Ten Years of Watershed Assessment in the Conservation Effects Assessment Project (CEAP): Insights and Lessons Learned

Webcast sponsored by EPA's Watershed Academy

Thursday, February 5, 2014

1:00pm – 3:00pm Eastern

Instructors:

- **Lisa Duriancik,** M.S., CEAP Watersheds Component Leader, USDA NRCS, Resource Assessment Division in Beltsville, MD
- **Dr. Mark Tomer,** Research Soil Scientist, USDA-ARS National Laboratory for Agriculture and the Environment in Ames, IA
- **Dr. Deanna Osmond**, Professor and Dept. Extension Leader, Soil Science Department, North Carolina State University in Raleigh, NC
- **Dr. Douglas R. Smith**, Research Soil Scientist, USDA-ARS Grassland, Soil and Water Research Laboratory in Temple, TX
- **Dr. Roger Kuhnle**, Hydraulic Engineer, USDA-ARS National Sedimentation Laboratory, Watershed Physical Processes Research Unit in Oxford, MS
- **Dr. Claire Baffaut**, Research Hydrologist, USDA-ARS Cropping Systems and Water Quality Research Unit in Columbia, MO

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Webcast Logistics

- **To Ask a Question** – Type your question in the "Questions" tool box on the right side of your screen and click "Send."

- **To report any technical issues** (such as audio problems) – Type your issue in the "Questions" tool box on the right side of your screen and click "Send" and we will respond by posting an answer in the "Questions" box.

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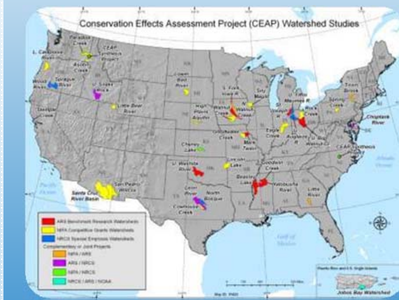
Outline of Today's Webcast on CEAP Watershed Assessments

- Overview of key findings
- New conservation insights related to:
  - Nitrogen
  - Phosphorus
  - Sediment
- Review approaches to targeting



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Natural Resources Conservation Service

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Ten Years of Watershed Assessment in the Conservation Effects Assessment Project (CEAP):

Insights and Lessons Learned

Lisa F. Duriancik, NRCS
Resource Assessment Division
CEAP Watersheds Component Leader

Watershed Academy Webcast
February 5, 2015

United States Department of Agriculture
Natural Resources Conservation Service

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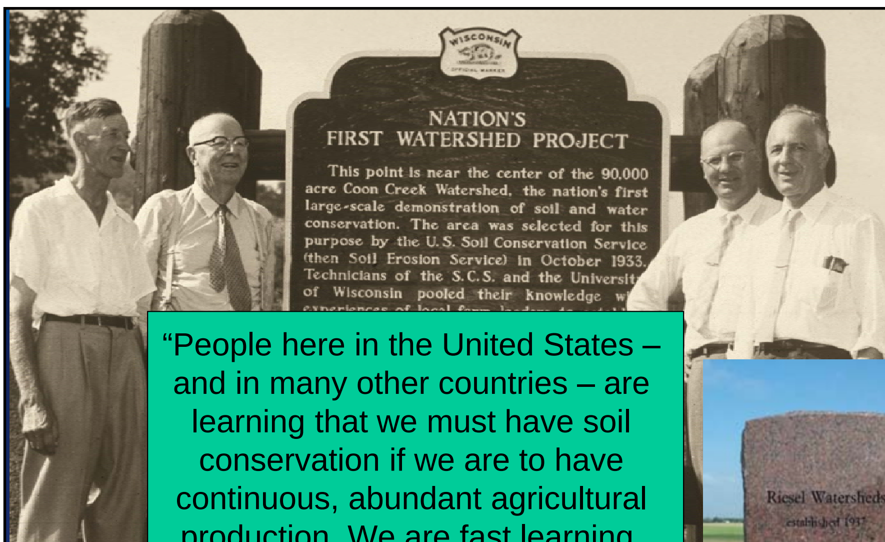
Looking Back

CEAP Goals Over Last 10 Years

- Estimate conservation effects and benefits at regional and national scales
- Develop scientific understanding of conservation practice effects at watershed scales

Duriancik, et al., 2008, JSWC Vol. 63, No. 6, pp.185A-197A.



"People here in the United States – and in many other countries – are learning that we must have soil conservation if we are to have continuous, abundant agricultural production. We are fast learning, too, that it must be effective conservation…"

Dr. Hugh H. Bennett, 1946, JSWC 1 (1): 21-24.

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Carrying on the Vision:

- **Vision:** enhanced natural resources and ecosystems through
  - more effective conservation
  - better management of agricultural landscapes
- **Goal:** Improve efficacy of conservation practices and programs
  - Conservation Planning and Implementation
  - Management Decisions and
  - Policy

Maresch, et al., 2008, JSWC Vol. 63, No. 6, pp. 198A-203A.

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CEAP Project Organization: Activities

- National / Regional Assessments

  Cropland Grazing Lands
  Wetlands Wildlife
- Watershed Assessment Studies
  - ARS, NRCS, NIFA
  - 2 Special Issues of JSWC (2008 and 2010)
  - Books: NIFA CEAP lessons learned, MAL I and MAL II
  - 1 Special section of JSWC (2014), 3 JEQ articles
- Bibliographies and Literature Reviews
  - 2 new dynamic bibliographies – Targeting & Modeling

    Recent literature syntheses: rangelands and pasture

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American Academy for the Advancement of Sciences (AAAS) Recognition

- "Exemplary Collaborative Case Study" in 2011
- Numerous partners in CEAP Watersheds:
  - USDA leads: ARS, NRCS, NIFA, FSA
  - Universities, conservationists and producers
  - NOAA, EPA, USGS, SWCS, ASA/SSSA/CSSA, etc.
- Impact stems from strong collaboration between the operational and research conservation communities

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Goals of the Watershed Studies:

- quantify the measurable effects of conservation practices at the watershed scale
- enhance understanding of conservation effects in the biophysical setting of a watershed

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Key Questions for CEAP Watershed Studies

- Effects of timing and location of practices
- Interaction among practices (additive, independent, or contradictory)
- Optimal suite and placement of conservation practices (modeling)
- Socio-economic factors that facilitate or impede implementation and maintenance

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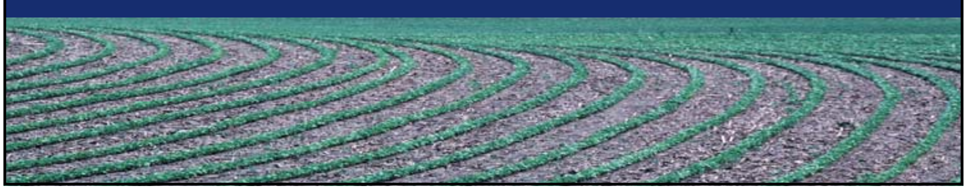
What Have We Learned?

