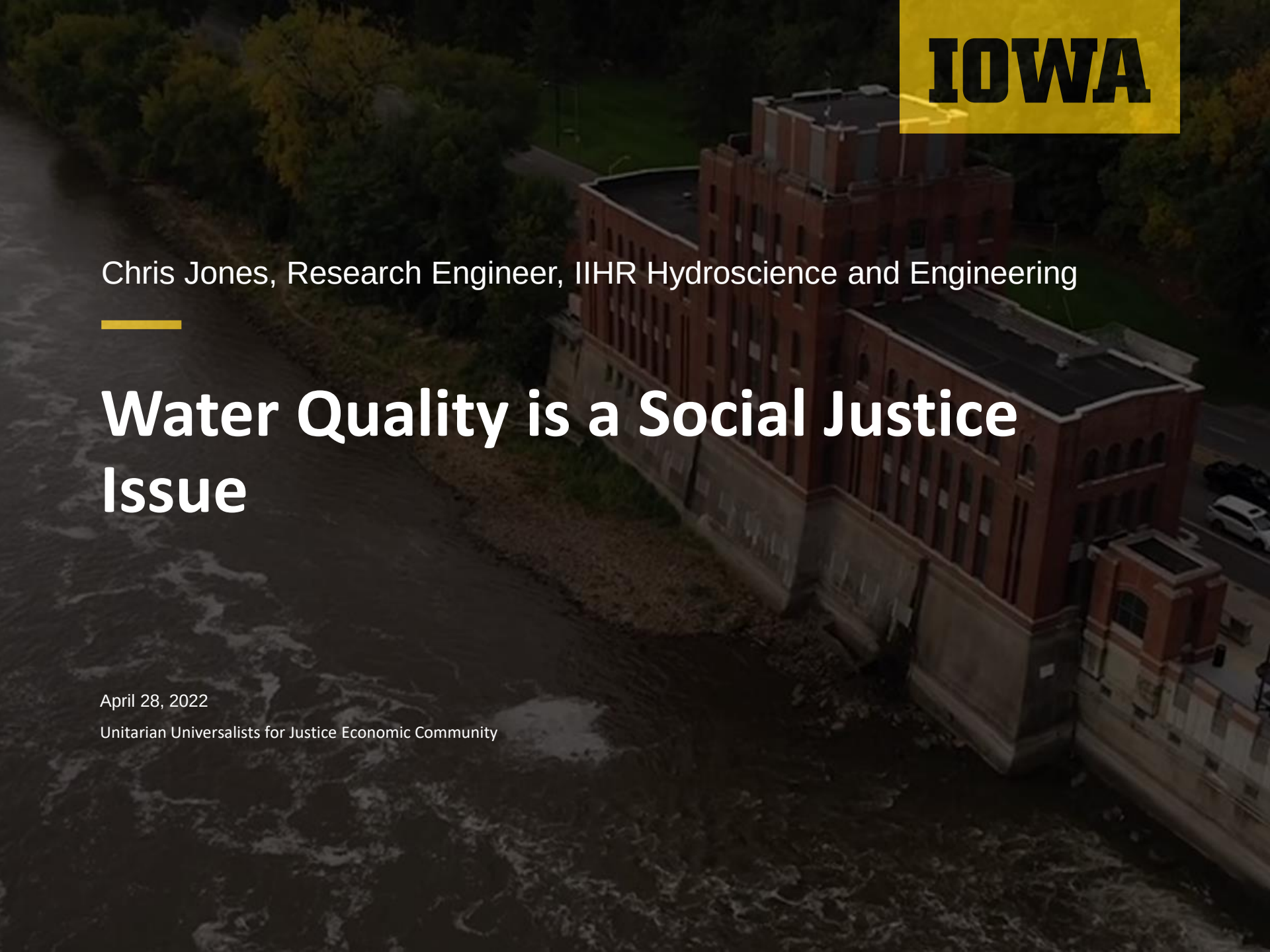


Chris Jones, Research Engineer, IIHR Hydroscience and Engineering

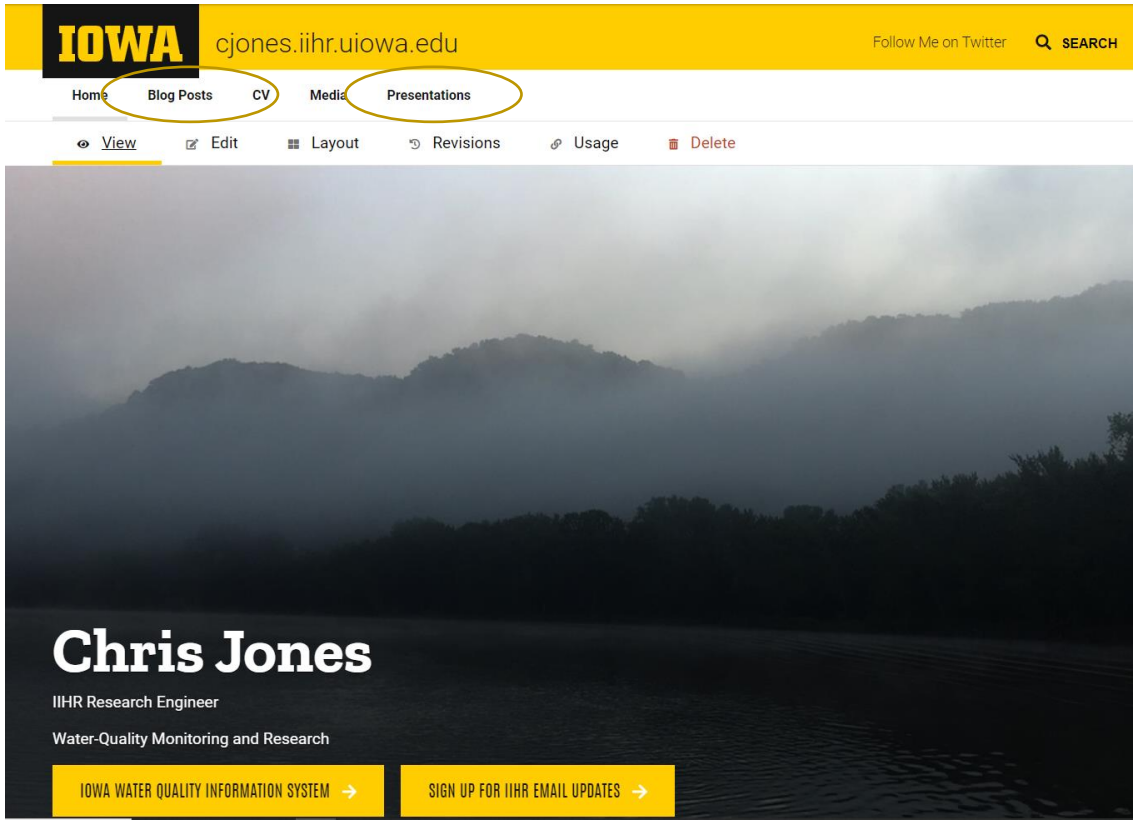
Water Quality is a Social Justice Issue

April 28, 2022

Unitarian Universalists for Justice Economic Community

Slides Available at:

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



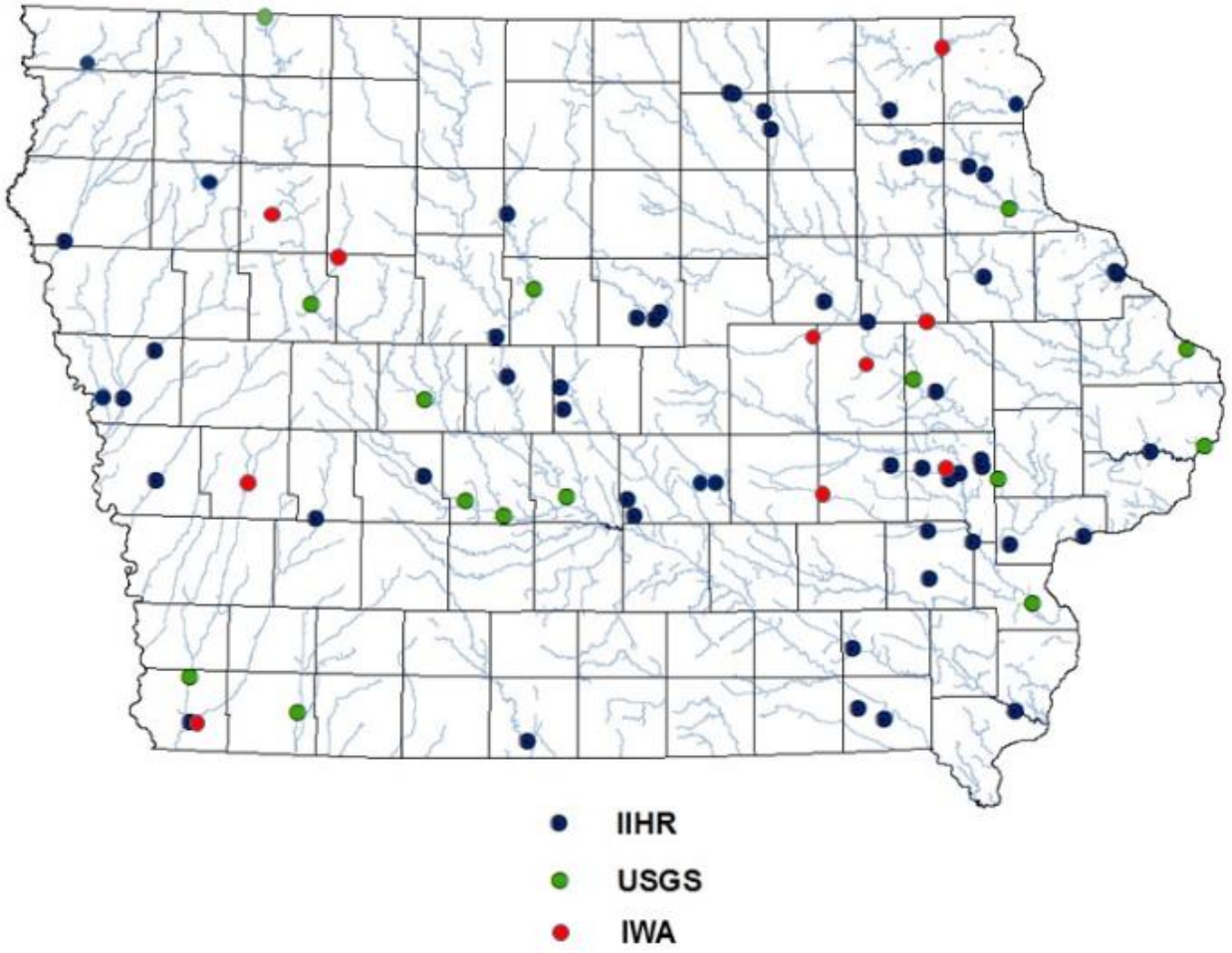
IIHR Water Quality Sensor Network

Sites

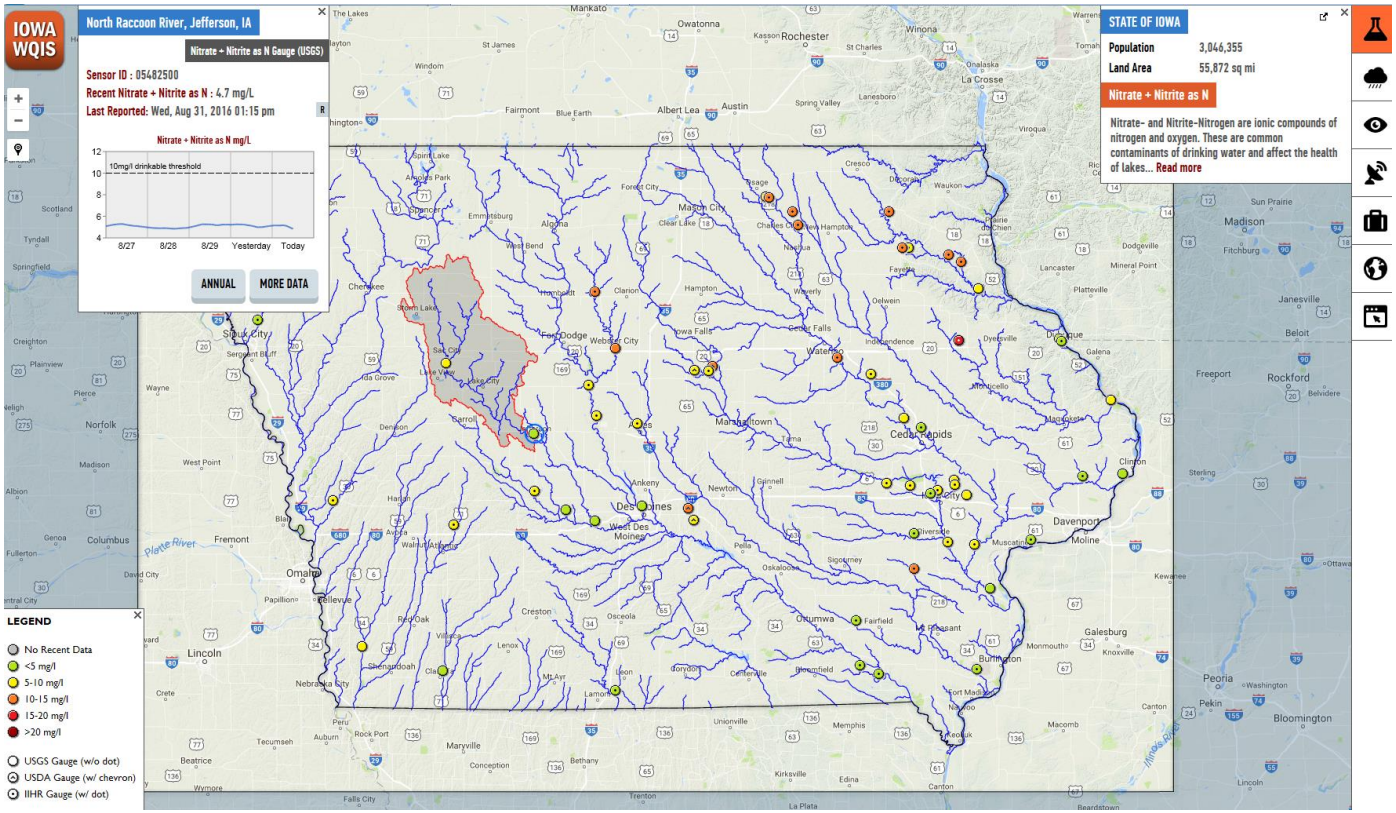
70+ sites
Nitrate-N

20-25 sites

- Temperature
- pH
- SC
- DO
- Turbidity



Iowa Water Quality Information System



iwqis.iowawis.org/

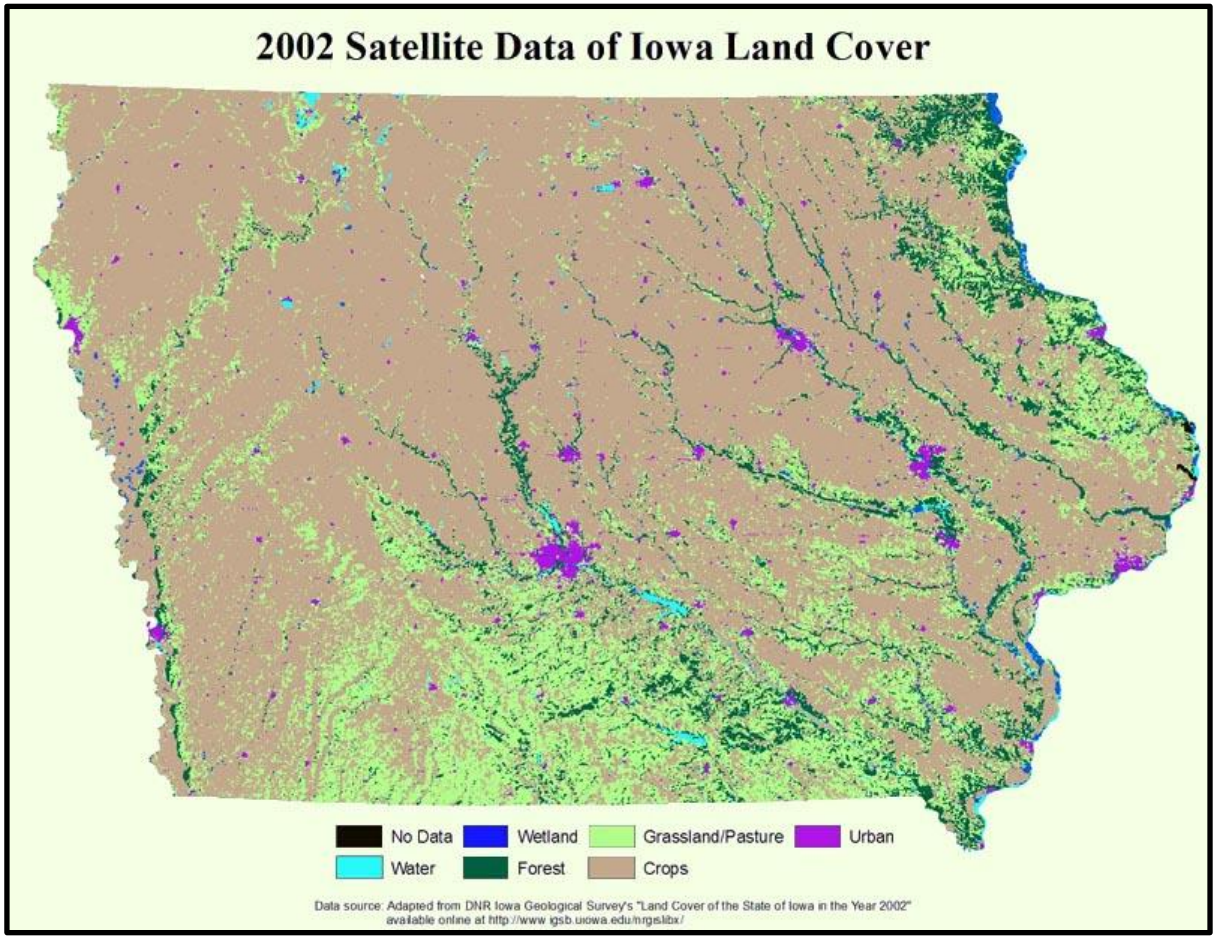
http://iwqis.iowawis.org/app/?datetime=2017-06-06T13:00


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


Oak Savannah: ~5%, < 1% remains


Prairie: 70%, 0.1% Remains

Iowa Land Cover



9 Treaties to displace Native Americans, 1824-1853

Native Americans (Sac, Fox, Winnebago, Sioux, and Potawatomie) forced to sell land for an average of 8 cents per acre.

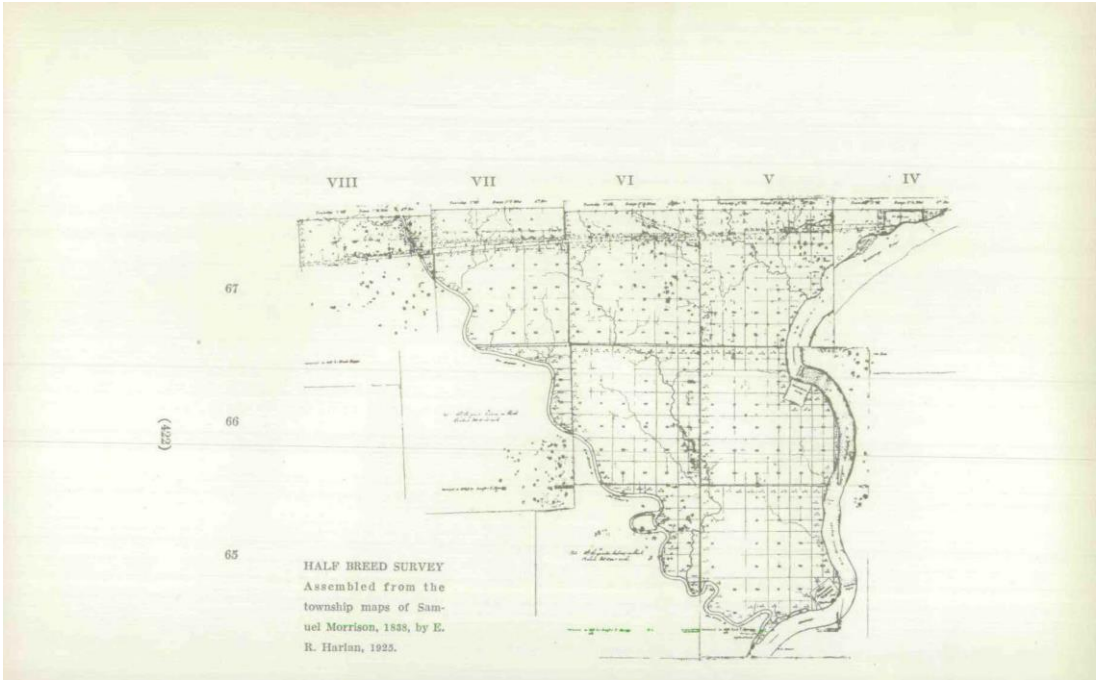
1850s: Mesquaki begin returning by buying land; first land purchases by Native Americans in the U.S.

1856: Iowa Legislature voted to ‘let’ Mesquakies own this land; purchased at $12.50/acre.

80 acres now about 8000.

Via Prof Silvia Secchi, UI

Half Breed Tract



1824: reserved for children of white men/N.A. women

1834: Repealed

Via Prof Silvia Secchi, UI

Iowa Farming is White

2017 USDA Data

- 86,104 ‘Primary’ Producers
  - 85,827 White (99.6%)
  - 378 Hispanic (0.4%)
  - 64 Asian (<0.1%)
  - 45 Native American (<0.1%)
  - 40 African American(<0.1%)
  - 6 Pacific Islander (<0.1%)

Iowa as a Whole

- White (90.2%)
- Hispanic (5.7%)
- Asian (2.4%)
- Native American (0.38%)
- African American (3.7%)
- Pacific Islander (0.1%)

Via Prof Silvia Secchi, UI

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.

PUBLISHED BY AUTHORITY.

DU BUQUE:
RUSSELL & REEVES, PRINTERS.
1839.

REPRINTED BY THE
HISTORICAL DEPARTMENT OF IOWA,
1900.

BLACKS AND MULATTOES.

AN ACT to regulate Blacks and Mulattoes.

