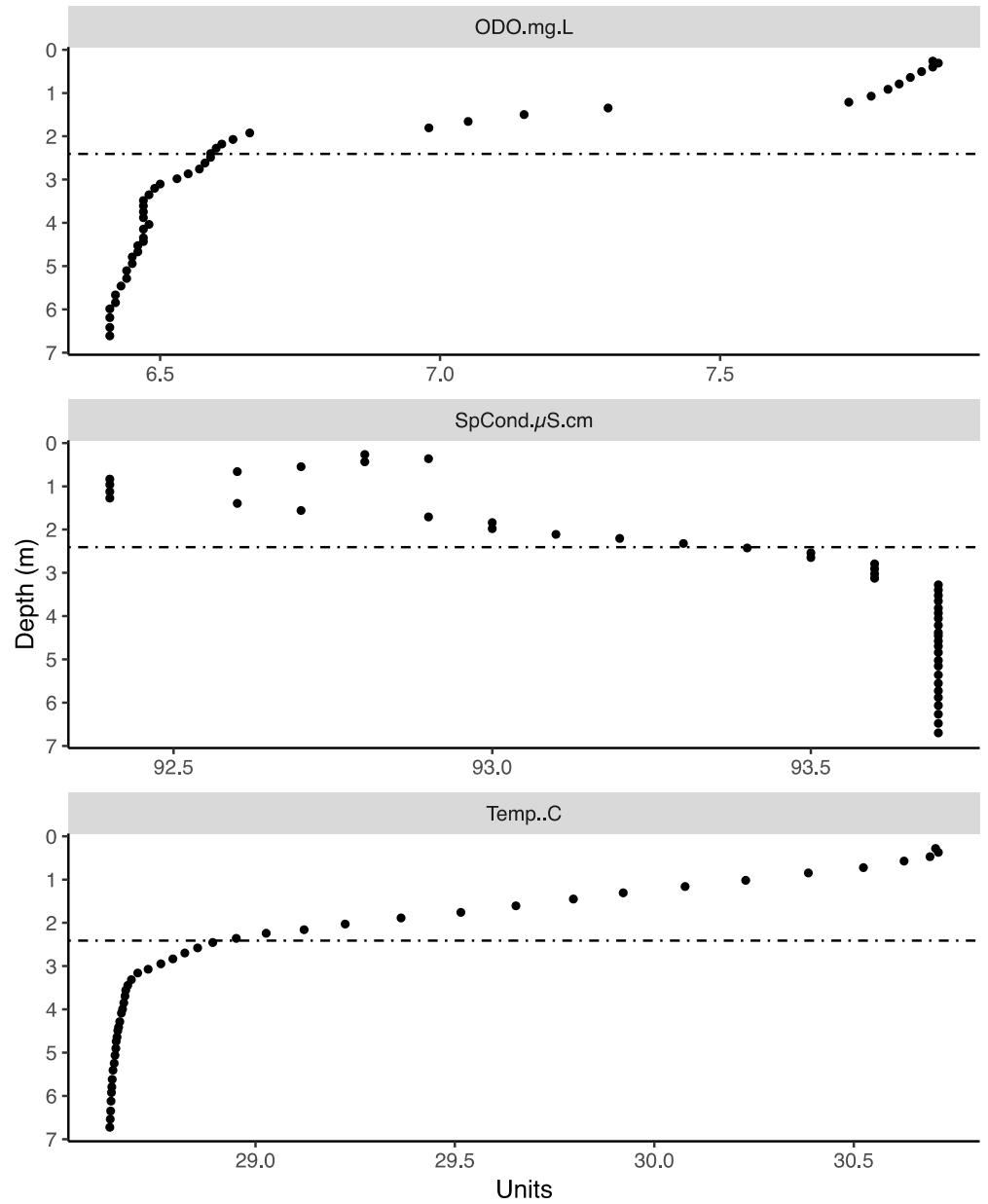


● Water Sample Locations

Lake Oliver Site 5



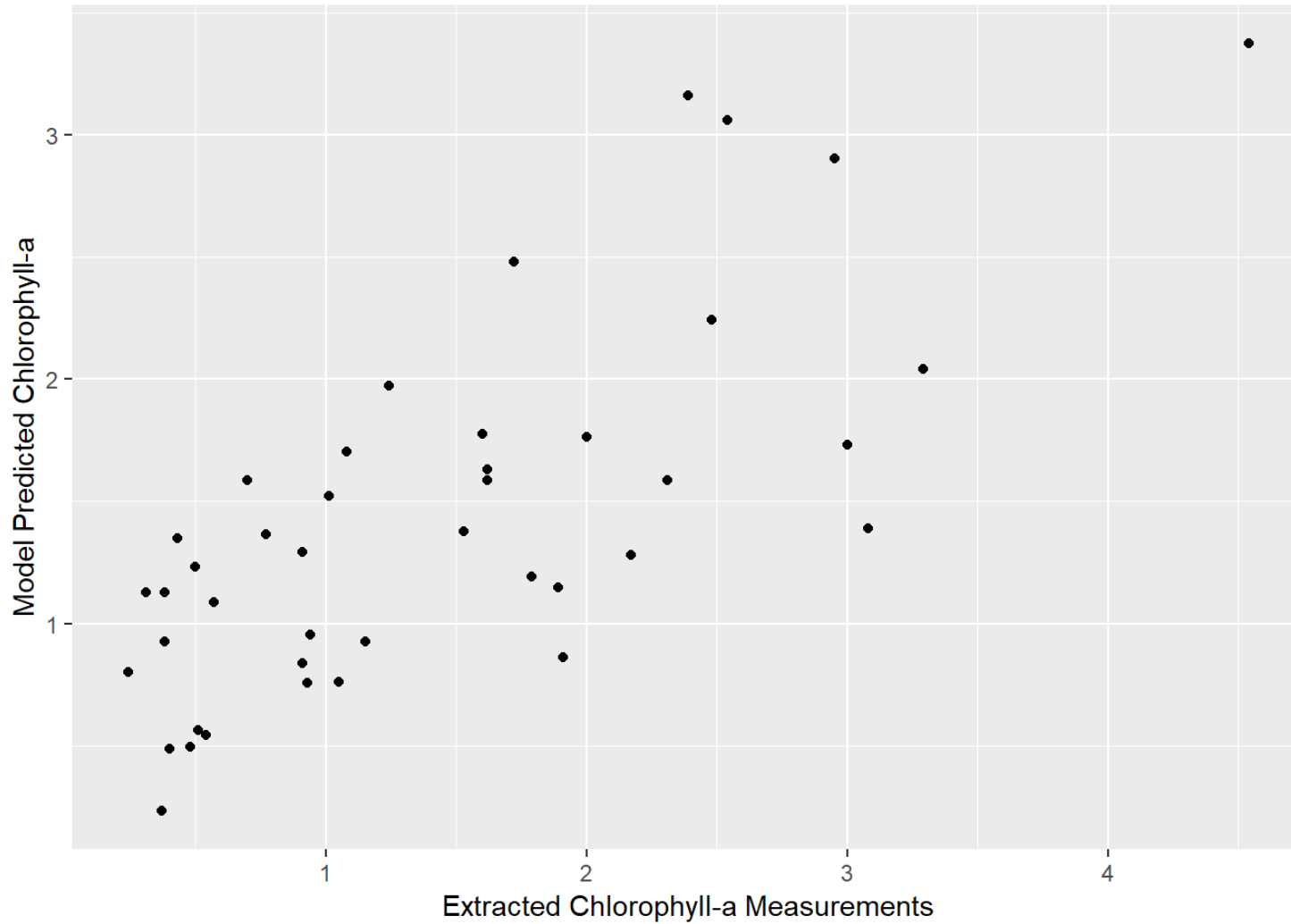
DO, SpC, & Temp



Water Column Position

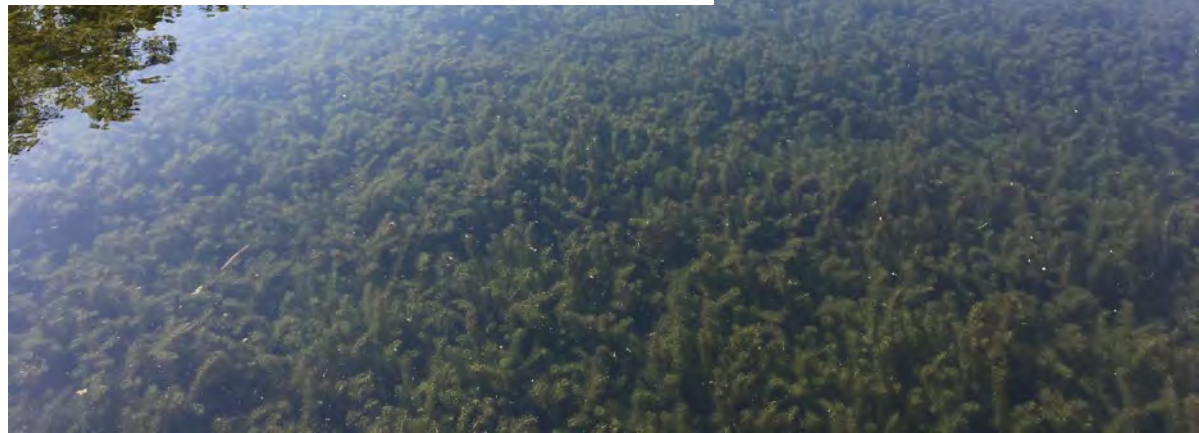
- - Thermocline

Predicting Chlorophyll-a with Sensor Data



Results: *SAV Sampling*

- Hydrilla was detected and sampled at five locations on Lake Harding in September 2018
 - *Aetokthonos hydrillicola* was not detected on any of the samples taken from Lake Harding.
- Surveys were unable to detect Hydrilla in Lake Oliver and Lake Goat Rock





Further Research Possibilities

- Would the model be valid at higher Chlorophyll-a concentrations ($>5 \mu\text{g/L}$)?
- Could we use sensor data as a surrogate for more expensive laboratory analysis?
- Investigate areas within each reservoir at risk for *Aetokthonos hydrillicola* growth
- Confront water quality model with historical GA Power data
- Watershed HAB risk analysis using 2016 landcover data





Aetokthonos hydrillicola
“eagle killer living on hydrilla”

