



# **Wisconsin P Index Basics**

## for Watershed Planning

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# Wisconsin P Index Basics

## for Watershed Planning

- What it is
- What makes it change
- How it varies across watersheds

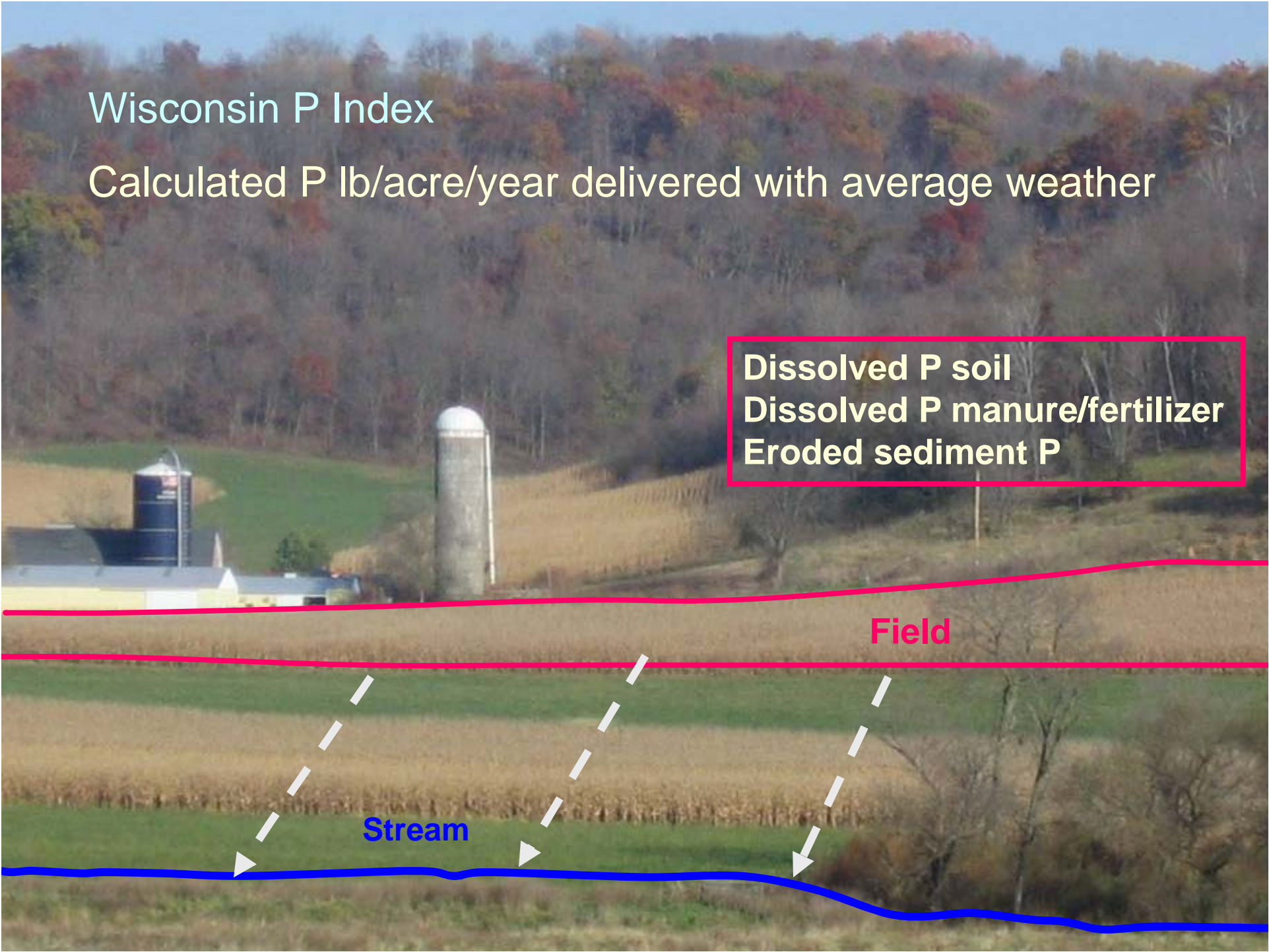
# Wisconsin P Index

Calculated P lb/acre/year delivered with average weather

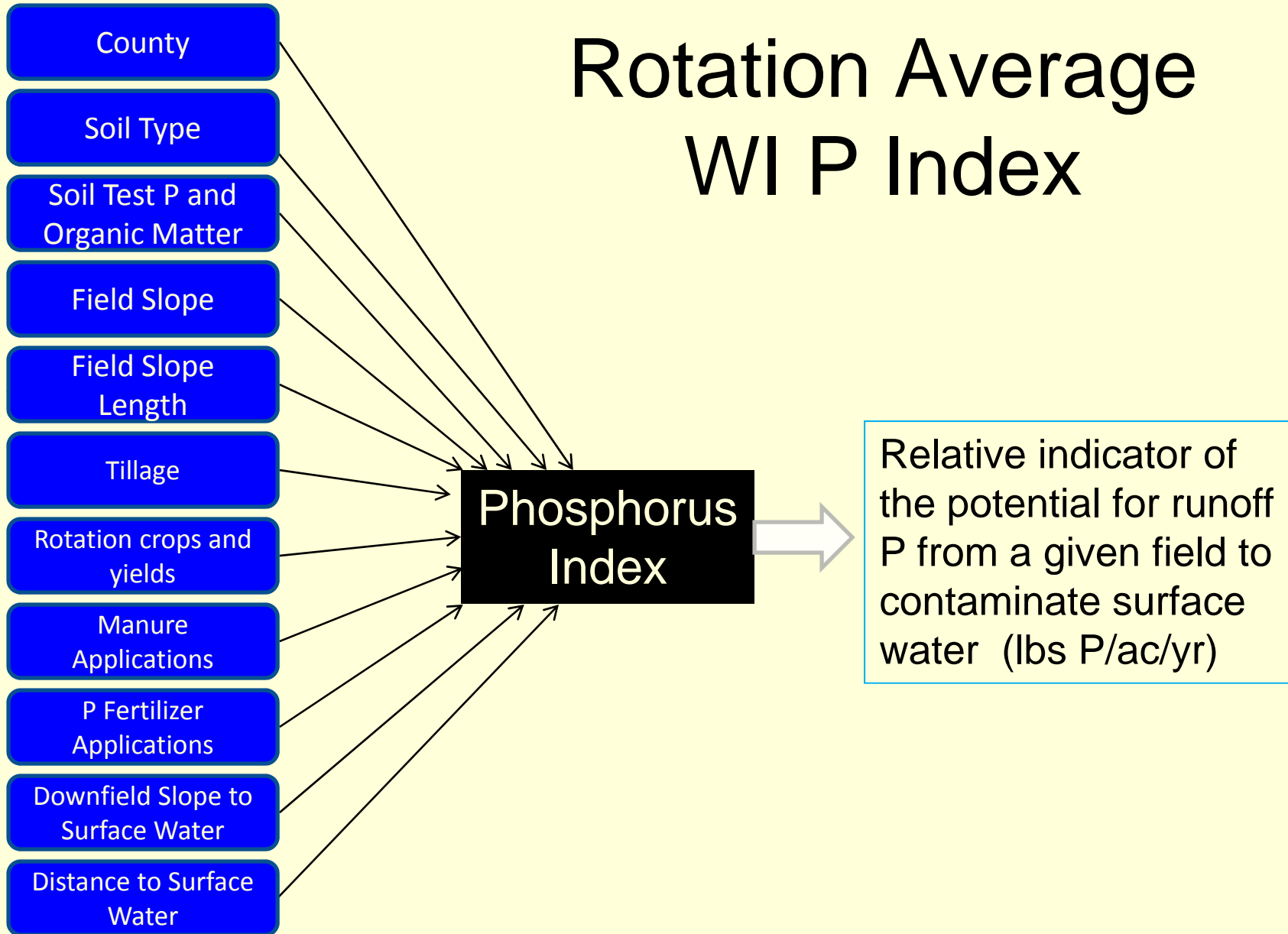
Dissolved P soil  
Dissolved P manure/fertilizer  
Eroded sediment P