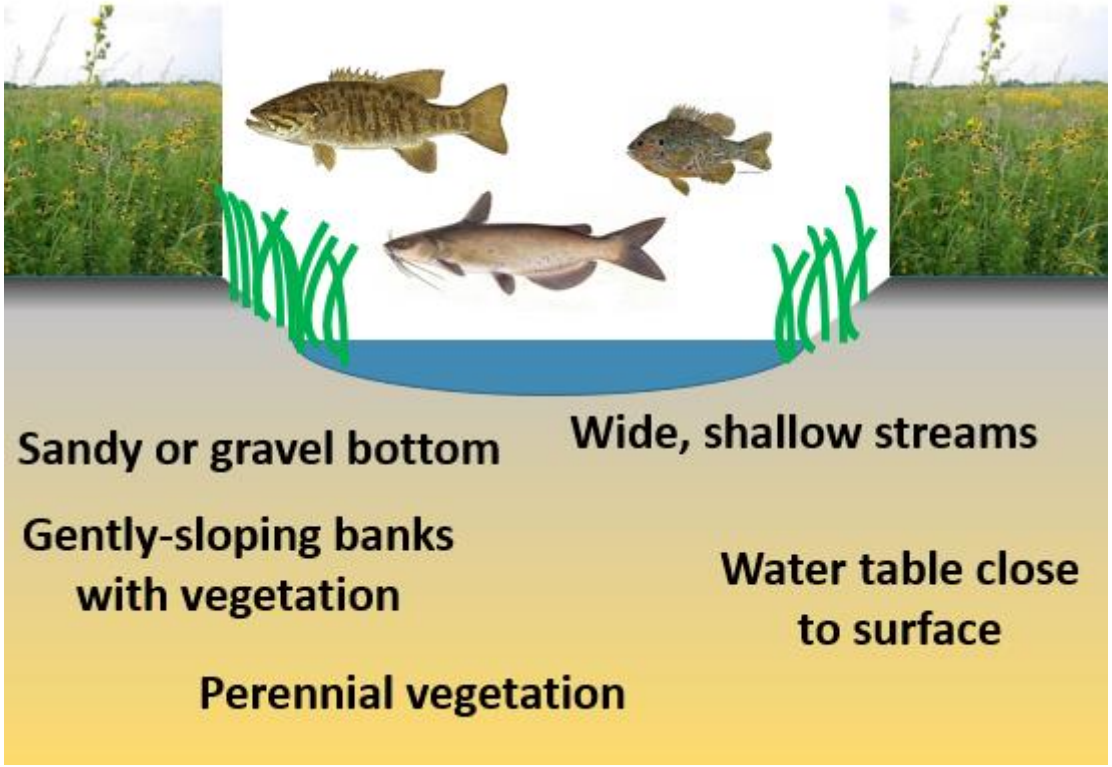
SEC. 1. *Be it enacted by the Council and House of Representatives of the Territory of Iowa*, That, from and after the first day of April next, no black or mulatto person shall be permitted to settle or reside in this Territory, unless he or she shall produce a fair certificate, from some court within 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

Certificate of freedom required under seal.

Bond and se-

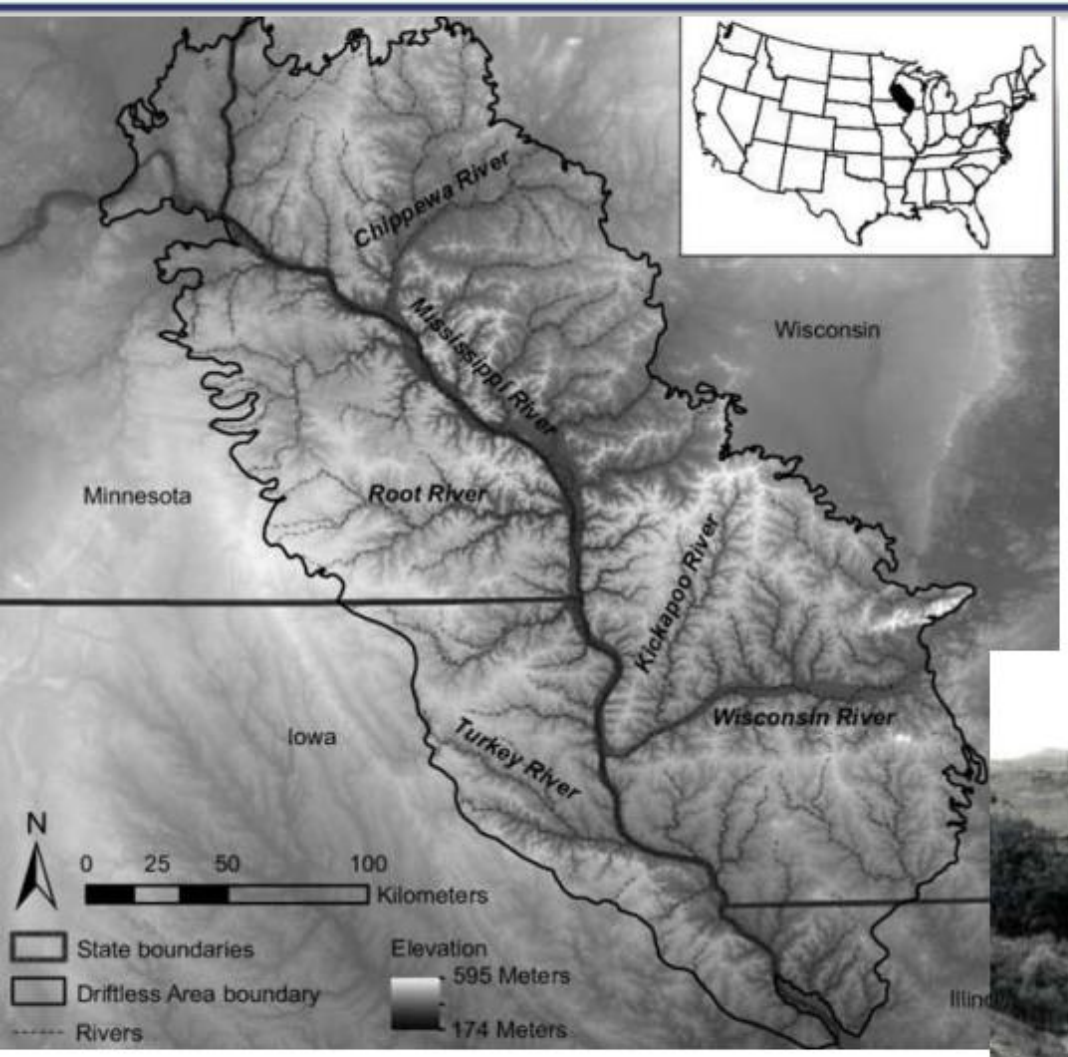
$500 bond made land purchases impossible

Pre-European Settlement Streams



Breaking the prairie

Photo courtesy of Deere and Company



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

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

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

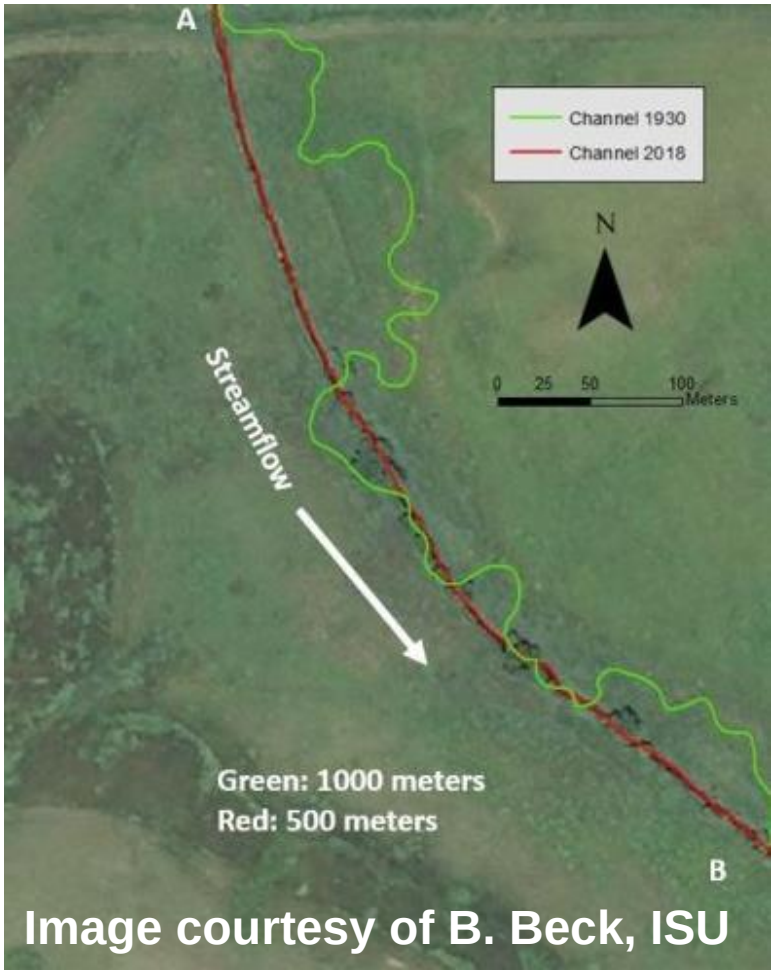
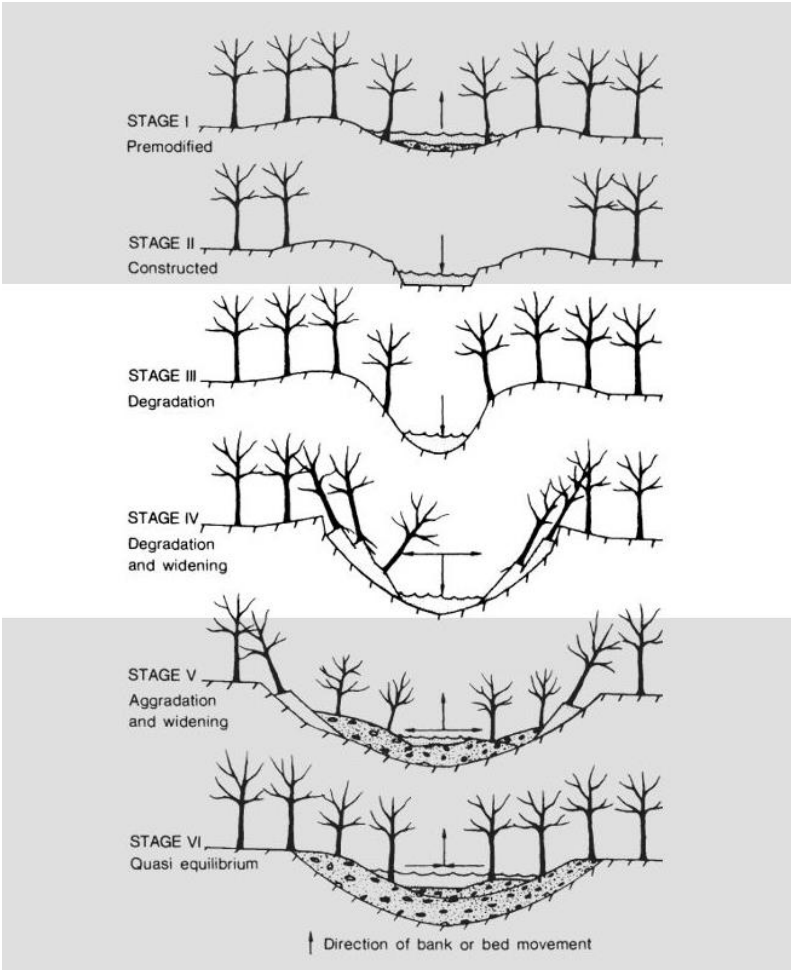
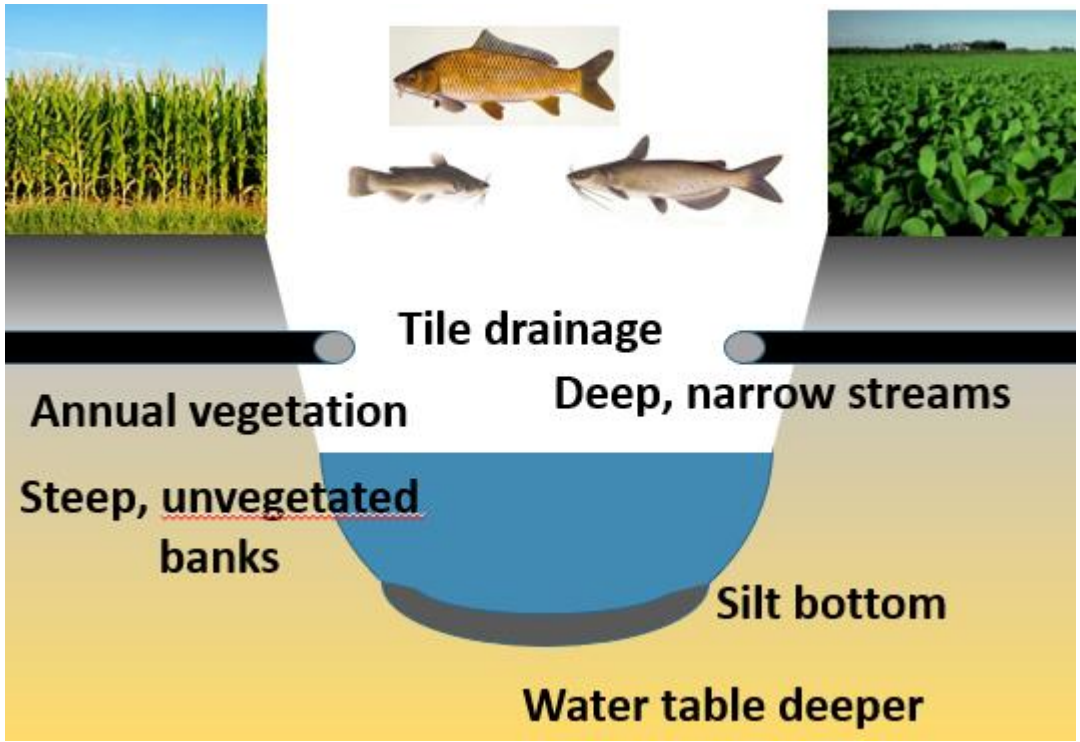


