Plum Creek Watershed Phosphorus Loss

Marty Jacobson, Kevin Fermanich and Paul Baumgart

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Outline

- Overview and Introduction
- Objectives
- Methods
- Findings
- Conclusions

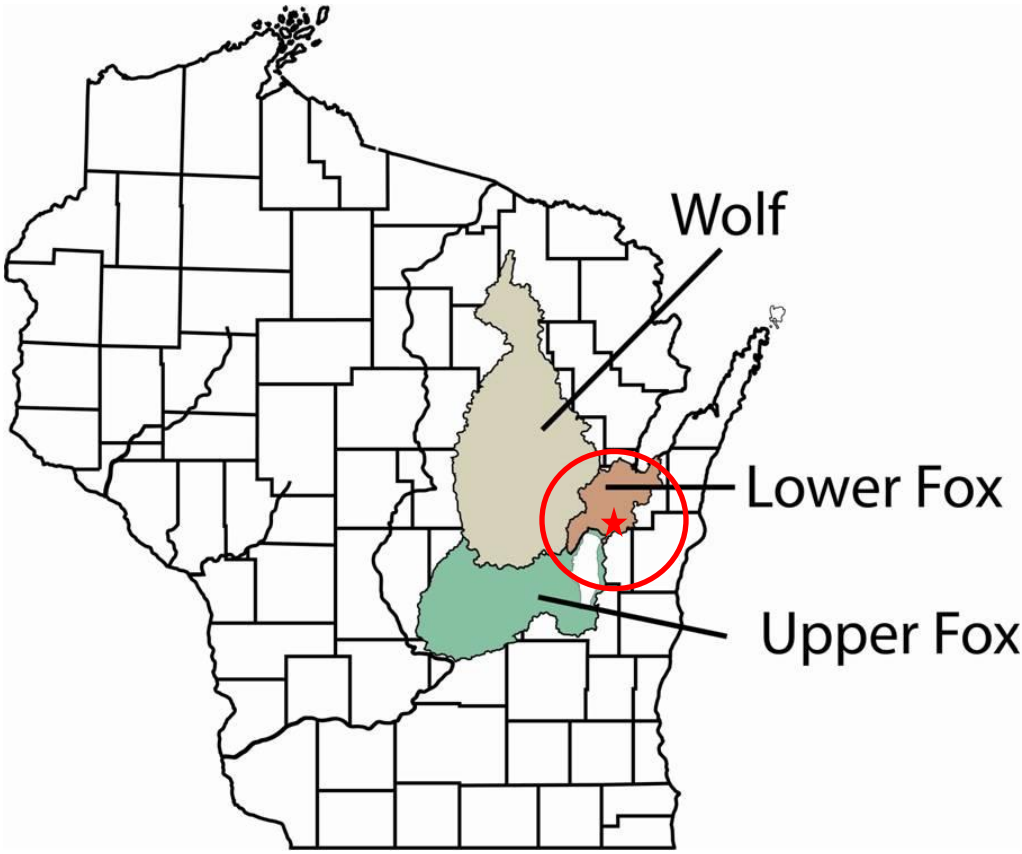
Green Bay

Phosphorus

- Essential for agriculture
- Source in NE Wisconsin = Manure
- Transported via surface and subsurface flow
- Elevated water concentrations cause problems
- Total P = Particulate P + Dissolved P
- Wisconsin manages P with the P-Index
  - Risk of edge-of-field P loss
  - Calculated in Snap-Plus

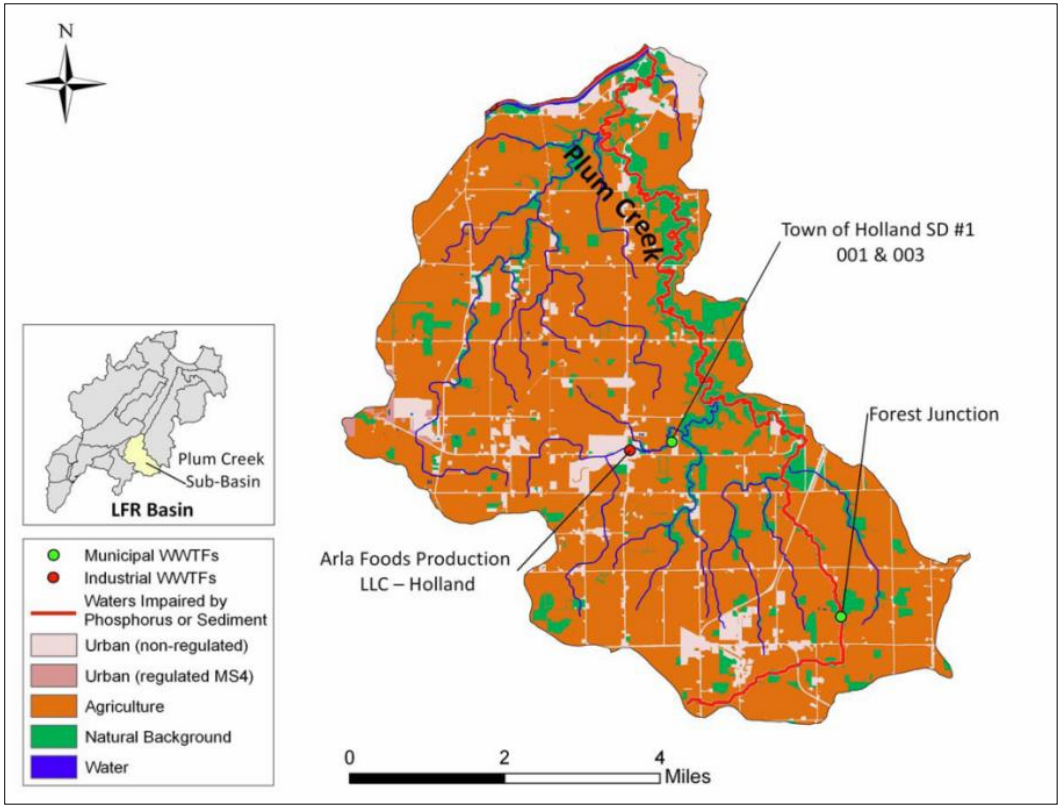
Lower Fox River

- Draft TMDL
  - Summer 2010
- Water quality goals
  - TP summer median concentration
    - Tributaries = **0.075 mg/l**
    - Fox main channel = 0.100 mg/l



Plum Creek

- 23,000 acres
  - 76% agricultural
    - Aggressive tillage
  - Red clay soils
    - Hydro-group C
    - High % runoff
  - Slope = 2.34%



Plum Creek and TMDL

- Highest P and TSS contributor per acre to the Lower Fox River
- Major reductions needed
  - 77% P
  - 70% TSS

Plum Creek Project Objectives

1. Characterize P loads at watershed scale
   a) What is Plum Creek's P contribution to the LFR?
2. Assess P loss at multi-field catchment (MFC) scale
   a) How do residue, STP and manure applications affect water quality?
3. Assess the phosphorus index (PI)
   a) Do NMP-based PIs accurately predict water quality?

