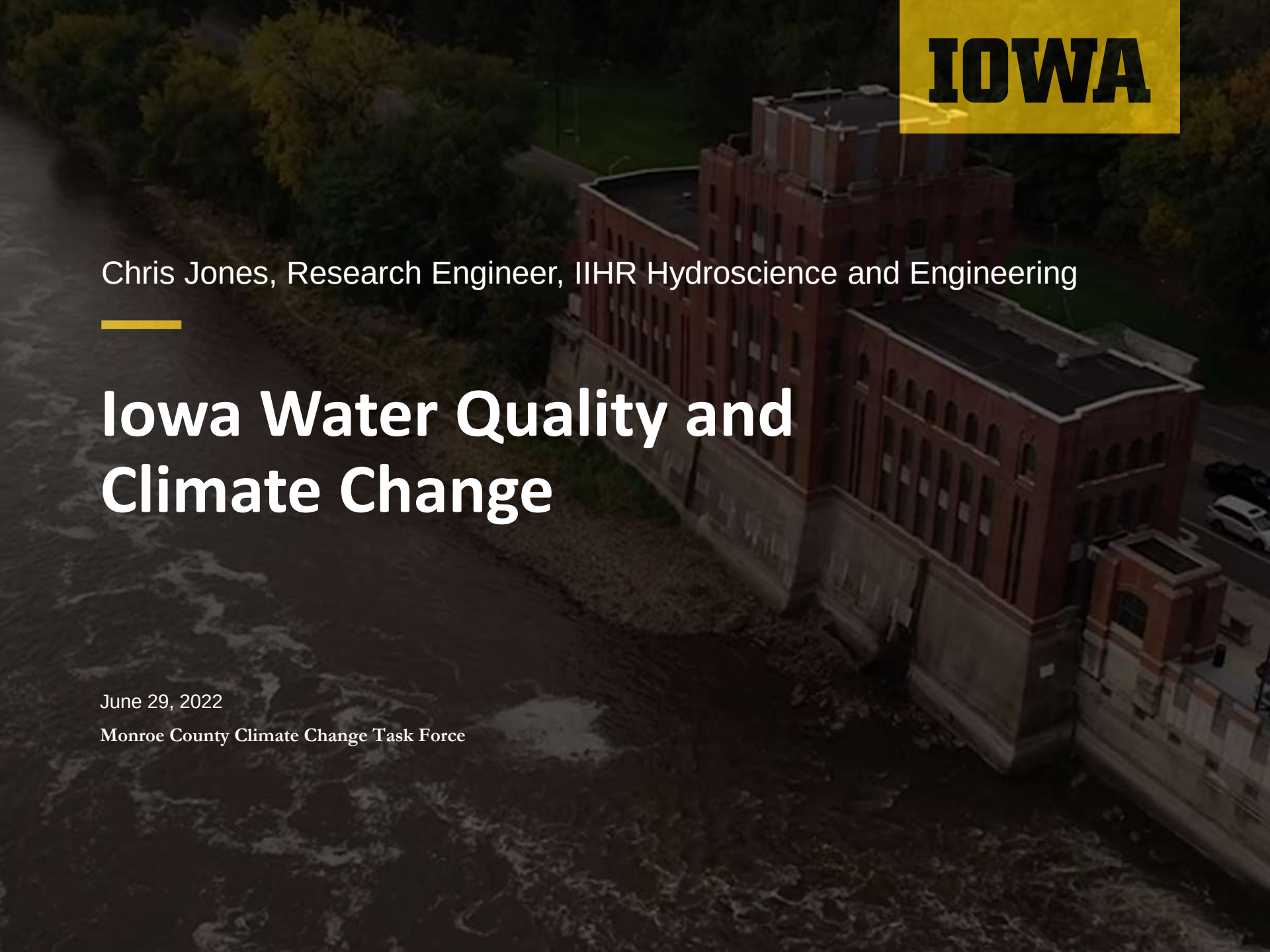




IOWA

Chris Jones, Research Engineer, IIHR Hydroscience and Engineering

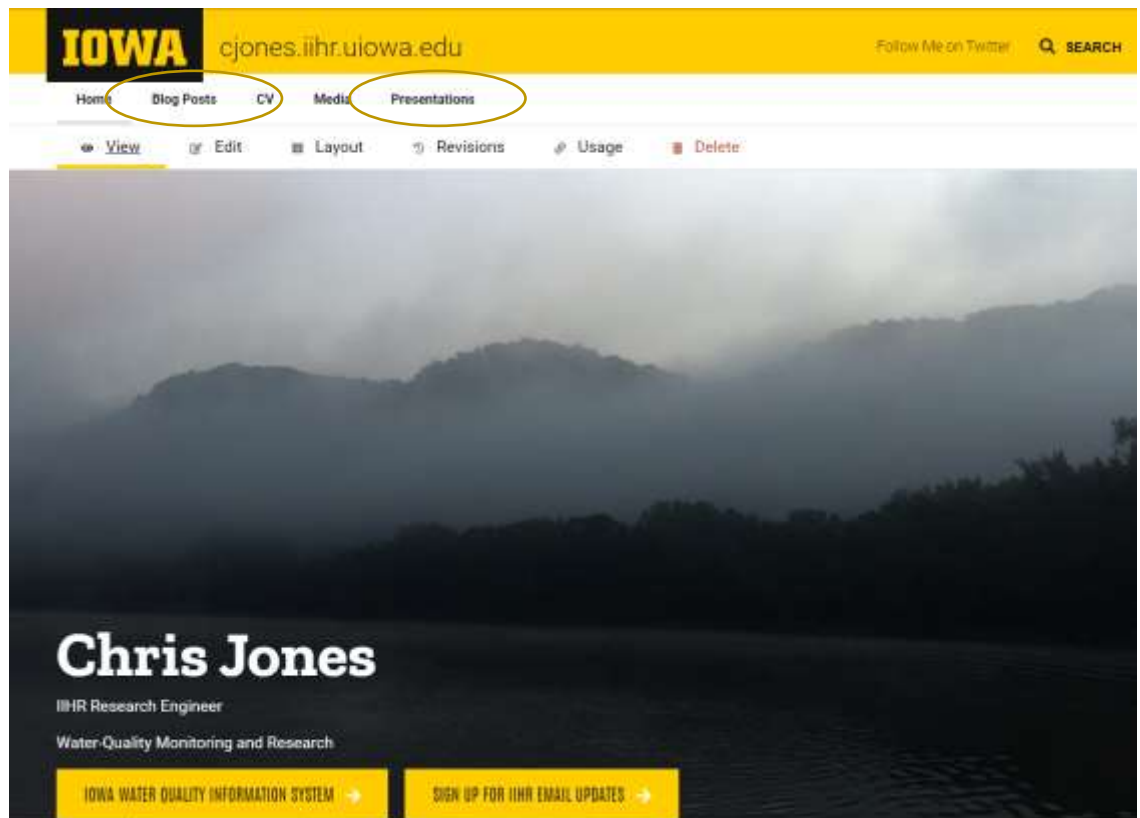
Iowa Water Quality and Climate Change

June 29, 2022

Monroe County Climate Change Task Force

Slides Available at:

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



IIHR Water Quality Sensor Network

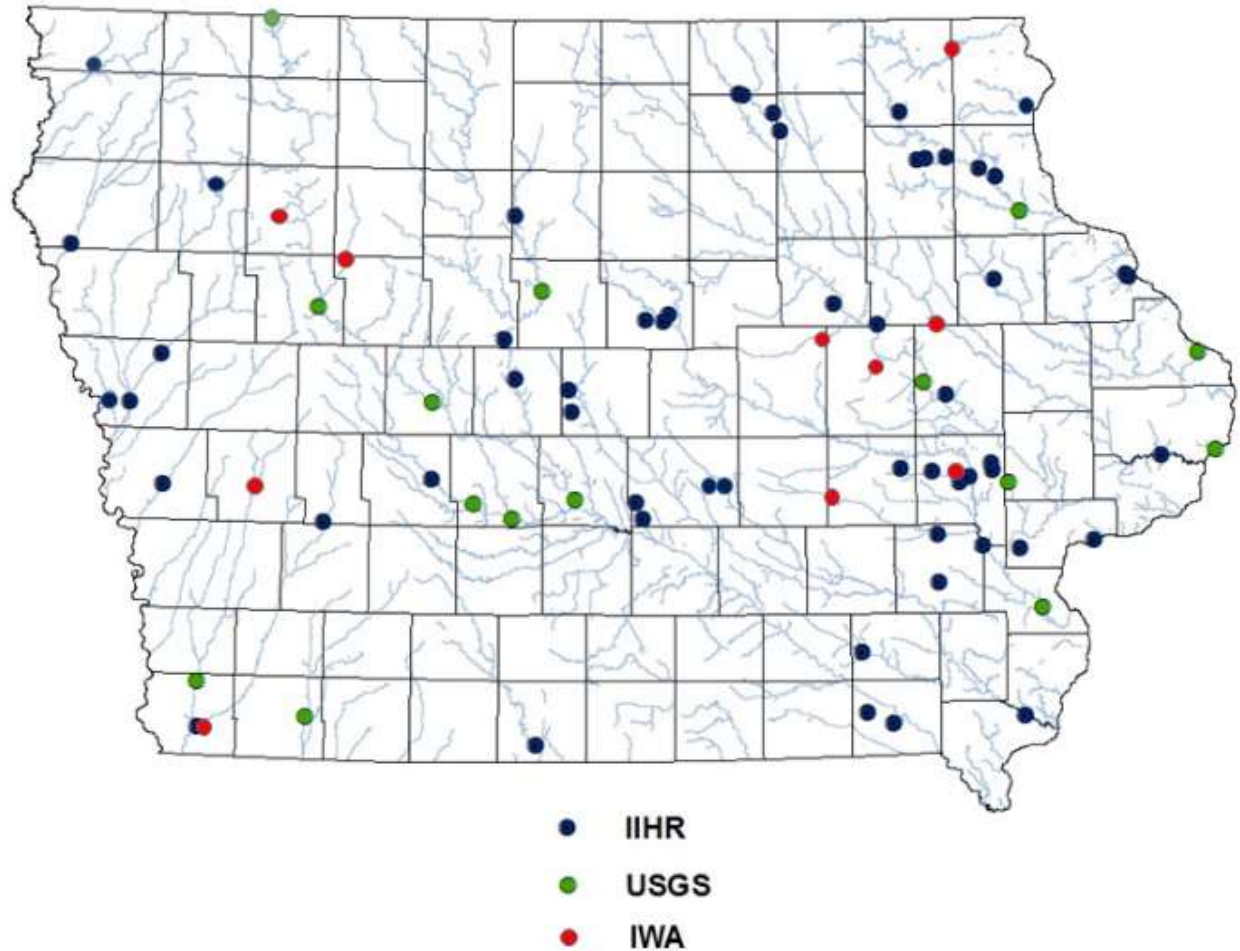


Sites

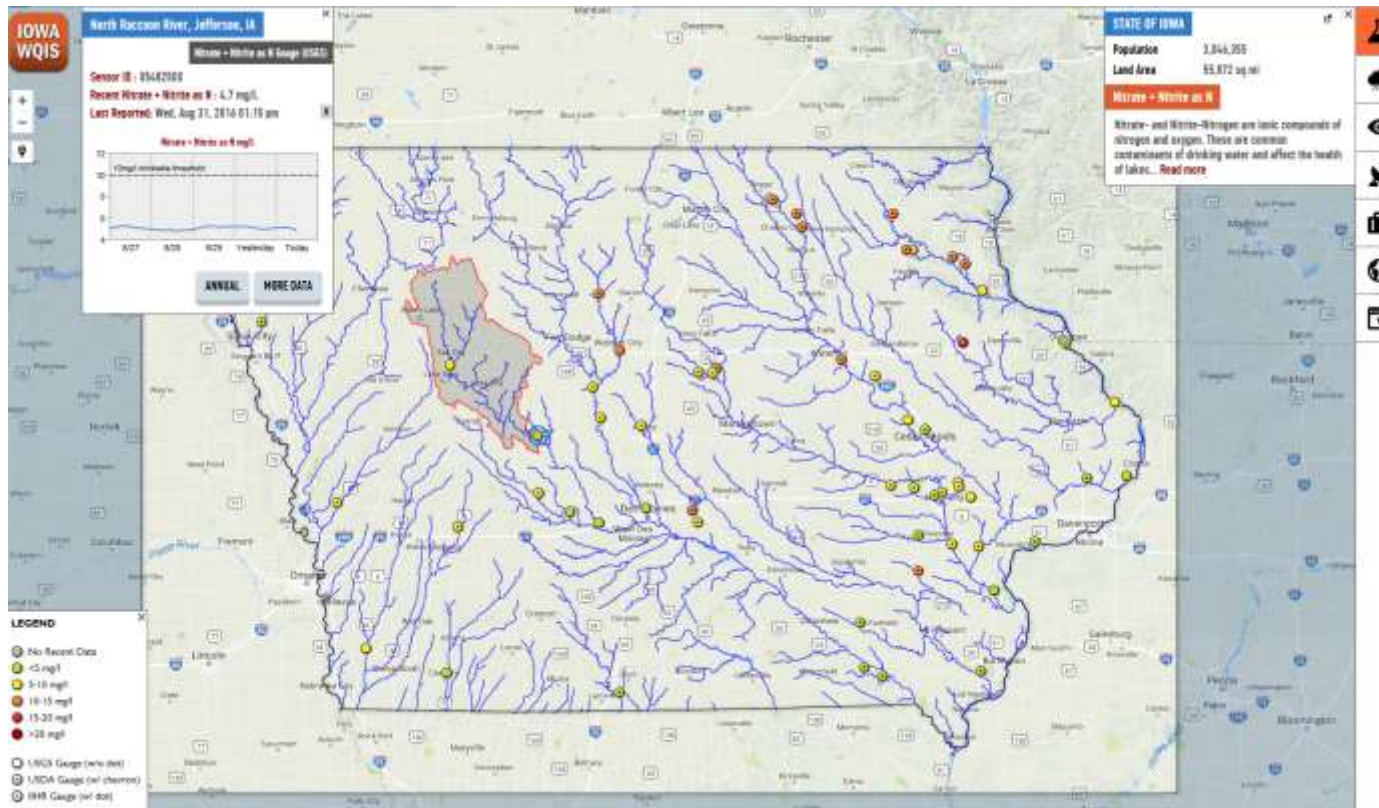
70+ sites
Nitrate-N

20-25 sites

- Temperature
- pH
- SC
- DO
- Turbidity



Iowa Water Quality Information System



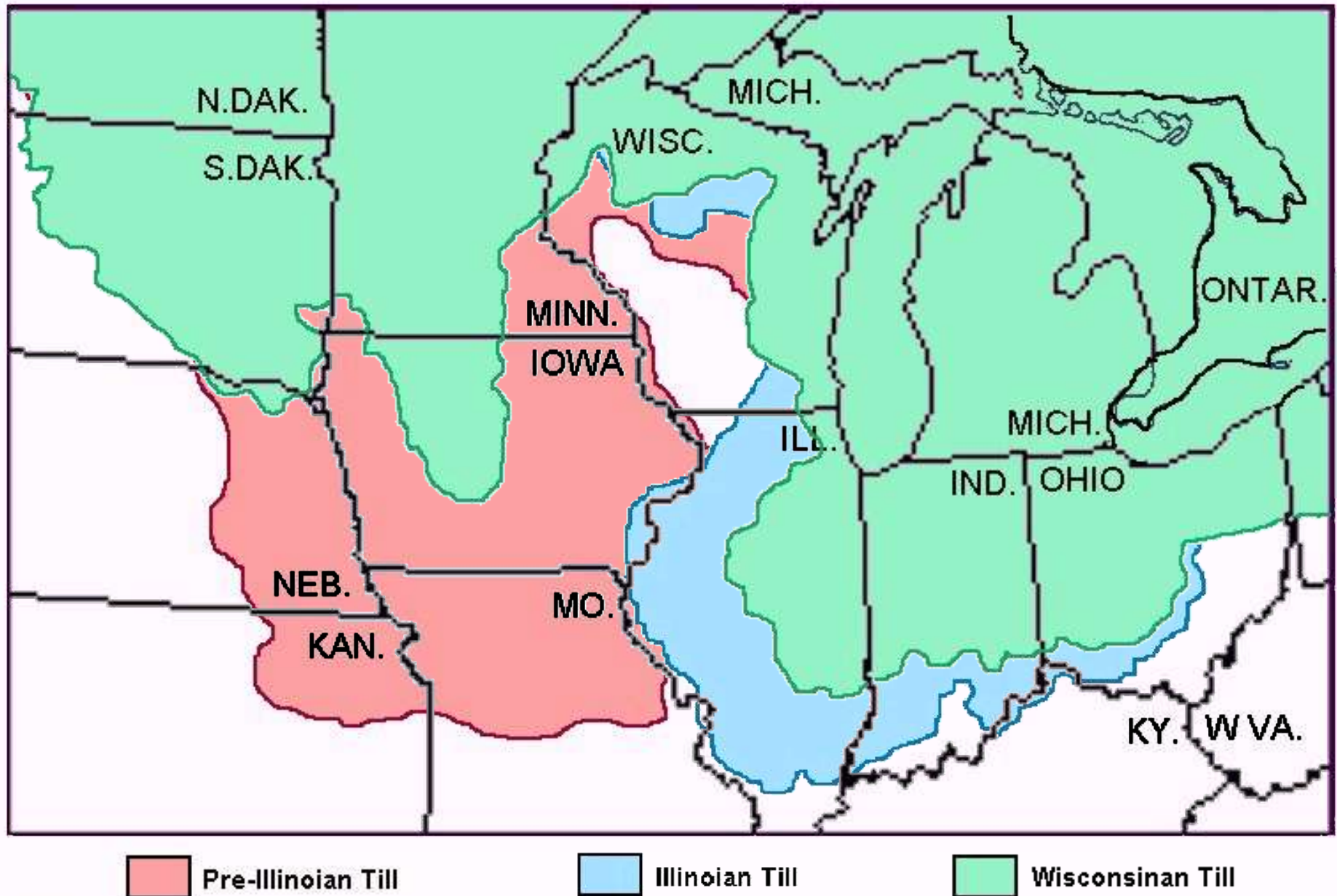
iwqis.iowawis.org/

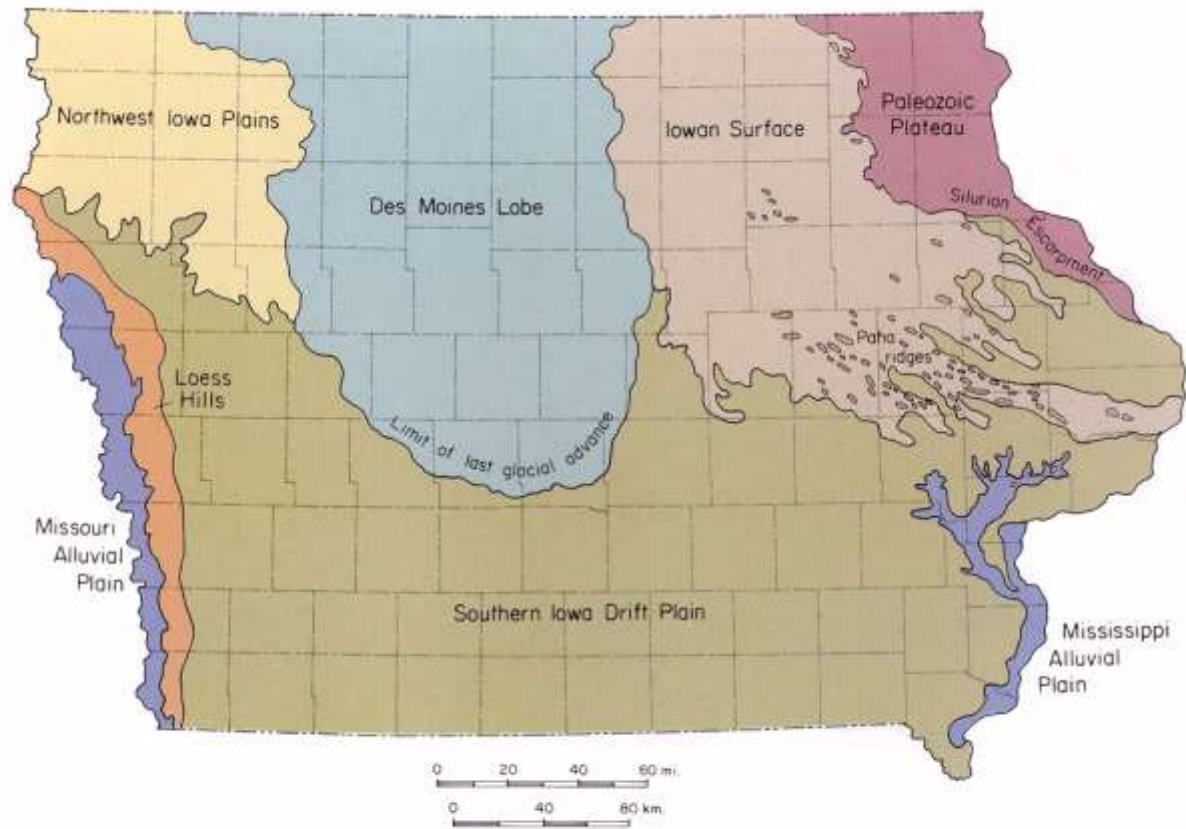
<http://iwqis.iowawis.org/app/?datetime=2017-06-06T13:00>

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IIHR-Hydroscience & Engineering