- Conservation practices work.
- Gains have been made in some cases, but critical conservation concerns still exist.
- Comprehensive planning needed.
  - systems vs single practices
- Targeting critical areas improves effectiveness.



JSWC Special Section Overview:

Conservation Effects Assessment Project Findings Over Ten Years

Highlights from ARS Benchmark Watershed Studies

Mark Tomer, USDA-ARS

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What is in this CEAP Special Section of the Journal of Soil and Water Conservation?

- A Section:
  - Feature article authored by J. Arnold and eight others.
- Research Section:
  - Overview article authored by M. Tomer and nine others.
  - Three research articles; lead authors J. Garbrecht, R. Kuhnle, and D. Karlen.

All papers are available (no subscription required) through the NRCS-CEAP website:

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=stelprdb1260812

Or directly from the journal website:
http://www.jswconline.org/content/69/5.toc

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“Impact of the ARS Watershed Assessment Studies on the CEAP Cropland National Assessment” (Arnold and eight others)

- The CEAP National Assessment was based on nation-wide application of the APEX and SWAT models to HUC8 watersheds.
- Results were used to calculate the benefits of USDA programs that fund conservation practices.
- The National Assessment was published as a series of regional reports.
- This article describes how the National Assessment benefited from the ARS watershed studies.

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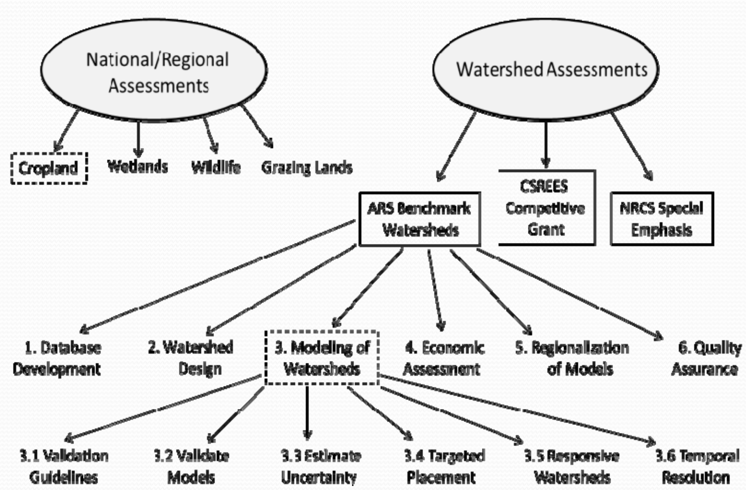
CEAP Assessment



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Watershed Modeling Sub-Objectives

Number	Subobjective	Description
3.1	Validation Guidelines	Develop model validation guidelines for systematic quantification of accuracy in WAS simulations.
3.2	Validate Models	Validate models using water quantity and water quality databases from the ARS benchmark watersheds and make recommendations for further model enhancement and development and identify data gaps.
3.3	Estimate Uncertainty	Estimate uncertainty in model predictions resulting from calibration parameter identification and ranges of input data resolution and quality.
3.4	Targeted Placement	Estimate the sensitivity of water quality responses to targeted placement of conservation practices and suites of conservation practices within individual watersheds.
3.5	Responsive Watersheds	Develop tools to identify watersheds and/or sub-watersheds most likely to have the highest magnitude of positive response to conservation practice implementation.
3.6	Temporal Resolution	Develop tools to estimate the temporal resolution (timing and magnitude) of conservation practice effects within watersheds.

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Three Research Articles

- The overall intent is to provide examples of how assessments of multiple watersheds can strengthen the outcome of watershed-scale research.
- Each of the three papers provide results from at least three ARS benchmark watersheds.
- Topics include climate change impacts (Garbrecht), sediment-source assessments (Kuhnle), and soil quality assessments (Karlen)

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Impact of Weather and Climate Scenarios on Conservation Assessment Outcomes (Garbrecht and six others)

- Increased precipitation clearly leads to increases in runoff, erosion and sediment yield. The risk is that ongoing conservation efforts will become less effective in protecting soil and water resources over time.
- Greater conservation efforts will be required in the future to respond to impacts of ongoing climate trends.
- Scale impacts sediment transport processes in watersheds, blurring our ability to discern climate impacts on conservation effectiveness.

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Surface Soil Quality in Five Midwest Cropland CEAP Watersheds (Karlen and five others)

- Soil organic carbon impacted by crop rotation and watershed. Water-stable aggregates was the variable most responsive to location and management factors (tillage, manure, rotation) among ten response variables analyzed.
- Results demonstrate the feasibility of multi-watershed soil quality assessments.
- Results provide a good baseline of data for monitoring soil quality changes in multiple watersheds over time.

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Fine Sediment Sources in Conservation Effects Assessment Watersheds (Kuhnle and six others)

- Dr. Kuhnle will describe this study later in the webinar.

A Decade of Conservation Effects Assessment Research by USDA-ARS: Progress Overview and Future Outlook (Tomer and nine others)

- Overviews two sets of practices that were researched at multiple CEAP locations, cover crops and minimum disturbance application methods.
- One of the “Four Rs” involves right placement of nutrients, manure, and pesticides, but these often must be incorporated. Incorporation involves soil disturbance, which can increase erosion risks.
- Minimum disturbance applications technologies must be designed for the product and the cropping system in which it is applied.

Cover crops

- Research contributions on monitoring of cover crops, and on timing and management issues are briefly reviewed.
- Timing of fall planting of cover crops is important in the Upper Mississippi River and Chesapeake Bay watersheds

Edge-of-field and riparian practices

- P sorption materials
- Vegetative filters to mitigate pesticide transport
- Denitrifying bioreactors
- Riparian buffers – modeling studies

Watershed Assessment

- Suggests strategy to address the disconnection between conservation efforts and watershed responses, based on precision conservation, minimum disturbance farming methods, riparian management, and ongoing watershed assessment that includes land use and water quality.
- Studies to help improve statistical analysis of monitoring data and model outputs.

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Precision Conservation

- We describe four examples of watershed research in which the capacity to translate information between watershed and farm scales was critical to project success, in terms of elucidating management options.
- Missouri, Illinois, Maryland, and New York.
- Watershed improvement projects may only be successful if the translation between watershed and farm scales can be made in a way that benefits farmers/landowners.

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Future Challenges

- Understanding ecosystem responses
- Technology development
- Social engagement

Future Challenges

- Improving simulation models and their demonstrated capacity to simulate nutrient loads (nitrogen and phosphorus) in streams and rivers, as well as pesticide transport.
- Developing watershed planning tools to optimize the efficiency of conservation practices with linkage to models to evaluate planning scenarios.
- Linking watershed and farm scale data and determining how to best apply those linkages in watershed management.
- Improving our understanding of how one conservation practice can improve or diminish the performance of another practice, and thereby develop a capability to combine multiple practices in a way that compensates for environmental tradeoffs.

