Research in Progress on Illinois River Total Phosphorus Loads Rock River Nitrate Loads and

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The results presented below should have not been subjected to peer review and should be considered preliminary and subject to revision.

Phosphorus loads in the Illinois River Basin: 1980s to 2019 (work in progress)

Gregory McIsaac (UIUC- NRES), Momcilo Markus (ISWS), Timothy Hodson (USGS), Rabin Bhattarai (UIUC – ABE), Daniel Kim (UIUC – ABE)

Funding: Illinois Nutrient Research and Education Council (NREC)

& USGS Cooperative Agreement

2015-19

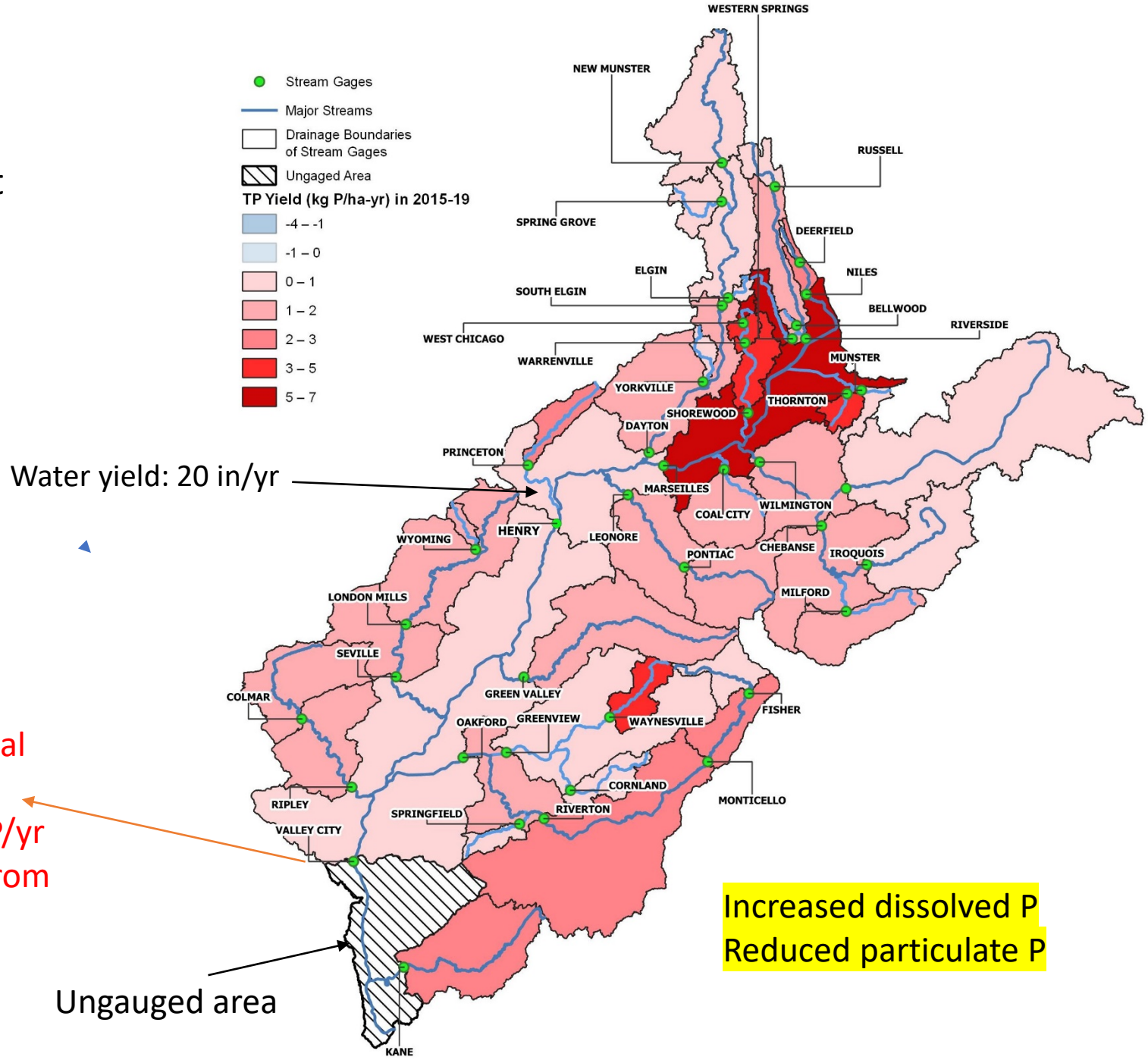
Incremental Total Phosphorus (TP) yields

TP load per area for each watershed segment

1 kg/ha = 0.89 lb/ac

kg P/ha-yr

- -4 – -1
- -1 – 0
- 0 – 1
- 1 – 2
- 2 – 3
- 3 – 5
- 5 – 7



Water yield: 20 in/yr

Valley City annual TP load:
21.2 Million lb P/yr
(30% increase from 1980-96)
Water yield:
15.9 in/yr

