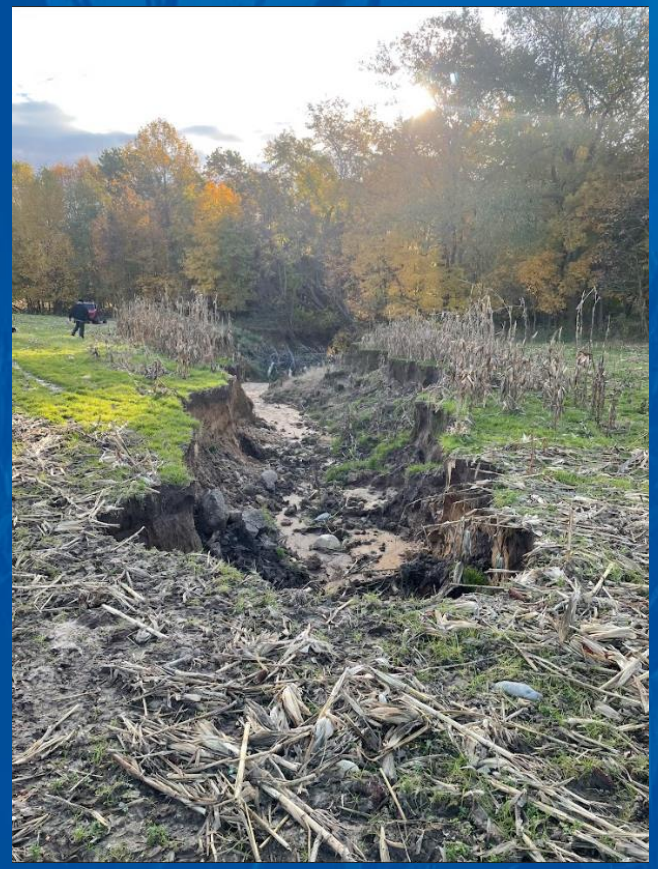
Stacking Conservation Practices to Improve Water Quality



Van Buren Conservation District
Colleen Forestieri, Senior Conservation Specialist

A little about Van Buren Conservation District

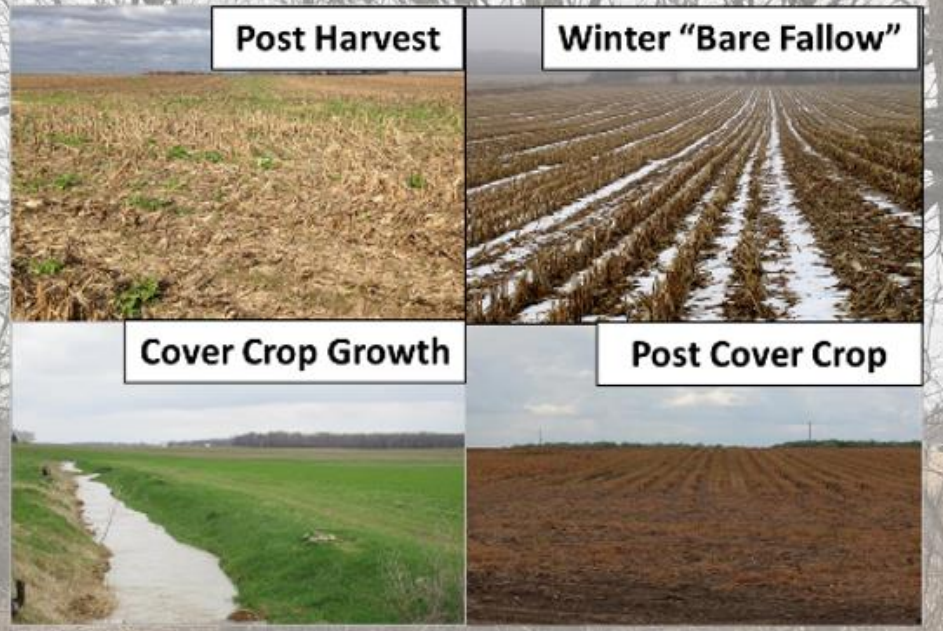

Antimicrobial Resistance
EXIT

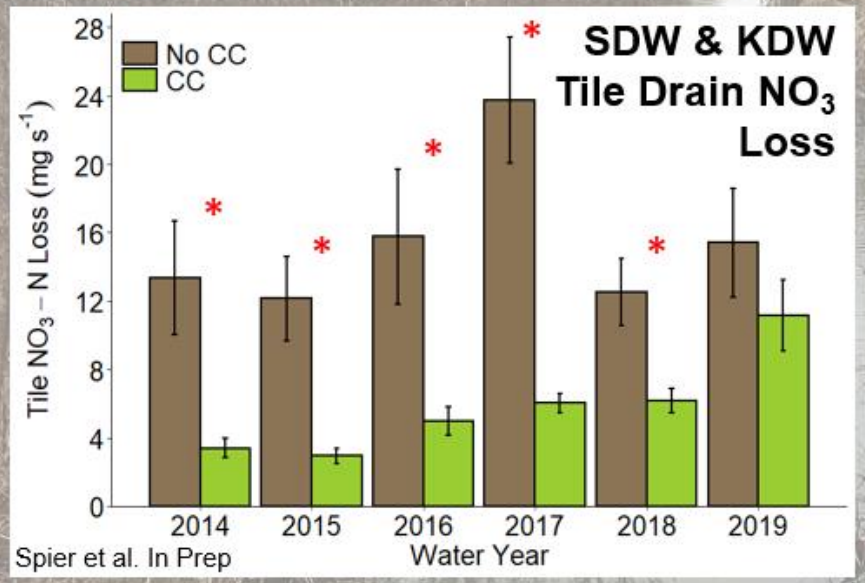
What have we been up to lately?

UNIVERSITY OF NOTRE DAME

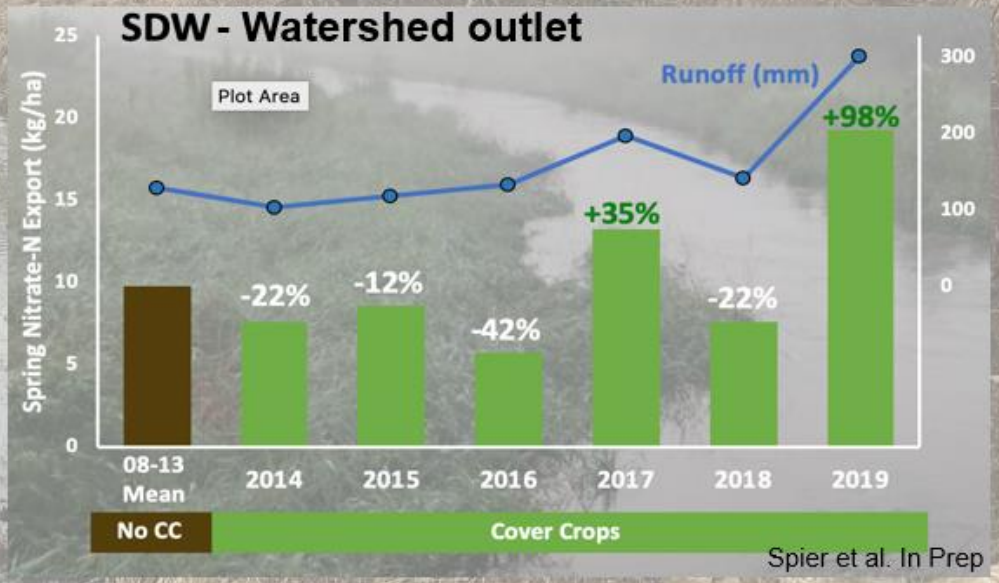
Cover Crops to Reduce Nutrient Runoff

- **Winter cover crops mitigate nutrient losses from agricultural landscapes to adjacent freshwaters**

