Policy Working Group

February 9, 2022

Illinois Environmental Protection Agency

Illinois Department of Agriculture

Illinois Extension
University of Illinois Urbana-Champaign

Illinois Nutrient Loss Reduction Strategy

Type your name and affiliation in the chat box.

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Agenda

1:00 – 1:05 pm	Welcome and Introductions – Eliana Brown, University of Illinois Extension
1:05 – 2:05 pm	Legacy Phosphorus – Dr. Andrew Margenot, University of Illinois
2:05 – 2:35 pm	Influence of livestock on statewide nutrient loads – Dr. Ted Funk, P.E., University of Illinois Extension (retired)
2:35 – 2:45 pm	Biennial Report Production Review – Eliana Brown, University of Illinois Extension
2:45 – 2:55 pm	Iowa Nutrient Strategy Dashboard – Trevor Sample, Illinois EPA
2:55 – 3:05 pm	BREAK

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Agenda (con't)

3:05 – 3:30 pm	Partners for Conservation Funding Bill – Max Webster, American Farmland Trust
3:30 – 3:50 pm	Illinois Climate Smart Ag Initiative – Dr. Michael Woods, Illinois Dept. of Agriculture
3:50 – 3:55 pm	Gulf Hypoxia Program – Trevor Sample, Illinois EPA
3:55 – 4:15 pm	Open discussion – Lisa Merrifield, University of Illinois Extension
4:15 – 4:20 pm	Wrap up – Trevor Sample and Michael Woods

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Lags and gaps: unknowns and knowns on legacy P and streambank erosion, and why it matters for the Illinois NLRS

9 February 2022

Andrew Margenot, Ph.D.
Shengnan Zhou, Ph.D.
https://margenot.cropsciences.illinois.edu/

Thanks to the funders that make this work possible

ILLINOIS NREC

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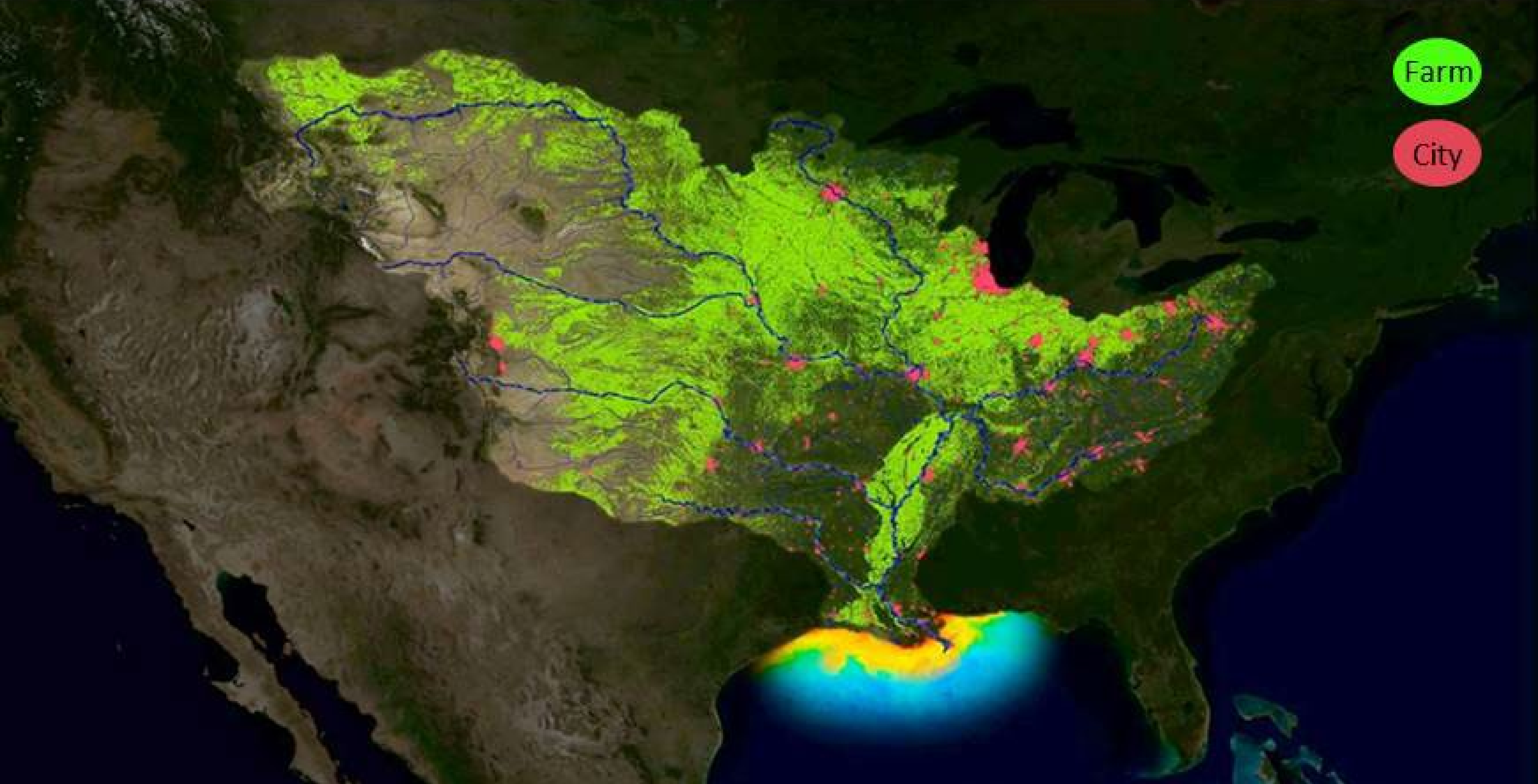
STUDENT SUSTAINABILITY COMMITTEE
ssc.sustainability.illinois.edu

Overview

Goal of the research group: integrate history and biogeochemistry of P in Illinois croplands to support agronomic production, and support Illinois NLRS goals on nutrient loss reductions

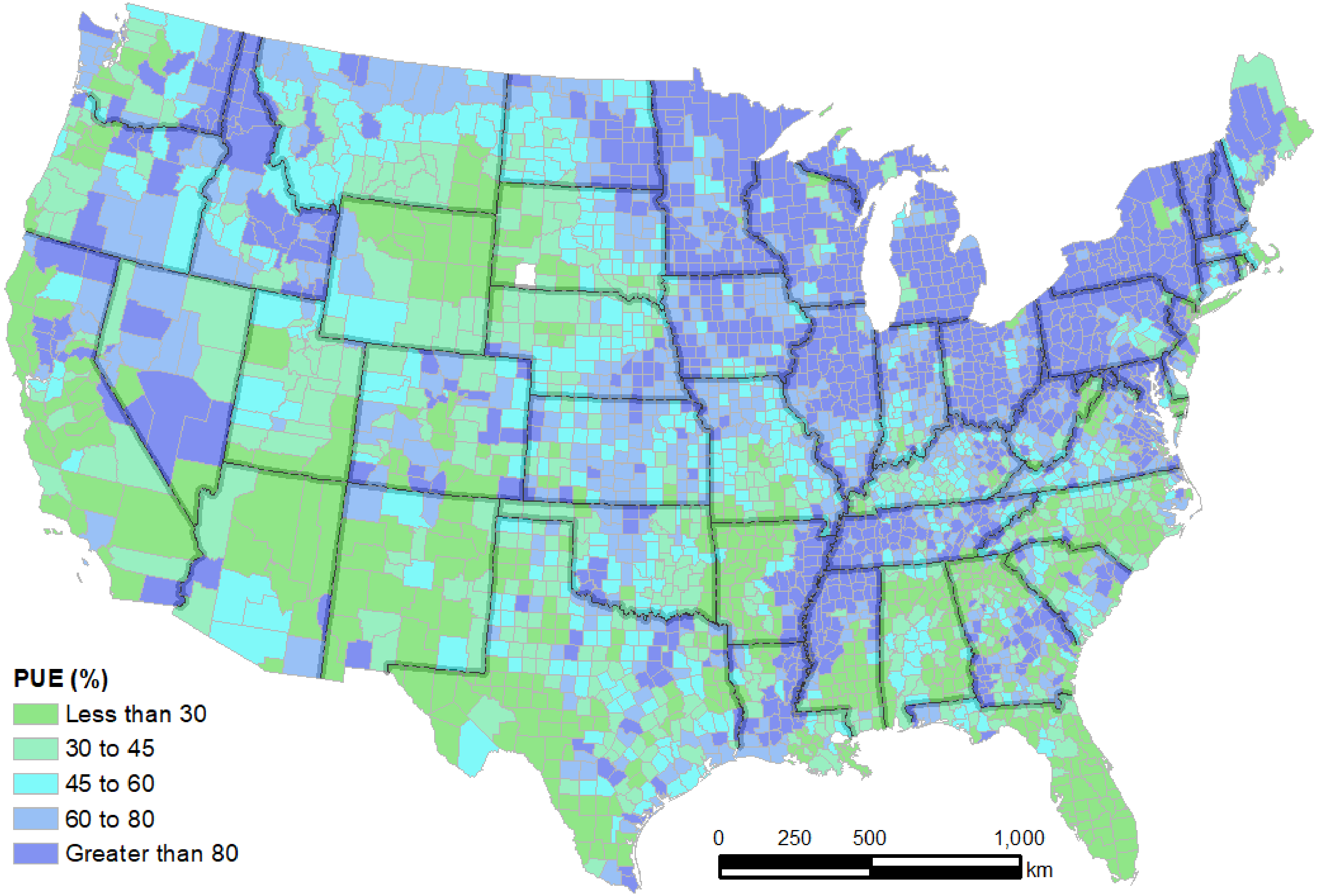
Goal of this talk: overview of key overlooked pathways of P loss and implications for lag time in achieving NLRS reduction goals

1. Legacy P: soil
2. Streambank erosion: a non-ag, non-point source
3. Legacy P: sediments



Map shows the entire Mississippi River Basin. Massive phytoplankton blooms depicted in rainbow colors in the Gulf of Mexico.
Image source: NOAA Environmental Visualization Laboratory, video "The Dead Zone"

Agronomic phosphorus use efficiency (PUE) is high in Illinois



USDA

- PUE by difference
  - County-level
  - Grain P harvested / P fertilizer sales
  - Likely overestimated (and because of legacy P!)
- Global PUE: ~16%

Phosphorus paradox?

How can there be such high agronomic PUE in Illinois,
but also
high P loading from agricultural fields to surface waters?

Total P losses

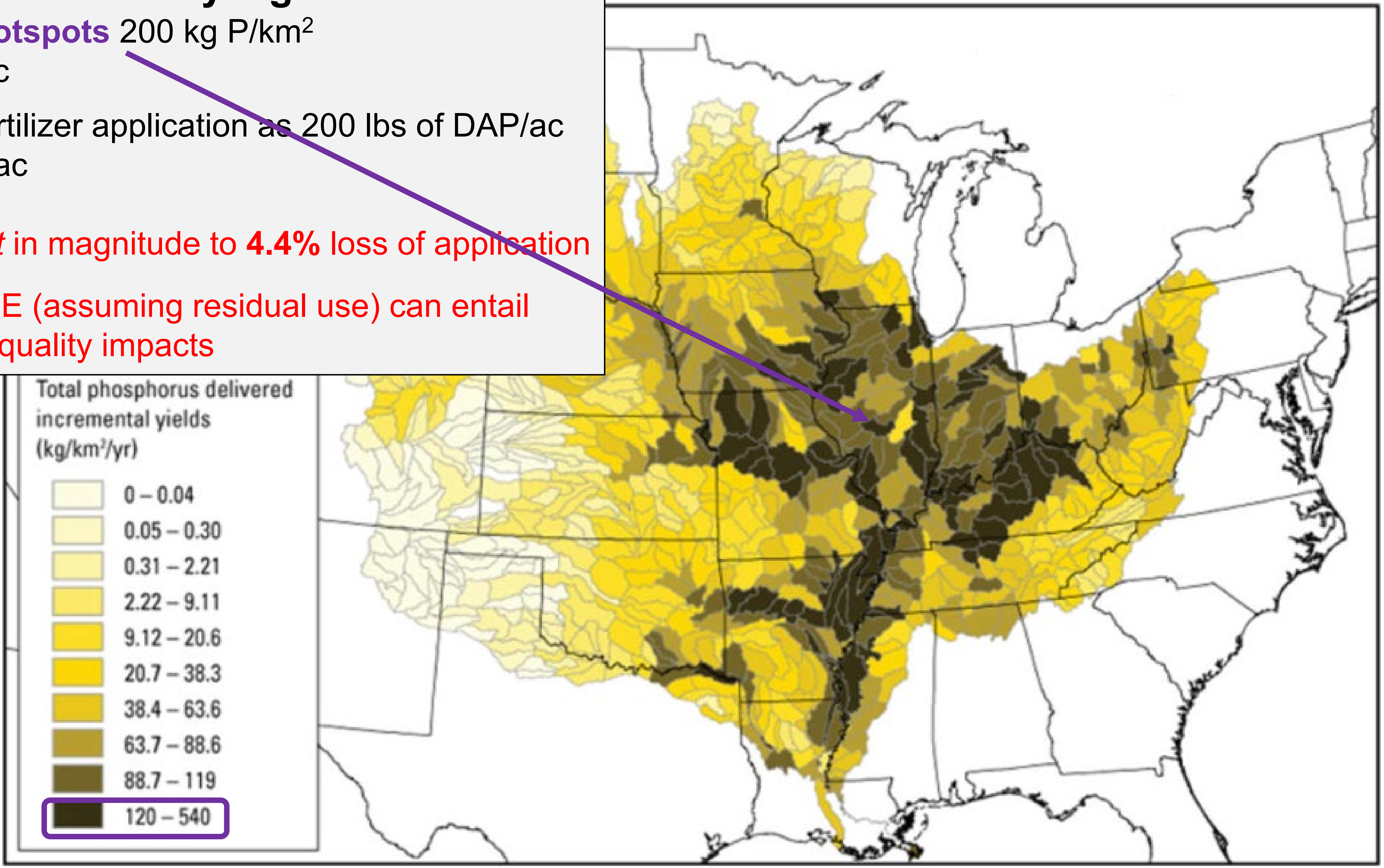
Agronomically minor but environmentally significant

Example: **hotspots** 200 kg P/km^2
= 1.8 lb P/ac

Typical P fertilizer application as 200 lbs of DAP/ac
= 40.5 lb P/ac

= *equivalent* in magnitude to **4.4%** loss of application

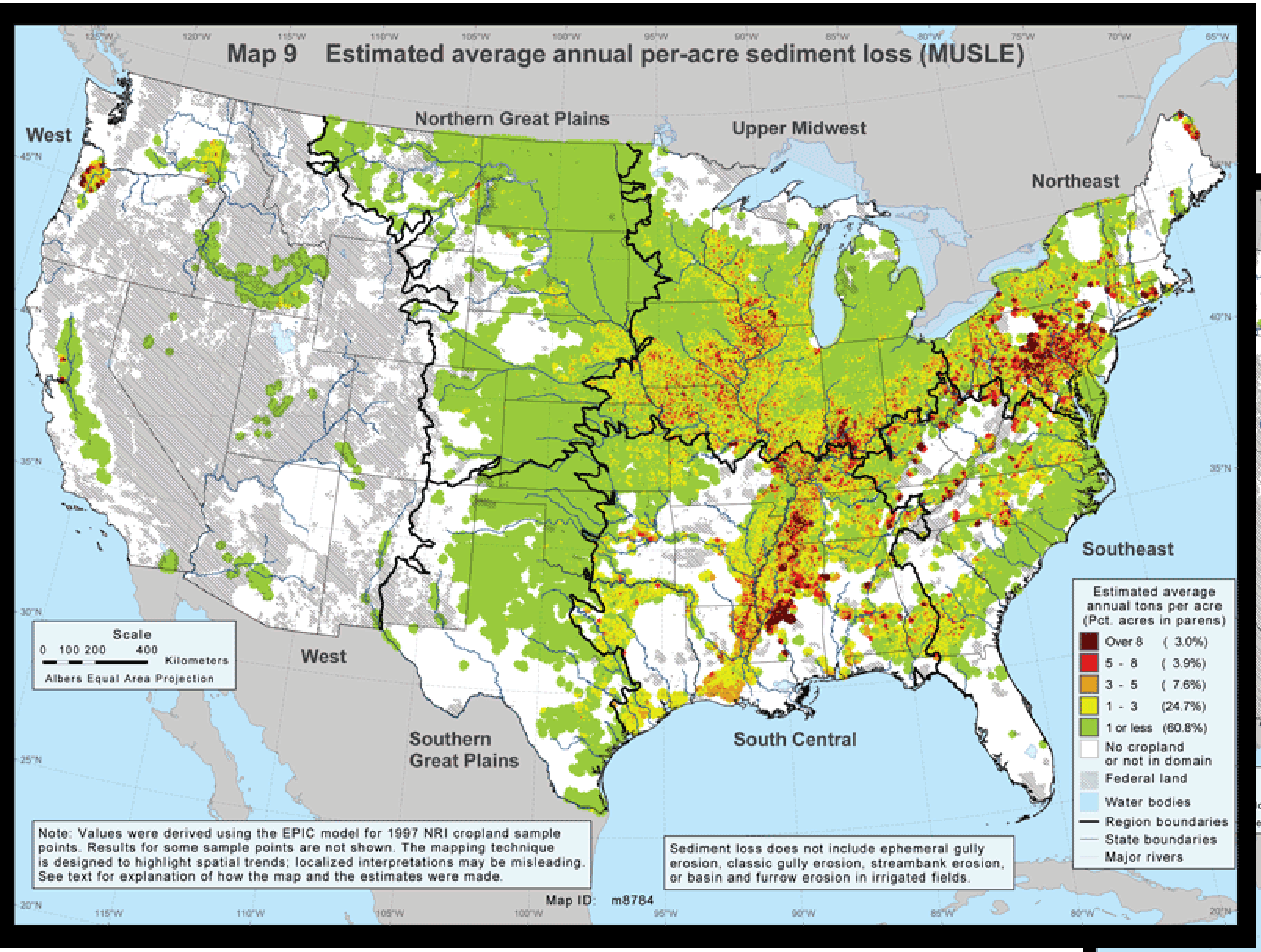
Or: 95% PUE (assuming residual use) can entail large water quality impacts



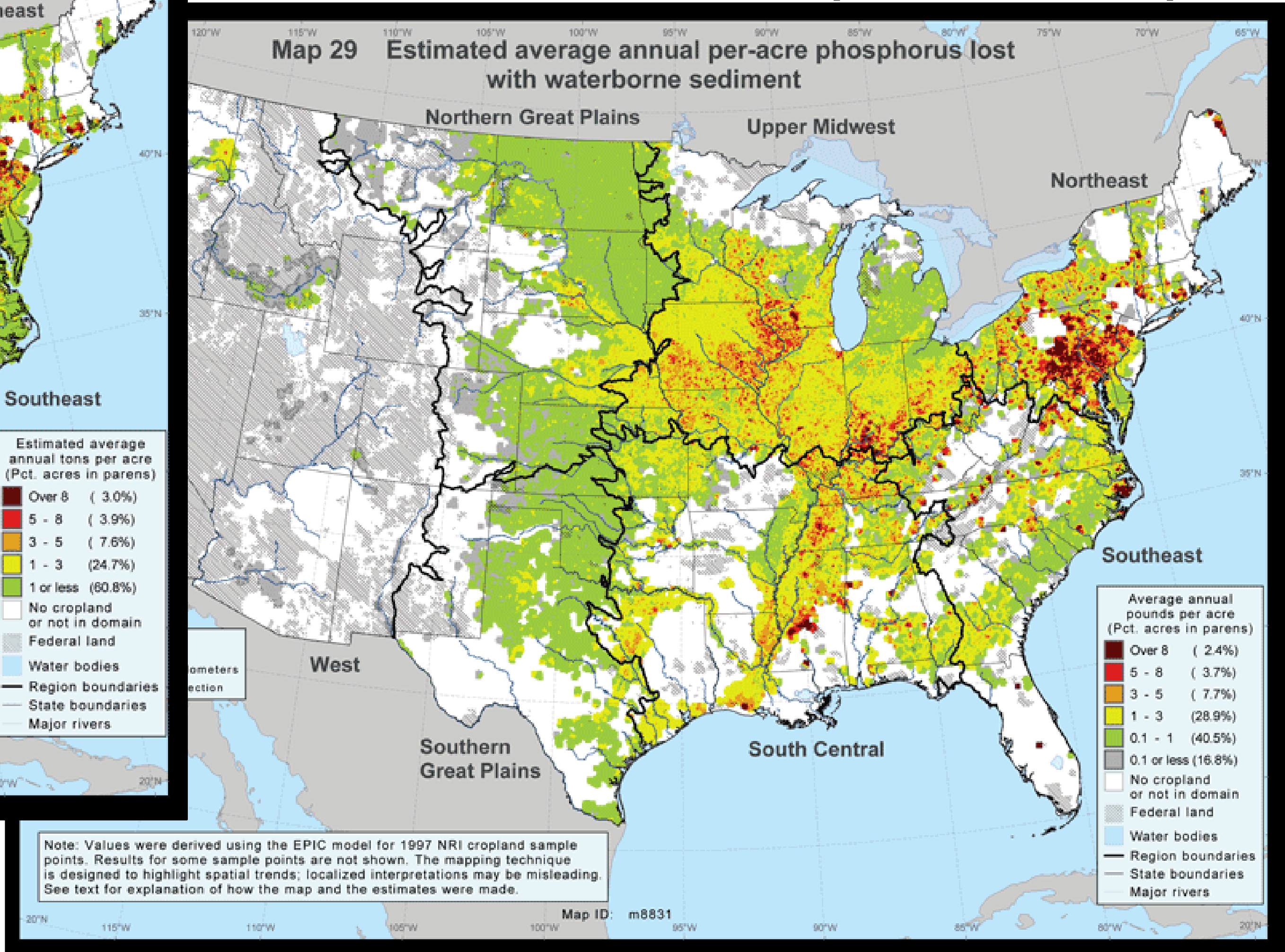
USGS Wisconsin Water Science Center

How much of our P losses are from fertilizer?

Soil erosion…..



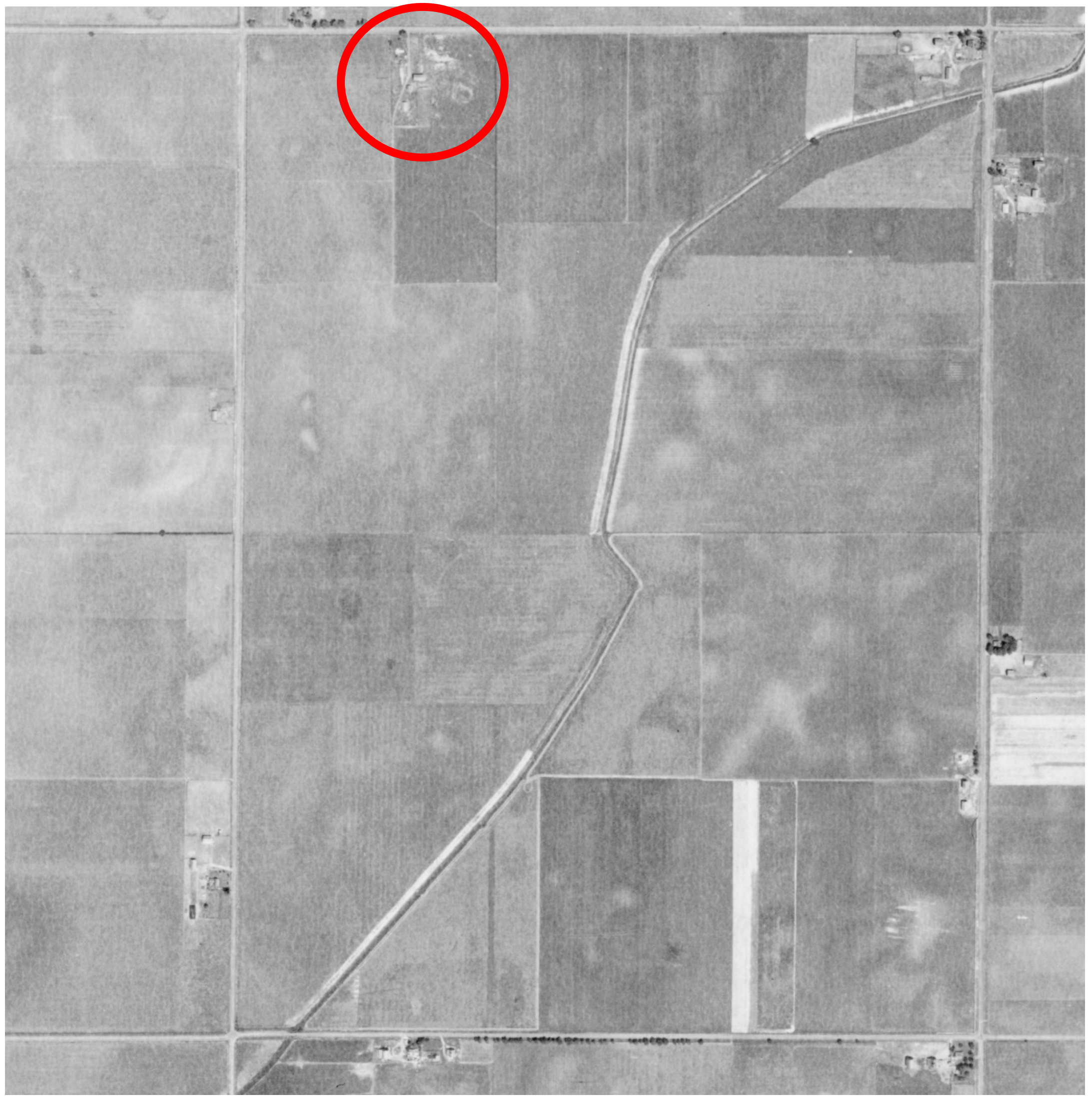
….is a driver of cropland P export



USDA NRCS

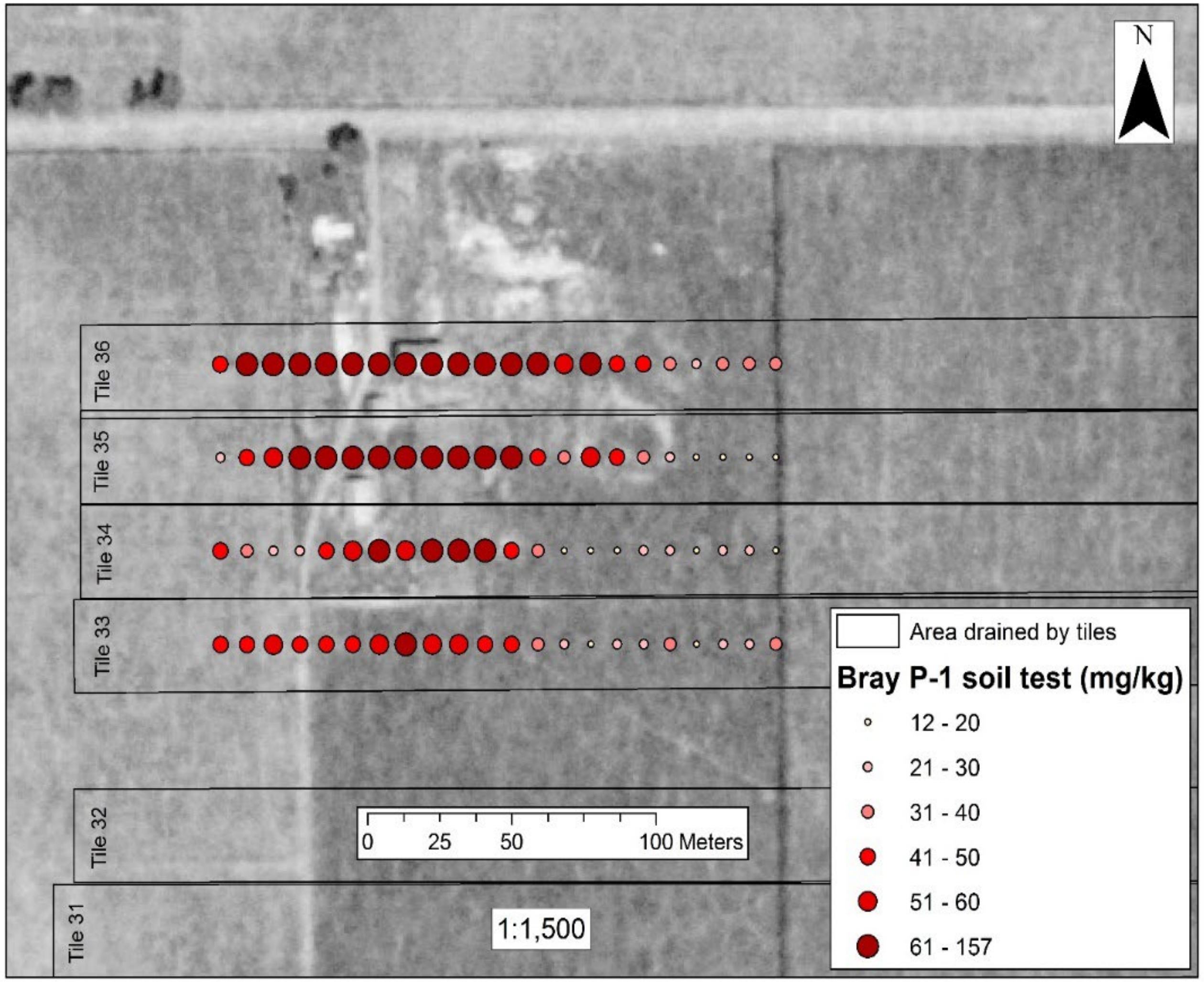
How much is from *contemporary* fertilizer/manure?
Example of legacy P: Douglas Co.