Ungauged area

Increased dissolved P
Reduced particulate P

The past: 1989-96

Incremental Total Phosphorus (TP) yields

TP load per unit area for each watershed segment

kg P/ha-yr

-4 – -1

-1 – 0

0 – 1

1 – 2

2 – 3

3 – 5

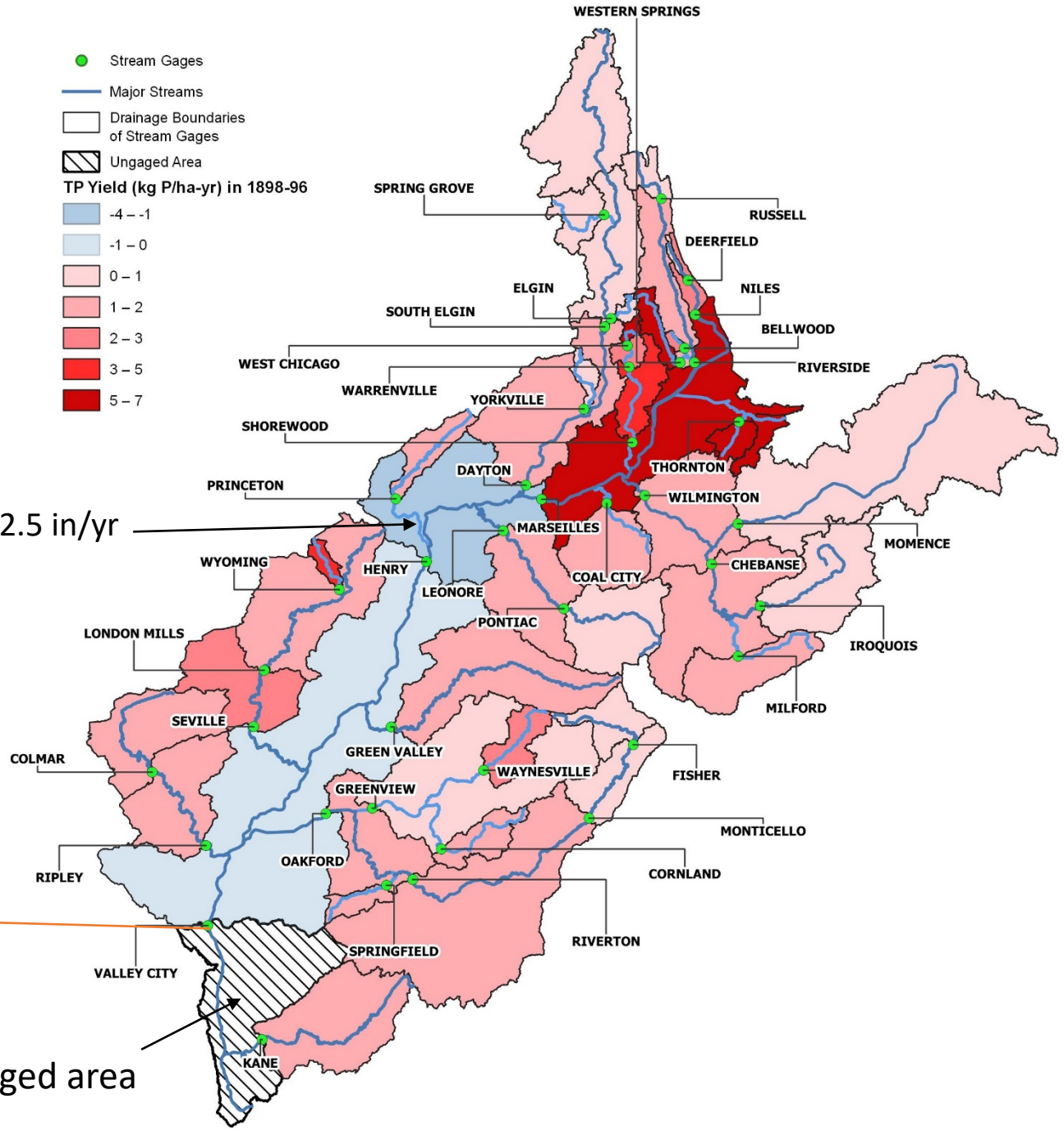
5 – 7

1 kg P/ha = 0.89 lb P/ac

Water yield: 2.5 in/yr

Valley City annual
TP load:
15.2 Million lb P/yr
Water yield:
13.8 in/yr

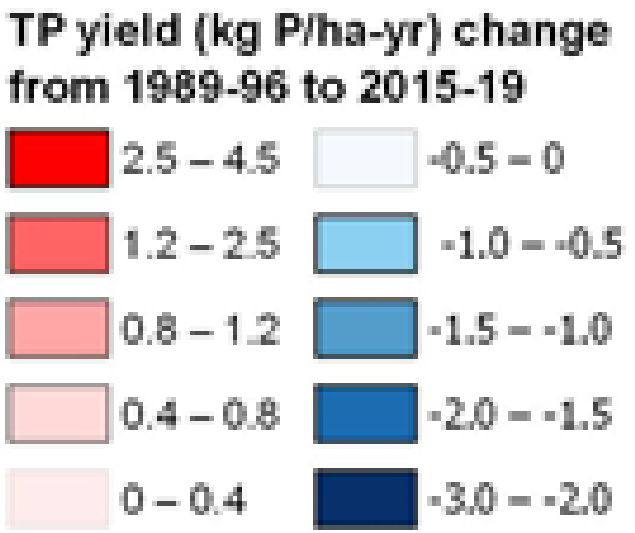
Ungauged area

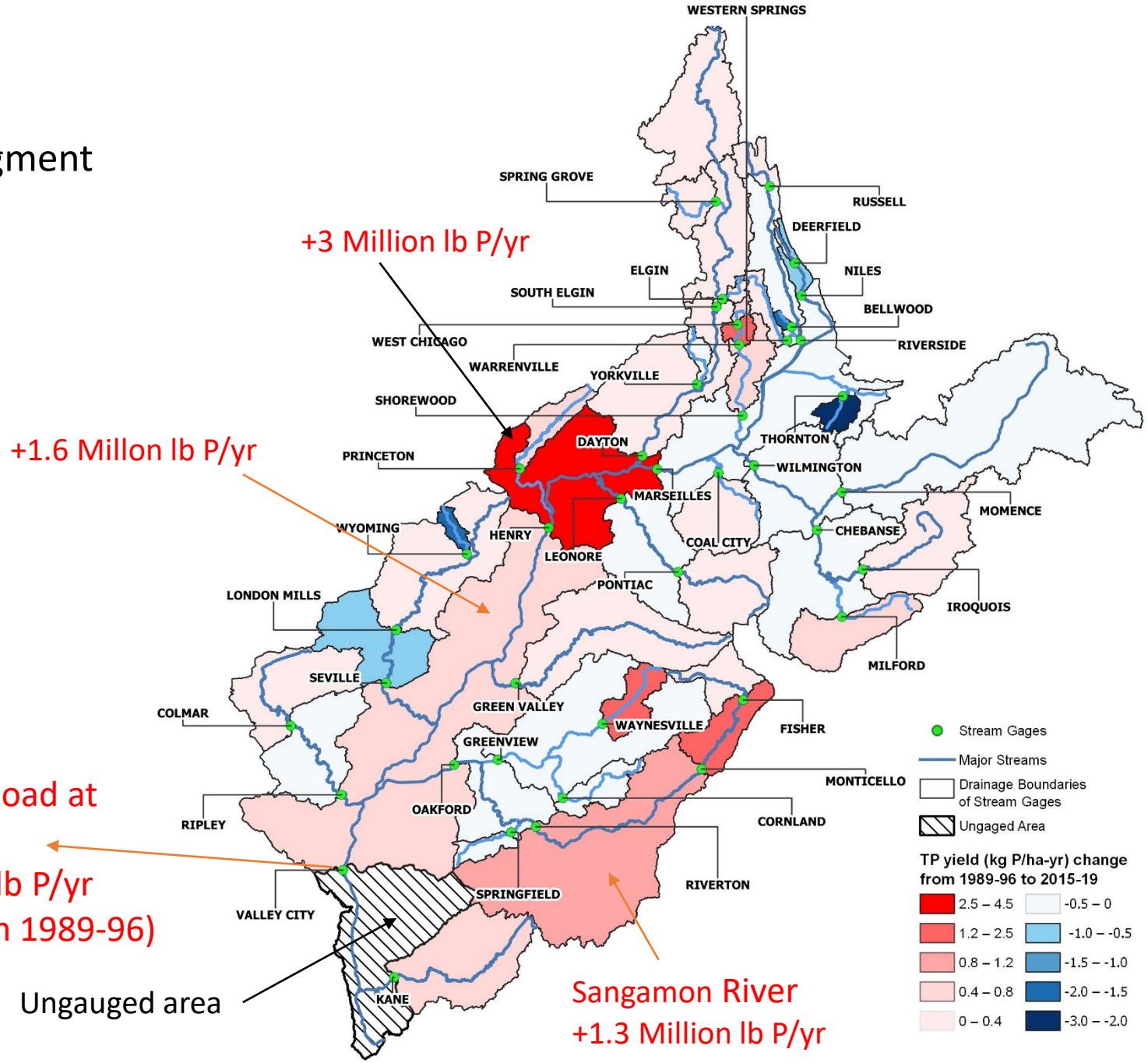


Change from 1989-96 to 2015-19
Incremental Total Phosphorus (TP) yields

TP load per unit area for each watershed segment
kg P/ha-yr

Blue indicates decrease
Red indicates increase





Summary

- In the Illinois River, TP appears to have been accumulating in the flatter sections of during 1989-96. Increased flows and increased dissolved P seem to have reduced TP deposition and increased TP loads downstream of Marseilles. IL River TP loads are correlated with increased chloride and declining sulfate concentrations, but we don’t know if those are causal correlations. Work in Progress.

Analysis of Rock River Nitrate Loads (work in progress)