Field

Stream



# Rotation Average WI P Index

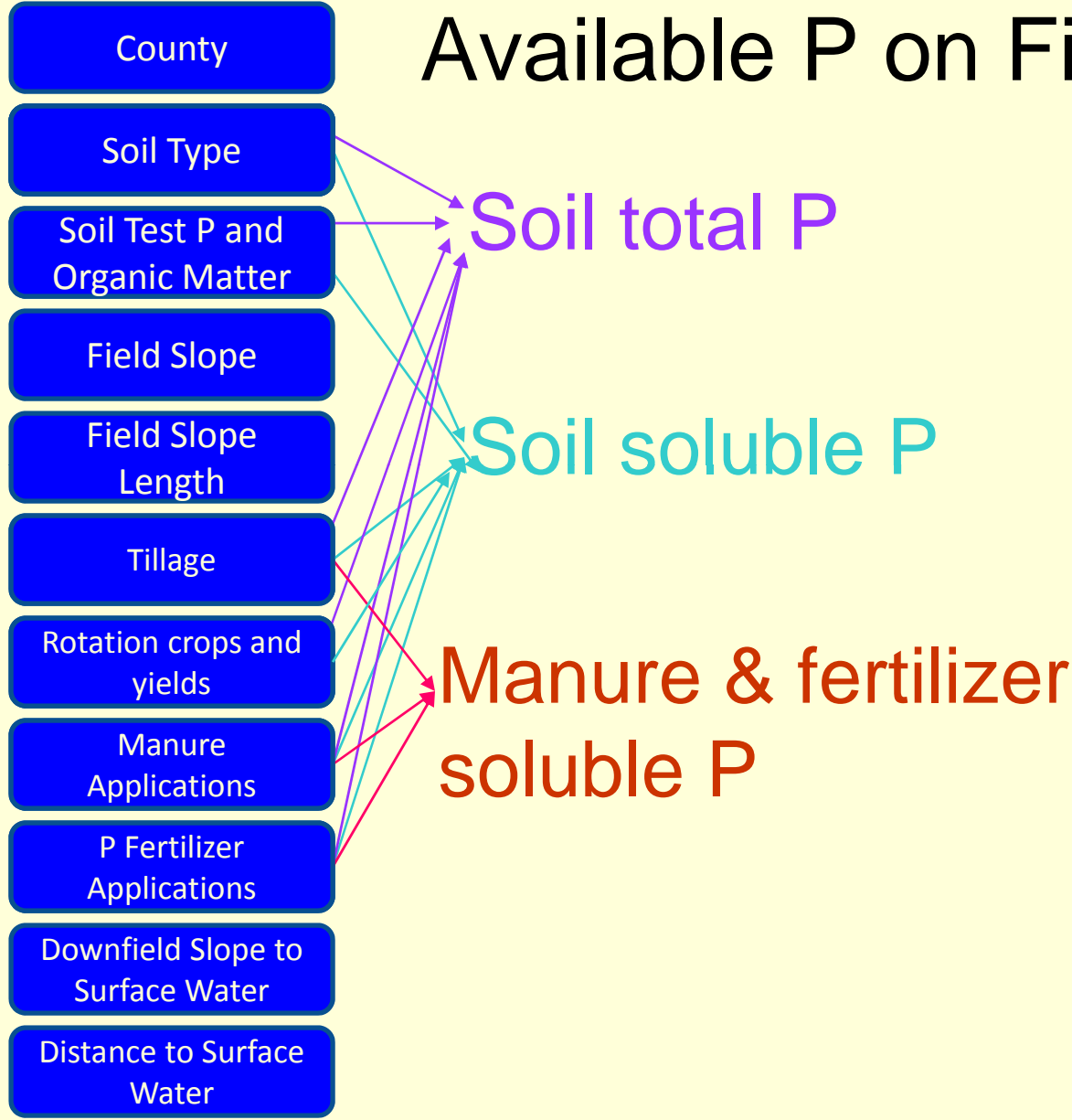


# Phosphorus Index Equations

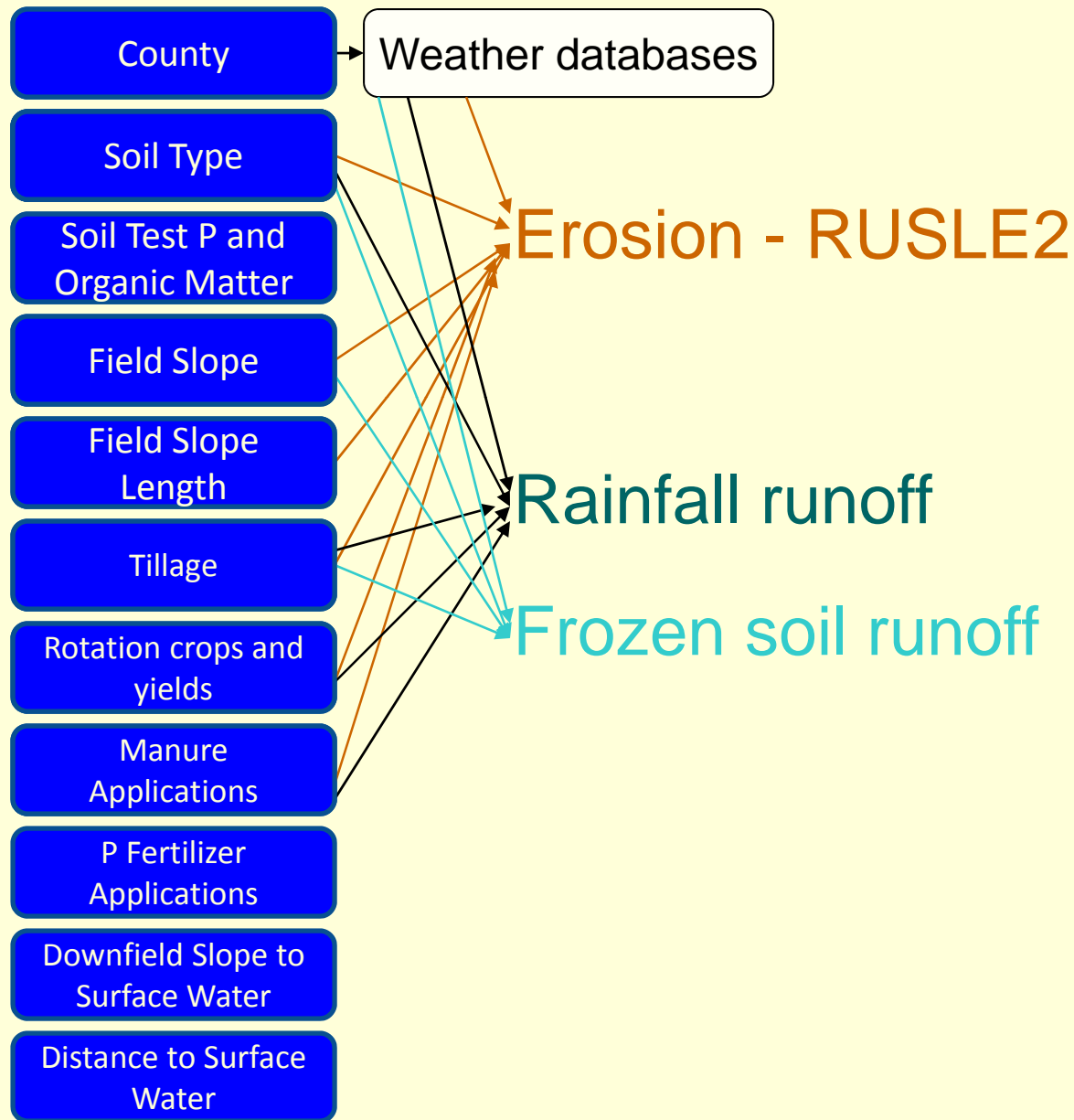
Dissolved P from soil  
Dissolved P from manure and fertilizer  
Eroded sediment P