1940 image



Courtesy of **Lowell Gentry**

Soil P hotspots from former barns….



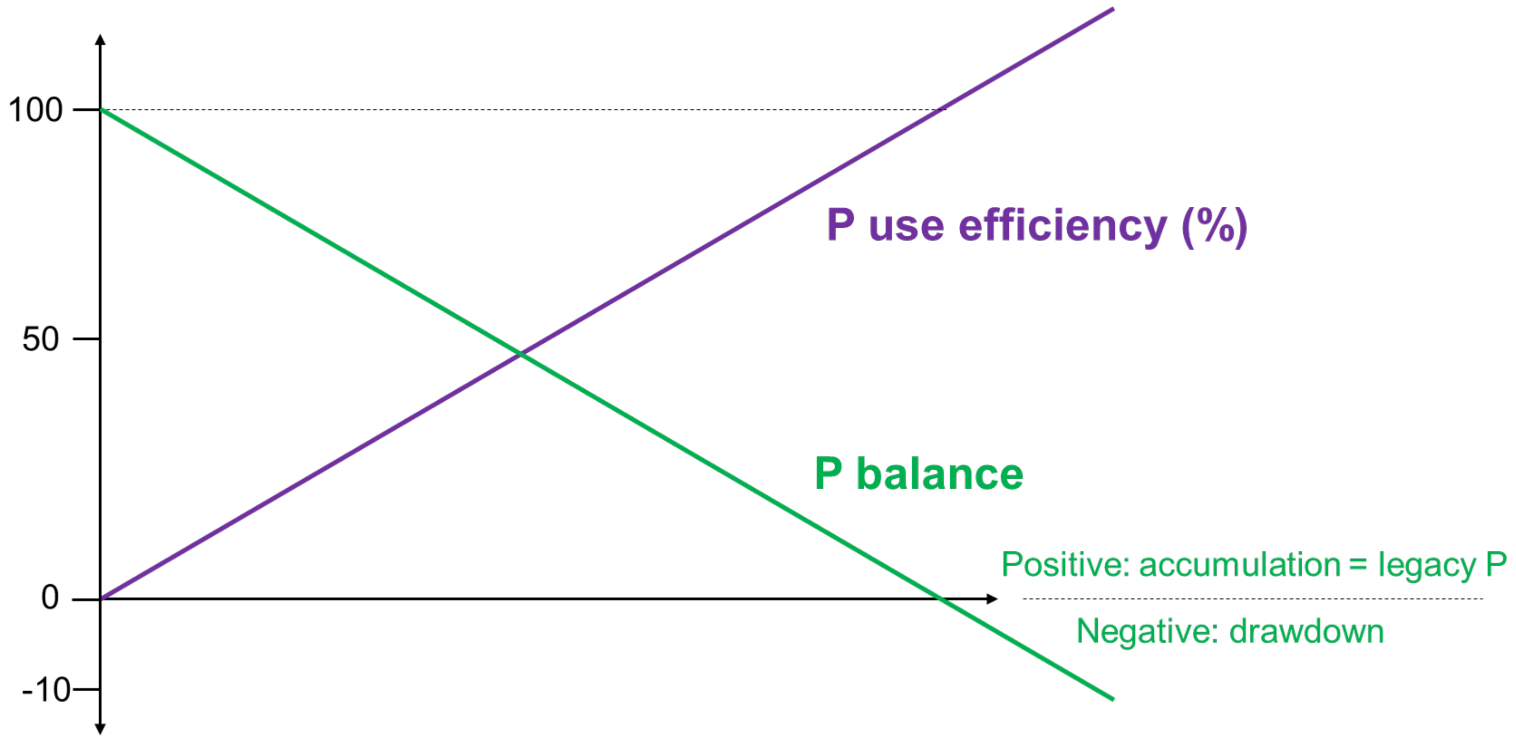
…partly explains higher DRP loads from tiles

Andino et al 2020 *JEQ* 49(5):1273

1. Legacy P in soils

- P from past applications that was not removed with crop harvest
- Results from a positive P balance “sometime” in the past
  - Agnostic to age: from years to centuries
  - Can be mitigated by ‘drawdown’ = negative balances

- Related to, but *not* the same as soil test P
  - Usually <15% of legacy P registers in the soil test
  - Determined directly as total soil P
  - Determined indirectly by balances or soil test P
- Inverse to PUE



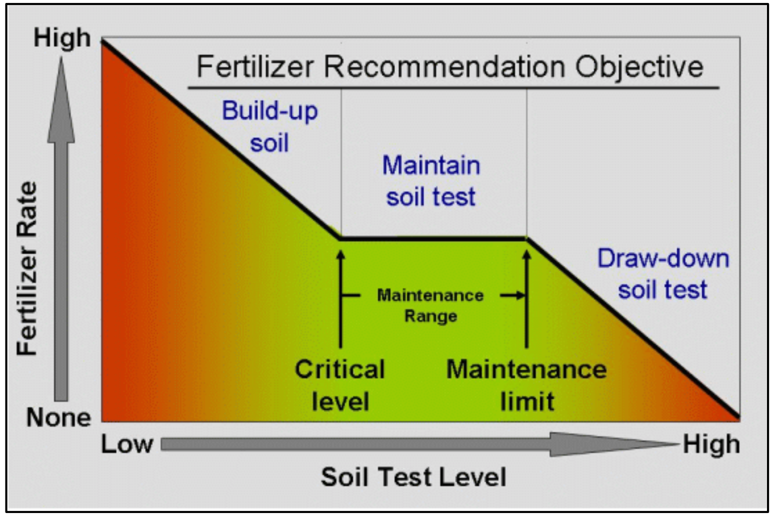
How to quantify legacy P?

Soil legacy P can be estimated *indirectly* based on soil test P trends and agronomic balances at vary space-time scales

Soil test

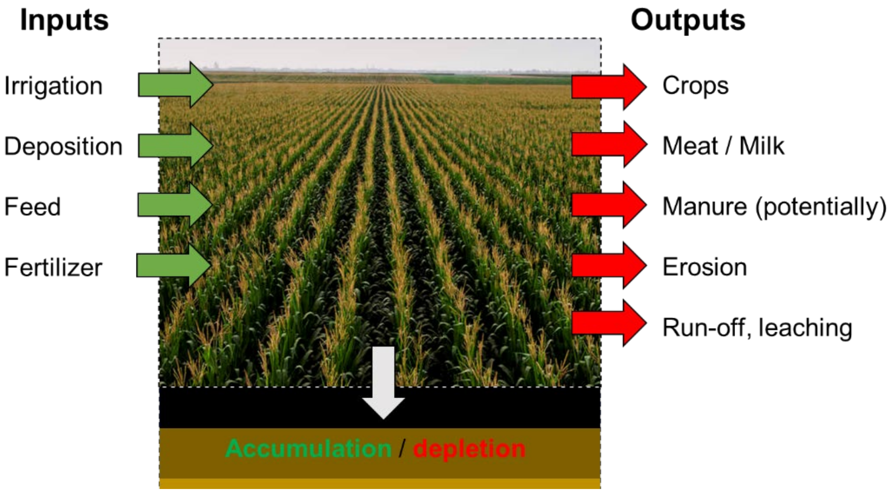
Chemical extraction of P from soil; usually <1-5% of total soil P
Historically Bray-1, now more commonly Mehlich-3 extraction

+ Changes in soil test P are <u>generally</u> reflective of changes in total P
+ Soil test P values can be used to gauge run-off (DRP) risk
- Widely used but not publicly available



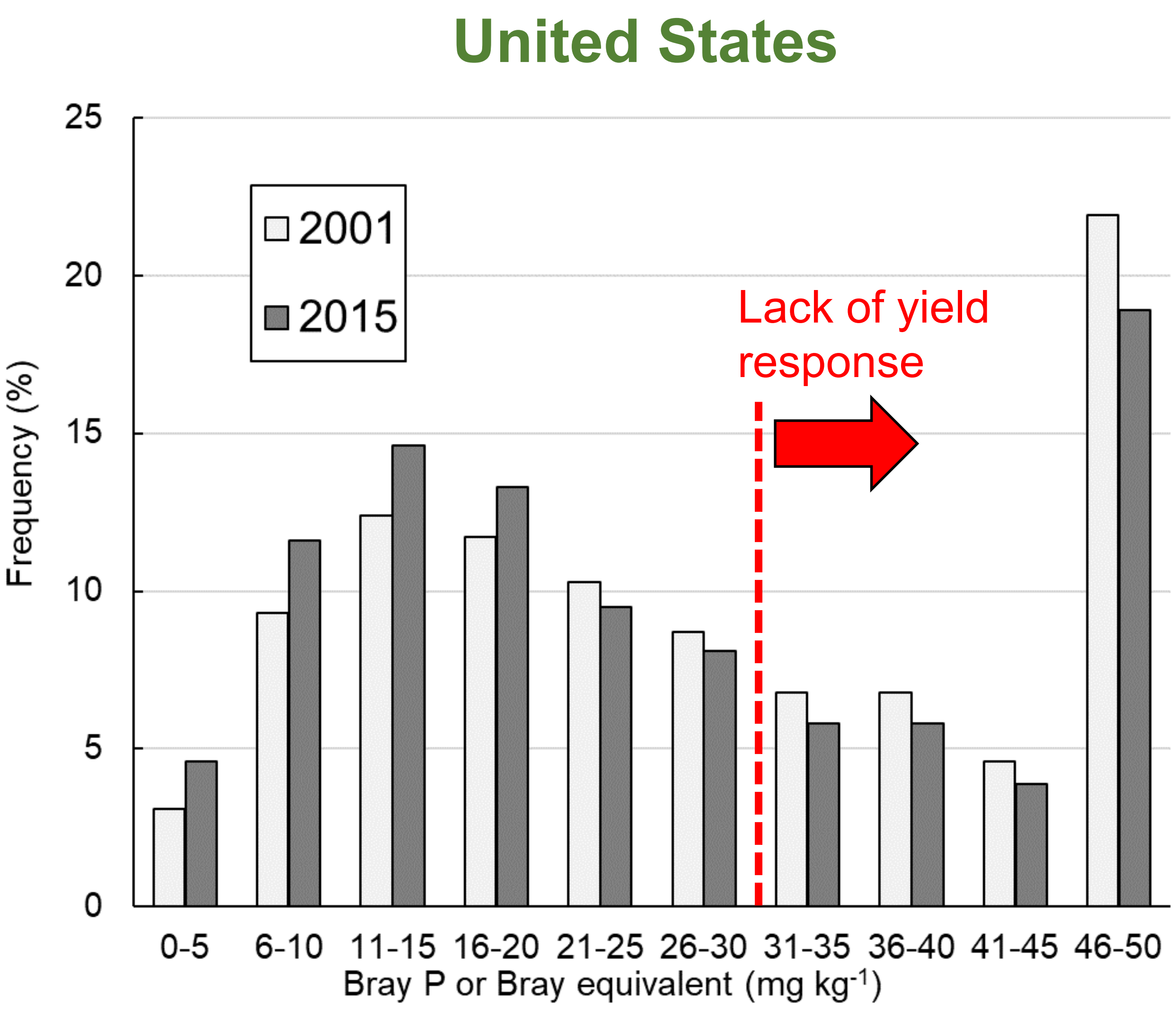
Agronomic balance

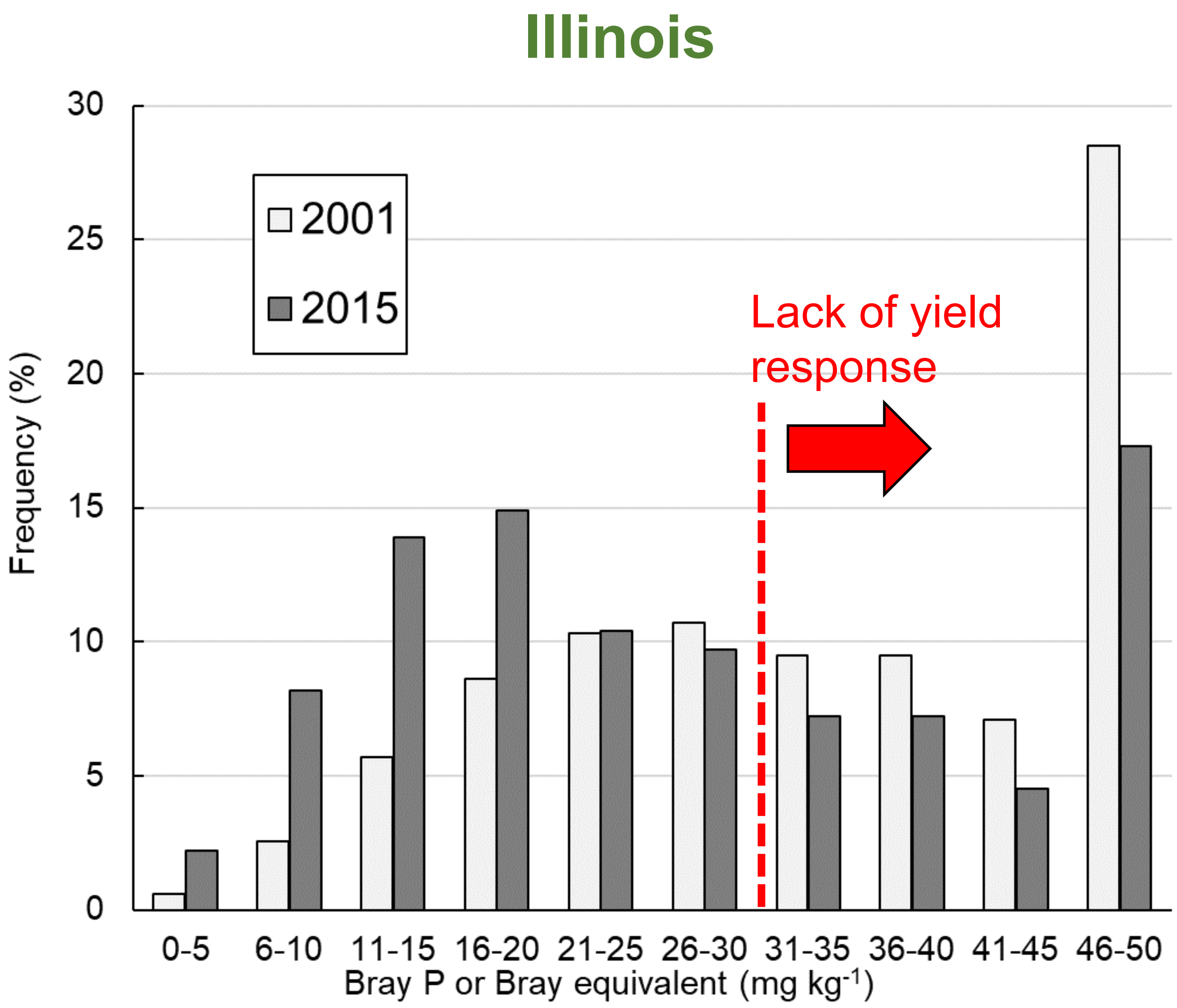
Balance = outputs – inputs
+ Well-established tool; used in EU for nutrient management
- Increasingly difficult at finer spatial and temporal scale
- Better suited for longer time periods (multiannual)



1. Soil test trends

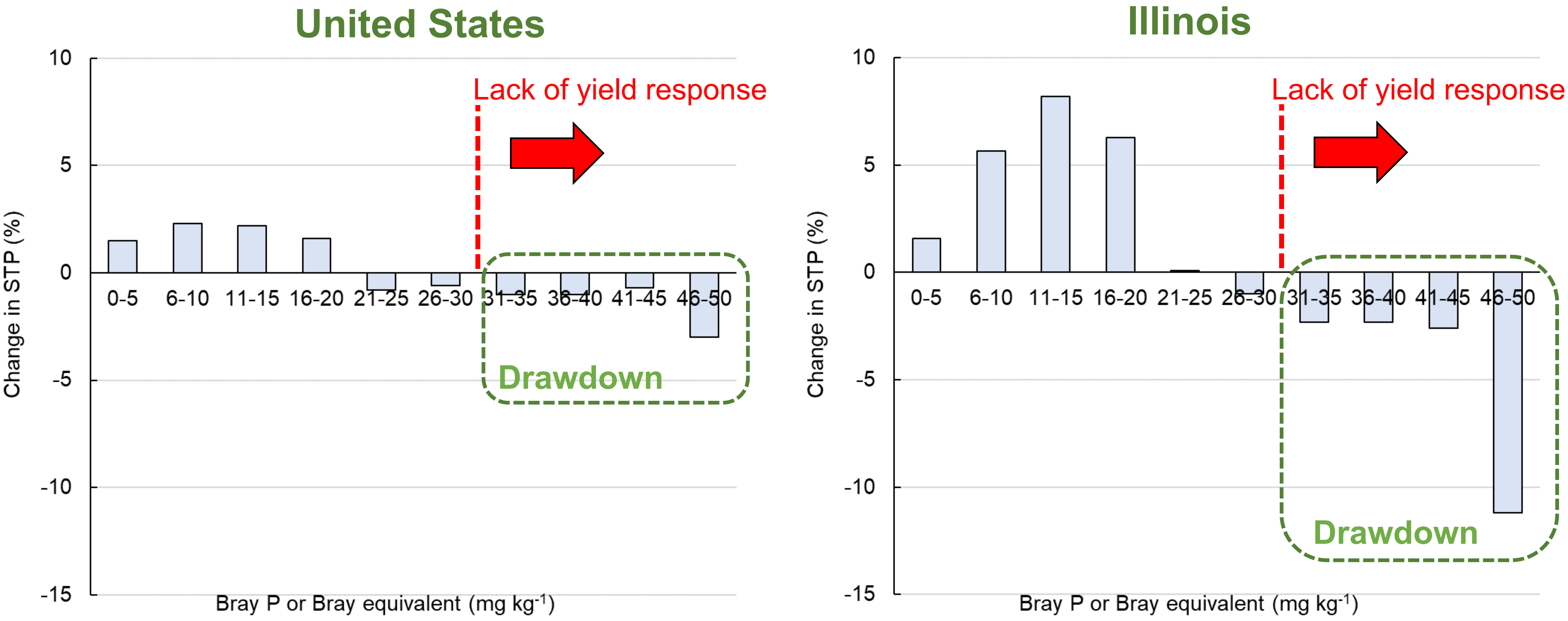
Illinois has slightly higher soil test P values than US mean





IPNI data

However, Illinois has seen greater decrease in ‘very high’ soil test values from 2001 to 2015

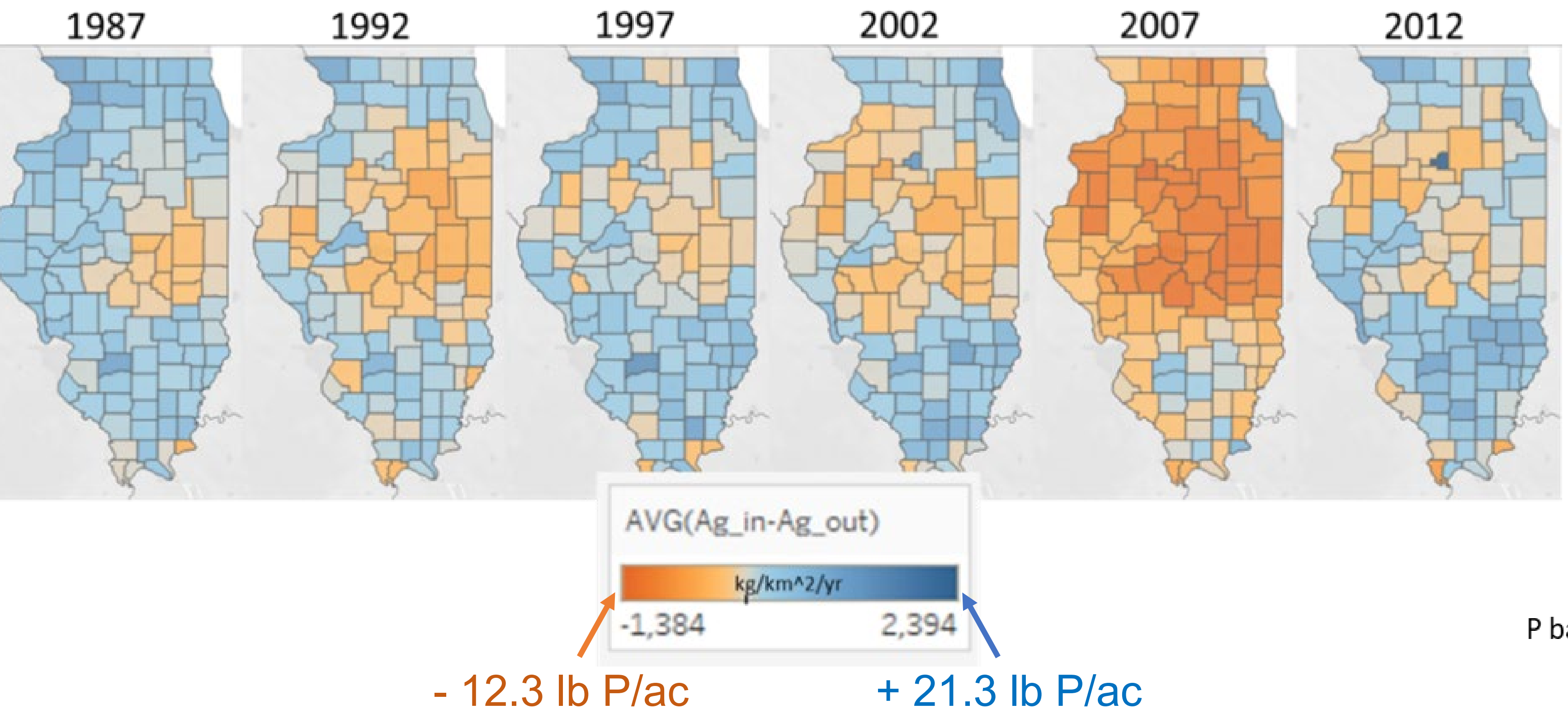


Calculated from IPNI data

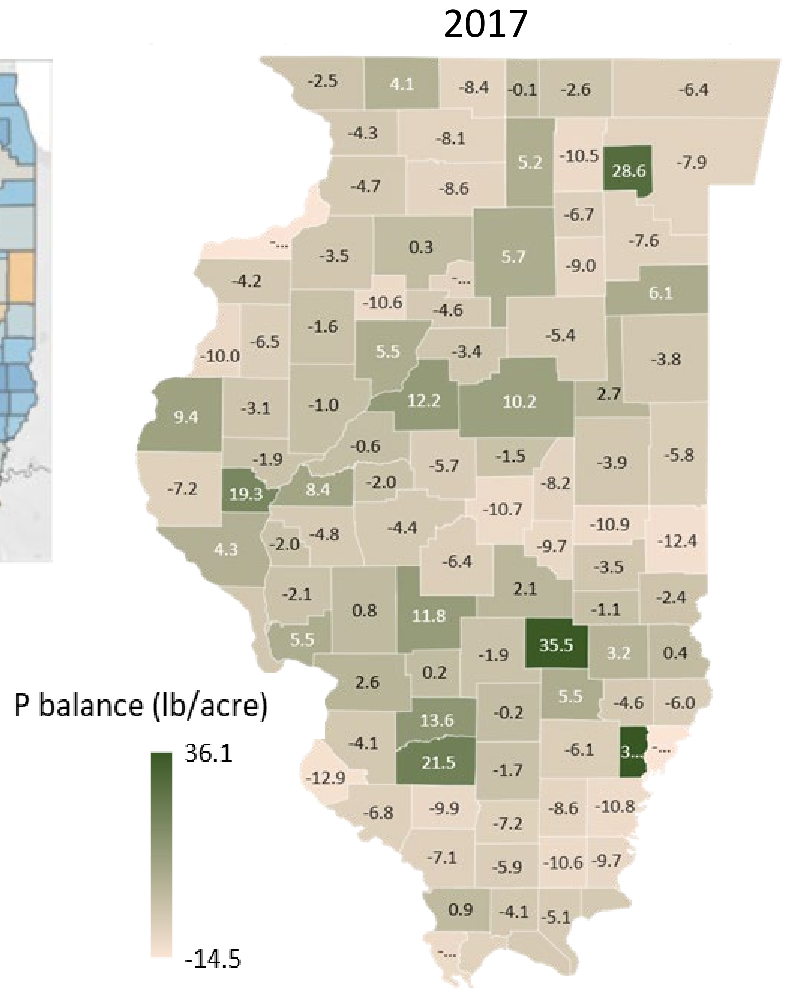
2. Agronomic balances: county-level

- Variable at county scale, form negative to positive
- Trend toward less positive and more negative balances

