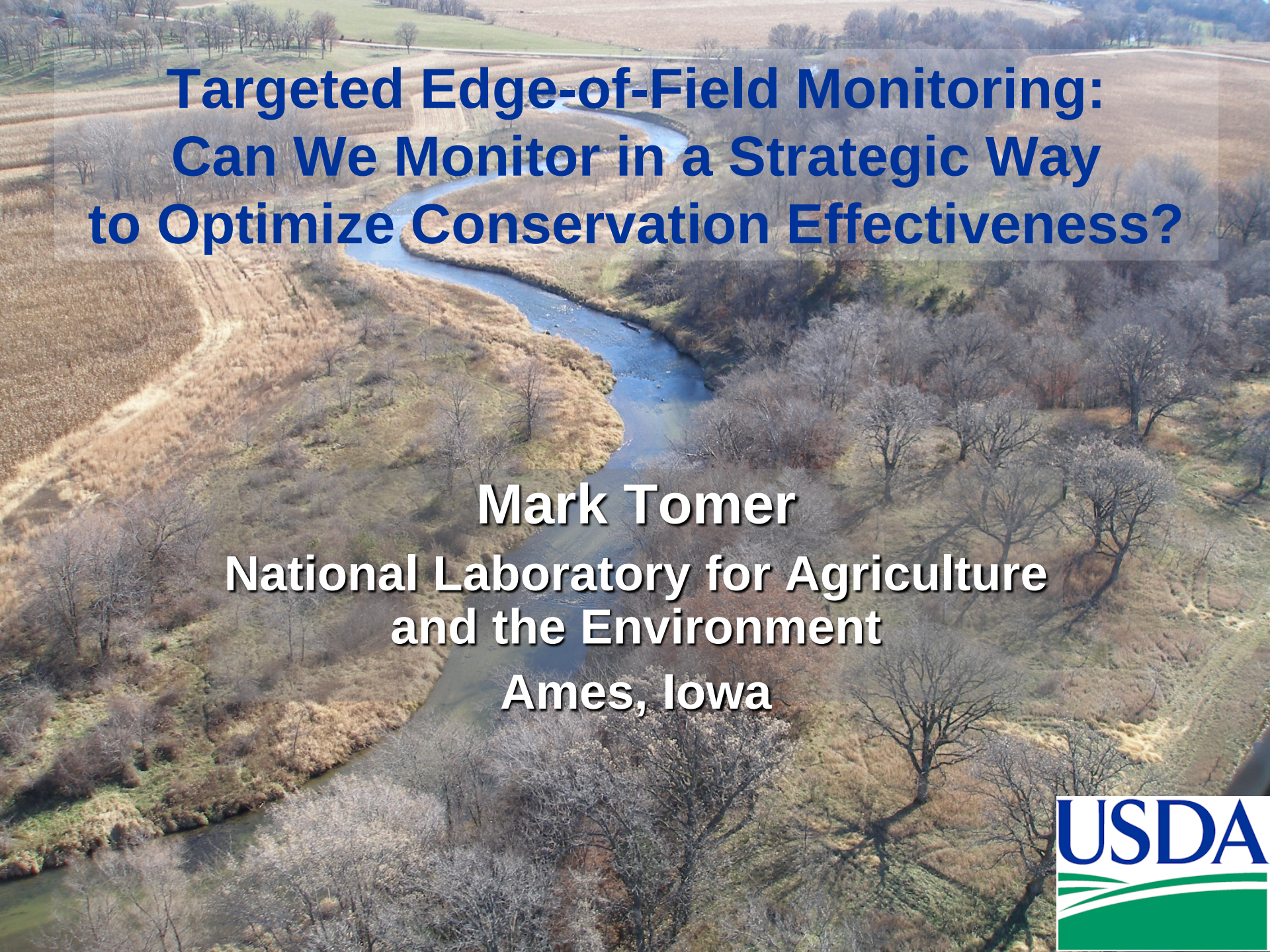


Targeted Edge-of-Field Monitoring: Can We Monitor in a Strategic Way to Optimize Conservation Effectiveness?

Mark Tomer

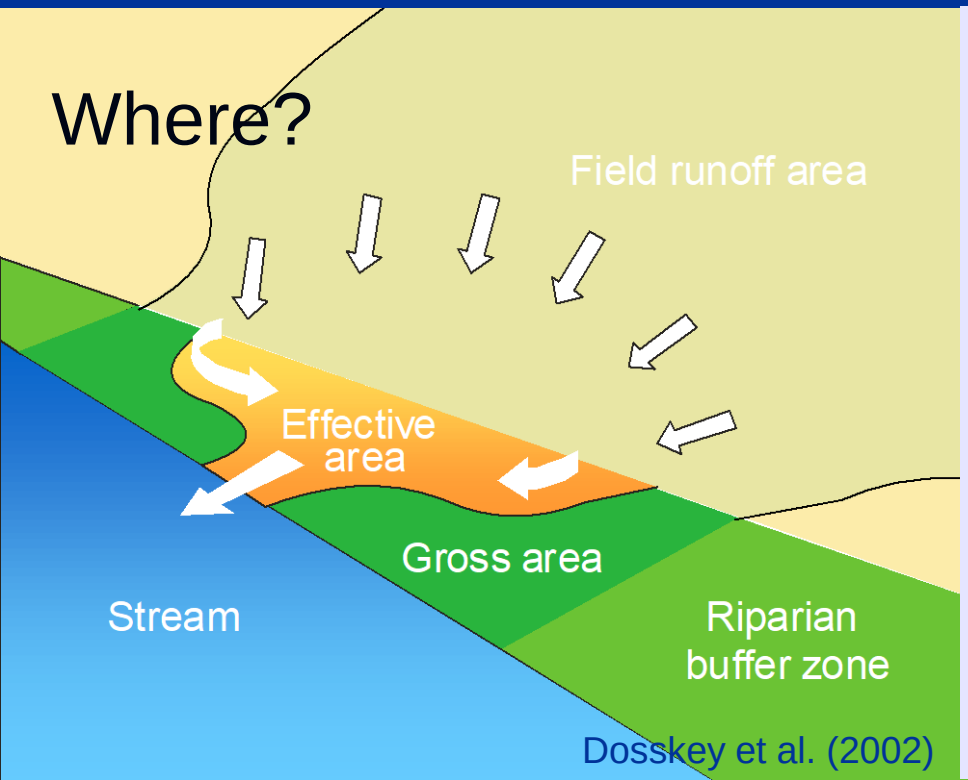
National Laboratory for Agriculture and the Environment

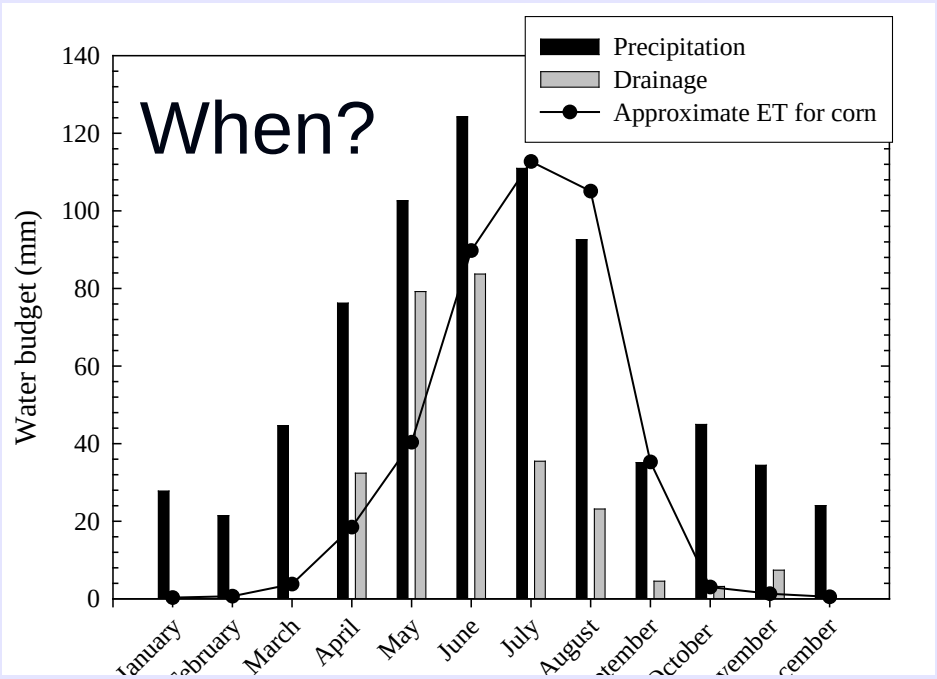
Ames, Iowa

USDA

Aspects of ‘targeted’ monitoring: know your landscape!

