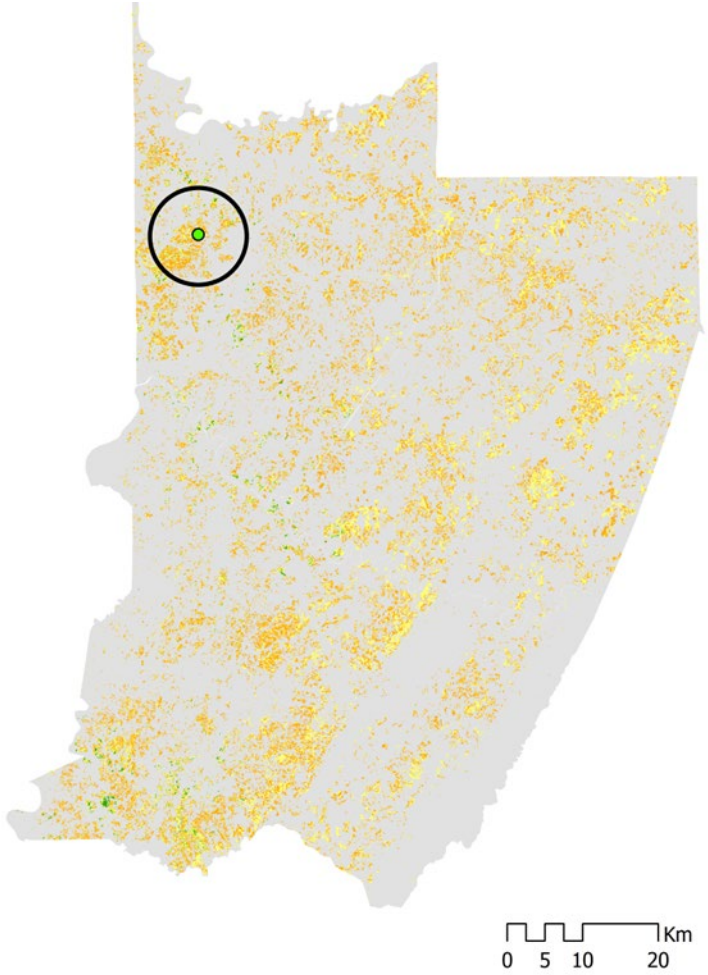
Manureshed Modeling: Water quality outcomes of manureshed management

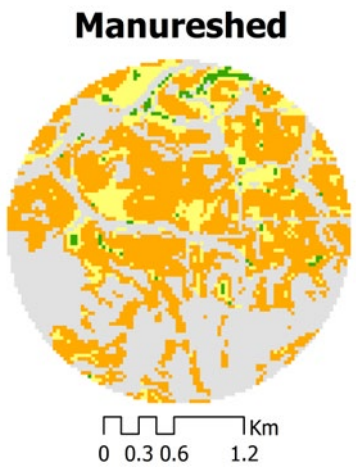
Cibin Raj

Associate Professor
Department of Agricultural and Biological Engineering
Department of Civil and Environmental Engineering

Pennsylvania State University

Manureshed: A framework for sustainable manure management



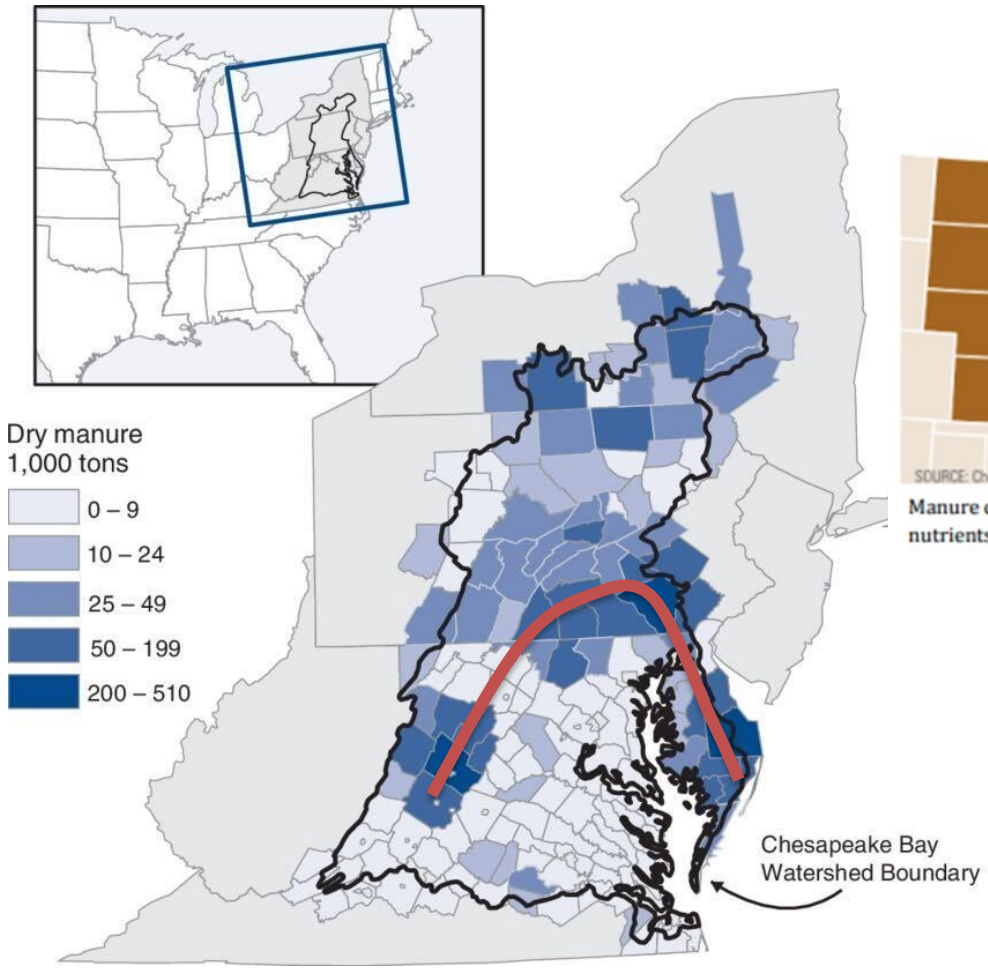


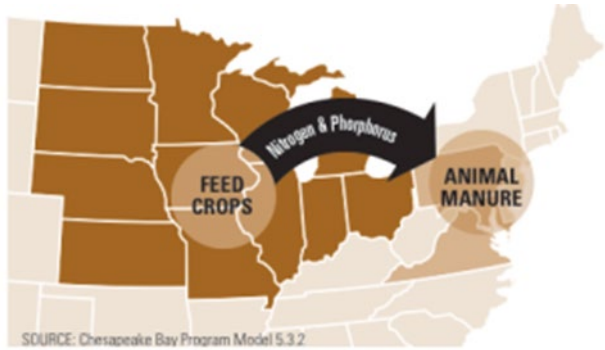
Manureshed: A land surrounding a livestock operation containing enough suitable acreage for crop utilization of nutrients from the generated manure.