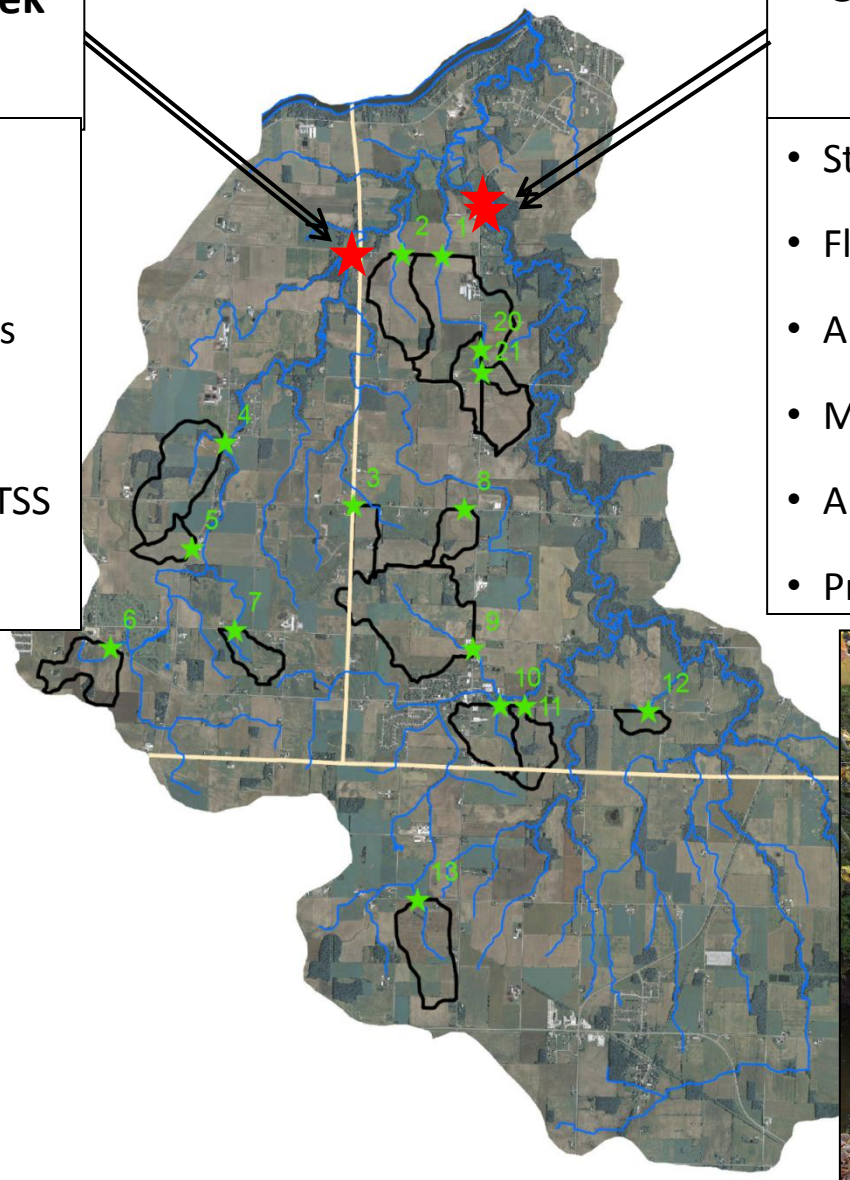
Objective 1 – P Loads

UWGB West Plum Creek Monitoring Station

- Stage measurements
- Flow measurements
- Manual low flow samples
- Manual event samples
- Analyzed for TP, DP and TSS
- No loads yet

USGS Main Plum Creek Monitoring Station

- Stage measurements
- Flow measurements
- Automated Event Sampler
- Manual Low flow samples
- Analyzed for TP, DP and TSS
- Preliminary Loads



What is Plum Creek's P contribution to the Lower Fox River?

Automated Event Sampler Samples

P Loads – WY 2011 Findings

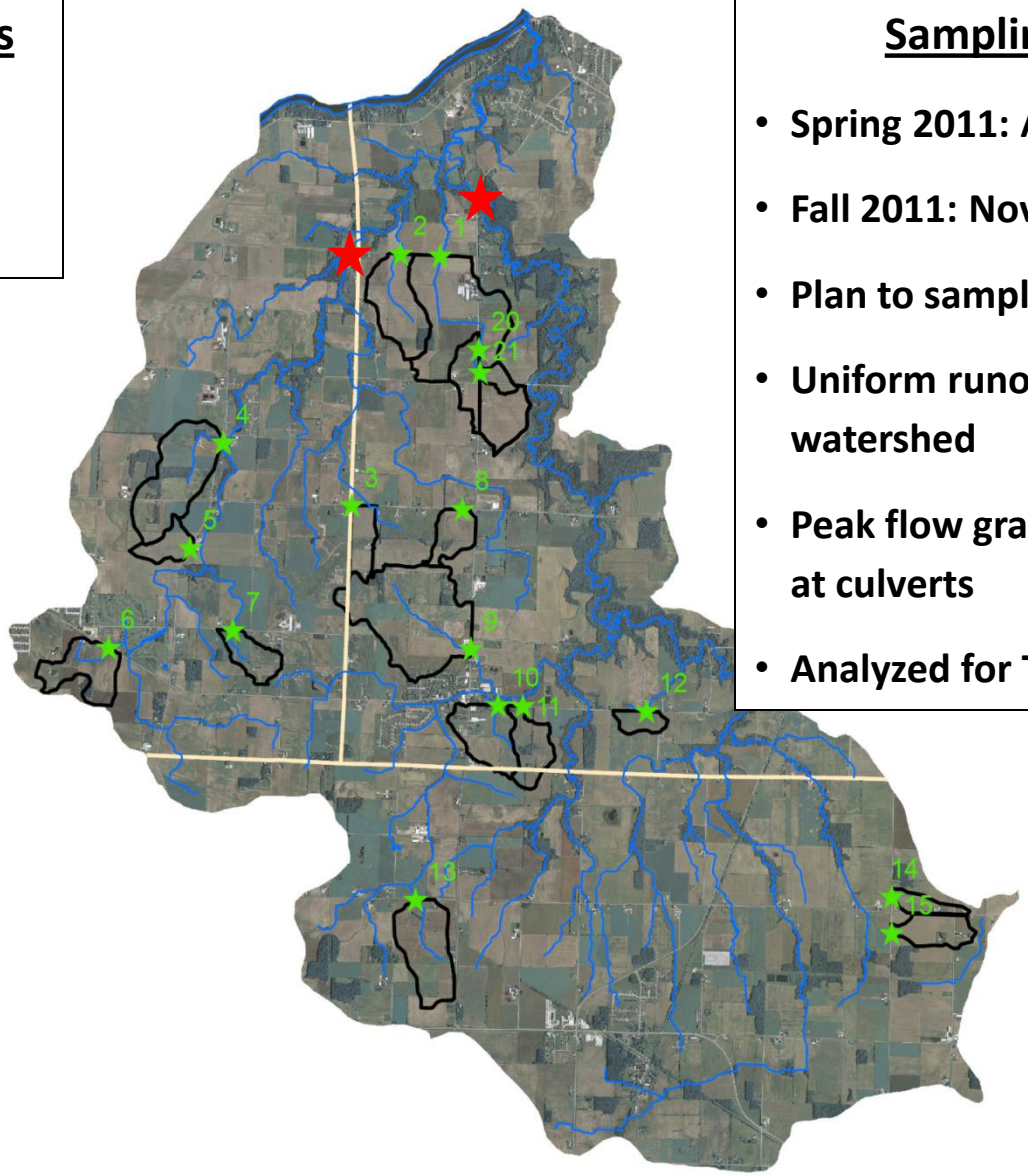
- Plum Creek (USGS station – Preliminary Data)
  - 2011 summer median TP = 0.35 mg/l
  - TP load (extrapolated) = 23,637 kg
  - TP Ag yield = 2.94 (lbs/ac/yr)

- Baird Creek (USGS station – Preliminary Data)
  - 2011 summer median low flow TP = 0.21 mg/l
  - TP load (extrapolated) = 6724 kg
  - TP Ag yield = 0.89 (lbs/ac/yr)

