Iowa - The Rivers of Her Valleys 4.0

Session 2

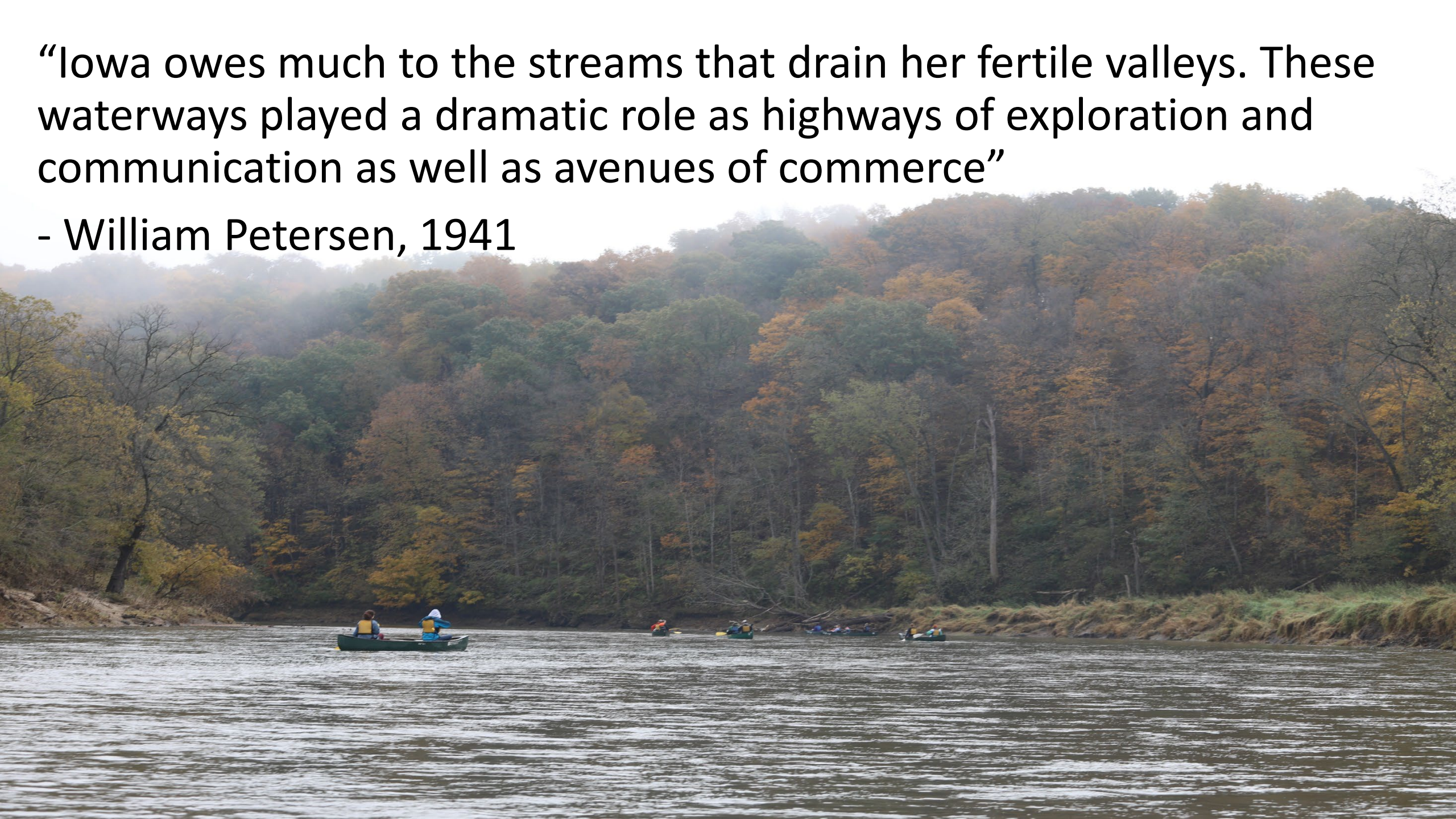
fernweh

(n.) an ache for distant places;
the craving for travel

Rivers and Human History

“Iowa owes much to the streams that drain her fertile valleys. These waterways played a dramatic role as highways of exploration and communication as well as avenues of commerce”

- William Petersen, 1941



Primary questions

How do Iowan's view our streams and rivers, Today?

- Source of transportation
- Means of disposal
- Recreation
- Source of distress – Contamination, Flooding

- Possibly not at all, no connection..?

Contributing to humanity's *Sense of Place & Perception of Time*

"If you love a place you have a duty to protect it & to love a place you must know it first!"

Jeff Johnson – 180° South

Rivers Mystery to Mythology

Gros Ventres – Creation of the World, Creator's Tears

Music

- Spillville, Iowa
  - Billy Clocks Museum
- Turkey River
- #9 New World Symphony

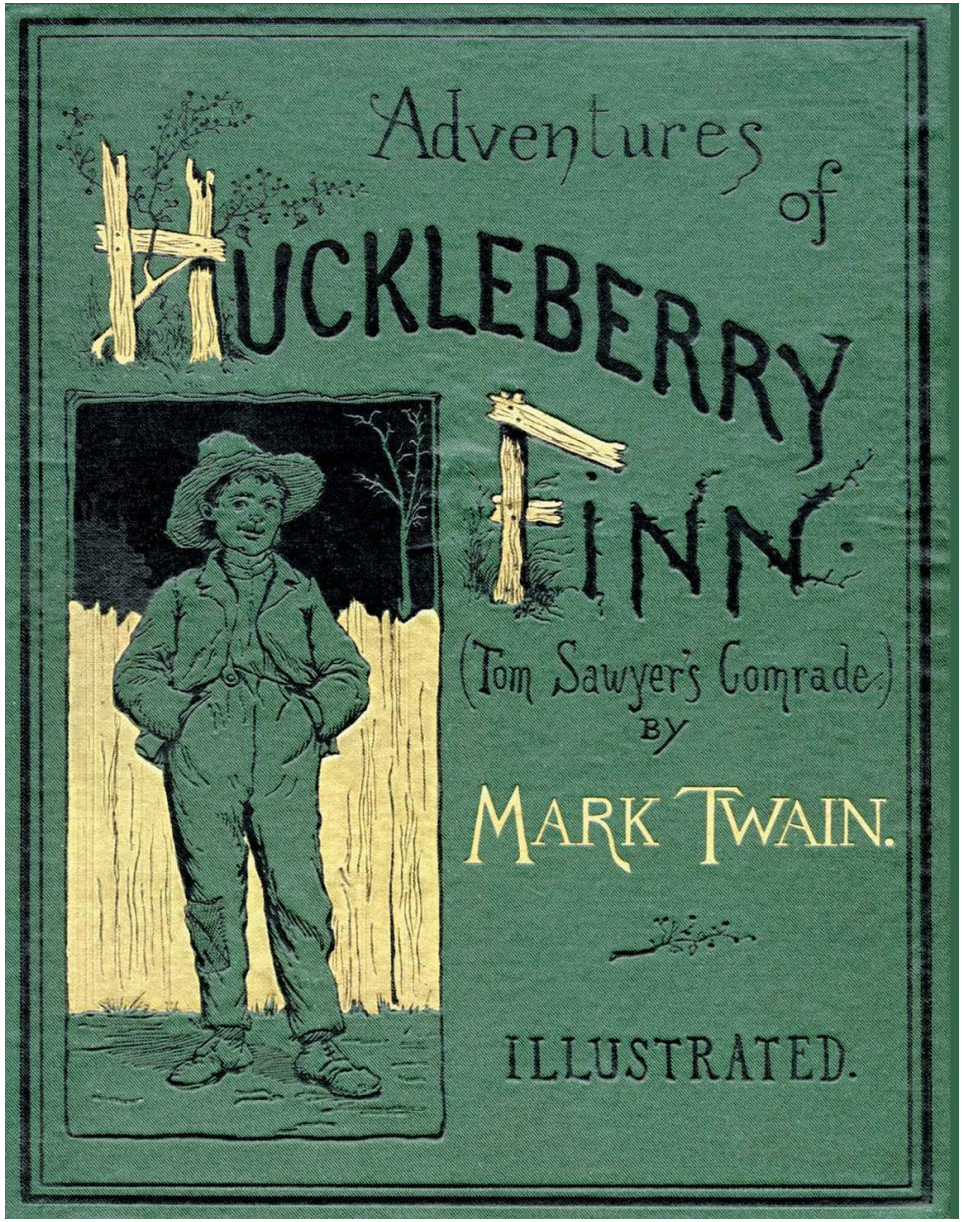
Apollo 11 Mission
Neil Armstrong

Fascinated by Native American and African American melodies
“These beautiful and varied themes are the product of the soil”


ONE ON ONE: LAUGHING RIVER


BISHOP BRIGGS
"River"

Literature, Novels and Poetry



Emily Dickinson

My River runs to thee –
Blue Sea – Wilt welcome me?

My River wait reply.
Oh Sea – look graciously!

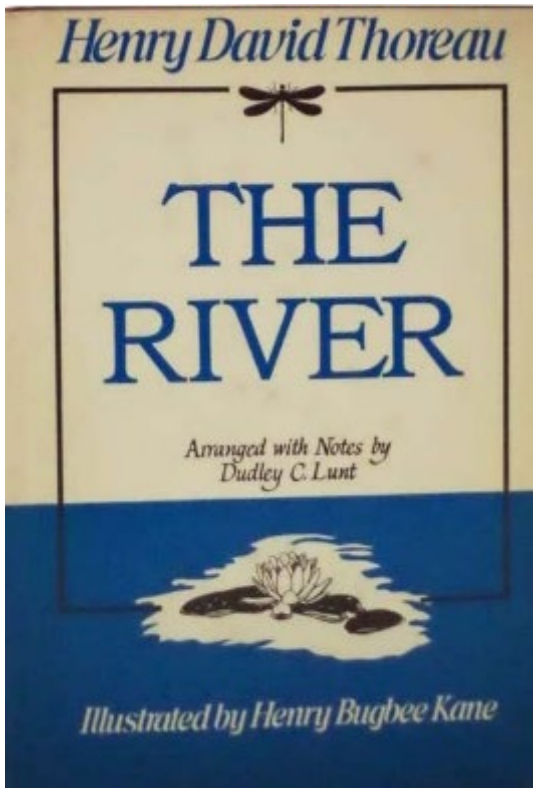
I'll fetch thee Brooks
From spotted nooks –

Say Sea – take Me?