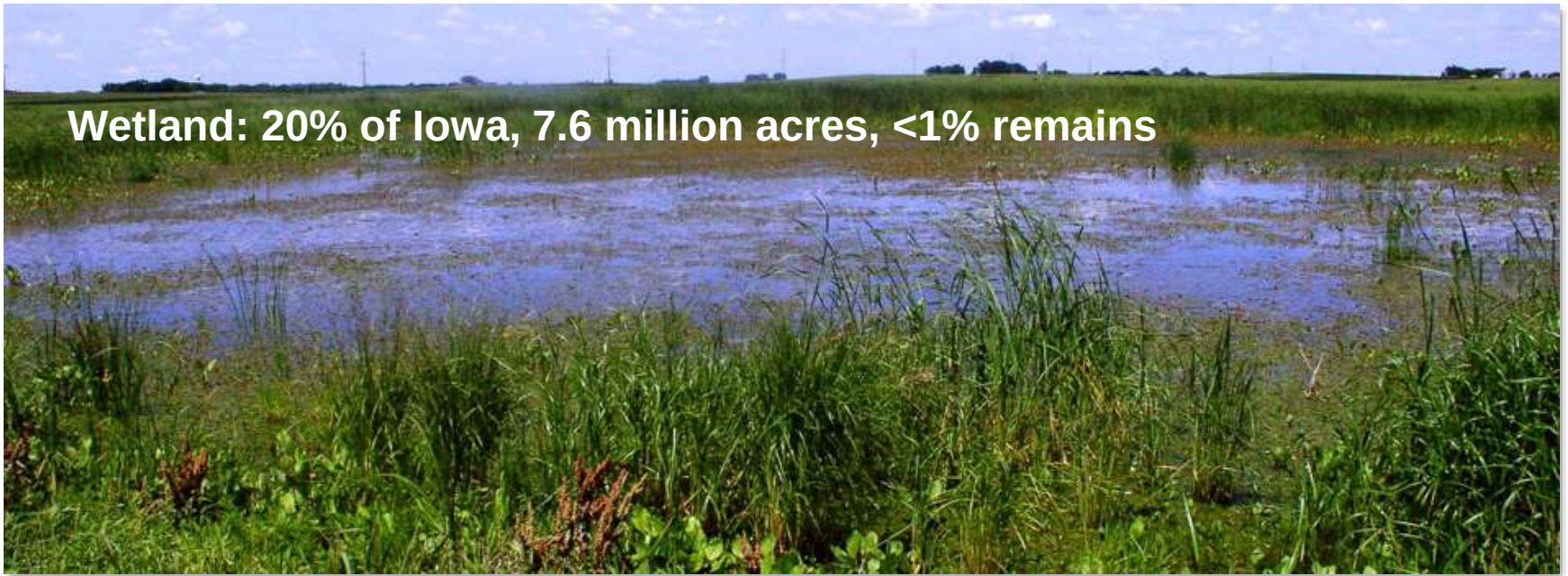
30,000 – 10,500 years





Landform Regions of Iowa

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



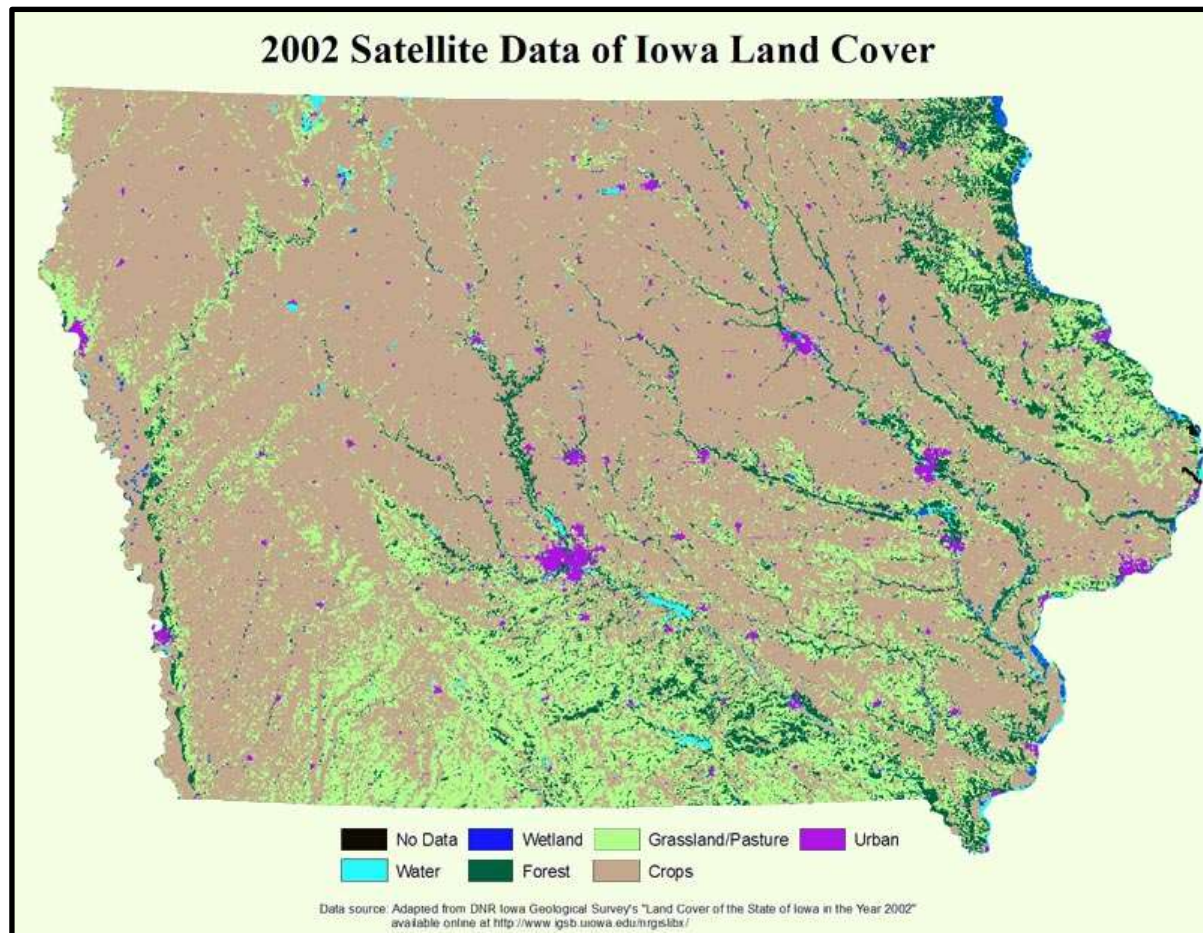
Prairie: 70%, 0.1% Remains



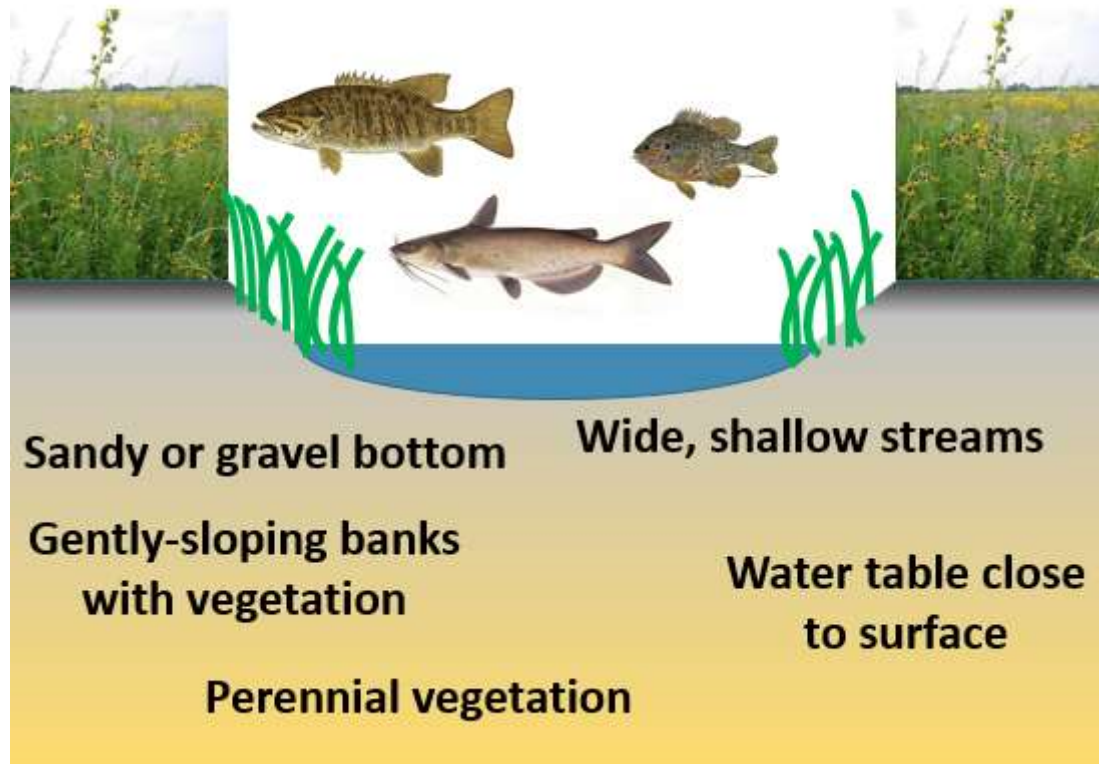
Oak Savannah: ~5%, < 1% remains



Iowa Land Cover



Pre-European Settlement Streams



Breaking the prairie



Hydrological Modification: 1860s-1910s



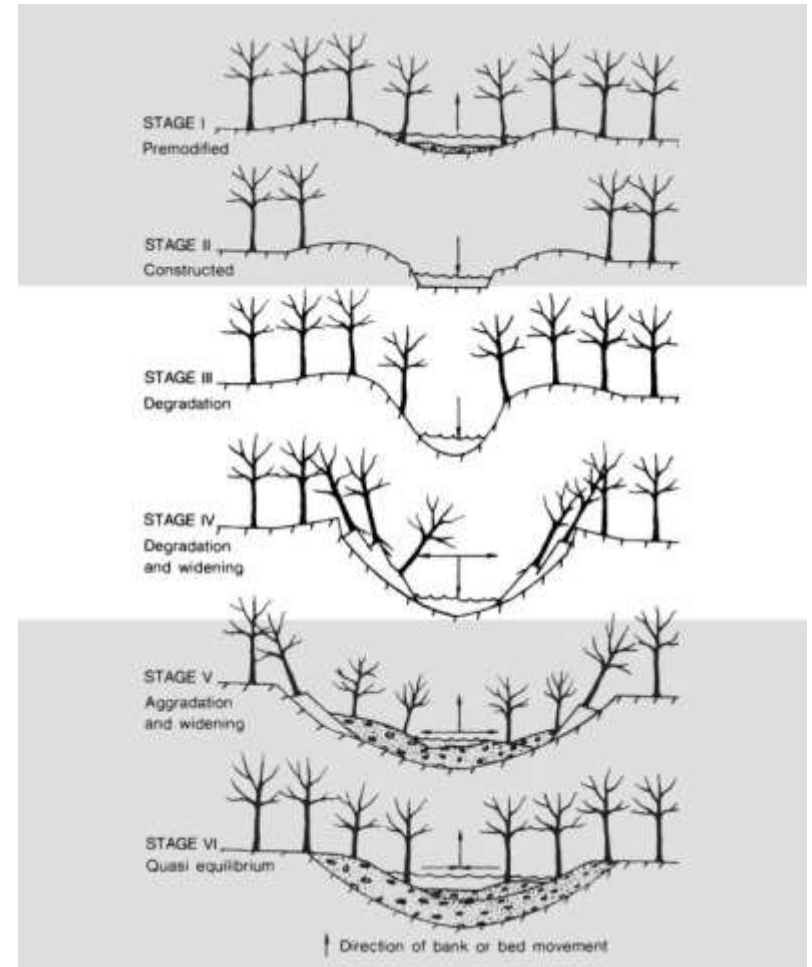
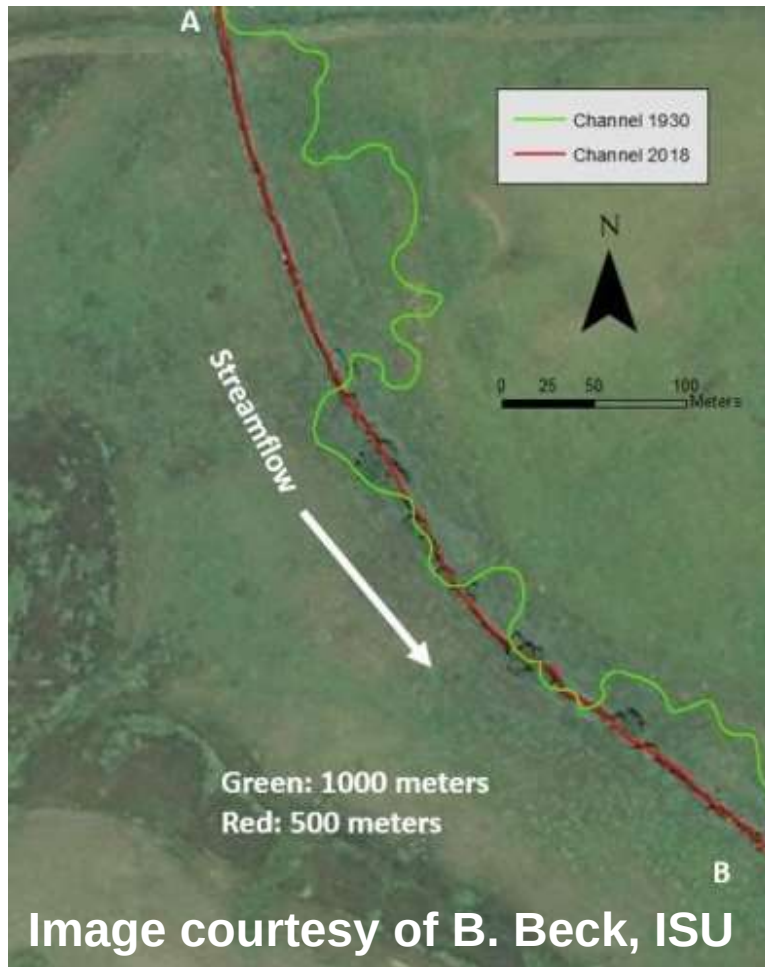
Tiling field now



Source of the Iowa River



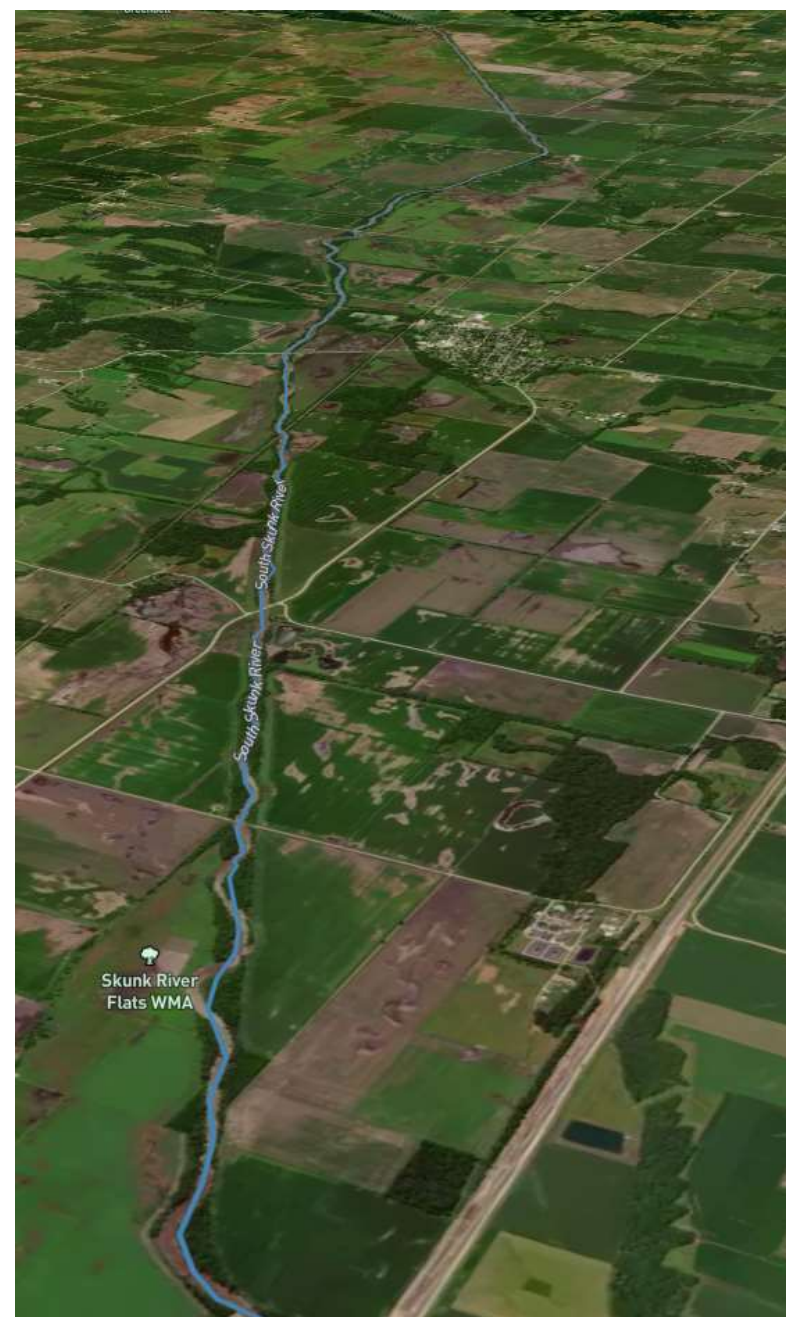
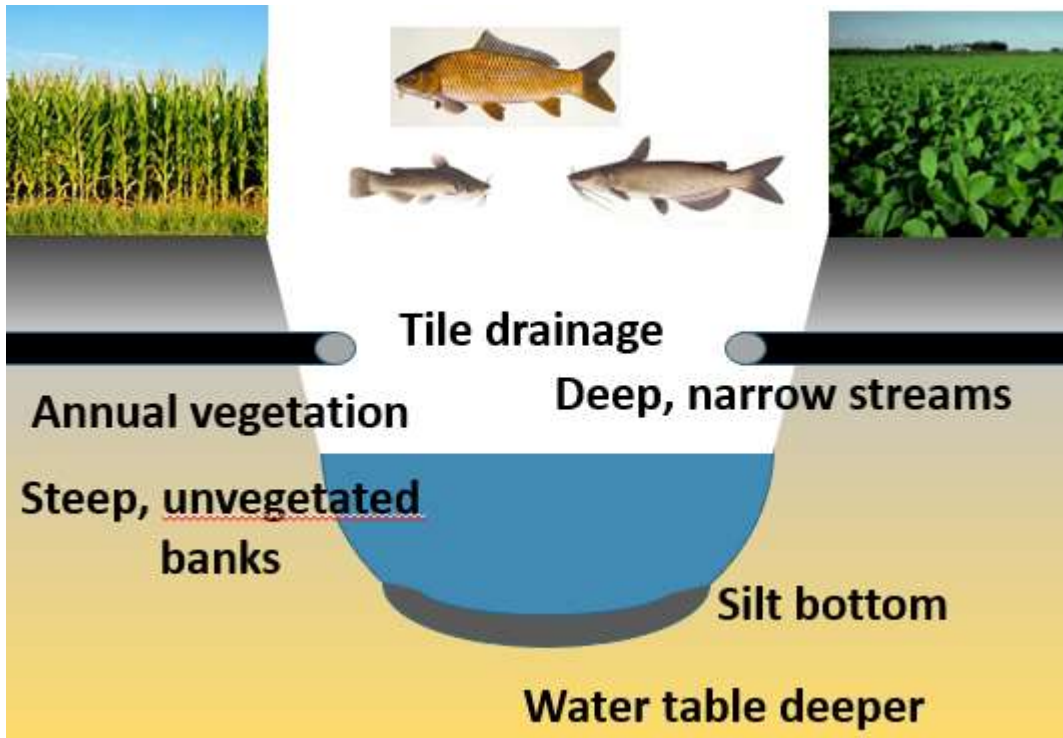
Stream Straightening, 1930-1975