Future Challenges

- Establishing soil and water quality monitoring networks to track long term changes in soil and water resources and ecosystem services, and impacts of changes in conservation, agricultural management, and climate.
- Determining how conservation practices can improve the resilience of agricultural soils and watersheds under conditions that range from drought to extreme events.
- In concert with social scientists, balancing the importance of resource protection to future generations with the entrepreneurial independence of individual farm operations, while demonstrating successful watershed outcomes.

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Questions

All papers are available (no subscription required) through the NRCS-CEAP website:

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=stelprdb1260812

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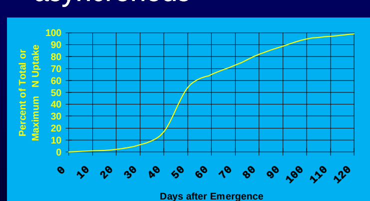
Challenges and Opportunities for Greater Success in Managing Nitrogen Export from Agricultural Lands

Watershed Academy Webcast
10 years of Watershed Assessment in CEAP
February 5, 2015

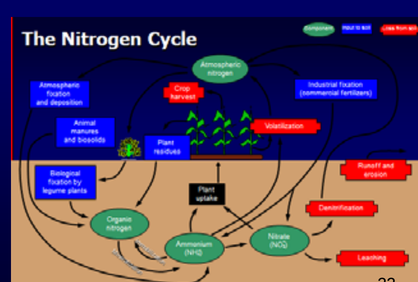
Deanna L. Osmond
Department of Soil Science
NC State University

Benefits and Challenges of Nitrogen

- Crop Production
  - Generally the most limiting nutrient
  - Usually the greatest application rates
  - N rates uncertain
  - For annual crops, N uptake is short and organic N release is asyncronous



- Environmental Loss
  - Multiple N transformation processes
  - Crop uptake limitations
  - Multiple loss pathways
    - Leaching dominant



NIFA CEAP Watersheds: Watersheds and Pollutants of Concern

Lessons Learned from NIFA-CEAP: Intentional Conservation

Conservation planning must be done at the **watershed scale by trained personnel** who have access to sufficient water quality and potentially modeling information.

Cheney Lake (KS CEAP)

Lessons Learned from NIFA-CEAP: Intentional Conservation

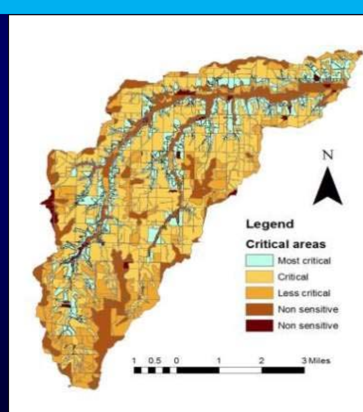
Before determining which conservation practice(s) to implement, identify if N is a problem, its source(s), and its hydrology.

Eagle Creek (IN CEAP)

- Conservation practices may function differently than expected
- Conservation practices may affect pollutants differentially

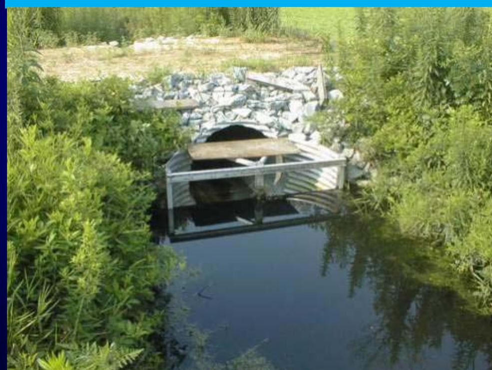
Lessons Learned from NIFA-CEAP: Intentional Conservation

Identify critical source areas to target conservation practices within the watershed.



Lessons Learned from NIFA-CEAP: Intentional Conservation

Even after conservation practices have been adopted, continue to work with farmers on maintenance and sustained use of the practices.



Agricultural survey conducted in Neuse River Basin (NC)

- 20 water control structures to control N
  - 6 managed
  - 7 not managed
  - could not tell remaining

Little Bear River (UT CEAP)

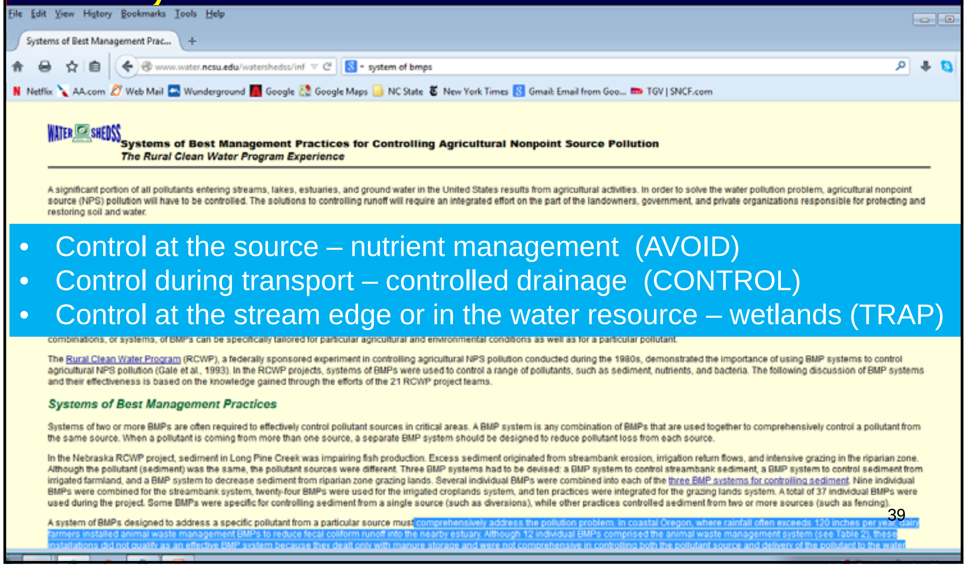
Lessons Learned from NIFA-CEAP: Working With Farmers

Identify farmers' attitudes toward agriculture and conservation practices to promote adoption and use.

- Economic incentives often required for adoption of conservation practices not obviously profitable or fitting with current farming systems
- Ease of use or management
- Type of practice – structural
- Conservation practices that have multiple benefits
- Ability to see the pollutant

- Threat of regulation
- Changes in technology
- Belief system of farmer
- Age of farmer
- Family dynamics
- Land ownership: type and length of lease
- Additional partners providing resources

Controlling Nitrogen: Systems of Conservation Practices



- Control at the source – nutrient management (AVOID)
- Control during transport – controlled drainage (CONTROL)
- Control at the stream edge or in the water resource – wetlands (TRAP)

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Control Nitrogen at the Source: Nutrient Management:

Controlling nitrogen pollution will continue to be a significant challenge due to social and technical issues of nutrient management.