USDA data



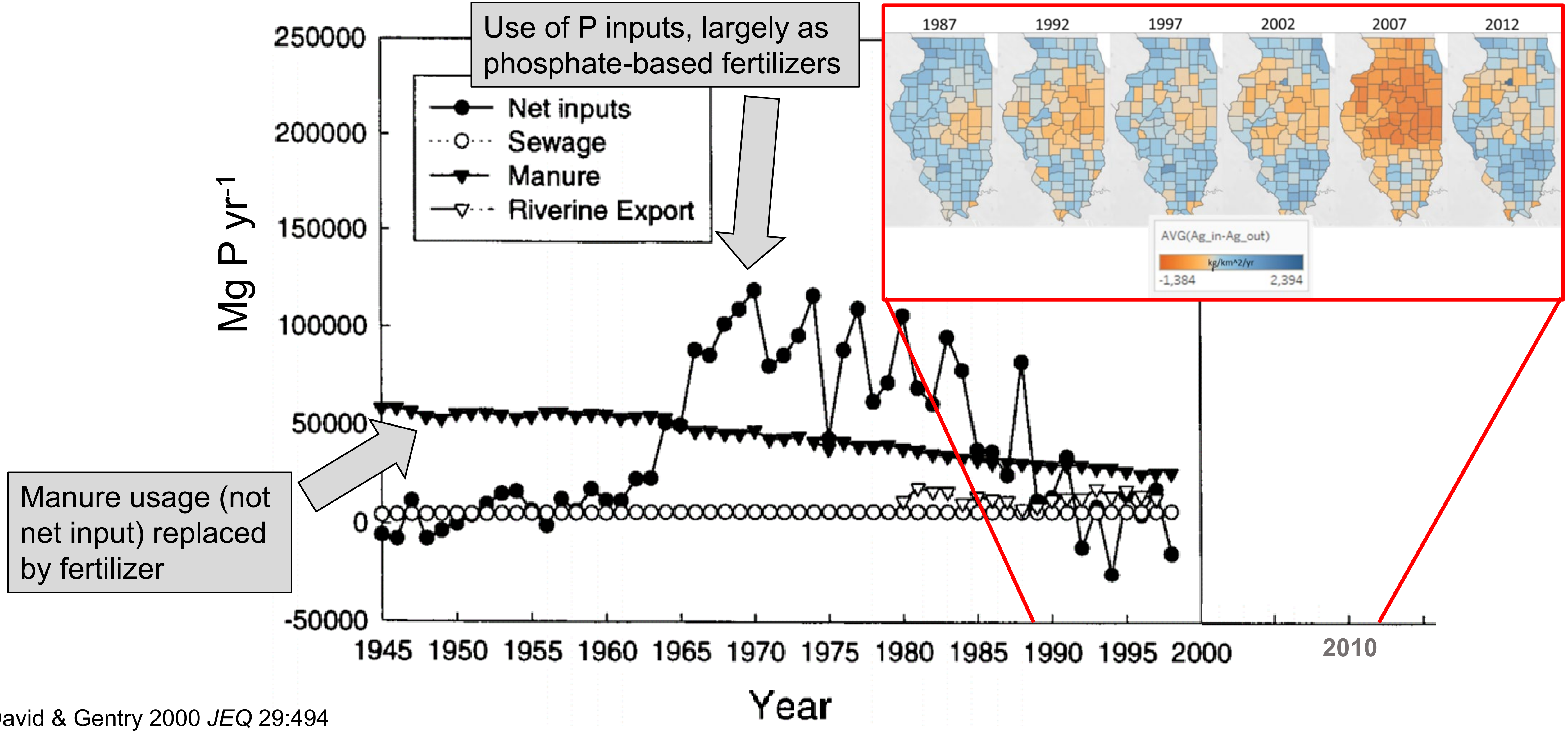
IDOA data



R. Christianson, A. Sadeghpour – NREC Legacy P project

3. Agronomic balances: state

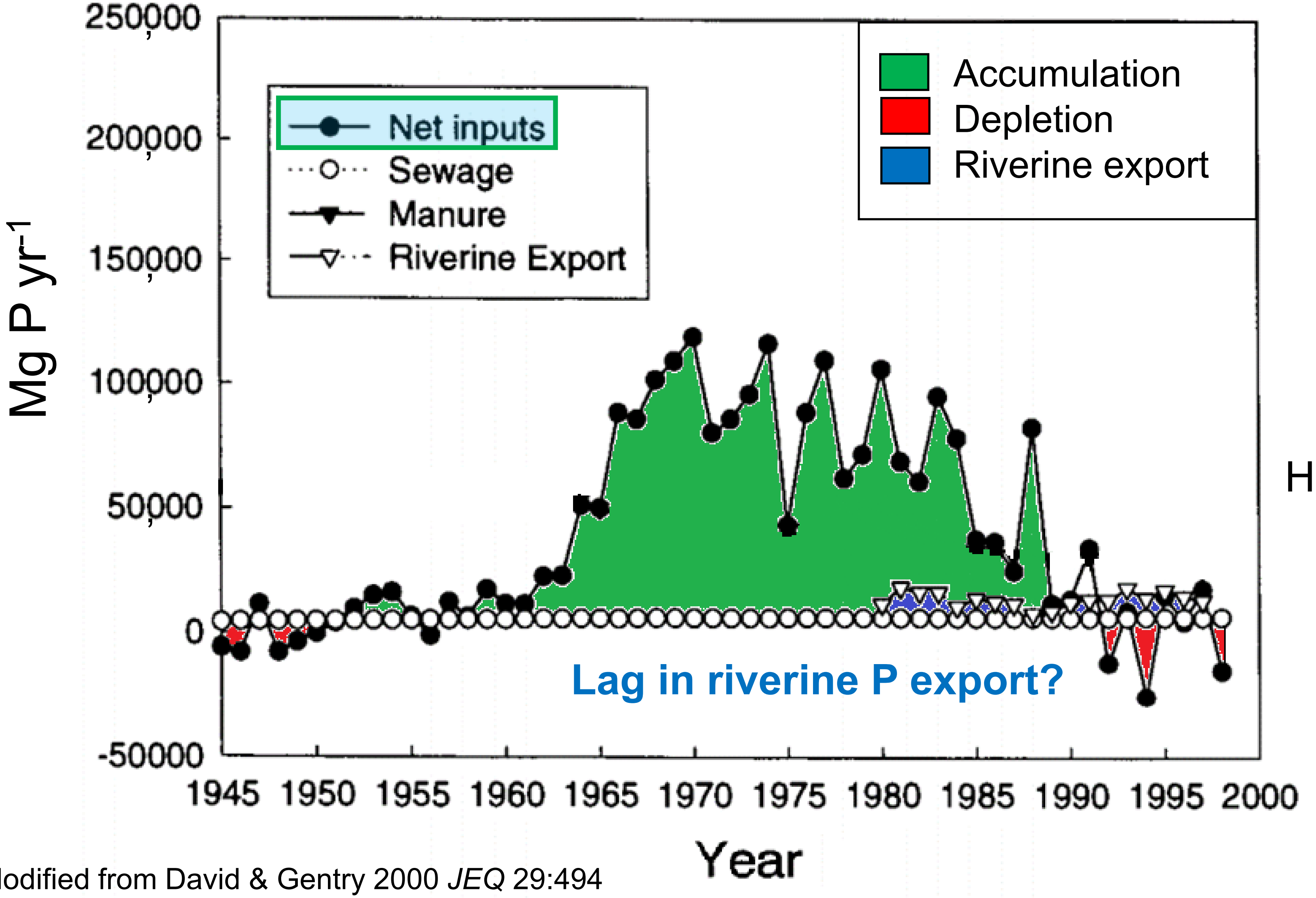
"No net inputs since 1990" (through 2000)



David & Gentry 2000 *JEQ* 29:494

Legacy P in Illinois: how much?

Large positive balance encumbered in ≈ 25 year period



Modified from David & Gentry 2000 *JEQ* 29:494

≈ +4.85 billion lbs P
(2.2 million Mg) **positive balance**

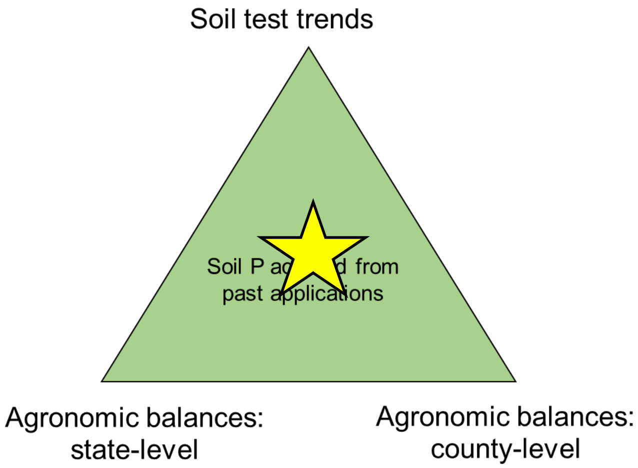
203 lb P/ac across Illinois Cropland

How much of a *relative* enrichment?

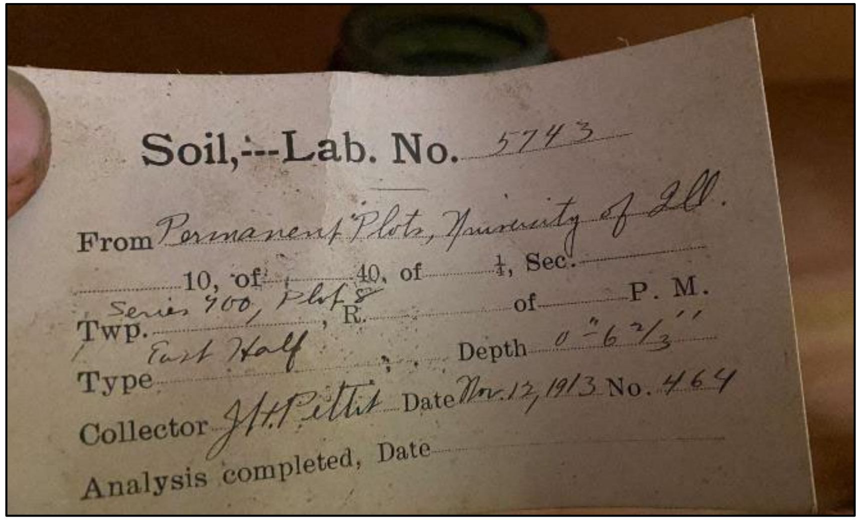
21 million ha of cropland
Assume 4500 lb P/ac to 3' depth
=94.5 billion lbs P

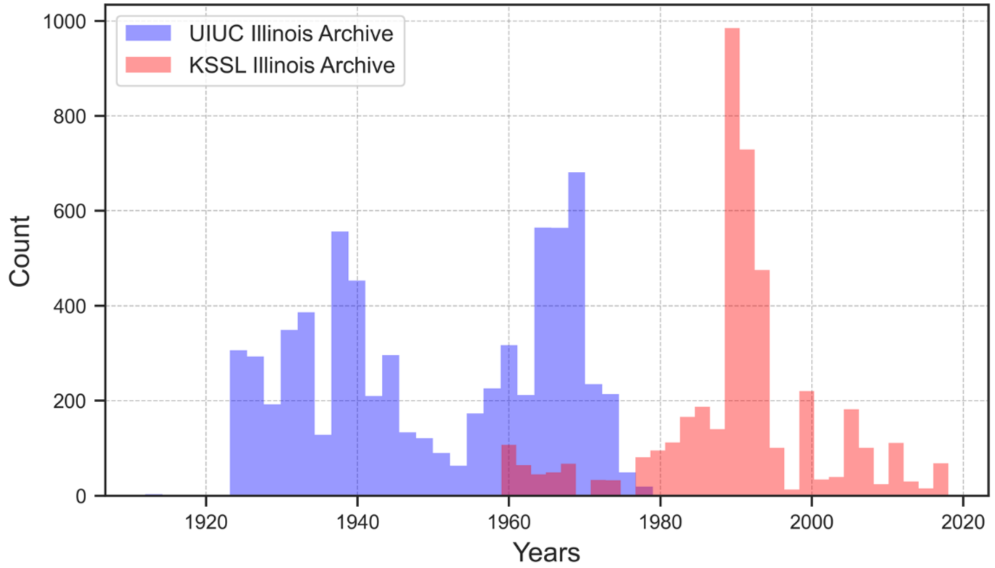
≈ +5% of soil P stocks

How to quantify soil legacy P? Chronosequence approach

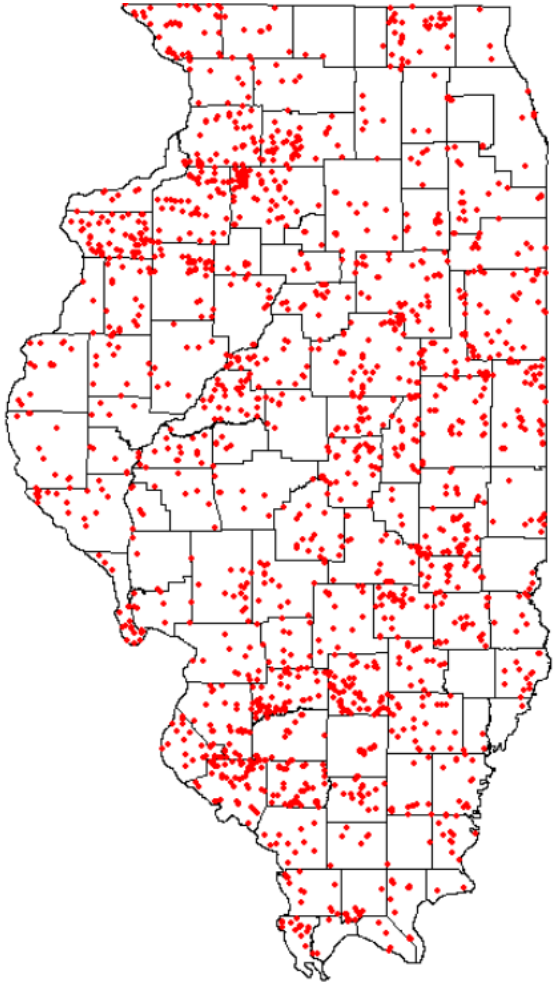


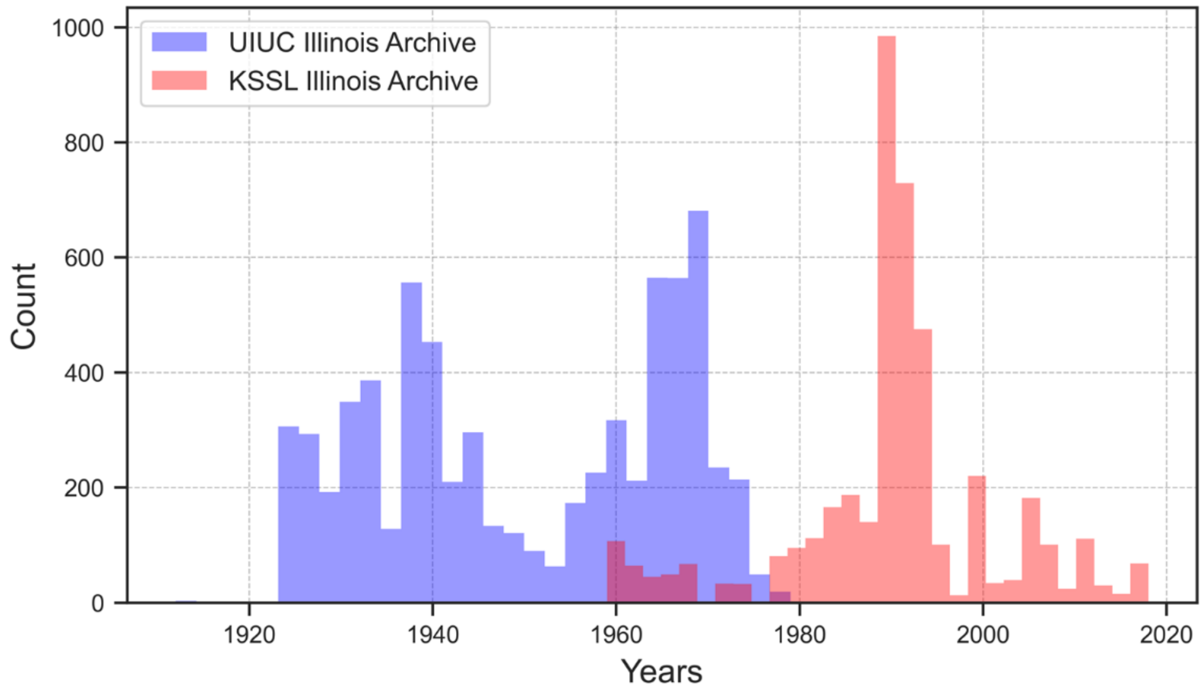
- University of Illinois and NRCS KSSL pedon archives
- Archive of geolocated soil samples (pedons) on campus extend 1861 through 2021
- Most pedons are 1920 - 1990
- Re-sampling sites to establish 150-year chronosequence



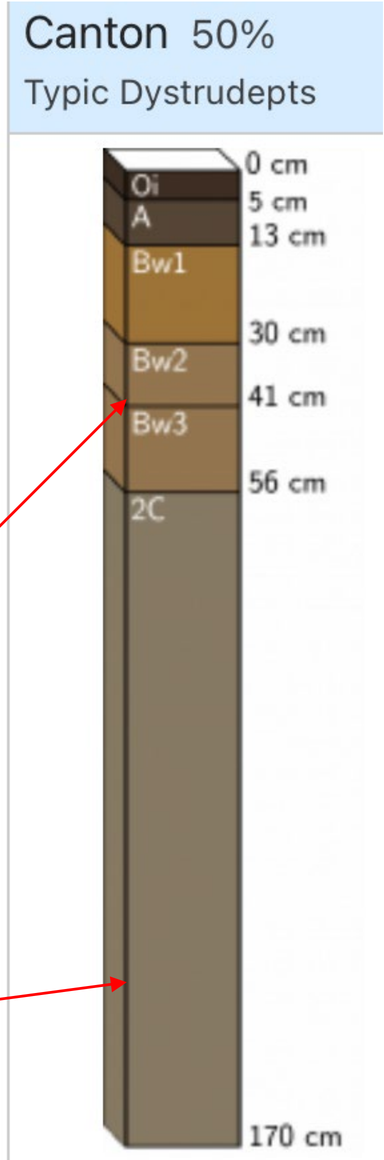


Resampling pedons for comparison of P stocks





- ~7,000 samples used to map Illinois soils over the past century
- P stocks by horizon → pedon
- Comparing P stocks in originall vs present day pedons enables **direct** calculation of legacy P

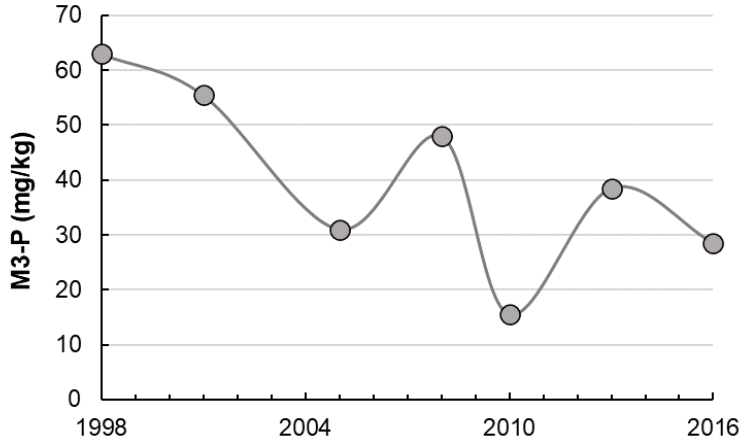


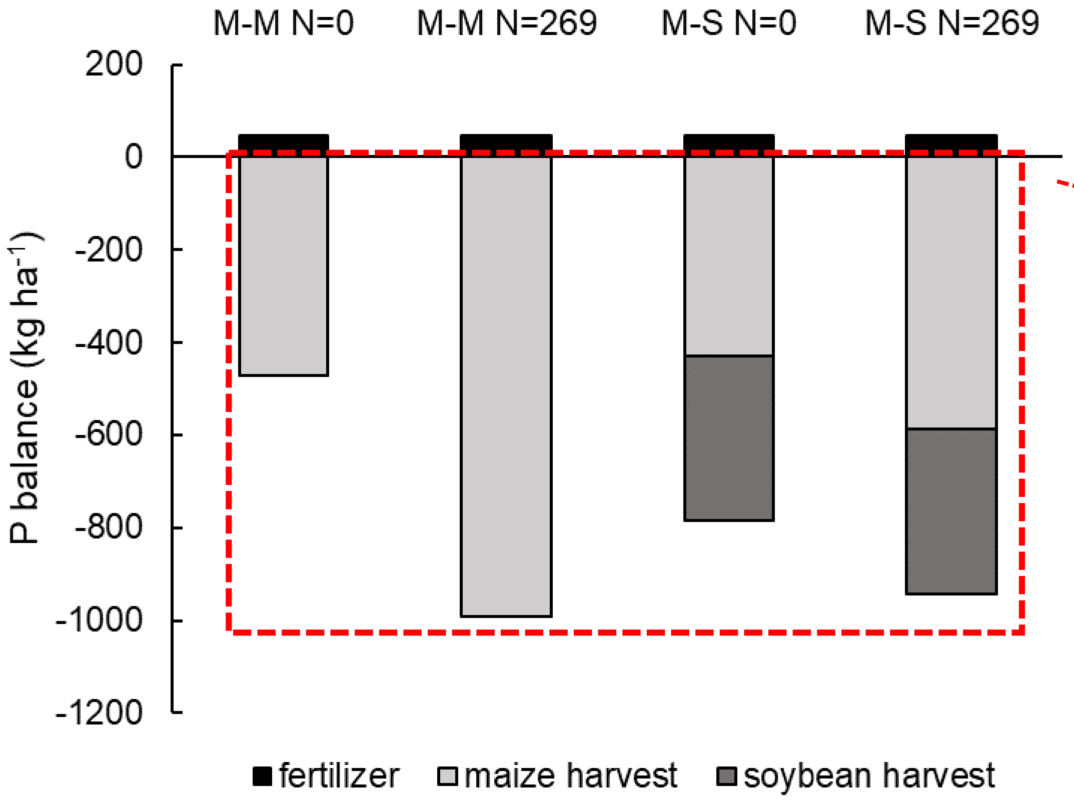
Case Study #1: 37 years of drawdown

(Northwestern Illinois Agricultural Research & Demonstration Center in Monmouth, IL)

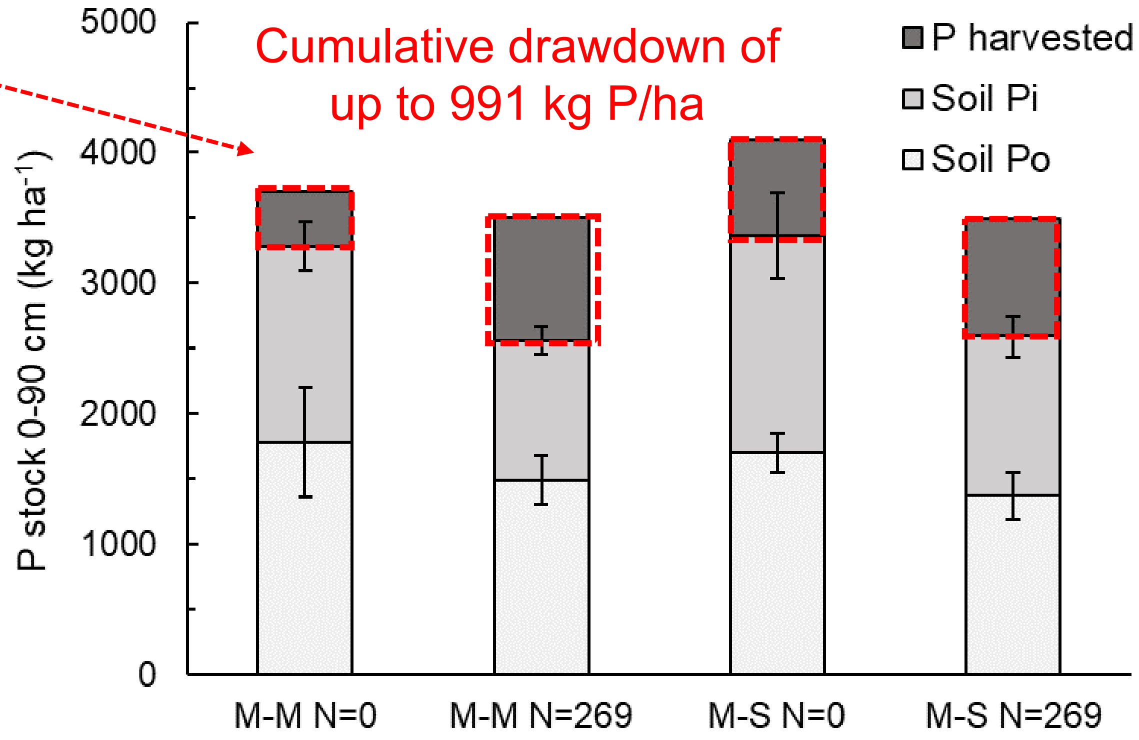
- Former swine manure application
- 1980-2017 balance reveals large magnitude of drawdown….