$$[P] \times \text{Transport} = P \text{ delivered}$$

# Available P on Field Surface



# Field Transport Potential



County

Soil Type

Soil Test P and  
Organic Matter

Field Slope

Field Slope  
Length

Tillage

Rotation crops and  
yields

Manure  
Applications

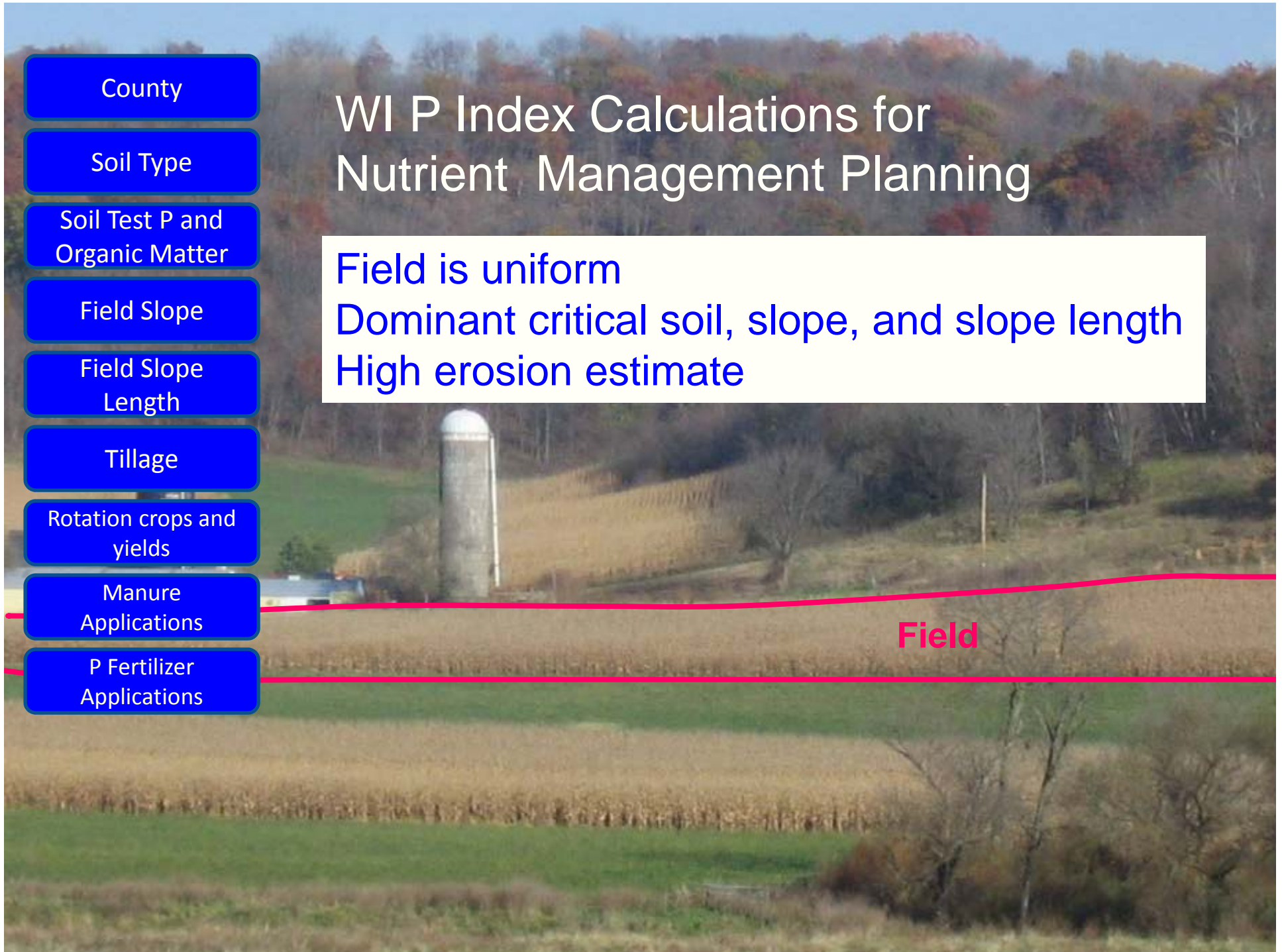
P Fertilizer  
Applications

# WI P Index Calculations for Nutrient Management Planning

Field is uniform

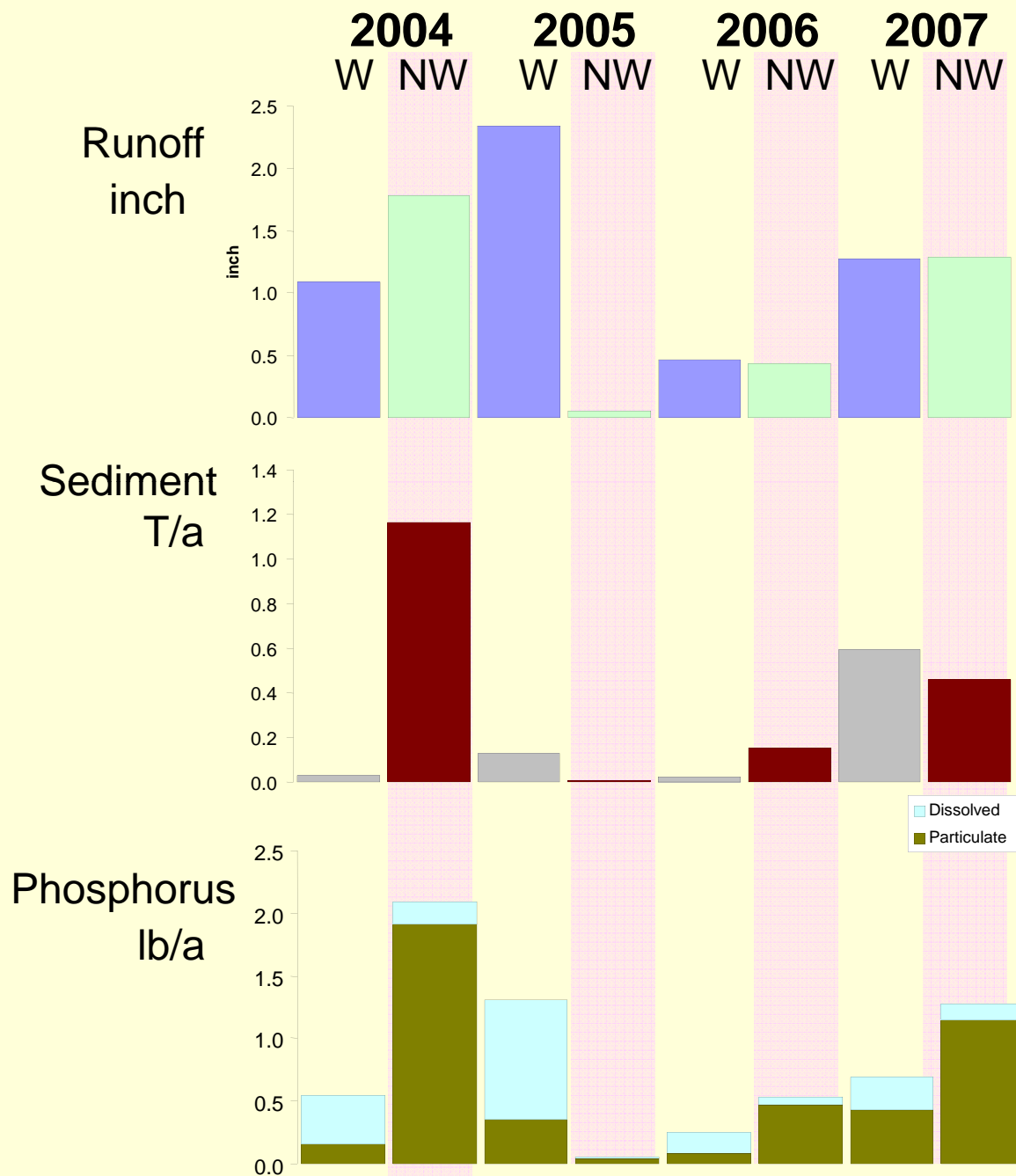
Dominant critical soil, slope, and slope length  
High erosion estimate

