

Exploring the role of channel processes and legacy sediment in nutrient and sediment delivery, Upper Pecatonica River, Wisconsin

Faith Fitzpatrick and Rebecca Carvin (USGS WI Water Science Center),
Robert Hansis (WI Department of Natural Resources),
John Panuska and Laura Ward Good (University of Wisconsin –
Madison)

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Study Partners

Dane County, Land Conservation Division

Iowa and Green County Land Conservation Departments

University of Wisconsin-Madison

University of Wisconsin-Extension

U.S. Geological Survey

Natural Resource Conservation Service

Wisconsin DNR

Wisconsin DATCP

The Nature Conservancy

Monsanto Corporation

McKnight Foundation

USDA Cooperative State Research, Education, and Extension Service

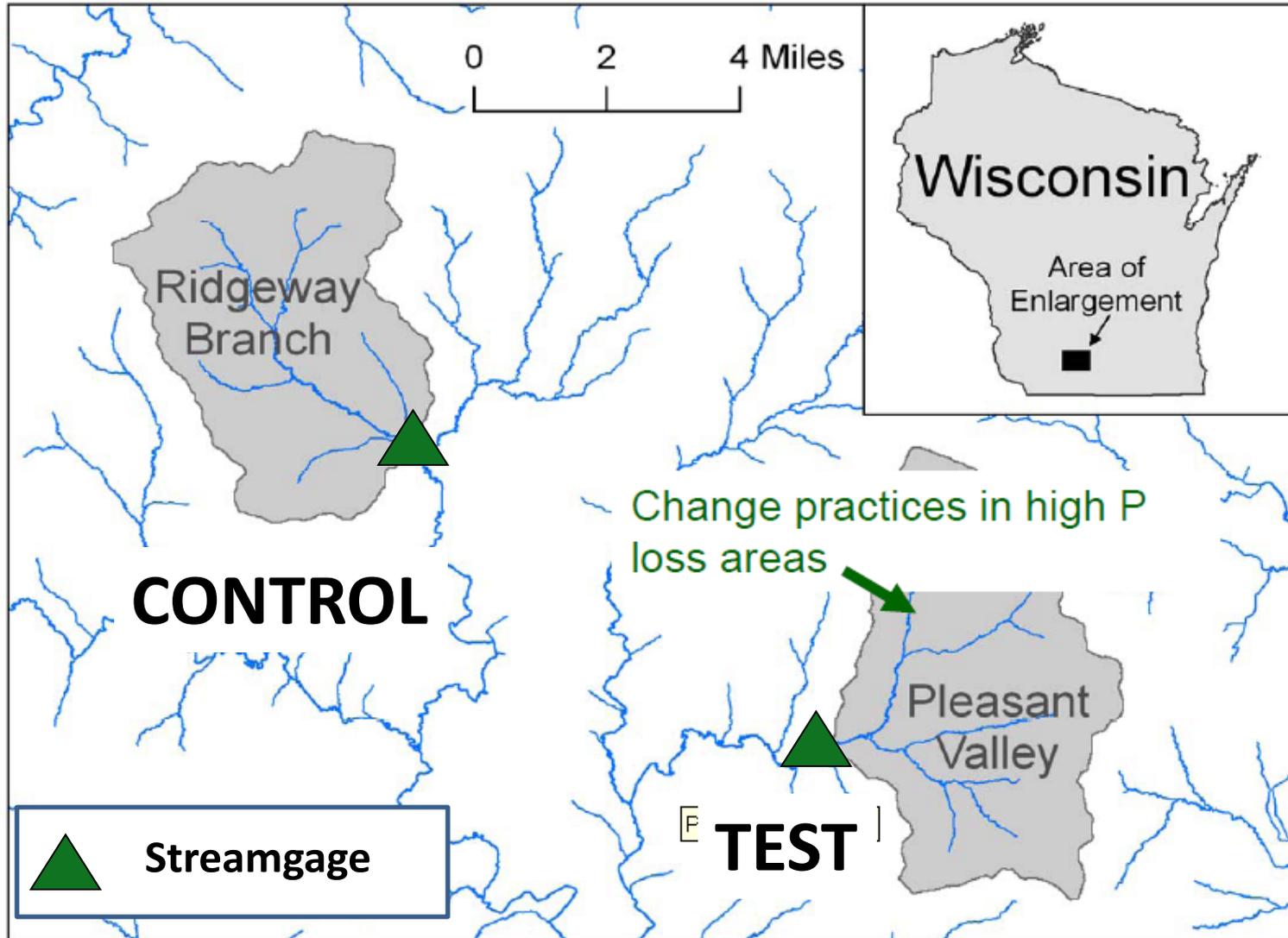
Testing Wisconsin Buffer Initiative Theories

- Reduce nutrient and sediment loads while keeping sustainable, economically viable agricultural resources
- Targeting best management practices to areas with the highest nutrient and sediment losses
- Use the Wisconsin Phosphorus Index to locate areas with high P losses within the watershed (potential runoff connection from field to stream)
- Evaluate effectiveness of targeted approach through monitoring nutrients, sediment, and biological response
- Reduce costs and improve efficiency for meeting water-quality goals





