

Wetlands...Everybody's doing it!

Science around nutrient removal
Factors affecting wetland performance



Situation High level of nitrate in groundwater (80% of total nitrate) to rivers and streams from agricultural tiles

4.7 million hectares of subsurface drainage in Illinois (12 million acres)



Illinois contributes 16.8% of the nitrogen and 12.9% of the phosphorus to the Gulf of Mexico

(Alexander et al., 2008)



2015



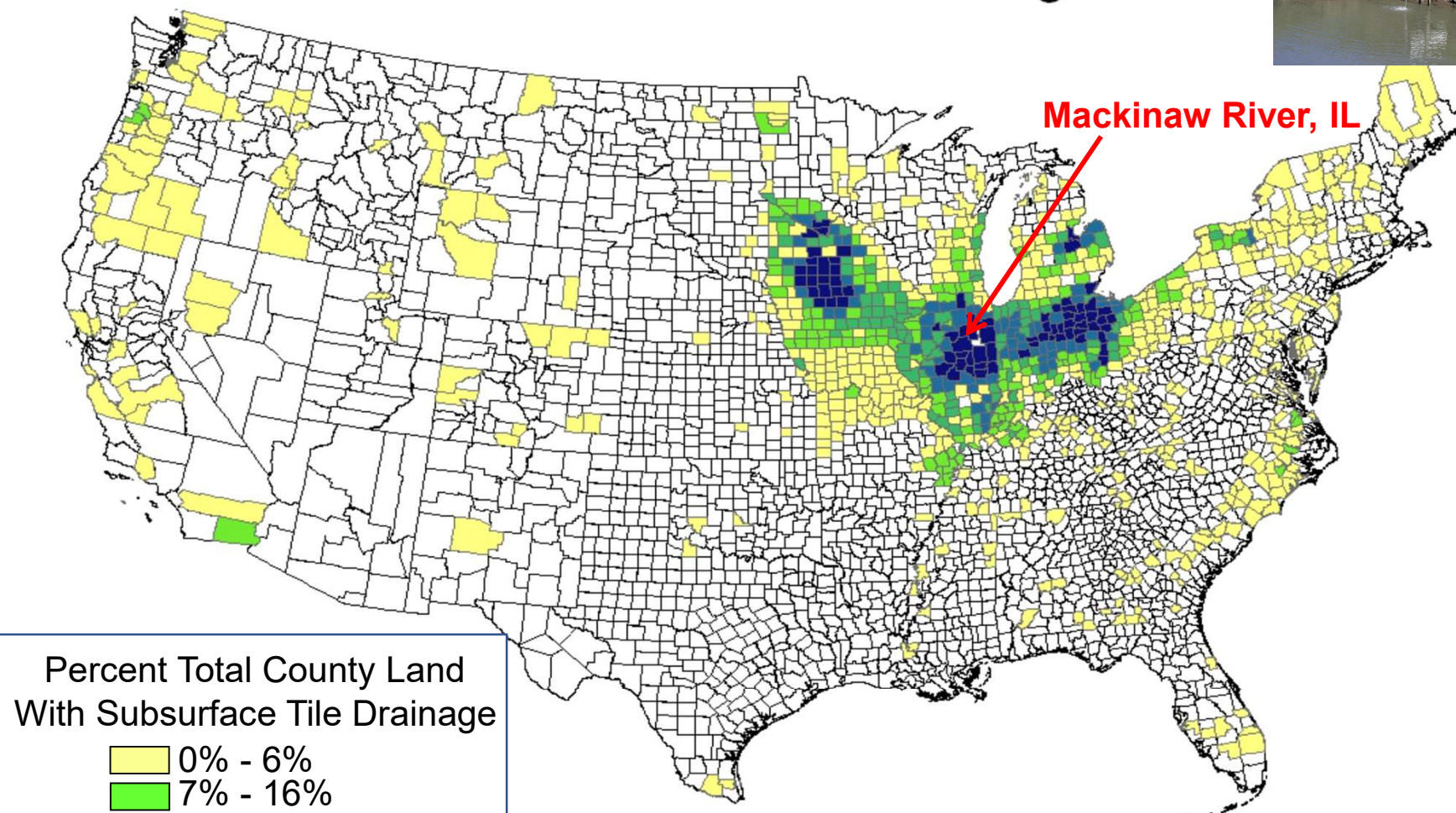
ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY



Subsurface Tile Drainage



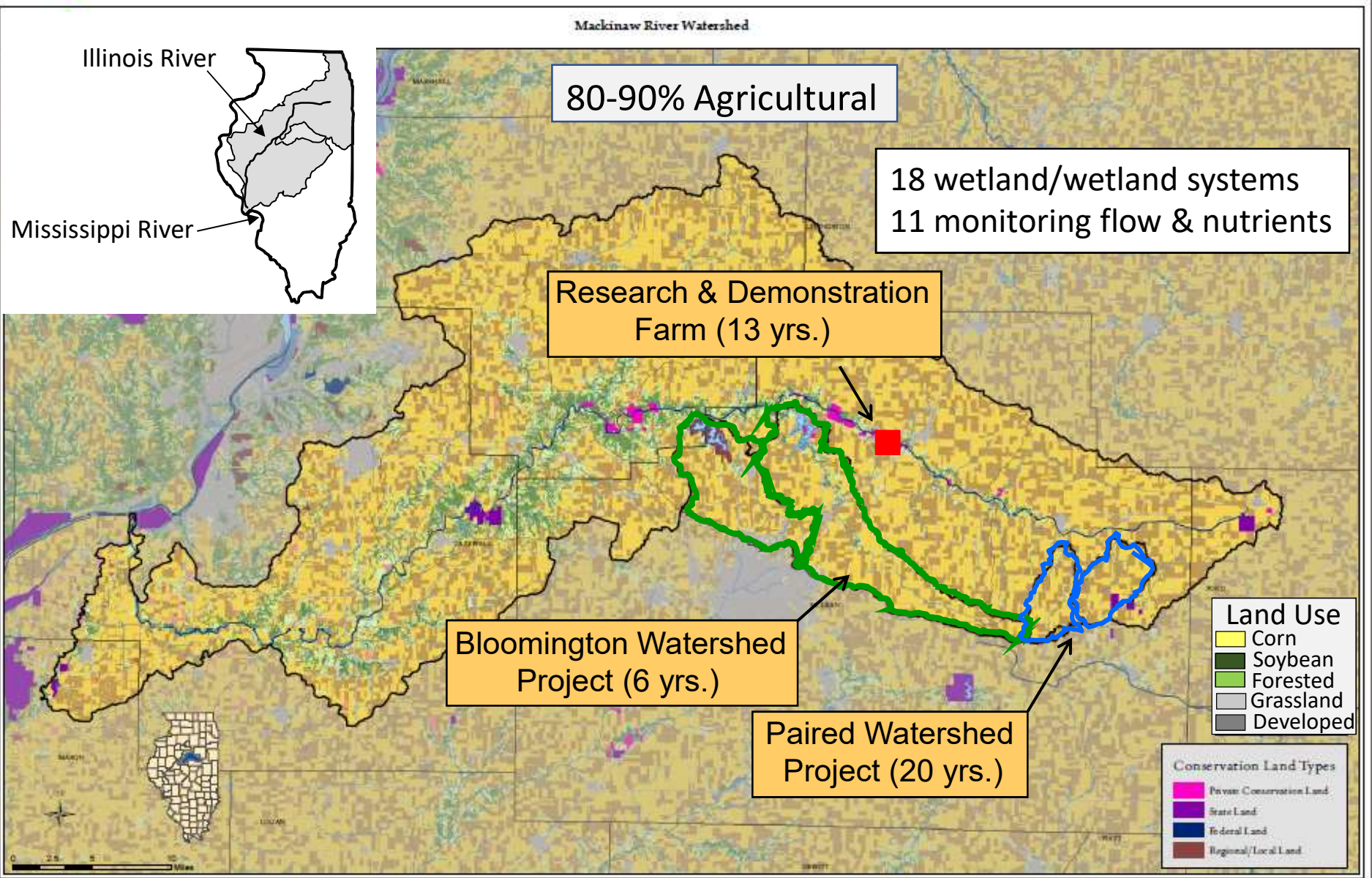
Mackinaw River, IL

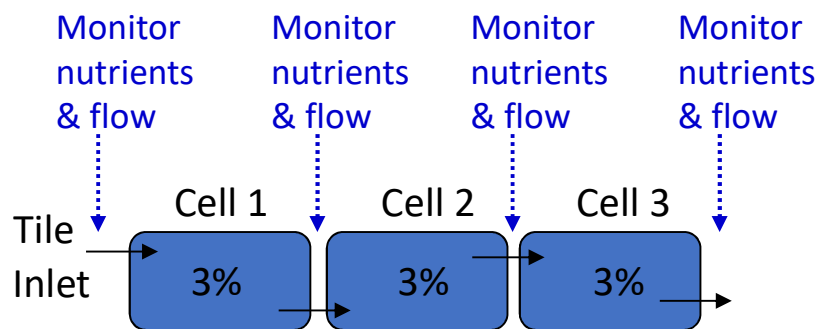
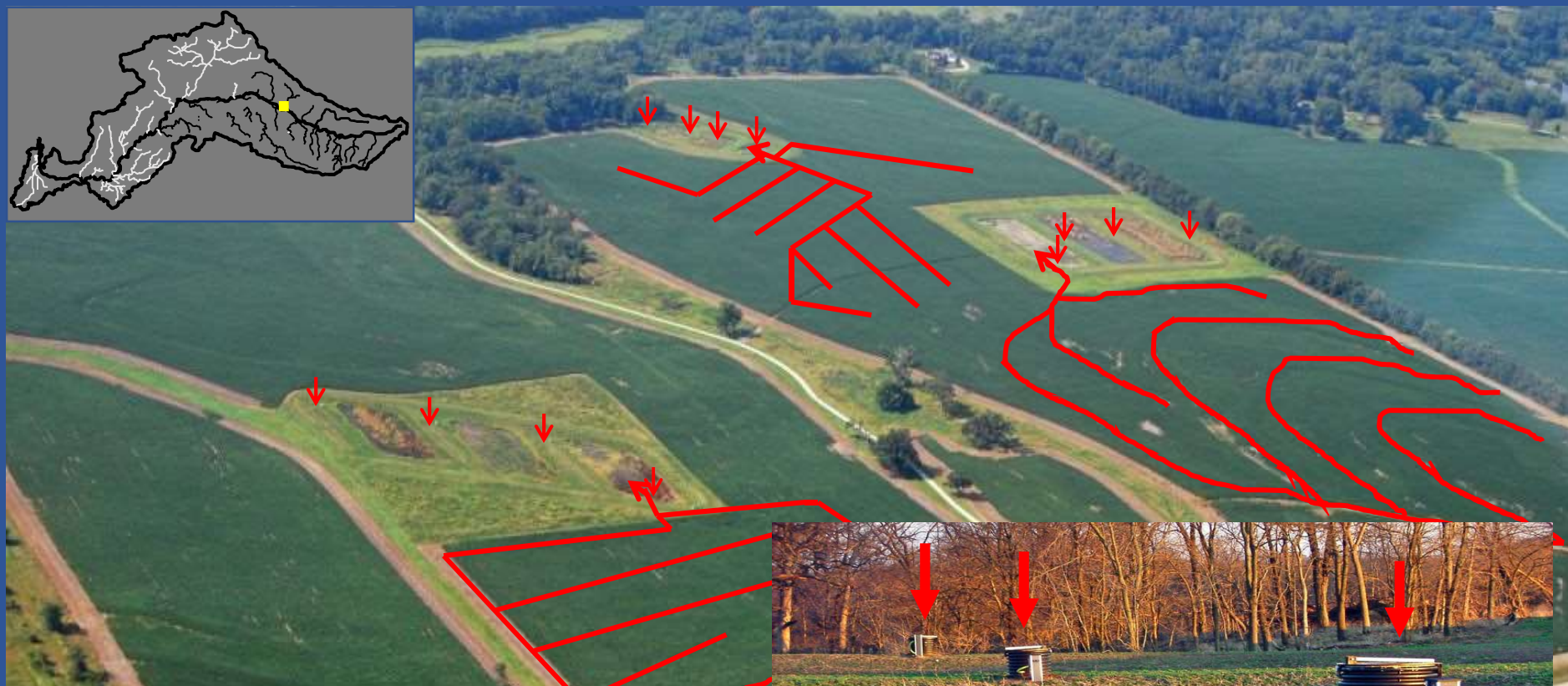
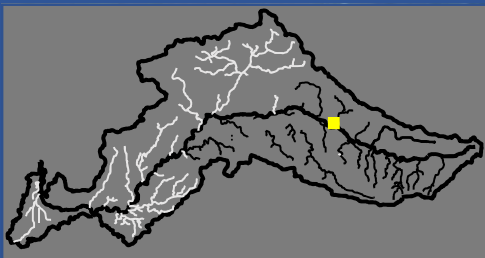


Source: Sugg, Z. 2007. Assessing U.S. Farm Drainage: Can GIS Lead to Better Estimates of Subsurface Drainage Extent? World Resources Institute, Washington D.C.

Mackinaw River Watershed

60-70 fish species
25-30 mussel species
High quality stream

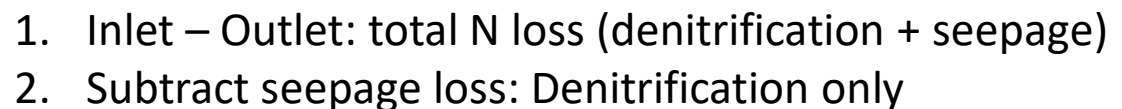




What size of wetland is most effective at reducing nutrients in tile runoff?