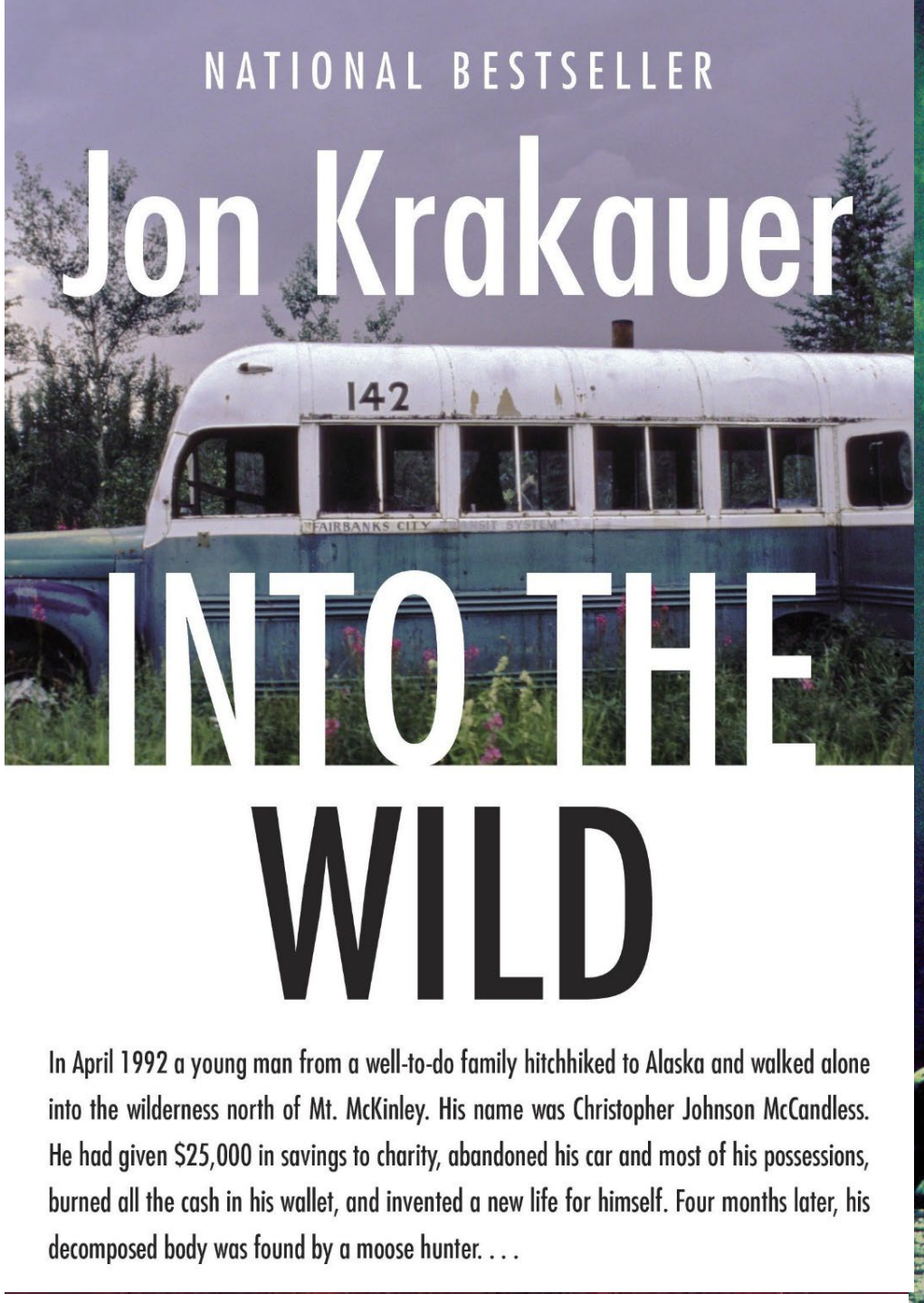
“The river is my own highway, then only wild and unfenced part of the world hereabouts.”

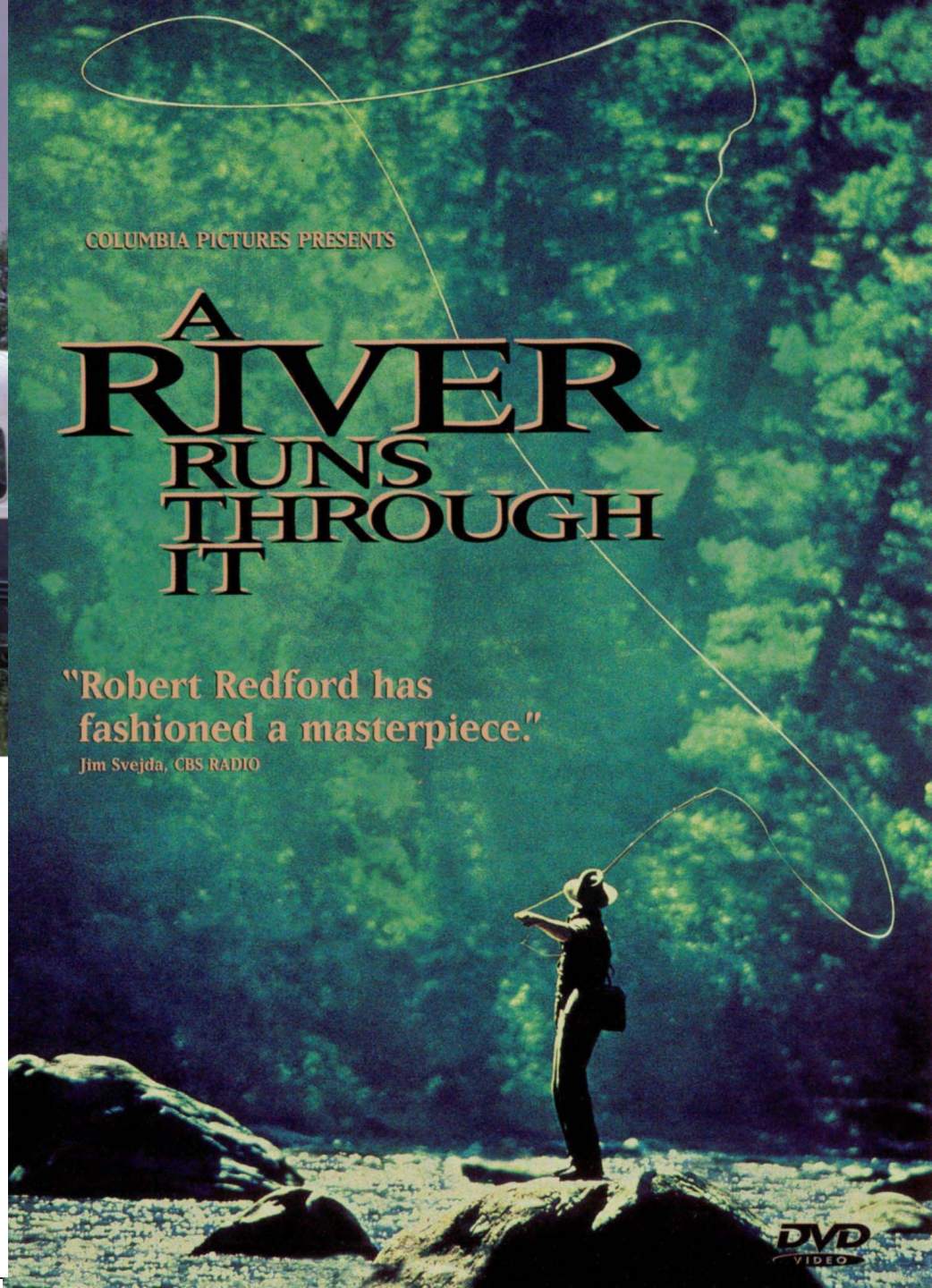
30 May 1852

Henry David Thoreau



Films


NATIONAL BESTSELLER
Jon Krakauer
142
FAIRBANKS CITY
INTO THE WILD
In April 1992 a young man from a well-to-do family hitchhiked to Alaska and walked alone into the wilderness north of Mt. McKinley. His name was Christopher Johnson McCandless. He had given $25,000 in savings to charity, abandoned his car and most of his possessions, burned all the cash in his wallet, and invented a new life for himself. Four months later, his decomposed body was found by a moose hunter. . . .


COLUMBIA PICTURES PRESENTS
A RIVER RUNS THROUGH IT
"Robert Redford has fashioned a masterpiece."
Jim Svejda, CBS RADIO
DVD VIDEO

“Loch water rushing over rocky falls, barley malted over moorland peat slow distillation and long maturation in oak casks; all help us to shape Lagavulin’s robust and smoky character. “Time”, say the islanders TAKES OUT THE FIRE but LEAVES IN THE WARMTH.”

The Strange Horse of Suinabhal by William Black

I hef been in Isa more as three or tow times myself, and I hef been close to the Lagavulin Distillery and I know that it is the clear water of the spring that will make the Lagavulin Whisky just as fine as new milk’

Historical Timeline

Along the river's side

Rivers of Babylon

- Psalm 137
- Song that depicts the Jewish people fleeing Jerusalem, in 586BC after the Babylonian conquest
- By the rivers of Babylon, there we sat down, yea, we wept, when we remembered Zion ... They carried us away in captivity requiring of us a song ... Now how shall we sing the LORD's song in a strange land?

Saul Raskin
(American, 1878–1966)

Tigris & Euphrates Rivers

- Two of the Four Rivers of biblical Eden
- Fertile Crescent
- Start of the Neolithic – Agricultural expansion

Tiber River

Expansion of Rome

Western Civilization

Fontana dei Quattro Fiumi

Nile River


Mediterranean Sea
Alexandria
Cairo
Nile
LIBYA
EGYPT
Luxor
Aswan
Lake Nasser
Red Sea
CHAD
ERITREA
Khartoum
SUDAN
Blue Nile
Lake Tana
ETHIOPIA
CENTRAL AFRICAN REPUBLIC
SOUTH SUDAN
White Nile
Juba
Lake Albert
UGANDA
Lake Kyoga
DEMOCRATIC REPUBLIC OF THE CONGO
Jinja
KENYA
RWANDA
BURUNDI
Lake Victoria
TANZANIA
0
(km)
3 000
0
(mi)
2 000