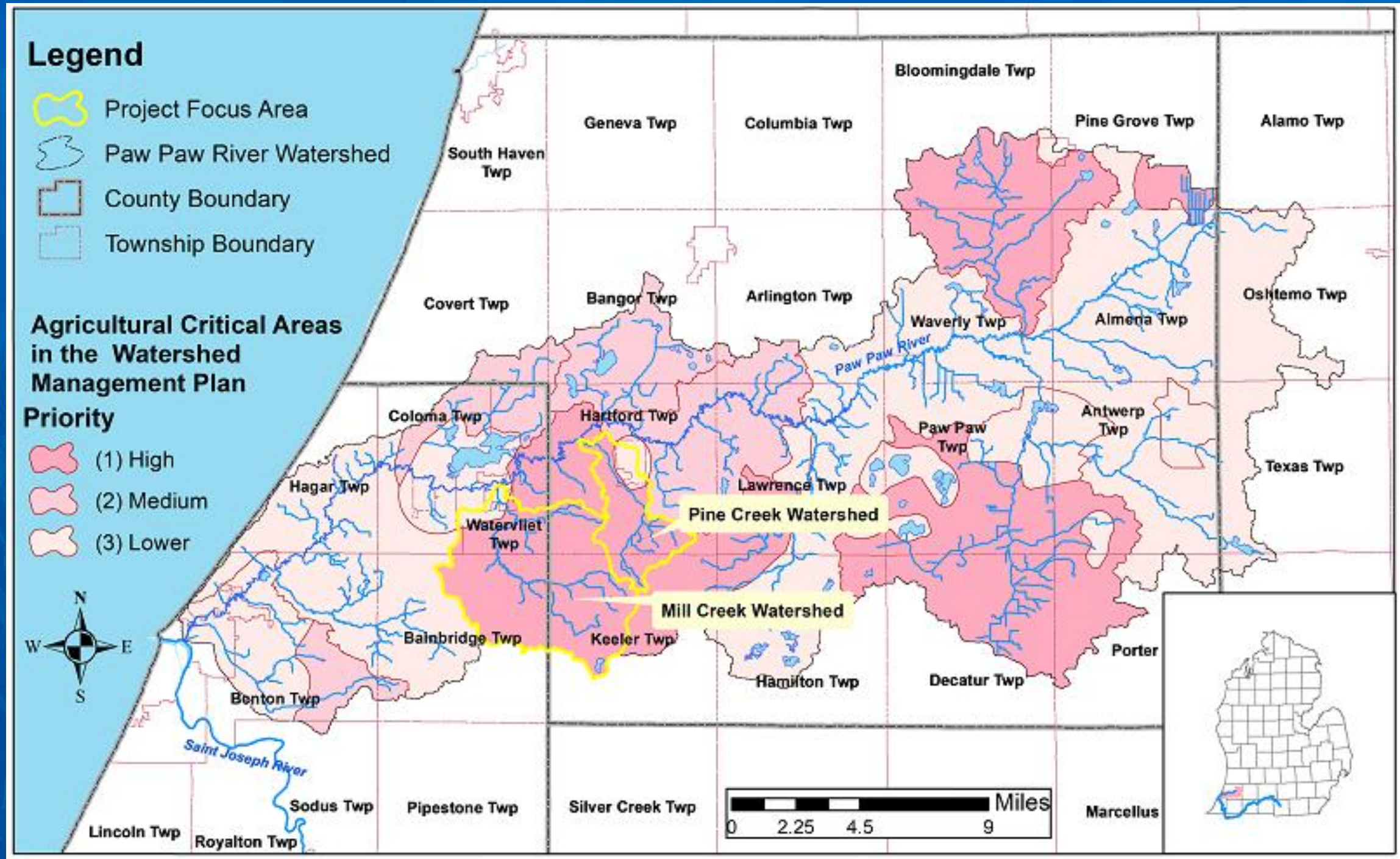


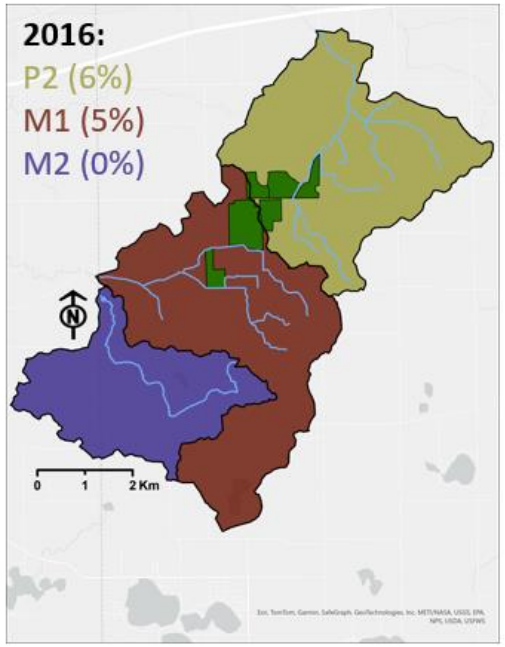


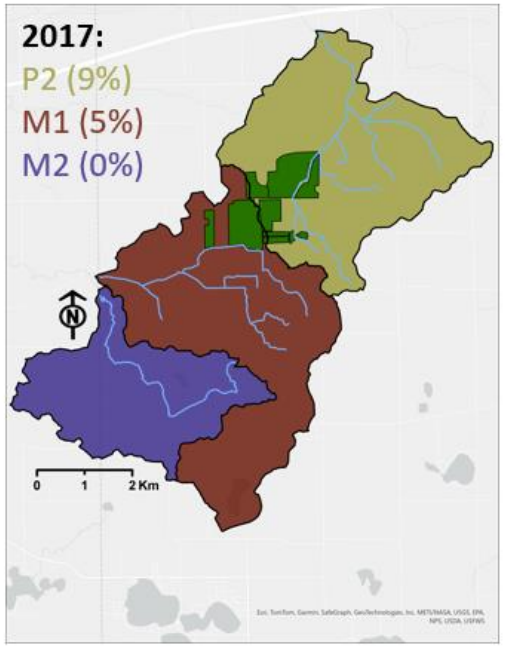
Spier et al. In Prep



Spier et al. In Prep


Legend
Project Focus Area
Paw Paw River Watershed
County Boundary
Township Boundary
Agricultural Critical Areas in the Watershed Management Plan
Priority
(1) High
(2) Medium
(3) Lower
N
W
E
S
Bloomingdale Twp
Geneva Twp
Columbia Twp
Pine Grove Twp
Alamo Twp
South Haven Twp
Covert Twp
Bangor Twp
Arlington Twp
Waverly Twp
Almena Twp
Oshtemo Twp
Paw Paw River
Coloma Twp
Hartford Twp
Paw Paw Twp
Antwerp Twp
Texas Twp
Hagar Twp
Lawrence Twp
Pine Creek Watershed
Watervliet Twp
Mill Creek Watershed
Bainbridge Twp
Keeler Twp
Porter
Hamilton Twp
Decatur Twp
Benton Twp
Saint Joseph River
Sodus Twp
Pipestone Twp
Silver Creek Twp
Marcellus
Lincoln Twp
Royalton Twp
Miles
0
2.25
4.5
9


