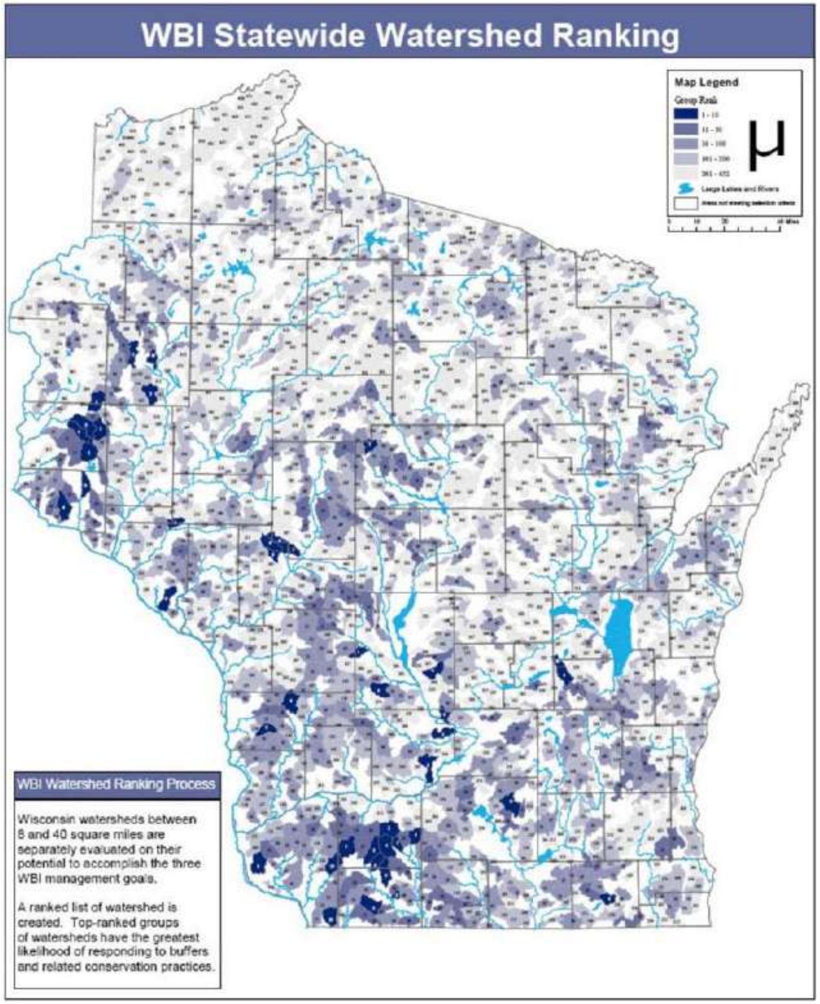
Success: Producer Implemented Water Quality Improvement in the Driftless Area

Steve Richter, The Nature Conservancy
Laura Ward Good, Soil Science, University of Wisconsin
Pat Sutter, Curt Diehl, and Duane Wagner, Dane County Land Conservation
Adam Dowling, NRCS; Kim Meyer and Jim Leverich, UW Extension
Faith Fitzpatrick and Rebecca Carvin, US Geological Survey
Jasmeet Lamba and John Panuska, Biological Systems Engineering

Messages

- Farmers can make management changes to reduce phosphorus loads
- Develop trust with farmers, but this was not a farmer-led project
- Success requires staff for inventory, implementation, and tracking. Things are always changing year to year
- Lessons learned to help your project

2005: Wisconsin Buffer Initiative Report



Watersheds ranked for their potential to meet three management goals:

(1) Improve stream water quality

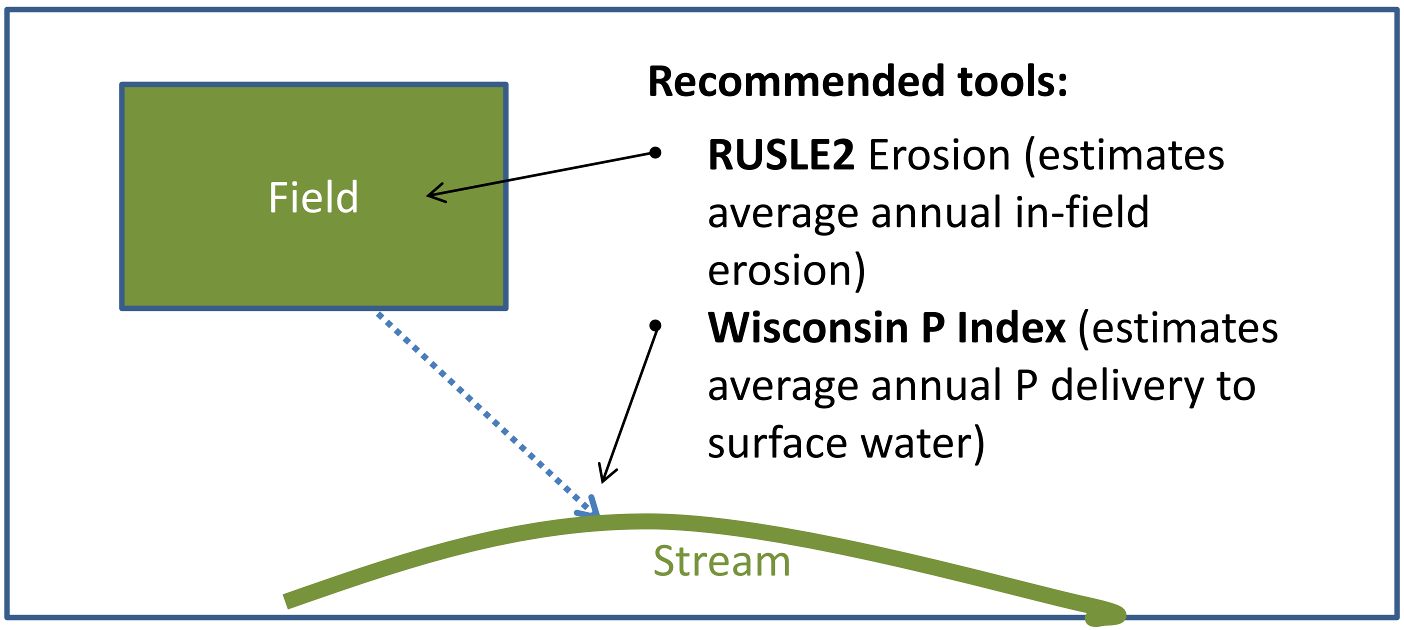
(2) Protect and enhance biological communities