M3-P decreased erratically





…supported by high P stocks



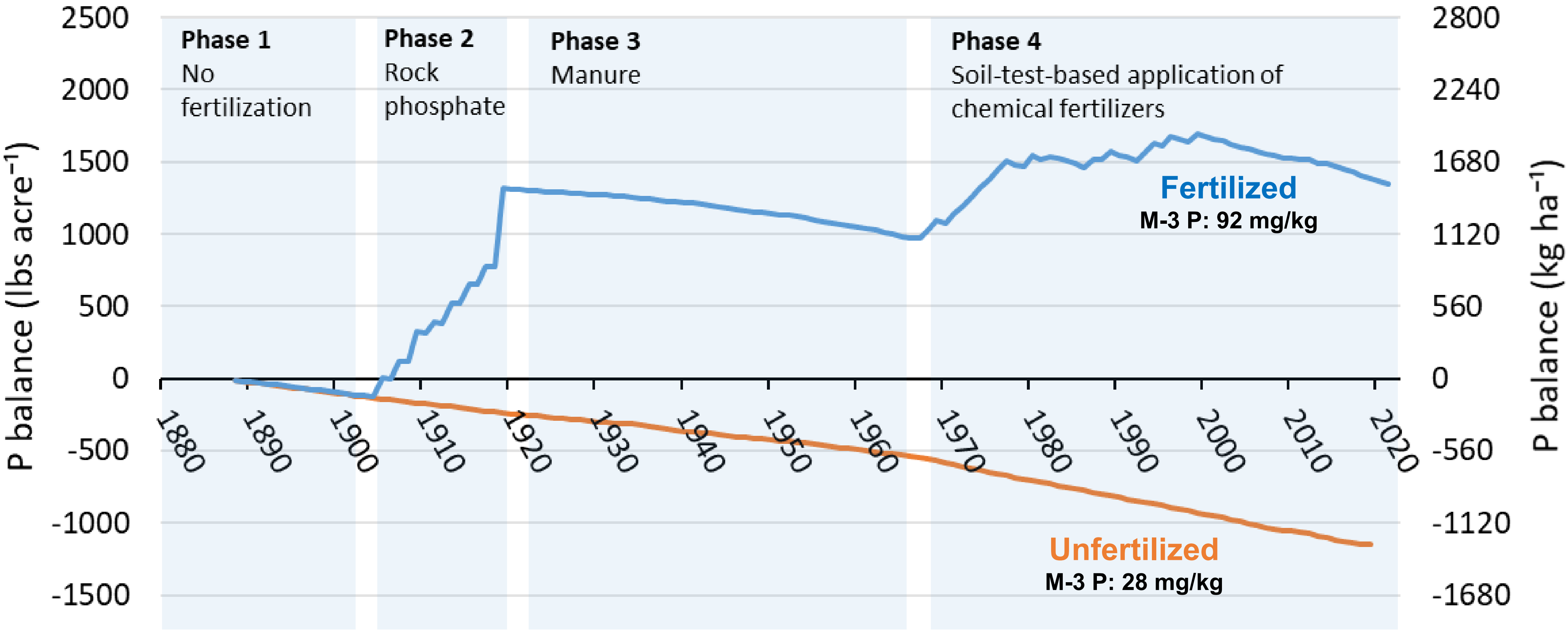
Sun, Margenot et al. In review.

Case Study #2: 145 years

Morrow Plots, est. 1876

(University of Illinois, Urbana, IL)

Large positive balance accrued in short period of time



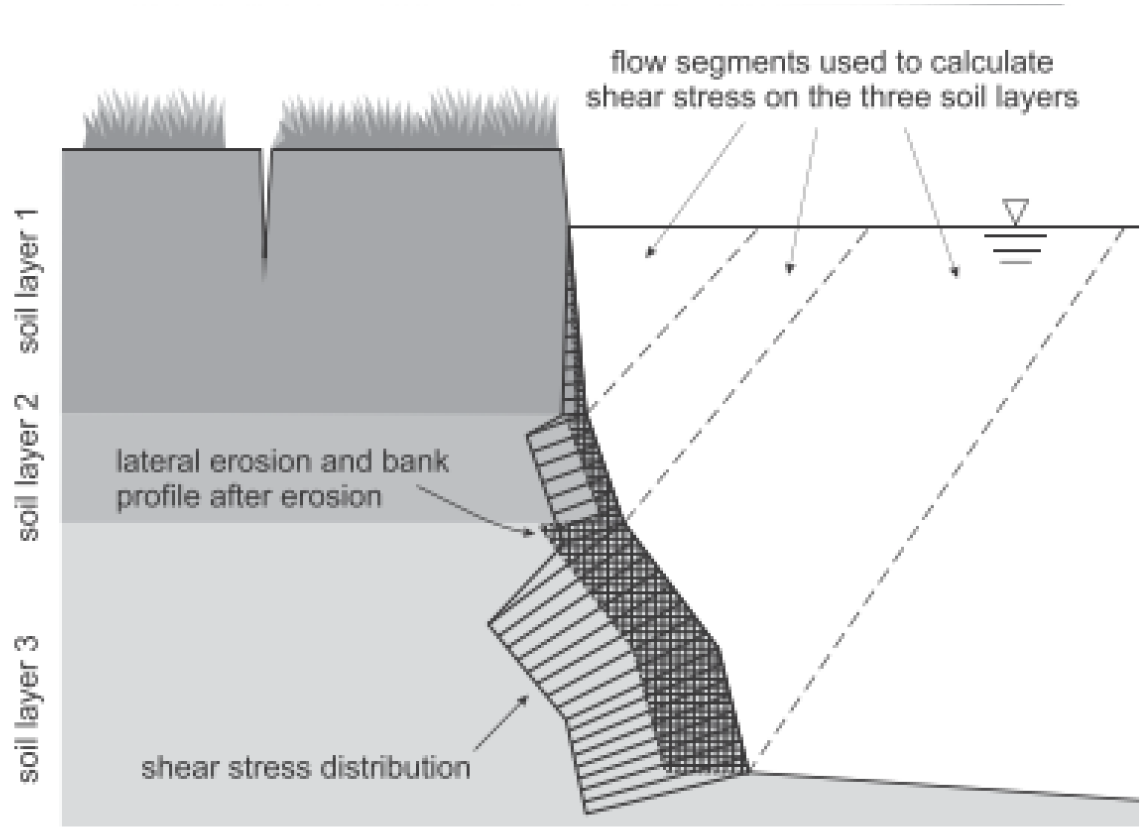
- Potentially large legacy P magnitudes can be accrued in relatively short period
  - Fertilized plot contains +170% P than unfertilized plot, +150% P than either in 1876
  - Majority of 150% increase over 145 years occurred in ~10% of that time
- >150 years of drawdown needed to restore to 1876 levels

Rothman, Margenot. In prep.

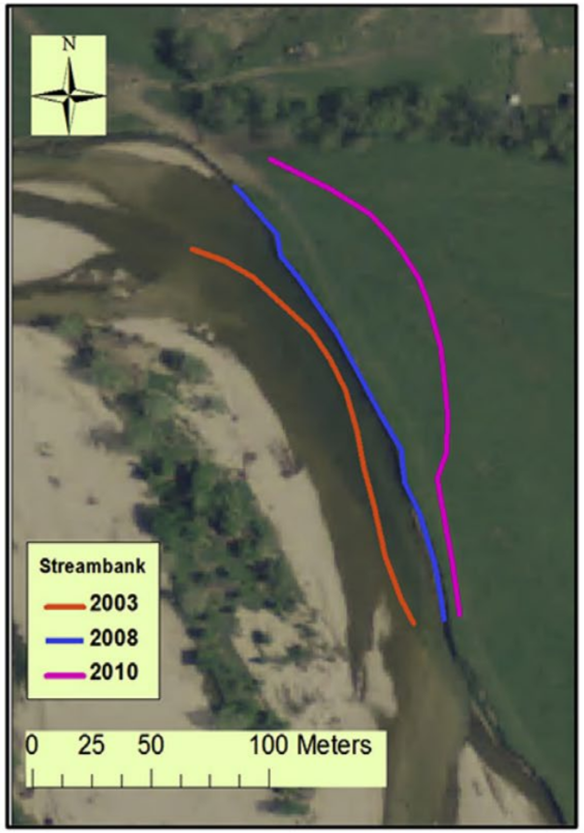
The other kind of legacy P

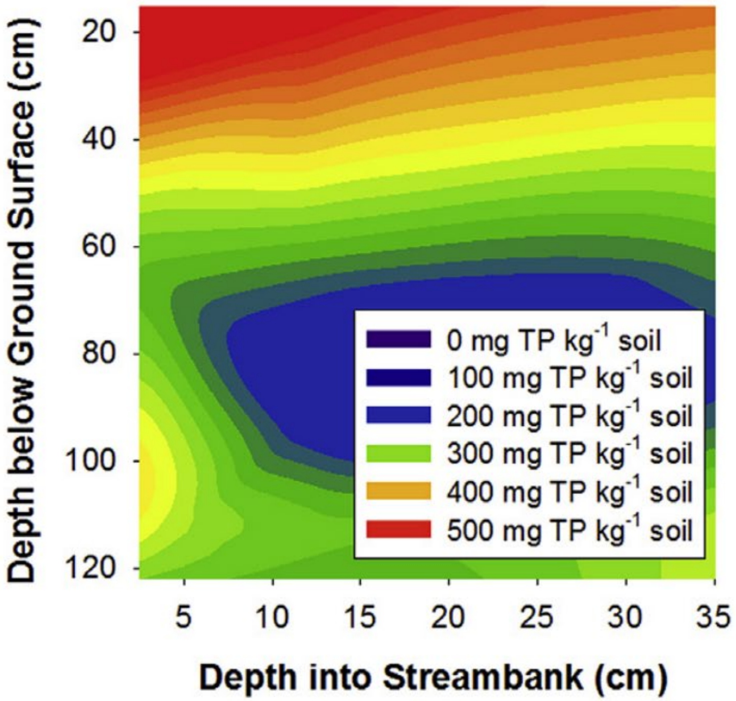
2. Streambank erosion

- "Natural process" that occurs when the forces exerted by flowing water exceed the resisting forces of bank material and vegetation
- Indirectly, can be influenced by agriculture (e.g., altered hydrology)
- Streambank erosion can account for **6-93%** of riverine export TP due to soil P loading



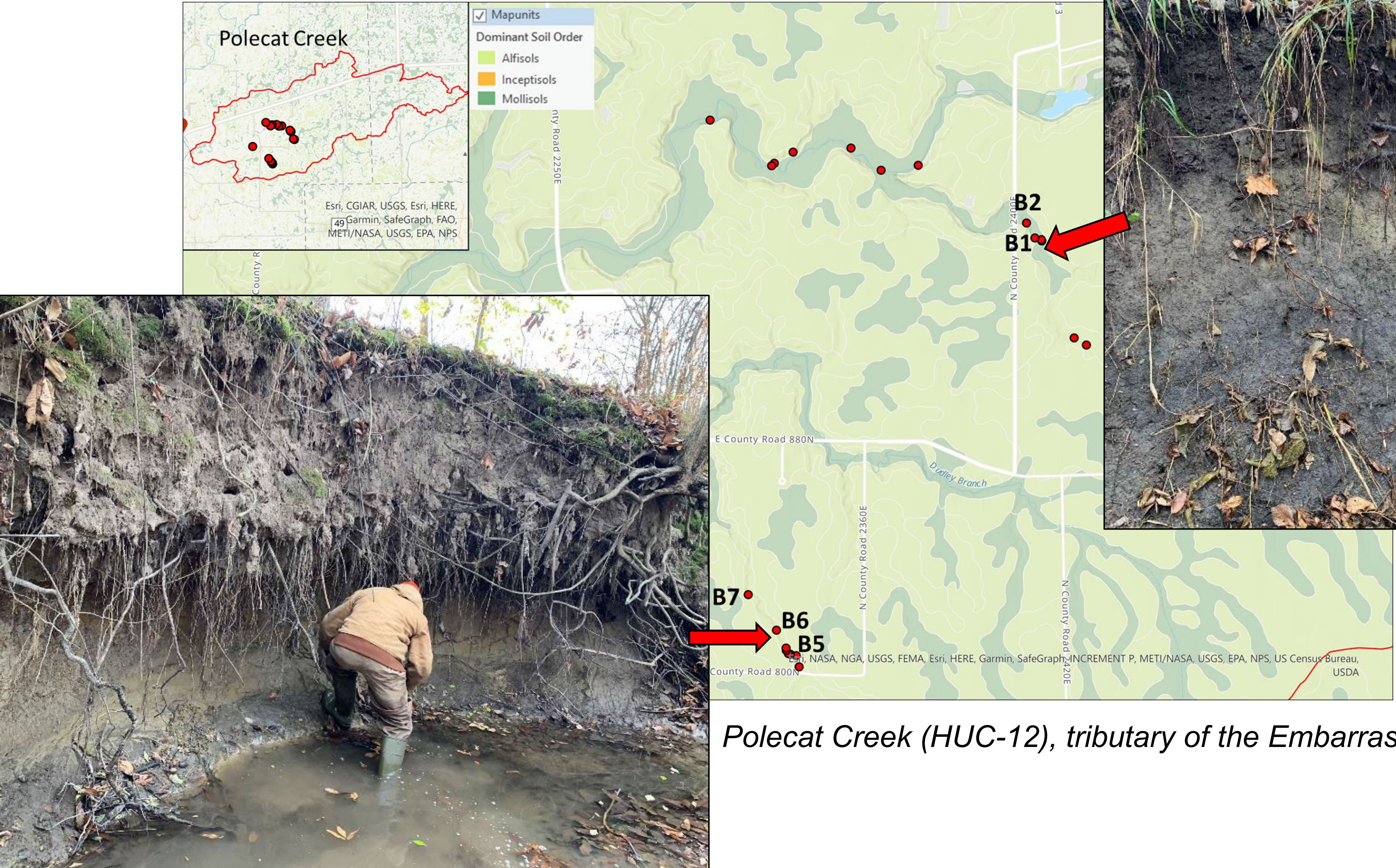
Daly et al 2015 *Adv Water Res* 881:114-127





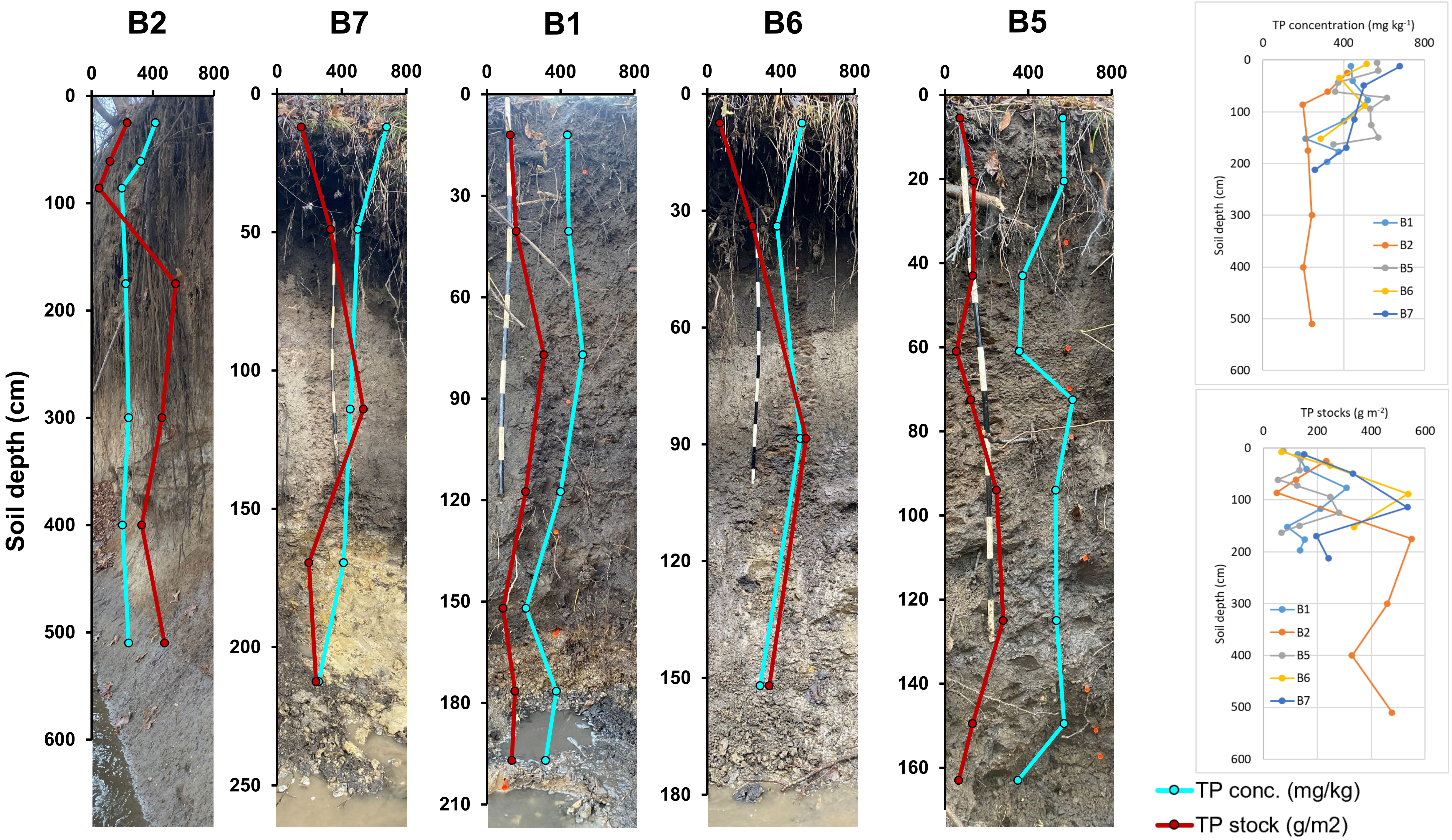
Fox et al 2016 *J Environ Managen* 181:602-612

Example of magnitudes and variability of potential streambank P erosional loading in Illinois: Embarras watershed



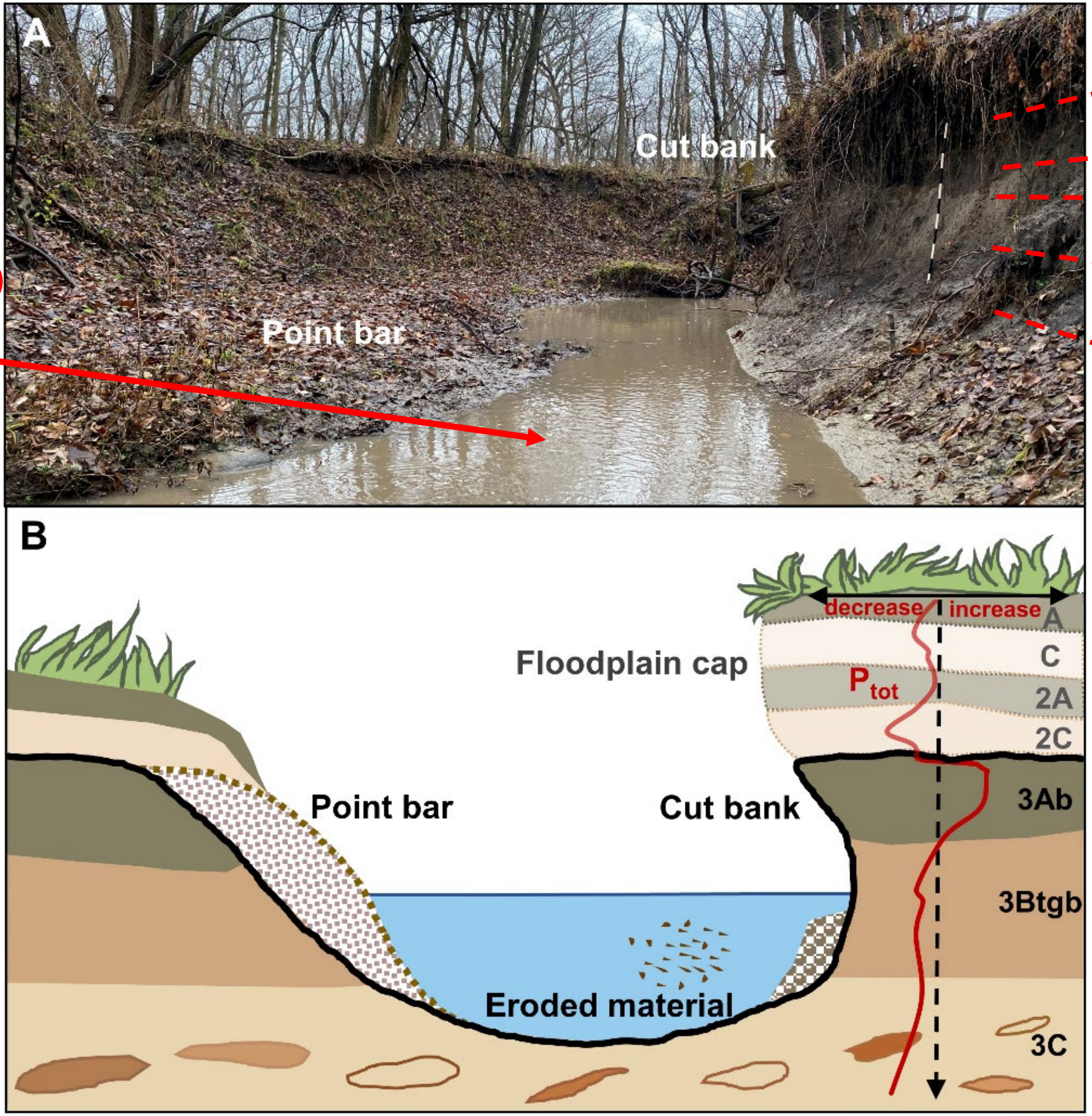
Polecat Creek (HUC-12), tributary of the Embarras

How much P is injected into streams with streambank erosion?


B2
B7
B1
B6
B5
Soil depth (cm)
TP concentration (mg kg-1)
TP stocks (g m-2)
Soil depth (cm)
B1
B2
B5
B6
B7
TP conc. (mg/kg)
TP stock (g/m2)

The “other” legacy P: sediment *already* in the channel (past streambank erosion)

Sediments in Polecat Creek ranged **254 – 462 mg/kg**

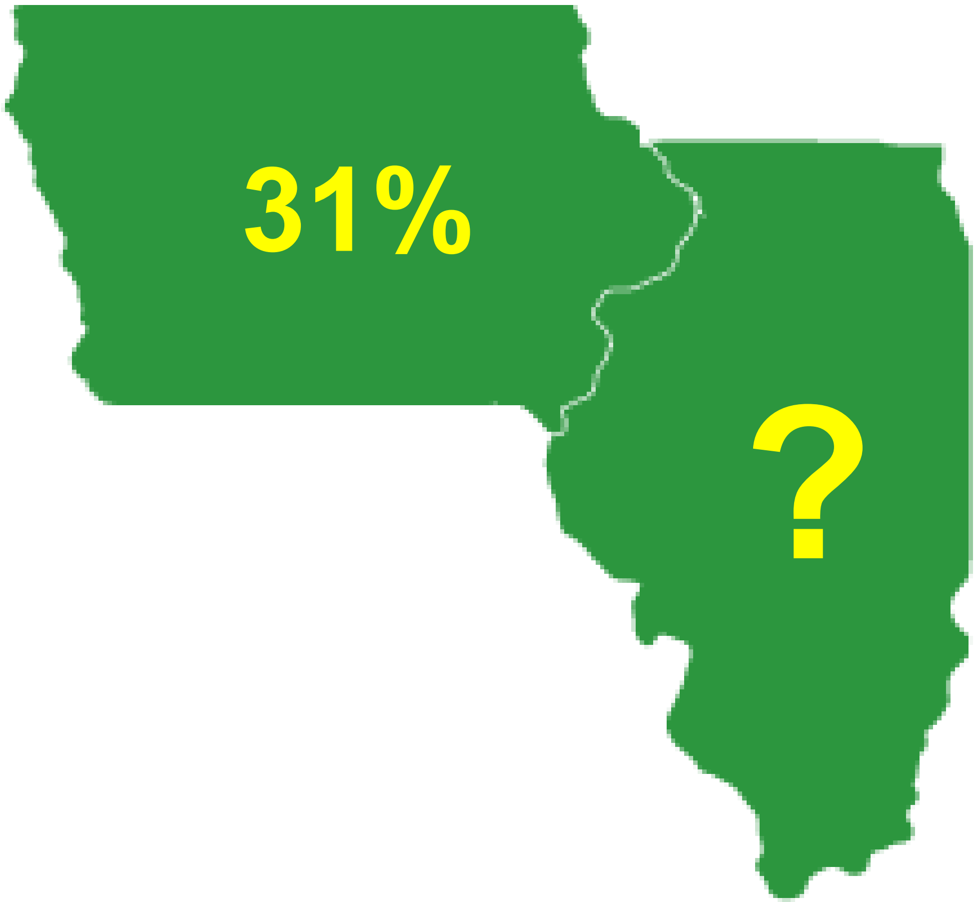


mg/kg
678
499
453
412
257

Streambank height is 95 in height = **12,900 lb P/ac**

If 6” along 3’ of the bank erodes (a big erosion event), **3.2 lbs P**

How much does streambank erosion contribute to state riverine P loads?



Streambank erosion is counted as non-point source (NPS), but it is *not* agricultural NPS

Streambank erosion adds up

Total streambank P contributions = eroding bank length × recession rate × bank height × bulk density × total P conc.

Assume (from Iowa Geological Survey):

- Eroding bank length of 35,200 km
- Average recession rate ~ 12.4 cm/year
- Average height of bank: 3.2 m
- Bulk density of 1170 kg/m^3 (low)

Total streambank soil load =

- 35,200,000 m x 0.124 m x 3.2 m x 1170 kg/m^3

  = 16.3 million tons of sediment
- At 470 mg P/kg soil (conservative),

  = 7,680 tons of P

~ 16.9 million lbs P = exactly the Illinois NLRS full reduction goal

Annual erosion changes could help explain interannual variability in P losses

- In Iowa, 31% of riverine P export from streambank erosion is the *average* over 18 years
- Annual estimated *magnitude* ranges 11 to 143% of annual P load

Table 2
Variations in estimated annual total phosphorus (TP) export from Iowa streambanks using standard assumptions (equation 1) and likely low and high range values of parameters.

Parameter	Equation 1 assumption	Low range	Total streambank TP loss (Mg)	High range	Total streambank TP loss (Mg)
Streambank recession (±1 s.d.)	12.4 cm y^{-1}	2.4 cm y^{-1}	1,487 (6%)	22.4 cm y^{-1}	13,875 (56%)
TP concentration (±1 s.d.)	470 mg kg^{-1}	278 mg kg^{-1}	4,543 (18%)	662 mg kg^{-1}	10,818 (44%)
Eroding lengths (±10%)	35,200 km	31,680 km	6,913 (28%)	38,720 km	8,449 (34%)
Eroding lengths (±25%)	35,200 km	26,400 km	5,760 (23%)	44,000 km	9,601 (39%)

Note: Percentage of mean annual riverine TP from Iowa (24,842 Mg).

