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Chris Jones, Research Engineer, IIHR Hydroscience and Engineering

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# The Swine Republic

June 12, 2023

Mines of Spain

**<https://riverraccoon.substack.com>**



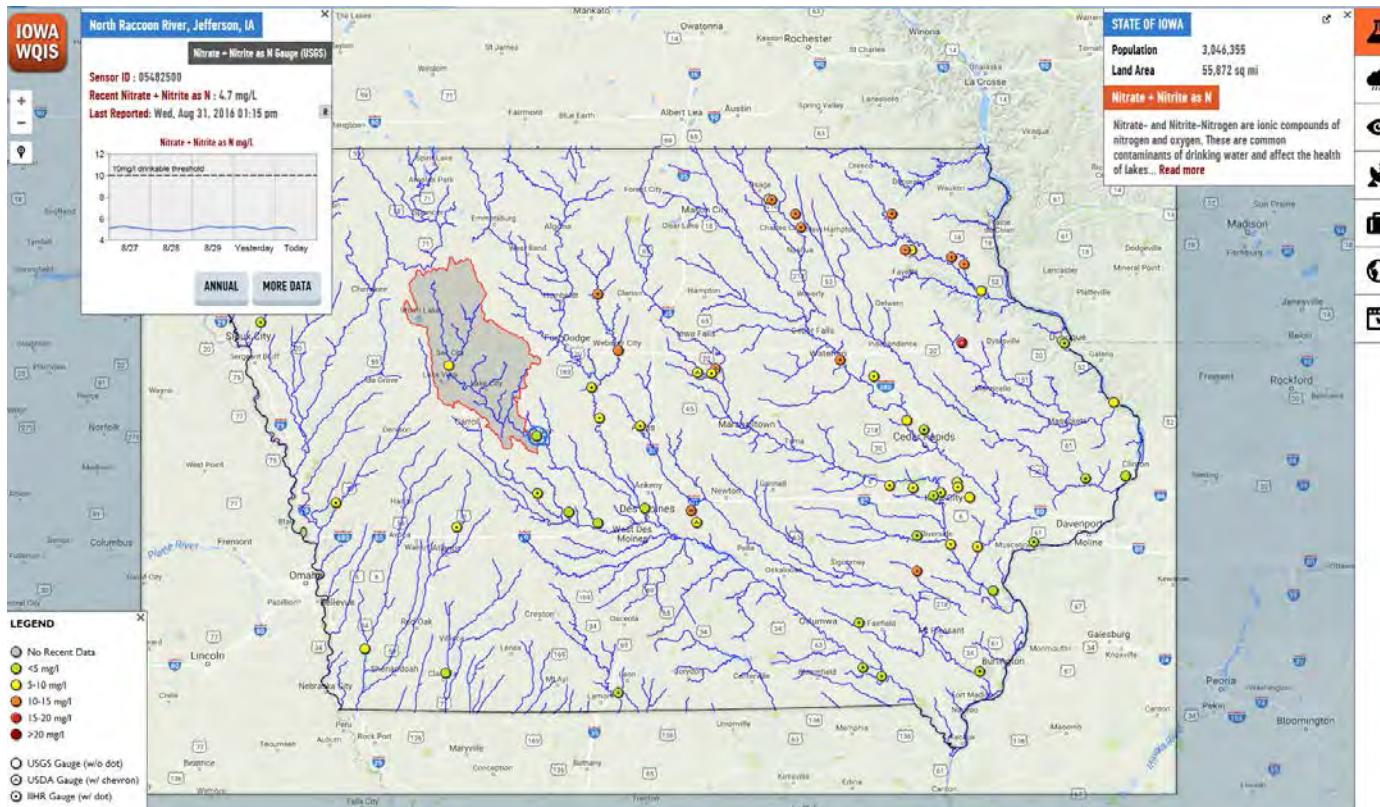
# IIHR Water Quality Sensor Network



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# Iowa Water Quality Information System



[iwqis.iowawis.org/](http://iwqis.iowawis.org/)

