



IOWA

Chris Jones, Research Engineer, IIHR Hydrosience and Engineering

The Swine Republic

June 12, 2023

Mines of Spain

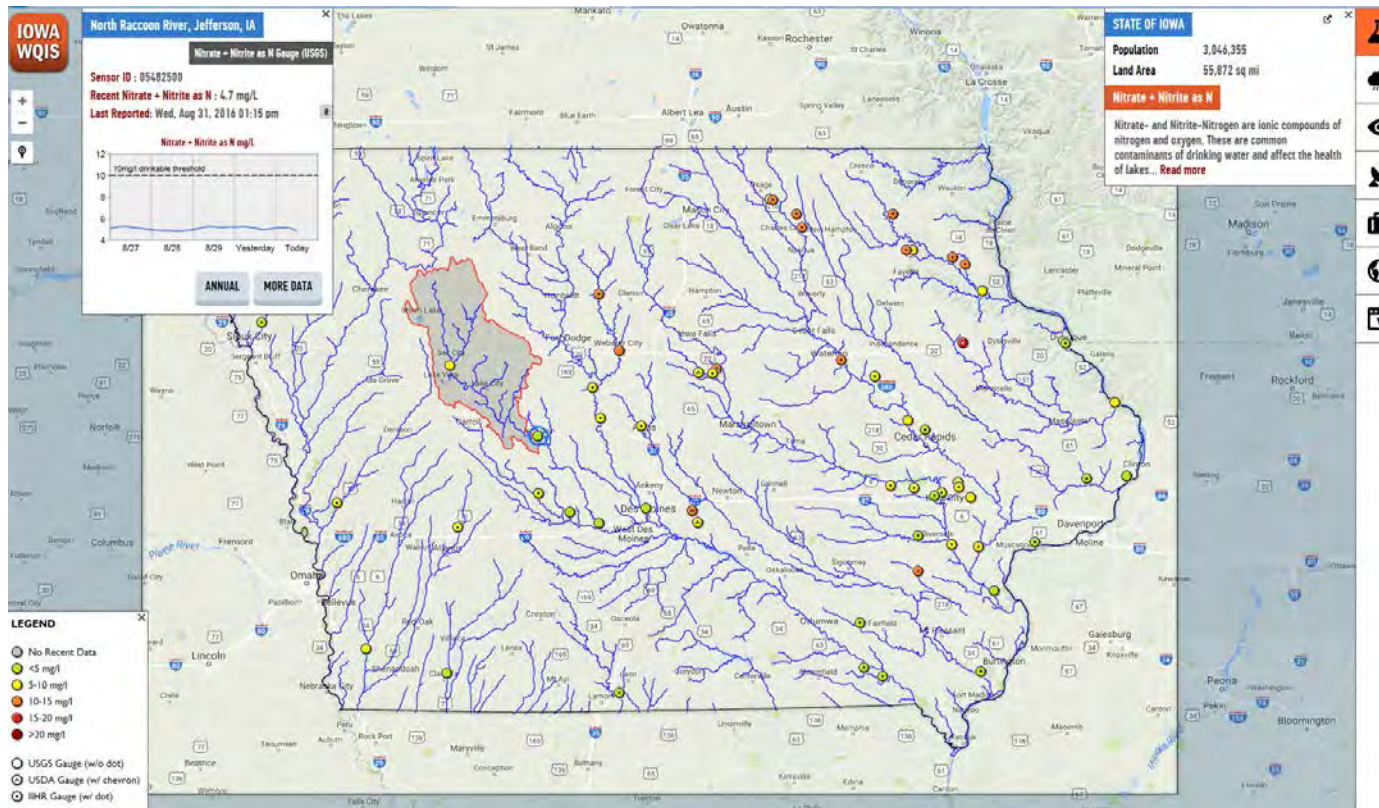