Objective 2 – MFC Water Quality

Multi-Field Catchments

- **Number: 17**
- **Size Range : 38-524 acres**



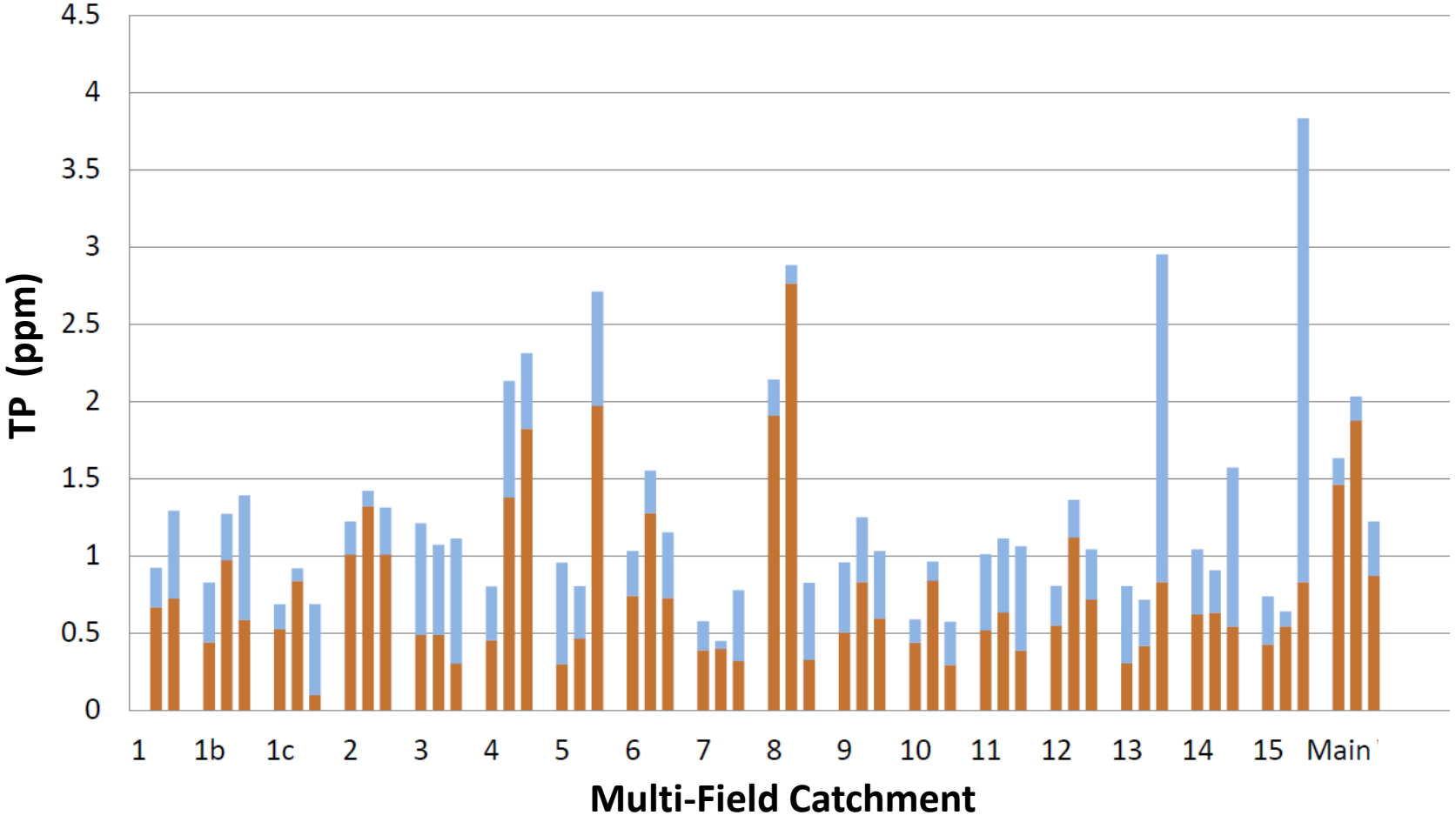
Sampling Events

- **Spring 2011: April 16 and 26**
- **Fall 2011: November 9**
- **Plan to sample minimum of 5**
- **Uniform runoff across entire watershed**
- **Peak flow grab samples taken at culverts**
- **Analyzed for TP, DP and SSC**

MFC Water Quality – Findings

04/16/11	TP	DP	PP	DP Fraction	SSC	Stream Yield (mm)
Mean	0.96	0.36	0.60	39%	246	59%
Median	0.89	0.33	0.50	41%	122	
04/26/11	TP	DP	PP	DP Fraction	SSC	Stream Yield (mm)
Mean	1.21	0.28	0.93	25%	367	74%
Median	1.09	0.27	0.83	21%	270	
11/09/11	TP	DP	PP	DP Fraction	SSC	Stream Yield (mm)
Mean	1.51	0.80	0.71	52%	330	27%
Median	1.15	0.57	0.59	58%	131	

