Evaluation of Classification Schemes for Establishing Reference Conditions for Wisconsin Streams

Michael Miller

Wisconsin Dept. of Natural Resources - Madison, WI

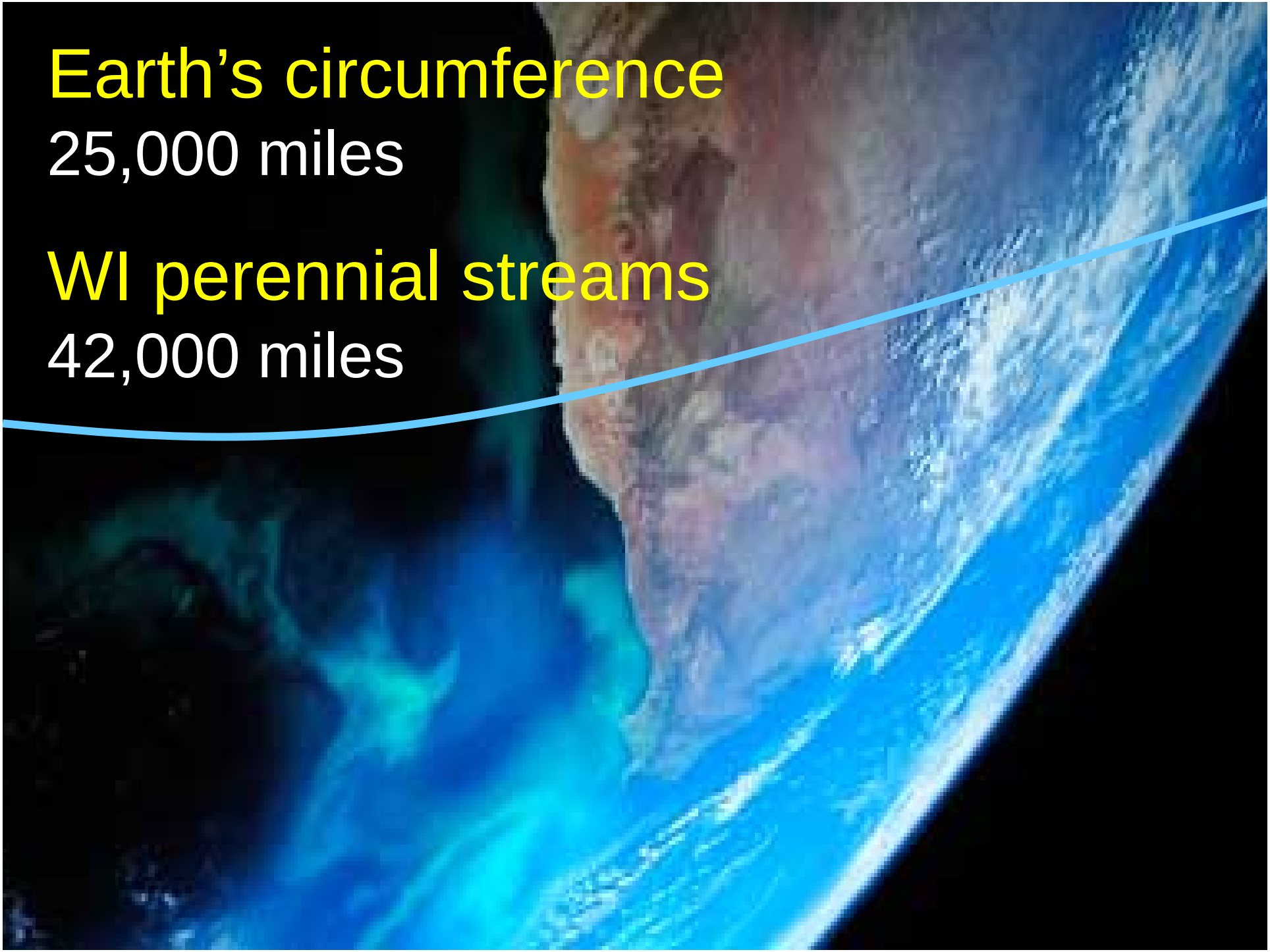
Project Goals

1. Develop Stream Classes
2. Set Expectations
   - Physical
   - Chemical (Phosphorus example)
   - Biological

Overview

1. Reference Sites Selection
2. Classification Confounded by Disturbance
3. Spatial Regression Tree Analysis (SPARTA)
   - Residualization
   - Regression Trees

