Quantifying Stored Sediment in Southwest Wisconsin Stream Channels

> Robert Hansis Faith Fitzpatrick

March 5, 2012

Minneapolis, MN

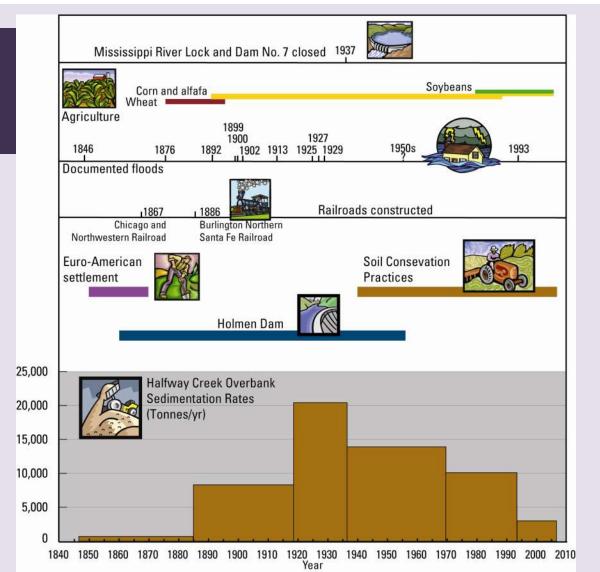




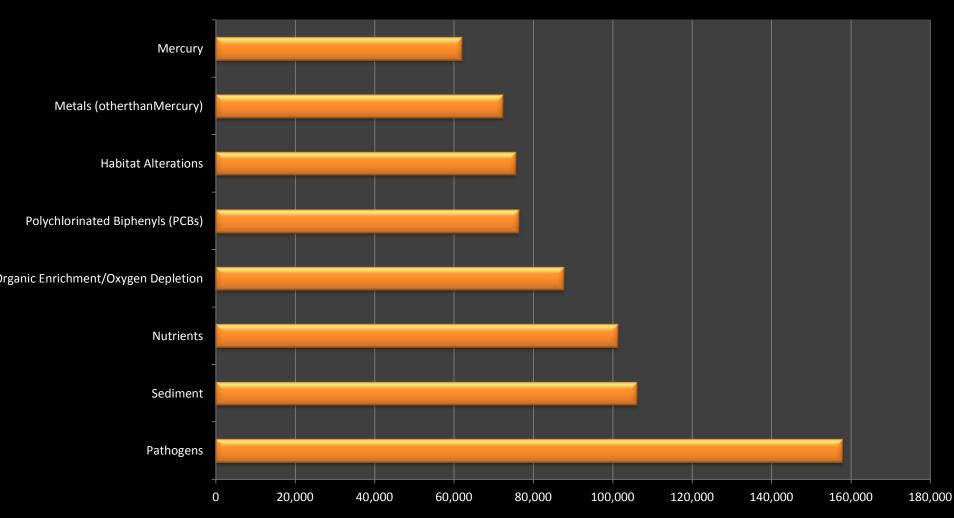
Historical sedimentation (and erosion) rates have decreased by an order of magnitude over the last 75 years because of widespread adoption of soil conservation practices