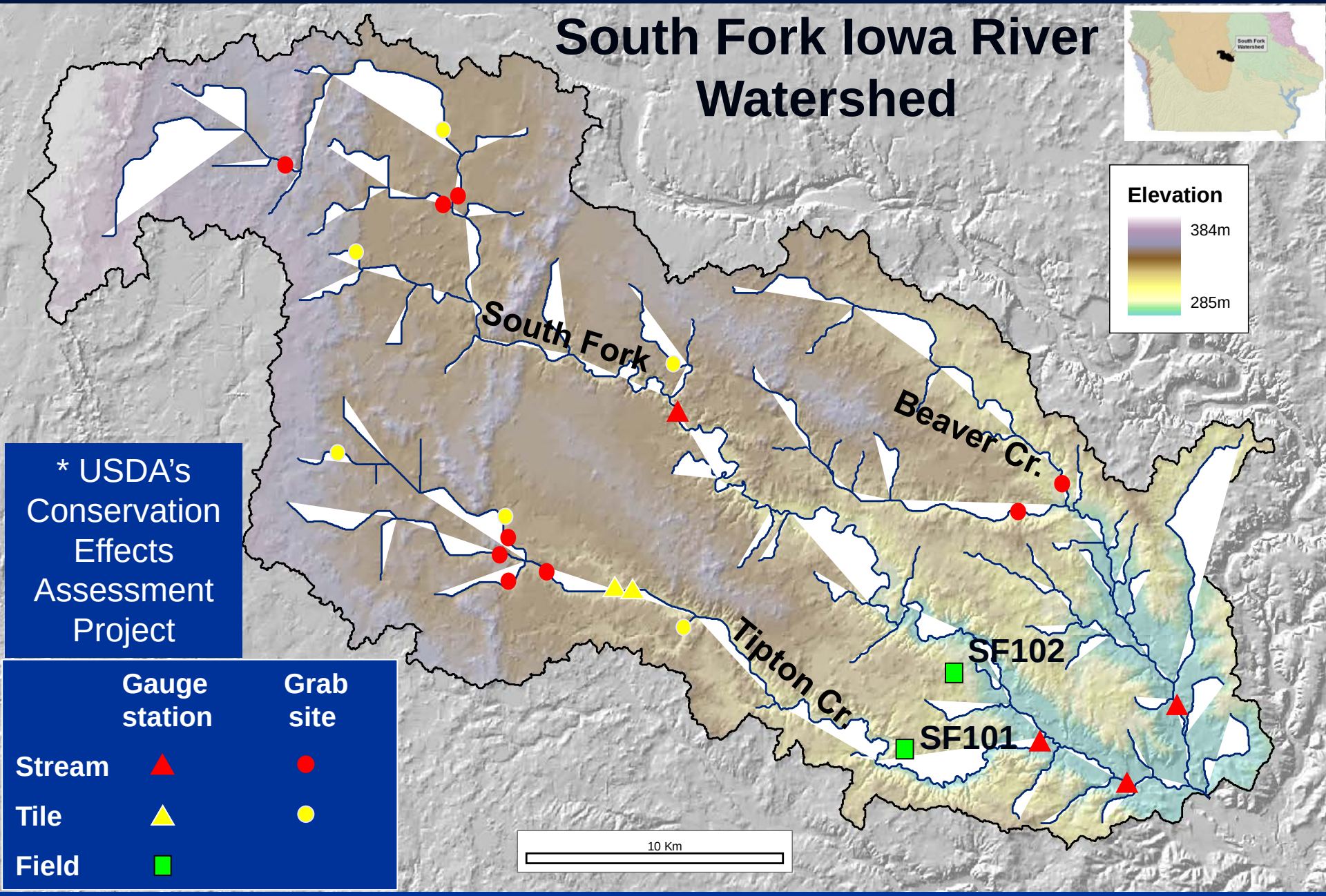
What pathway?





Helmers et al., 2005

Lessons from a CEAP* Watershed



Tipton Creek Basin

TC242

TC240

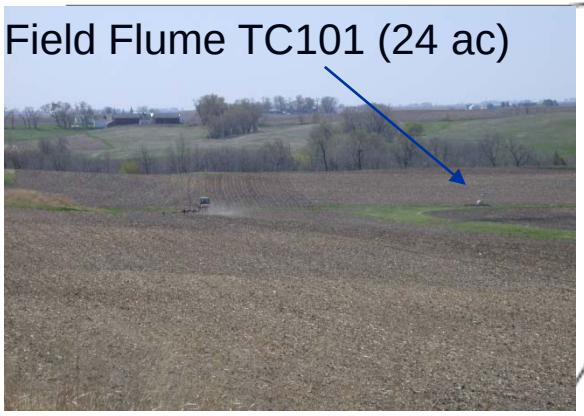
TC101

TC325

Catchment source

- Stream gauge
- Tile outfall
- Field runoff flume

Field Flume TC101 (24 ac)

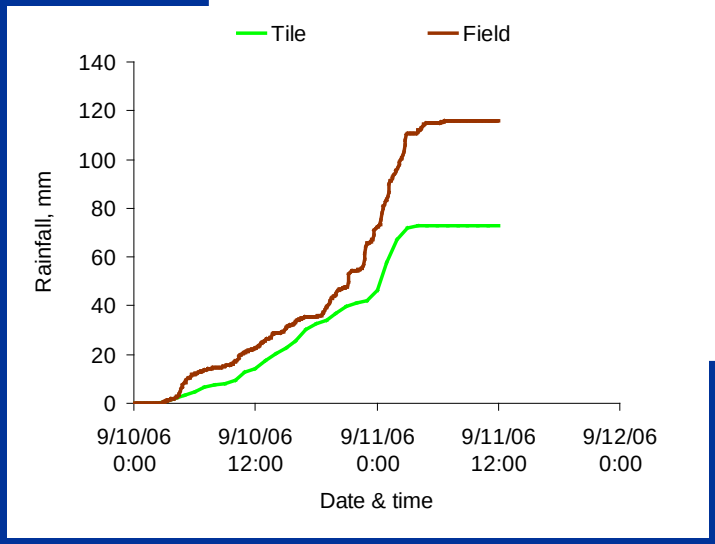


10

Kilometers

Upper Tipton watershed - Tile drained, farmed wetlands (potholes)