Water Defines
Wisconsin


Earth’s circumference
25,000 miles
WI perennial streams
42,000 miles

WI Clear-cut by 1910

Legacy
Impacts

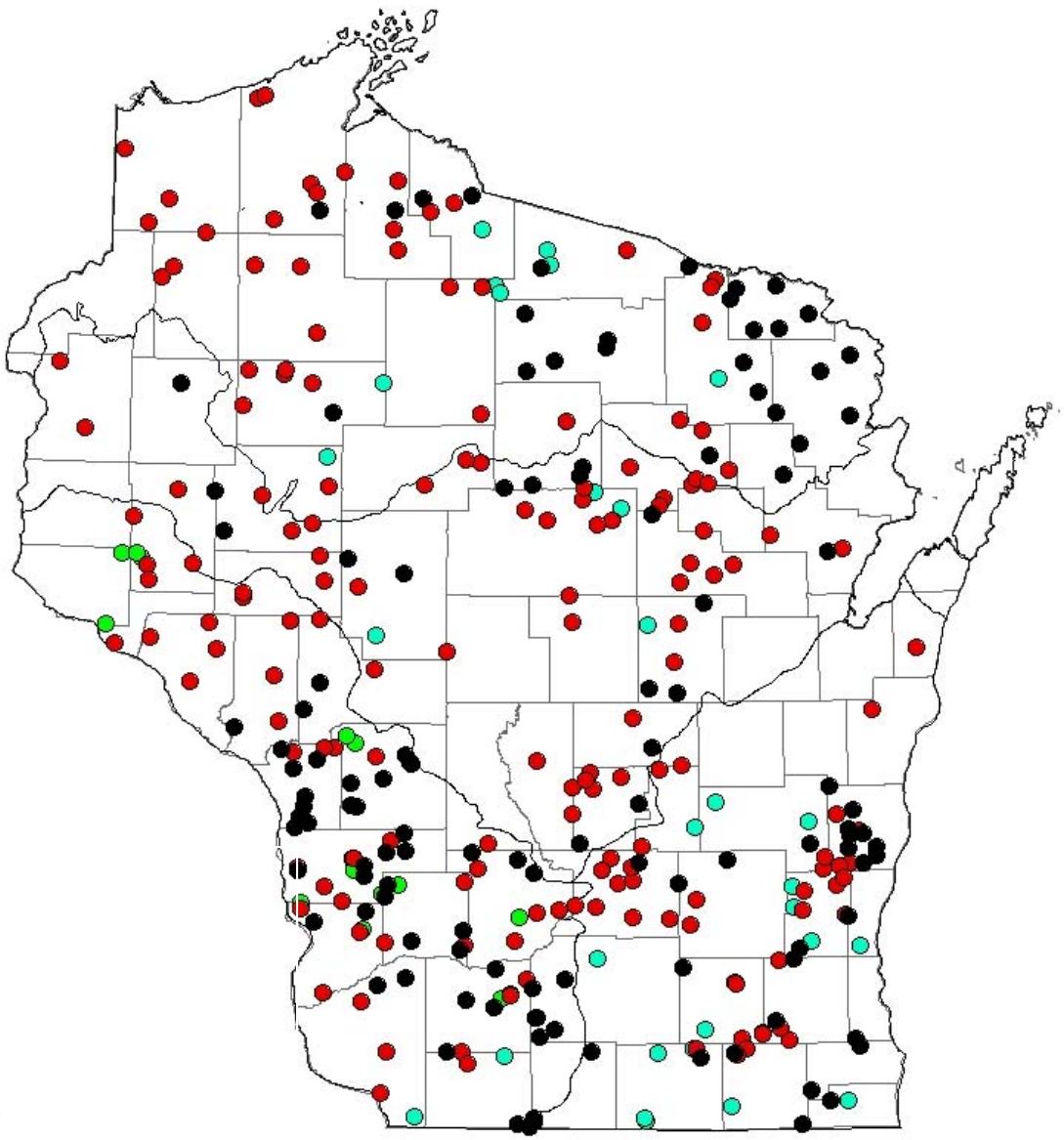
Current Impacts

Reference Conditions*

- ~~Minimally disturbed~~
- Least - disturbed
- Best Attainable (Using SPARTA)

*Stoddard et al. 2006

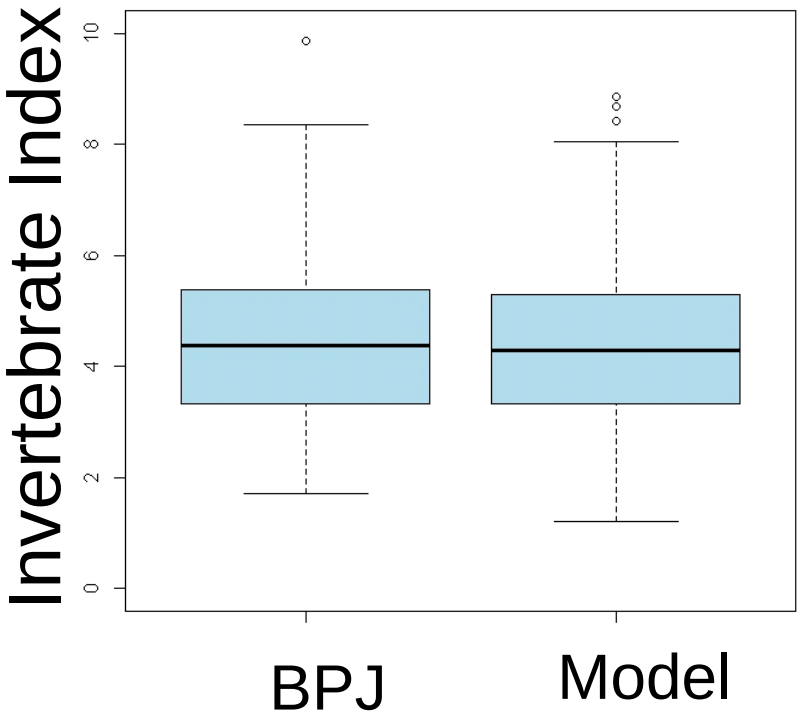
1. Reference Sites Selection

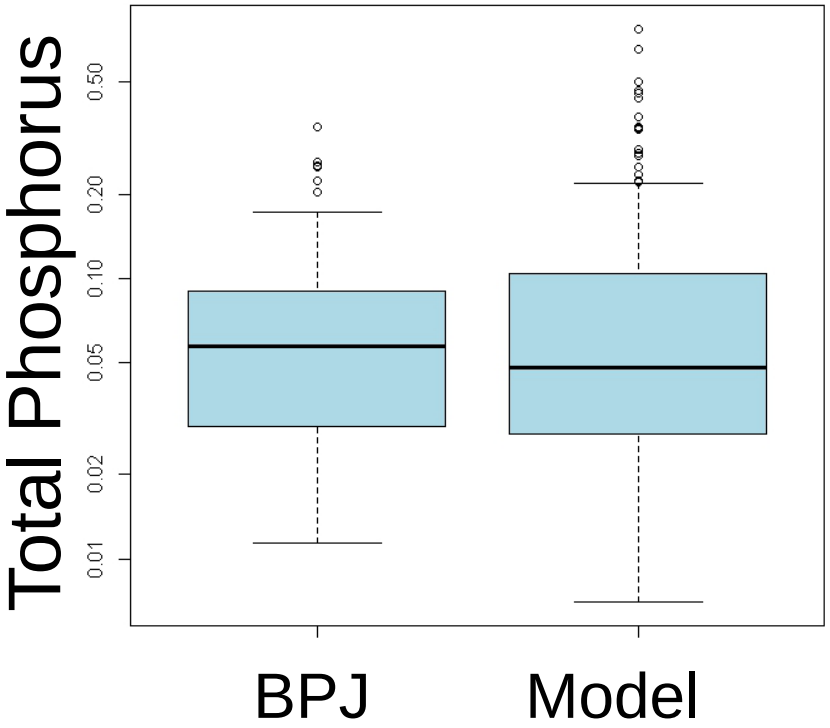


- **2003** & **2007** BPJ
- **2008** Model or BPJ
- **2009** Model

n = 338 sites

Comparison of BPJ and Model-Selected Reference Sites Data



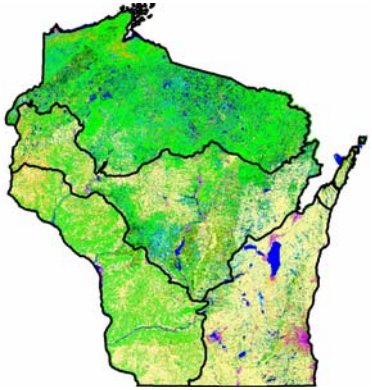


BPJ sites: n = 99
Model sites: n = 239

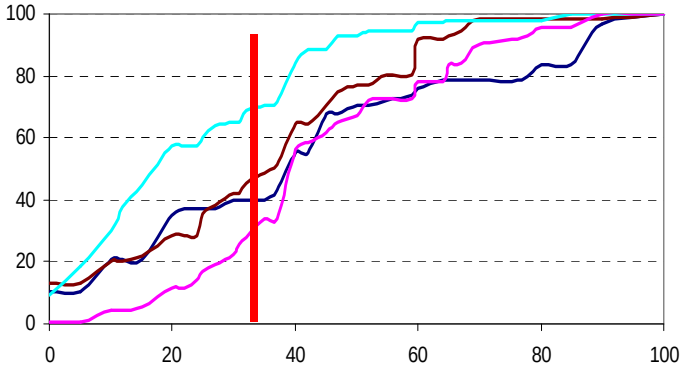
Follow NRSA Template in Wisconsin

(**cartoon**: do not cite or quote)