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





Fluvial sediment is a national and global challenge



NATIONWIDE IMPAIRED WATERS CAUSES—USEPA 2010

RIVER MILES

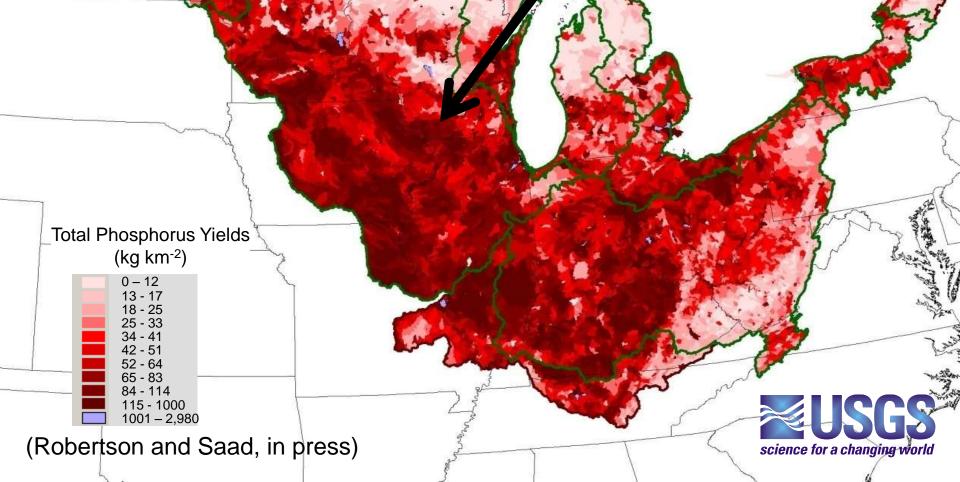




The Sediment – Phosphorus connection:

PARROW Total Phosphorus Yields

Pecatonica River watershed





Siltation causes biological impairments

45% of stream impairments are habitat losses due to sedimentation

Wisconsin 2010 Consolidated Assessment and Listing Methodology (WisCALM)

> Clean Water Act Section 305(b), 314, and 303(d) Integrated Reporting

Wisconsin Department of Natural Resources Last Revised 11/30/2009



Wascomm Department of Natural Resources 101 S. Webster Street • PO Box 7921 • Malinan, Wincomm 53707-79/ 606-200-2021 Table 36. Elevert and Streemt - Impairment: and their Sources

Wisconsin Water Quality Report to Concrease

And the second second	Total Des (ACRES)	The state
TIGH & AGUARCELET UP	and the second second	
Degraded Hakitat	1452.00	
Low DO	808.05	25
Exvated Water	234.60	15
Containmaked Sediment	102.10	- 85
Dennis Aquatio Territy	177.45	15
Containualed Faith These	154.3	35
Editophycation	30.1	25
Degraded Submerged Aquatic Vegetation (SAV)	451	16
Elwyahad plit	28.85	15
Acute Aguero Turicity	28.75	75
SedmentTotal Suspended Solati	18.47	15
Turbicky	11.75	6.3%
Essees Agal Growth	1.00	635
Fish Samers (Fish Passage)		0.2%
Live flaw attentione	115	025
Patrigens	2	275
RECREATION UNEX	10 A 10 A 10	111
Patropen Patropen	112-56	1005
PIPI CONSUMPTION UN		
Customaski Reh Tesue	1621.04	995
Contanyuated Sectorers	11.5	75
Acute Aquatic Toronty	2.25	1175
PUBLIC HEALTH & WELL	ANE UNES	
145	1.000	1.0
GENERAL USES	1	
Water Guality User Nastrotions	290.7	100%

	b and a second	
UNE DESIGNATION Source of Repairment	Total Tics (ACRES)	The second second
INSPERIATE LIFE LINE	10000	
	. 2051	345
New Law Mathumeneous Lippion	545	85
Linestock (Grazing or Feeding Operations)	404	15
Decharges from Warriopal Separate Sterm Se Systems (MS4)	1997 B	
Mart Integrated Chap Previouthers	118	15
Cantanivipled Sectorents	204	15
Loss of Riparian Habitat	245	45
Historic Point Sources - Legeus Polisitants	218	45
Impacts from Hydrostructure Flow Regulation/modification	12	
Animal Paeding Operations (NPS)	125	25
Dis Overance Land Development of Redevelopment		25
Conveltation	118	H
Drug Production (Chip Land or Dry Land)	. 10	
Inclustrial Point Source Discharge	12	25
Post-development Evolution and Second-station		15
Perrolasi Hursell Inon Carlines Annual Feelin	w 11	15
Operations (CAFOs) Corries (Outside Mills Partor Aness)	55	15
Source Unknown	9	675
Municipal (Utbanized High Density Area)	55	175
Sediment Recutpension (Clear) Sediment)		675
Mahwaye, Rolate, Bridges, Infrastructure Pier Canadructure		145
Farmentes of Mayol Flooding	- 21	175
Contains Linux	28	6.85
Oraging in Ripartan or Charaline Zones	28	0.85
W other Sources and less than 5%		Late Au
RECHERTION LINES		
Intertion Chaptery or Passing Operational		
Ner-Port Source		135
Remitted Runoff from Confilied Annual Feedle Operations (CAFOR)	u 4	115
Scence Unknown		185
Dares (Dublice Mill Party Anuts)	1	75
THE CONSTRUCTION ASSES	and a set	
Centenimeted Sectorette	140	425
Acrospheric Deposition - Toolice	850	345
Source Linkestern	801	288
Ratoric Point Sources - Legacy Pollutants	5	25
Upetreani Source	29	10
Industrial Point Source Decharge	. T.	100
Ner-Port Source	1 2	616
PUBLIC SEALTH & WELFARE USER		
14.		
GENERAL USES	19	
History Front Scores - Legars Robitsets		- 015