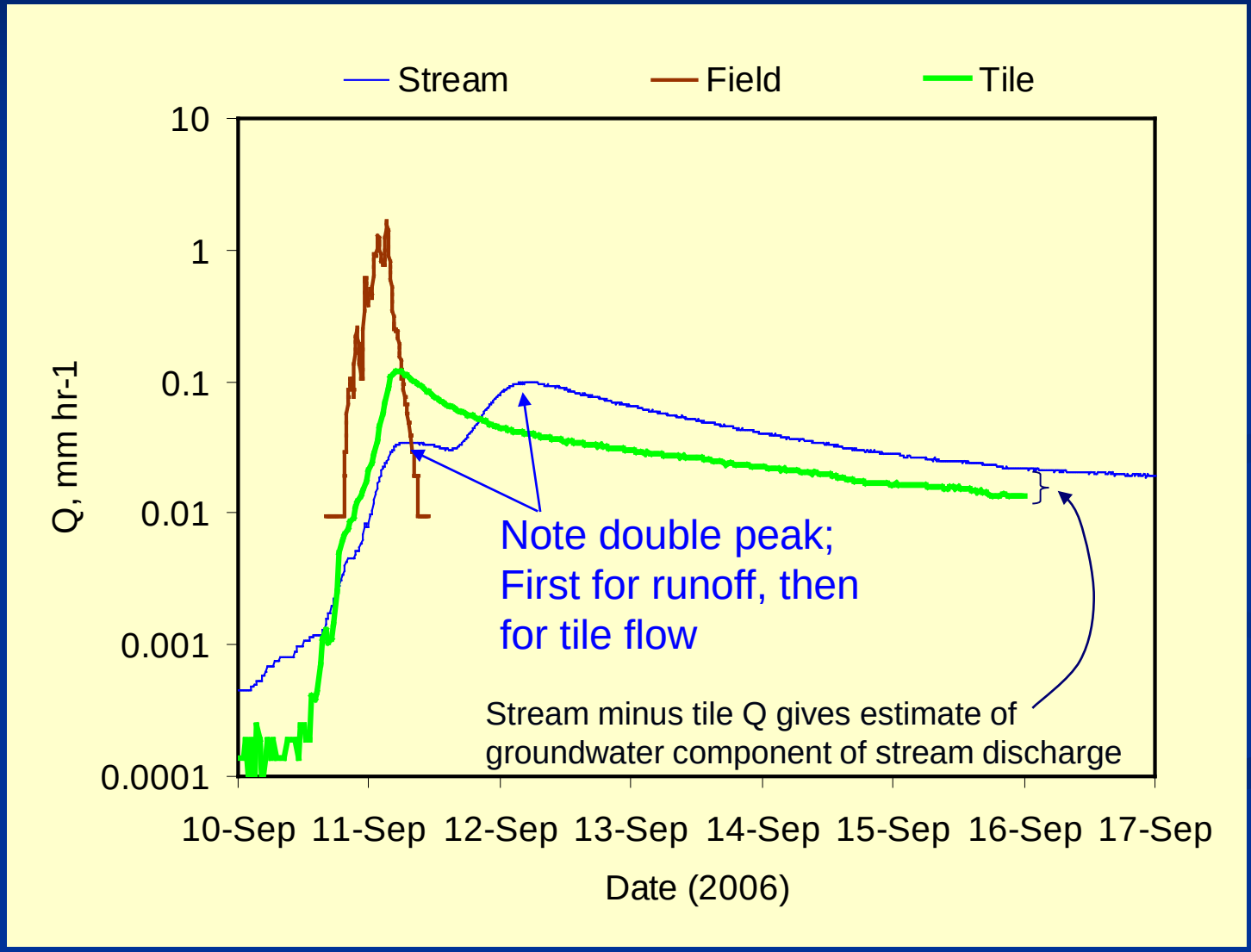
Rainfall event, Sept. 10-11 2006



Tile

Field

Hydrologic and water quality responses to rainfall event at three scales

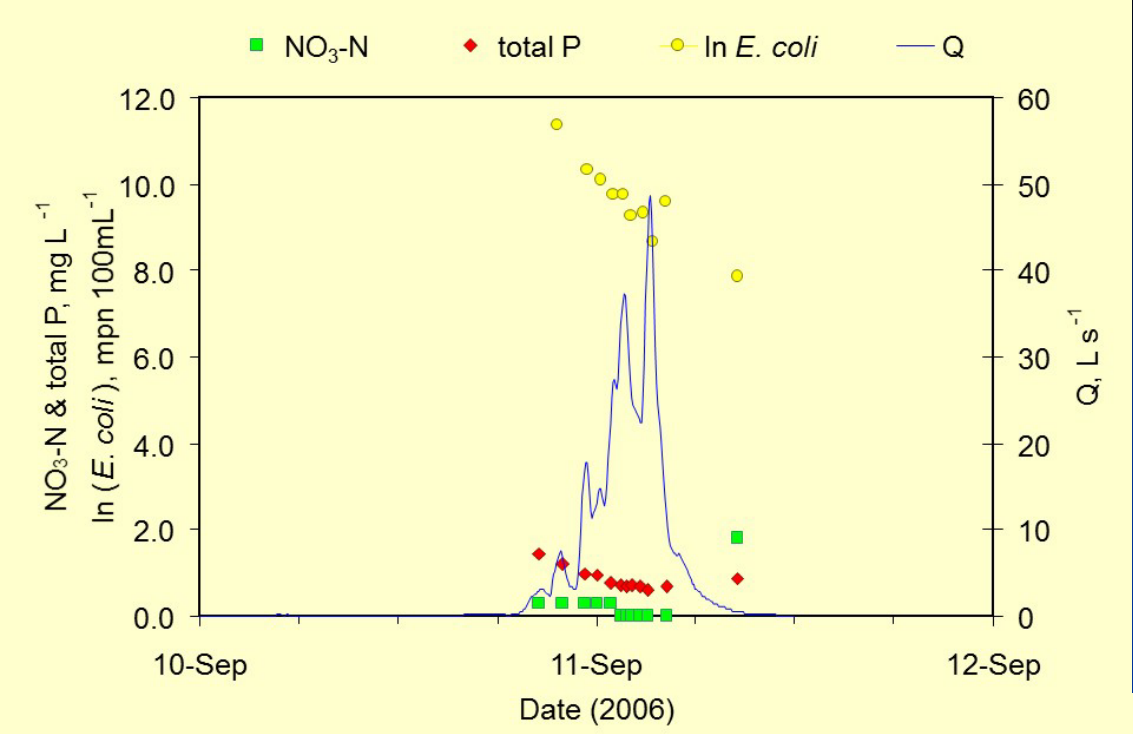


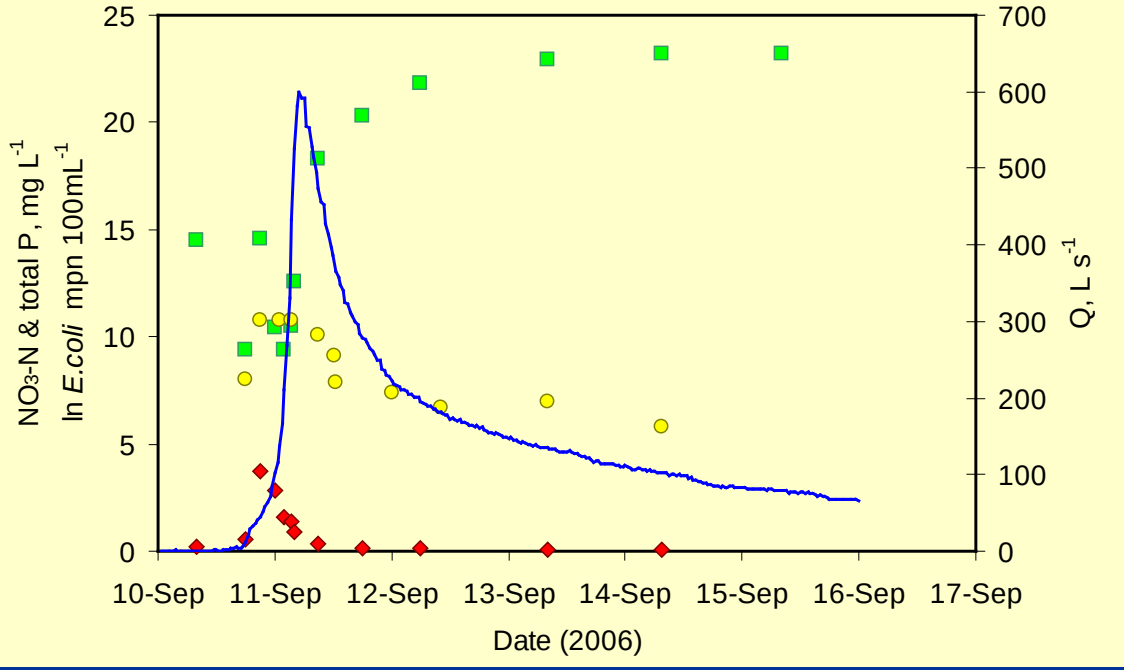
Flow volume, N, P, & *E. coli* during event