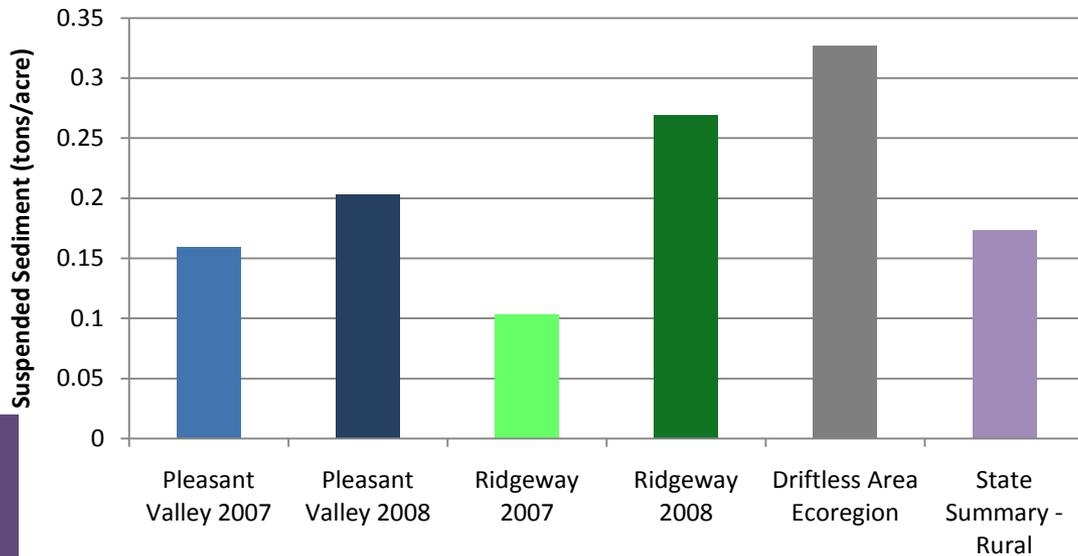
Paired Watersheds



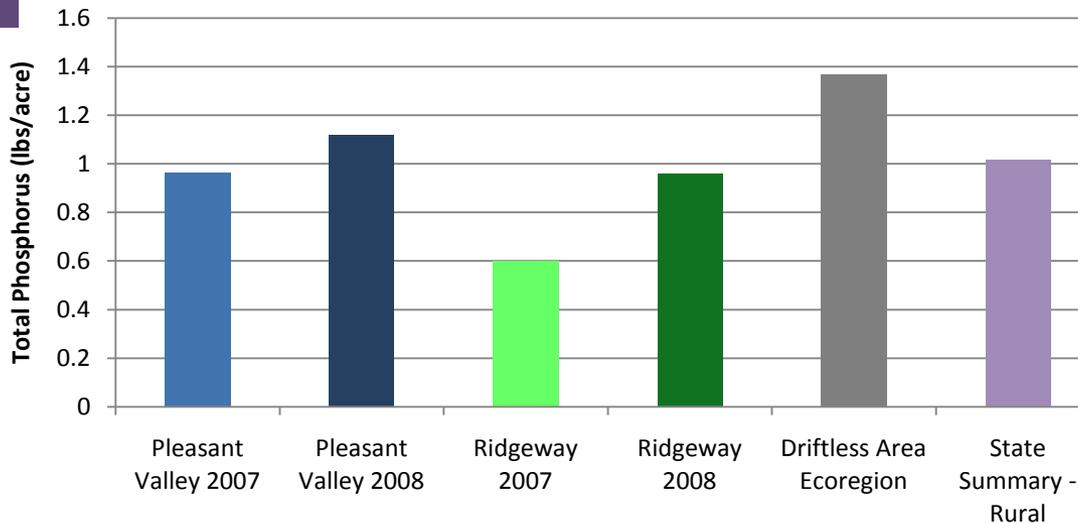


Watershed Outlet Baseline Data (2007-08)