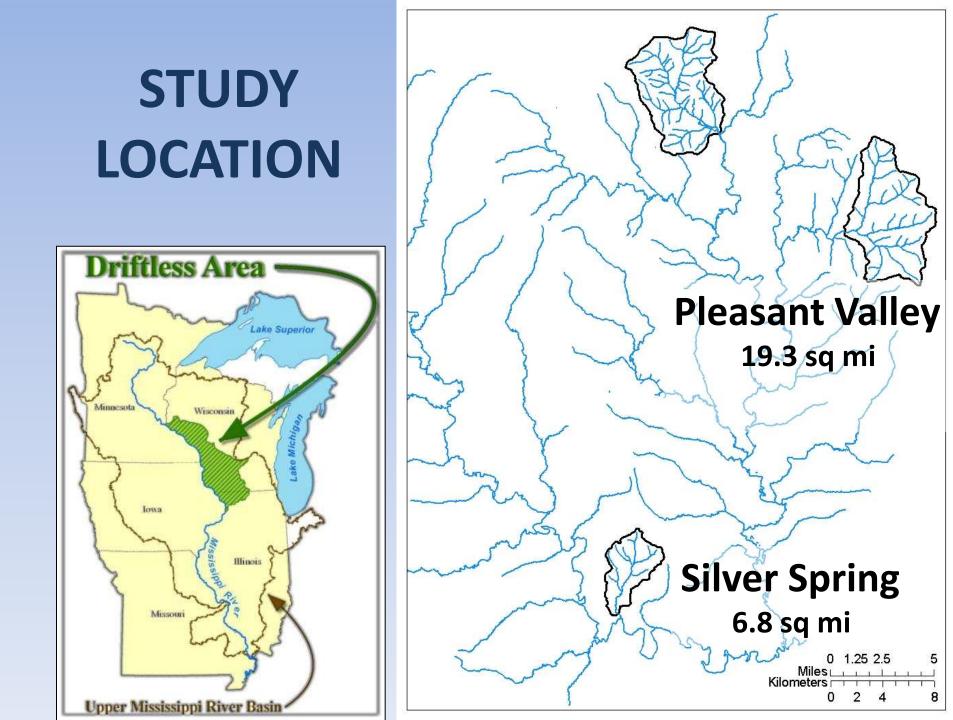
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Connecting Field to Stream Transport of Sediment

Photo Credit: WDNR

Identify watersheds that are major contributors

Target areas

Inventory major sources and sinks Upland versus stream corridor



Connecting Field to Stream Transport of Sediment

Identify watersheds that are major contributors

Target areas

Inventory major sources and sinks Upland versus stream corridor

Target best management practices in
areas with high lossesStream corridor rehabilitation
Soil conservation

Evaluate effectiveness

LAG TIME?

geomorphology, water chemistry, habitat, biological response





Upper Pecatonica Pleasant Valley Nested Design Baseline Assessment and Monitoring

30 total sites (2009)

-Ephemeral and perennial throughout watershed

-Rapid channel/sediment stability assessment

-Quantitative measurements of eroding banks and fine sediment deposition

-Low-flow discharge measurements

• 15 nested sites (2009-11)