Field flume

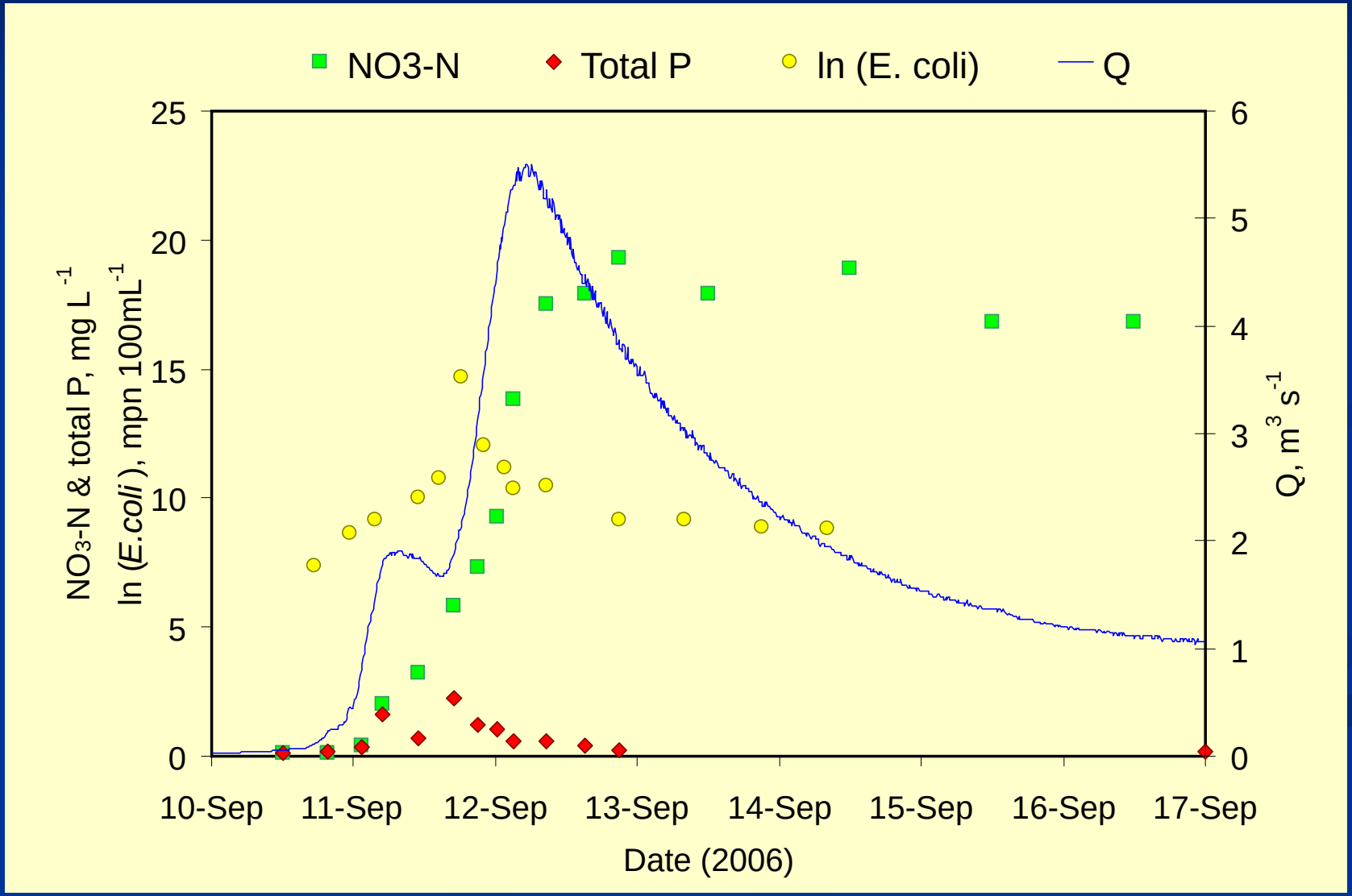
&

Tile outfall

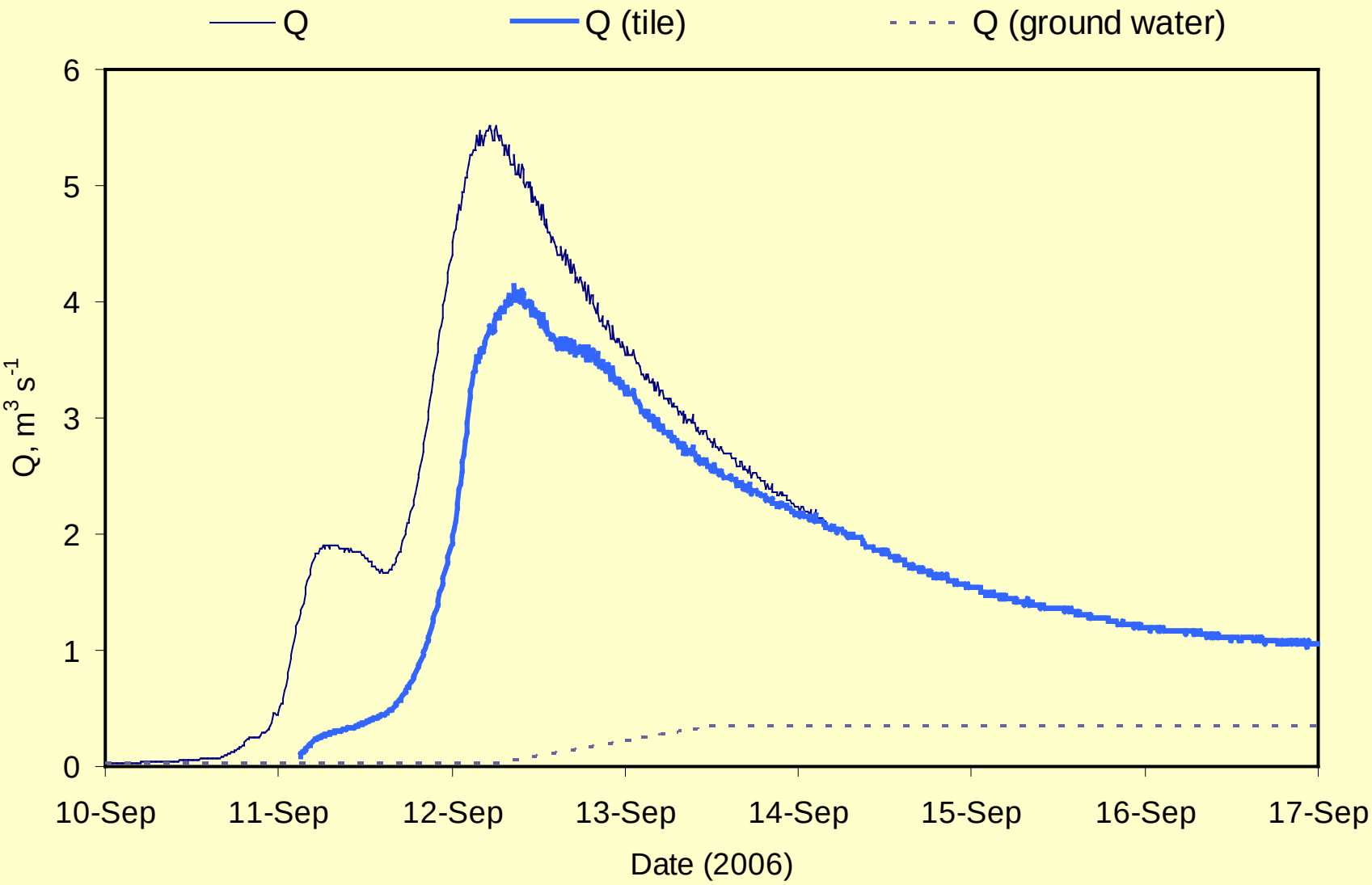




Stream outlet: discharge, nutrients, and *E. coli*



Hydrograph separation – Stream outlet



Insight from nested monitoring of a single event on managing sources and pathways:

- ✓ Nutrient management
- ✓ Erosion control
- o Glacial depressions
- o Channel sources

Sub-surface

Surface

Blind Inlet Installation

Excavated hole prior to lining with geotextile

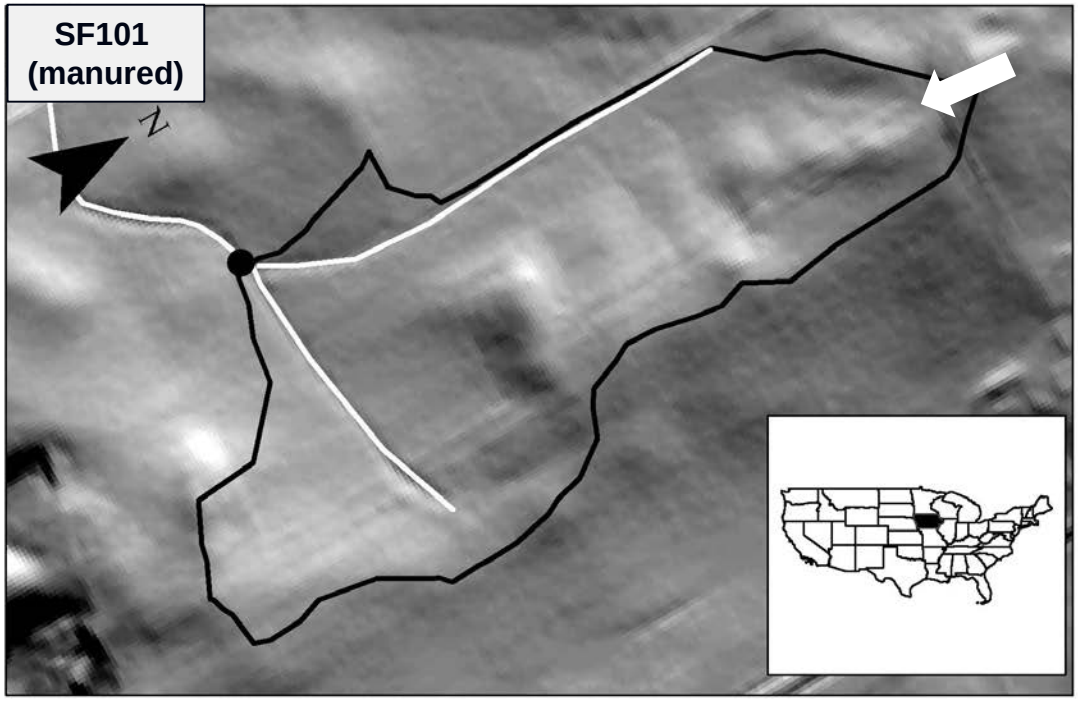
Plumbing placed on top of geotextile & gravel