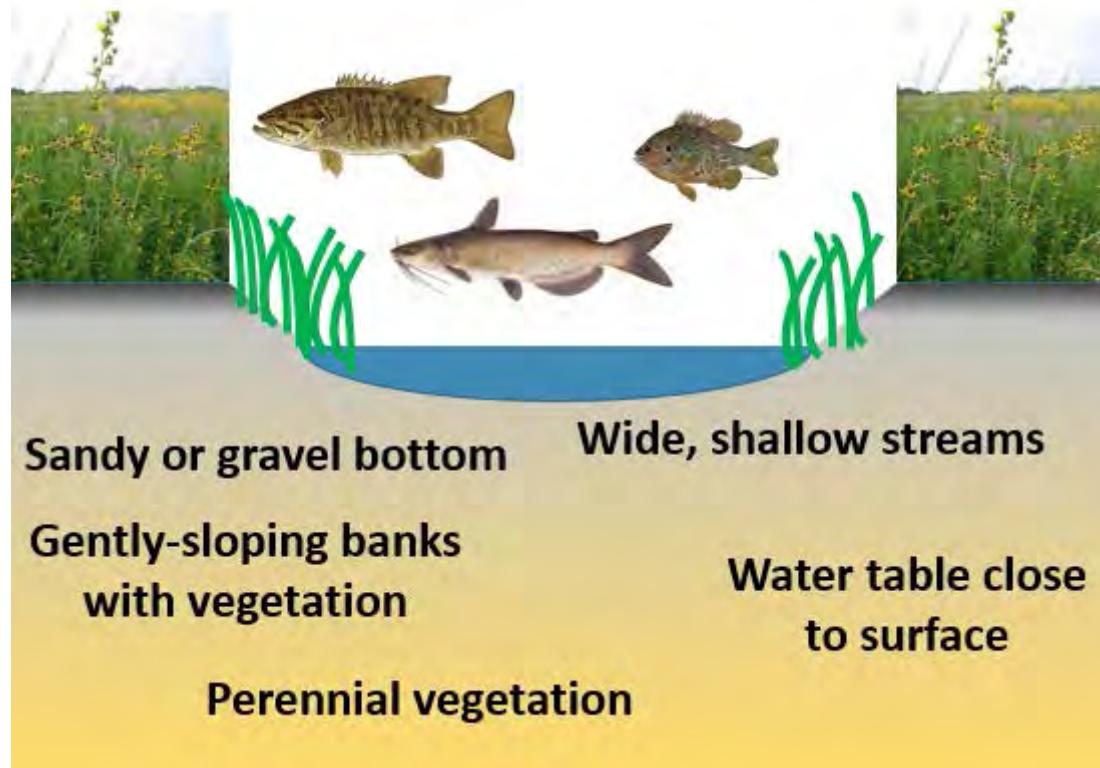
<http://iwqis.iowawis.org/app/?datetime=2017-06-06T13:00>

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# Pre-European Settlement Streams

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# Breaking the prairie

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*Photo courtesy of Dure and Company*