Field



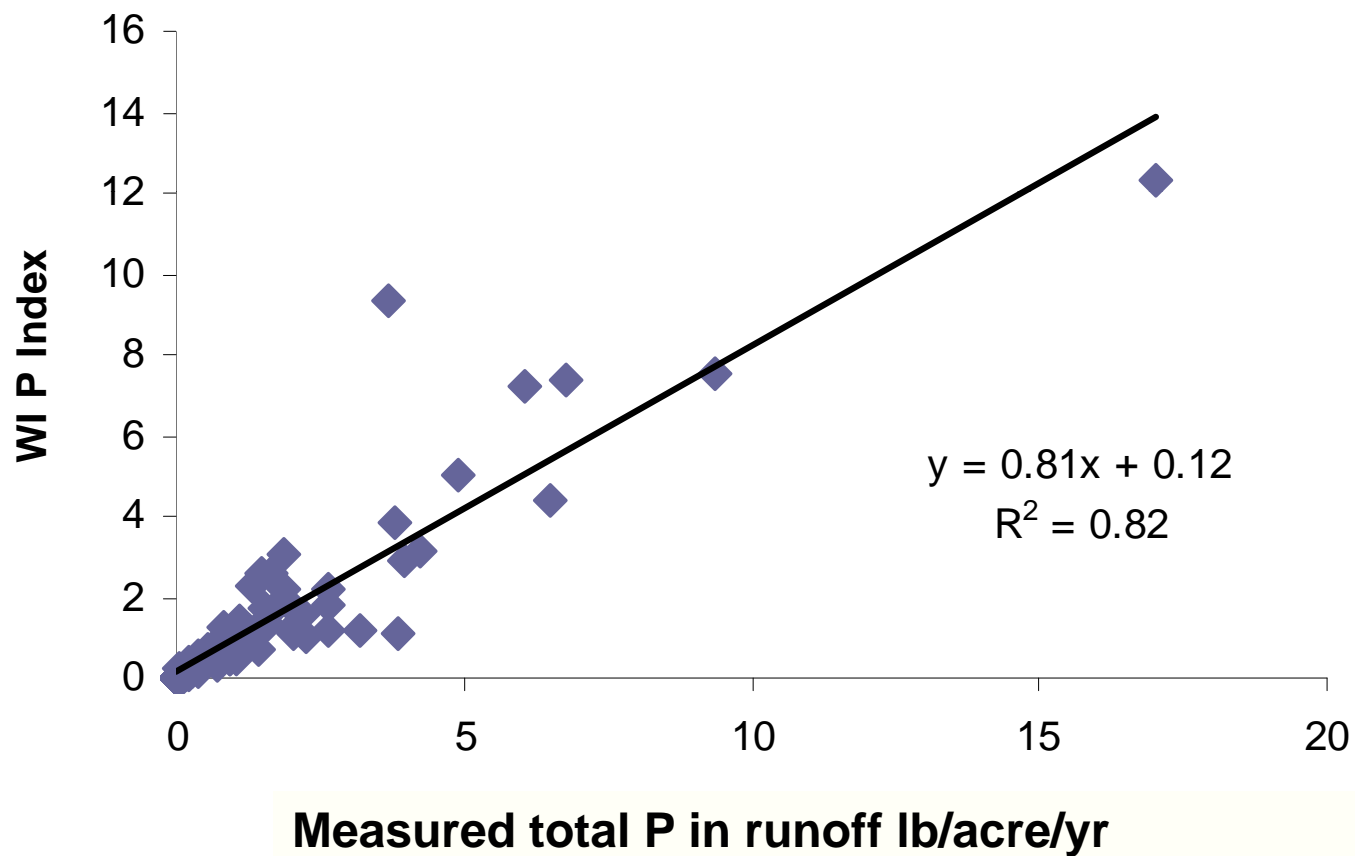
# Fields lose P with runoff and erosion

Average winter (W, frozen soil) and non-winter (NW) runoff, sediment and phosphorus loss for monitored fields and pastures, 2004 – 2007.

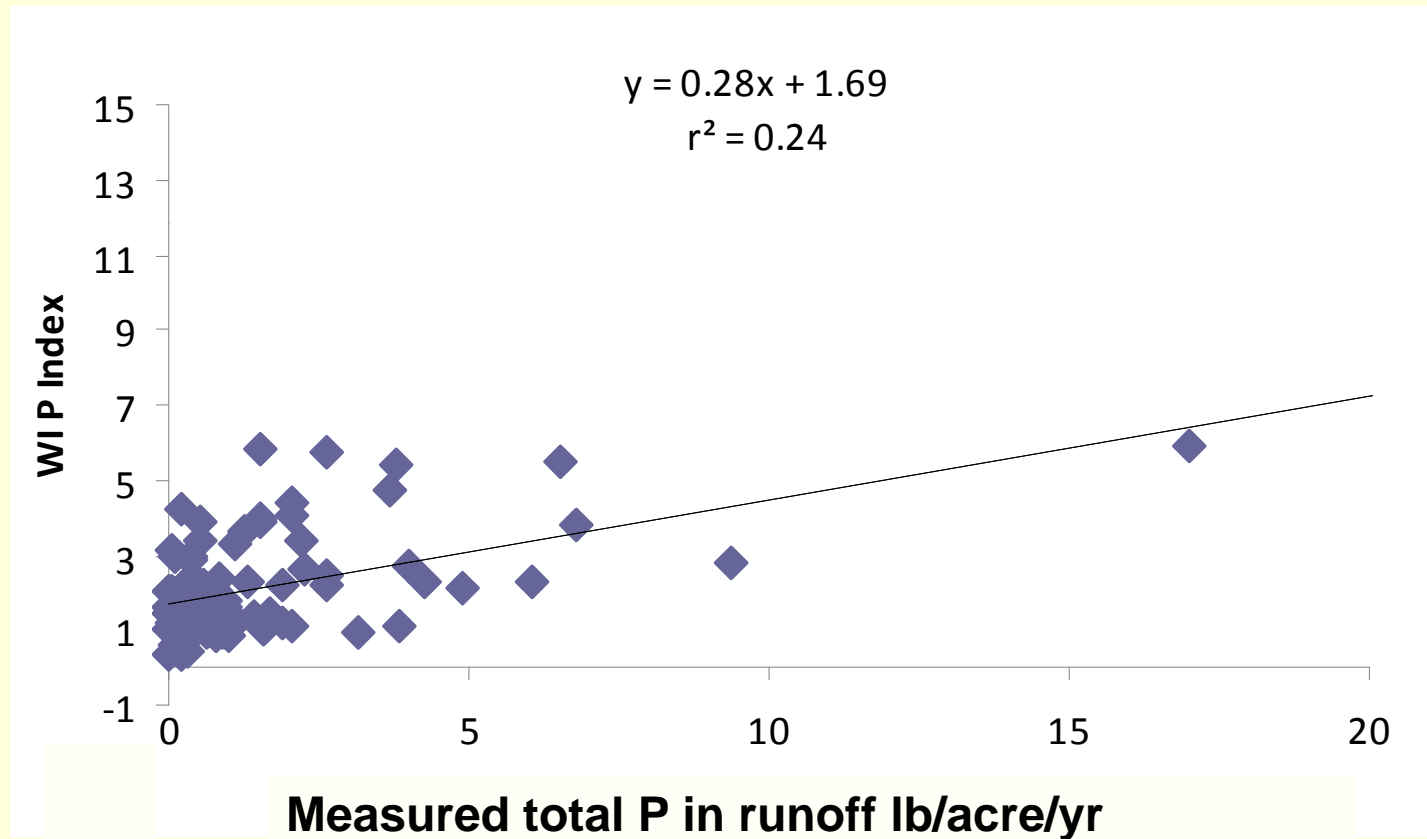


# Testing “Source” Components of P Index Equations

WI Total P Index compared to measured runoff losses for 86 site years using measured sediment and runoff volume in the equations



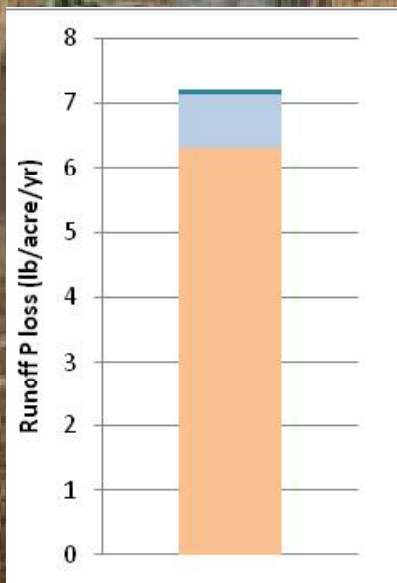
Year-to-year variability in precipitation means annual P Index values will not match measured loads



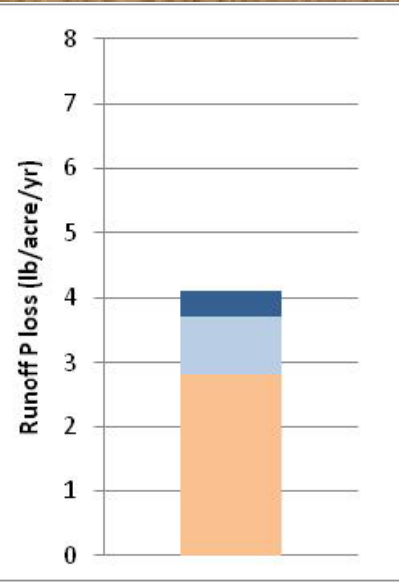
# P Index Varies with Management: Driftless Area Example

