Phosphorus Forms at Different Spatial Scales in The Lower Fox River Sub-Basin

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Lower Fox River Watershed Monitoring Project

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The Lower Fox River Watershed Monitoring Program

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Primary Goal

To better understand and predict the forms of phosphorus in agricultural watersheds to enhance management decisions and improve the usability and biological integrity of our water resources.
Presentation Outline

1. Effects of Phosphorus Loading
2. Phosphorus Forms
3. Description of Study Area
4. Apple Creek Phosphorus Forms Study
   - Background-Methods-Results-Conclusions
   - Multi-field Analysis with the Wisconsin P-Index
5. Conclusions
Why Care About P Loading?
How Can We Decrease P Loading?

- Riparian Buffers
- Grassed Water Ways
- Vegetative Filter Strips

- Decrease P in soils
- Decrease fertilizer use
Grassed Waterway – Apple Creek
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Why Care about P-Forms?

- Most Dissolved P is bioavailable
  - Bioavailable = Algae can consume and grow

- Particulate P can be transformed to bioavailable P in the stream

- Implications for Best Management Practices
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Apple Creek Watershed

- 117 km²
- 63% Agriculture
- 26% urban development
- Rapidly urbanizing southern section
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P-Forms Objectives

- Determine DP & TP concentrations and the DP fraction in streams at different scales
- Relate results to watershed characteristics (i.e. soils, topography, and land management)
- Apply Wisconsin P Risk Index to source areas and compare to water quality
P-Forms Methods
Monitoring Methods

- **Study Period**: 2004 – 2006

- **EVENT SAMPLING**: Targeted uniform precipitation events
  - Grab samples at 11 source area (0.2 to 2.3 km²) and 4 integrator sites (12 to 85 km²), at or near peak flow

- **Main stem USGS site**: Continuous discharge & automated sample collection (117 km²)

- **TSS, TP, and DP analysis** at Green Bay Metropolitan Sewage District Lab
Results

P-Forms Study
WY 2004-2006
Total Phosphorus (mg/L) – 2004 - 2006

Source Area Mean: 0.56 mg/L

Integrator Mean: 0.43 mg/L
Dissolved Phosphorus (mg/L) – 2004 - 2006

Source Area
Mean: 0.21 mg/L

Integrator Mean:
0.18 mg/L

Max. 5.51
Dissolved/Total Phosphorus Ratio – 2004 - 2006

Source Area Mean: 40%
Integrator Mean: 42%
Soil-Test P levels in Apple Creek Sub-Watershed (ppm Bray-P1)
Soil Test P vs. DP in Streams

- Strong response to increasing STP on DP in streams

\[ y = 0.0057x - 0.0084 \]

\[ R^2 = 0.8682 \]
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Conclusions

- DP fraction is high at main stem sites (40-70%)
  - Similar to earlier findings in LFR Sub-Basin
- In stream DP conc. predicted well by soil test P (Bray-P1) and P-Index
- In some areas, managing nutrients (i.e. lowering STP) may be the most effective means of reducing TP in streams
- DP fractions were similar at the small scale to previous findings
- No obvious net concentration change observed at different scales

Main stem → Integrator → Source Areas
“…the answer to the question, Which form of P is predominant in surface runoff from agricultural land, dissolved or particulate?, is that it depends very much on the individual circumstances.”

Hart et. al., 2004
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Questions?

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