500 μm

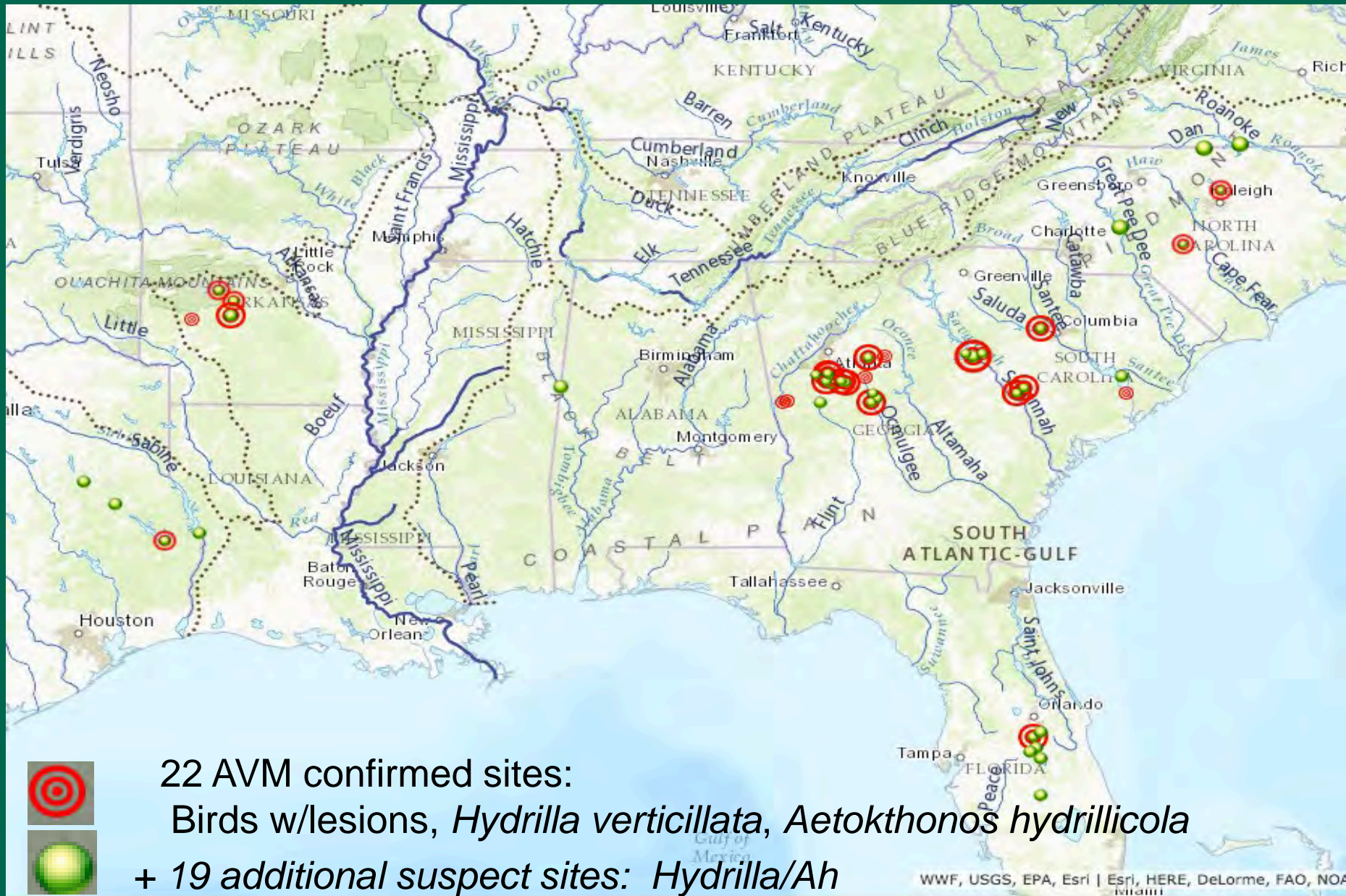


Neurological impairment



- 
- Eagles may overshoot perches or fly into objects

"Avian" Vacuolar Myelinopathy 2019

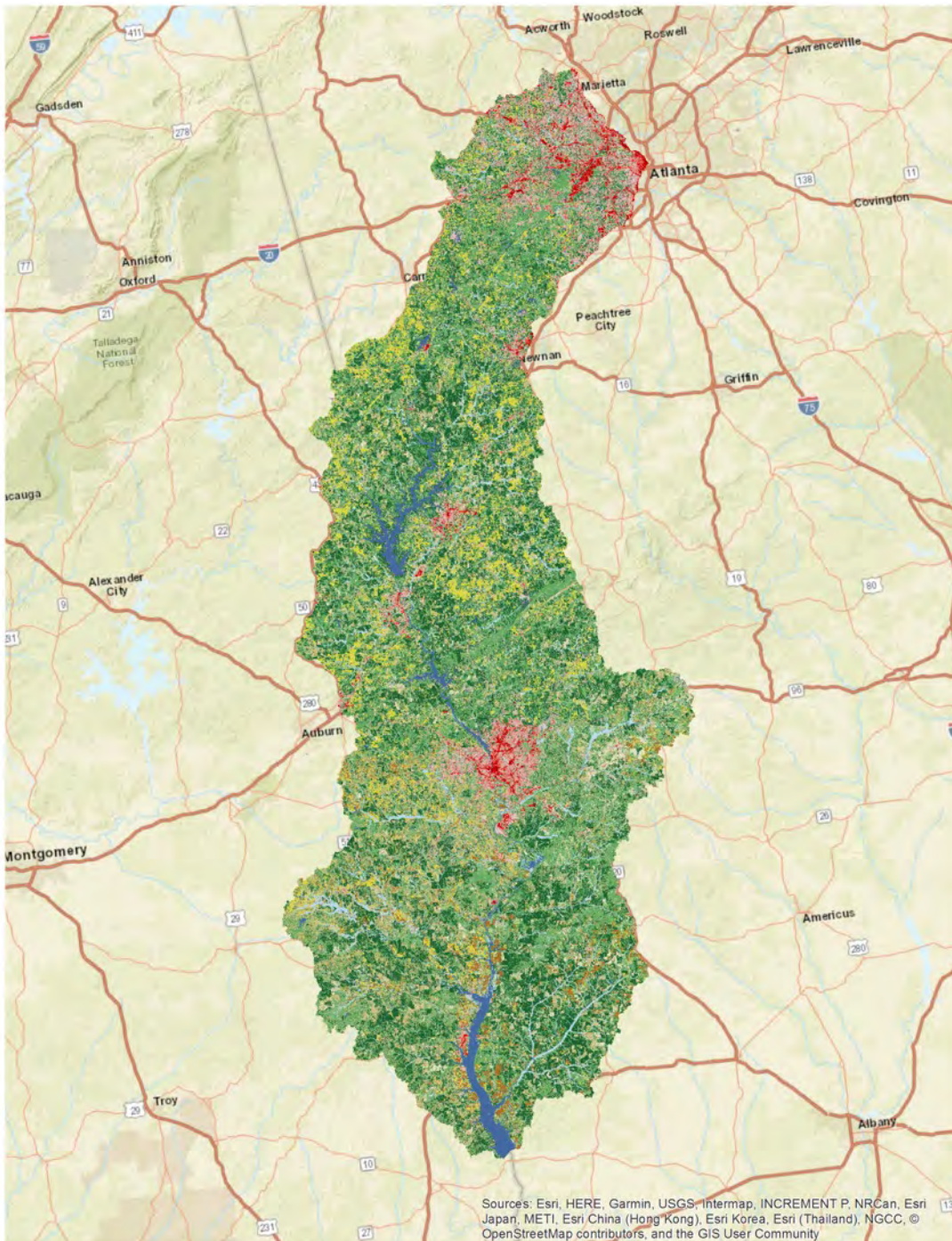


Identifying Priority Areas for Source Water Protection in the Middle Chattahoochee Watershed

Duncan Elkins



River Basin Center
UNIVERSITY OF GEORGIA



2011 Class	Percent
Open Water	2.7%
Developed, Open Space	6.2%
Developed, Low Intensity	3.6%
Developed, Medium Intensity	1.1%
Developed High Intensity	0.5%
Barren Land (Rock/Sand/Clay)	0.3%
Deciduous Forest	27.1%
Evergreen Forest	25.7%
Mixed Forest	3.9%
Shrub/Scrub	9.2%
Grassland/Herbaceous	5.5%
Pasture/Hay	7.9%
Cultivated Crops	1.9%
Woody Wetlands	4.1%
Emergent Herbaceous Wetlands	0.3%