- Manure DP
- Soil DP
- Particulate P

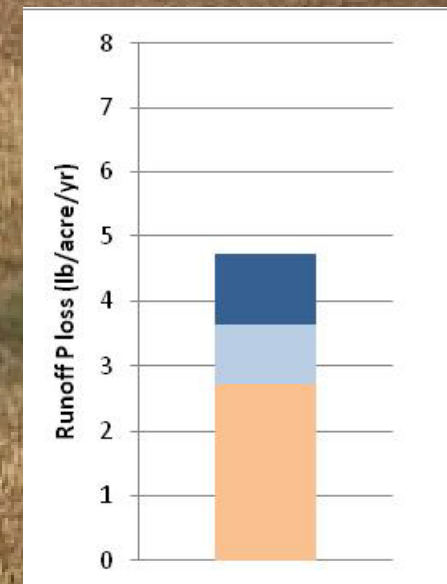
Soil test P = 70 ppm



Fall chisel in  
10,000 gal/acre  
dairy manure  
5 T/a/yr erosion



No till, fall apply  
10,000 gal/acre  
dairy manure  
2 T/a/yr erosion

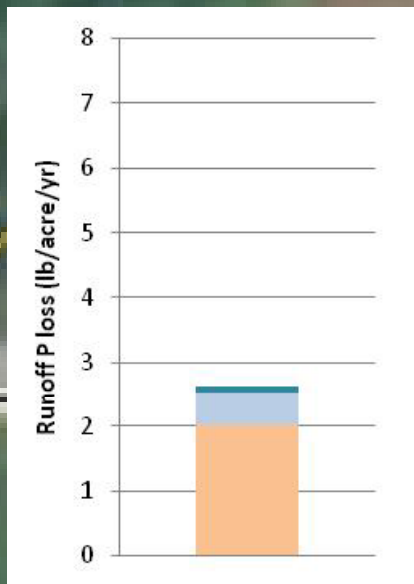


No till, winter apply  
7,000 gal/acre dairy  
manure  
2 T/a/yr erosion

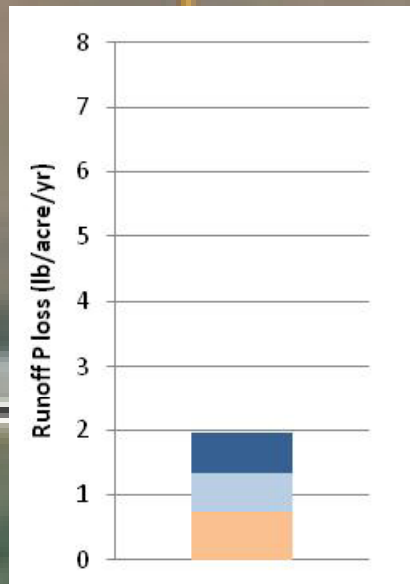
# P Index Varies with Management: Eastern Wisconsin Example



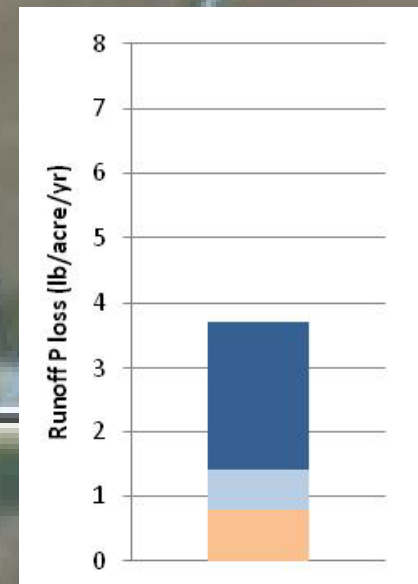
Soil test P = 70 ppm



Fall chisel in  
10,000 gal/acre  
dairy manure  
1.3 T/a/yr erosion



No till, fall apply  
10,000 gal/acre  
dairy manure  
0.5 T/a/yr erosion



No till, winter apply  
7,000 gal/acre dairy  
manure  
0.5 T/a/yr erosion

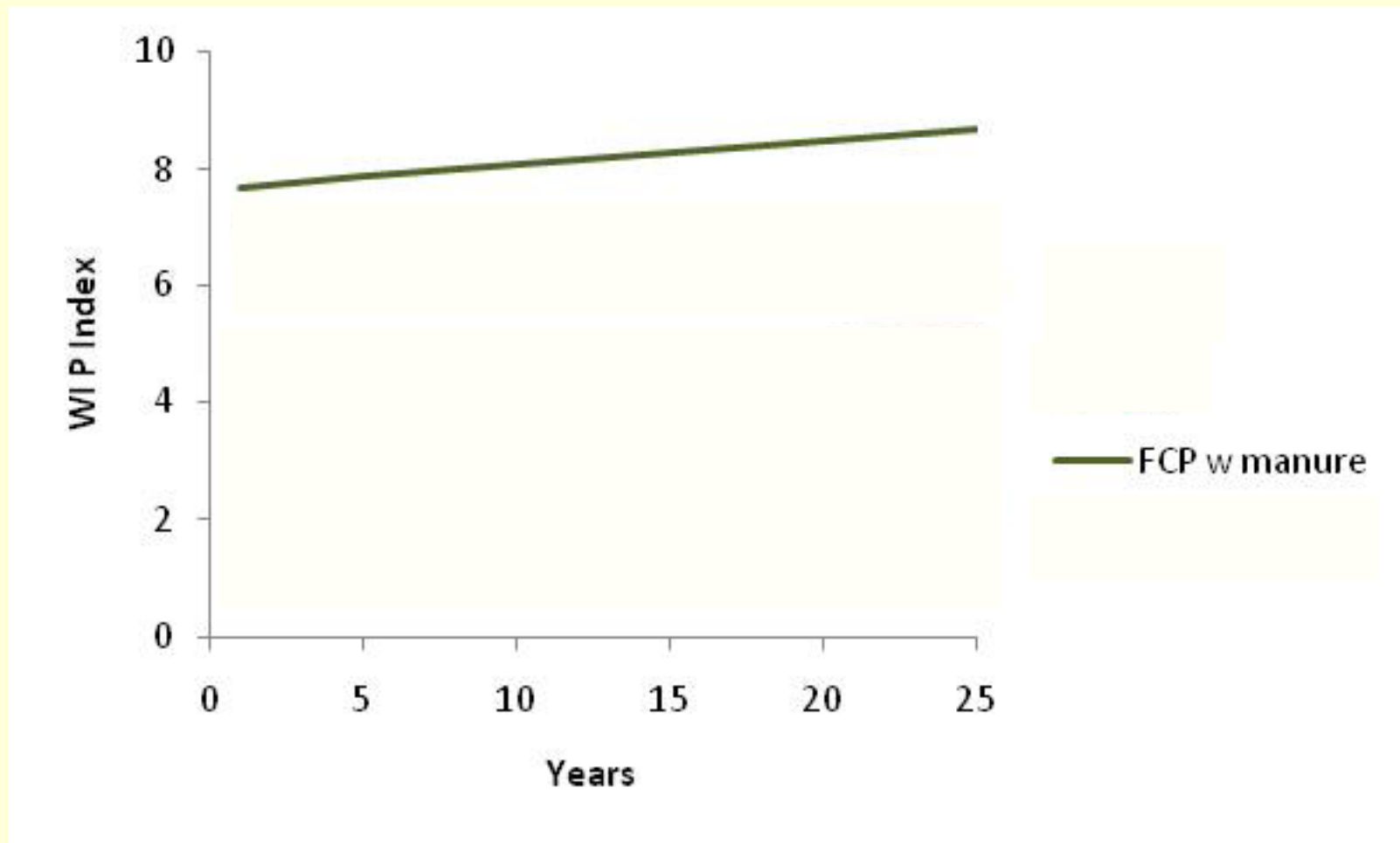
# P Index over time with continuous corn silage