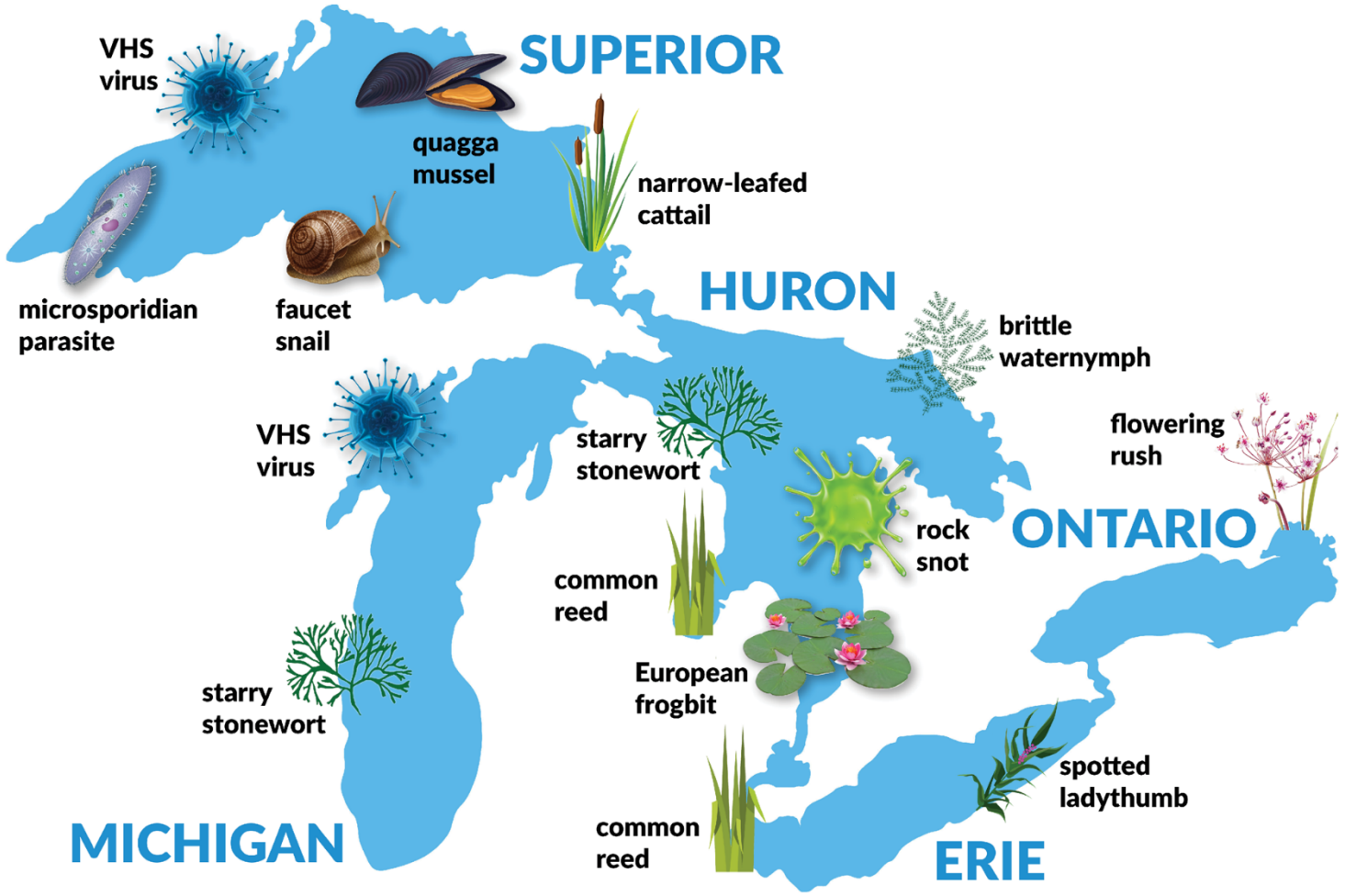
GREAT LAKES ST. LAWRENCE

Thunder Bay
MINNESOTA
LAKE SUPERIOR
ONTARIO
QUE
Duluth
Whitefish Bay
Sault Ste. Marie locks
MICHIGAN
WISCONSIN
Green Bay
LAKE MICHIGAN
LAKE HURON
Milwaukee
Goderich
Oshawa
Toronto
Hamilton
Lake St. Clair
Sarnia
Detroit
Chicago
Monroe
Windsor
LAKE ERIE
Erie
Burns Harbor
Toledo
Conneaut
Ashtabula
Lorain
Cleveland
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
Ottawa
St. Lawrence
Trois-Rivières
Sorel
Montréal
Salaberry-de-Valleyfield
Prescott
Ogdensburg
SAINT LAWRENCE SEAWAY
LAKE ONTARIO
Oswego
Nantikoke
Buffalo
NEW YORK
Boston
ATLANTIC OCEAN
New York
Philadelphia
Ports
0 100 200 300 km

Invasive species

Invaders keep spreading

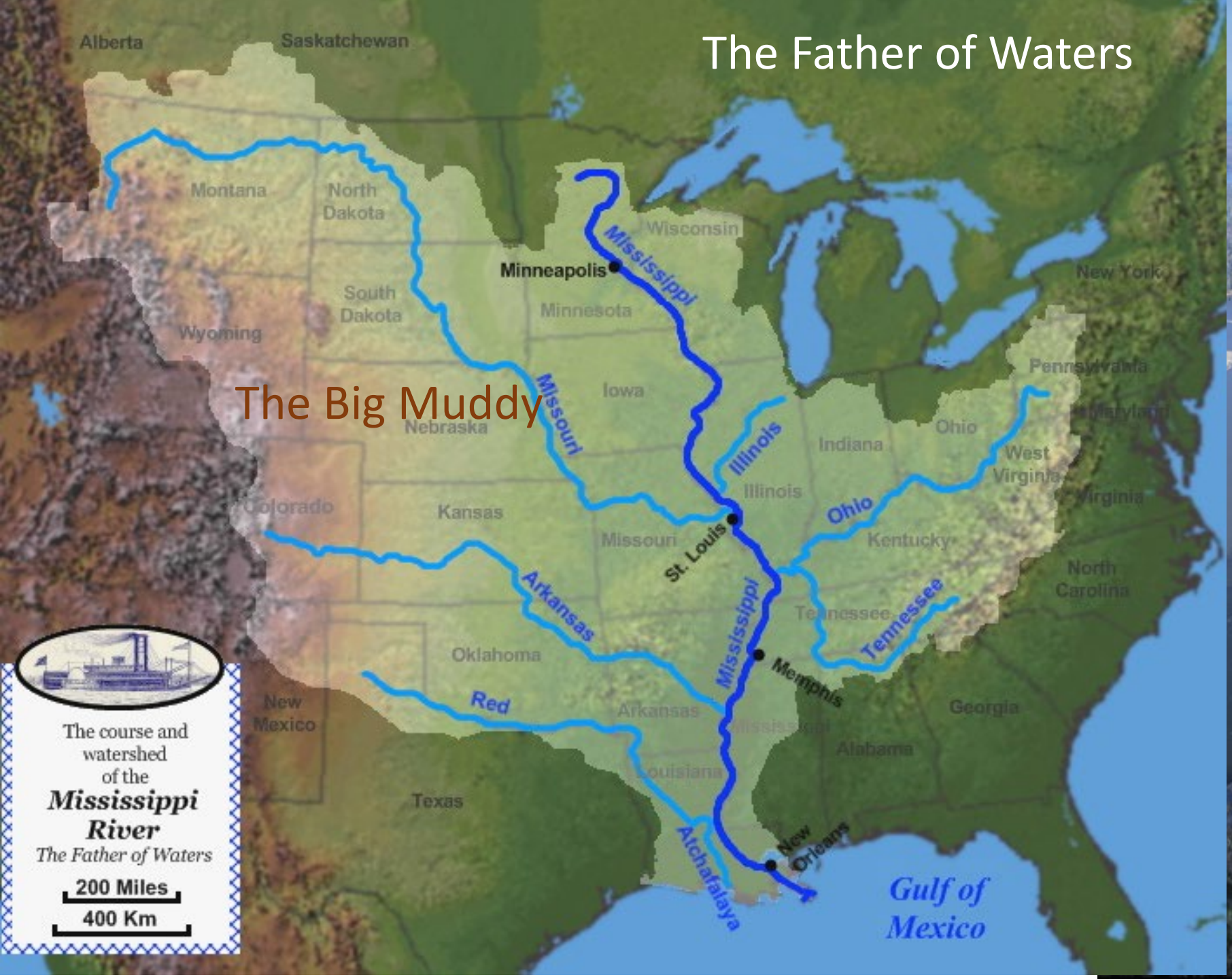
Just three new nonnative species have been detected in the Great Lakes in recent years. Their introduction has been slowed by ballast water regulations for ocean-faring ships. But scientists and regulators struggle to keep unwanted creatures from traveling between lakes. Here's a look at species that have spread to each lake over the past decade.

