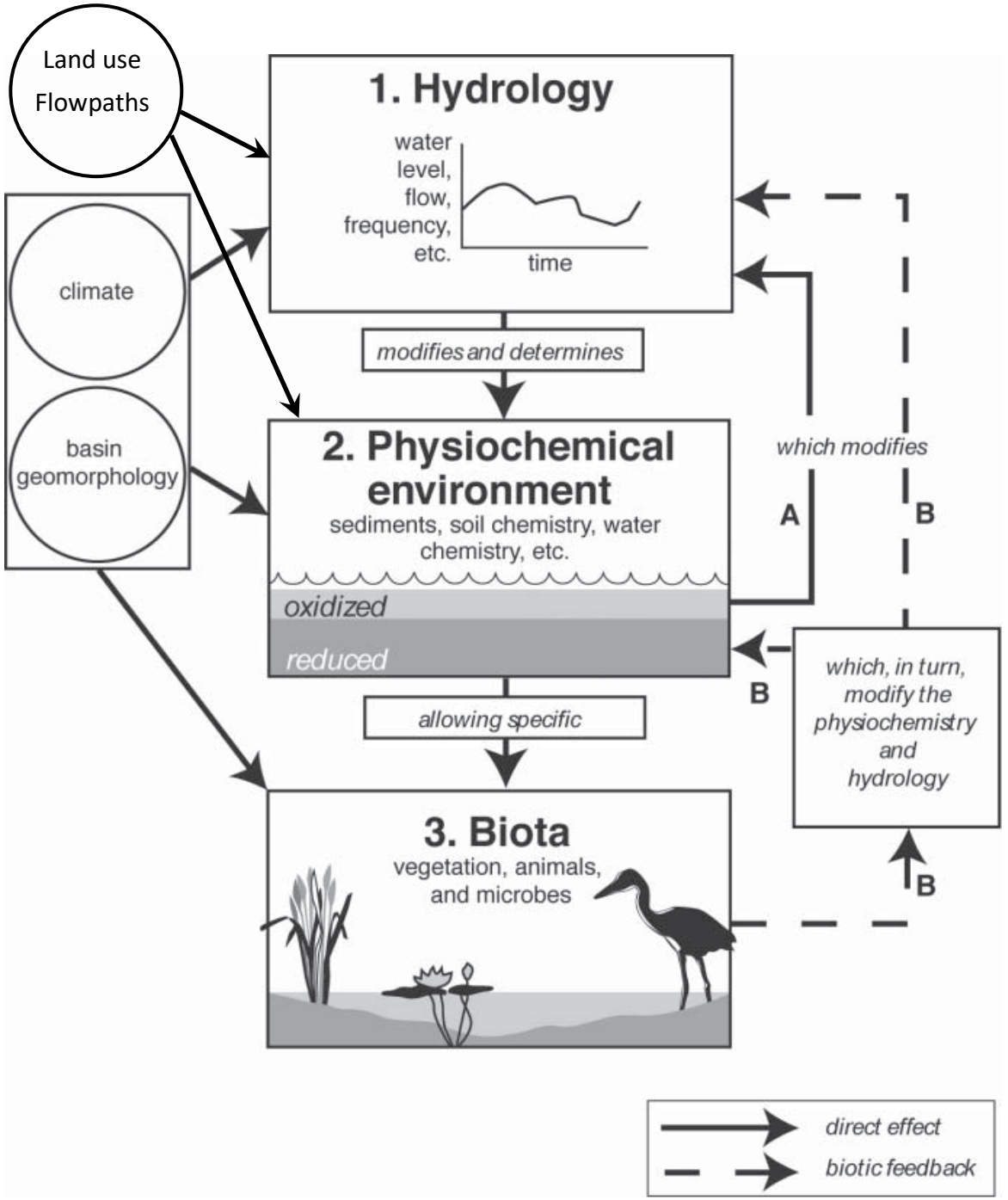
Novel hydrology and water quality of wetlands in agricultural landscapes

Dr. Sara Winnike-McMillan
Agricultural & Biological Engineering, Purdue University

