

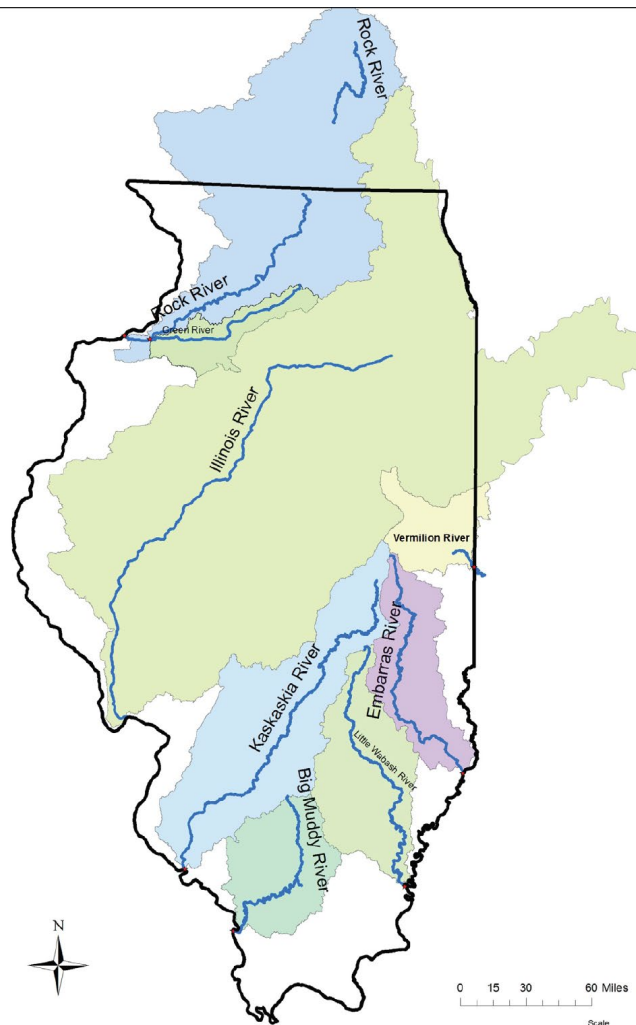
Nitrate-N and Total Phosphorus Load Estimates in Illinois Rivers: Update through the 2017 water year

Gregory McIsaac, Associate Professor Emeritus
University of Illinois at Urbana Champaign

Adjunct Research Scientist
Agricultural Watershed Institute

Objective: Update Nitrate and TP loads statewide and HUC8

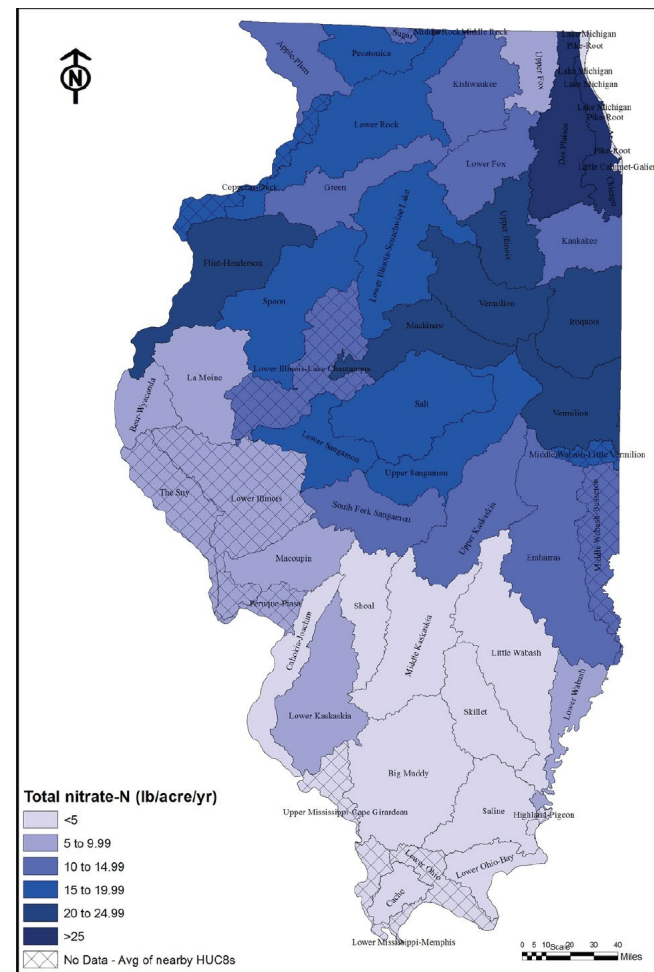
Statewide loads based on 8 major river systems



~40 HUC 8s with sufficient flow and concentration data for load estimation

Point source discharges also reported by HUC 8

HUC 8 Nitrate-N yields 1997-2011 (NLRS 2015)



Load Calculation Methods same as NLRS

Load = water flow (volume/time) x concentration (mass/volume)

Yield = Load/area

USGS provides daily water flow

IEPA and USGS provide sample concentrations approximately monthly

Daily Load = daily water flow x estimated daily concentration

Daily concentrations estimation methods

Nitrate: Linear Interpolation over time between measured samples

Phosphorus: Weighted Regressions on Time, Discharge and Seasonality (WRTDS)

Statewide Riverine Flow and Loads

	<u>1980-96</u>	<u>2013-17</u>	<u>% change</u>
Water Yield (in/yr)	13.0	14.7	+13%
Nitrate-N Load (Million lb N/yr)	397	425	+7%
Total P Load (Million lb P/yr)	34	43	+26%

Statewide Point Source Discharges

	2011	2017*	% change
<u>Total N</u> (Million lb N/yr) # of facilities incl.	87.3 392	75.0 898	-14%
<u>Total P</u> (Million lb P/yr) # of facilities incl.	18.0 1660	14.1 1371	-22%

*2011 discharge data was used for facilities included in the NLRS estimate, for which 2017 data was unavailable

Cooling water discharge not included in 2017

Note that we do not have point source discharge data during the 1980-96 baseline period. Riverine load increases in the previous slide were relative to the baseline period and are not directly comparable to these decreases. Statewide riverine NO₃-N loads in 2017 were 5% lower than in 2011 and 2017 TP loads were 6% lower than in 2011.

Statewide Point Source Discharge 2011 and 2017 compared to statewide river loads 2011 and 2017

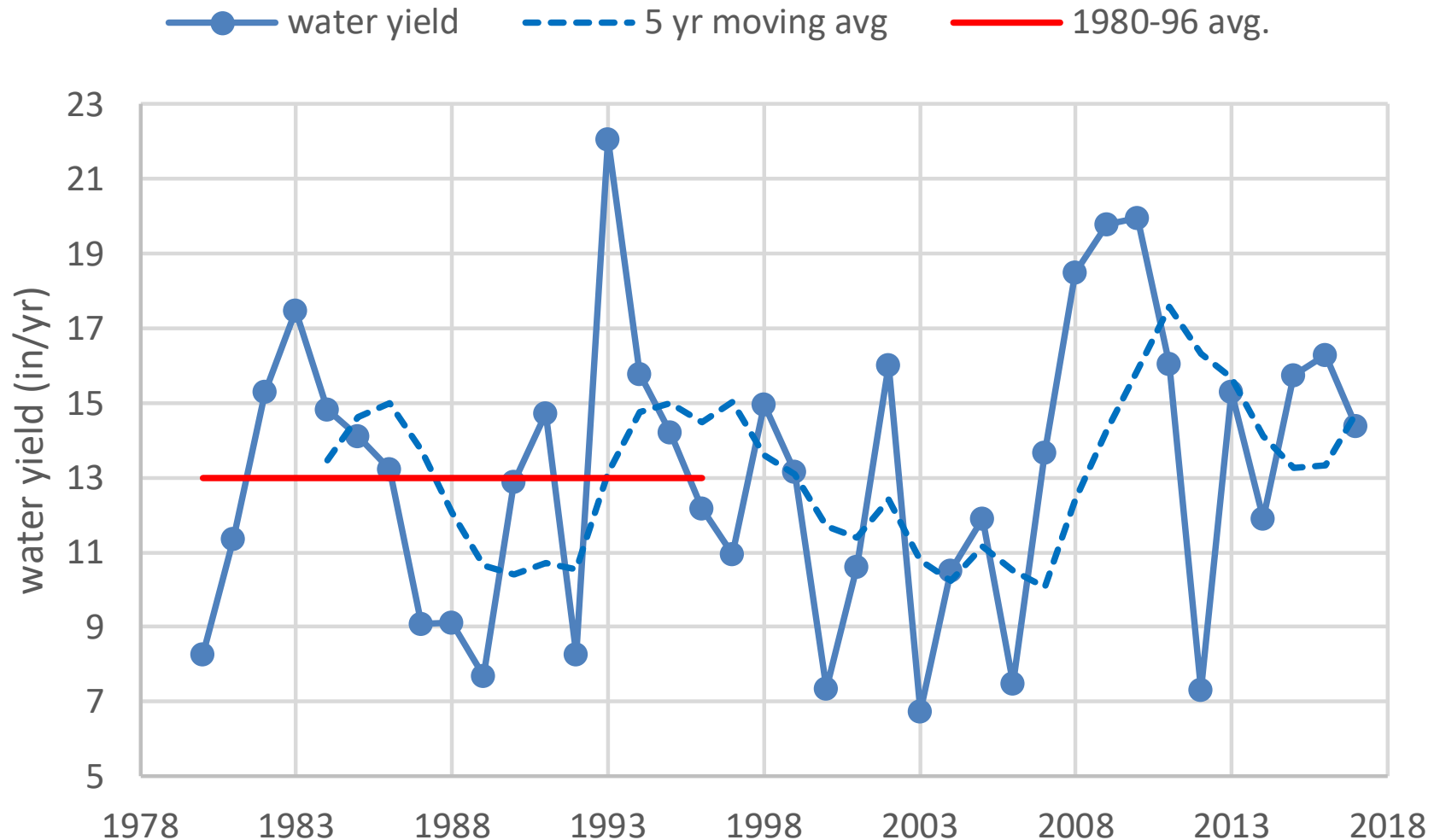
	2011	2017*	% change
<u>Total N</u> (Million lb N/yr)	87.3	75.0	-14%
Statewide Riverine NO3-N	485	459	-5%
<u>Total P</u> (Million lb P/yr)	18.0	14.1	-22%
Statewide Riverine TP	44.3	41.6	-6%

*2011 point source discharge data was used for facilities included in the NLRs estimate, for which 2017 data was unavailable.

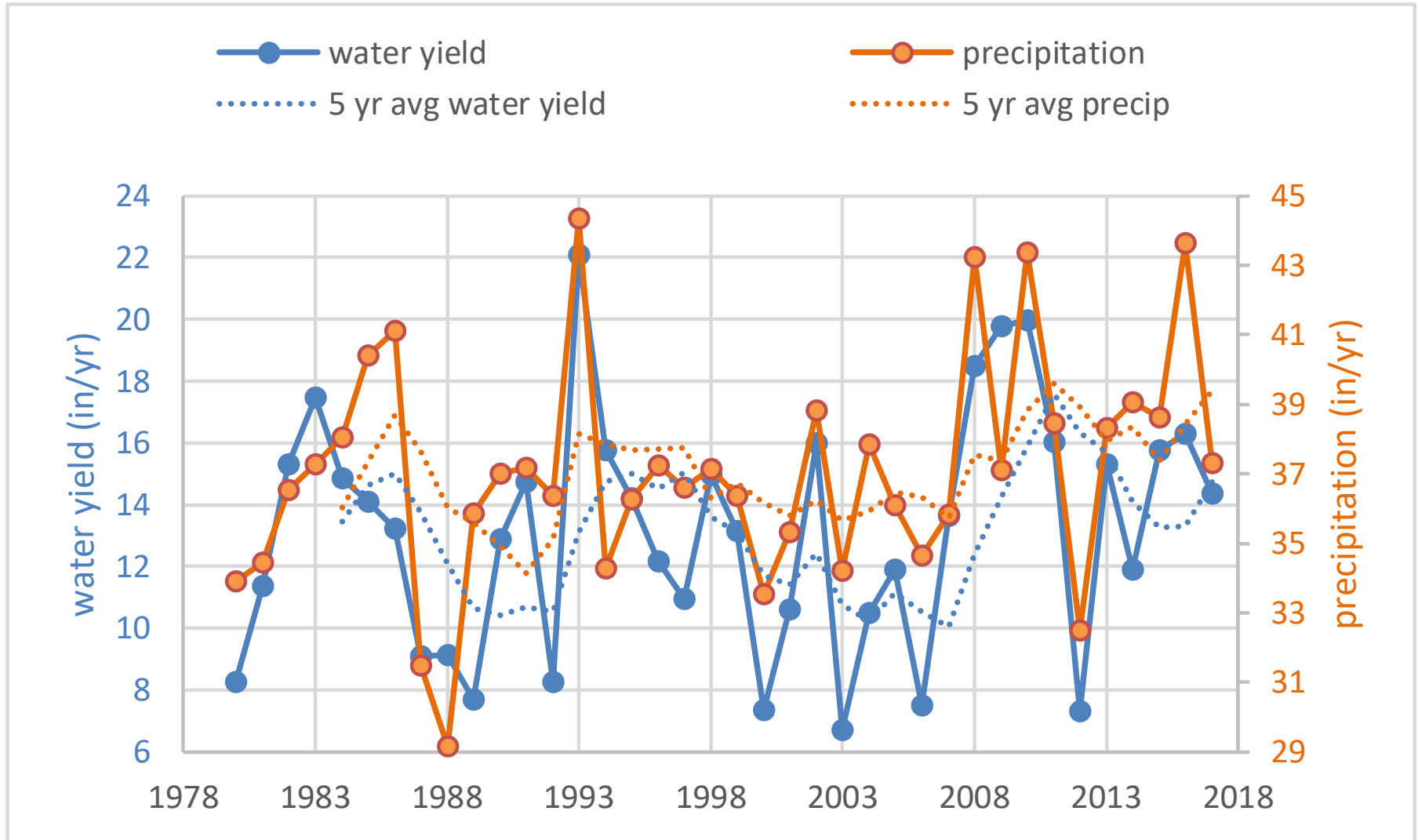
Cooling water discharge not included in 2017

Statewide annual water yield

annual, 5 year moving average, and 1980-96 average

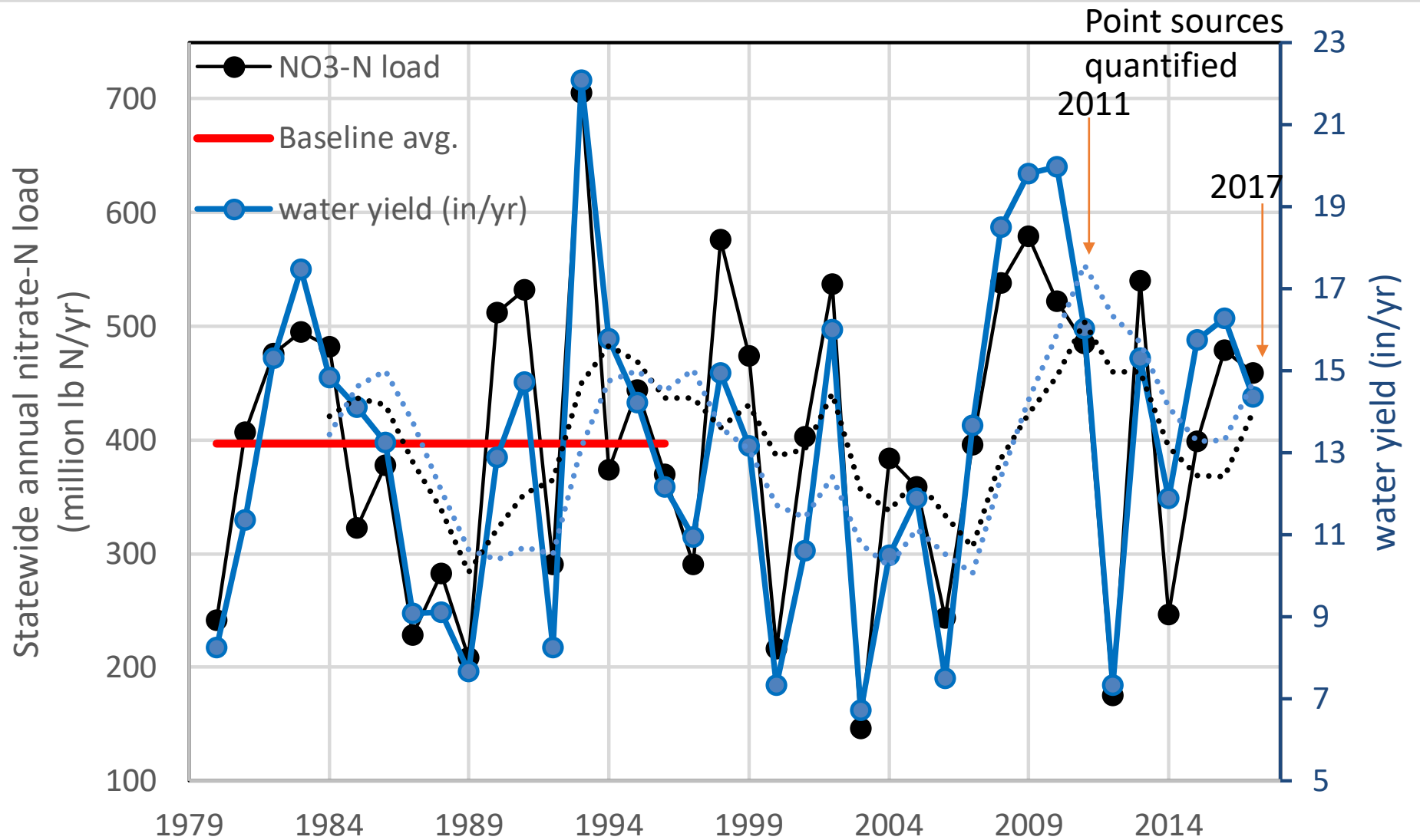


Statewide average precipitation and water yield

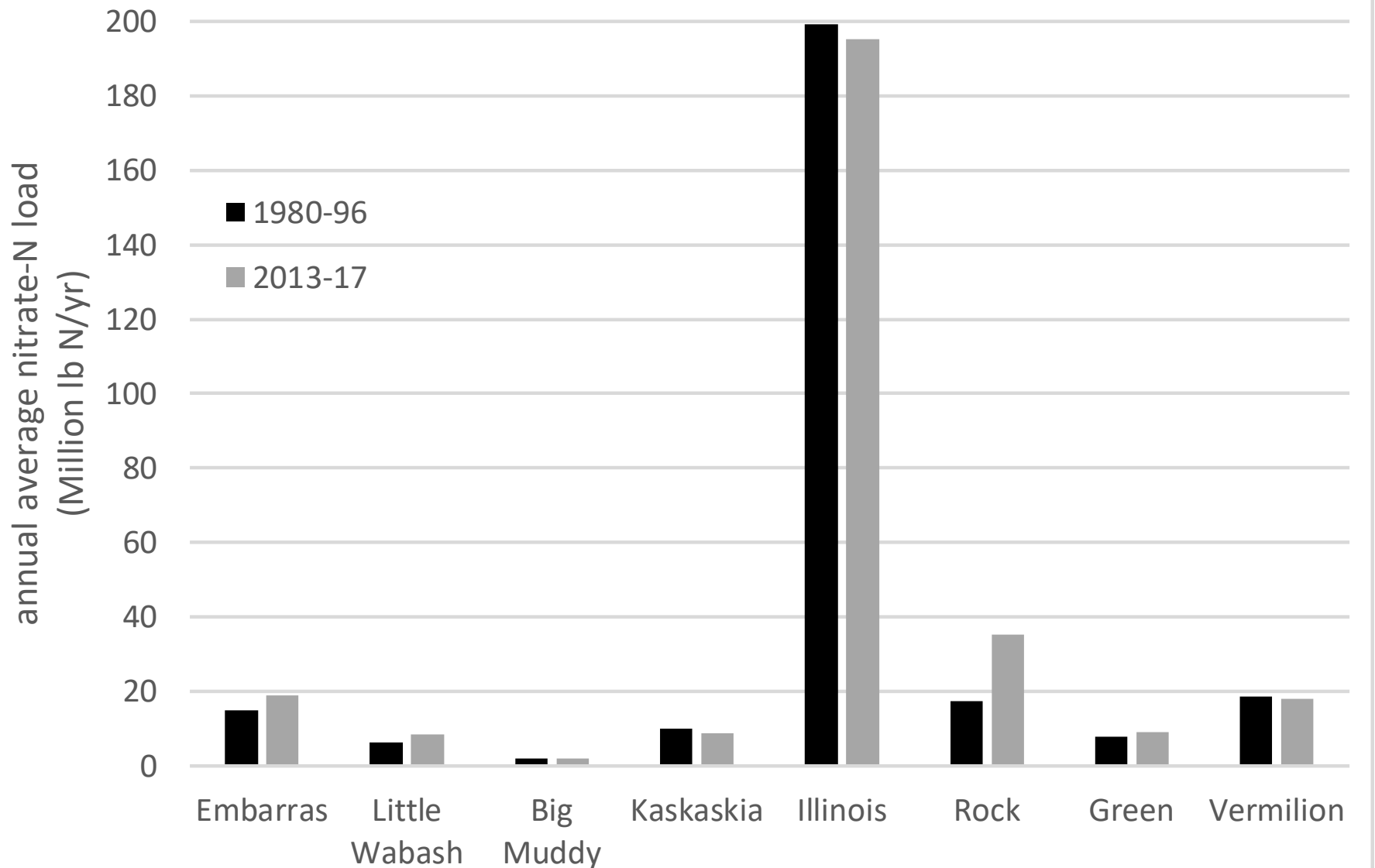


water year basis (Oct 1 to Sept 30)