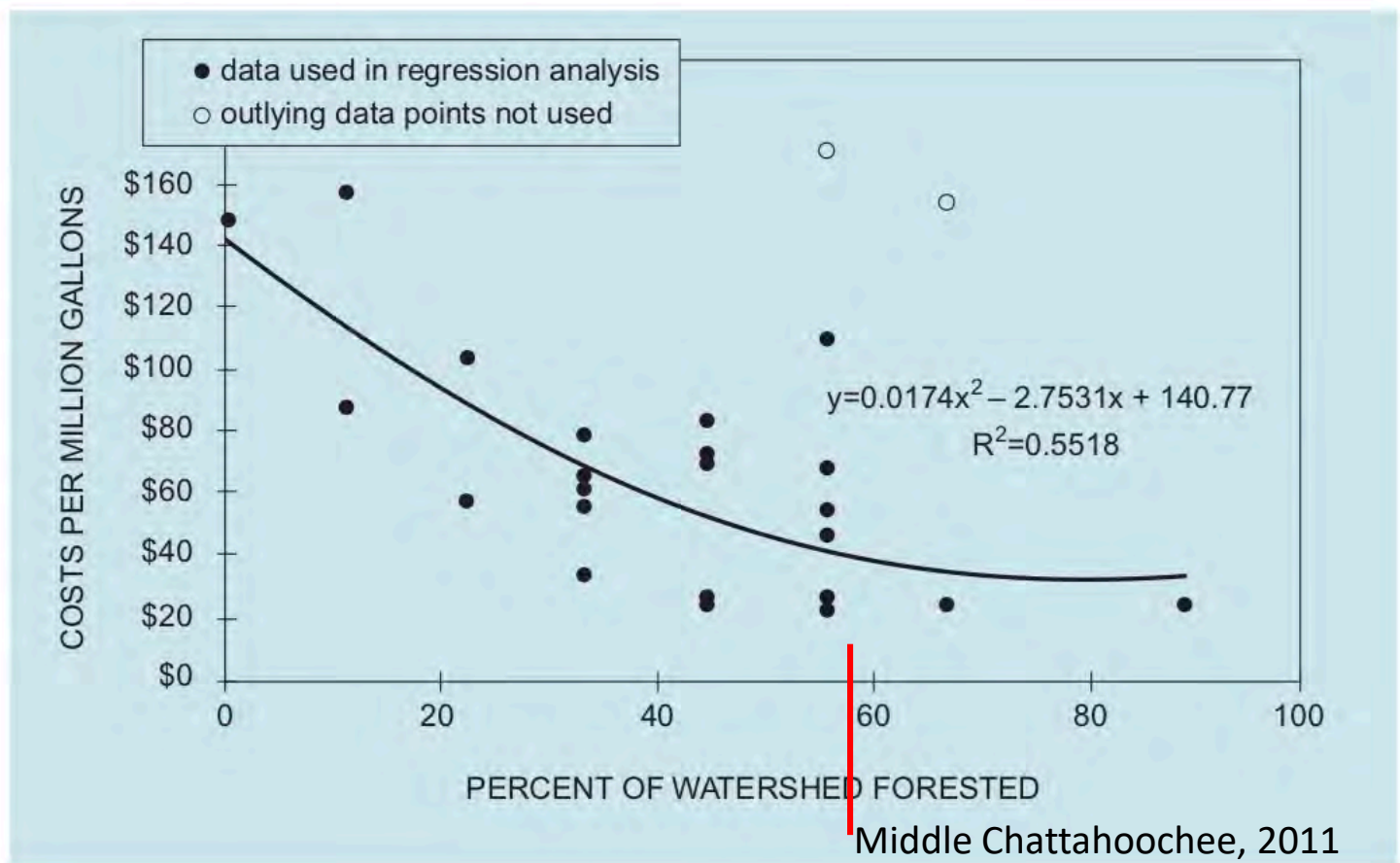
Currently ~57% Forested
~78% "Natural"

Loss of Forest & Wetland Acres 2001-2011

Class in 2001	Class in 2011							Grand Total
	Developed, High Intensity	Developed, Med. Intensity	Developed, Low Intensity	Developed, Open Space	Cultivated Crops	Pasture/ Hay	Grassland/ Herb.	
Evergreen Forest	632	2,122	5,110	6,754	185	770	50,846	66,418
Mixed Forest	53	186	442	669	53	61	5,920	7,384
Deciduous Forest	716	2,401	5,815	8,543	119	425	11,852	29,870
Woody Wetlands	4	54	133	290	24	6	371	882
Em. Herb. Wetlands	0	4	8	15	4	1	25	57
Grand Total	1,405	4,767	11,508	16,271	386	1,262	69,013	104,612

~34,000 Acres Developed

Upstream Forests Predict Treatment Costs



(Ernst, et al, 2004)

Factors Affecting Surface Runoff

- Land Use
- Proximity to Streams
- Proximity to Ponds/Wetlands
- Soil Permeability
- Soil Erodability
- Slope
- Floodplain

7 Factors, 3 points each

Conservation vs Restoration

Conservation Priority Index (CPI)

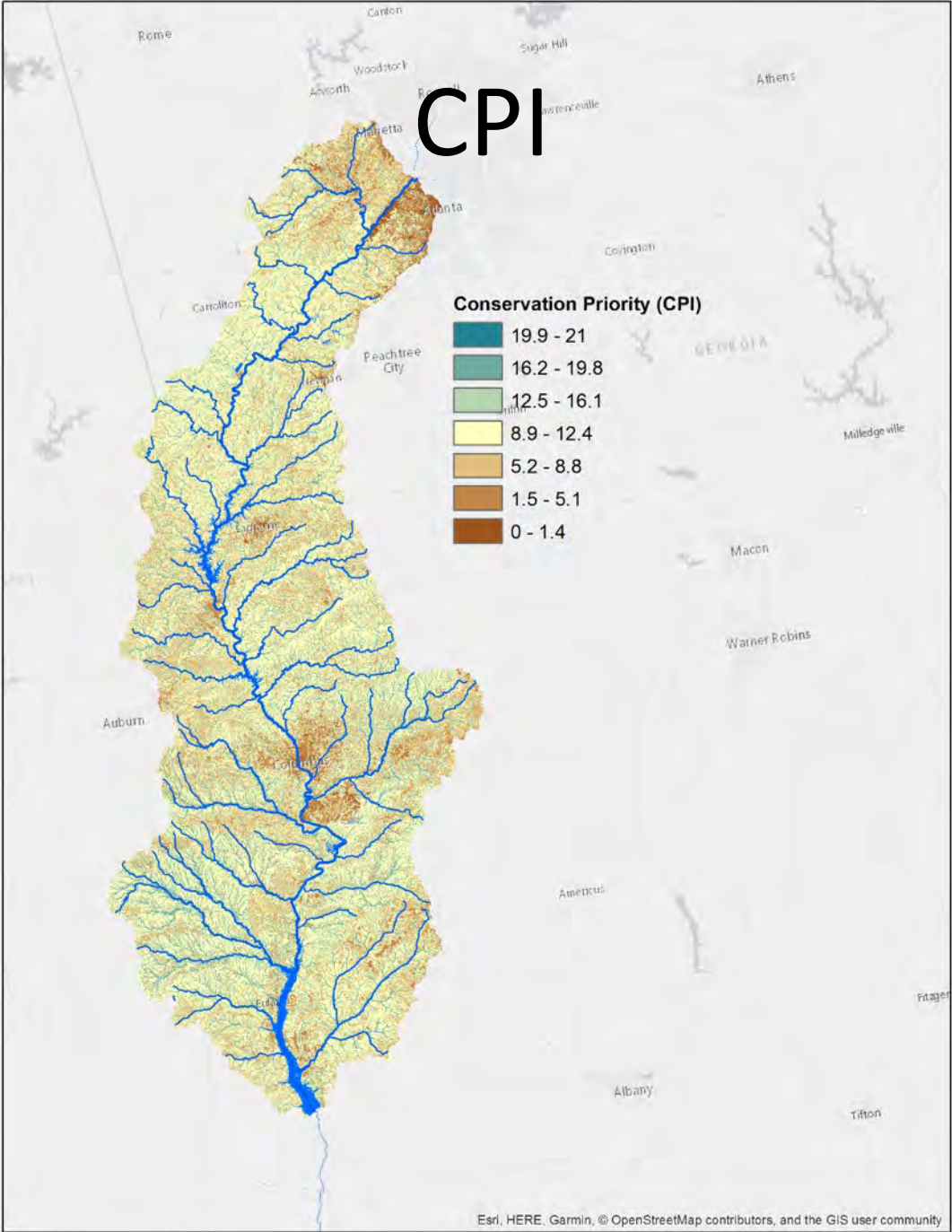
- 3 points for Forested Land Cover

Restoration Priority Index (RPI)

