

An aerial photograph of Simpson College buildings, featuring a prominent red brick structure with a central tower. The buildings are situated along a riverbank, with a wide, turbulent river in the foreground. The image is darkened to serve as a background for text.

IOWA

Chris Jones, Research Engineer, IIHR Hydroscience and Engineering

This Land is Their Land

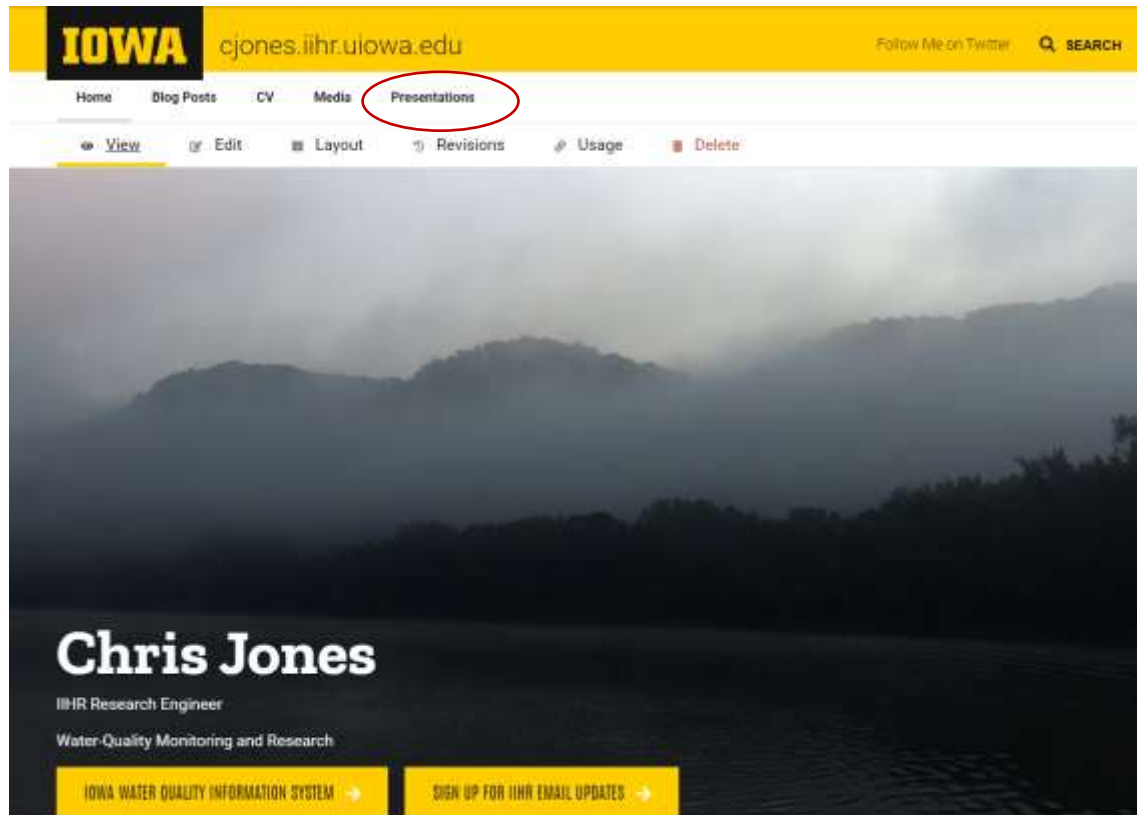
April 20, 2023

Simpson College

Slides Available at:

<https://cjones.iihr.uiowa.edu/>

- Grew up in Ankeny, IA
- Went to Simpson College in Indianola, IA
- PhD work at Montana State University (1989)
- Managed commercial analytical testing laboratory in MN, 1988-1999
- Consulting work for water and wastewater utilities, MN, 1999-2003
- Des Moines Water Works, supervisor of water quality, 2003-2011
- Iowa Soybean Association, environmental scientist, 2011-2015
- UI, 2015-present



Chris Jones



[View Full Size](#)

On Blogger since
April 2023

Profile views - 2762

My blogs

[The Swine Republic](#)

About me

Gender	Male
Industry	Science
Occupation	Research Engineer
Location	Iowa City, Iowa, United States
Introduction	Studying and writing about Iowa agriculture and the environment.
Favorite Books	People's History of the United States, 1984, A River Runs Through It, Goodbye to a River

IIHR Water Quality Sensor Network



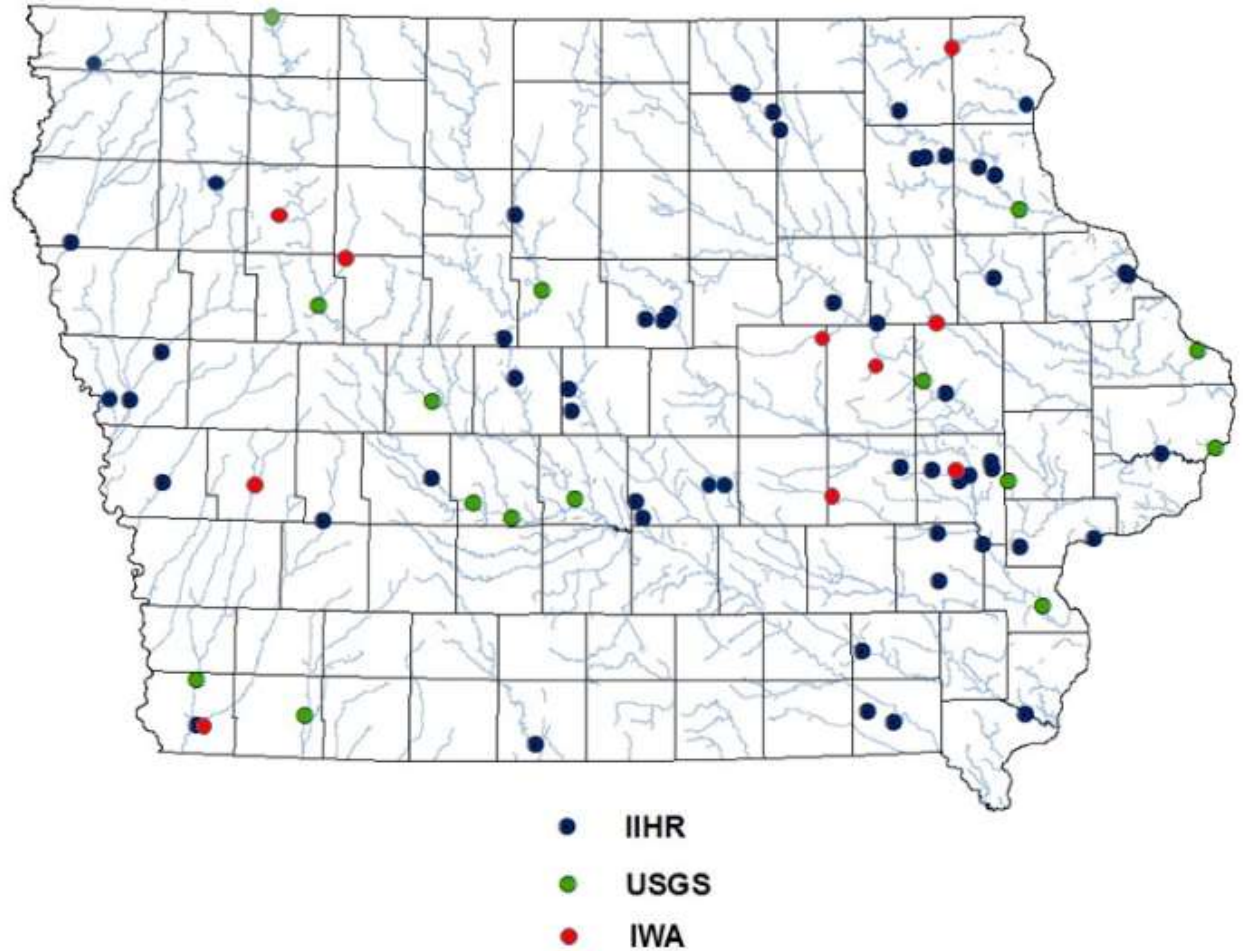
Sites



70+ sites
Nitrate-N

20-25 sites

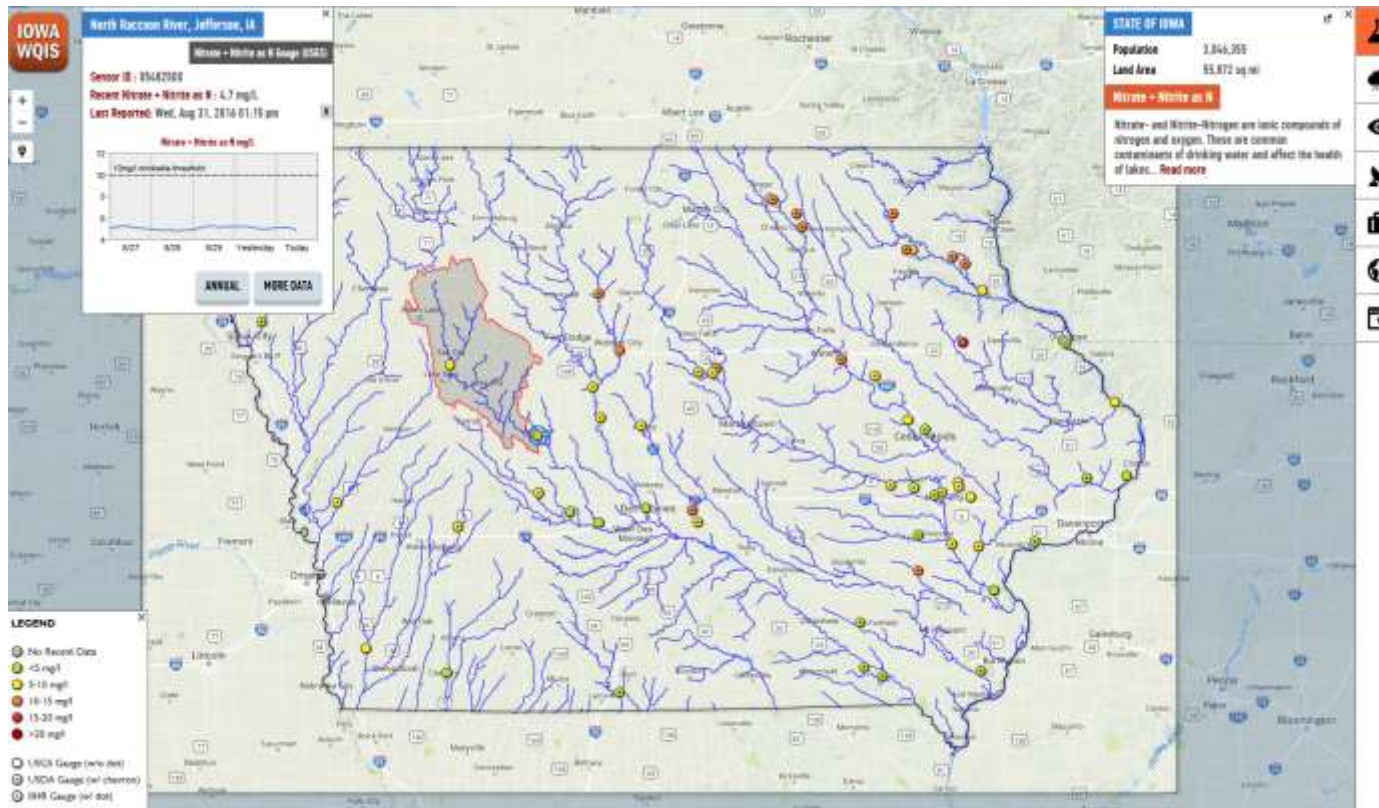
- Temperature
- pH
- SC
- DO
- Turbidity



Site infrastructure



Iowa Water Quality Information System



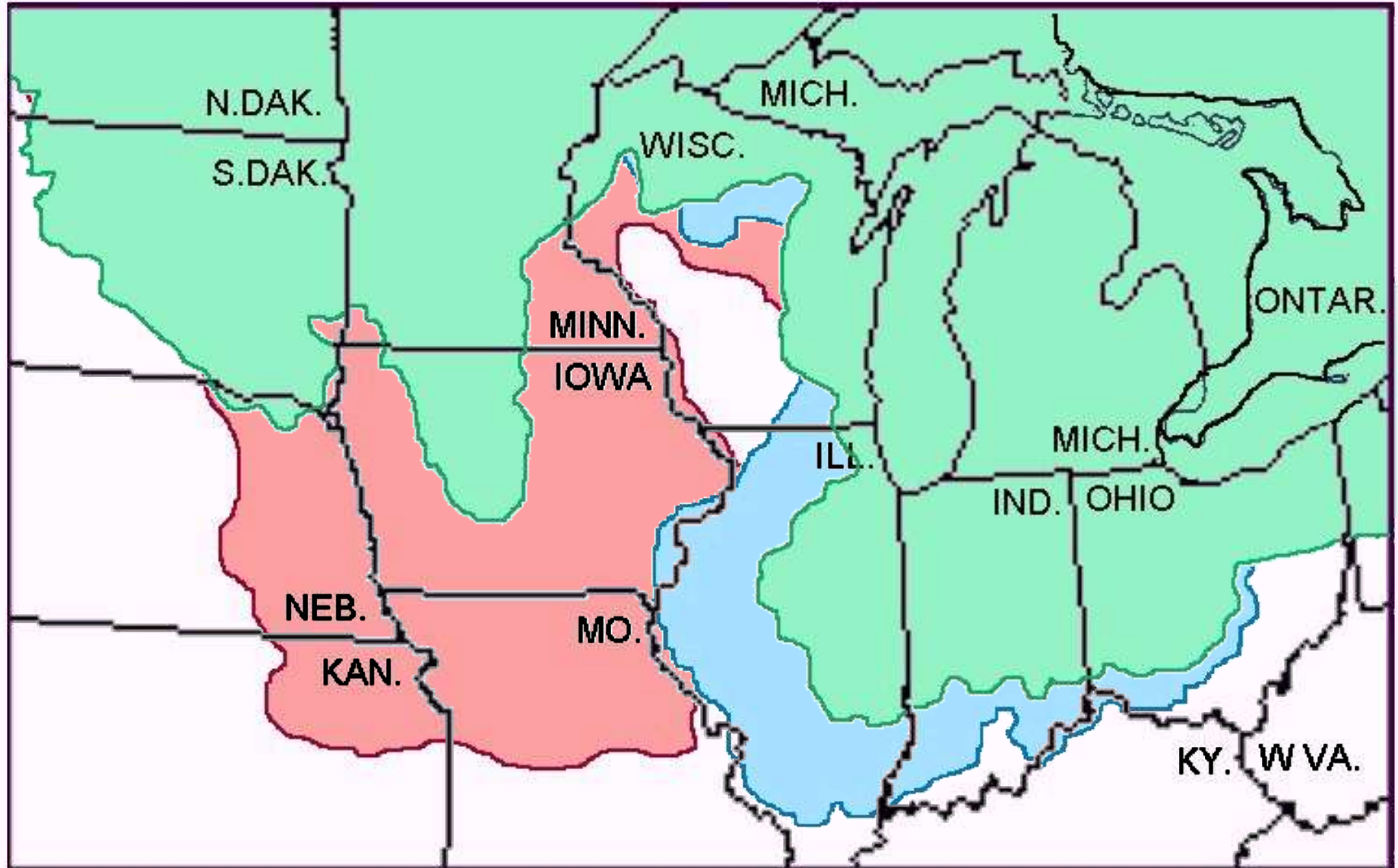
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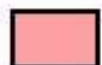
<http://iwqis.iowawis.org/app/?datetime=2017-06-06T13:00>