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Controlling Nitrogen at the Watershed Scale: N Rates Based on Soil Test vs Farmer Applied

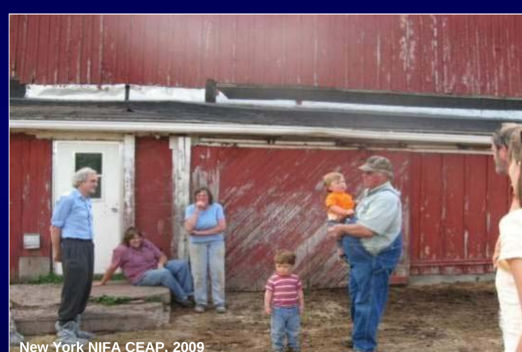
Flow-weighted Average Annual Nitrate Concentration: Control vs Treatment

Subbasin	Control Years	Treatment Years
	mg NO3-N/L	mg NO3-N/L
CN1	10.88	12.95
CN2	13.14	14.65
TR	10.68	10.93

Jaynes et al. 2004. JEQ 33:669-677

Nutrient Management: It's Use is Problematic

- Often didn't work
  - "Nutrient management was a failure."
- Sometimes worked
  - Dedicated, local agent to work exclusively on nutrient management
  - One-to-one outreach
  - Nutrient management plans simplified
  - Economic incentives
  - Continued investment

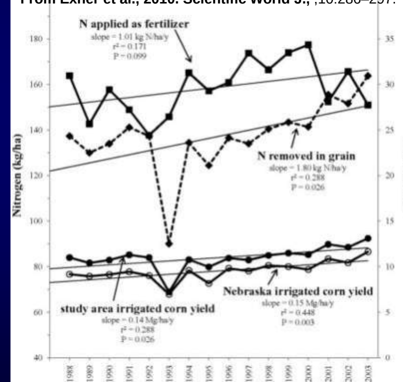


New York NIFA CEAP, 2009

Nitrogen Management: Did It Reduce Groundwater N in a Phase III Management Area? (Central Platte Natural Resources District, NE)

- Excess groundwater nitrate
- Reduction of 0.26 mg/L/yr (1986 – 2002)
  - 50% due to irrigation change
  - 20% due to N fertilizer rate increase slower than yield increases

From Exner et al., 2010. Scientific World J., ,10:286–297.



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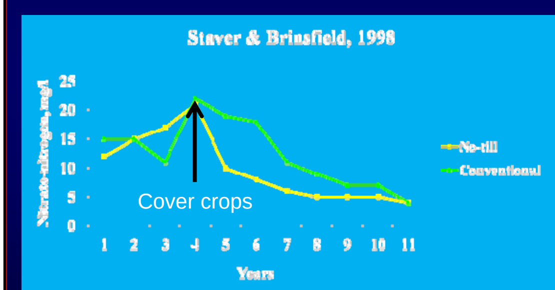
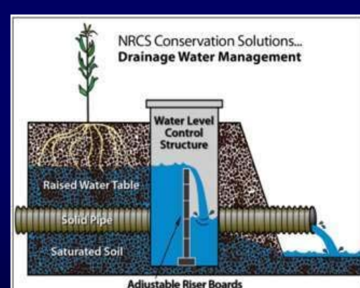
Control Nitrogen During Transport: Conservation Practice Examples

Cover Crops

Controlled Drainage





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Control Nitrogen at Stream Edge or In-Stream

"One of things is always economics. That always hits the top of the list of everything I can think of. If the farmers don't see the economics behind it, then they're not prone to even give it a try."

Reducing Nitrogen from Agricultural Lands: The Challenge and the Opportunity

Controlling nitrogen pollution will continue to be a significant challenge:

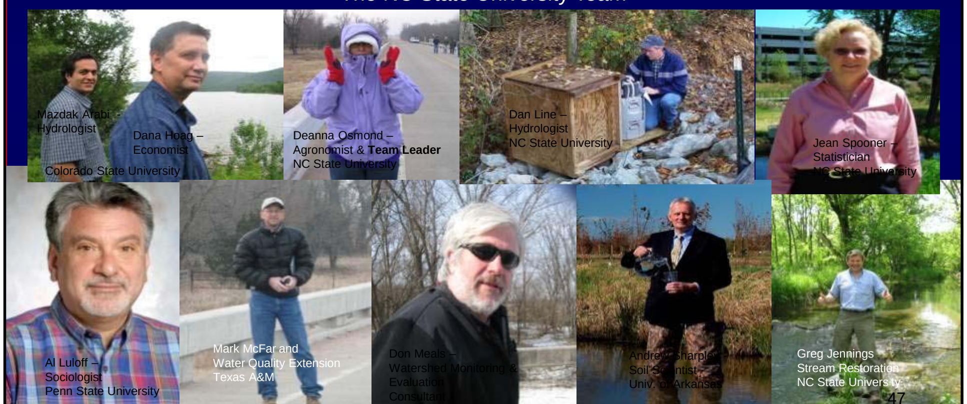
- **management practices are harder for farmers**
- **greater difficulty implementing practices that control pollutants farmers cannot see**
- **farmers use nutrients to reduce risk**
- **antagonistic outcomes of conservation practices**
- **tile drainage is being added much faster than conservation practices can be adopted**
- **marginal land transformation**
- **need for conservation practice systems**
- **one management solution does not fit all agroecological regions**
- **climate change may change the timing and duration of rainfall that increases nutrient losses**

NIFA CEAP Watershed Synthesis Project

Thanks all the NIFA-CEAP watershed project personnel, key informants, USDA NIFA-CEAP and NRCS-CEAP personnel

Our Sponsors

The NC State University Team



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Questions

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Challenges & opportunities for addressing P delivery: What have we learnt from CEAP?

Douglas Smith, Andrew Sharpley & Peter Kleinman

69th SWCS International Annual Conference
MAKING WAVES IN CONSERVATION
Our Life on Land & its Impact on Water
LOMBARD, IL • JUL 27–30, 2014

USDA ARS

U of A DIVISION OF AGRICULTURE RESEARCH & EXTENSION
University of Arkansas System

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Planned practices include improvement of woodlands, wildlife habitat and pastures, better rotations and fertilization, strip cropping, terracing, and gulley and stream bank erosion control

Dr. Hugh Hammond Bennett, (2nd from left), first Chief of the Soil Conservation Service & others at the site of the Nation's first watershed project in Coon Valley, WI

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What have we learned?

- Avoid conflicting support programs & initiatives
- Move towards targeted conservation systems
- Future measures must manage for both N & P
  - Maximize synergies
  - Avoid tradeoffs
- Message outreach
  - Work closer with fertilizer dealers & farm consultants
- Address legacy sources and sinks

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Complexities of P delivery & land mgt.