2016:
P2 (6%)
M1 (5%)
M2 (0%)
0 1 2 Km


2017:
P2 (9%)
M1 (5%)
M2 (0%)
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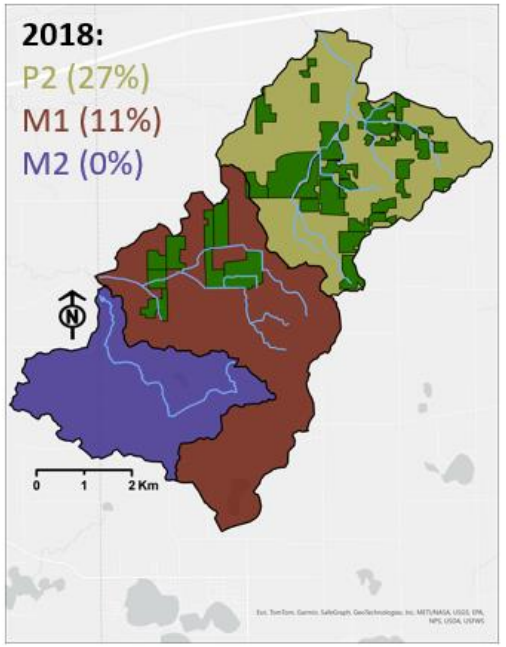
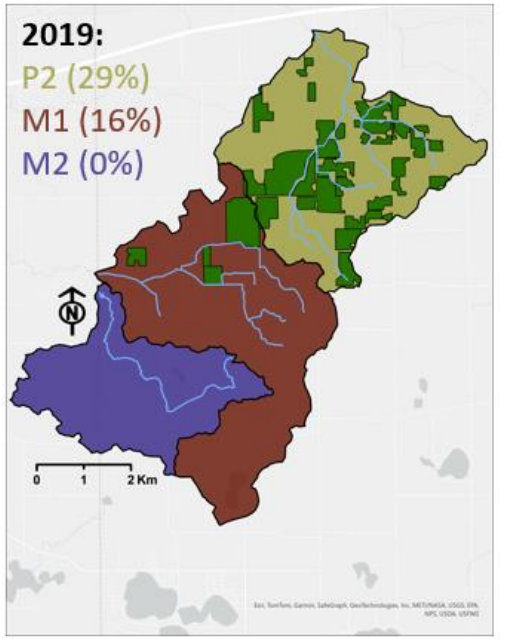
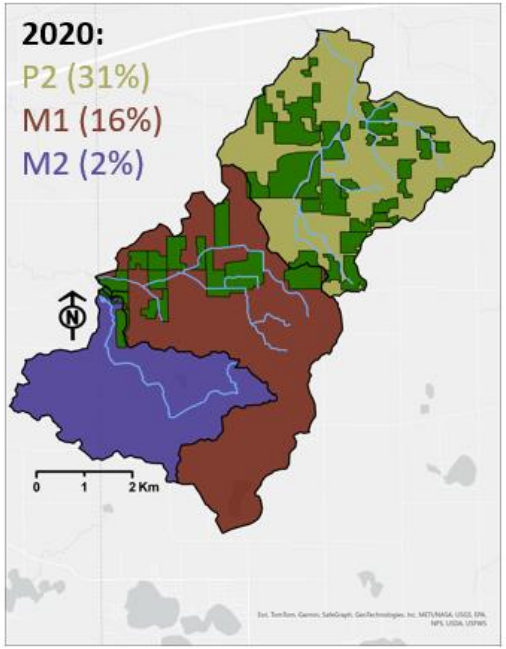
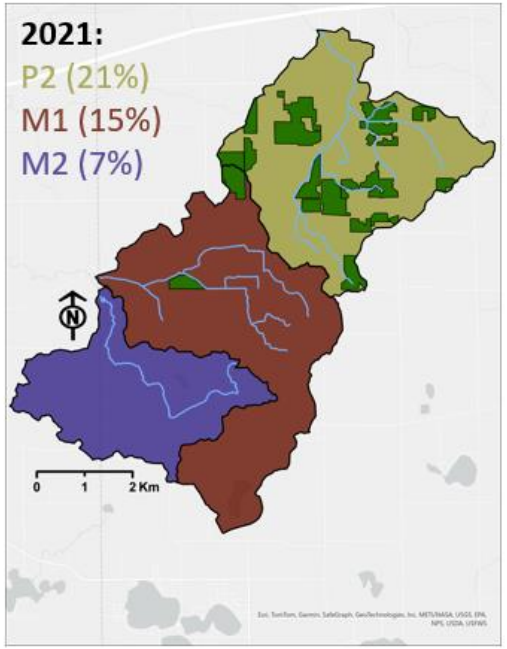
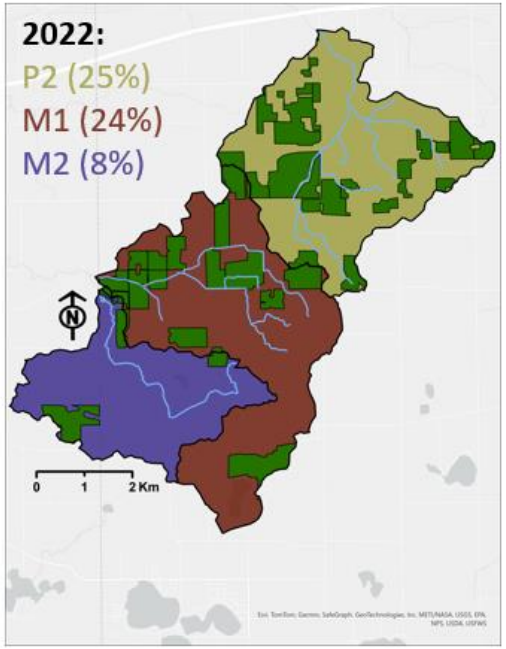
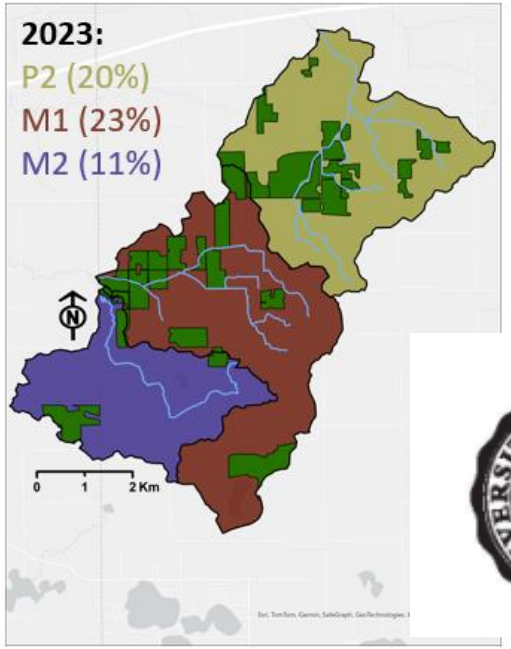