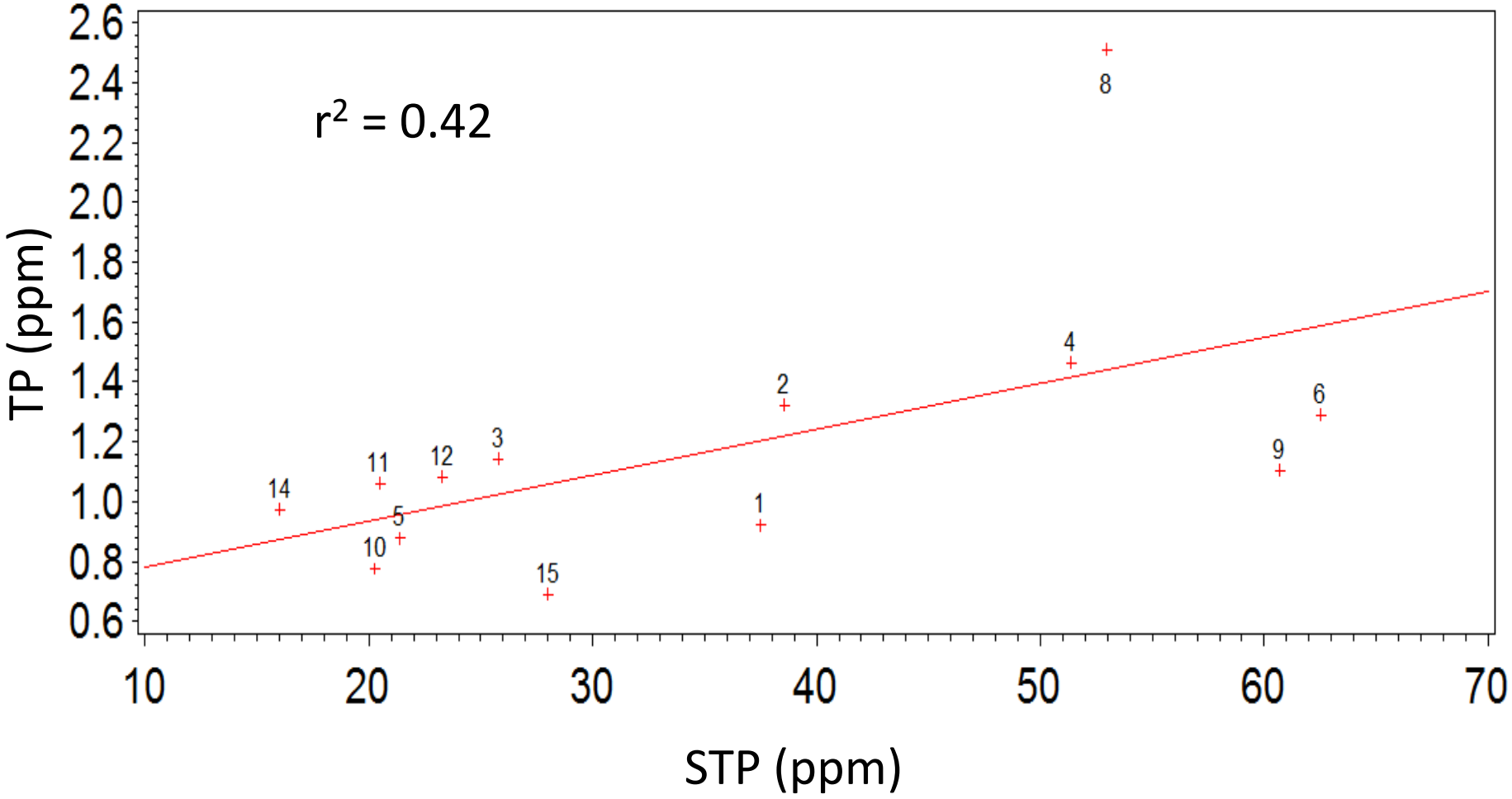
Plum Creek MFC Water Quality Data



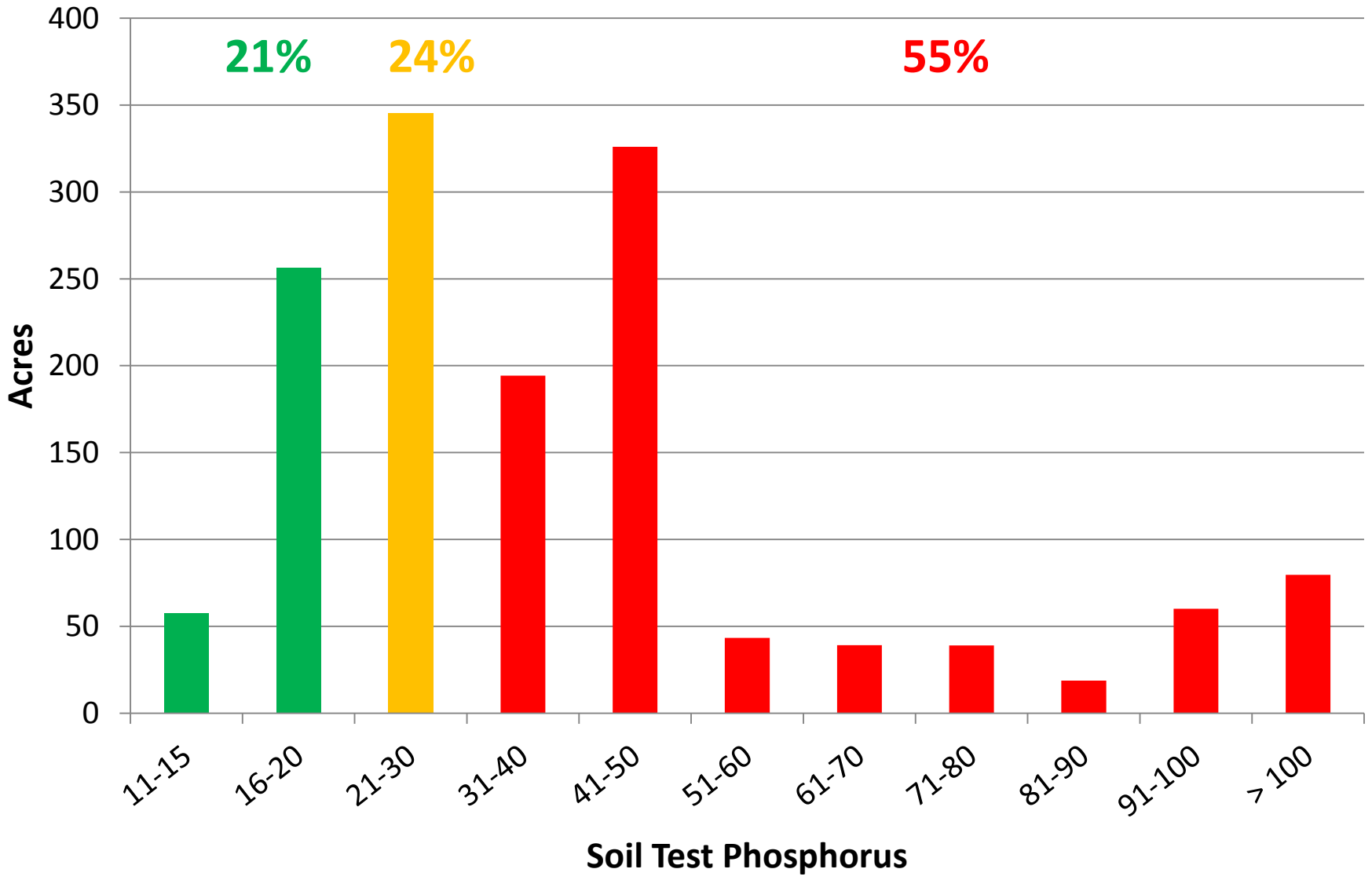
- High P concentrations
- Differences between spring and fall events
  - Influences of land use characteristics and practices?

How do STP, residue and manure applications affect water quality?