(3) Sustain lake water quality

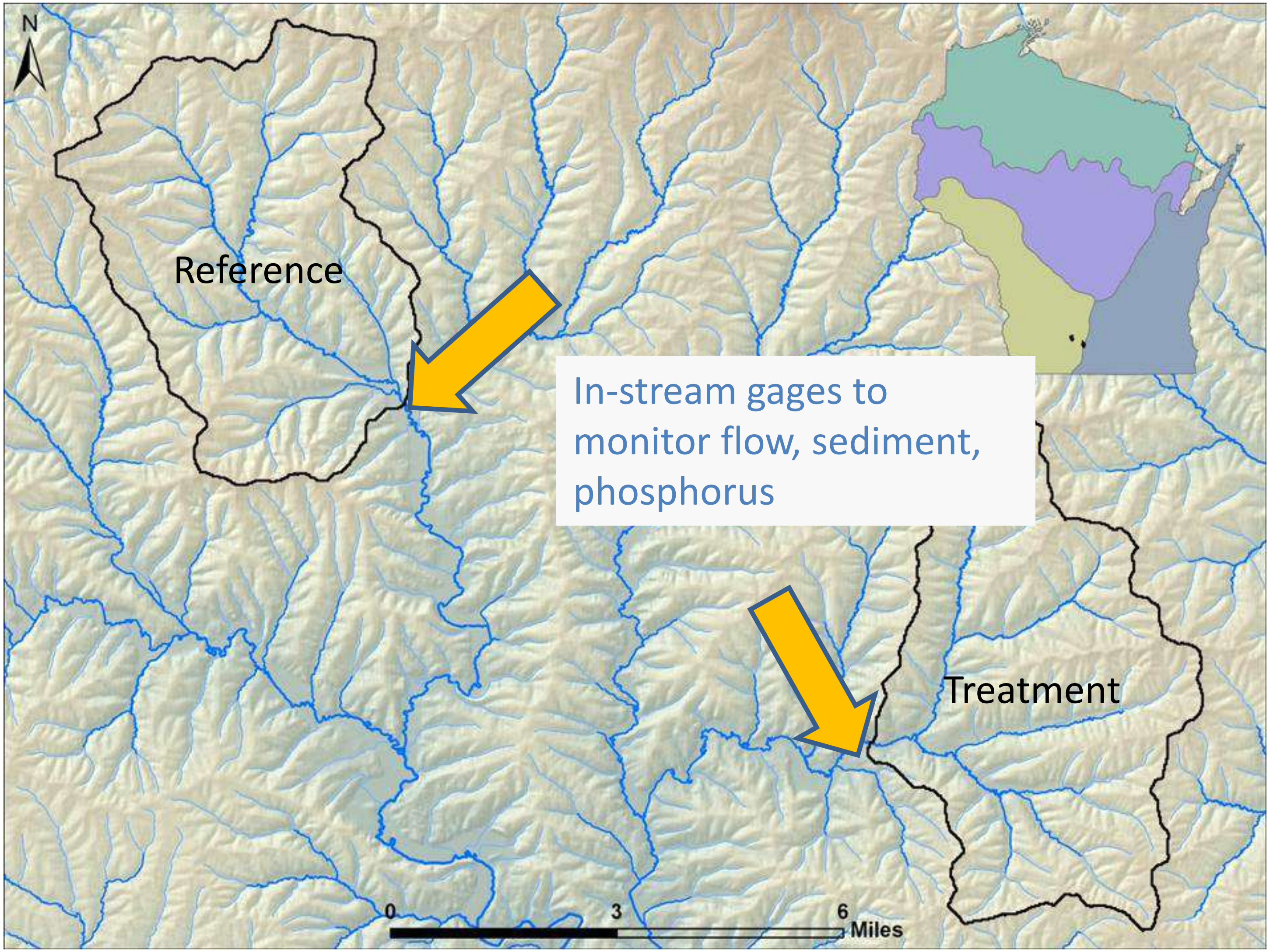
WBI Recommendations for Targeting Conservation in Watersheds

Focus efforts on fields contributing highest amounts of sediment and nutrients to surface water.

Use assessment tools that quantify runoff losses to identify high loss fields



Paired watershed study , but not the route for most projects



2006	2007	2008	2009	2010	2011	2012	2013	2014	2015

Stream monitoring, sediment and P budgeting

Partners: US Geological Survey, University Wisconsin, WI Department of Natural Resources, The Nature Conservancy