Saha et al., 2018. https://doi.org/ 10.13031/aim.201801218

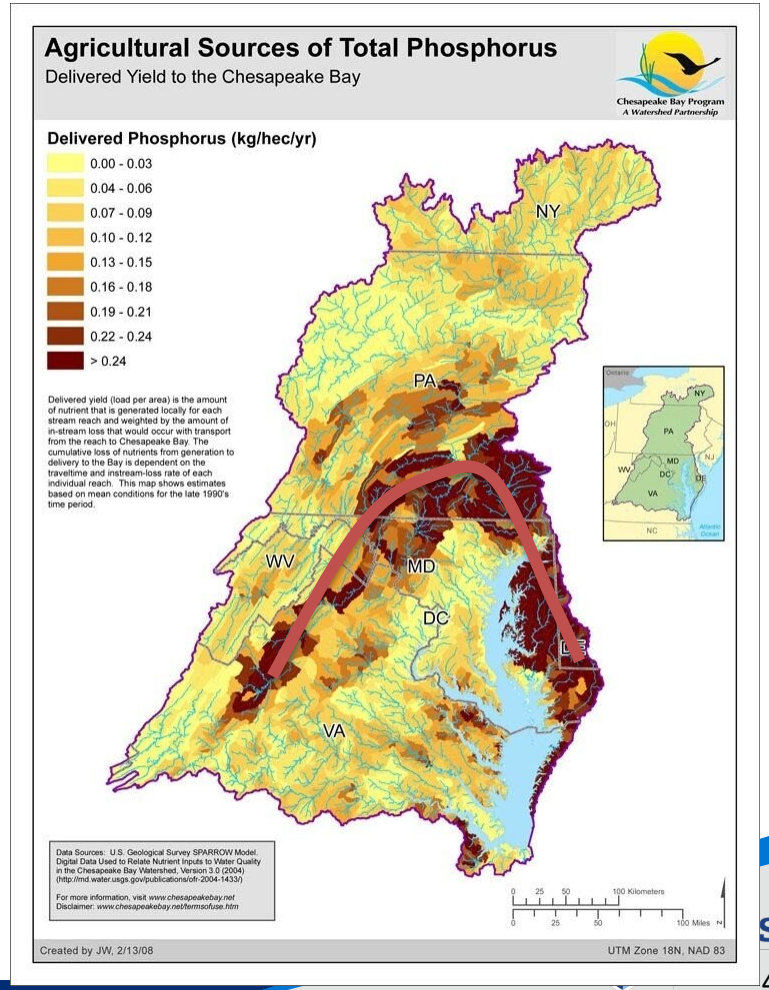
Manureshed modeling in Susquehanna River Basin – Chesapeake Bay watershed

Nutrient Imbalance – Chesapeake Bay watershed – Manure hotspots and nutrient hotspots



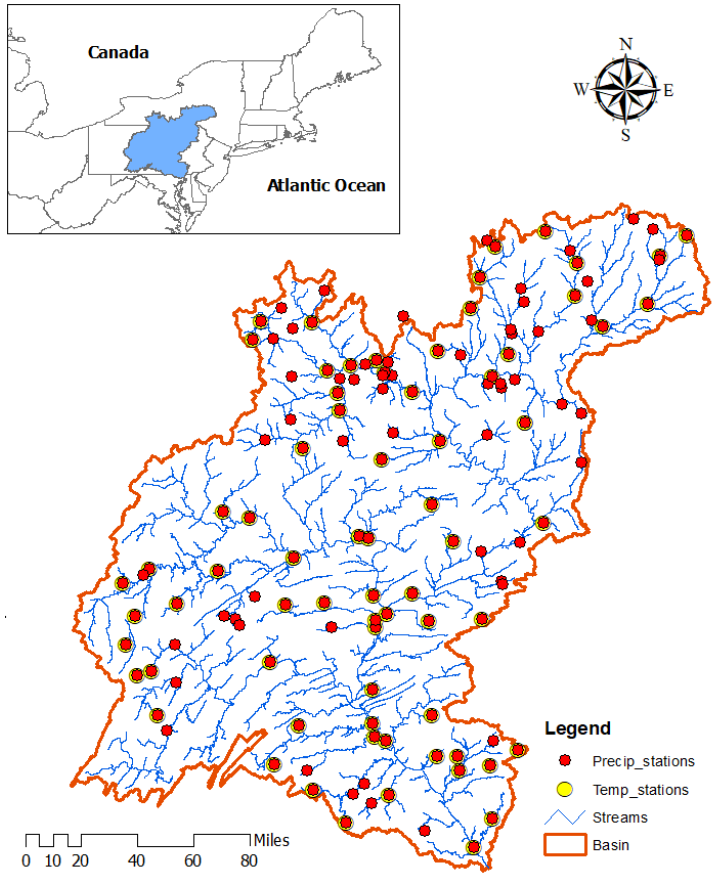


Manure concentrations do not occur where crops are using the nutrients. (Graphic by Chesapeake Bay Commission).



Soil and Water Assessment Tool (SWAT) was used for evaluating water quality impacts of nutrient management strategies

Process-based model. Represents on-farm management practices and crop growth processes.