Image courtesy of B. Beck, ISU



Images courtesy of B. Beck, ISU

Modified Streams



Transformation of Iowa Farms

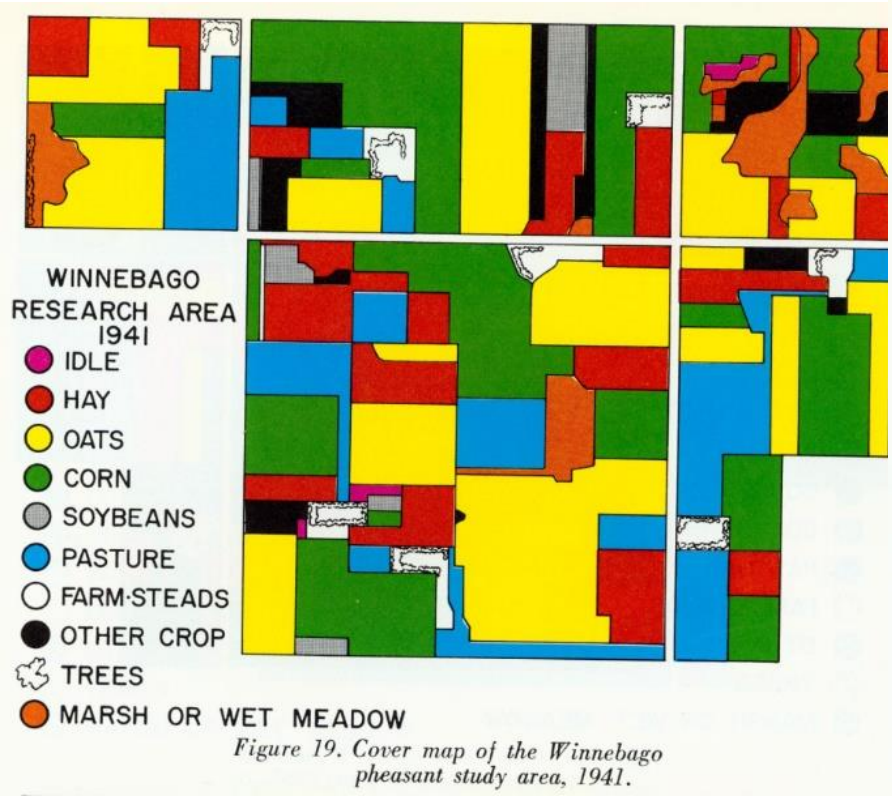


Figure 19. Cover map of the Winnebago pheasant study area, 1941.

1941

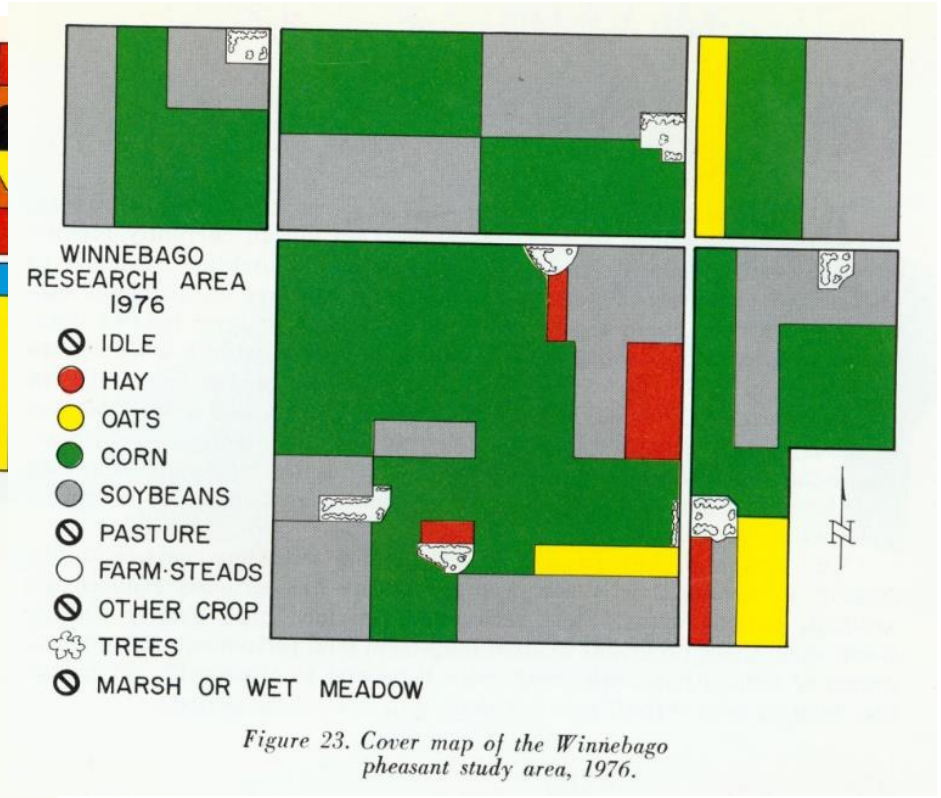
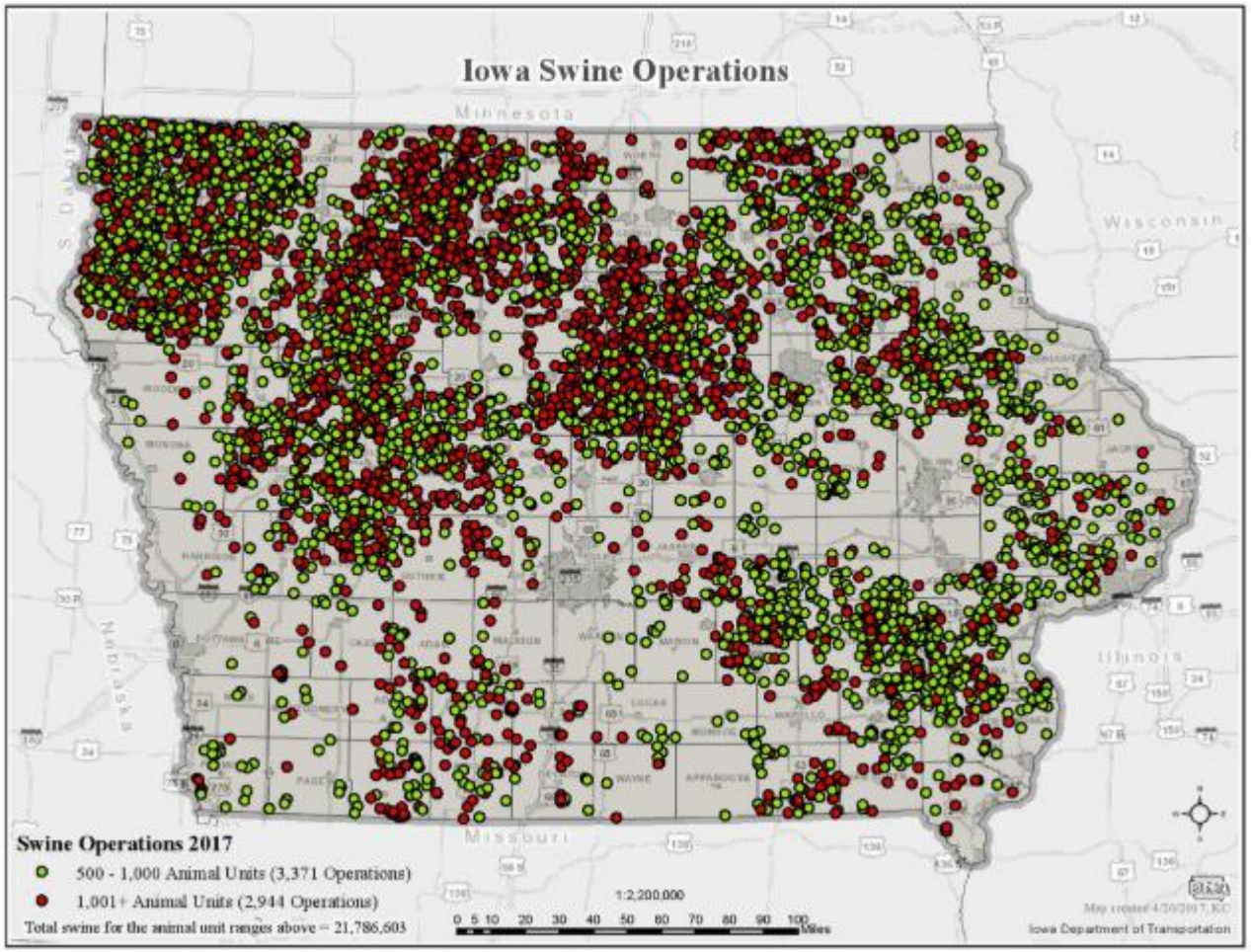


Figure 23. Cover map of the Winnebago pheasant study area, 1976.