9%

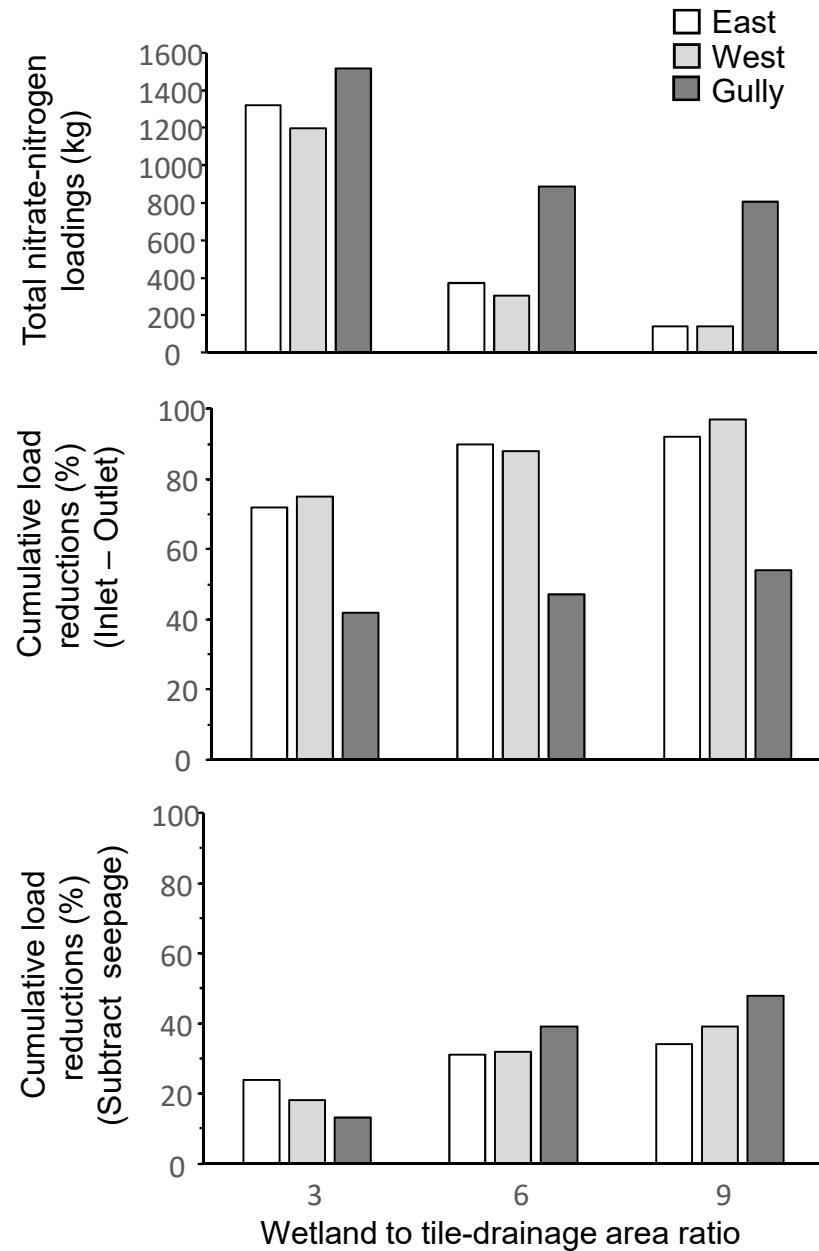
- Plant Uptake (recycled)
- Denitrification (permanent)
 - No oxygen
 - Carbon source



10-year wetland monitoring results: Nitrate-nitrogen ($\text{NO}_3\text{-N}$)



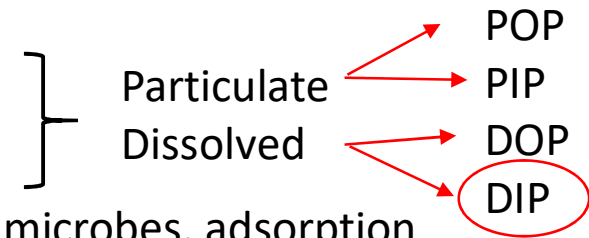
1. Inlet - Outlet: total N loss
(denitrification + seepage)
2. Subtract seepage loss:
Denitrification only



Phosphorus Retention by Tile-treatment Wetlands

Organic: associated with biological material (plants, algae)

Inorganic: associated with particles (e.g. clay)

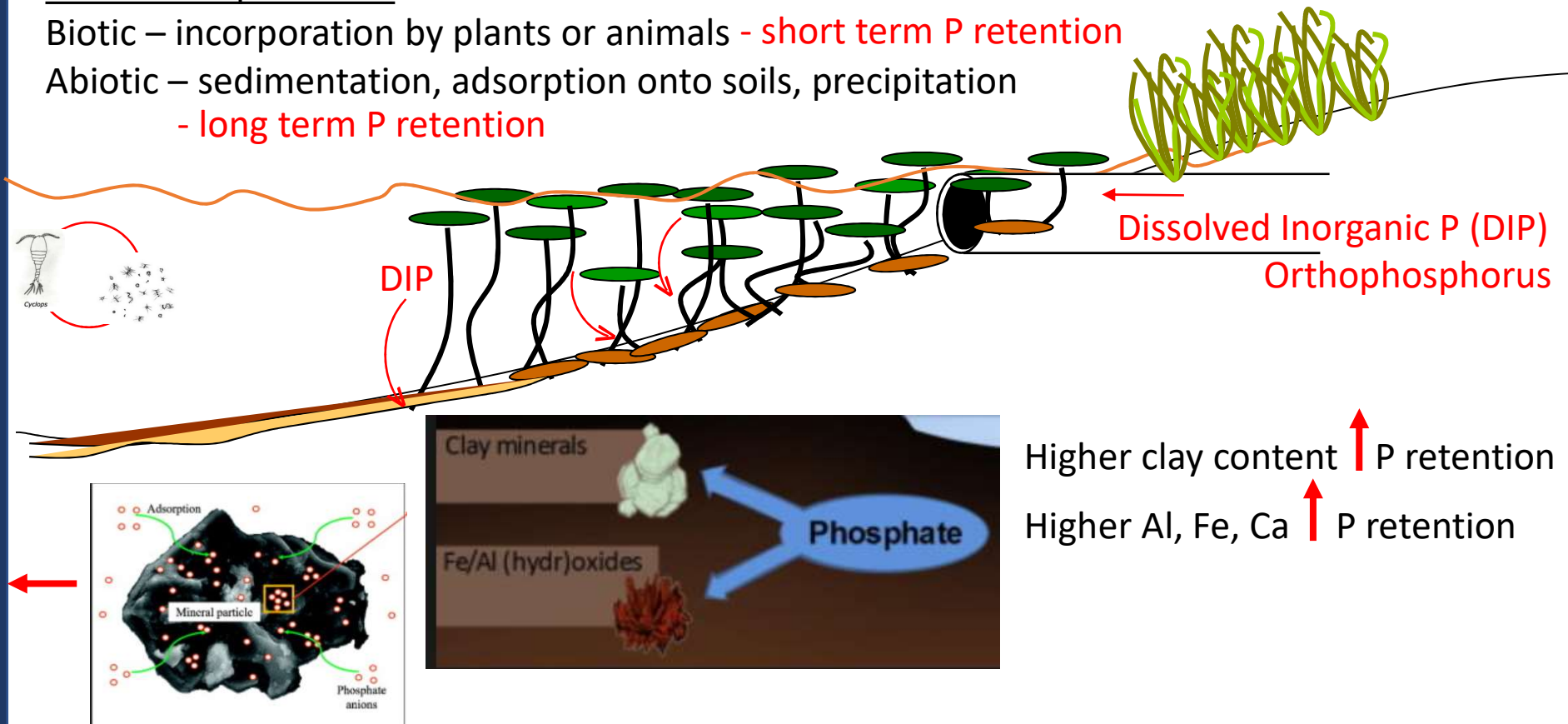


Dissolved Inorganic P (DIP) – readily available to vegetation, microbes, adsorption