# Stream Straightening, 1930-1975

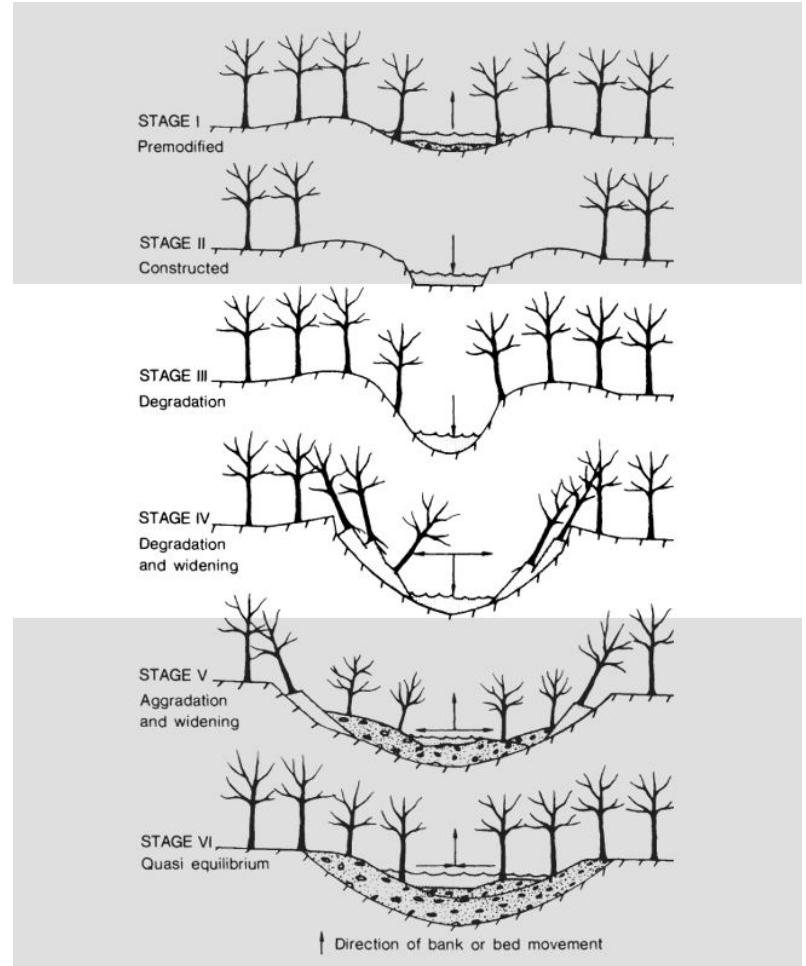
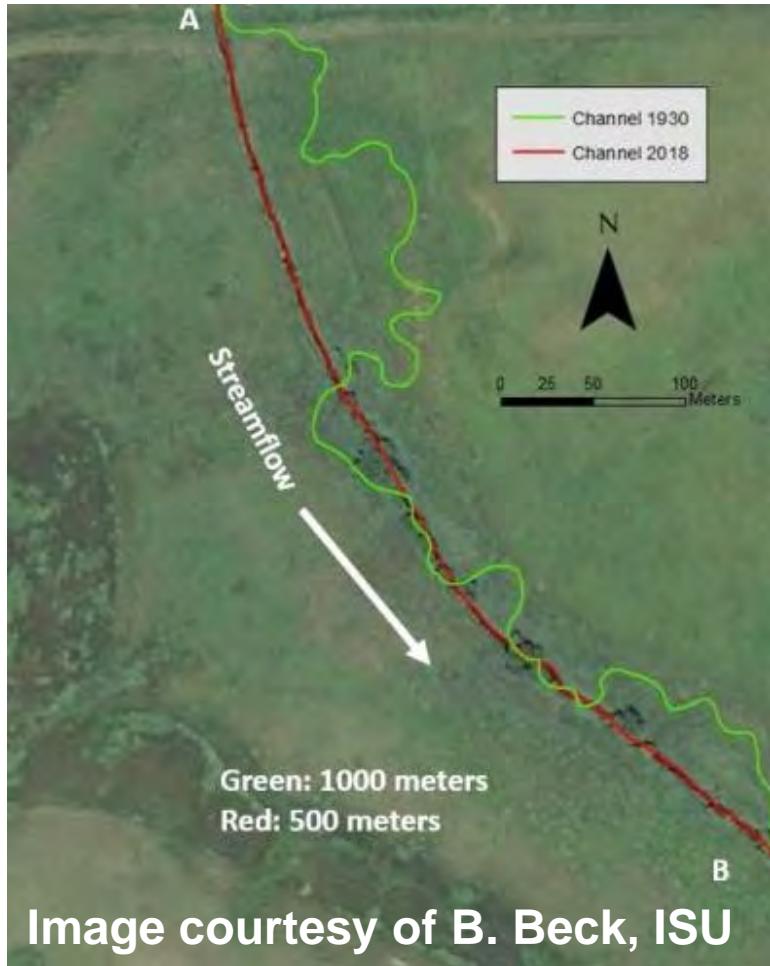