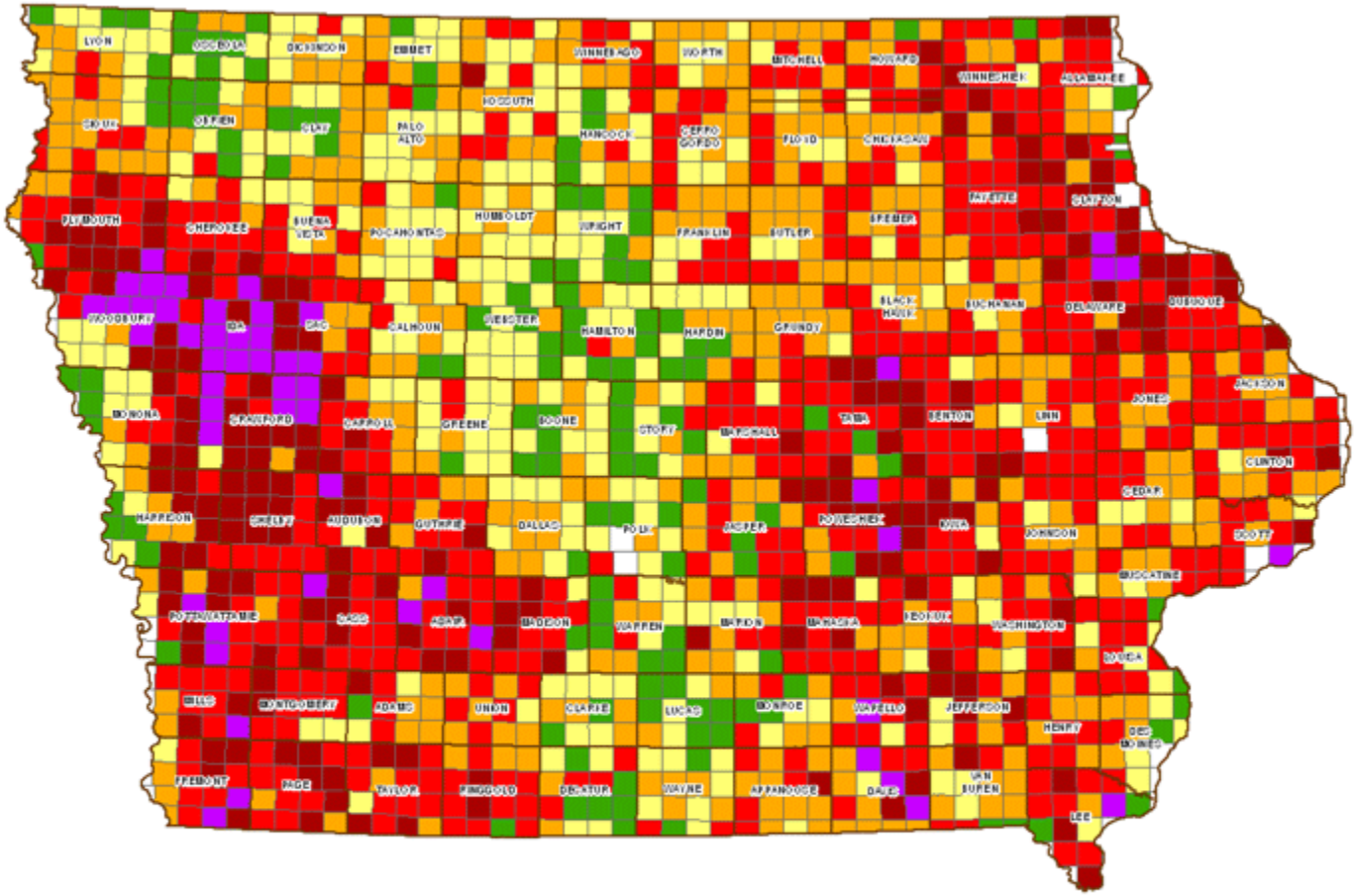
1976

8000 CAFOs


Iowa Swine Operations
Minnesota
Wisconsin
Illinois
Missouri
Nebraska
Swine Operations 2017
500 - 1,000 Animal Units (3,371 Operations)
1,001+ Animal Units (2,944 Operations)
Total swine for the animal unit ranges above = 21,786,603
1:2,200,000
0 5 10 20 30 40 50 60 70 80 90 100 Miles
Iowa Department of Transportation

Water Quality Consequences

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

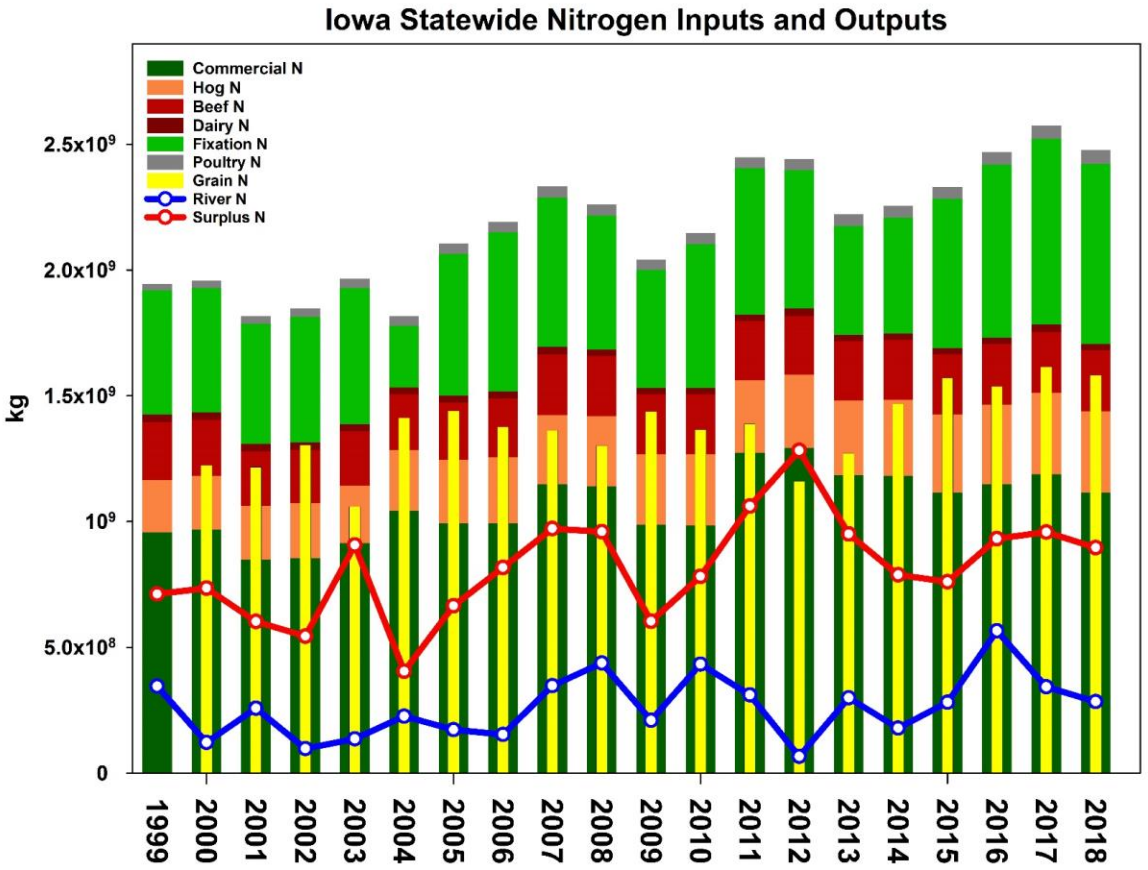
Roughly 40% applied in fall, 60% in spring

Especially important in marine ecosystems

VERY WATER SOLUBLE

Loss through tile systems and leaching to groundwater

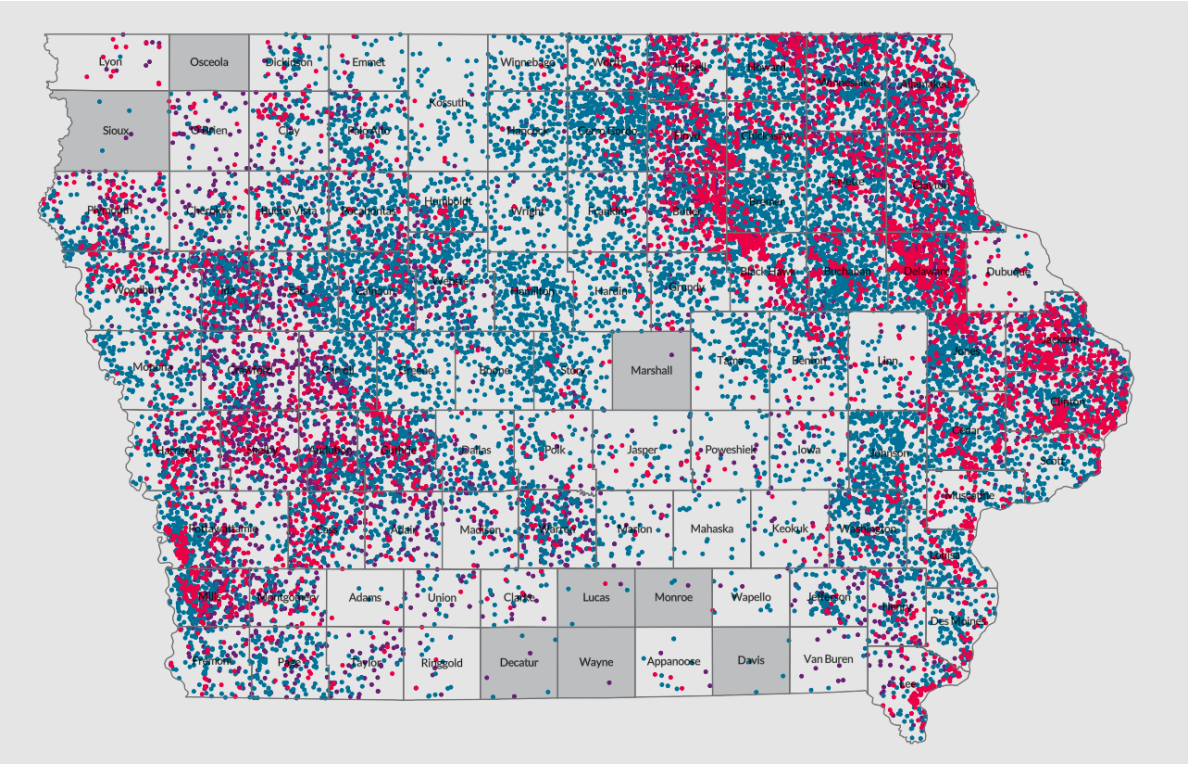
Nitrate: NO_3^-
Regulated drinking water contaminant since 1974
Limit: 10 ppm (as N)



We over-apply nutrients because the taxpayer shoulders the burden for the environmental consequences

About 32% of “surplus” makes it to streams

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

PWSs requiring nitrate removal treatment

PUBLIC WATER SUPPLY	POPULATION SERVED
DES MOINES	233020
WEST DES MOINES	63541
ANKENY	62416
URBANDALE	42469
UNIVERSITY OF IOWA WATER SYSTEM	26684
JOHNSTON	20495
WARREN RURAL WATER DISTRICT	18838
WAUKEE	17945
CLIVE	17506
BOONE	12934
XENIA RURAL WATER DISTRICT-DM	9792
NORWALK	8948
SIOUX CENTER	7050
SOUTHEAST POLK RURAL WATER DISTRICT	6050
BONDURANT	5493
WINTERSET	5253
MANCHESTER	5191
XENIA RURAL WATER DISTRICT-BOONE	4358
ADEL	3682
POLK CITY	3418
RURAL WATER SYSTEM #1	3300
POWESHIEK WATER ASSOCIATION (IAC)	2000
EPWORTH	1860
MANNING	1510
SLATER	1489
CLARINDA	1439
KINGSLEY	1411
HOLSTEIN	1402
MAPLETON	1224

