

Small-scale Watershed Monitoring

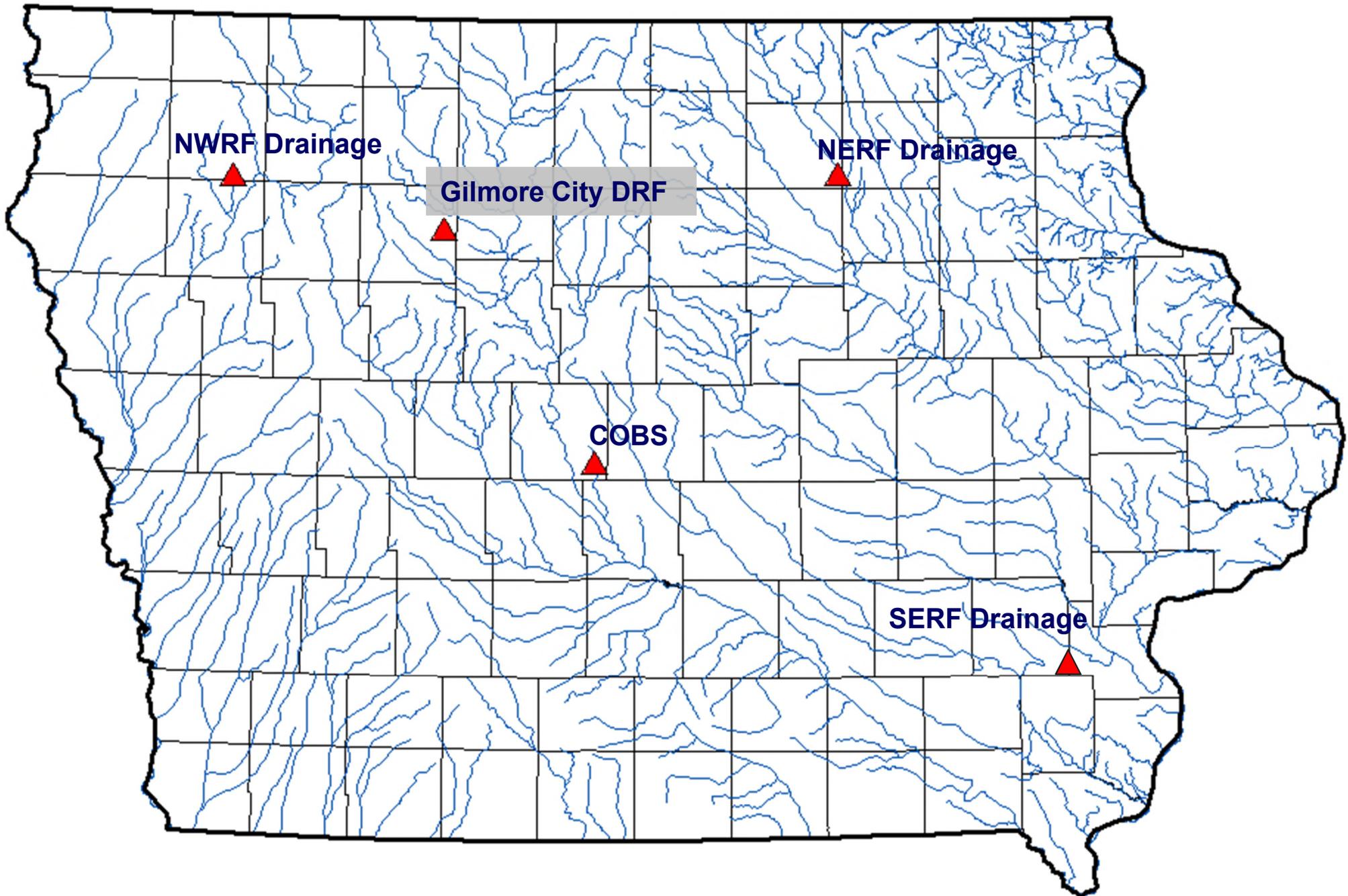
Matthew Helmers

Dean's Professor, College of Ag. & Life Sciences

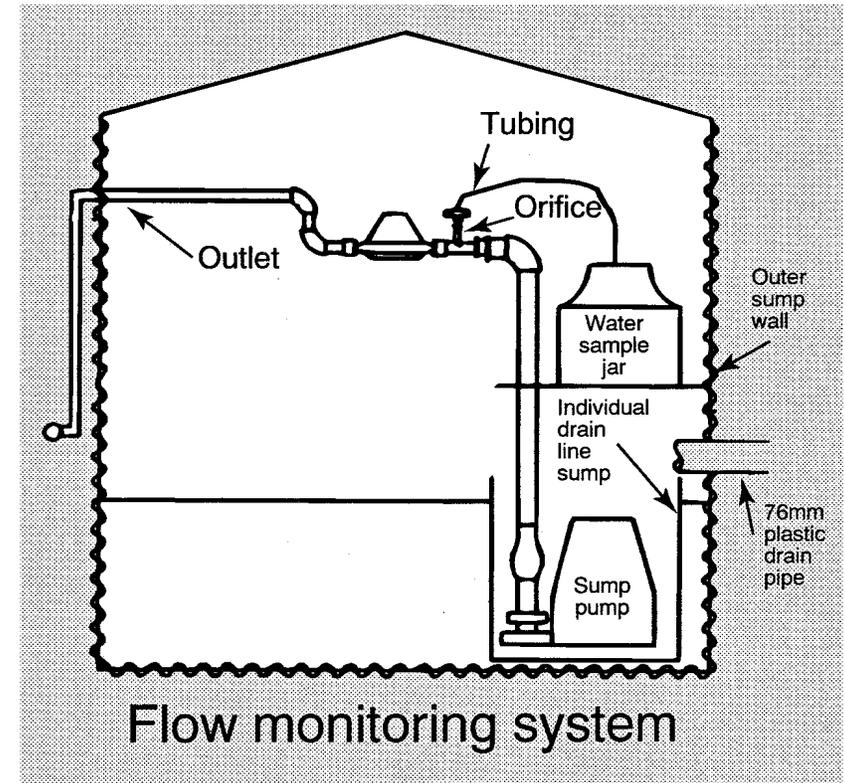
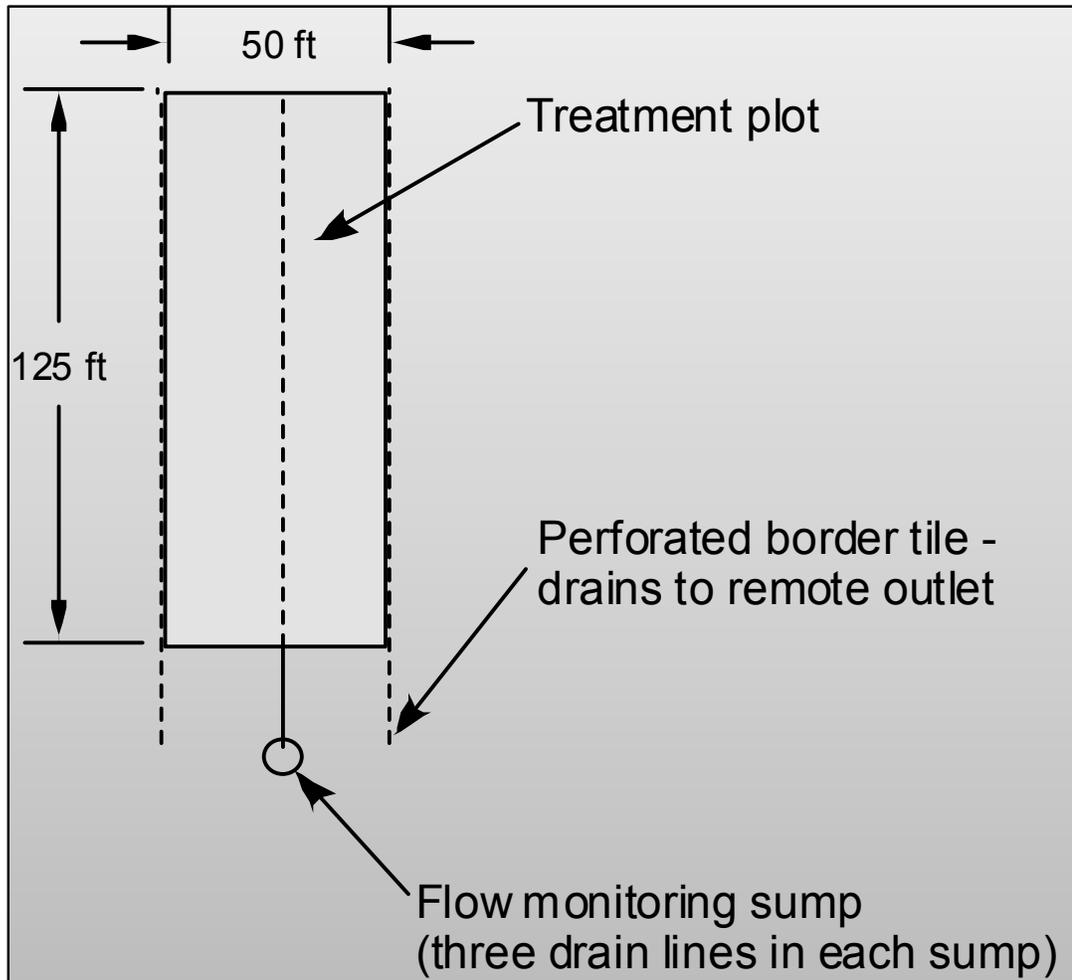
Professor, Dept. of Ag. and Biosystems Eng.