Additional funding: USDA-NIFA

Inventory and Assessment

Partners: Dane County Land Conservation Department and Univ. of Wisconsin

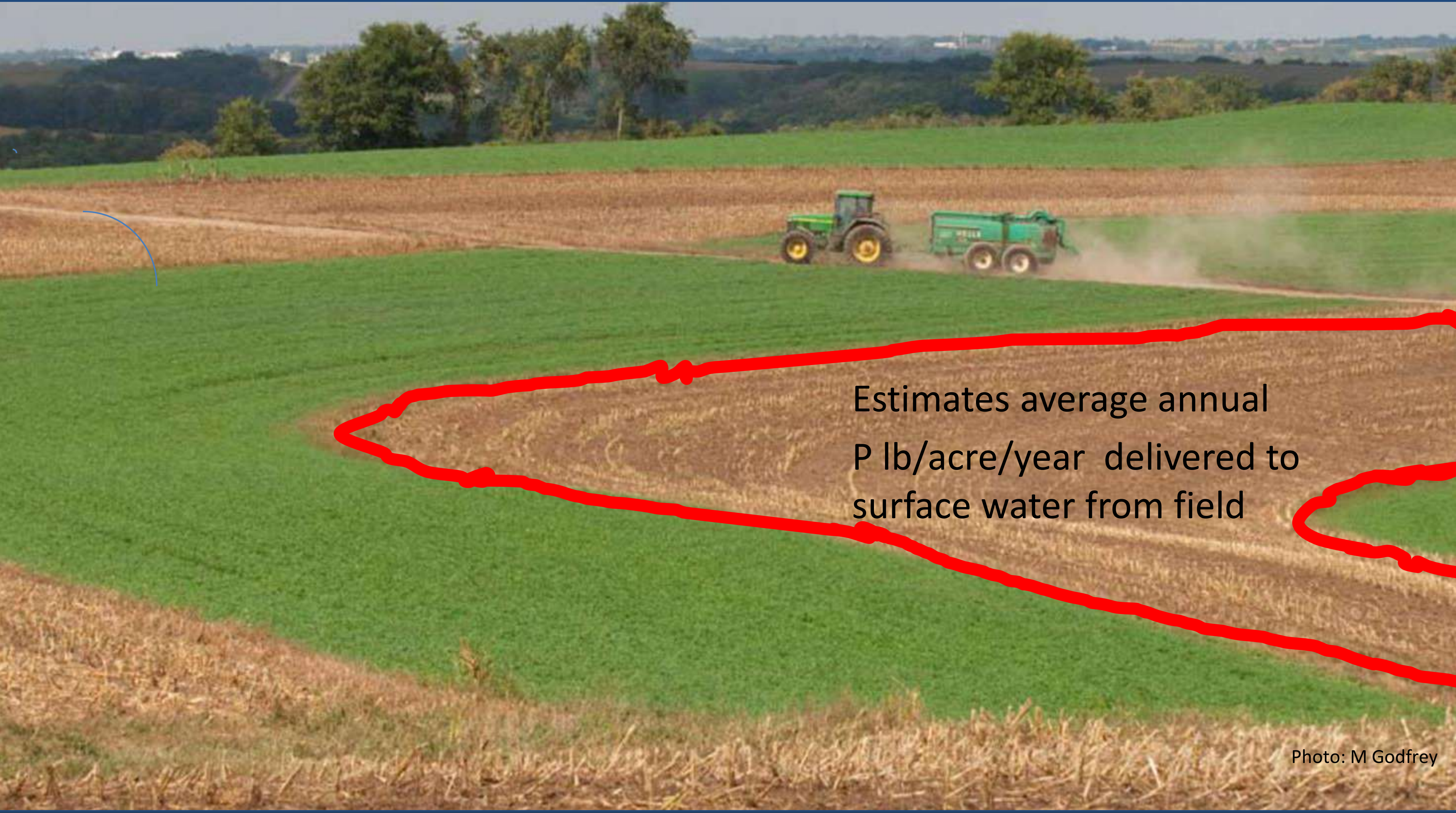
Additional funding: The Nature Conservancy

Implementation

Partners: Producers, Dane County Land Conservation Department, NRCS, UW-Extension

Practice funding: NRCS, The Nature Conservancy

Wisconsin P Index used as targeting tool

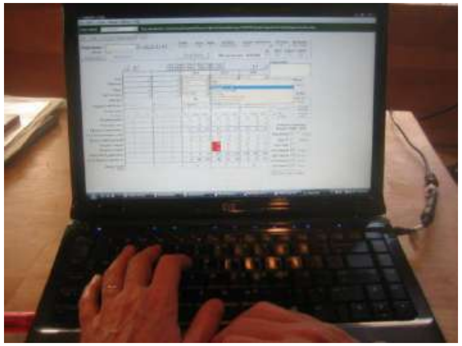


Developed for use in Nutrient Management Planning, uses “conservative” assumptions

Inventory

Baseline Inventories for Erosion and Runoff and P Loss Assessment

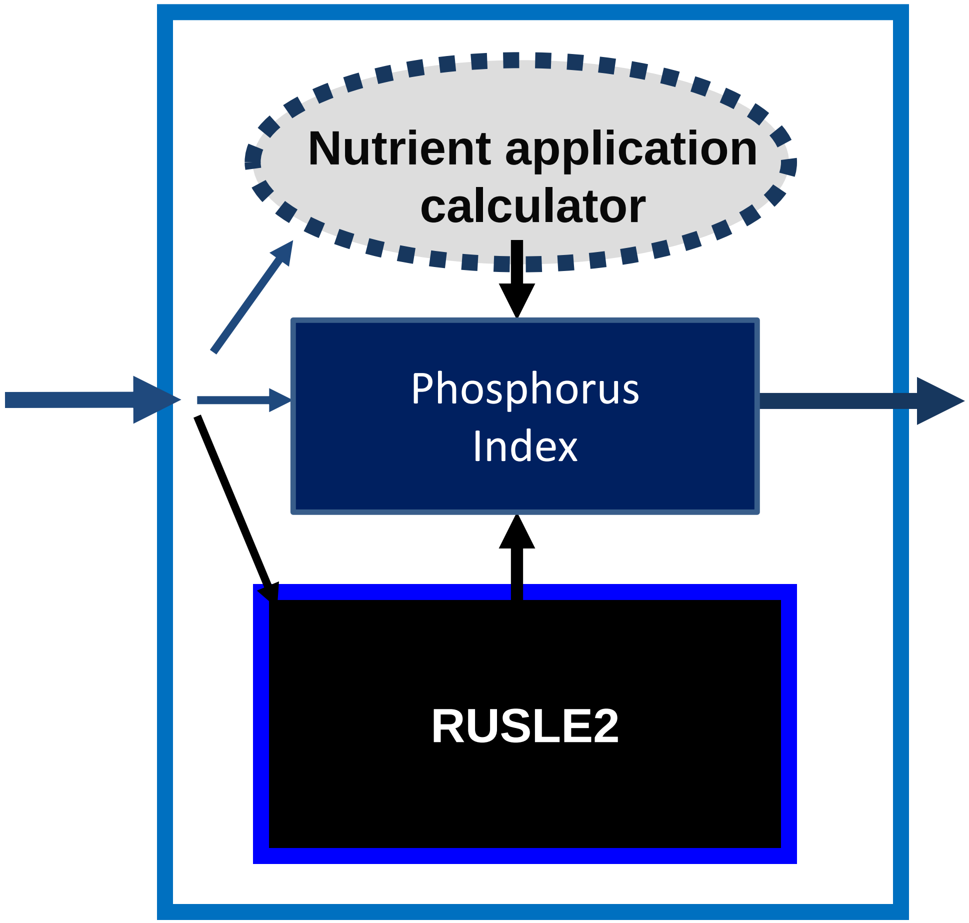
- Interview farmers to find out crops and field management
- Soil sample fields (routine analysis for crops)
- Calculate soil loss and P Index in SnapPlus