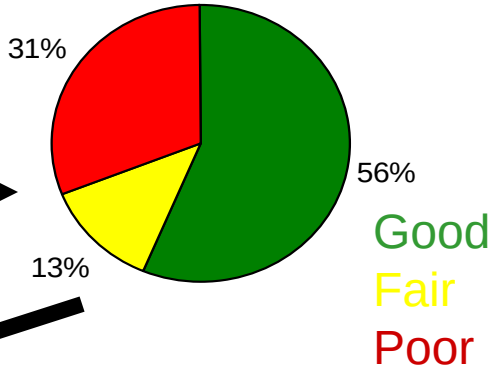
Stratify



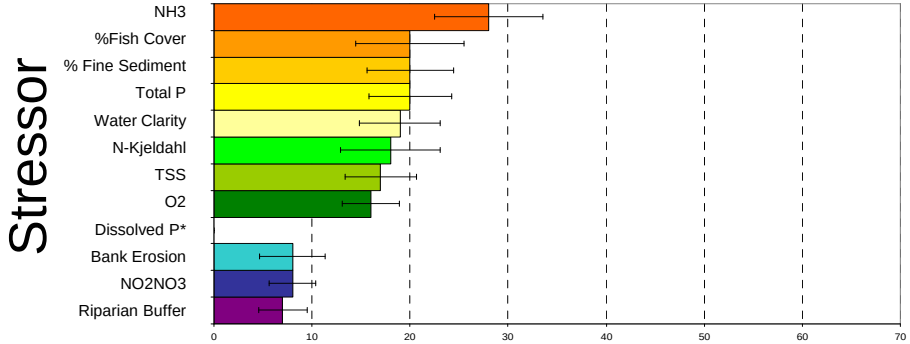
CDF Plots



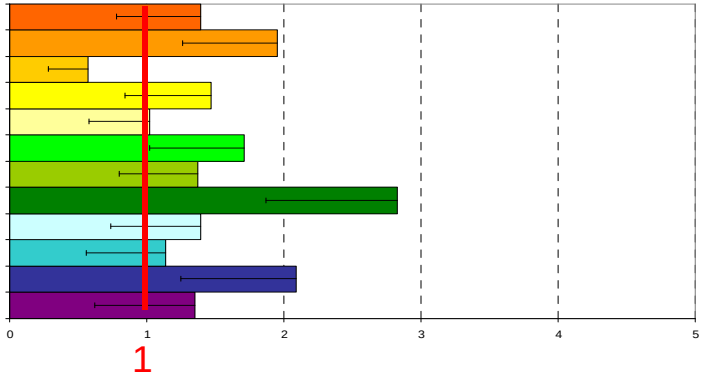
Statewide Proportions



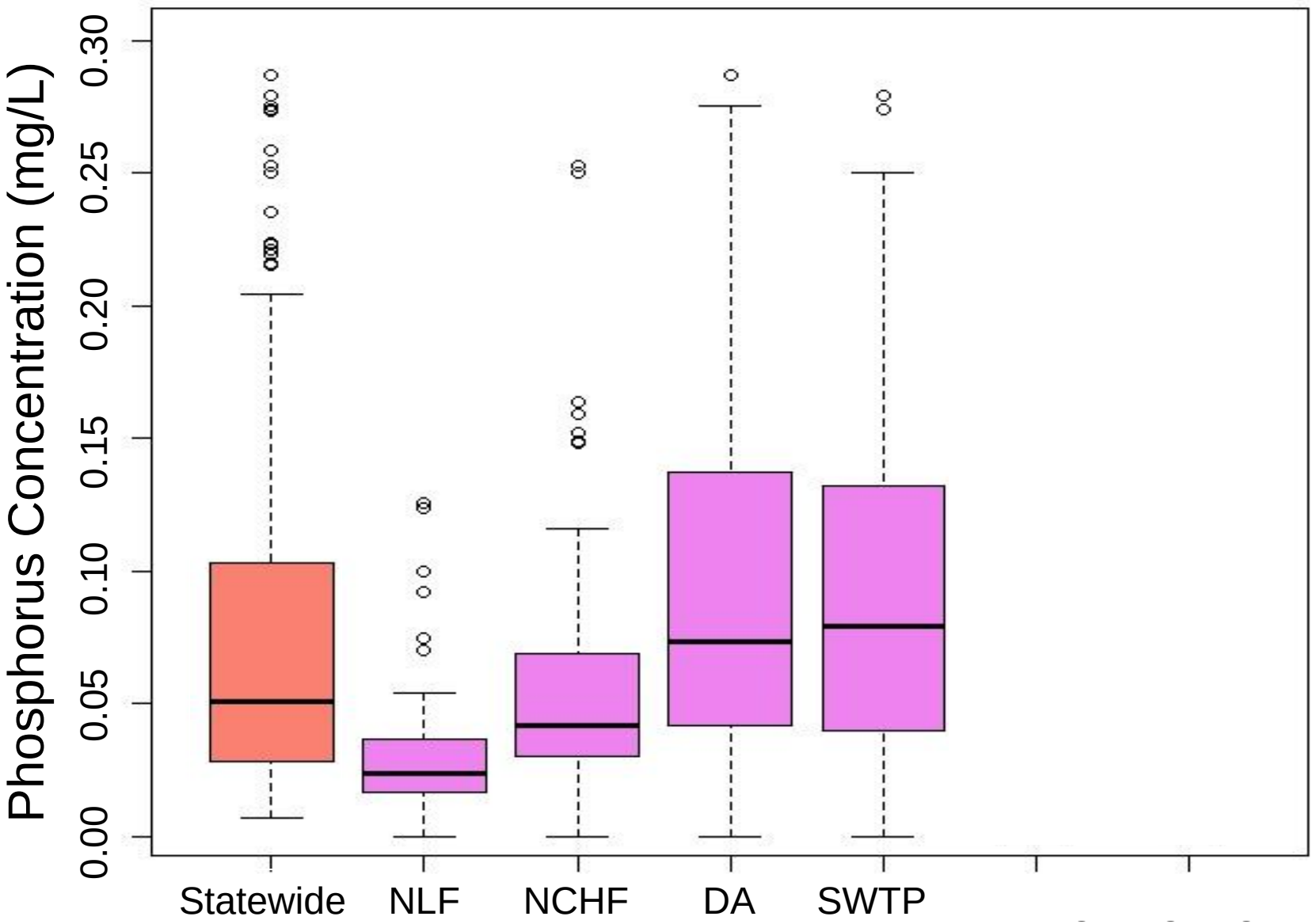
% Stream Mi. Impaired