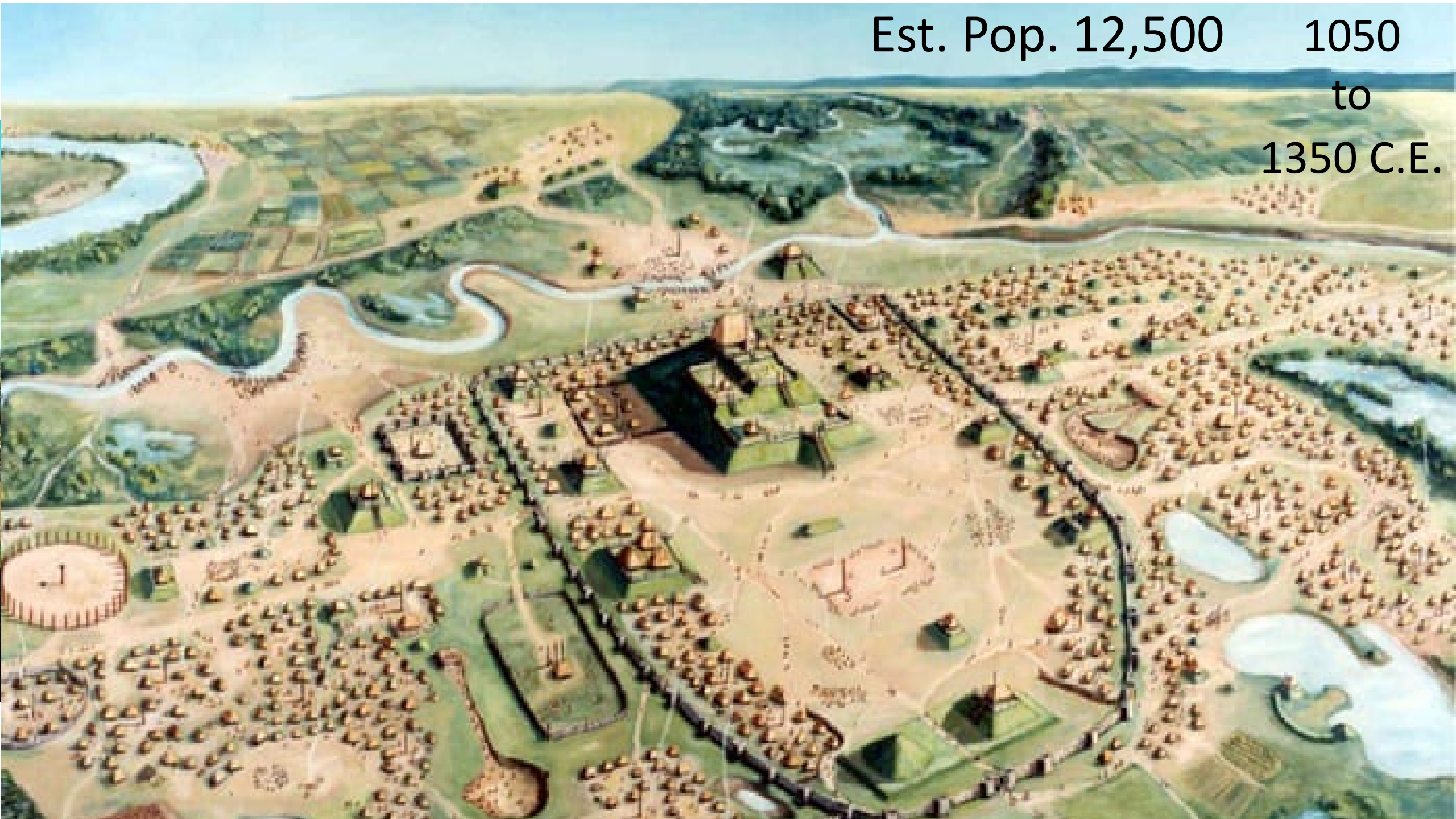


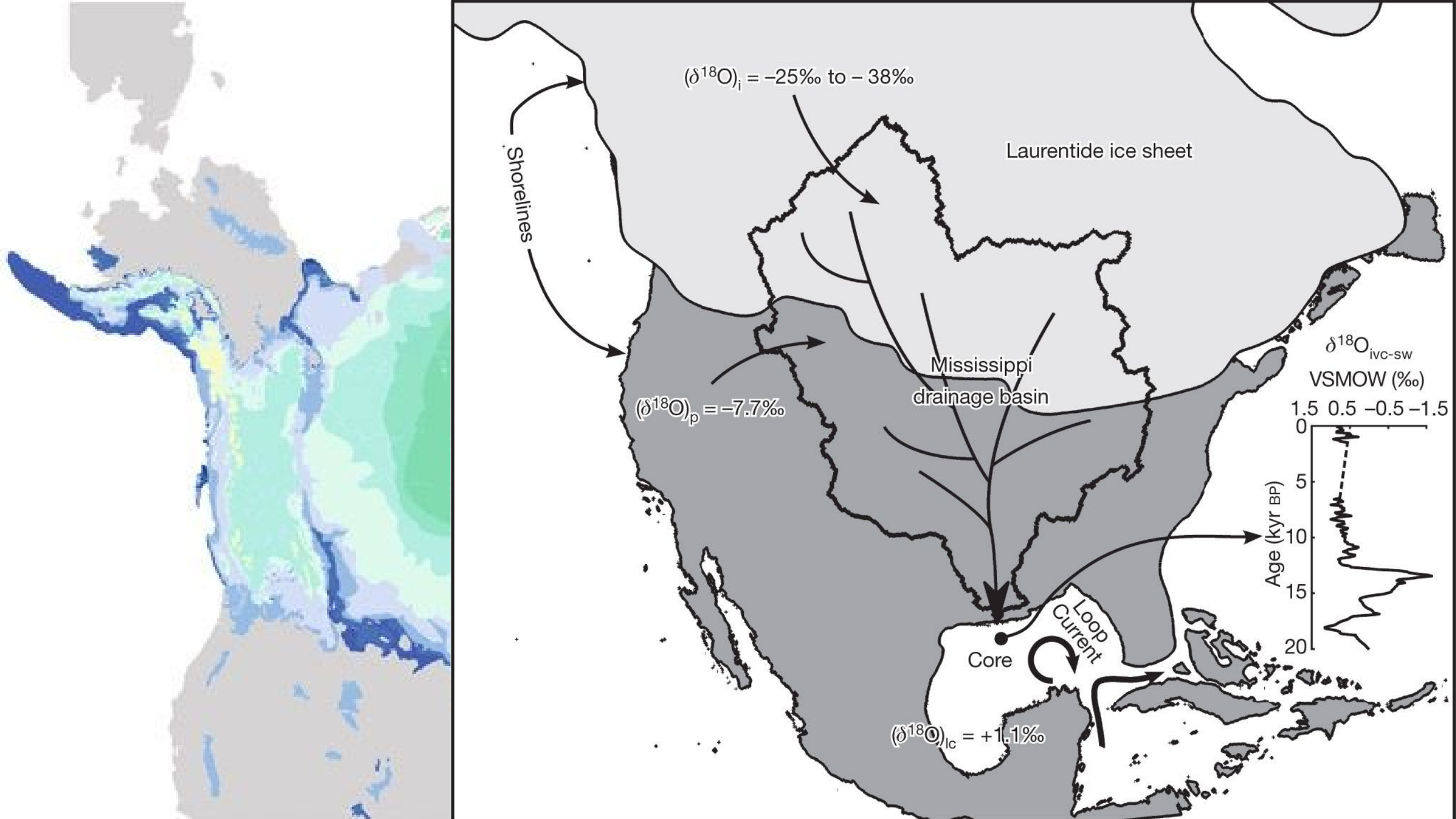
Source: U.S-Canadian State of the Great Lakes 2019 report

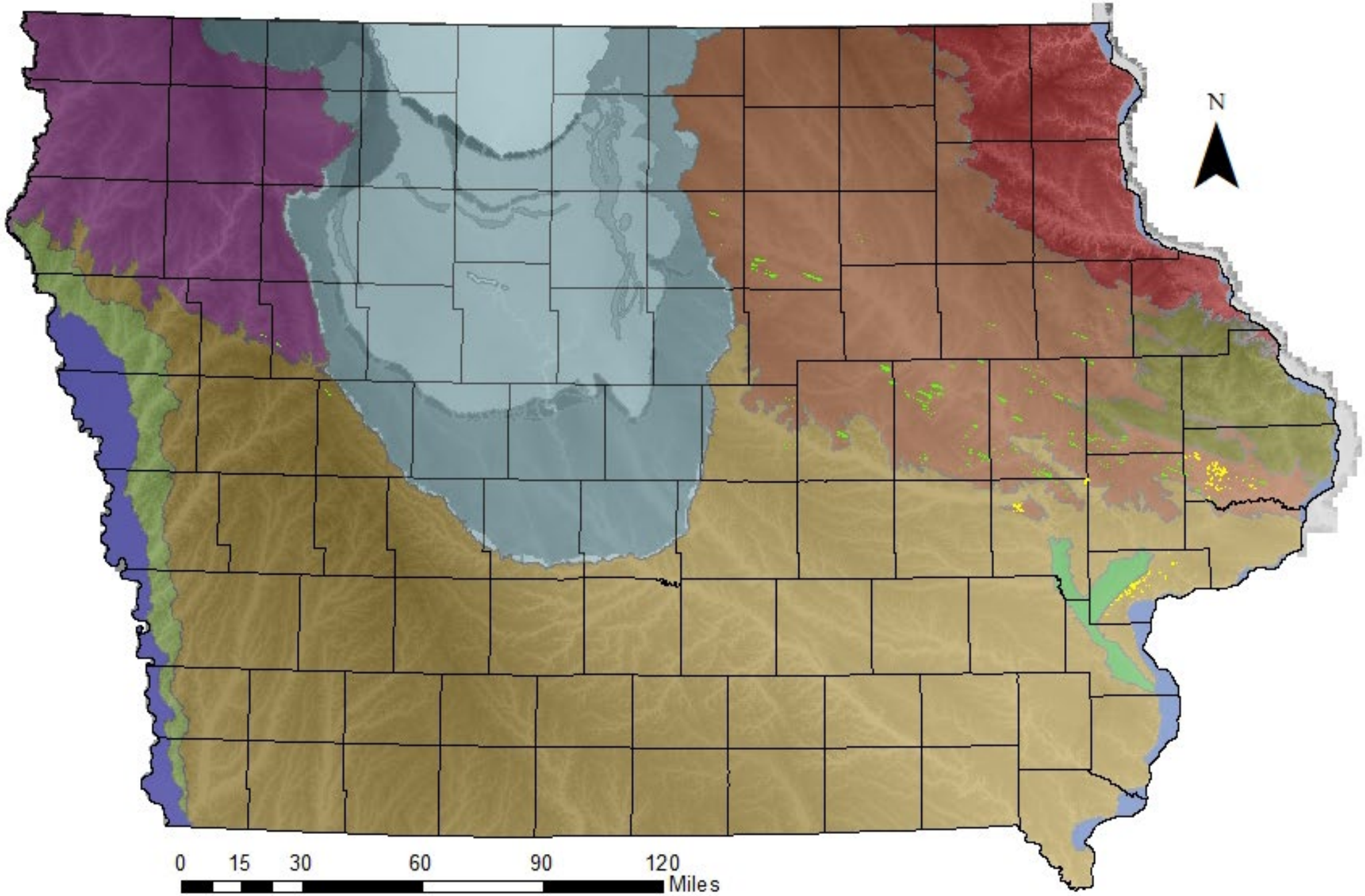
The Father of Waters

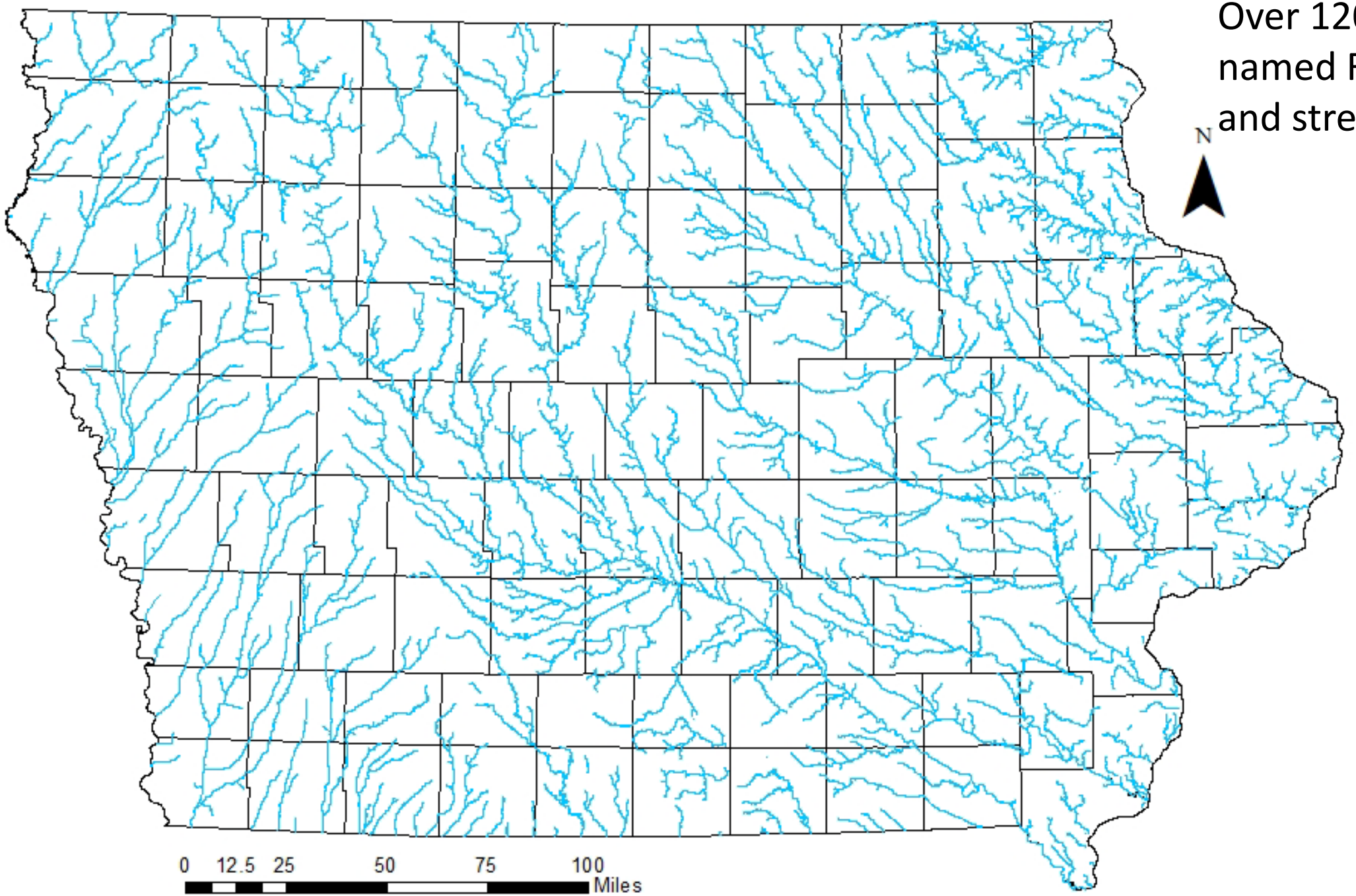
The Big Muddy




Est. Pop. 12,500
1050
to
1350 C.E.