SnapPlus Inputs and Outputs

Inventory Information

- 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



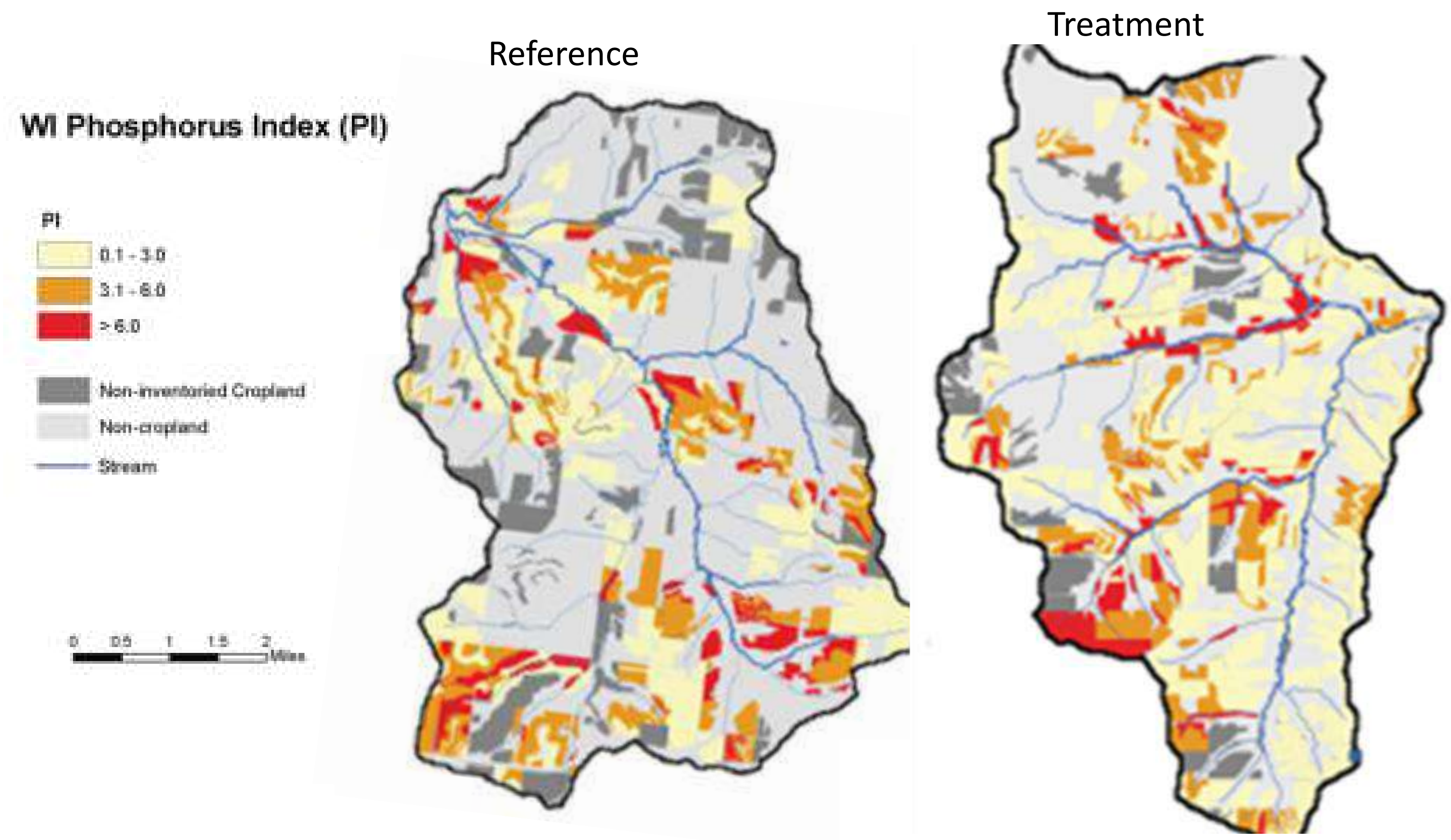
Calculations

P Index:
- **Rotation Average**
- **Annual**
  - **Dissolved**
  - **Particulate**