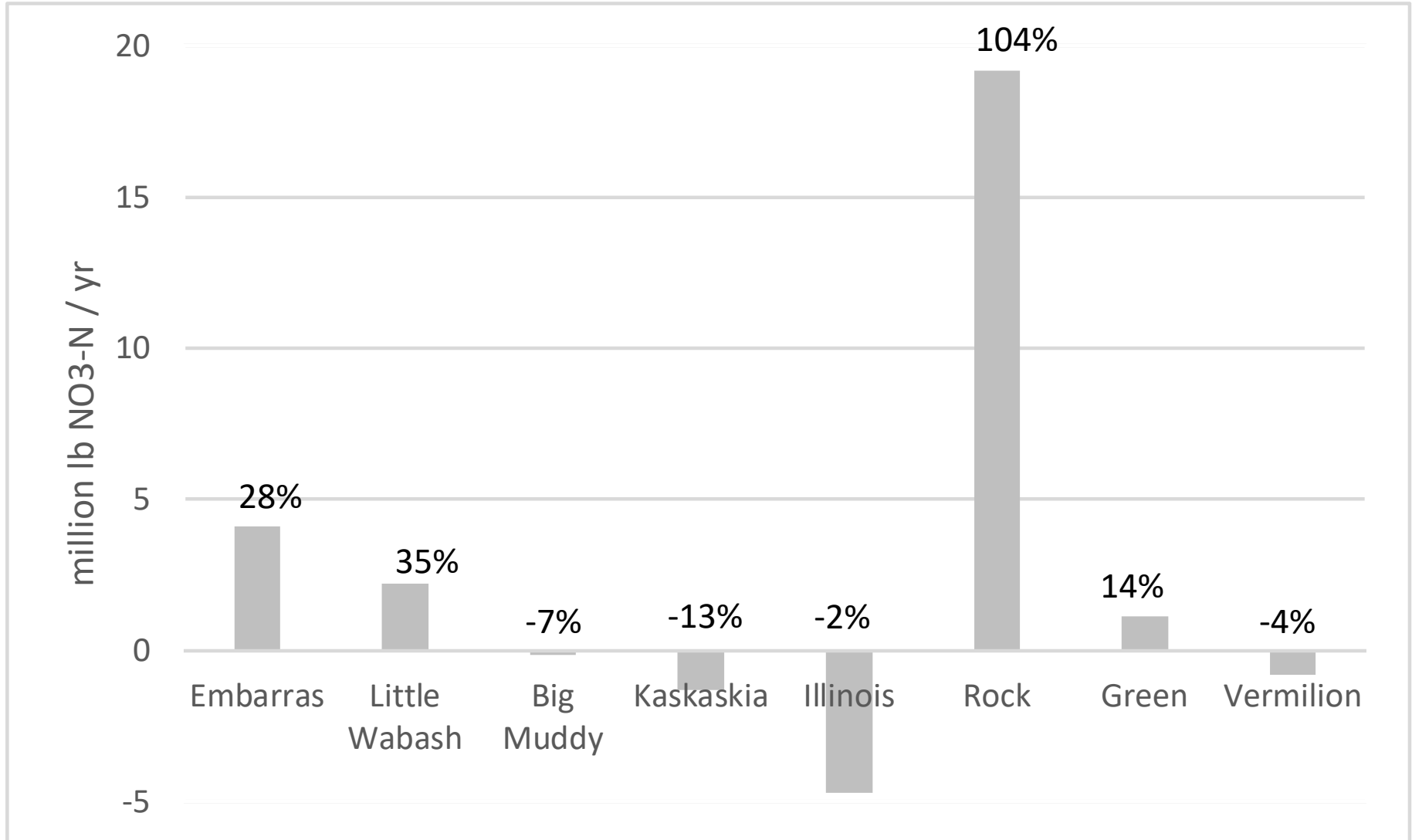
Statewide estimates of annual nitrate loads (black), water yield (blue), 1980-96 baseline average (solid red line), and five year moving average values (dashed lines)



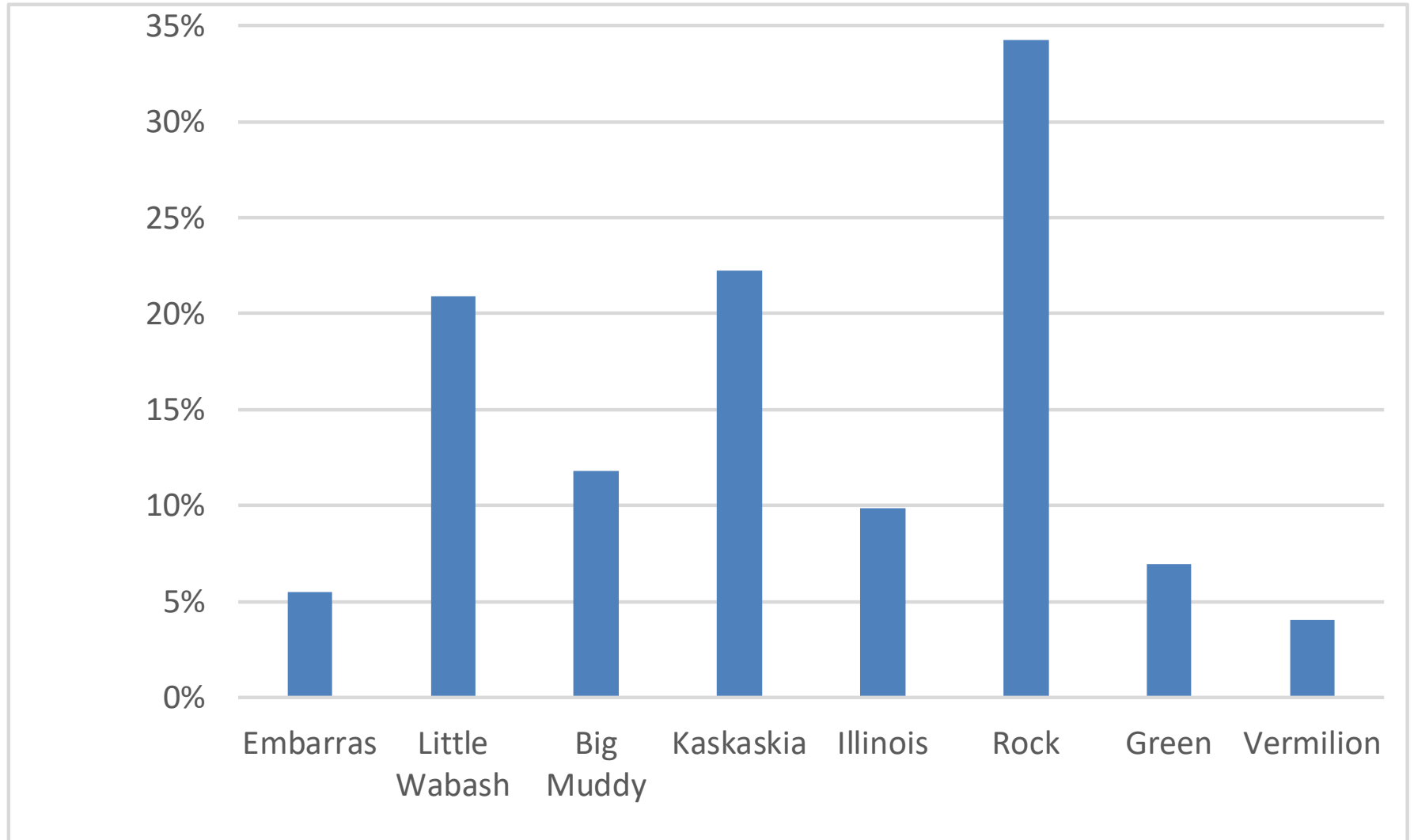
Nitrate-N Load Estimates in Major Rivers in Illinois 1980-96 and 2013-17



Changes in Riverine Nitrate-N Loads from 1980-96 to 2013-17 for major rivers in Illinois

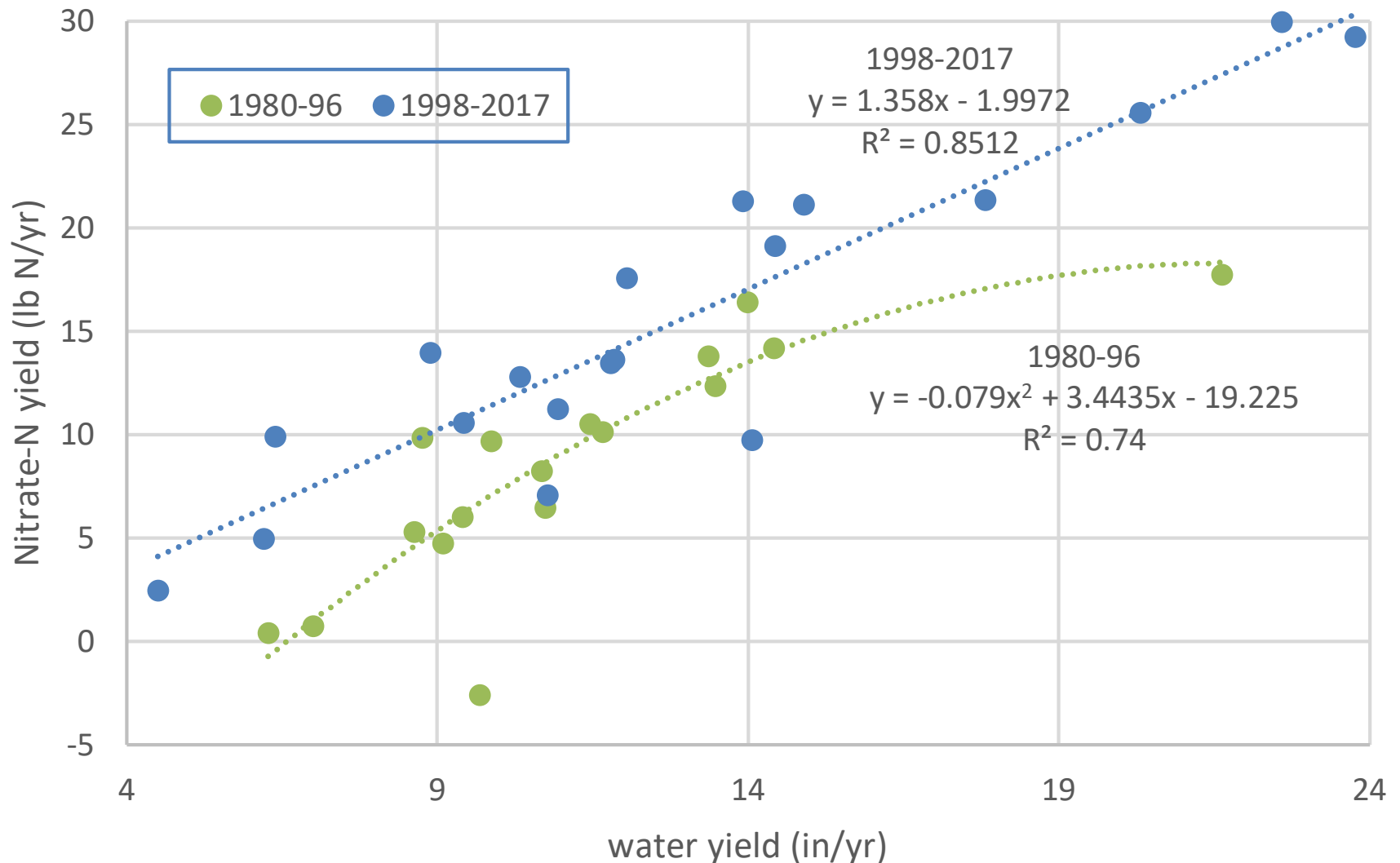


% Changes in water flow from 1980-96 to 2013-17 for major rivers in Illinois

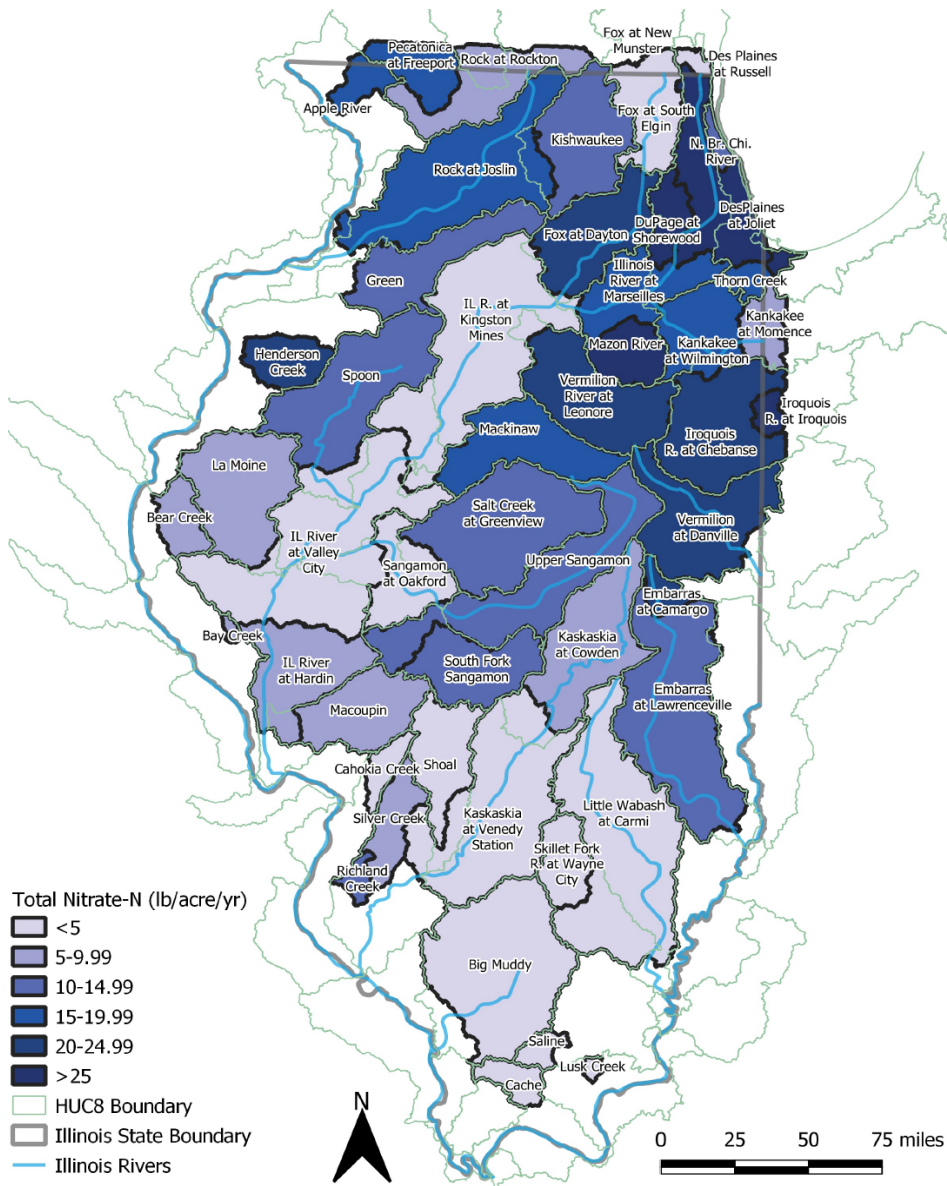


Rock River between Rockton and Joslin

Nitrate-N yield as a function of water yield for 1980-96 and 1998-2017



Nitrate-N yield (2012-17) at monitoring locations



(Aaron Hoyle-Katz, NCSA)

HUC-8 Challenges

Drainage areas of the monitoring locations do not match HUC boundaries.

Extrapolating from monitored area to HUC area introduces uncertainty and probability of inaccurate estimates

For 16 HUCs, monitored drainage area is between 85% and 115% of HUC area.

For another 9 HUCs, monitored drainage area is between 65% and 135% of HUC area.

For 15 HUCs, monitored drainage area differs from HUC area by more than 35%.

For 9 HUCs there is no monitoring data

2 HUCs draining to Lake Michigan are ignored

Estimated Average Annual Nitrate-N Yields by HUC (lb N/ac-yr)

1997-2011, NLRS

2012-17 update

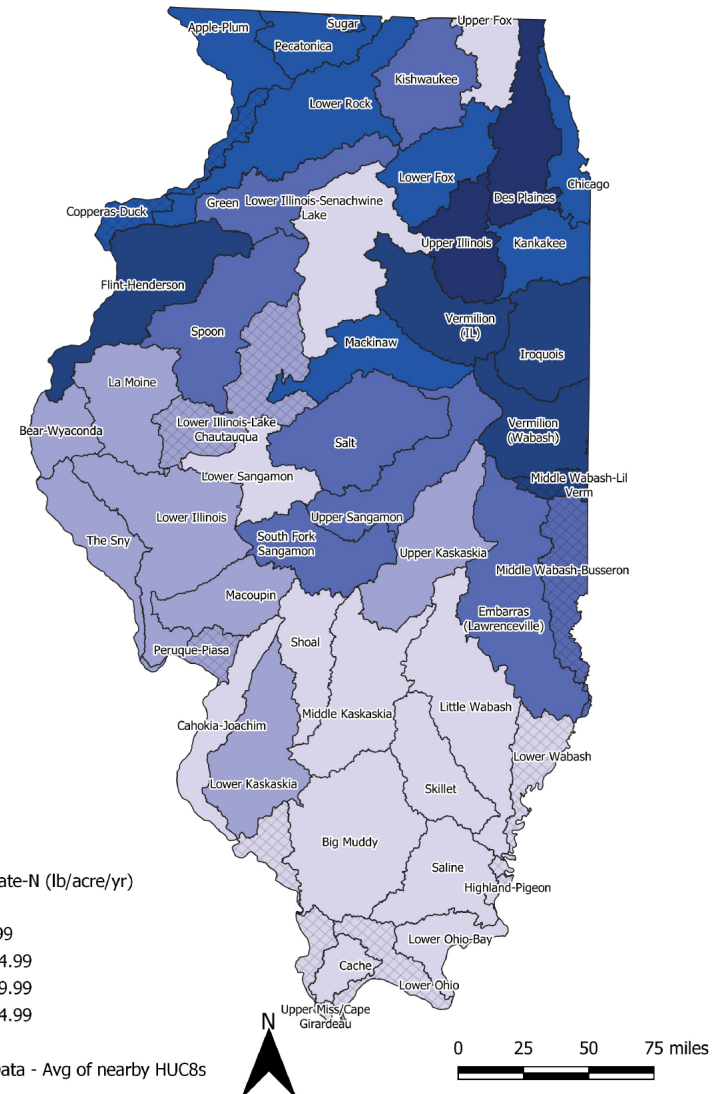
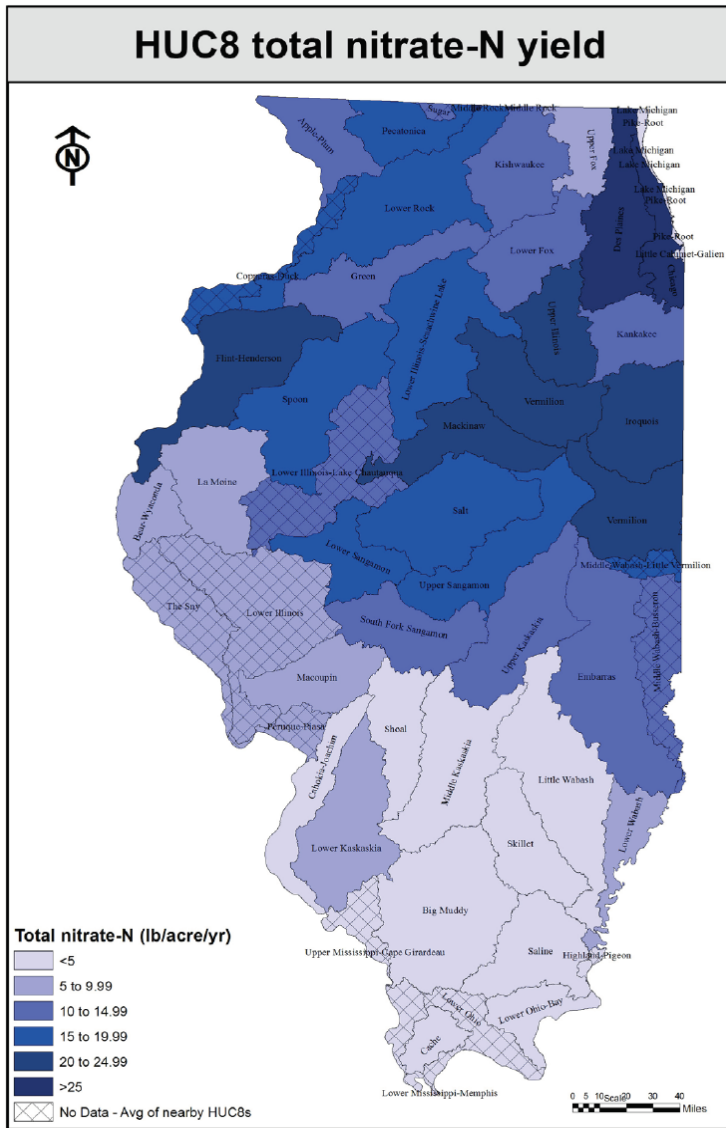