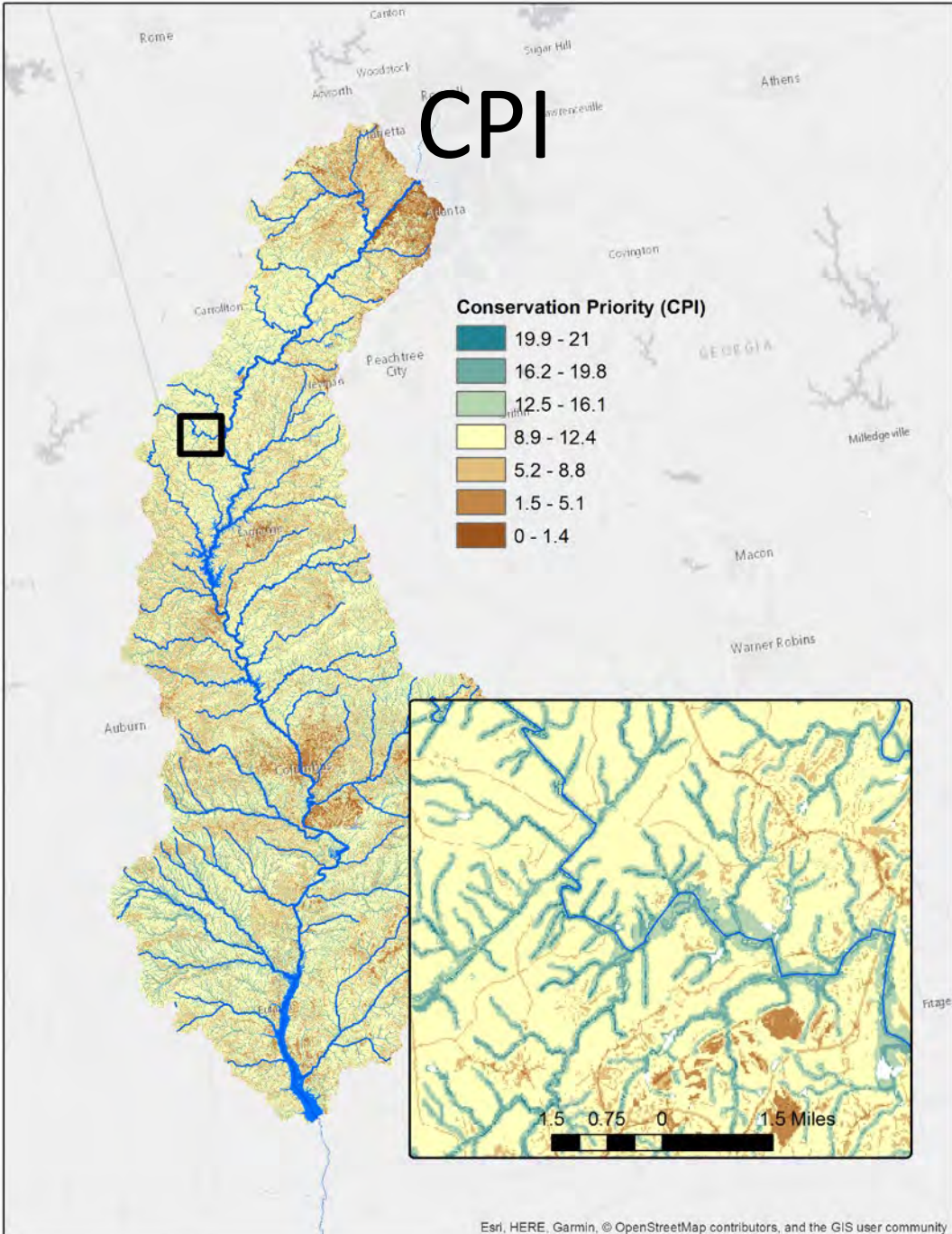
- 3 points for Agricultural Land
- 2 points for Grassland

(Same Soil, Water, and Topographic Factors)