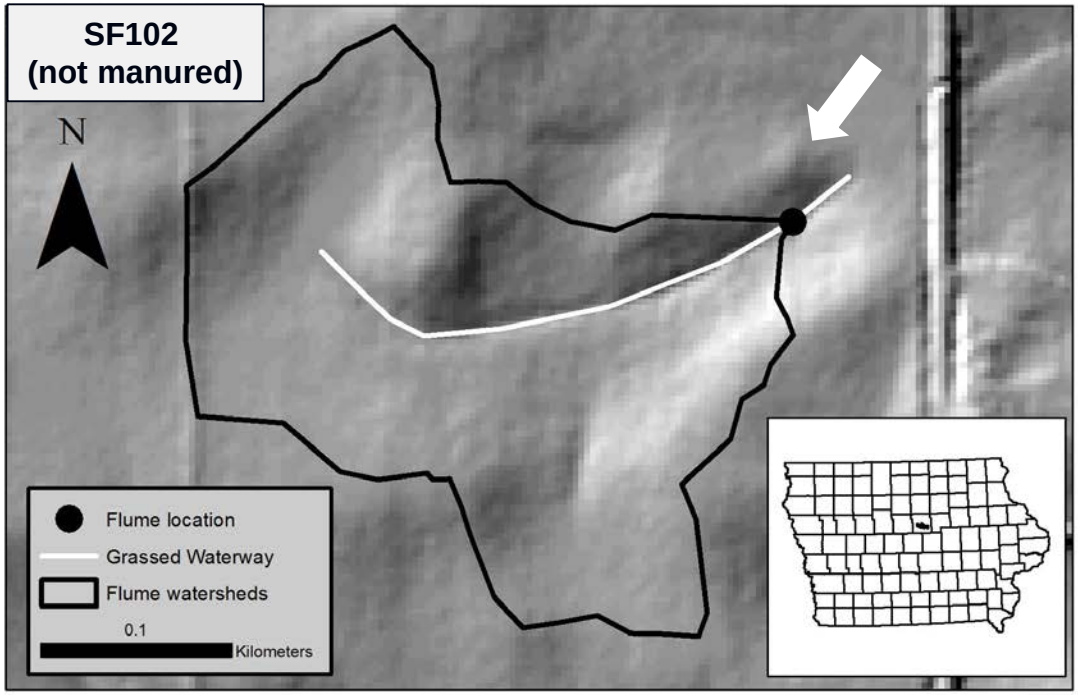
Covering plumbing with gravel

Covering gravel with geotextile

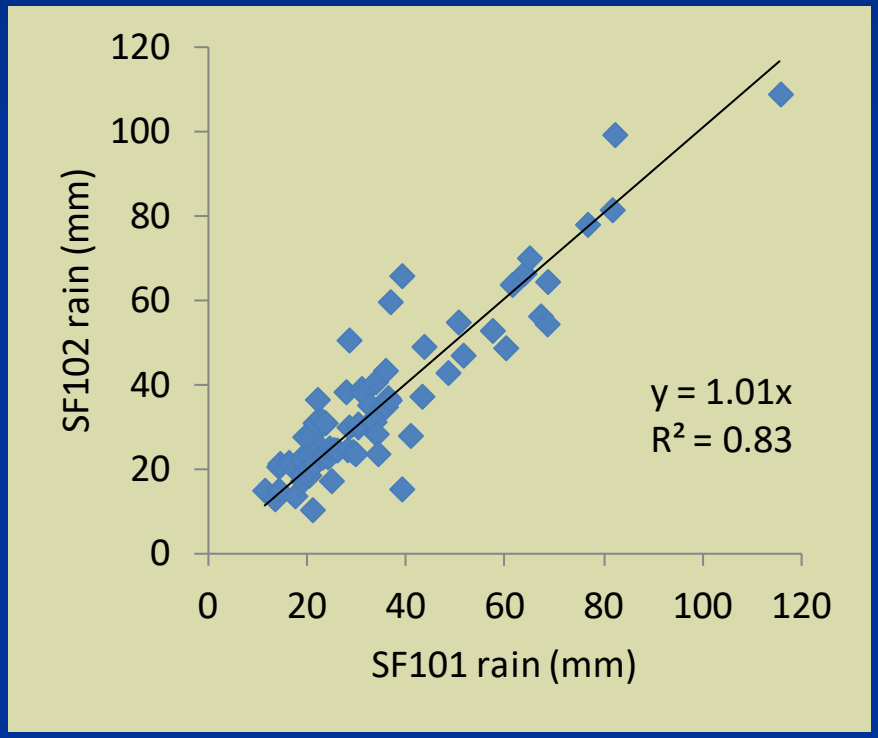

Monitoring filter socks around surface inlet

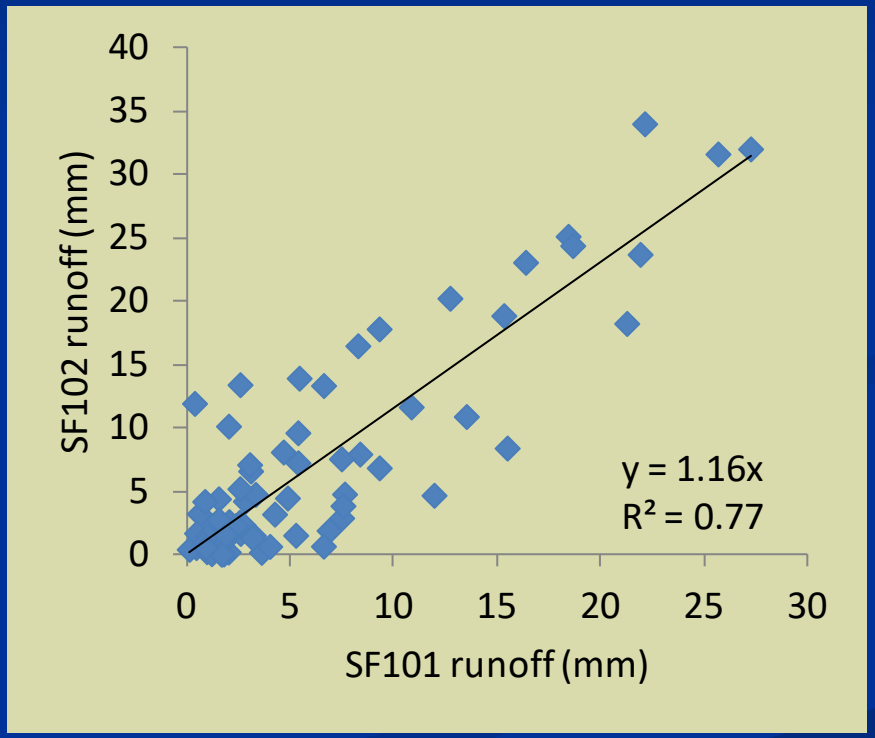
Observations from monitoring paired fields