2018:
P2 (27%)
M1 (11%)
M2 (0%)
0 1 2 Km


2019:
P2 (29%)
M1 (16%)
M2 (0%)
0 1 2 Km


2020:
P2 (31%)
M1 (16%)
M2 (2%)
0 1 2 Km


2021:
P2 (21%)
M1 (15%)
M2 (7%)
0 1 2 Km


2022:
P2 (25%)
M1 (24%)
M2 (8%)
0 1 2 Km


2023:
P2 (20%)
M1 (23%)
M2 (11%)
0 1 2 Km

Cover Crops are Effective at Retaining Nitrate and SRP

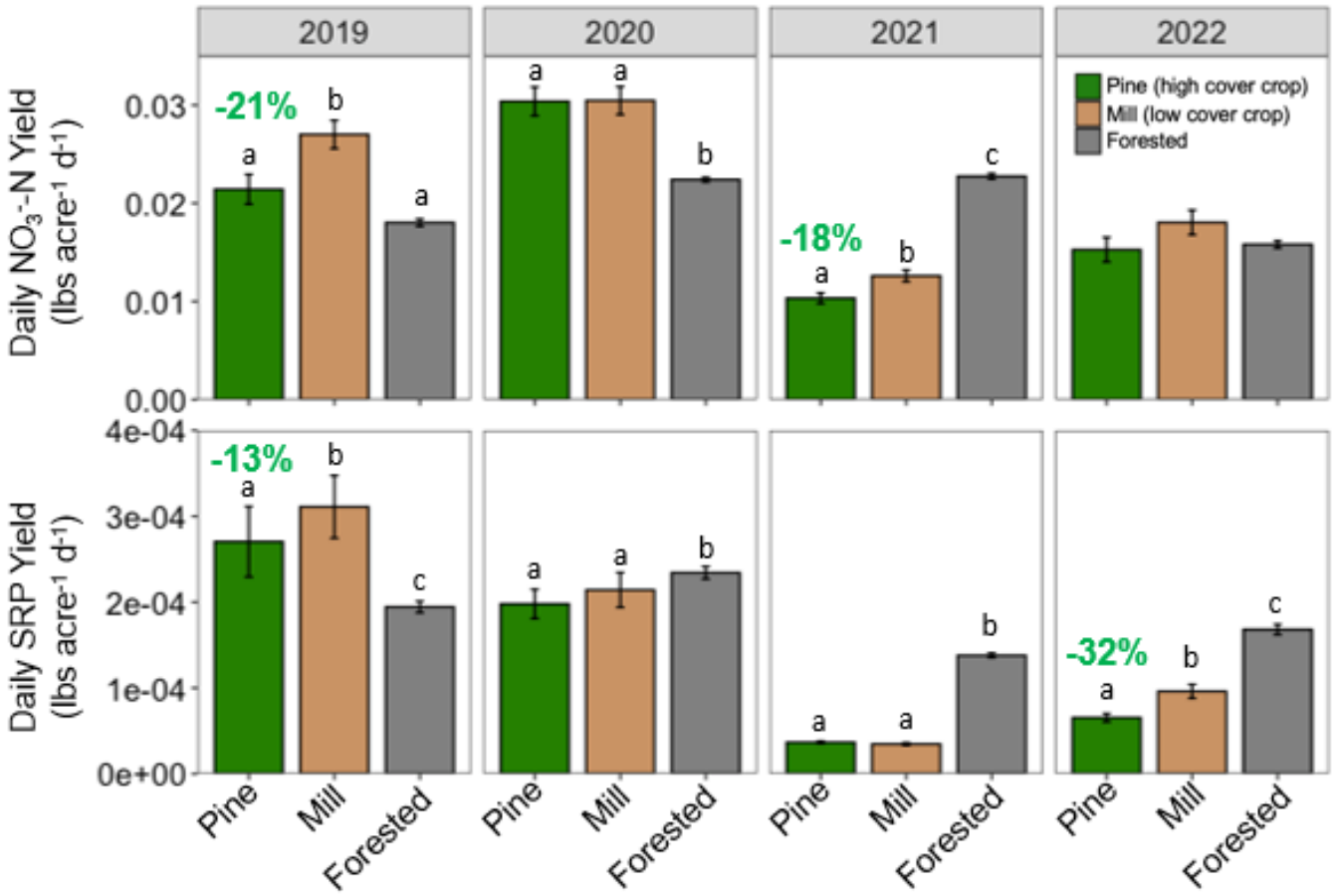
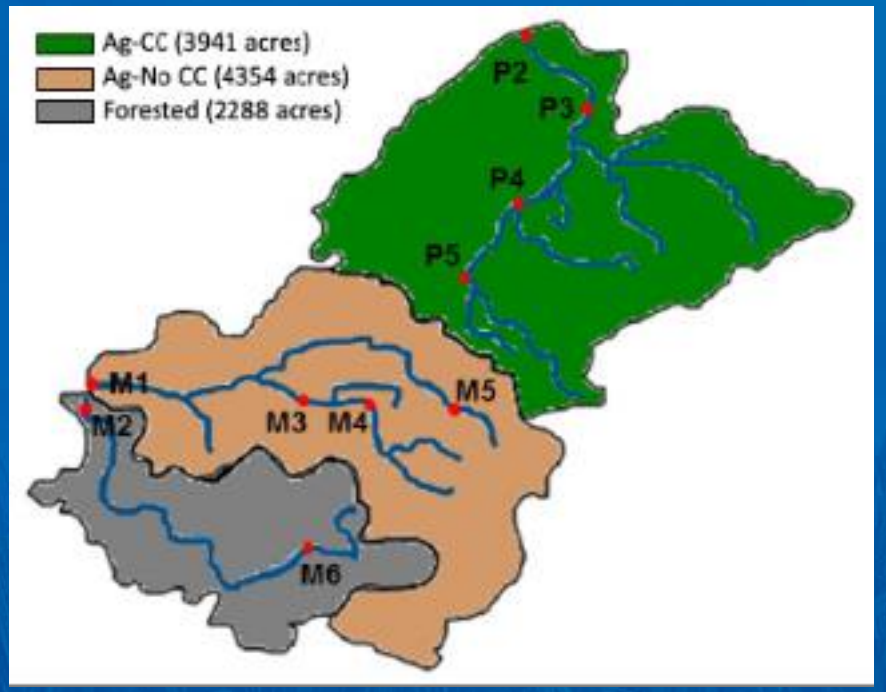


Figure 2. Nitrate-N (top) and SRP (bottom) daily yields (in lbs acre^{-1} d^{-1}) from three watersheds of contrasting land use during the fallow (post harvest) season. Letters indicate significant differences across land-use types from Tukey's post-hoc test ($p<0.05$). Percentages in green note the significant reduction from the high cover crop (Pine) subwatershed relative to the low cover crop (Mill) subwatershed.

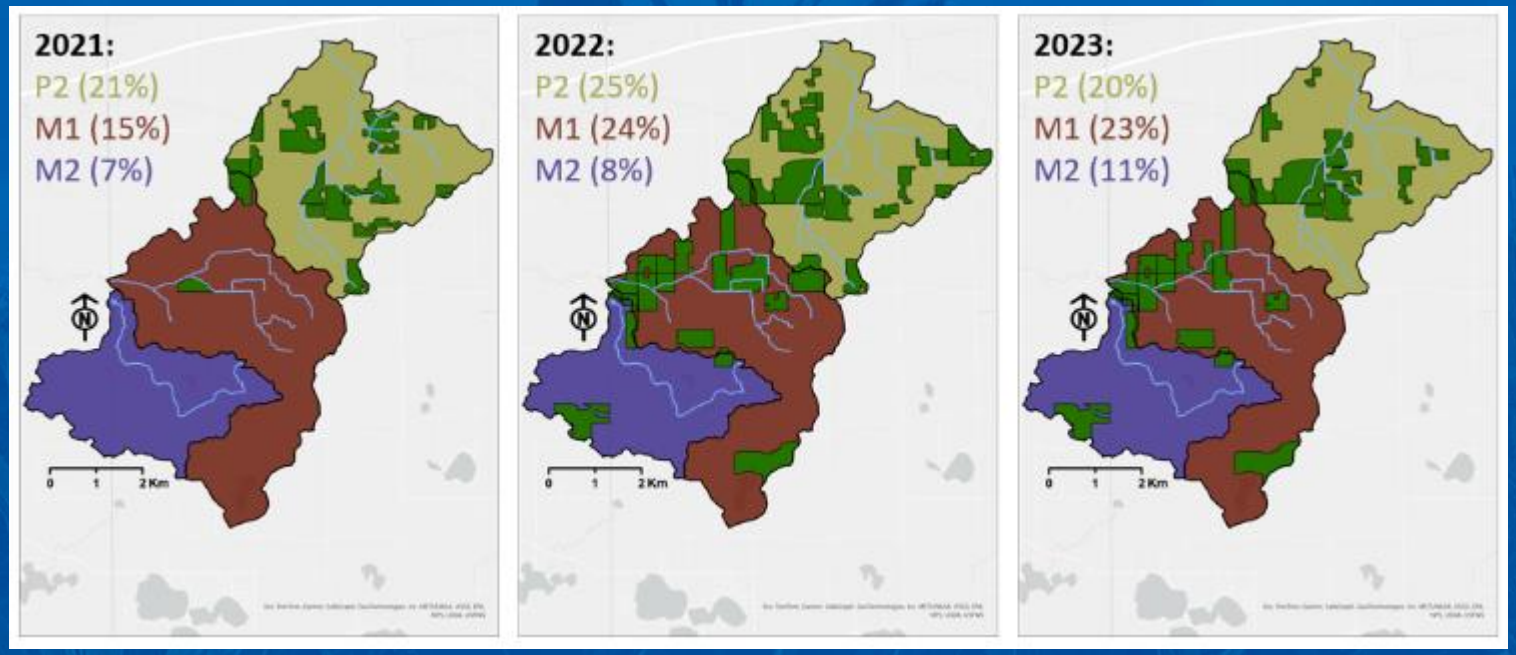


	Nitrate - % Reduction in Pine Creek	SRP - % Reduction in Pine Creek
2019	-21%	-13%
2020	-0.3%	-8%
2021	-18%	+6%
2022	-15%	-32%