- Conflicting conservation initiatives
  - Tile drainage increases
    - Soil productivity
    - Critical source area
    - Connectivity to streams
  - Soil health and preferential fl
    - No-till leads to macropore development
    - Pathways for nutrient movement
    - Nutrient management should change

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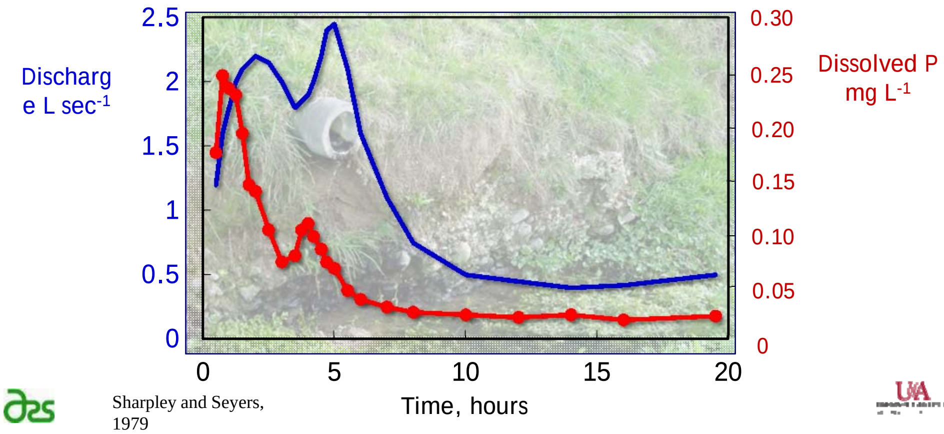
Tile discharge & dissolved P



Sharpley and Seyers, 1979

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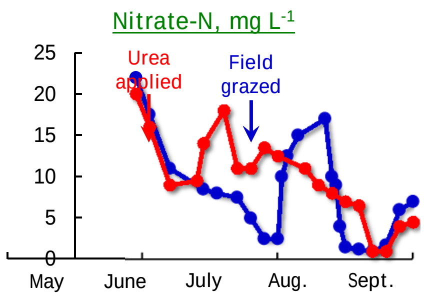
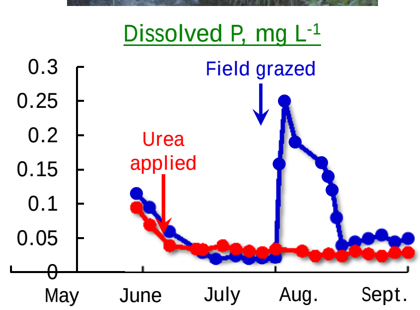
Tile response to land mgt.





Sharpley and Seyers, 1979

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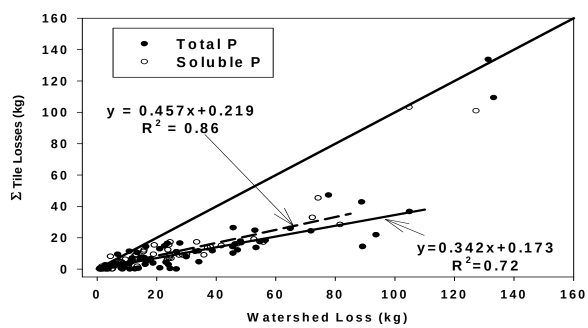
Watershed sources

Contribution of pathways, %

	Surface runoff	Tile flow	Base flow	Fluvial
Discharge	10	28	62	
Dissolved P	32	27	12	29
Particulate P	9	6	1	84
Total P	11	8	3	78

Sharpley et al., 1976; Palmerston North, New Zealand

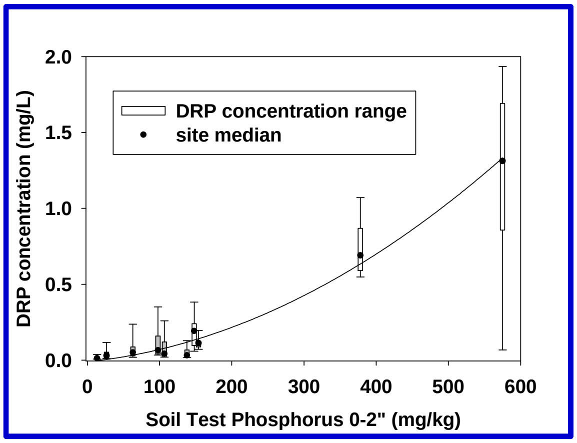
Watershed Results (2005-2010 UBWC)



King et al., 2015

Fraction of annual watershed loading originating from tile		
2005	0.317	0.234
2006	0.346	0.300
2007	0.313	0.264
2008	0.756	0.759
2009	0.591	0.485
2010	0.669	0.630
AVG	0.499	0.445

Tile Drain Connectivity to Surface Soil



Ohio,
K. King

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Alternative Surface Drainage

Percent Reductions in Sediment and Nutrient Loads: blind inlet vs tile risers

Nutrient	2009 % Reduction	2010 % Reduction
Sediment	11*	79
Soluble P	64	72
Total P	52	78

Smith and Livingston, 2013

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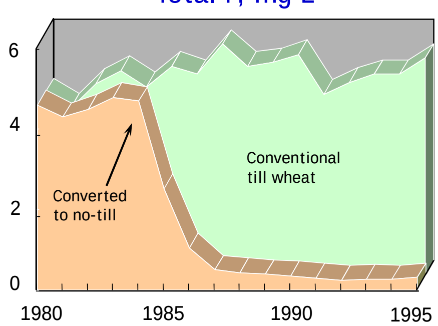
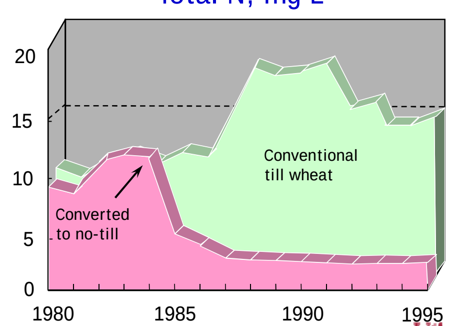
Conservation benefits

No-till reduced erosion from wheat 95%

Total P, mg L^{-1}



Total N, mg L^{-1}



Sharpley & Smith, 1994 – El Reno, OK

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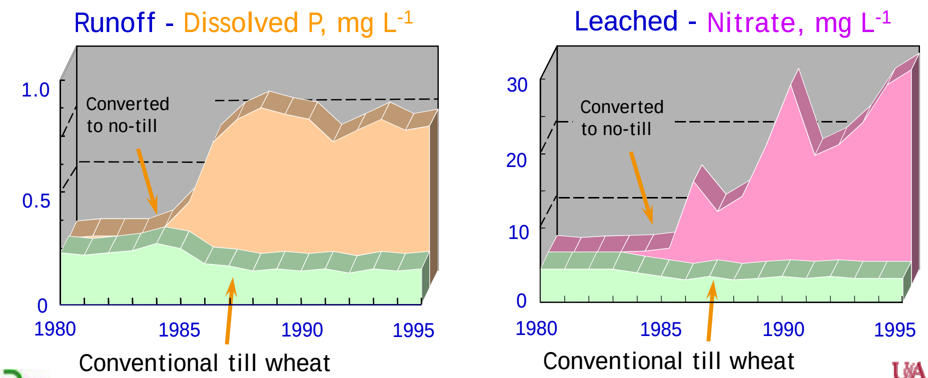
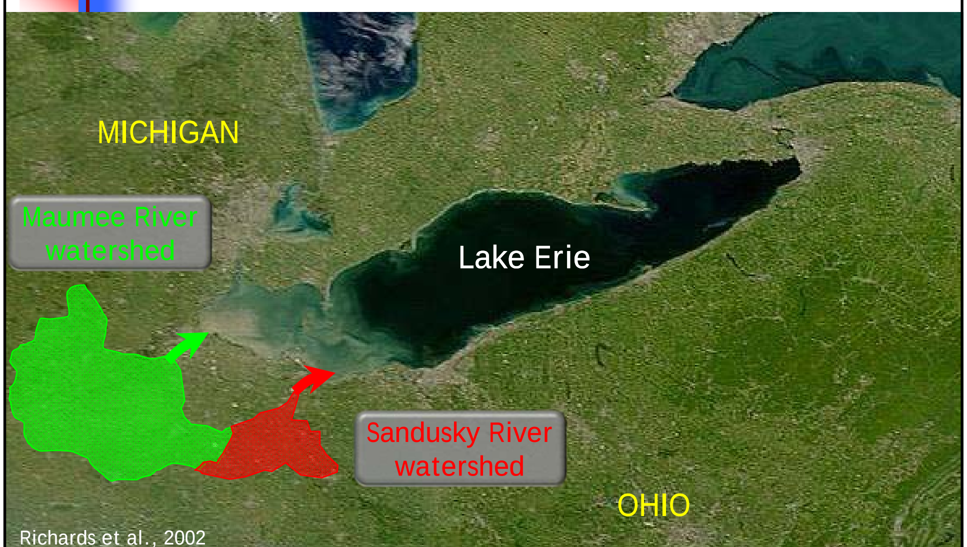
Conservation tradeoffs