Table 3
Annual riverine export of total phosphorus (TP) in Iowa and the estimated annual contribution from streambanks. Note that the annual streambank export is a constant (from equation 1).

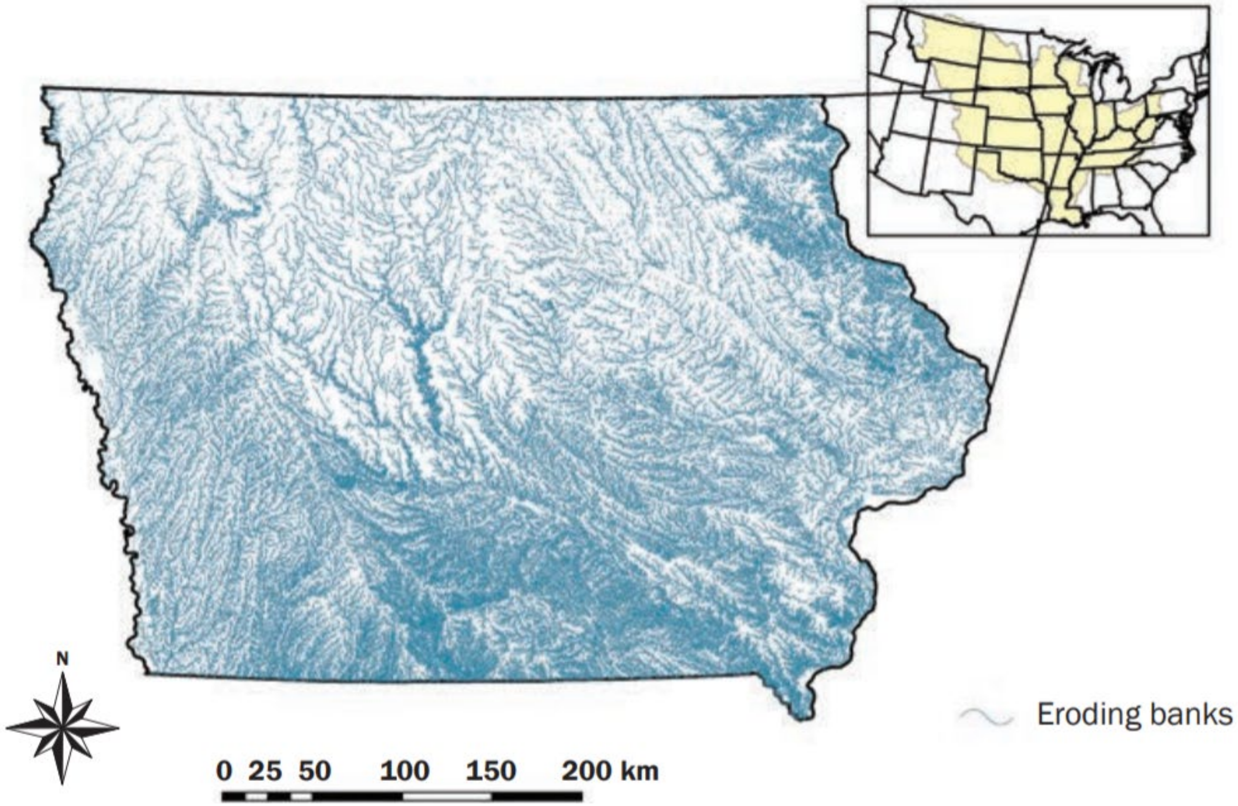
Year	Iowa mean TP yield (kg ha^{-1})	Iowa TP load (Mg)	Estimated annual TP from streambanks	Fraction of Iowa TP load from streambanks (%)
2000	0.49	7,128	7,681	108
2001	2.11	30,701	7,681	25
2002	0.63	9,232	7,681	83
2003	0.74	10,744	7,681	71
2004	1.99	29,065	7,681	26
2005	0.68	9,936	7,681	77
2006	0.52	7,576	7,681	101
2007	3.51	51,211	7,681	15
2008	4.95	72,182	7,681	11
2009	1.33	19,415	7,681	40
2010	3.49	50,929	7,681	15
2011	1.30	19,015	7,681	40
2012	0.37	5,377	7,681	143
2013	1.47	21,368	7,681	36
2014	2.12	30,900	7,681	25
2015	1.88	27,354	7,681	28
2016	1.89	27,573	7,681	28
2017	1.20	17,444	7,681	44
Mean	1.70	24,842	7,681	31

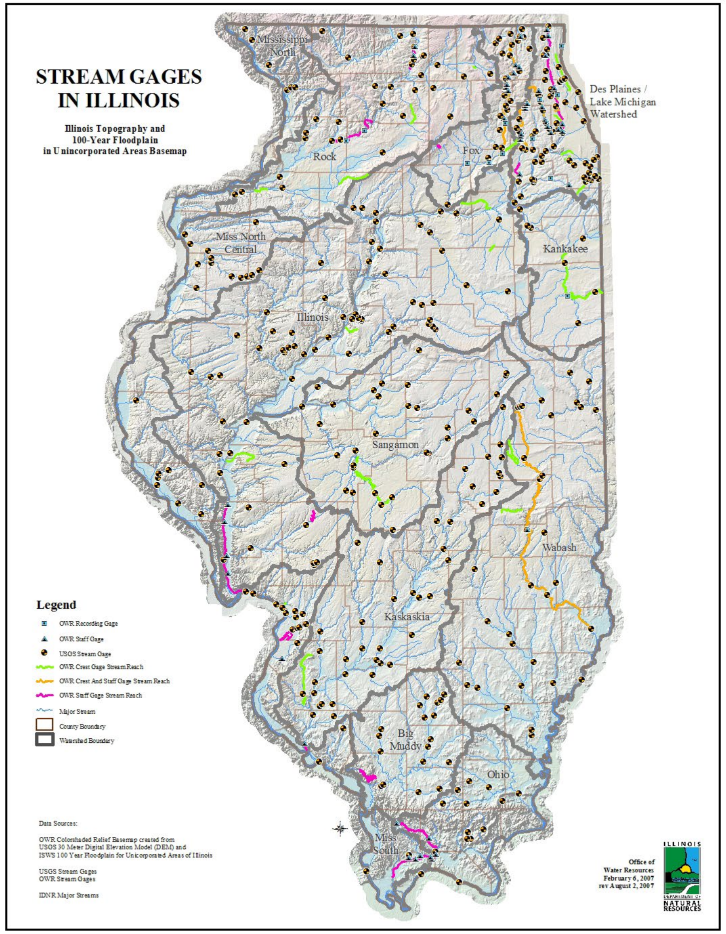
Schilling et al 2021 *JSWC* 77(1)

What would it take to do this in Illinois?

>35,200 km of streambanks may be severely eroding, or approximately 41% of all third- to sixth-order streambanks

- Estimates of eroding stream length
- Estimates of recession rate
- Soil P concentrations and bulk density





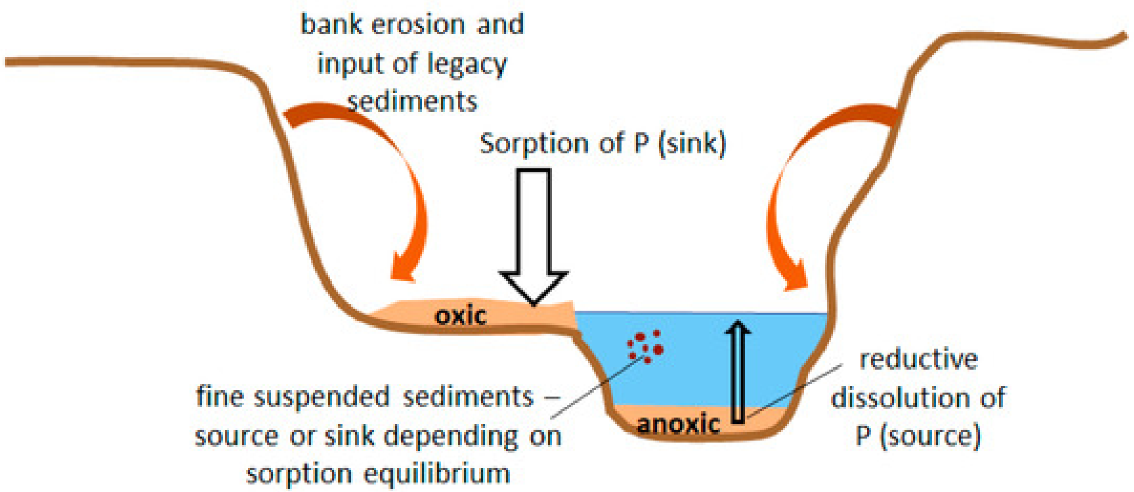
Schilling et al 2021 *JSWC* 77(1)

3. Legacy P: sediments

- Streams are important for transport and storage of P
- Streambank erosion + overland erosion = sediment P

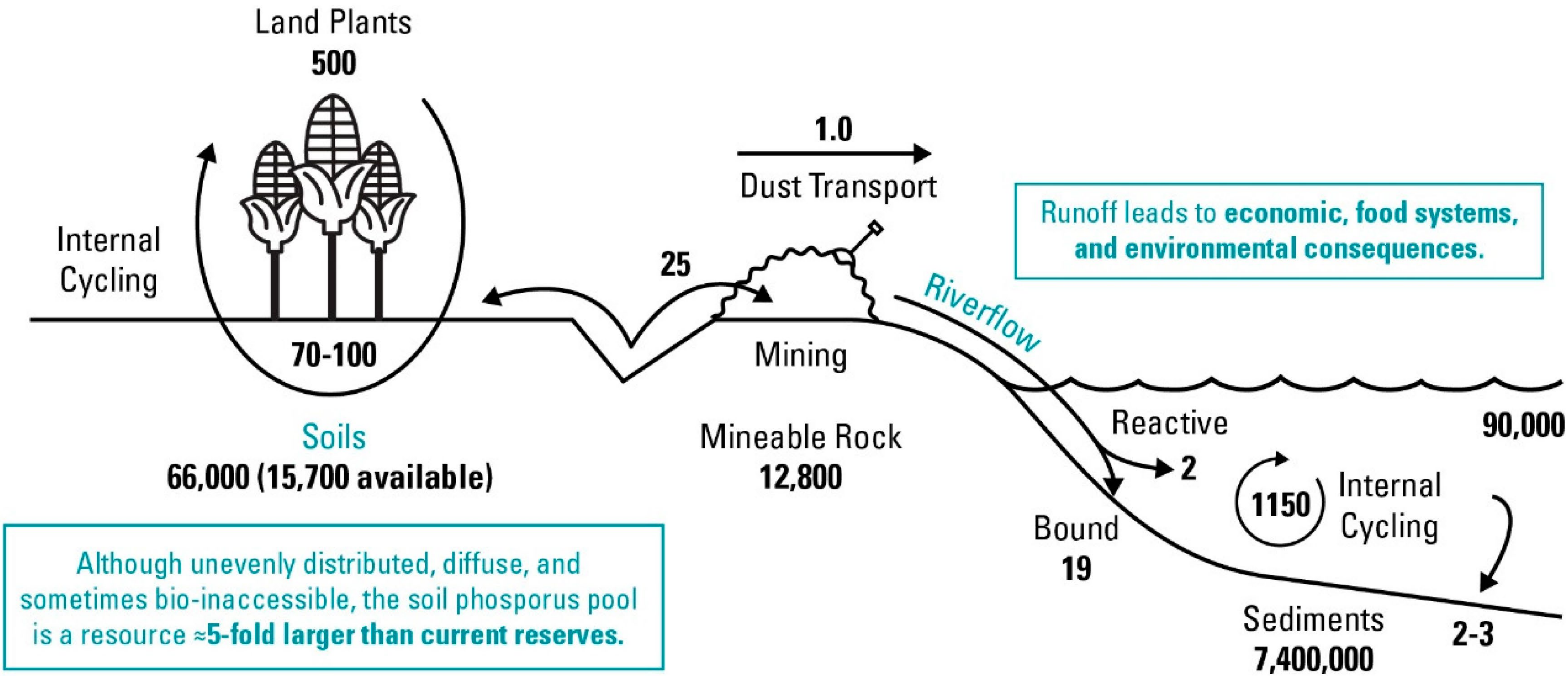
- P stored in streambed sediment may be a missing link between non-point P sources and riverine export loads

- Sediments <u>can switch from net sinks to net sources</u> of dissolved reactive P
  - P release when streamwater is lower P conc than in streambed
  - The “off-on” dynamics of sediment P can contribute to variation in year-to-year P export



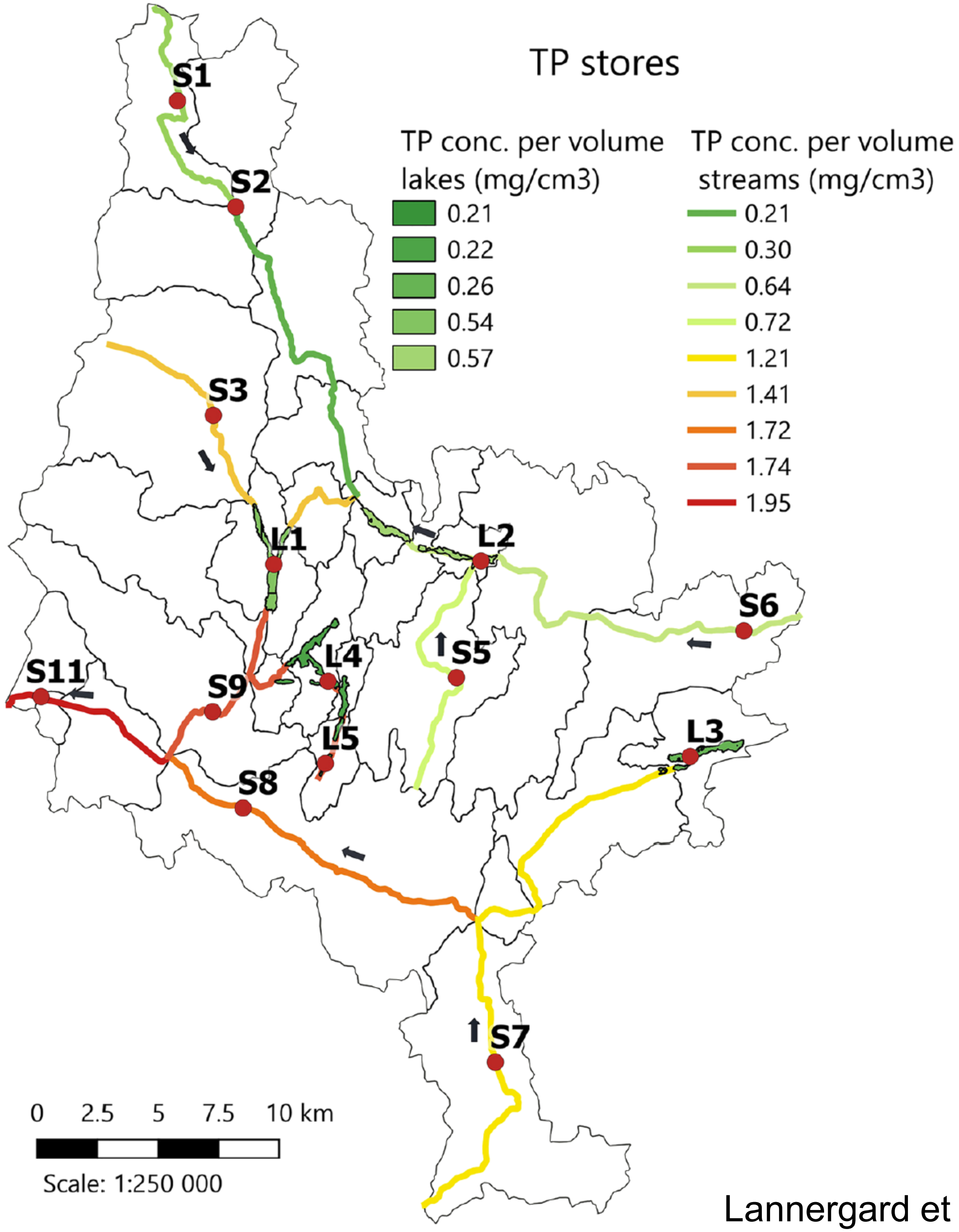
Inamdar et al 2020 *Soil Systems* 4(2): 30

Globally, sediments hold 10x more P than soils



Inamdar et al 2020 *Soil Systems* 4(2): 30

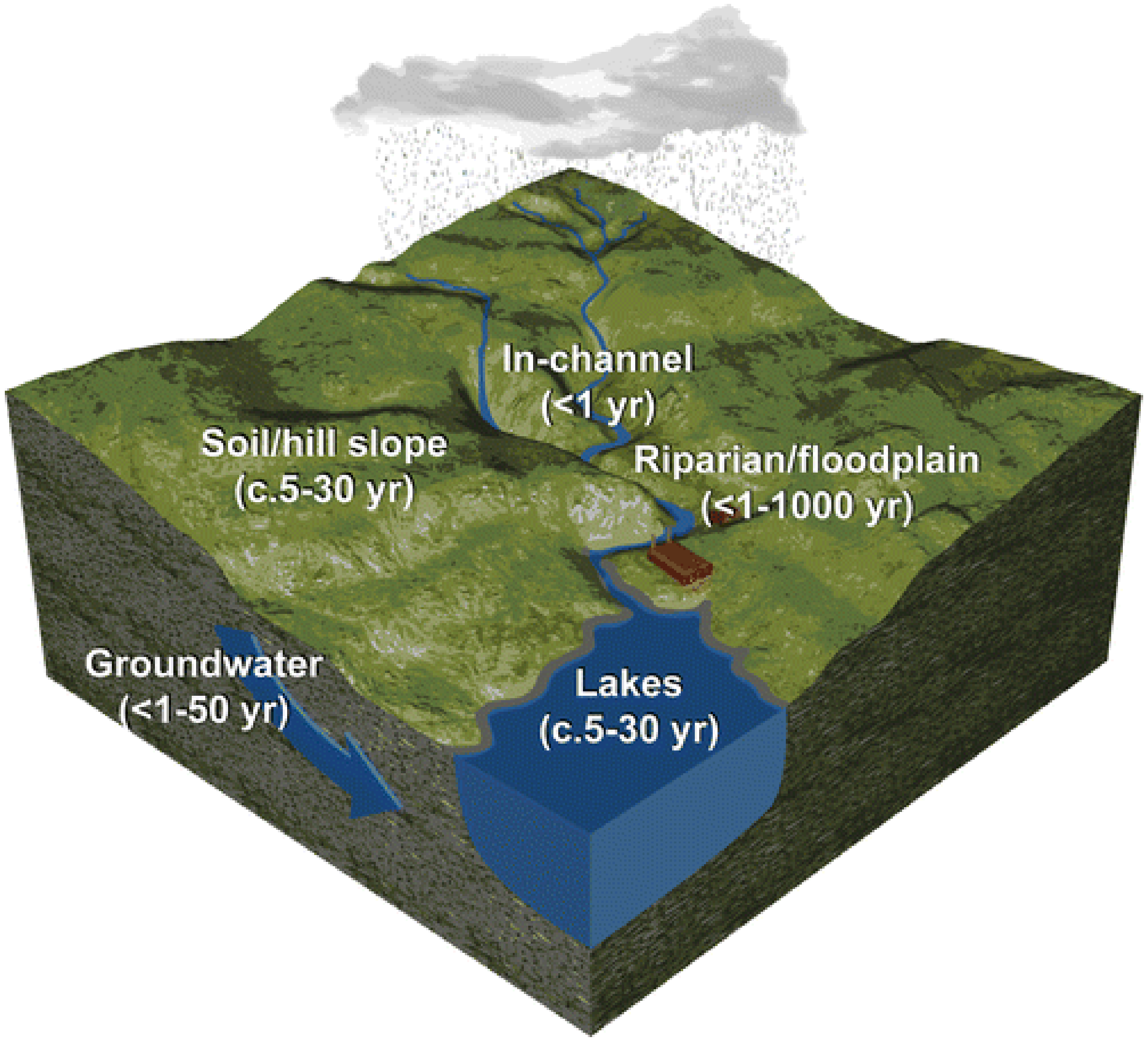
Legacy P stored in stream sediments



- Bed sediments often contain less P than their corresponding streambank soils, but release P more easily.
- Dissolved reactive P release following sediment resuspension
- P retention in bed sediments is regulated by Fe and Al oxyhydroxides
- Due to historical erosion, large magnitudes of sediment P loads may be stored in stream channels

Lannergard et al., 2020 *JGR Biogeosciences* 125:9

Typical time scales in soils and water of a watershed entail a chronic release of “legacy P” that will impair downstream water quality over timescales of years to centuries



Implications

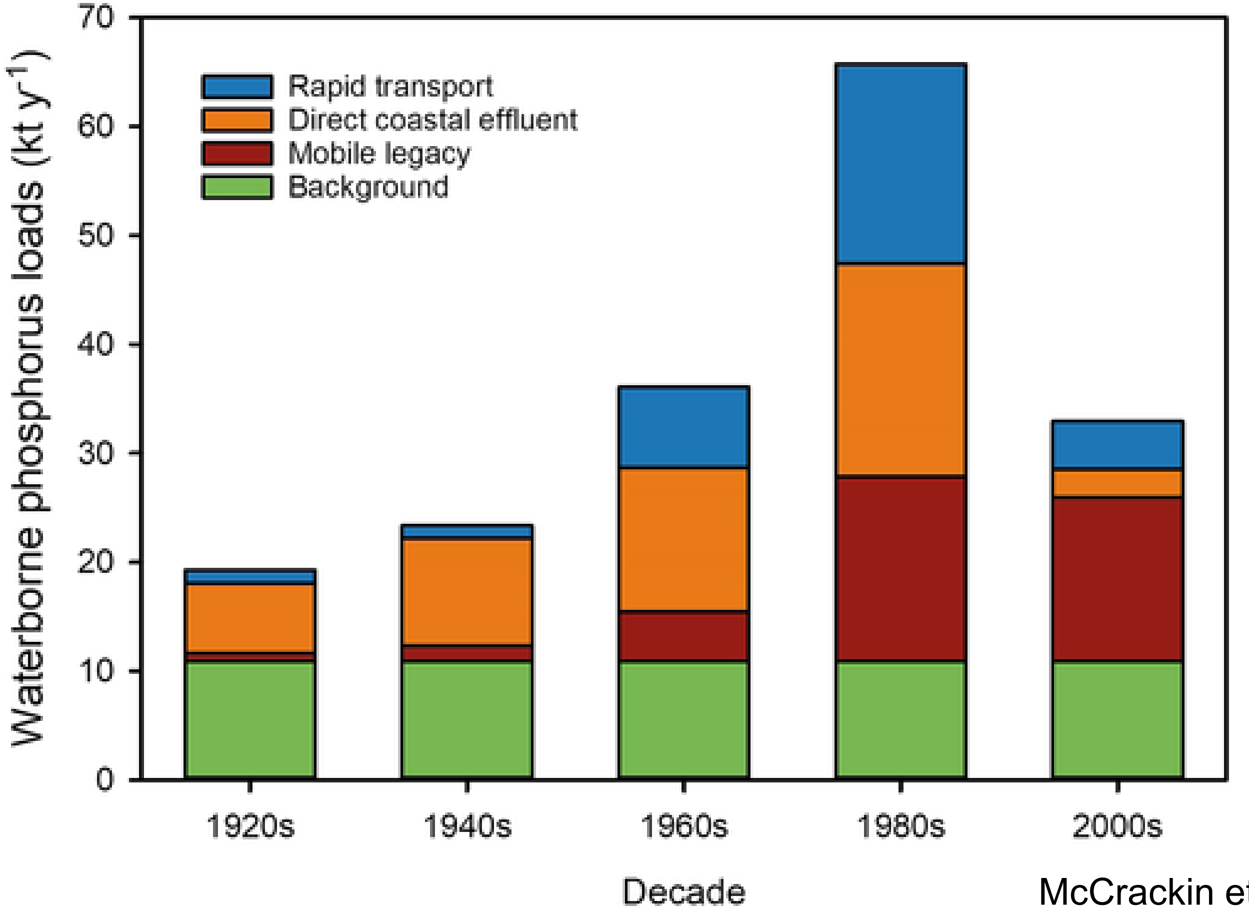
1. Constant loading of legacy P can create lag times between the implementation of nutrient abatement measures on land and the reduction in nutrient loads
2. Legacy P-based **lags in water quality recovery** must be quantified so that need-based evaluation of P loss reduction goals at longer time scales of recovery

Jarvie et al 2013 *ES&T* 47(16): 8997

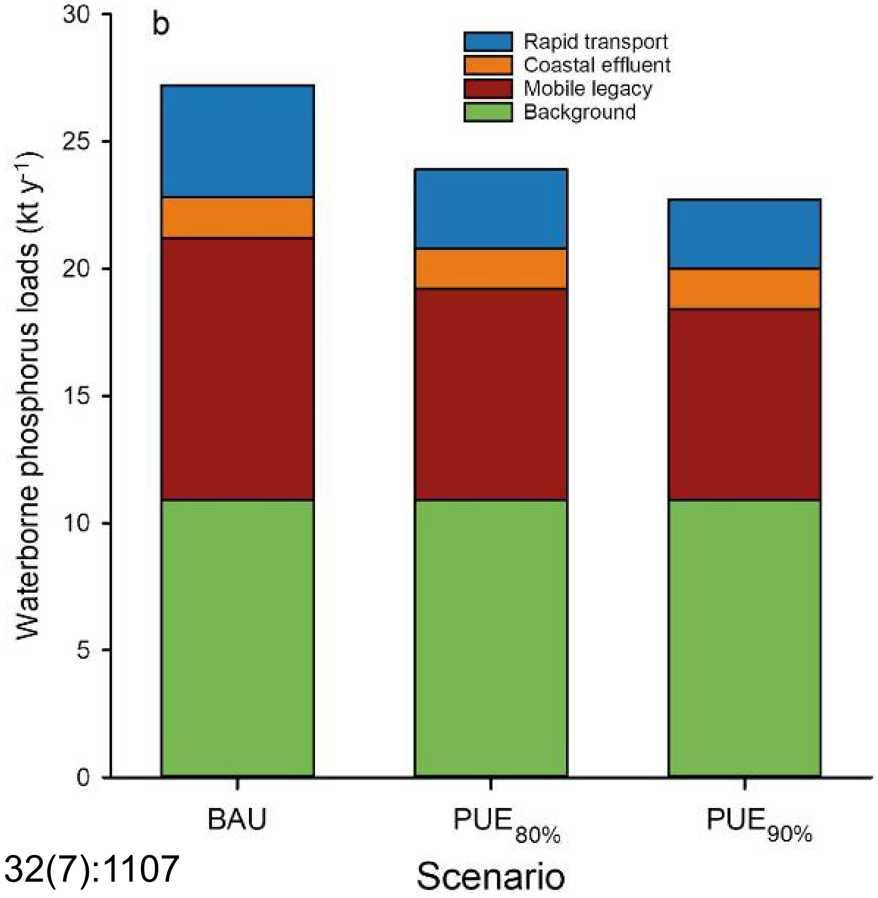
Lag of legacy P loading to surface water: the Baltic case