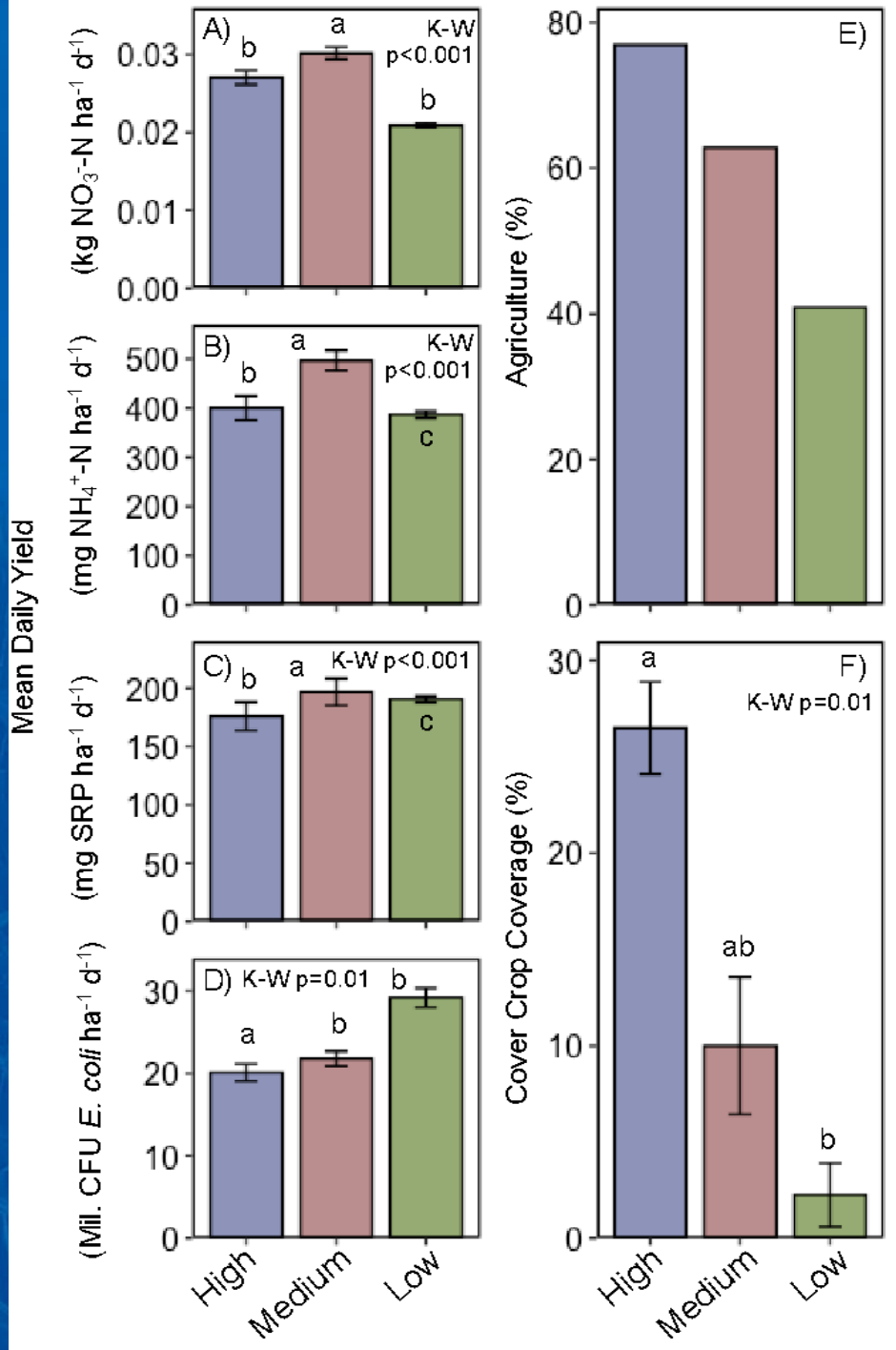
	Nitrate - % Reduction in Pine Creek	SRP - % Reduction in Pine Creek
2019	-21%	-13%
2020	-0.3%	-8%
2021	-18%	+6%
2022	-15%	-32%

- Cover crops can reduce nutrient runoff during the fallow period
- Due to variability in precipitation, flow, and the use of mixed agricultural practices each year, results can vary from year to year.
- These are mostly storm- driven runoff event

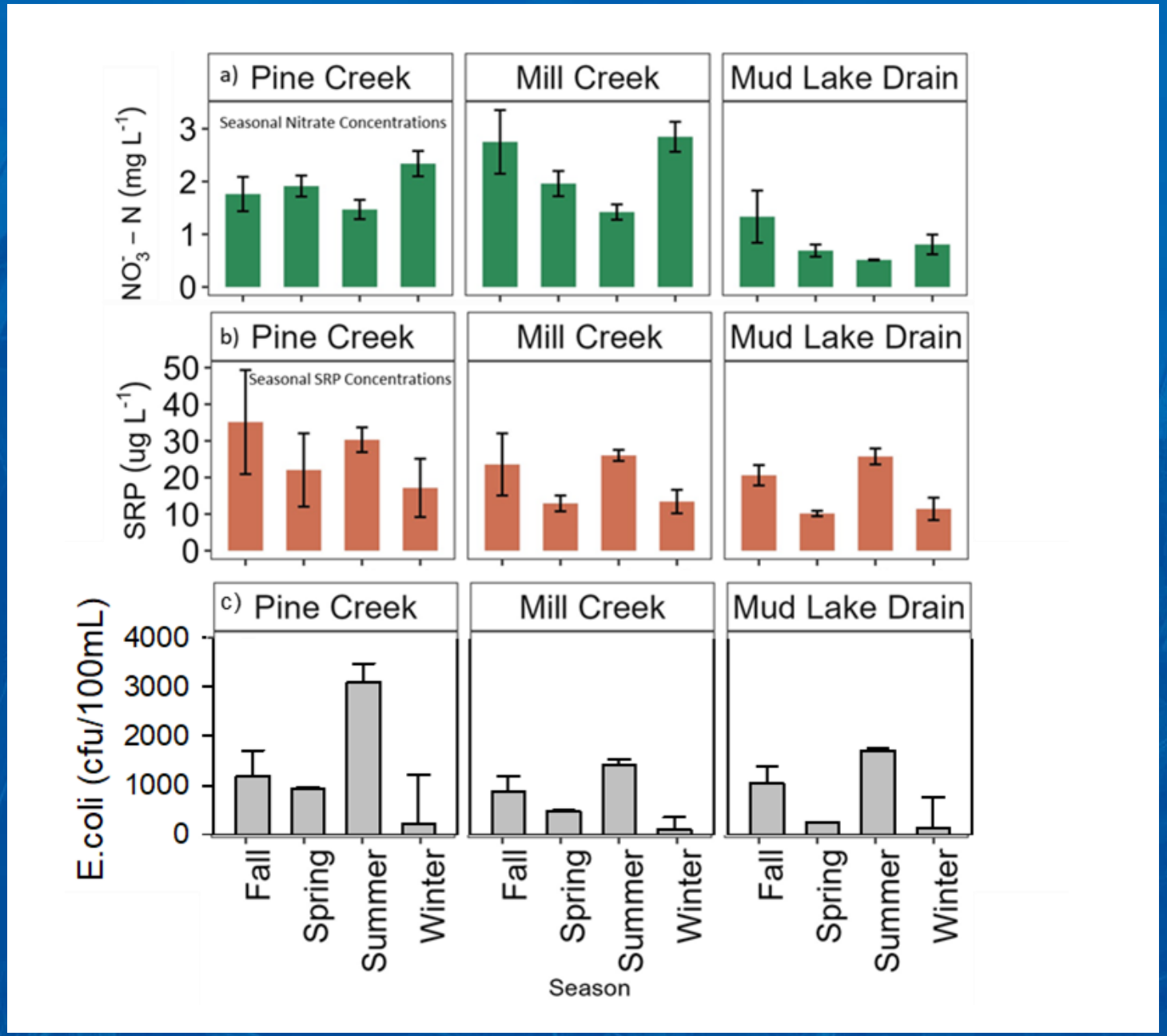
We complicated everything by adding more cover crops to Mill Creek



High - Pine Creek
Medium - Mill Creek Ag
Low- Mill Creek Wooded



- Results from our Pine and Mill Creek stream sampling (which began in 2018) suggest that cover crops can reduce nitrate and soluble reactive phosphorus export at the watershed-scale, however, the efficacy of this practice can vary from year-to-year (Vincent et al. in prep).
- Stream sampling for our current EGLE project shows that stream nitrate-N, SRP and E. coli concentrations varied seasonally and among watersheds.
- SRP was lower for Mud Lake Drain compared to Pine and Mill Creek, likely due to differences in land use and management among the watersheds



Panel shows the average seasonal concentrations for NO_3^-–N **(a)**, SRP **(b)**, and E. coli **(c)** (+/-SE) for three watershed outlets.

