

*Reevaluating the consequences of land use:
accelerated dissolution of geologic phosphate
deposition in humic lakes*

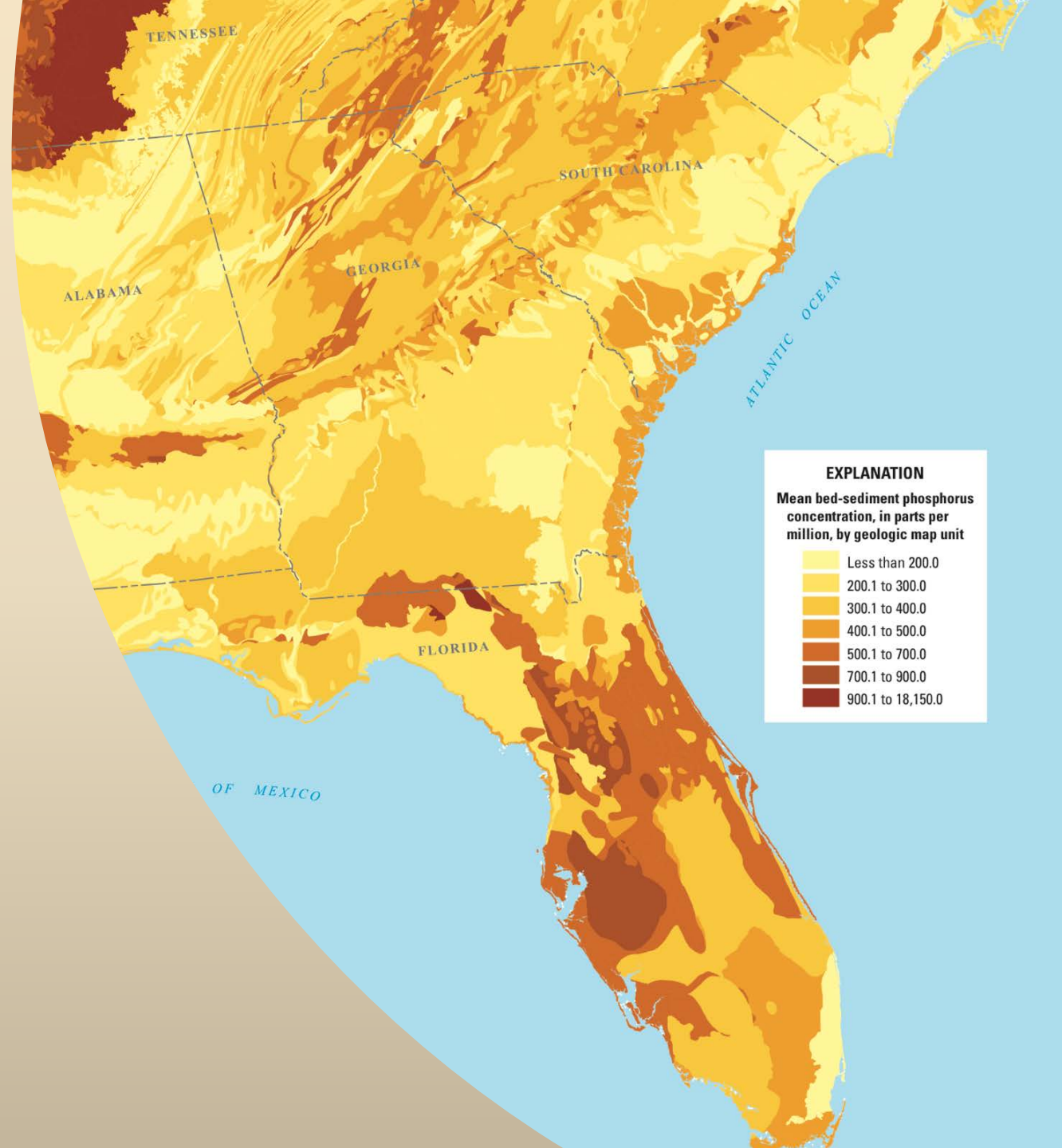
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12th International Symposium on Biogeochemistry of Wetlands