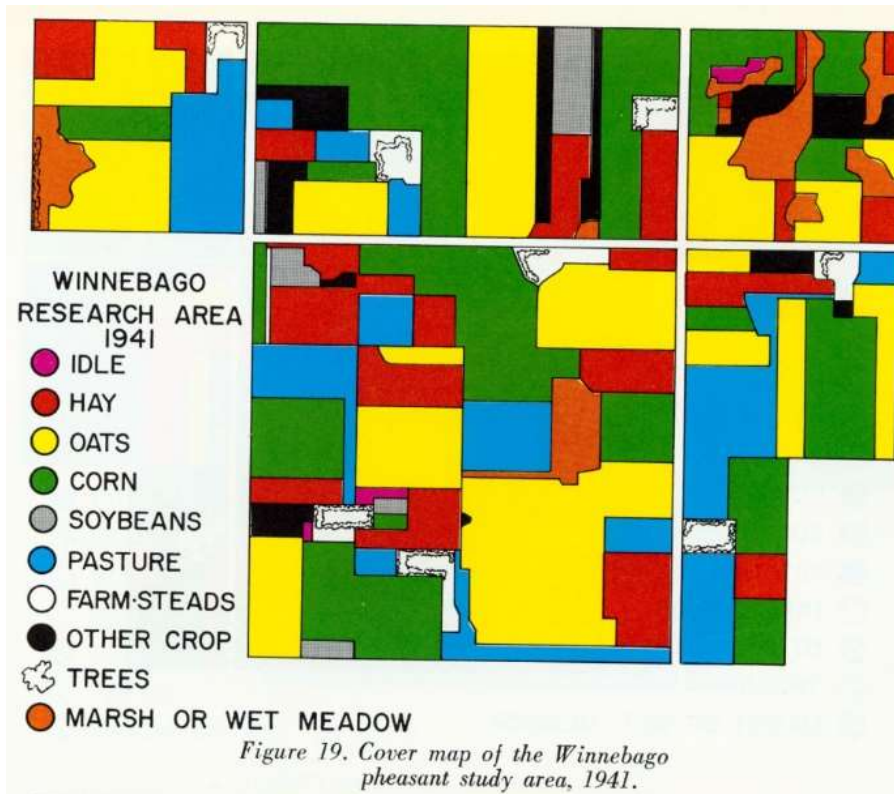


Images courtesy
of B. Beck, ISU

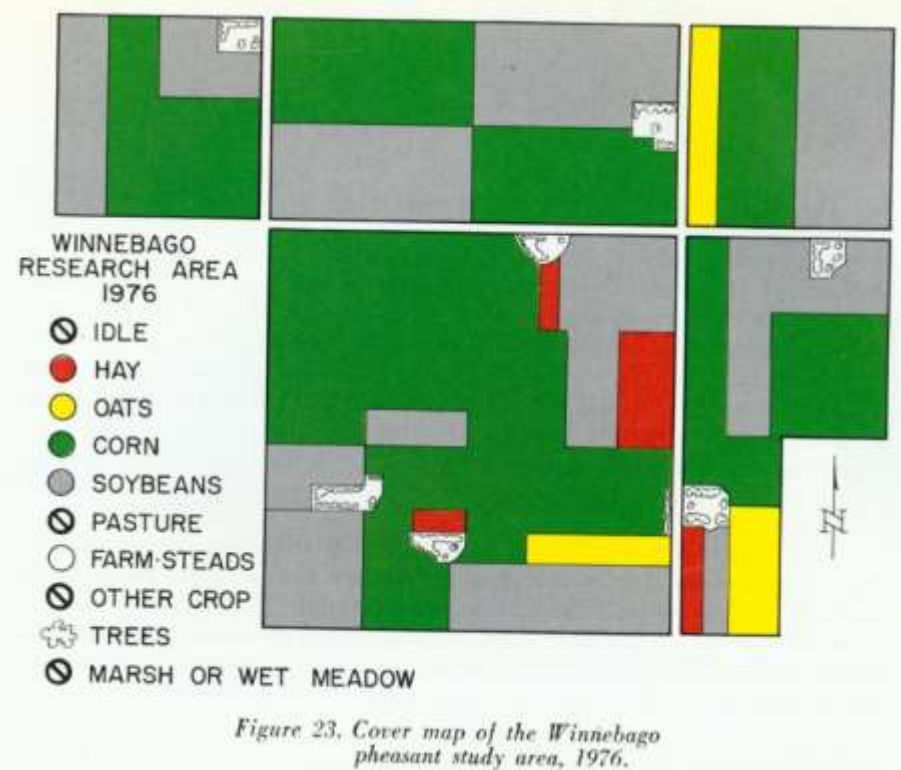
Modified Streams



Transformation of Iowa Farms



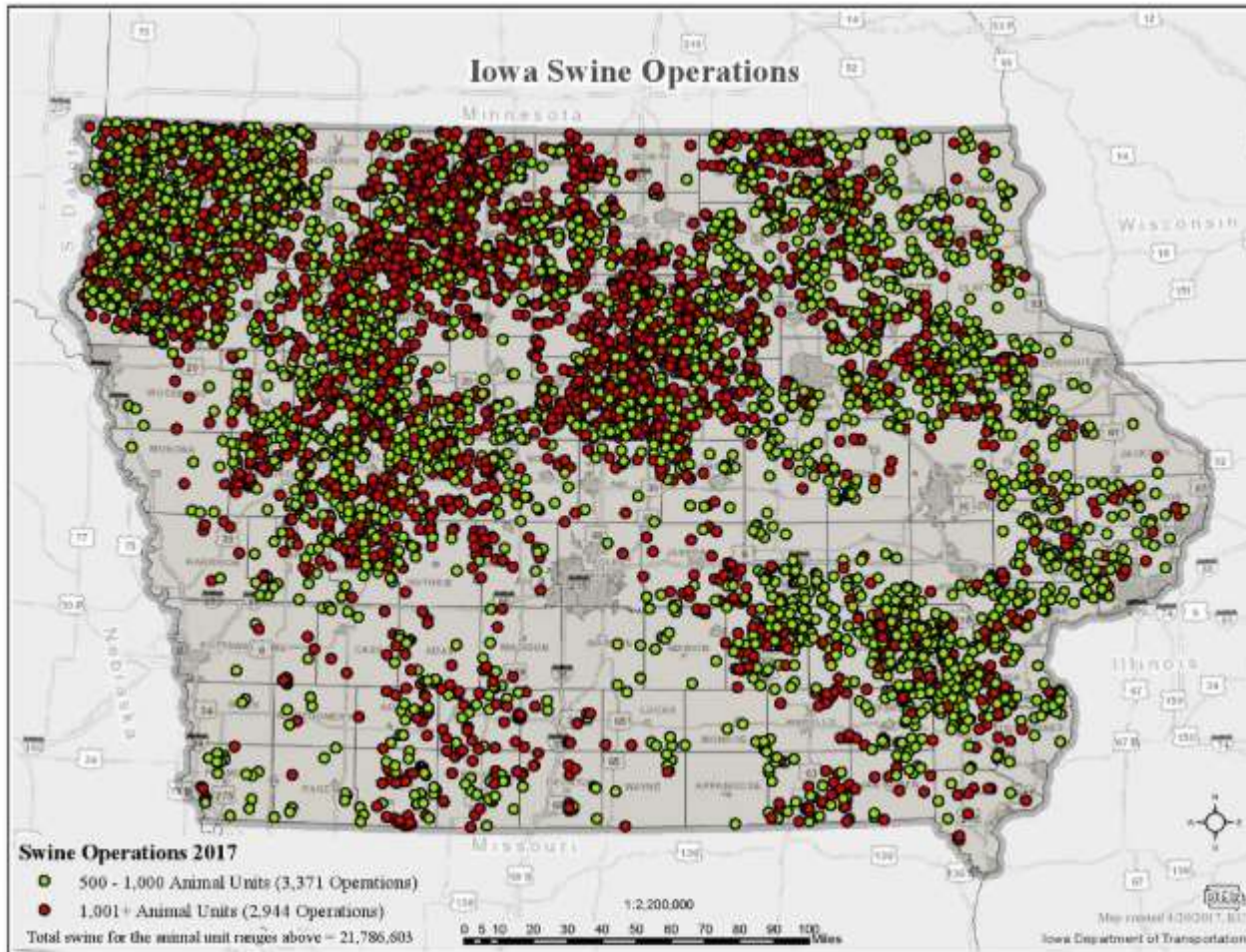
1941



1976



8000 CAFOs



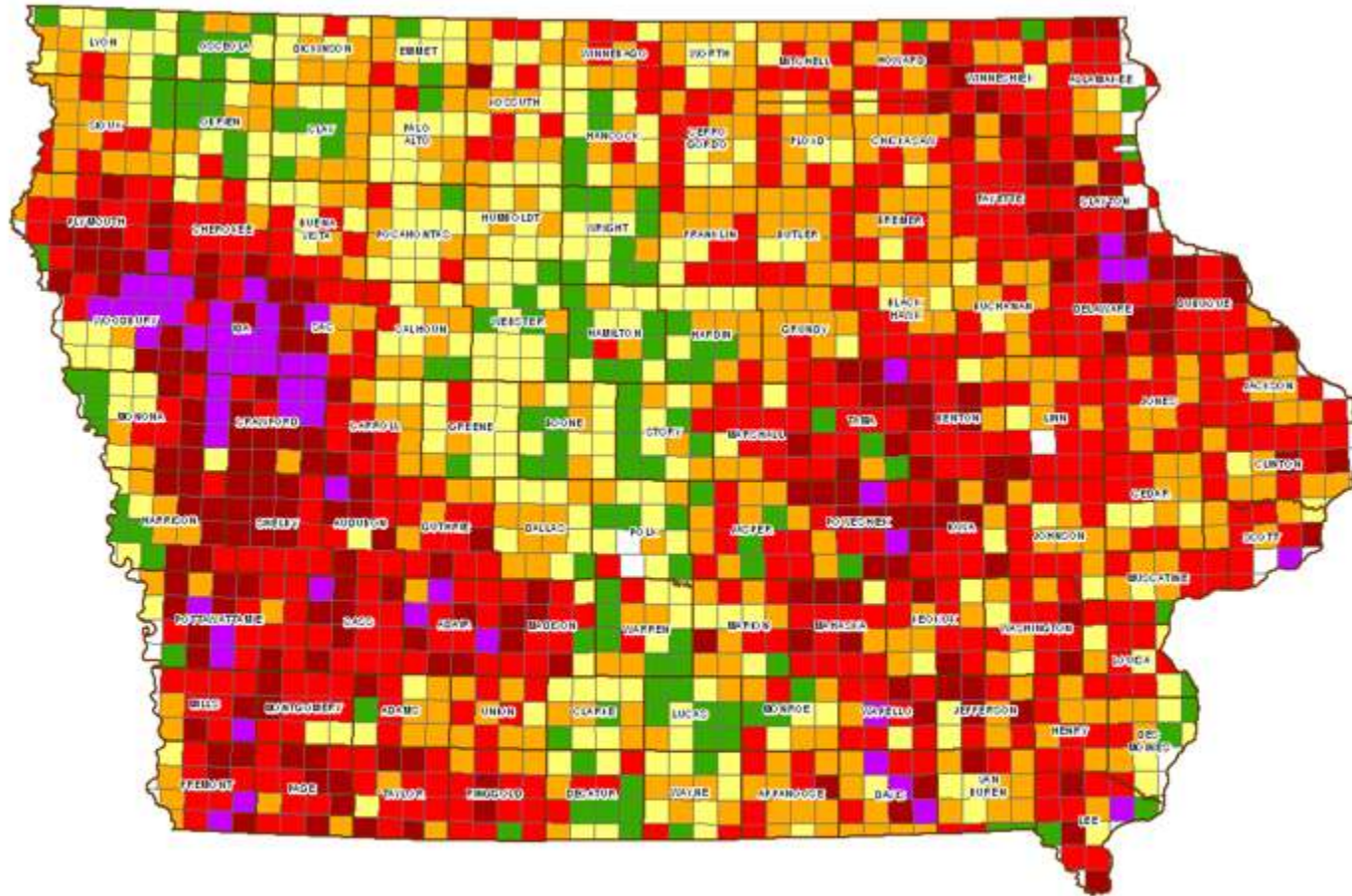
Problem of Scale

- 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

Water Quality Consequences

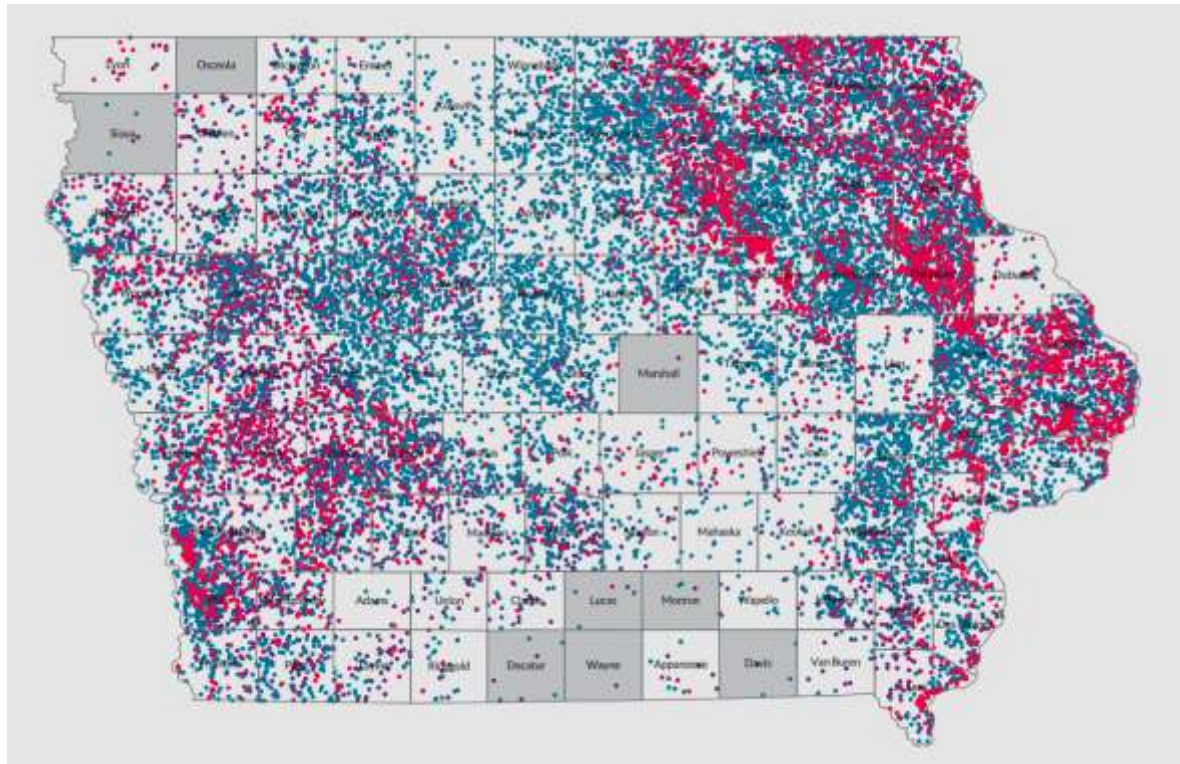


Soil loss is still very high



Source:
EWG

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

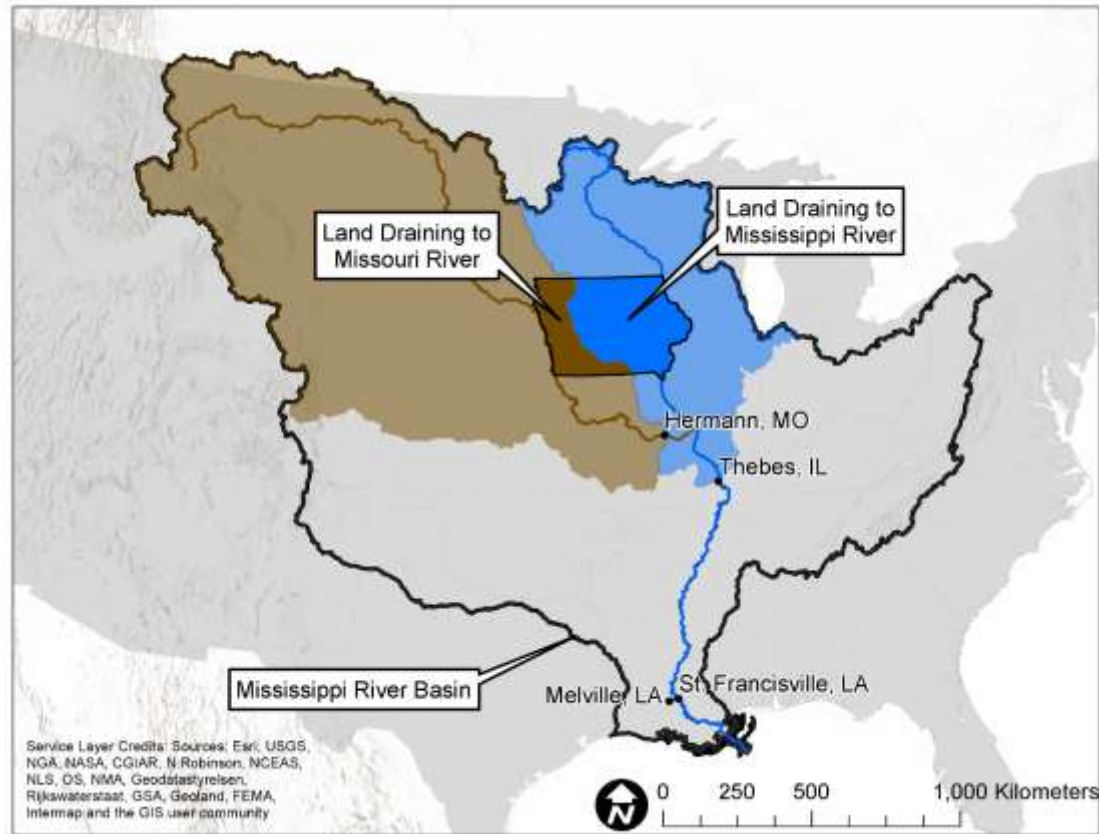


IOWA

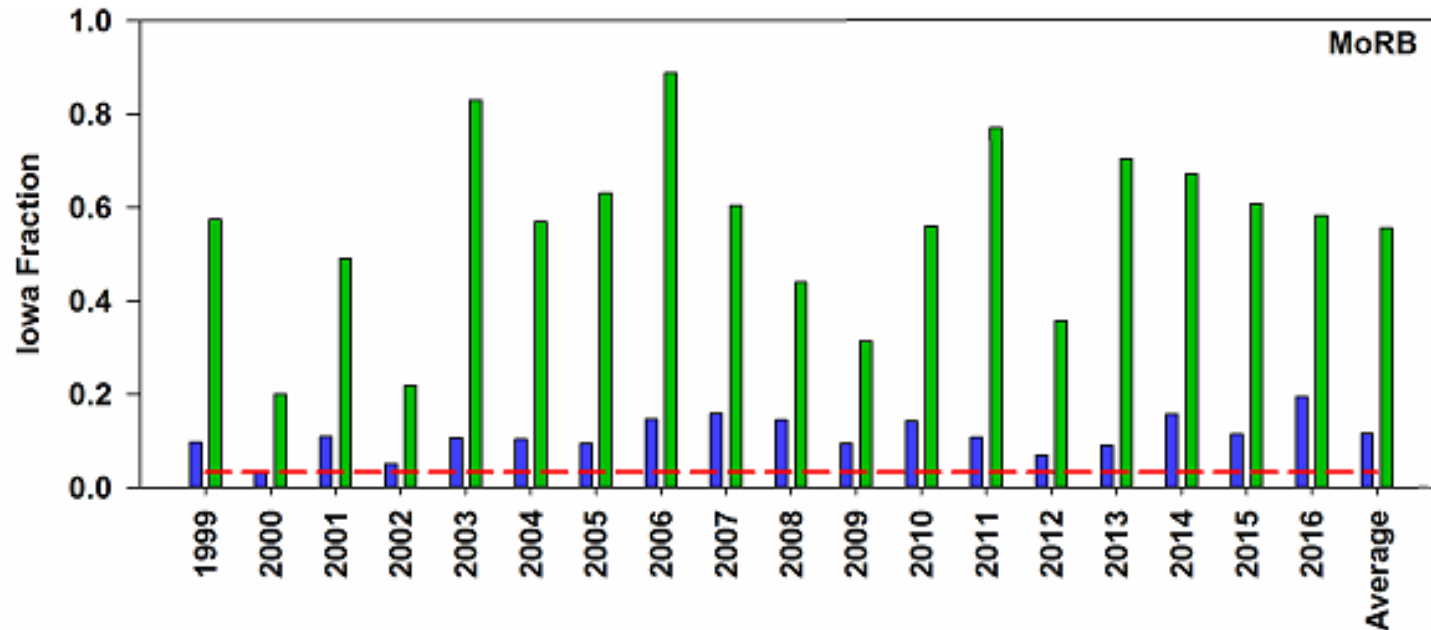