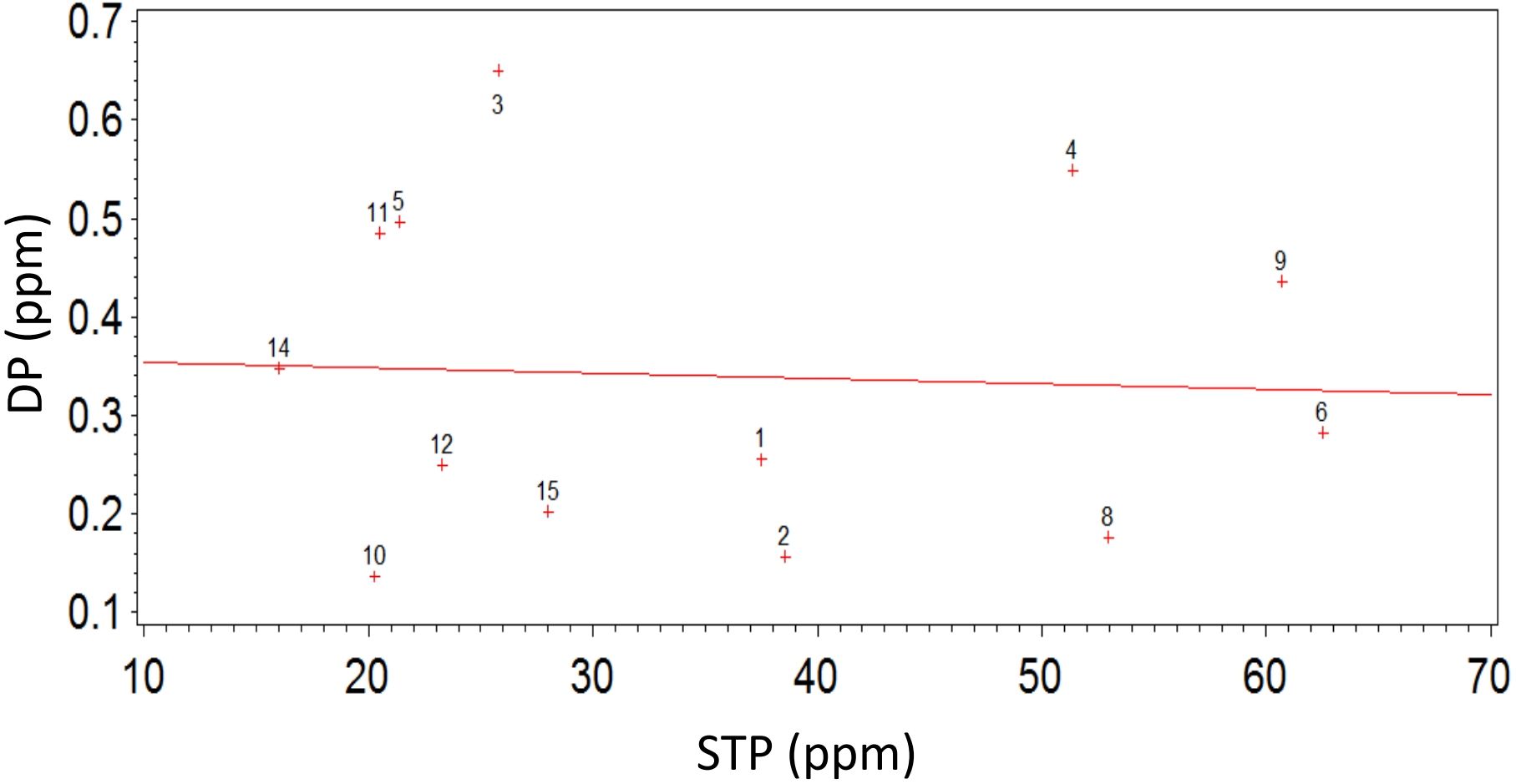
Spring Mean - Influence of STP



MFC Acreage Soil Test Phosphorus

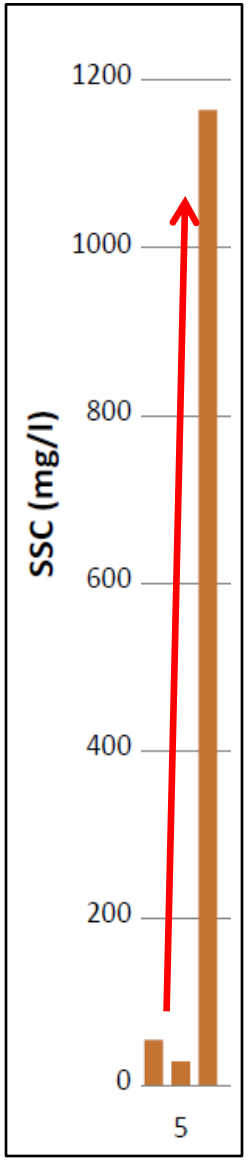


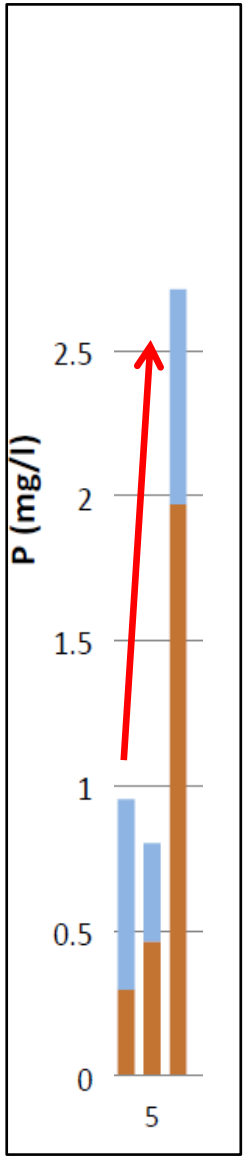
Spring mean – DP vs STP



Influence of Residue

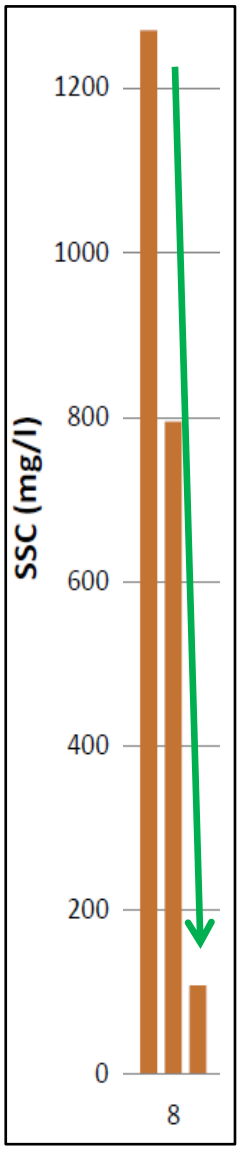
- MFC 5
- Spring events
  - Alfalfa
  - Low TP and SSC
- Fall event
  - Low residue
  - High TP and SSC

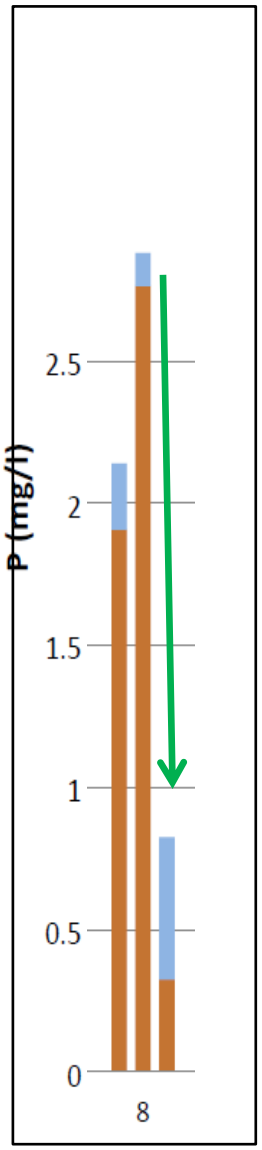




Influence of Residue

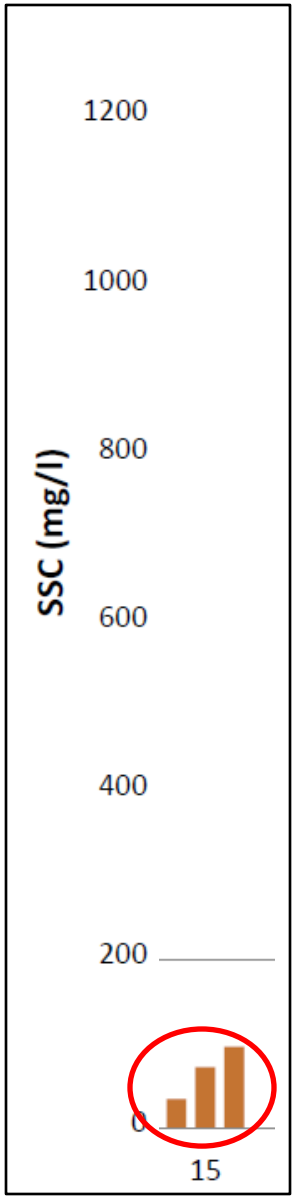
- MFC 8
- Spring events
  - Low residue
  - High TP and SSC
- Fall event
  - High residue
  - Low TP and SSC