Infiltration increased 33%





Trends in P - Maumee River

Annual flow-weighted, mg L^{-1}

0.6

Adaptive management may have reduced nutrient loss

- Incorporation of fertilizer & manure
- Winter cover crops
- Spring fertilization

But not always compatible with day-to-day farm decisions

0.4

0.2

0

1975 1985 1995 2005 2012

Dave Baker & Peter Richards, OH

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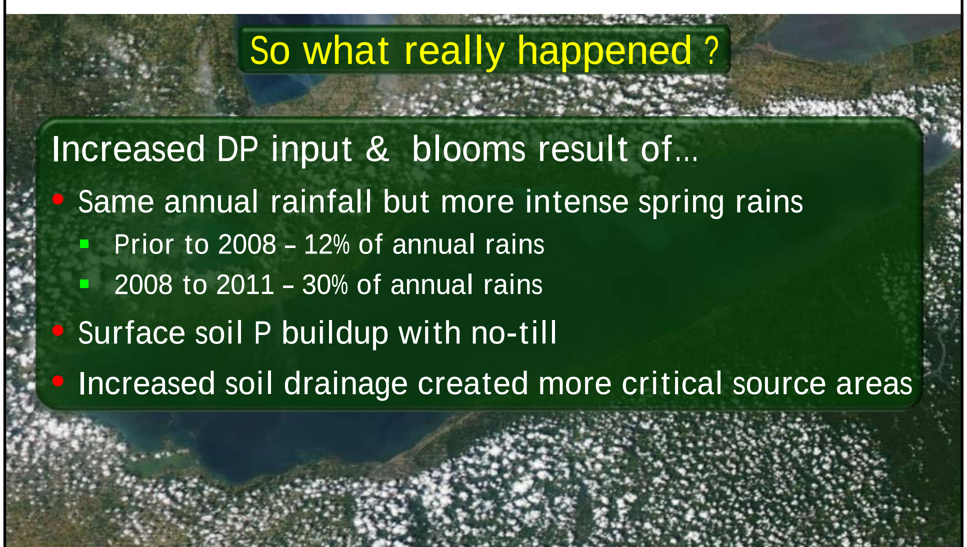

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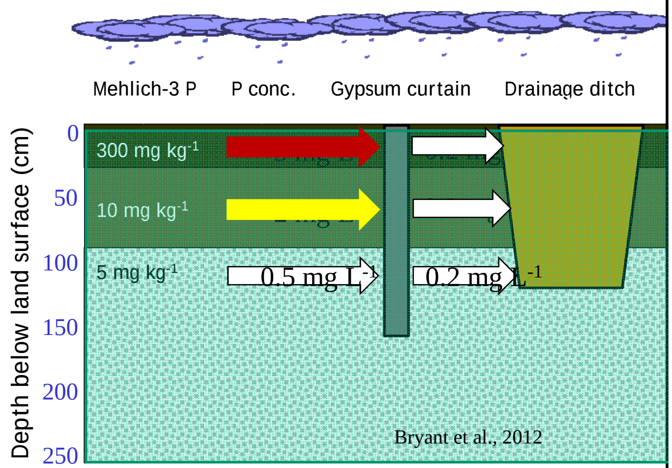
Gypsum Curtains



Where farmers get advice

- According to agency personnel -
  - Agency personnel
  - Field days, workshops, meetings & flyers
- According to farmers -
  - Too busy to attend fields days, etc…
  - Agency personnel – locally variable
  - Other farmers
  - Self research

Woods et al., 2014

What worked

- Conservation tillage
  - Saved farmers time and money
  - Trusted equipment available - John Deere

Osmond et al., 2014; Osmond et al., 2012;
Luloff et al., 2012;



What didn’t work

- Stream buffers
  - They take valuable land out of production
- Nutrient management
  - Too complicated, with little farmer benefit
  - Farmers like to brag about yields not profits
  - Family considerations
- Compliance standards too rigid
  - Effective practices vary by region
  - Impracticalities

Osmond et al., 2014; Osmond et al., 2012;
Luloff et al., 2012;

Questions

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Fine Sediment Sources on CEAP Watersheds

R. A. Kuhnle
USDA-ARS,
Oxford, MS

C. R. Wilson
IIHR, U. Iowa,
Iowa City, IA

R. N. Lerch
USDA-ARS,
Columbia, MO

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Negative effects of sediment

1. Reduces soil fertility
2. Impacts aquatic biota
3. Annual damages – billions of dollars

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Problem:
From where is the sediment transported in streams coming?

Fields?
Channel?

How can you tell the difference?

Answer:
1. Detailed study of bank erosion
2. Using naturally occuring radionuclides.