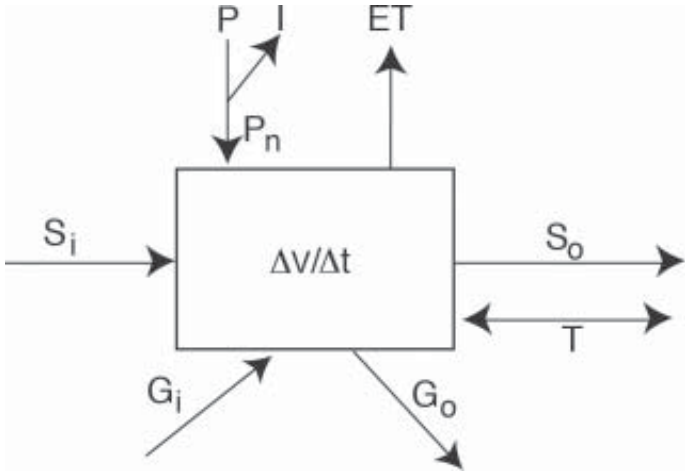
Dynamic interactions of hydrology and ecology

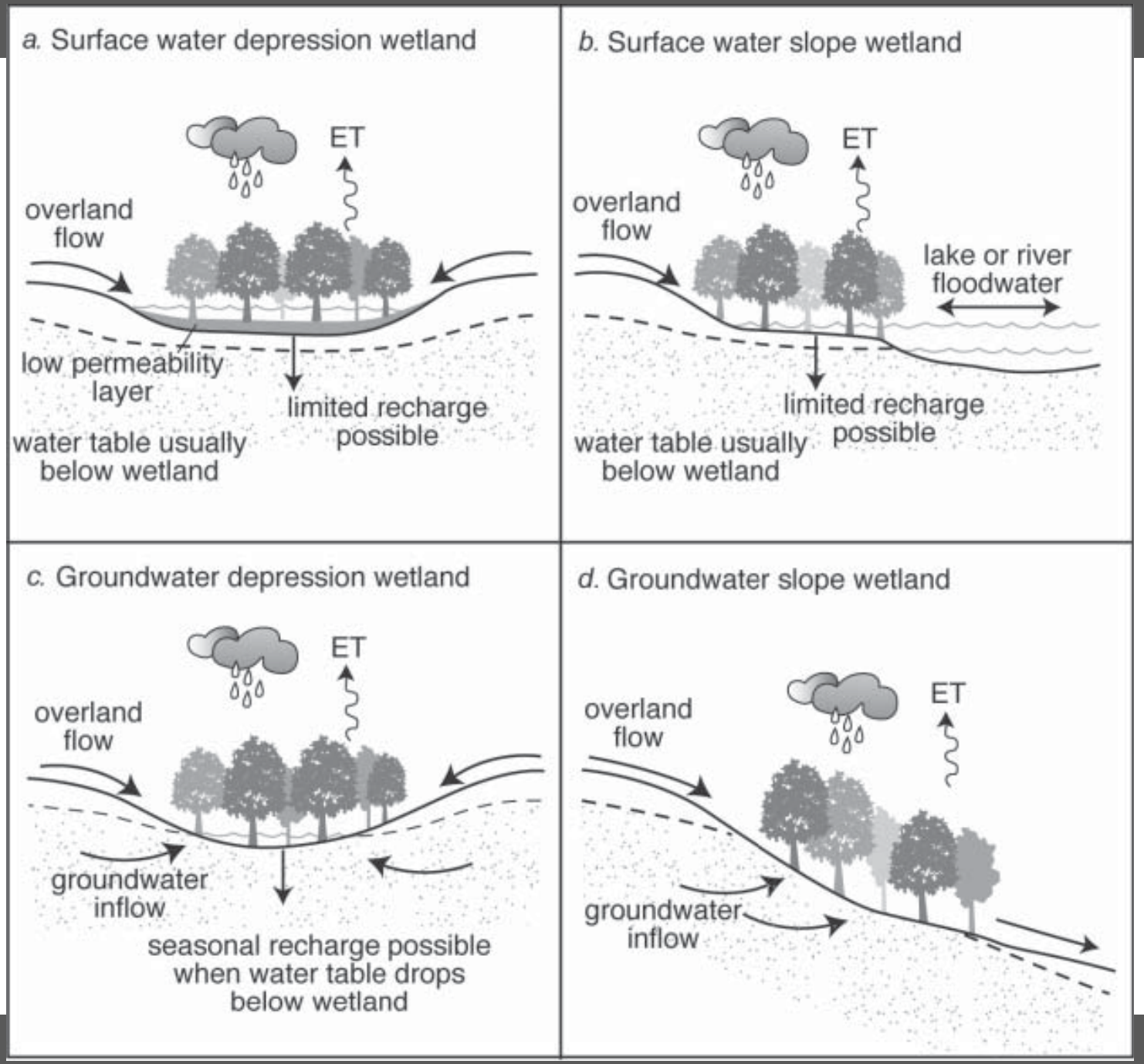
- Surface and groundwater inputs control water levels & supply key nutrients.
- Transport sediment, chemicals, pesticides, etc.
- Transitional ecosystems at interface
- Dynamic hydroperiods – temporal variation in extent & function
- Active feedback mechanisms