Suspended Sediment

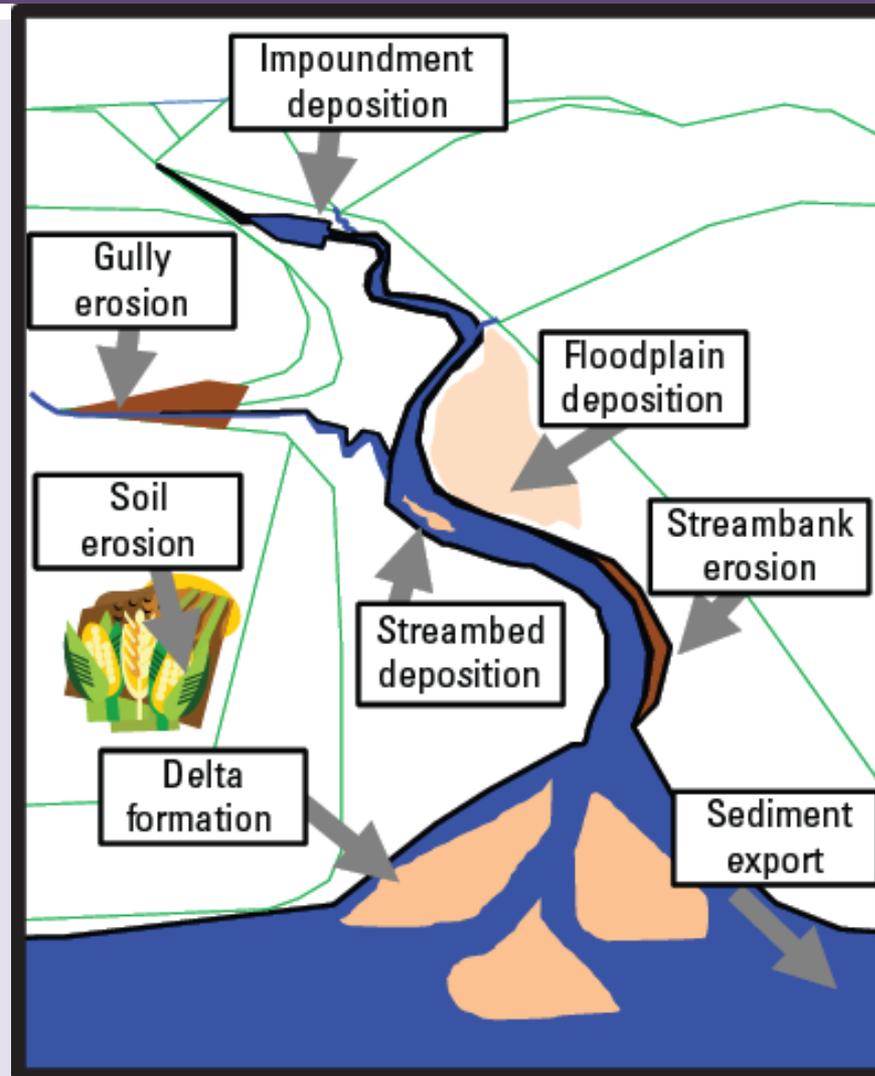


Total Phosphorus



(Graphs courtesy David Graczyk, USGS)