Gregory McIsaac

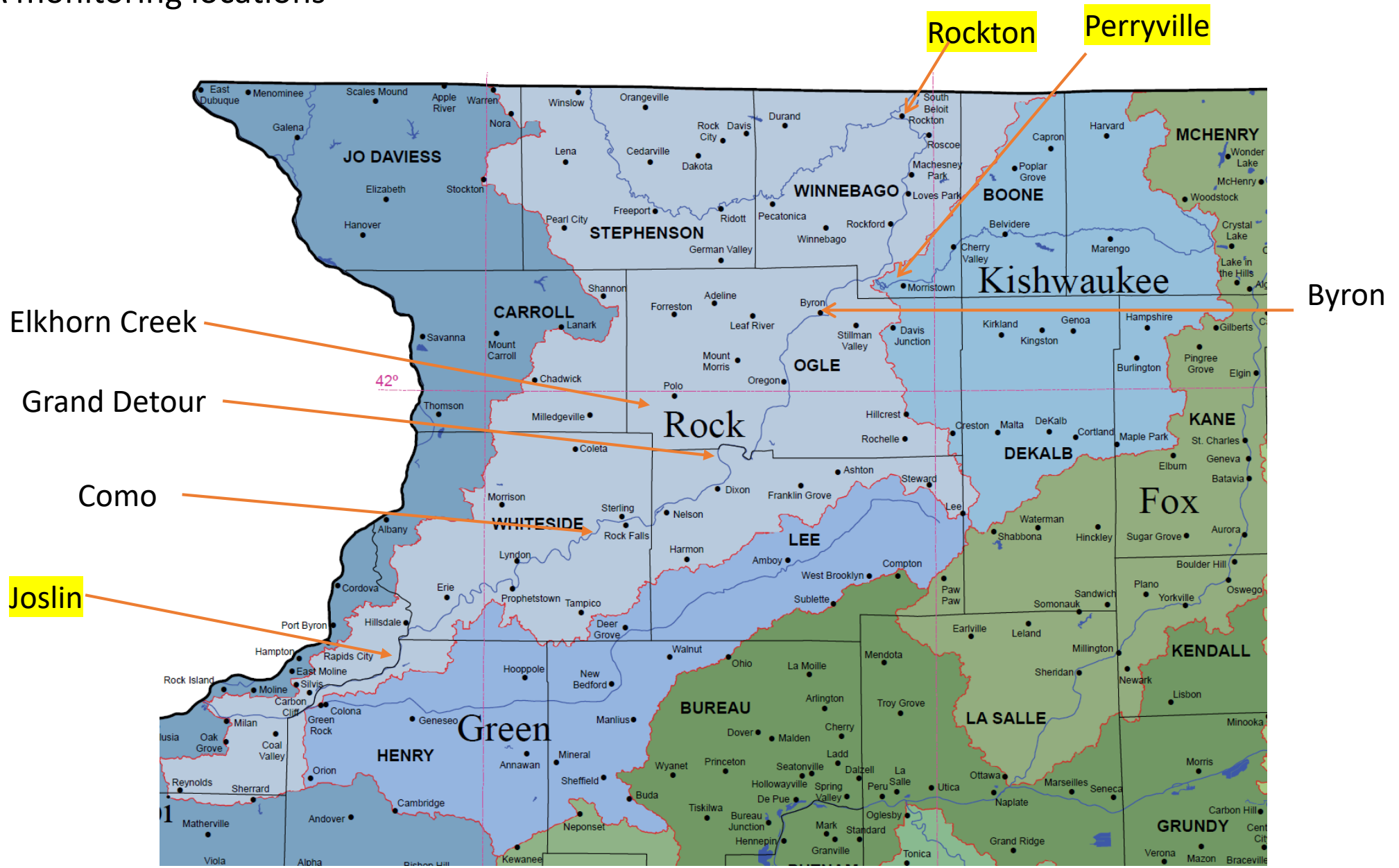
Daniel Perkins

Funding from Illinois Corn Growers Association

Administrator: Megan Dwyer

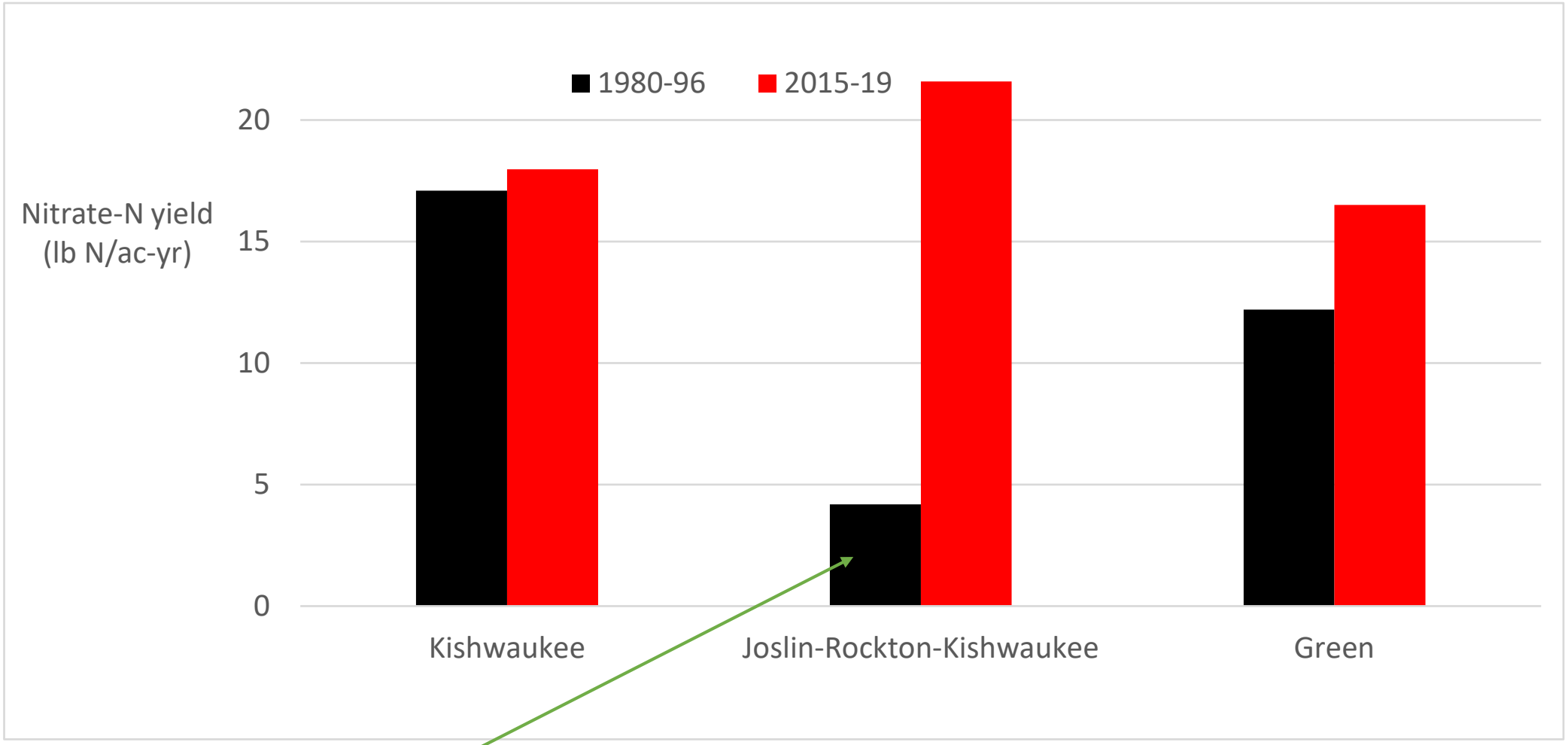
Nitrate loads more than doubled in the Illinois portion of the Rock River from 1980-96 to 2015-19. The 24 million lb N/yr increase was the largest in the state, by far. See the 2021 Biennial Report Figure 3.5.