<https://riverraccoon.substack.com>



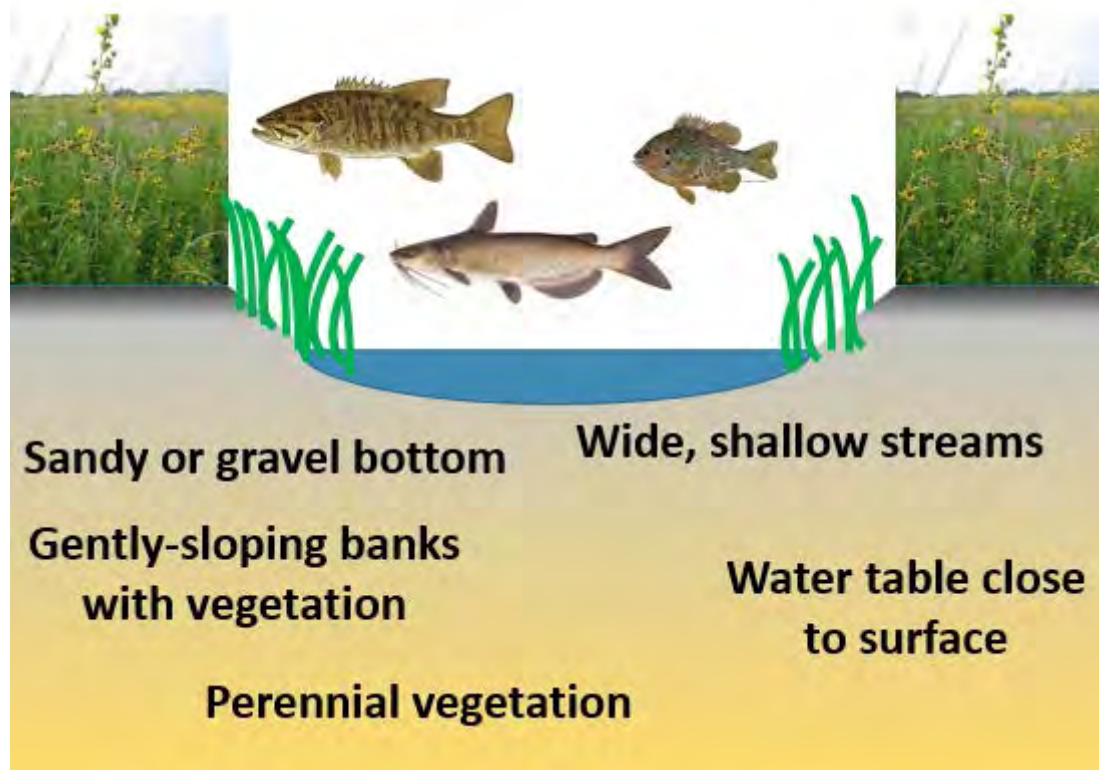
IIHR Water Quality Sensor Network



Iowa Water Quality Information System



Pre-European Settlement Streams