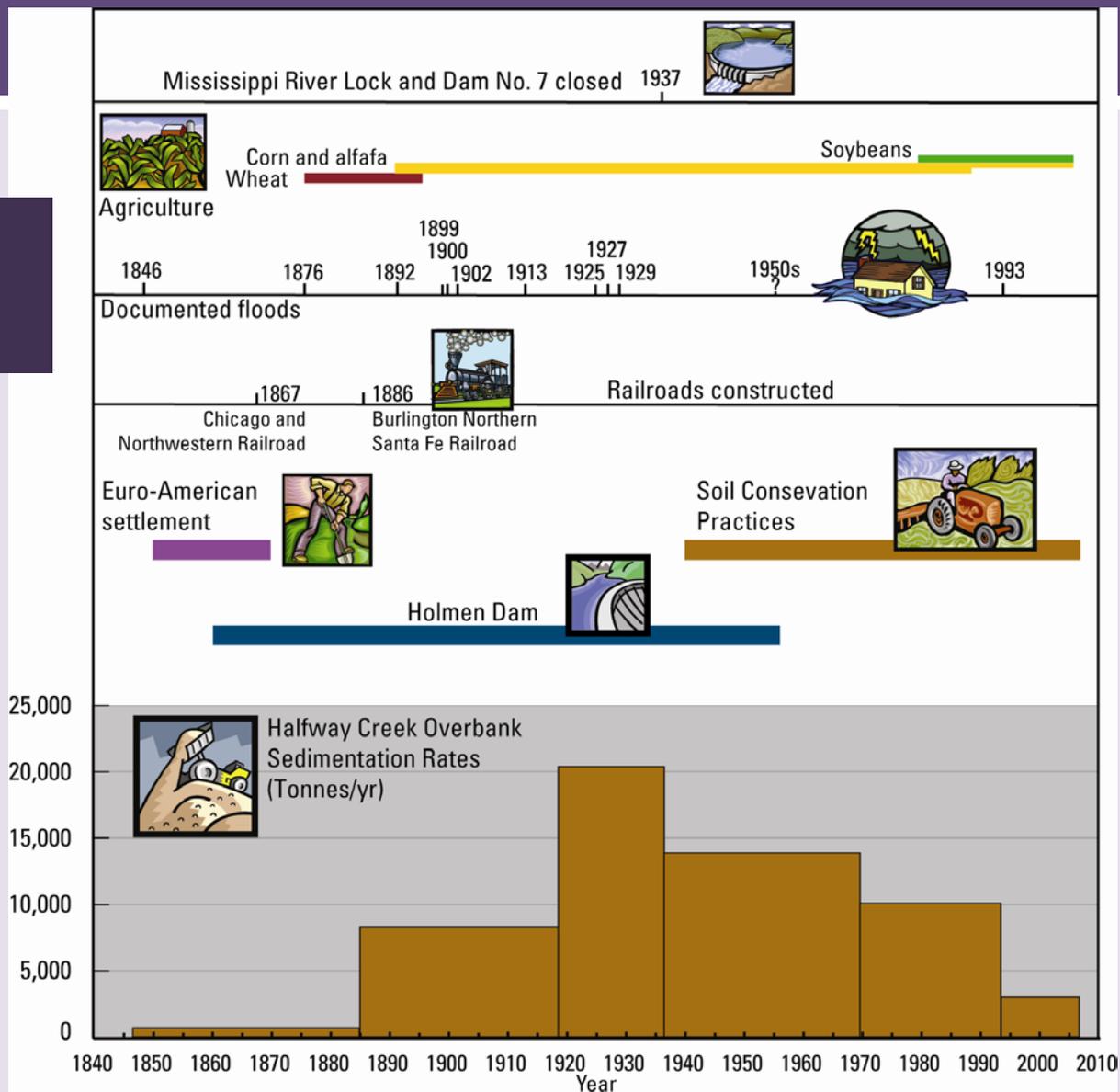
Sediment Sources and Sinks



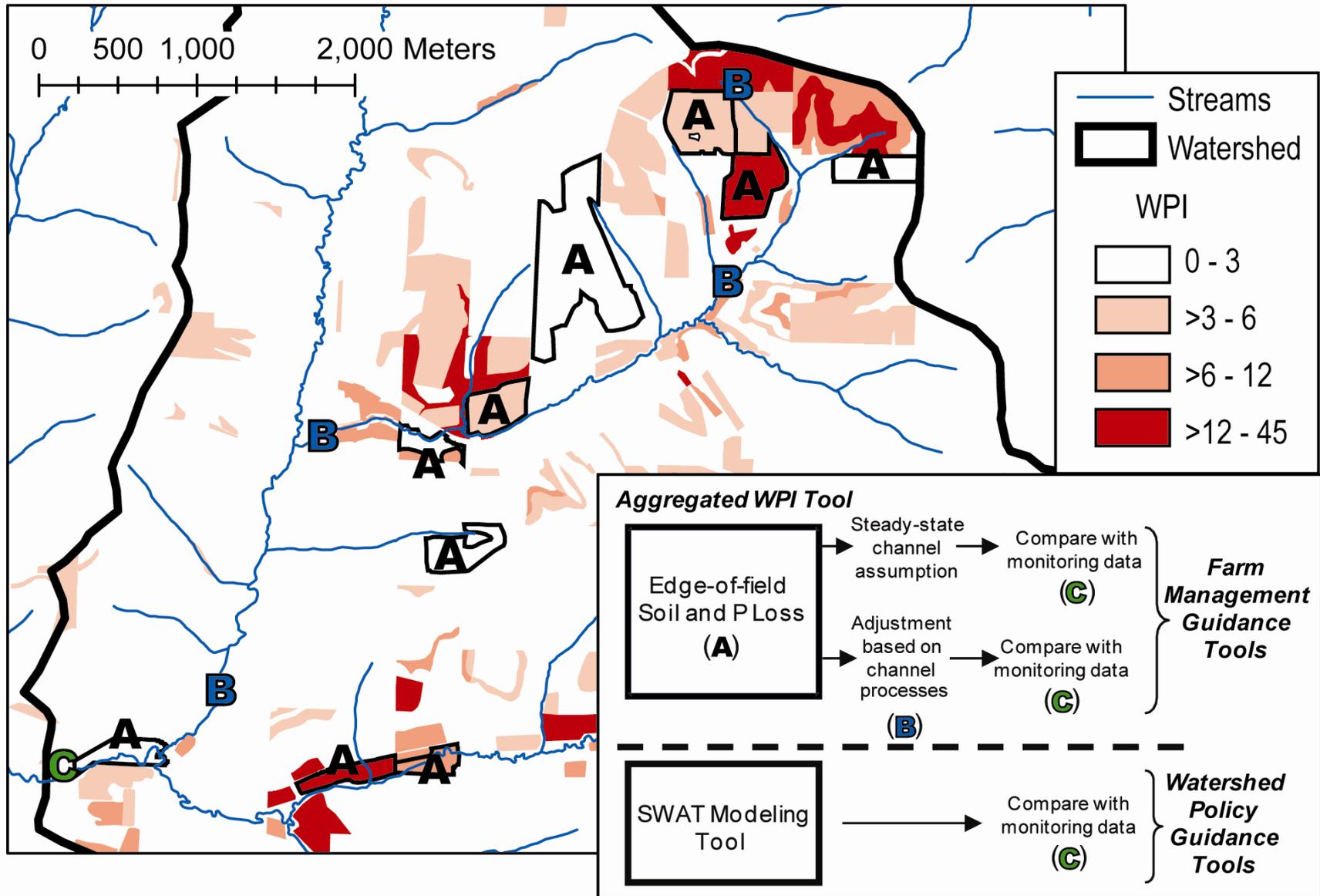
Historical Sedimentation Rates



WI Driftless Area
Halfway Creek
(Fitzpatrick, et al. 2009)



Approach: Field to Stream to Watershed Outlet



Nested Design

- 30 total sites

- Ephemeral and perennial throughout the 19 mi² watershed
- Rapid channel/sediment stability assessment
- Quantitative measurements of eroding banks and soft sediment deposition
- Low-flow discharge measurements

- 15 nested sites

- Modified pebble counts
- Bank, streambed, and soil samples for particle size, total P, organic matter, and radioisotopes for sediment fingerprinting, streambed samples for EPC₀ analysis

- 10 nested sites

- Channel cross sections
- Historical macroinvertebrate, fish, and habitat surveys

- 6 nested sites

- Walling sediment tube samplers, EPC₀ analysis
- event based sediment fingerprinting