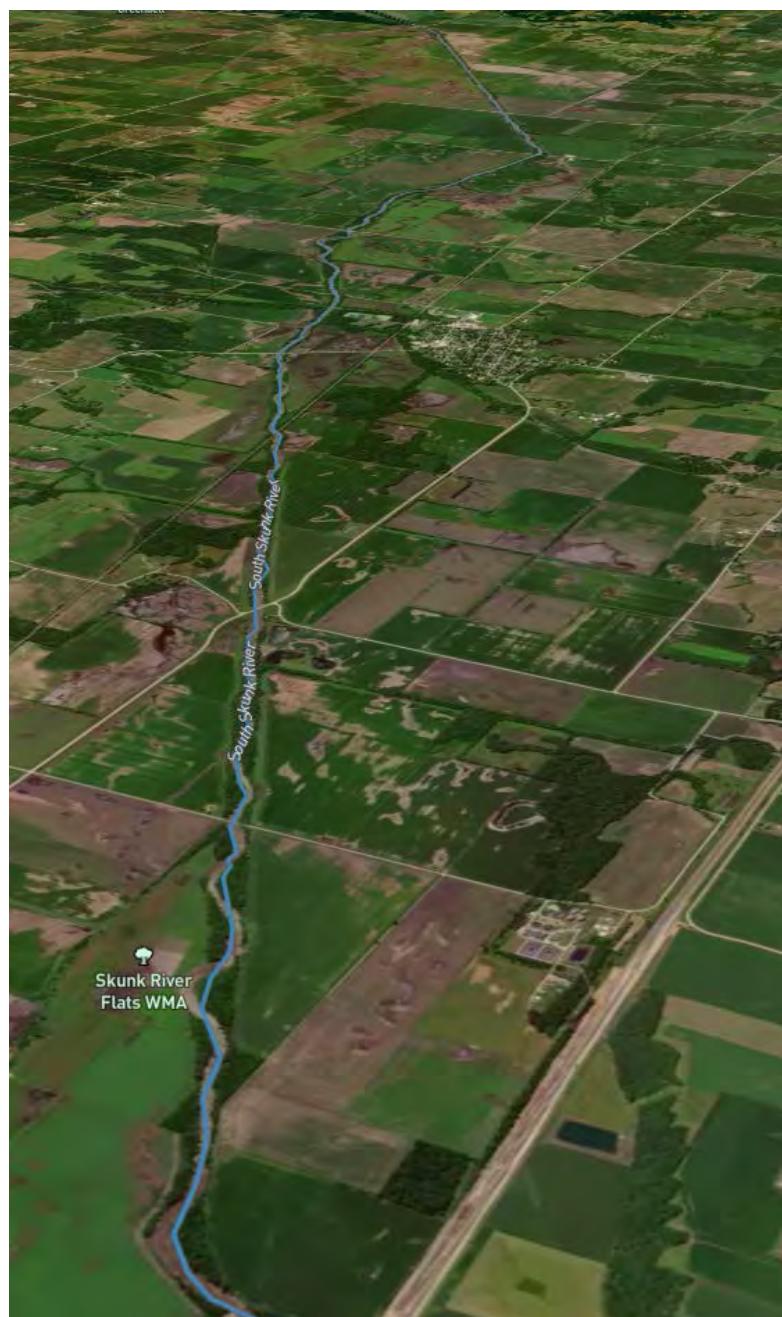
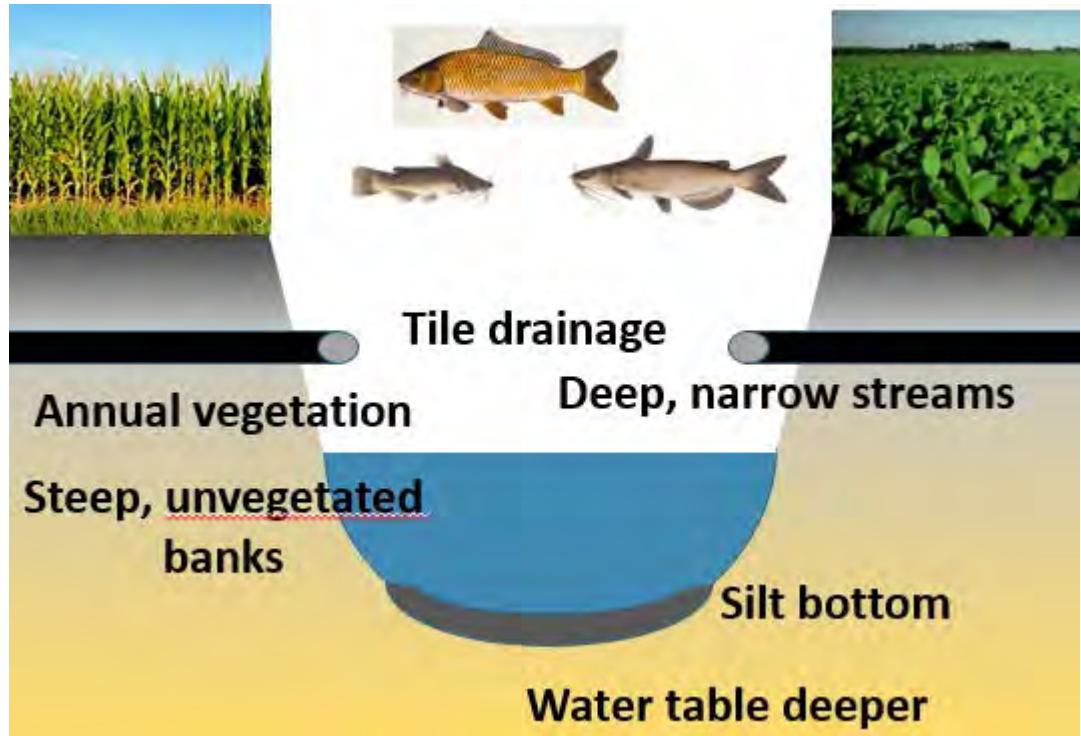