- Between 1900-2013, an estimated 27,000 Mg P accumulated in the Baltic Sea basin
- Losses from the legacy mobile pool contribute nearly half of P loads → near-term reductions difficult
- Basin-wide assessment revealed legacy P and streambank erosion as key contributors to lag effect

*Contribution of **legacy P** has increased in absolute and relative terms*



*Slower response of **legacy P** = lag in P reductions*



McCrackin et al 2018 *GBC* 32(7):1107

How to manage legacy sediment P? Case study: Dane Co., Wisconsin

- In 2014, Dane Co and WI Dept. Natural Resources discovered that 7x greater P concentrations in the stream sediments of Dorn Creek than in crop fields
- Sediment in Dorn Creek has existed since the late 1800s
- If the accrued legacy sediment remains at the bottom of the streams, it would take ~ 100 years for P to continue to leach out of the sediments and enter the lake.
- Dane Co. selectively dredging streams that are (1) smaller and (2) have higher P loads, costing **$14/lb P**

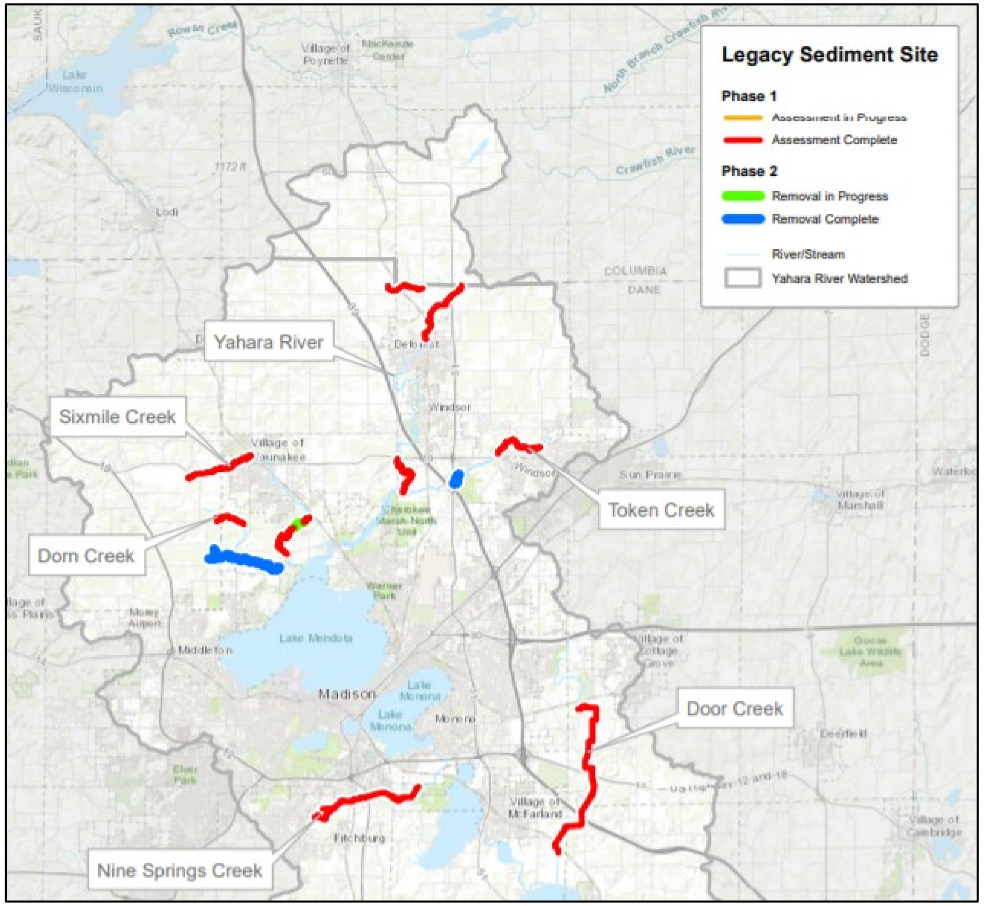


Table 3.7. Conservation practice costs included in the Illinois NLRS

Practice	Cost ($/ac)	Other Economic Concerns, as Noted in Illinois NLRS
Reduced tillage	-$17.00	Potential yield reductions
Phosphorus rate reduction	-$7.50	—
Stream buffer	$294.00	Cost is per acre of buffer; negative impacts on farmland
N rates reduced from background to MRTN	-$8.00	—
N inhibitor with fall-only fertilizer application	$7.00	—
Split N fertilizer application on tiled soils (50% fall and 50% spring)	$17.00	—
Spring-only N fertilizer application on tiled acres	$18.00	Timeliness
Cover crops	$29.00	Planting difficulty; potential impact on yields
Bioreactors	$17.00	Large investment costs; increasing costs with large adoption
Wetlands	$60.63	Large investment costs
Perennial crops	$86.00	Lower forage prices due to large shifts

NLRS 2021 Biennial Report

Summary

- Legacy P in soils is accumulated P from past inputs
  - Typically inferred by balances
  - Challenging to measure with decreasing spatial scale (state to field)
  - Soil archives at UIUC enable 100-year chronosequence approach to estimate legacy P at county scale
- Large magnitude of soil-based P transfers to surface waters via streambank erosion
  - Potentially large contribution to total P export
- Legacy P as sediment in stream channels entails major lags
  - Constant loading of legacy P can create lag times between the implementation of nutrient abatement measures on land and the reduction in nutrient loads
  - Legacy P-based **lags in water quality recovery** must be quantified so that need-based evaluation of P loss reduction goals at longer time scales of recovery are not dismissed as ‘buying more time’

Questions?

margenot@illinois.edu

217.300.7059 (office)

References

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The livestock component in nonpoint source nutrient loss reduction

TED FUNK, PhD, PE

UNIVERSITY OF ILLINOIS EXTENSION (RET.)

Issues and questions

How are manure nitrogen and phosphorus being managed now, relating to the NLRS?

Does Illinois livestock industry produce too much manure to fertilize the state's crops?

What significant changes in situation, management practices, and technologies have appeared recently?

What other tactics for manure nutrient management are being considered and researched?

Livestock manure nutrients overview—Farm practices

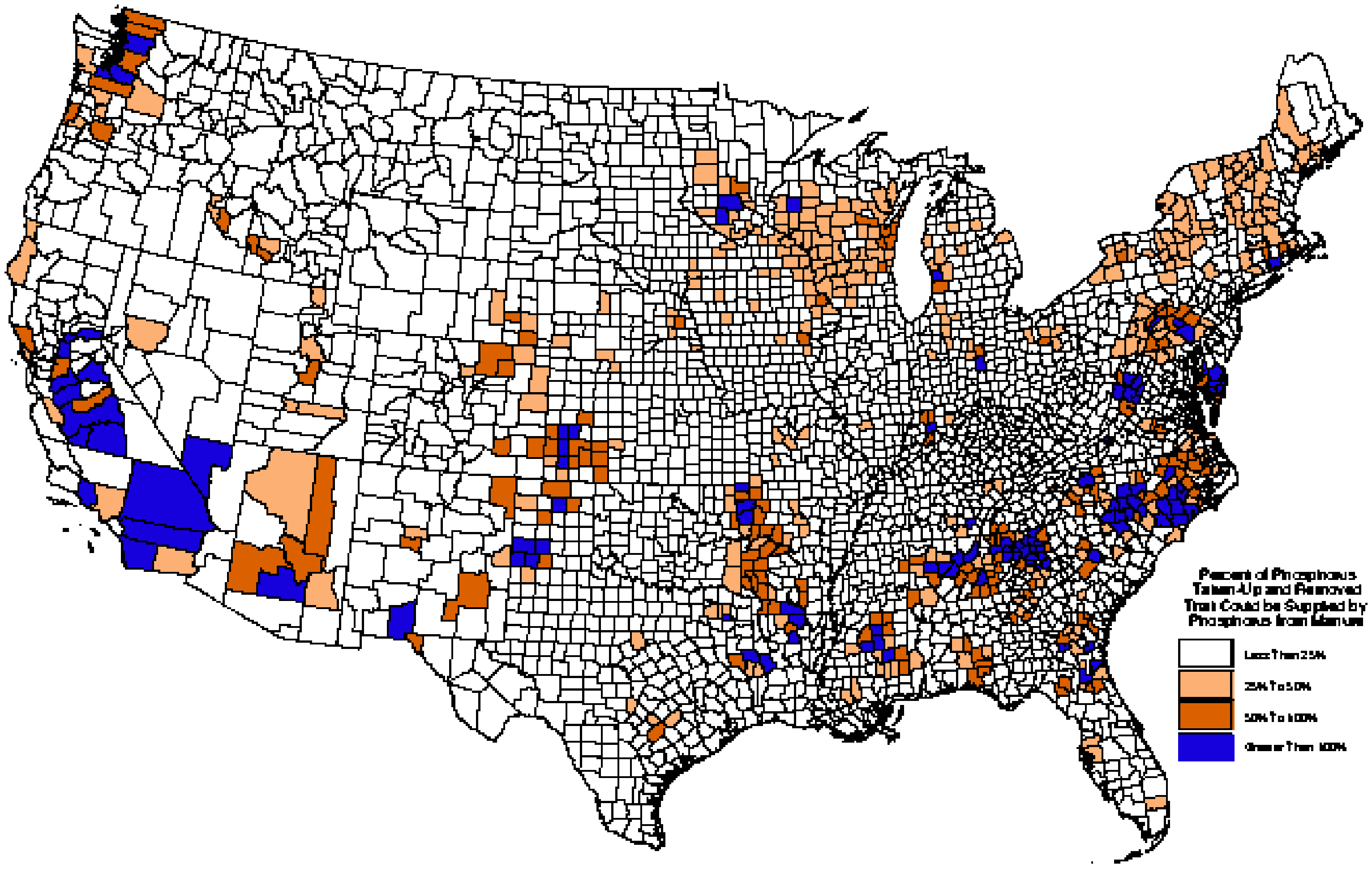
Swine, dairy, beef, poultry (turkey, layers) are the major species

Virtually all animal manure in Illinois is recycled onto cropland; no "treatment to discharge" like municipal sewage wastewater

Manure is routinely analyzed for N, P, and K—the major crop nutrients—plus sulfur and micronutrients

CAFOS are required to test soils regularly; high P test soils have manure application limits imposed

Where in the US is there an excess of manure phosphorus? Manure P supplied *vs.* crop uptake potential



Source: LPES Curriculum Lesson 2

Livestock manure nutrients overview—

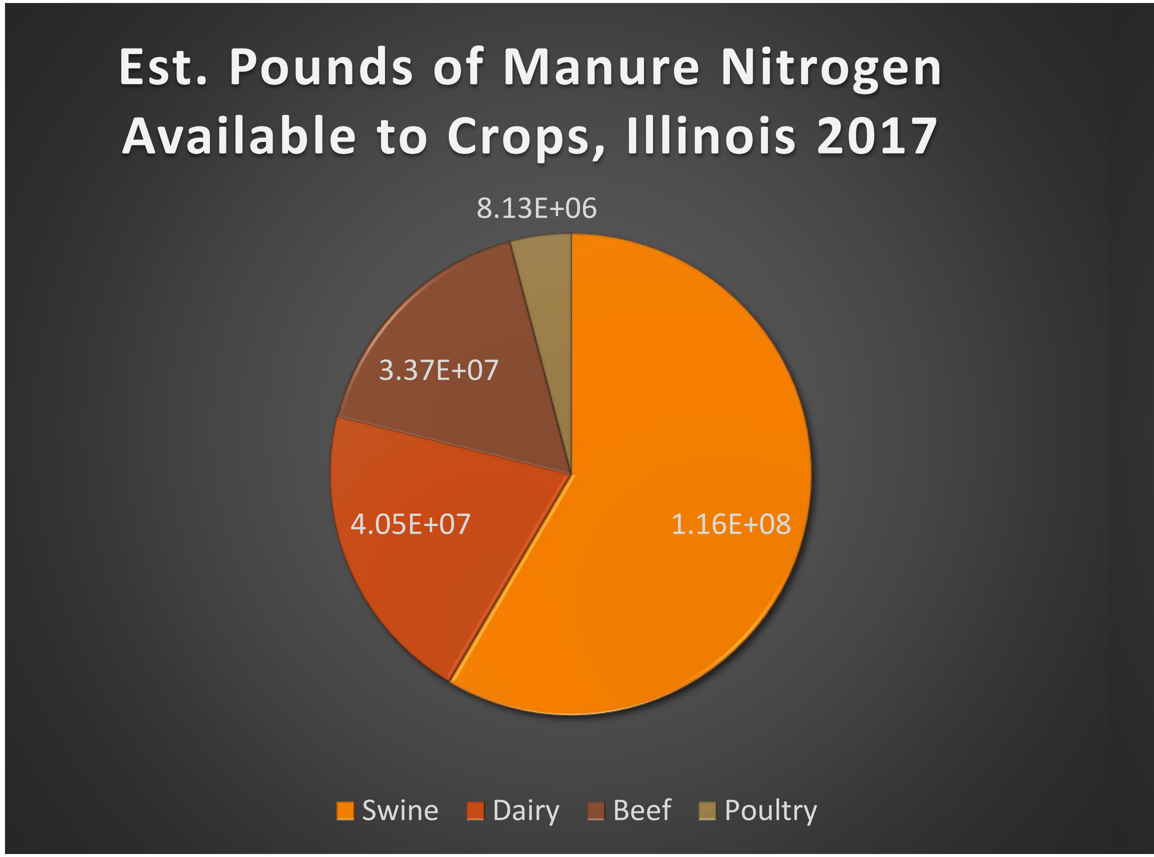
Quantities

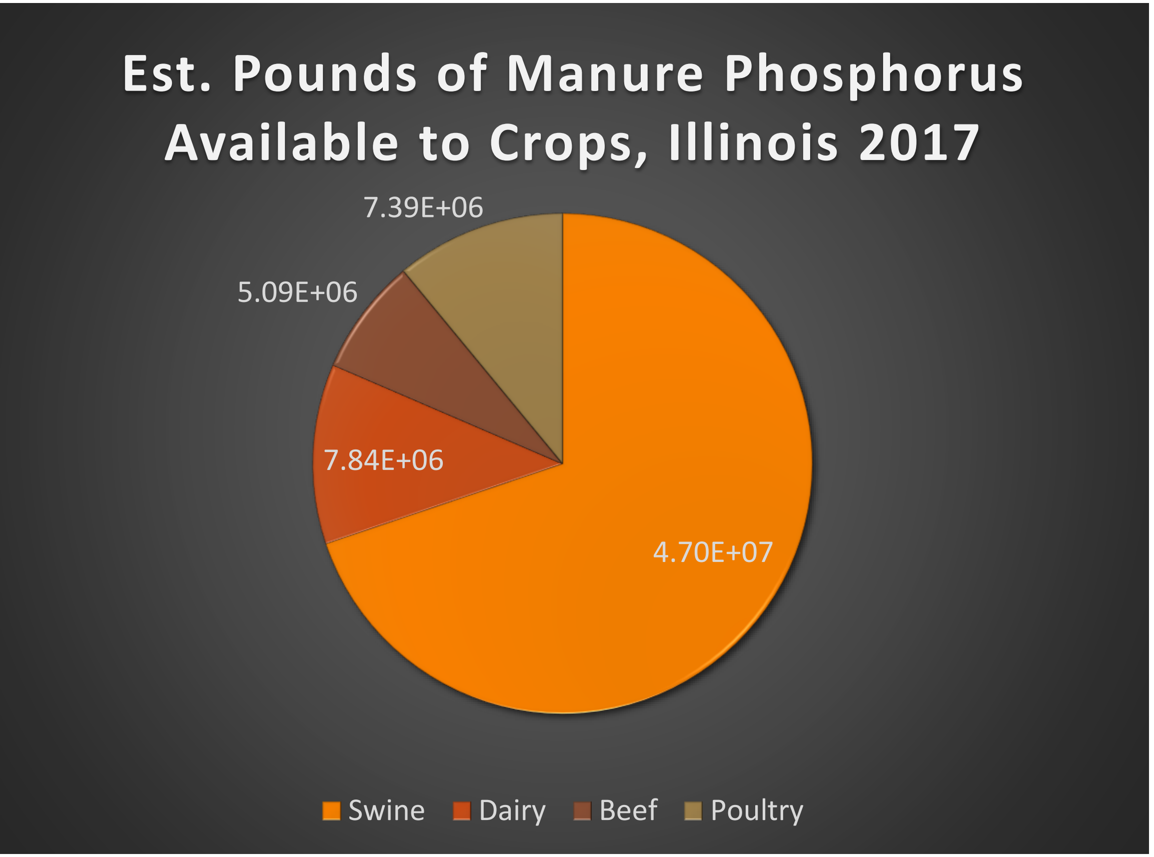
USDA Ag Statistics Survey every 5 years—2012, 2017—gives county-based estimates of animal inventories, sales

Handbook data are used here to estimate annual manure nutrients production

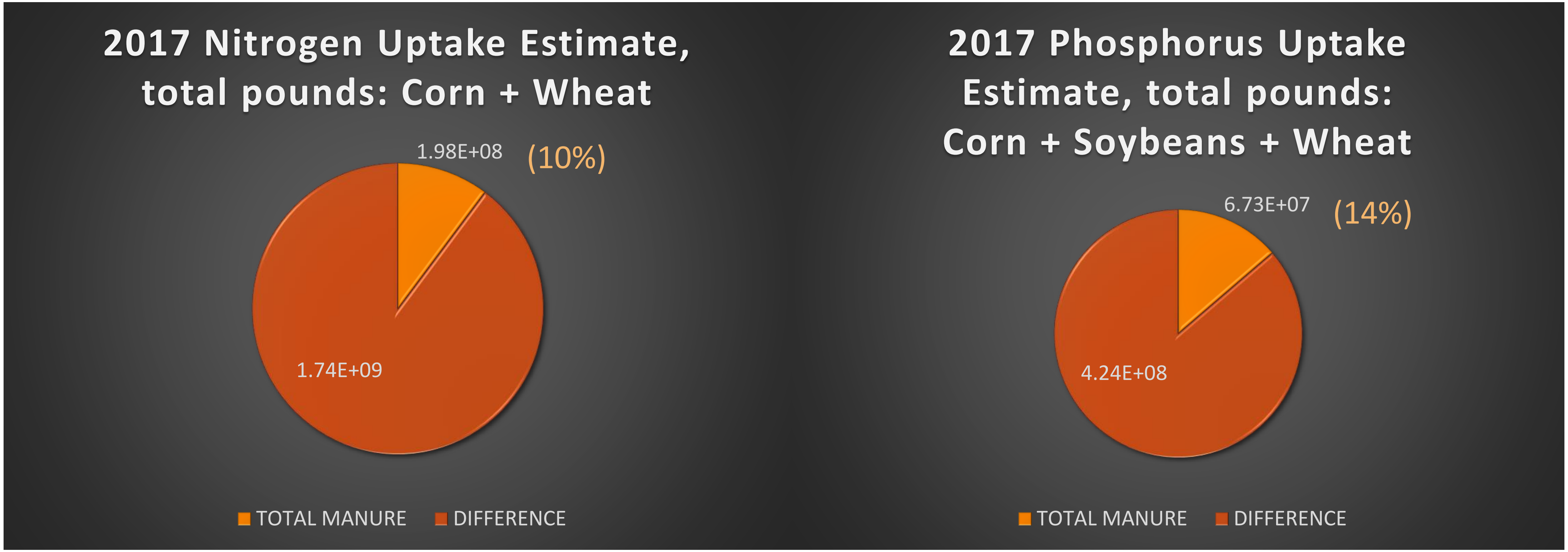
Note that site-specific data are required for individual farm plans; every operation is unique and dynamic

How much N and P can Illinois livestock supply to our major crops?





How much of the Illinois crop can be supplied with N and P from manure?



Motivations for improving environmental sustainability of manure use in the IL cropping system

Regulatory

- IL Livestock Management Facilities Act & Rules
- IEPA Title 35 Subtitle E Parts 501, 502, 506, 560, 570, 580
- US EPA 2008 CAFO Rule 40 CFR Parts 9, 122, and 412

USDA programs (NRCS)

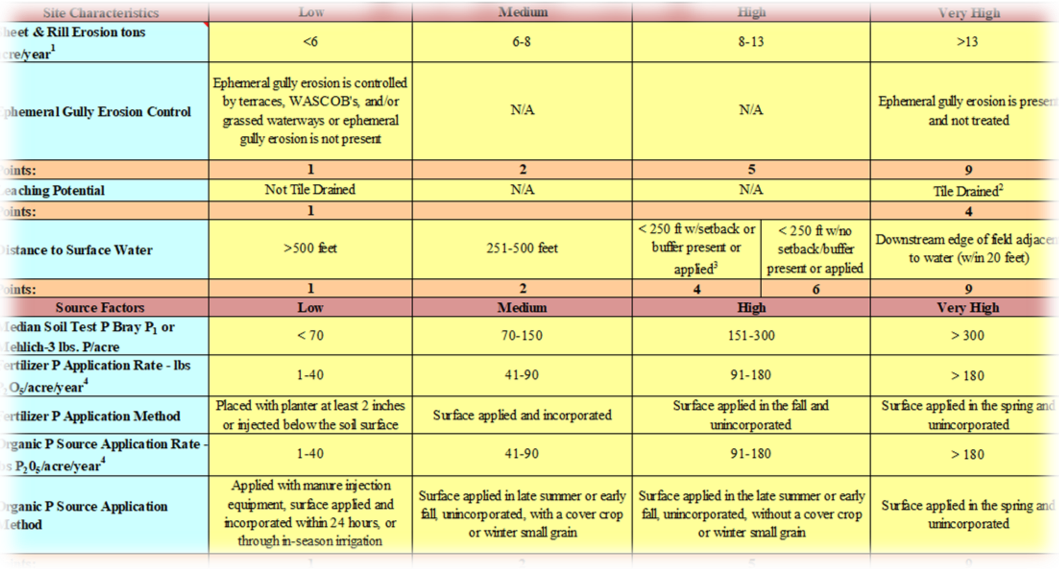
Technological

Educational (Extension & Industry)

USDA program incentives: NRCS practices define boundaries for manure utilization

Nutrient Management, Conservation Practice Standard 590: 4R approach (product, rate, timing, placement)

- N leaching soils risk assessment (rev. 2021)
- P index soils risk assessment (rev. 2021)



Site Characteristics	Low	Medium	High		Very High
heet & Rill Erosion tons cre/year[1]	<6	6-8	8-13		>13
phemeral Gully Erosion Control	Ephemeral gully erosion is controlled by terraces, WASCOB's, and/or grassed waterways or ephemeral gully erosion is not present	N/A	N/A		Ephemeral gully erosion is presen and not treated
oints:	1	2	5		9
eaching Potential	Not Tile Drained	N/A	N/A		Tile Drained[2]
oints:	1				4
istance to Surface Water	>500 feet	251-500 feet	< 250 ft w/setback or buffer present or applied[3]	< 250 ft w/no setback/buffer present or applied	Downstream edge of field adjacen to water (w/in 20 feet)
oints:	1	2	4	6	9
Source Factors	**Low**	**Medium**	**High**		**Very High**
edian Soil Test P Bray P_1 or ehlich-3 lbs. P/acre	< 70	70-150	151-300		> 300
ertilizer P Application Rate - lbs $_2O_5$/acre/year[4]	1-40	41-90	91-180		> 180
ertilizer P Application Method	Placed with planter at least 2 inches or injected below the soil surface	Surface applied and incorporated	Surface applied in the fall and unincorporated		Surface applied in the spring and unincorporated
rganic P Source Application Rate - s P_2O_5/acre/year[4]	1-40	41-90	91-180		> 180
rganic P Source Application ethod	Applied with manure injection equipment, surface applied and incorporated within 24 hours, or through in-season irrigation	Surface applied in late summer or early fall, unincorporated, with a cover crop or winter small grain	Surface applied in the late summer or early fall, unincorporated, without a cover crop or winter small grain		Surface applied in the spring and unincorporated

NRCS Environmental Quality Incentive Programs are well received by Illinois livestock producers

	Year	Contracts	Acres enrolled	$ obligated
Grazing	2019	23	1864	$ 1,996,657
	2020	17	1508	$ 2,279,133
	2021	28	2733	$ 3,452,619
Confined livestock	2019	15	5475	$ 3,830,236
	2020	11	3478	$ 2,414,359
	2021	13	3379	$ 2,363,810
CAP—Comprehensive Nutrient Management Plan	2019	30	2054	$ 209,756
	2020	33	3463	$ 244,945
	2021	15	493	$ 88,733

Significant **practice changes** improve manure nutrient utilization

Animal diets

Manure storage and cropland application

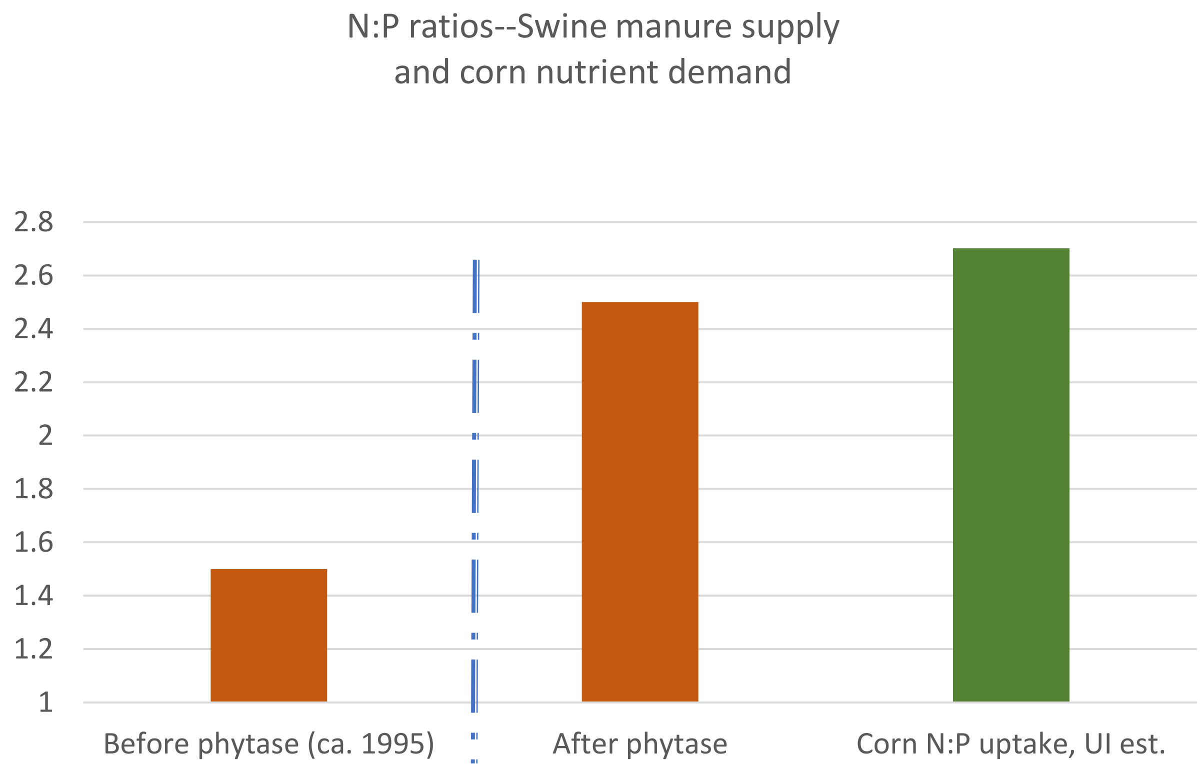
Land use

Nutritional—synthetic phytase in monogastric animal (swine and poultry) diets

Since late 1990's, adding phytase to diets has greatly reduced phosphorus excretion

Brought manure nitrogen/phosphorus ratios into balance with major crop needs—reduces high P soil tests over time

Adding synthetic phytase to swine diets reduces phosphorus excretion in manure



Example: Growth of custom manure hauler industry and associated scale factors

- Custom haulers facilitate more timely land application
- Use specialized equipment and labor resources on more product
- Have more appropriate equipment for reducing runoff and leaching losses
- Enable greater hauling distances from the farm, to access more cropland needing nutrients

Example: Manure side-dressing in spring.