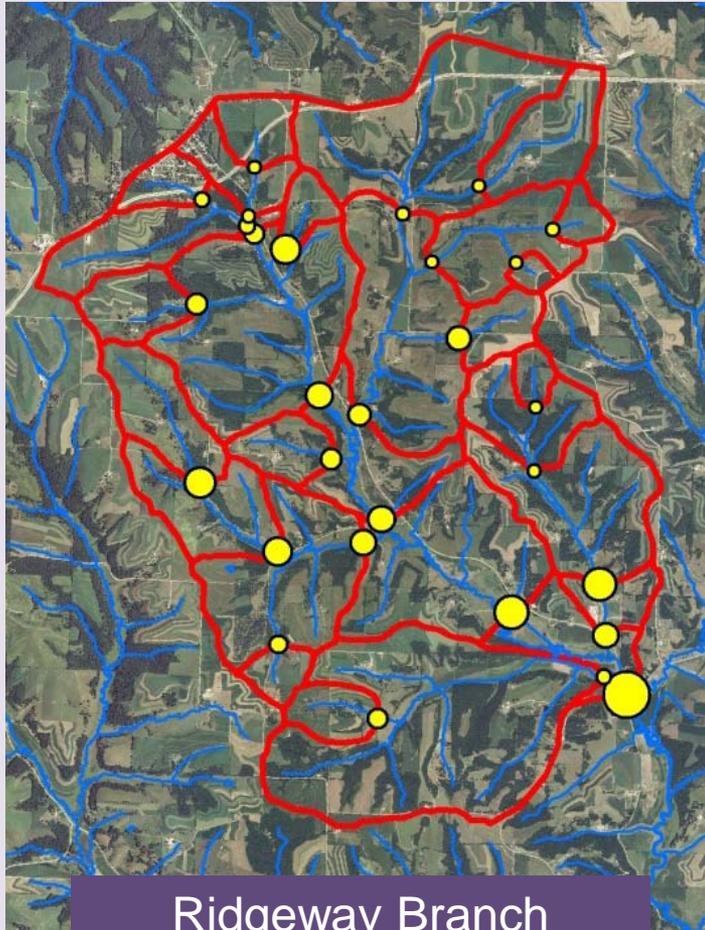
- 1 streamgage at outlet

- discharge, total P and suspended sediment loads

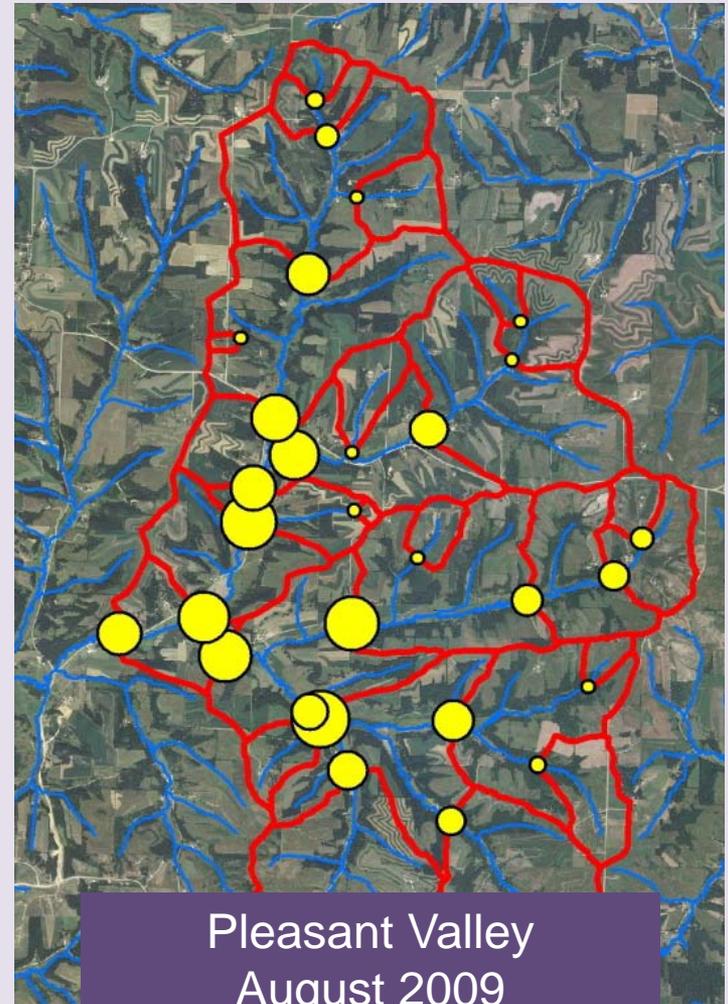


Photo Credits:
Rebecca Carvin (top),
Bob Hansis (bottom)

Distribution of Baseflow (0 - 10.2 liters/s/km²)