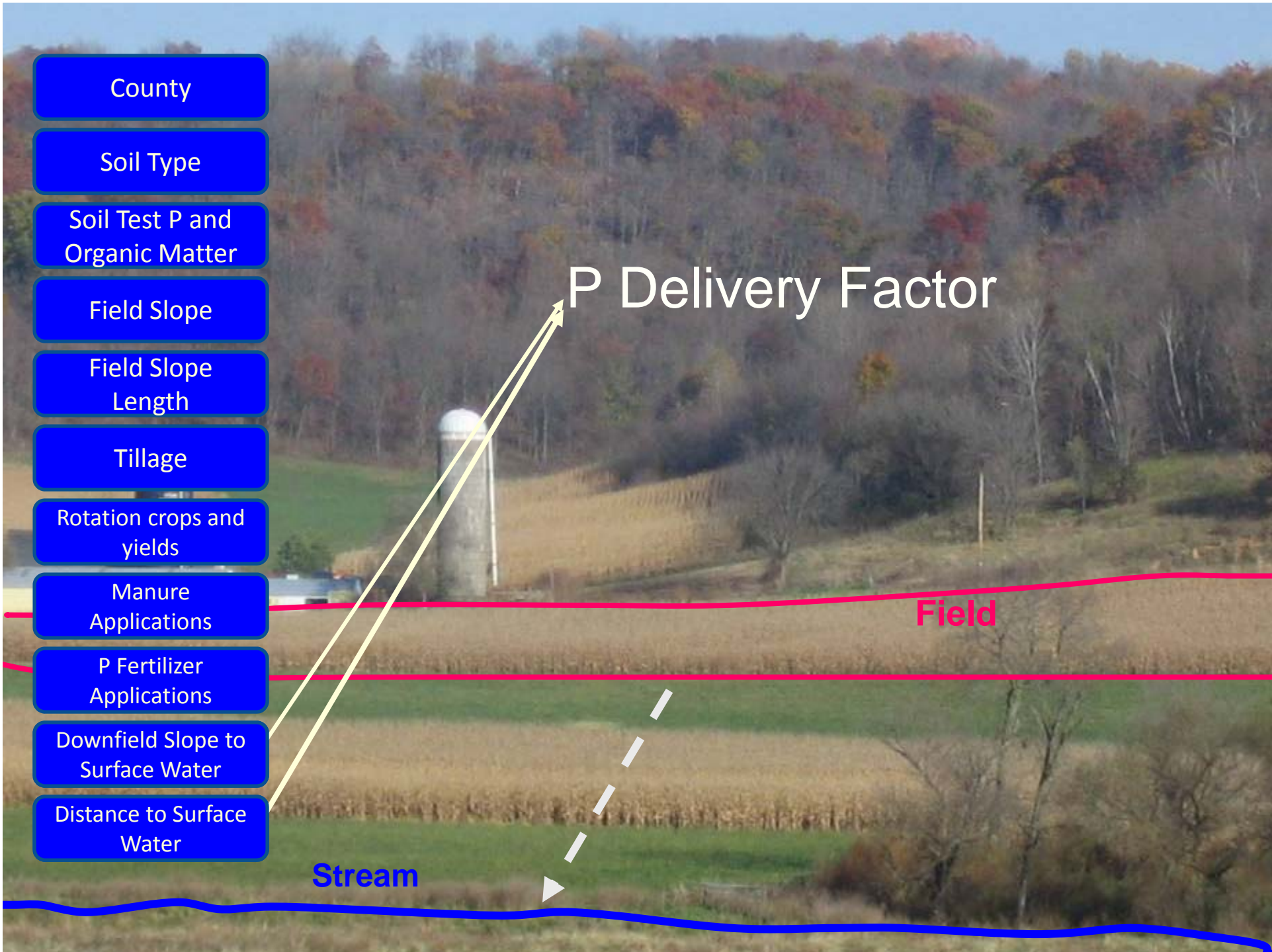
Marathon County, Loyal silt loam, 4% slope.

Initial soil test P is 100 ppm.

Corn silage, 18 in rows. Fall chisel plowed or no-till.

With and without 12,000 gallons/acre liquid dairy manure in Fall.