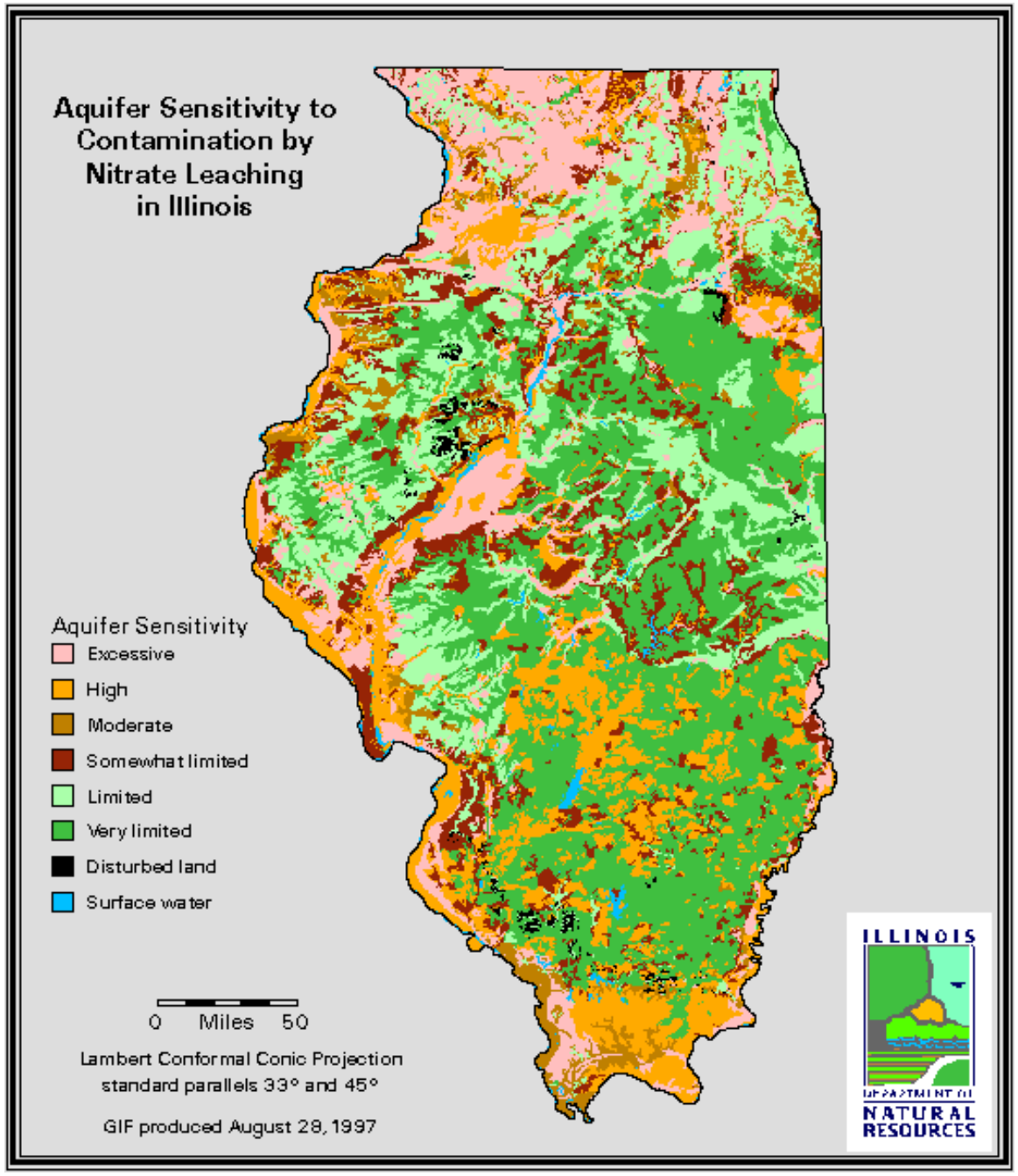
Illinois portion of the Rock River Watershed
USGS and IEPA monitoring locations



Modified from ISWS

Nitrate-N yield 1980-96 and 2015-2019
Rock River subbasins and neighboring Green River