-Modified pebble counts

-Bank, streambed, and soil samples for particle size, total P, organic matter, and radioisotopes

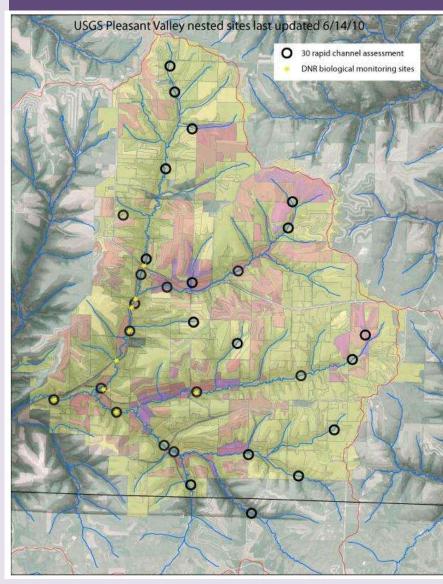
• 10 nested sites

- -Channel cross sections (2010-11)
- Historical macroinvertebrate, fish, and habitat surveys (2008-10)
- -Resurveys of fine sediment deposition using updated mapping techniques (2011)
- 6 nested sites (2010+)

INC PERSON TO A

-Walling suspended sediment tube samplers for event based sediment fingerprinting

1 streamgage at outlet (2006+)
 —discharge, total P and suspended sediment loads





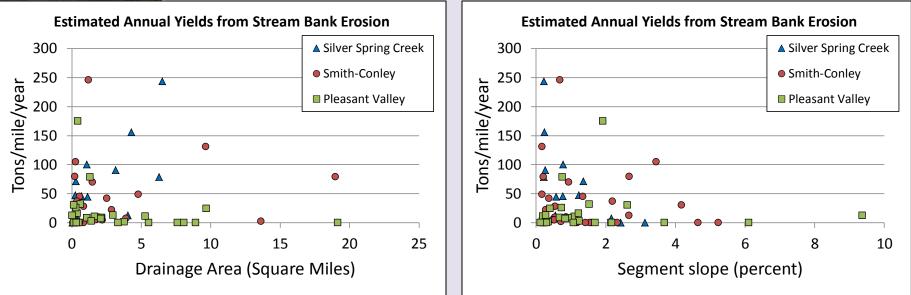
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and and income and west two descents

(April and Galon ?)



Bank Erosion Preliminary Sediment Yields by Drainage Area and Slope



[Yields based on:

* surface area of bank erosion measured during 2009-10 rapid channel assessments

* estimated mean annual retreat rate = 0.13 ft/year (UW Pioneer Farm; Fitzpatrick and Peppler in draft) Segment slopes measured from 1:24,000 quadrangle maps]



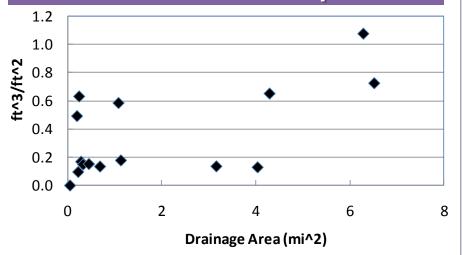


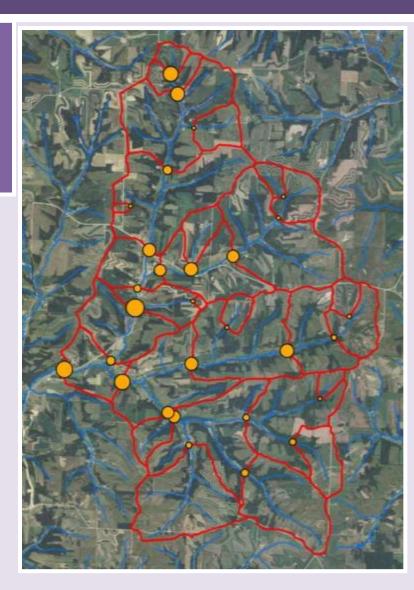
Fine Sediment Deposition Highly variable within watersheds