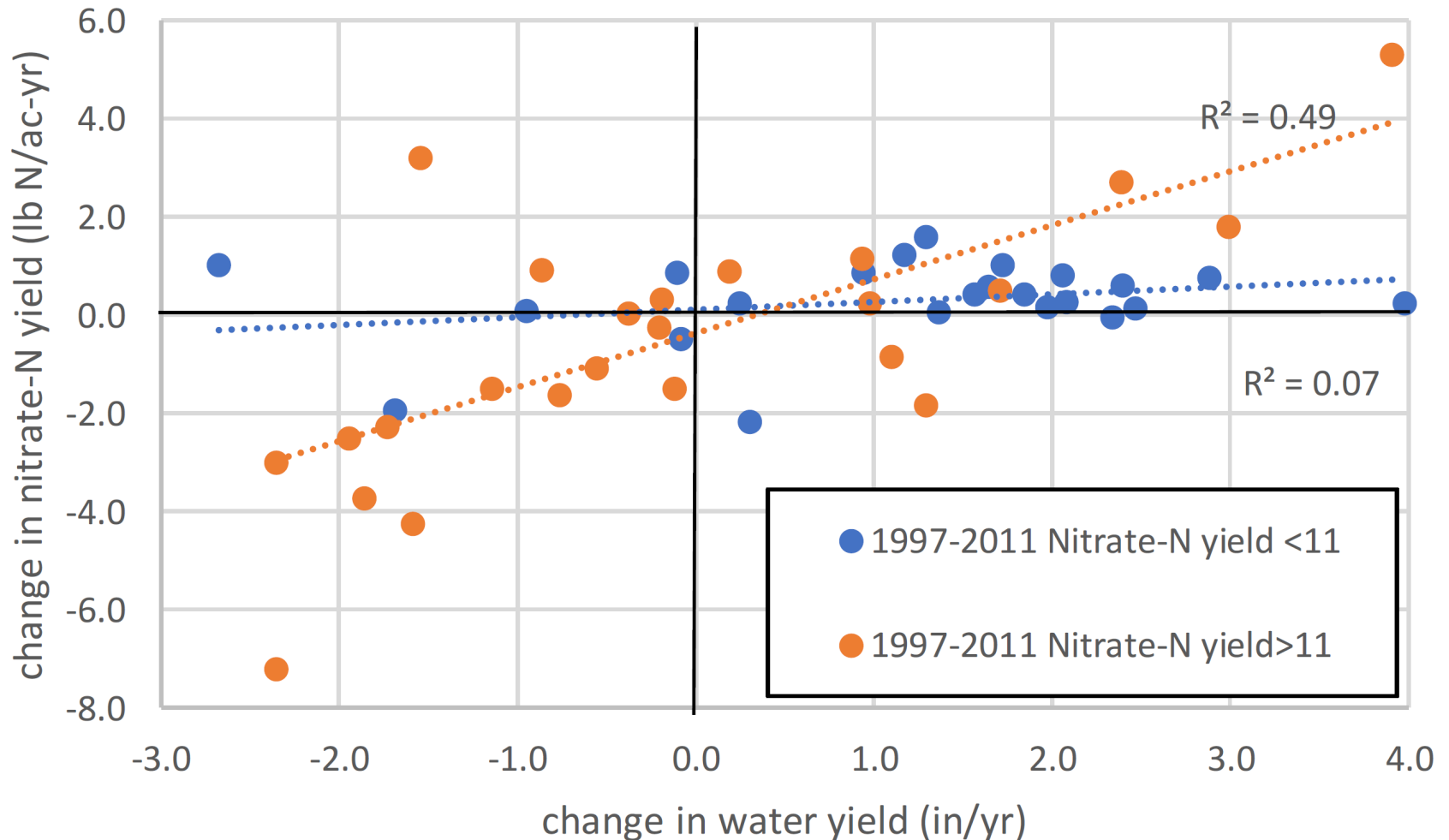
Figure 3.12. Total nitrate-nitrogen yields by HUC8 in Illinois.

Aaron Hoyle-Katz, NCSA

Changes in HUC 8 estimation methods for the Lower Sangamon and Lower Illinois-Senachewine Lake

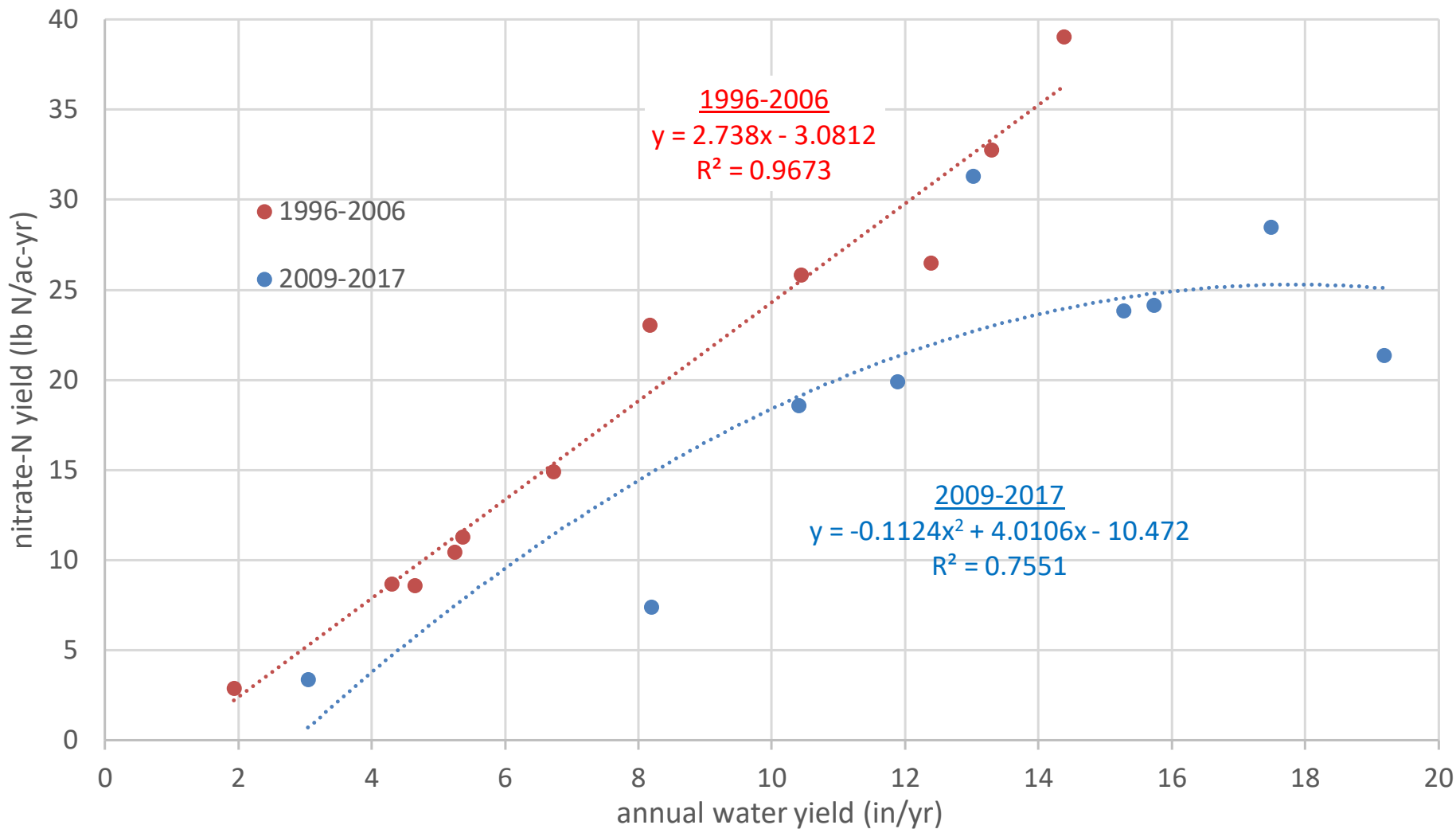
- For NLRs (2015), small tributaries were used as proxies
 - Lower Sangamon: Spring Creek (12% of HUC area)
 - LI-SL: Big Bureau Creek (10% of HUC area)
- For 2012-17 Update
 - Upstream loads were subtracted from downstream load
 - Negative load estimates occurred in some years possibly due to denitrification
 - Comparison of upstream and downstream concentrations is consistent with denitrification losses

Change in Nitrate-N yields vs Change in Water Yield 1997-2011 to 2012-17



Mackinaw River at Green Valley (05568000) and South Pekin (DK-12)

Annual nitrate yield vs annual water yield 1996-2006 vs 2009-2017 water years



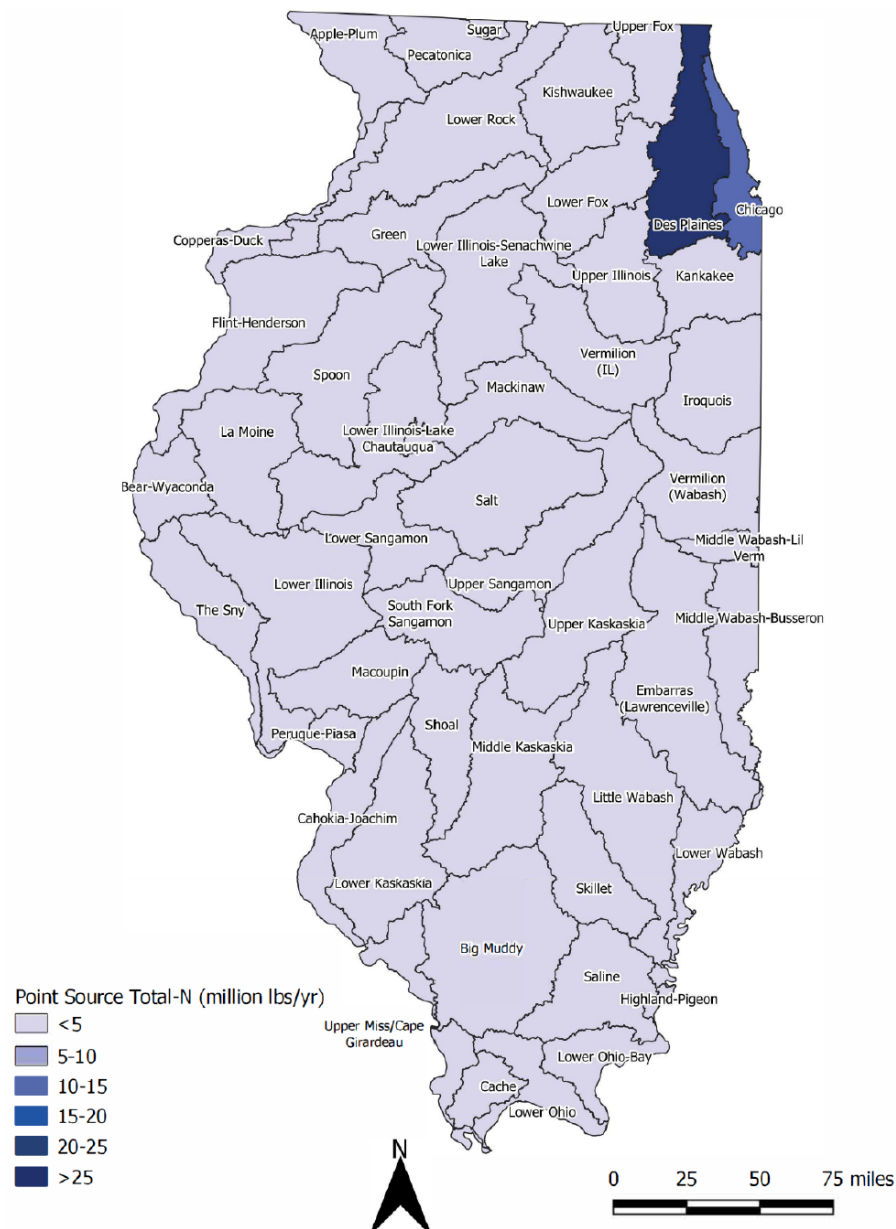
Similar patterns occurred for the Spoon River and Henderson Creek

2017 Estimated Point Source Total N Loads by HUC

Statewide total: 75 million lb N/yr

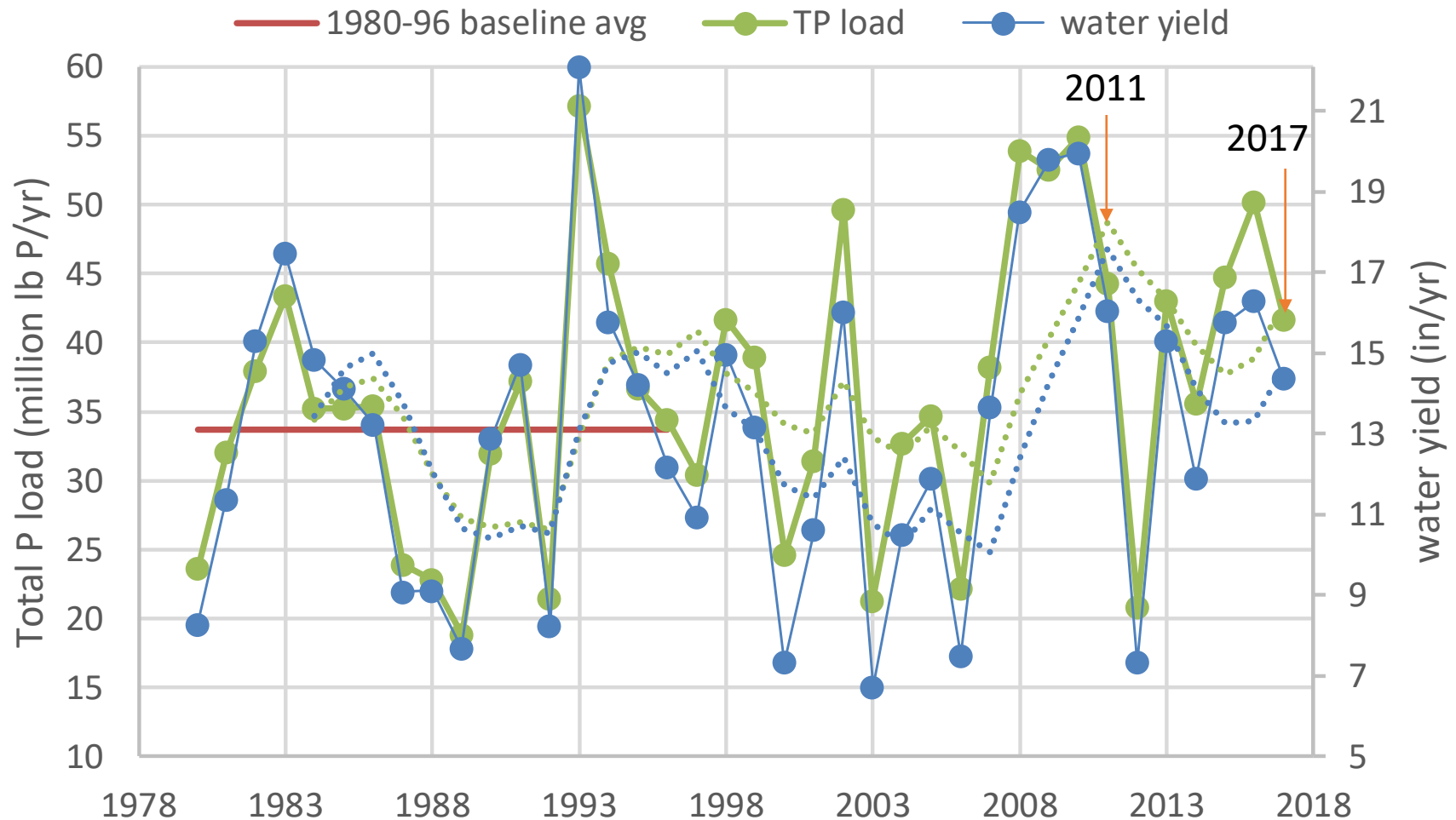
Des Plaines HUC: 32.2 million lb N/yr

Chicago HUC: 14.4 Million lb N/yr

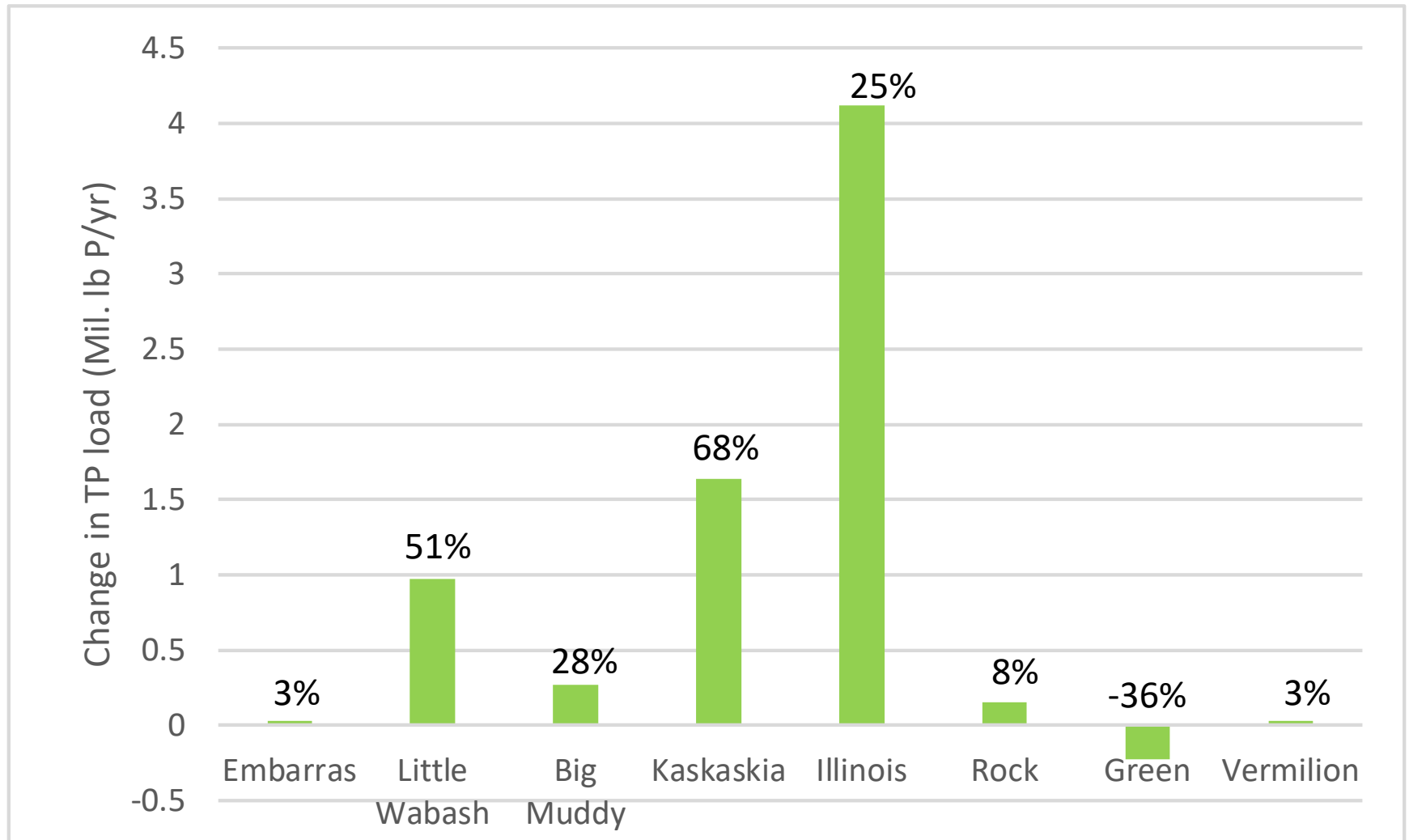


Total Phosphorus (TP) Loads

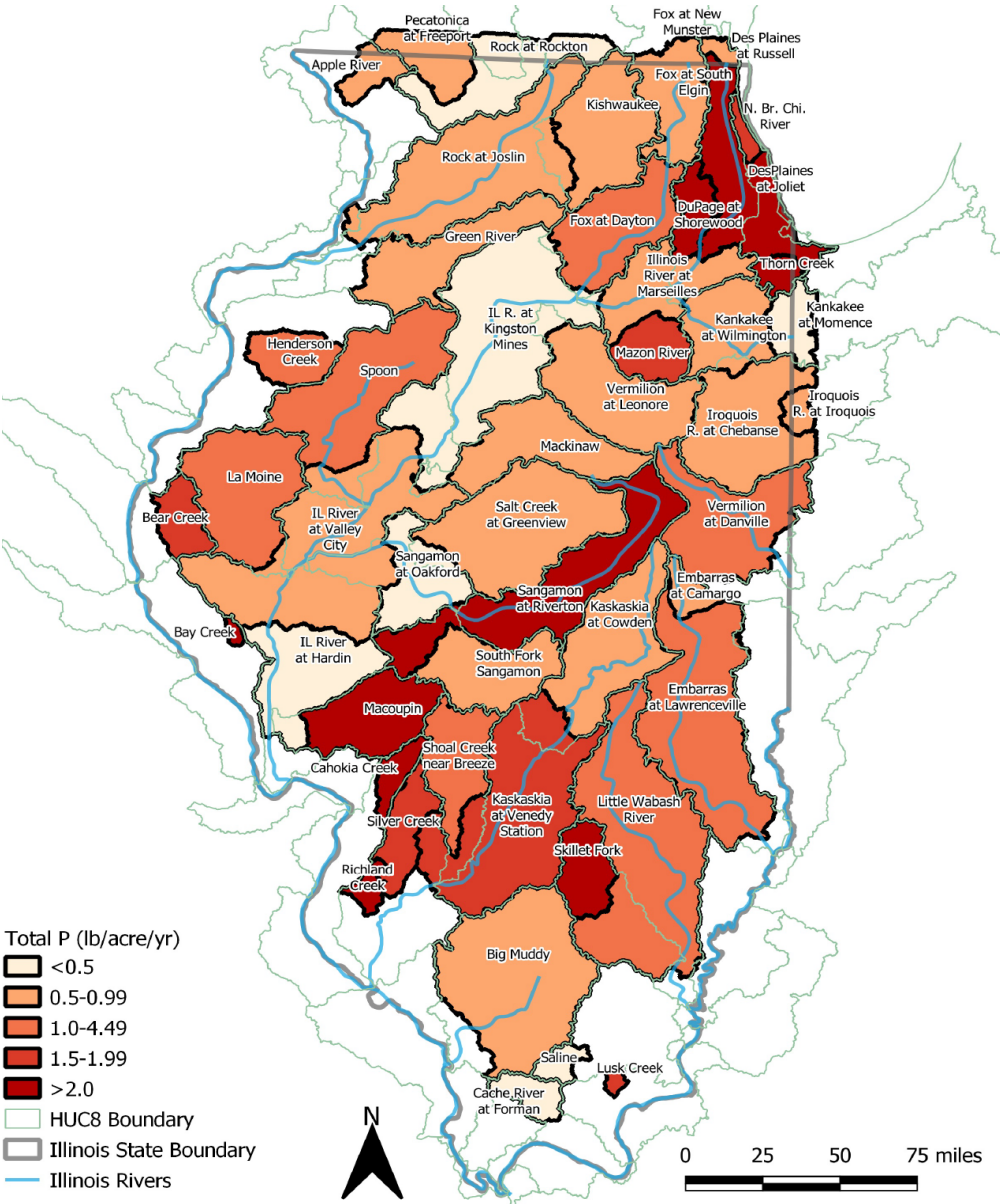
Statewide estimates of annual TP loads (green), water yield (blue), 1980-96 baseline average (solid red line), and five year moving average values (dashed lines) point-source loads were quantified in 2011 and 2017