$(\delta^{18}O)_i$ = –25‰ to – 38‰
Laurentide ice sheet
Shorelines
Mississippi
drainage basin
$(\delta^{18}O)_p$ = –7.7‰
$\delta^{18}O_{ivc\text{-}sw}$
VSMOW (‰)
1.5 0.5 –0.5 –1.5
0
5
10
15
20
Age (kyr BP)
Loop
Current
Core
$(\delta^{18}O)_{lc}$ = +1.1‰


N
0
15
30
60
90
120
Miles


Over 1200
named Rivers
and streams
N
0 12.5 25 50 75 100
Miles

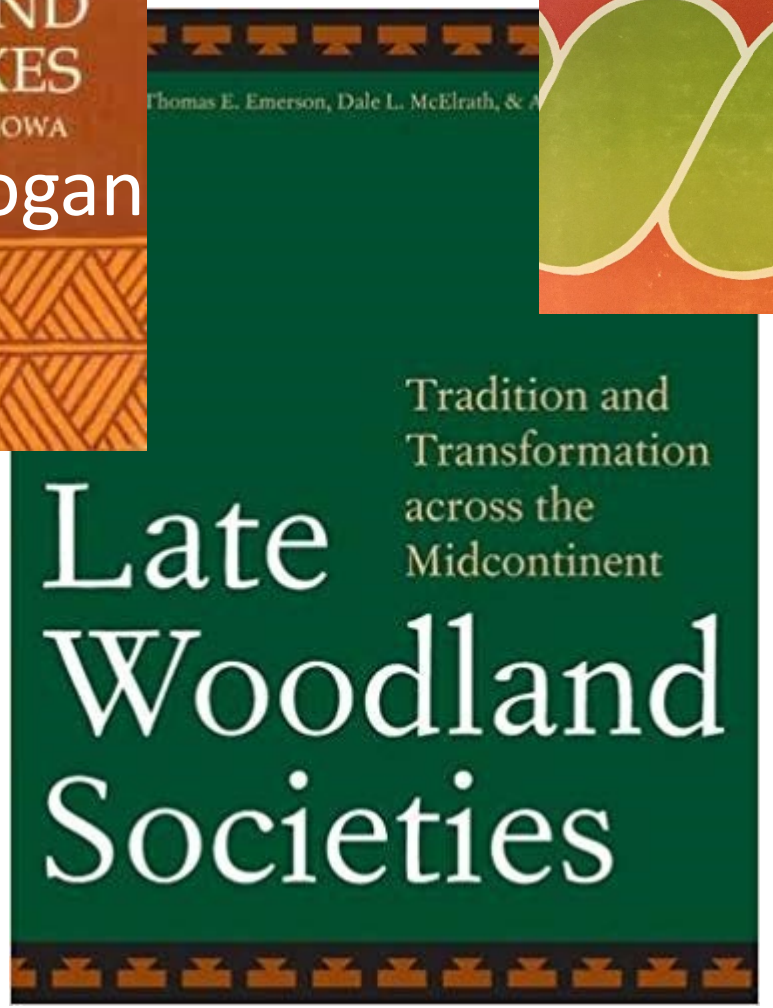
Native Americans

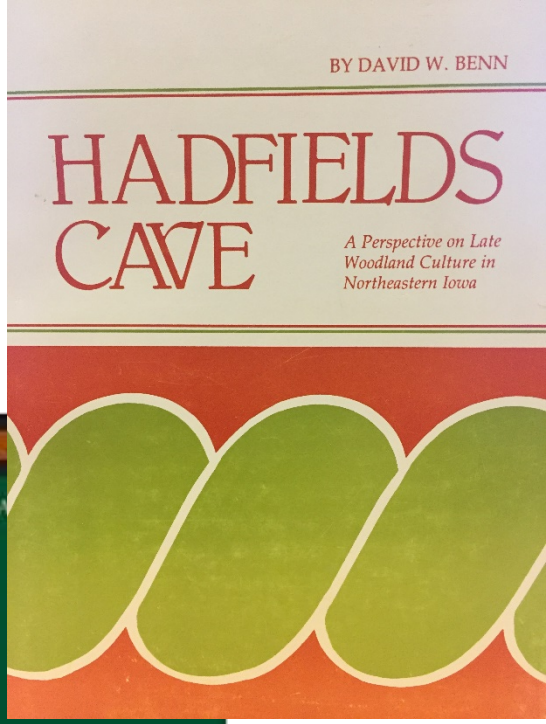
Algonquian

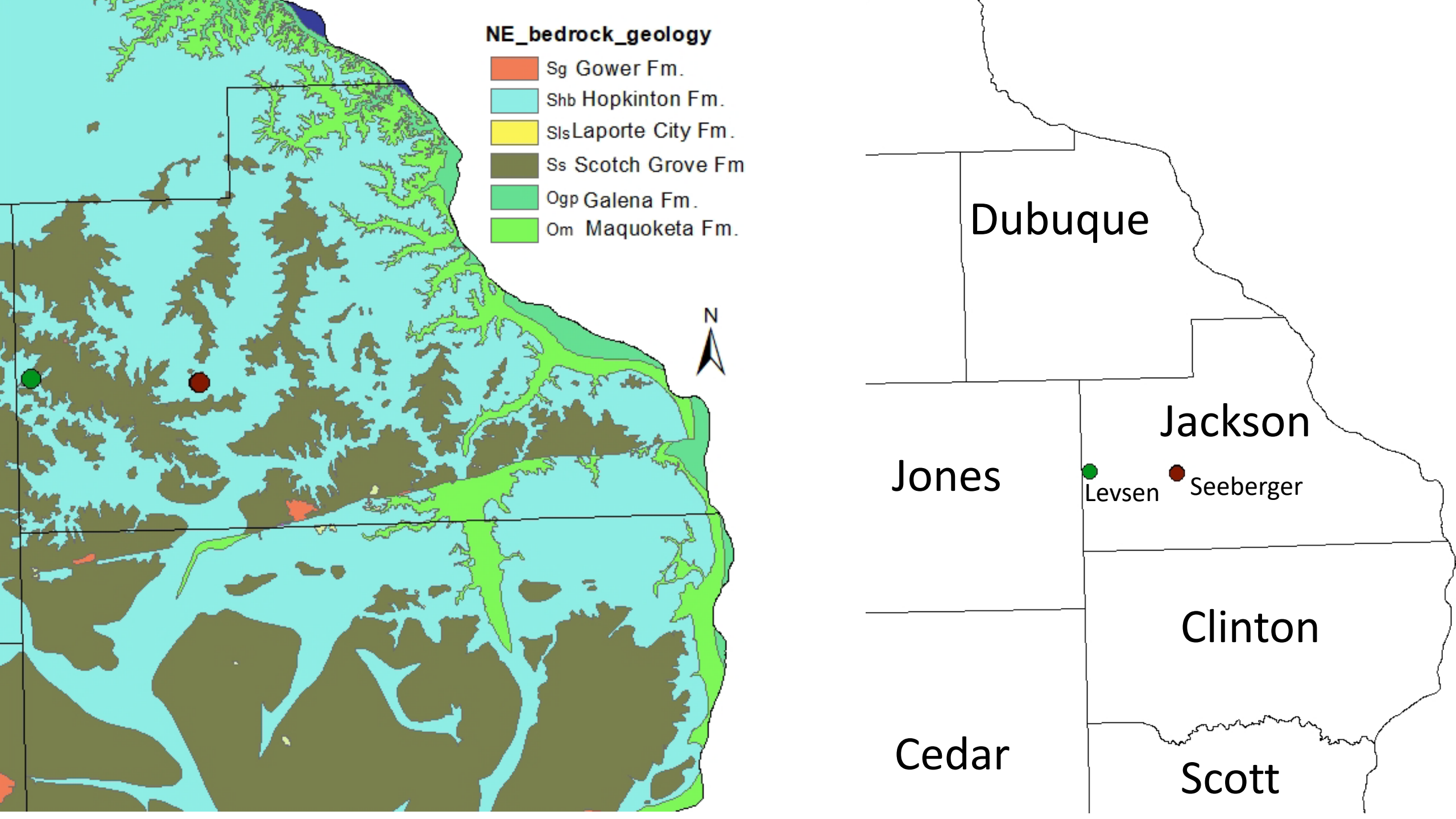
Oneota

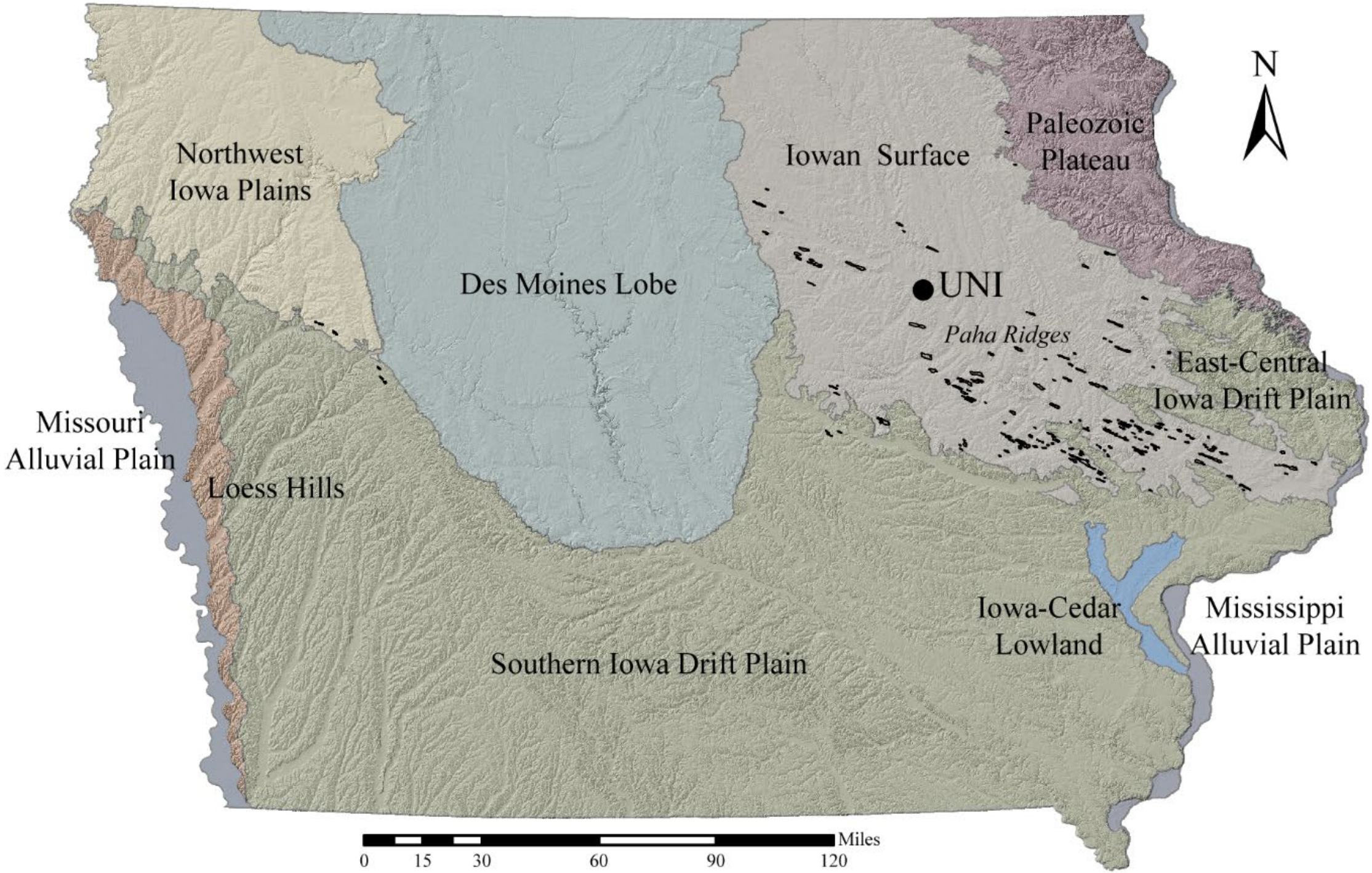
Mill Creek

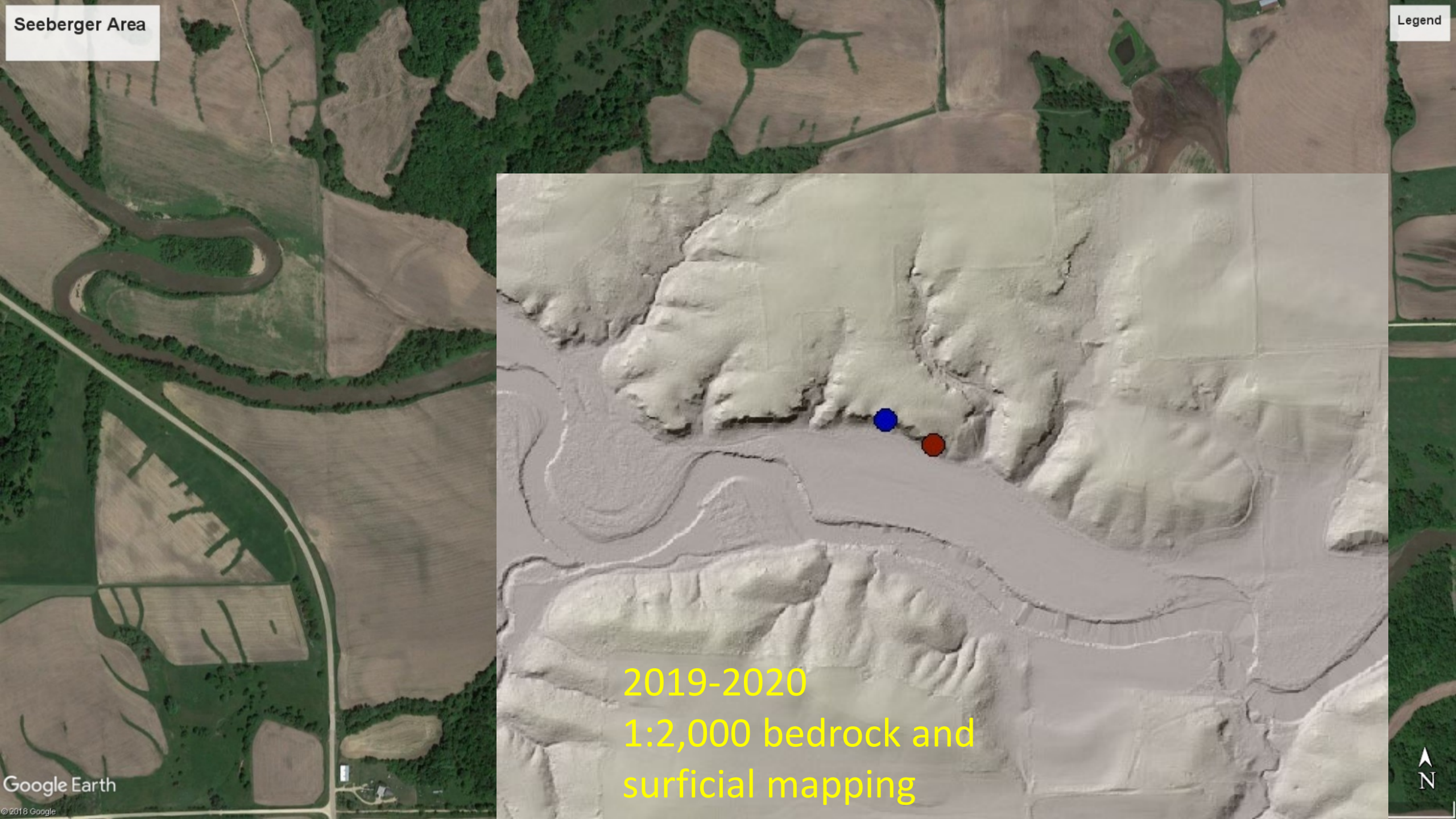