SF101
(manured)
N

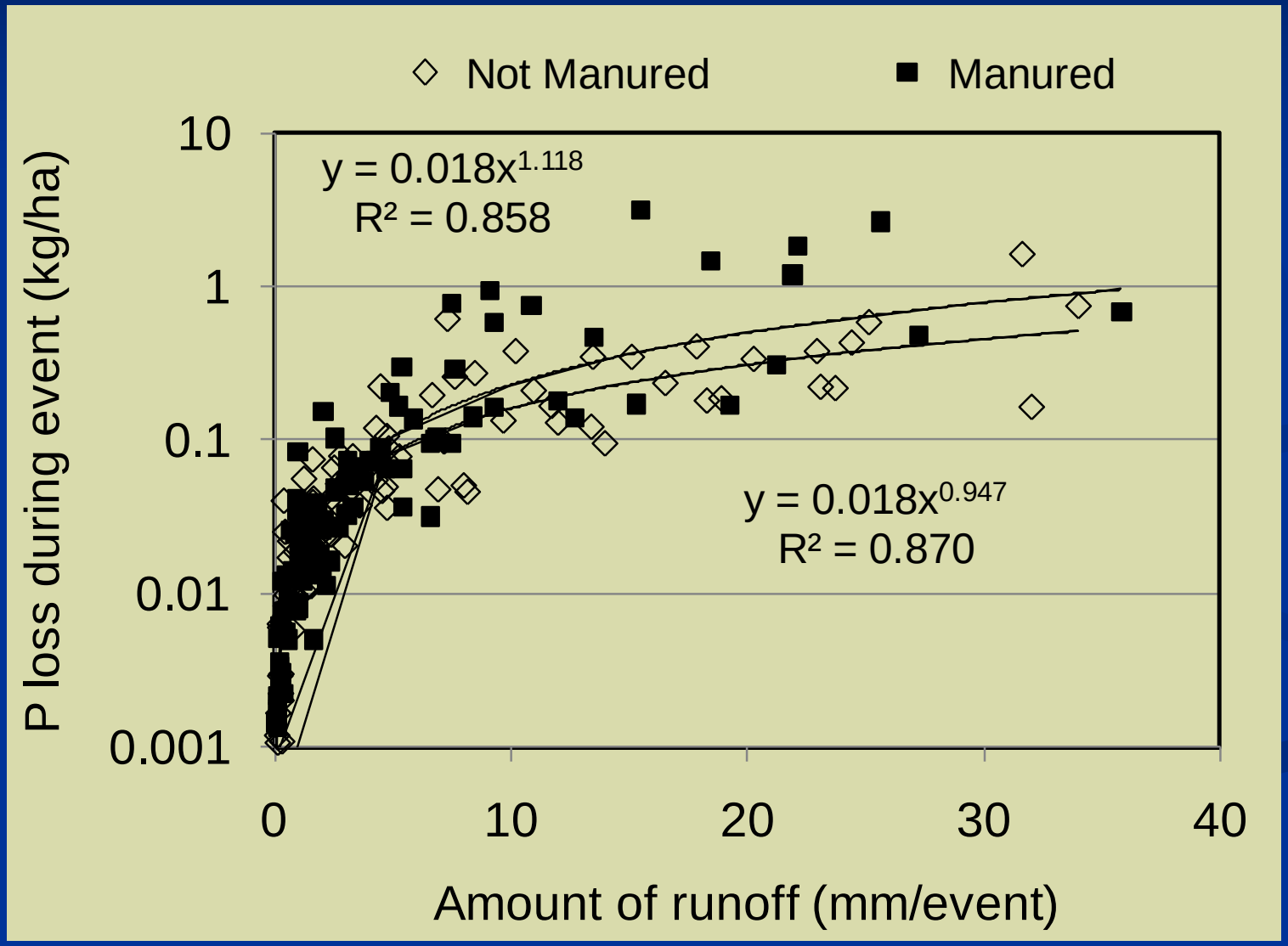

SF102
(not manured)
N
Flume location
Grassed Waterway
Flume watersheds
0.1
Kilometers

Similarity in amounts of rainfall and runoff per event

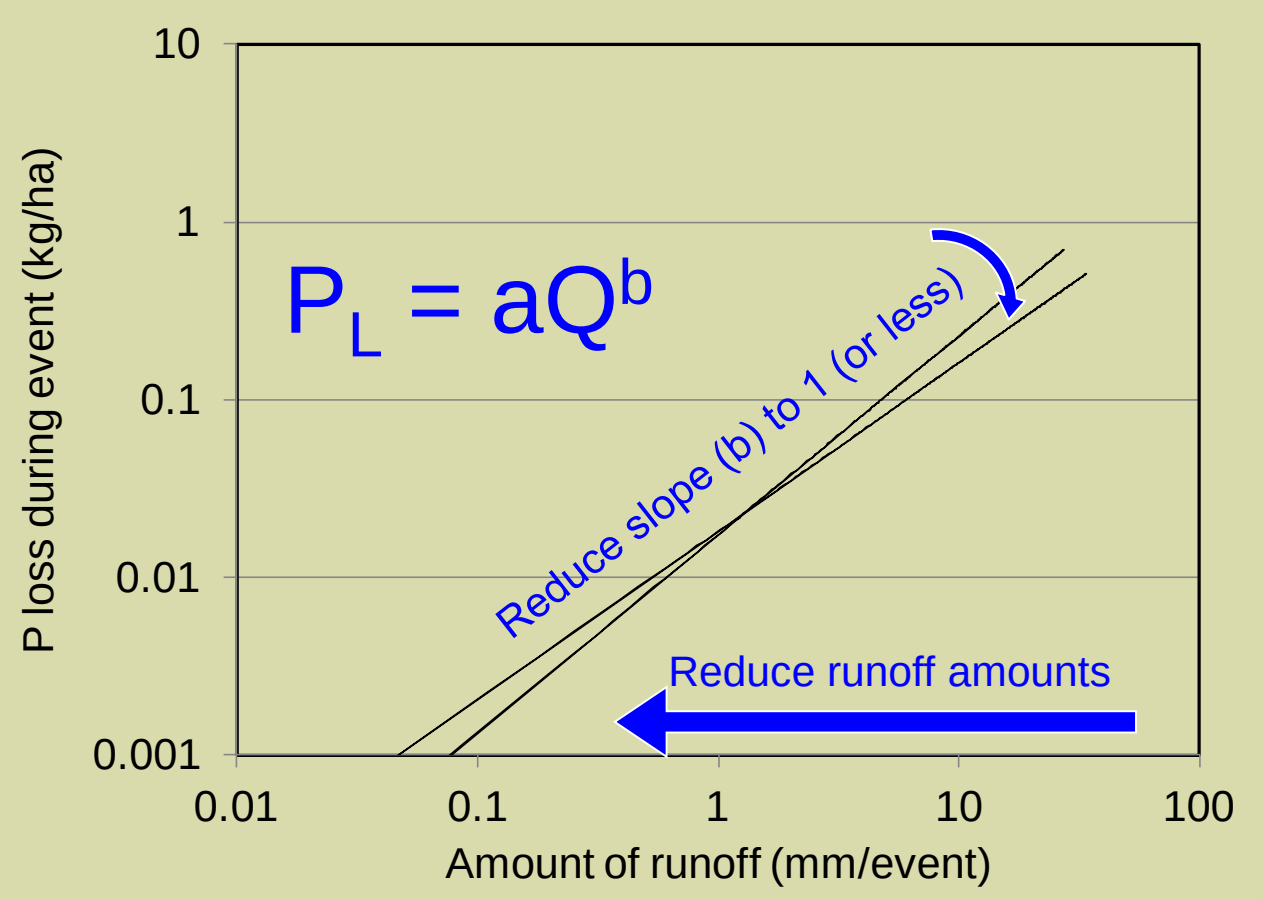




Significant difference in runoff – P load relationship



In-Field Conservation Practices Impact on Runoff-P Load Relationship Could Influence Effectiveness of Edge of Field Practices

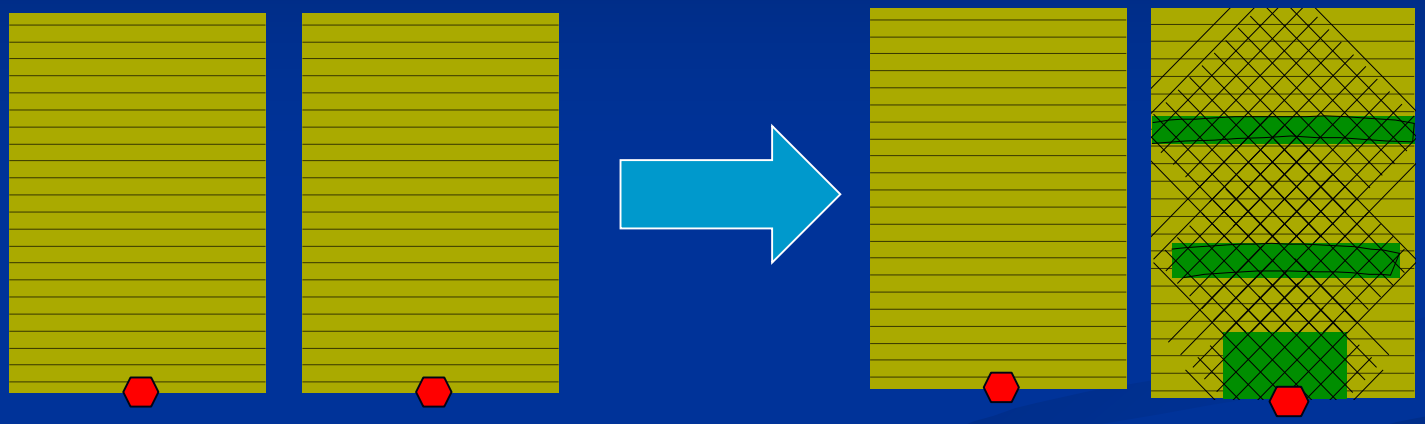


“Edge of field” practices

- Bioreactors
- Nutrient removal wetlands
- Water and sediment control basins
- Phosphorus traps
- Surface intake filters
- Saturated buffers

Are all most effective at low inflow rates compared to high inflow rates.