Drainage Water Management

Van Buren Conservation District

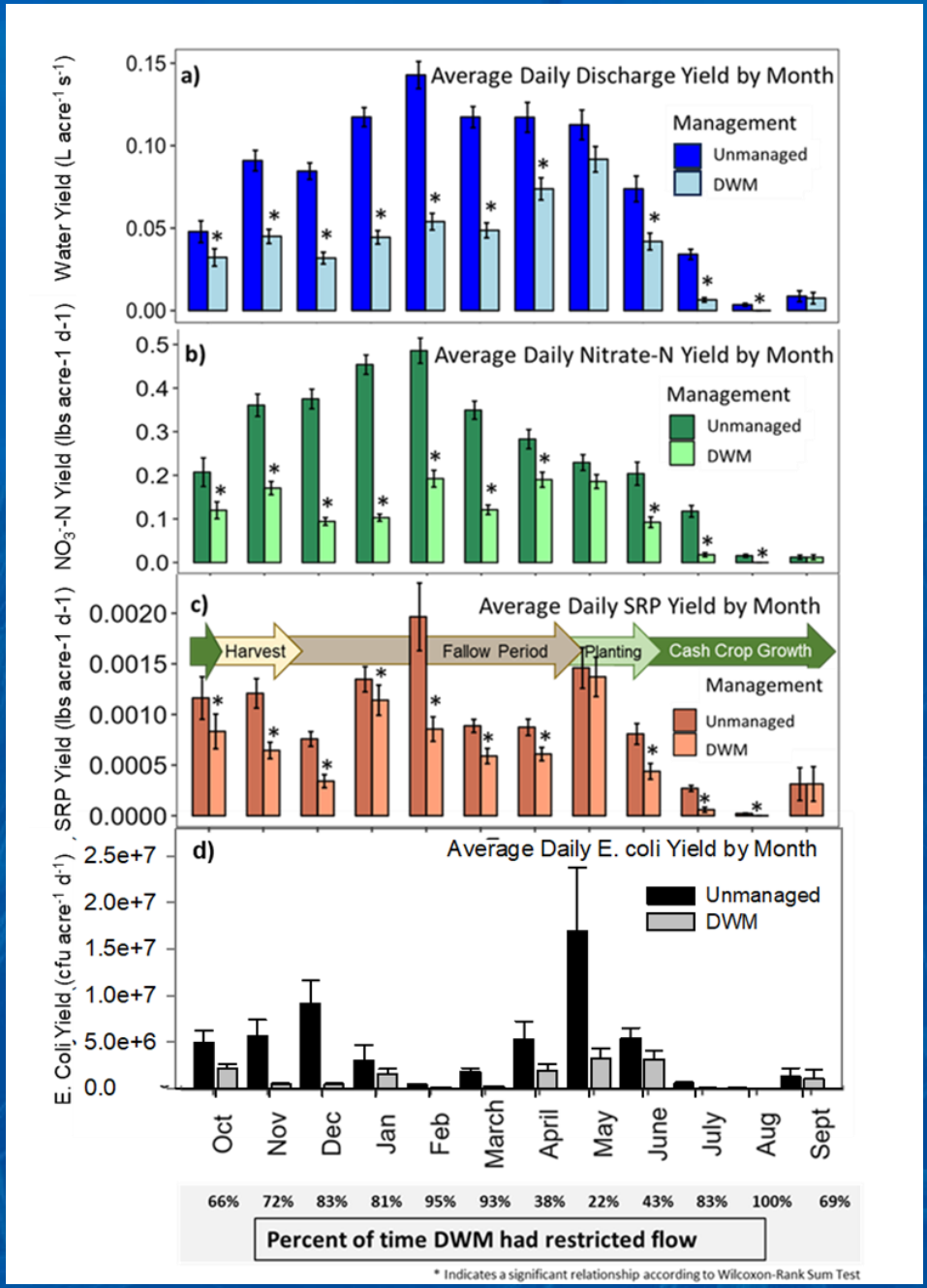
Celebrating 80 Years

DWM Main Objectives

Improve water quality

Improve the soil environment for vegetative growth

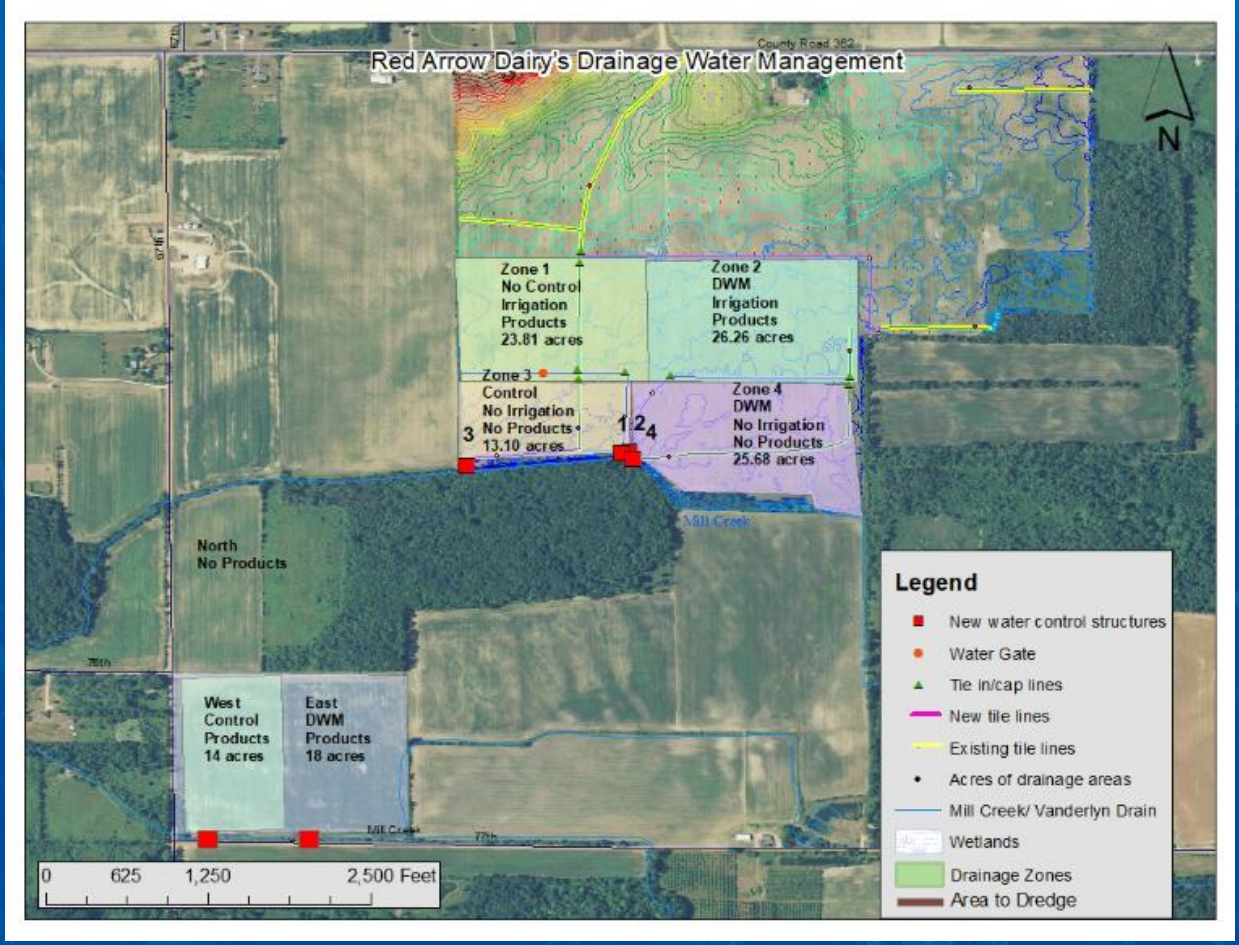
Increased yields

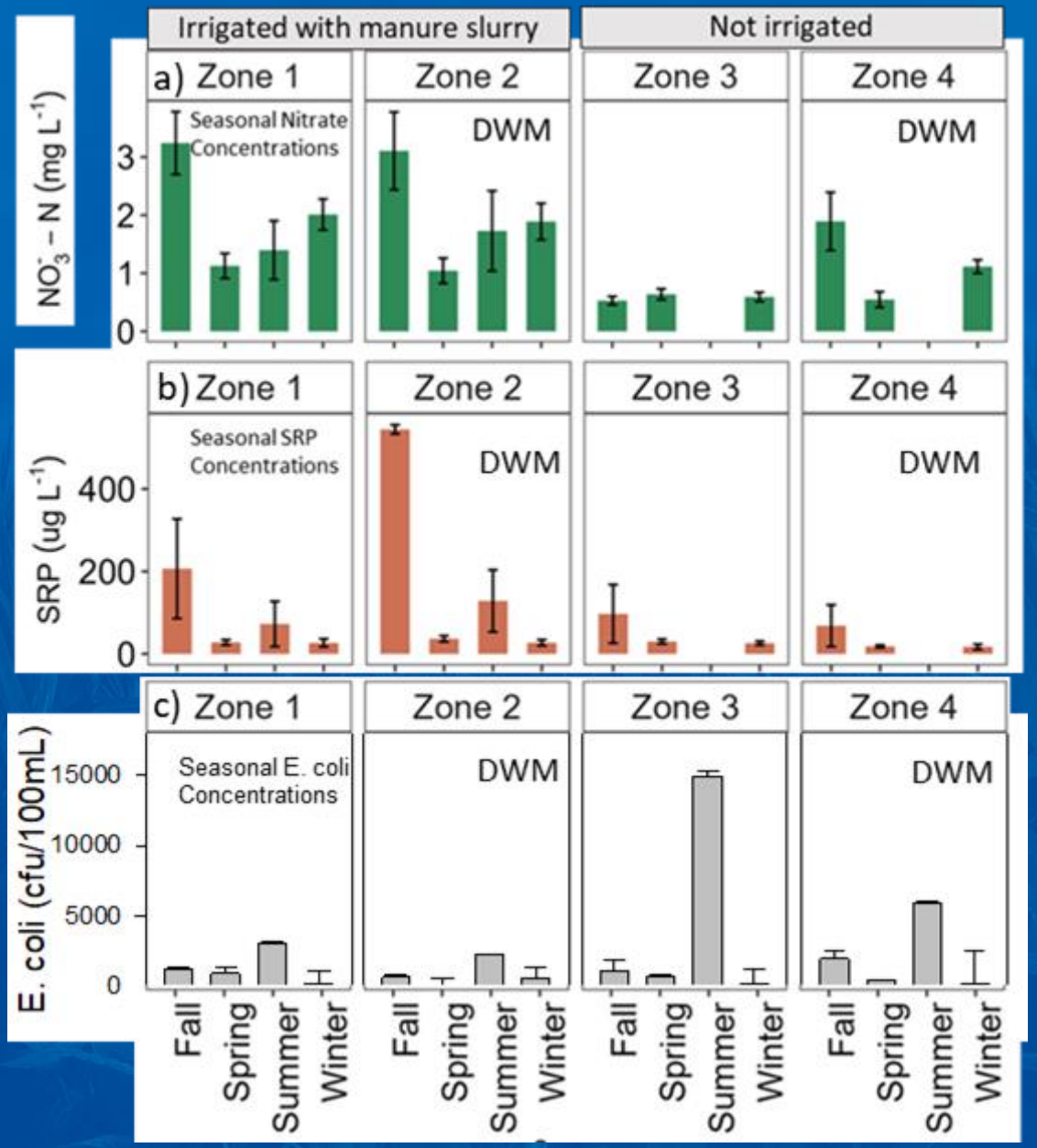


DWM Reduces Flow = Reduces Nutrient Loss

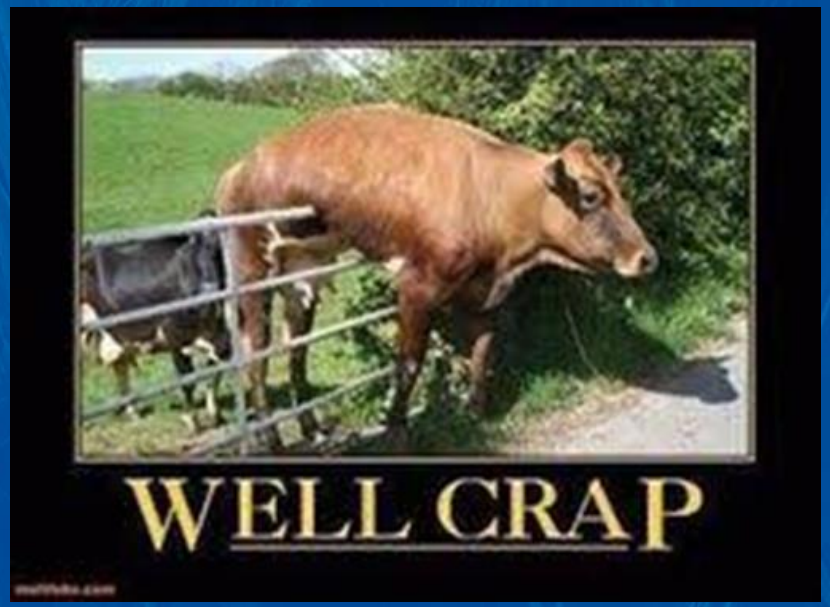
- Restricting flow reduced nitrate-N losses by 35-85%, phosphorus losses by 15-78%, and E. coli export by 19-95%