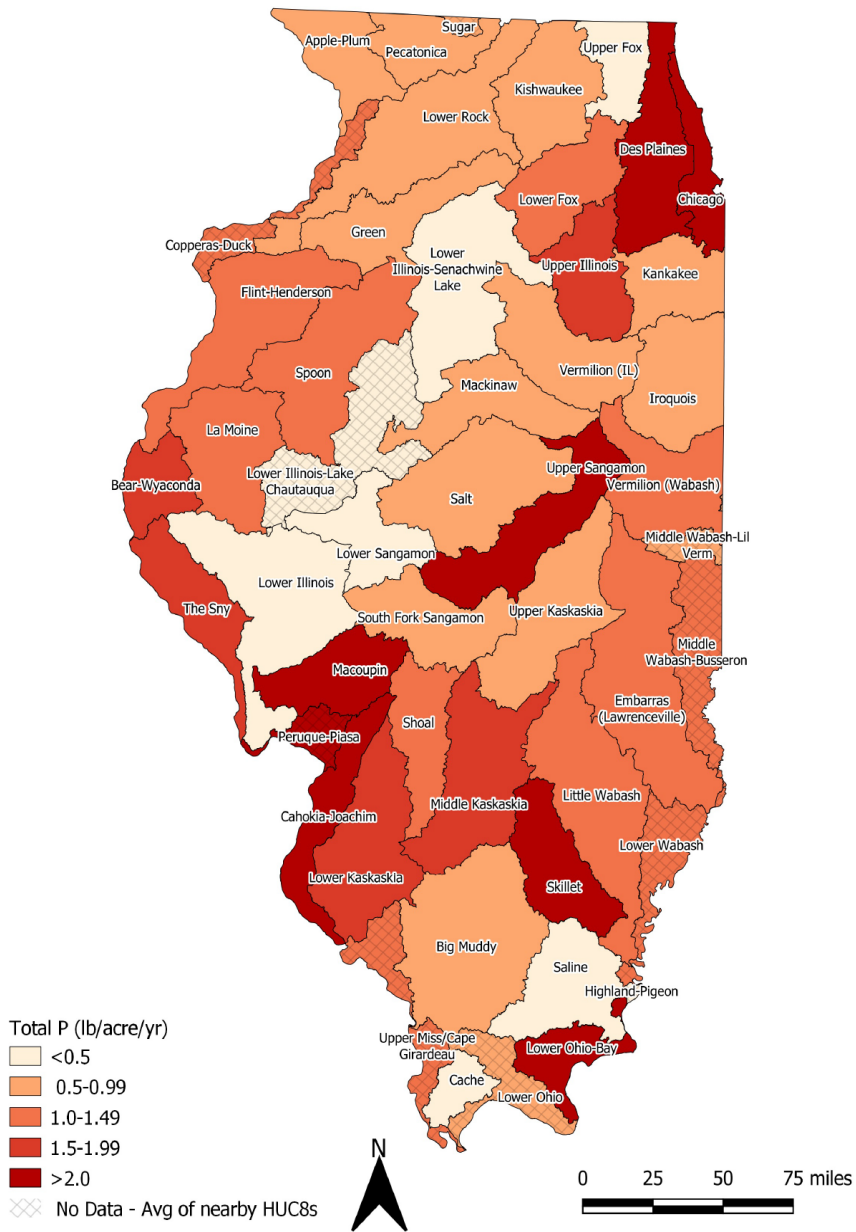
Changes in Riverine TP Loads (mass and percentage) from 1980-96 to 2013-17



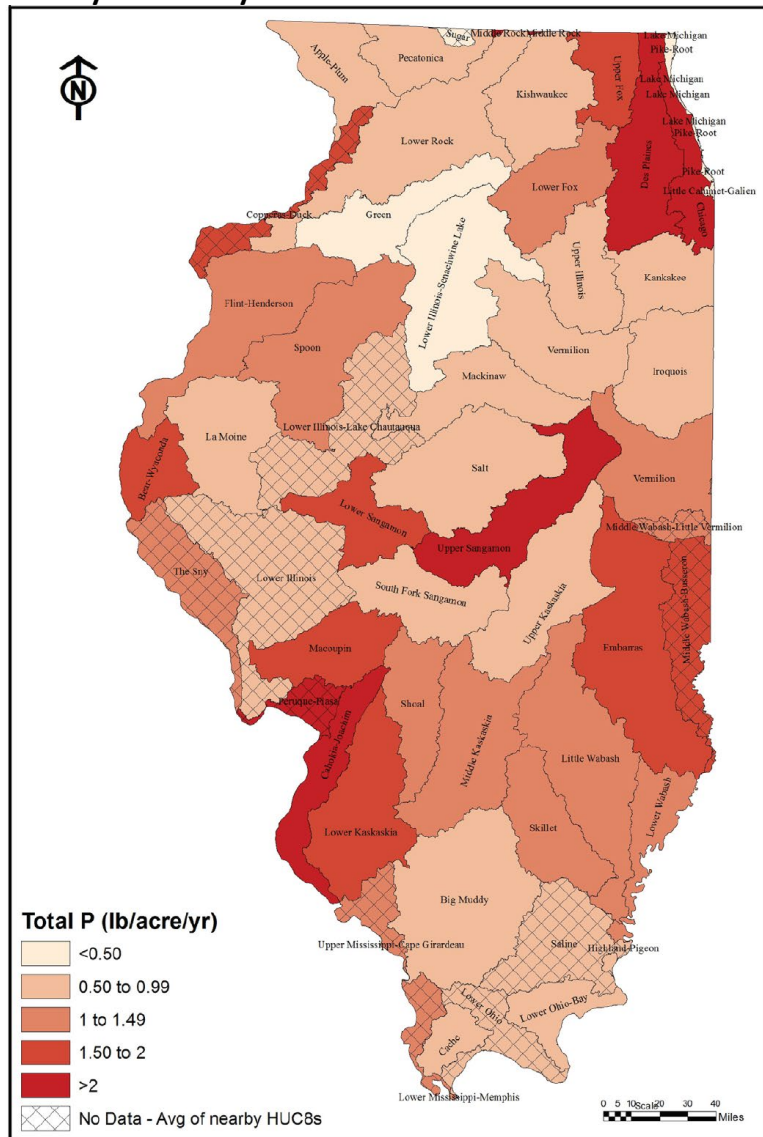
Total P yield by monitored drainage area 2012-17



Total P yield by HUC 8 2012-17

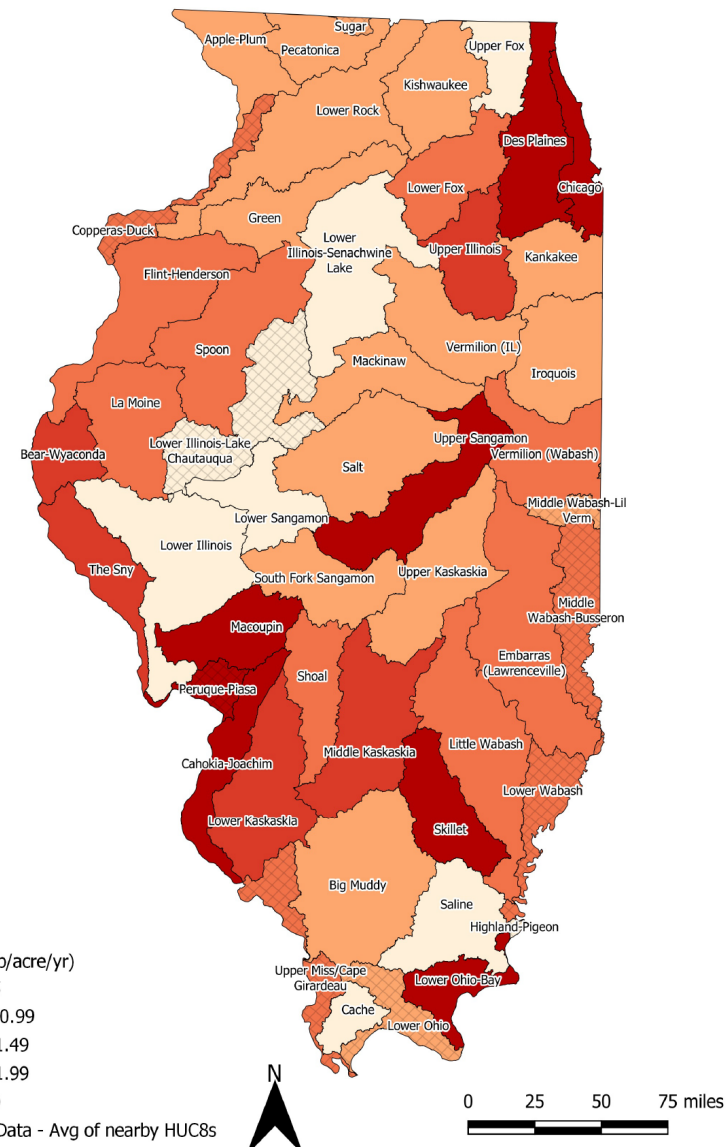


TP yields by HUC 8 1997-2011



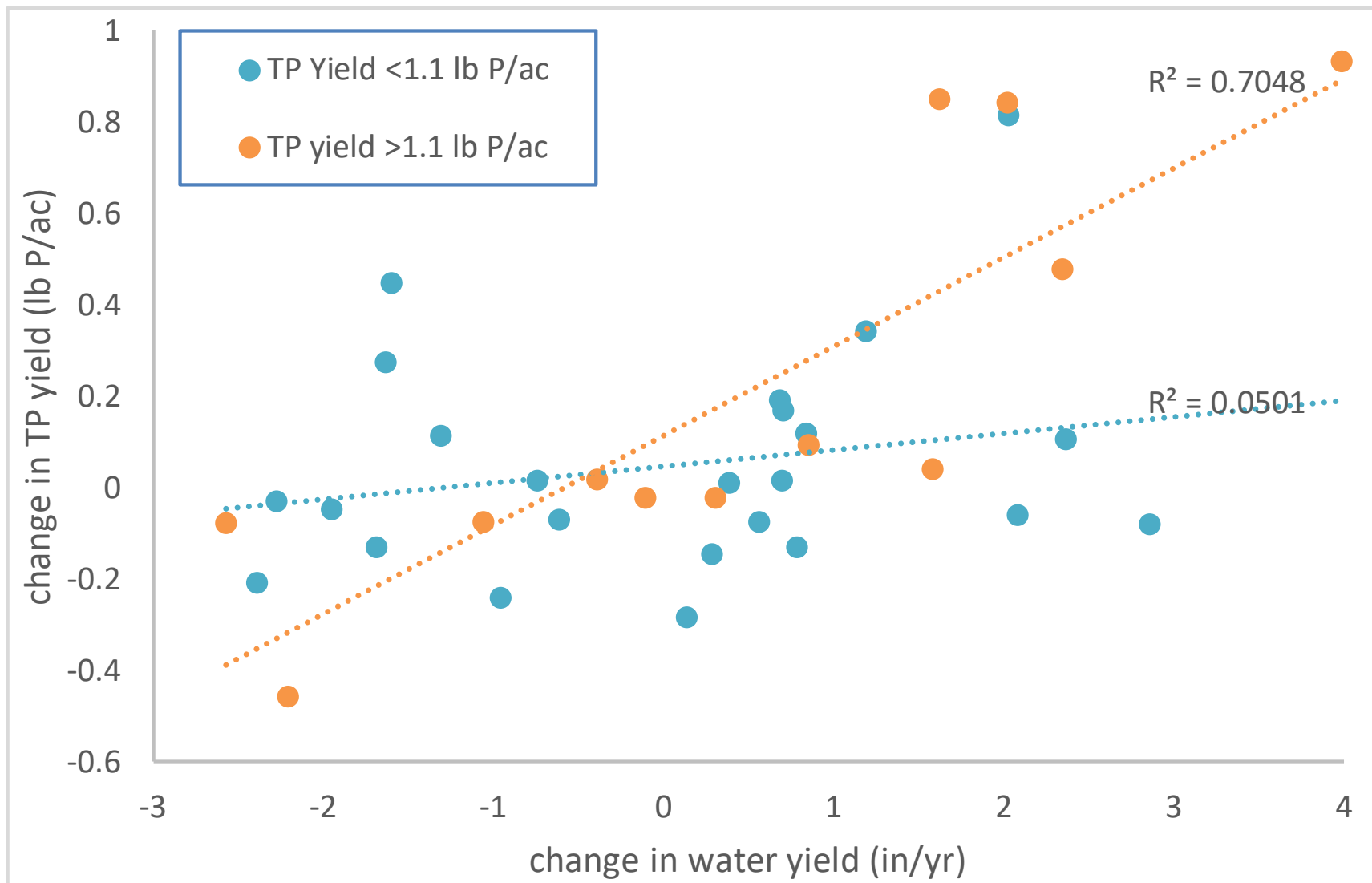
IL NLRs (2015)

TP yields by HUC 8 2012-17



Aaron Hoyle-Katz NCSA

Change in HUC 8 estimates of TP yield from 1997-2011 to 2012-17 plotted against change in water yield from 1997-2011 to 2012-17. Chicago, Des Plaines, Sangamon Basins are excluded due to high point source inputs. The Sny is excluded due to high uncertainty in yield estimate.



2017 Estimated Point Source Total P Loads by HUC 8

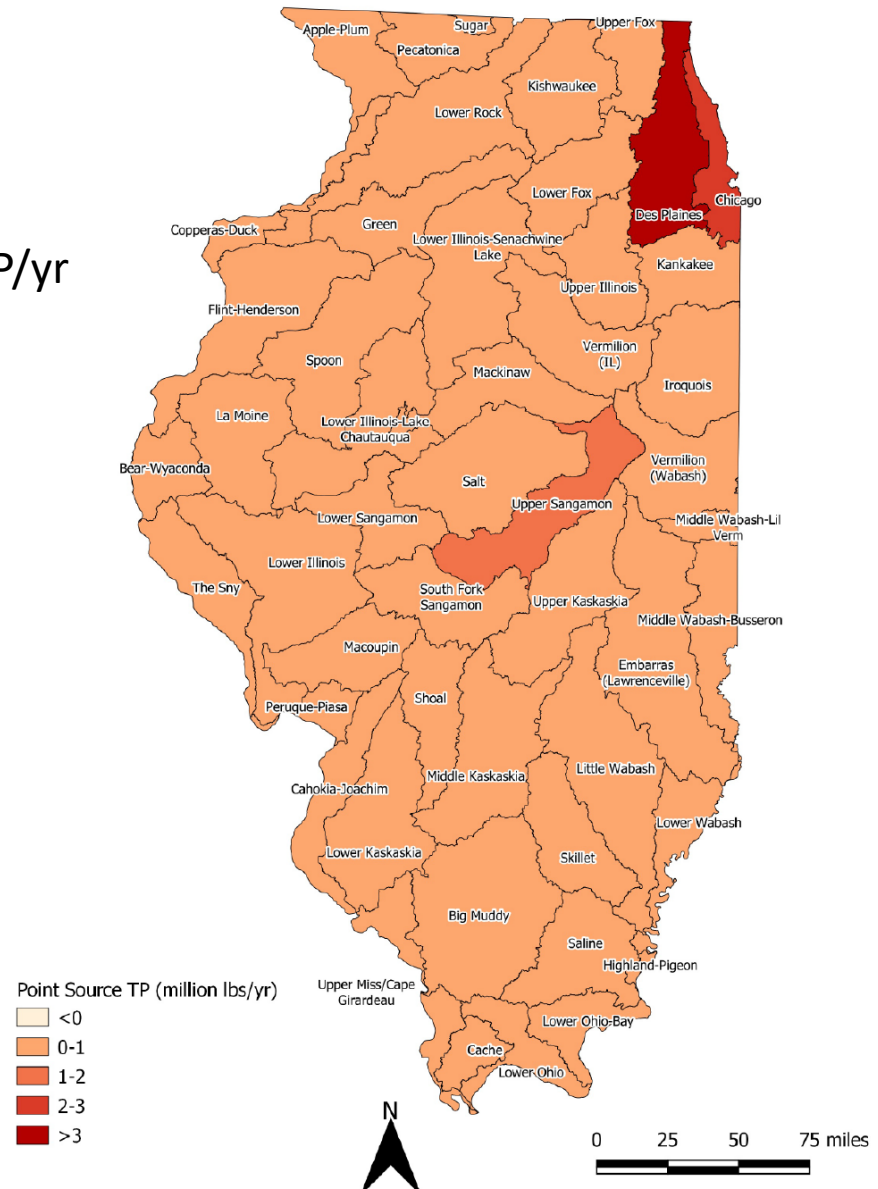
Statewide TP riverine load: 43 million lb P/yr