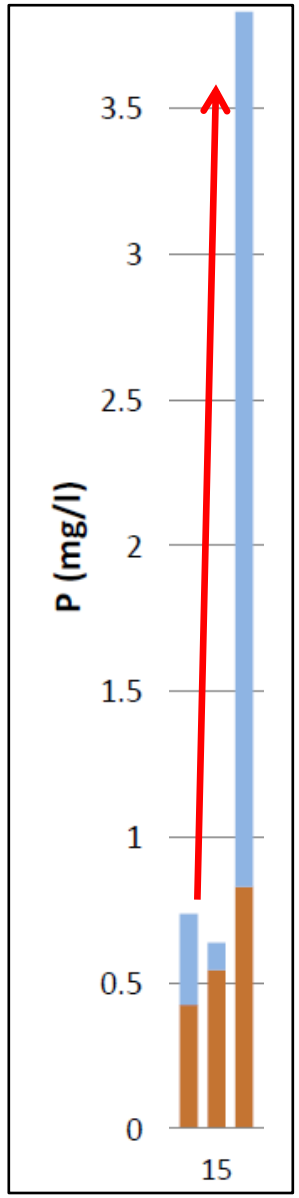




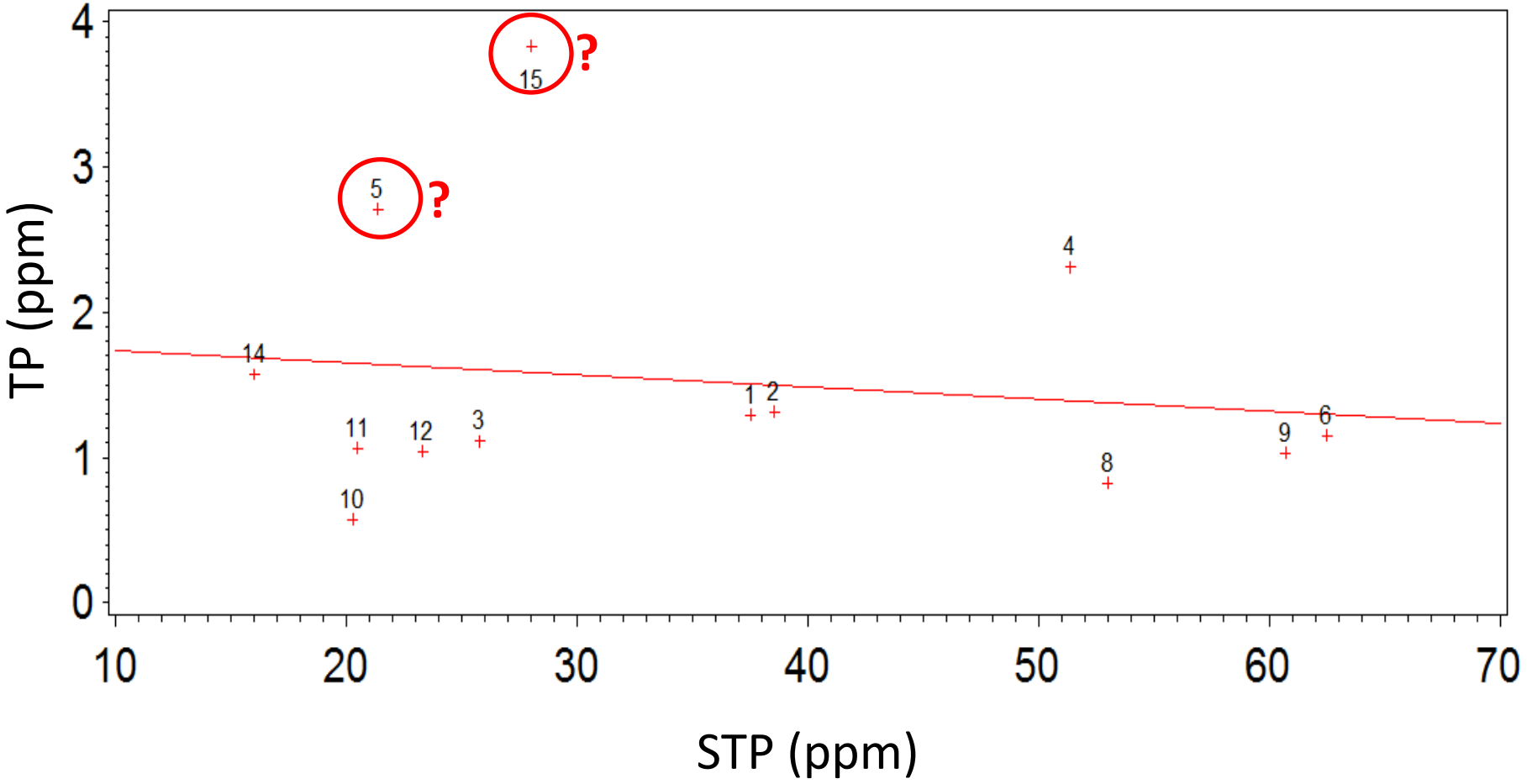
Influence of Manure?

- MFC 15
- Spring events
  - Alfalfa
  - Low SSC, TP and DP
- Fall event
  - Alfalfa
  - Low TP and SSC
  - High DP
- Manure application?