IOWA

IIHR-Hydroscience & Engineering

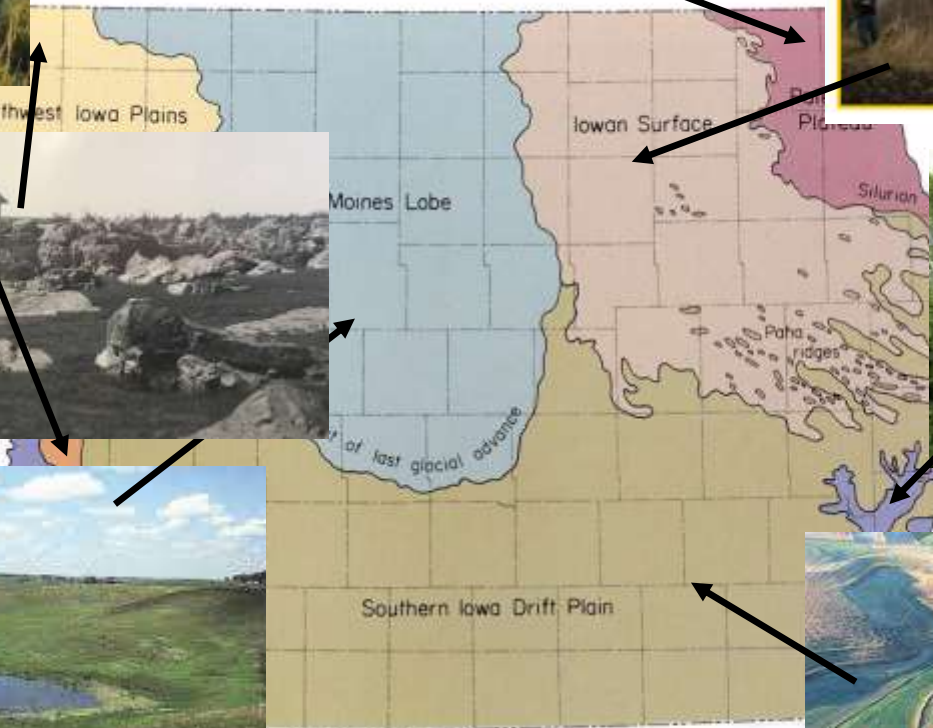
30,000 – 10,500 years



 Pre-Illinoian Till

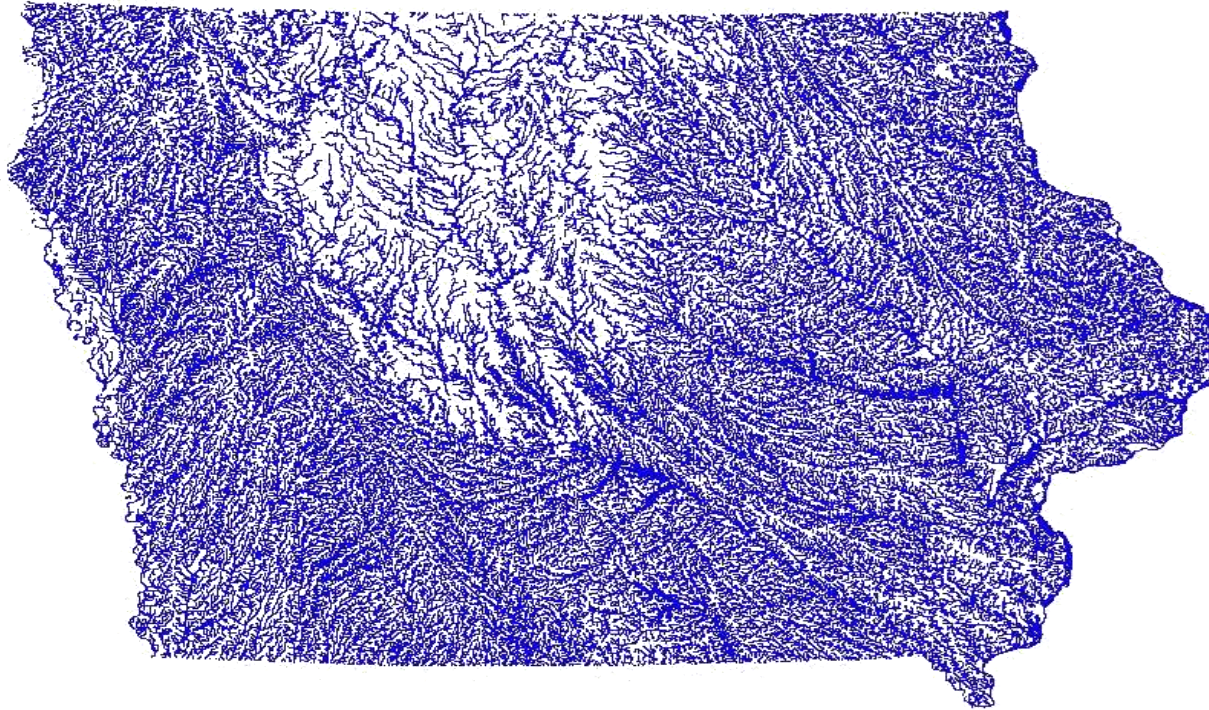
 Illinoian Till

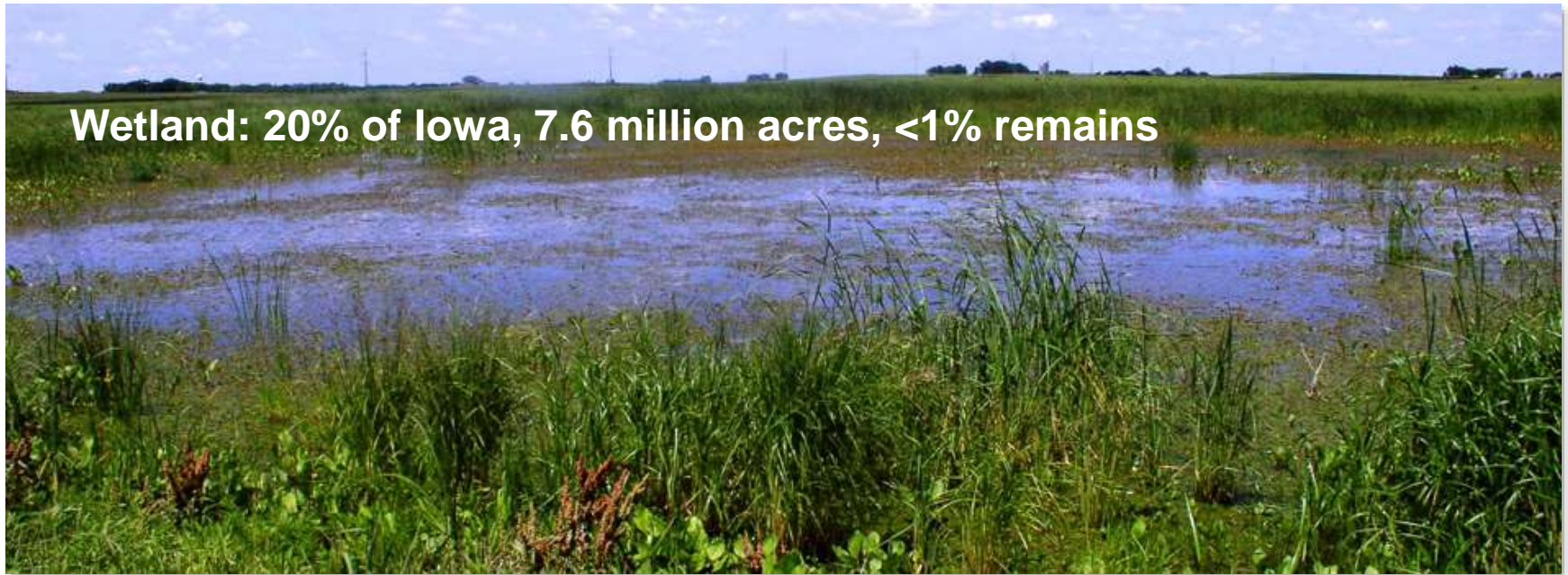
 Wisconsinan Till



Landform Regions of Iowa

Stream Density low on Des Moines Lobe





Wetland: 20% of Iowa, 7.6 million acres, <1% remains

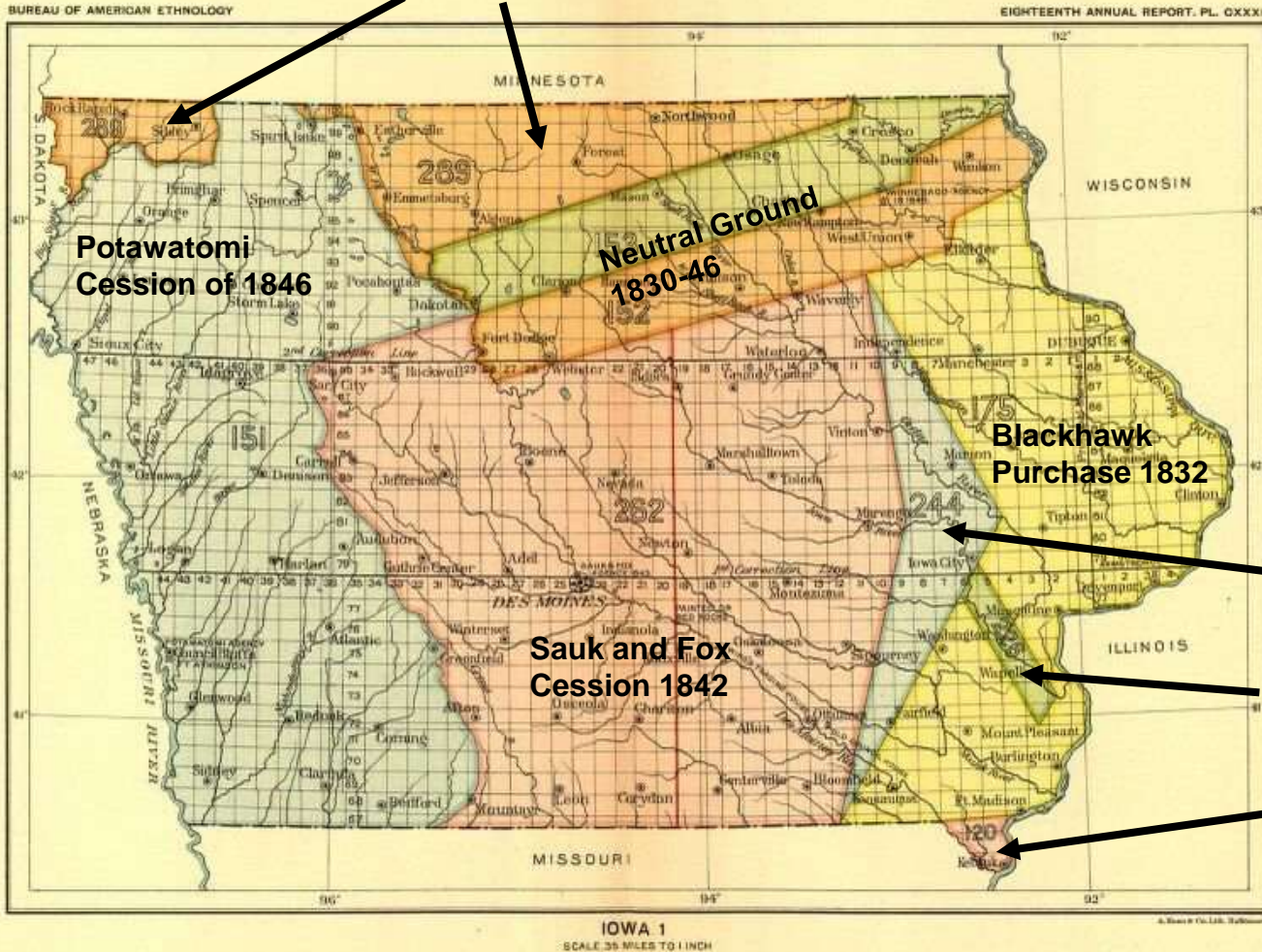


Oak Savannah: ~5%, < 1% remains



Prairie: 70%, 0.1% Remains

Sioux Cession of 1846



**Potawatomi
Cession of 1846**

**Neutral Ground
1830-46**

**Blackhawk
Purchase 1832**

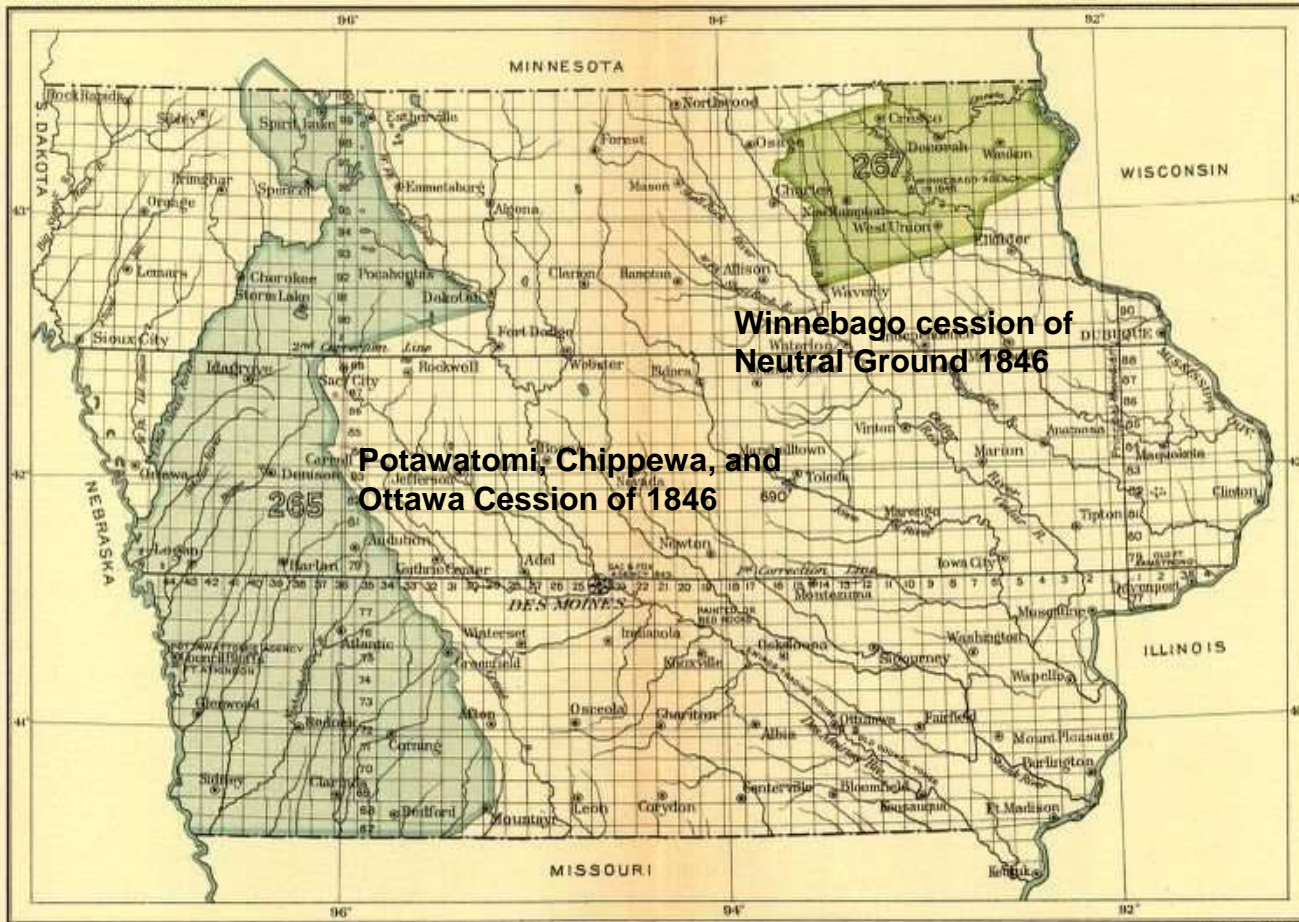
2nd Purchase 1837

**Cession of
Keokuk's Reserve
1836**

**Half Breed Tract
1824**

**Sauk and Fox
Cession 1842**

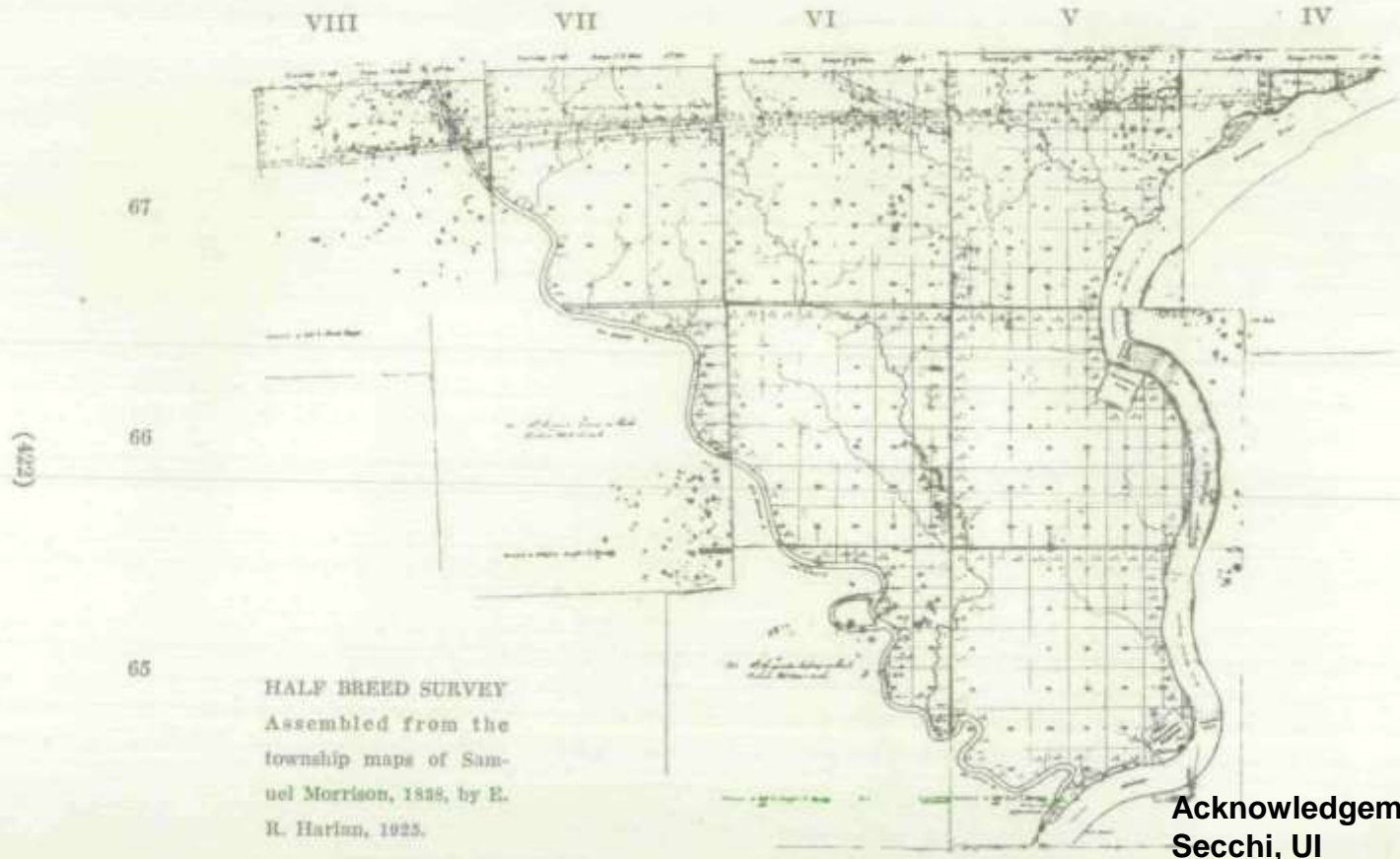
**Acknowledgement: Silvia
Secchi, UI**



IOWA 2
SCALE 35 MILES TO 1 INCH

Acknowledgement: Silvia Secchi, UI

Half Breed Tract 1824,
repealed 1834



Black Codes of 1838-9 and 1850

BLACKS AND MULATTOES.

AN ACT to regulate Blacks and Mulattoes.

SEC. 1. *Be it enacted by the Council and House of Representatives of the Territory of Iowa.* That, from and after the first day of April next, no black or mulatto person shall be permitted to settle or reside in this Territory, unless he or she shall produce a fair certificate, from some court within the United States, of his or her actual freedom, which certificate shall be attested by the clerk of said court, and the seal thereof annexed thereto by the said court, and give bond, with good and sufficient security, to be approved of by the board of county commissioners of the proper county in which such person of color may reside, payable to the United States, in the penal sum of five hundred dollars, conditioned that such person shall not at any time become a charge to the said county in which the said bond shall be given, nor to any other county in this Territory, as also for such person's good behaviour, which bond shall be filed in the clerk's office of the county where the same may be taken. And a conviction of such negro or mulatto, of any crime or misdemeanor against the penal laws of this Territory, shall amount to a forfeiture of the condition of such bond.