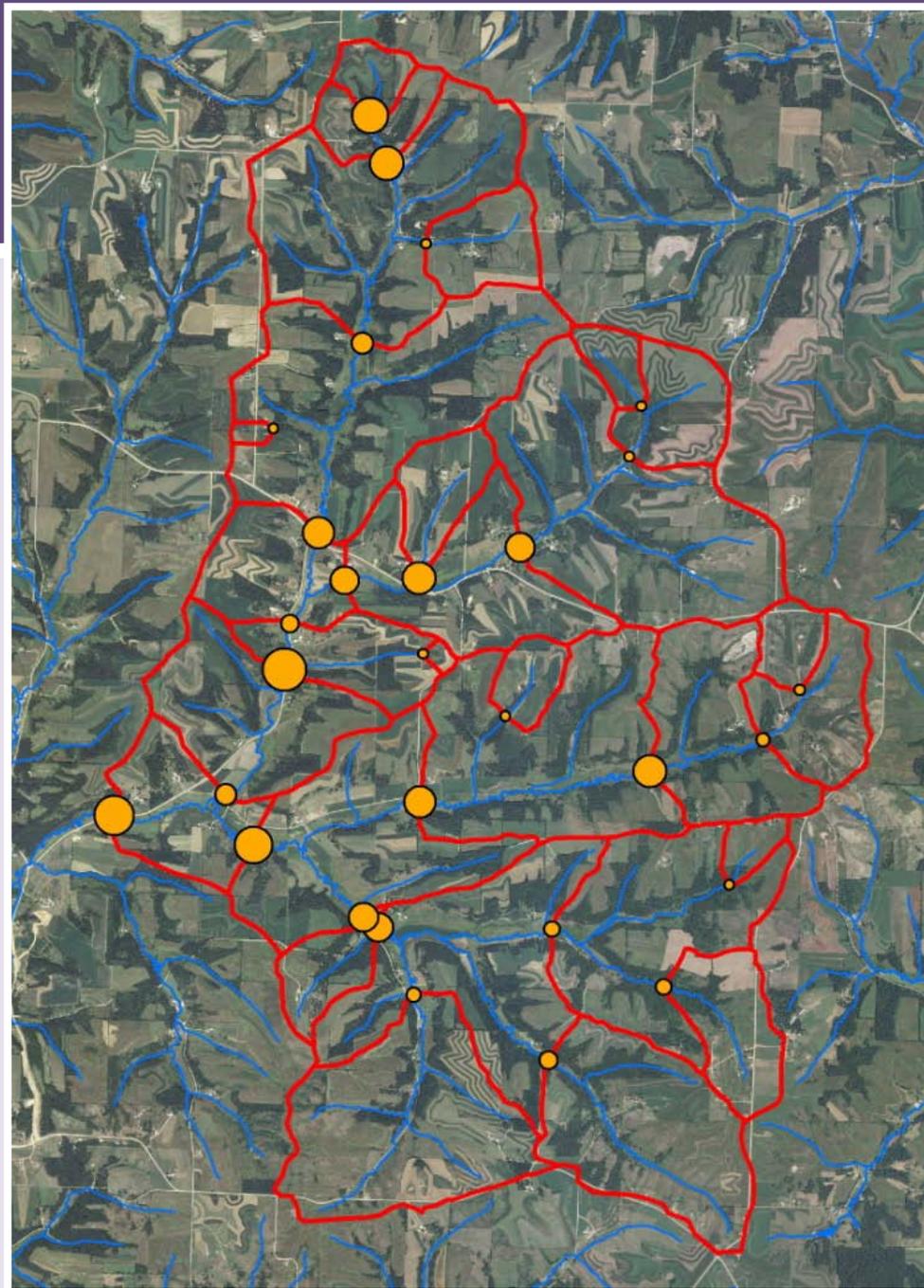
Ridgeway Branch
December 2009



Pleasant Valley
August 2009



PLEASANT VALLEY
Fine Sediment Deposition
(Average Depth 0 to 164 mm)



Modified Pebble Counts

Map of points

Thickness of fines

Presence of macrophytes

Artificial substrate

WISCONSIN REGIONAL BANKFULL CURVES FIELD SHEET

Developed by Marie Pepler (USGS), 2007

SECTION 4 - Pebble Counts

RIVER KITTLESON VA. STATION ID _____ DATE 10/19/2008
 LOCATION TRUMAN RD. / ABOVE CTH. RD. H USGS GAUGE (ON BACK) TIME 9:10 AM - 1:20 PM
 FIELD CREW FAITH FITZPATRICK, RYAN KURTZ DNR HABITAT SITE # 19
 WEATHER (Clear) → Partly Cloudy Cloudy Rain Snow Windy Breezy Temperature: _____
 RIVER STAGE (Stable, normal) Peak Falling Rising Stable, low (Stable, high) Not Determined

PROTOCOL SUMMARY:

Size in mm will be recorded for 100 pebbles chosen at random from the channel bed from 10 transects
 If the sample is covered in an organic fluff layer, MARK sample in box.
 Sand or finer particles will be hand textured with the aid of a sand gauge:

For <2 mm, record as follows:

- VCS - very coarse sand
- FS - fine sand
- CL - clay
- CS - coarse sand
- VFS - very fine sand
- OR - organic detritus
- MS - medium sand
- SI - silt
- M - MACROPHYTES

If channel bed is more than 50% sand, see protocol for QA sampling method.
 If channel bed is 100% sand, see protocol for sampling method.

PC1 - PEBBLE COUNT - Note location on Reach Map

RIFFLE at Transect Number _____
 measurements in mm

FS ₃₀	FS ₁₀	FS ₁₀	150 ₁₀	400 ₂₅	35 ₂₀	25	210	110	200	10
	CS ₁₀	11	FS ₁₀	MS ₁₀	150 ₁₀	400 ₁₀	65 ₁₀	20 ₁₀	510	9
9	VCS ₁₀	FS ₁₀	95 ₁₀	42 ₁₀	14 ₁₀	15	130	350		8
		MS ₁₀	3	MS ₁₀	MS ₁₀	CS ₁₀	20 ₁₀	150	32	7
15	110	FS ₁₀	50 ₁₀	25 ₁₀	40	250				6
			FS ₁₀	60 ₁₀	20 ₁₀	60 ₁₀	40 ₁₀	80 ₁₀	160	5
	MS ₁₀	FS ₁₀	160 ₁₀	VFS ₁₀	16 ₁₀	300	70	250		4
			SI ₁₂₀	MS ₁₀	MS ₁₀	MS ₁₀	VFS ₁₀	FS ₁₀	125	25
	FS ₂₀	40	80	75 ₁₀	CS ₁₀	FS ₁₀	25	60		2
	SI ₅₀	SI ₁₀	FS ₁₀	10	70	MS ₁₀	15	40	15	CS ₃₀

Notes: SOFT SEDIMENT PRESENT, MACROPHYTES, ON BOTTOM GRID, BOTTOM SUBSTRATE (WIDTH) X (PEBBLE SIZE), DEPTH OF FLUFF (SOFT) SEDIMENT, DOWNSTREAM START