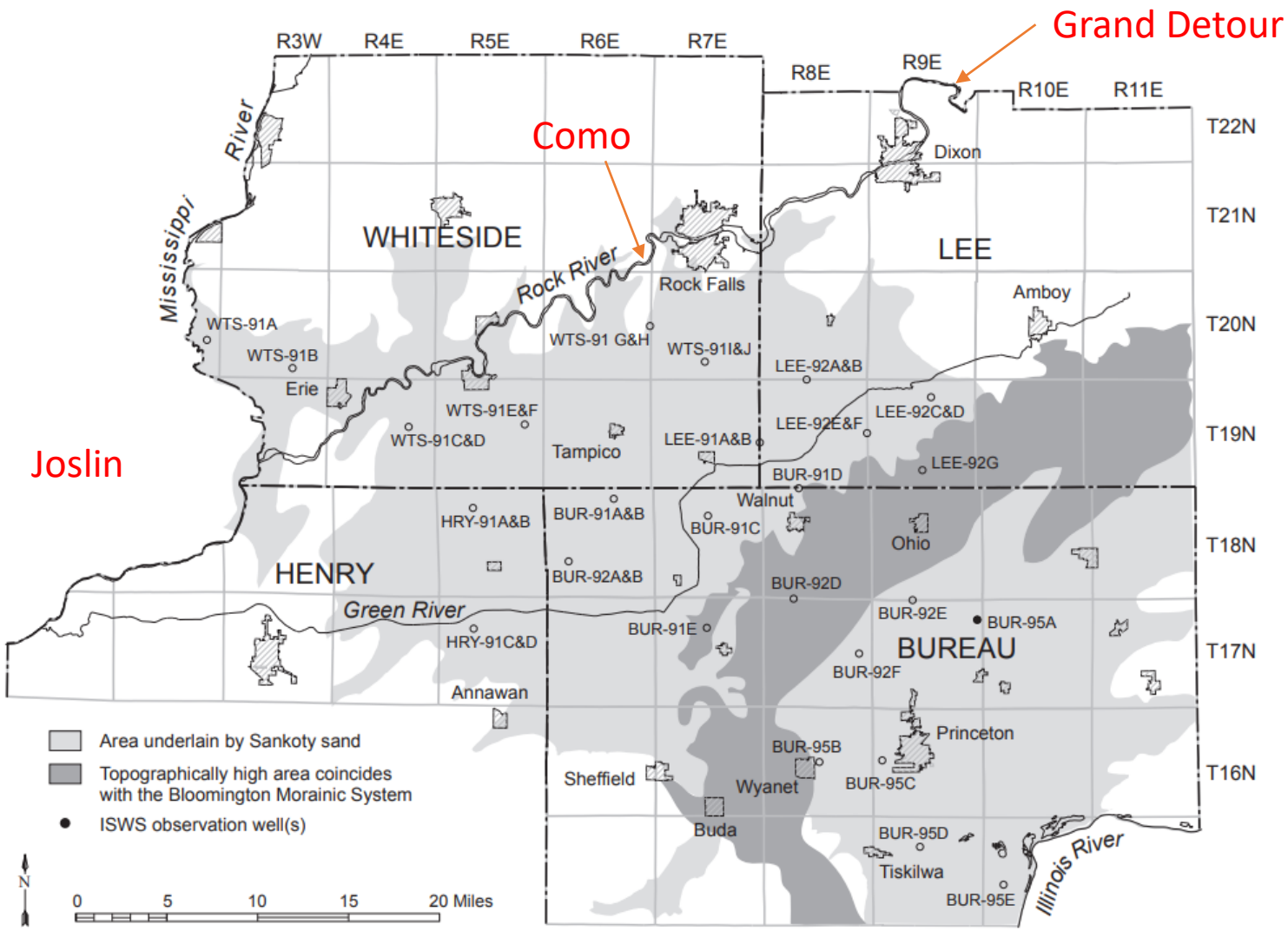




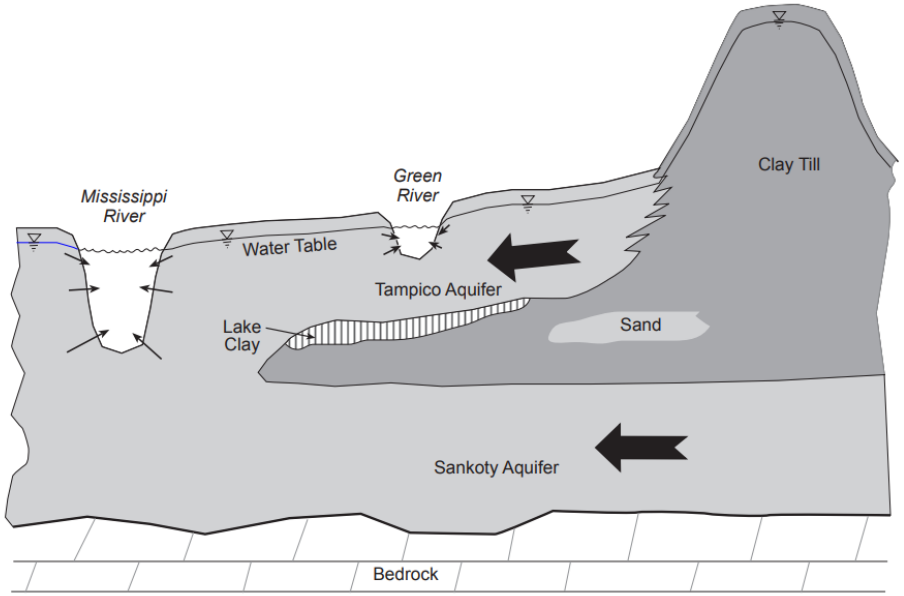
Nitrate may have accumulated in groundwater during the 1980s and early 1990s may have started appearing in the lower Rock River in the late 1990s.

https://clearinghouse.isgs.illinois.edu/sites/clearinghouse.isgs/files/Clearinghouse/data/ISGS/Hydrology/images/no3aqsensb.gif