Certificate of freedom required under seal.

Bond and security required, and by whom approved. In what sum. Condition.

Forfeiture.

SEC. 2. If any negro or mulatto, coming into this Territory as aforesaid, shall fail to comply with the provisions of the first section of this act, it shall be and is hereby made the duty of the county commissioners, in any county where such negro or mulatto may be found, to summon him, her, or them, to appear before some justice of the peace to show cause why he, she, or they shall not comply with the provisions of this act; which summons shall be issued by a justice of the peace, on the application of any county commissioner in this Territory, and shall be executed by the proper constable. And if such negro or mulatto shall still fail to give the bond and security required by the first section of this act, after being brought before such justice as aforesaid, it shall be the duty of the county commissioners of such county to hire out such negro or mulatto, for six months, for the best price in cash that can be had. The proceeds arising from such hiring shall be paid into the county treasury of the

On failure to comply with this act, proceedings to be instituted.

Failing to give bond, negro or mulatto to be hired out.

Proceeds of hiring, how disposed of.

THE STATUTE LAWS

OF THE

TERRITORY OF IOWA,

ENACTED AT THE FIRST SESSION OF THE LEGISLATIVE ASSEMBLY OF SAID TERRITORY, HELD AT BURLINGTON, A. D. 1838-'39.

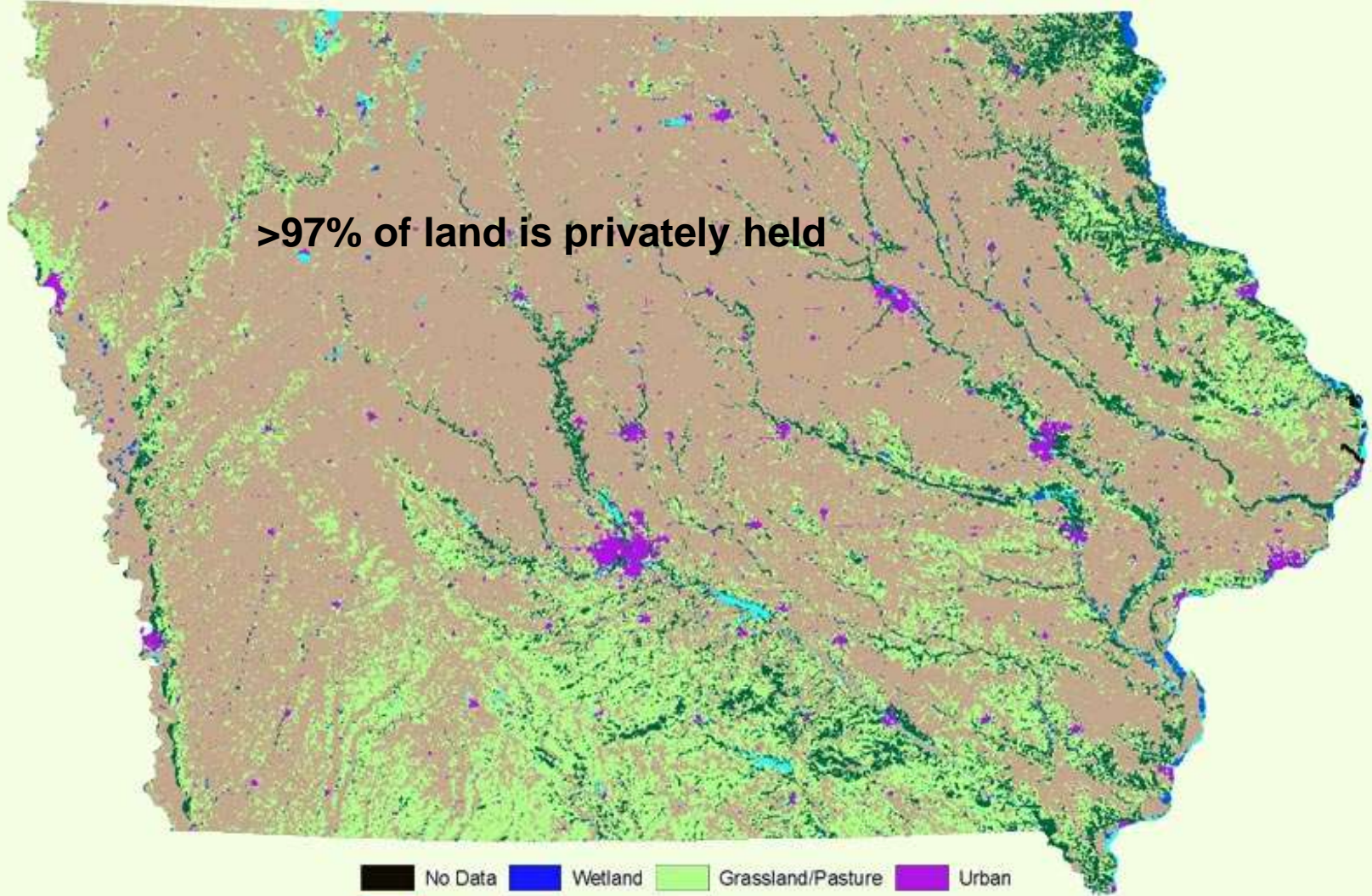


Acknowledgement: Silvia Secchi, UI



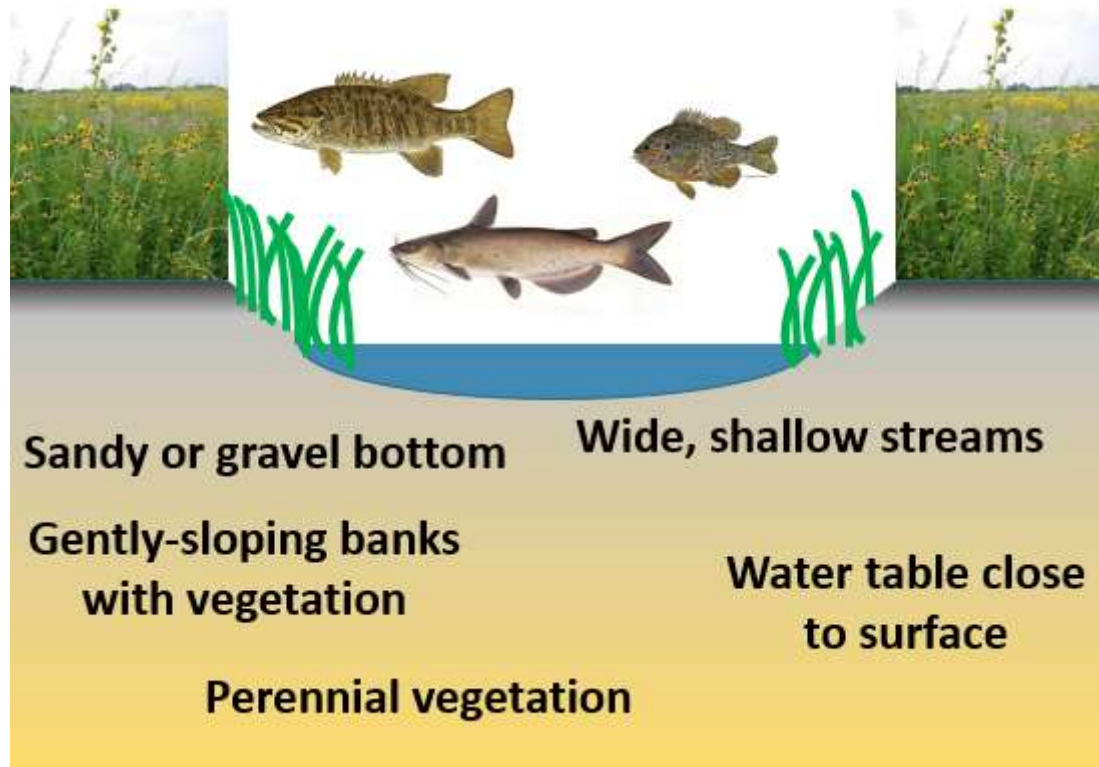
Iowa Land Cover

>97% of land is privately held



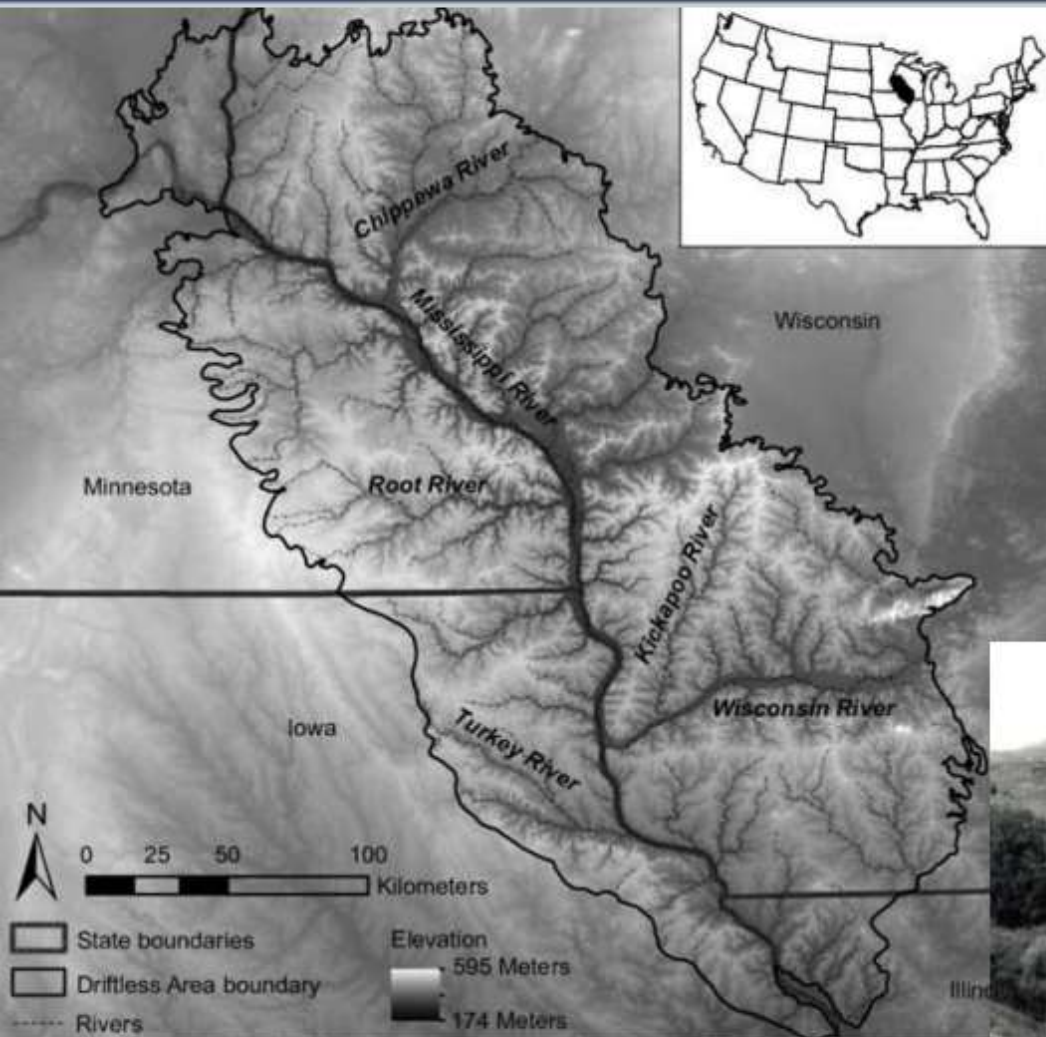
Data source: Adapted from DNR Iowa Geological Survey's "Land Cover of the State of Iowa in the Year 2002" available online at <http://www.igsb.uiowa.edu/mrgs/libx/>

Pre-European Settlement Streams



Breaking the prairie





Credit: Shea, M.E., Schulte, L.A. and Palik, B.J., 2014. Reconstructing vegetation past: pre-Euro-American vegetation for the midwest driftless area, USA. *Ecological Restoration*, 32(4), pp.417-433.