P retention processes:

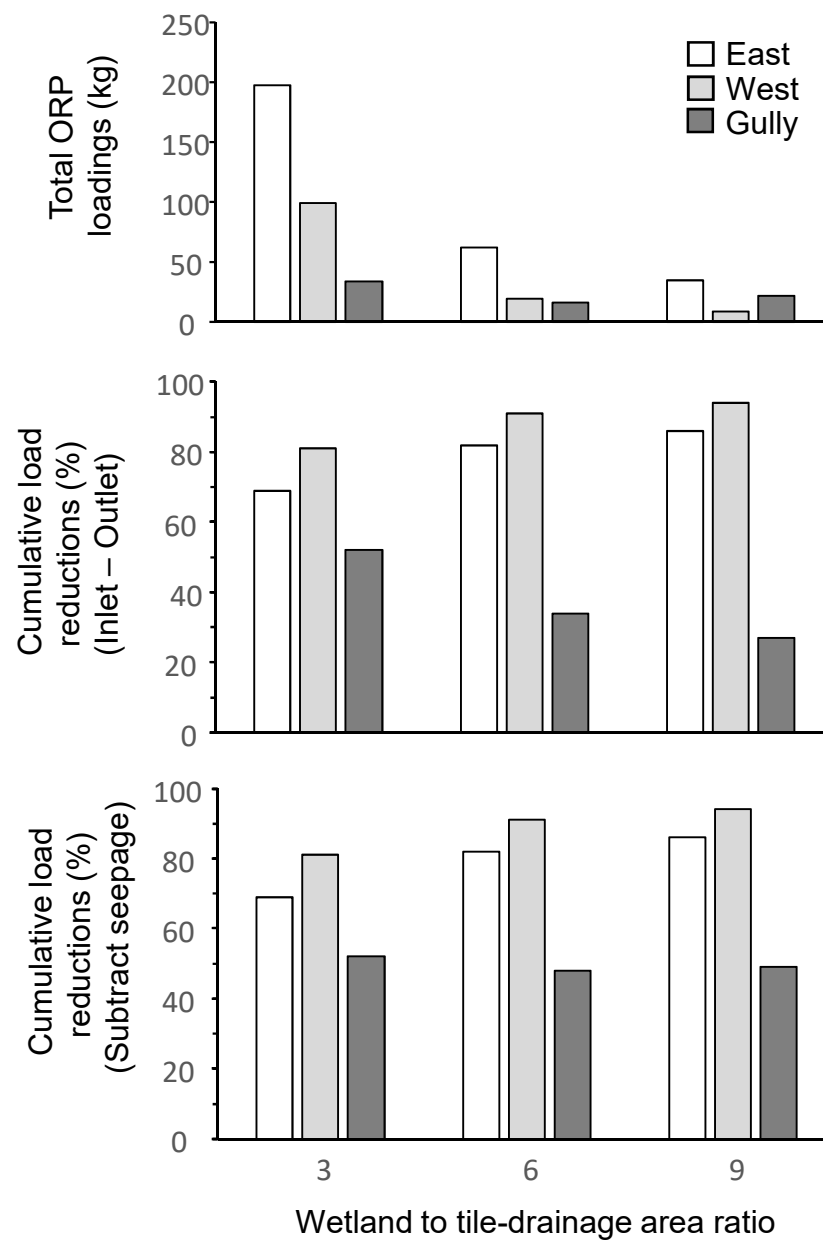
Biotic – incorporation by plants or animals - **short term P retention**

Abiotic – sedimentation, adsorption onto soils, precipitation
- **long term P retention**

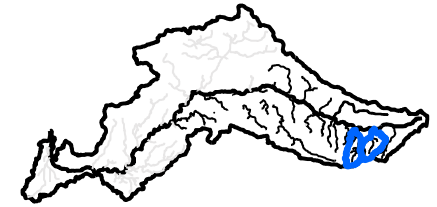


Higher clay content ↑ P retention
Higher Al, Fe, Ca ↑ P retention

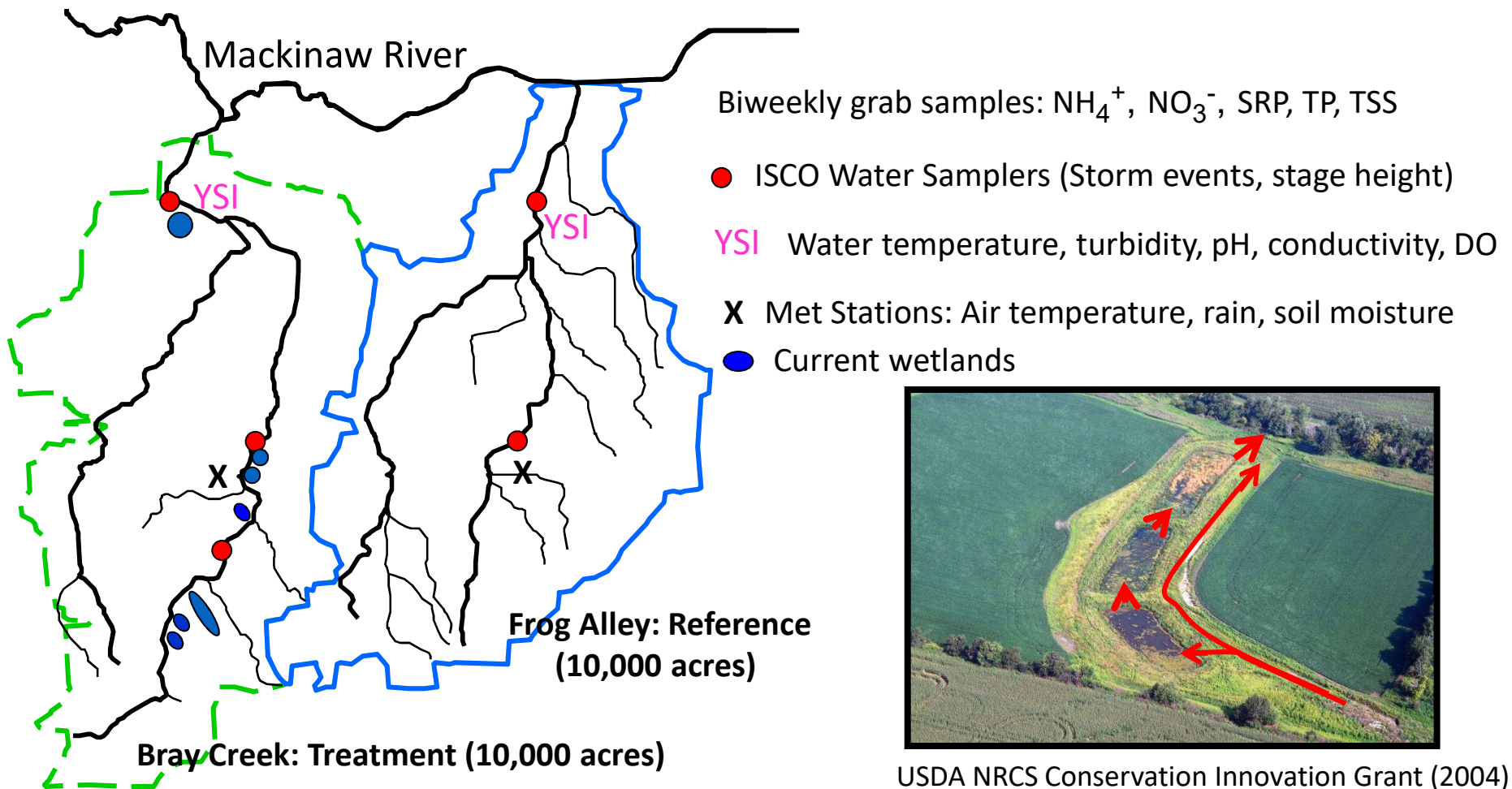
10-year wetland monitoring results: Orthophosphorus (ORP)