PANORA	1189
LAKE VIEW WATER SUPPLY	1147
GEORGE	1088
AUTUMN RIDGE ESTATES	1032
CORRECTIONVILLE	839
MILO	784
SIOUX RAPIDS	777
BATTLE CREEK	717
HOSPERS	706
SOUTHRIDGE ESTATES	648
EVERLY	606
EARLY	592
GILMORE CITY	504
NEW VIRGINIA	477
MARTENSDALE	465
EMERSON	463
EWING TRACE	455
LEWIS	436
UTE	377
PIERSON	376
HICKORY HOLLOW WATER SERVICE	375
CUMMING	351
DANBURY	349
GRANVILLE	317
KELLEY	309
NORWALK WILSHIRE MHP	216
RIVER OAKS DEVELOPMENT	215
NORWALK HARTFORD MHP	183
AMES MHP	160
HAMMOND ESTATES	150
LOGANSPORT	150
ST MARY'S	145
BENEFIT WATER DISTRICT #2	80
DEER HUNTERS RUN	70

Drinking Water


Great Lakes Basin
0 75 150 225 km
St Marys River
Straits of Mackinac
St Clair River
Lake St Clair
Detroit River
St Lawrence River
Welland Canal
184 m
177 m
174 m
75 m
64 m
229 m
177 m
281 m
405 m
244 m
Sea Level
Lake Superior
Lake Huron
Lake Erie
Lake Michigan
Lake Ontario
Great Lakes Basin
Diverted drainage
Lake basin
CANADA
USA
Ontario
Quebec
Minnesota
Wisconsin
Michigan
Illinois
Indiana
Ohio
Pennsylvania
New York
Lake Nipigon
Isle Royale
Lake Nipissing
Georgian Bay
Saginaw B
St Clair
Mississippi River
Ottawa River
St Laurence R
Kenora
Dryden
Fort Frances
Thunder Bay
Nipigon
Longlac
Hearst
Marathon
Timmins
Rouyn-Noranda
New Liskeard
Wawa
Sault Ste Marie
Greater Sudbury
Manitoulin
Parry Sound
Midland
Owen Sound
Alpena
Escanaba
Marquette
Houghton
Duluth
Superior
St Paul
Eau Claire
Green Bay
Manitowoc
Ludington
Saginaw
Goderich
Kingston
Oshawa
Toronto
Hamilton
Buffalo
Rochester
Montréal
OTTAWA
Binghamton
Scranton
Erie
Cleveland
Akron
Pittsburgh
Sarnia
Windsor
Detroit
Toledo
Sandusky
Benton Harbor
South Bend
Gary
Fort Wayne
Chicago
Peoria
Madison
Milwaukee
Racine
Grand Rapids
Columbus
N
90°
50°
45°
40°
85°
80°
75°
www.atlas.gc.ca
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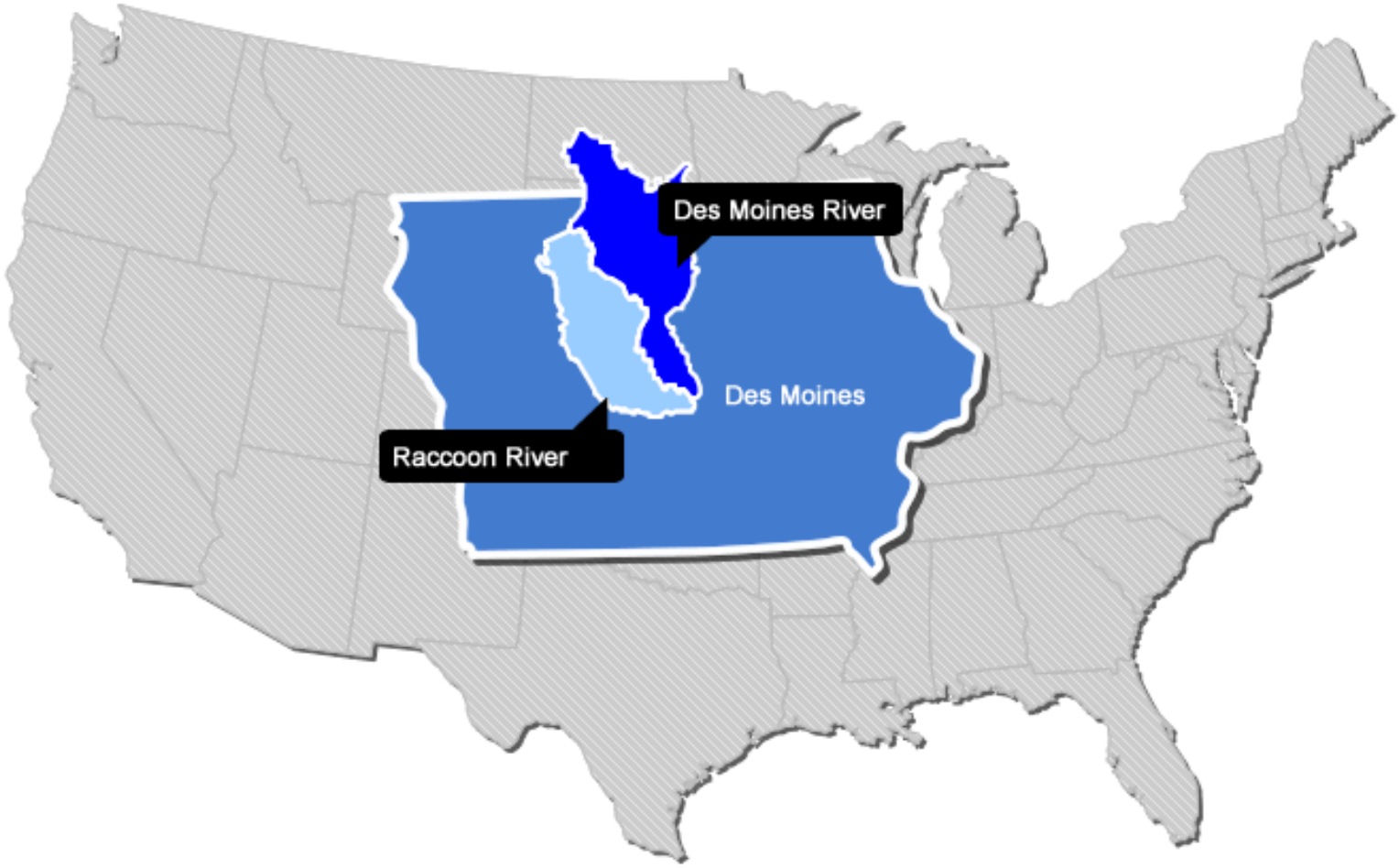
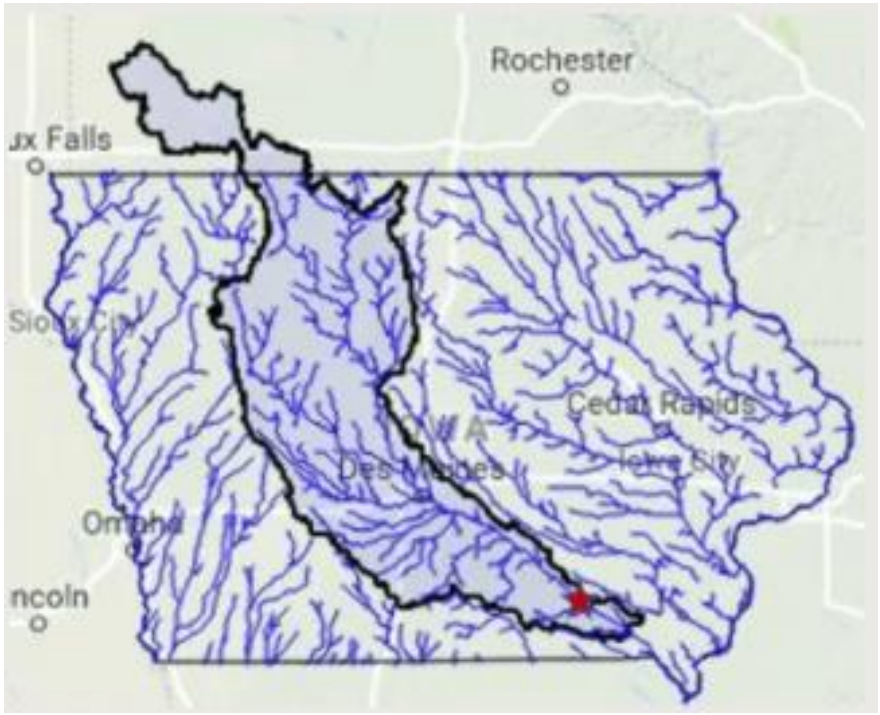


Image credit: Des Moines Water Works

Ottumwa Water Works

mid-700s out of about 900 Iowa communities in median household income

The city lies in Wapello County, which ranked 94th out of 99 Iowa counties in median household income in 2019.



Surface Water

Lake Erie Algae Blooms

Gulf of Mexico Hypoxia

IOWA STATE UNIVERSITY

Iowa Nutrient Reduction Strategy

Search

- 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:

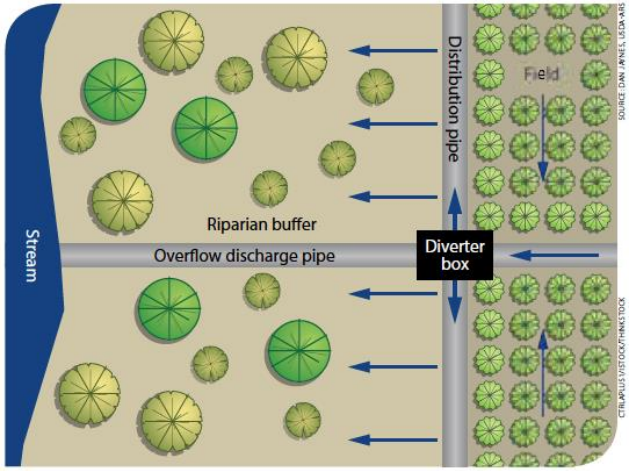
IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

IOWA DEPARTMENT OF NATURAL RESOURCES

IOWA STATE UNIVERSITY

Practices

Cover crops



Saturated
Buffer

Economics of N loss

Cost of Nitrogen: today about $1.20/lb

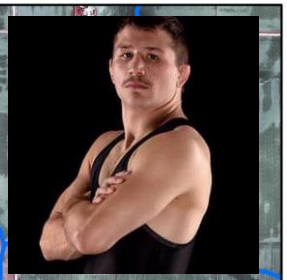
Cost to remove nitrogen using BMPs: $2-$10/pound