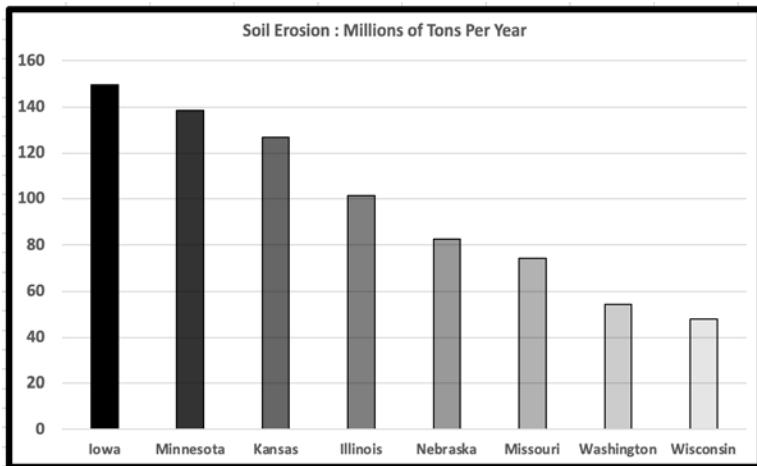
Image courtesy of B. Beck, ISU

# Modified Streams





# Water Quality Consequences

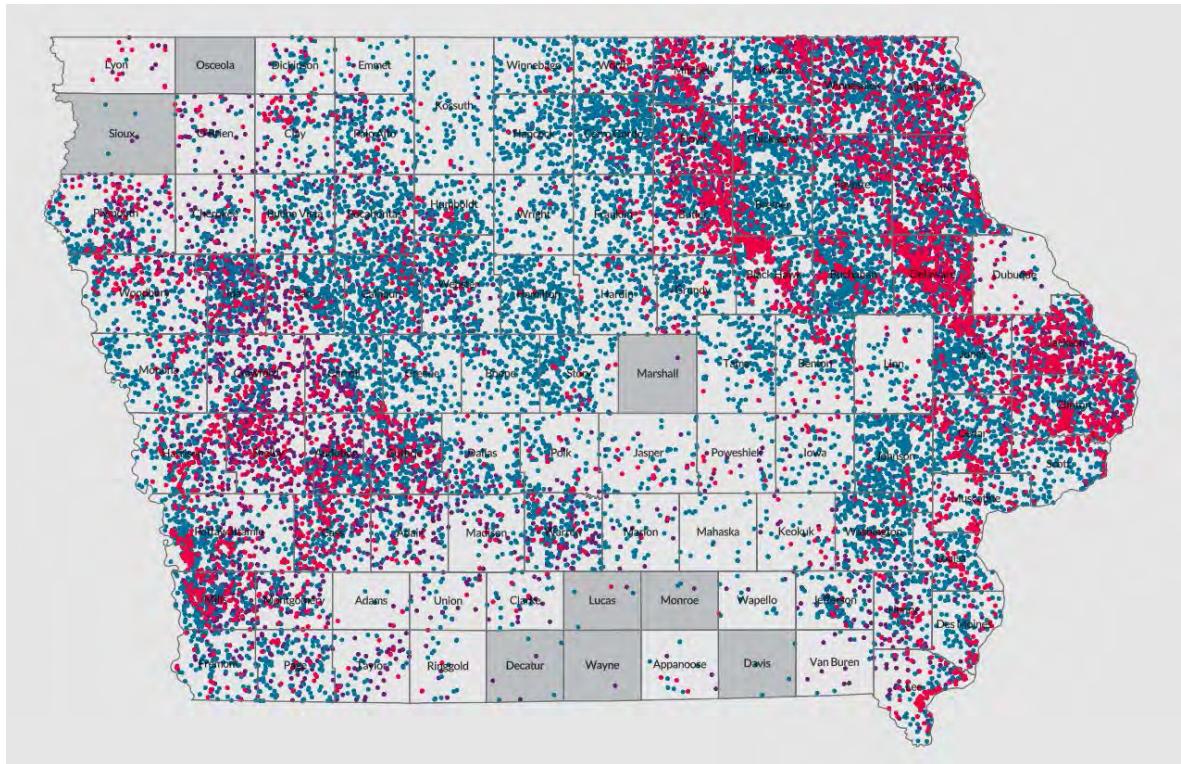


Iowa contributes:

- 55% of the nitrate in the Missouri River (3.3% of the area)
- 45% of the nitrate in the Upper Mississippi River (21% of the land)
- 29% of the nitrate and 15% of phosphorus at the Mississippi outlet (4.5% of the land)