Paired Watershed Project

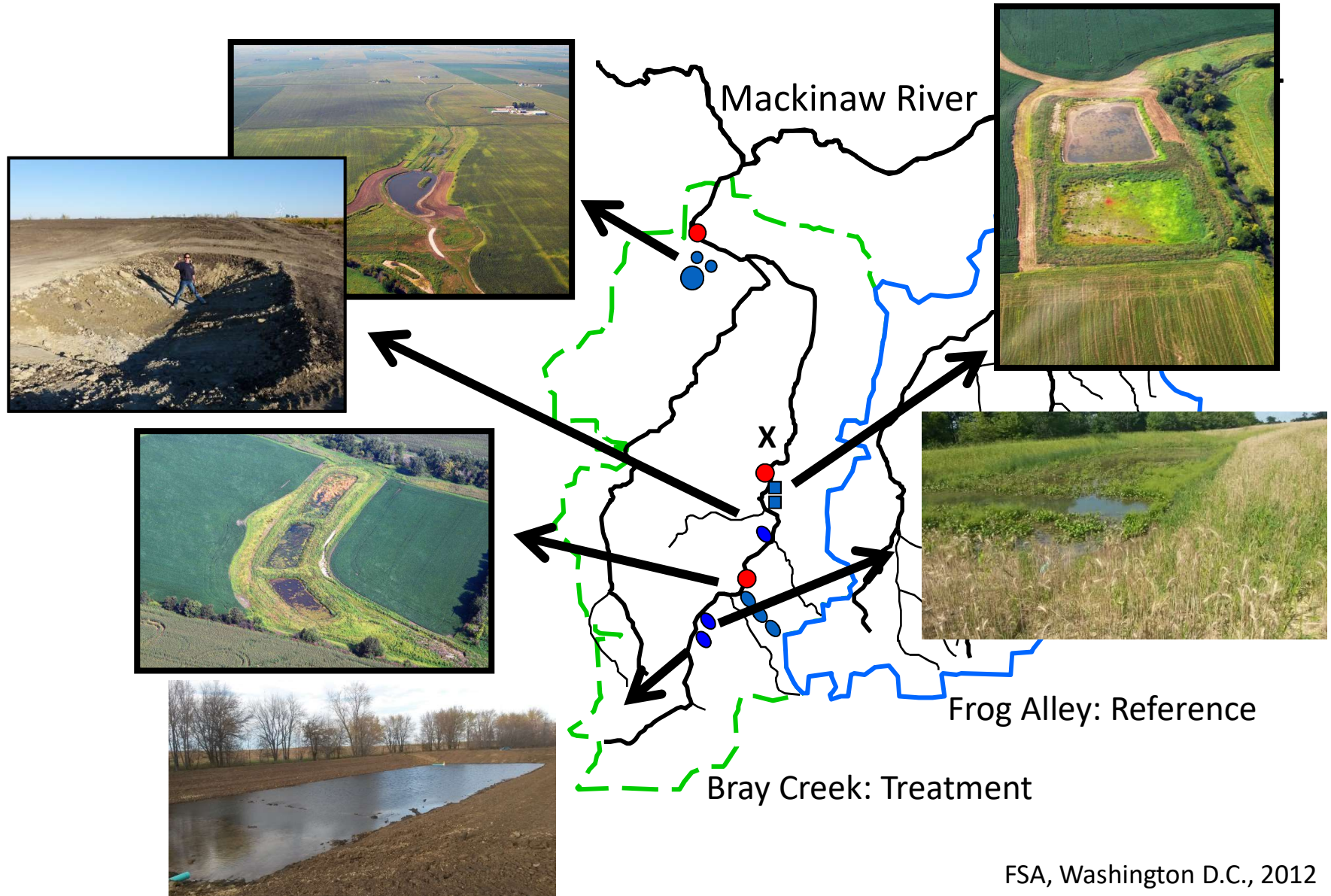


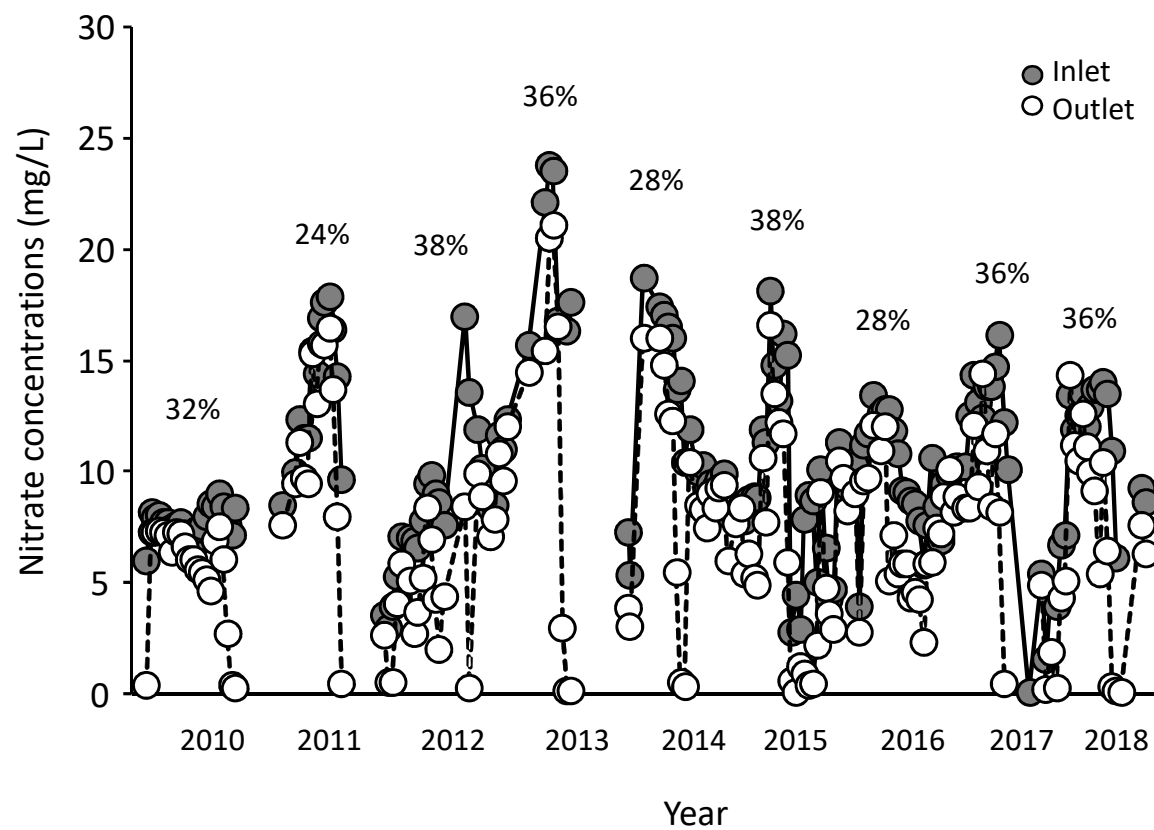
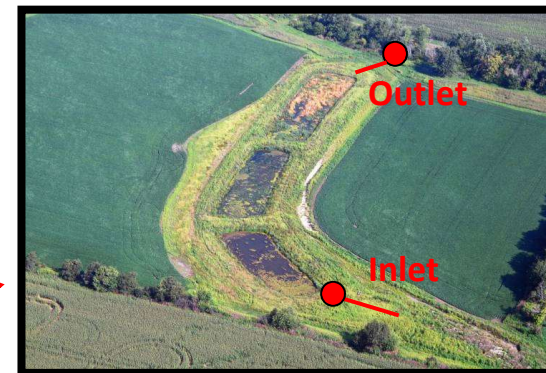