Iowa State University

Replicated subsurface drainage plots to evaluate performance of various in-field management practices



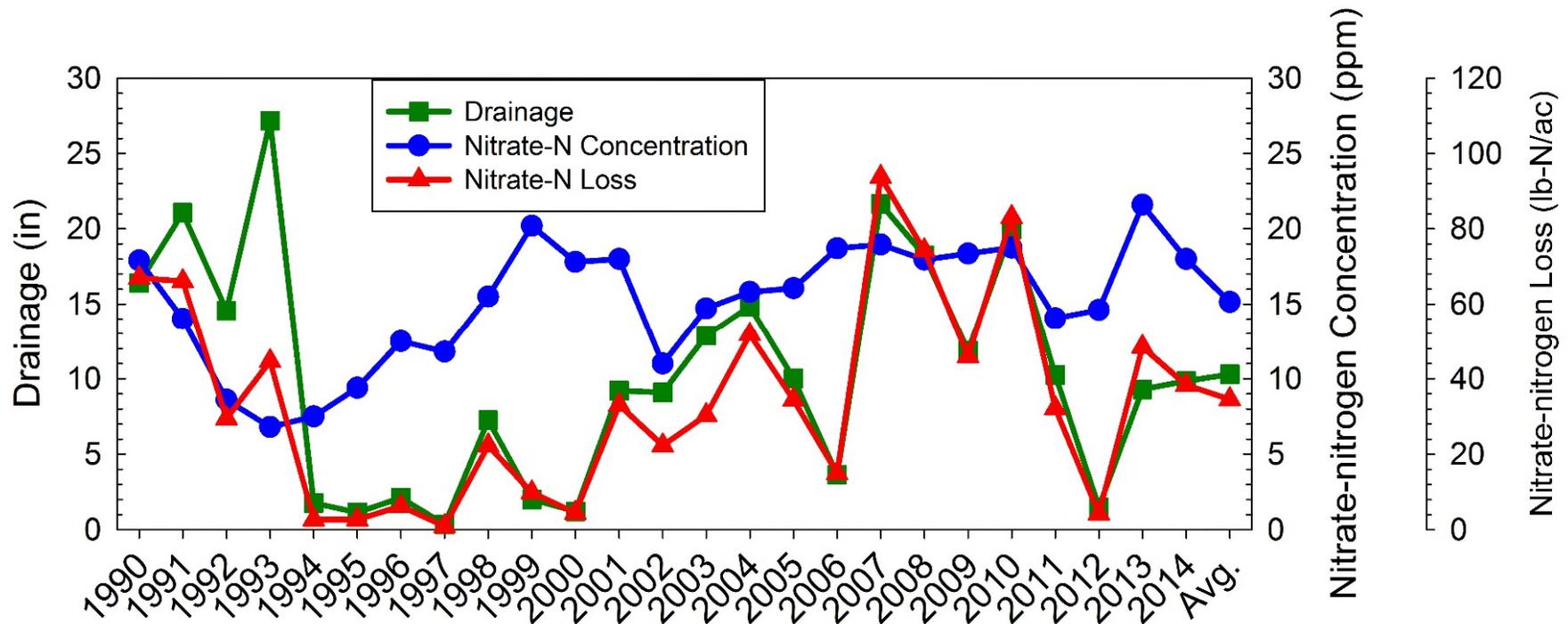
Plot Sampling Layout



Flow and sampling set-up at Gilmore City site

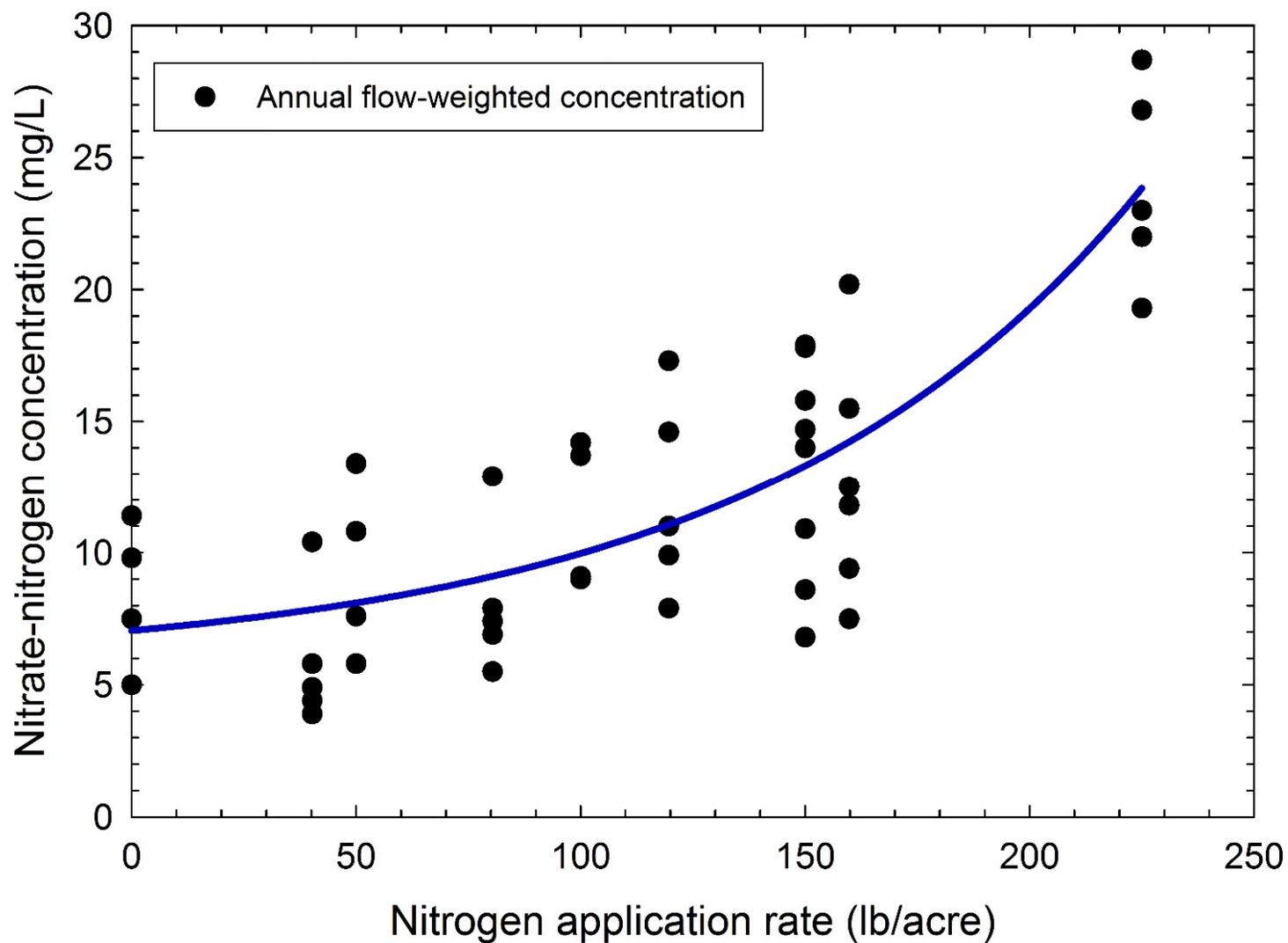


Variability in Drainage, Nitrate Concentration and Nitrate Loss – Weather a Major Driver