Breaking the prairie





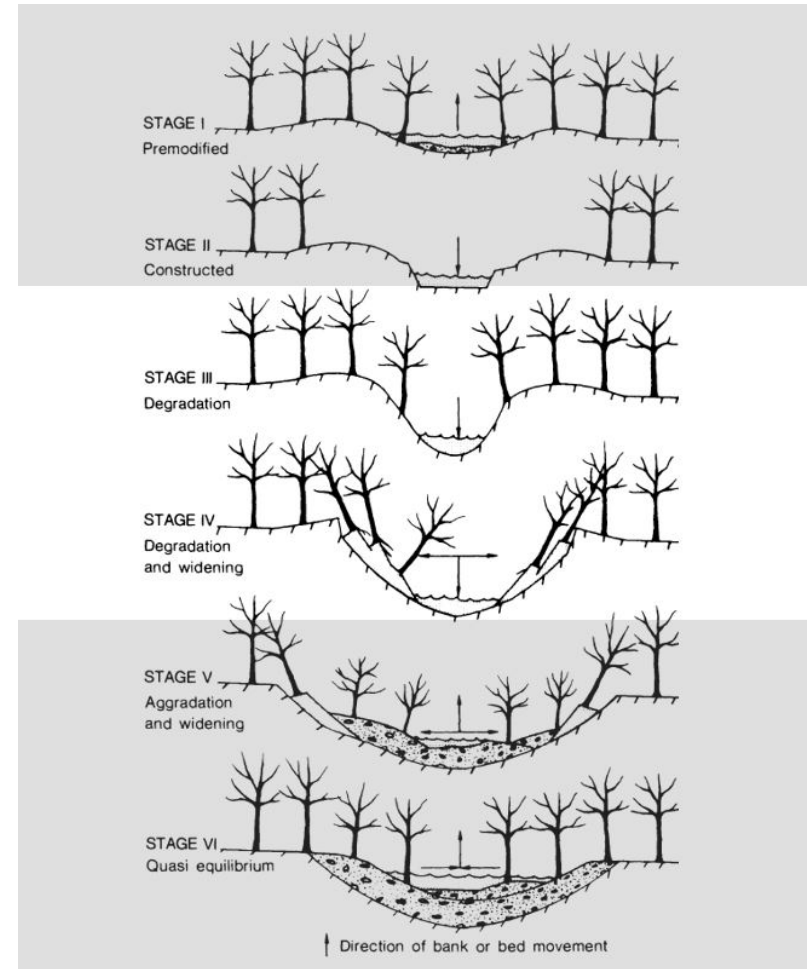
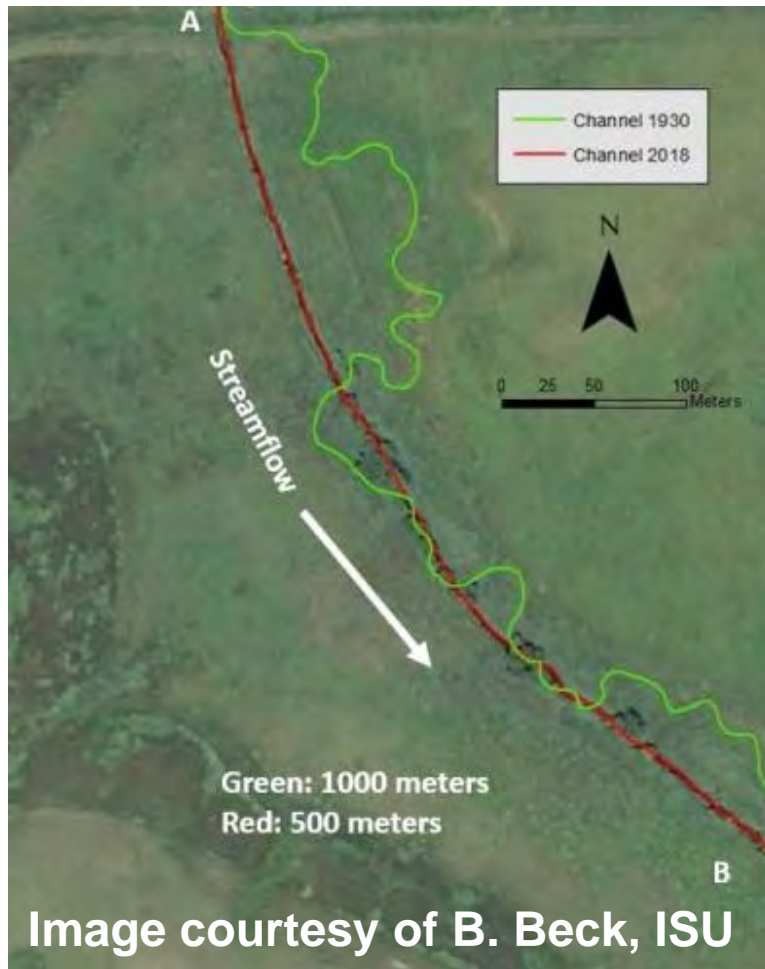
Excavating a large ditch using steam power, circa 1910.