Statewide TP point source load 14.1 million lb P/yr

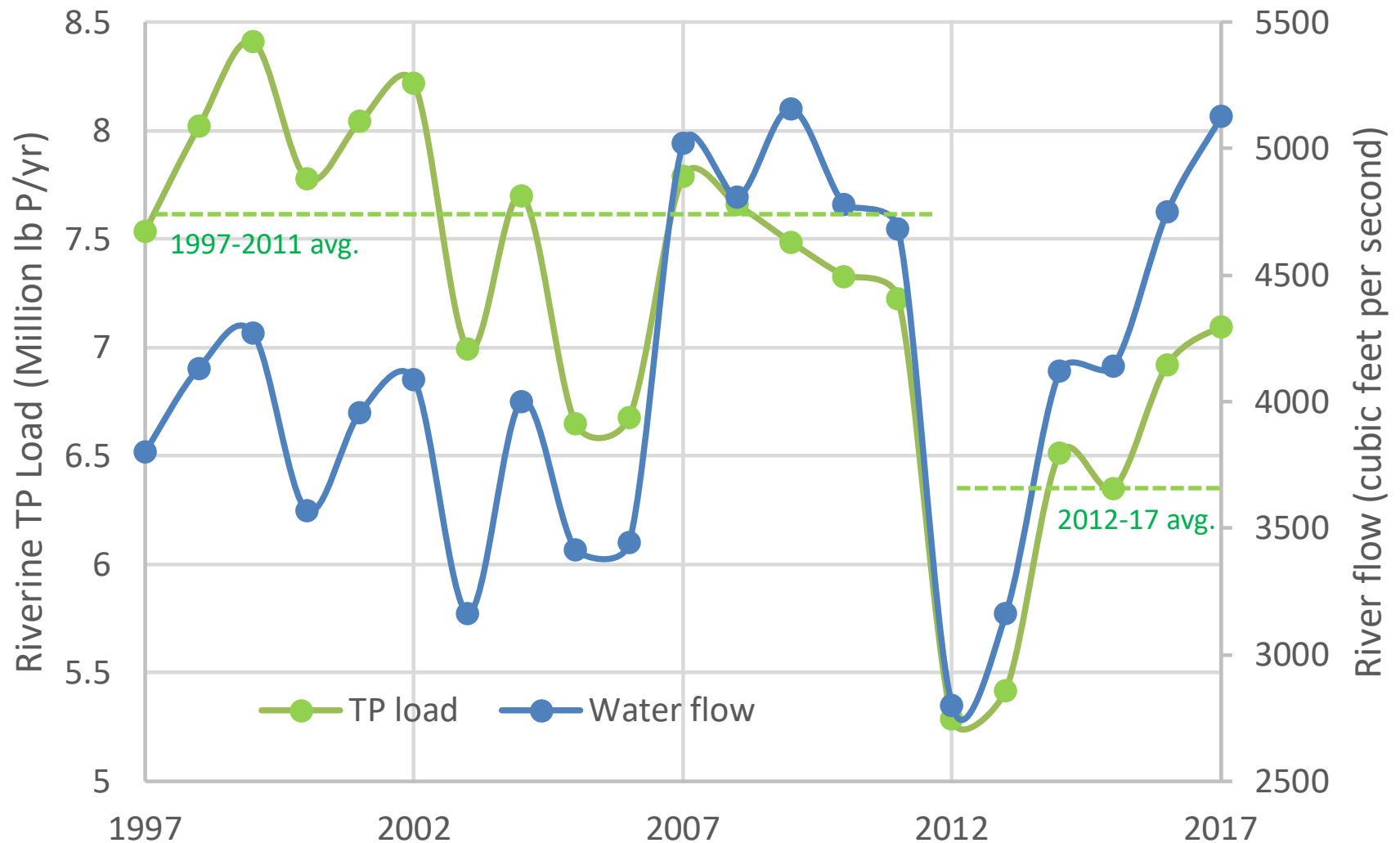
Des Plaines HUC: 4.1 million lb P/yr

Chicago HUC: 2.9 million lb P/yr

Upper Sangamon HUC 1.8 million lb P/yr



Riverine TP Load and Water Flow for the Des Plaines River at Joliet minus Des Plaines at Russell plus DuPage River at Shorewood
(Approximately Des Plaines plus Chicago HUCs; Point source load reduction of ~2.3 million lb P/yr from 2011 to 2017)



Summary

- Statewide average riverine waterflow, nitrate-N load and TP load estimates 2013-2017 were 13%, 7%, and 26% greater than the 1980-96 baseline period.
- Point source 2017 estimated point TP and TN discharges were 22% and 14% lower than 2011 estimates.
- At the HUC 8 scale, nitrate and TP yields 2012-17 were generally similar to 1997-2011 values, with some exceptions:
 - TP load reductions in Chicago and Des Plaines
 - TP increases in the Upper Sangamon and elsewhere
 - Changes in nitrate-N load were correlated with changes in water flow for HUCs with high N yields
 - Nitrate-N reductions per unit of water yield in the Mackinaw, Spoon and Kaskaskia Rivers and Henderson Creek

Suggestions for Further Study and Future Updates

- Identify factors causing changes in loads
- More frequent sampling of rivers, especially for P at high flow
- QA/QC point source data
- Use more than one year of point source discharge data
- Focus on monitored watersheds rather than HUCs
- Estimate loads in unmonitored watersheds by watershed characteristics rather than by neighboring HUC
- Evaluate Uncertainty and Climate Change Impacts

Acknowledgements

- Funding from IEPA
- River flow and concentration data from USGS, IEPA, Lowell Gentry (U of IL), Fox River Study Group and Metropolitan Water Reclamation District of Greater Chicago (MWRD)
- Point Source discharge data from USEPA and IEPA (Trevor Sample) and Sanitary District of Decatur
- GIS from Aaron Hoyle-Katz and Jong Sung Lee at the National Center for Supercomputing Applications
- Helpful comments from Trevor Sample, Dennis McKenna, George Czapar, Momcilo Markus, Clark Bullard, Bruce Hannon.

Thank you!

IL NLRs Biennial Report Review

Chapter 4: Agricultural Sector

Warren D. Goetsch, Illinois Department of Agriculture



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector



Figure 2.1. The NLRS Logic Model



Chapter 4: Agricultural Sector

- *Resources Measures*

- Staff Resources
- Funding Resources

- *Outreach Measures*

- Activities
- Topics

- *Land and Facilities Measures*

- USDA-FSA
- IDNR
- USDA-NRCS

- *Land and Facilities Measures (con't)*

- University of Illinois
- IDA
- IEPA
- USDA-NASS
- Current Programs
 - State Programs & Projects
 - Federal Programs & Projects
 - NGO Programs & Projects
 - ***New Initiatives***



Chapter 4: Agricultural Sector:

Staff Resources

- 2016 -- **89** staff members were engaged in Illinois NLRs outreach, implementation, or research for the agricultural sector. *(2015-2017 Biennial Report)*
- 2017 – **250** Full-Time Equivalents engaged in NLRs outreach activities
- 2018 – **377** Full-Time Equivalents engaged in NLRs outreach activities



Chapter 4: Agricultural Sector:

Funding Resources

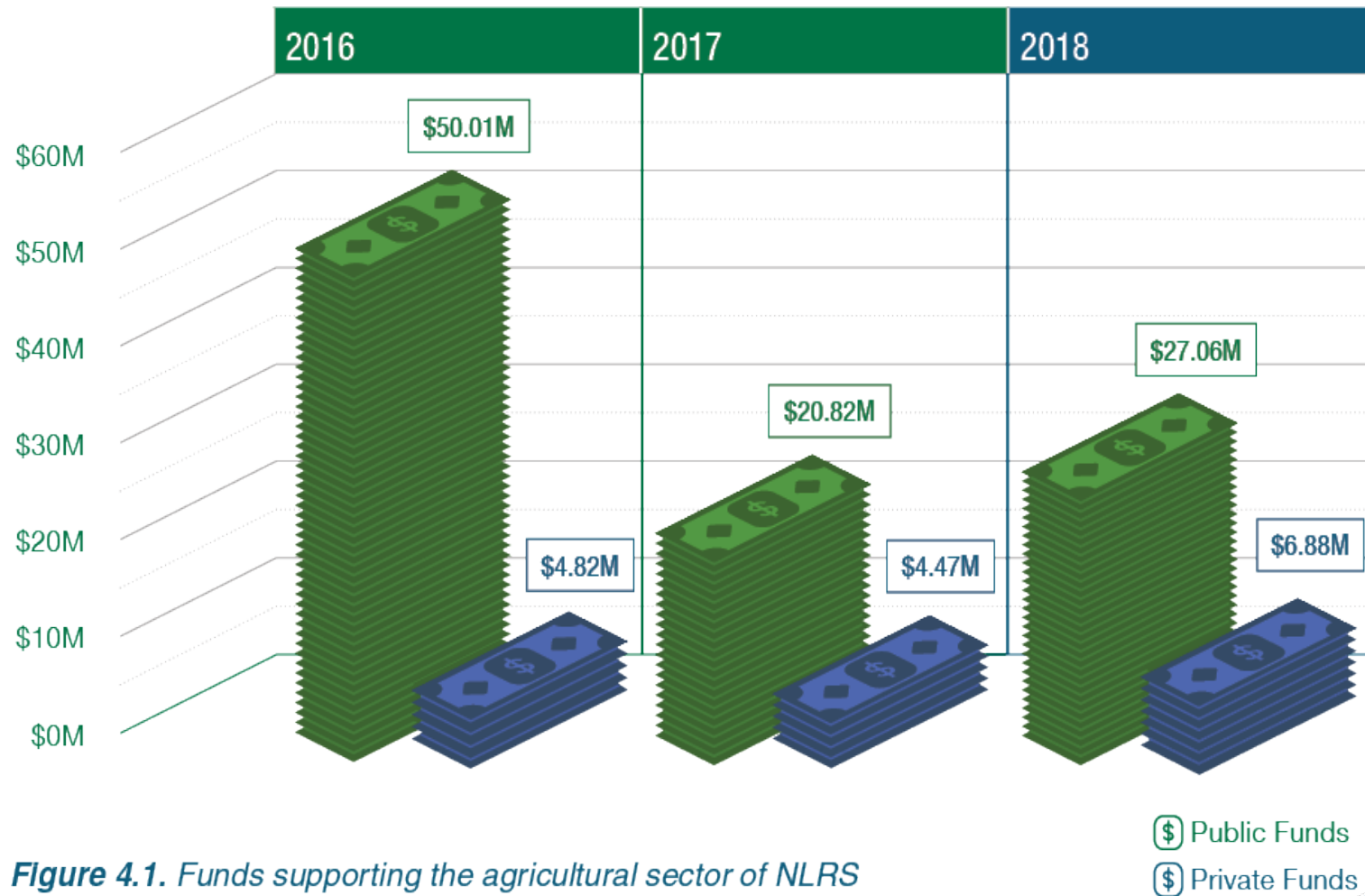


Figure 4.1. Funds supporting the agricultural sector of NLRs



Chapter 4: Agricultural Sector: *Outreach Measures*

Table 4.1. Outreach activities and associated attendance

	2015–2016		2017–2018	
Type of Outreach	Number of Events	Total Attendance	Number of Events	Total Attendance
Presentations	457	16,000	602	38,155
Field Days	130	3,692	204	18,493
Workshops	607	12,695	423	18,478
Conferences	27	6,935	42	9,355
Total	1,221	39,325	1,271	84,481



Agricultural Sector:

Outreach Measures

	Topic	Number of Activities	% of Activities
General Topics	NLRS (<i>strategy</i>)	576	52 %
	BMPs	473	43 %
	Soil Health	390	35 %
	Programs	10	10 %
Specific BMPs	Nutrient Management	31	31 %
	Cover Crops	31	31 %
	Edge of Field	19	19 %
	Tillage	2	2 %



Chapter 4: Agricultural Sector: *Outreach Measures*

Table 4.3. Illinois NLRS survey result—Farmer BMP knowledge (percent reporting in 2019)

	Not at all Knowledgeable	Slightly Knowledgeable	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable
Nutrient Loss Reduction Strategy	21.0%	27.0%	38.4%	11.6%	2.0%
MRTN Strategy	20.3%	33.5%	25.5%	14.1%	6.6%
Bioreactors	53.8%	23.0%	15.0%	5.5%	2.7%
Constructed Wetlands	19.7%	29.6%	38.0%	10.2%	2.5%
Cover Crops Management	15.2%	16.7%	35.5%	28.4%	4.2%



Chapter 4: Agricultural Sector:

Land and Facilities Measures

USDA-FSA

- Conservation Reserve Program (CRP)
- Cover Crops Reporting

IDNR

- Conservation Reserve Enhancement Program (CREP)

USDA – NRCS

- Environmental Quality Incentives Program (EQIP)
- Conservation Stewardship Program (CSP)
- Wetlands Reserve Easement Program (WREP)
- Regional Conservation Partnership Program (RCPP)

University of Illinois

- Woodchip Bioreactors

Illinois Department of Agriculture

- Partners for Conservation Cost Share Program
- IL Soil Conservation Transect Survey

Illinois Environmental Protection Agency

- Section 319 Non-Point Source Program

USDA-National Agricultural Statistics Service

- Illinois NLRs Survey



Chapter 4: Agricultural Sector:

Land and Facilities Measures

USDA-FSA

Table 4.4 Acres in CRP Wetlands and Buffers

	2011	2015	2017	2018
CRP Wetlands	57,463	45,790	43,826	55,716
CRP Buffers	145,813	279,534	270,002	265,753

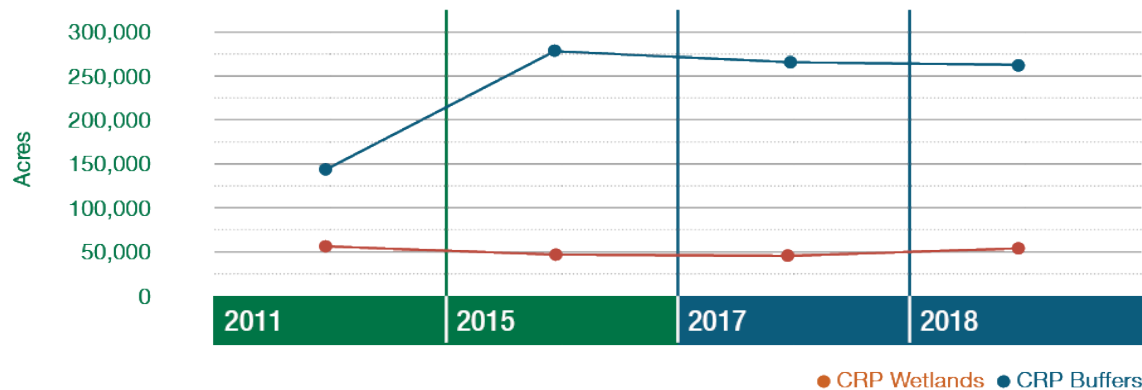


Figure 4.2. Acres in CRP wetlands and buffers.

Table 4.6. Acres in Cover Crops reported by producers to FSA

	2011	2015	2017	2018
Cover crops	768	11,064	83,980	92,970

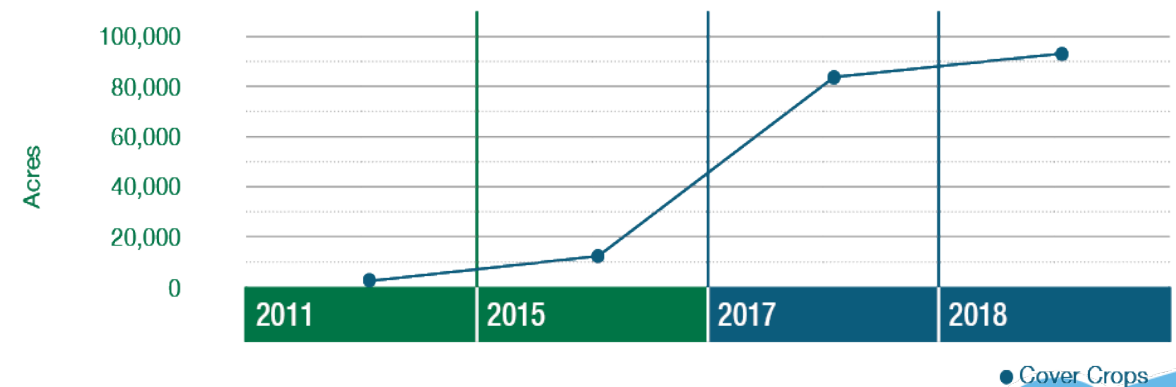


Figure 4.4. Acres in cover crops reported by producers to the Farm Service Agency.



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

Table 4.7. Acres with Illinois DNR Conservation Reserve Enhancement Program Easements

	2011	2012	2013	2014	2015	2016	2017	2018
Wetlands	20	651	3,681	11,976	17,406	19,467	19,523	19,523
Buffers	526	1,324	2,720	5,467	8,768	13,568	13,764	13,850
Perennial/Energy	0	7	84	1,622	2,107	4,395	4,670	4,718

IDNR

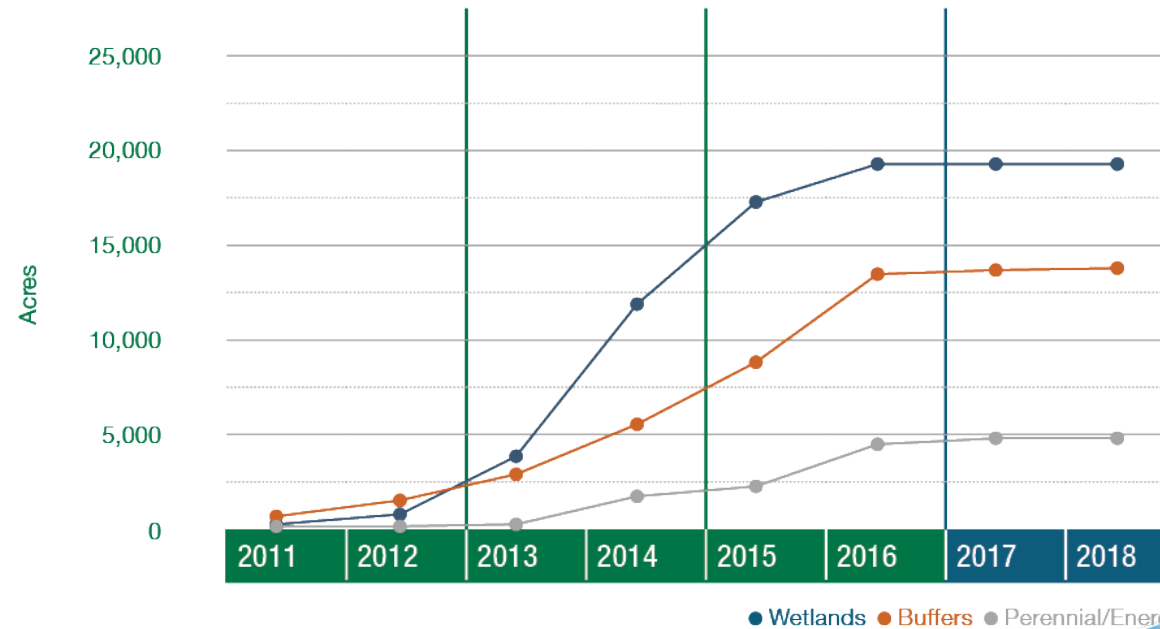


Figure 4.6. Acres with Illinois Department of Natural Resources CREP Easements.



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

Table 4.10. New wetland acres enrolled in Wetland Reserve Easement Program

USDA-NRCS

	2011	2012	2013	2014	2015	2016	2017	2018
Acres Per Year	1,788	1,420	569	305	396	1,237	2,600	260
Cumulative Acres	1,788	3,208	3,777	4,082	4,478	5,715	8,315	8,575

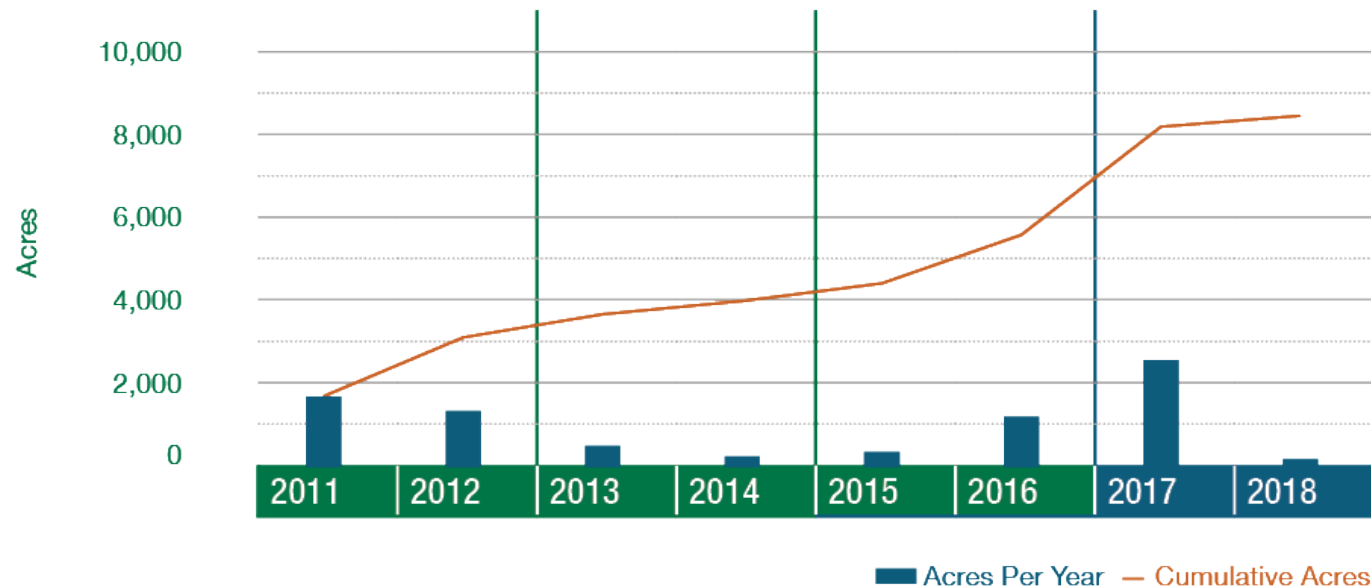


Figure 4.9. New acres enrolled in the Wetland Reserve Easement Program from 2011 to 2018.