Average statewide load: 600 million lbs

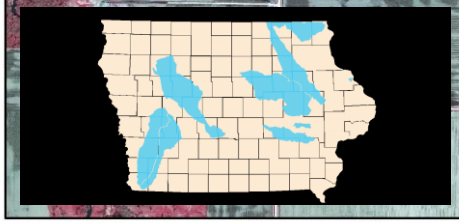
45% reduction = 270 million lbs/year

$540M to $2.7B/year

Tile Mapping for the Iowa Watershed Approach



Jeren Glosser



New Tile

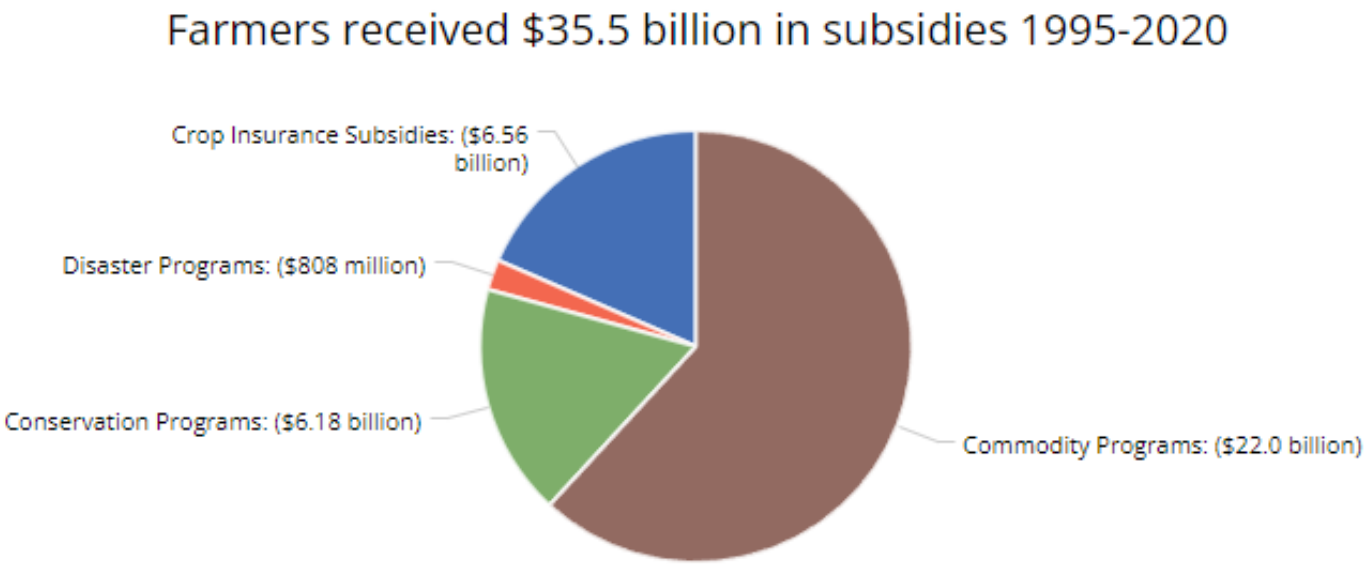
Watershed	2002	2007	2016
Middle Cedar	$1,900,000	$5,100,000	$5,600,000
Upper Wapsi	$1,800,000	$2,200,000	$6,600,000
English River	$187,000	$492,000	$1,124,000
North Raccoon	$536,000	$936,000	$1,175,000
Upper Iowa	$106,000	$231,000	$931,000
Clear Creek	$9,350	$4,300	$50,500

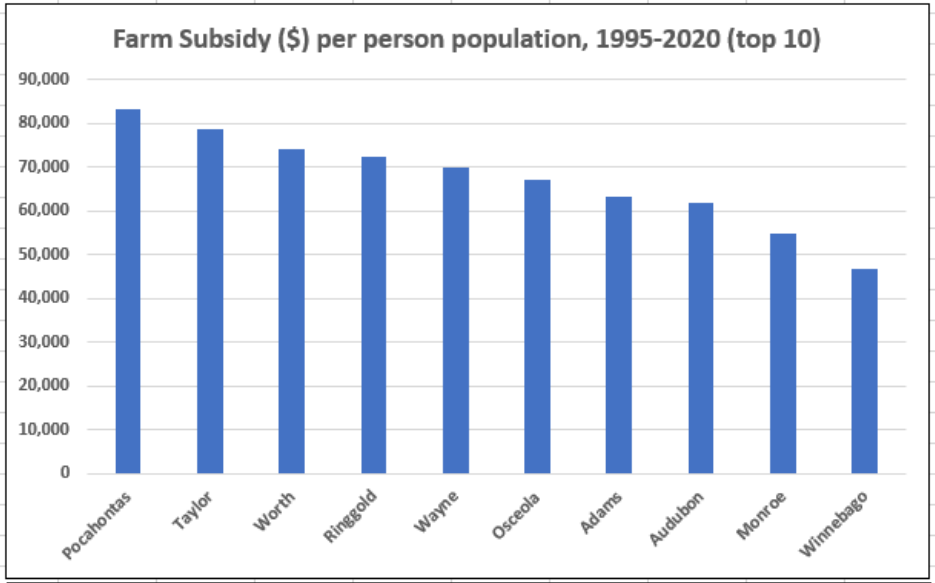
Table 1: Estimated amount spent on new drainage tile in six Iowa watersheds.

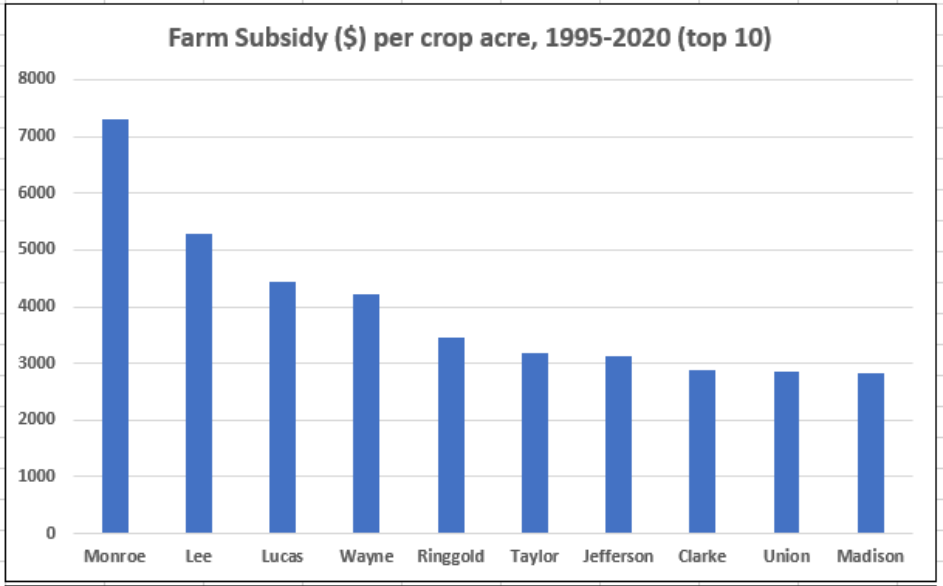
Landform	% of Iowa's Area	$/year spent on new tile
Iowan Surface	16.9	$24,500,000
Des Moines Lobe	21.4	$5,845,000
Northwest Iowa Plains	8.3	$2,272,545
Paleozoic Plateau	4.6	$3,580,862
Southern Iowa Drift Plain	41.3	$33,837,580
Total	92.5	$70,064,878

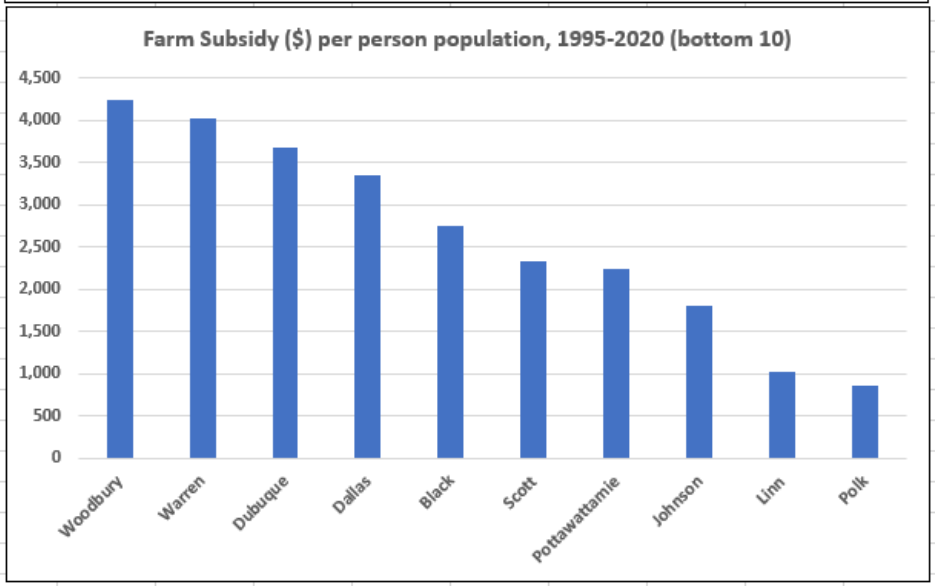
Table 2: Estimated amounts spent in 2016 on new drainage tile in five of Iowa's landforms.