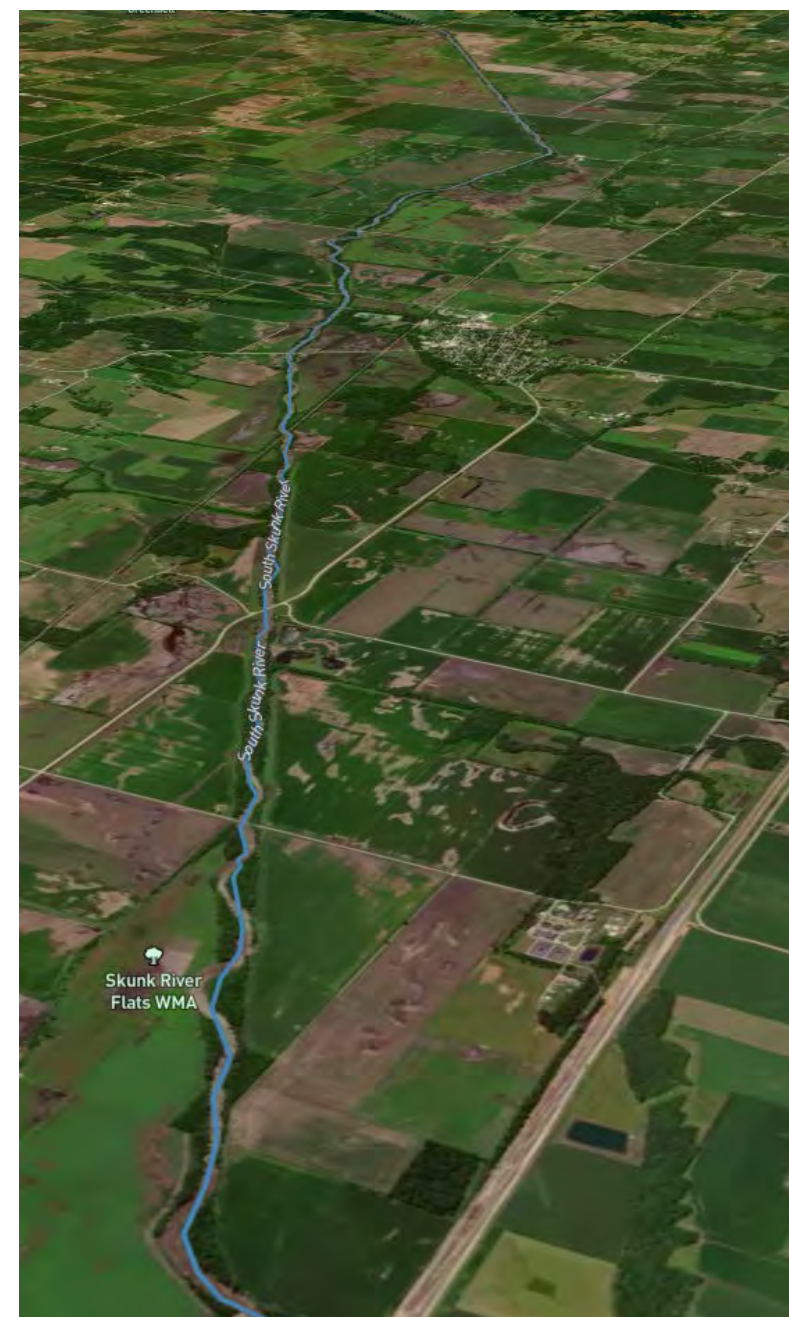
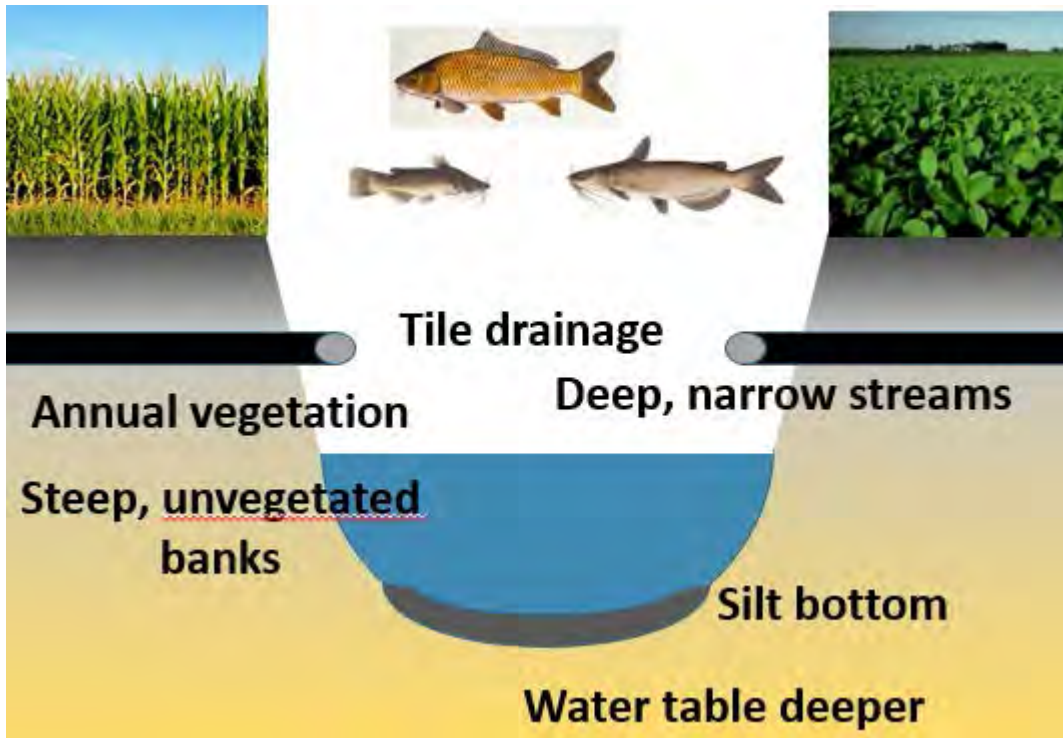
Hand digging tile, Boone Co. IA, ca 1914
Source: 'An Iowa album: a photographic history, 1860-1920' by M. J. Bennet, University of Iowa Press, Iowa City, Iowa