Geologic phosphate in Florida

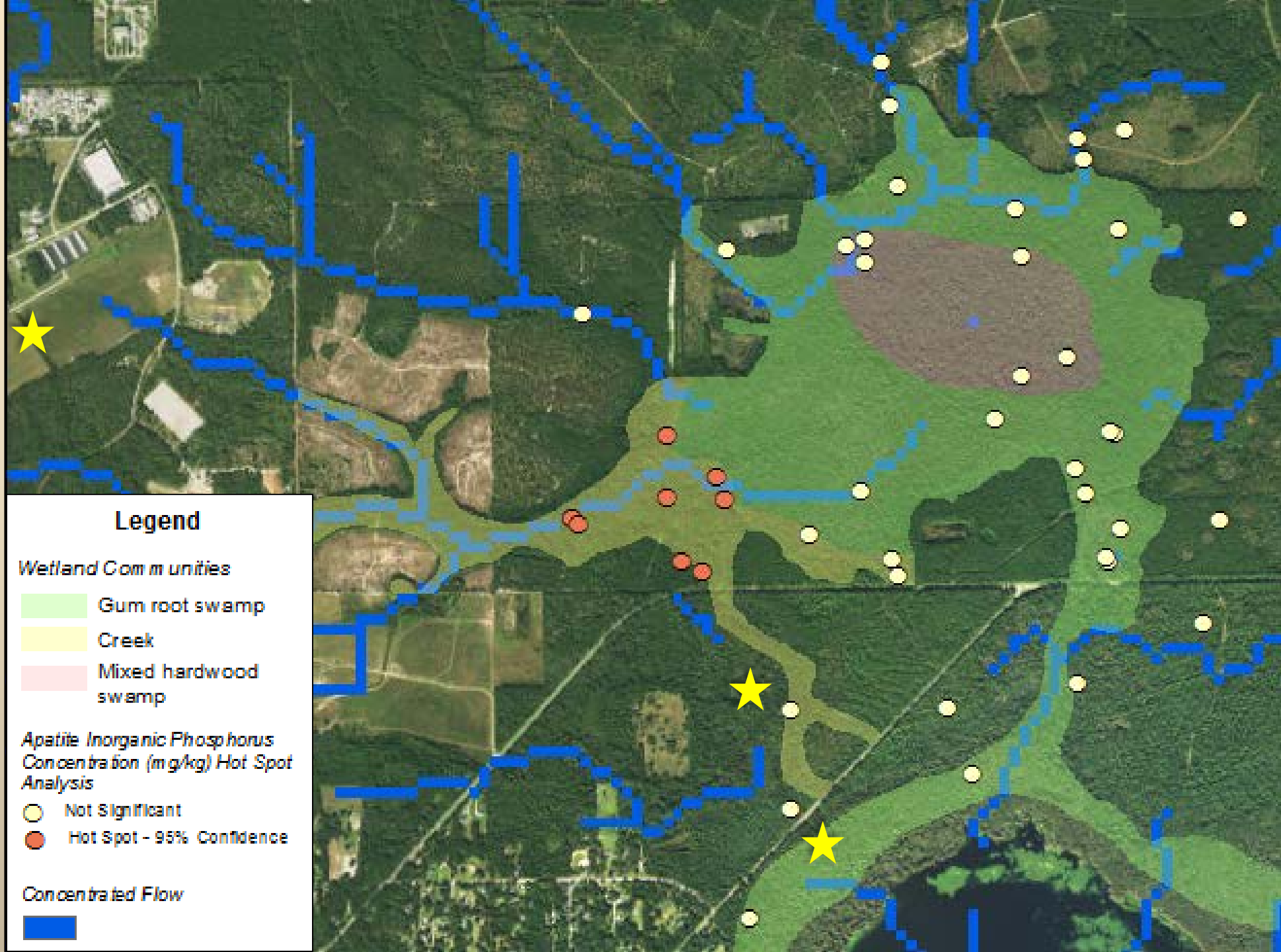
- Covers ~ 19% of Florida
- Exposed and transported to varying degrees
- How does geologic phosphate impact water quality?