Better timing—less nutrient loss.

Image: Ohio State University

Example: Rotational grazing of beef and dairy cattle.

Improves ground cover, soil water holding capacity; and reduces runoff.

Other examples of technology affecting manure nutrient loss reduction

Nitrification inhibitor in liquid manure, to reduce N loss via nitrate leaching

In slurry storages:
- Less water input
- Larger capacity -> better seasonal application timing

Improved liquid manure soil-injection tools for more efficient placement

Smart-phone apps for quickly calculating field nutrient balances and recording application events

GPS as-applied mapping—where manure was applied, how much, when

On-the-go manure nutrient sampling equipment, for fine-tuning application rates in the field

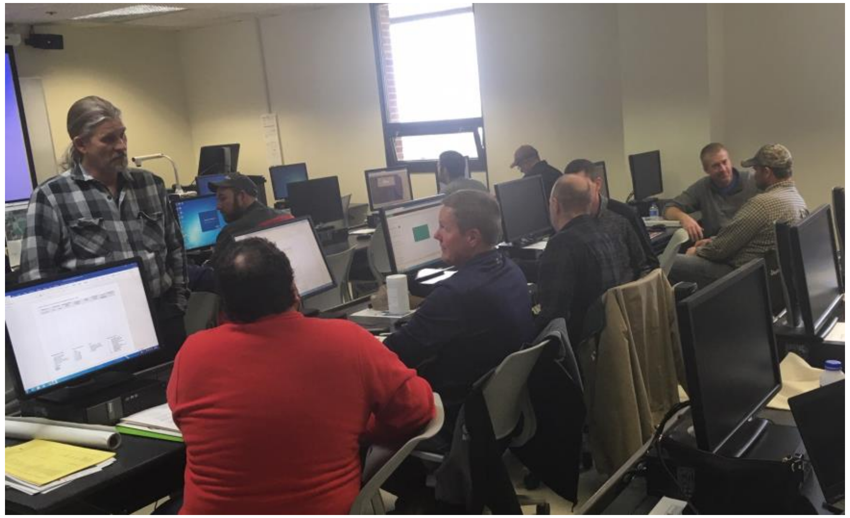
Regulatory changes drive some aspects of educational programming for livestock producers

Illinois LMFA— introduced 1996

Federal CAFO rules 2003, 2008

IL EPA Title 35 Subtitle E

Continuing Education efforts target environmental stewardship



Extension- and **industry**-led

Regular **producer training** (CLM program mandated by LMFA)

Field days at county and regional levels: manure nutrient management, spreader calibration demonstration workshops, etc.

Manure Nutrient Management **Plans workshops**

Custom Manure Hauler **Training workshops**

Technical Service Provider **(TSP) Training**

Farm Gate individual **on-farm environmental reviews**

Species-specific **Resource Guides** for IEPA's livestock rules

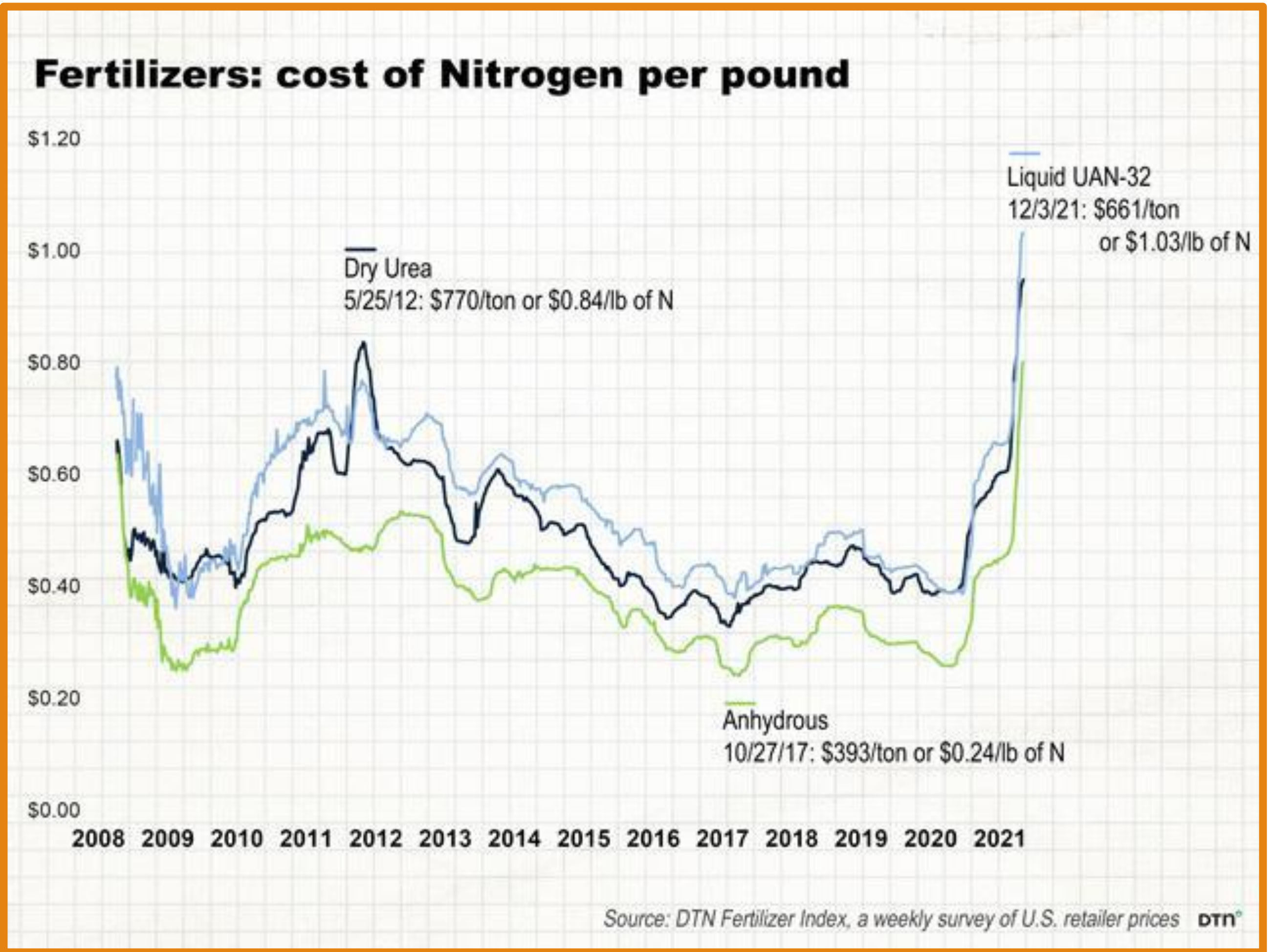
Other economic incentives for improving environmental sustainability of manure use in the IL cropping system

Prices of nutrients

Supply chain and availability of commercial fertilizer products

--and--

Demand for off-farm transport/sales



Summary

IL livestock produce only a small portion of the N and P needed for the state's major crops

Manure storage, handling, and land application are regulated at the state and federal levels

Major changes in technology and practices for utilizing livestock manure have improved environmental stewardship

Implications: The regulatory climate, education, and incentives are keeping livestock industry in step with the NLRS goals

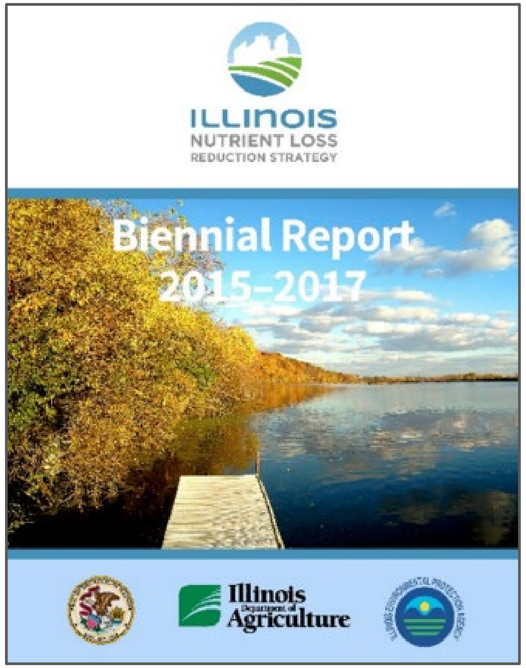
Questions or comments?

TED FUNK

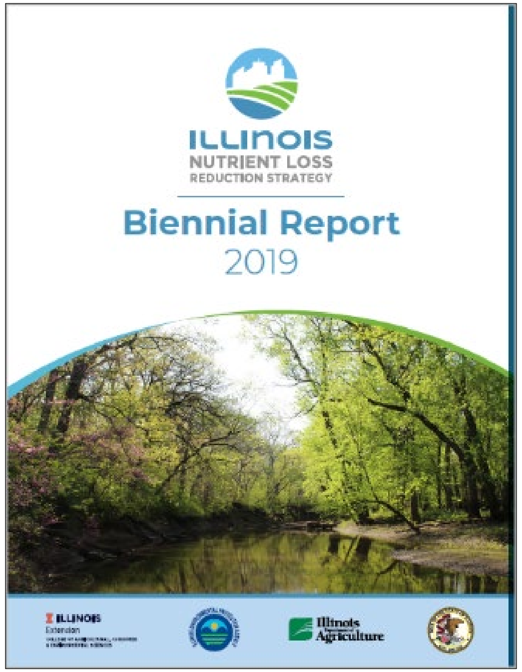
FUNKT@ILLINOIS.EDU

Biennial Report Production Review

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

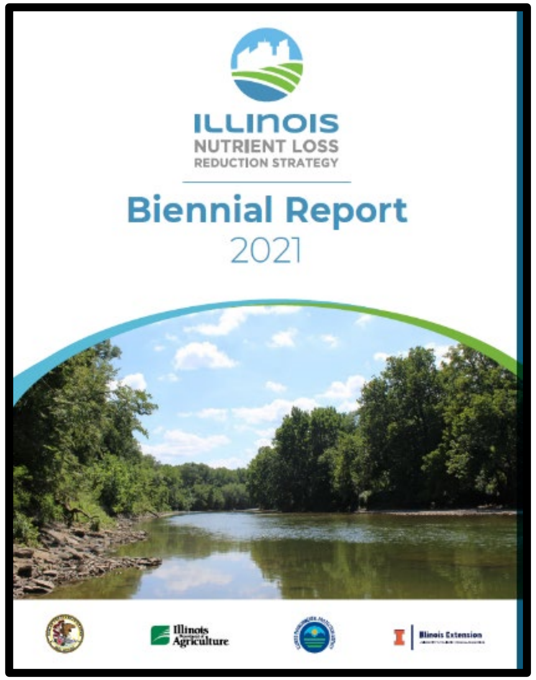


83 pages



163 pages

2x as long



210 pages

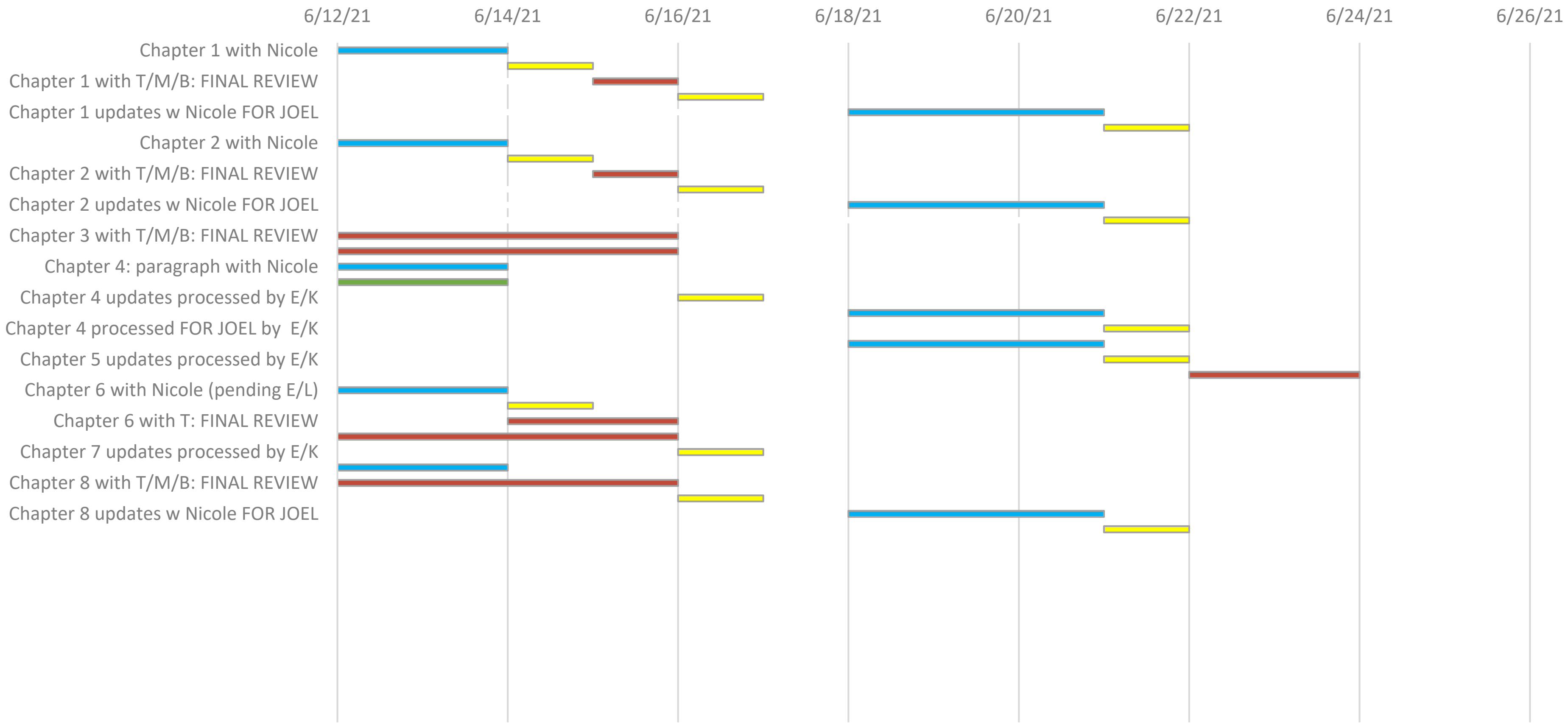
2.5x as long

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Timeline

Draft Review	Due Date
First draft due to PWG	15-Apr
Comments due back to Extension	30-Apr
Draft due to Steering Committee	15-May
Comments due back to Extension	30-May
Develop appendices of spreadsheets (Resource & Outreach)	7-Jun
Final changes before design	7-Jun
Design	
Text and photos (and alt-text) to graphic designer	9-Jun
Design work	9-Jul
Final Stretch	
Notify directors of incoming draft report	2-Jul
Notify print shop of incoming printing job	7-Jul
Copy editing	9-Jul
Final changes	16-Jul
Hand to Directors	16-Jul
Directors hand in review	30-Jul
Due to printer	7-Aug
Biennial Report completed	31-Aug
Online version with Appendices	31-Aug

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY



ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

- DATA TIMING: We have to wait for previous year's data which causes a TIME CRUNCH and then, long hours on our part.

- POLISH: It takes considerable work to create graphs that synthesize date and also to have the report read as one voice.

- CAPACITY: We think the NLRS effort is growing (which is good!) but we have already surpassed our limit.

- It is not sustainable as is.

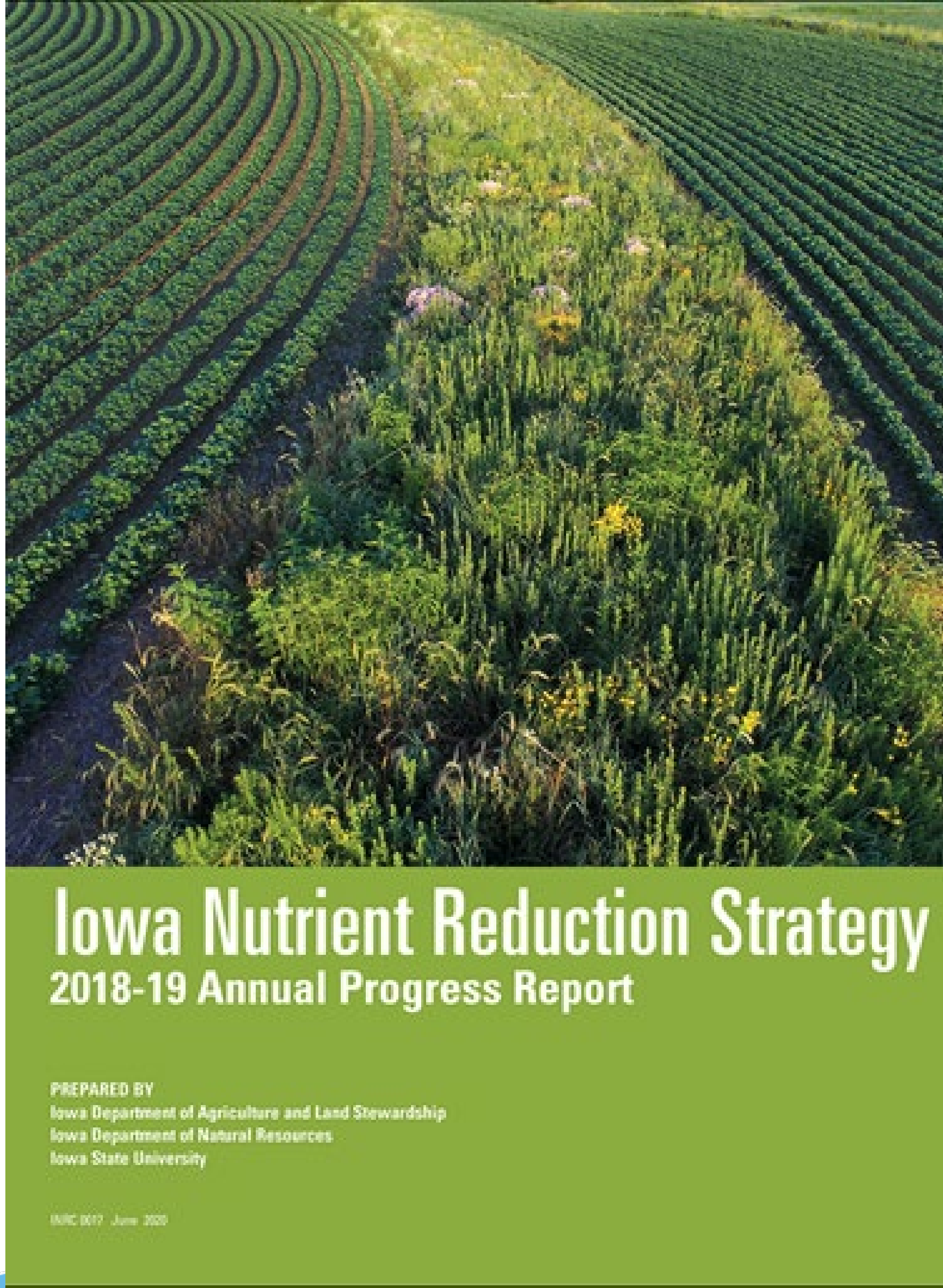
ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Iowa Nutrient Strategy Dashboard

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Iowa Nutrient Reduction Strategy

- Since the release of their Nutrient Strategy in 2013, Iowa has provided annual updates or annual progress reports.
- Reporting process is time consuming and a strain on resources.
- In process of developing an online Nutrient Strategy Dashboard



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Coordinator - Laurie Nowatzke
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ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

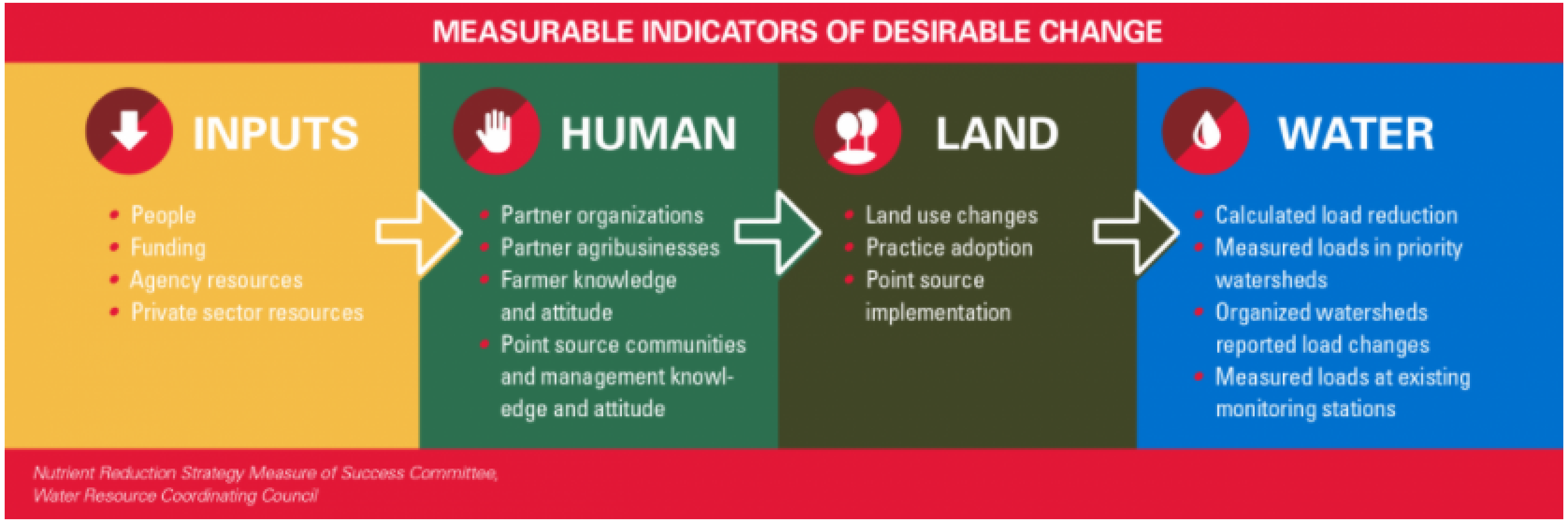
The Iowa Nutrient Reduction Strategy Measurement Project

Measuring progress of the Iowa Nutrient Reduction Strategy

The Iowa Nutrient Reduction Strategy measurement project was established in 2015 to track and report nutrient reduction efforts in Iowa. A program logic model was introduced to set measurable indicators of change. The logic model expands on four dimensions: Inputs, Human, Land, and Water.

To affect change in water quality, there is a need for increased inputs, measured as funding, staff, and other resources. Inputs affect change in outreach efforts and human behavior. This shift towards more conservation-oriented attitudes among farmers, landowners, point source facility operators, and other stakeholders is a desired change in the human dimension of water quality efforts. With changes in human attitudes and behavior, changes on the land may occur, measured as conservation practice adoption and wastewater treatment facility upgrades. Finally, these physical changes on the land may affect change in water quality, which ultimately can be measured through both empirical water quality monitoring and modeled estimates of nutrient loads in Iowa surface water. The model outlines measurable parameters that can be tracked year-to-year.

- **Inputs:** funding, staff, and resources
- **Humans:** knowledge of, attitudes towards, and engagement with conservation work
- **Land:** conservation practice adoption, and upgrades to wastewater treatment and industrial facilities
- **Water:** empirical water quality monitoring and modeled estimates of nutrient loads in Iowa surface water



ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

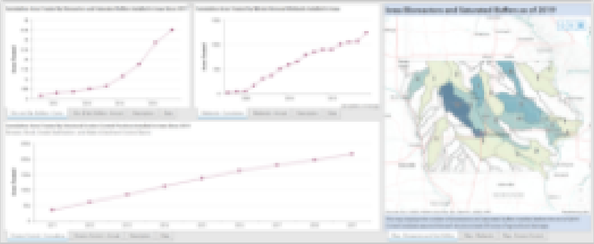
Tracking the Iowa Nutrient Reduction Strategy

Interactive Data Dashboards

The process of reporting Iowa Nutrient Reduction Strategy efforts transitioned in 2021 to a revised approach by publishing data and findings in a set of web-based dashboards. This revised reporting structure aims to increase the timeliness, frequency, and transparency of updates on Iowa Nutrient Reduction Strategy efforts and nutrient loss in Iowa. Access topic-specific dashboards below.