Mitsch & Gosslink 2015

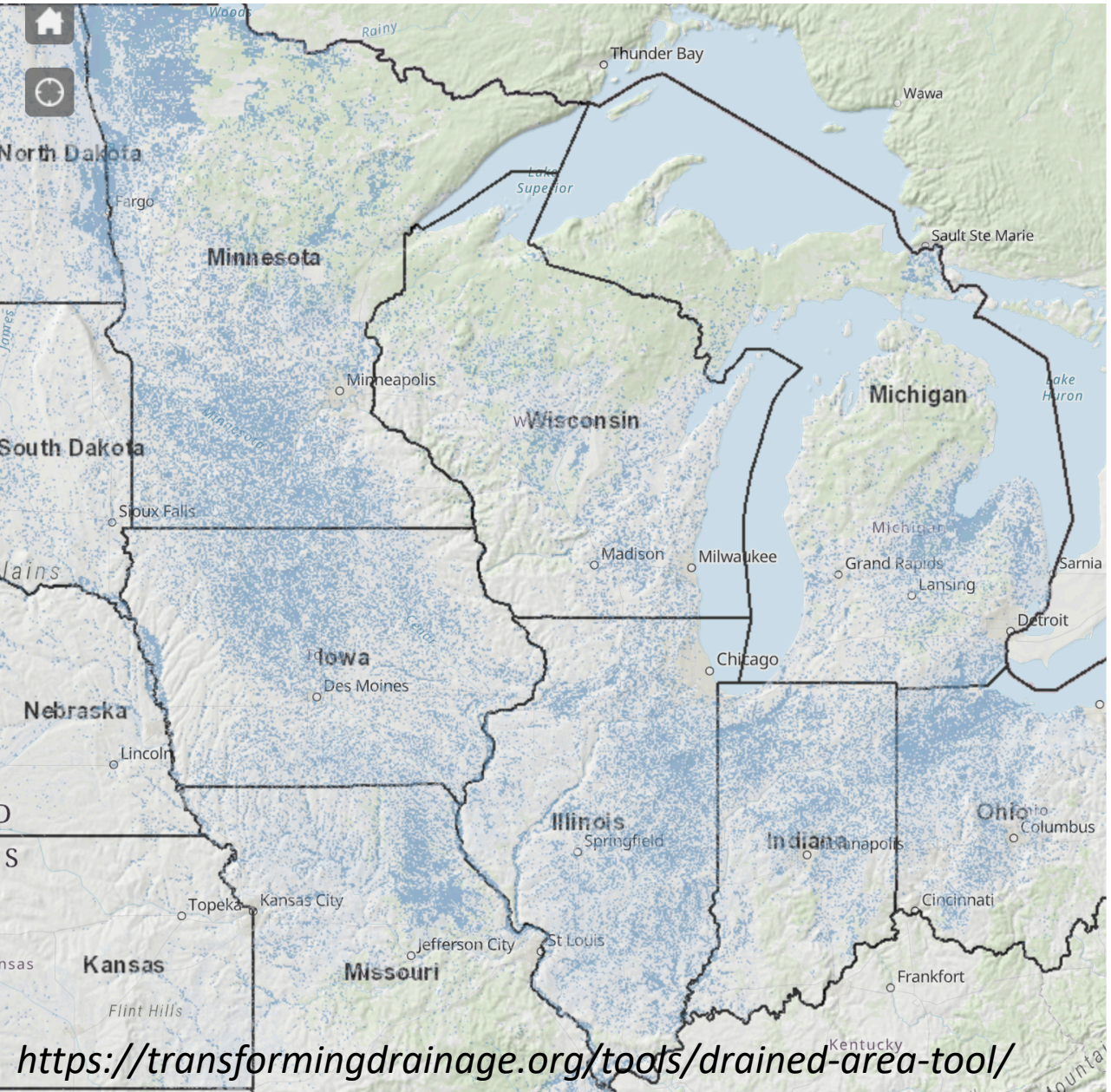
Wetland hydrology



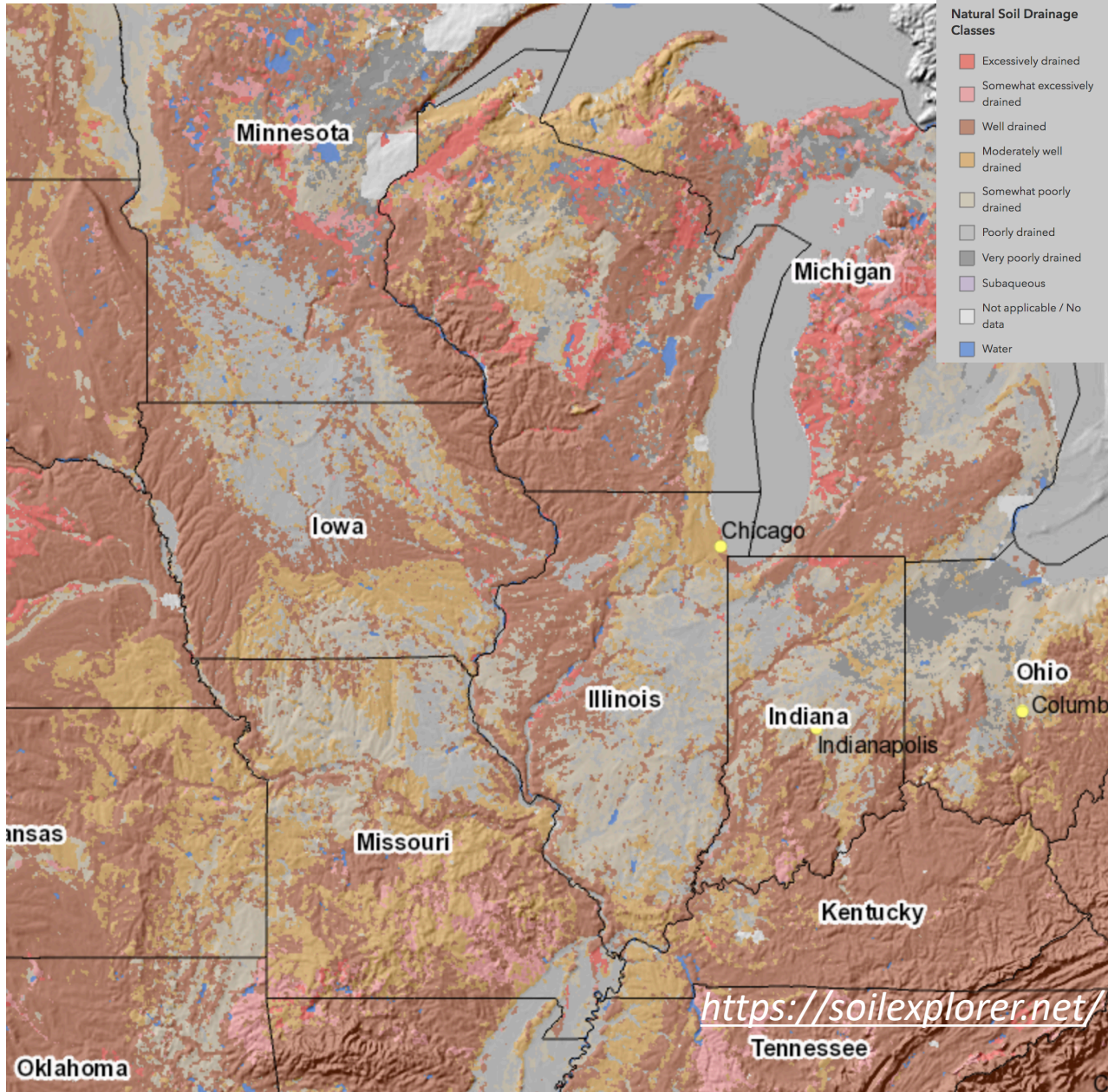


Mitsch & Gosslink 2015

Agricultural Midwest

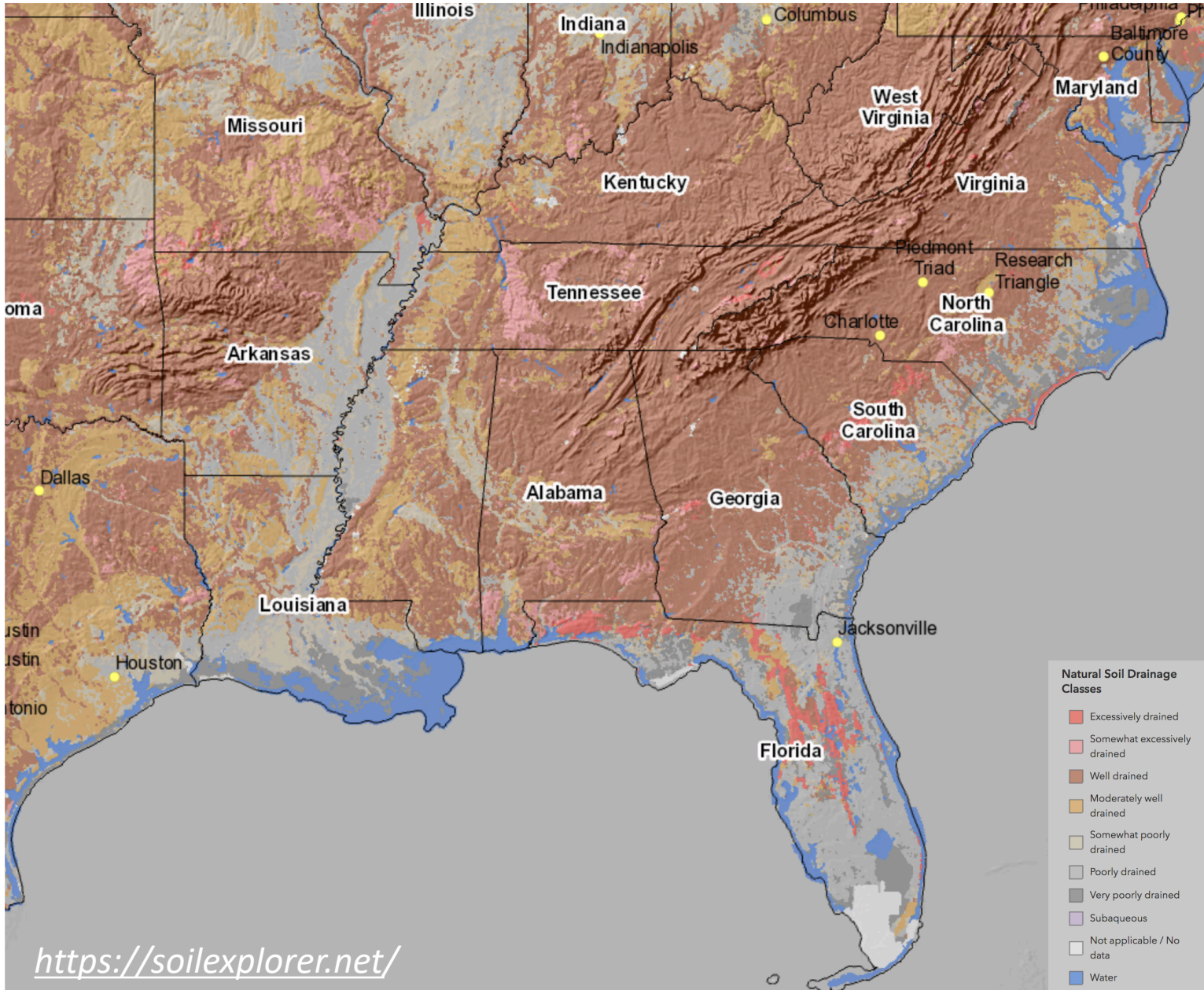