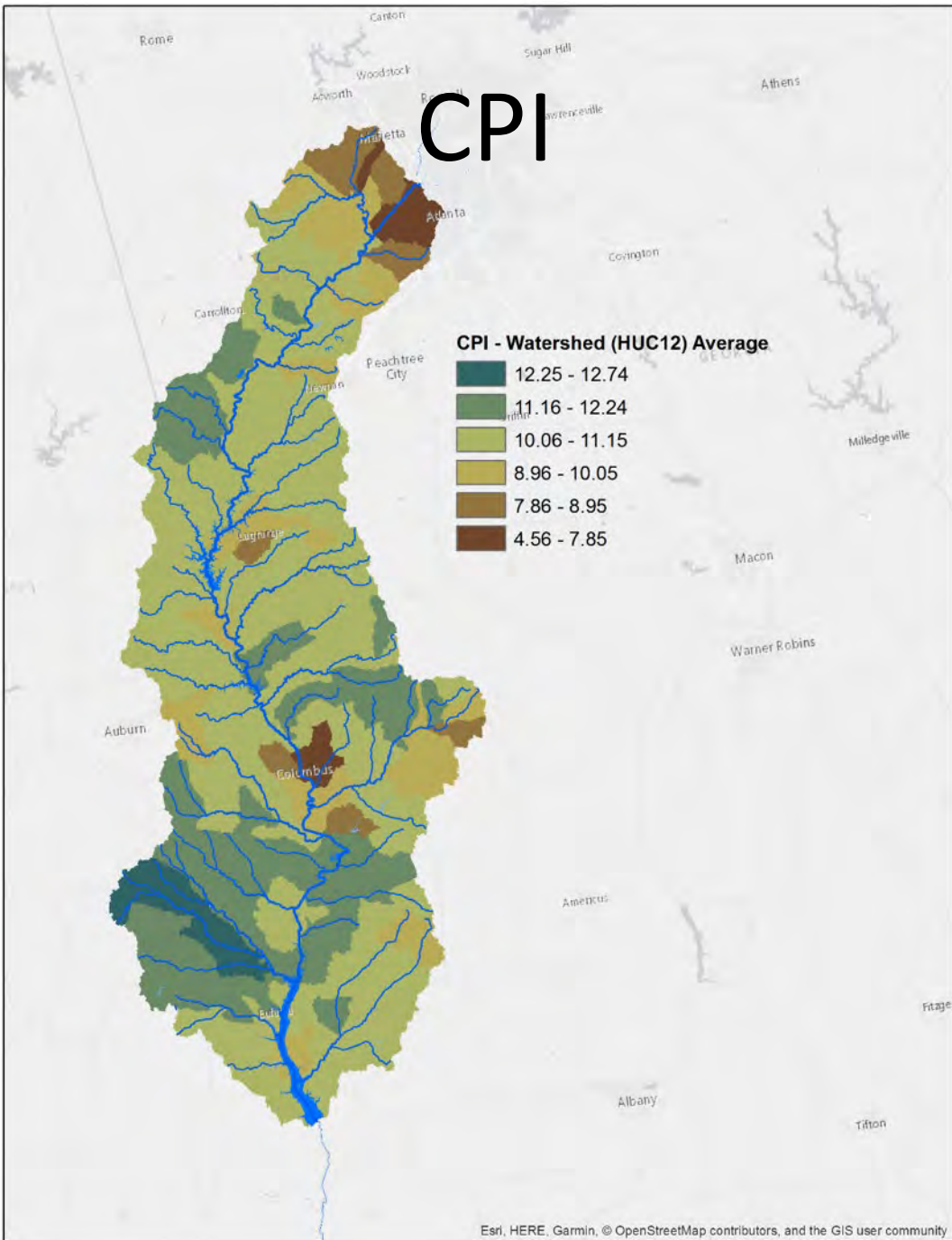
CPI



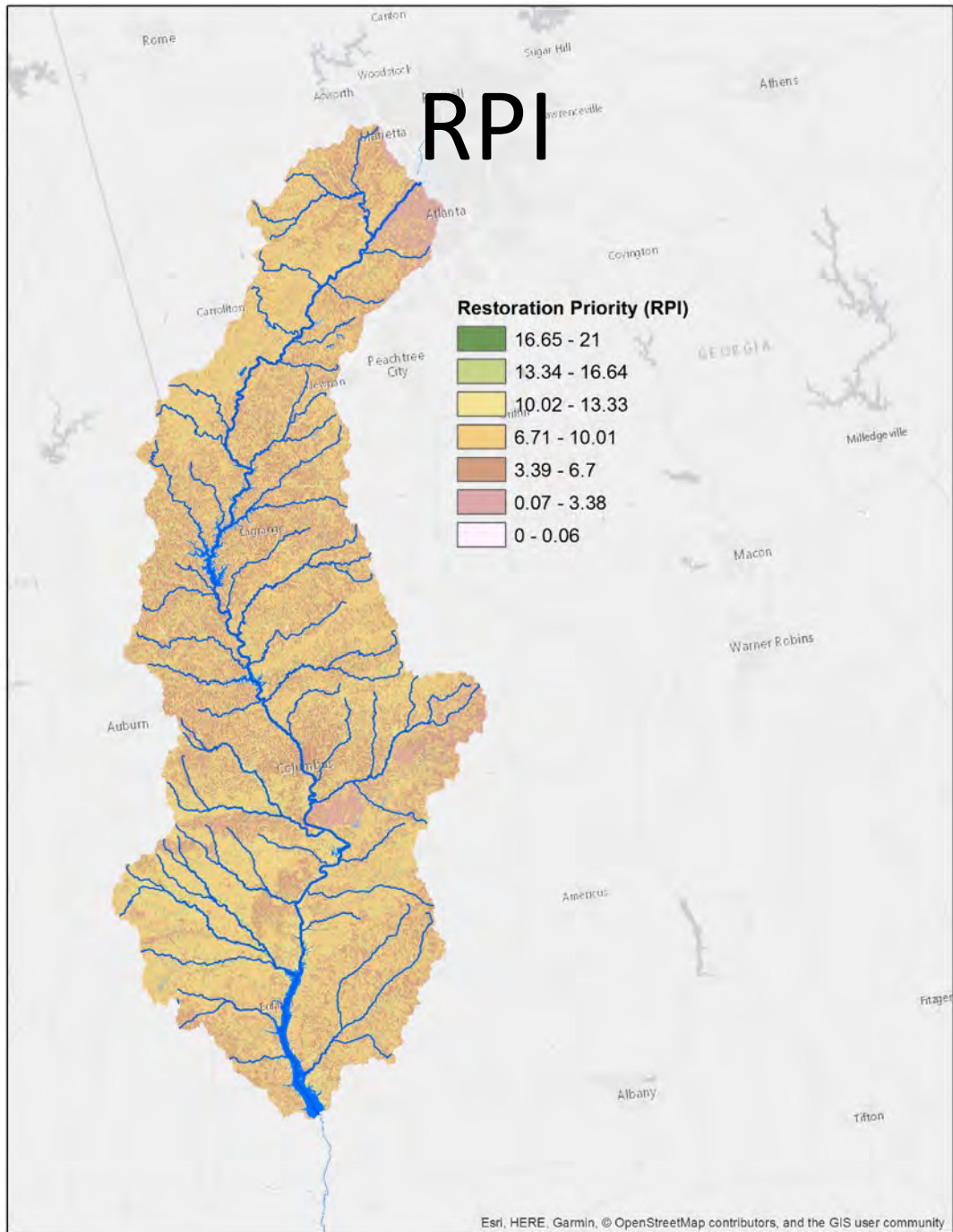
CPI



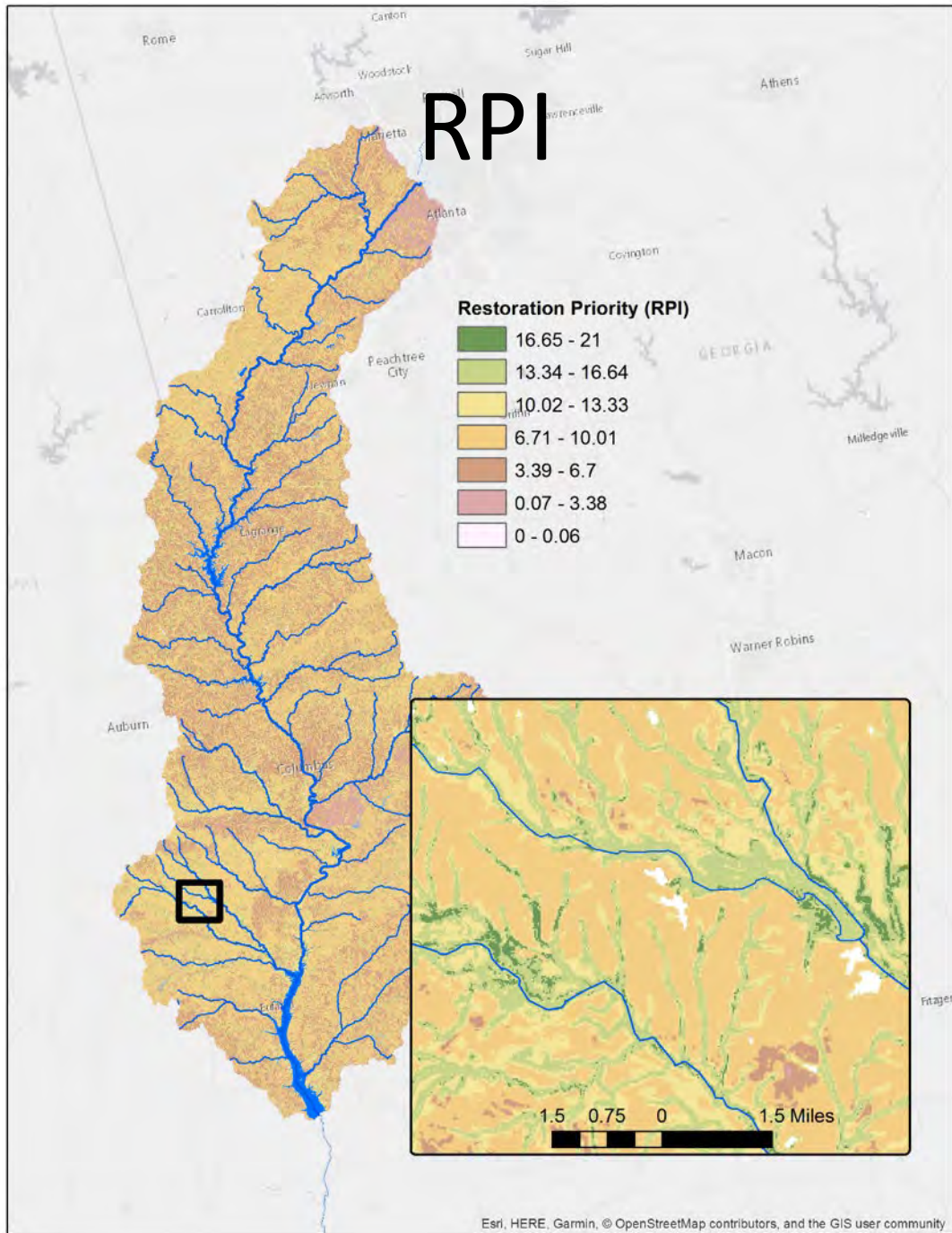
CPI



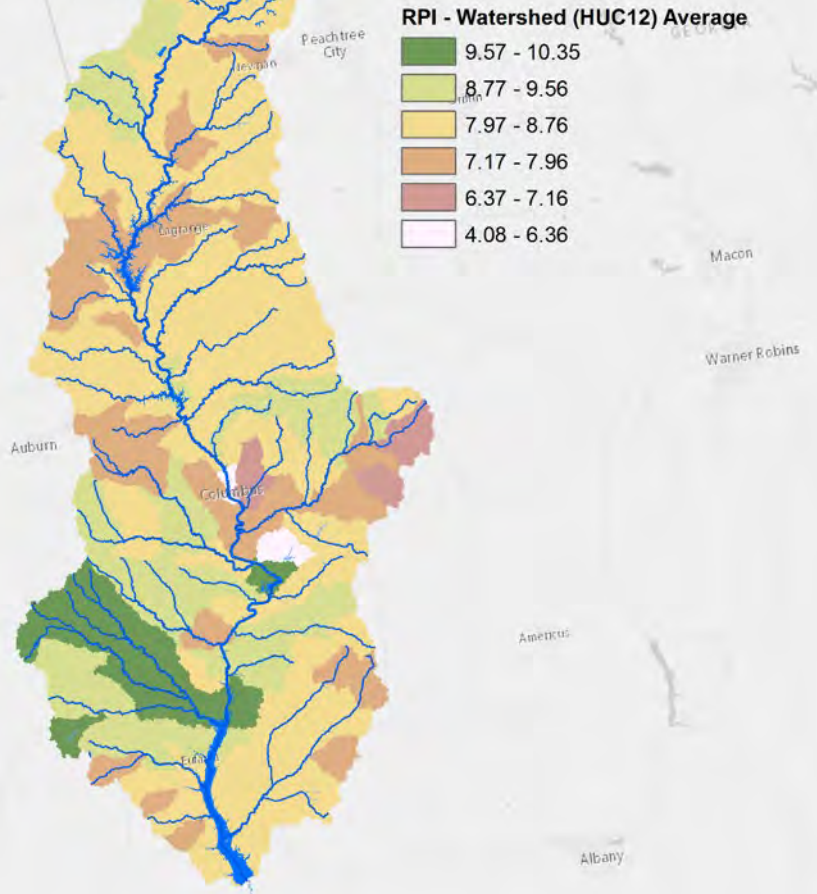
RPI