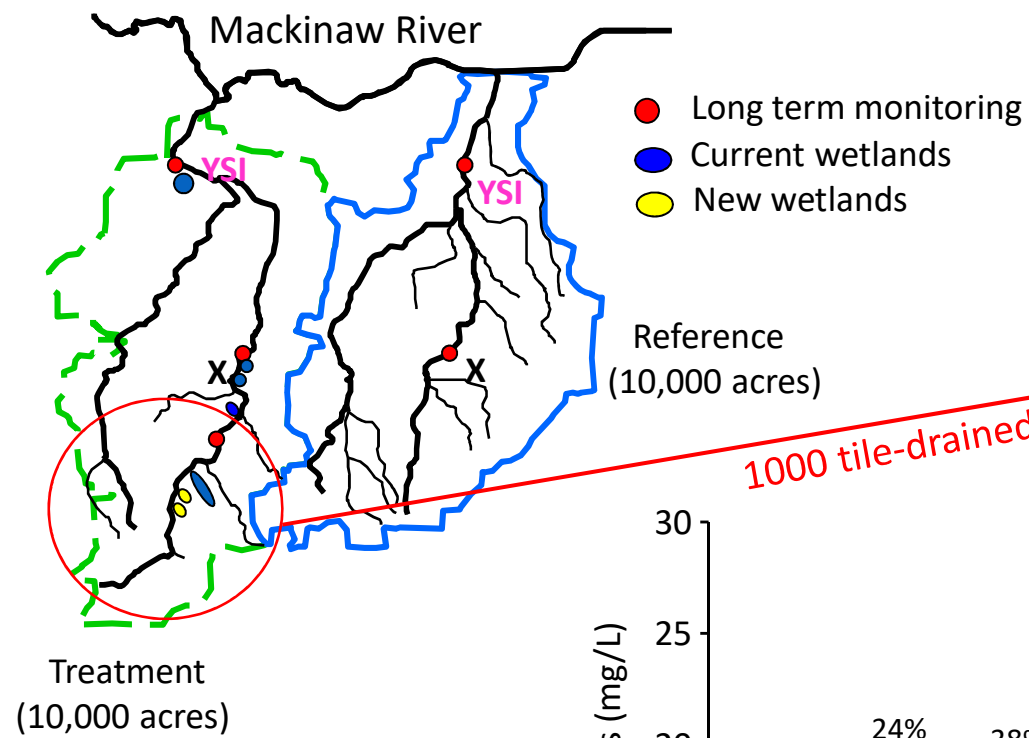
Question: How well do wetlands work to improve water quality, hydrology, and biodiversity at the watershed scale?



