Exploring the Influence of External Loading and Internal Reactions On Stream Phosphorus Concentrations

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Objective

• The Temporal Concentration-Duration
  ▫ Lots of information there
  ▫ Important to understand
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Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin

By Dale M. Robertson, David J. Graczyk, Paul J. Garrison, Lizhu Wang, Gina LaLiberte, and Roger Bannerman
Objective

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Acknowledgements

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Approach

• SWAT to estimate the time-varying terrestrial contribution to the stream

• Explore combination with other models (eg OTIS) to explore near- and in-stream contributions, sorption, mobile/immobile, net uptake/release

• Examine phosphorus concentrations
Example Watersheds

- Point Creek
- Upper Fever River
Watersheds

- Upper Fever River
  - 8 km² watershed
  - Largely agricultural
  - High baseflow
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- Point Creek
  - 45 km² watershed
  - Ag/Forested
  - Low summer baseflow
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Model Configuration

- **SWAT**
  - “Simplified”
  - Row crop HRU
  - Forested HRU
  - 5 Subbasins
  - Hourly

- **OTIS**
  - USGS
  - 1-D A/D/R
Concentration Duration Examples

- Fever River
  - External Input
- Point Creek
  - Internal Reaction
Fever River
Waterway Calibration

Modeled Runoff (mm)

○ Measured (mm)

Fever River

- Waterway Storms Only
- SWAT/OTIS Concentration
Fever River

- Waterway Storms Only
- SWAT/OTIS Concentration

- Matching Large Flow Events
- Missing Many Changes in Concentration
Fever River

- Waterway Storms
- “Riparian Contribution”

- Many Changes in Concentration Associated with Precipitation (but no waterway runoff)
• Concentration Duration / Waterway Only
• Concentration Duration / Waterway & “Riparian”
Point Creek

Dissolved P (mg/l)

Day of Year

2005
2006
2007
2008
2009
Point Creek

OTIS Reach 1-D Adv/Disp

Sediment Release
Unit area release
Or uptake (mass/area/time)
Additional Considerations

- Sorption
- Transient Storage
- Mass Transfer Rates
Summary

• The Importance & Complexity of the Concentration-Duration Relationship

• Useful to Understand the Controls over Concentration to Effect Change in Concentration-Duration
Continue the conversation...

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