- On average, this reduction equated to 54 lbs of nitrate-N acre-1 year-1 and 0.11 lbs of SRP acre-1 year-1.
- Compared to freely flowing unmanaged drains, periodically restricting flow from DWM drains reduced average monthly yields for NO_3^--N **(b),** SRP **(c)**, and E. coli (**d**) (+/- SE).

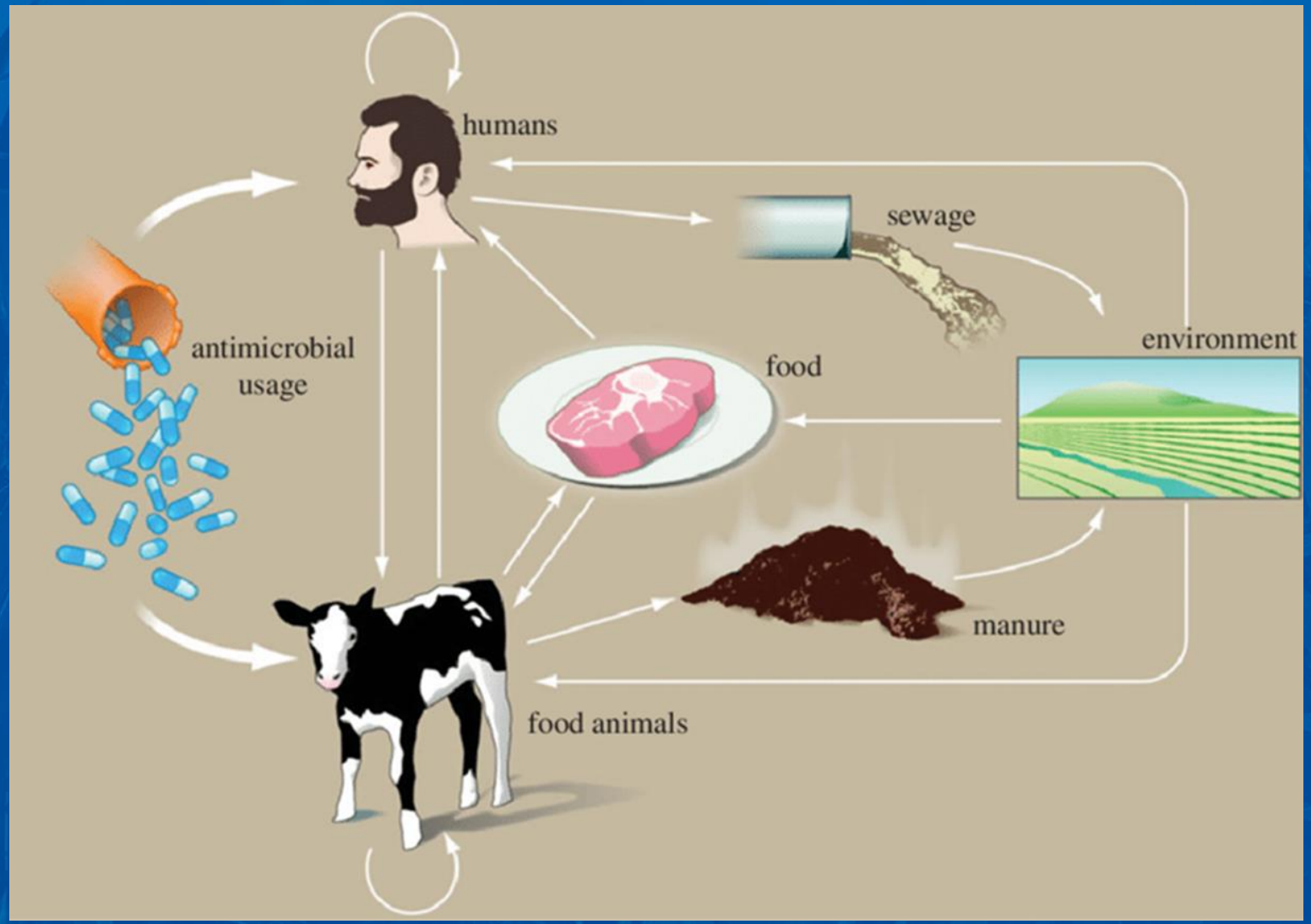
While we have not yet detected obvious effects of DWM on nutrient concentrations and E. coli in tile outflow from this field, we do see higher nutrient concentrations in tiles draining the zones that are irrigated with manure slurry from a biodigester