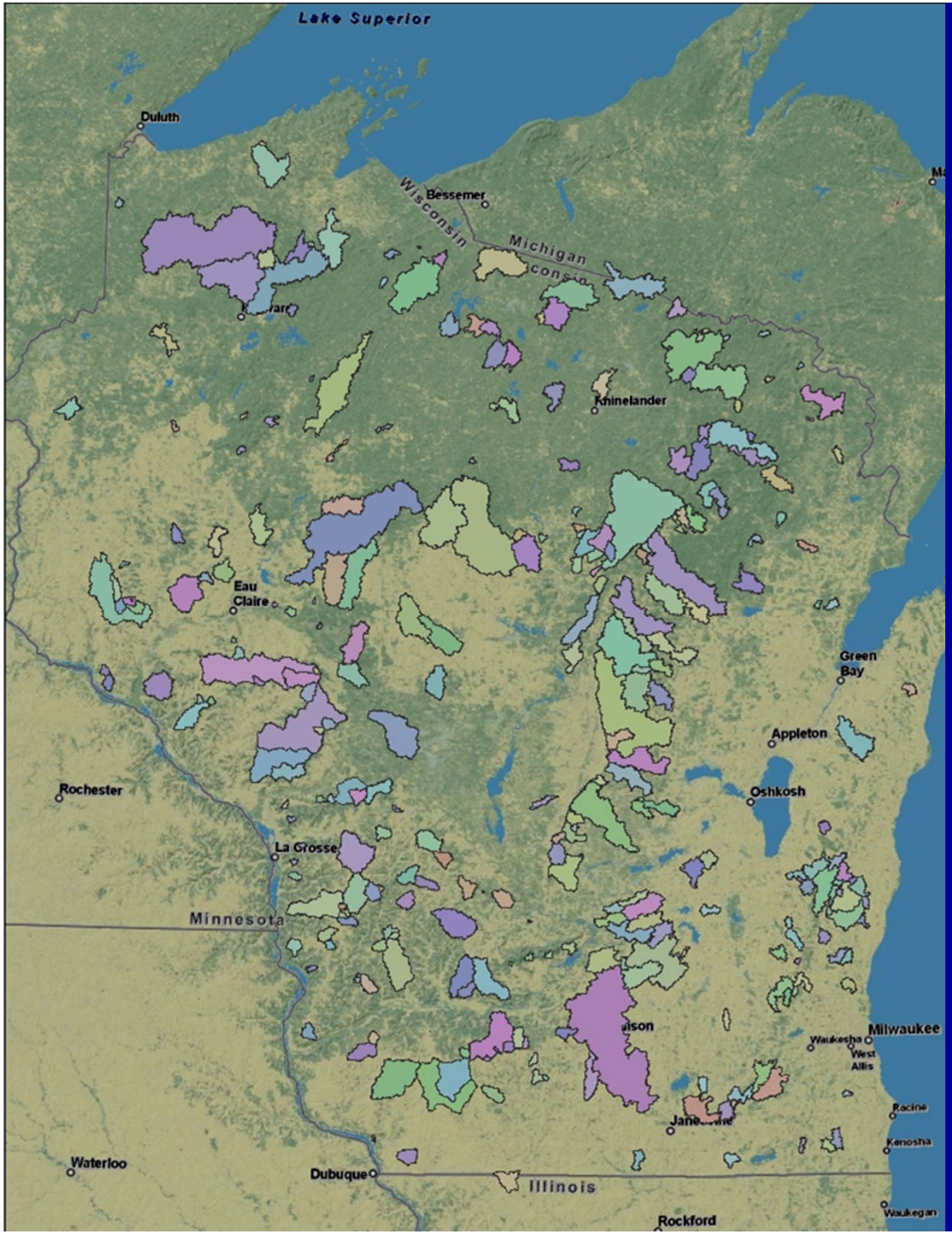
Relative Risk



Classification Iterations (e.g. Phosphorus)



Classification Method – *a priori* by EPA ecoregions



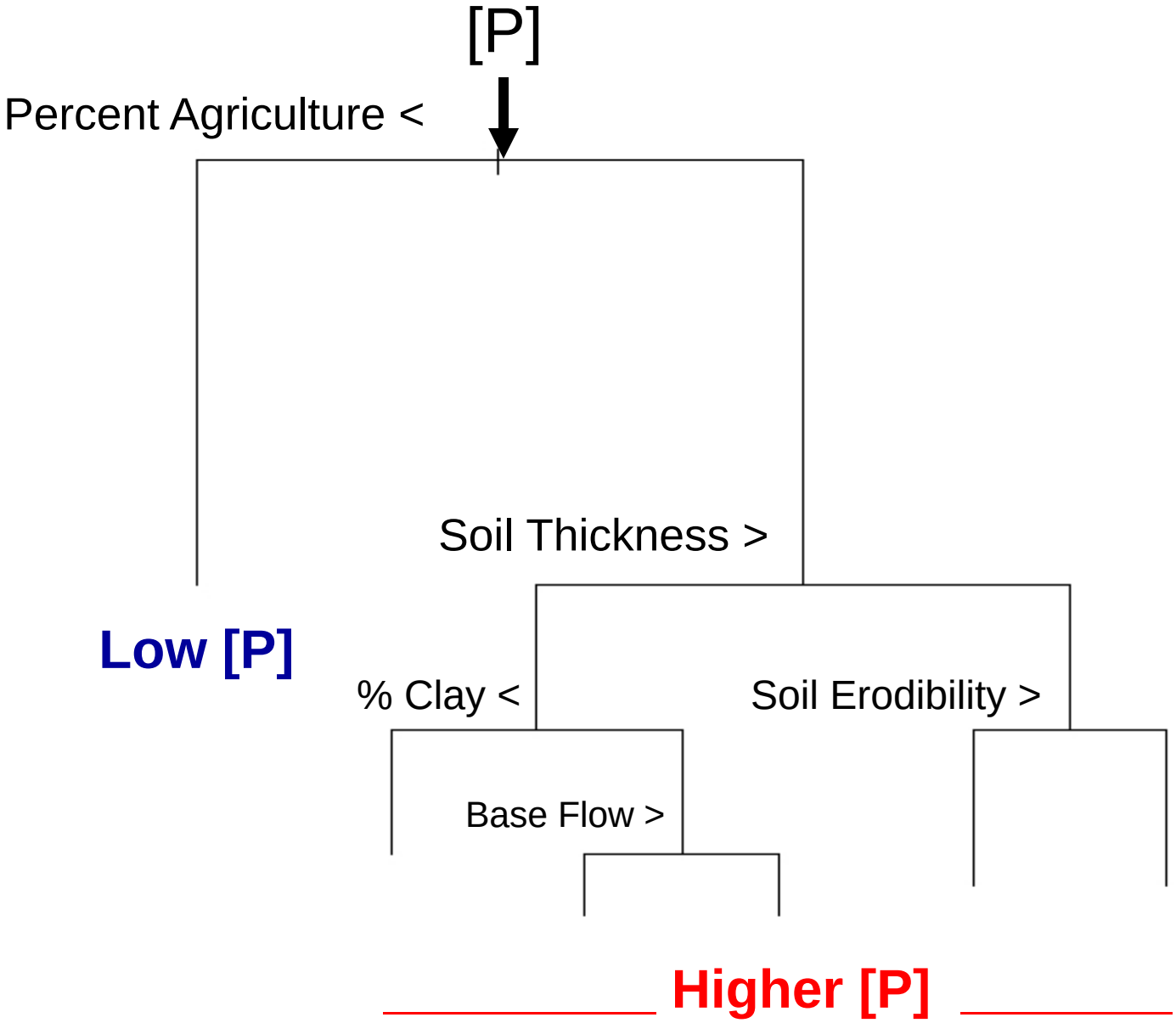
Classify using Watershed Explanatory Variables in **CART**:

- Climate
- Geology
- Land Cover
- Hydrology
- Chemistry
- Stream Physical features

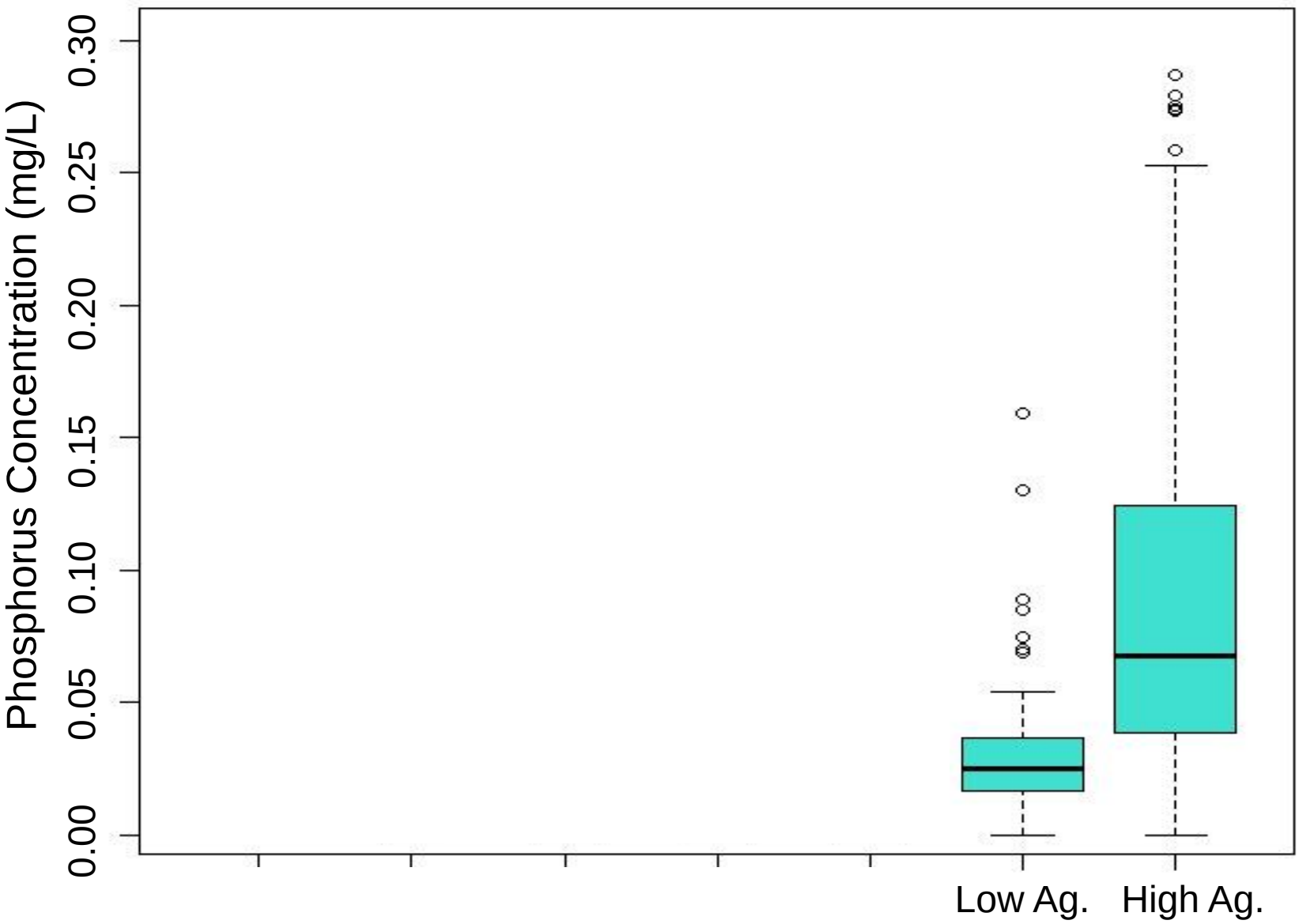
n = 25 watershed parameters

Percent Agriculture - Primary Driver for [P]

(other response variables as well)

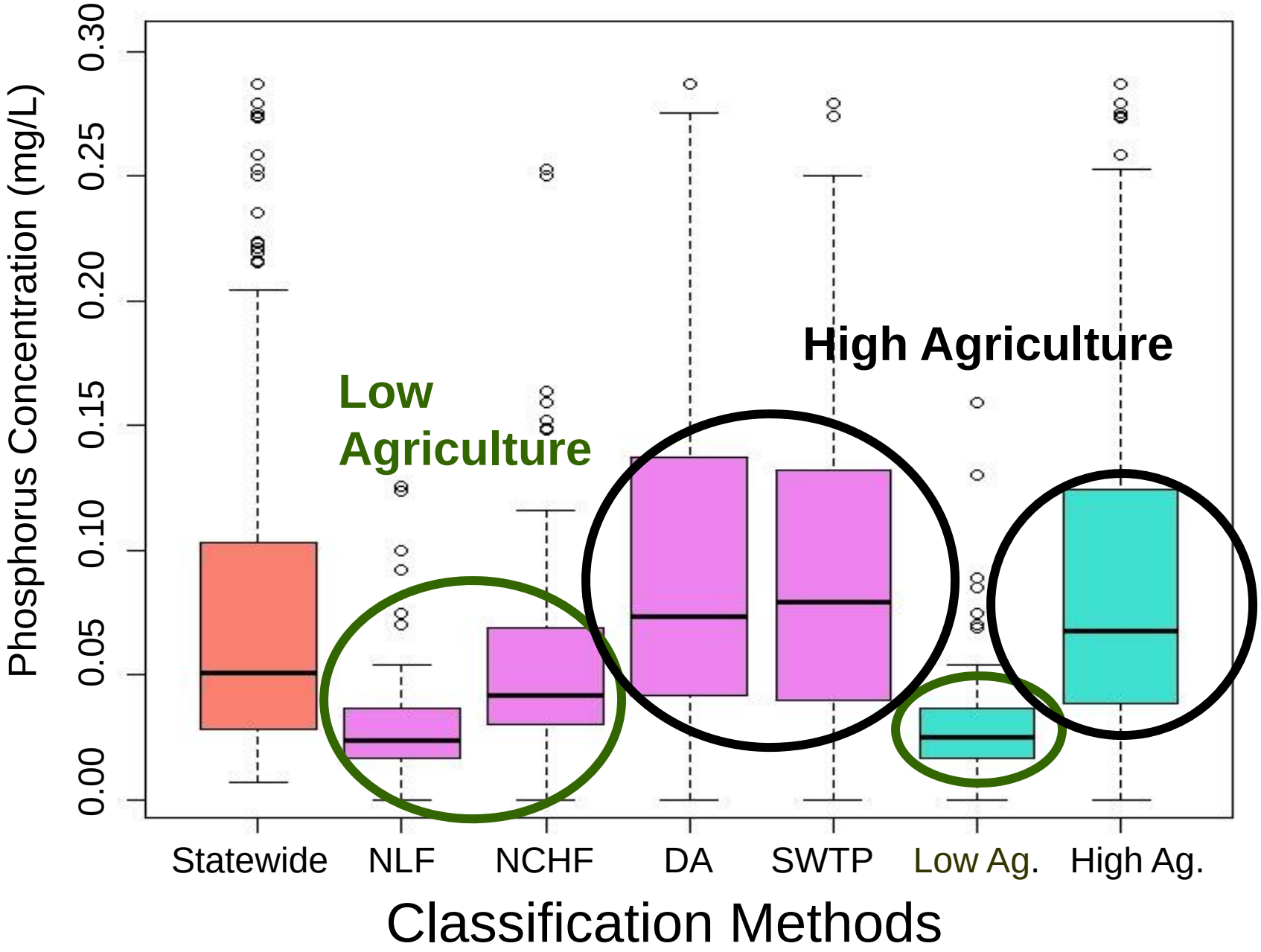


Classification Iterations (e.g. Phosphorus)

