

# Nitrogen Removal in Agricultural Watersheds: Ecological Interactions Associated with Forested and Agricultural Headwater Streams

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# Why are we concerned with nitrogen removal in these systems?

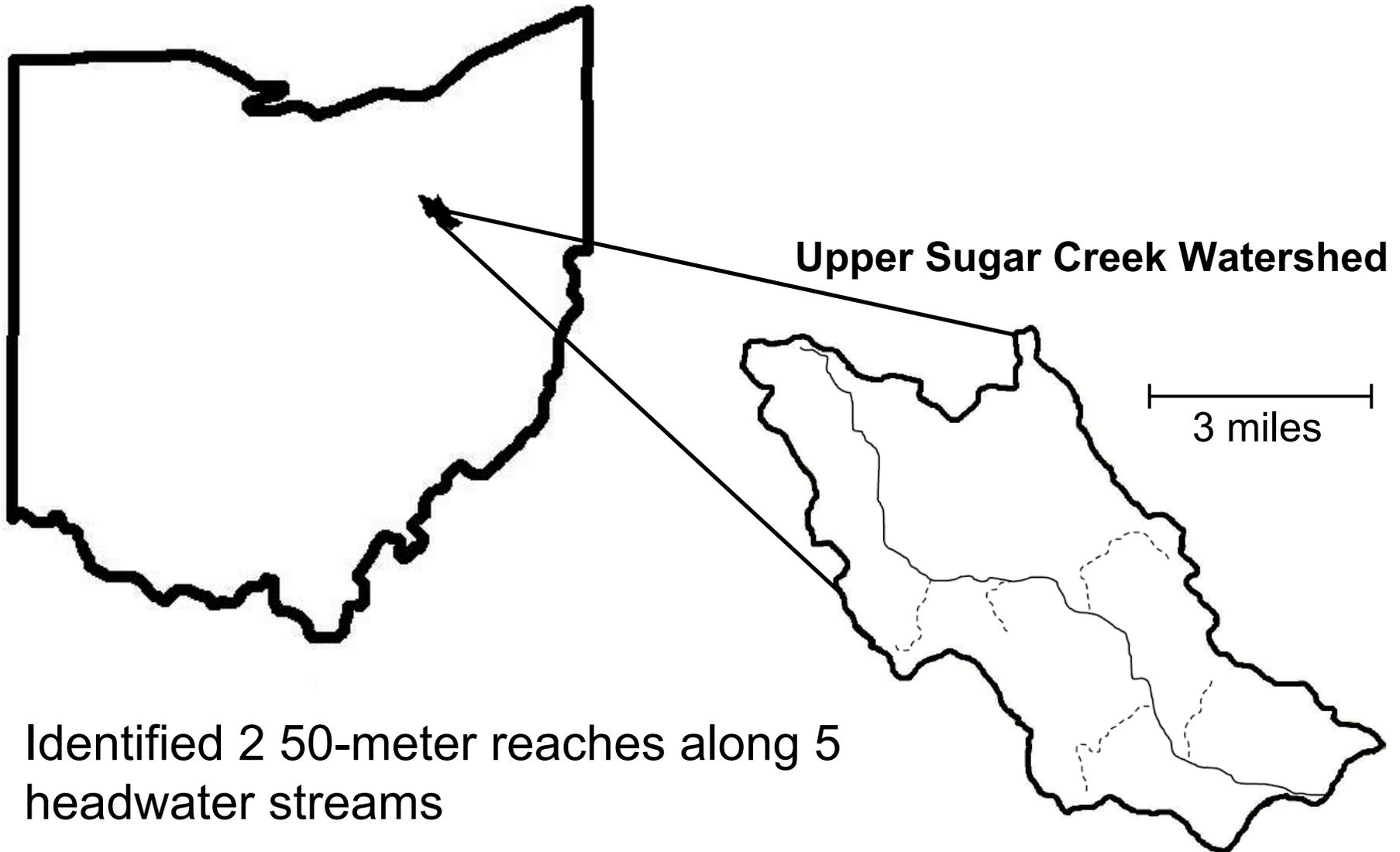
- Human Health Concerns (direct and indirect)
- Ecological Impacts (hypoxia)
- Disparity in the literature...how well do these systems remove nitrogen?

# Objective

- Determine what controls nitrogen removal in agricultural headwater streams



1. Riparian land use
2. Enzymatic effects (temp,  $\text{NO}_3^-$ , Org C)
3. Hydrology (Q, depth, residence time, transient storage, etc.)