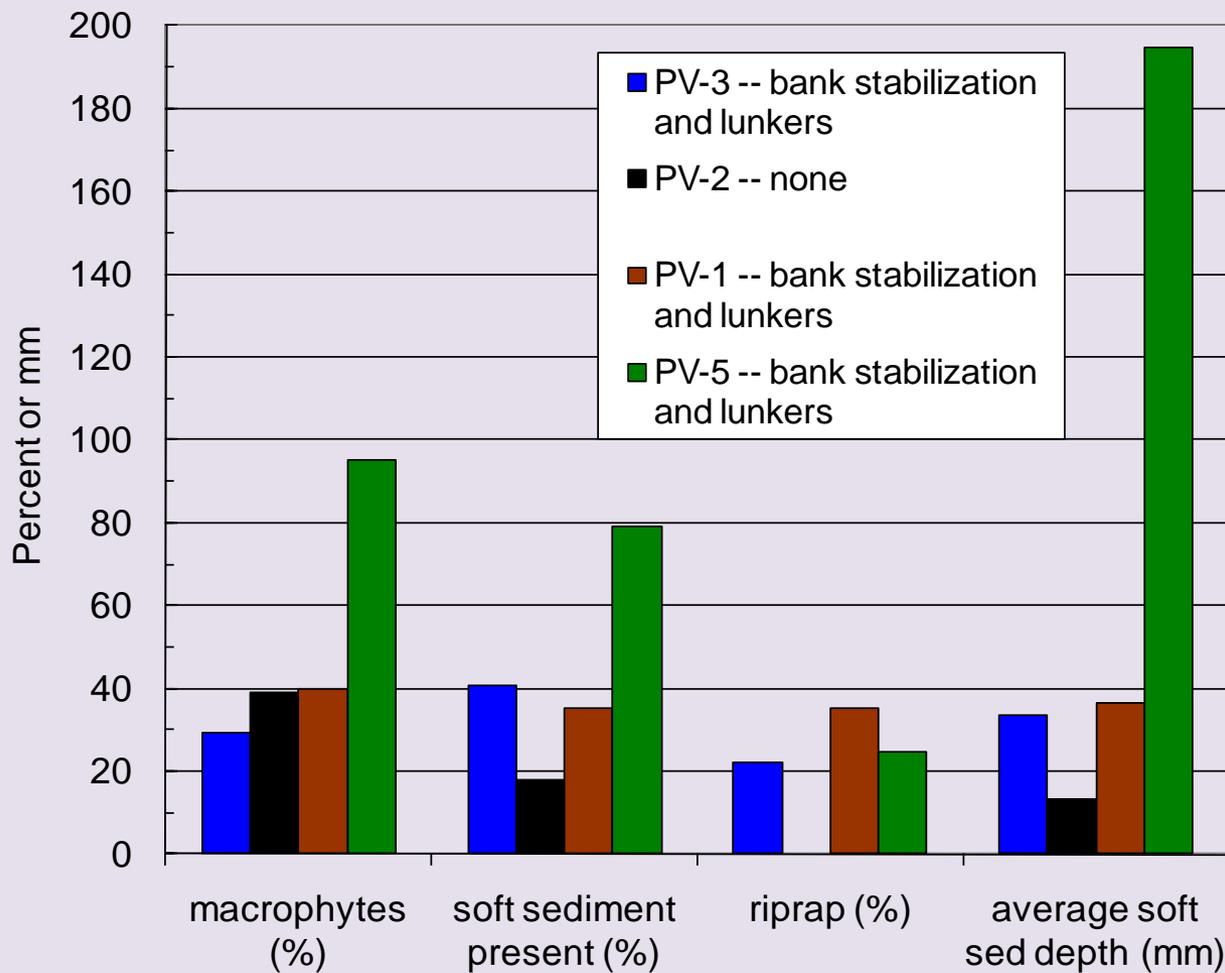
PC2 - PEBBLE COUNT - Note location on Reach Map