https://transformingdrainage.org/tools/drained-area-tool/

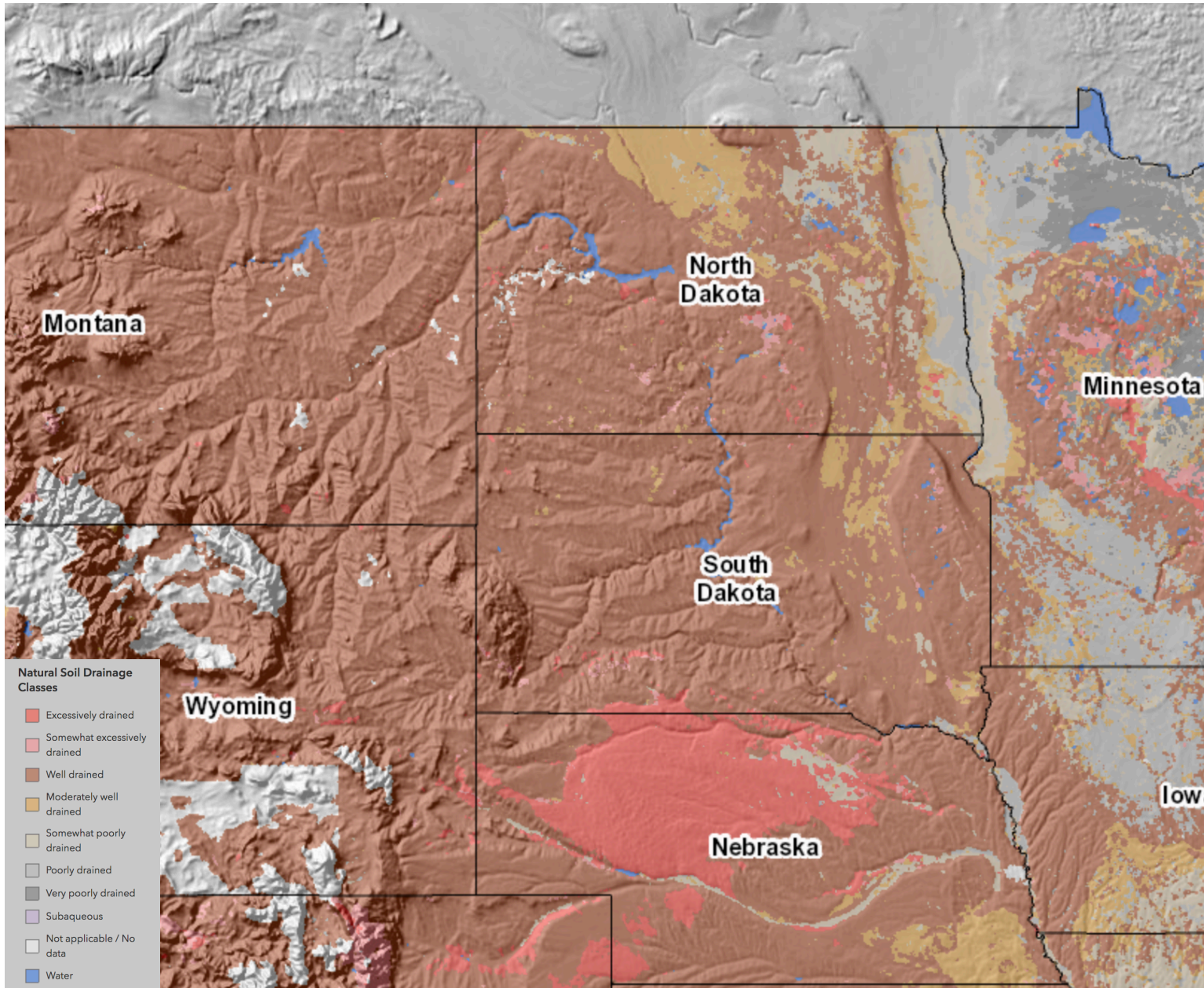


https://soilexplorer.net/

Mid-Atlantic / Southeast

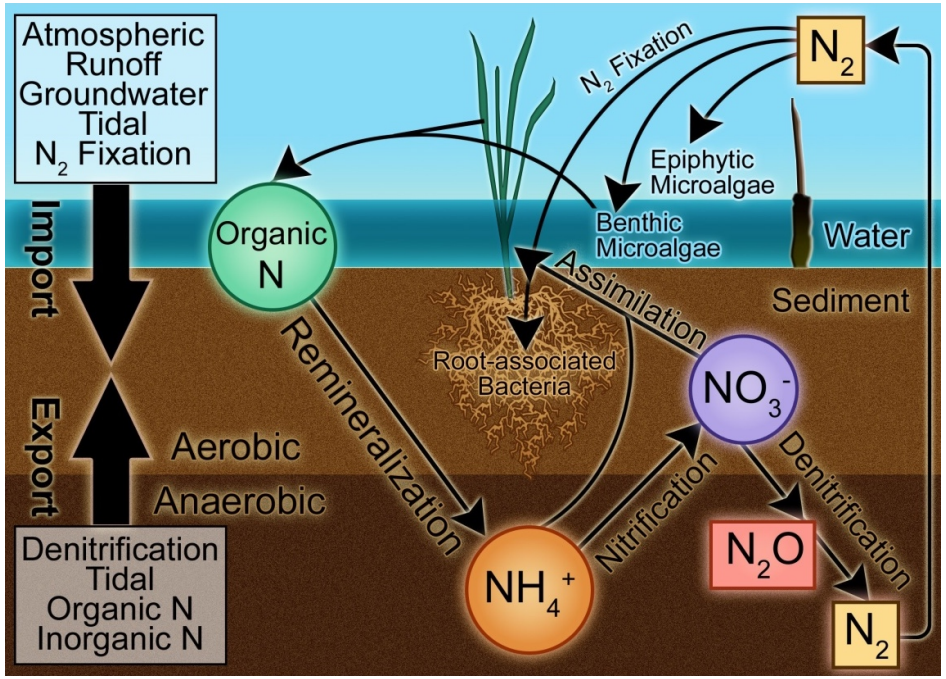


Prairie pothole region

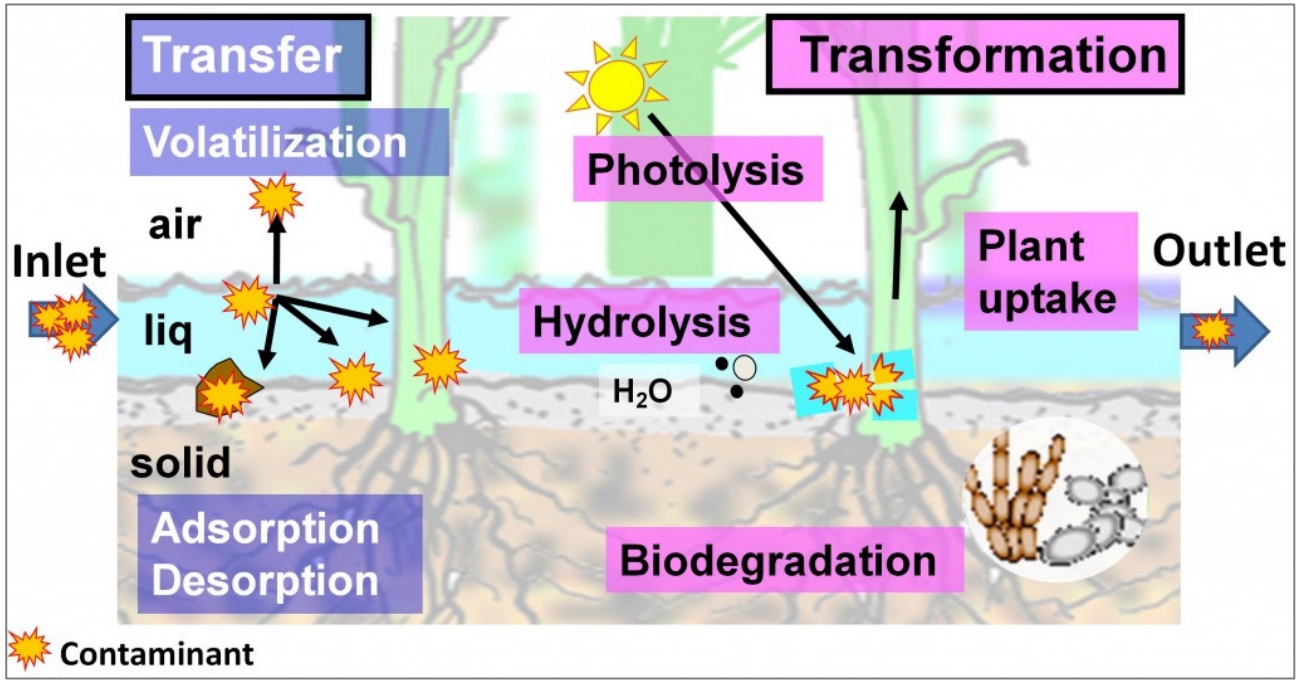