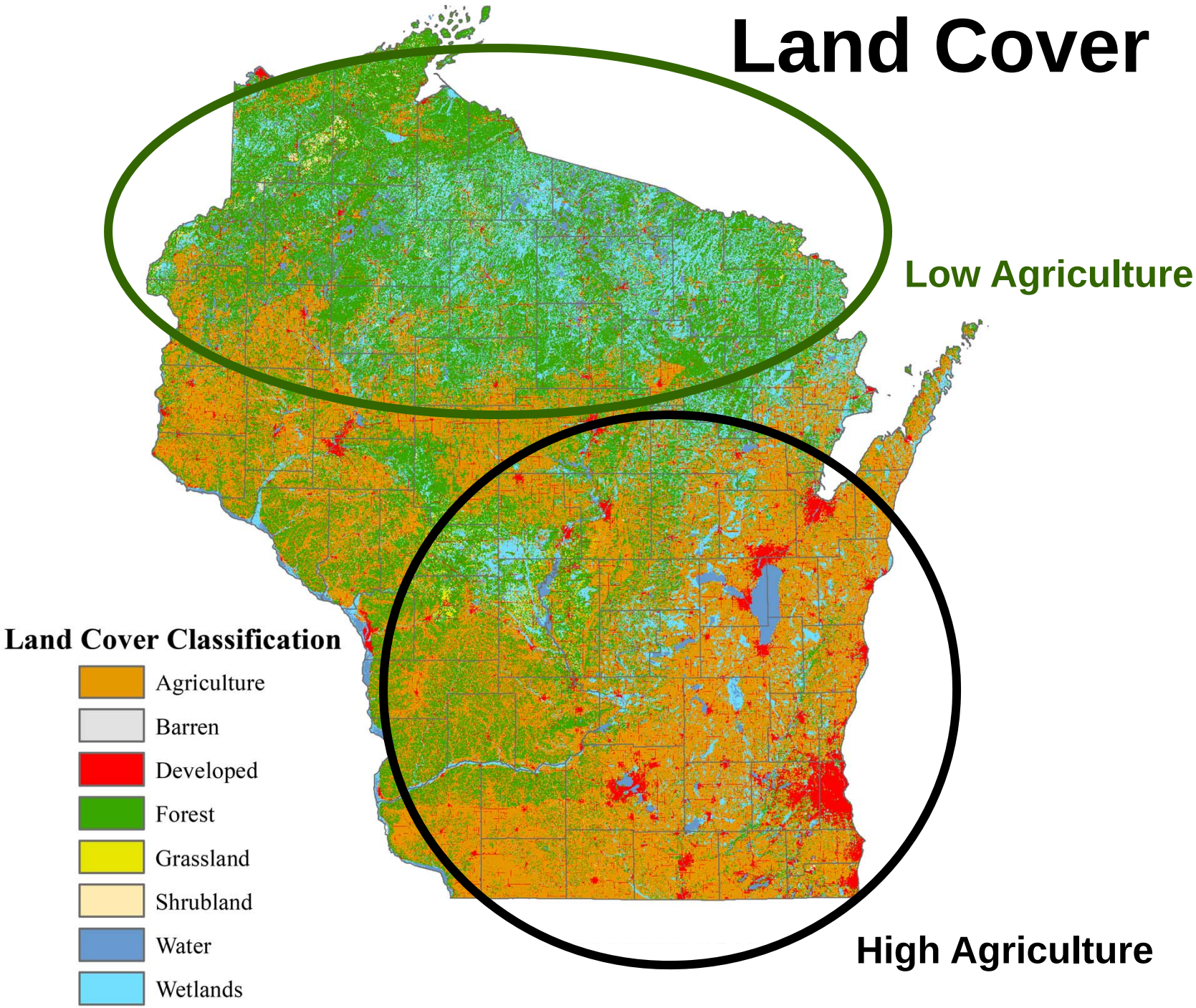


Classification Method - CART

2. Classification Confounded by Disturbance



Land Cover

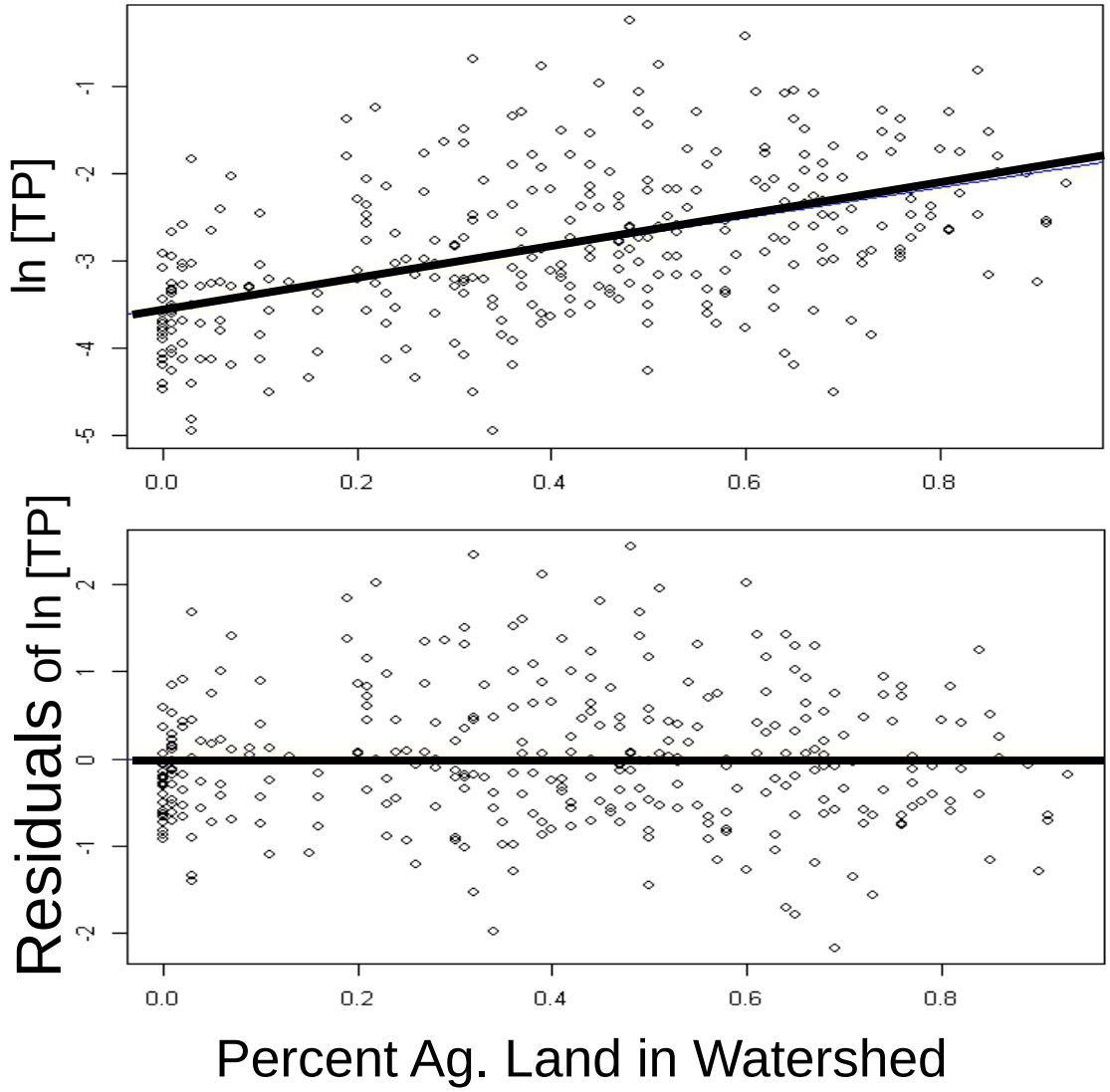

Low Agriculture
High Agriculture
Land Cover Classification
Agriculture
Barren
Developed
Forest
Grassland
Shrubland
Water