Credit: USDA



Hydrological Modification: 1860s-1910s



How the landscape used to hold water



Attachment 1. Photo of ponded water in drained wetlands of Iowa's Prairie Pothole Region after a heavy rain temporarily backed up the drain tile in early May, 2005. Photo courtesy of Guy Zenner, Iowa DNR Waterfowl Biologist.

In the early 1800s, Iowa contained about 10 to 15 million ha of wetlands. About 99% of that acreage is gone.

Tiling field now

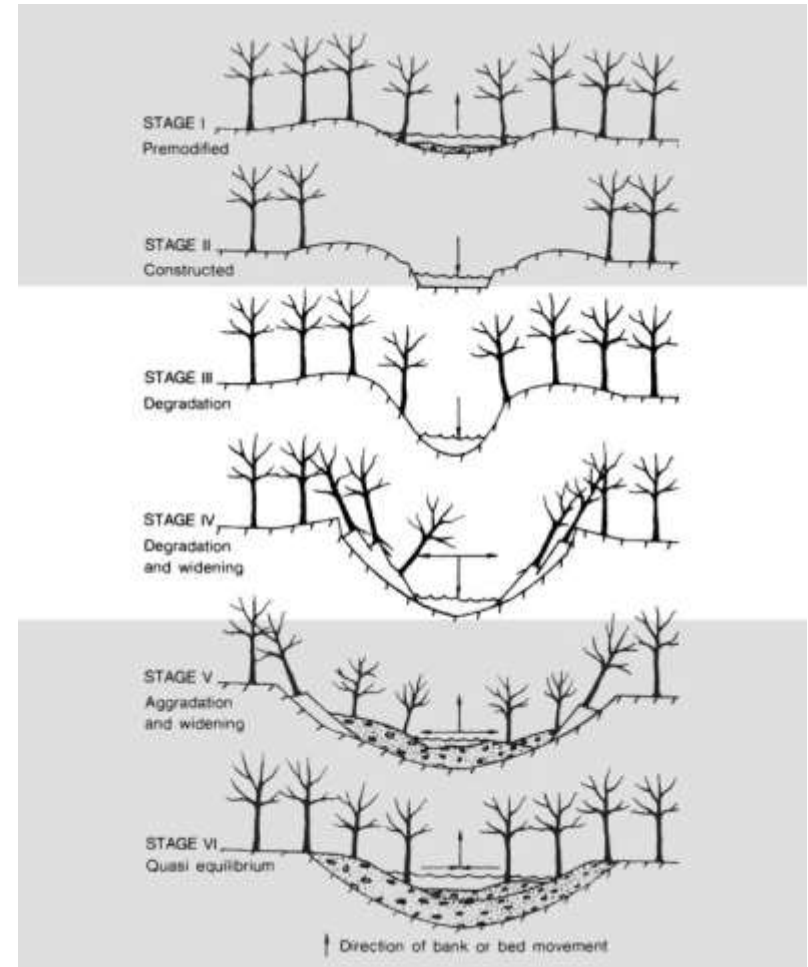
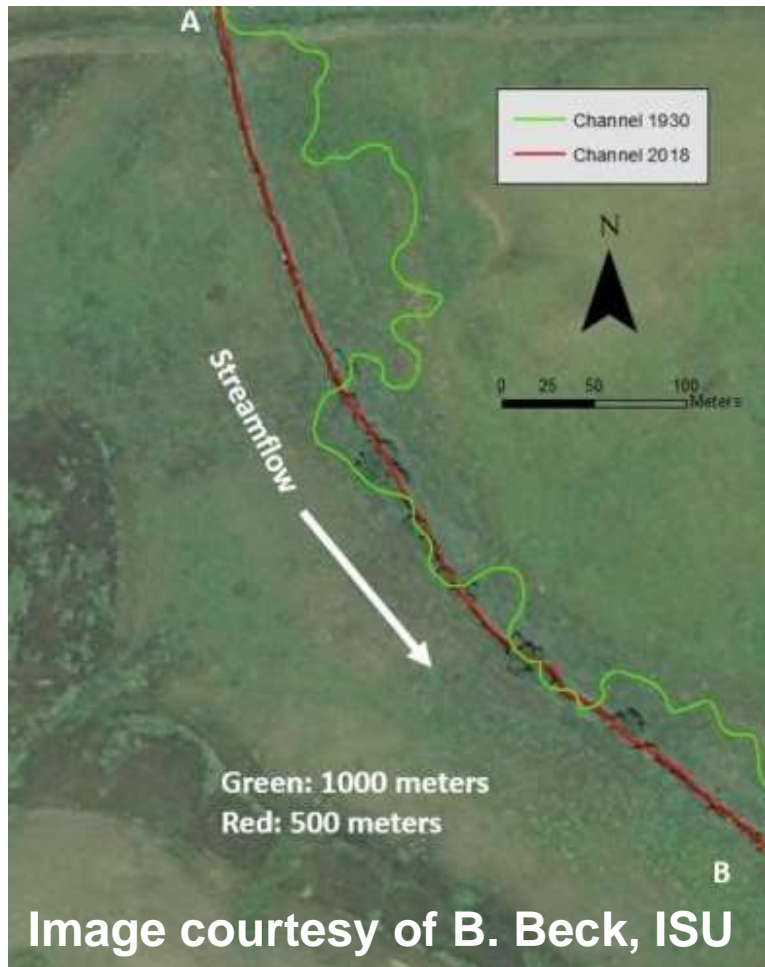




Source of the Iowa River



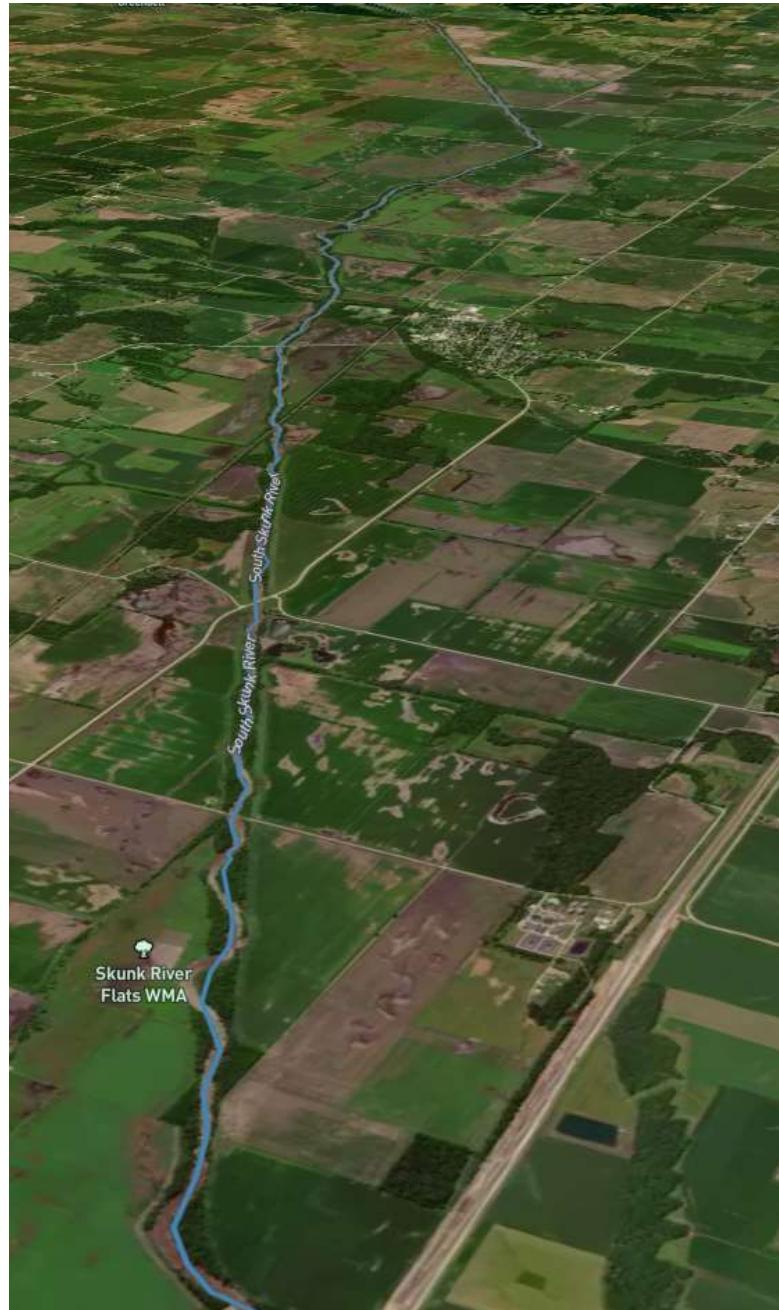
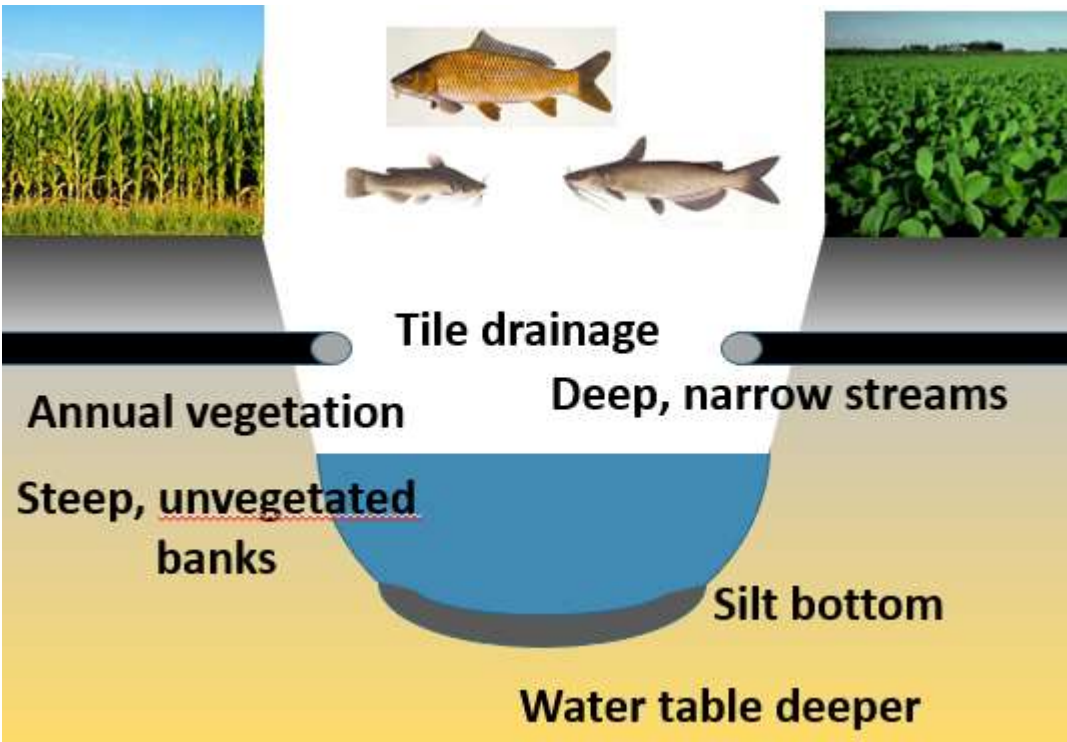
Stream Straightening, 1930-1975





Images courtesy
of B. Beck, ISU

Modified Streams



Transformation of Iowa Farms

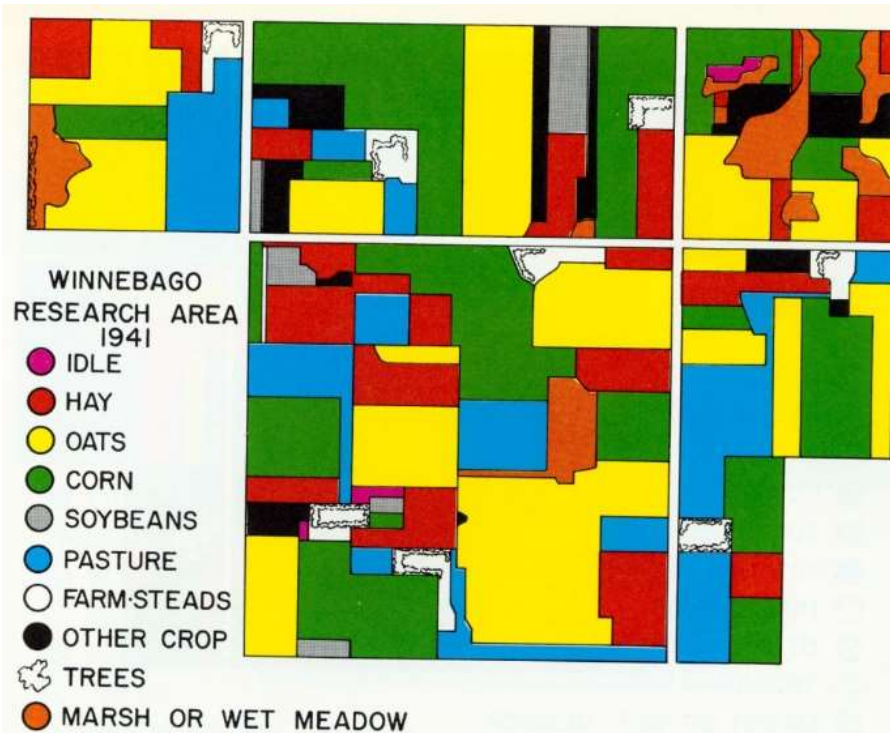


Figure 19. Cover map of the Winnebago pheasant study area, 1941.