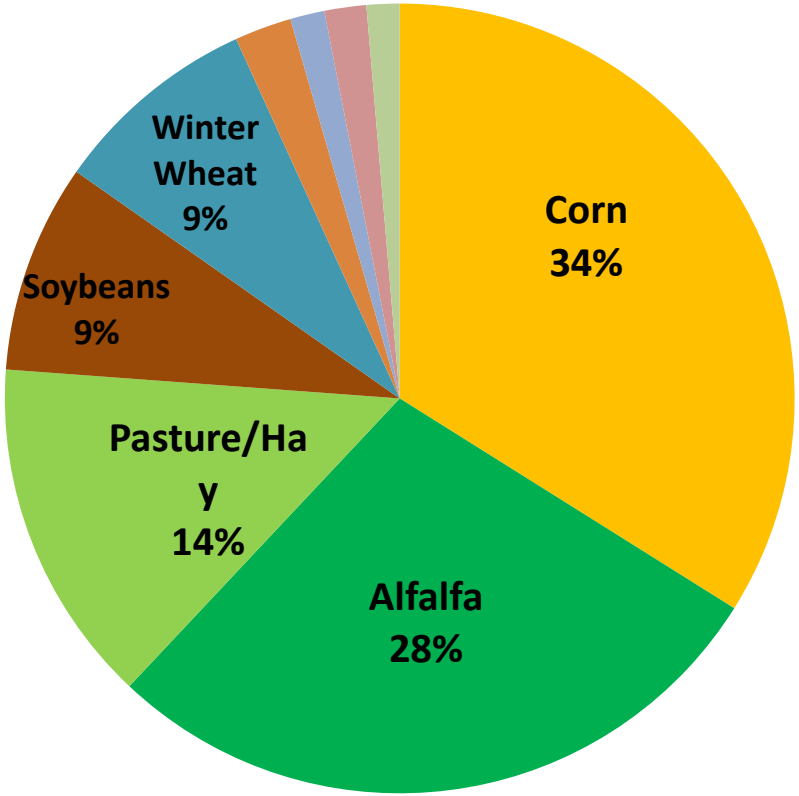


Fall Event – Influence of Manure

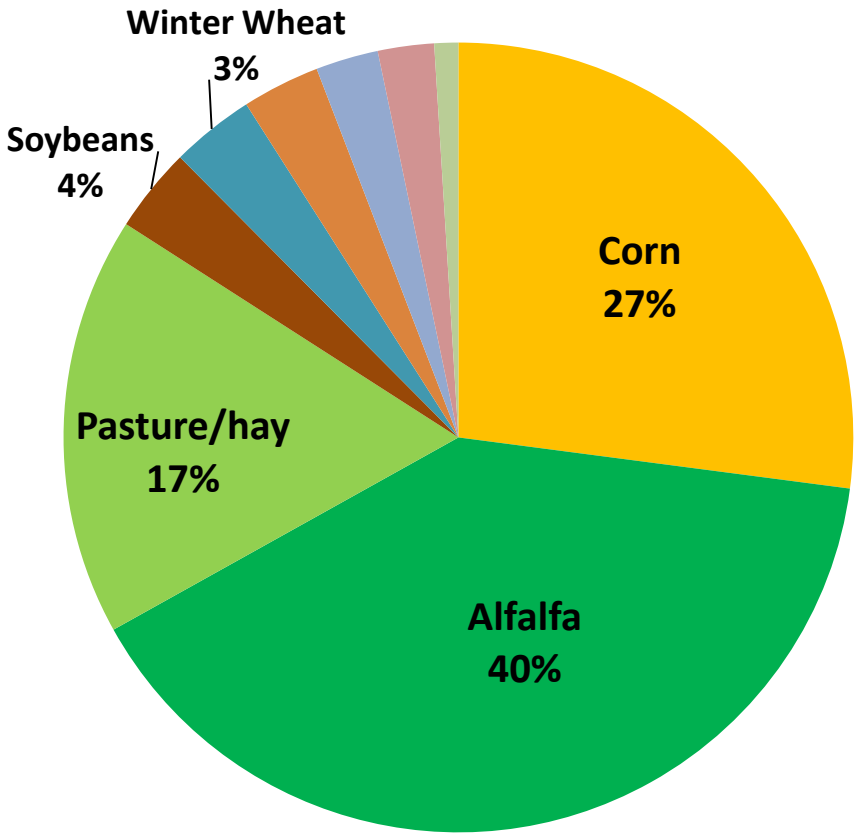


Land Cover 2011

Plum Creek Agricultural Land



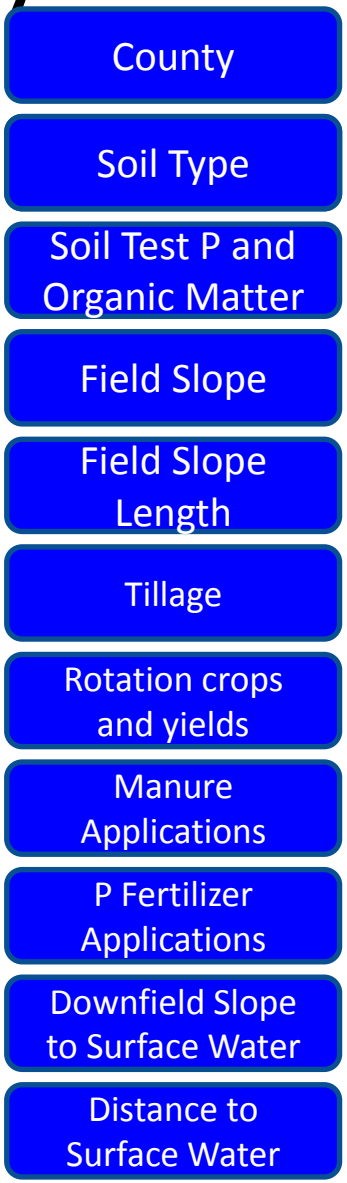
Multi-Field Catchments



Less intensive row cropping

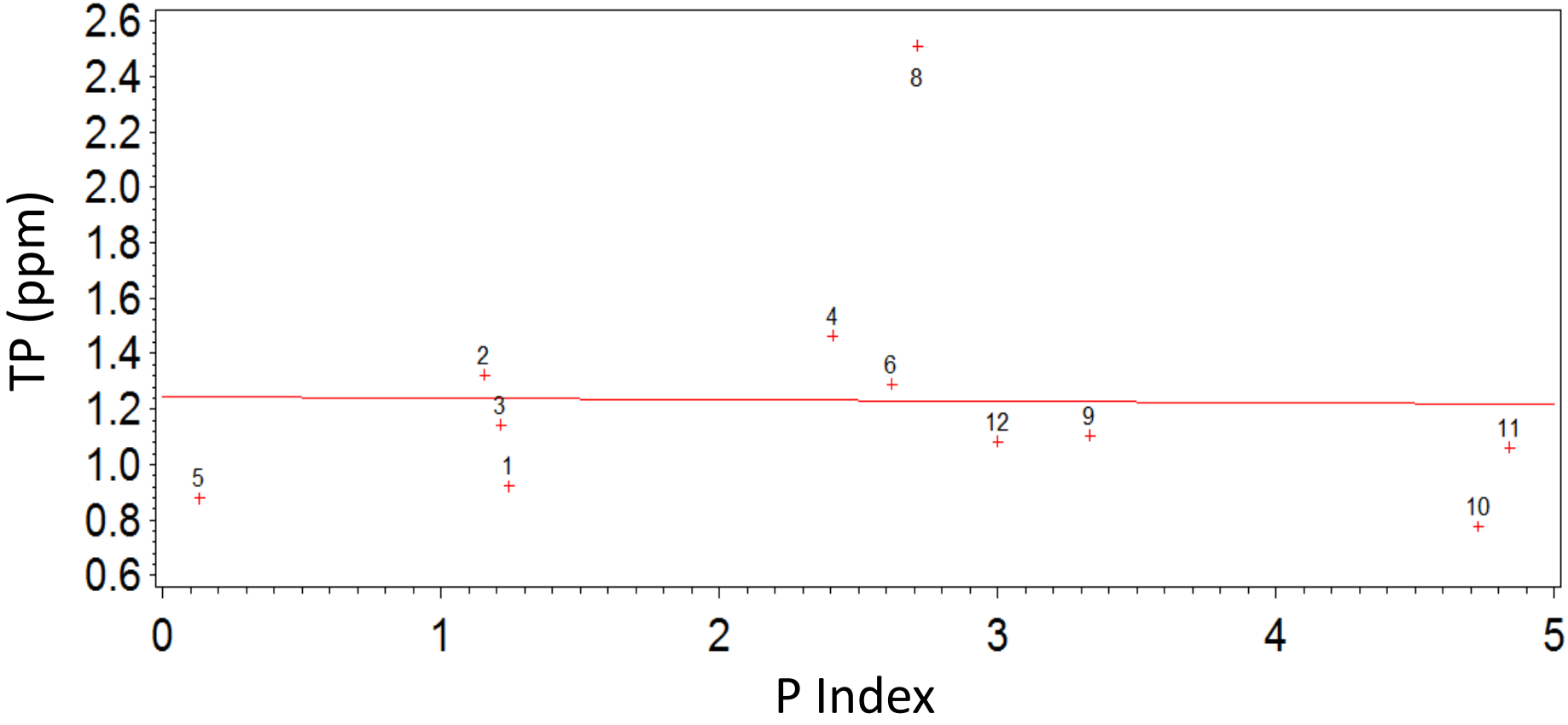
Objective 3 – PI Accuracy

- Snap-Plus and P-Index
  - Best available management inputs
  - 3 yr rotation (2010-2012)
    - 2011 PI values vs. water quality
  - Outputs: PI, PPI and DPI
- Analysis
  - Greater than 50% NMP coverage (11 MFCs)