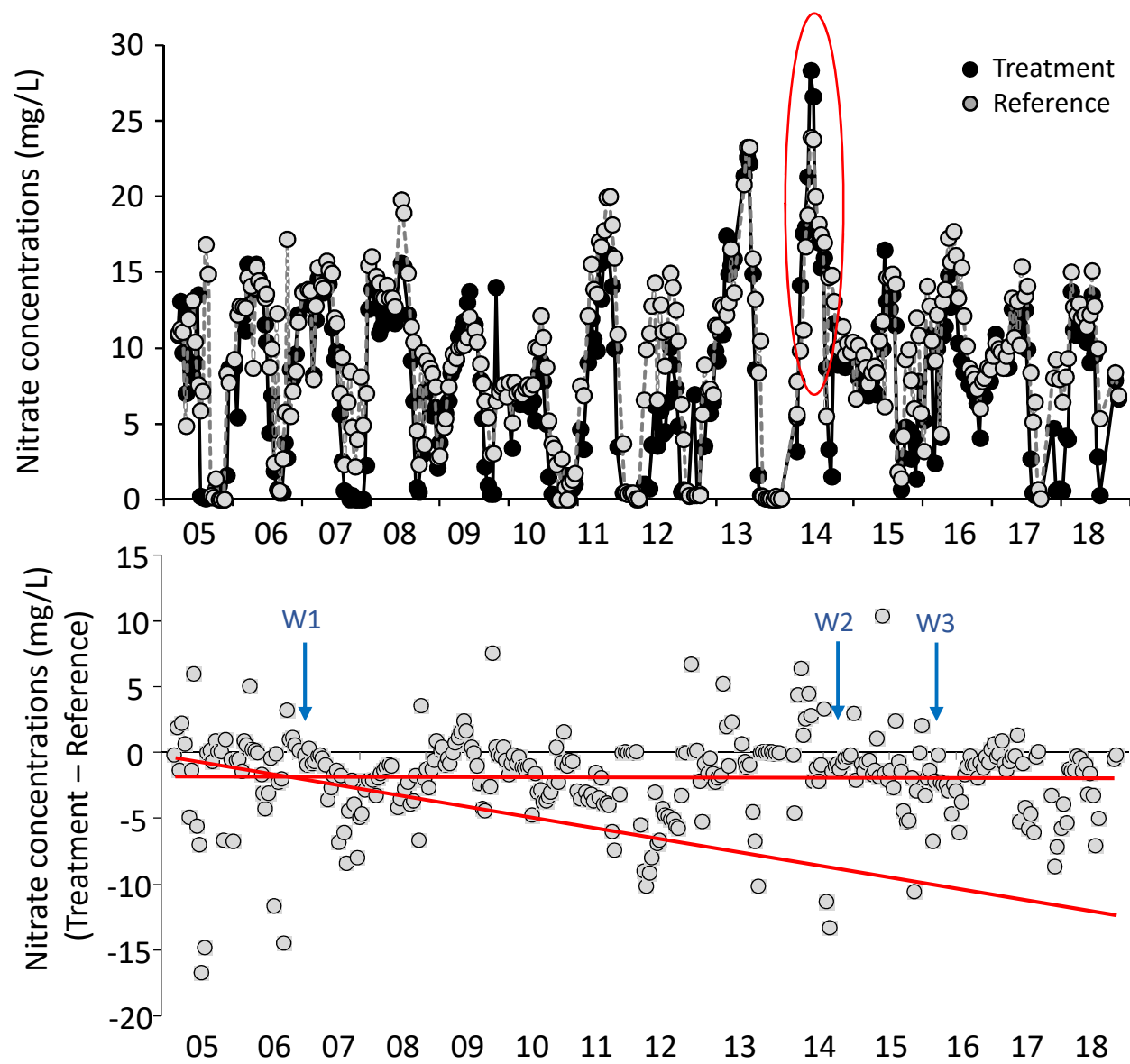
Paired Watershed Project

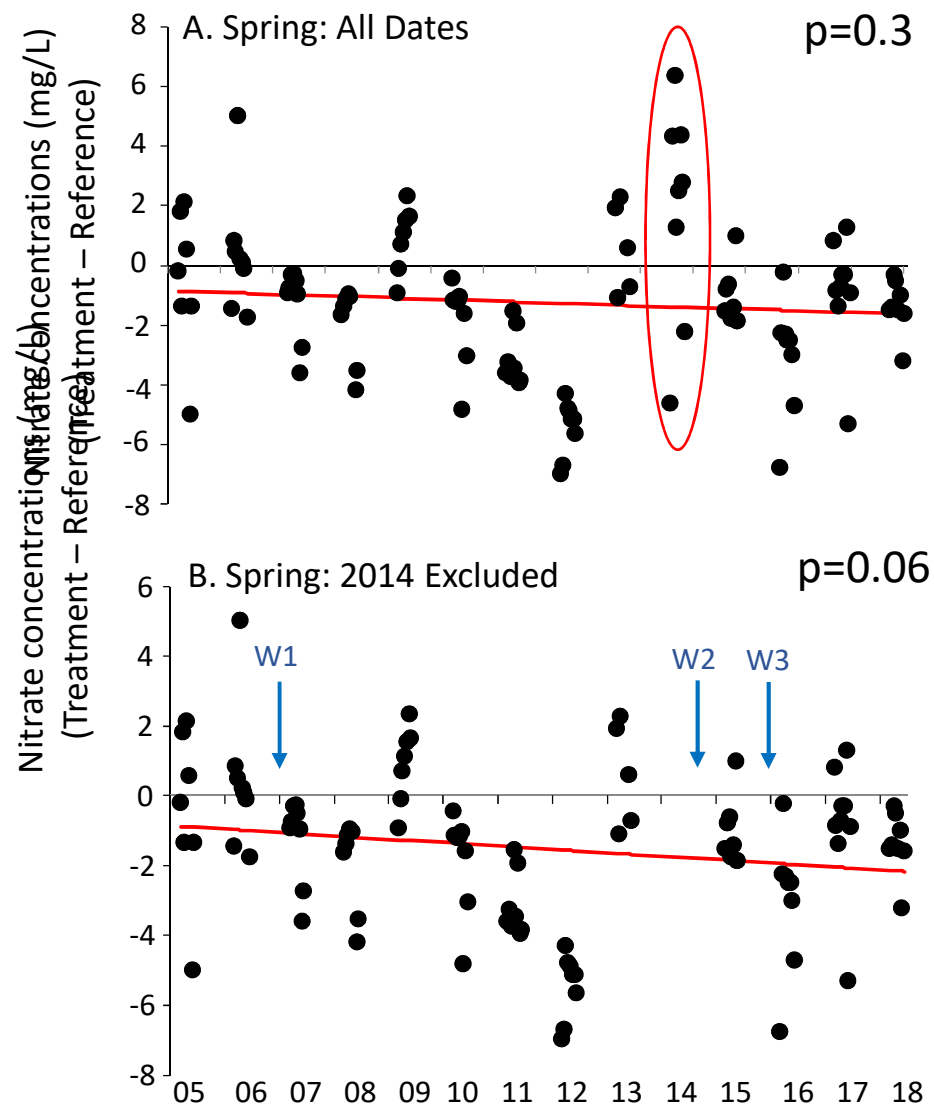
Quantify watershed-scale effectiveness of constructed wetlands at restoring altered hydrology and reducing nutrient and sediment transport (10,000 acre-scale)