Newnans Lake Watershed Case Study

- Close proximity to the Hawthorn Group
- Hypereutrophic
 - Impaired for TN and TP
- “Urban stream syndrome”
 - Flashy hydrograph
 - Elevated nutrients
 - Altered geomorphology





Legend

Wetland Communities

- Gum root swamp
- Creek
- Mixed hardwood swamp

Apatite Inorganic Phosphorus Concentration (mg/kg) Hot Spot Analysis

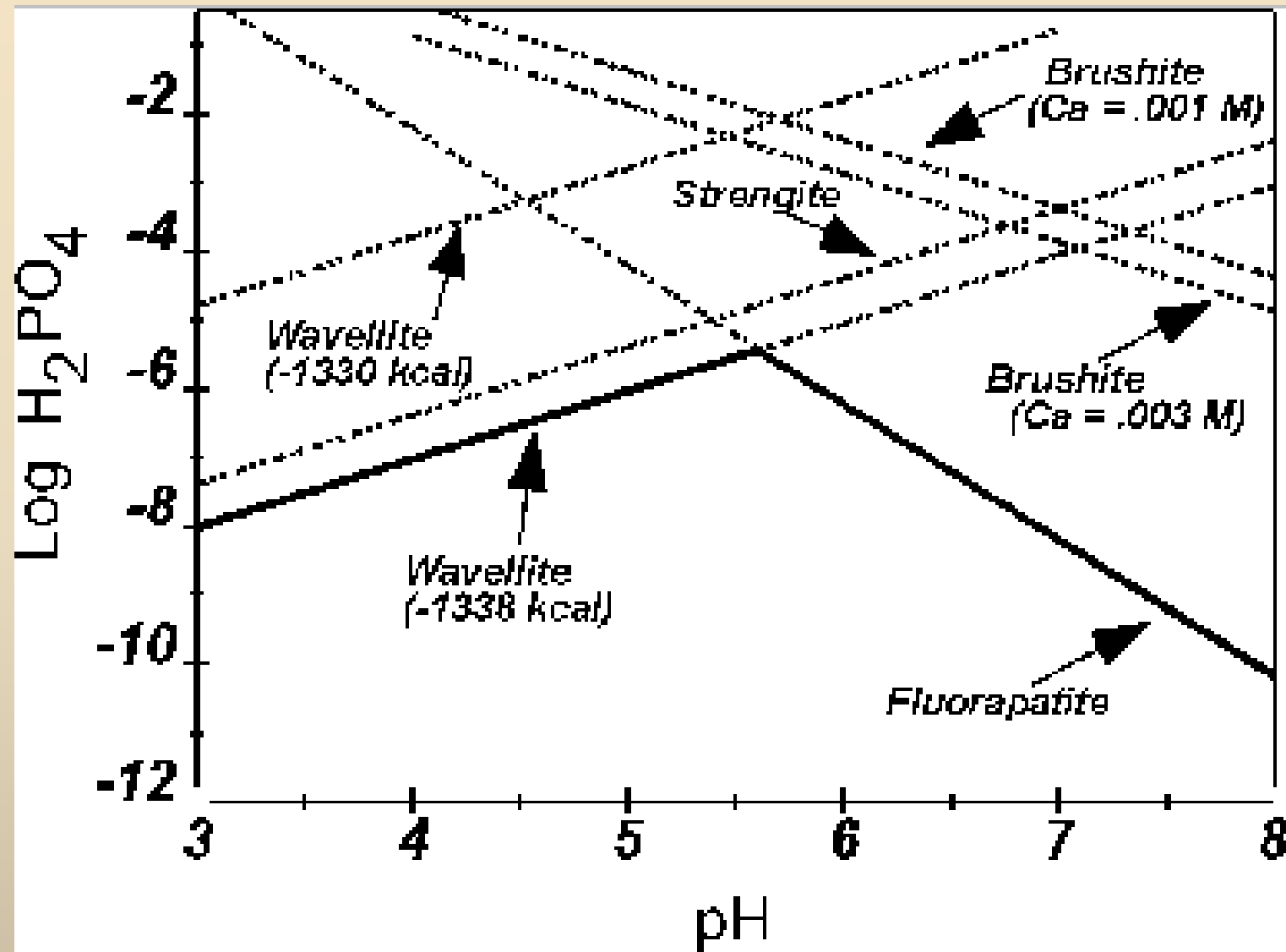
- Not Significant
- Hot Spot - 95% Confidence