Microbial processes in sediments

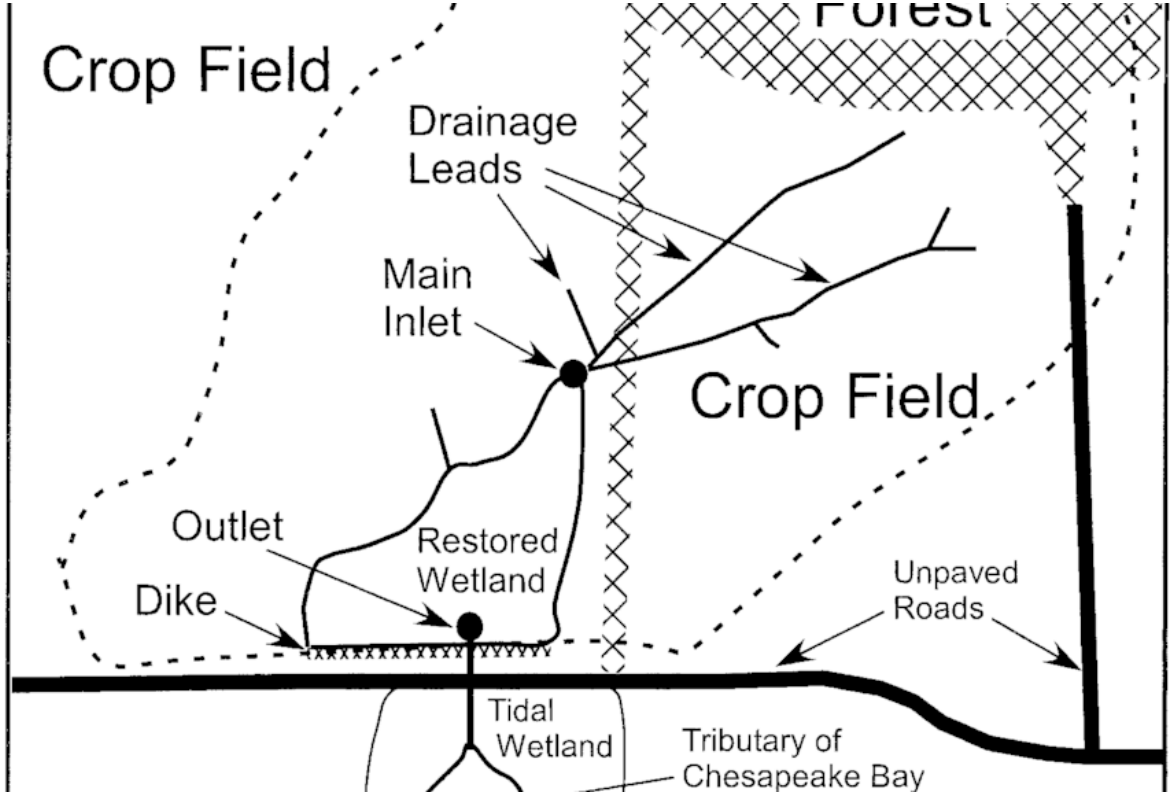
- Hydrology is critically important
- Dynamic feedbacks between vegetation + microbes
- Processes can be amplified in wetlands – design for removal?
- What are the feedback between nutrient biogeochemistry + contaminant transformation?



Winnike-McMillan Lab



E. Passeport Lab



Monitoring challenges

- diverse flowpaths
- temporal variable (storm v. baseflow; application)
- technology


W 350 N
Deerfield Ln
W 300 N
Purdue University Pond
N 825 W
N 650 W
W 200 N
26
© 2020 Google
3734 ft

Restoration

- Goals of restoration are primarily nutrient reduction or habitat creation
- What does that mean for pesticides and other agronomic chemicals?
- Where are their opportunities for synergy?
- Do restoration strategies need to be modified in higher risk areas to minimize ecological impacts?
- What regulatory, economic, or stakeholder barriers exist?