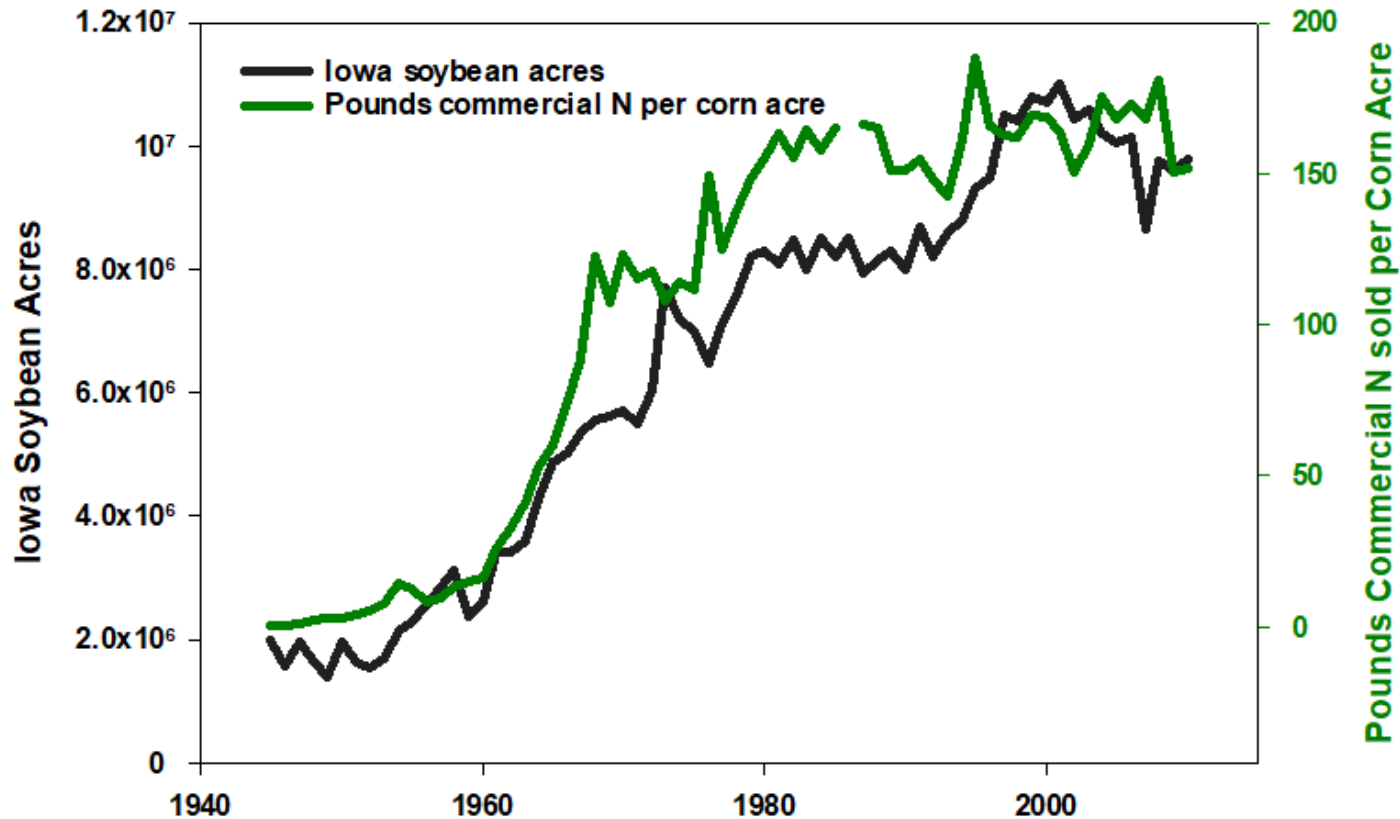
1941



Figure 23. Cover map of the Winnebago pheasant study area, 1976.

1976

Role of Soybeans

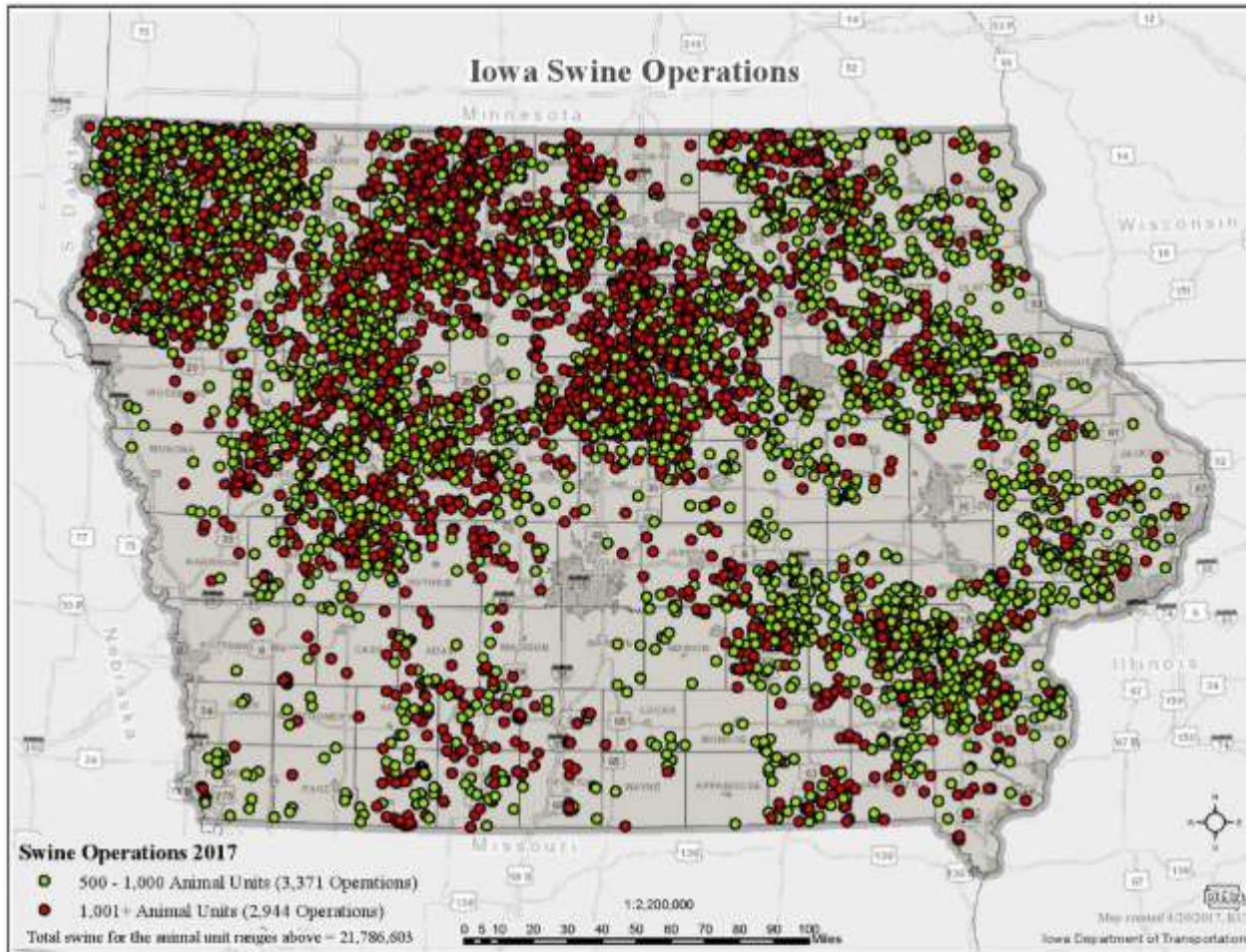




Water Quality Consequences



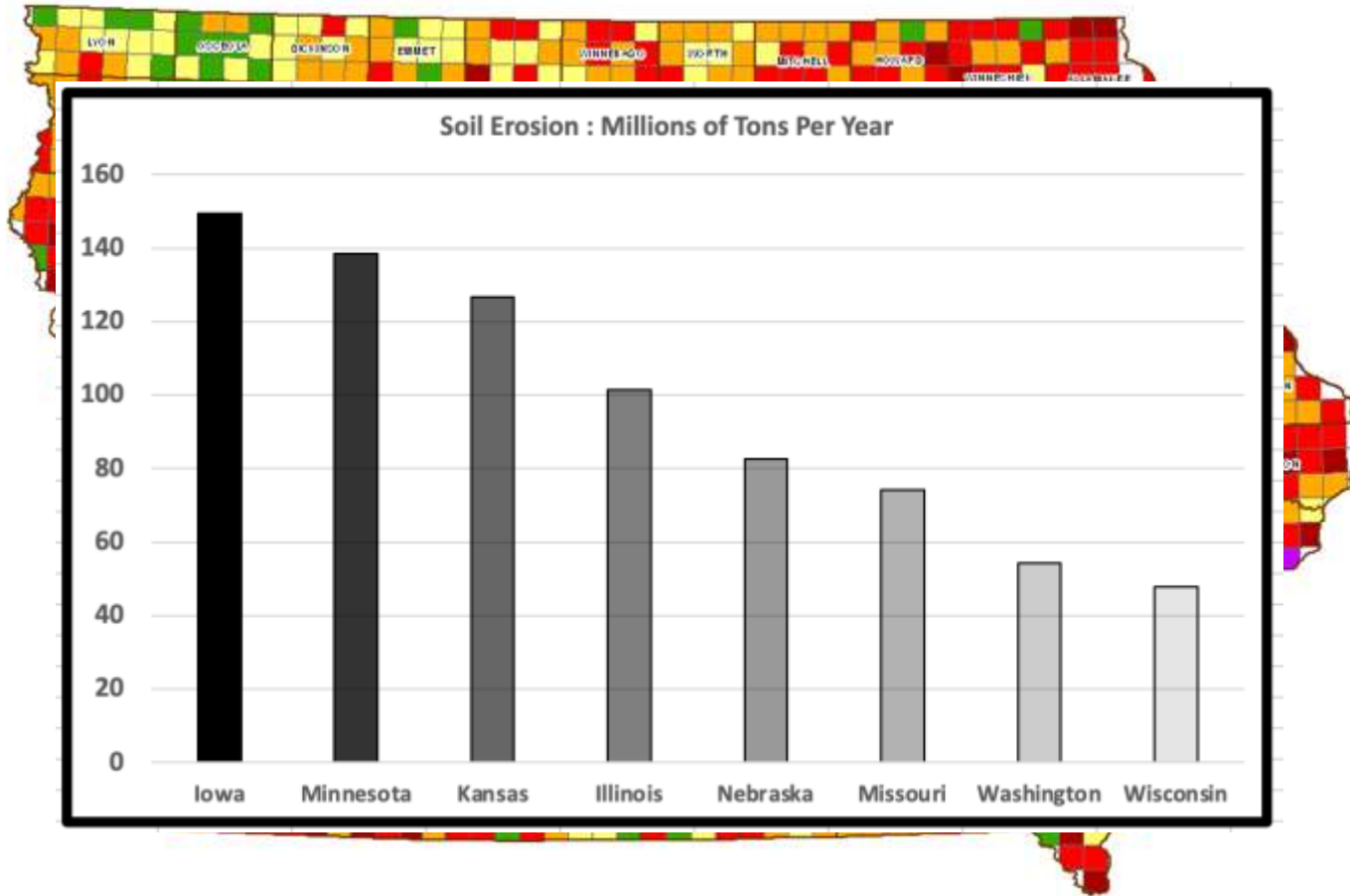
8000 CAFOs



Problem of Scale

- 70% of land in corn-soy rotation
- 11,000 square miles used for ethanol production
- 25 million hogs
- 4 million beef cattle
- 80 million laying chickens
- 5 million turkeys
- 4 million broiler chickens
- 220,000 dairy cows

Soil loss is still very high



Source:
EWG

Average Soil Erosion (tons/acre)

○ No Data ● 0 - 5.0 ● 5.1 - 10.0 ● 10.1 - 20.0 ● 20.1 - 50.0 ● 50.1 - 100.0 ● Greater than 100

Nutrients

Nitrogen: Applied as anhydrous ammonia, urea, UAN, manure, MAP and NAP.

Converted to nitrate in the soil profile, mediated by bacteria

Roughly 40% applied in fall, 60% in spring

Especially important in marine ecosystems

VERY WATER SOLUBLE

Loss through tile systems and leaching to groundwater

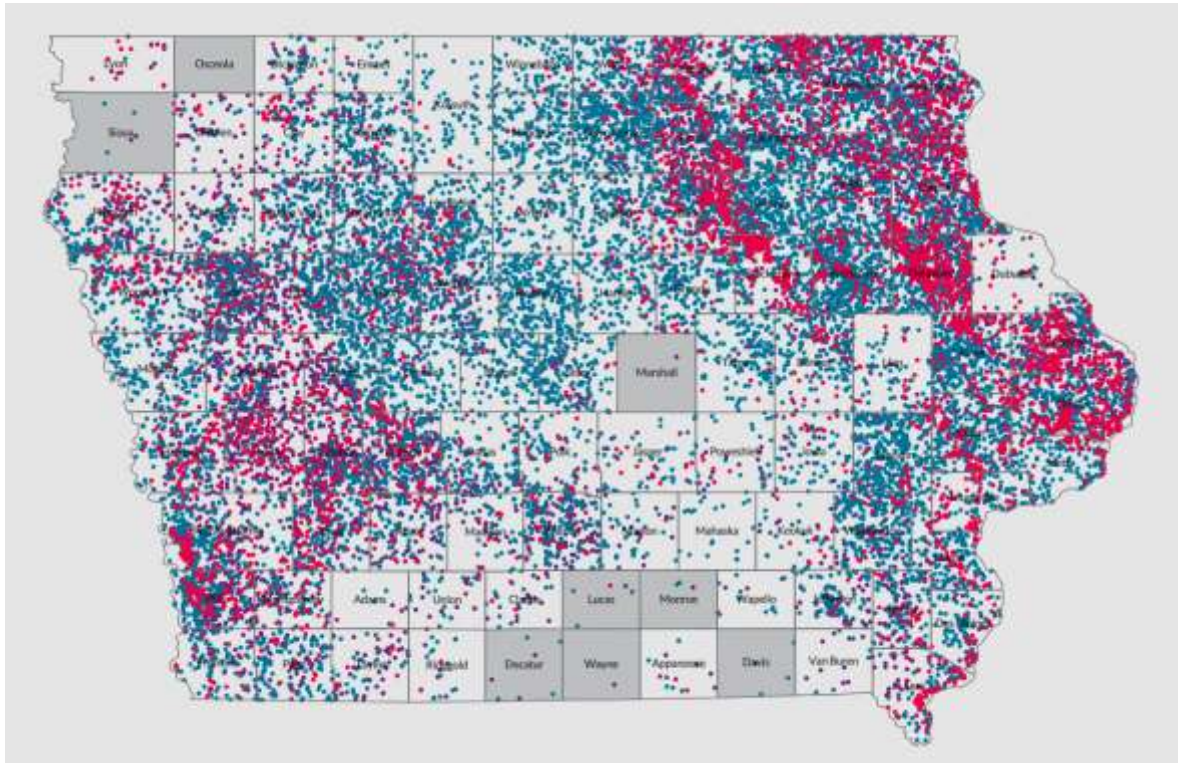
Nitrate: NO_3^-

Regulated drinking water
contaminant since 1974

Limit: 10 ppm (as N)



Drinking Water



7000 private wells have tested above the safe drinking water level of 10 mg/L since 2000