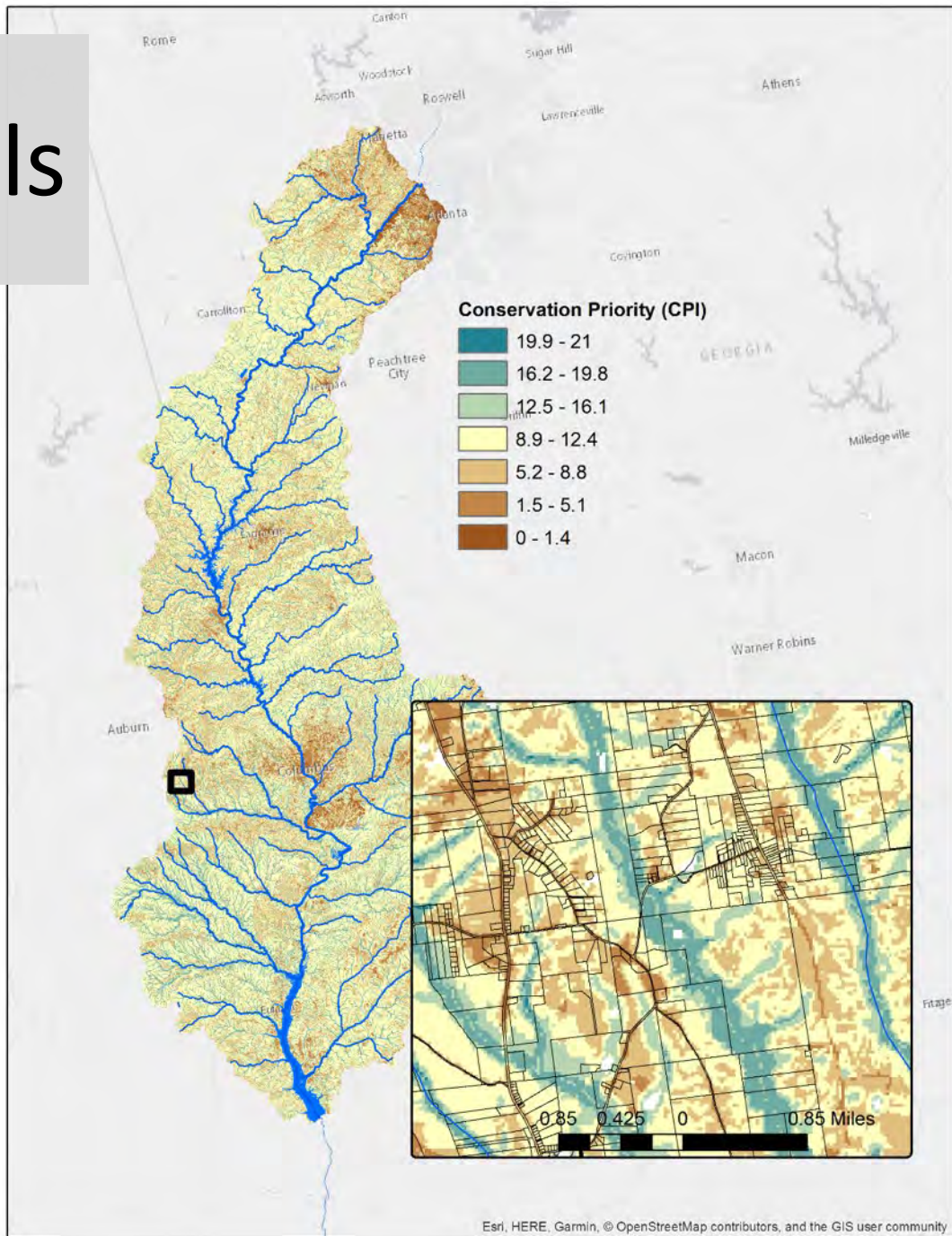
RPI



RPI

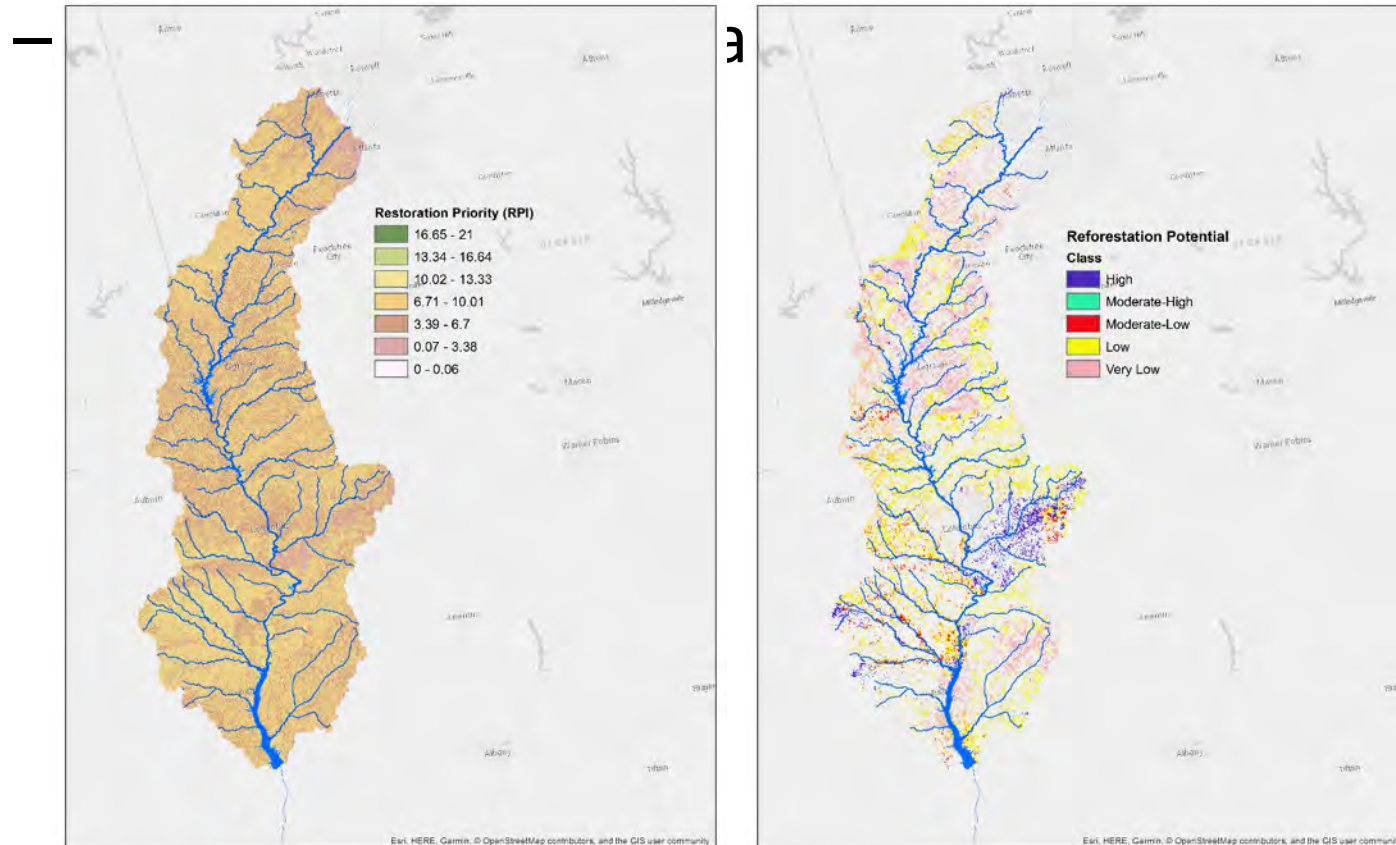


Parcels



Potential Additional Factors

- Greene: Forest Retention/Reforestation Potential



Potential Additional Factors

- Greene (MSU): Forest Retention/Reforestation Potential
 - Matches well in some areas
- SA-LCC Conservation Blueprint
 - Prioritizes habitat connectivity
- Craighton (TNC): Longleaf Priority Areas
- Urban Growth?