Paired watershed experiments are not designed to assess effects of stacked conservation practices



1. Pretreatment calibration (2+ years)

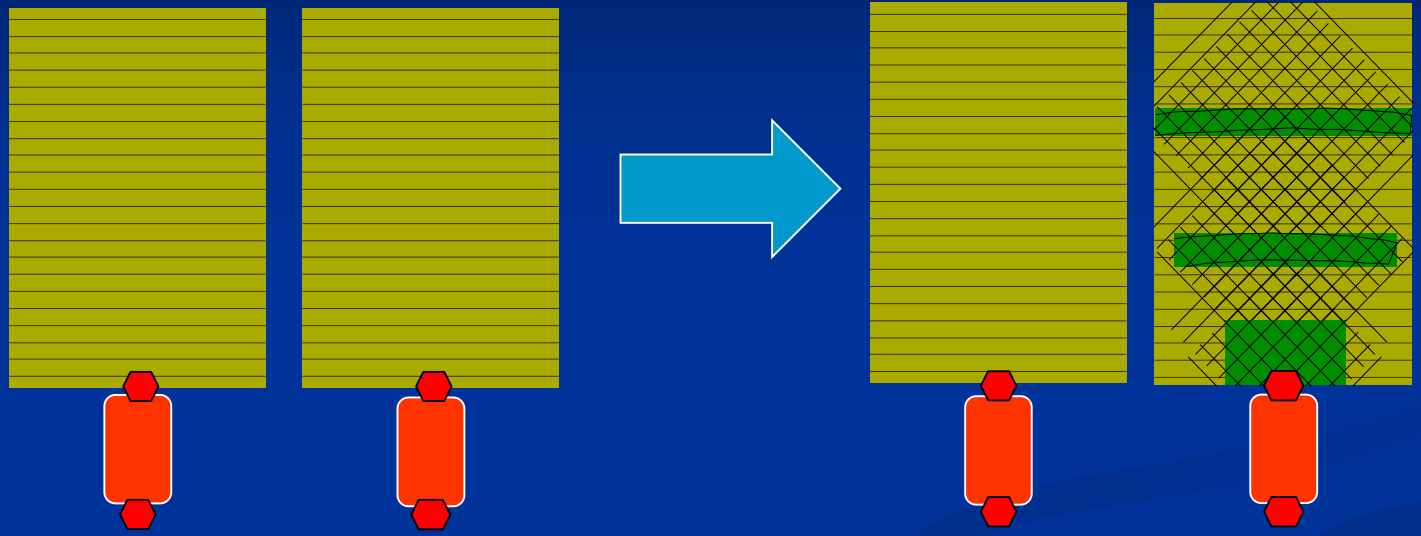
2. Treatment evaluation (3+ years)

- Five years duration (minimum)
- Requires two monitoring points to answer one question
- How many fields are represented by this experiment?

Evaluation of field edge practices (denitrifying bioreactor example)

- Three years duration (likely minimum)
- Requires two monitoring points to answer one question
- How does in-field management impact EoF practice performance?

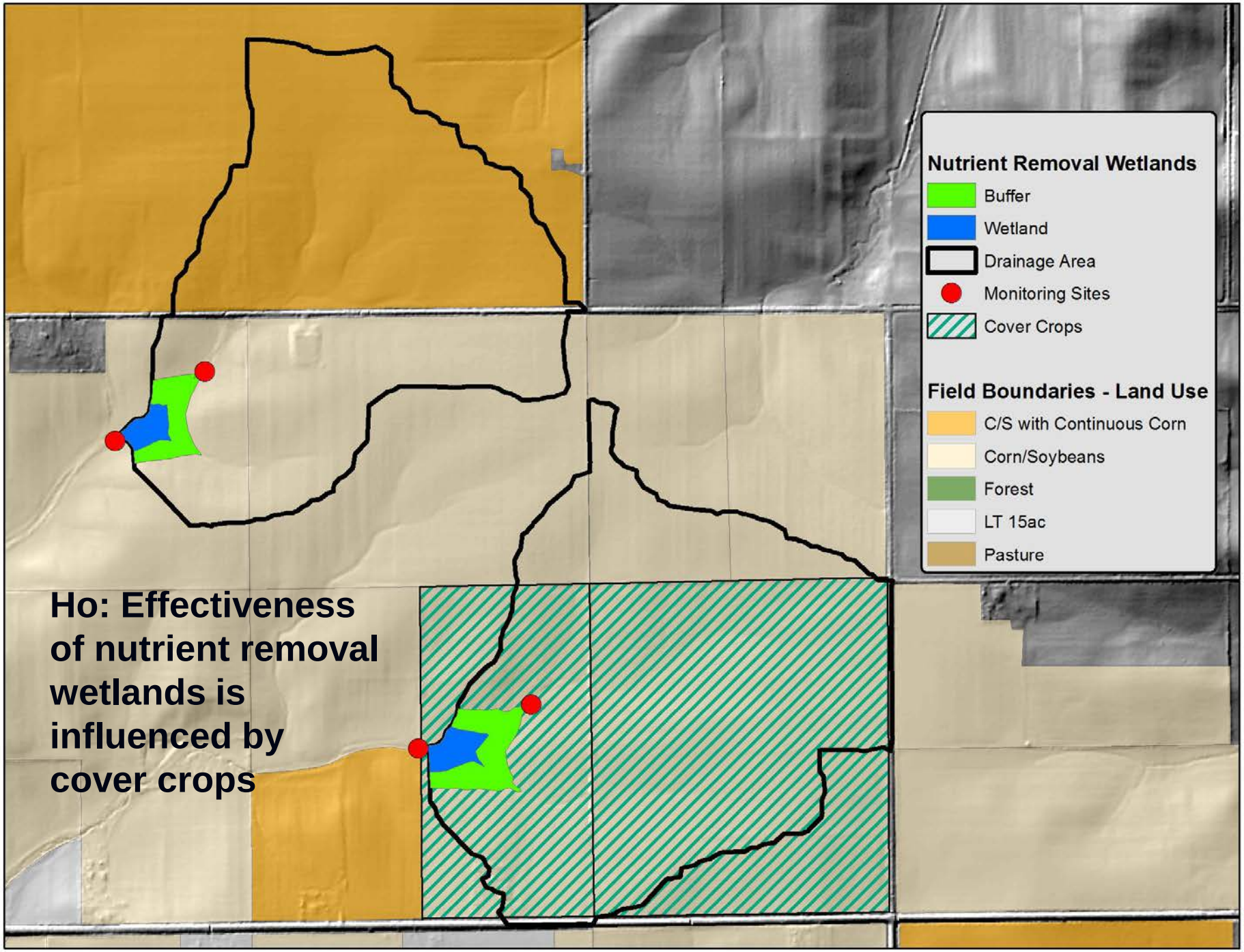
An alternative experimental design (twice-paired watershed experiment)