1/3 of Iowa's Public Water Supplies are vulnerable to nitrate contamination

60 PWSs are removing nitrate

25% of Iowa drink water that has been treated for nitrate reduction

Drinking Water



Toledo, OH



Surface Water

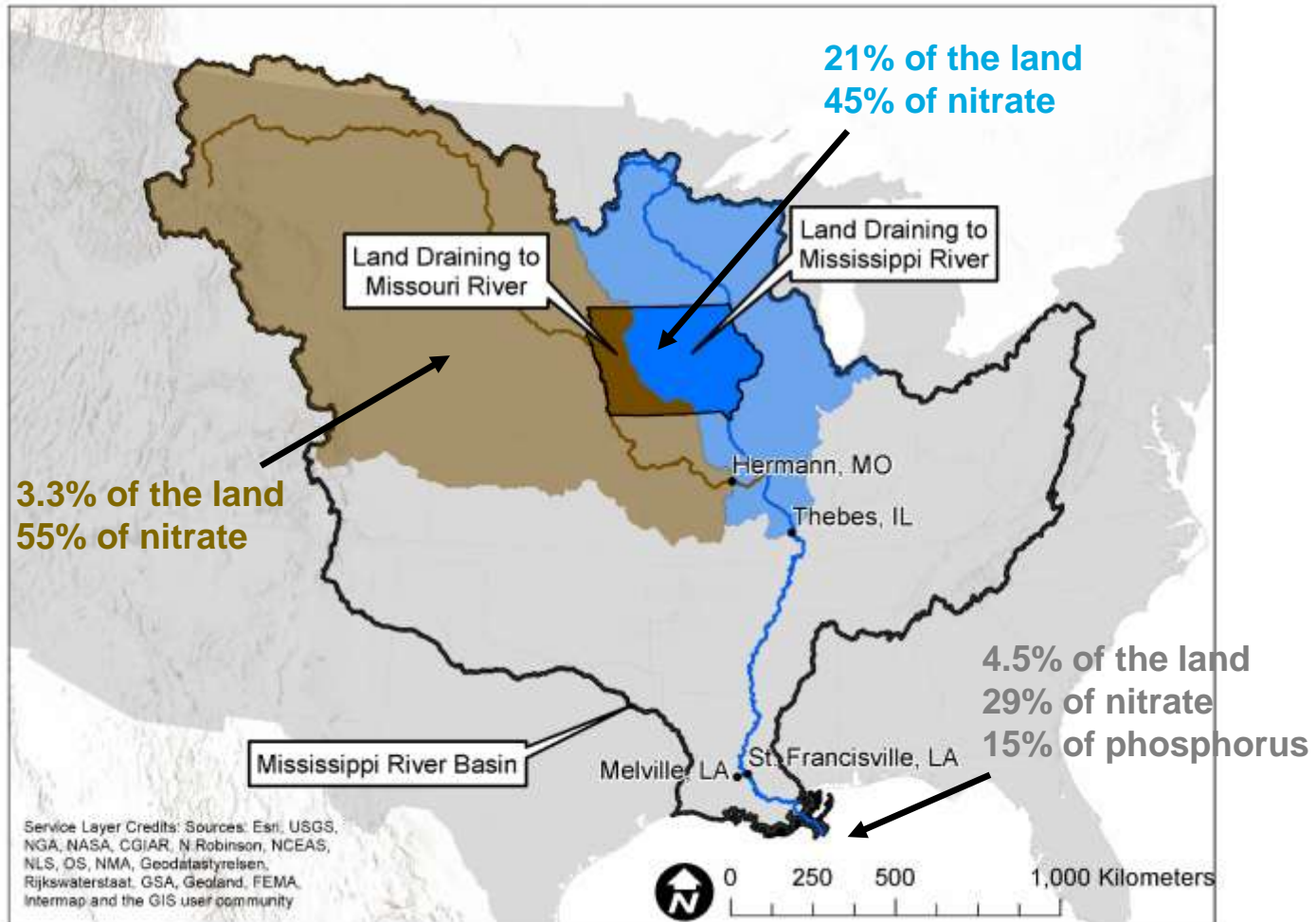


Lake Erie Algae Blooms



Gulf of Mexico Hypoxia

Iowa Contributions





Mississippi River/Gulf of Mexico Hypoxia Task Force



Hypoxia Task Force

[2008 Action Plan](#)

- Home >
- Strategy documents >
- News releases >
- Resources >
- Contacts >
- Submit comments >
- Comments and responses >
- Iowa Nutrient Research Center >



Iowa Nutrient Reduction Strategy

The Iowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost effective manner.

The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force was established in 1997 to coordinate activities to reduce the size, severity and duration of hypoxia in the Gulf. Hypoxia is a large area of low oxygen that can't sustain marine life. Nutrients that lead to algae growth are the main culprit.

In its 2008 Action Plan, the task force called upon each of the 12 states along the Mississippi River to develop its own nutrient reduction strategy.

Working together, the Iowa Department of Agriculture and Land Stewardship, the Iowa Department of Natural Resources, and the Iowa State University College of Agriculture and Life Sciences developed this proposed strategy.

The Iowa Nutrient Reduction Strategy was developed by:



IOWA STATE UNIVERSITY

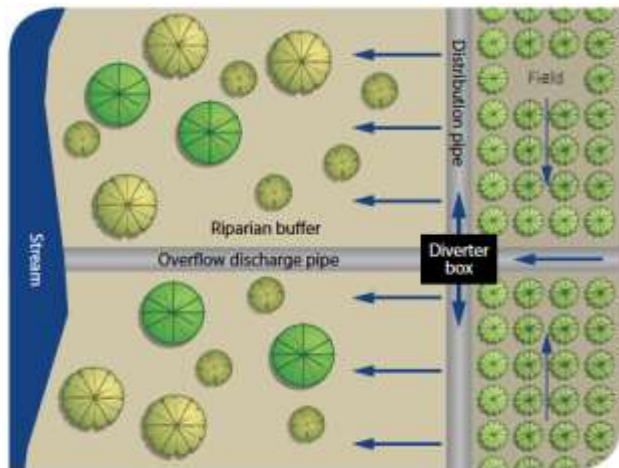
Practices



Cover crops

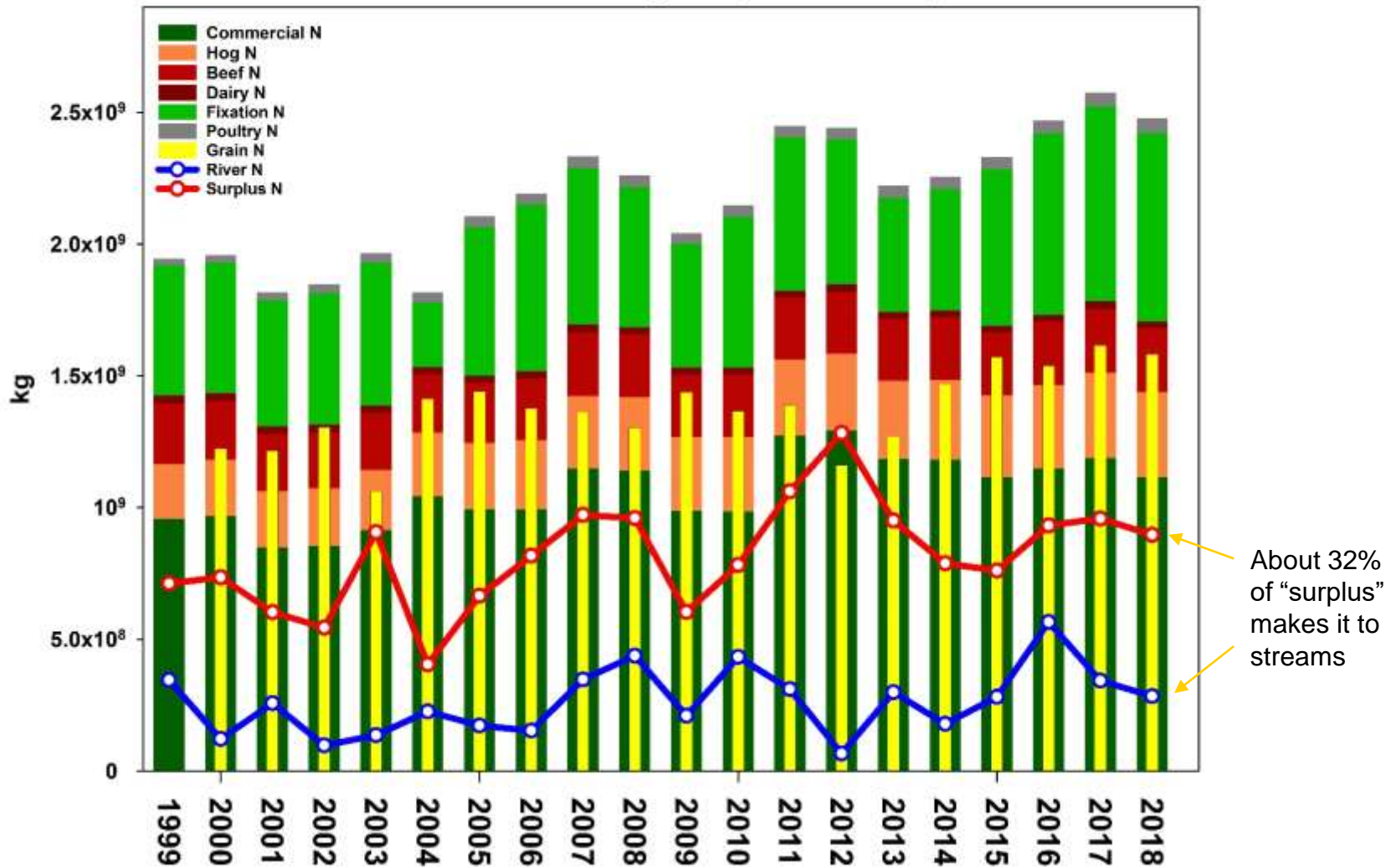


Wetland construction



Saturated Buffer

Iowa Statewide Nitrogen Inputs and Outputs

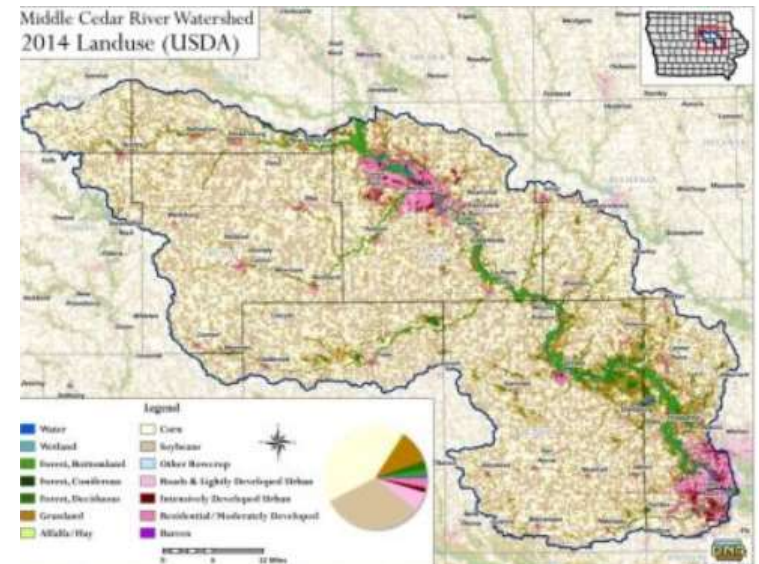
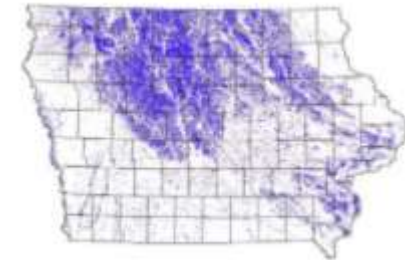




Landform	% of Iowa's Area	\$/year spent on new tile
Iowan Surface	16.9	\$24,500,000
Des Moines Lobe	21.4	\$5,845,000
Northwest Iowa Plains	8.3	\$2,272,545
Paleozoic Plateau	4.6	\$3,580,862
Southern Iowa Drift Plain	41.3	\$33,837,580
Total	92.5	\$70,064,878

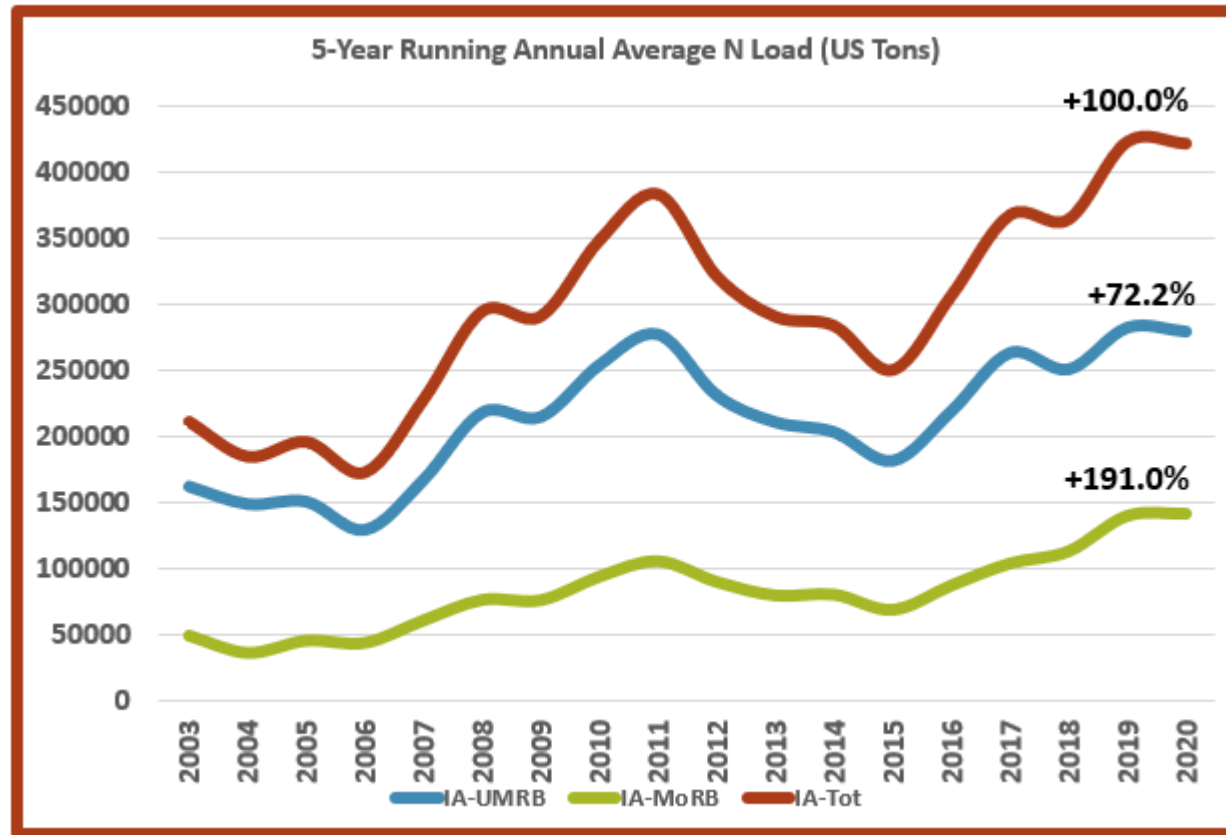


2 million miles of tile in Iowa



1200 miles new tile/year!

How Much Nitrogen Leaves Iowa?