PLEASANT VALLEY Rapid Channel Assessment 2009 Fine Sediment Deposition (Average = 0 to 0.54 ft³/ft²)

SILVER SPRING CREEK 2010 Fine Sediment Deposition

≊USGS

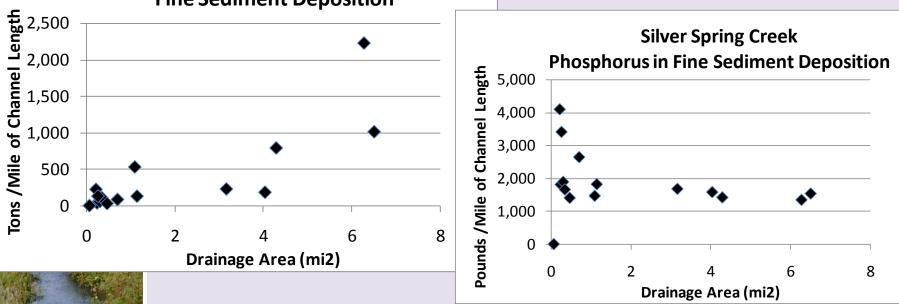






Fine Sediment Depositional Areas Sediment and Phosphorus "Savings and Loan"

Silver Spring Creek Fine Sediment Deposition





BANK EROSION SS PV 0.22 0.06 TONS/AC/YR

RUSLE2 SOIL LOSS

1.5 1.1

TONS/AC/YR

PV

N. FARMER

SS

SEDIMENT BUDGETS FROM FIELDS TO WATERSHED OUTLETS

SS = Silver Spring Creek PV = Pleasant Valley 2007-2010 data FINE SEDIMENT SAVINGS AND LOAN SS PV 1.2 1.2 TONS/AC