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

U of I

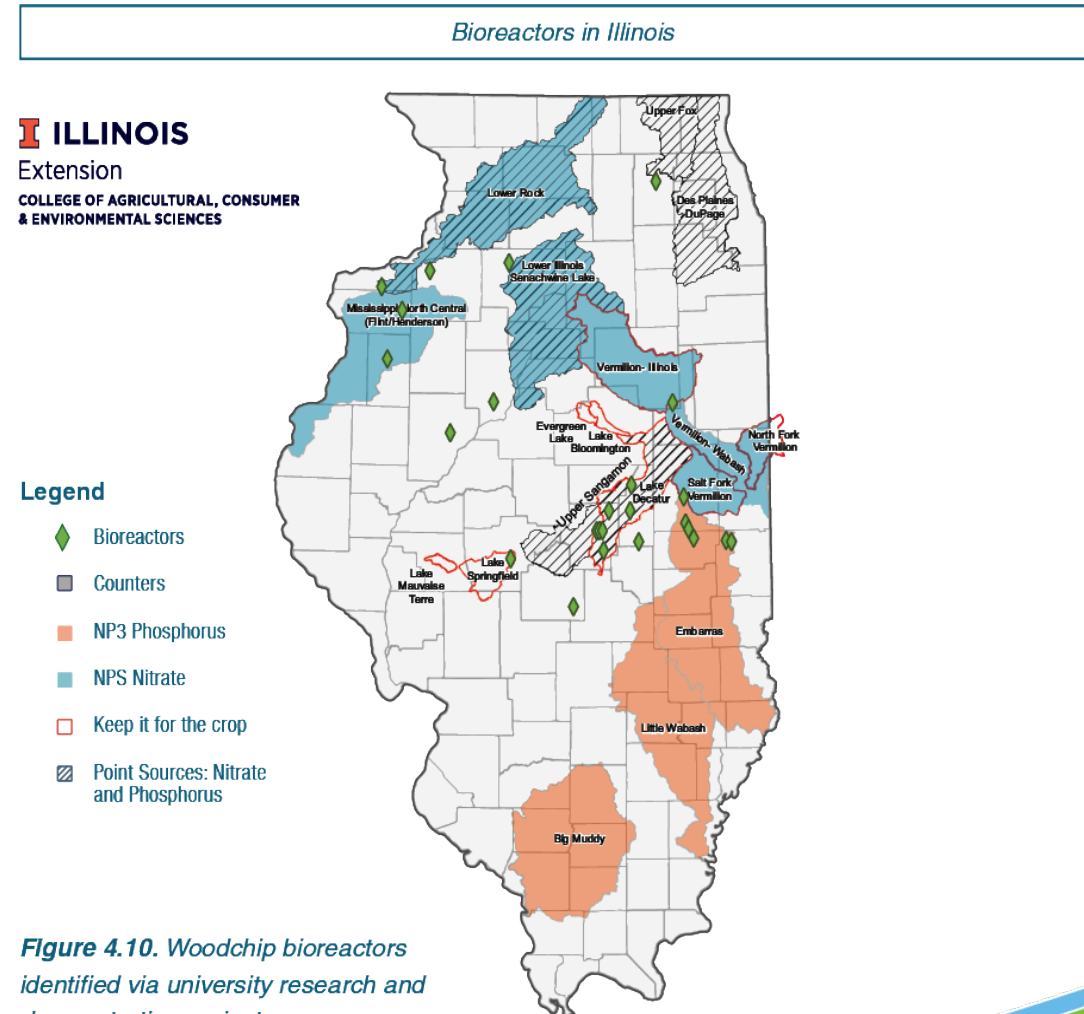


Figure 4.10. Woodchip bioreactors identified via university research and demonstration projects.

2X

In just two years, the number of woodchip bioreactors in Illinois has
nearly doubled



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

Soil Transect Survey

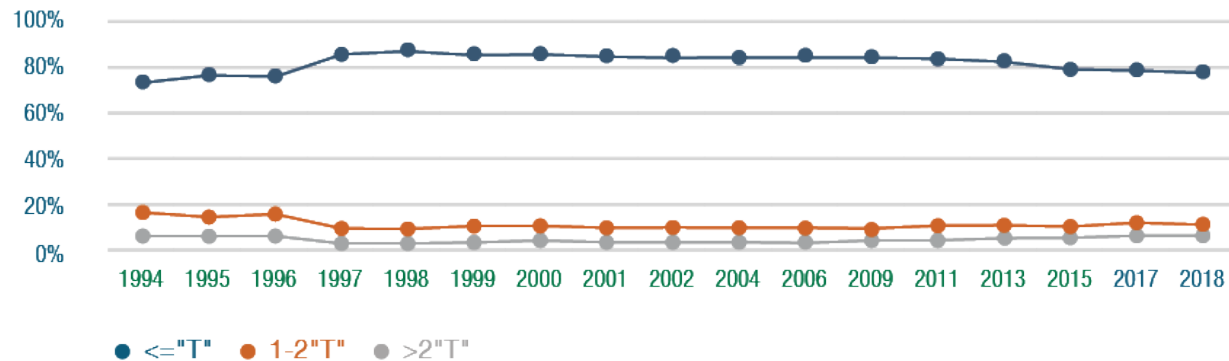


Figure 4.18. Soil loss relative to "T" from the Soil Transect Survey

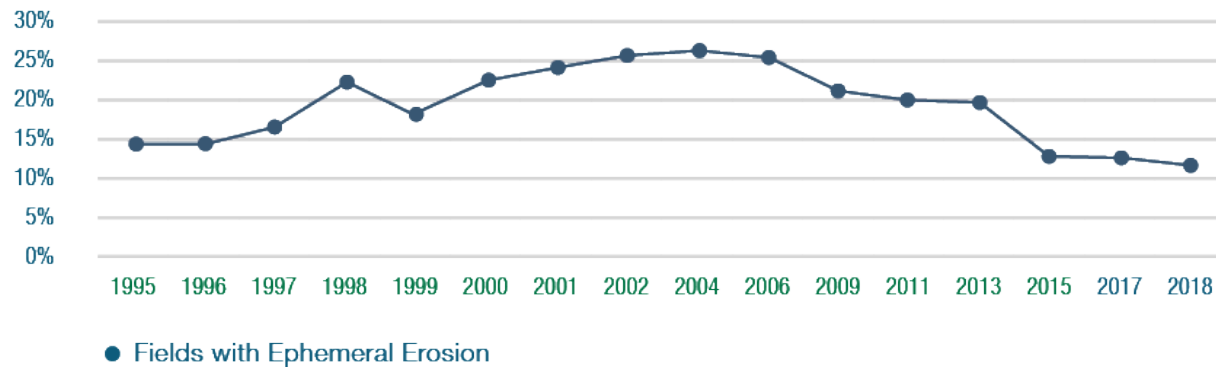


Figure 4.19. Percent of fields with ephemeral erosion from the Soil Transect Survey



Chapter 4: Agricultural Sector:

Land and Facilities Measures

Soil Transect Survey

HUC8 watersheds percent of transect points $\leq 1T$



Legend

- 85.0–100.0
- 80.0–85.0
- 75.0–80.0
- 60.0–75.0
- 48.4–60.0

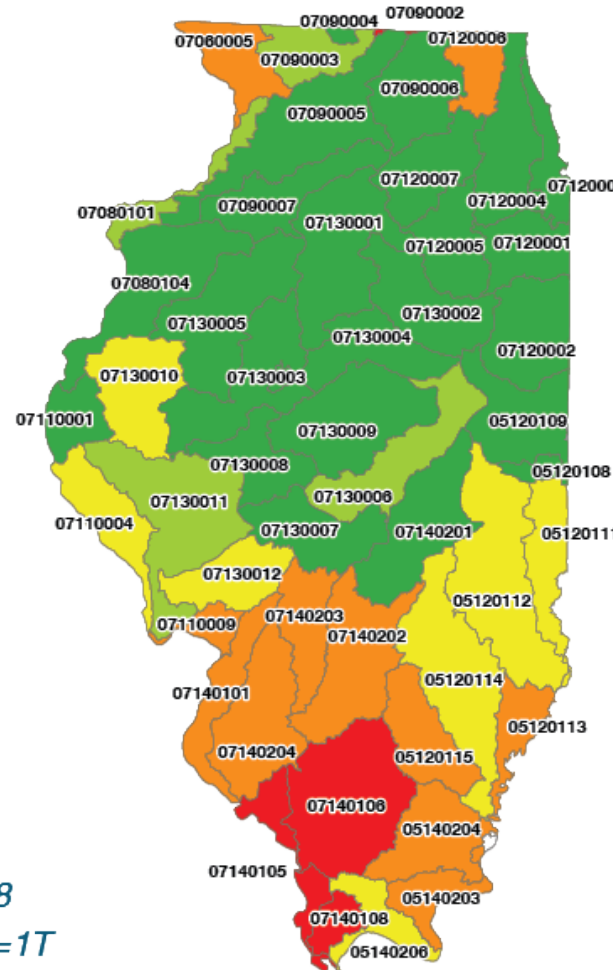


Figure 4.20. *Percent of HUC8 watersheds transect points $\leq 1T$*



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

Table 4.15. Acres with a nitrogen management strategy

	Acres in 2011	Acres in 2015	Acres in 2017
Acres of corn planted	12,600,000	11,700,000	11,200,000
Acres where an MRTN strategy was used to determine application rates	8,820,000 or 70% of planted acres	9,430,000 or 81% of planted acres	3,730,000 or 33% of planted acres
Other industry-approved technique	Not asked	Not asked	7,750,000 or 69% of planted acres

USDA-NASS
Survey

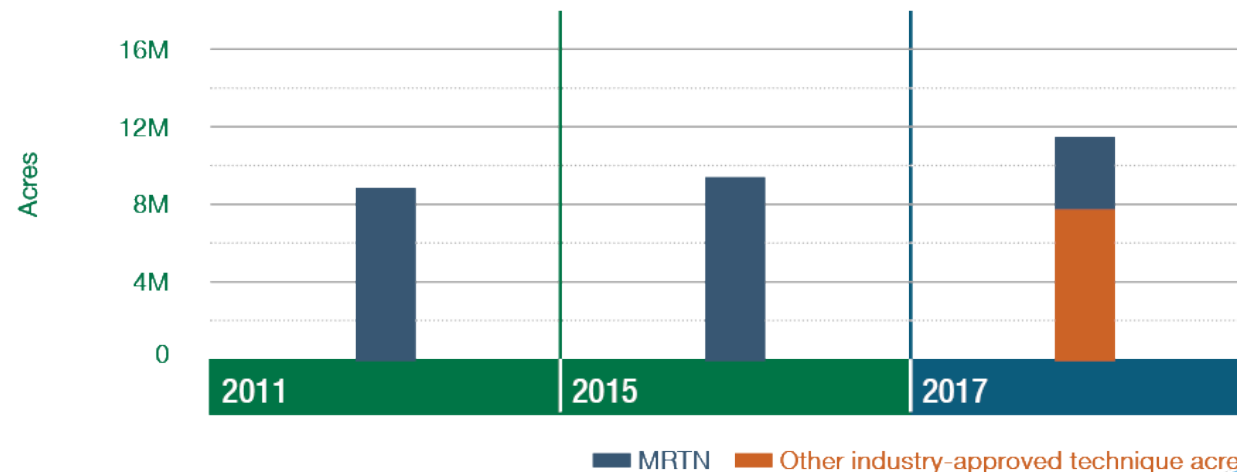


Figure 4.23. Acres where a nitrogen management strategy was used to determine application rates.



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Chapter 4: Agricultural Sector:

Land and Facilities Measures

USDA-NASS Survey

Table 4.16. *Tiled acres with fertilizer application strategies for corn*

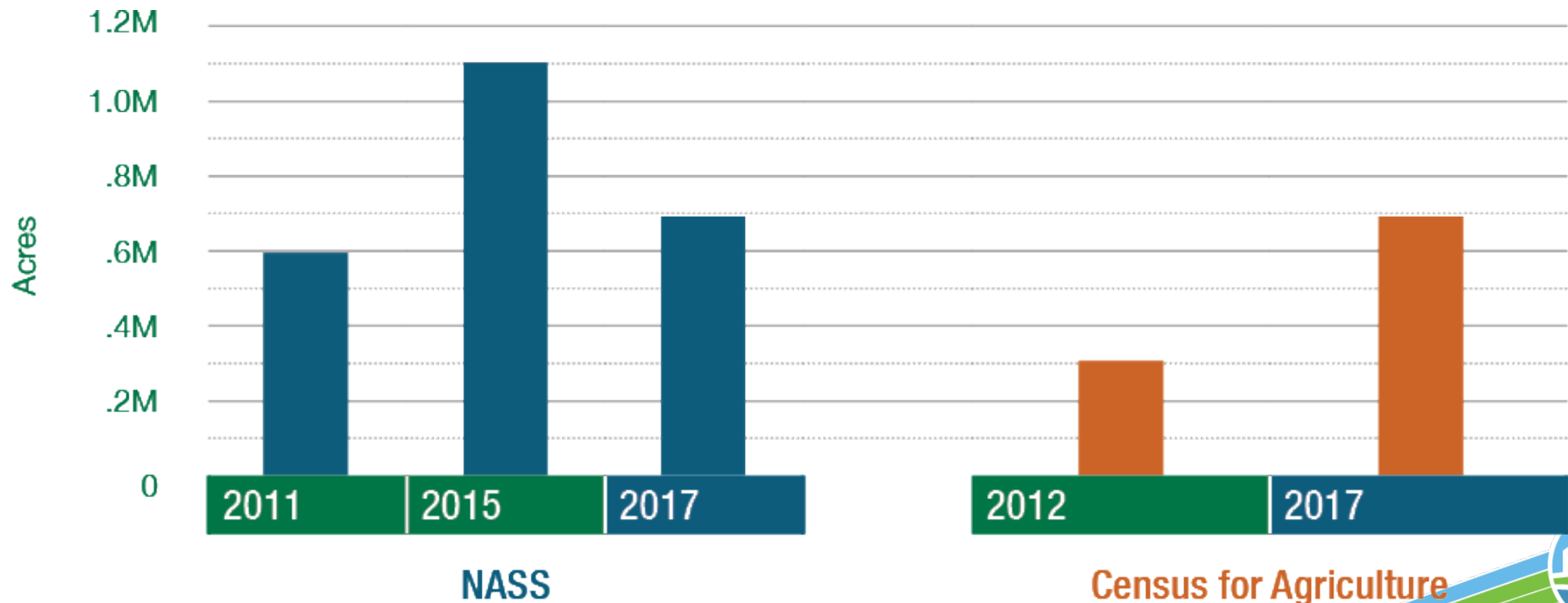
	Acres in 2011	Acres in 2015	Acres in 2017
Acres of corn planted	12,600,000	11,700,000	11,200,000
Fall/winter nitrogen was applied with a nitrification inhibitor	3,240,000 or 26% of planted acres	2,970,000 or 25% of planted acres	3,550,000 or 32% of planted acres
Spring nitrogen was applied with a nitrification inhibitor	Not asked	Not asked	2,790,000 Or 25% of planted acres



Chapter 4: Agricultural Sector:

Land and Facilities Measures

USDA-NASS Survey – Cover Crops



Chapter 4: Agricultural Sector:

Land and Facilities Measures

- 39 agricultural-related programs, initiatives, and projects developed by agencies and non-government organizations listed in the original state Nutrient Loss Reduction Strategy

State Programs

- Conservation Reserve Enhancement Program (CREP)
- Partners for Conservation Cost-Share Program
- Clean Water Act Section 319 Program
- State Revolving Fund
- Streambank Stabilization and Restoration Program (SSRP)



Chapter 4: Agricultural Sector:

Land and Facilities Measures

- 39 agricultural-related programs, initiatives, and projects developed by agencies and non-government organizations listed in the original state Nutrient Loss Reduction Strategy

Federal Programs

- Conservation Stewardship Program (CSP)
- Cost-Share and Technical Assistance Funding
- Easement Programs
- Environmental Quality Incentives Program (EQIP)
- Driftless Area Landscape Conservation Initiatives Program
- Mississippi River Basin Initiative
- National Water Quality Initiative
- Regional Conservation Partnership Program (RCPP)



Chapter 4: Agricultural Sector:

Land and Facilities Measures

- 39 agricultural-related programs, initiatives, and projects developed by agencies and non-government organizations (NGO) listed in the original state Nutrient Loss Reduction Strategy

NGO Programs & Projects

- 4R Metrics
- 4R4U: a Nutrient Stewardship Partnership
- 5-year Soil Health Transition
- Advanced Conservation Drainage Training
- Advanced Soil Health Training
- Building Connections with Absentee Farmland Owners
- Cover Crop Training Initiative



Chapter 4: Agricultural Sector:

Land and Facilities Measures

NGO Programs & Projects (continued)

- Crop Grower Satellite Imagery Analysis
- Demonstration Farm partnership
- Field Laboratories
- The Franklin Demonstration and Research Farm
- Free, Confidential Water Testing Program
- Illinois Alphabet Soup Group
- Illinois Buffer partnership
- Illinois Cover Crop Programs
- Illinois Sustainable Agriculture partnership
- Keep it 4R Crop Program
- Leadership for Midwestern Watersheds
- Local Farmer-Led Networks
- N-WATCH™
- Nitrogen Rate Trials
- Nutrient Research & Education Council
- Nutrient Stewardship Grant Program
- Precision Conservation Management
- Risk Management Conference
- The S.T.A.R. Farmer Recognition Program
- Upper Macoupin Watershed Regional Conservation partnership Program
- Water Supply & Industry Partnerships
- Women for the Land
- 4R Metrics
- ***New Initiatives***
 - ***Edge-of-Field Partnerships for Saturated Buffers***
 - ***Edge-of-Field Partnerships for Woodchip Bioreactors***
 - ***Fall Covers for Spring Savings***
 - ***Illinois Extension Watershed Outreach Associates***



Chapter 4: Agricultural Sector:

Land and Facilities Measures

NEW INITIATIVE: Edge-of-Field Partnership for Saturated Buffers

- Saturated Buffer connects a drainage tile outlet with an edge-of-field buffer using denitrification and vegetative uptake to remove nutrients from drainage water.
- Partners
 - Illinois Farm Bureau
 - Illinois Chapter of the Land Improvement Contractors of America
 - USDA-NRCS
 - Southern Illinois University
- First installation planned for 2019
- One new site each year for 5 years in different counties



Chapter 4: Agricultural Sector:

Land and Facilities Measures

NEW INITIATIVE: Edge-of-Field Partnership for Woodchip Bioreactors

- Purpose to study the effectiveness of woodchip bioreactors designed to USDA-NRCS standards in treating tile drainage waters.
- Partners
 - Illinois Farm Bureau
 - Illinois Chapter of the Land Improvement Contractors of America
 - USDA-NRCS
 - University of Illinois College of Agricultural, Consumer and Environmental Sciences
- First installation completed in 2017 in Henry County, second completed in 2018 in Bureau County
- Partnership plans to install 5-10 woodchip bioreactors over 5 years with at least one per year
- University researchers to monitor performance for a minimum of five years after installation



Chapter 4: Agricultural Sector:

Land and Facilities Measures

NEW INITIATIVE: Fall Covers for Spring Savings

- Incentive program for the use of cover crops
- Crop Insurance Premium Discount Program for the planting of cover crops on insured acres
- Partners
 - Illinois Department of Agriculture
 - USDA-RMA
 - Soil and Water Conservation Districts
 - Individual farmers
- \$5 per acre premium discount on crop insurance invoice
- 50,000 acre limit for 2020
- Proposing a 100,000 acre limit for 2021 and 200,000 acre limit for 2022, depending on future IL General Assembly appropriations



Chapter 4: Agricultural Sector:

Land and Facilities Measures

NEW INITIATIVE: Illinois Extension Watershed Outreach Associates

- Two watershed outreach associates, one stationed in Effingham (*Little Wabash River and Embarras River*) and one in Galva (*Mississippi Central/Henderson Creek and Lower Rock River*)
- Partners
 - Illinois Environmental Protection Agency
 - University of Illinois Extension
- Purpose to develop and deliver education, outreach and technical assistance centered in and focused on selected priority watershed basins. Started in 2018.



IL NLRs Biennial Report 2019

Chapter 4: Agricultural Sector

Questions?



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY



CHAPTER 5

POINT SOURCE SECTOR

- ▶ **Resource Measures**
 - ▶ **Outreach Measure**
 - ▶ **Land and Facility Measures**
- 
- A series of three parallel white lines of varying lengths, slanted diagonally upwards from left to right, located in the bottom right corner of the slide.