Stream Straightening, 1930-1975

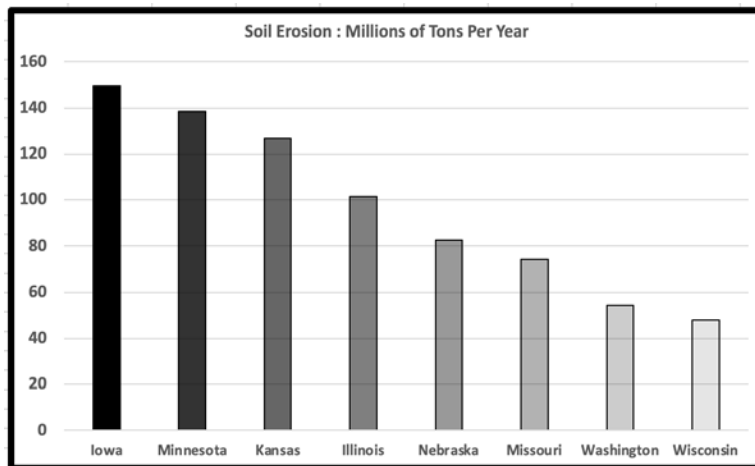


Modified Streams





Water Quality Consequences

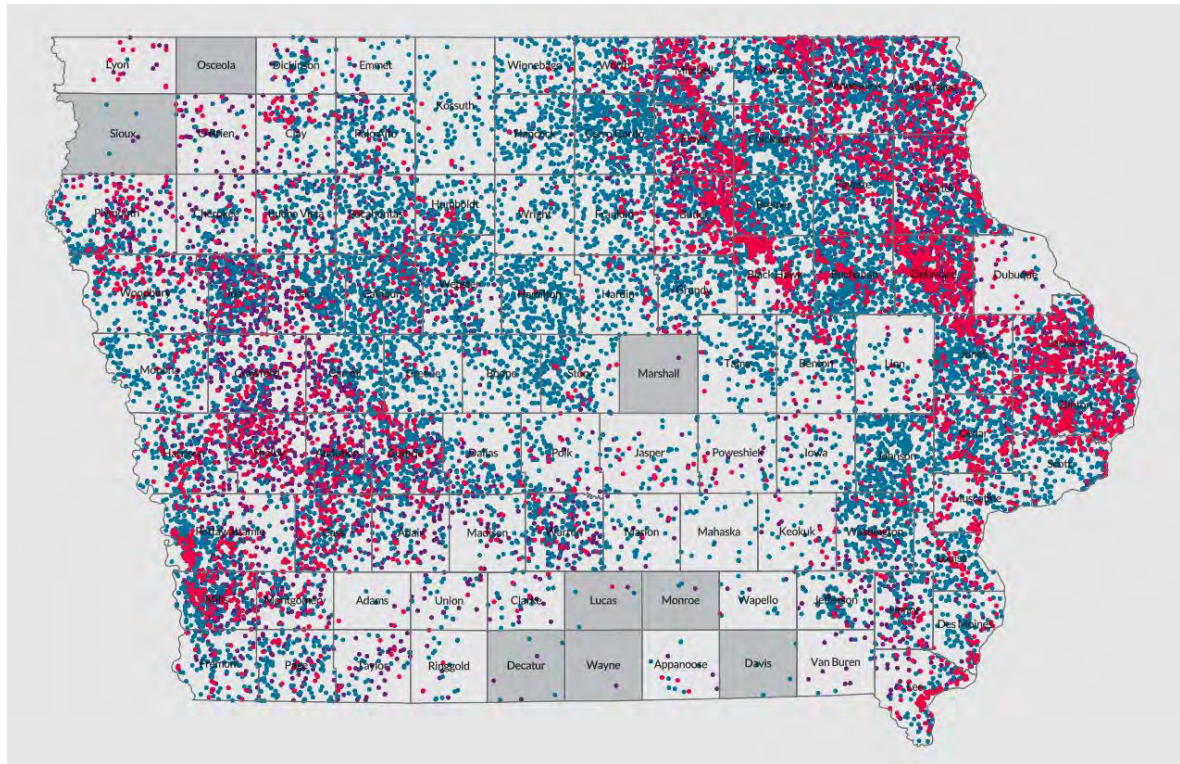


Iowa contributes:

- 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

- 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



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

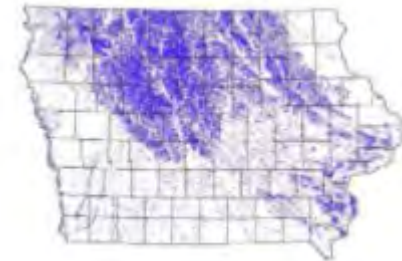
45% reduction = 270 million lbs/year

\$540M to \$2.7B/year



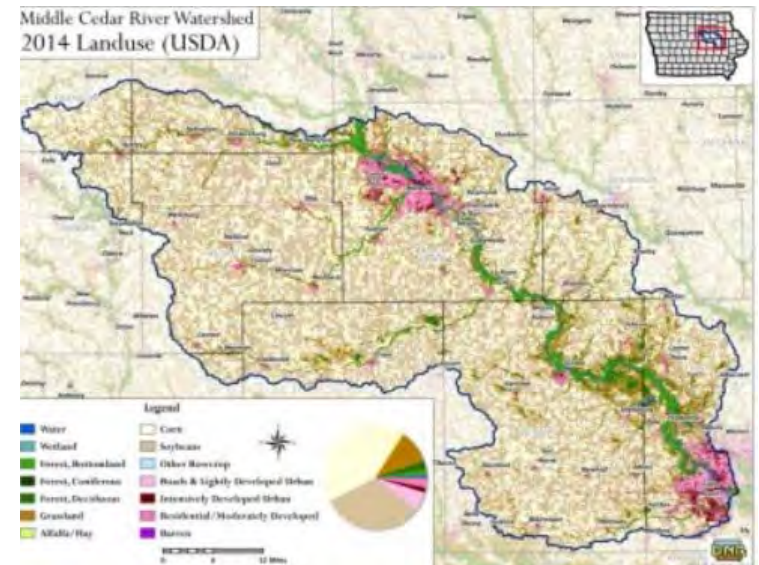
New Tile

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.



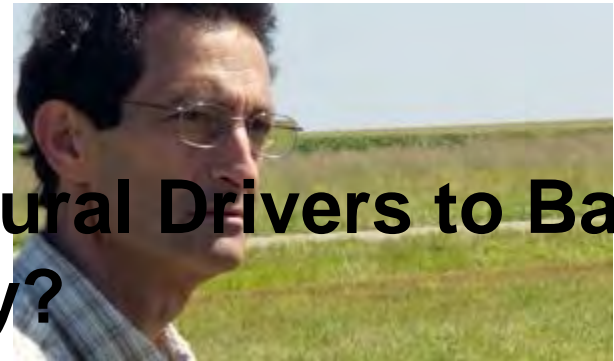
1200 miles new tile/year!