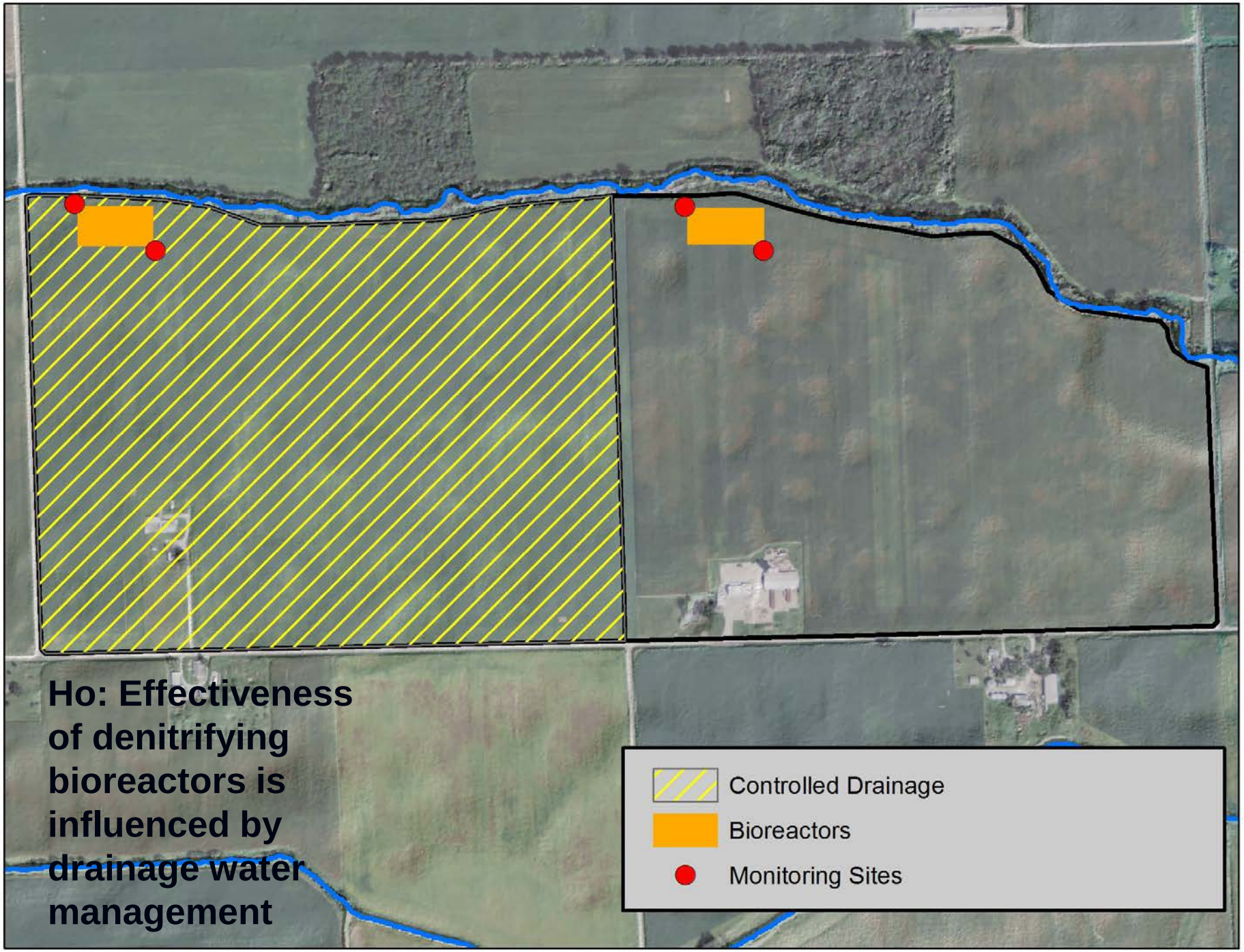


1. Implement field edge practice and calibrate two fields (replicated experiment, 2+ years)

2. Implement field practice evaluate two practices (3+ years)

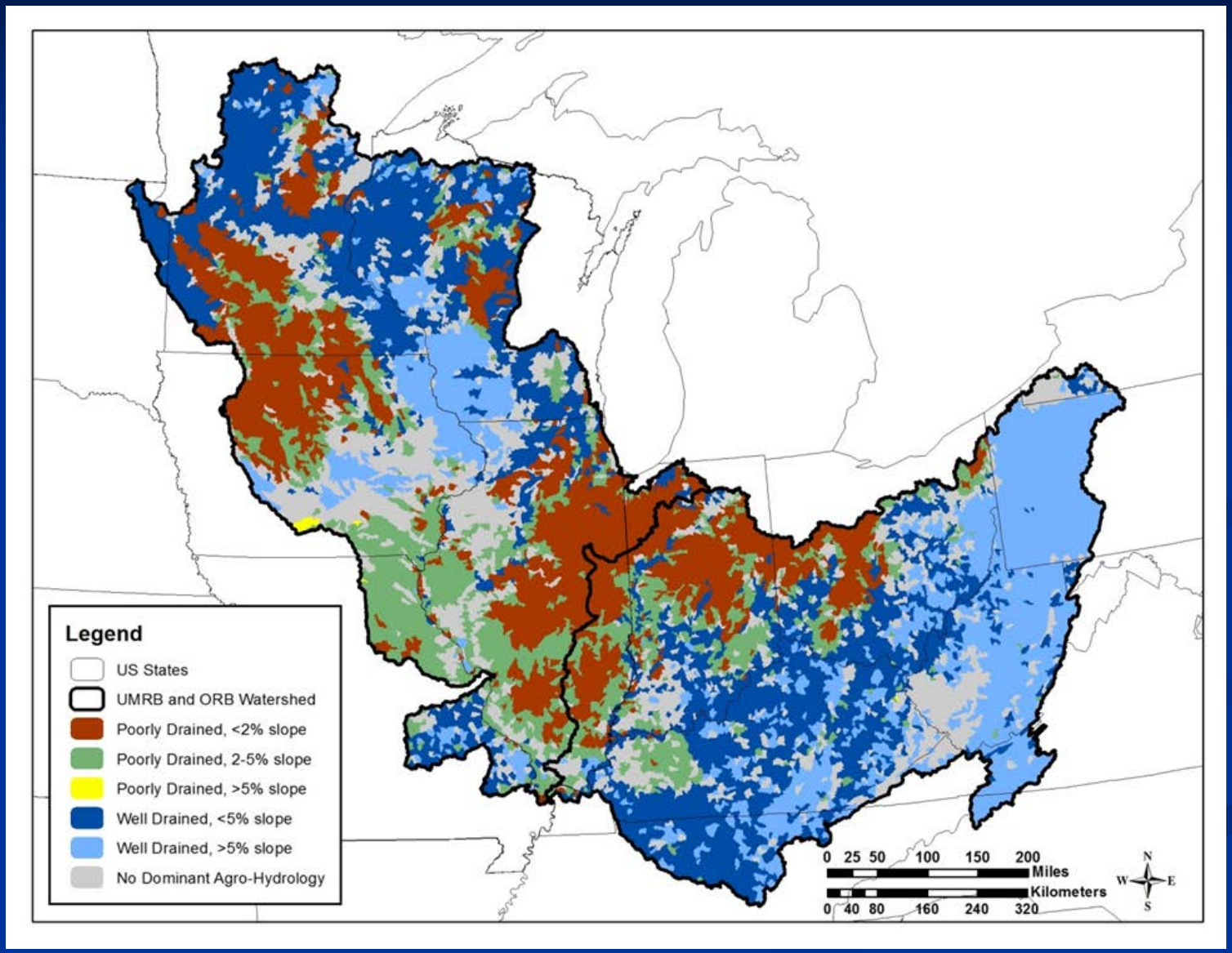
- Five years duration (but useful data within 2-3 years)
- Requires four monitoring points but answers three questions
- Can pair practices that represent regional opportunities


Nutrient Removal Wetlands
Buffer
Wetland
Drainage Area
Monitoring Sites
Cover Crops
Field Boundaries - Land Use
C/S with Continuous Corn
Corn/Soybeans
Forest
LT 15ac
Pasture
Ho: Effectiveness of nutrient removal wetlands is influenced by cover crops


Ho: Effectiveness of denitrifying bioreactors is influenced by drainage water management
Controlled Drainage
Bioreactors
Monitoring Sites

How do we select combinations of practices for monitoring/evaluation?

Distribution of Different Types of Watersheds Across the UMORB



Can we Match Conservation Practices to Different Types of Watersheds/Landscapes?

<table>
<tr><th></th><th colspan="2">Poorly Drained Soils</th><th>Well Drained Soils</th></tr>
<tr><td>High relief (slopes > 5%)</td><td colspan="2">Grass waterways, contour filter strips, terraces, ponds, riparian buffers, cover crops</td><td>In-field source controls important, riparian buffers, springs, seeps, floodplain reconnection, in-stream practices</td></tr>
<tr><td rowspan="2">Low relief (slopes < 5%)</td><td>Dissected (slopes 2 - 5%)</td><td>Non-dissected (slopes < 2%)</td><td rowspan="2">In-field source controls important, 2-stage ditches, floodplain reconnection, off-channel wetlands</td></tr>
<tr><td>Grass waterways, filter strips, ponds, cover crops, riparian buffers, wetlands, bioreactors</td><td>Drainage water management, treatment wetlands, bioreactors, 2-stage ditches</td></tr>
</table>

Schilling et al, *Environmental Management*, 2015

Summary

- Use nested monitoring and/or landscape analyses to propose conservation strategy for watershed / region.
- Identify dominant pathways and practices to manage flows along those pathways.
- Include practices placed along a landscape continuum in strategy.
- Experiment to evaluate single / stacked practices that can be applied regionally.
- Adapt strategy and its implementation.

Fodder for discussion:
Edge of field monitoring networks
Environmental certification
Regulatory assurance
Role of producers in monitoring

Concluding thought:
A best approach for monitoring agricultural fields and watersheds will provide on-farm data and lessons that producers can use in applying conservation practices to enhance profitable production systems and environmental outcomes on their farms.