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^{7}Be and ^{210}Pb

	^{7}Be	***^{210}Pb***
Half-life	53 days	22 years
Source	Spallation	^{238}U decay series
Delivery	Precipitation	Precipitation
partition coeff -K_d	10^4 to 10^5	10^5 to 10^6

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1. Identify unique signature of sediment sources

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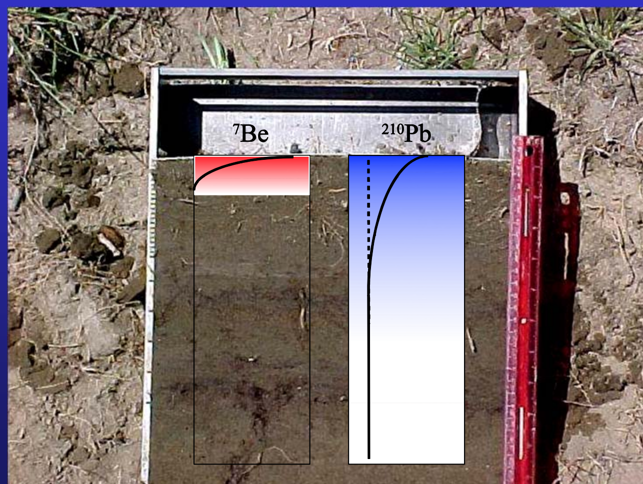
Soil Profiles of ^{7}Be & ^{210}Pb



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1. **Identify unique signature of sediment sources**
2. **Attribute source signature to sediment transported through watershed**

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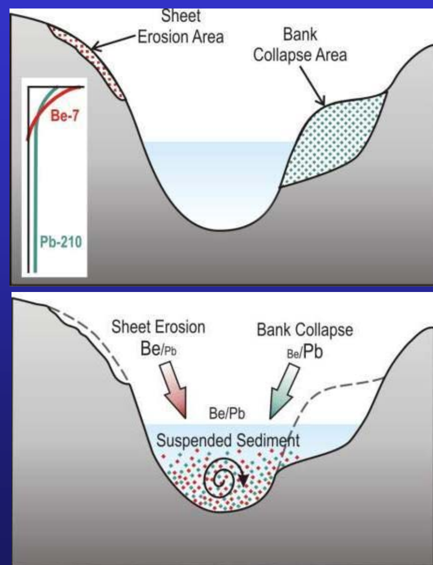
Sediment Contributions to Suspended Load



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Discrimination of Channel Sources

1. Channels – includes sources
   erode >2-4 cm depth – headcuts
   gullies

2. Discriminate gullies – channels?
   not with 2 tracers.

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1. Identify unique signature of sediment sources
2. Attribute source signature to sediment transported through watershed
3. Determine relative amount of eroded surface soils in suspended load

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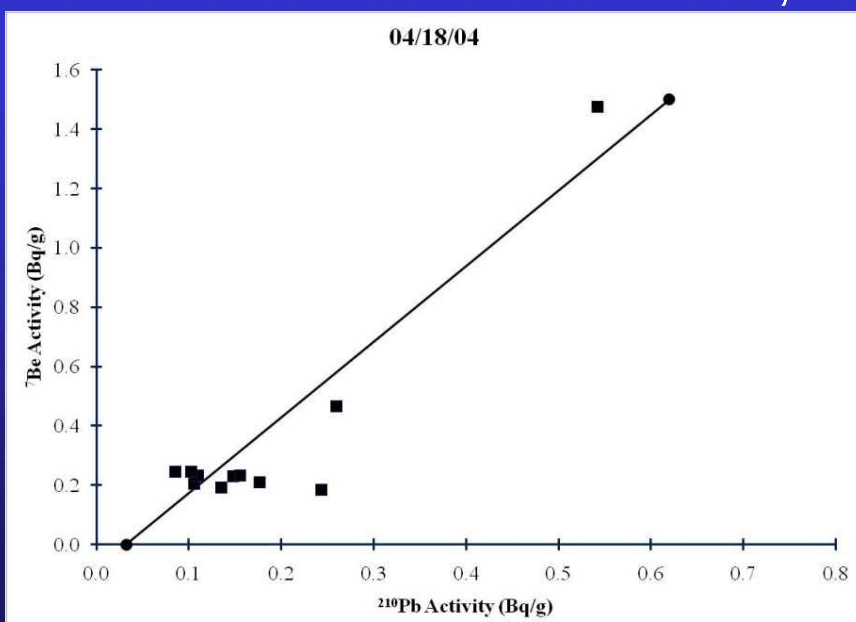
Two End Member Model for Goodwin Creek, MS



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Procedure

- Collect source samples and run through gamma spectrometer
- Collect transported sediment samples during runoff event
- Determine relative amount of eroded surface soils in suspended load using a two end member model

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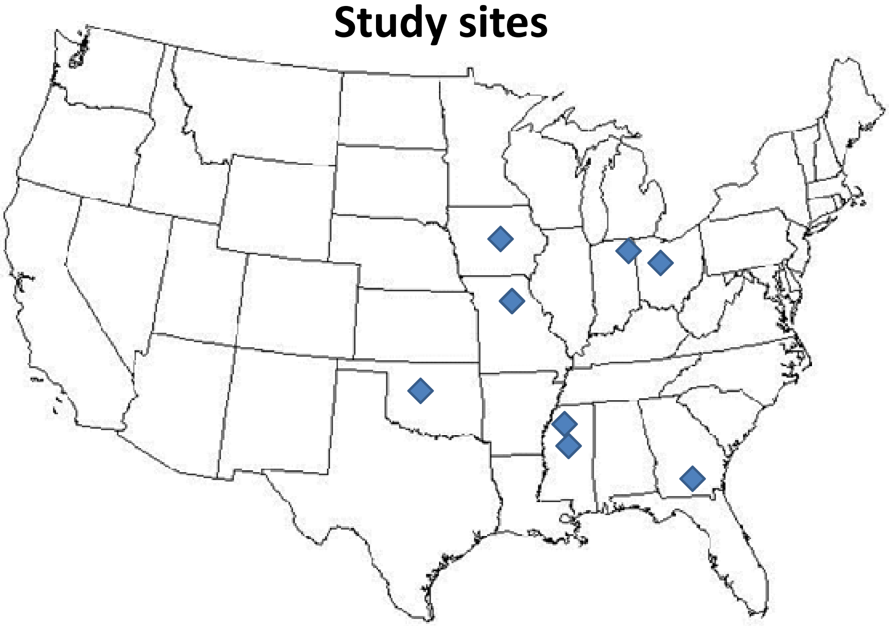
Study sites



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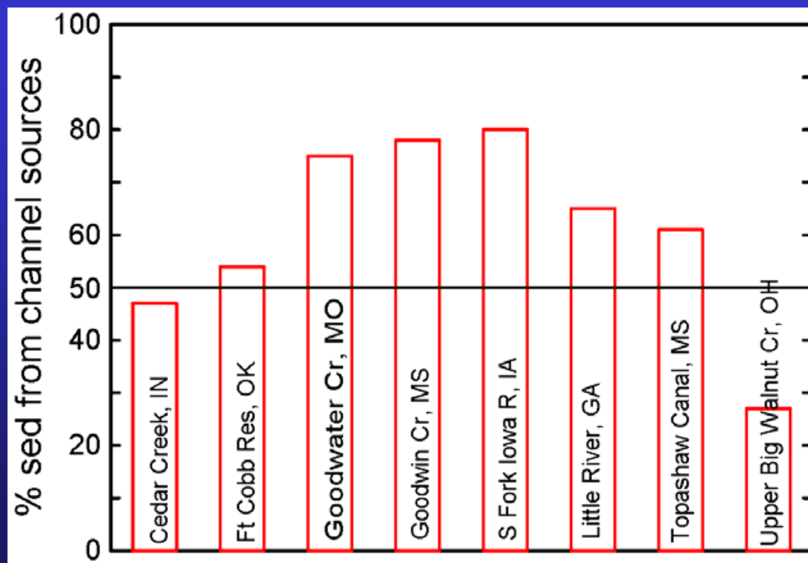
Percent sediment from channels



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Conclusions

- Fine sediment, channel sources dominant on the 7 of 9 CEAP watersheds sampled
- Corroborated by other studies on similar watersheds
- Need for management practices which consider streambank erosion and/or gullies (ephemeral or edge-of-field) if present.