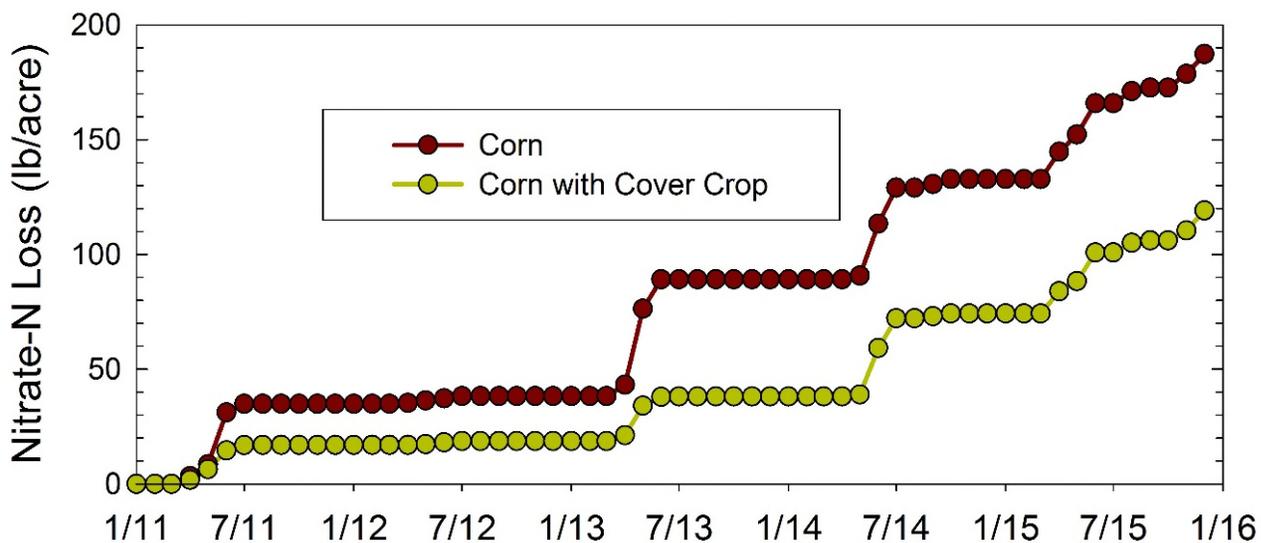


Corn-Soybean Rotation 150/160 lb-N/acre Application Rate

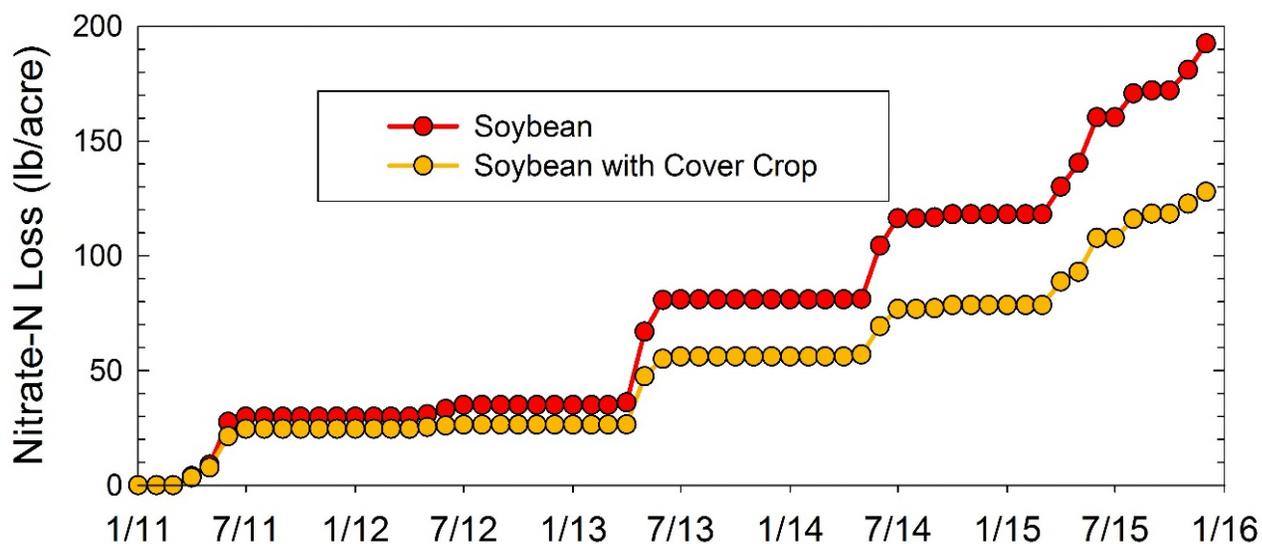
Impact of Nitrogen Application Rate



Impacts of Cover Crops on Nitrate-N Load in Drainage Water – Gilmore City



36% Reduction



34% Reduction





Using Prairie Strips to Reduce Sediment and Nutrient Loss



prairiestrips.org



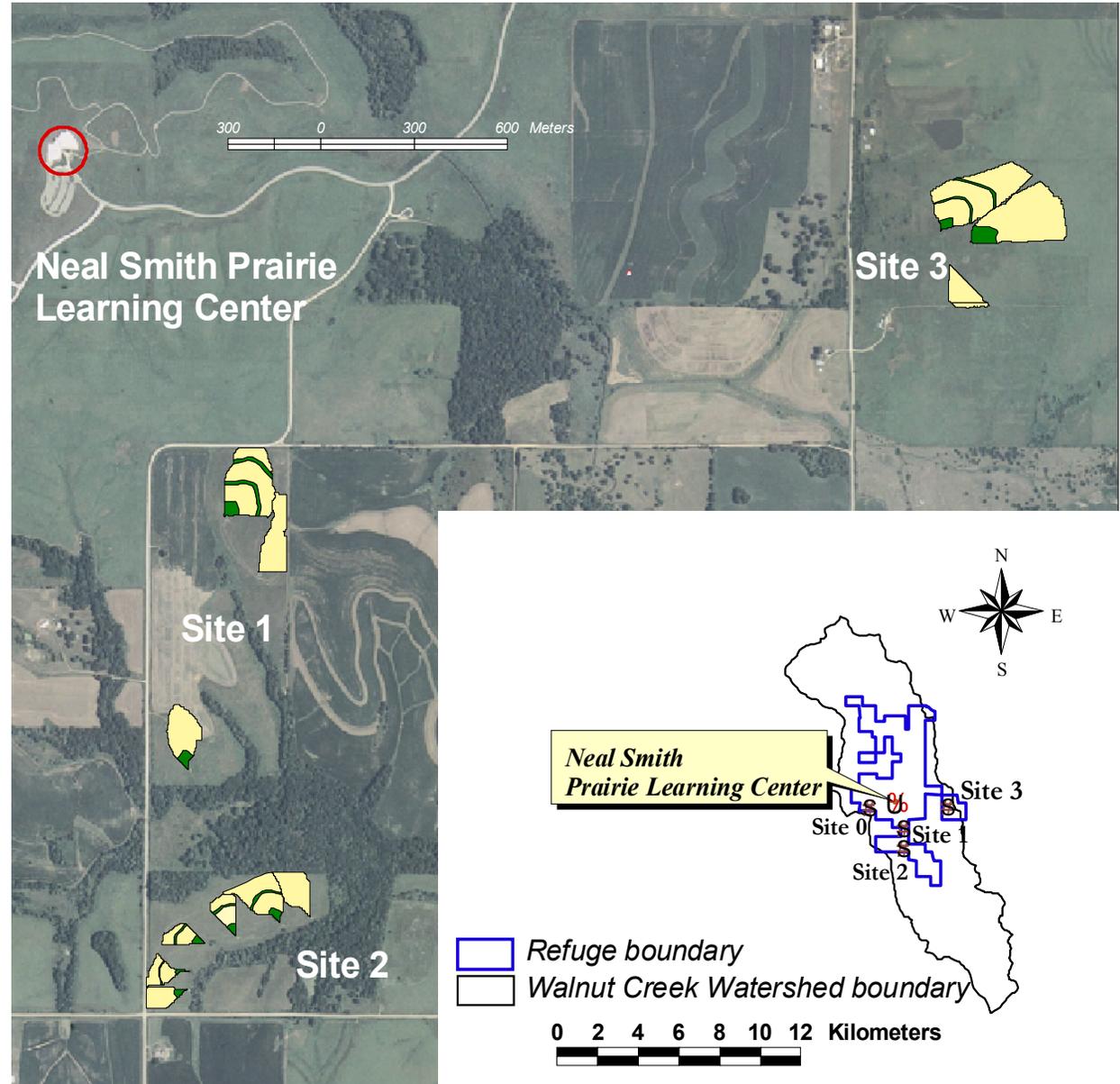
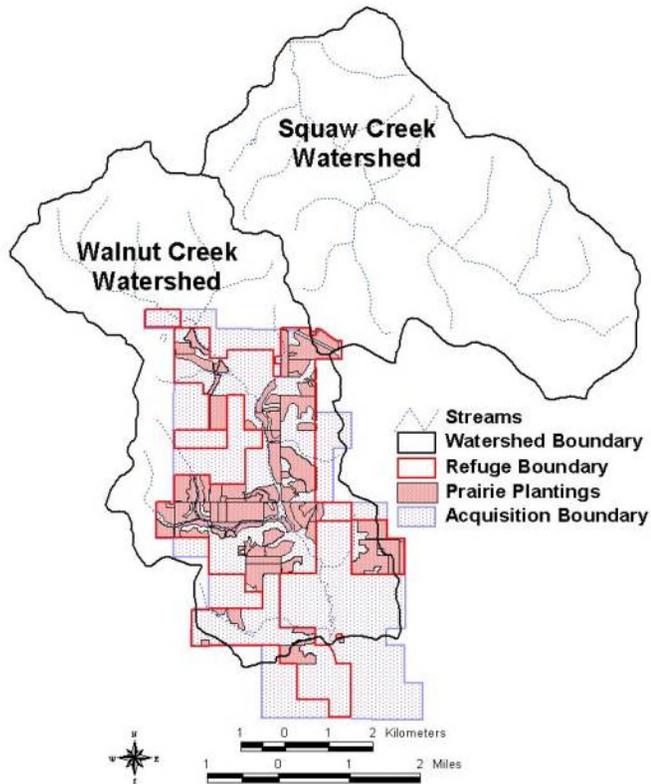
NIFA



The WALTON FAMILY FOUNDATION



Watershed Experiment: NSNWR



What is unique?