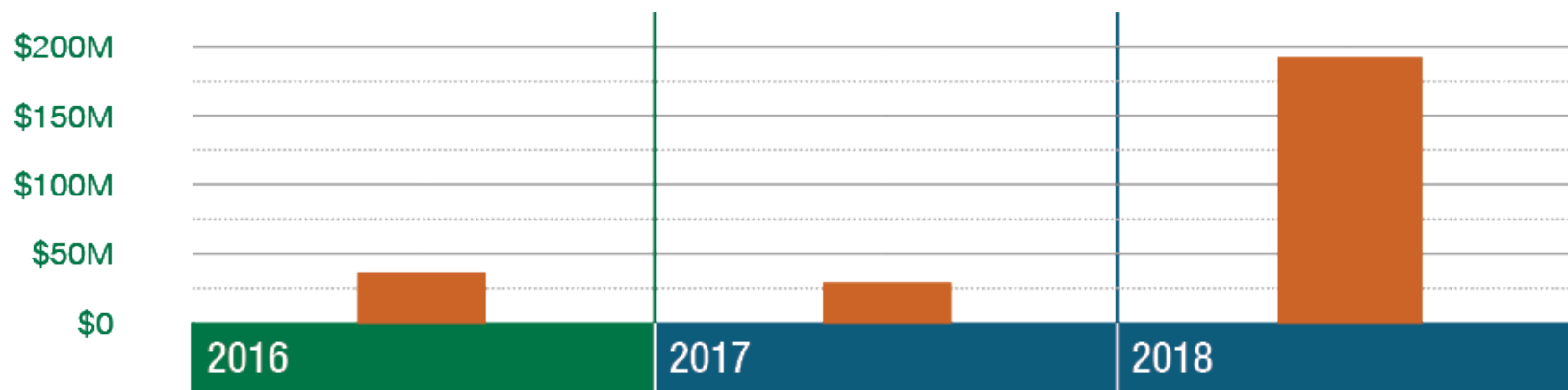


Figure 5.1. Point source spending comparison for 2016, 2017, and 2018 reported by IAWA member wastewater treatment agencies

Nutrient reduction-related activity	2017 Totals	2018 Totals
Capital improvement	\$26,025,314	\$186,175,448
Operations and maintenance	\$934,474	\$2,398,542
Feasibility studies or permit required projects	\$1,255,866	\$2,328,001
Staff	\$1,979,250	\$2,283,170
Other	\$135.800	\$555.500

RESOURCE MEASURES

2017-2018

Type of Activity	Number of Events	Attendance
Conferences	2	140
Field Days	2	160
Presentations	23	2467
Workshops	2	160
Totals	29	2927

OUTREACH MEASURES



Table 5.3. Statewide total phosphorus loads by the point source sector in 2018

Point Source Sector	Total Phosphorus Load (million lb/yr)
2011 Baseline	18.1
2018 Total Phosphorus Load > 213 Major Municipals > Minor Municipals > Major and Minor Industrials	13.8 11.1 2.4 0.3
Reductions from 2011 Baseline	4.3 (24%)



■ 213 Major Municipals
 ■ Minor Municipals
 ■ Major and Minor Industrials

24%
Total Phosphorus Reduction

Figure 5.2 Statewide total phosphorus loads by the point source sector in 2018

LAND AND FACILITY MEASURES

Facility Name	NPDES Permit	2011 TP Load (lb/yr)	2018 TP Load (lb/yr)	Reduction (lb/yr)	Percent Reduction
MWRDGC-Stickney	IL0028053	2,344,030	707,230	1,636,800	70
MWRDGC-Kirie	IL0047741	141,985	40,012	101,973	72
MWRDGC-Calumet	IL0028061	2,058,425	1,990,902	67,523	3
Sangamon County Water Reclamation District-Spring Creek	IL0021989	113,296	49,419	63,877	56
North Shore Sanitary District-Gurnee	IL0035092	116,070	52,700	63,370	55
Village of Fox Lake	IL0020958	76,657	17,808	58,849	77
City of Belleville	IL0021873	67,701	11,040	56,661	84
DuPage County Public Works	IL0065188	73,625	17,683	55,942	76
Village of Plainfield	IL0074373	63,469	7,918	55,551	88
Greater Peoria Sanitary and Sewage District	IL0021288	96,827	42,477	54,350	56

LAND AND FACILITY MEASURES

Facility Name	NPDES Permit	Average Flow	Average TP Concentration (mg/L)
MWRDGC-Stickney	IL0028053	775	0.31
MWRDGC-Kirie	IL0047741	38.48	0.27
MWRDGC-Calumet	IL0028061	247	2.6
Sangamon County Water Reclamation District-Spring Creek	IL0021989	34.98	0.48
North Shore Sanitary District-Gurnee	IL0035092	15.4	1.11
Village of Fox Lake	IL0020958	9.19	0.63
City of Belleville	IL0021873	5.32	0.65
DuPage County Public Works	IL0065188	7.59	0.72
Village of Plainfield	IL0074373	4.59	0.58
Greater Peoria Sanitary and Sewage District	IL0021288	22.4	0.64

Table 5.6 Comparison of statewide total nitrogen loads 2011–18

Point Source Sector	Total Nitrogen Load (million lb/yr)
2011 Baseline	87.3
Total Nitrogen Load	78.5
Reductions from 2011 Baseline	8.8 (10%)

**10%
Total Nitrogen
Reduction**

LAND AND FACILITY MEASURES

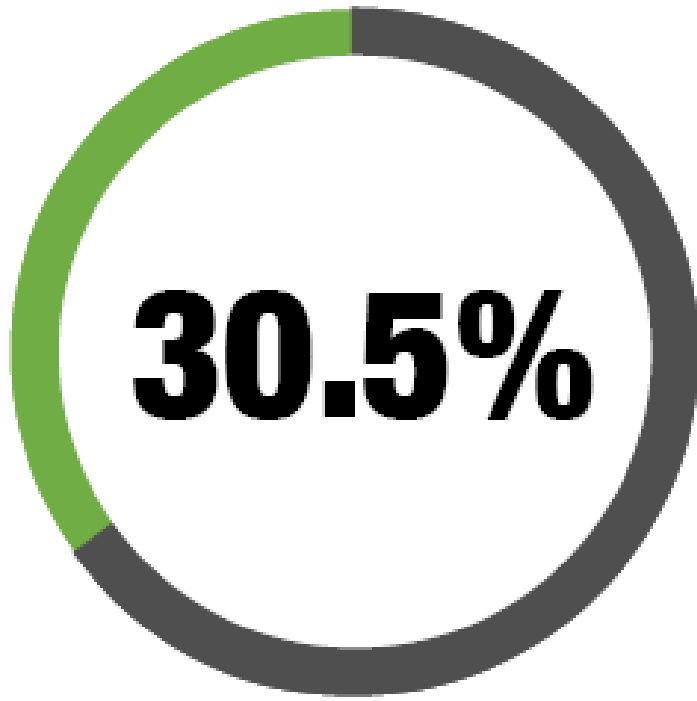


Figure 5.3 *Percentage of major municipal NPDES permits with total phosphorus limits statewide*



LAND AND FACILITY MEASURES

Table 5.7. Feasibility studies and optimization studies submitted by major facilities (222 total)

2018

Optimization

146

Permits to be issued
requiring optimization study

(2016)

122 (50)

Issued permits awaiting
optimization study

(2016)

72 (26)

Optimization studies
submitted

Feasibility

146

Permits to be issued
requiring feasibility study

111 (55)

Issued permits awaiting
feasibility study

84 (44)

Feasibility studies
submitted

LAND AND FACILITY MEASURES

Additional Program Updates

Illinois EPA Total Maximum Daily Load Program—Through 2018

- ▶ 94 approved Total Phosphorus TMDLs
- ▶ 8 approved nitrate-nitrogen TMDLs

LAND AND FACILITY MEASURES

Additional Program Updates

Illinois EPA Concentrated Animal Feeding Operations

- ▶ 536 active large CAFOs identified
- ▶ Since July 1, 2015—351 livestock facility site visits
- ▶ 19 facilities covered under general CAFO National Pollutant Discharge Elimination System (NPDES) permit

Illinois Department of Agriculture State Livestock Management Facilities Act

- ▶ Applications received and reviewed for siting and construction
 - ▶ 2017—124
 - ▶ 2018—90
 - ▶ Approved projects designed as zero discharge facilities
 - ▶ Waste management plans required

LAND AND FACILITY MEASURES

Additional Program Updates

Illinois EPA State Revolving Fund Water Pollution Control Loan Program

▶2017

- ▶7 Nutrient Reduction Projects= \$121,566,879**
- ▶Total program funding= \$358,848,130**

▶2018

- ▶4 Nutrient Reduction Projects= \$54,624,463**
- ▶Total Program Funding= \$309,560,356**

LAND AND FACILITY MEASURES



ILLINOIS

NUTRIENT LOSS REDUCTION STRATEGY

Improving our water resources with
collaboration and innovation

Chapter 6: Urban Stormwater Sector

Eliana Brown

University of Illinois Extension/Illinois-Indiana Sea Grant



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Table 6.1. Funds supporting 2018 nutrient reduction-related activities in the stormwater sector.

Nutrient reduction-related activity	2018 Totals
Grants or Loans Received	\$607,944
Grants Given	\$334,934
Other	\$13,000
Total	\$955,878



Table 6.2. Outreach events reported by the stormwater sector.

Type of Activity	Number of Events	Attendance
Field Days	9	555
Presentations	31	3,815
Conferences	3	650
Workshops	17	1,150
Totals	60	6,170



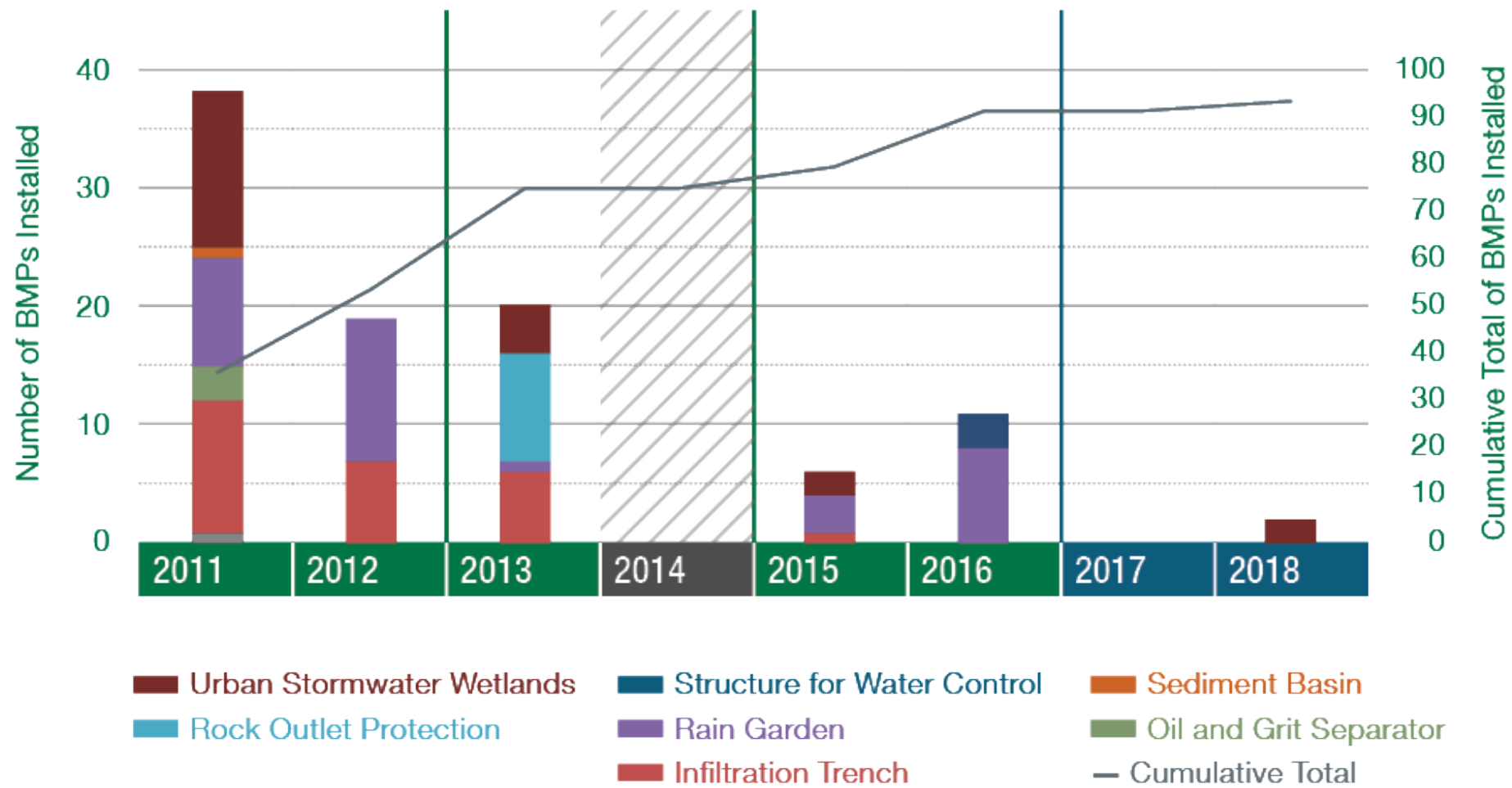


Figure 6.1. Number of urban practices installed under Section 319 Grant Program 2011–18



Location of Illinois MS4 Communities

I ILLINOIS

Extension

COLLEGE OF AGRICULTURAL, CONSUMER
& ENVIRONMENTAL SCIENCES

Legend

● MS4 Communities



Figure 6.5. MS4 communities
with available annual reports

Note: The unincorporated
communities of Ingleside
and Mossville are also MS4
communities



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Table 6.4. Number of MS4s implementing practices

		Practice	Number of MS4s	Percent of MS4s
Physical Practices		Dry Weather Screening	143	49%
		Street Sweeping	114	39%
		De-icer Management	101	35%
		Detention Basin Maintenance	89	31%
		Litter Clean up Event	51	18%
		● Community Rain Gardens	30	10%
		● Bioswales	16	5%
Plans and Policies		● Green Infrastructure Grants	32	12%
		Stormwater Master Plans	27	9%
		● Stormwater Utility Fees	24	8%
Residential Programs		Community Outreach	278	97%
		Household Hazardous Waste Collections	92	32%
		● Rain Barrel Programs	80	27%
		Electronic Recycling	40	14%
		● Homeowner Rain Garden Incentives	23	8%

● Practices and programs depicted in Figure 6.6



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Number of GI Practices in Illinois MS4 Communities

I ILLINOIS
Extension
COLLEGE OF AGRICULTURAL, CONSUMER
& ENVIRONMENTAL SCIENCES

Number of GI Practices

- 5 or More
- 3-4
- 1-2
- 0

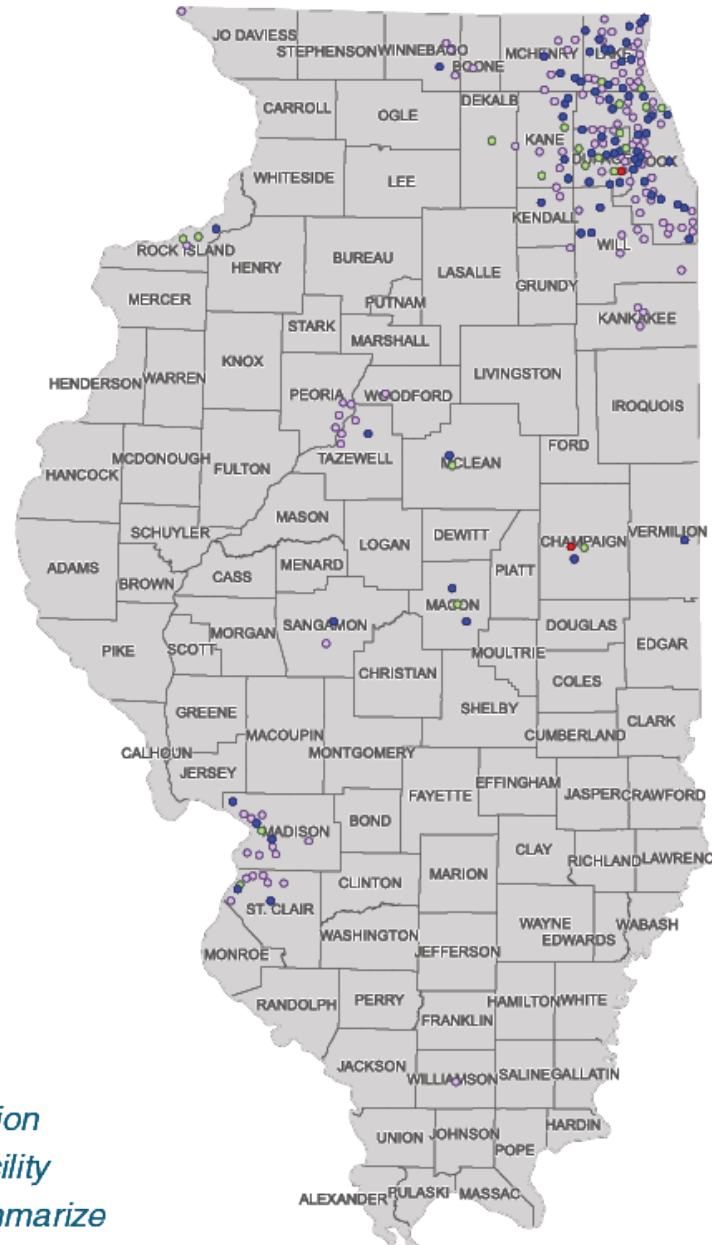


Figure 6.6. Illinois Extension reviewed MS4 Annual Facility Inspection Reports to summarize urban stormwater implementation

Note: The unincorporated communities of Ingleside and Mossville are also MS4 communities



ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.

Chapter 6

Adaptive Management and Measuring Progress

Adaptive Management and Measuring Progress

- ▶ Discussions during Policy Working Group and Performance Benchmark Committee meetings led to the formation of this new chapter
- ▶ Purpose is to assess current progress in meeting water quality goals and implementation with goals discussed in the NLRS.
- ▶ The NLRS is a “living” document that is updated every two years through the Biennial Reports

Adaptive Management and Measuring Progress

- ▶ Performance Benchmark Committee looked to information in the NLRs as a guide
 - ▶ Water Quality Goals
 - ▶ Interim Nutrient Loss Goals by 2025
 - ▶ Nitrate 15%
 - ▶ Total Phosphorus 25%
 - ▶ Long Term Nutrient Loss Goal
 - ▶ 45% reduction nitrate and total phosphorus
 - ▶ Implementation Scenario Examples
 - ▶ Scenarios NP2 and NP3