Concentrated Flow

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Research Objectives

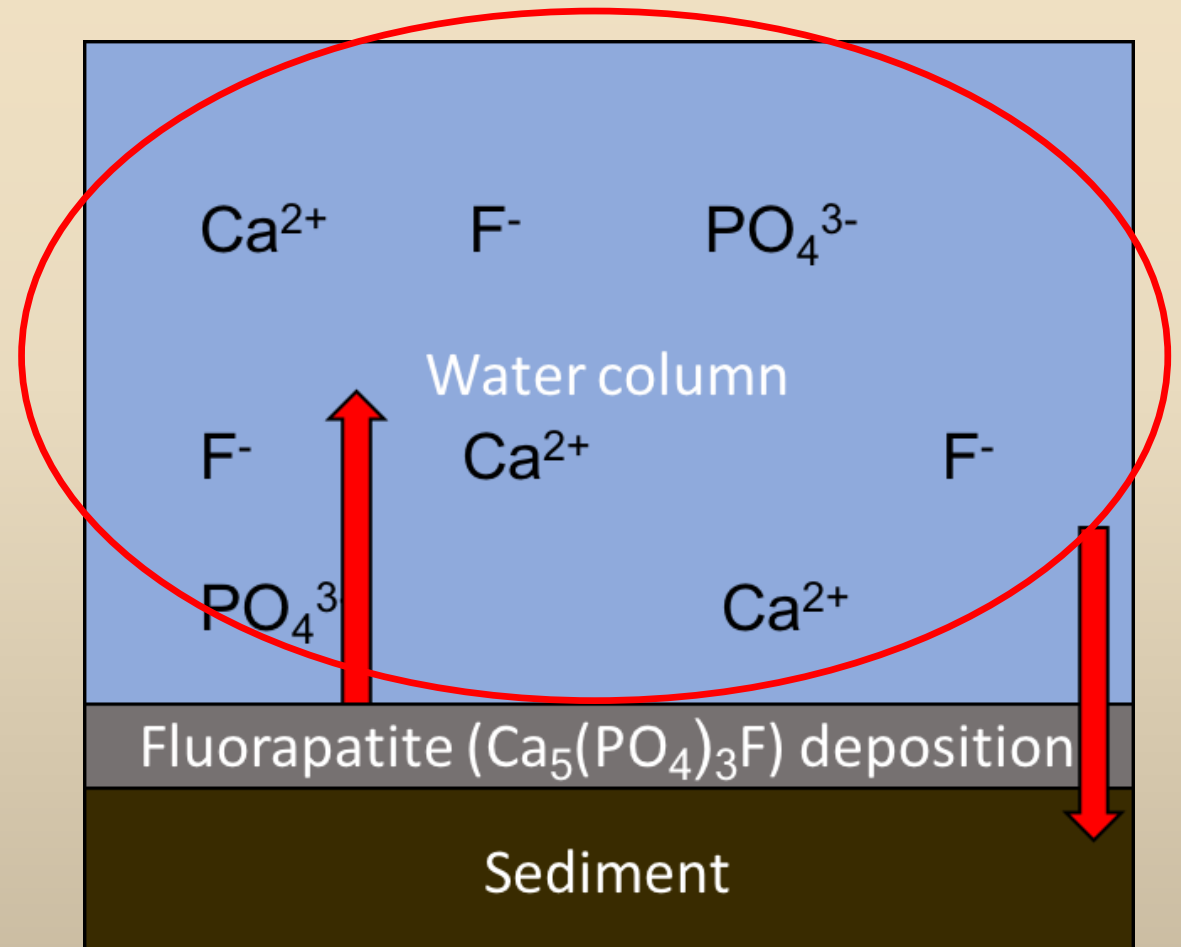
- If geologic phosphate is delivered to humic water bodies, what does mineral dissolution look like under natural conditions?
- What does geologic phosphate dissolution in humic waters mean for nutrient budgets and water quality?