**Upper Sugar Creek Watershed**

3 miles

- Identified 2 50-meter reaches along 5 headwater streams
  - One reach is in agricultural/urban land use
  - The other reach is in forested land use

# Methods



- Sediments collected randomly and homogenized for each reach
- Denitrification measured with  $C_2H_2$  inhibition on slurries
- N and P measured with Lachat Quikchem 8500
- DOC measured on Rosemont-Dohrmann Carbon Analyzer
- Rhodamine WT slug injections were run for each reach to measure residence time and yield breakthrough curves
- OTIS-P was used to calculate dispersion and storage area on breakthrough curves

# RDA

Monte Carlo p value = 0.0010  
Variance Explained = 60%

Depth:Residence Time

Depth

Discharge

Uptake Velocity

Transient Storage

Loss Rate

NO<sub>3</sub><sup>-</sup>

Temperature

Carbon

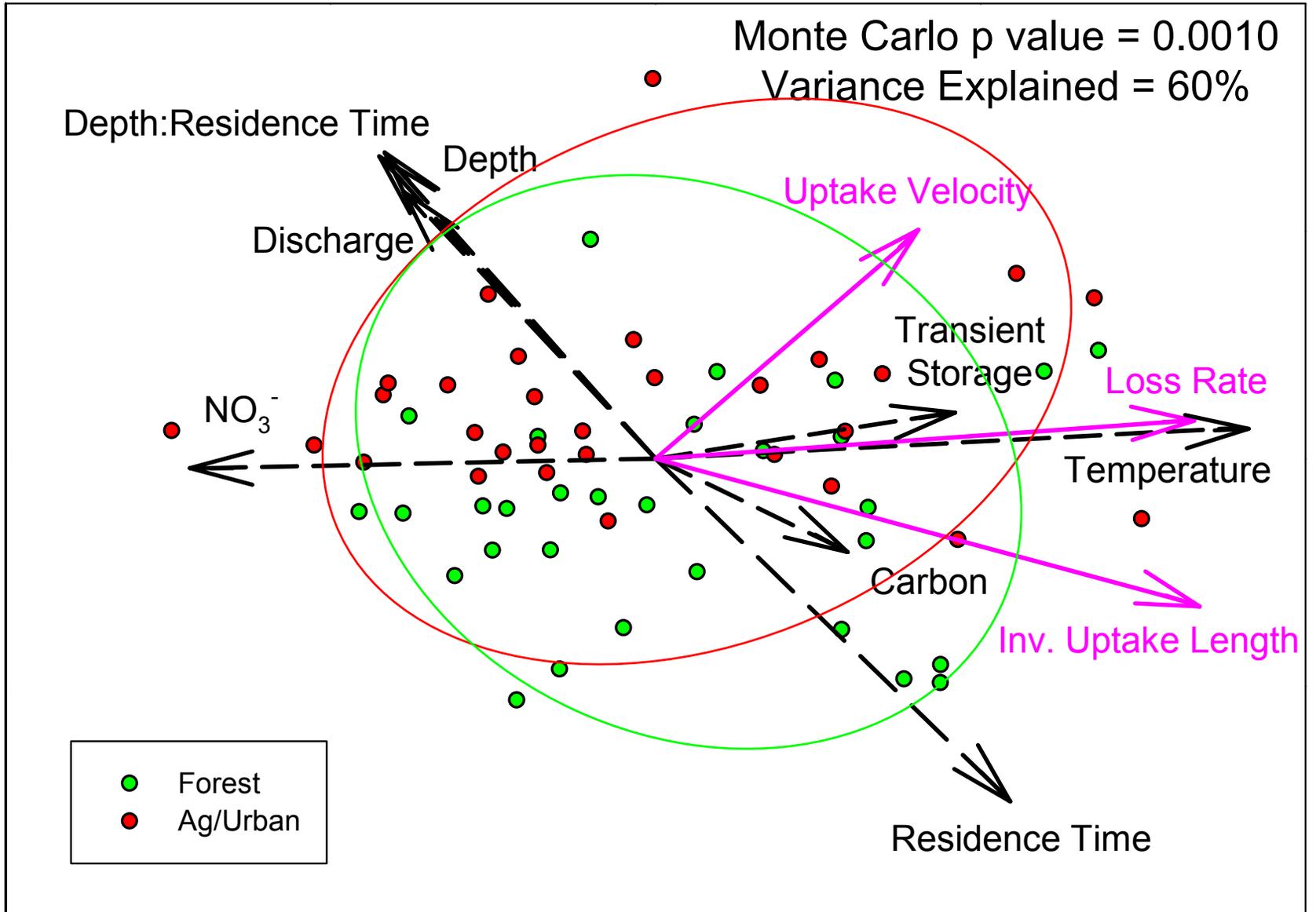
Inv. Uptake Length

Residence Time

- Forest
- Ag/Urban

Axis 2 (11.1%)