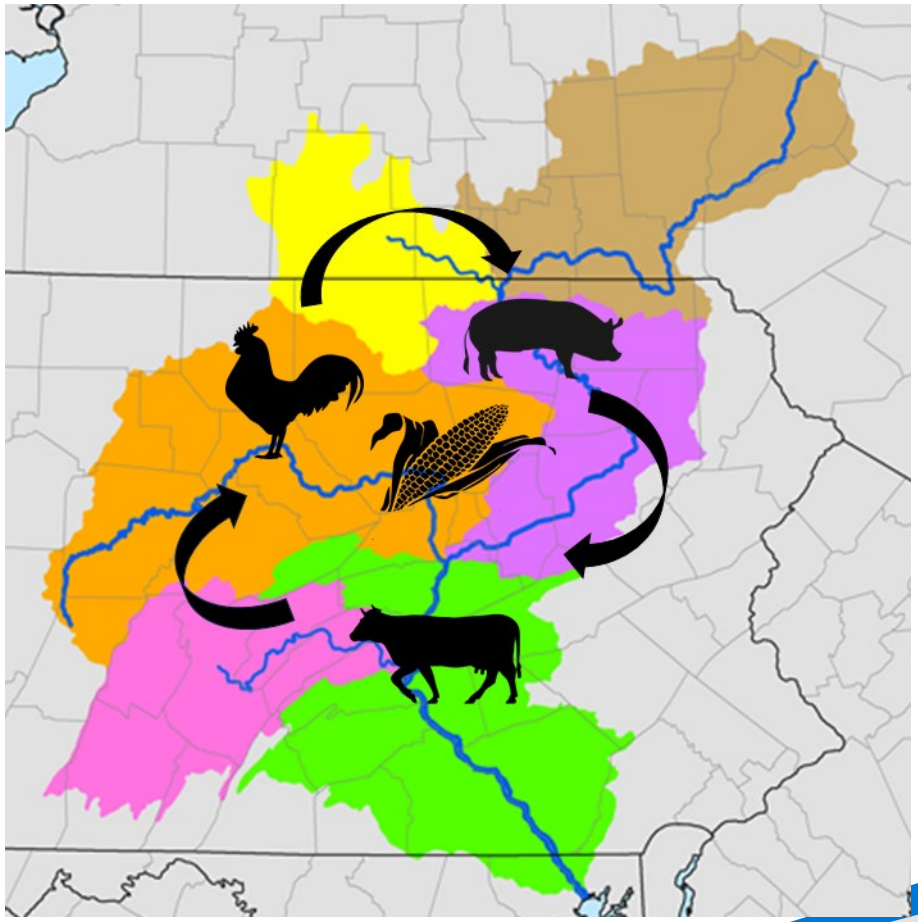


Saha et al., 2022. JEQ

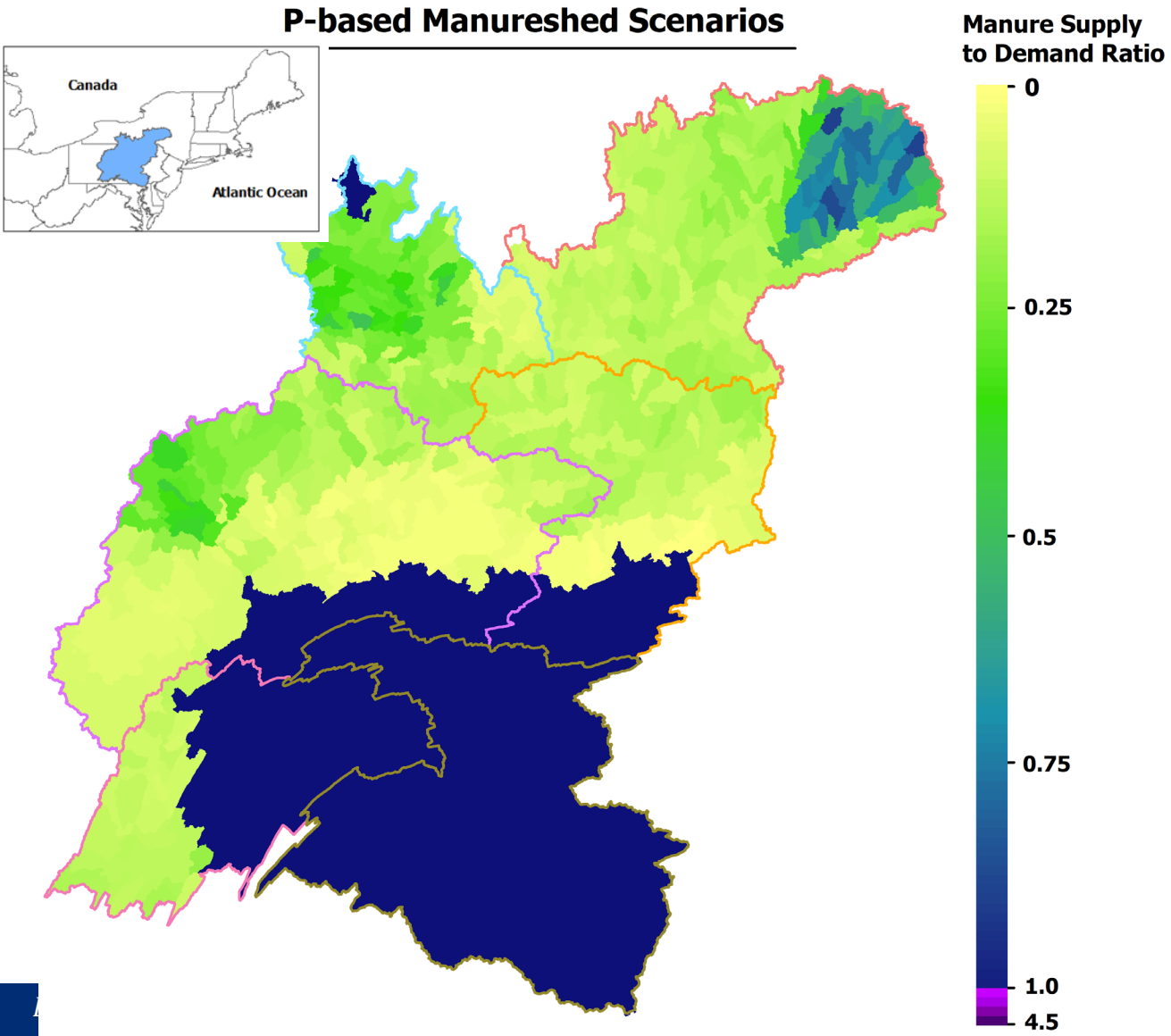
- Drainage Area ~71,000 km^2

Manure management scenarios in SRB

- Manure transport restricted –manure utilized in the same region
- Manure balanced – no transportation constraint – manure utilized based on crop demand
- Manure applied based on land suitability
- Crop nitrogen demand-based application
- Crop phosphorus demand-based application

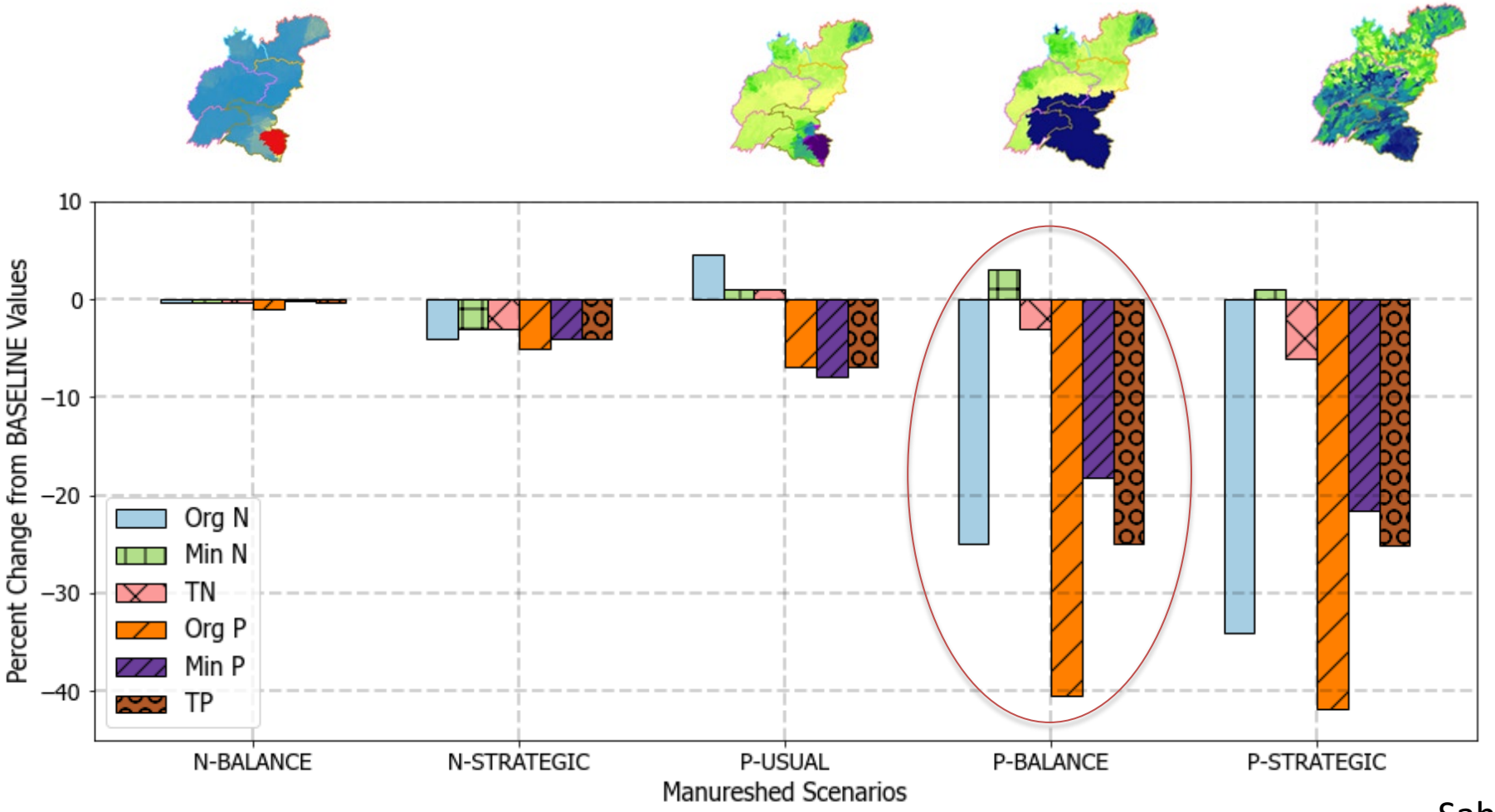


Manure transported and applied based on crop phosphorus demand – 67% of SRB crop area under manure