County

Soil Type

Soil Test P and  
Organic Matter

Field Slope

Field Slope  
Length

Tillage

Rotation crops and  
yields

Manure  
Applications

P Fertilizer  
Applications

Downfield Slope to  
Surface Water

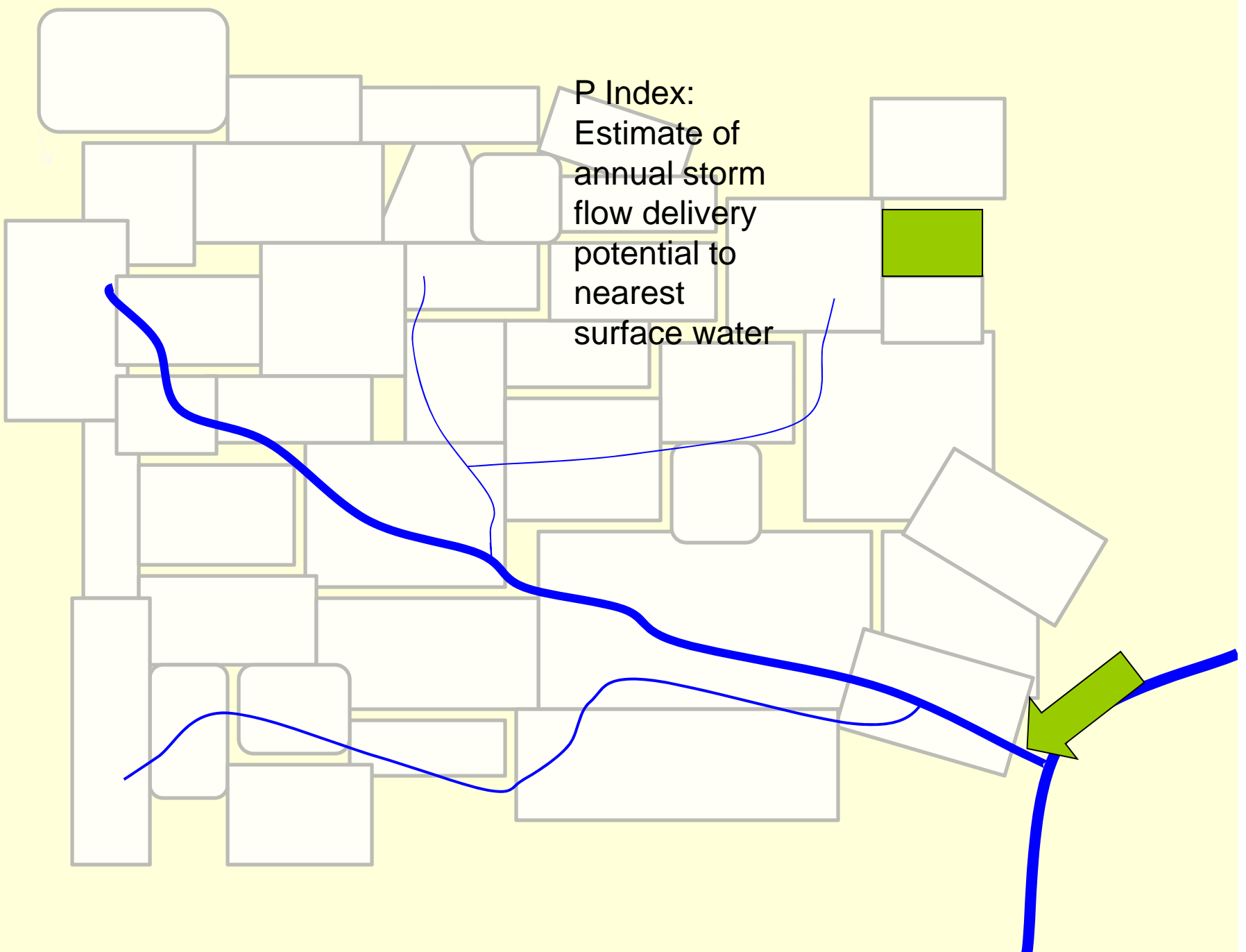
Distance to Surface  
Water

P Delivery Factor

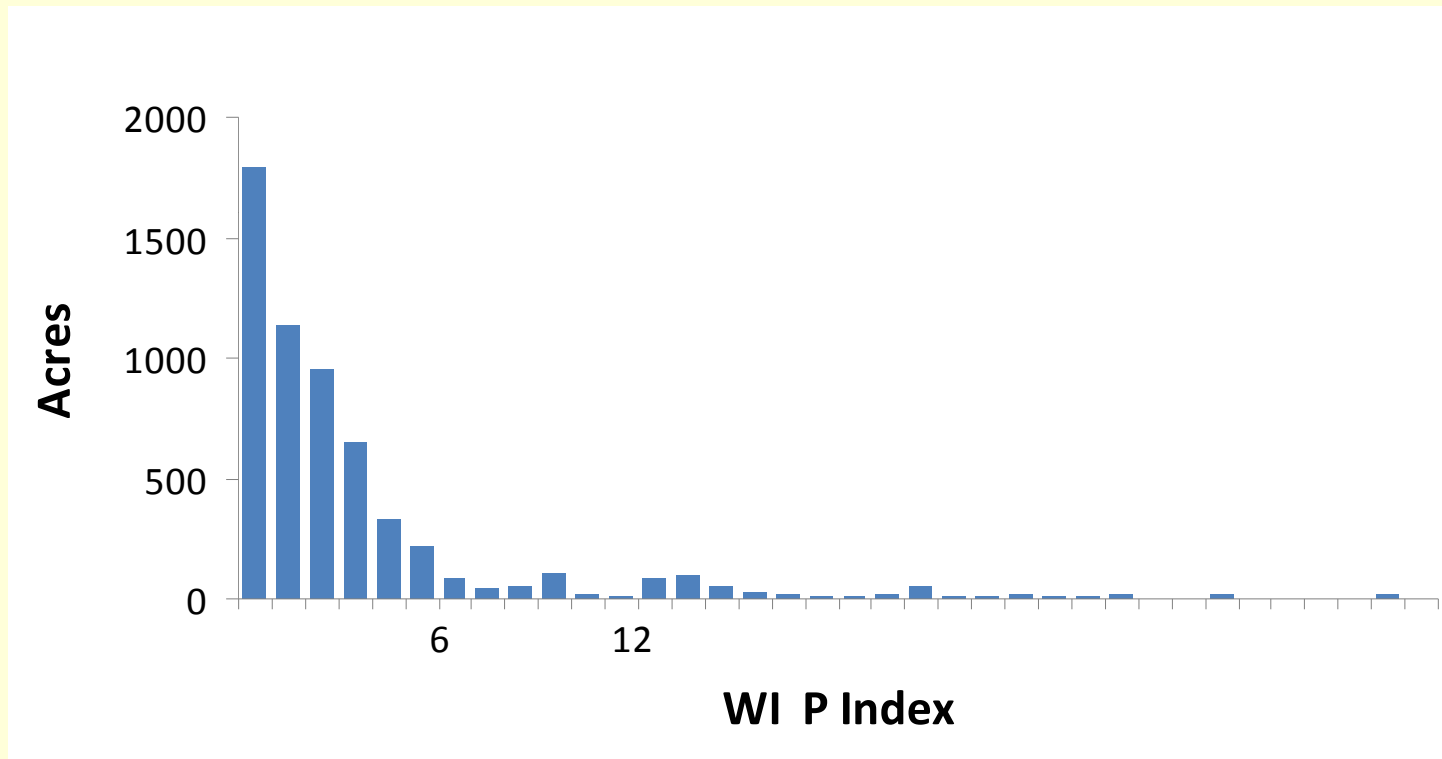
Field

Stream

P Index:  
Estimate of  
annual storm  
flow delivery  
potential to  
nearest  
surface water

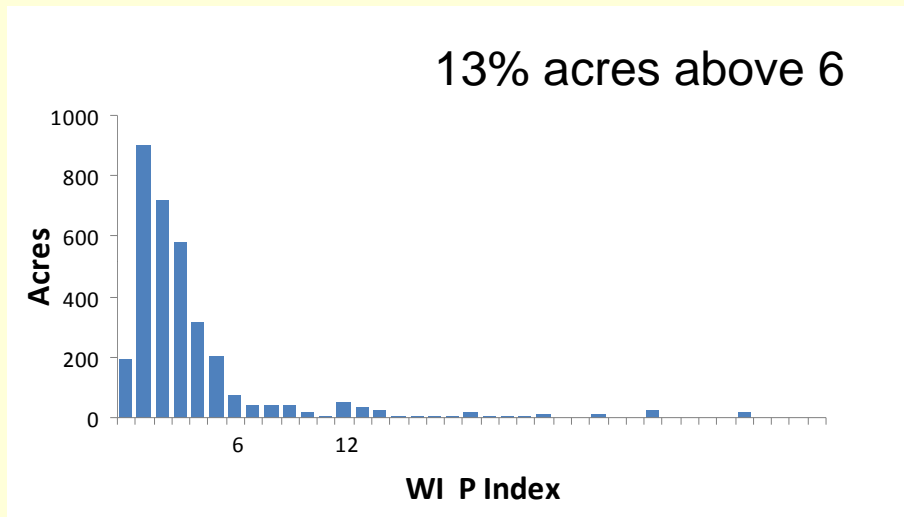


# P Loss Potential Varies Across A Watershed

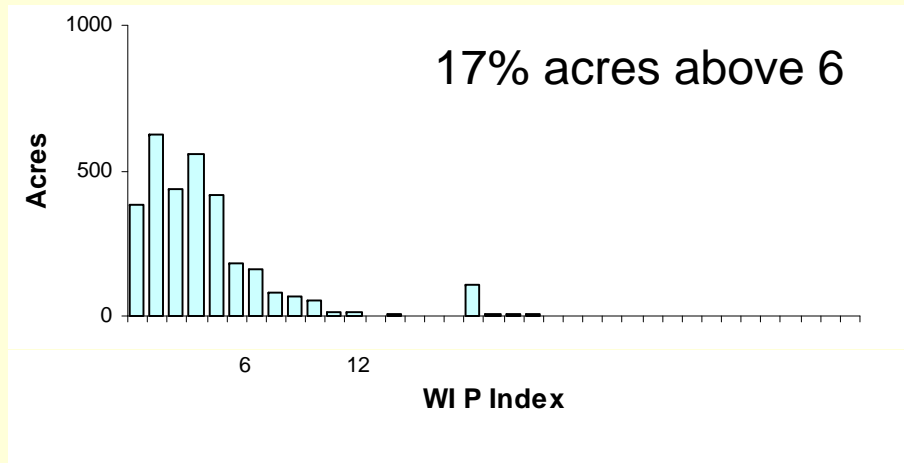


# Similar watersheds have similar PI Index distribution

Paired watersheds in Driftless Area – cropland, intensive grazing



Average soil test P: 34 -37 ppm  
Average soil loss: ~ 2.5 T/acre/yr  
Average WI P Index: 4