More Diverse Farming Systems

Marsden Long Term Rotation Study-
ISU

Corn/Soybean/Oats/Alfalfa/Alfalfa vs
Corn/Soybean

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



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

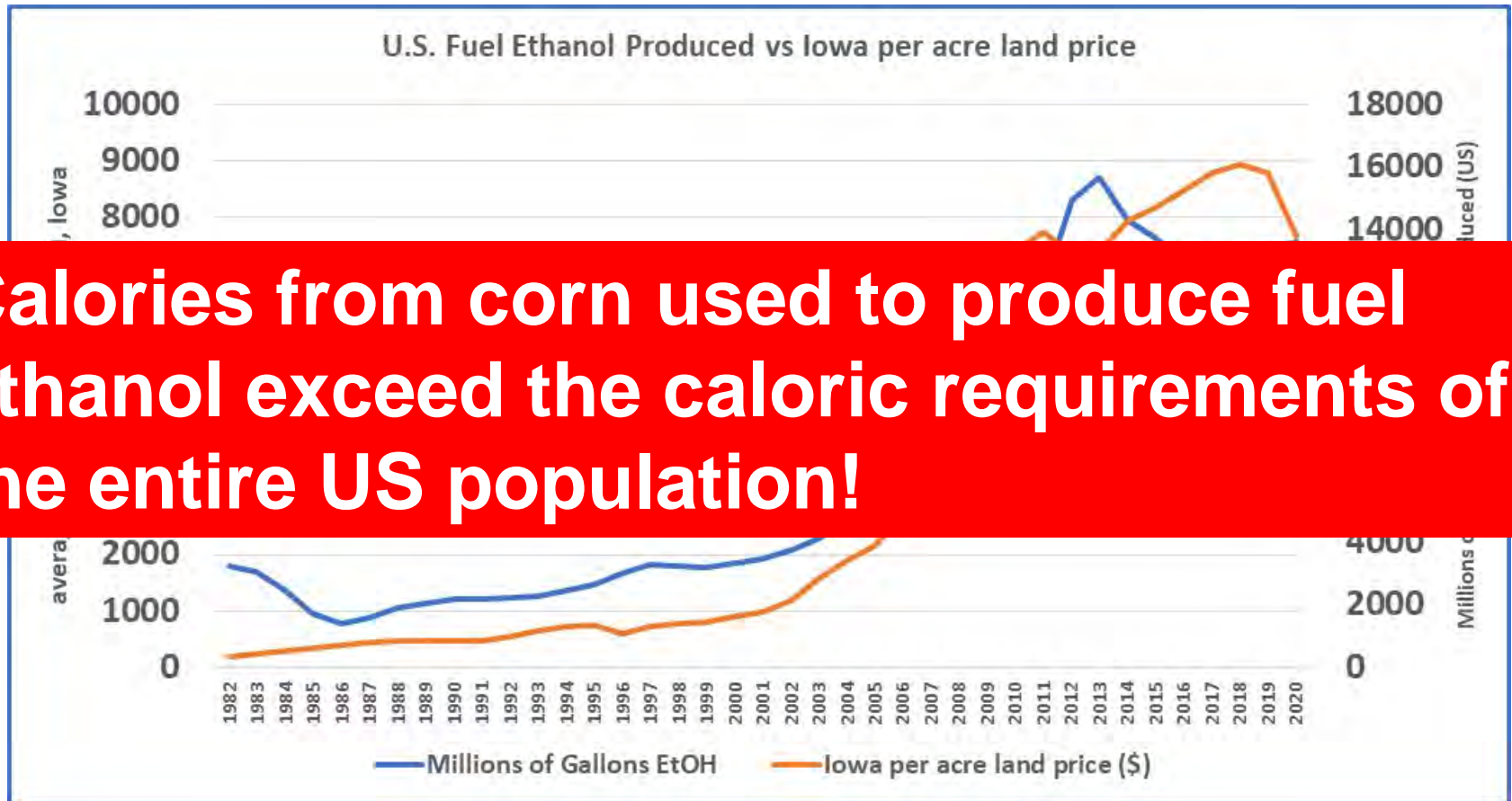
Soil erosion 50% lower

Fossil Fuel use 60% lower

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



Fuel Ethanol



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 ½ 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