- Manure could meet 67% of crop phosphorus demand in the Susquehanna River Basin
- Manure not transported into or outside Susquehanna River Basin

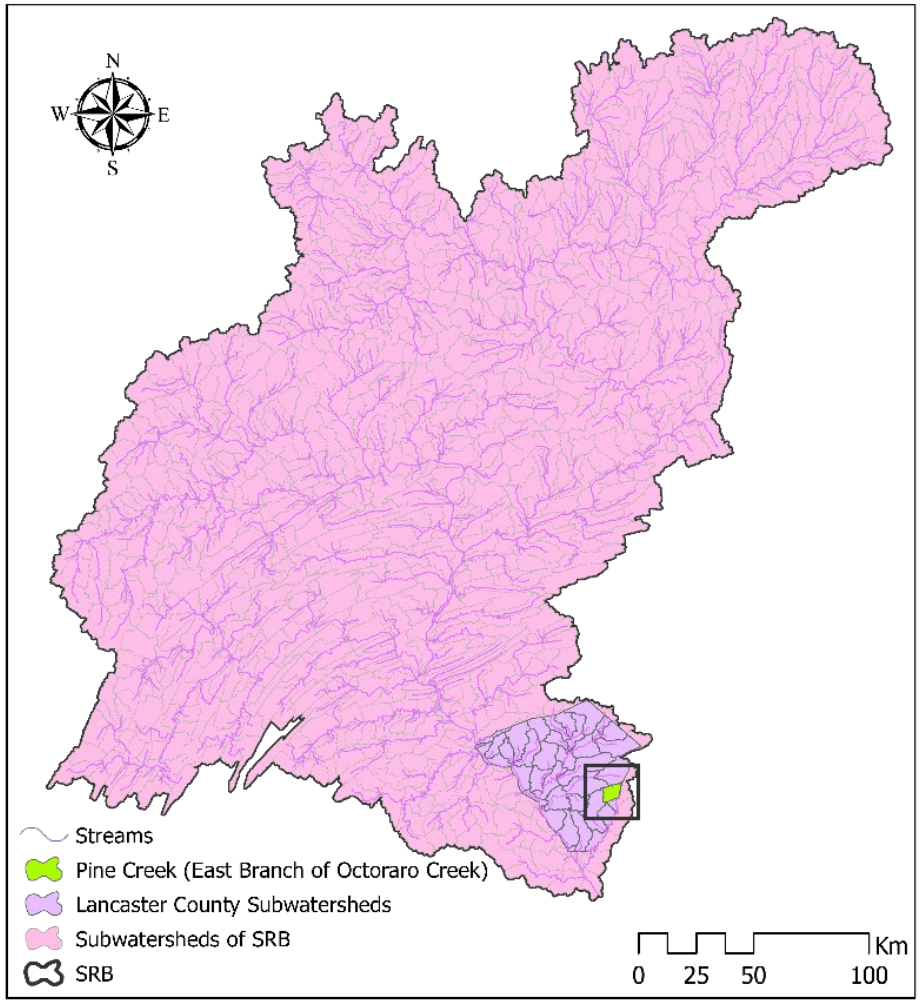
Manure transportation and application based on phosphorus demand-based reduce nutrient loading to the Chesapeake Bay



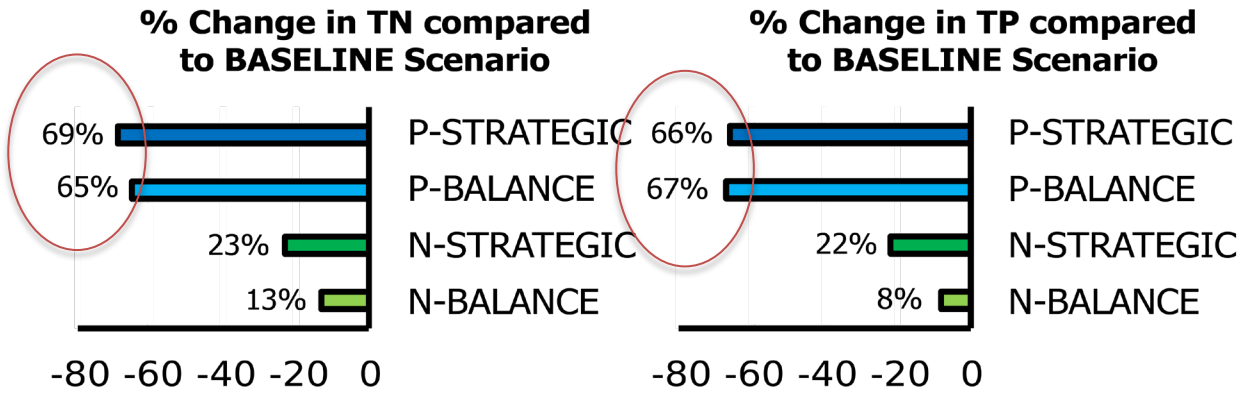
Strategic: no manure application in vulnerable areas (high slope, shallow/wet soils)

Saha et al., 2022. JEQ

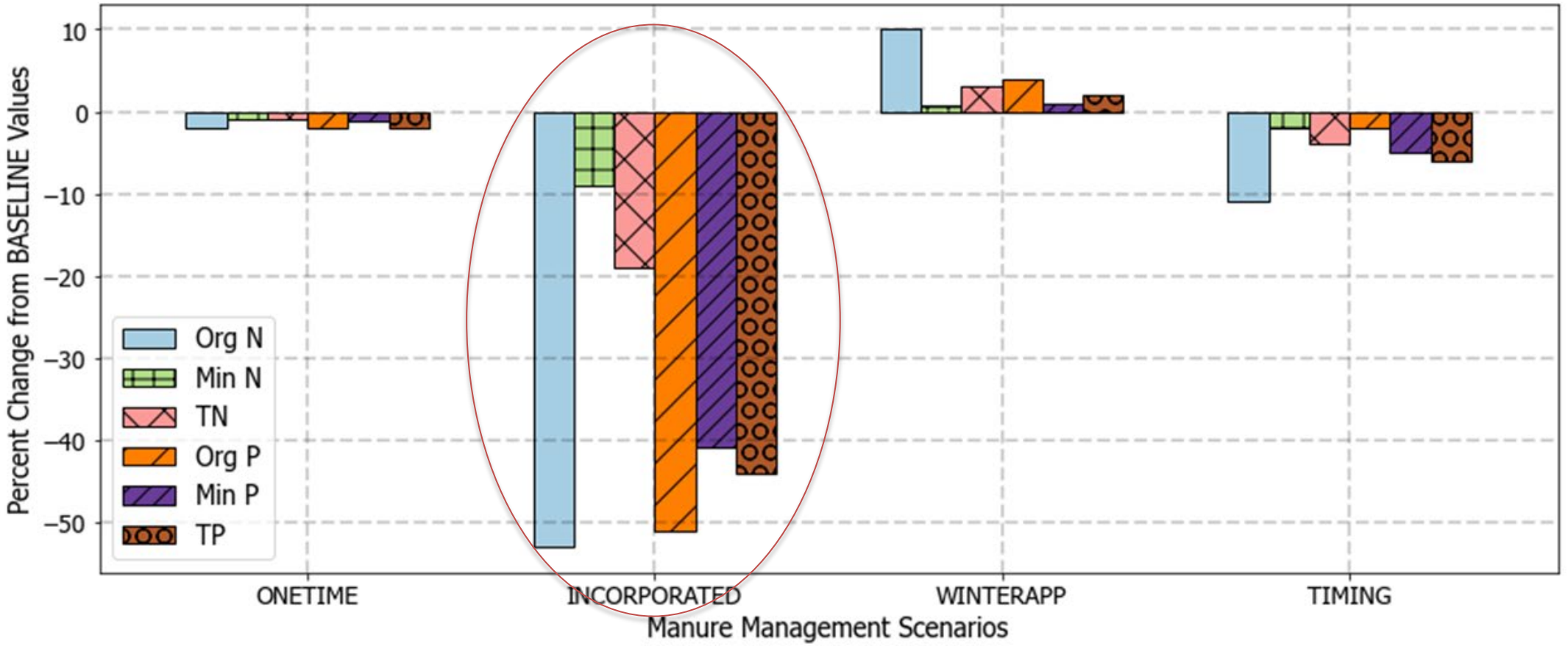
Manure transport scenarios were more effective in improving the quality of local streams in livestock-intensive regions