Green River Lowlands



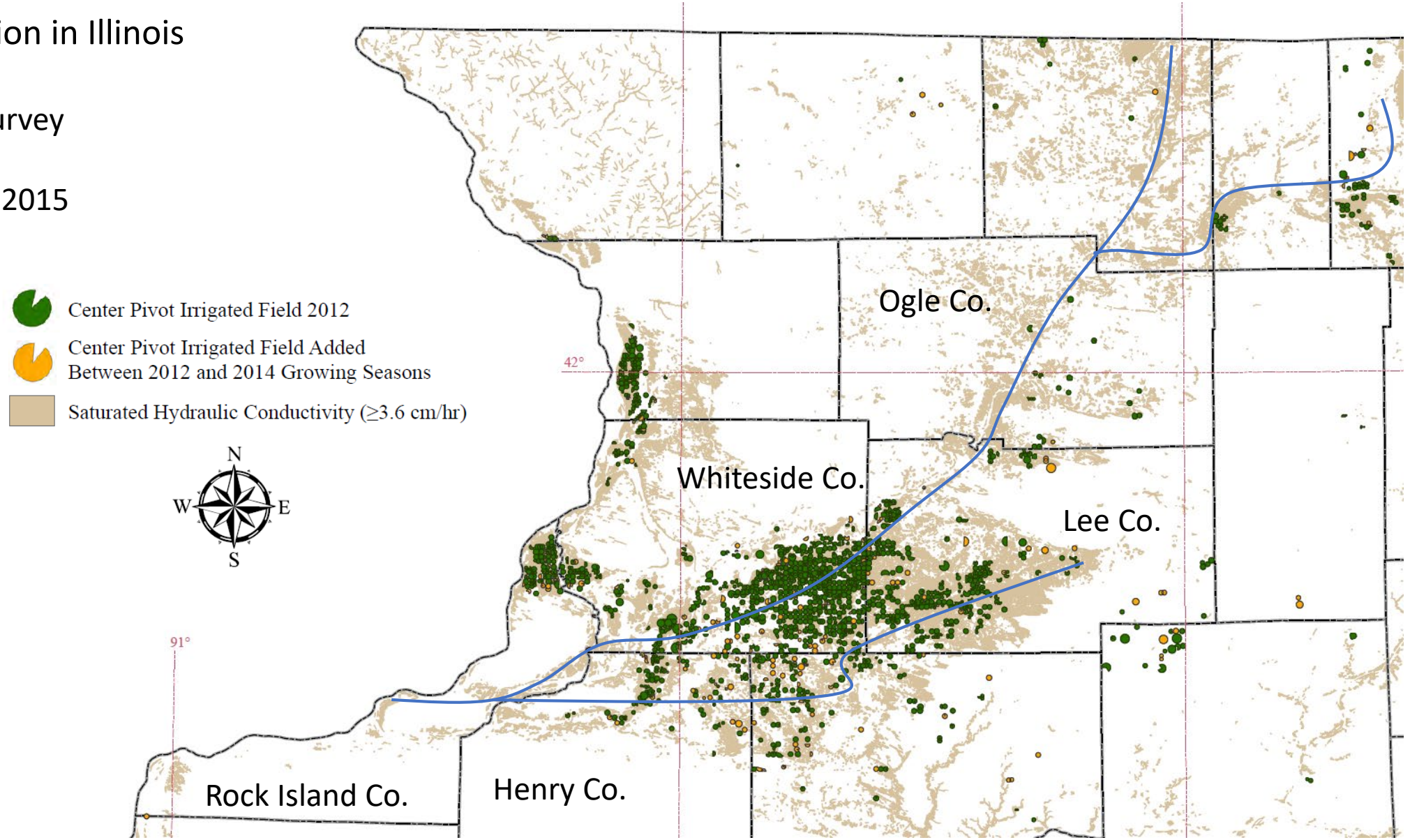
Dams with hydroelectric generation at Dixon and Rock Falls



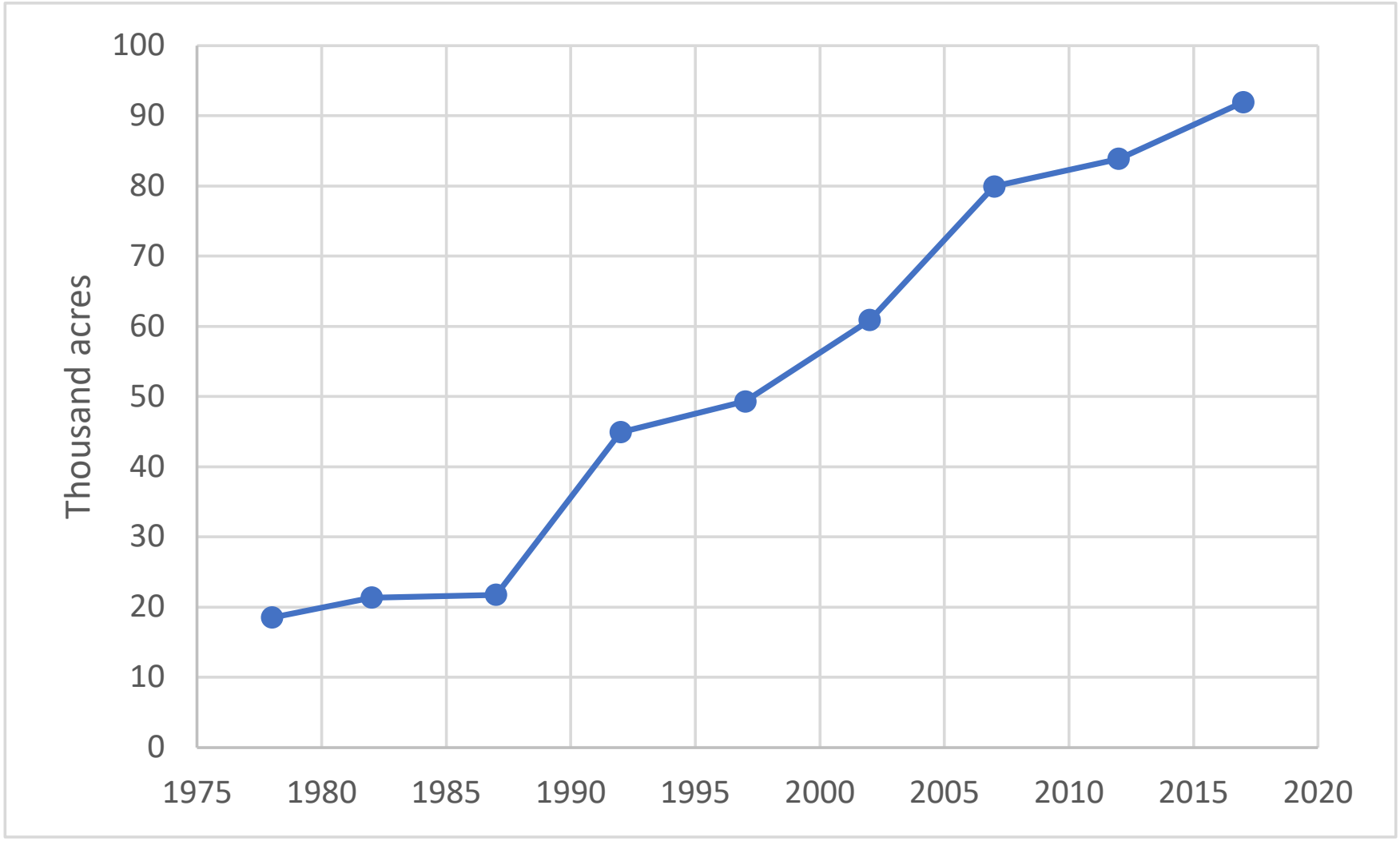
https://www.isws.illinois.edu/groundwater-science/groundwater-monitoring-well-networks/green-river-lowlands-monitoring