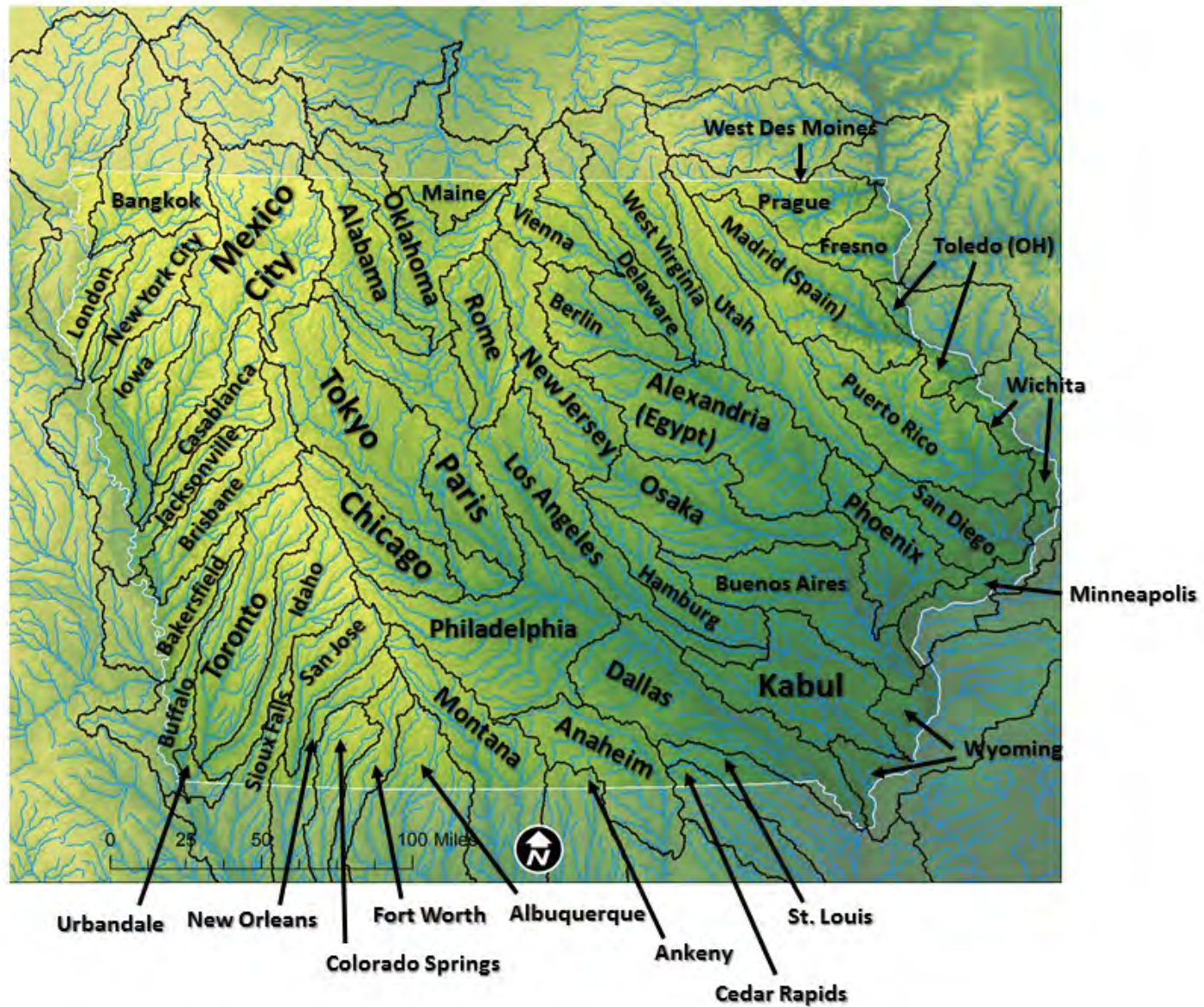
February 14, 2022 | 119 (9) e2101084119 | <https://doi.org/10.1073/pnas.2101084119>

- 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%

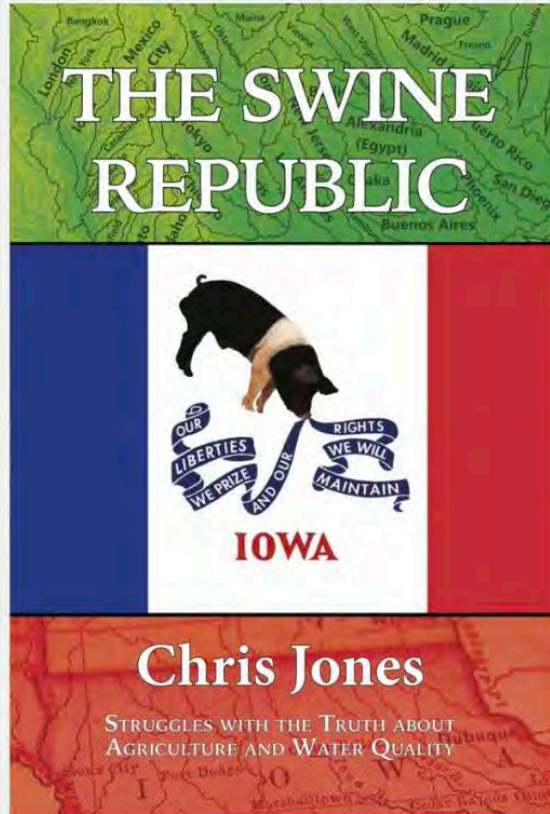
What could we do with 11,000 square miles (7 million acres)?



- 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!**



The Swine Republic



The Swine Republic

\$29.99

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**The Swine Republic:
Struggles with the
Truth about Agriculture
and Water Quality |
Chris Jones | Foreword
by Tom Philpott | \$29.99
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“Truly brilliant—new ways of thinking about stuff that’s right in front of us. I guarantee this will make you see not just the Midwest

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