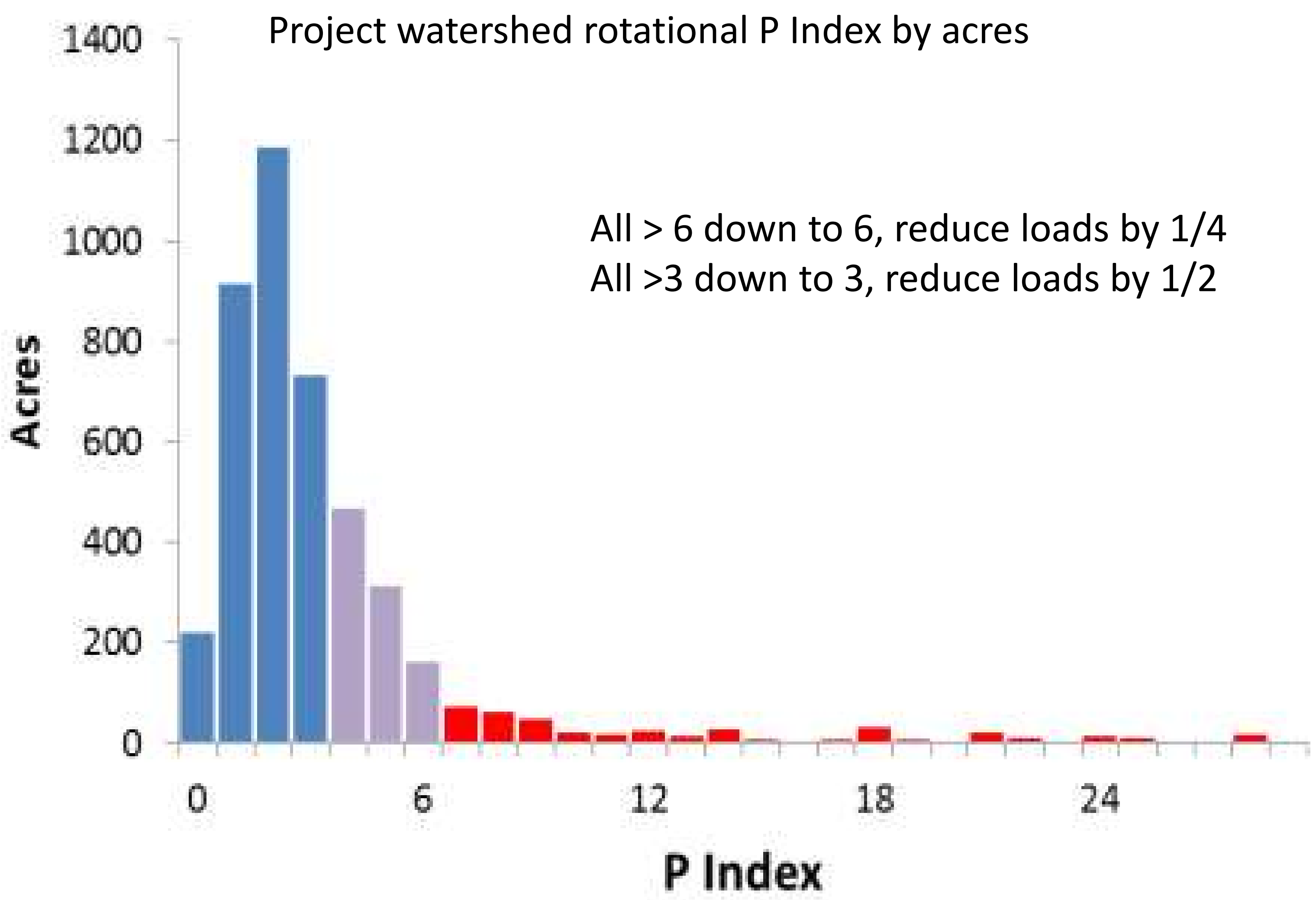
Erosion

Now also have P Trade Report

Baseline P Index Distribution

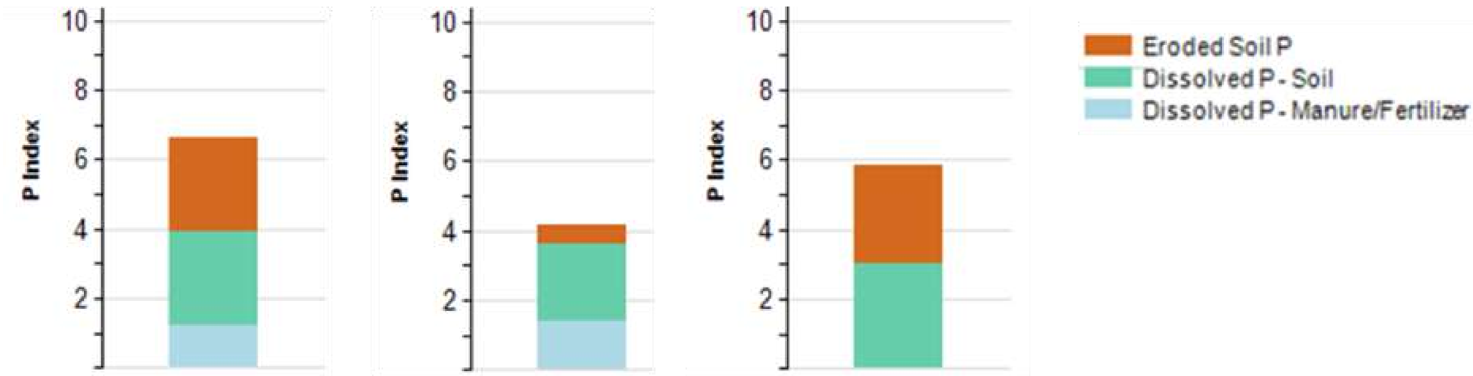


Baseline P Index Distribution



Example High P Loss Field

Flat field (1% slope) in continuous corn silage with excessively high soil test P (200 ppm)



Original

Spring chisel
Winter solid manure
46 lb P_2O_5 commercial

Alternative A

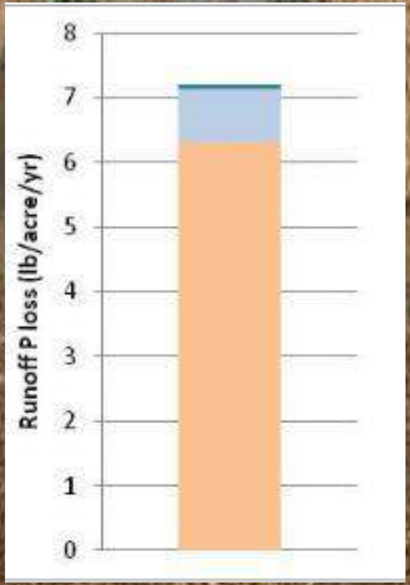
No-till,
Same manure and fertilizer

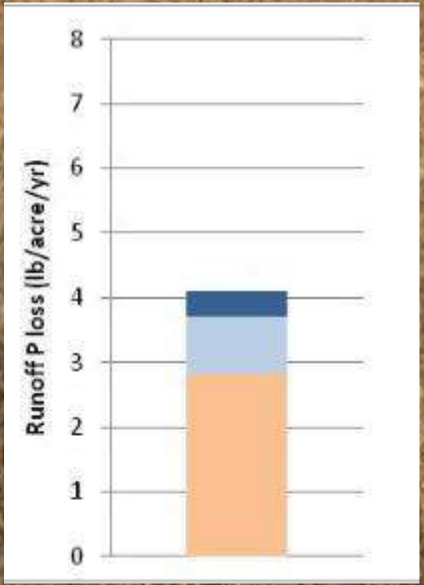
Alternative B

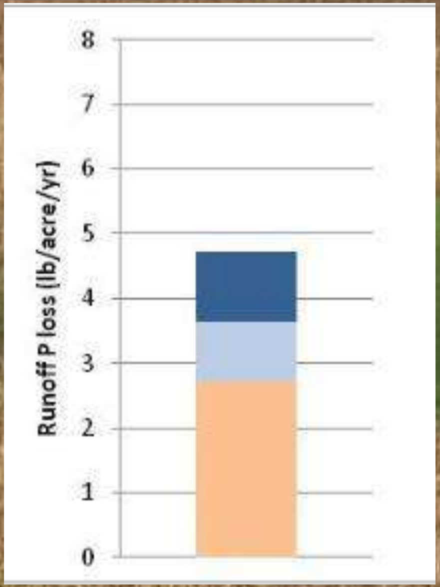
Same tillage,
no manure,
Starter fertilizer

P Index Varies with Management

Rotation: 3 years corn silage and 3 years alfalfa
9% slope, silt loam
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

Local land conservation staff key to project

- Fields and pastures for 70 landowners inventoried
- 11 farmers where selected for project focus based on P delivery risks. Ended up working with 13 of 44 farmers.