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Questions

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Developing and Testing Tools to Improve Targeting of Conservation Programs and Practices

Claire Baffaut

Watershed Academy Webcast, February 5, 2015

Context

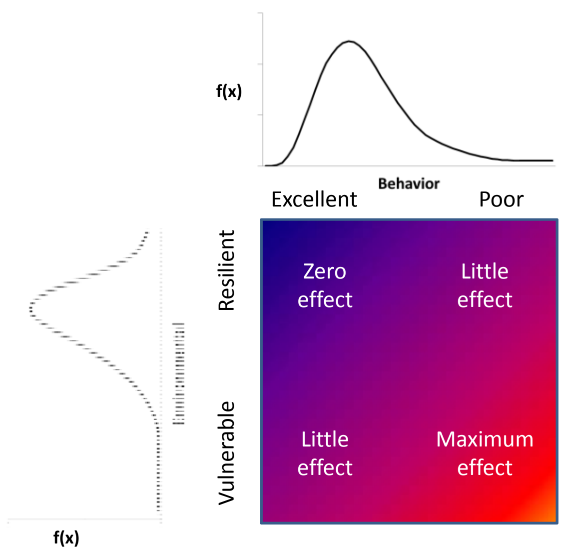
Problem

- Erosion and pollutant transport continues in spite of significant implementation of management practices

Causes

- Changes in land use
- Changes in management
- Climate change
- BMP not placed where most needed in the agricultural landscape

Vulnerability, behavior & practice effectiveness



After Nowack and Cabot, JSWC, 59(6), 2004

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What is targeting?

Geographic targeting

- Most vulnerable areas
  - Soil, land use, topography
- Most pristine areas
  - Management
- Areas with the greatest potential improvement
  - Soil, land use, topography, and management

Benefit/cost targeting

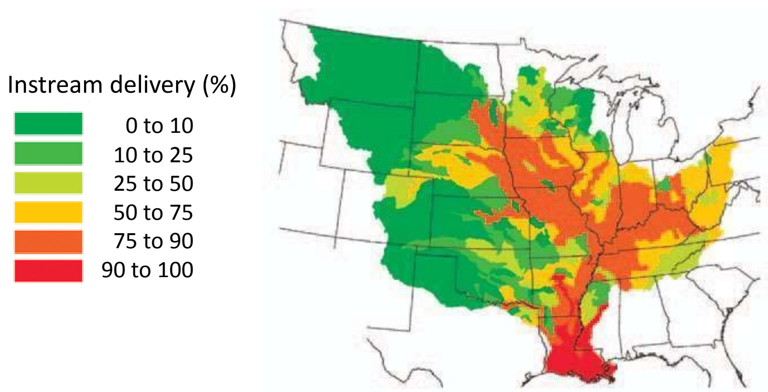
- Areas with the greatest potential improvement per dollar spent

(After World Resource Institute presentation by Michelle Perez)

Effects of targeting

Small fractions of watersheds contribute heavily to pollutant export:

- White et al. (2014) show that the worst 10% areas contribute 33% of the N load to the Gulf.



White et al., JSWC, 2014

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How do we solve the problem?

Tools

- Policy: voluntary vs mandatory
- Technical tools:
  - Identify vulnerable areas
  - Identify areas with potential environmental improvement
- Optimization tools

Required Characteristics

- User friendly
- Accurate
- Validated

Objectives

- Review selected targeting tools and their validation techniques
- Identify gaps and next steps

Some existing targeting tools

- Water input index (WII) and sediment retention index (SRI, Dosskey, Forest Service, Nebraska)
- Pesticide index (Shea group, U of Nebraska)
- Conductivity claypan index (CCI, Baffaut, Missouri)
- Hydrology characterization tool (HCT, Brooks and Boll group, U of Idaho)
- Soil vulnerability index (SVI, NRCS)
- Topographic Index (Cornell University)

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Photo by Newell Kitchen

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Validation of the Topographic Index

- Visual comparison of predicted and GPS located saturated areas in a small watershed (2 km^2).
- Additional corroboration by comparison with thermal images that qualitatively approximate wet areas in that same watershed.
- Comparison of high saturation probability with piezzometer data (different watershed).

From Lyons et al. Hydrol. Processes **18**, 2757–2771 (2004)

Validation of Other Indices

Tool	
HCT	1,5
WII and SRI	1,2,3
Pesticide Index	1,5
CCI	1,2,4
SVI	1,2,3,4

Validation method

1. Professional judgment
2. Qualitative comparison to aerial photos
3. Comparison to other indices
4. Comparison to model results
5. Comparison to measured data

Gaps / Limitations

- Spatial analysis tools to identify visible critical areas in aerial photos.
- Tools for spatial comparison of maps.
- Identification of non-visible critical areas?

Next steps

- Develop and use advanced spatial and GIS analysis tools
- Conduct experimental work to test the validity of targeting.

Questions

Speaker Contact Information

Lisa F. Duriancik
CEAP Watersheds Component Leader
USDA Natural Resources Conservation Service
Resource Assessment Division, Beltsville, MD
lisa.duriancik@wdc.usda.gov

Dr. Mark Tomer
Research Soil Scientist
USDA-Agricultural Research Service (ARS)
Soil and Water Research Laboratory, Ames, IA
mark.tomer@ars.usda.gov

Dr. Deanna Osmond
Professor and Dept. Extension Leader
Soil Science Department
North Carolina State University, Raleigh, NC
dosmond@ncsu.edu

Dr. Douglas R. Smith
Research Soil Scientist
USDA-Agricultural Research Service
(ARS) Grassland, Soil and Water
Research Laboratory, Temple, TX
Douglas.R.Smith@ars.usda.gov

Dr. Roger Kuhnle
Hydraulic Engineer
USDA-Agricultural Research Service
(ARS) National Sedimentation Laboratory,
Watershed Physical Processes Research
Unit, Oxford, MS
Roger.kuhnle@ars.usda.gov

Dr. Claire Baffaut
Research Hydrologist
USDA-Agricultural Research Service
(ARS), Cropping Systems and Water
Quality Research Unit, Columbia, MO
Claire.Baffaut@ars.usda.gov

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Next Watershed Academy Webcast

ELI/TNC's Watershed Approach Handbook: Improving Outcomes and Increasing Benefits Associated with Wetland and Stream Restoration Projects

Information will be posted at
www.epa.gov/watershedwebcasts

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Participation Certificate

If you would like to obtain participation certificates **type the link below into your web browser:**

http://water.epa.gov/learn/training/wacademy/upload/2015-02-05-certificate.pdf

You can type each of the attendees names into the PDF and print the certificates.

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Questions

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