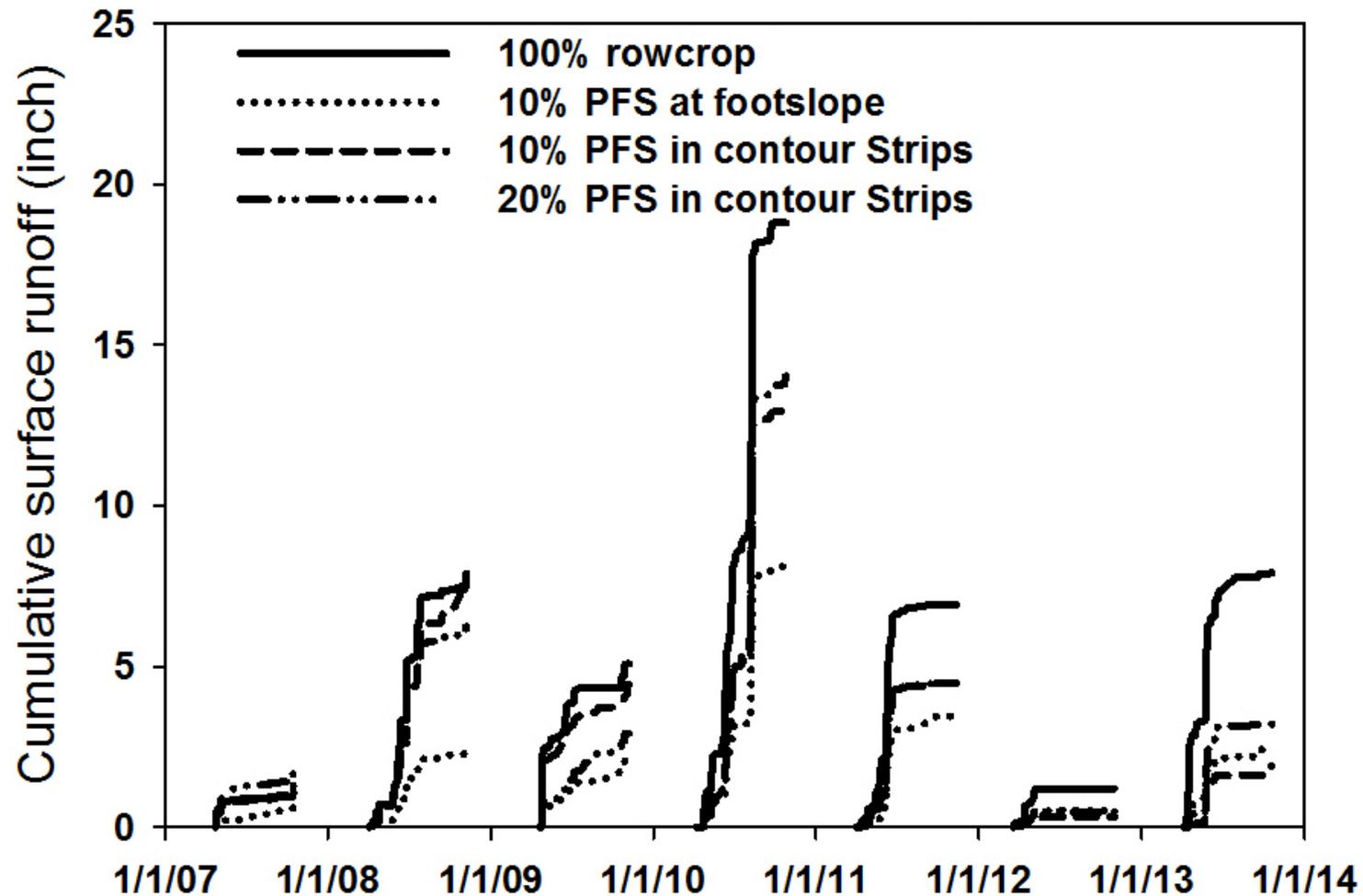
Natural Flow Conditions

Surface Runoff Monitoring

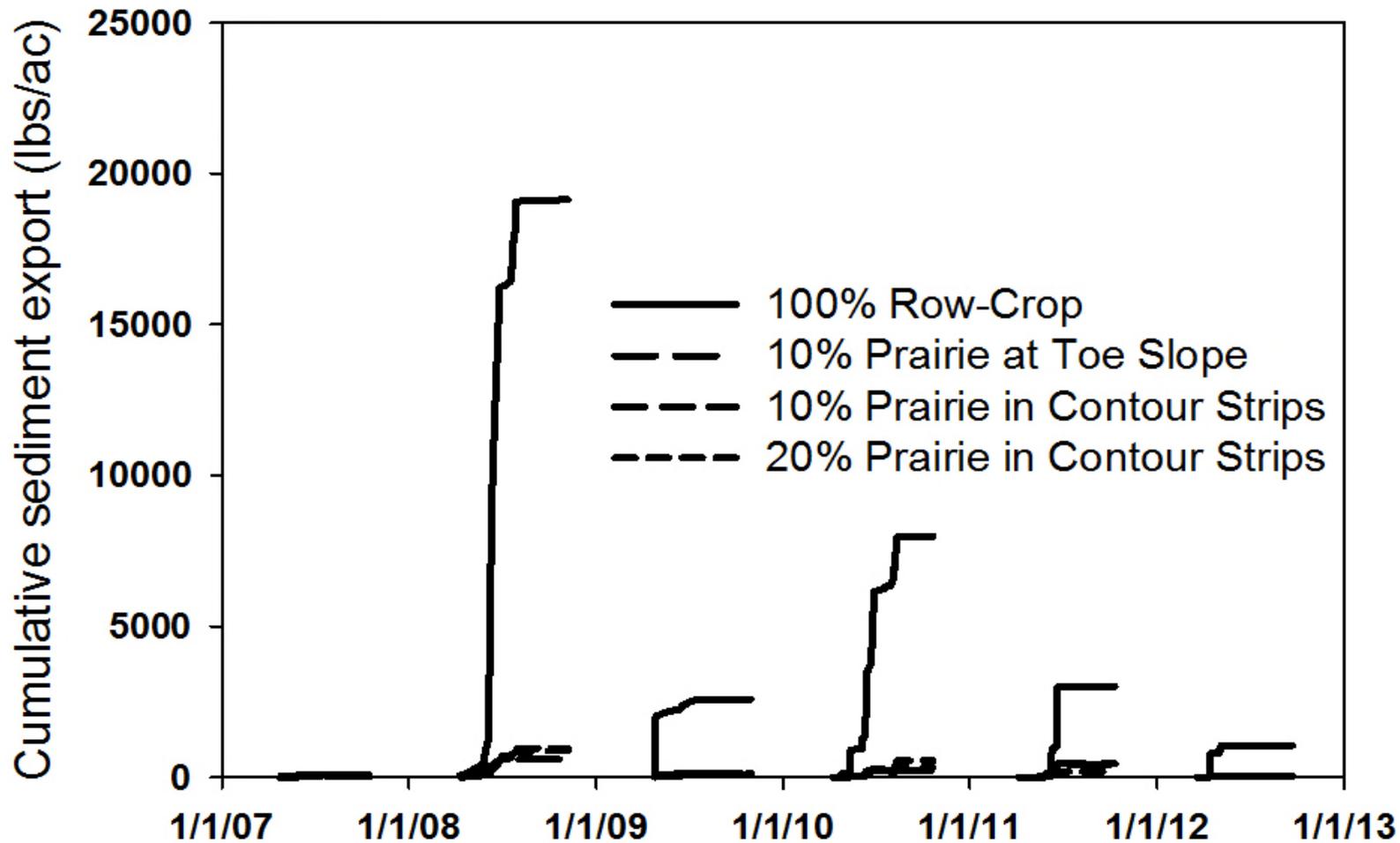
H-flumes monitor movement of
water, sediment, and nutrients



Surface Runoff

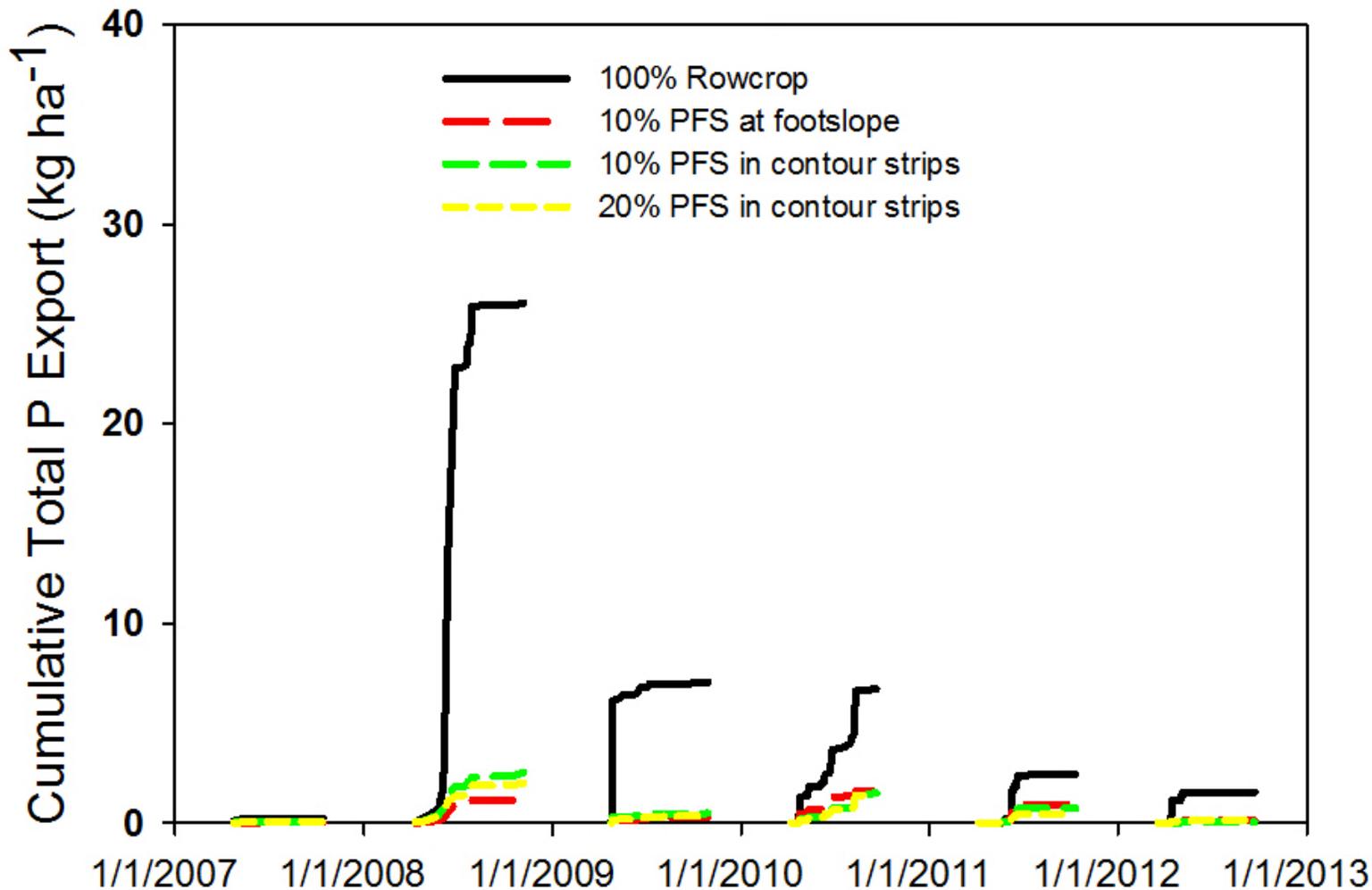


Sediment Loss in Runoff (2007-2012)



>95% Reduction
in sediment
export from
watersheds with
prairie filter strips

Phosphorus Loss in Runoff (2007-2012)



>90% Reduction
in TP export from
watersheds with
prairie filter strips

Visual Examples (4 inch rain in June 2008)