Axis 1 (48.7%)



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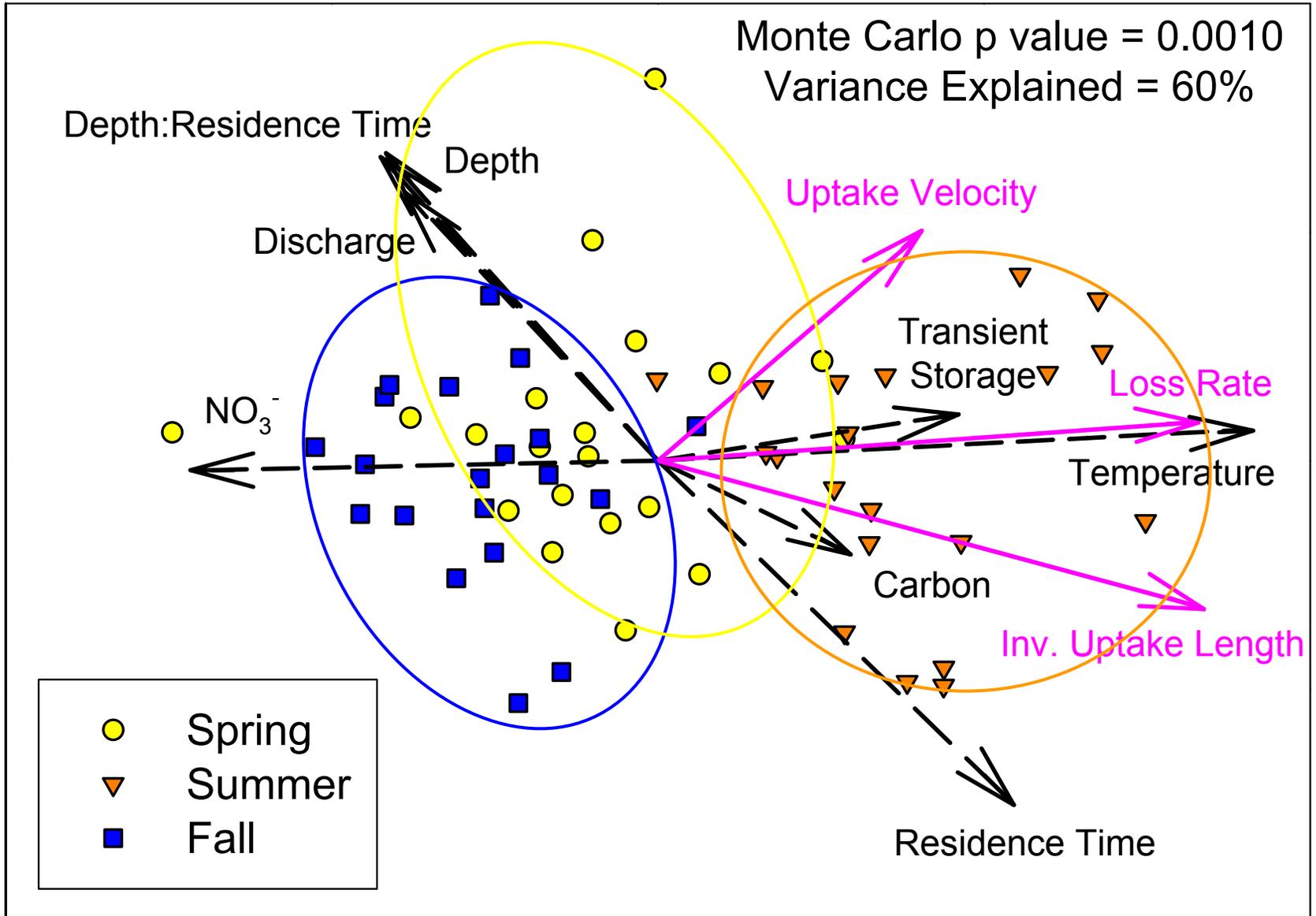
Inv. Uptake Length

Residence Time

- Spring
- ▼ Summer
- Fall

Axis 1 (48.7%)

Axis 2 (11.1%)



# Conclusion

- Nitrogen removal in agricultural headwater streams is low and is significant only during brief periods in summer