IIHR-Hydrosience & Engineering

Des Moines, IA

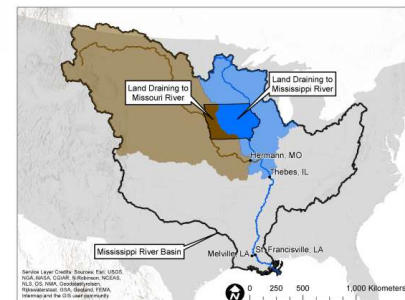
Iowa Contributions



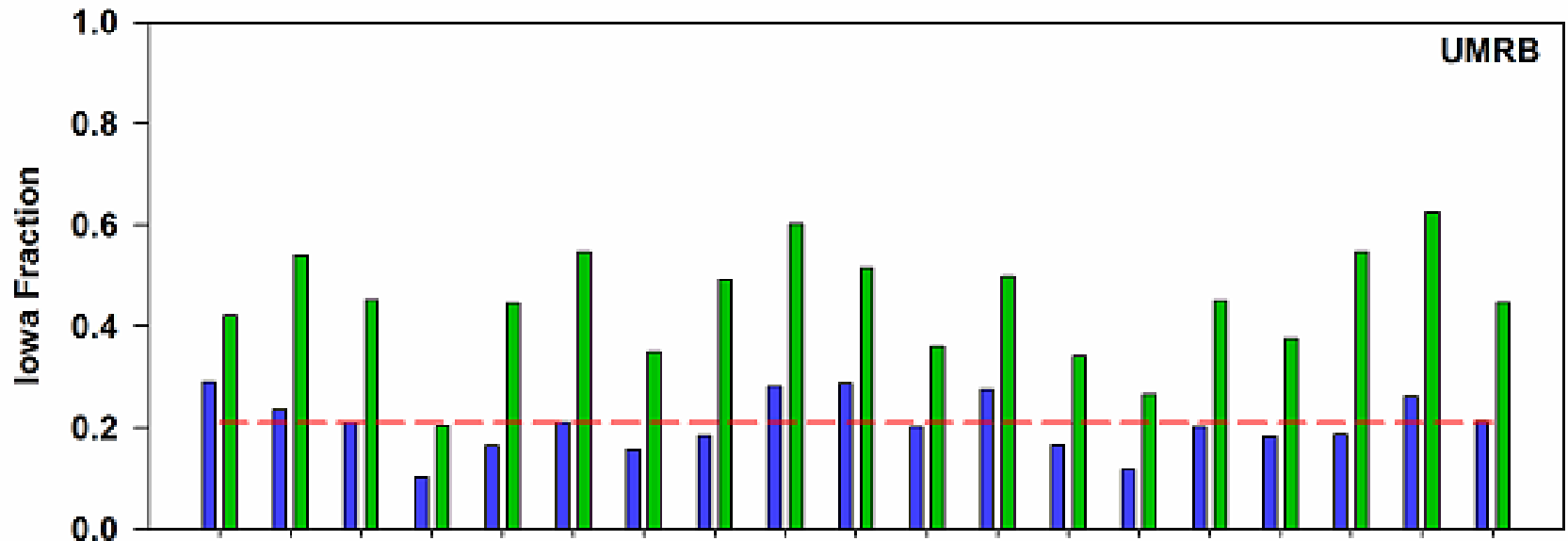
Missouri Basin: Nitrogen



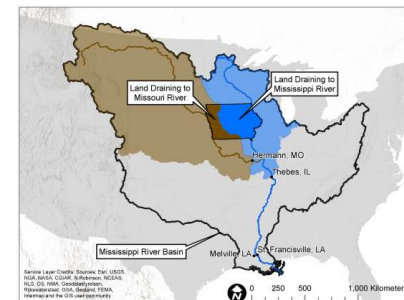
3.3% of the land
12% of the water
55% of the nitrate



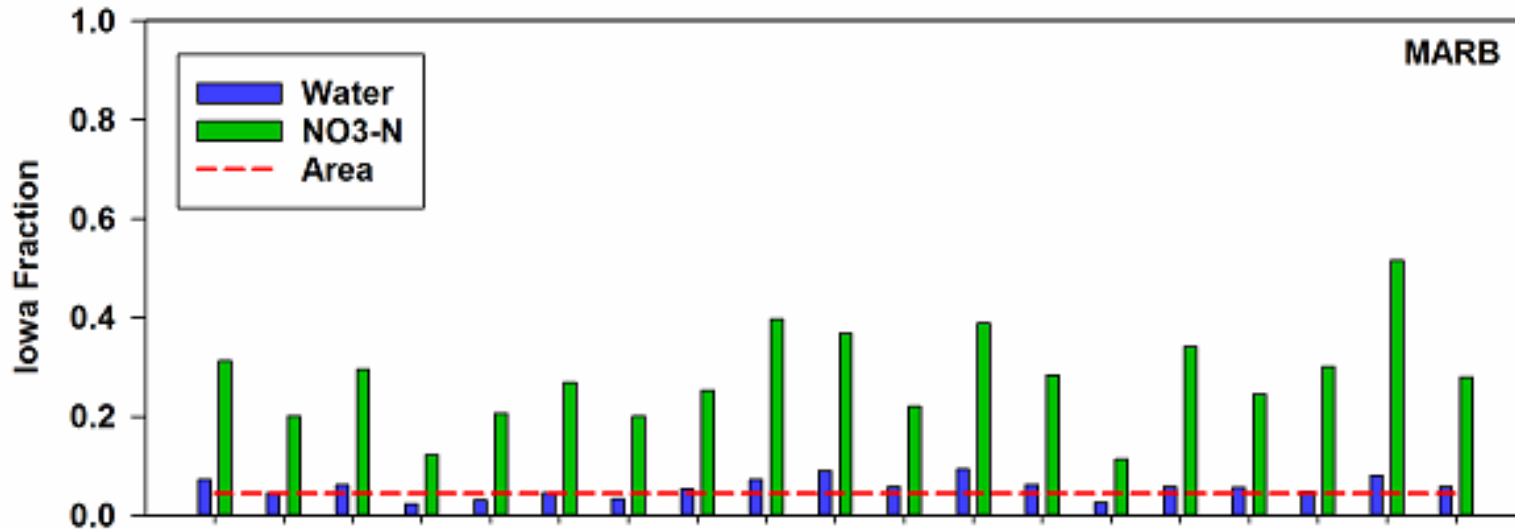
Upper Mississippi: Nitrogen



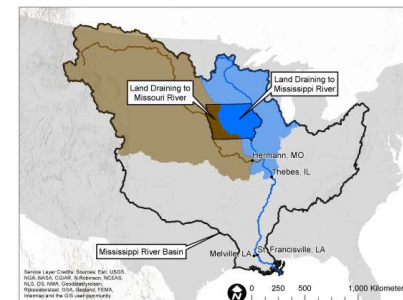
21% of the land
21% of the water
45% of the nitrate



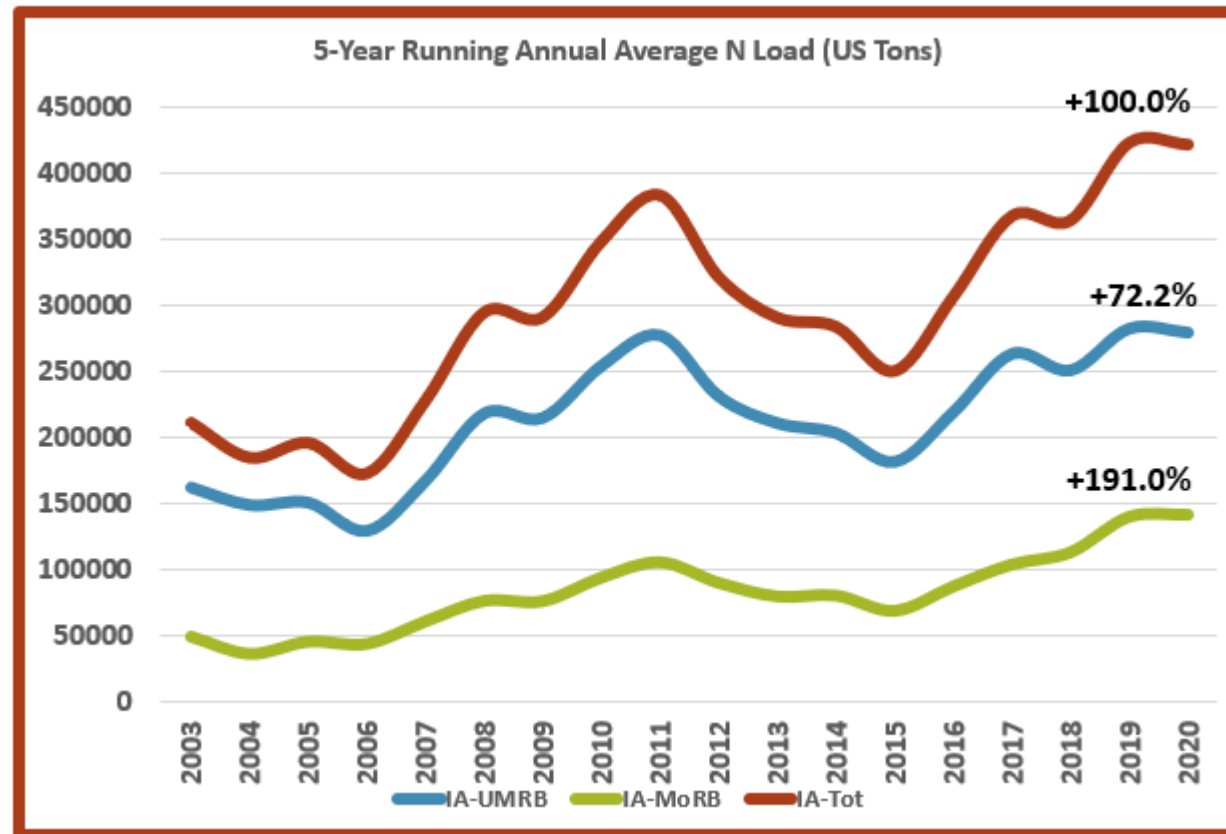
Mississippi-Atchafalaya: Nitrogen



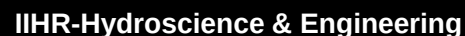
4.5% of the land
5.9% of the water
29% of the nitrate