Management Practices

Cropland practices:

- No-till, reduced till
- Forage crops after silage
- Rotation change
- Nutrient management planning

Pasture practices:

- Pasture management, reseeding

Reductions went below runoff standards

First targeting: Fields with P Index above 6

Second targeting: Fields with P Index between 3 and 6

Reality: Farmers applied practices across many fields, not just high P Index fields

“Hard” Practices

Barnyard runoff,
Stream crossings,
Small water control projects

Streambank restoration

Project Implementation Costs

-Inventory soil samples (routine, 5 ac/sample): $20,000
-County staff to engage farmers and tracking: $50,000/year

-Monitoring and sample analysis: $45,000/year (2 stations)

-Farmer Incentives (NRCS, TNC, WDNR, County):

Field practices $130,000 — No-till, NMP, grass waterways

Constructed practices $570,000 — barnyards, fencing, stream work, crossings

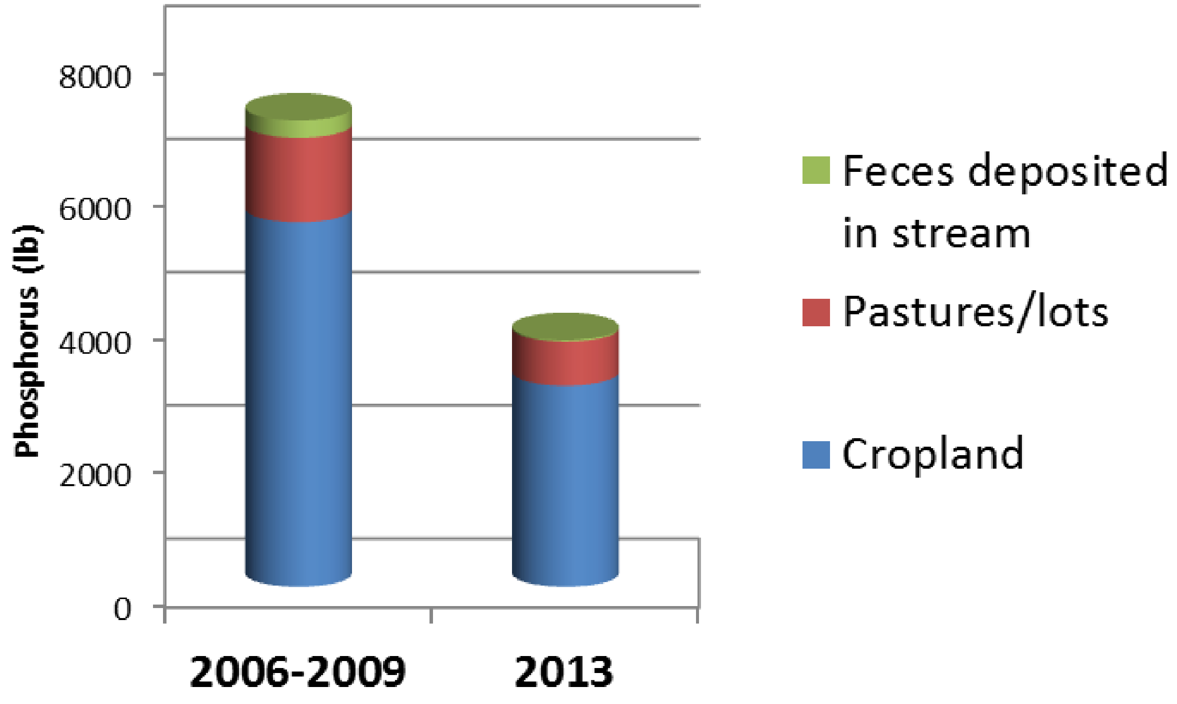
Ten Participating Farms Reduced Runoff P Loss and Erosion

Estimated average annual runoff P and erosion reductions in Pleasant Valley from cost-shared managements in the implementation period (2010-2013) compared to baseline (2006-2009)

		Acres	P reduction (lb/yr)	Erosion reduction (ton/yr)
	No-till/reduced till/residue management	**1840**	**3300**	**2000**
	Pasture systems (stream crossings, fencing, seeding)	**315**	**1100**	**100**

Participating farms cut runoff P losses in half

Estimated average annual runoff P losses for participating farms, baseline (2006-2009) and 2013



Farmer Experience

Mark Keller operates a 300 cow dairy along with his brother Tim. Mark took ownership of the nutrient management plan on their farm and learned the SnapPlus program. He used the program to test out various cropping scenarios that reduced erosion and runoff phosphorus losses and that would fit into their current farming operation, including less tillage and adding winter rye to the rotation in some fields.

Challenges of inventory and tracking

- Many (970) small fields (average field size <5 acres)
- Labor intensive to keep crops and management records up-to-date
- Farm ownership and field boundaries and names changed
- Project management critical, yet many times forgotten

Challenges of implementation

- Short time-frame for sign-up for federal cost-share
- Two of ten farms in initial target group reluctant to participate
- “Learning curve” for all partners
- Local agricultural consultants not brought in as initial partners
- Shifts in land operators
- Making the economic case for the change

Challenge: Quantifying Constructed Practices

- Small water control structures
- Stream bank protection
- Barnyards/feeding areas

  BARNY reductions: 550 lb P/yr

Photos: Curt Diehl, Dane LCD

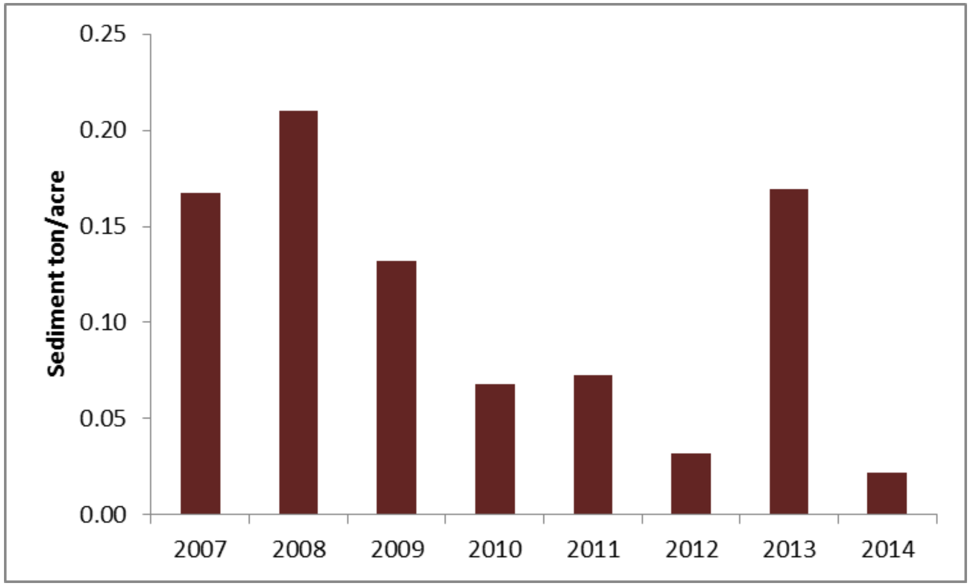
Stream Banks as a Source of Sediments and Nutrients in Treatment Watershed