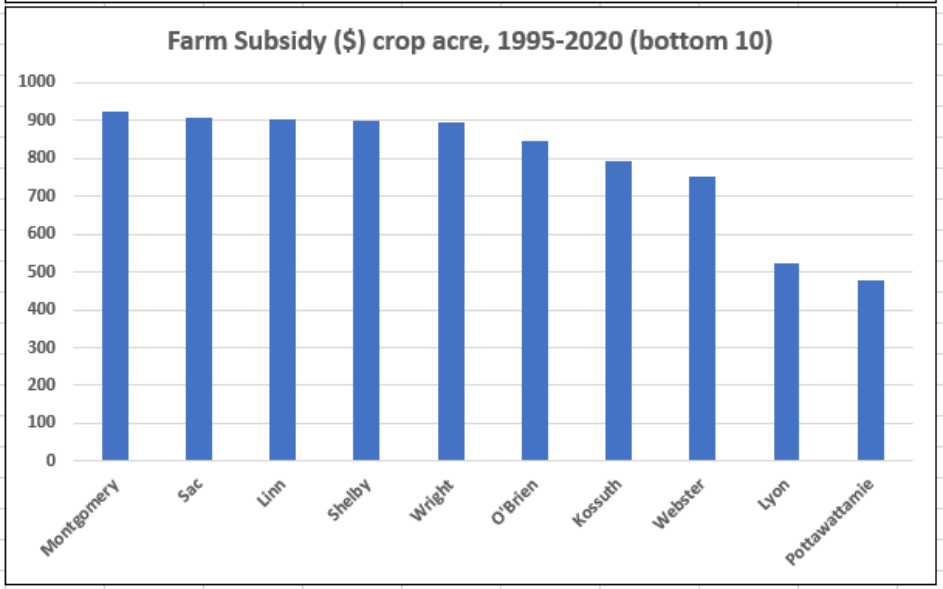
Iowa Farm Subsidy Information



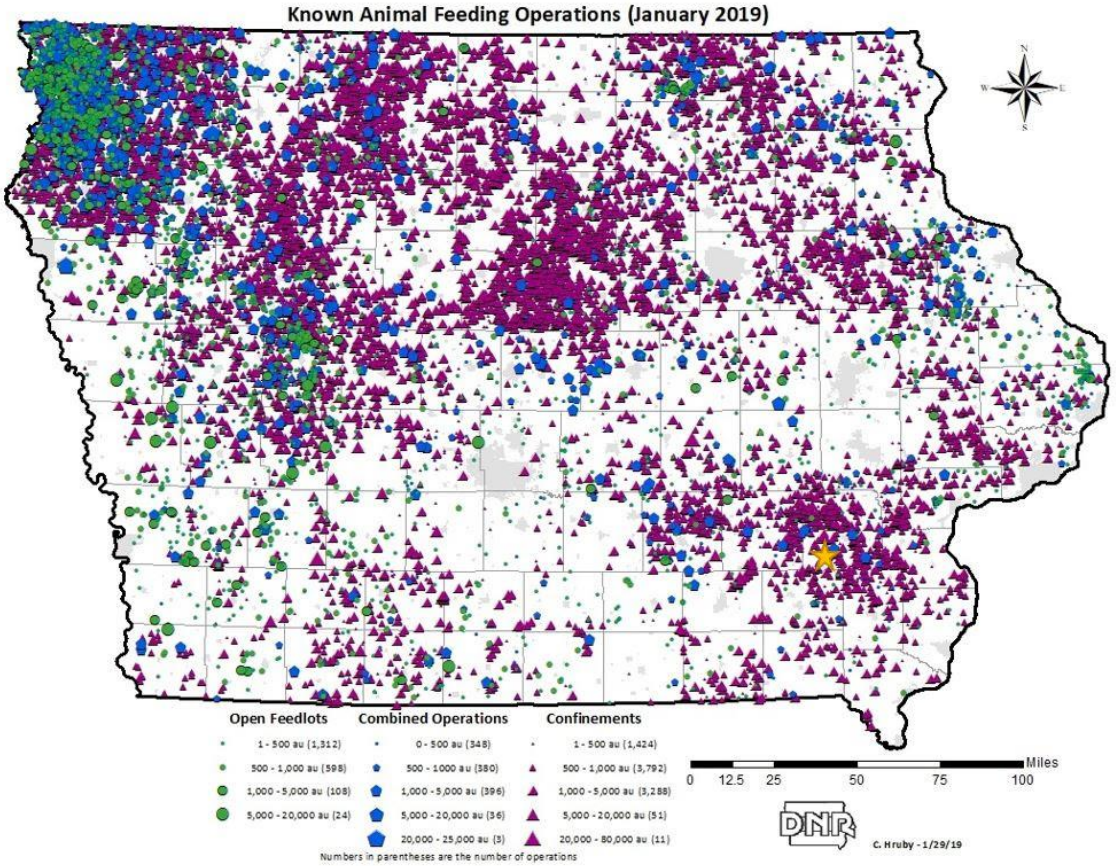

Farm Subsidy ($) per person population, 1995-2020 (top 10)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Pocahontas
Taylor
Worth
Ringgold
Wayne
Osceola
Adams
Audubon
Monroe
Winnebago


Farm Subsidy ($) per crop acre, 1995-2020 (top 10)
8000
7000
6000
5000
4000
3000
2000
1000
0
Monroe
Lee
Lucas
Wayne
Ringgold
Taylor
Jefferson
Clarke
Union
Madison


Farm Subsidy ($) per person population, 1995-2020 (bottom 10)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Woodbury
Warren
Dubuque
Dallas
Black
Scott
Pottawattamie
Johnson
Linn
Polk


Farm Subsidy ($) crop acre, 1995-2020 (bottom 10)
1000
900
800
700
600
500
400
300
200
100
0
Montgomery
Sac
Linn
Shelby
Wright
O'Brien
Kossuth
Webster
Lyon
Pottawattamie

How Do You Overcome Structural Drivers to Bad Water Quality?



IIHR Hydroscience & Engineering
The University of Iowa College of Engineering

More Diverse Farming Systems

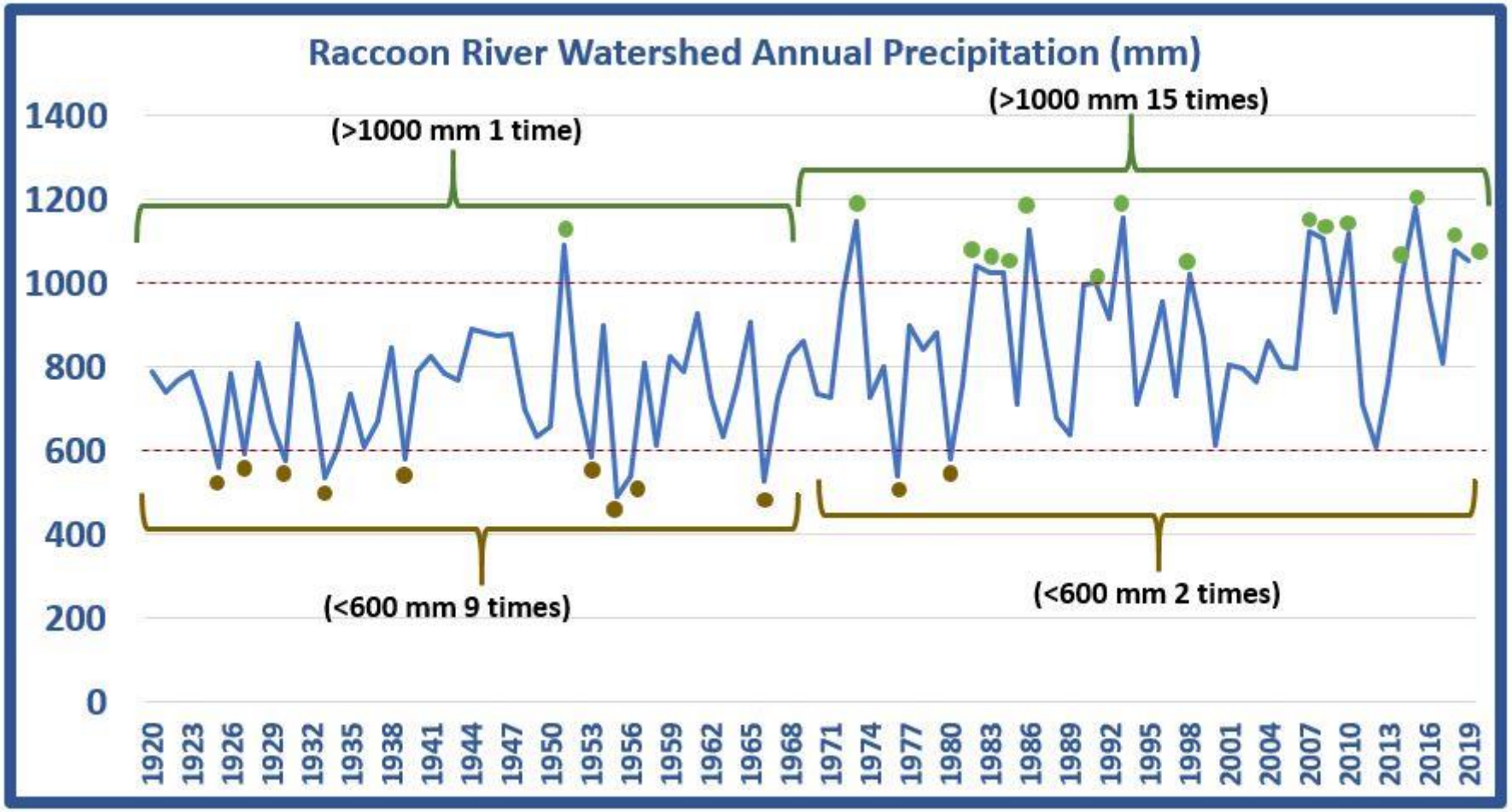
Marsden Long Term Rotation Study-ISU

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)

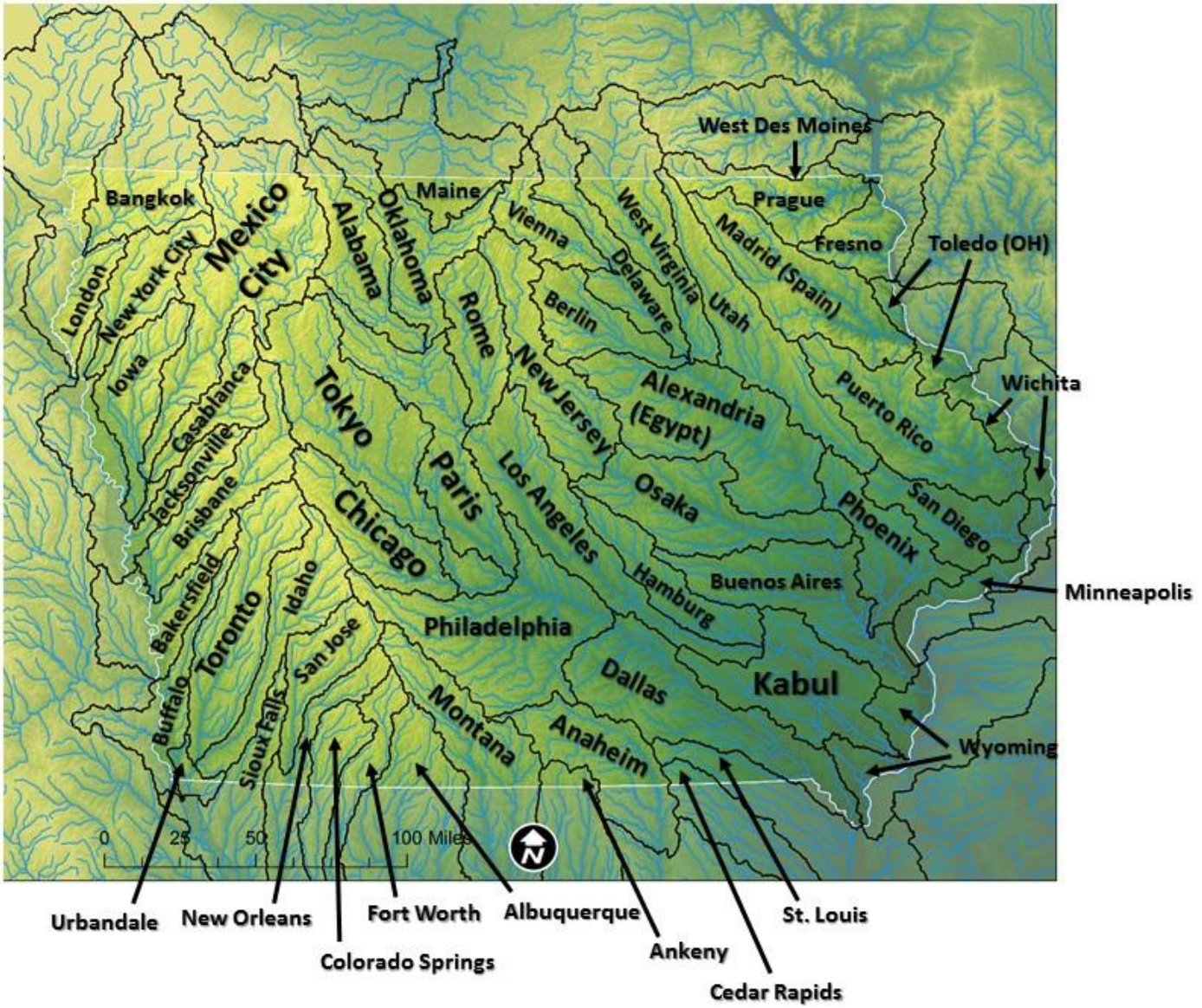
Climate Change



What do we want our production system to look like?

Commerce

Nutrition, Equity and Environmental Outcomes?


West Des Moines
Bangkok
Mexico City
Maine
Prague
Vienna
West Virginia
Madrid (Spain)
Fresno
Toledo (OH)
London
New York City
Alabama
Oklahoma
Delaware
Utah
Berlin
Rome
Iowa
Casablanca
Tokyo
New Jersey
Alexandria (Egypt)
Puerto Rico
Wichita
Jacksonville
Brisbane
Paris
Los Angeles
Osaka
Phoenix
San Diego
Chicago
Hamburg
Buenos Aires
Minneapolis
Bakersfield
Idaho
Toronto
Philadelphia
San Jose
Dallas
Kabul
Buffalo
Sioux Falls
Montana
Anaheim
Wyoming
0
25
50
100 Miles
N
Urbandale
New Orleans
Fort Worth
Albuquerque
St. Louis
Colorado Springs
Ankeny
Cedar Rapids

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