Wetlands

3. SPARTA*

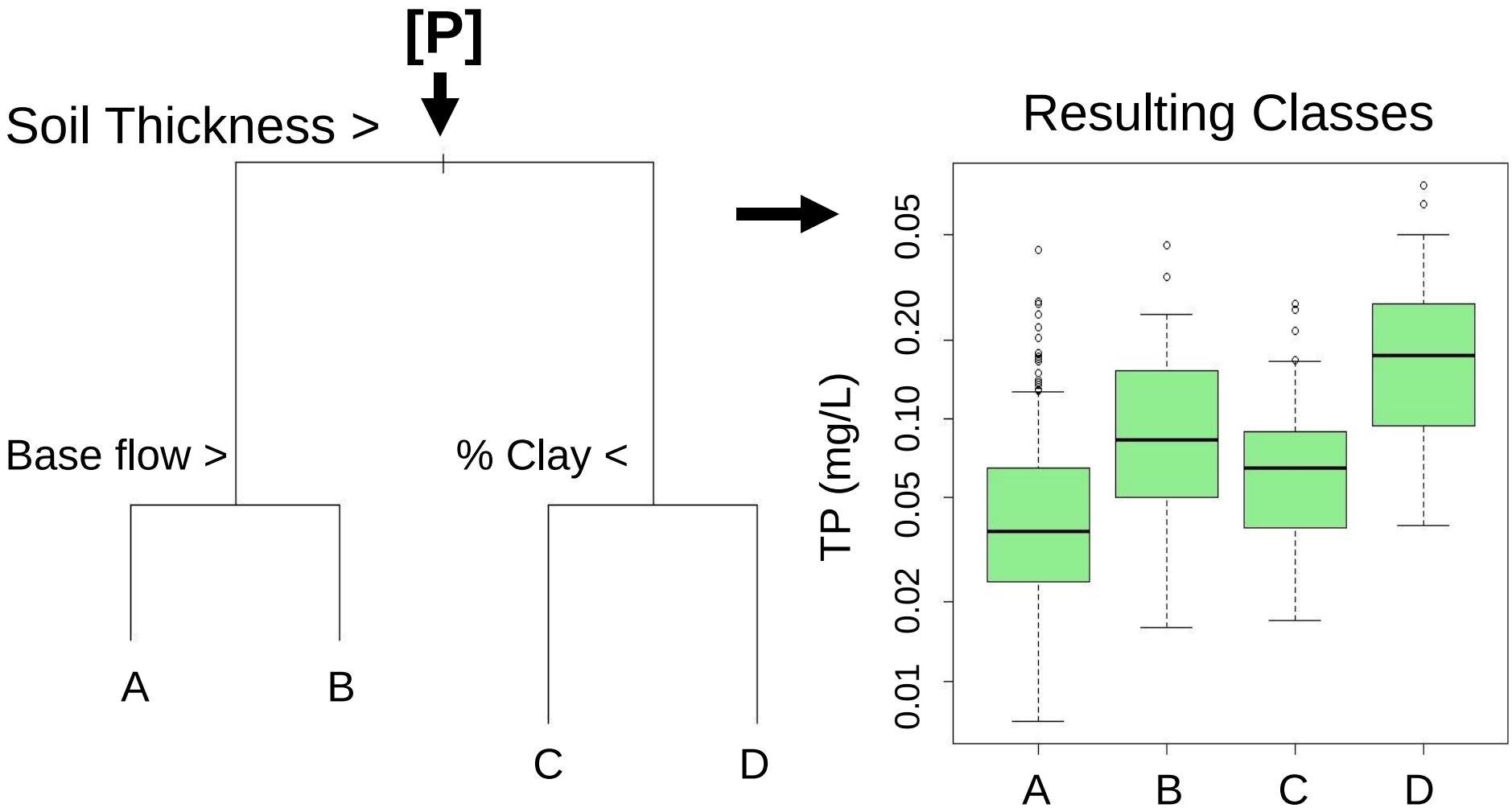
- Classify watersheds / streams using intrinsic non-anthropogenic factors
- Estimate Best Attainable Conditions

* Robertson et al. 2006

Residualize All Candidate Explanatory and Response Variables Influenced by Percent Agriculture