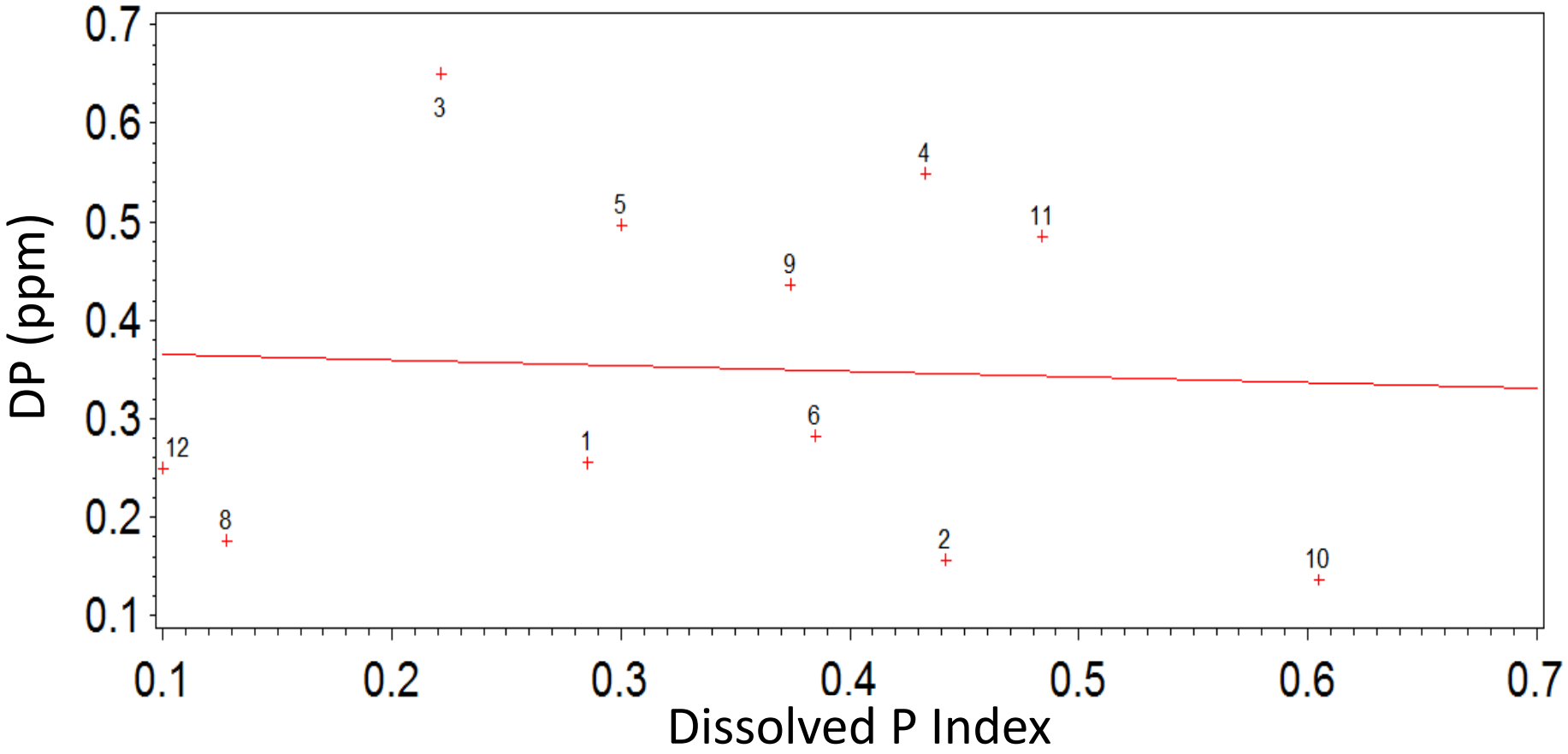


Do Nutrient Management Plan Phosphorus Indices Accurately Predict Water Quality?

Spring Mean TP vs. PI



Spring Mean DP vs. DPI

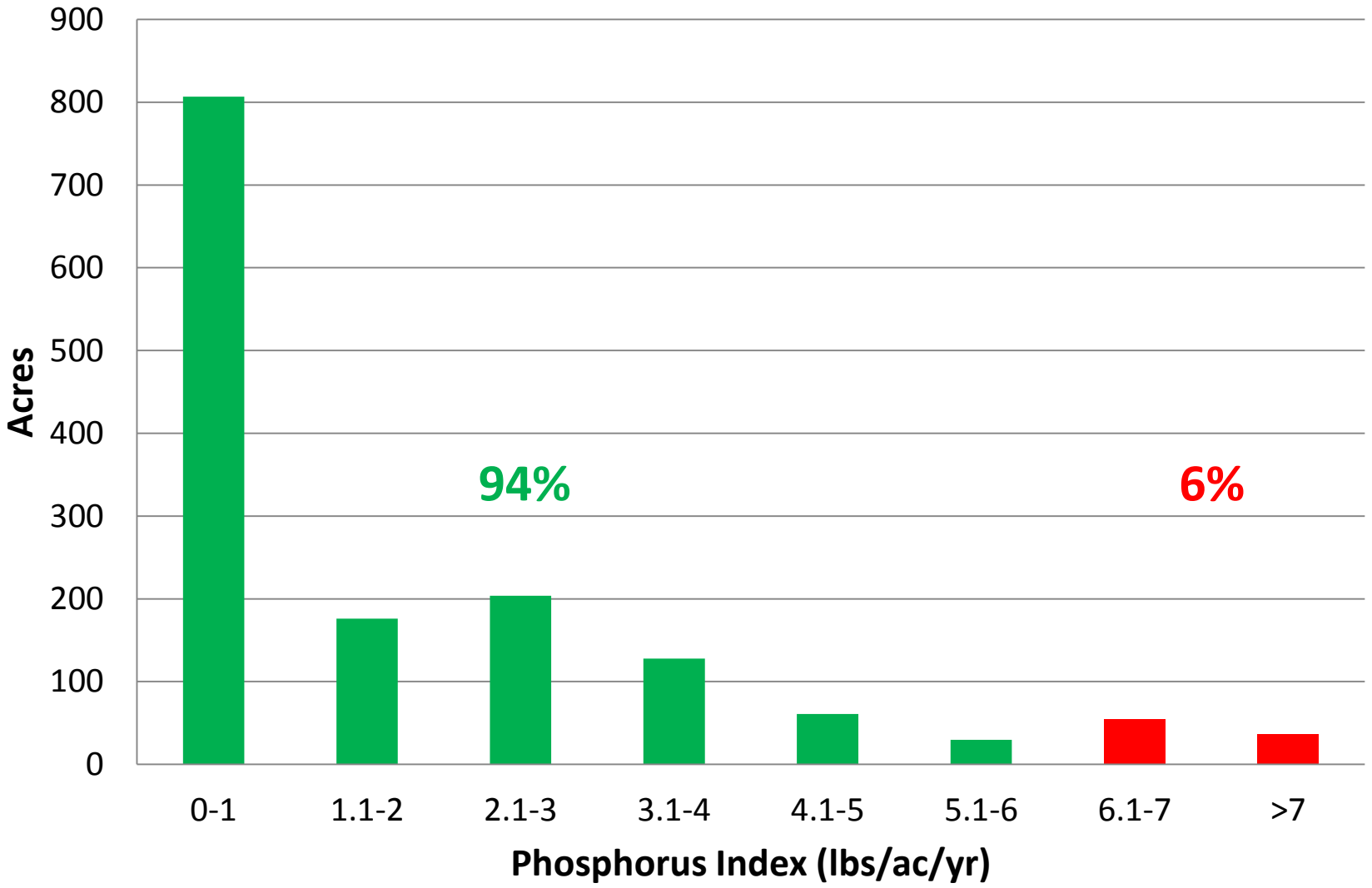


PI Challenges and Questions

- Accurate Snap-Plus inputs are essential
  - NMP info vs. what is happening on the landscape

- PI required by state = 6

MFC Acreage Phosphorus Index



PI Challenges and Questions

- PI required by state = 6
- 94% of MFC acreage has a PI of 6 or less
- Plum Creek water quality = very poor

- Agricultural Trends
  - More corn and more manure?

- Can Plum Creek meet TMDL water quality goals?

Conclusions

- Confirmation of draft TMDL modeling: Plum contributes a disproportionately large amount of P to the LFR
- Land characteristics (STP) and practices (tillage and manure applications) influence P loss at the multi-field catchment scale
- NMP-based PI is not accurately predicting water quality in Plum Creek watershed
- Current PI requirement of 6 will not likely achieve water quality goals in Plum Creek

Acknowledgements

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