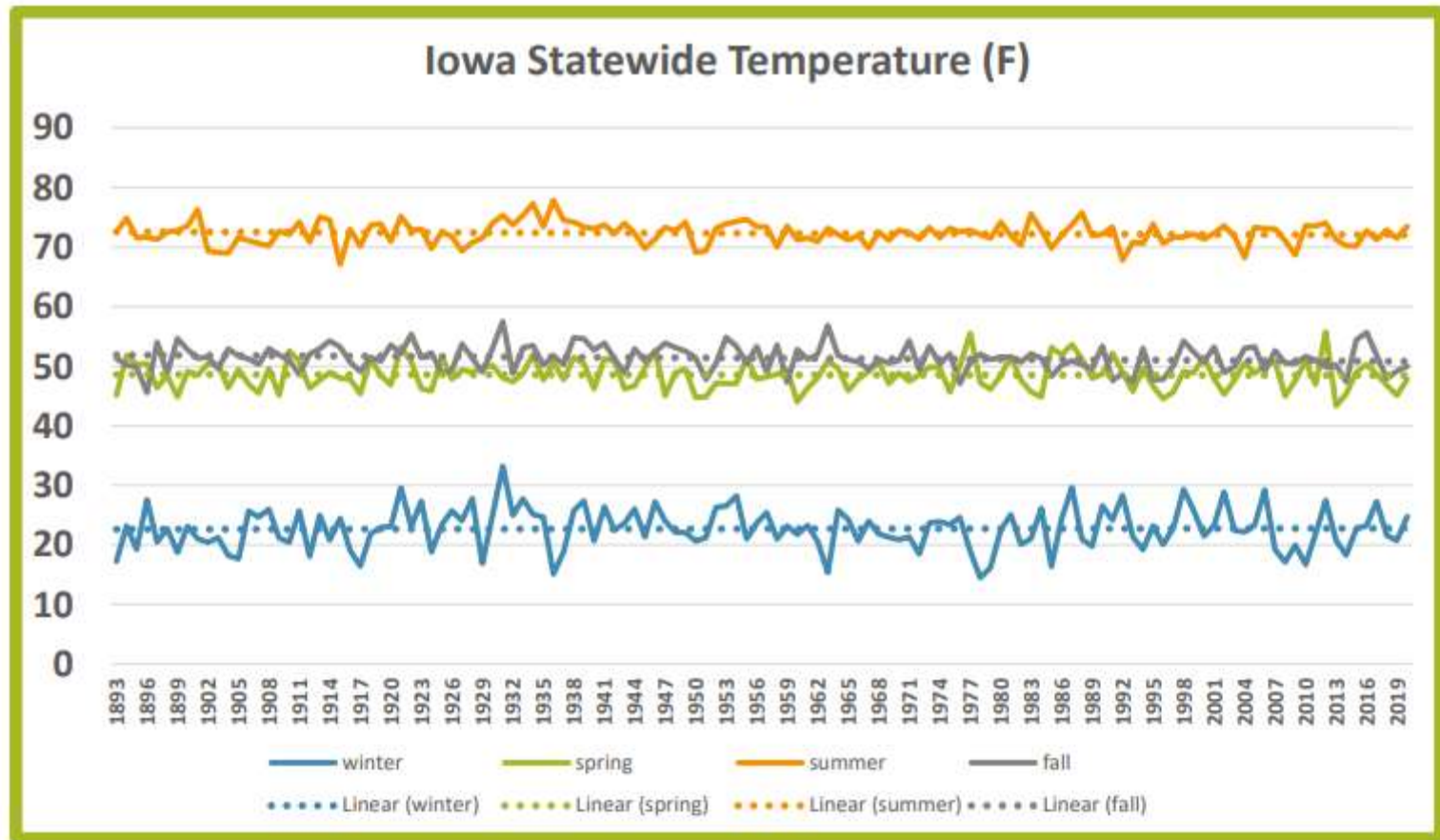
How Much Nitrogen Leaves Iowa?

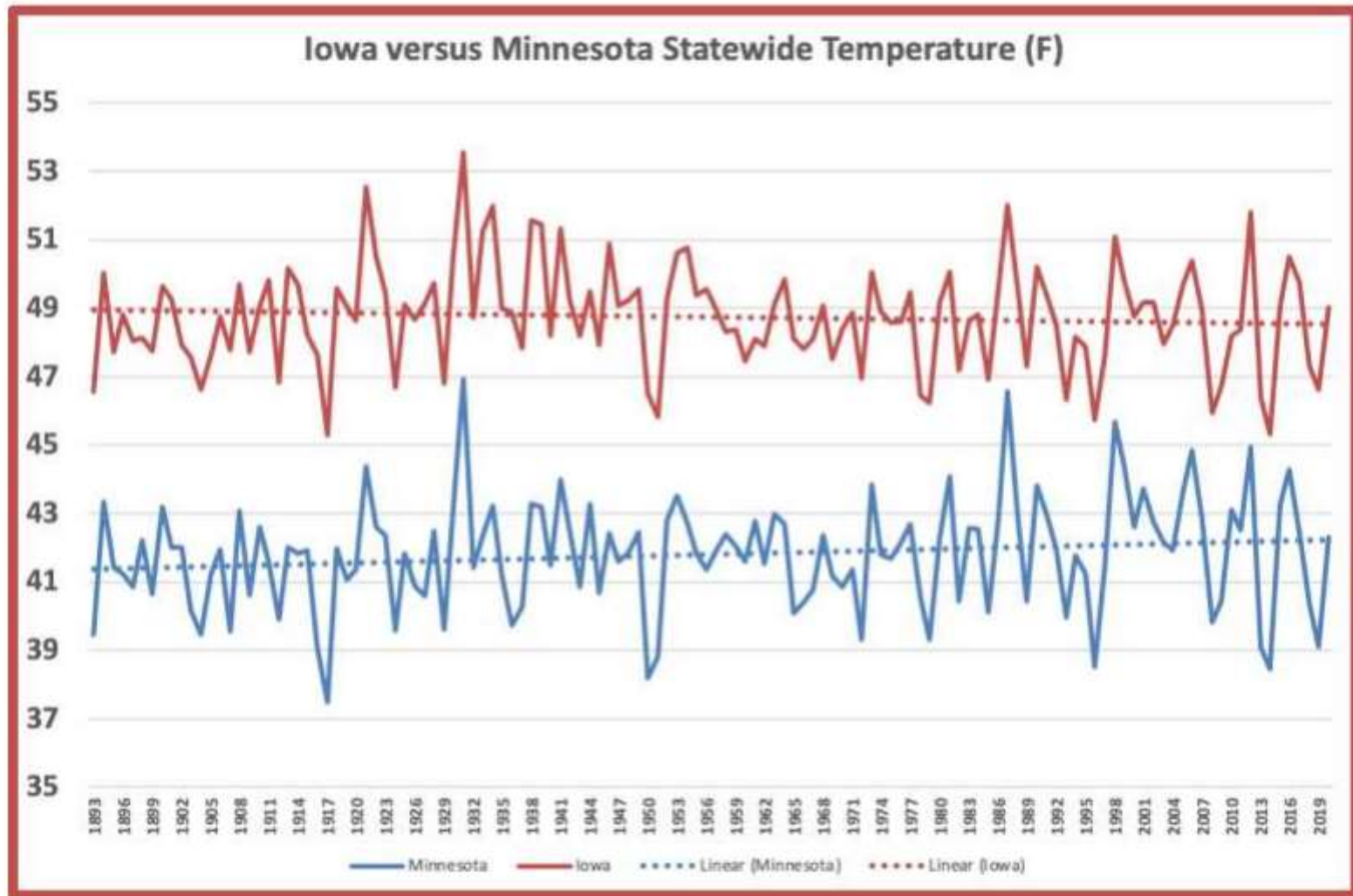


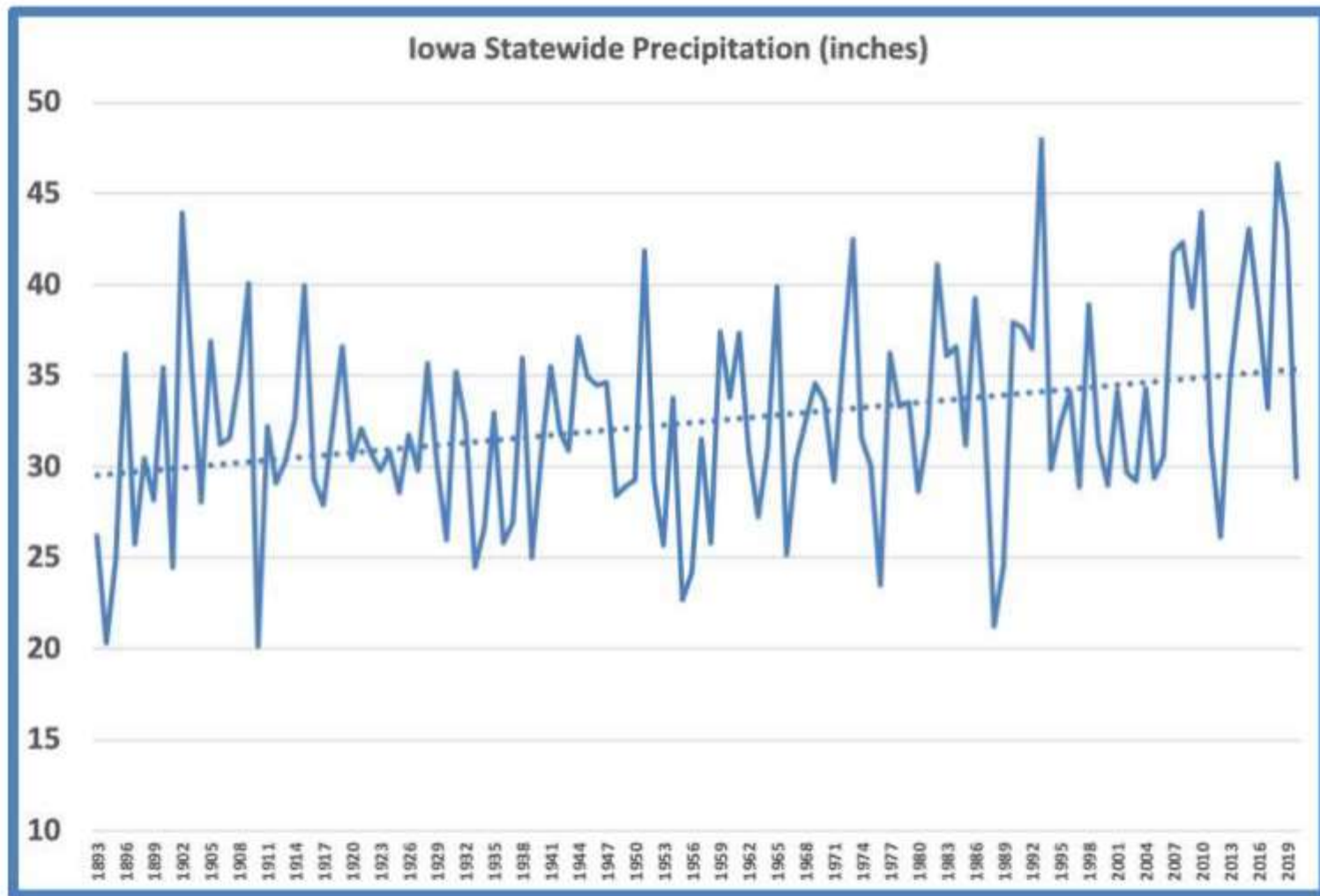
“P loads 43% higher in 2017 than in 2004”

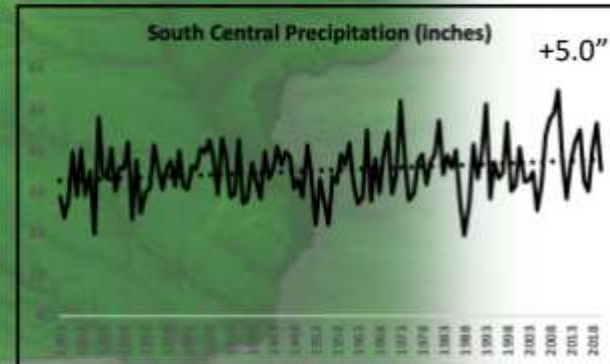
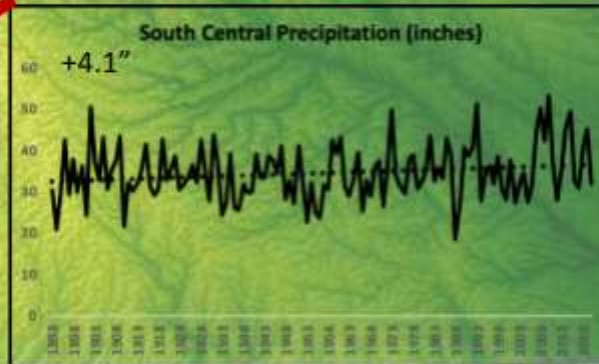
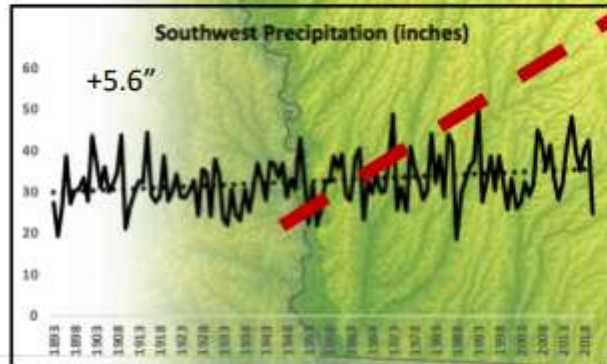
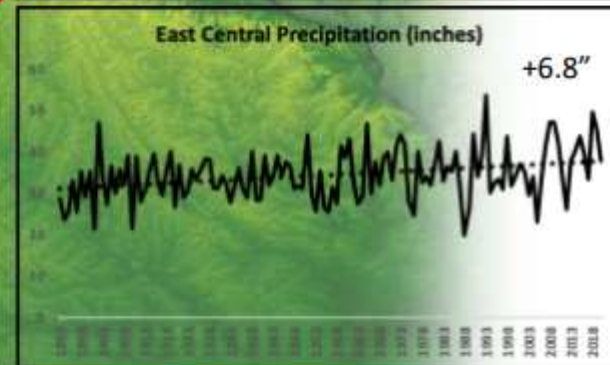
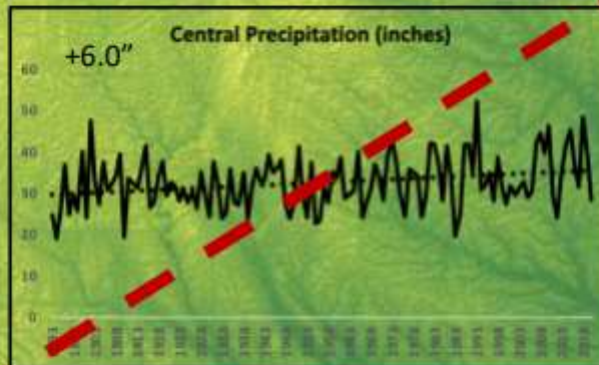
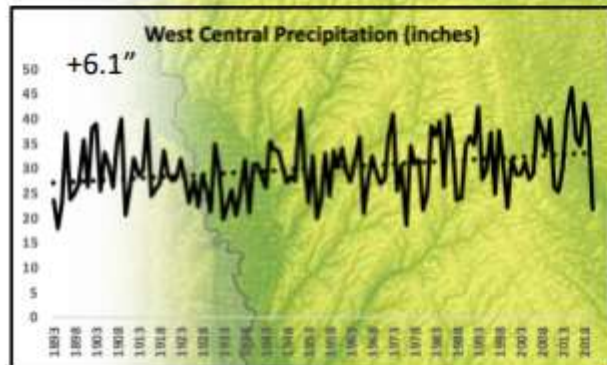
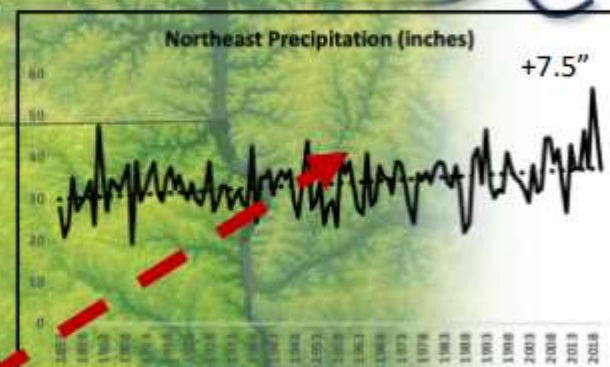
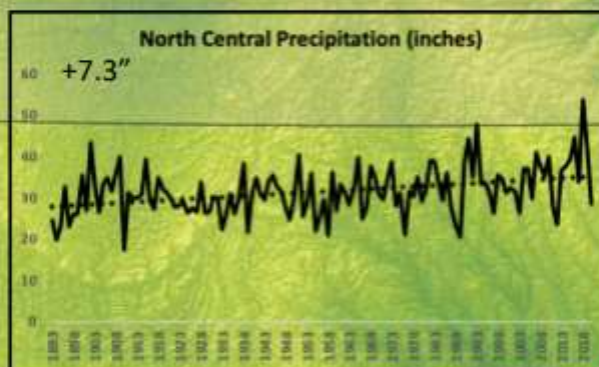
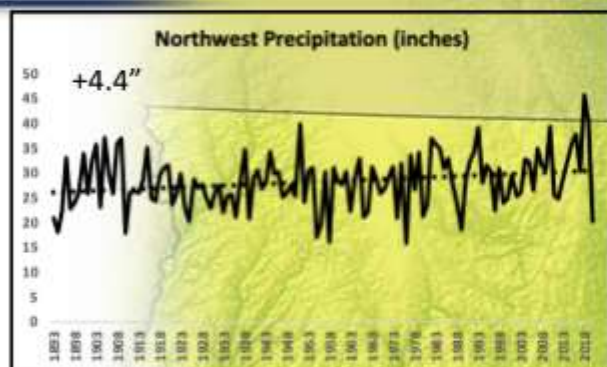