78% manure is transported in P-based application



Manure injection reduced nutrient loading compared to surface application



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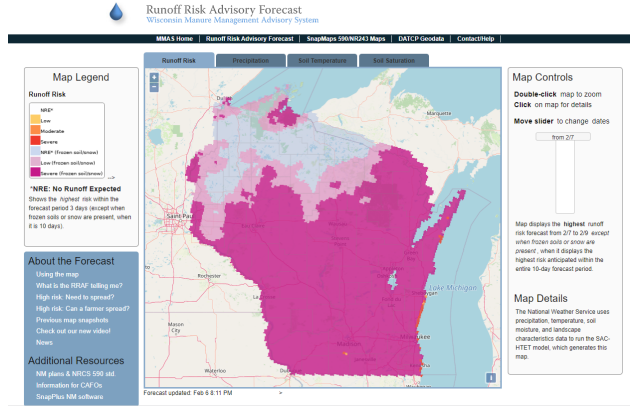
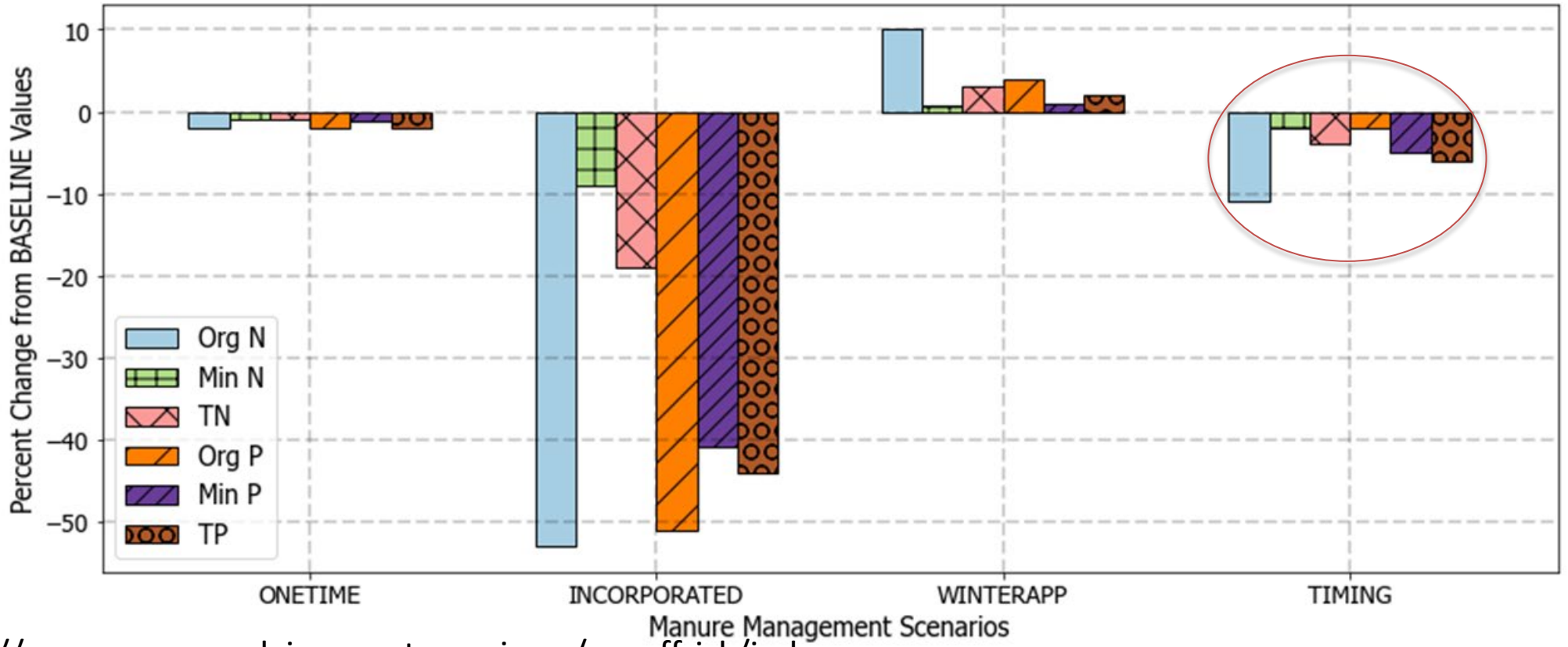
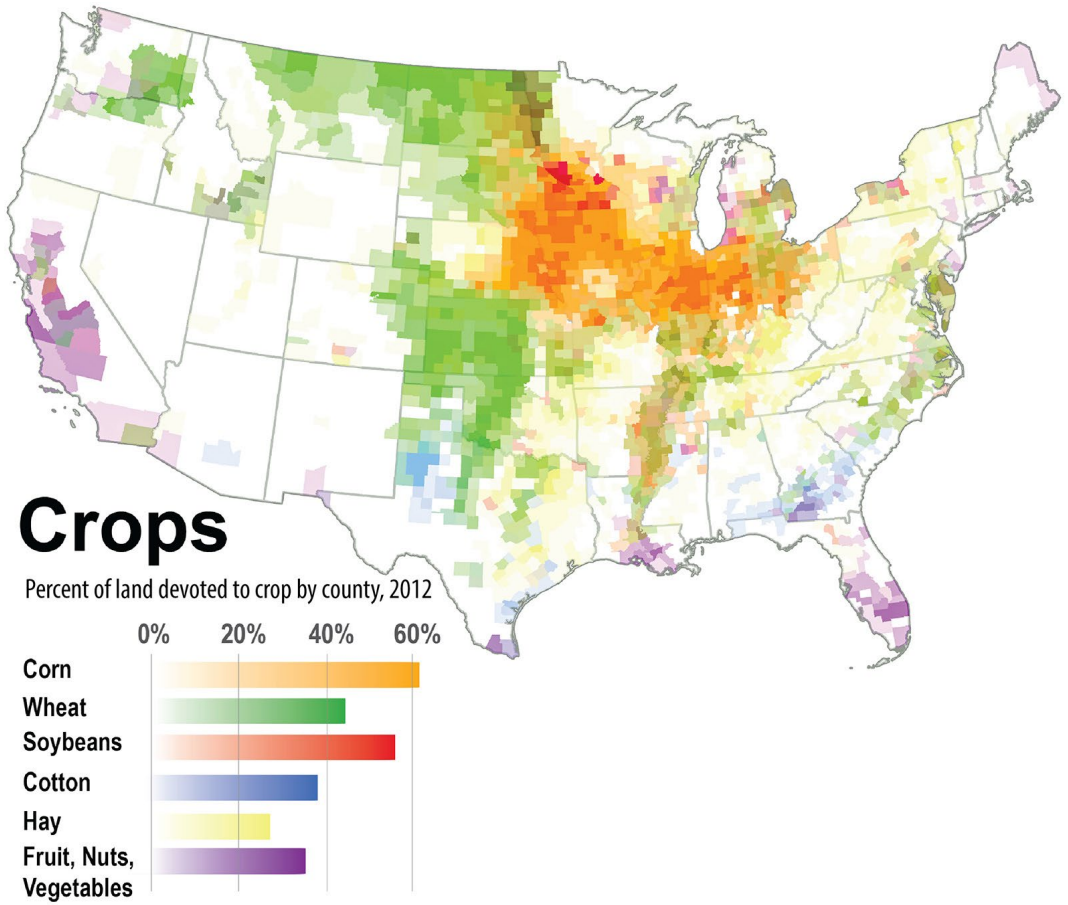
Manure application considering weather forecast (application in a period which expects low rainfall) reduced nutrient loss (4% TN, 6% TP)