Wilfred Logan



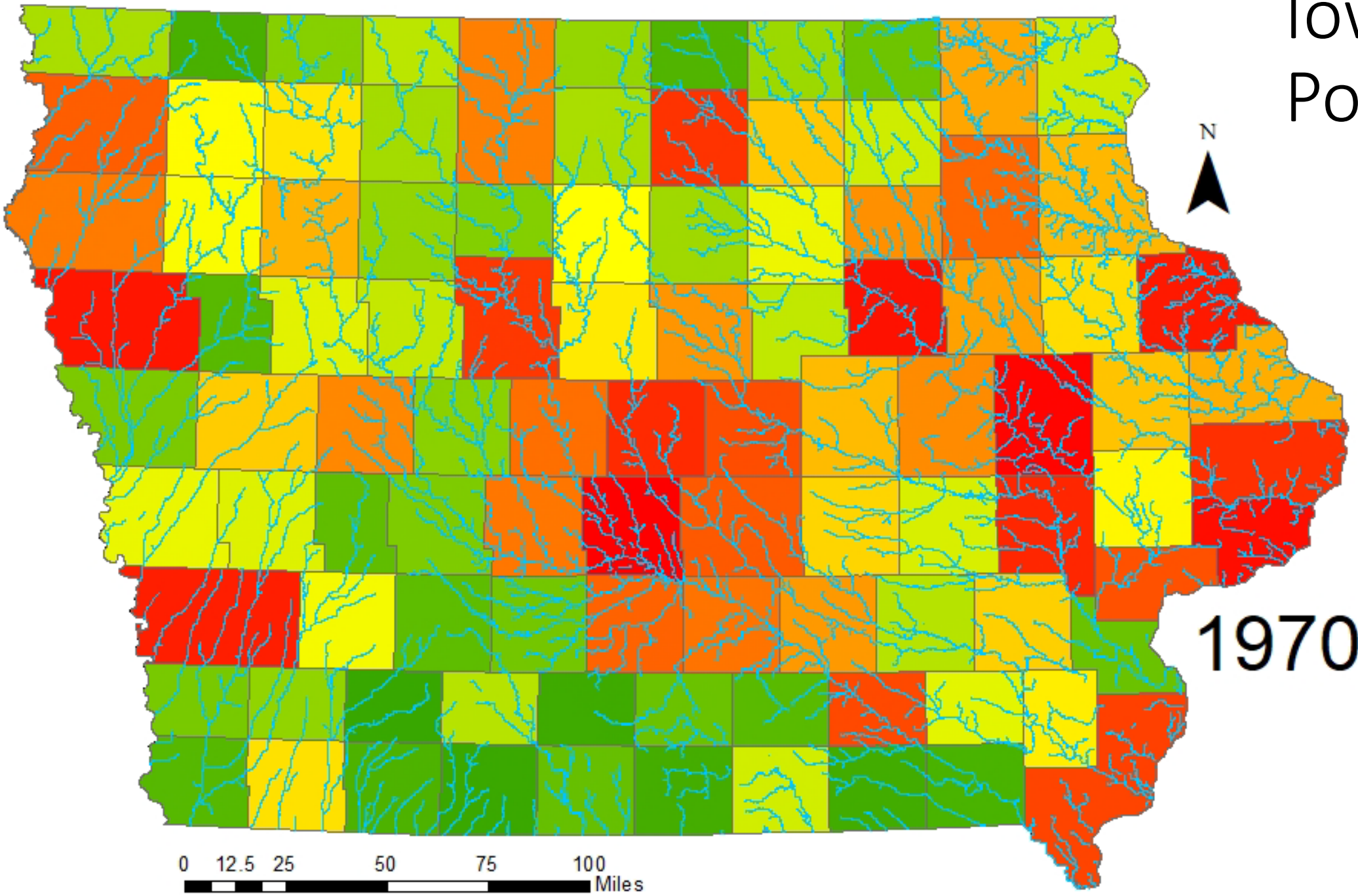



NE_bedrock_geology
Sg Gower Fm.
Shb Hopkinton Fm.
Sls Laporte City Fm.
Ss Scotch Grove Fm
Ogp Galena Fm.
Om Maquoketa Fm.
N
Dubuque
Jackson
Jones
Levsen
Seeberger
Clinton
Cedar
Scott


N
Northwest
Iowa Plains
Des Moines Lobe
Iowan Surface
Paleozoic
Plateau
UNI
Paha Ridges
East-Central
Iowa Drift Plain
Missouri
Alluvial Plain
Loess Hills
Iowa-Cedar
Lowland
Mississippi
Alluvial Plain
Southern Iowa Drift Plain
Miles
0
15
30
60
90
120


Seeberger Area
Legend
2019-2020
1:2,000 bedrock and
surficial mapping
Google Earth
© 2018 Google
N