Iowa Temperature since 1893

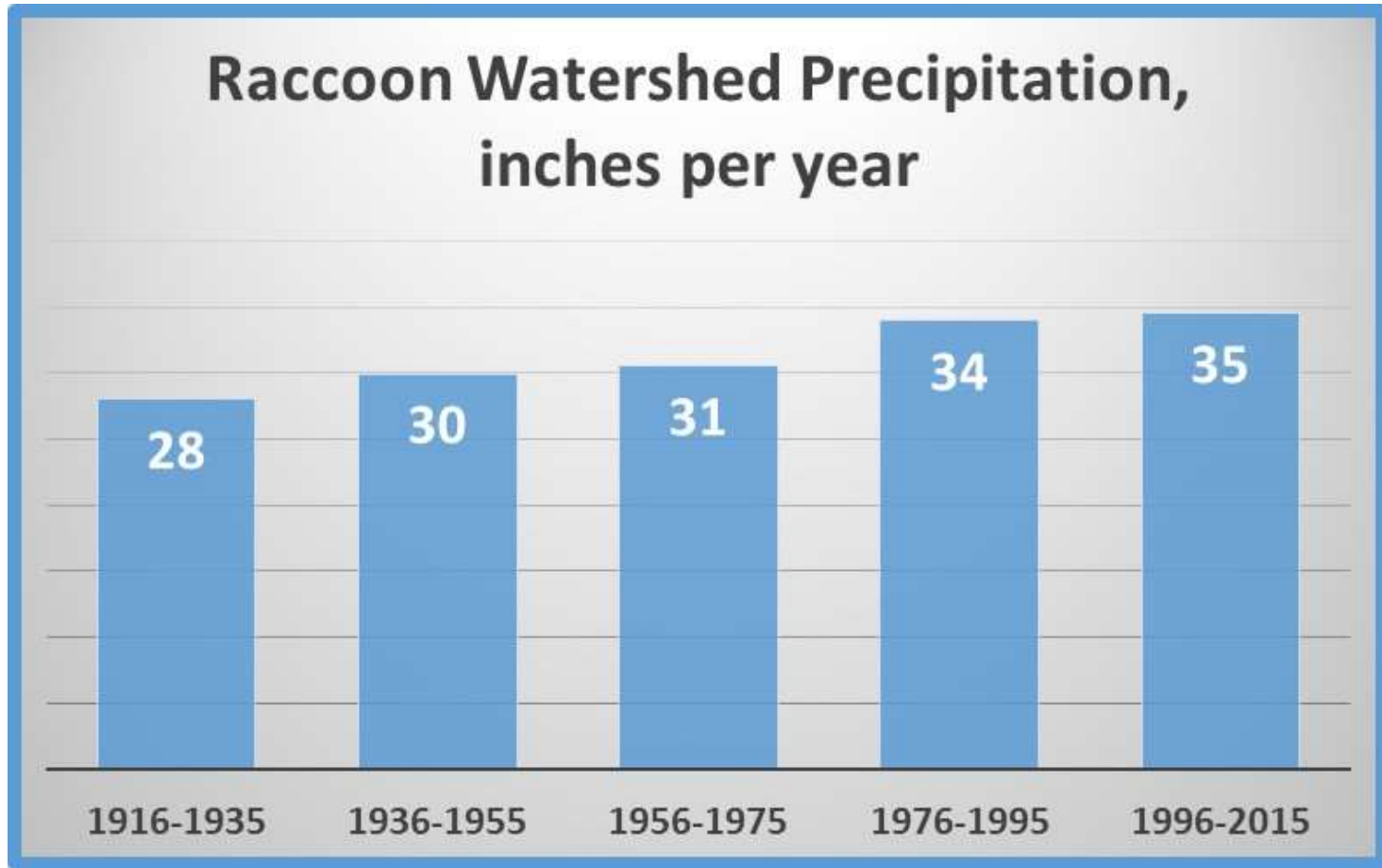




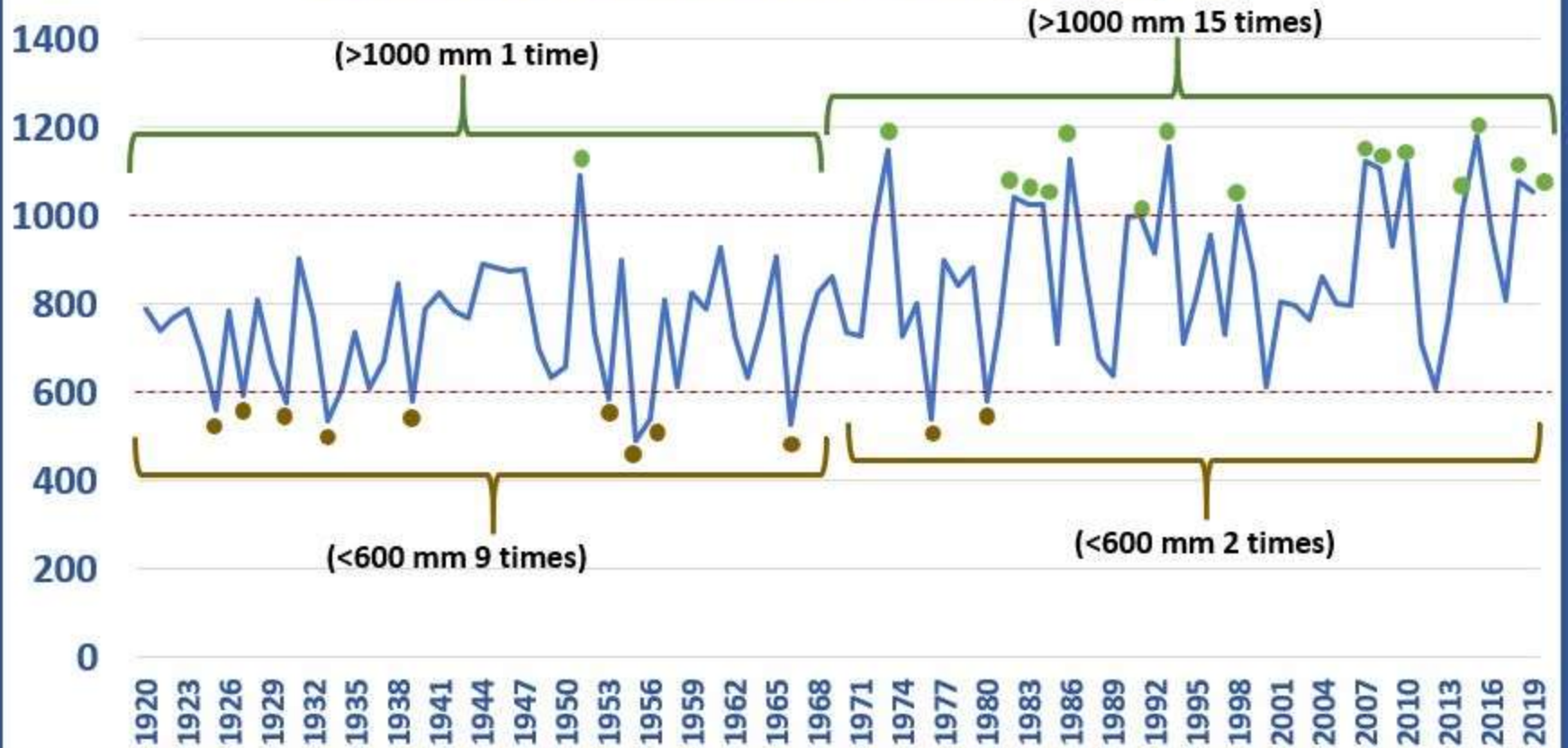


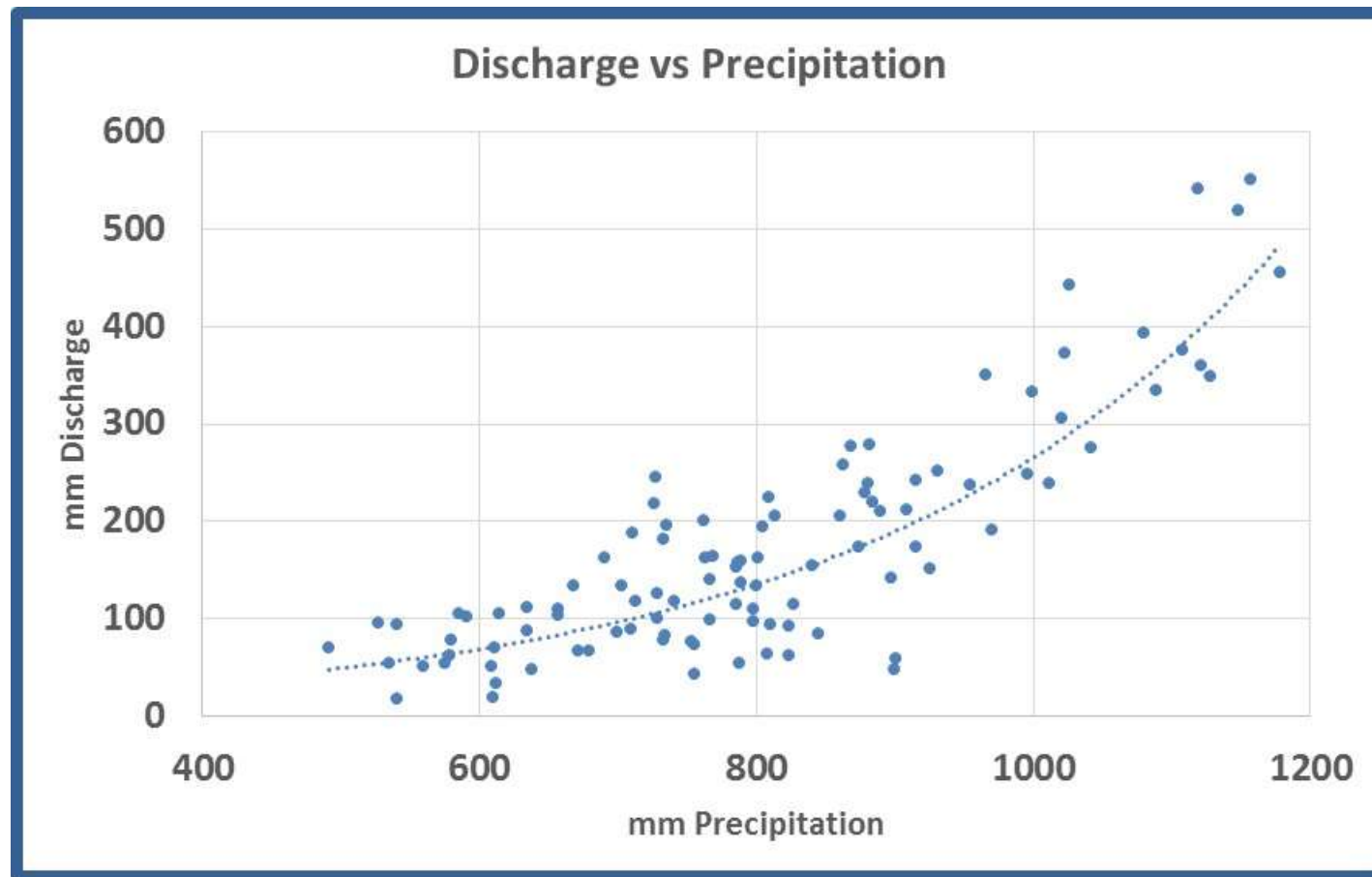


Raccoon Watershed



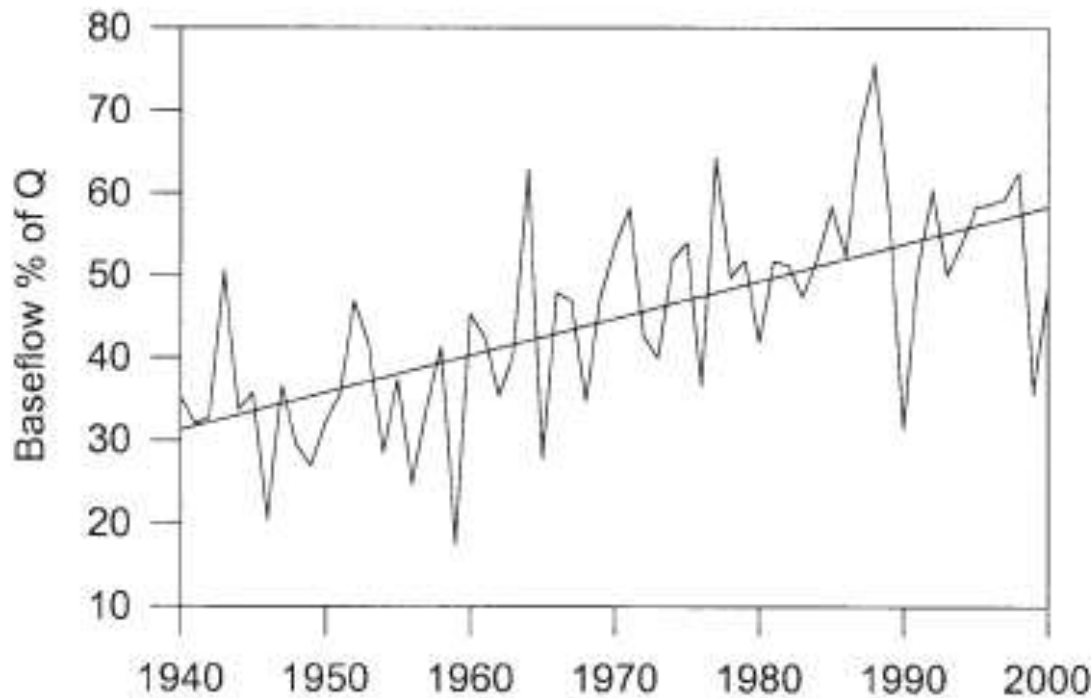
Raccoon River Watershed Annual Precipitation (mm)