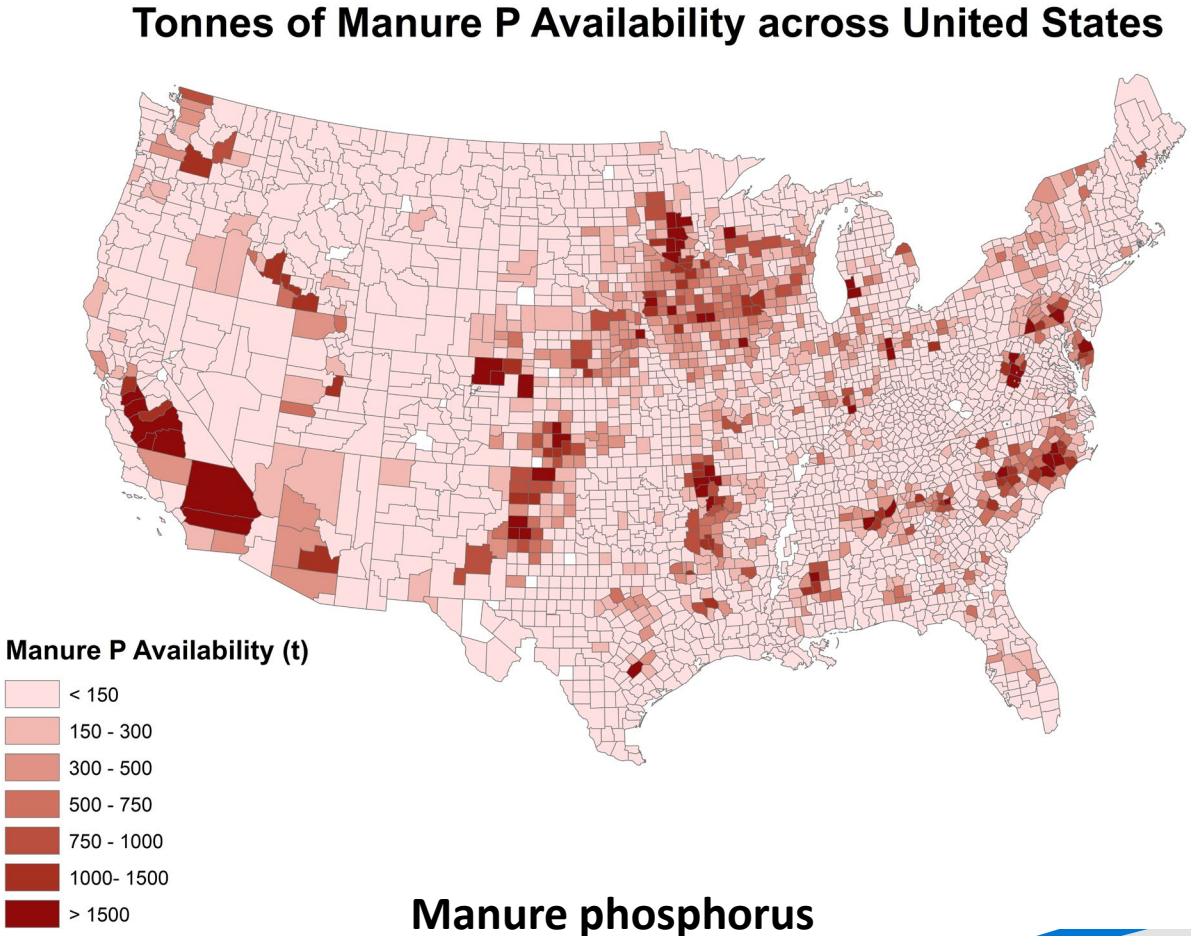




http://www.manureadvisorysystem.wi.gov/runoffrisk/index

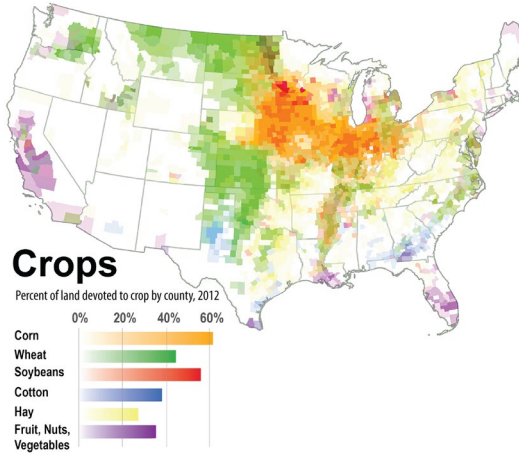
National scale analysis of manuresheds – disconnect in nutrient demand areas and manure sources