More agriculture in a subwatershed = greater proportion of sediment from agricultural land

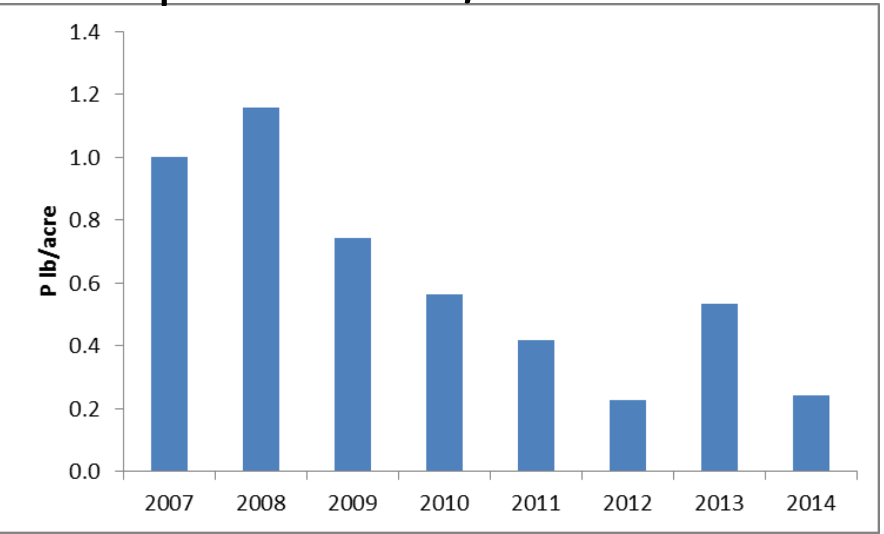
Sediment at outlet:
30% from stream banks
70% from croplands and pastures

Monitoring: Annual Sediment and Phosphorus Loads in Treatment Watershed

Sediment in ton/acre



Phosphorus in lb/acre

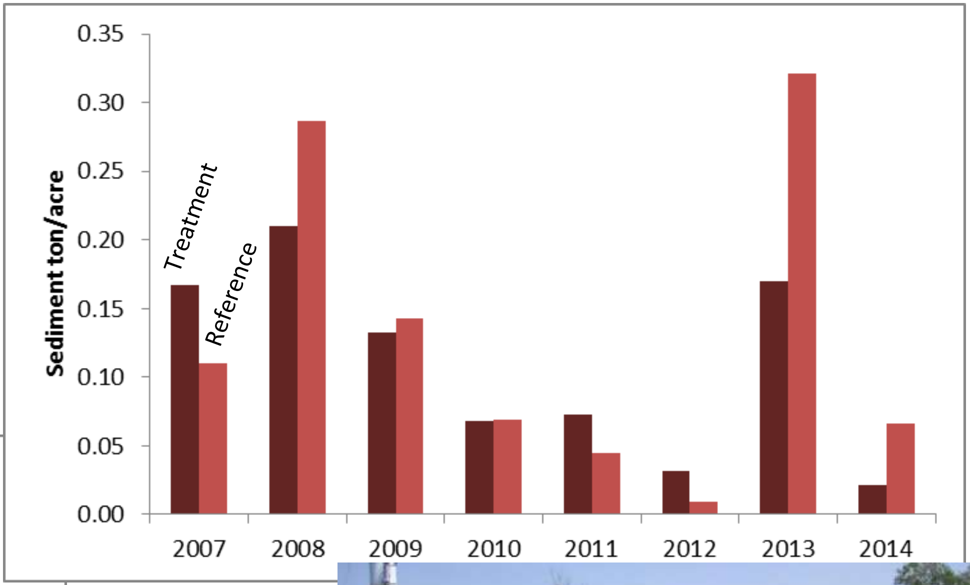


Weather-caused variability in annual loads obvious in treatment watershed

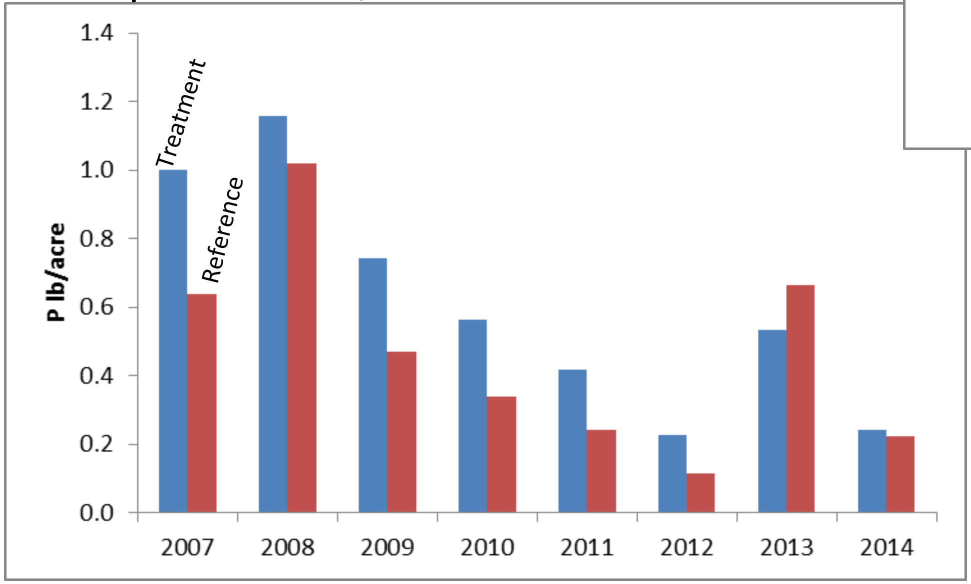
Annual Sediment and Phosphorus Loads in Treatment and Reference Watersheds

Reference watershed had weather-caused variability similar to the Treatment watershed.