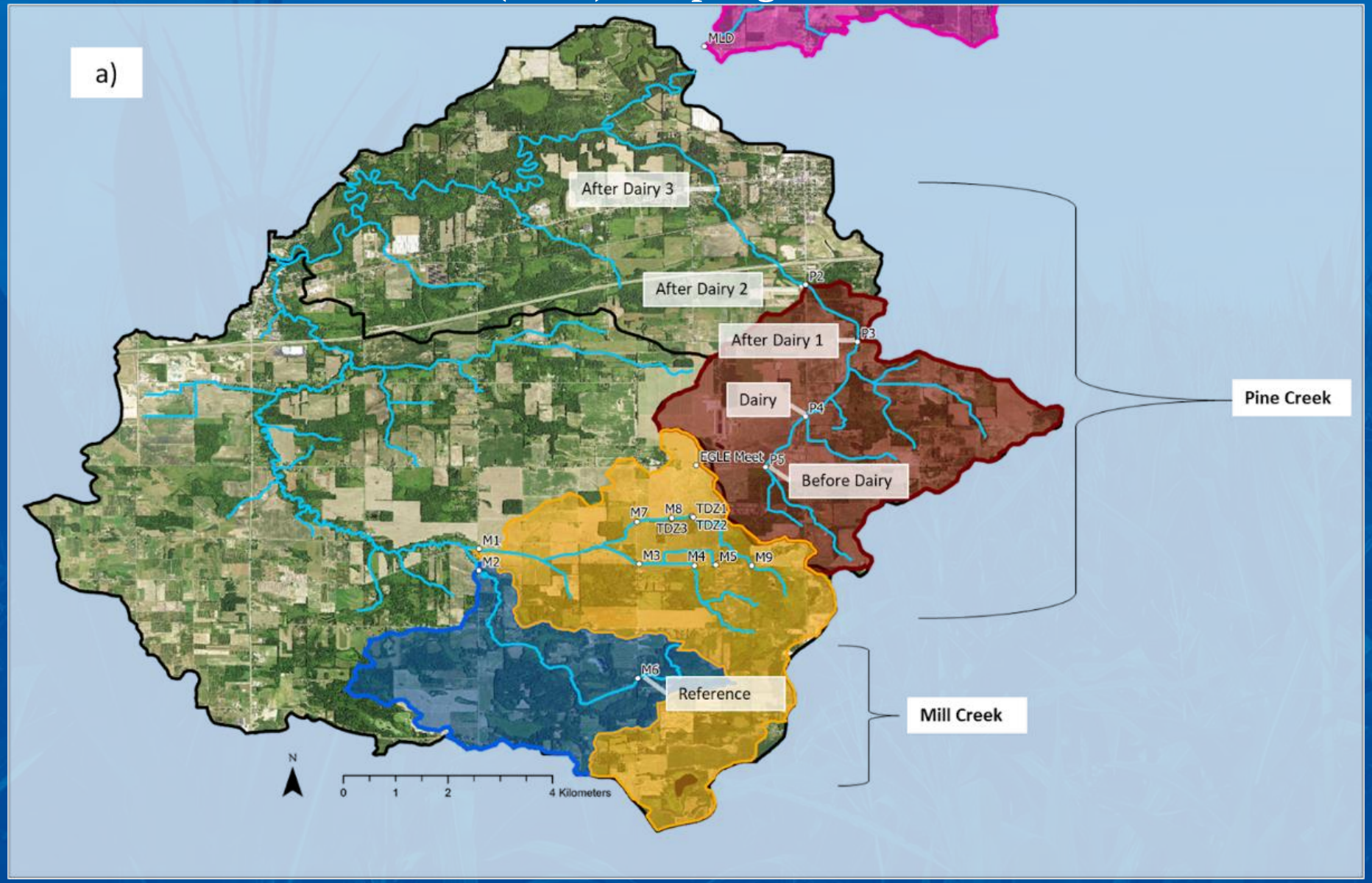


Antimicrobial Resistance

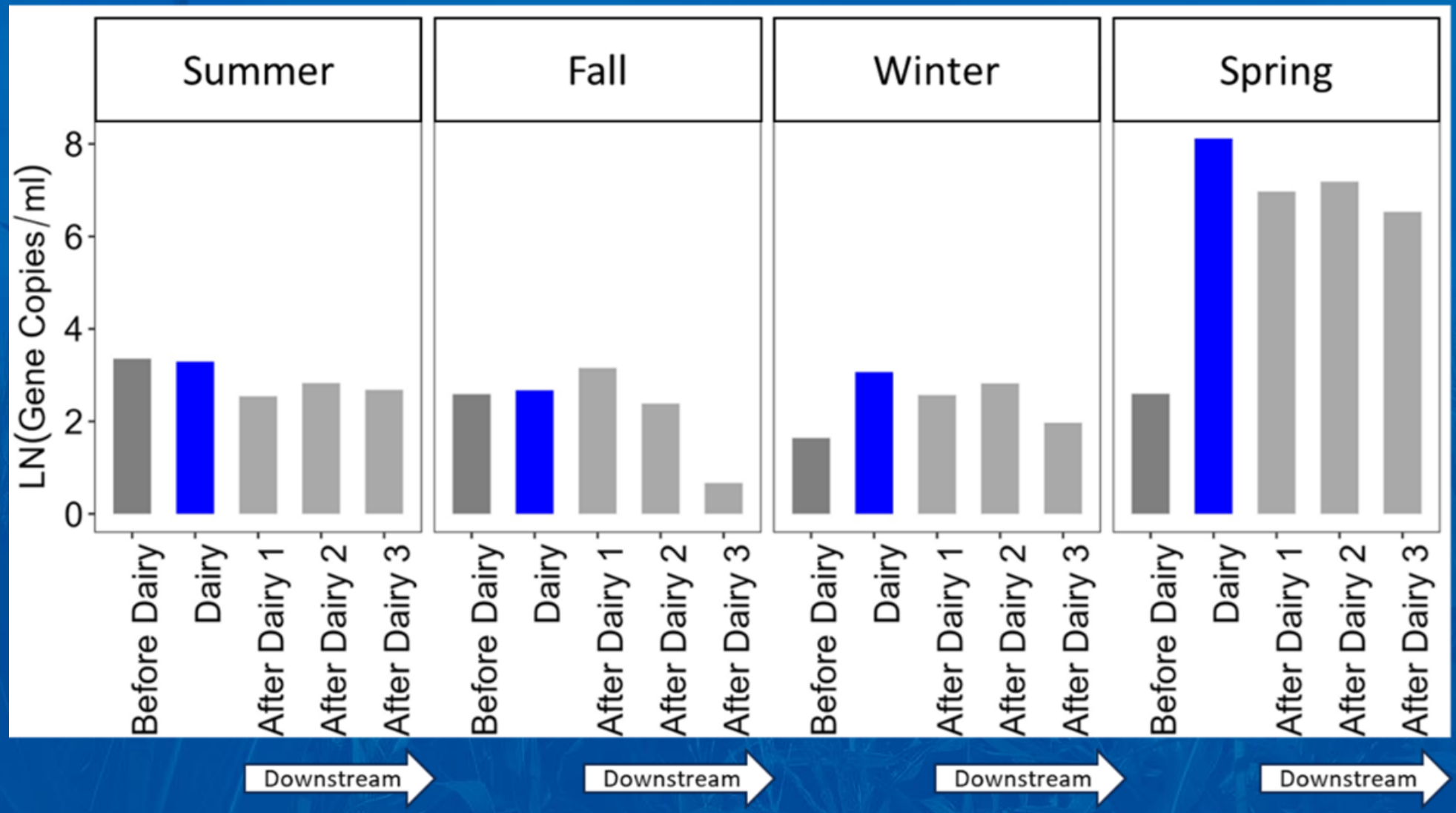




Antimicrobial Resistance Gene (ARG) Sampling Sites in the Pine Creek Watershed



Preliminary analyses show that antimicrobial resistance genes (ARGs) are present throughout the watershed and that during some seasons concentrations increase at the site directly below the dairy and decrease at downstream sites



Gene copies of Antibiotic Resistance Gene TetW across four seasons in the Pine Creek Watershed from upstream a dairy operation to downstream sampling locations.

What's next?

Submitted a few grant applications

- Stacking conservation practices to get more water quality benefits
  - Continue work in Pine/Mill Creek with farmers and ND
- Farmer-led meetings
  - having input early on from farmers to guide us when writing grant
  - implementing practices without cost share?

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