Adaptive Management and Measuring Progress

Water Quality Goals—Nitrate

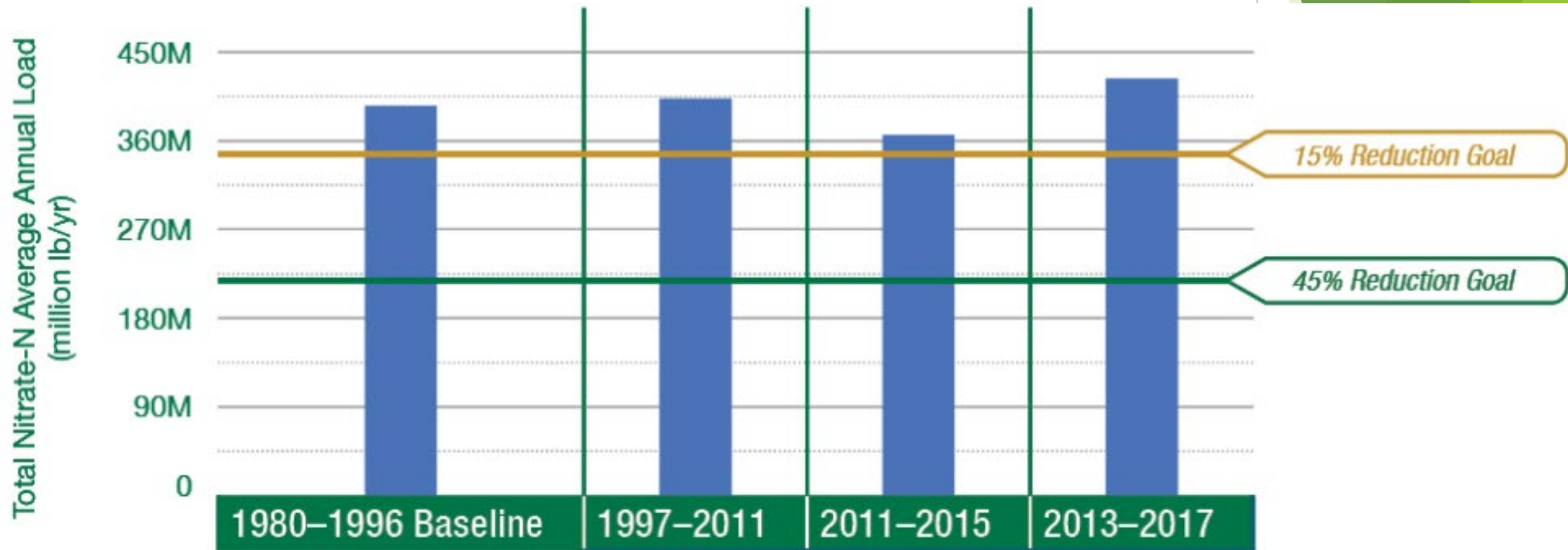


Figure 8.1. Illinois Nitrate Load

Adaptive Management and Measuring Progress

Water Quality Goals—Total Phosphorus

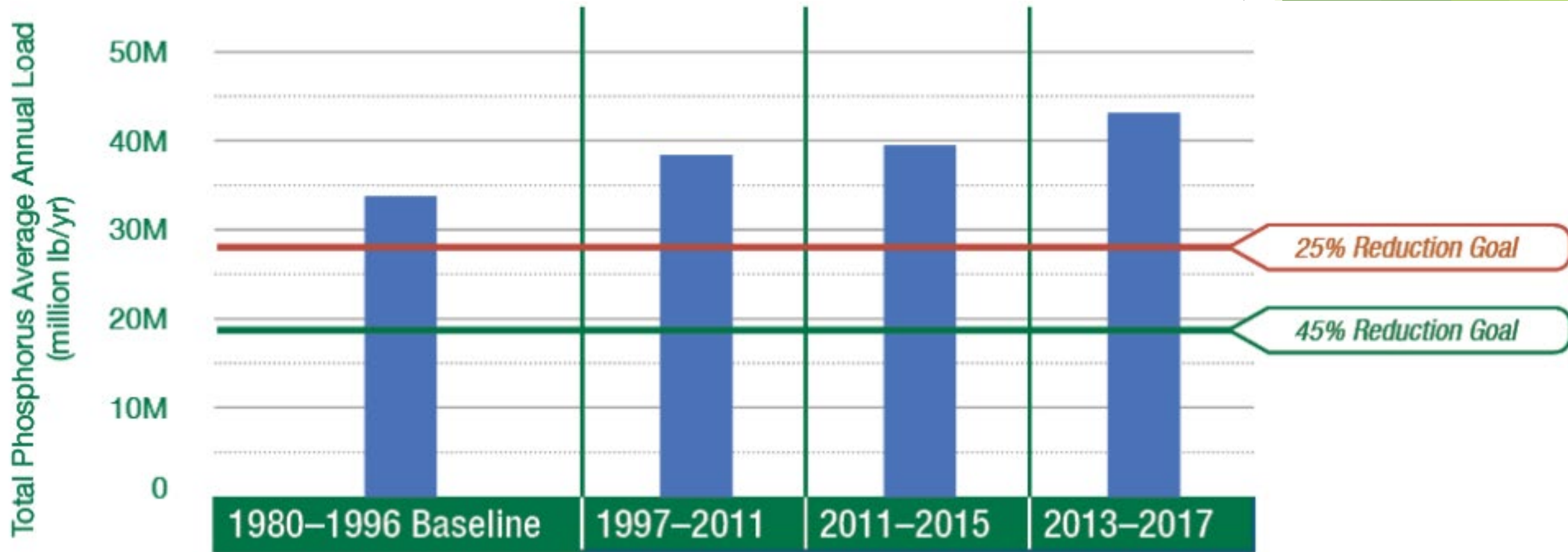


Figure 8.2. Illinois Total Phosphorus Load

Adaptive Management and Measuring Progress

Practice/scenario	Nitrate-N reduction per acre (percent)	Nitrate-N reduced (million lb)	Nitrate-N reduction from baseline (percent)	Cost (\$/lb removed)
Reducing N rate from background to MRTN on 10 percent of acres	10	2.3	0.6	-4.25
Nitrification inhibitor with all fall-applied fertilizer on tile-drained corn acres	10	4.3	1	2.33
Split application of 50 percent fall and 50 percent spring on tile-drained corn acres	7.5-10	13	3.1	6.22
Spring-only application on tile-drained corn acres	15-20	26	6.4	3.17
Split application of 40 percent fall, 10 percent pre-plant, and 50 percent side dress	15-20	26	6.4	
Cover crops on all corn/soybean tile-drained acres	30	84	20.5	3.21
Cover crops on all corn/soybean non-tiled acres	30	33	7.9	11.02
Bioreactors on 50 percent of tile-drained land	25	35	8.5	2.21
Wetlands on 35 percent of tile-drained land	50	49	11.9	4.05
Buffers on all applicable crop land (reduction only for water that interacts with active area)	90	36	8.7	1.63
Perennial/energy crops equal to pasture/hay acreage from 1987	90	10	2.6	9.34
Perennial/energy crops on 10 percent of tile-drained land	90	25	6.1	3.18
Point source reduction to 10 mg/L		14	3.4	3.3

- Implementation Scenarios
 - Nitrate

Adaptive Management and Measuring Progress

Practice/scenario	Total P reduction per acre (percent)	Total P reduced (million lb)	Total P reduction from baseline (percent)	Cost (\$/lb removed)
1.8 million acres of conventional till eroding >T converted to reduced, mulch, or no-till	50	1.8	5	-16.6
P rate reduction on fields with soil test P above the recommended maintenance level	7	1.9	5	-48.75
Cover crops on all corn/soybean tile-drained acres	30	4.8	12.8	130.4
Cover crops on 1.6 million acres eroding >T currently in reduced, mulch, or no-till	50	1.9	5	24.5
Wetlands on 25 percent of tile-drained land	0	0	0	
Buffers on all applicable crop land	25-50	4.8	12.9	11.97
Perennial/energy crops equal to pasture/hay acreage in 1987	90	0.9	2.5	102.3
Perennial/energy crops on 1.6 million acres >T currently in reduced, mulch, or no-till	90	3.5	9	40.4
Perennial/energy crops on 10 percent of tile-drained land	50	0.3	0.8	250.07
Point source reduction to 1 mg/L (majors only)		8.3	22.1	13.71

► Implementation Scenarios

► Total Phosphorus

Adaptive Management and Measuring Progress

Implementation Scenarios

Table 8.1

Name	Combined Practices and Scenarios	Nitrate-N reduction (percent)	Total P reduction (percent)	Cost of reduction (\$/lb)	Annualized costs (million \$/yr)
NP2	MRTN, spring-only N application, bioreactors on 50 percent of acres, wetlands on 10 percent of acres, no P fertilizer on 12.5 million acres above STP maintenance, reduced till on 1.8 million conventionally tilled acres eroding >T, cover crops on all corn/soybean acres, point source to 1 mg total P/L and 10 mg nitrate-N/L	45%	45%	**	878
NP3	MRTN, spring-only N application, bioreactors on 30 percent of acres, no P fertilizer on 12.5 million acres above STP maintenance, reduced till on 1.8 million conventionally tilled acres eroding >T, cover crops on 87.5 percent of corn/soybean acres, buffers on all applicable lands, perennial crops on 1.6 million and 0.9 million additional acres	45%	45%	**	827

Adaptive Management and Measuring Progress

Scenario NP 2	Recommendation	Est. Acres (Million)	Nutrient Reduced	Potential Data Sources for Tracking Metric
Reducing N rate from background to MRTN	Applies to all corn acres, but reductions only realized on 10%	11	N	NASS
Spring-only N application	Tile drained corn acres	5.7*	N	NASS
Bioreactors (acres treated)	50% of crop acres	11	N	Illinois EPA-from reported data
» Wetlands (acres treated)	10% of crop acres	2.2	N	NRCS, Illinois EPA
No P fertilizer above STP maintenance	Assumes 12.5M acres are above maintenance	12.5	P	Illinois Dept. of Agriculture, other. Assumes that 12.5M acres are above maintenance.
Reduced till of conventional eroding >T	Defined as leaving 30% or greater crop residue cover	1.8	P	Soil Transect Survey
Cover crops on all corn/soybeans	Fall planted	22	N&P	NASS, FSA, IEPA, NRCS, satellite imagery
» Point Sources (Majors only)	1 mg/L TP permit limit	N/A	P	Illinois EPA
» Point Sources (Majors only)	10 mg/L nitrate limit	N/A	N	Illinois EPA

» Practices are unique to that Scenario

*Estimated by Science Team

Adaptive Management and Measuring Progress

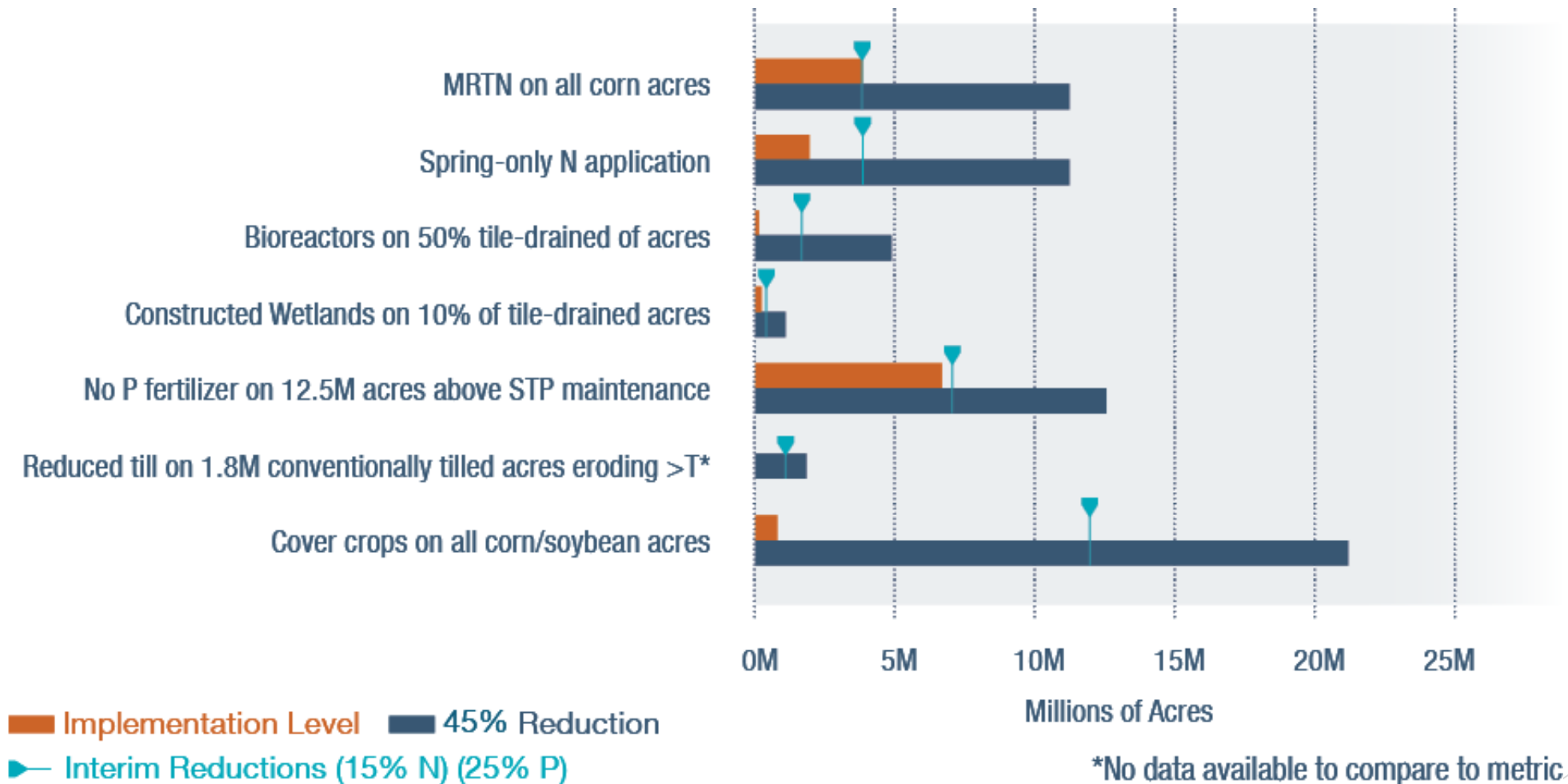


Figure 8.3. Agricultural implementation as compared to Scenario NP2

Adaptive Management and Measuring Progress

Scenario NP 3	Recommendation	Est. Acres (Million)	Nutrient Reduced	Potential Data Sources for Tracking Metric
MRTN	Applies to all corn acres, but reductions only realized on 10%	11	N	NASS
Spring-only N application	Tile drained corn acres	5.7*	N	NASS
Bioreactors (acres treated)	30% of crop acres	6.6	N	Illinois EPA-from voluntary reported data
No P fertilizer above STP maintenance	Assumes 12.5M acres are above maintenance	1.8	P	IL Dept of Ag tonnage report, other
Reduced till of conventional eroding >T	30% or greater crop residue cover	1.8	P	Soil Transect Survey
Cover crops on corn/soybeans	87.5% of acres	19.25	N&P	NASS, FSA, IEPA, NRCS, satellite imagery
» Buffers on all applicable lands	Estimated 100 feet from stream	0.2*	P	Illinois EPA, FSA, NRCS, GIS analysis
» Perennial crops on land eroding >T	Biofuels, hay, or CRP	1.6	N&P	FSA (CRP), IDNR (CREP), other
» Additional perennial crops	Biofuels, hay, or CRP	0.9	N&P	FSA (CRP), IDNR (CREP), other

» Practices are unique to that Scenario

*Estimated by Science Team

Adaptive Management and Measuring Progress

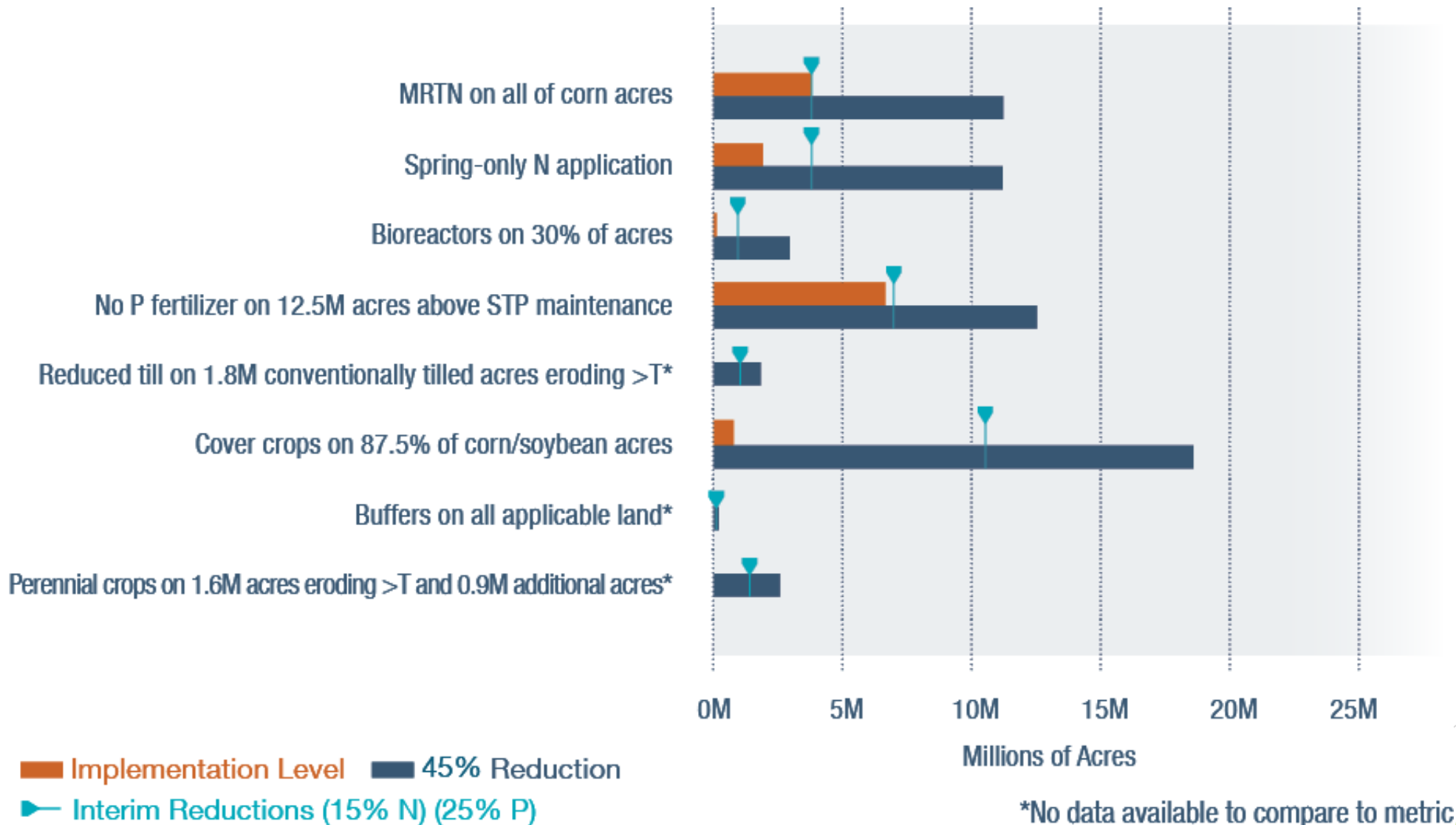


Figure 8.4. Agricultural implementation as compared to Scenario NP3

Adaptive Management and Measuring Progress

POINT SOURCE IMPLEMENTATION—Total Phosphorus

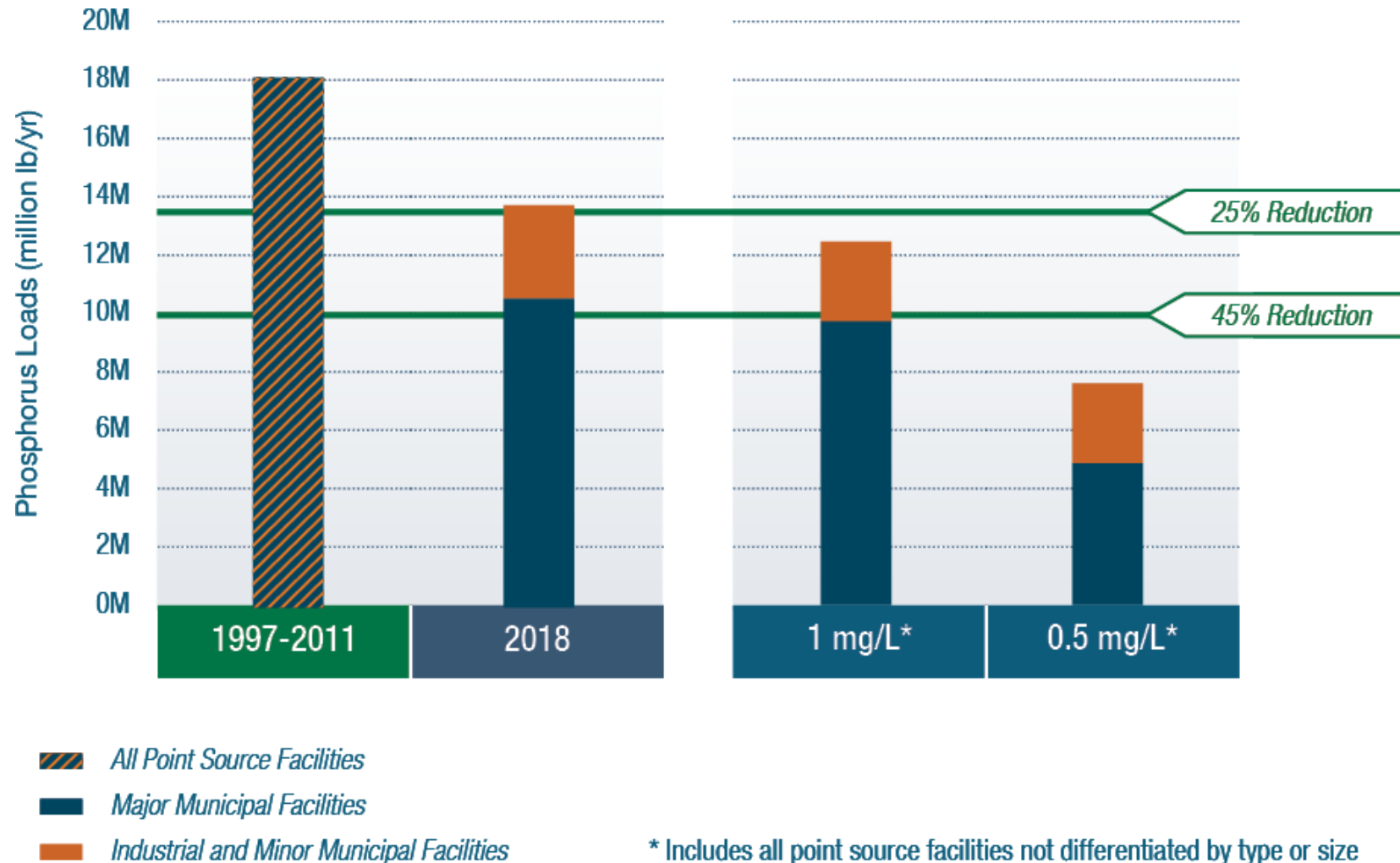


Figure 8.5. Total Phosphorus (Point Source Load), Estimated Future Total Phosphorus (Point Source Load)

Adopting New Conservation Practices and Updating Practice Performance

- ▶ U of I Extension NLRs Science Team developed procedure for adding new conservation practices and updating practice performance to the NLRs.
- ▶ Proposals should be submitted by December 31 of even numbered years.
- ▶ Proposals will be reviewed by the Illinois NLRs Steering Committee and then forwarded to the NLRs Science Team for review.
- ▶ NLRs Science Team will then make a recommendation to the Policy Working Group, and final recommendations will be included in the next biennial report.
- ▶ NLRs Practice Approval Process document is available on the Illinois EPA NLRs webpage.

Future Strategy Considerations

- ▶ Continue updating nutrient loads on a HUC 8 basis every 5 years.
- ▶ Develop additional Implementation Scenarios for meeting the interim water quality goals as well as the final 45% reduction.
- ▶ Continue striving to collect the most accurate implementation data from all three sectors.

Potential Future Resource Needs

- ▶ Extend Partners for Conservation Program—expires 2021
- ▶ Continued and enhanced support for Soil and Water Conservation districts
- ▶ Support for wastewater treatment facility upgrades
- ▶ Support for urban stormwater practice adoption

Potential Future Resource Needs

- ▶ Continue United States Geological Survey Super Gage Network
- ▶ Continue and enhance Illinois EPA Ambient Water Quality Monitoring Network
 - ▶ Consider recommendation put forth in the Science Assessment update for monitoring.
- ▶ Continue support for NLRs work group meetings and reporting structure.



ILLINOIS

NUTRIENT LOSS REDUCTION STRATEGY

Improving our water resources with
collaboration and innovation