Sediment in ton/acre



Phosphorus in lb/acre



Targeted Implementation Worked

Farmers responded, addressed 73% of the fields with PI>6 and 66% of those PI 3 to 6

Water quality improved

Reduction in phosphorus and sediment loads: 2013-2015 storms and snowmelt

Becky Carvin at USGS stream water sampling station

55%

95% confidence

$ per pound P and ton soil erosion reduction
How to measure outcomes, not by $$/acre

Cropland management practice cost-share expenditures per unit reduction in estimated average P delivery and erosion for three farms

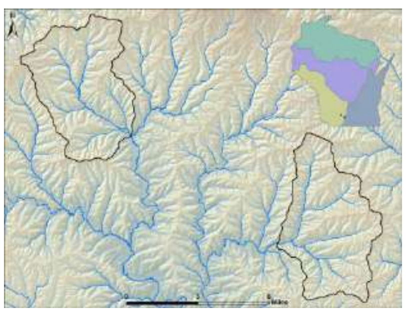
	P Index	**Erosion**
	$ per lb	*$ per ton*
Dairy farm	5	8
Beef farm	7	30
Cash grain	19	32

Adding in costs of technical assistance and verification could add $10 -100 per pound P

Caveats to Project Findings

for Trading or Adaptive Management Projects

lb/acre/yr
not
mg/L



- Project aimed at reducing loads, not concentrations. "Gains" from farm and pasture field practices

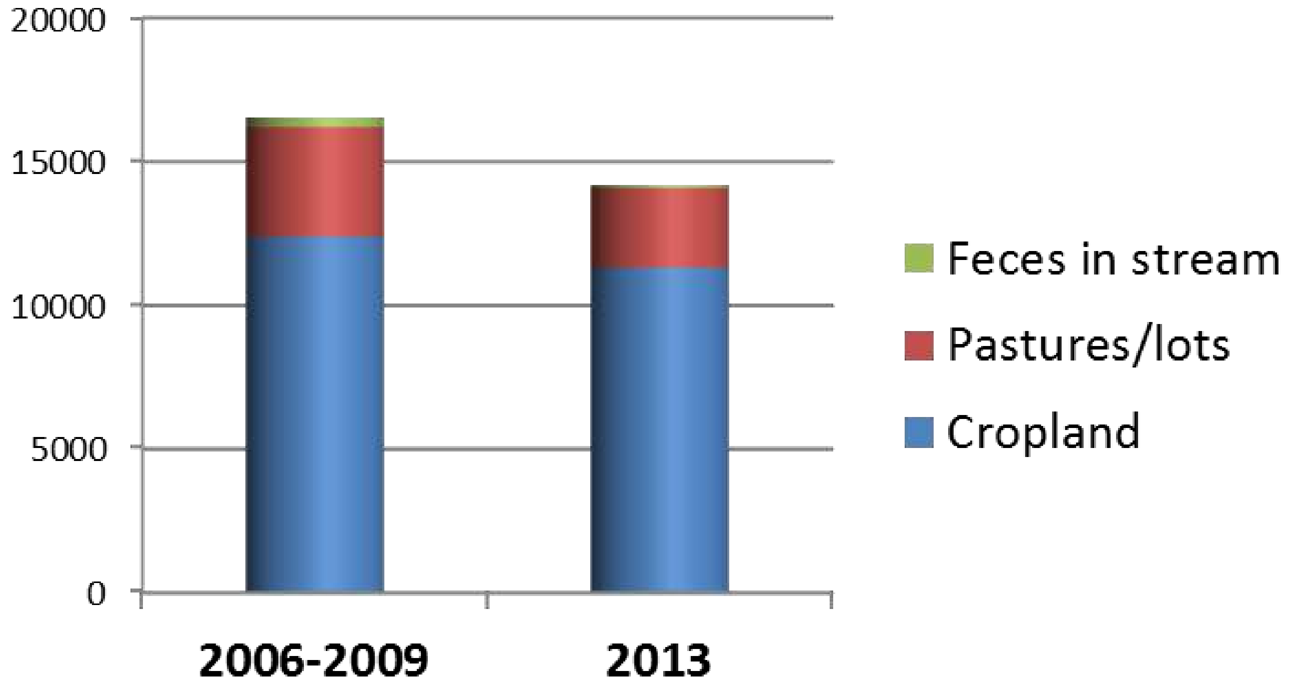
- Reductions were from "if the project did not exist" rather than baseline.

Did concentrations drop?

	Minimum sampling (1 x month)				Fixed interval (2 x month)		
	Total P [mg/L]		n		Total P [mg/L]		n
Watersheds	**Trtmt**	**Ref**			**Trtmt**	**Ref**	
Project Baseline Oct. 2006 - Sept. 2009	0.070	0.073	18		0.078	0.071	35
Post treatment Oct. 2012 – Sept. 2013	0.059	0.068	6		0.069	0.072	10

Runoff P losses increased on non-targeted farms, overall reduction from baseline: 12%

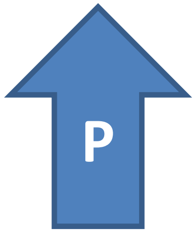
Estimated P delivery from all agricultural land in Pleasant Valley



Control watershed represents the no-project scenario

Similar land use trends in Treatment and Control watersheds

Grassland conversion to cropland ,



Declining animal numbers

Lessons for Water Quality Projects

- Involve all land managers and farm consultants at the start
- Periodically reassess watershed for new high delivery risks
- Provide adequate assistance and time for farmers to make decisions about their management changes
- Project management key, keeping everyone working together

Summary

- Famers implementing targeted conservation can reduce stream phosphorus loads

- Success requires staff for inventory, finding alternative managements, implementation, and tracking

SnapPlus

Partners, Assistance and Funding

Dane County, Land Conservation Department
Green County Land Conservation Department
University of Wisconsin-Madison
- Biological Systems Engineering
- Soil Science
- Nelson Institute of Environmental Studies
- Agricultural and Applied Economics
- Civil and Environmental Engineering
- Dairy Science and Agronomy

University of Wisconsin-Extension
U.S. Geological Survey
USDA Natural Resource Conservation Service
Wisconsin DNR
Wisconsin Department of Agriculture, Trade, and Consumer Protection
The Nature Conservancy
Landowners and Farmers
Monsanto Corporation
McKnight Foundation
USDA-NIFA award #2009-51130-06049
USGS cooperative program

Partners discuss new stream crossing on the Judd farm. © TNC