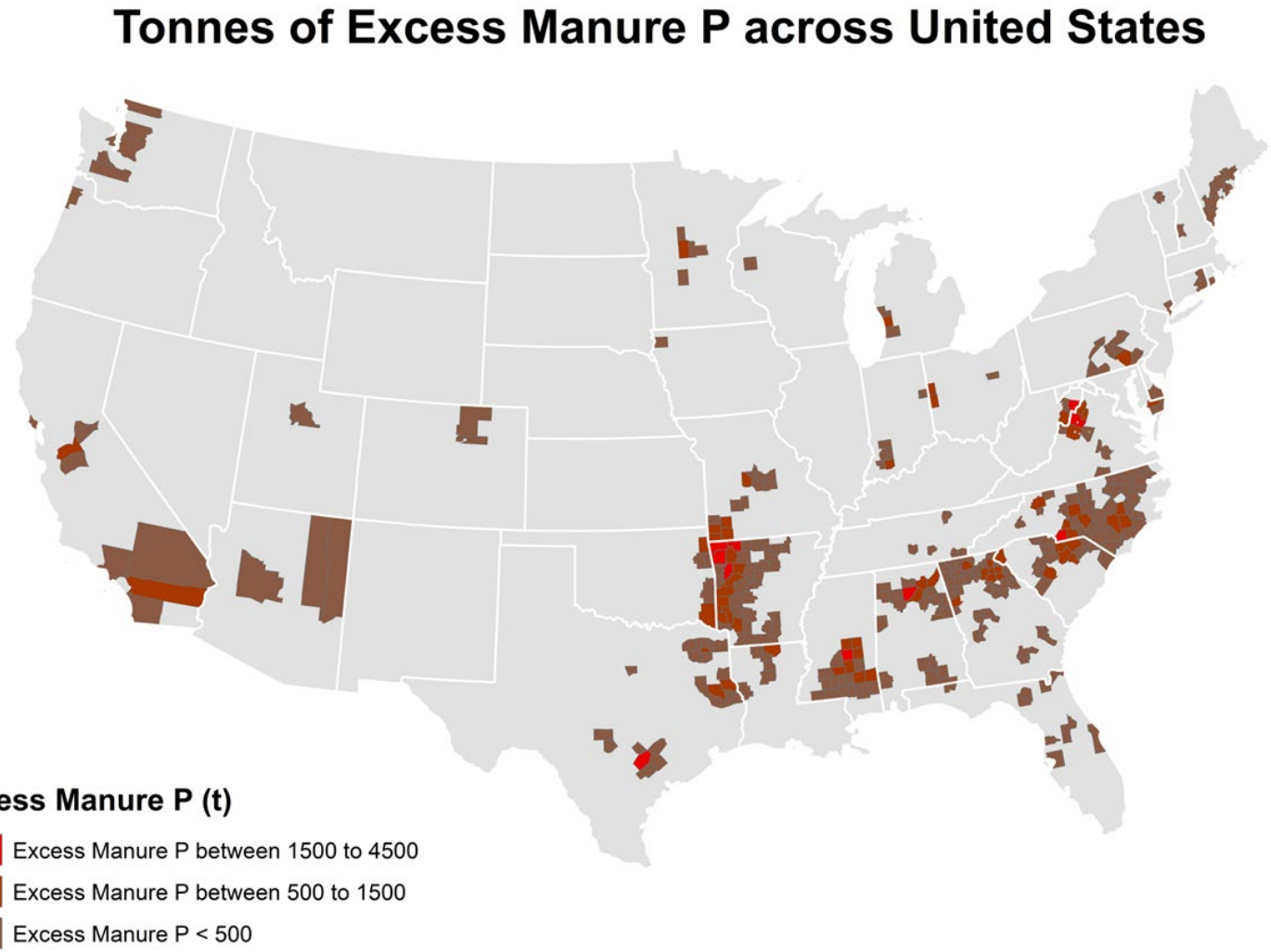


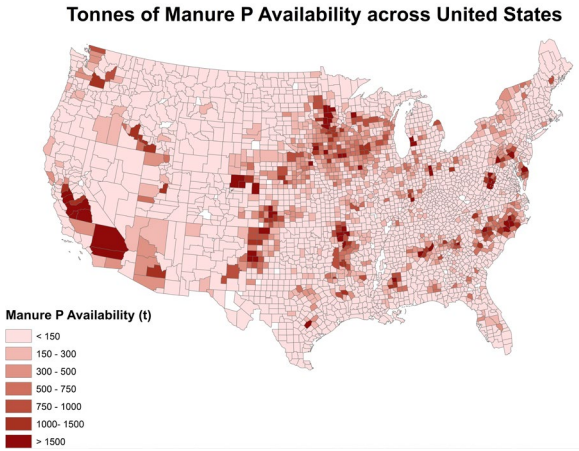


Manure phosphorus

National scale analysis of manuresheds – disconnect in nutrient demand areas and manure sources