Tracking Land Use and In-Field Practices

This dashboard presents data and findings on the use of land use and in-field nutrient reduction practices in Iowa agriculture. These practices have the potential to reduce nitrogen and phosphorus loss from agricultural fields to surface water bodies.



Tracking Edge of Field and Erosion Control Practices

This dashboard presents data and findings on the use of edge-of-field and structural erosion control practices in Iowa agriculture. These practices have the potential to reduce nitrogen and phosphorus loss from agricultural fields to surface water bodies.

Tracking Permits Issued to Wastewater and Industrial Facilities

This dashboard displays the status of permits issued by the Iowa Department of Natural Resources to facilities identified in the Iowa Nutrient Reduction Strategy. Facilities include major publicly owned treatment works, minor domestic facilities, and industrial facilities.

About | Accessibilty Version | Download Current Data | Archived Dashboard Versions

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

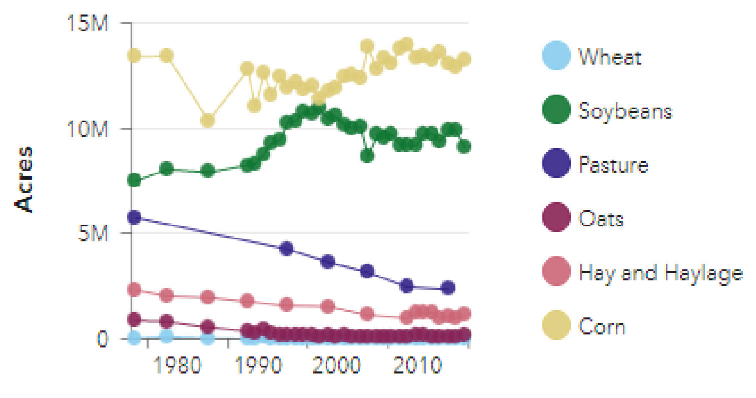
Iowa Nutrient Reduction Strategy - Land Use and In-Field Practices

This dashboard presents nonpoint source – or agricultural – efforts to reduce nutrient loss via in-field conservation practices. To view other related dashboards and download data, visit this site.

This dashboard is best viewed on a web browser, and may present difficulties in mobile format.

Accessibility information can be accessed here.

Iowa Agricultural Land Use Since 1980



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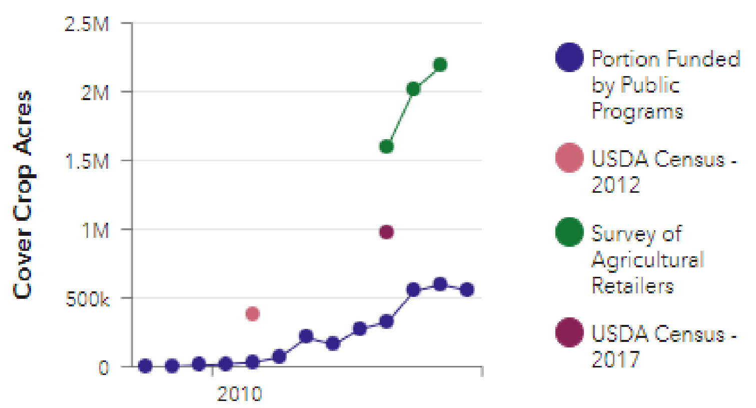
Land Use | CRP Acres | Description | Data

Iowa Cover Crop Acres, by Data Source



Cover Crops | Cover Crops Species | Description | Data

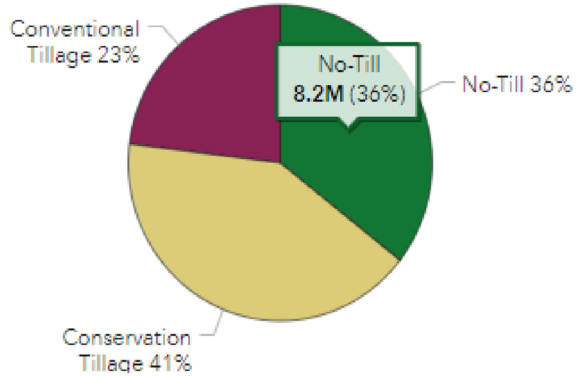
No-Till Acres in Iowa in 2017

Sources: Esri, USGS, NOAA | Sources: Esri, Garmin, USGS, NPS Powered by Esri

No-till acres in each HUC8 watershed were determined using county-level data from the 2017 USDA Census of Agriculture.

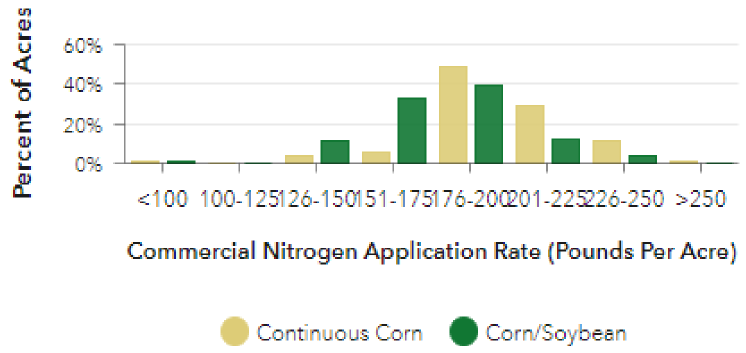
Map - No-Till

Tillage Practices in 2019 - Percent of Rowcrop Acres



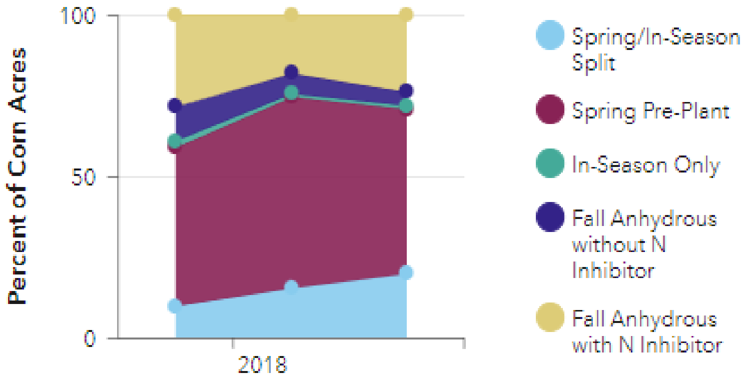
Tilllage - 2019

Percent of Acres with Commercial Nitrogen Rates in the 2019 Crop Year, by Rotation



N Rates - 2019

Commercial Nitrogen Fertilizer Timing - Percent of Corn Acres



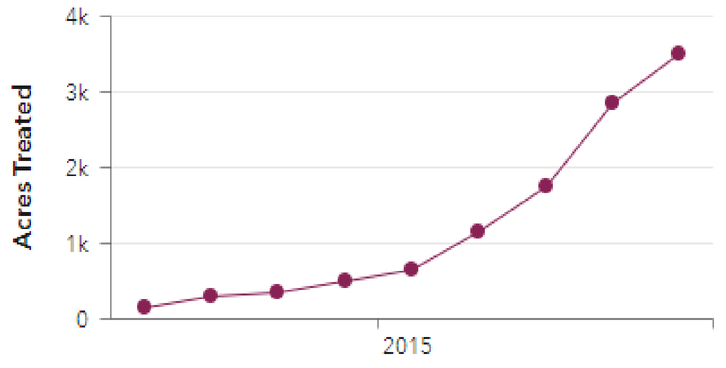
Nitrogen Timing | N Inhibitor Use | Description | Data

Iowa Nutrient Reduction Strategy - Edge-of-Field Practices and Structural Erosion Control

This dashboard presents nonpoint source – or agricultural – efforts to reduce nutrient loss via edge-of-field conservation practices and structural erosion control. To view other related dashboards and download data, visit this site.

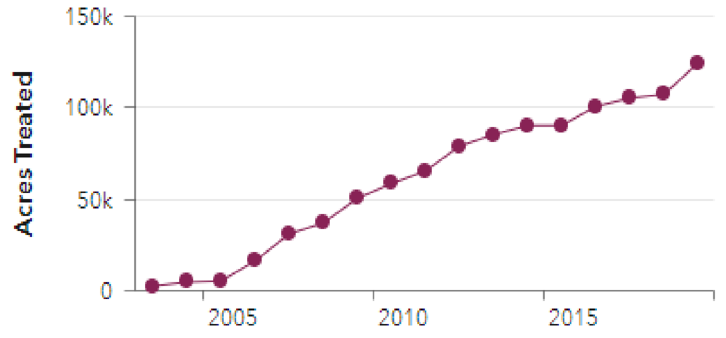
This dashboard is best viewed on a web browser, and may present difficulties in mobile format.

Cumulative Acres Treated by Bioreactors and Saturated Buffers Installed in Iowa Since 2011



Bio. and Sat. Buffers - Cumu.

Cumulative Acres Treated by Nitrate Removal Wetlands Installed in Iowa



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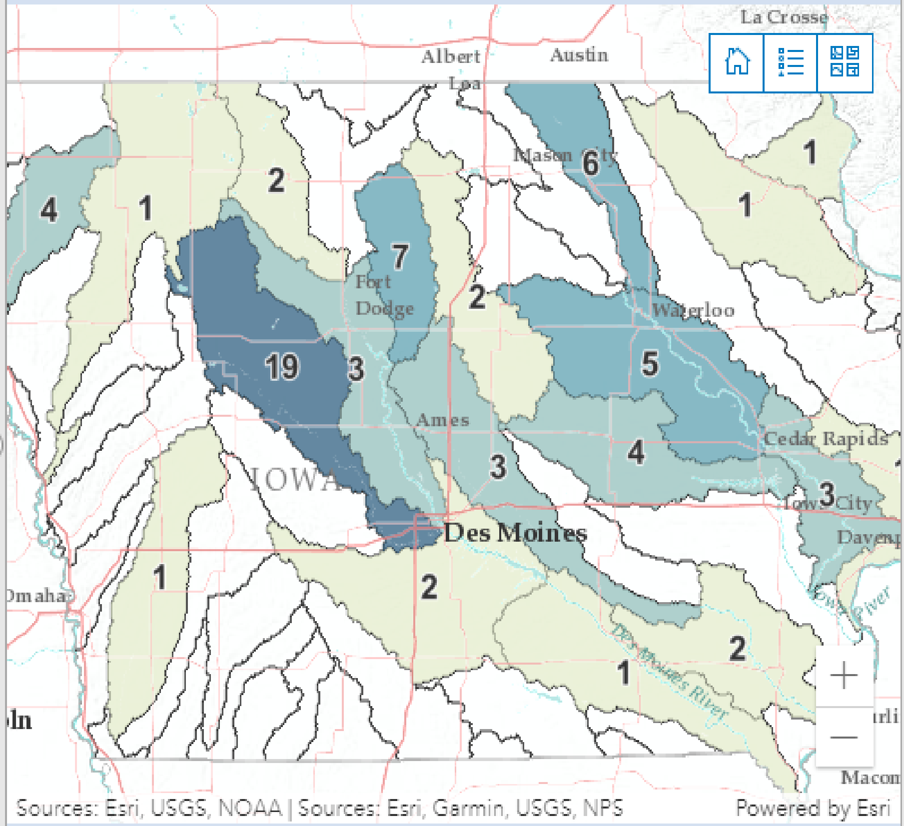
Wetlands - Cumulative

Iowa Bioreactors and Saturated Buffers as of 2019

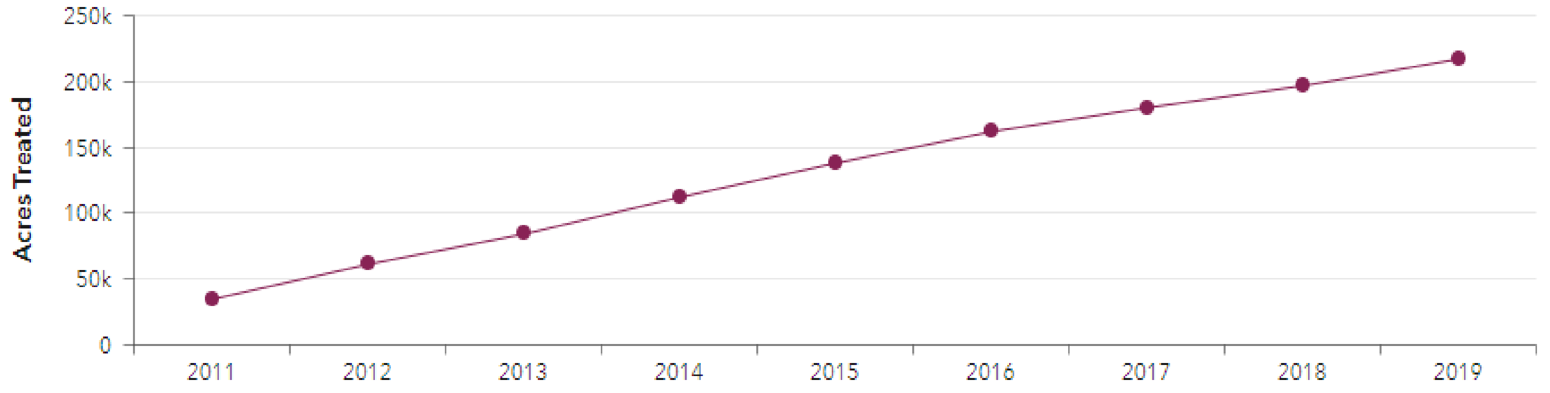


This map displays the number of bioreactors and saturated buffers installed before the end of 2019. Current analyses assume that each structure treats 50 acres of agricultural drainage.

Map - Bioreactors and Sat. Buffers

Cumulative Acres Treated by Structural Erosion Control Practices Installed in Iowa Since 2011

Terraces, Ponds, Grade Stabilization, and Water & Sediment Control Basins



Erosion Control - Cumulative | Erosion Control - Annual | Description | Data

Iowa Nutrient Reduction Strategy - Point Source Implementation

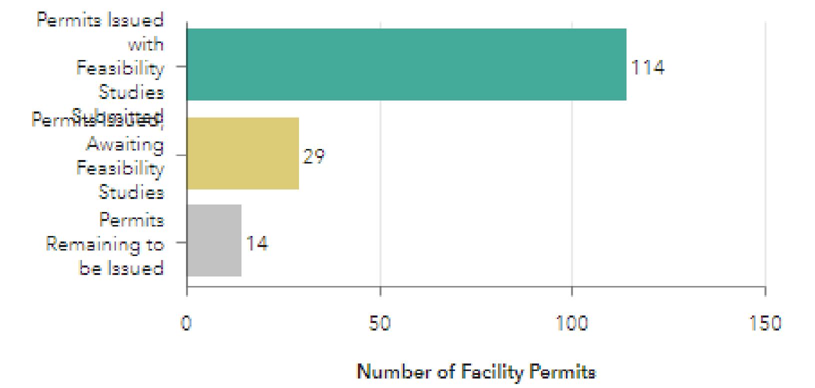
This dashboard presents point source efforts to reduce nutrient loss through the assessment and potential upgrade of processes used by municipal and industrial wastewater facilities. To view other related dashboards and download data, visit this site.

This dashboard is best viewed on a web browser, and may present difficulties in mobile format

Understanding Point Source Efforts Associated with the Iowa Nutrient Reduction Strategy

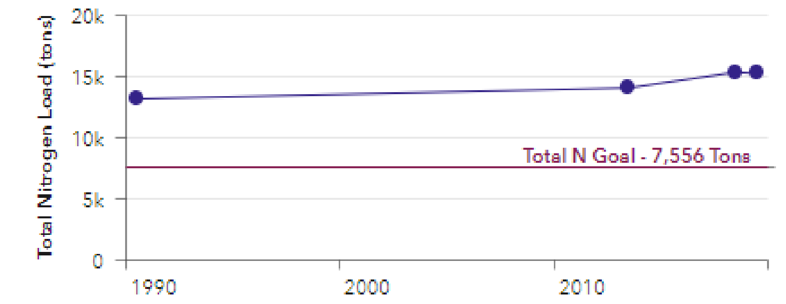
The Iowa Nutrient Reduction Strategy identifies 157 industrial and municipal wastewater treatment point source facilities that need to evaluate the amounts of nutrients in their discharges in order to meet the goals of the strategy. Upon receiving a National Pollutant Discharge Elimination System (NPDES) permit under the Strategy, each facility works to develop a feasibility study, which outlines the resources required to achieve nutrient reduction goals. The permits also incorporate requirements for measuring nutrient concentrations in influent and effluent to determine current nutrient removals and provide an empirical basis for feasibility studies.

Status of point source permits and feasibility studies as of the end of 2019



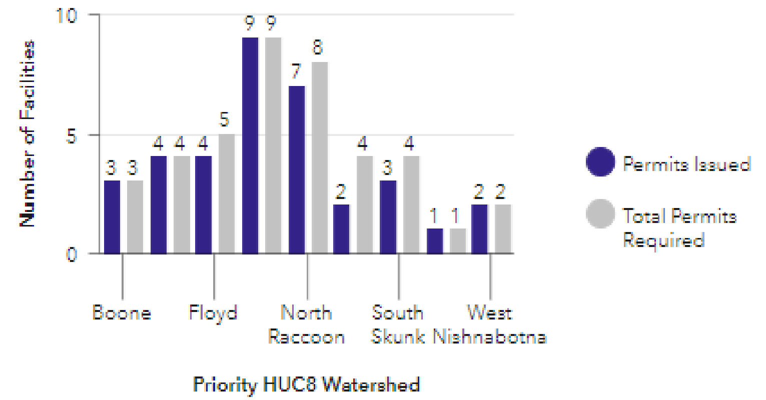
Permits Status - 2019 | Permits Issued Over Time

Annual Total Nitrogen Load from Major Publicly Owned Treatment Works, Minor Domestic, and Industrial Facilities with Biological Treatment of Process Wastewater



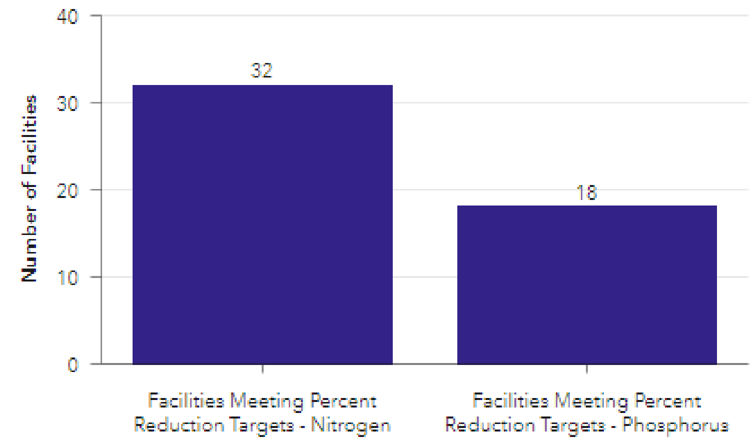
Annual N Load | Annual P Load

Permits Issued in Priority HUC8 Watersheds of the Iowa Nutrient Reduction Strategy



Permits in Priority Watersheds

Point Source Facilities Meeting Reduction Targets as of the End of 2019



Facilities Meeting Goals | Nutrient Limits

Municipal permits that have been amended with construction schedules to meet INRS goals, as of August 3, 2020

Count of Facilities	43
Earliest Completion Date	August 1, 2018
Latest Completion Date	October 1, 202
Average Length of Construction Schedule	4.4 Years

Industrial permits that have been amended with construction

About | Accessibilty Version | Download Current Data | Archived Dashboard Versions

- COMING SOON -

Tracking Funding and Resources

This dashboard will present data and findings on the extent of funding and resources dedicated to Iowa nutrient reduction efforts and water quality improvement.

- COMING SOON -

Tracking the Human Dimension

This dashboard will provide data and findings on farmer survey data, outreach, and education.

- COMING SOON -

Tracking Water Quality and Nutrient Export

This dashboard will provide data and findings on water quality monitoring. It will also provide links to extensive resources on more detailed water quality monitoring data.

Iowa Nutrient Strategy Dashboard

- The dashboards are updated as data becomes available, allowing more timely reporting of information.
- Narratives are still included but not to the extent that is in a traditional report.

- Is this something Illinois should invest in?
- Could this replace Biennial Reports?

Iowa Nutrient Strategy Dashboard

- https://nrstracking.cals.iastate.edu/tracking-iowa-nutrient-reduction-strategy

BREAK

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SB 3471 Partners for Nutrient Loss Reduction Act

MAX WEBSTER, MIDWEST POLICY MANAGER

The rise of algae blooms: This year, more than a dozen of the water bodies sampled in Illinois had toxin levels above recreation standards.

Chemical runoff increases Illinois water pollution

Fertilizer Runoff In Illinois Is Still On The Rise, Despite Program Designed To Slow It Down

Nutrient pollution in Illinois rivers rising unabated, Rock River nitrate pollution is up 135%

Algae bloom seen on parts of Illinois River

Illinois expanding Gulf of Mexico 'dead zone'

IL Budget Crunch Leaves Ag Conservation Funds in Danger

Quick Facts:
SB3471 Partners for Nutrient Loss Reduction Act

- Sponsors: Sens. Villivalam, Villa and Fine; more could be added
- 3rd Version of the bill to be introduced; substantially updated from previous versions
- Introducing new components related to: project planning and goal setting, adaptive management, required reporting and new funding & fundraising options
- Focus is on updating funding programs and providing guidance from NLRS to implement projects at the local level
- Builds on existing processes and procedures, utilize existing information
- In all likelihood, the bill will not pass as is.
- There will be amendments or the work will be rolled into the budget package

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From 2021 NLRS Report: *Future Strategy Considerations*

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Pages 204-207

- Scale and pace of adoption of all practices needs to accelerate to meet the interim loss goals
- Continued education and outreach is needed
- More financial and technical assistance is needed
- Improved methods for tracking ag conservation practice implementation outside of traditional cost-share programs, including using satellite data and publicly available land use coverages
- Adopt an outcomes approach rather than acres treated
- Incorporate better understanding of climate change

From the Policy Working Group

- Extend Partners for Conservation Fund
- Increase funding and capacity support for SWCDs

Key Components of the Bill

- **Illinois Healthy Soils and Watersheds Initiative**—Translate NLRS statewide work to the local level and provide SWCDs with guidance for setting feasible and attainable goals for implementing NLRS projects. Modeled after Sediment and Erosion Control Guidance.
- **Update Nonpoint Source Management Program**—NPS program has not been updated since 2013. Only 15 acres in 319 in 2020.
- **State-owned and leased ag lands**—Primarily at DNR, further integrating those lands into NLRS strategies and project demonstration
- **Require NLRS Reporting & Tracking**—Reporting currently all voluntary
- **Update and Extend Partners for Conservation**—Extends PFC for 10-years, as new eligible funding categories for local planning, FCSS, climate, capacity grants for SWCDs, option to develop an AmeriCorps Program. Also allows for PFC to collect public and private gifts grants and donations from sources other than the State.

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SUBTITLE GOES HERE

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Saving the Land that Sustains Us

American Farmland Trust

www.farmland.org

Illinois Department of Agriculture
Jerry Costello II, Director

Illinois Climate-Smart Ag Partnership

Presented by:

Michael Woods, PhD
Division Manager | IDOA

Max Webster
Midwest Policy Manger| AFT

Grant Hammer
Executive Director | AISWCD

- IDOA steps to expand climate-smart agriculture opportunities.
- In 2021, awarded funding through the USDA Regional Conservation Partnership Program to develop the Illinois Climate-Smart Agricultural Partnership (ICSAP).
- This program will focus on expanding financial and educational assistance to Illinois Producers.
- Working in partnership with IDOA, AFT and AISWCD convened the Climate-Smart Ag Workgroup
  - to collect initial stakeholder input
  - provide early recommendations to IDOA for developing the initiatives that will come out of the ICSAP over the coming years.
  - Those recommendations and the notes from those discussions are collected in a draft report that is out for review.

J.B. Pritzker, Governor

Illinois Climate-Smart Ag Partnership Working Group Update

- **The ICSAP Workgroup**
  - Met four times from September 2021-January 2022
  - Group considered a variety of factors that present challenges or opportunities for expanding climate-smart agriculture in Illinois.

- **Group proposed eight initial recommendations to be considered:**
  1) Integrate climate-smart ag into State strategies to fight climate change
  2) Empower the IDOA to continue to lead efforts to promote climate-smart agriculture.
  3) Build on and enhance the state's existing financial assistance programs
  4) Identify long-term stable sources of funding for climate-smart ag efforts
  5) Recover lost capacity support and technical assistance provided by Soil and Water Conservation Districts and the University Extension service to facilitate access to resources and programs for farmers and landowners to implement climate-smart practices.
  6) Strengthen relationships with the private sector and explore innovative partnerships to effectively leverage public and private resources.
  7) Convene an advisory committee, including subcommittees, to guide efforts going forward.
  8) Use the advisory committee to address key challenges for expanding climate-smart agricultural opportunities in Illinois.

USEPA
GULF OF MEXICO
GRANT PROGRAM

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

USEPA 104(b) Funds

- 2019-2020 USEPA provided $200,000 total to each HTF state for nutrient strategy purposes

- Illinois Projects
  - U of I – additional Scenarios development (completed)
  - Rock Island SWCD – Mill Creek watershed plan
  - Illinois State Water Survey – nitrate groundwater modeling in the Rock River watershed (compliment ongoing larger watershed study)
  - U of I – Green Infrastructure Inventory

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

H.R. 3684 Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law)

- Signed into law November 15, 2021
- Contains provision directing funds to USEPA to disperse to the 12 Hypoxia Task Force states
- $60 million each year for five years
  - Approximately $1 million per state
  - USEPA gets 3% for administrative purposes.
- Funds are non-competitive
  - each state is “guaranteed” their share
- HTF Funding workgroup has been meeting since December to provide input to USEPA on this program.
  - Discussion on possibility of multi-state projects.

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

H.R. 3684 Infrastructure Investment and Jobs Act

- This is a new cost-share program for USEPA
- USEPA staff are currently writing the guidelines
  - Hope to be released end of March 2022
- Once the guidelines are released, states will have 60 days to develop their workplan
  - States can develop one workplan for 5 years or multiple workplans for multiple years
- Based on the guidelines, Illinois EPA will consult with Illinois Department of Ag on the most appropriate projects to fund.

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

H.R. 3684 Infrastructure Investment and Jobs Act

- Potential Projects to Fund
  - U of I Extension: Meeting facilitation and NLRS reporting
  - U of I Extension: Watershed Coordinators and Science Team
  - United States Geological Survey: Continuous nutrient monitoring network and annual nutrient loads reporting.
  - Support for additional metrics tracking, reporting, monitoring and studies needed to fill data gaps.
- Still need clarification on timeline for using these funds

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Open Discussion

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Wrap up