# Drinking Water



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

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

60 PWSS are removing nitrate

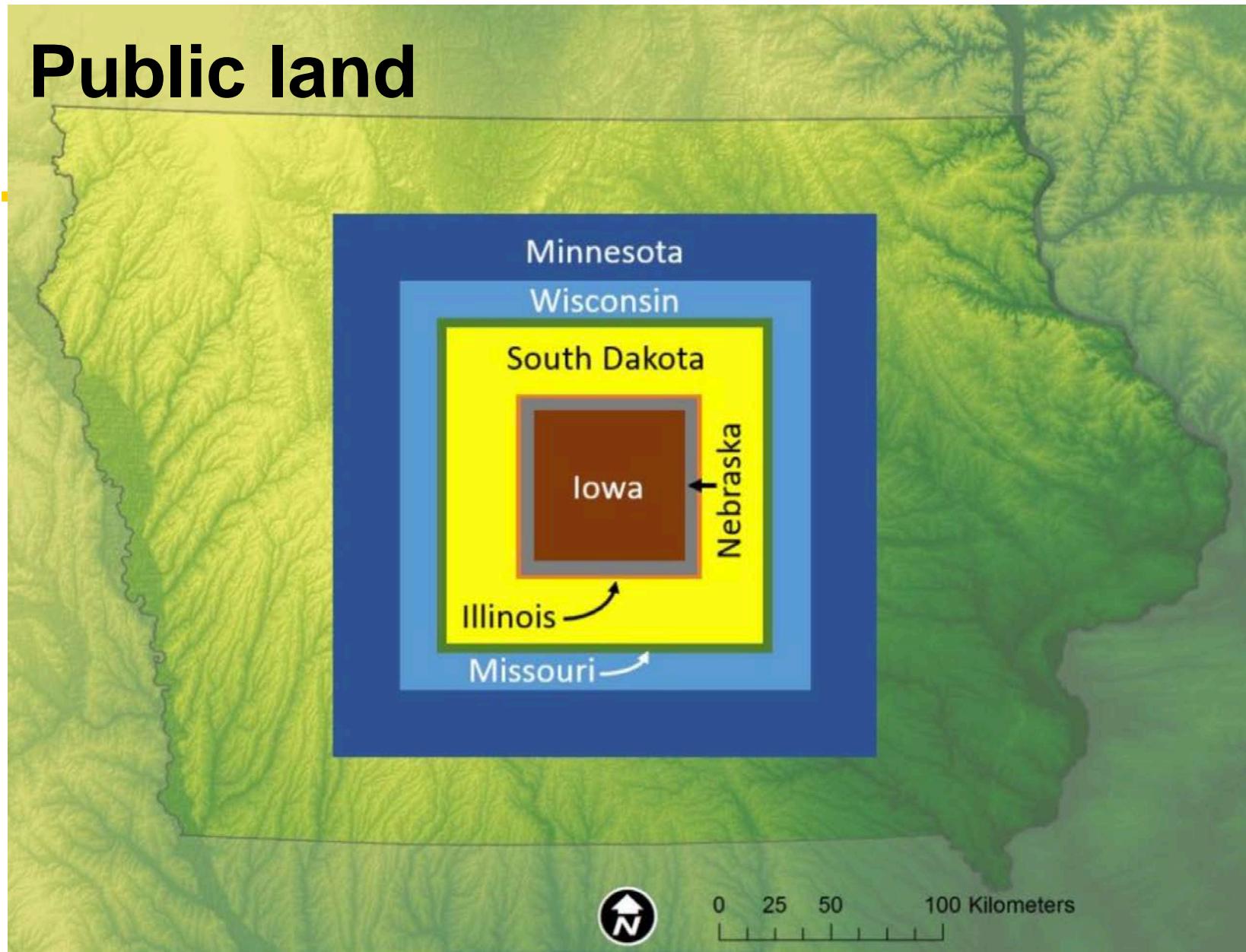
25% of Iowa drink water that has been treated for nitrate reduction

# Problem of Scale

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- 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

# Public land



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## 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