RESEARCH ARTICLE

Iowa stream nitrate and the Gulf of Mexico

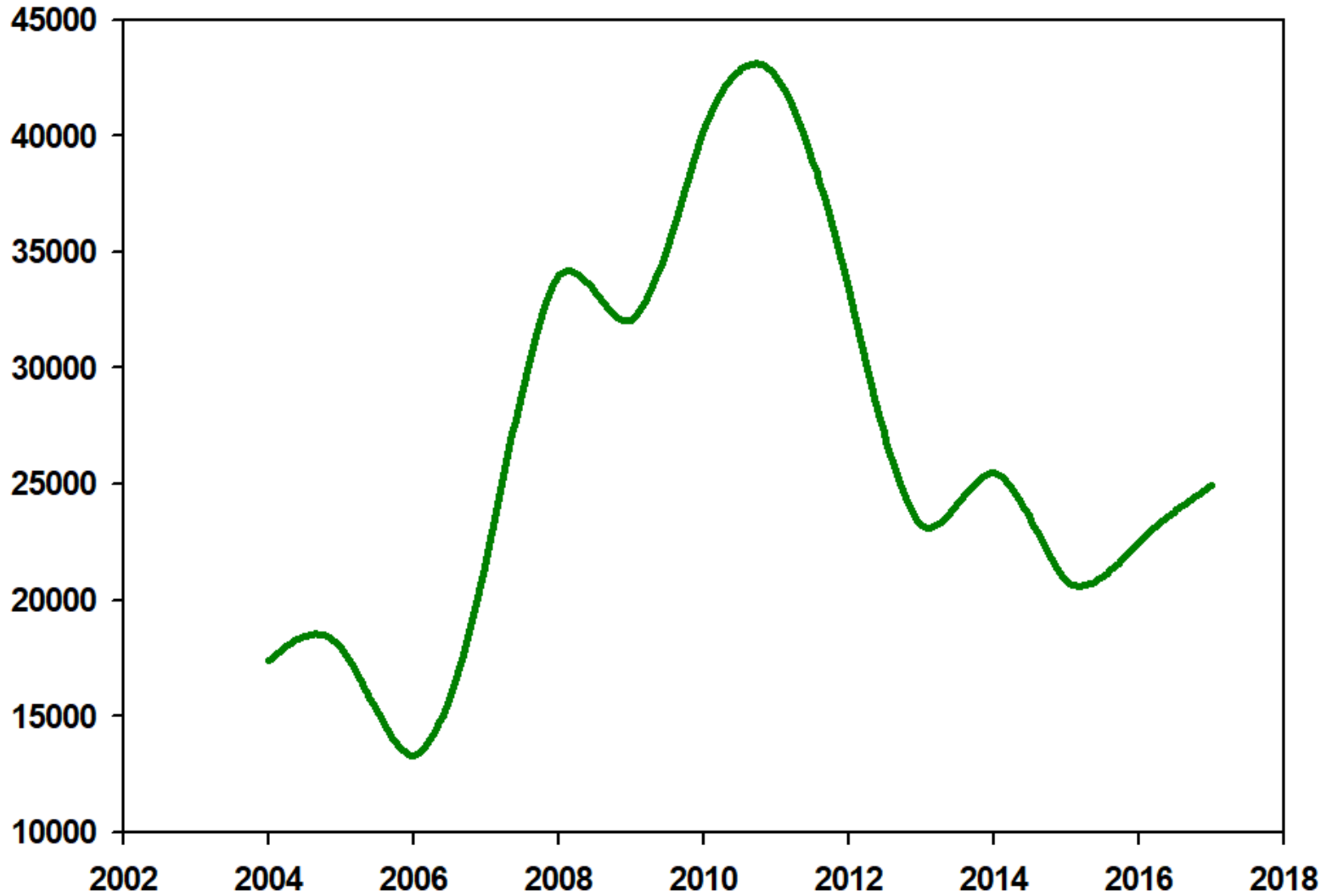
Christopher S. Jones¹*, Jacob K. Nielsen¹, Keith E. Schilling², Larry J. Weber¹

1 IIHR-Hydroscience and Engineering, University of Iowa, Iowa City, Iowa, United States of America, **2** Iowa Geological Survey, Iowa City, Iowa, United States of America

* These authors contributed equally to this work.

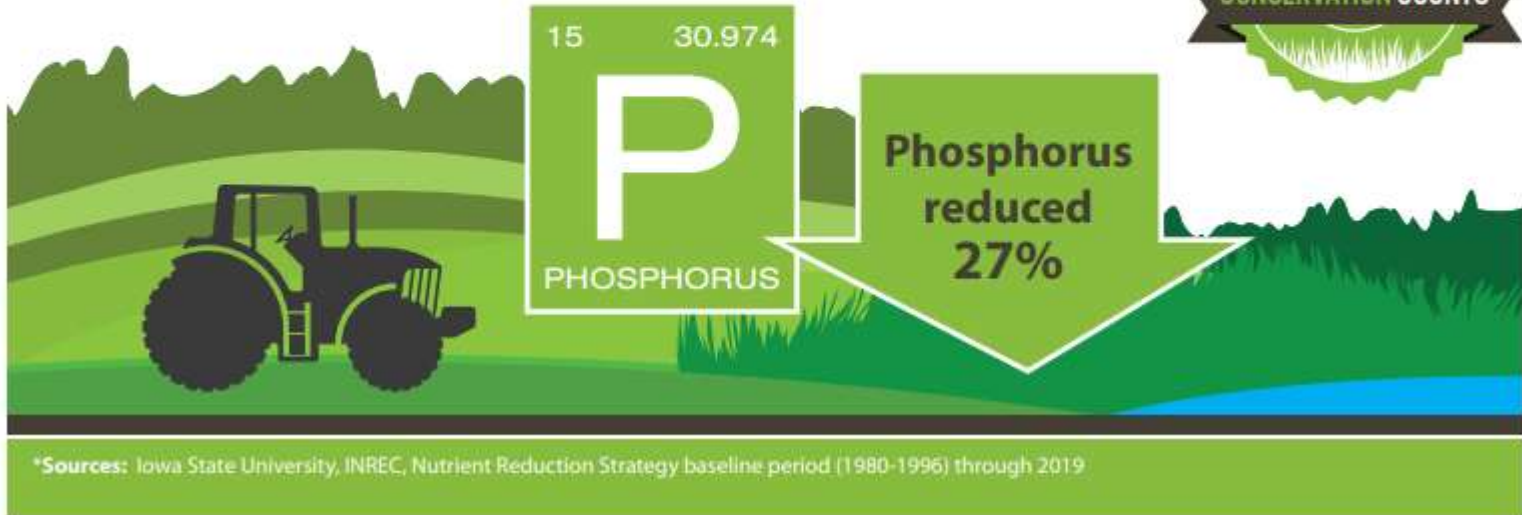
* Christopher-s-jones@uiowa.edu

Iowa Statewide P Load, 5-yr Running Annual Average (tons)



The “Low” Down on Phosphorus

Conservation practices on Iowa farms are reducing phosphorus loss by up to 27%.



WallacesFarmer.

Iowa makes progress on water quality

Iowa Nutrient Reduction Strategy annual report shows record conservation engagement by Iowans.

Nitrogen Change since 1999



N Category	% change
River	83
Chicken	76
Turkey	59
Hogs	59
Surplus	51
Fixation	41
total inputs	36
Commercial	34
Grain N	27
Beef	10
Dairy	-11

Economics of N loss

Cost of Nitrogen: today about \$0.86/lb

Cost to remove nitrogen using BMPs: \$2–\$10/pound

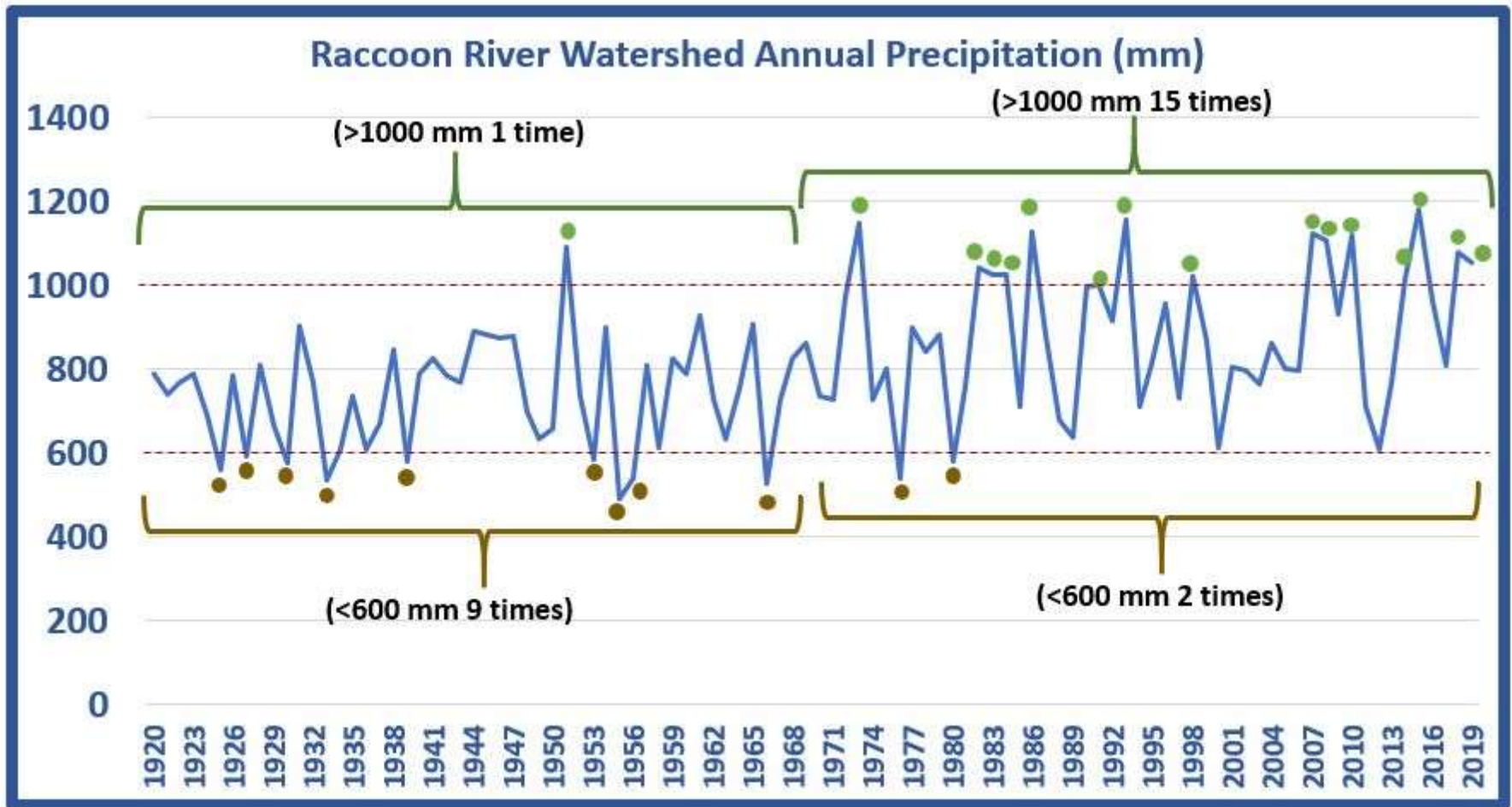
Average statewide load: 600 million lbs

45% reduction = 270 million lbs/year

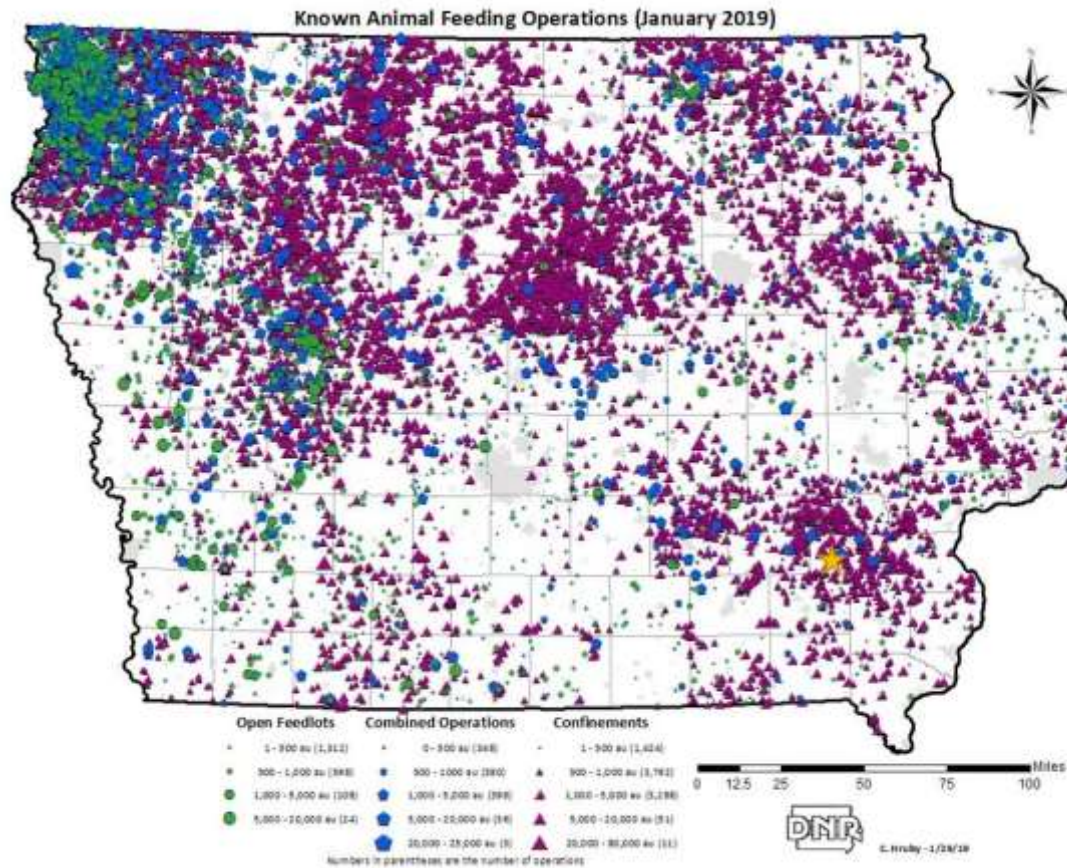
\$540M to \$2.7B/year



Climate Change



How Do You Overcome Structural Drivers to Bad Water Quality?



More Diverse Farming Systems



Marsden Long Term Rotation Study- ISU



Matt Liebman

Corn/Soybean/Oat/Alfalfa/Alfalfa vs Corn/Soybean

N fertilizer use 91% lower

Herbicide use 97% lower

Weed biomass similar

Soybean sudden death syndrome much lower

Soil health is better

Tile nitrate 57% lower

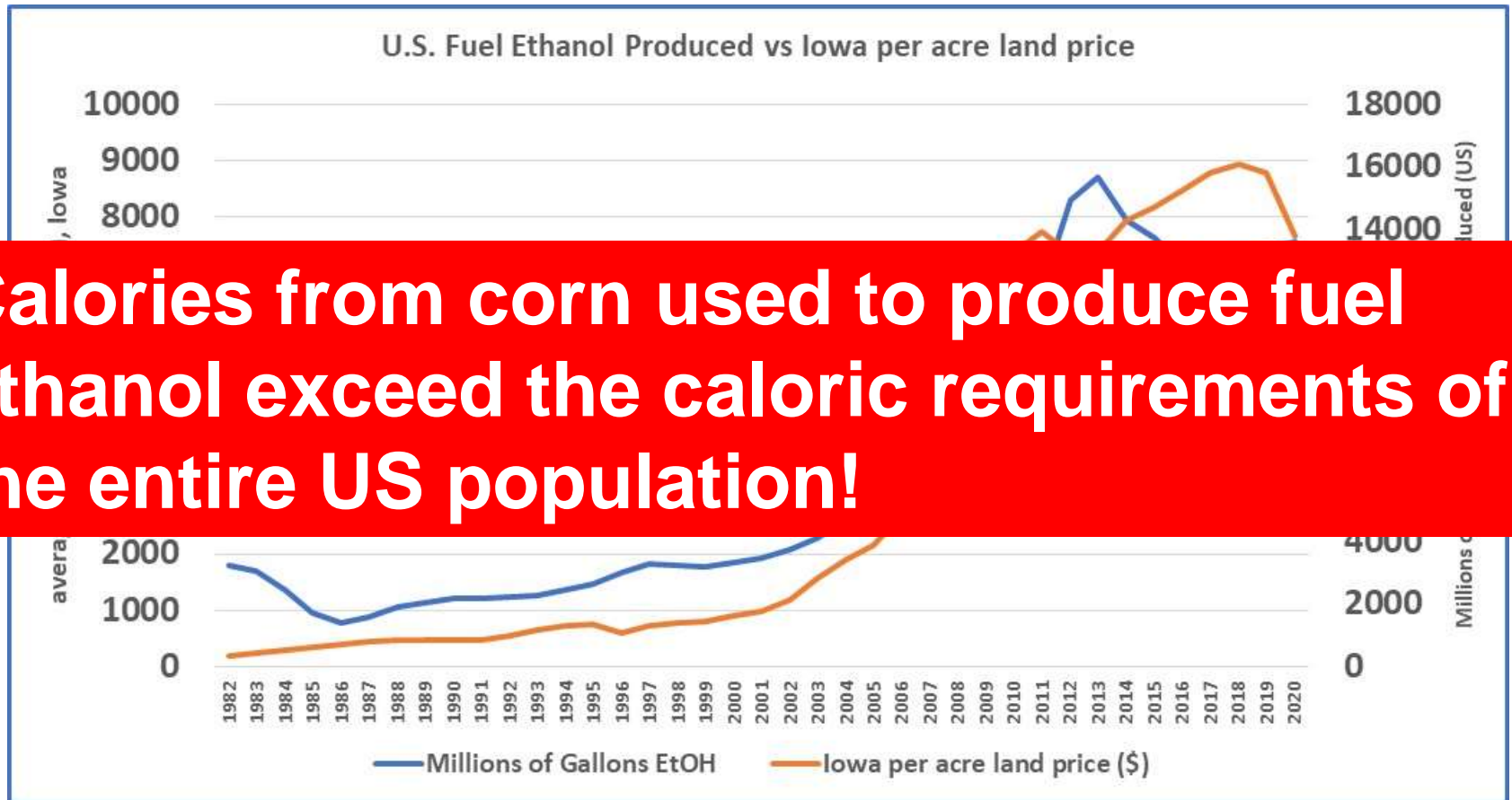
Soil erosion 50% lower

Fossil Fuel use 60% lower

Net returns similar (revenue lower but input costs also lower)



Fuel Ethanol



Calories from corn used to produce fuel ethanol exceed the caloric requirements of the entire US population!