Streams have more water

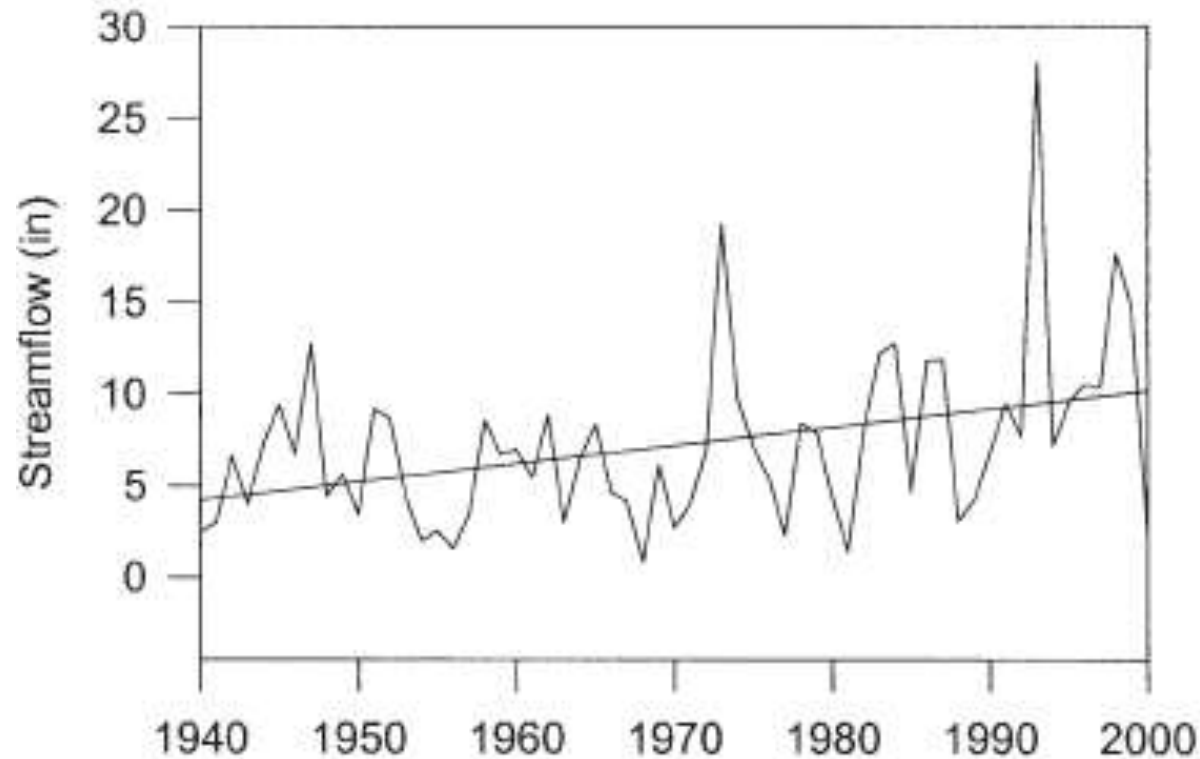
Wapsipinicon



Baseflow= is the portion of streamflow that comes from "the sum of deep subsurface flow and delayed shallow subsurface flow".

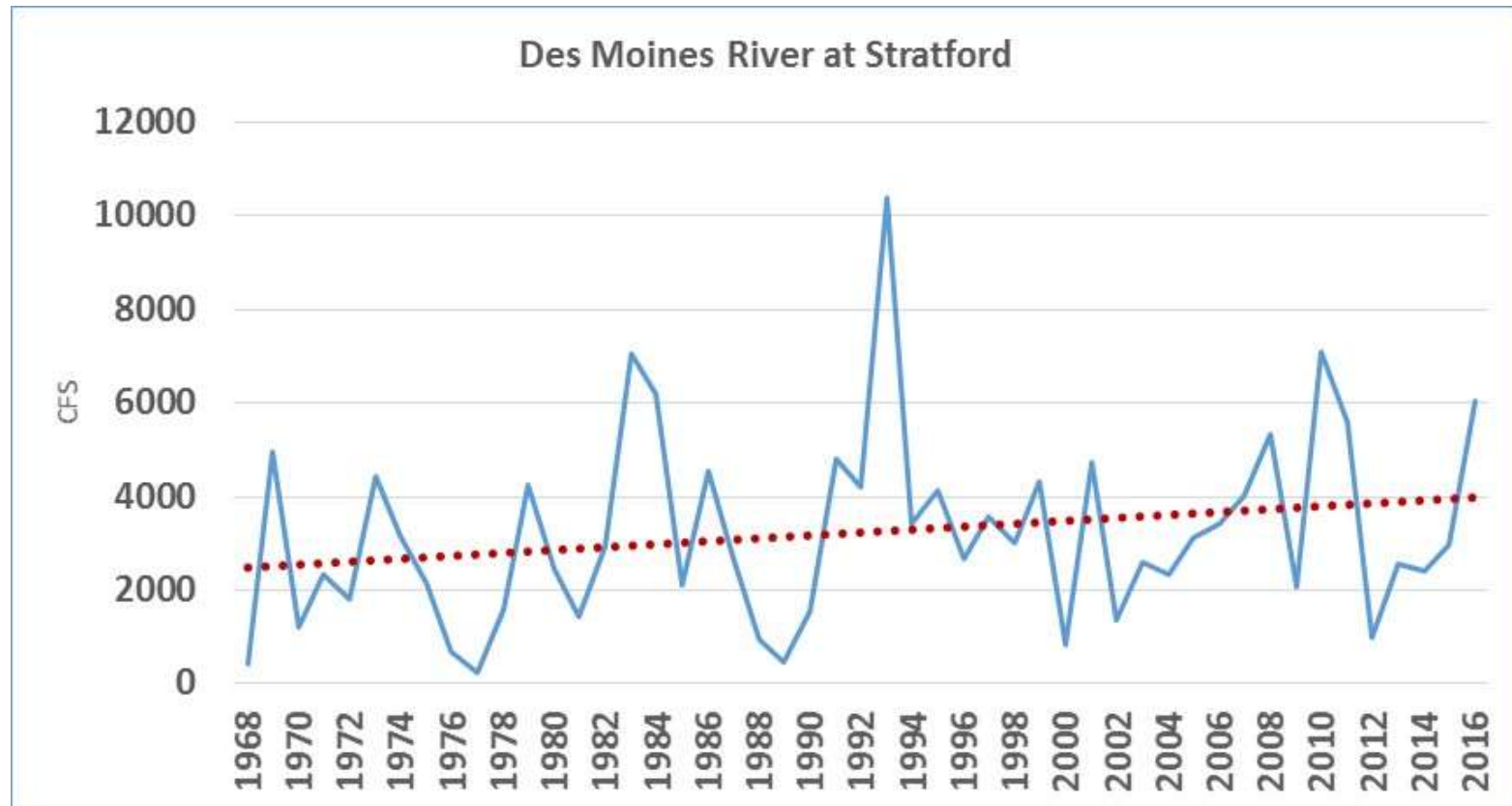
Schilling, K. E. and Libra, R. D. (2003), INCREASED BASEFLOW IN IOWA OVER THE SECOND HALF OF THE

E. Nishnabotna



Schilling, K. E. and Libra, R. D. (2003), INCREASED BASEFLOW IN IOWA OVER THE SECOND HALF OF THE

Des Moines R. at Stratford



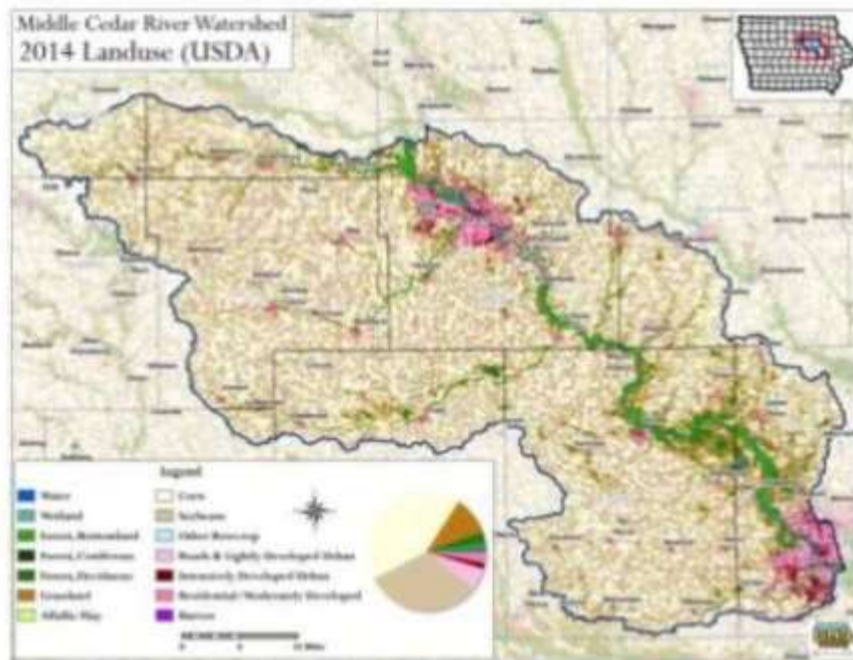
More tile



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

More N loss: Middle Cedar Example



Iowa's Middle Cedar Watershed (credit: Middle Cedar Watershed Management Authority and Iowa DNR)

1200 miles new tile per year

1 acre of pattern tile = 1452' (0.275 mi)

1200 miles = 4364 acres

2018 N loss = 31.5 lbs/ac

New tile multiply N loss by 1.5 (15.9 lbs)

Increase watershed N load by 69,000 lbs

- 136 woodchip bioreactors (we currently have about 50 statewide), or,
- 3 constructed wetlands (currently we have about 100 statewide), or
- Around 7000 new acres of cover crops (currently we have million ac statewide).

Potential Impact of Climate Change on Subsurface Drainage in Iowa's Subsurface Drained Landscapes

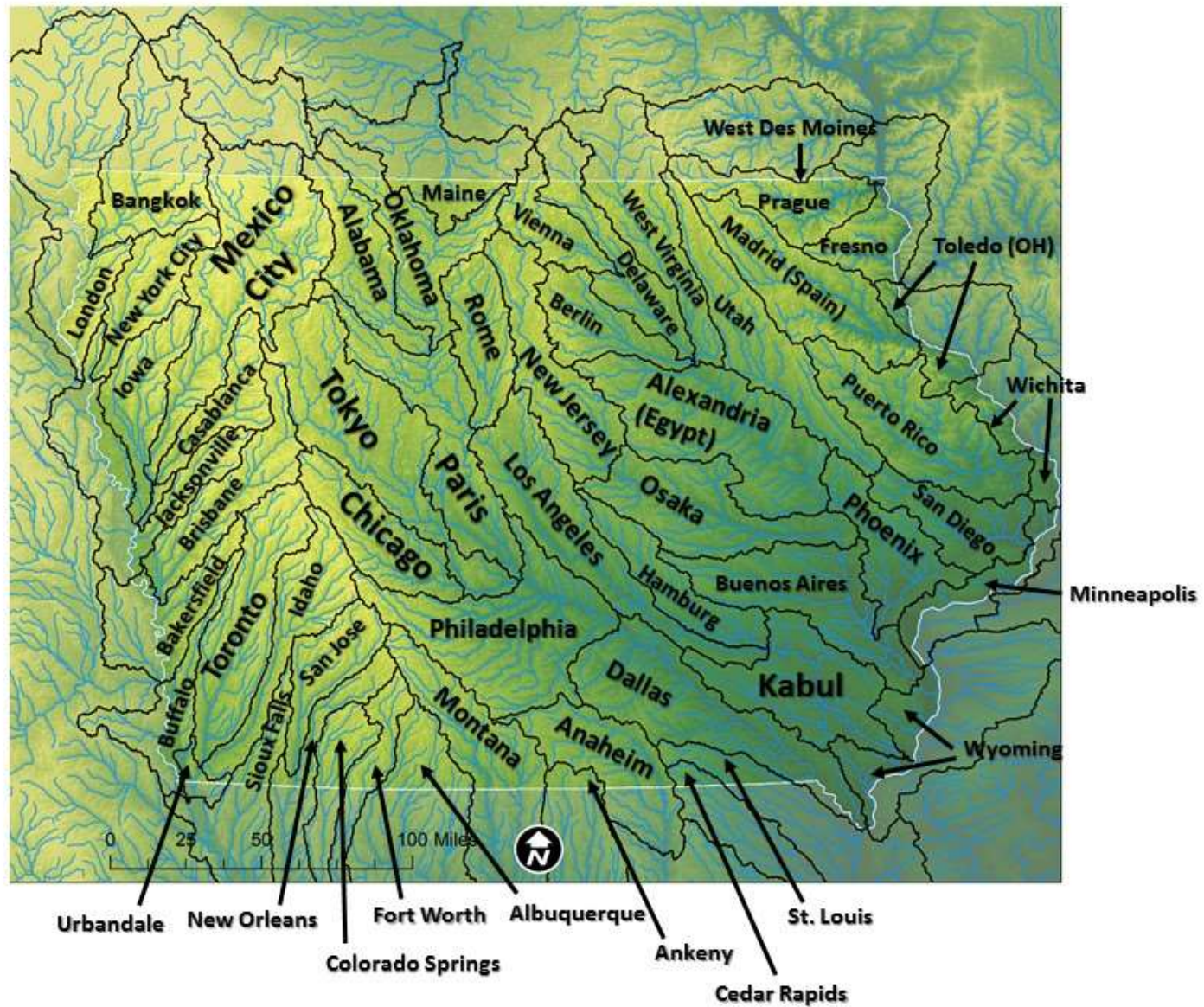
R. Singh¹; M. J. Helmers²; Amy L. Kaleita³; and Eugene S. Takle⁴

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Perry, Iowa

- **24-32% increase in annual precipitation**
- **Increase tile drainage flows**
- **Change distribution of flows within the calendar year**

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