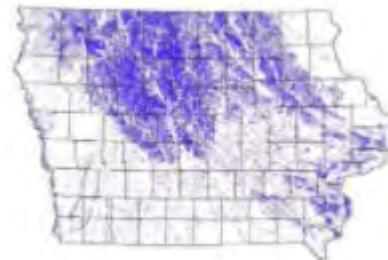
45% reduction = 270 million lbs/year

\$540M to \$2.7B/year



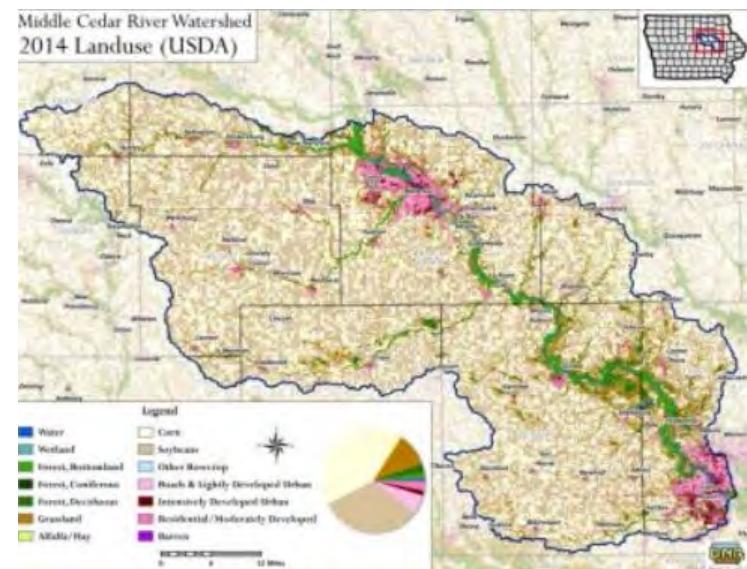
# New Tile

2 million miles of tile in Iowa



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

Table 2: Estimated amounts spent in 2016 on new drainage tile in five of Iowa's landforms.



1200 miles new tile/year!

## More Diverse Farming Systems



## How Do You Overcome Structural Drivers to Bad Water Quality?

Marsden Long Term Rotation Study-  
ISU



Matt Liebman

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)

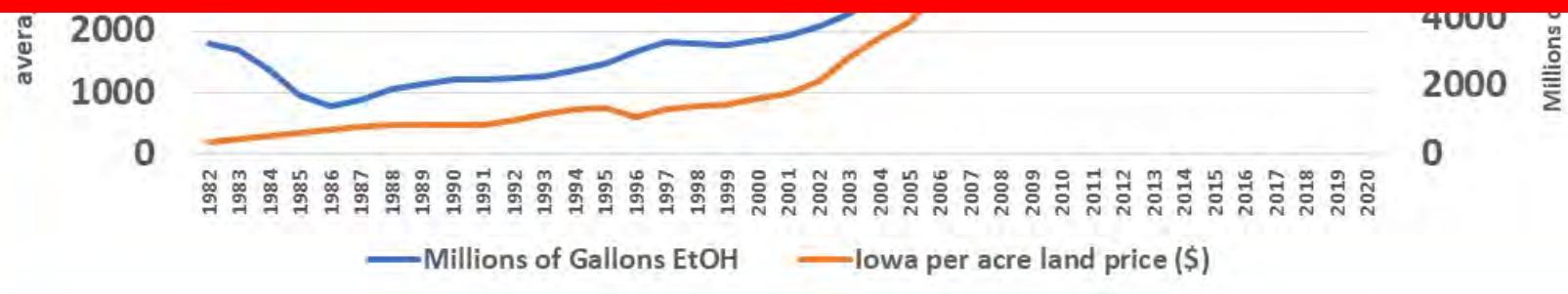


## Fuel Ethanol

U.S. Fuel Ethanol Produced vs Iowa per acre land price



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  $\frac{1}{2}$  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 , +5, 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