WATERSHED

EXPORT

0.20 0.15

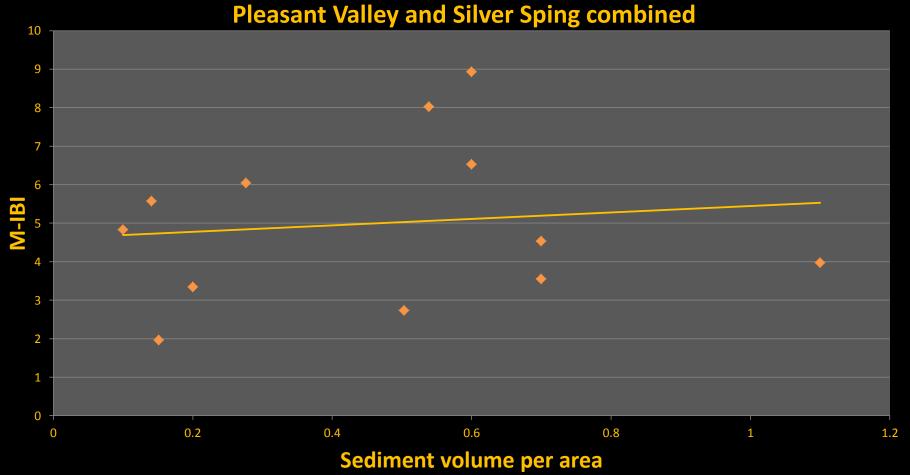
TONS/AC/YR

PV

SS

Factors other than fine sediment influence stream biological health

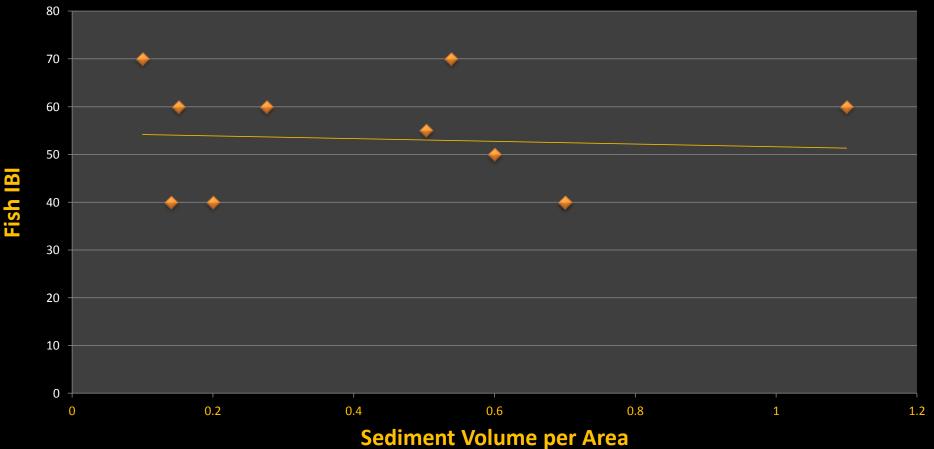
Sediment vs Macro-invertebrate IBI



Factors other than fine sediment influence stream biological health

Sediment vs Fish-IBI

Pleasant Valley and Silver Sping combined

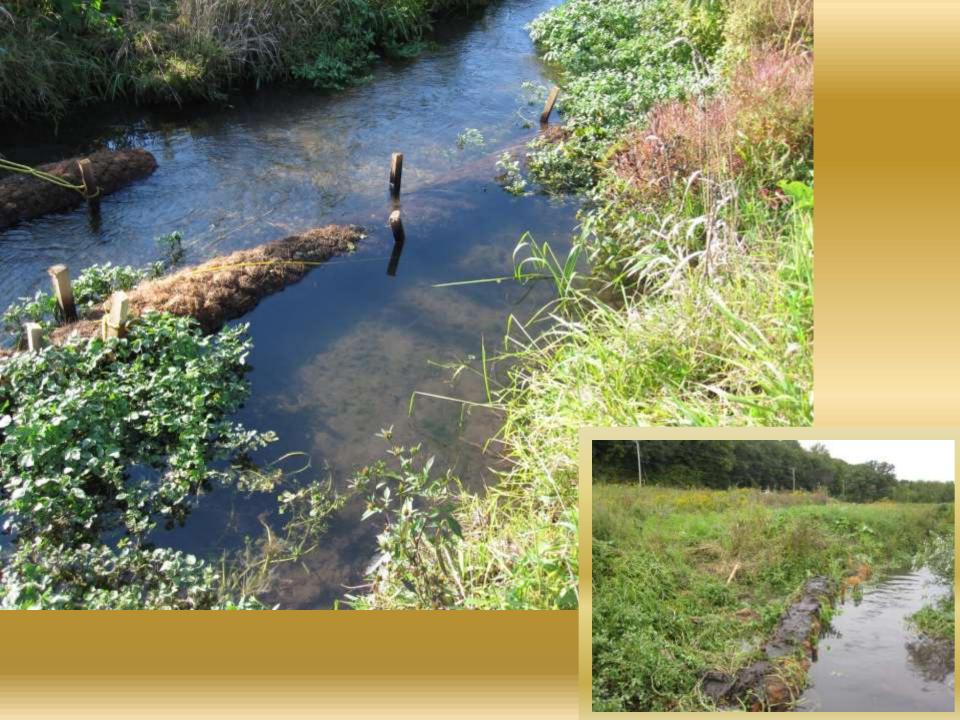


IS TRAPPING A SOLUTION?













Conclusions

- Fine sediment deposition in channels is an important source of sediment and nutrients in Driftless Area streams and should be included in sediment budgets
- Bank erosion is also a significant contributor to sediment and nutrients, but its importance varies from site to site
- Quantification of in-place sediment along with bank erosion (and overbank sedimentation) helps managers partition resources between upland practices and stream restoration techniques
- Quantification of channel sources and sinks help determine the lag effects from field-scale best management practices to improvements in aquatic biological integrity







STUDY PARTNERS AND FUNDING

Dane County, Land Conservation Division Lafayette County, Department of Land Conservation Iowa 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
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Wisconsin DATCP
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