RIFFLE at Transect Number _____
 measurements in mm

FS ₇₀	10	25 ₁₀	40 ₁₀	120 ₂₀	40 ₆₀	25 ₁₀	70	62	85	11
FS ₁₀₀	34	45 ₁₃₀	18 ₆₀	115 ₆₀	15	55	35	44		12

Notes: BASE FLOW IS HIGH, STREAM SEEMS STABLE, most w/s transect

Bank stabilization and lunker structures work at some sites better than others

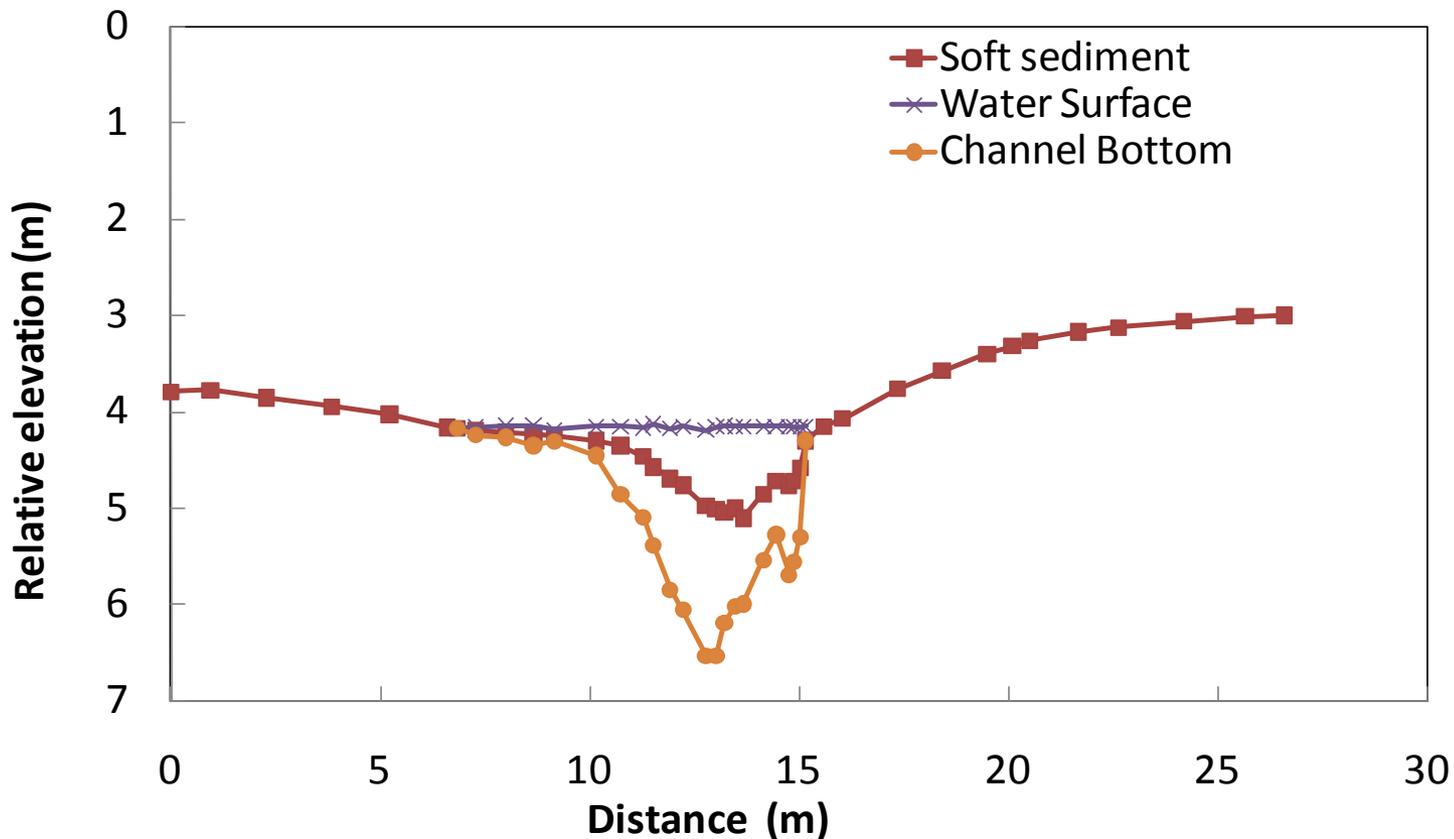


Cross sections



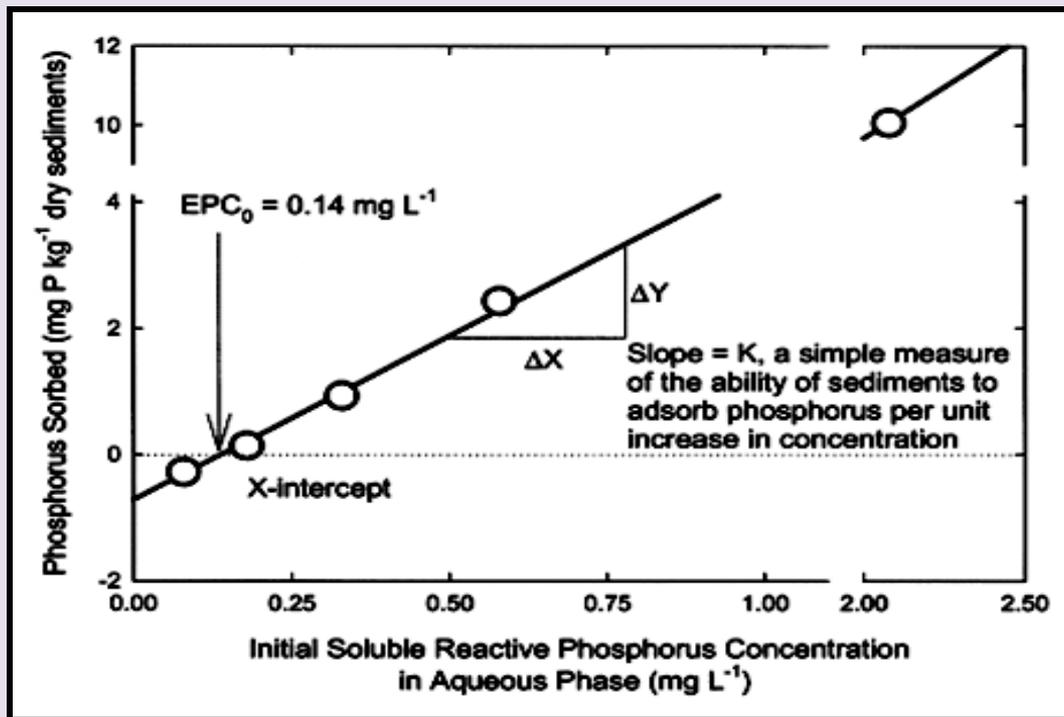
Pleasant Valley nr H

16D August 2008



Equilibrium Phosphorus Concentration (EPC_0)

(Sediments are neither sorbing nor desorbing P from the water column)



- For water column SRP $> EPC_0$, → sediments sorb P and act as a P sink.
- For water column SRP $< EPC_0$, → net release of P, sediments act as P source.

Source: Haggard, B.E., S. A. Ekka, M. D. Matlock and I. Chaubey 2004. Phosphate equilibrium between stream sediments and water: potential effects of chemical amendments. Trans ASABE. 47:1113 -1118.

Next Steps

- Sediment related (USGS):
 - Finish cross sections and pebble counts
 - Conduct sampling for sediment fingerprinting
 - Transfer rapid assessment site data to stream segment designations in a GIS
- SWAT/APEX modeling and add'l sediment sampling from tube samplers (UW-Madison)
- Install targeted BMPs in Pleasant Valley (Dane County, 2010-2012)
- Continue monitoring at streamgage (USGS) through 2012+
- Repeat biological (DNR) and geomorphic monitoring (USGS) in 5 yrs



Photo credit: Mark Godfrey

A landscape photograph showing a wide, open field in the foreground with tall, dry grasses and some small, bare trees. In the background, a line of trees with autumn foliage in shades of yellow, orange, and red stretches across the horizon under a pale, overcast sky. The overall scene is a natural, rural setting.

Questions?