100% Crop



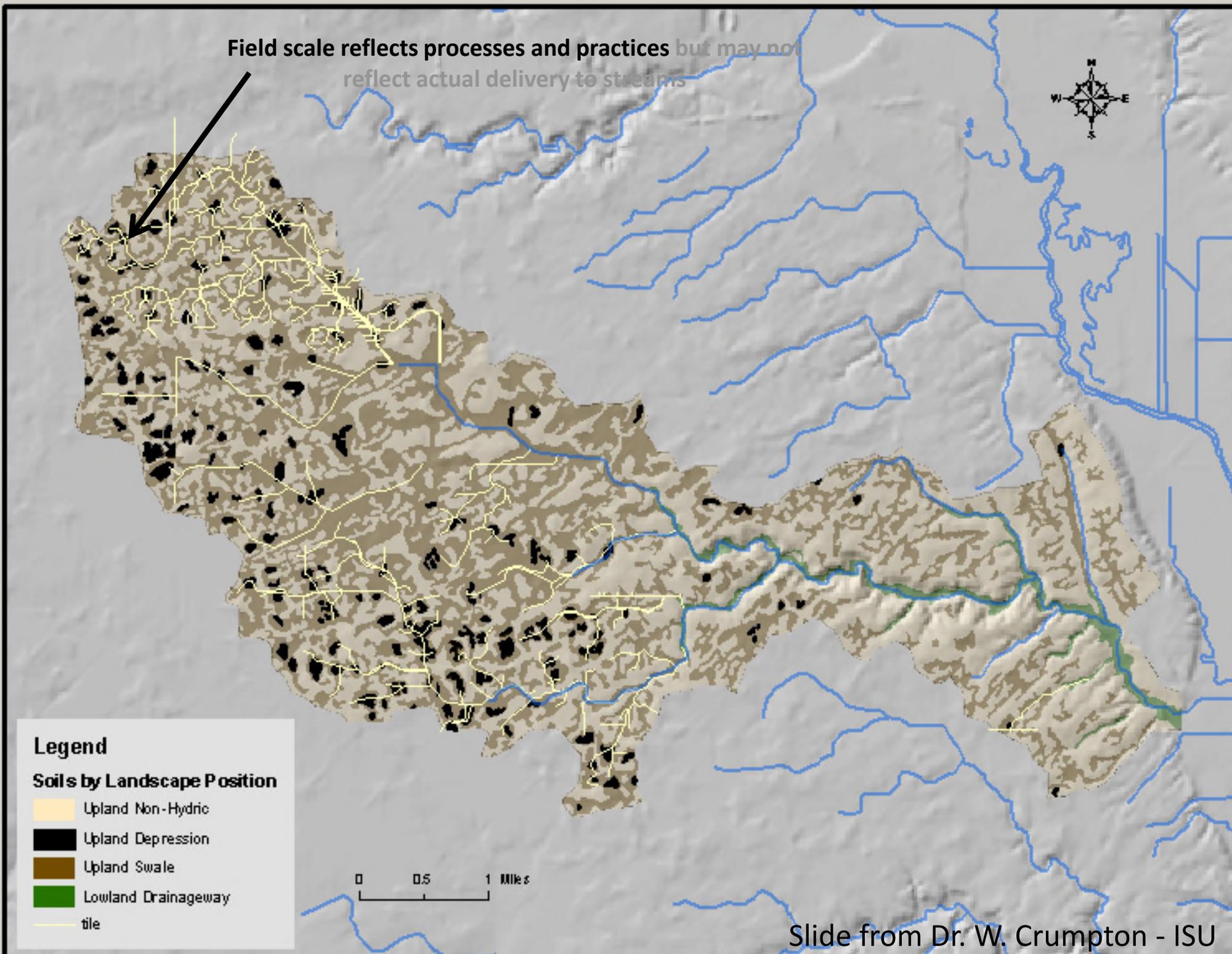
10% Prairie
90% Crop



100% Prairie



Field scale reflects processes and practices but may not reflect actual delivery to streams



Legend

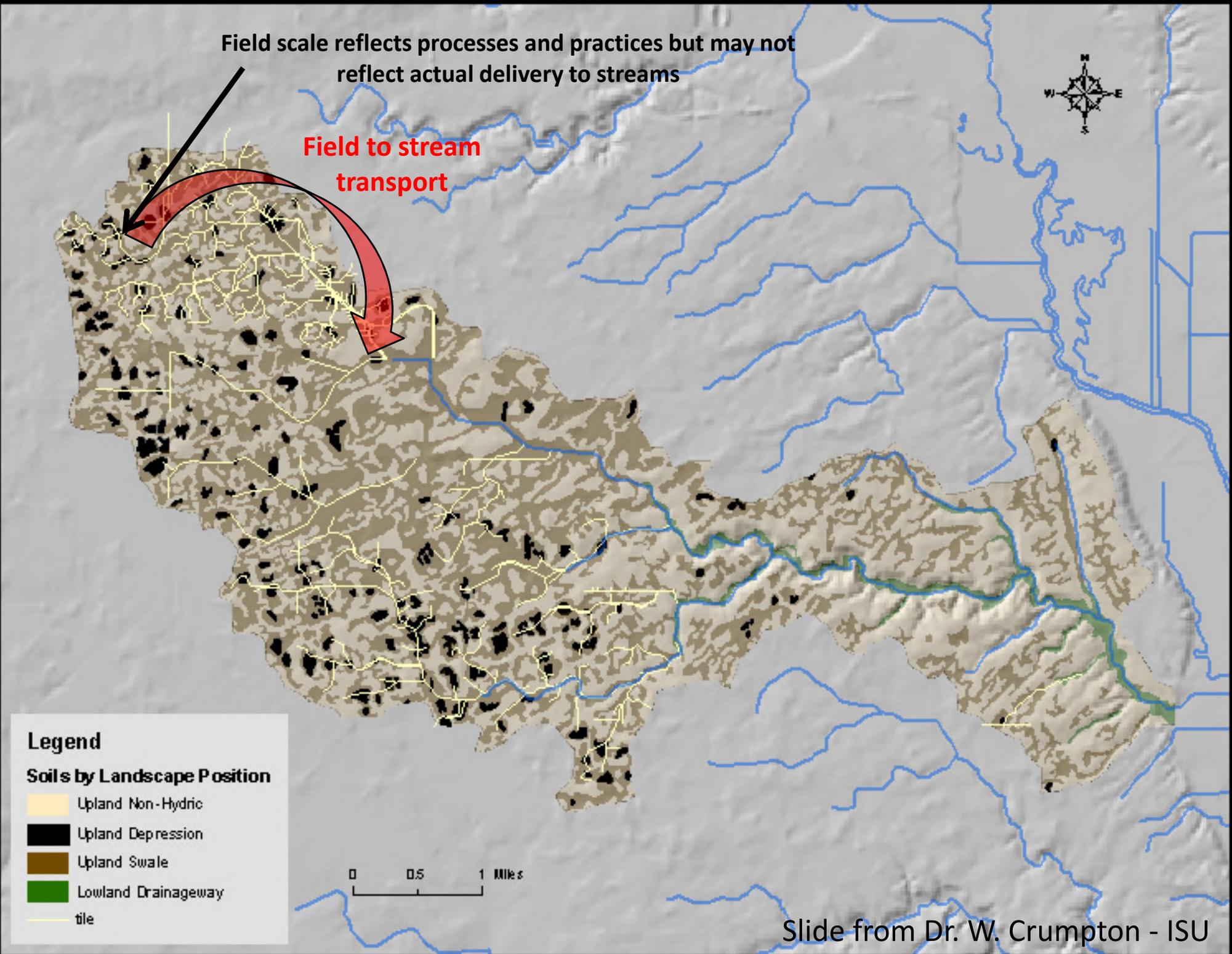
Soils by Landscape Position

-  Upland Non-Hydric
-  Upland Depression
-  Upland Swale
-  Lowland Drainageway
-  tile

0 0.5 1 Miles

Field scale reflects processes and practices but may not reflect actual delivery to streams

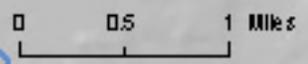
Field to stream transport



Legend

Soils by Landscape Position

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Field scale reflects processes and practices but may not reflect actual delivery to streams

Field to stream transport

Larger scales reflect combination of delivery and in-stream processes

Legend

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Field scale reflects processes and practices but may not reflect actual delivery to streams