Ethanol creates perversity in US Agriculture

- Corn Grown in Arid Areas for Ethanol and Livestock



6000 years to naturally replenish



- Irrigated Alfalfa Uses 1/2 of the Colorado River

Exported to China, Saudi Arabia, etc.



RESEARCH ARTICLE | ENVIRONMENTAL SCIENCES | 



Environmental outcomes of the US Renewable Fuel Standard

Tyler J. Lark  , Nathan P. Hendricks , Aaron Smith , , and Holly K. Gibbs [Authors Info & Affiliations](#)

Edited by Paul West, Applied Economics, University of Minnesota, St. Paul, MN; received January 18, 2021; accepted December 3, 2021 by Editorial Board Member Ruth DeFries

February 14, 2022 | 119 (9) e2101084119 | <https://doi.org/10.1073/pnas.2101084119>

- Increased corn acres 8.7%
- Increased total crop area 2.4%
- Increased fertilizer use 3-8%
- Increased water quality degradants 3-5%
- Increased GHG emissions 24%

What could we do with 11,000 square miles (7 million acres)?

- 1.1 million acres: grow enough dried beans for every person in the U.S.
 - 360,000 acres: grow enough potatoes for every person in the U.S.
 - 220,000 acres: grow enough apples for every person in the U.S.
 - 150,000 acres: grow enough canned sweet corn for every person in the U.S.
 - 140,000 acres: grow enough onions for every person in the U.S.
 - 37,000 acres: grow enough cherries for every person in the U.S.
 - 26,000 acres: grow enough walnuts for every person in the U.S.
-
- **5 million acres still left!**

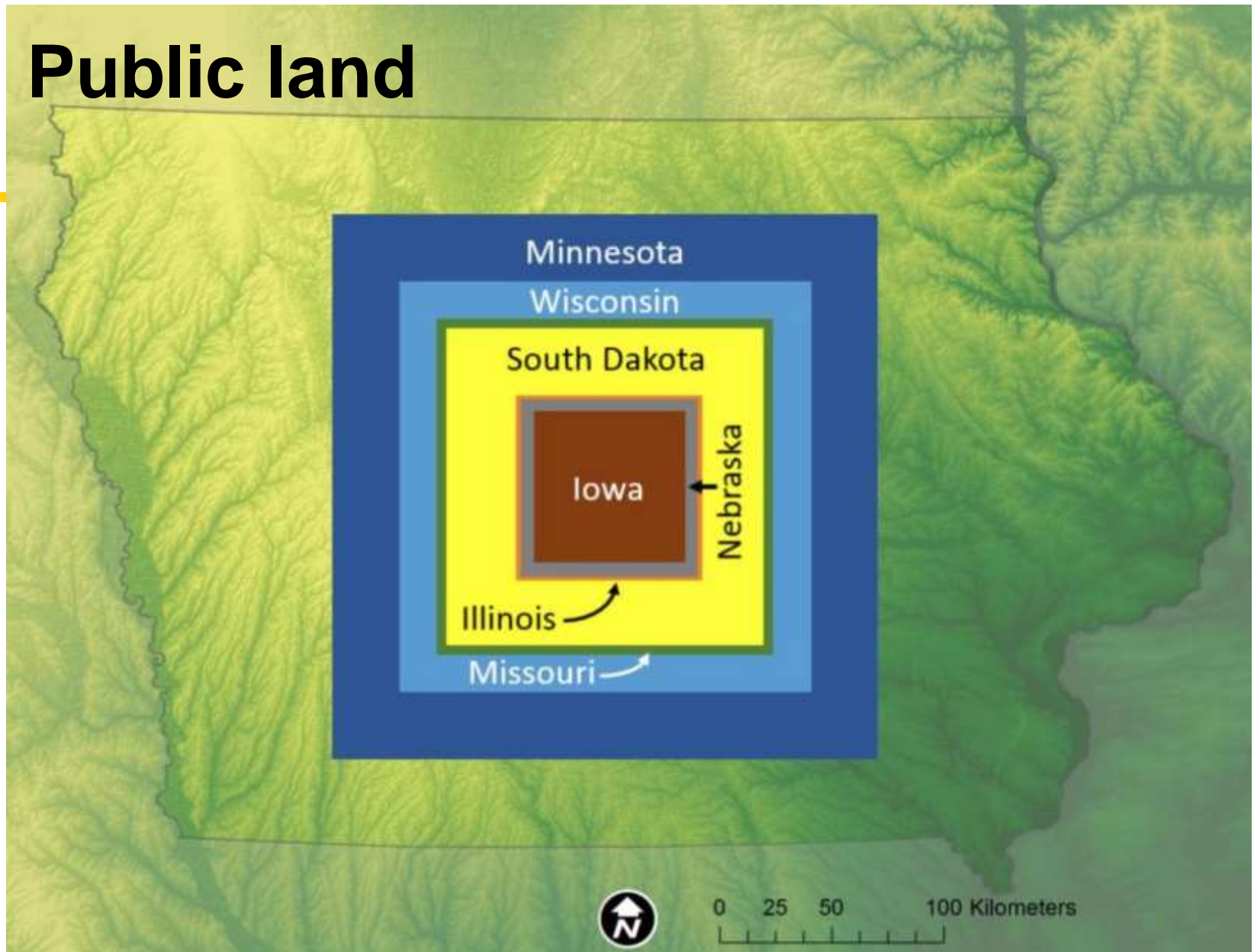


Regulations?

1. Ban cropping in the 2-year Flood Plain
2. Ban fall tillage
3. Ban manure on snow and frozen ground
4. Make farmers adhere to ISU fertilization guidelines
5. Reformulate CAFO Regulations

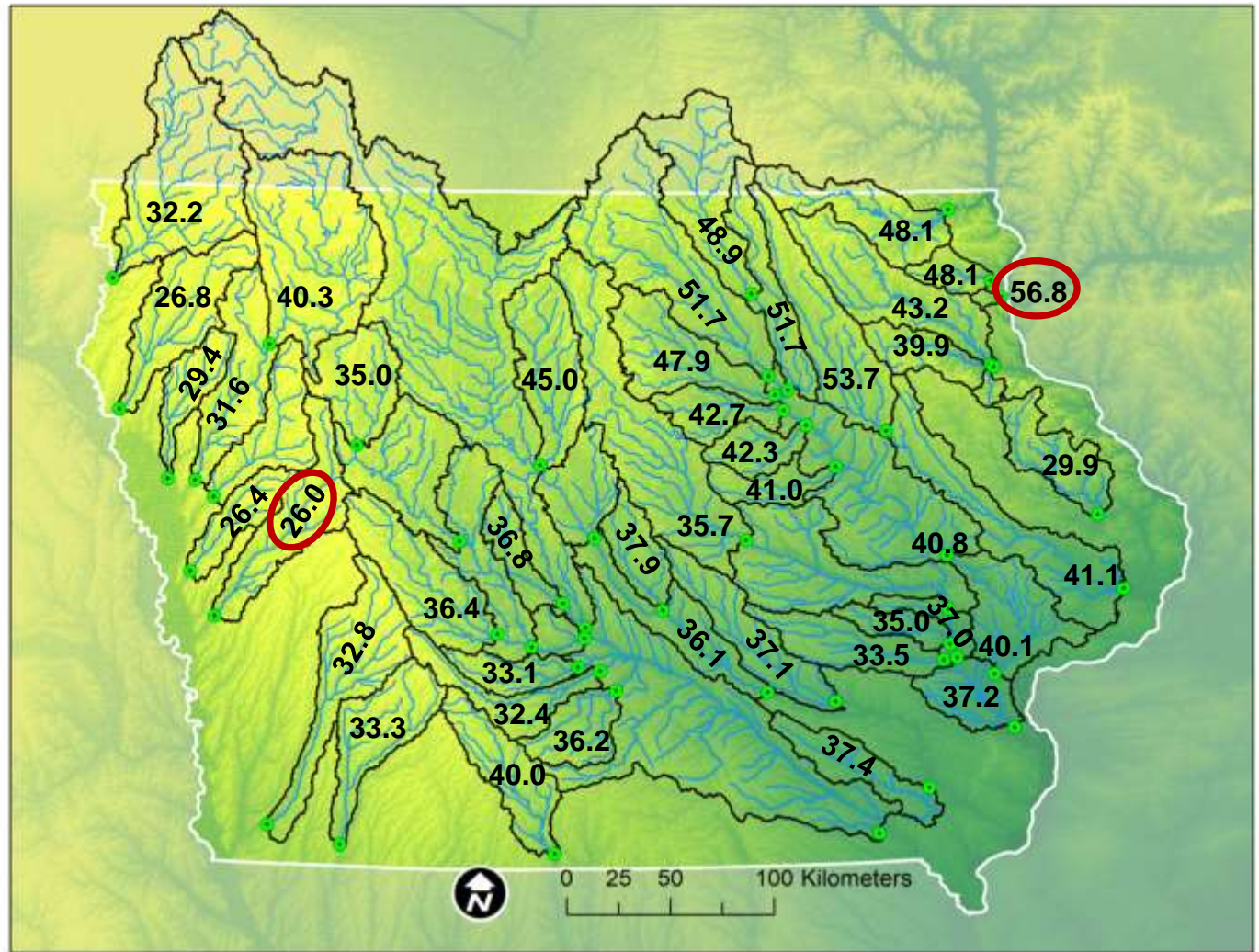


Public land



2000-2020

>96=Excellent
81-95=Good
66-80=Fair
46-65=Marginal
10-45=Poor
<10=Very Poor



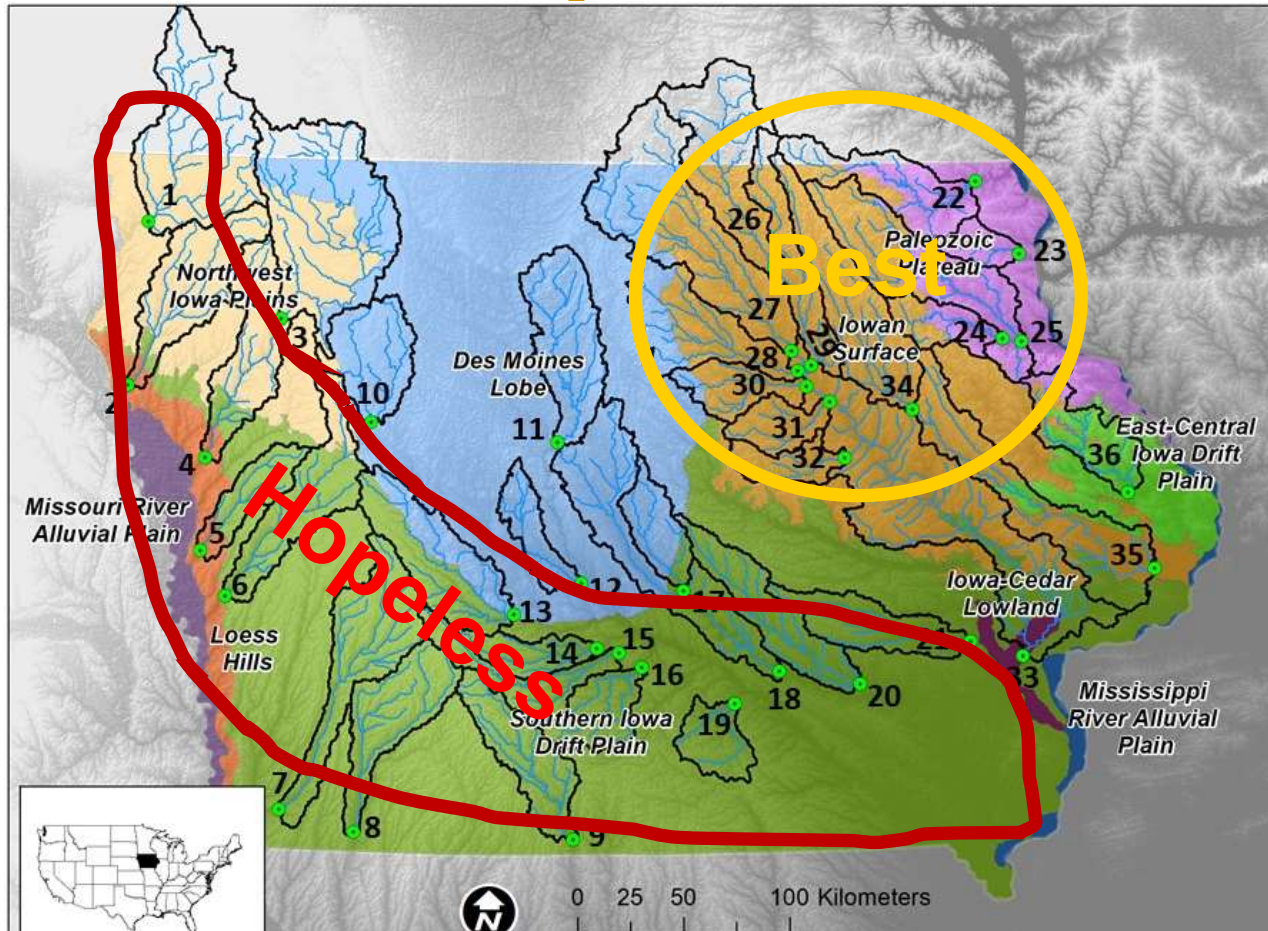
Stream Water Quality Since 1999

3/44 improving (>5%)

16/44 <5% change

25/44 declining (>5%)

Water Quality Index



What do we want our production system to look like?

Commerce



Nutrition?



THE SWINE REPUBLIC



IOWA

Chris Jones

STRUGGLES WITH THE TRUTH ABOUT
AGRICULTURE AND WATER QUALITY

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IIHR-Hydrosience & Engineering

<https://cjones.iihr.uiowa.edu/>

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