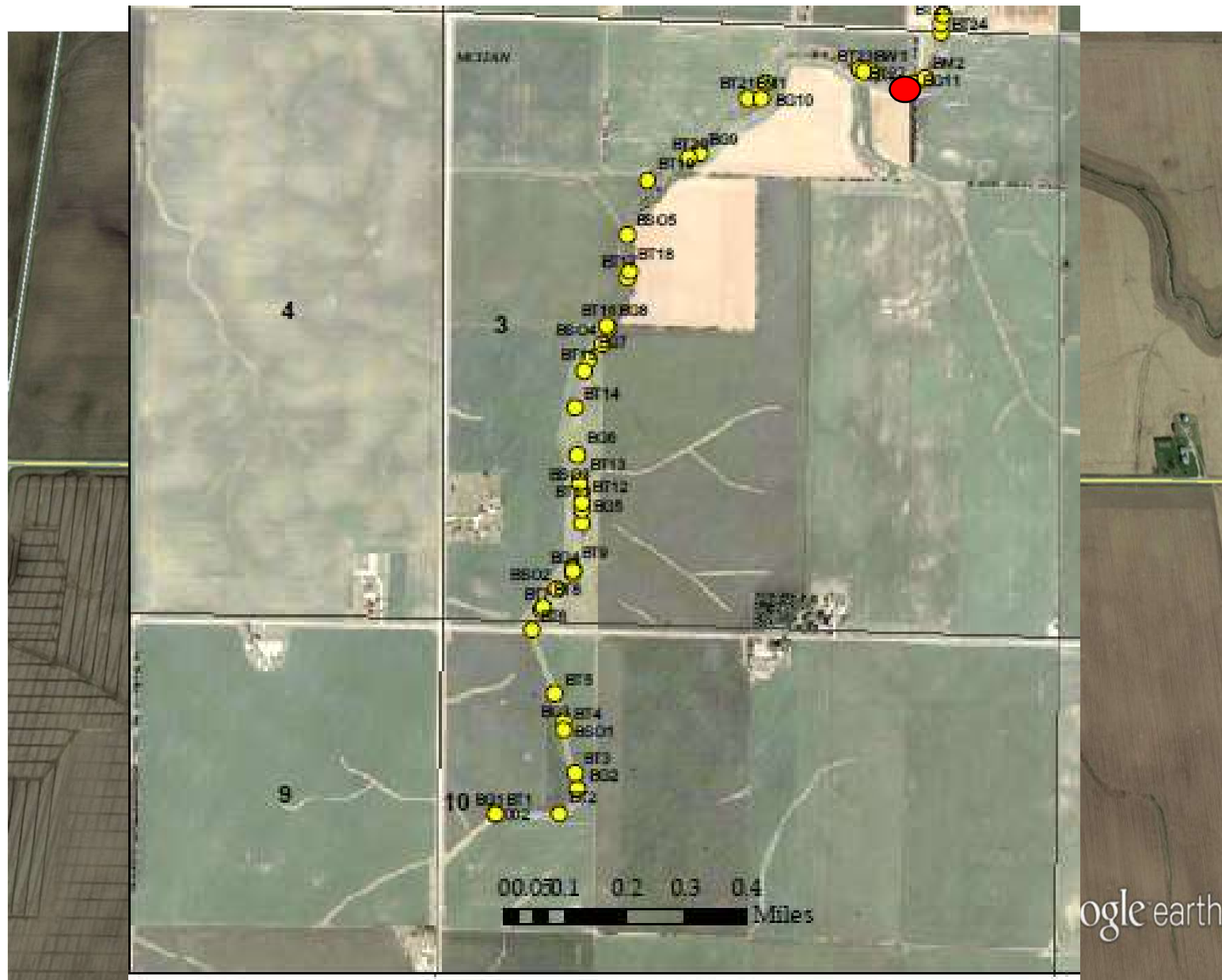








Pilot this fall (2019-2020): Cost-share cover crops up to 500 acres





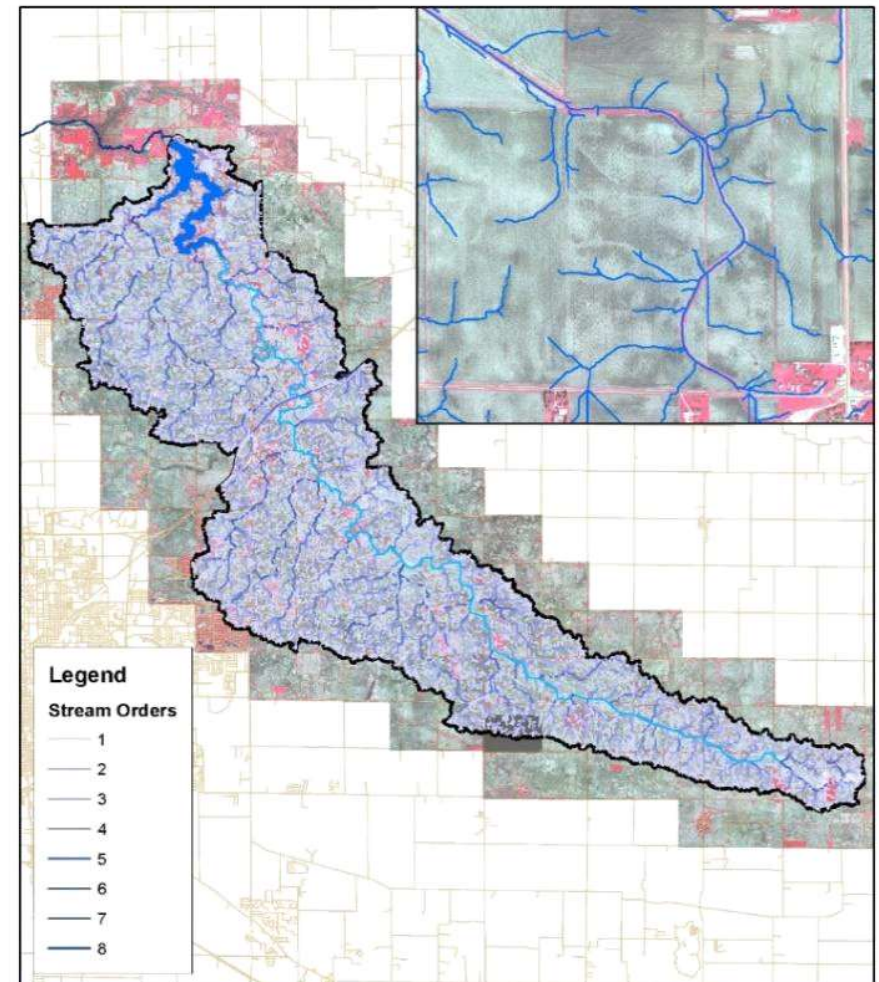
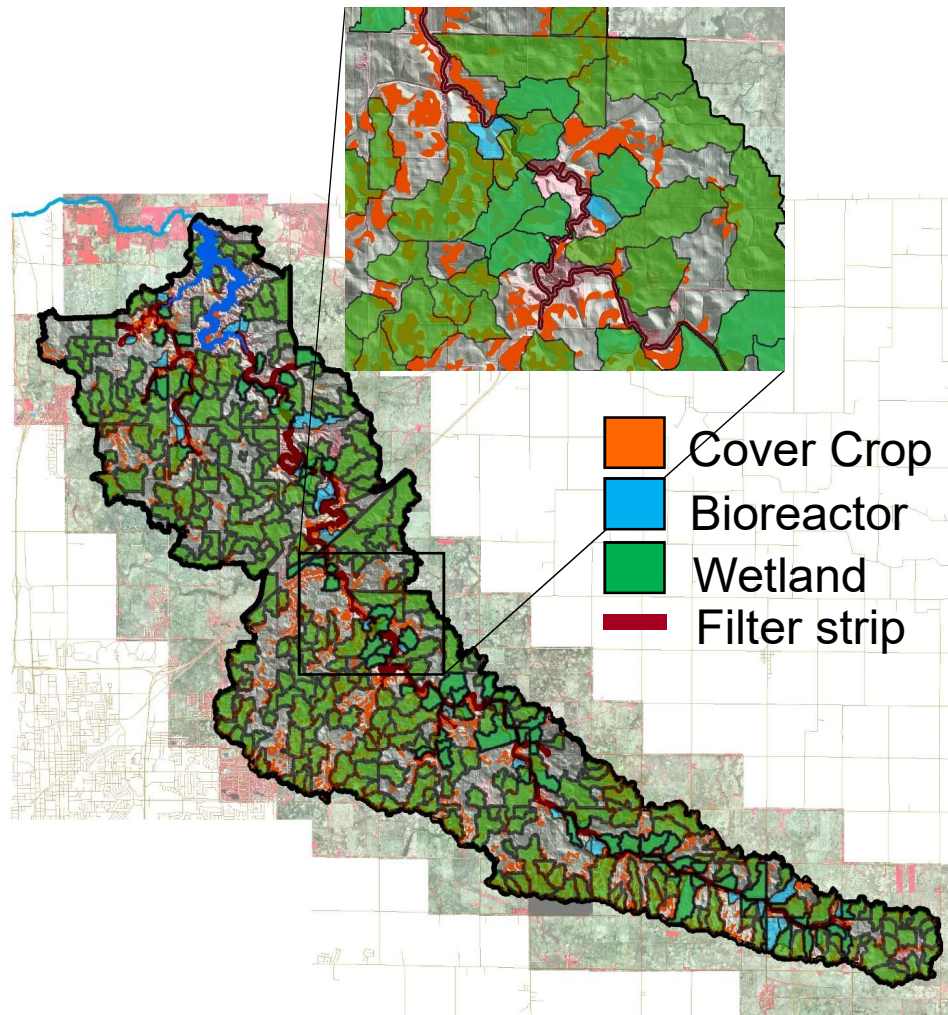
Miran Day
(California Polytechnic State University)

Watershed Mapping



Dr. David Kovacic
(University of Illinois)

LiDAR, GIS, and aerial infra-red data : Dev



Lake Bloomington Watershed - New Stream Orders
McLean County, IL







Thank you!