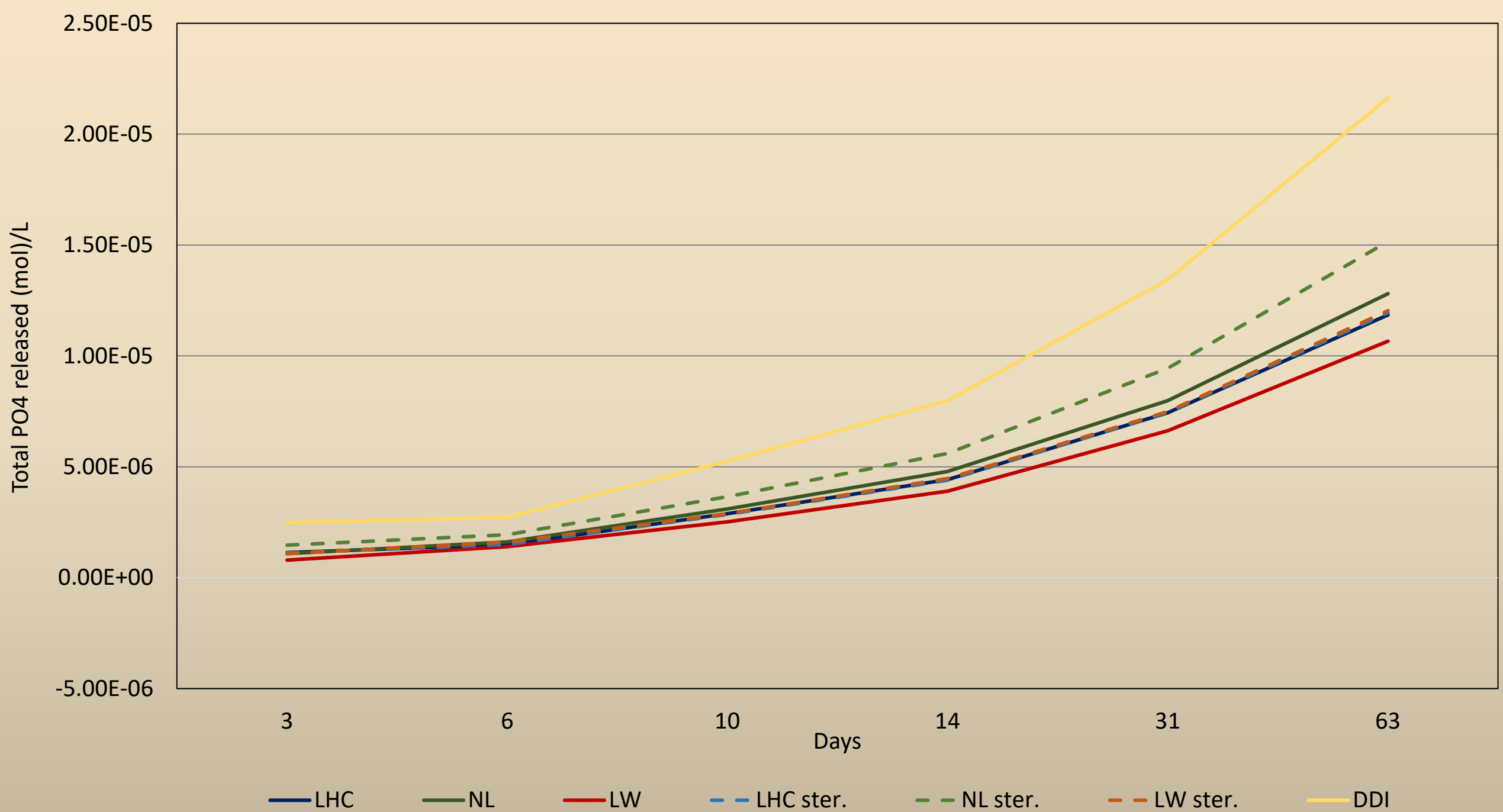


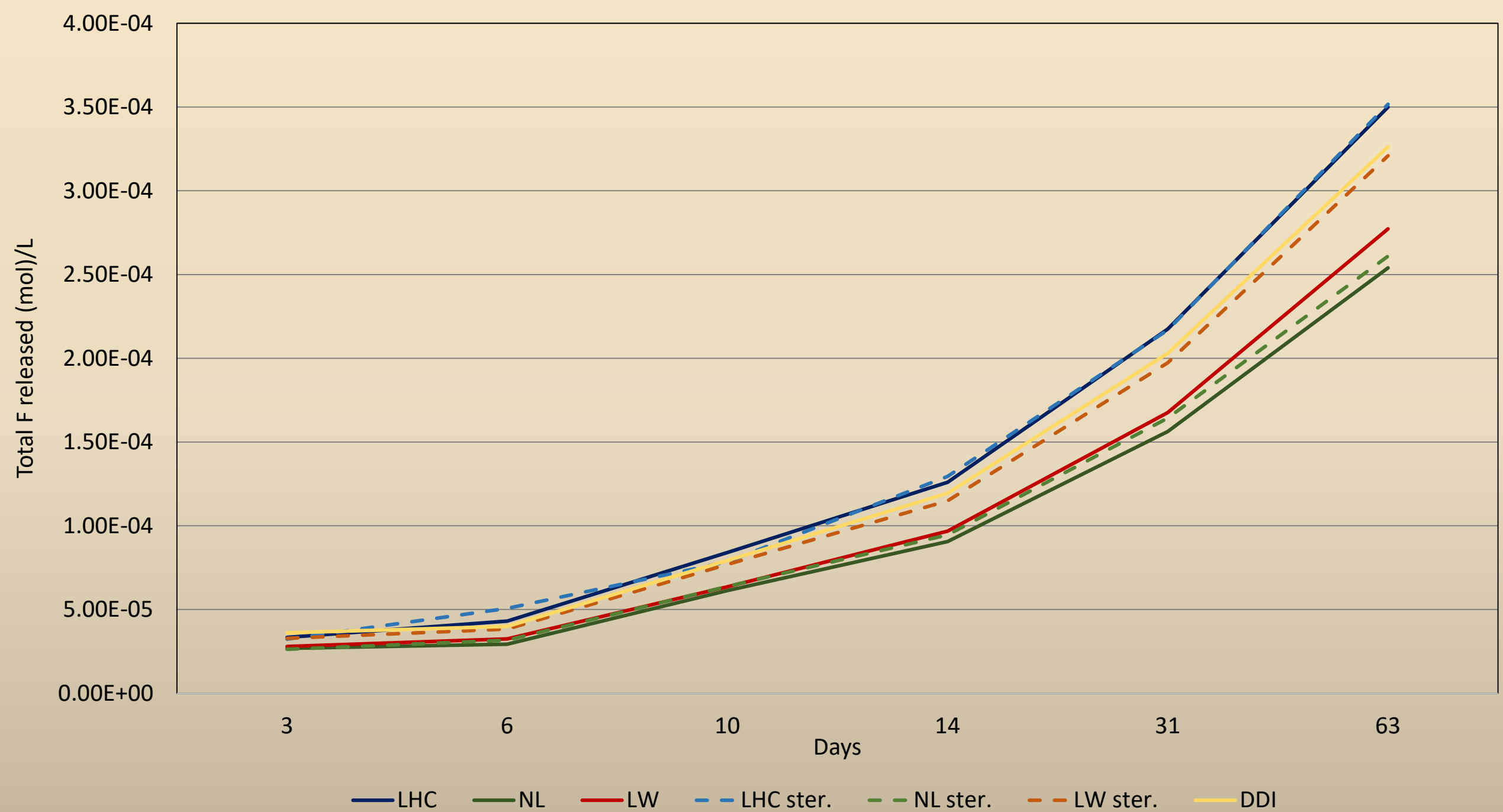
Source: Harris adapted from Lindsay et al., 1989

Geologic phosphate dissolution

- Do dissolution studies ~ concentrations under natural conditions?
- A lot more players than when dealing with DDI
- Does typical pH in humic waters allow for dissolution?