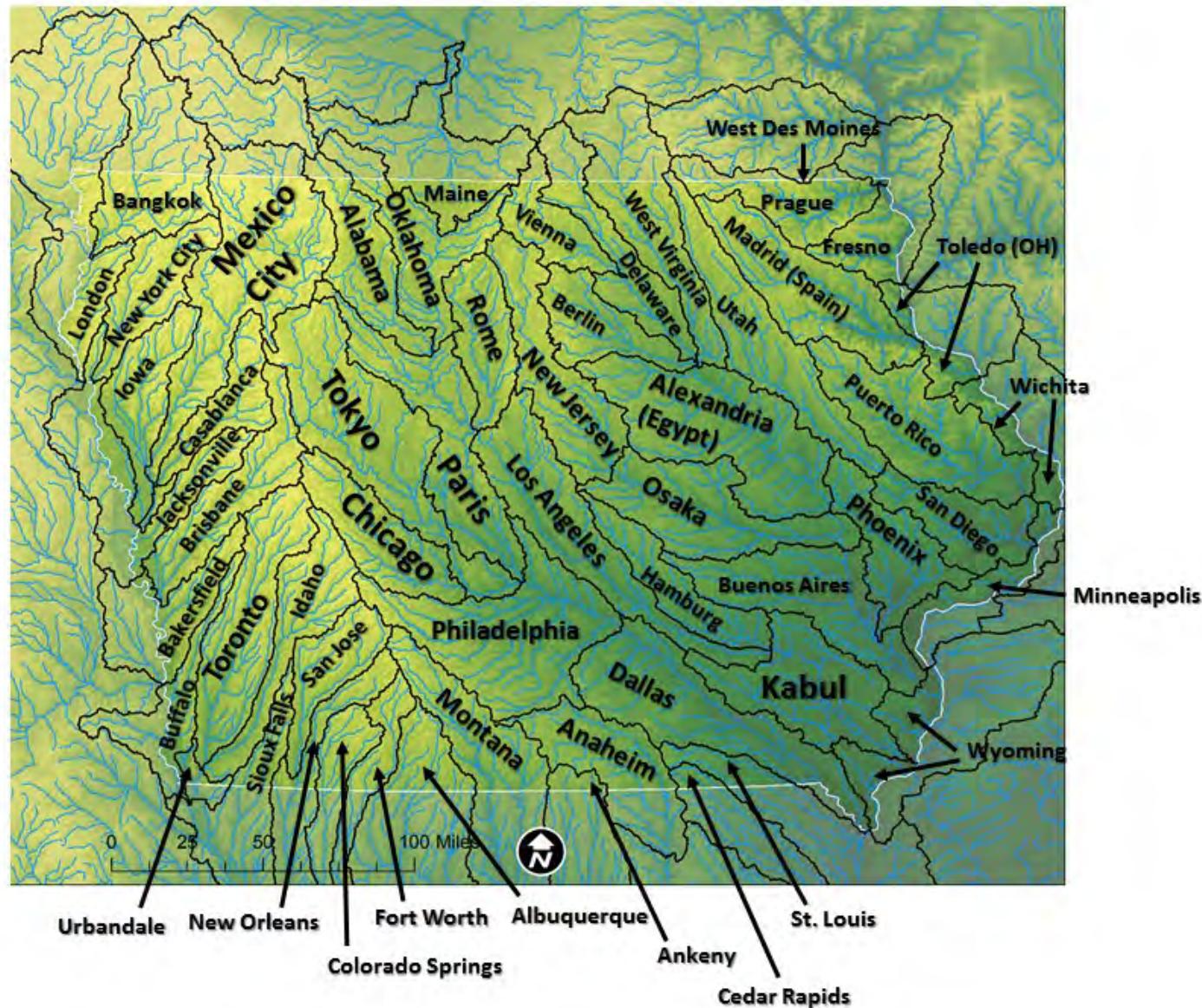
February 14, 2022 | 119 (9) e2101084119 | <https://doi.org/10.1073/pnas.2101084119>

- 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!**

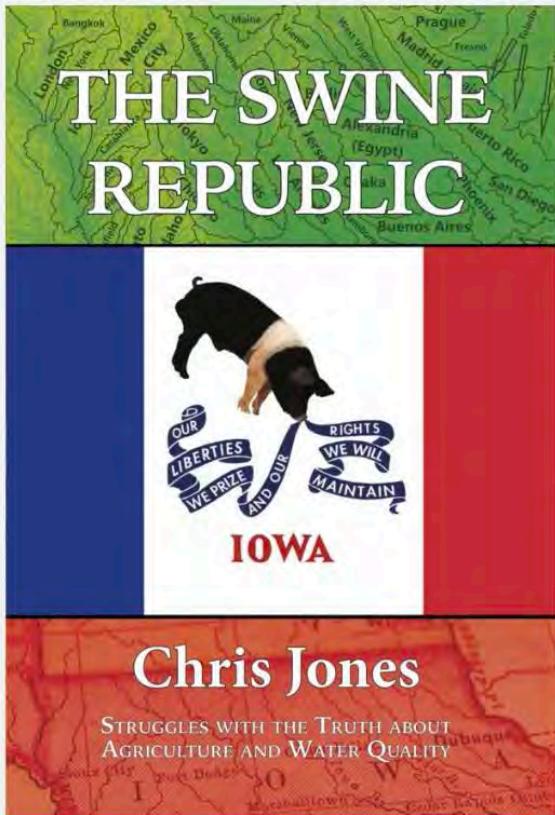




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but the whole world considerably differently.”—[Bill McKibben](#), author, *The*