Field to stream transport

In-stream processes

Larger scales reflect combination of delivery and in-stream processes

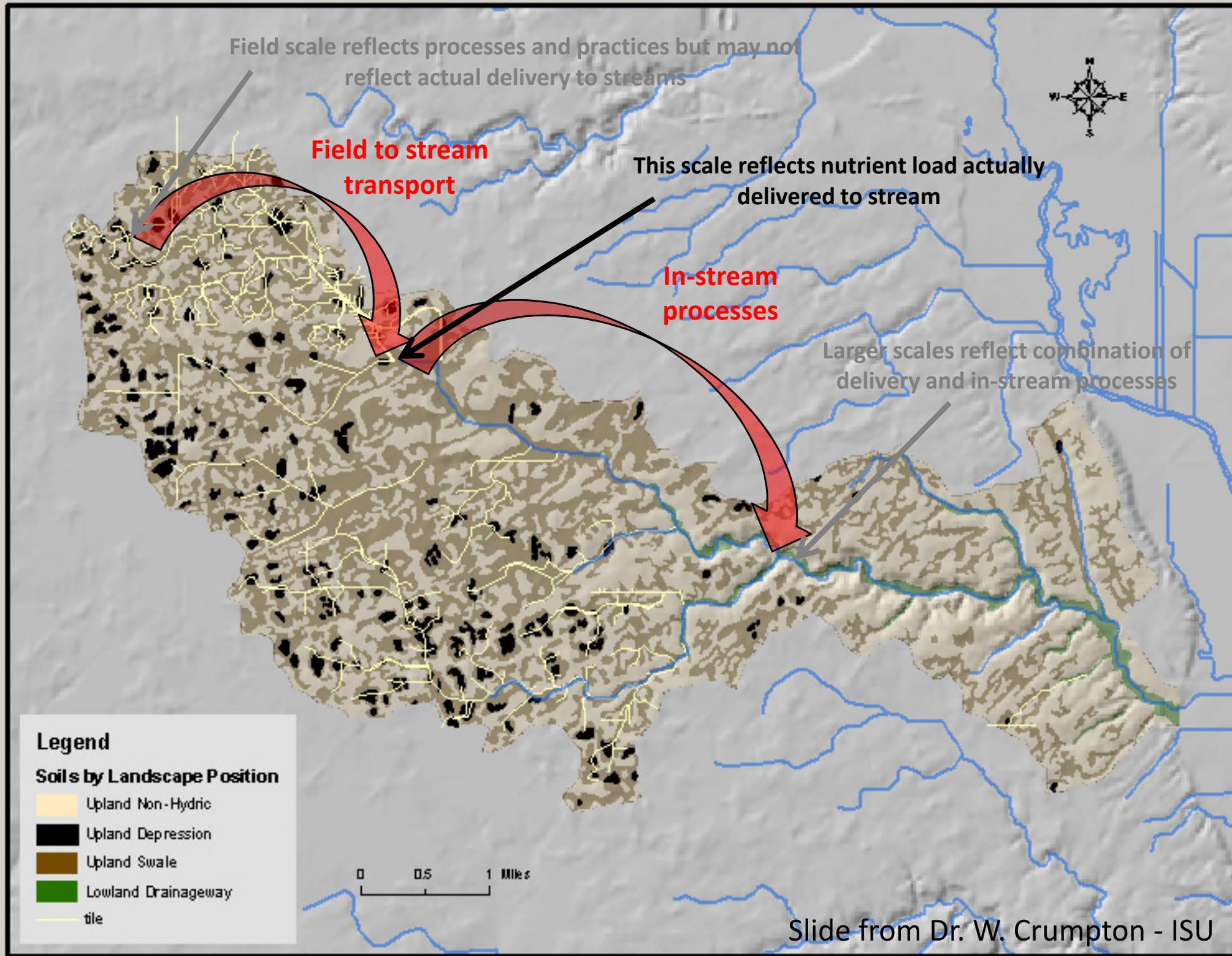


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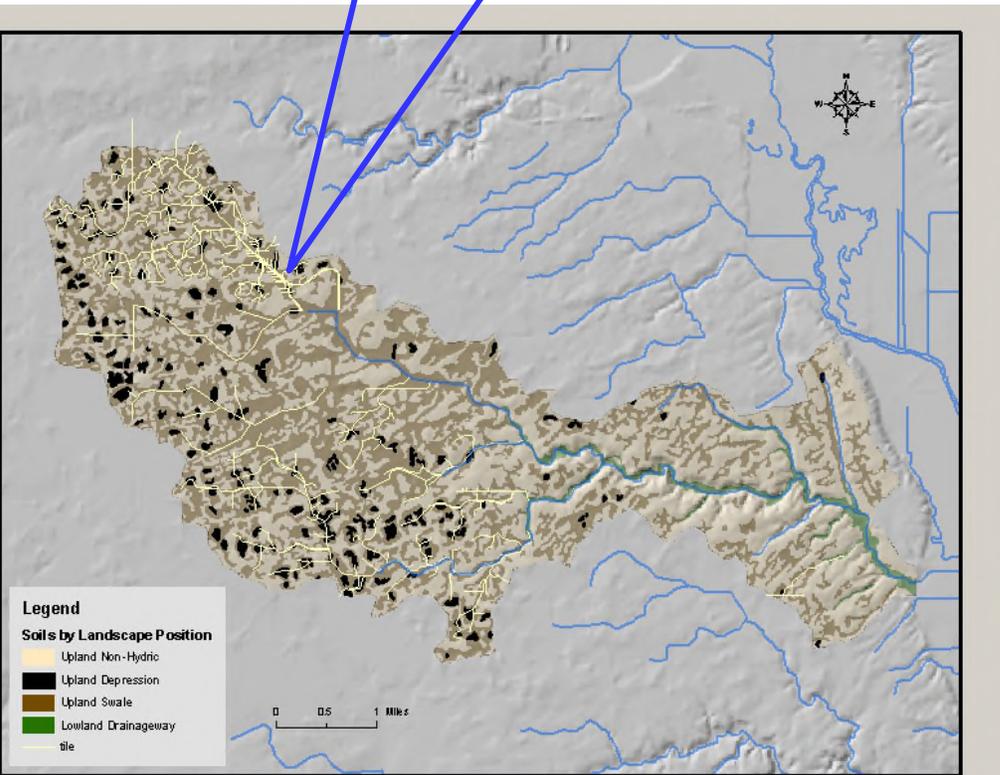
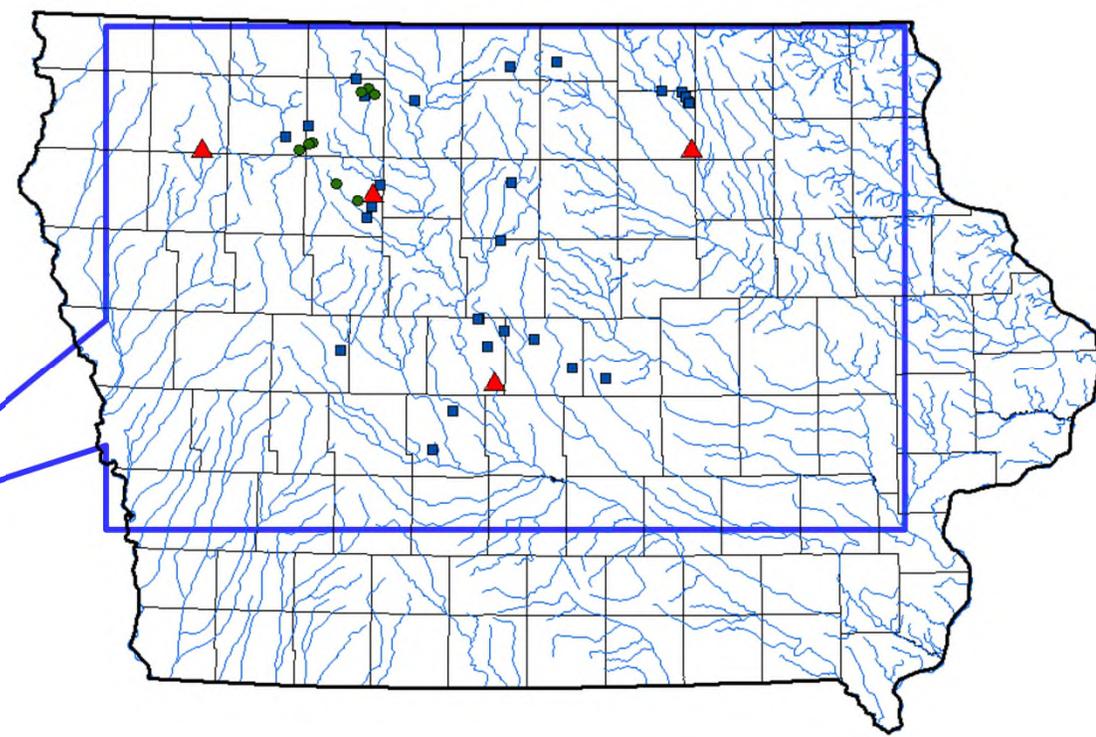
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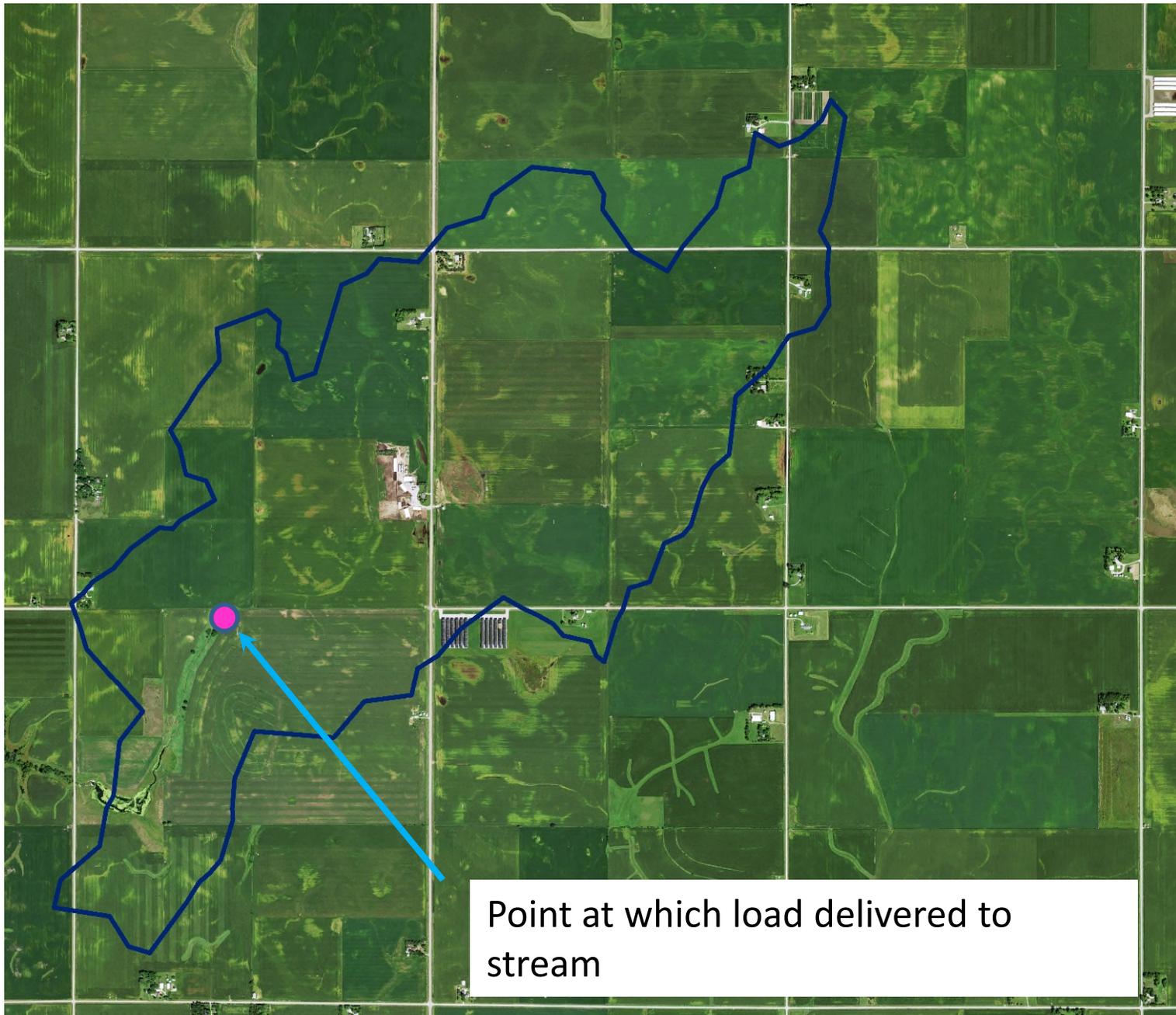