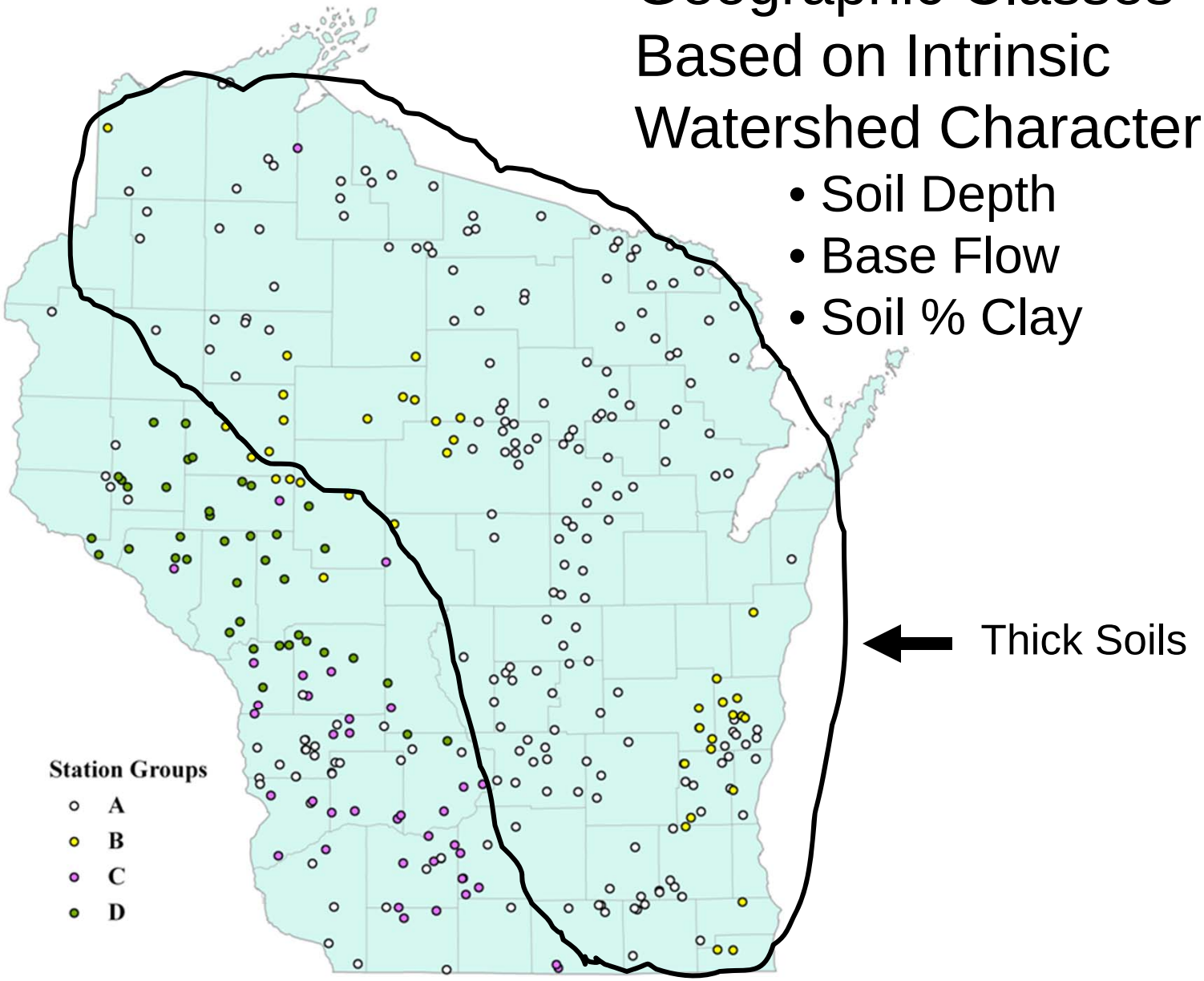
CART for e.g. phosphorus



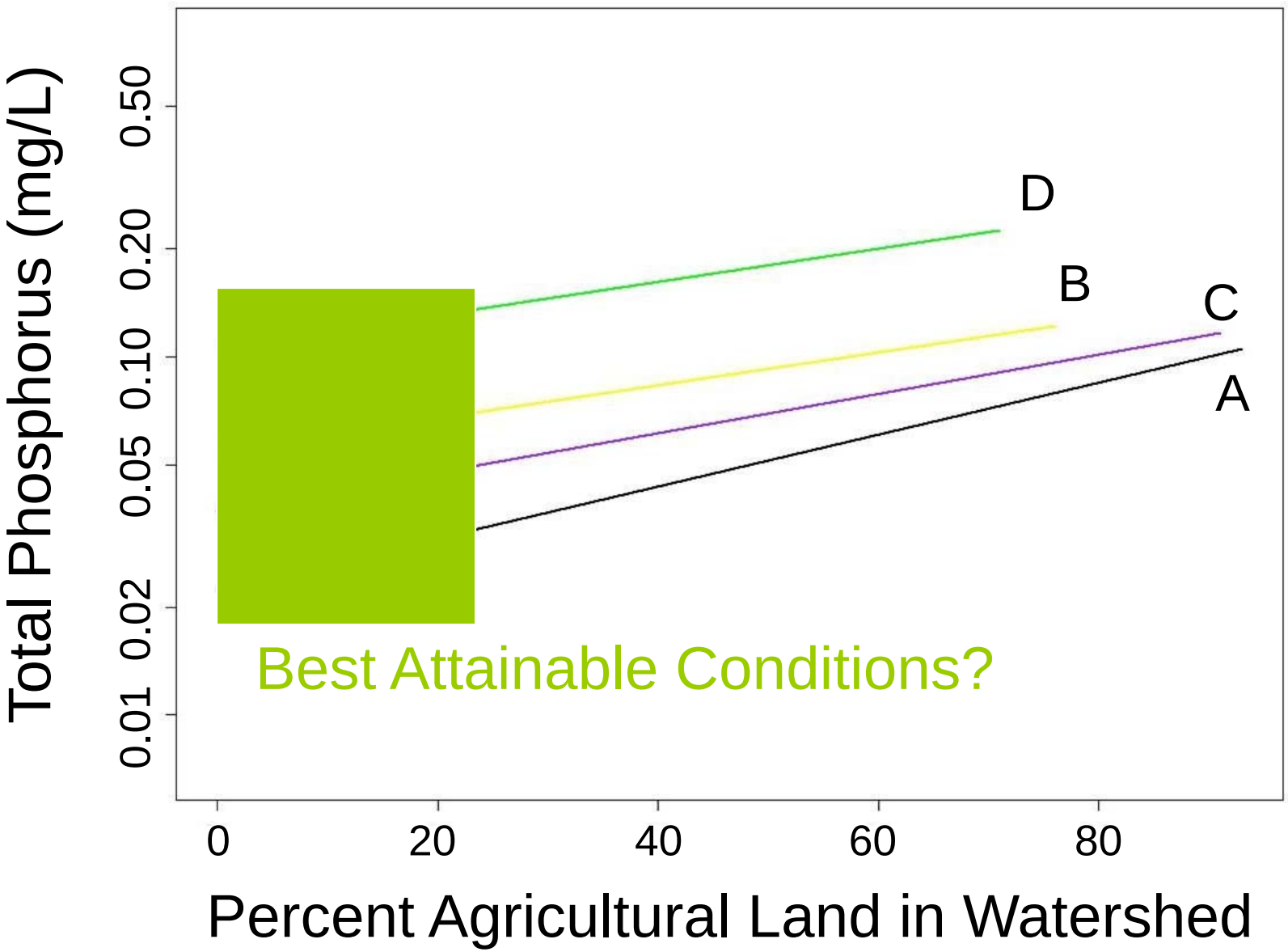
Residualized data is used to develop the stream classes, the values for the response variable of interest e.g. [P] are the measured stream values

Geographic Classes Based on Intrinsic Watershed Characteristics

- Soil Depth
- Base Flow
- Soil % Clay



SPARTA Classes – [P] Example



Summary:

1. Least-disturbed stream sites sampled
2. Land disturbance influenced classification
3. SPARTA being applied to dataset

Next Steps:

1. Fill-in geographic reference site gaps

2. Run SPARTA on all key stream condition measures (including % urban land use)

3. Develop Best Attainable Conditions for key measures of stream health

Questions?