Iowa's Population



Explorers, Pioneers and Steamboats

Rivers facilitated

Migration

Trade

Pelts

Grain

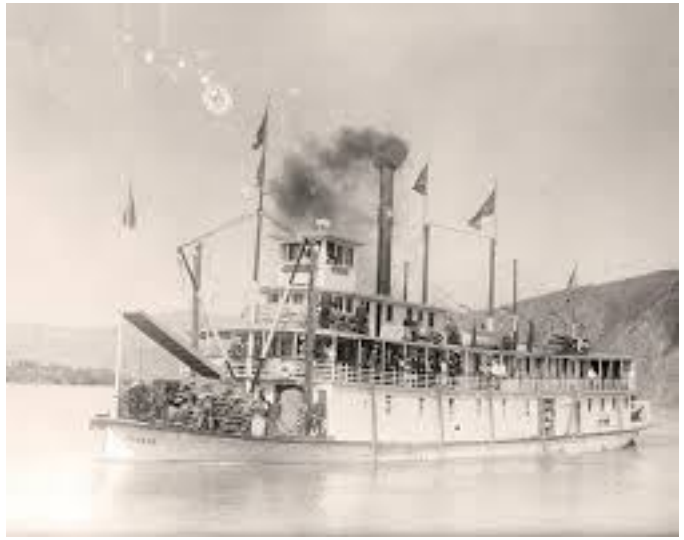
Wood

Ore

Gambling

Military

1823



Virginia

1860

Chippewa

1819

Old Times on the
Upper Mississippi
The Recollections of a Steamboat Pilot 1908 from 1854 to 1863
George Byron Merrick (1908)
https://www.gutenberg.org/files/47262/47262-h/47262-h.htm

Missouri pdf

Dubuque/Galena

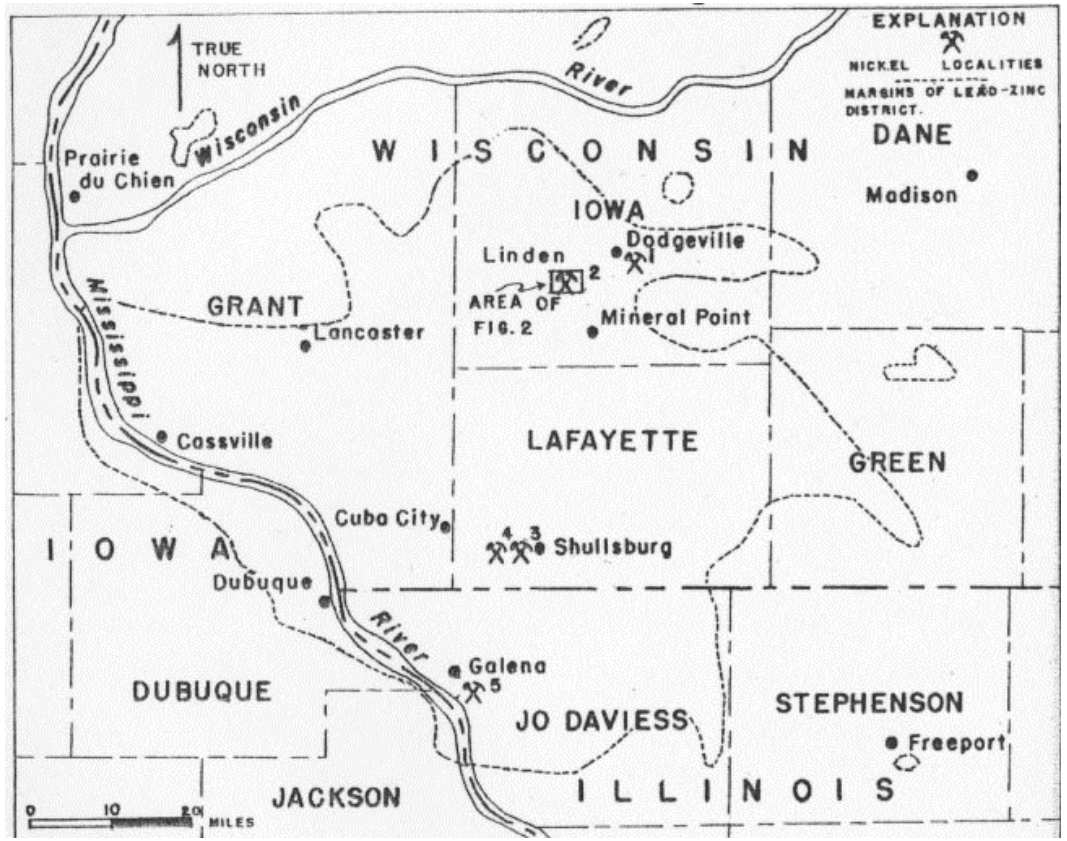
- 1823 to 1848
- 472,000,000 lbs or 6,728,000 pigs of lead went down stream
- 1847
  - $1,654,077 of lead
  - $52,186,150 today
- Approximately double the combined value of the St. Louis Fur Trade and Santa Fe Trail!

Roman Pig/Ingot of Lead

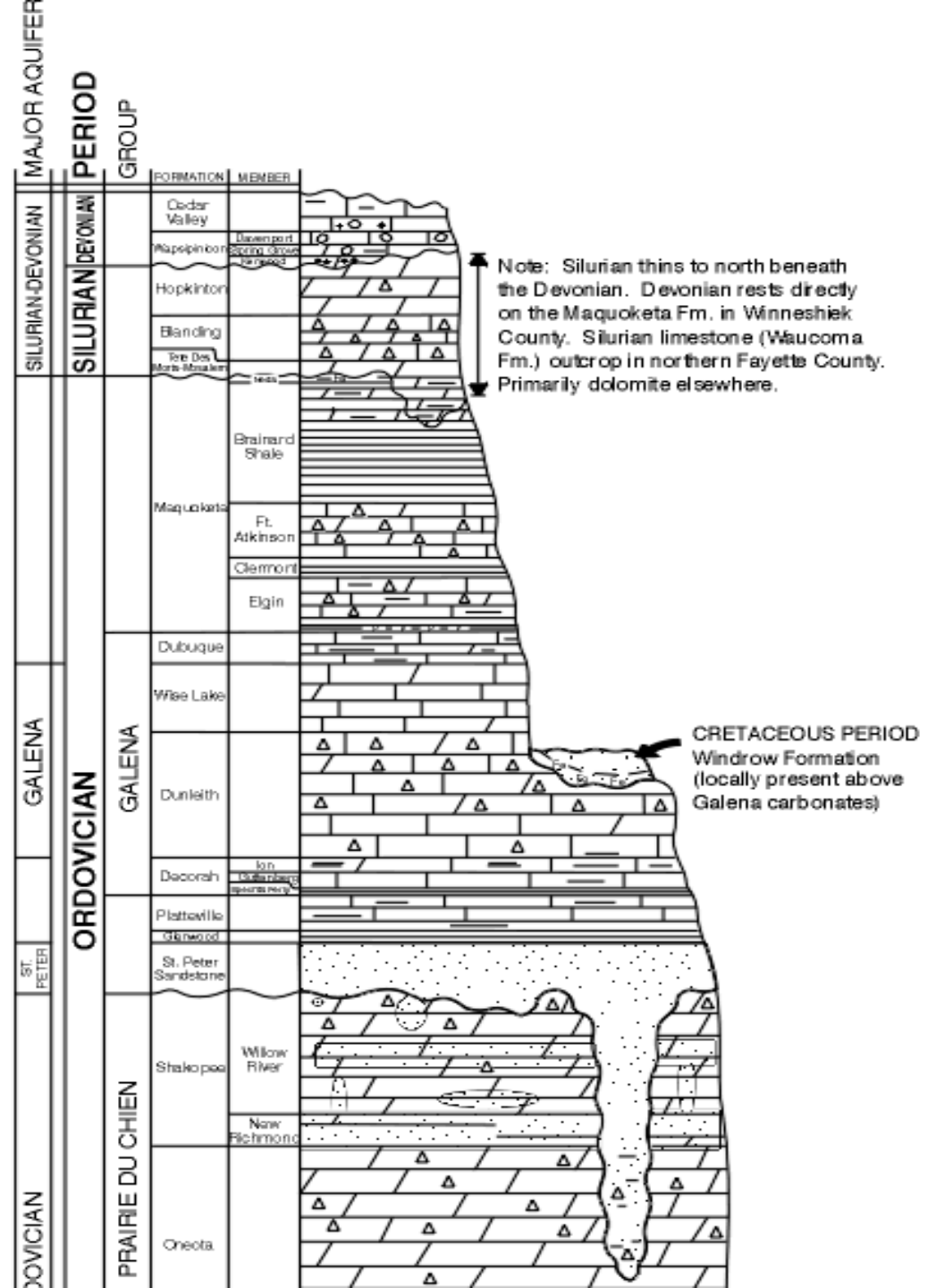
144lbs , 69Kg

Galena Group

- Dunleith, Wise Lake, and Dubuque Formations

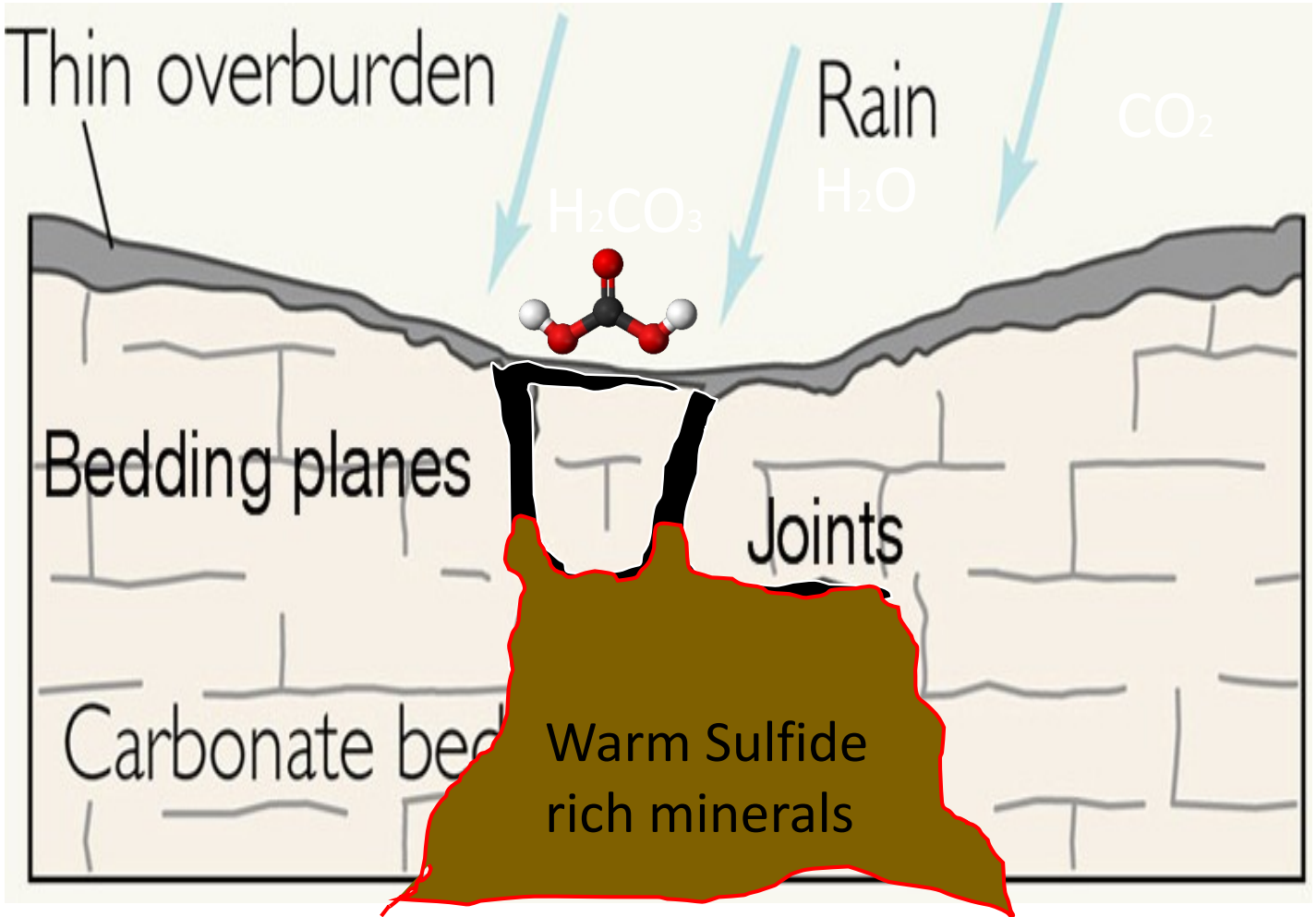


Upper Mississippi Valley Zinc and Lead District



How does Galena & Zinc form in Limestone?