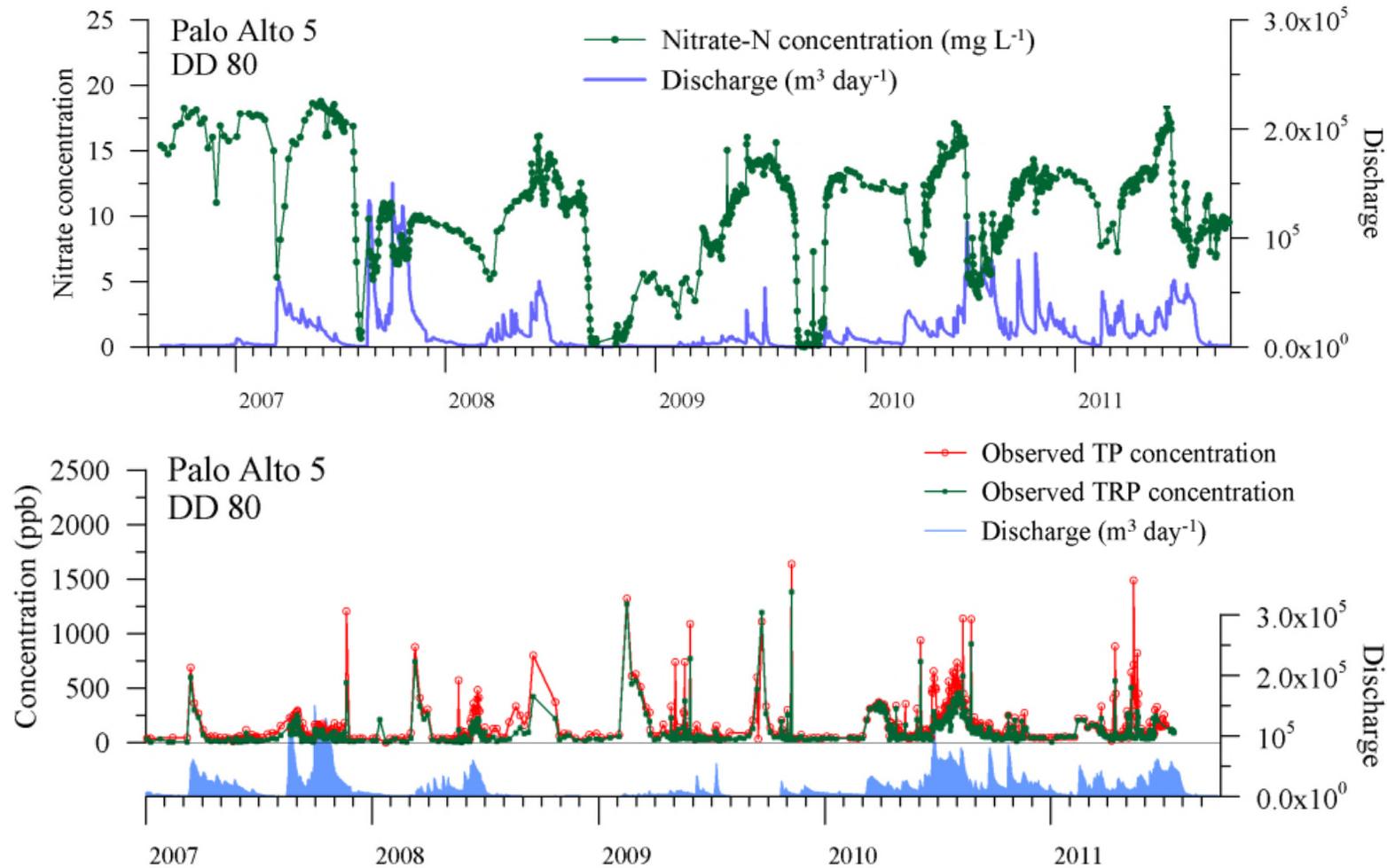


Monitoring sites instrumented for close interval sampling and flow measurement

Scale of Monitoring

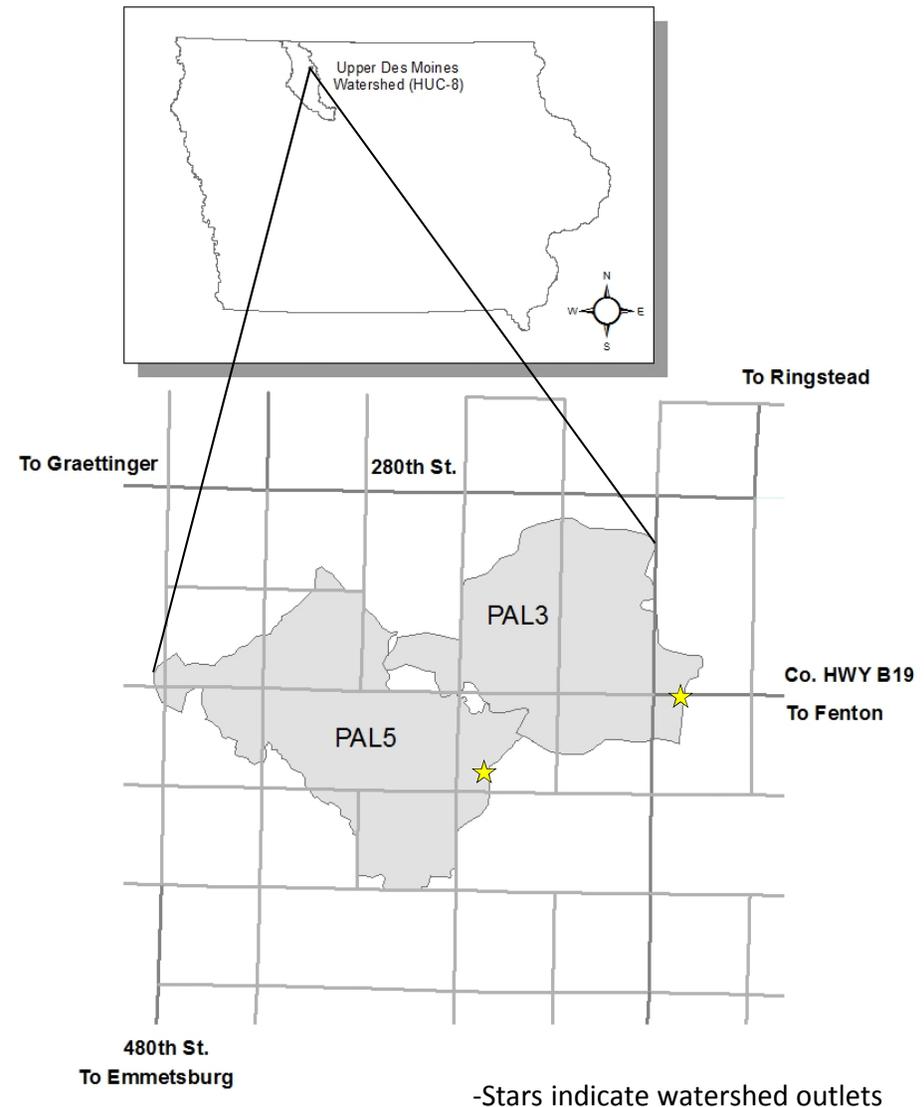


Example Results from One Watershed Monitored as Part of EPA – TWG Project

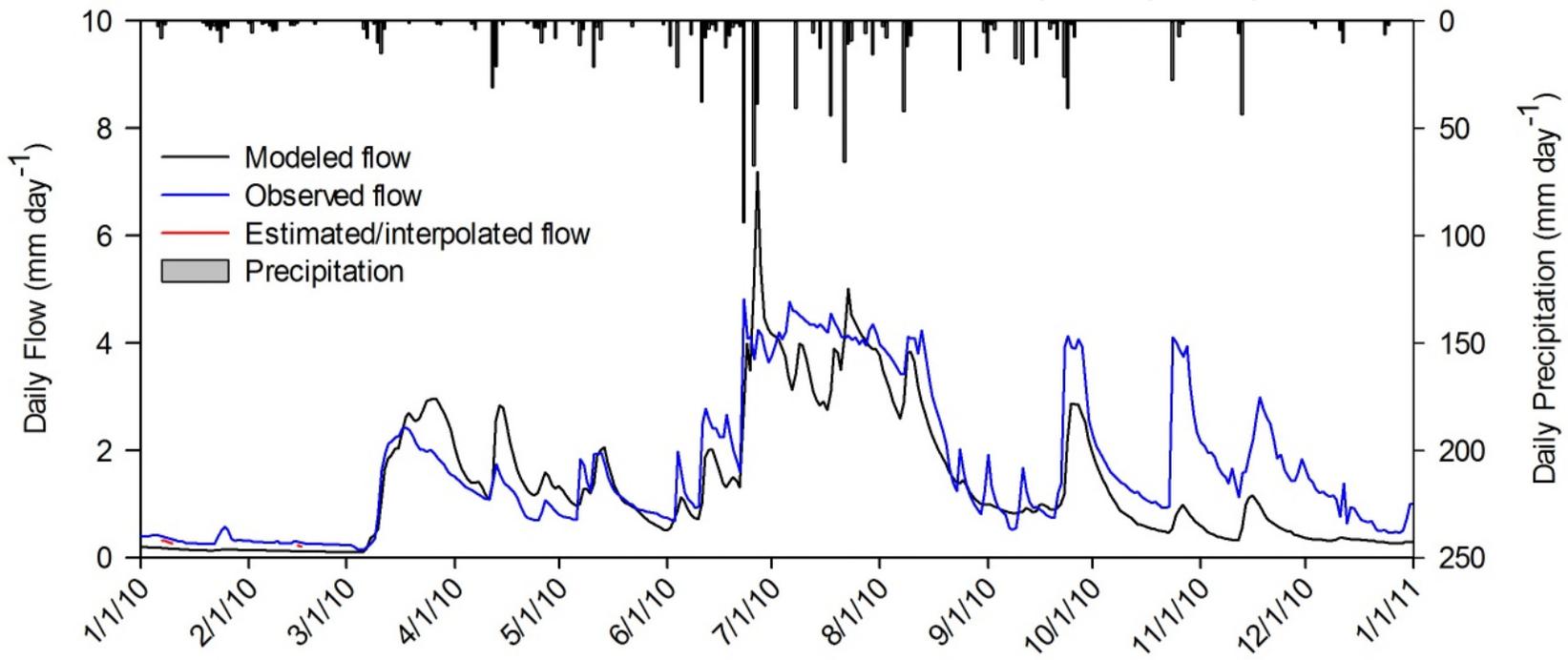
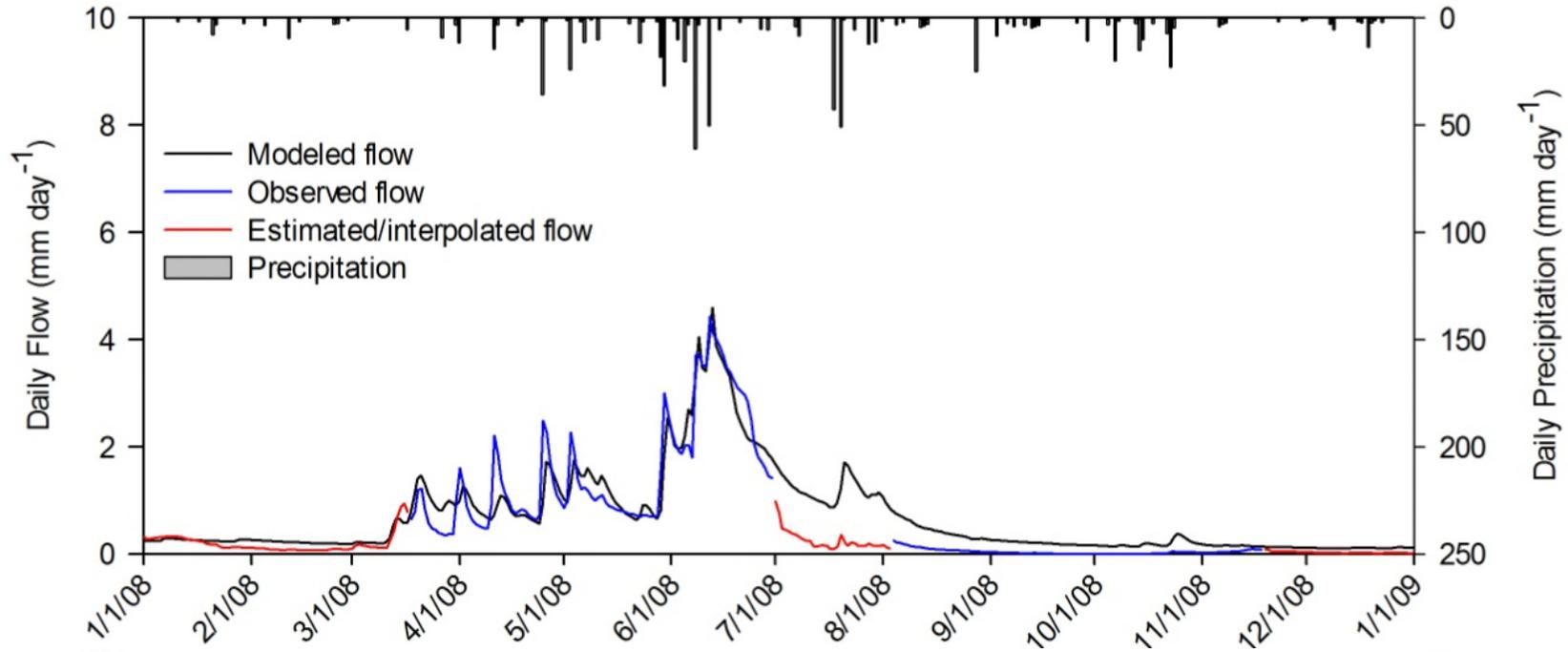