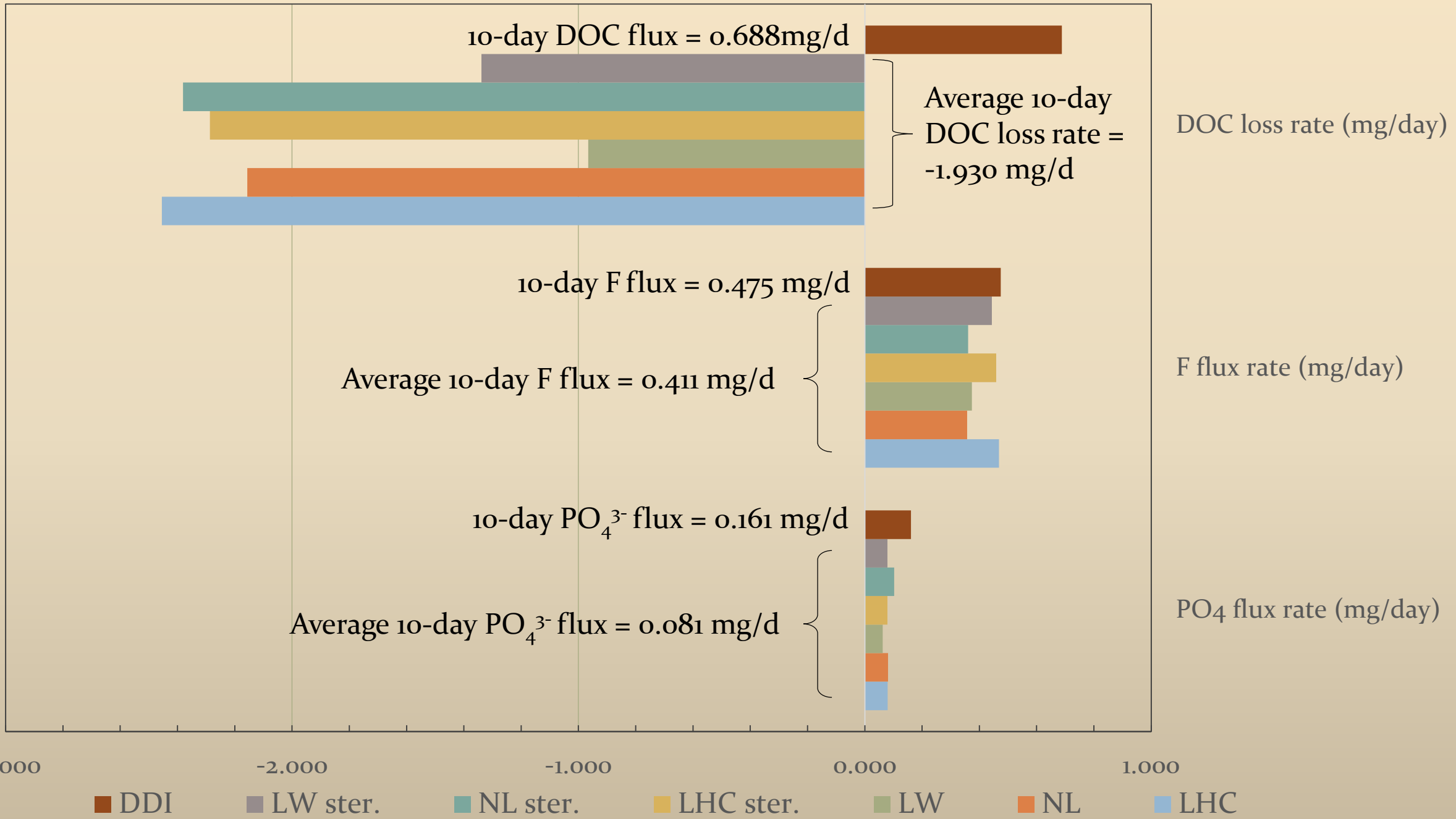






Dissolution conundrums

- $\text{Ca}_5(\text{PO}_4)_3\text{F}$
- Natural waters do not release PO_4^{3-} stoichiometrically...
 - Average $\text{PO}_4^{3-} : \text{F}$ ratio at days 10, 14, 31, 63 = 0.04
- But neither does DDI
 - $\text{PO}_4^{3-} : \text{F}$ ratio at days 10, 14, 31, 63 = 0.07
- Secondary mineral formation/precipitation?



Impacts to water quality

- Yearly PO_4^{3-} flux based on 10-day flux values: 1,923 kg/yr
 - 0.0002 g/m²/yr
- Actual flux depends on spatial extent of fluorapatite distribution across lake (engineering estimates of sediment transport ~ 311 tons/yr)
- Water quality improvement projects should focus on reducing geologic phosphate erosion and transport as well as continuing to reduce TN

Take-home message

- Geologic phosphate can be transported to humic lakes, especially in developed basins or those with earth-moving/exposure activities close to the Hawthorn
- Geologic phosphate is not stable in humic lakes, but equilibrium concentrations are likely less than in experiments with DDI
- There is the potential for tremendous implications to water quality, depending on the spatial extent of fluorapatite in lake bottoms

Questions?



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