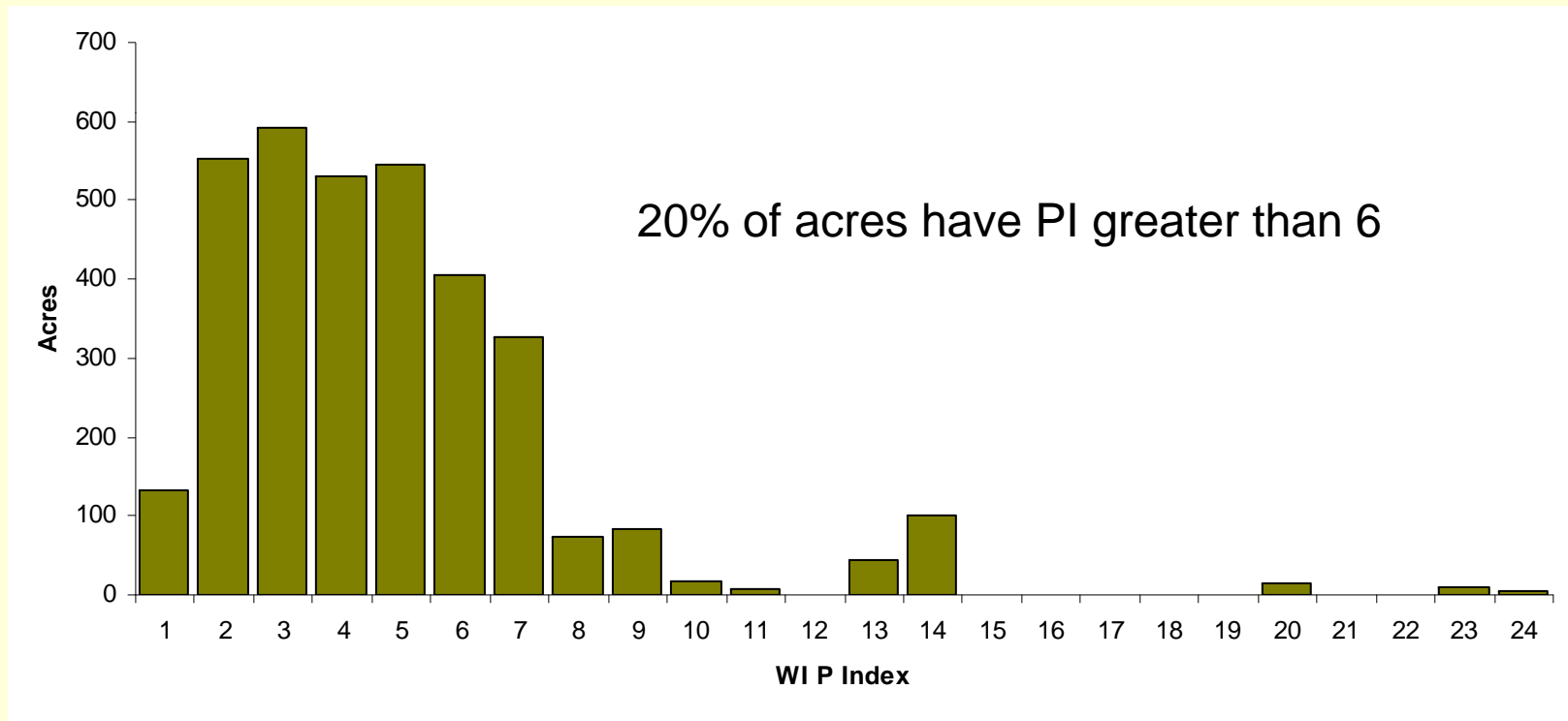
# Dane County

## N. Fork Pheasant Branch Cropland

Average soil test P: 93 ppm

Average soil loss: 2.5 T/acre/yr

Average WI P Index: 4

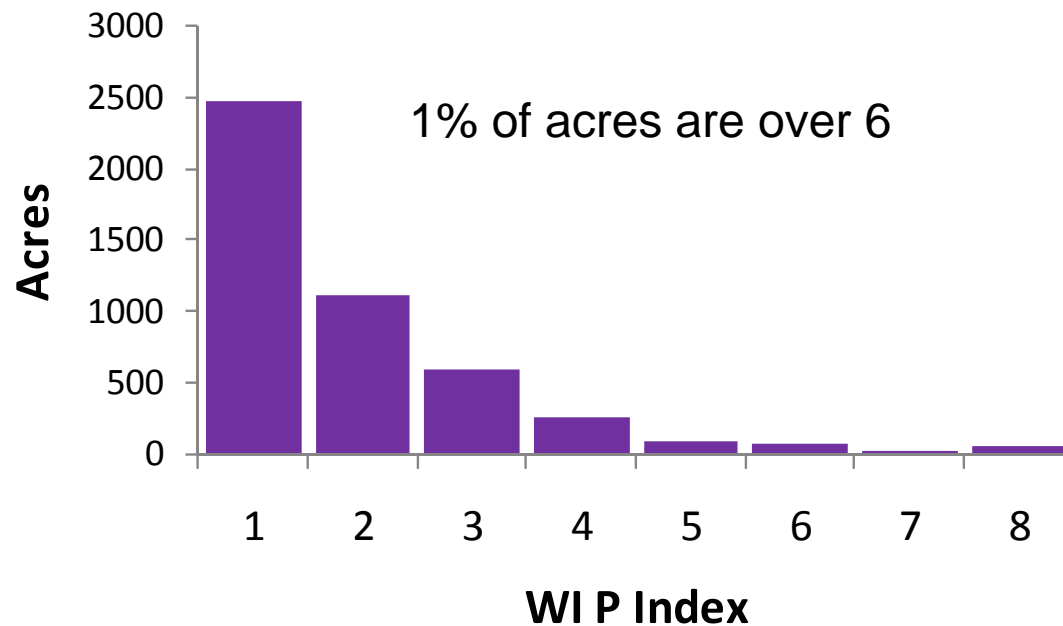


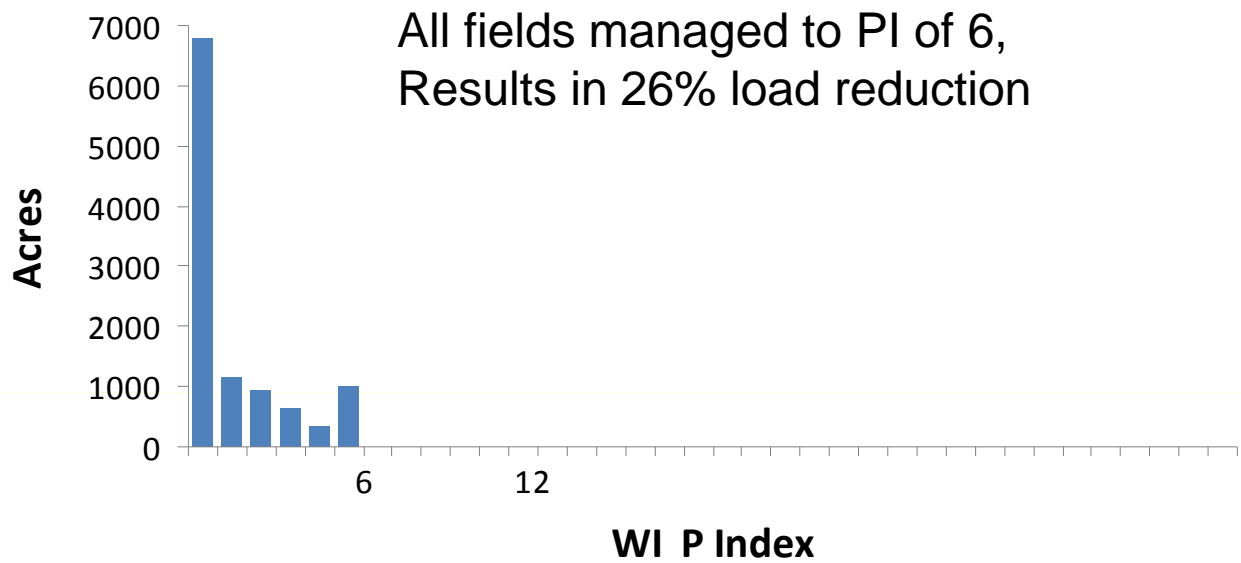
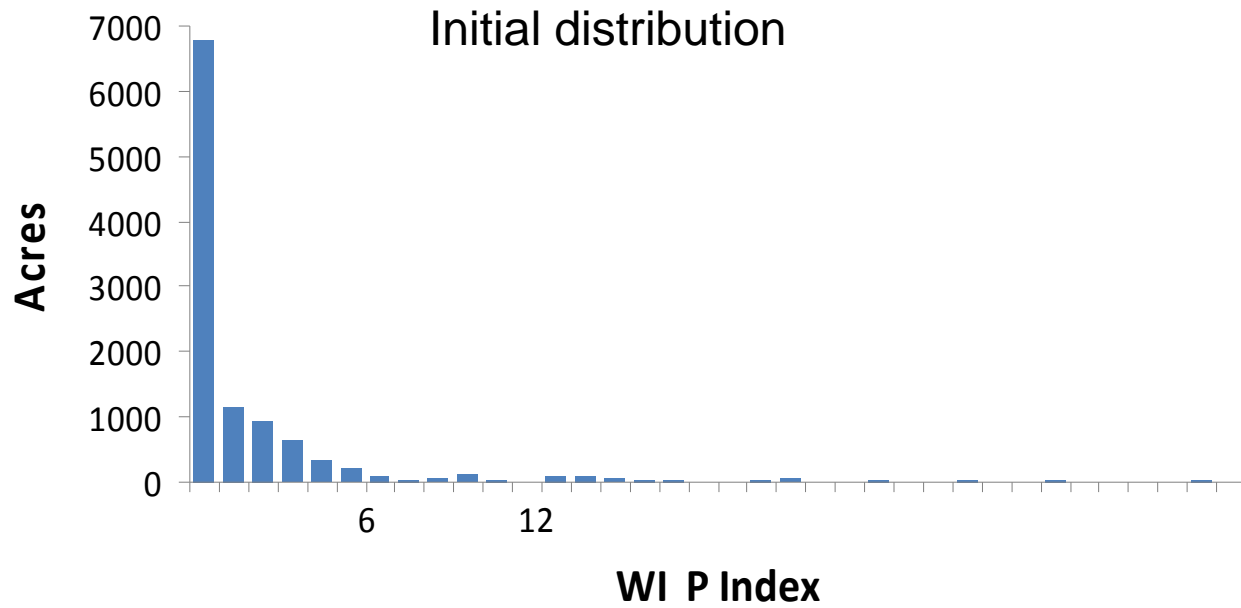
Source: Corey Anderson

# Lake Montello, Marquette County

Cropland

Average soil test P: 64 ppm  
Average erosion: 1.2 T/a/yr  
Average WI P Index: 1





# Need to quantify other sources of P delivery to stream

## Storm loads:

- Dry lots, night pastures
- Barnyards
- Bank erosion

## Base loads:

- Groundwater
- Cattle in stream channels
- Phosphorus sorption and release from sediments
- Tile drains





# **Wisconsin P Index Basics**

for Watershed Planning

- Reasonable field rating tool
- Fields vary
- Watersheds vary