The PAL3 and PAL5 watersheds

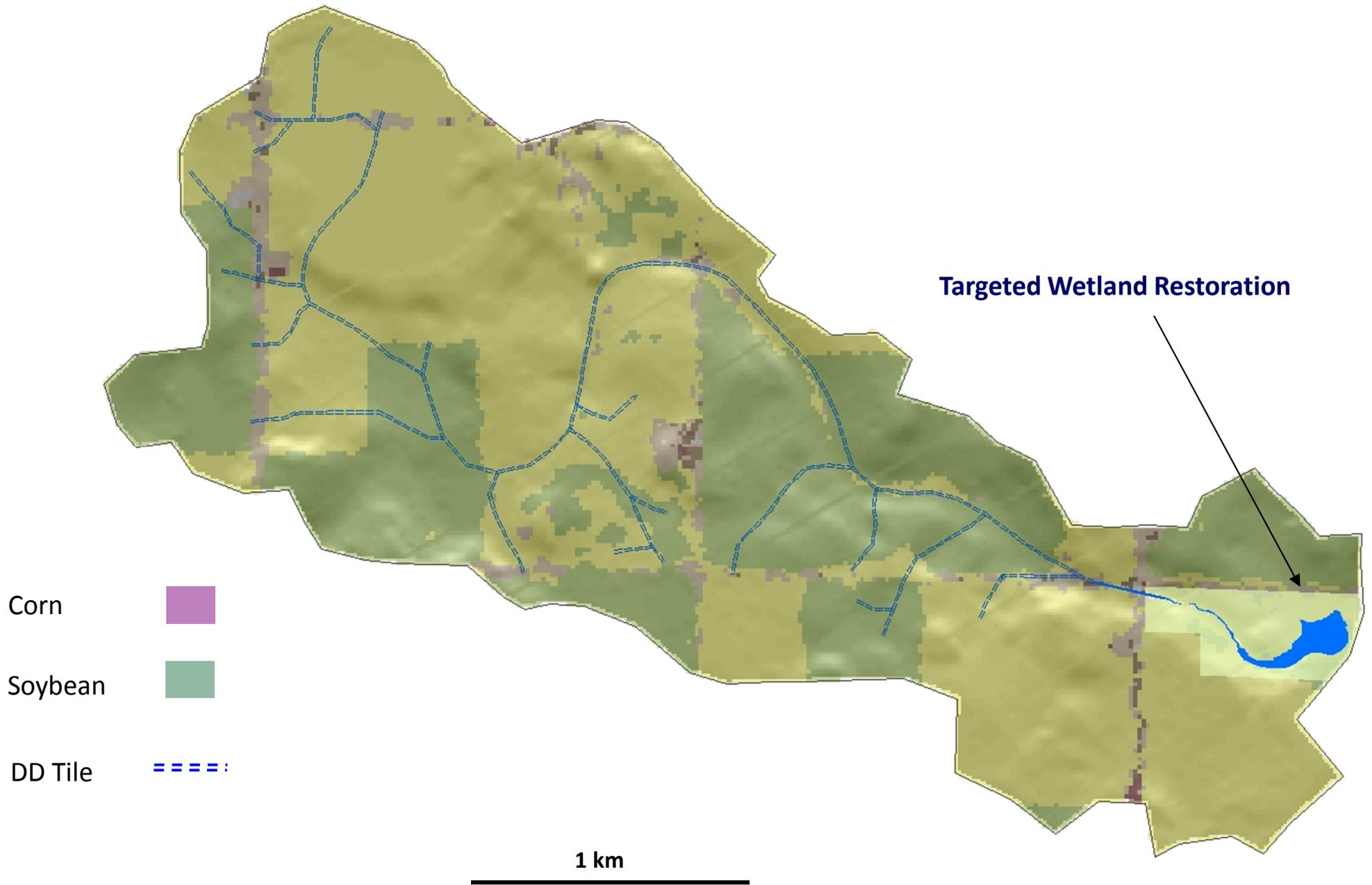
- Similar watersheds in the upper Des Moines lobe of Northcentral Iowa
- Similar watershed characteristics
 - Area (1128 ha and 1356 ha)
 - Elevation 400 m above sea level
 - Slope 0-2% with 0.5% avg
 - Soils lowland Canisteo and Clarion-Nicollet-Webster
 - Almost exclusively agricultural land use
 - Heavily tile drained throughout



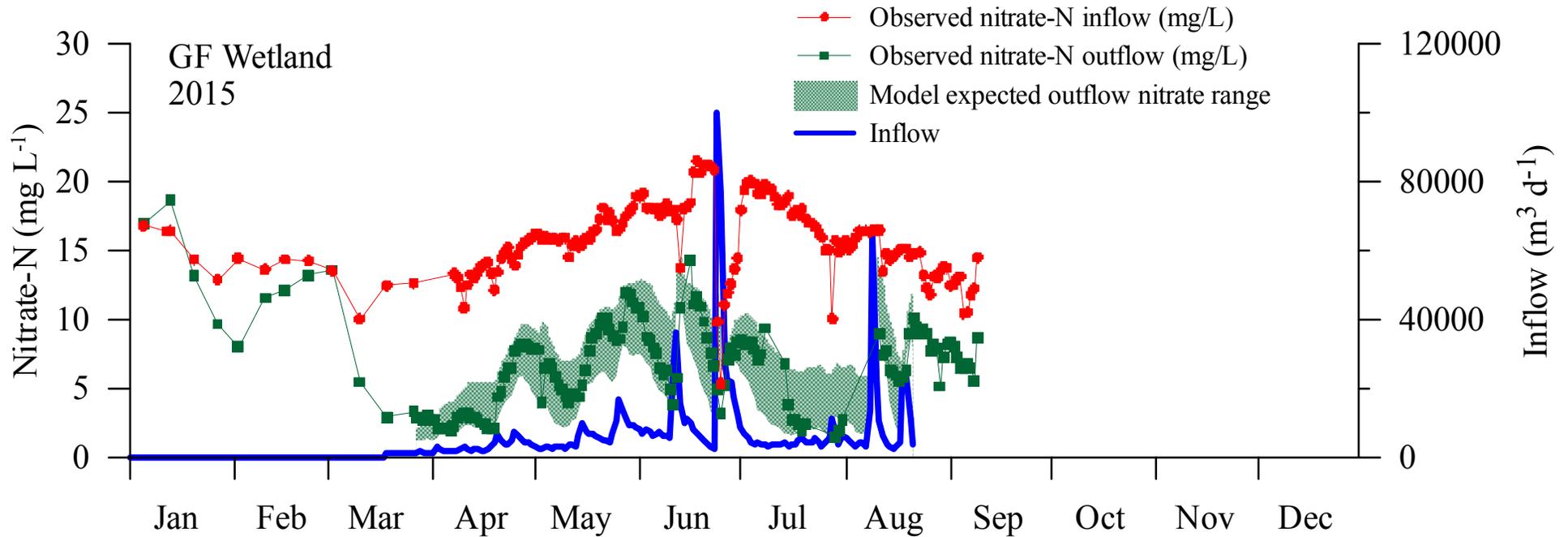
Model Validation Watershed– PAL 5



Iowa Conservation Reserve Enhancement Program (CREP)



Wetland Performance – Example from CREP Monitoring



Summary

- Small plots or small watersheds allow examination of specific management practices
- Depending on transport pathways small plots may or may not directly reflect stream delivery
- Monitoring at scale at which water, sediment, and nutrients are delivered to the stream is critical for assessing impacts of practices at scale of implementation

Contact

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