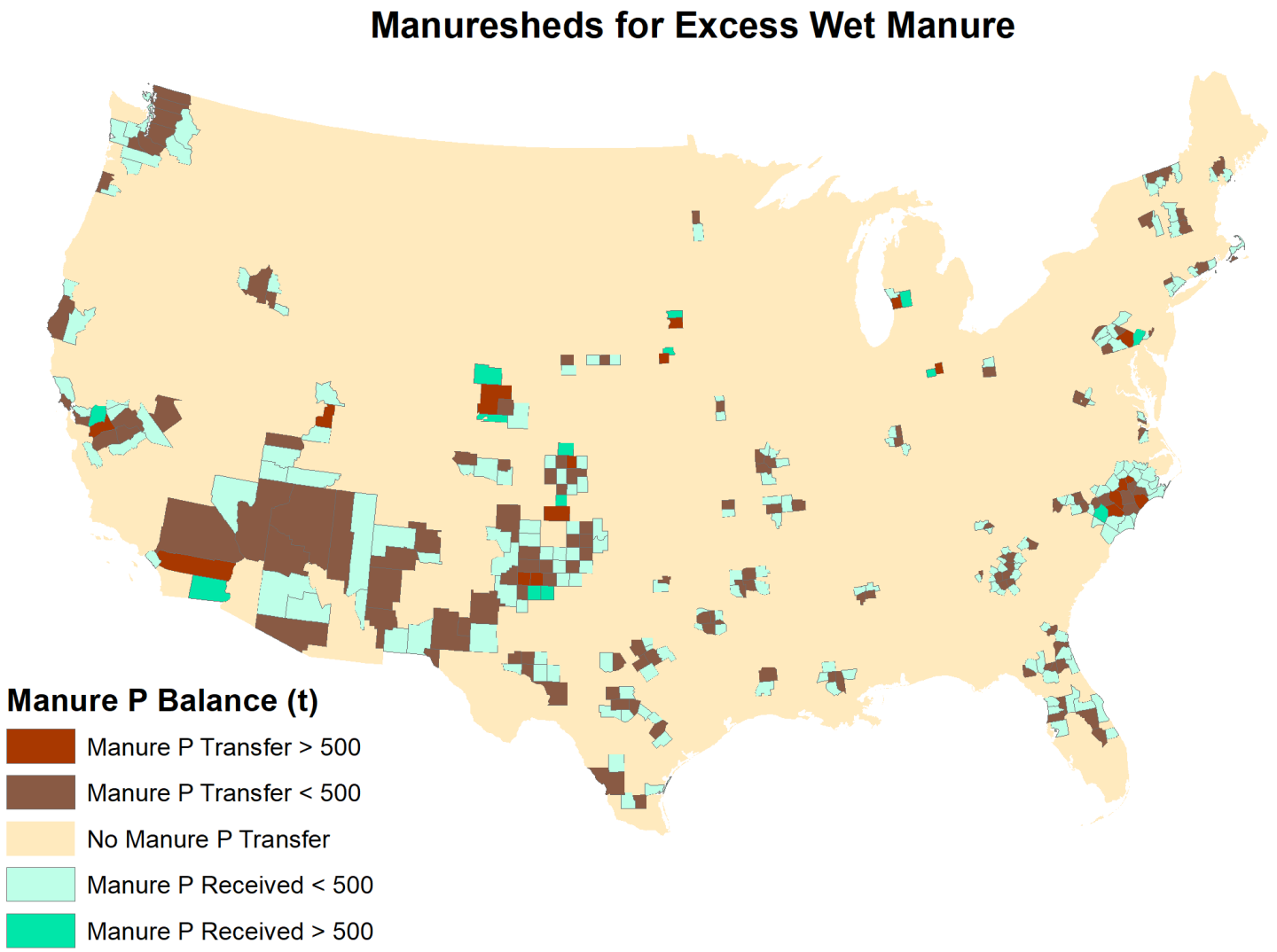






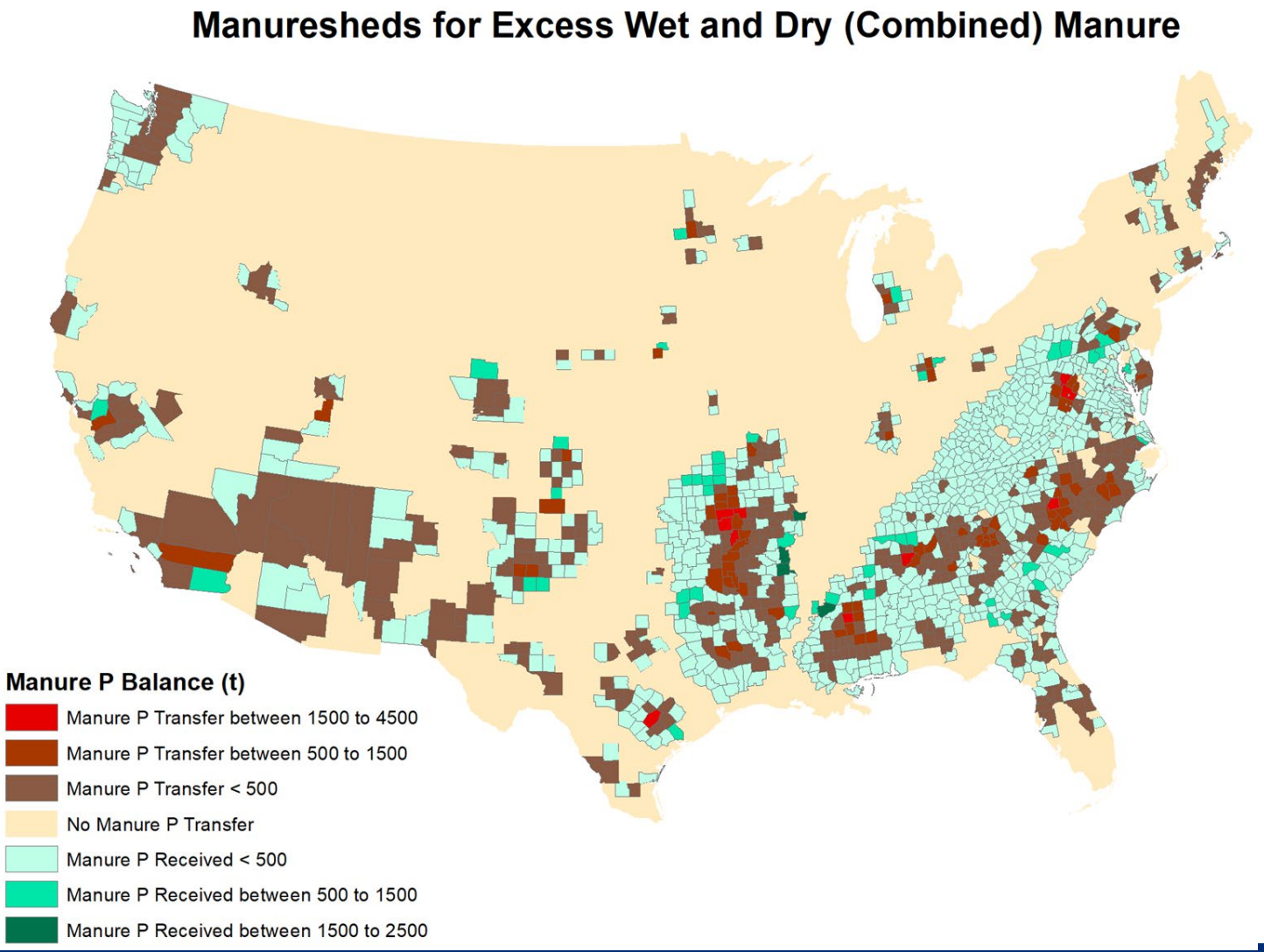
Manure phosphorus

Wet manure (beef, dairy, and hog) is difficult to transport



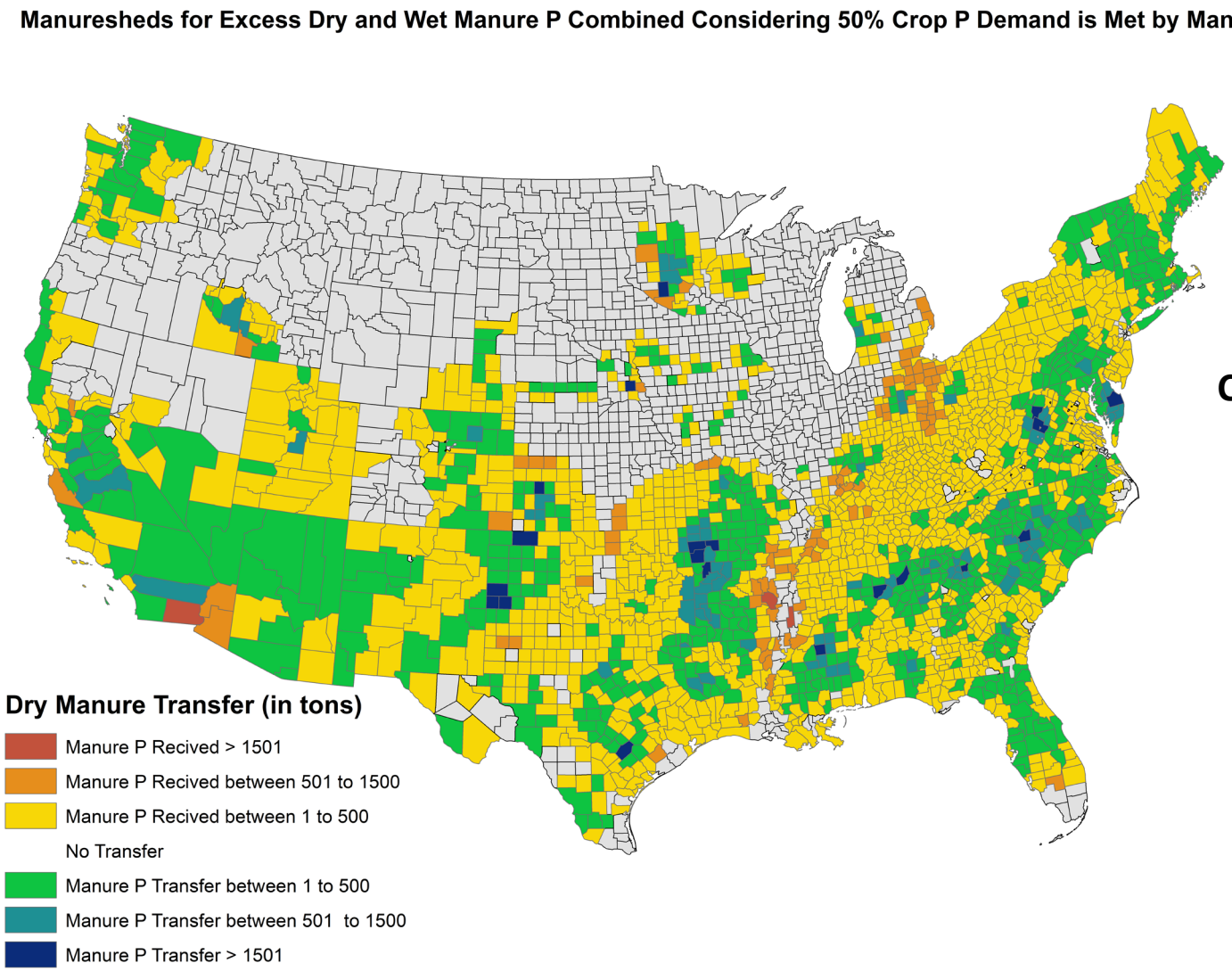
Crop P Demand based

Wet (beef, dairy, and hog) and Dry (Poultry) manureshed



Crop phosphorus Demand based

50% of the farms adopt manure application



Crop phosphorus Demand based

Take-Aways

- Manure transport scenarios were more effective in improving the water quality of streams in livestock-intensive regions
- Crop phosphorus demand-based manure application, manure injection, and weather-based manure application improves water quality
- More precise and consistent **data** will improve analysis!

craj@psu.edu