Center Pivot Irrigation in Illinois 2012 and 2014

Illinois State Water Survey
Map series 2015-03
Published November 2015



Irrigated acres in Whiteside + Ogle + Lee Counties



USDA Census of Agriculture data

~70,000 acre increase in irrigated acres

Much of it for seed corn and specialty crops.

30 lb N/ac-yr loss = 2.1 Million lb N/yr

~10% of the 24 Million lb N/yr increase

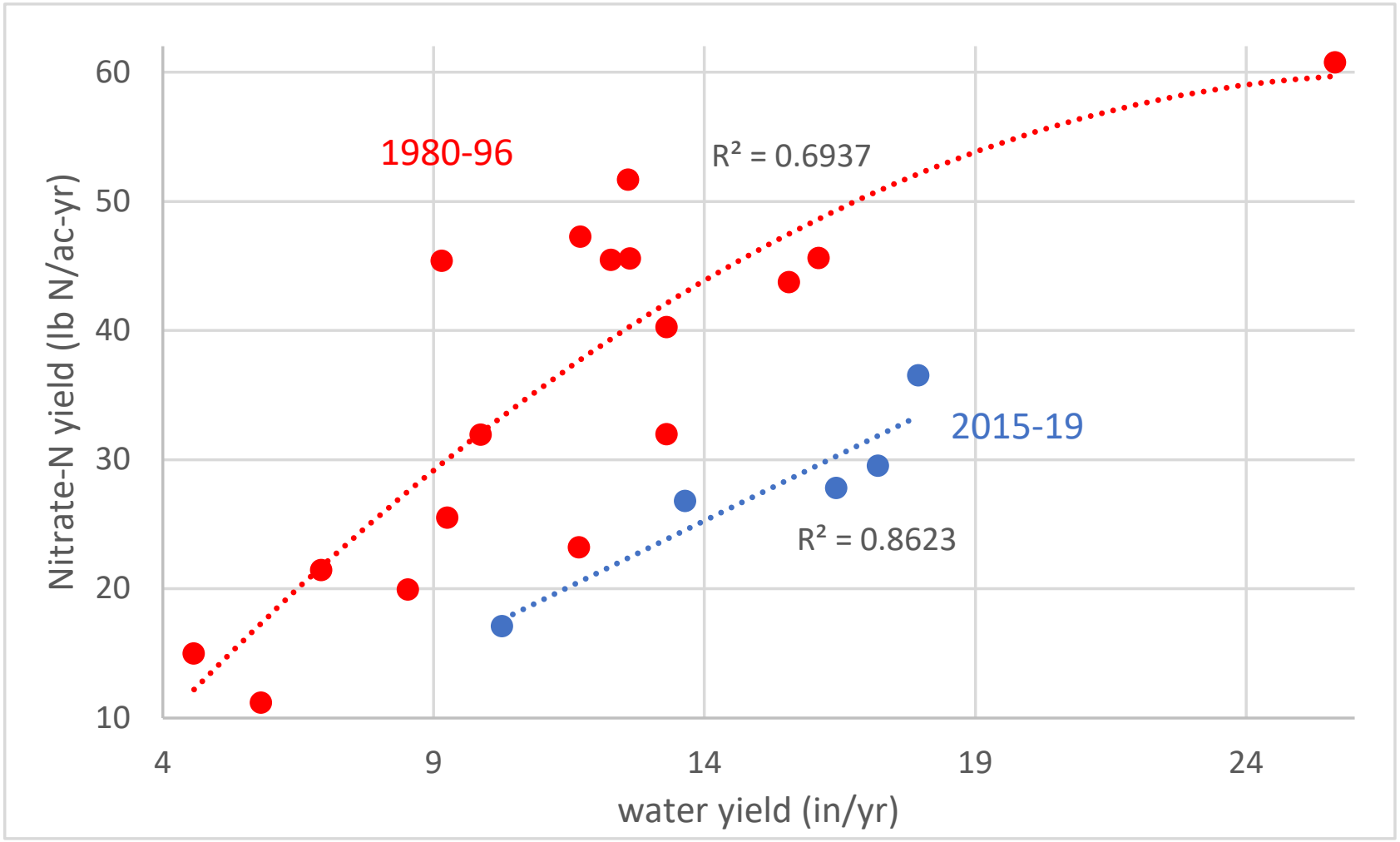
Preliminary findings

- Dan Perkins examined US EPA point source data (ECHO) and found the combined point sources were a small portion of the river loads.

- Analysis of monthly nitrate loads indicates loss of nitrate from the river in summer months, which is consistent with denitrification and/or loss to groundwater

- Analysis of monthly chloride loads is consistent with water exchanges between river and groundwater and net loss of chloride from the river to groundwater.

Vermilion River at Pontiac Nitrate-N and Water Yield



Nitrate-N yield

1980-90 35.6 lb N/ac-yr

2015-19 27.5 lb N/ac-yr

-23% decrease

Water yield

1980-96 11.7 in/yr

2015-19 15.1 in/yr

+29% increase

Load estimates from Tim Hodson, USGS, using WRTDS-K

Thank you!

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