- Space is created, through karst processes
- Warm sulfide-rich solutions migrate upwards and infiltrate the new space
- Sulfide minerals precipitate out of solution and along the edges of these new spaces
- The Mississippi cuts its channel into the landscape and lowers the water table
- Exposing the sulfide minerals, creating Iron sulfide, Lead sulfide, and Zinc sulfides



Lead and Zinc Mining 1788-1860

- Spain ruled Iowa via the Treaty of Paris (1763) as a product of the French and Indian War (1756-1763)
- Julien Dubuque became friends with the local Meskwaki, eventually marrying Potosa and entering their culture as *Little Night*.
- Julien, identified the mineral recourses and with the Meskwaki's permission began mining
- Julien, requested ownership/confirmation of his land from the Spain, and it was granted in 1796. 'The Mines of Spain'

Died at 45 (1810) deeply in debt

Continued Immigration into and through 1900

- Steamboat ‘Bills of Landing’ Post 1850 show increased arrivals of..
  - Rakes, hoes, spades, grindstones
  - Farm machinery
- Major populations of
  - Dutch to Pella
  - Tappist monks to New Melleray/Ireland
  - Luxemburgers to St. Donatus
  - Swiss to New Glarus
  - Germans to Davenport, Guttenburg, Reinbeck and New Berlin/Lincoln…
  - Mecklenburgers, set up a socialist community in Elkader
  - Czech and Slovak to Cedar Rapids

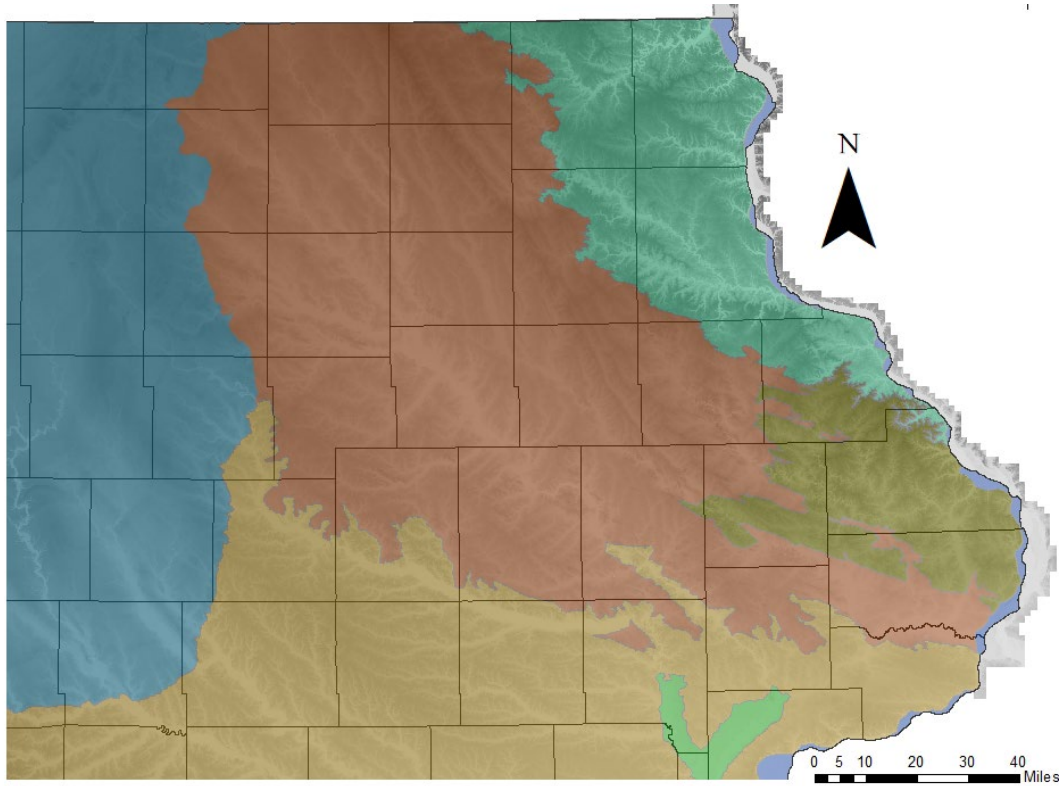
Iowa's Interior – Resources, Power, Goods

- Black Hawk Purchase, 1833
  - 1830s 1st Mills
    - Grist
    - Saw
- 1870
  - 502 Gristmills
  - 545 Sawmills


Close up of a few

The Maquoketa River

- Scenic, rugged beauty, bluffs, caves, rock shelters
- Black Hawk Purchase
- Pioneers pushed out horse thieves, counterfeiters
- First Governor Ansel Briggs
- Keel to steamboats
- Flooding
  - June 15, 1925
  - June 27, 1944
  - June 13, 1947
  - June 5, 2002



Wapsipinicon River

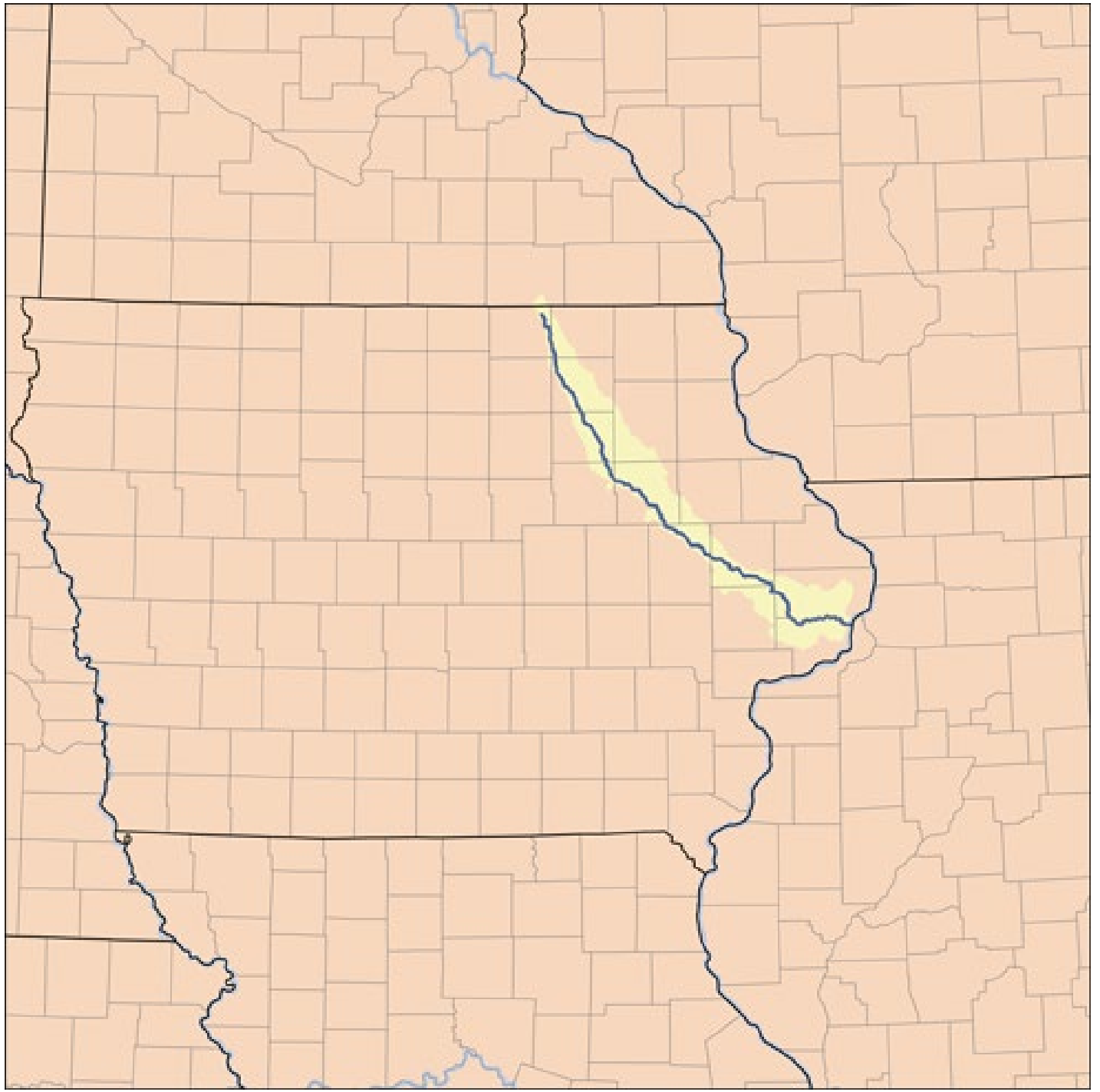
- Near Quasqueton
  - Wapsi, beautiful maiden
  - Pinicon, son of a prominent Chief
- Eve of their wedding
  - Jealous Fleet Foot
  - Drove an arrow through Pinicon's heart
- Waspi dives to help Pinicon
  - Their canoe tips over and they are both swept away

River of such tragic happenings,
River of such noble passions,
Named of each ill fated lover,
Sing their death song, sweet and haunting
Sing it through the countless eons,
Sing it days and years and ages,
Sing it while the sands are shifting,
Sing that name of wondrous meaning,
The enchanted Wapsipinicon.

White Potato River
Or Swan Apple River

Wapsipinicon

- Narrow valley
- No major tributaries
  - Buffalo Creek
    - Coddon to Anamosa



Still subject to flooding

- August 1858
- Spring 1865, Heavy snow/spring rain
  - Took out bridge in Independence then bridge, dam and sawmill in Quasqueton
- Spring 1871, ice jam

The Cedar River

“In point of beauty and fertility the Cedar Valley is unsurpassed by any portion of the United States”

- Major William Gordon, 1835

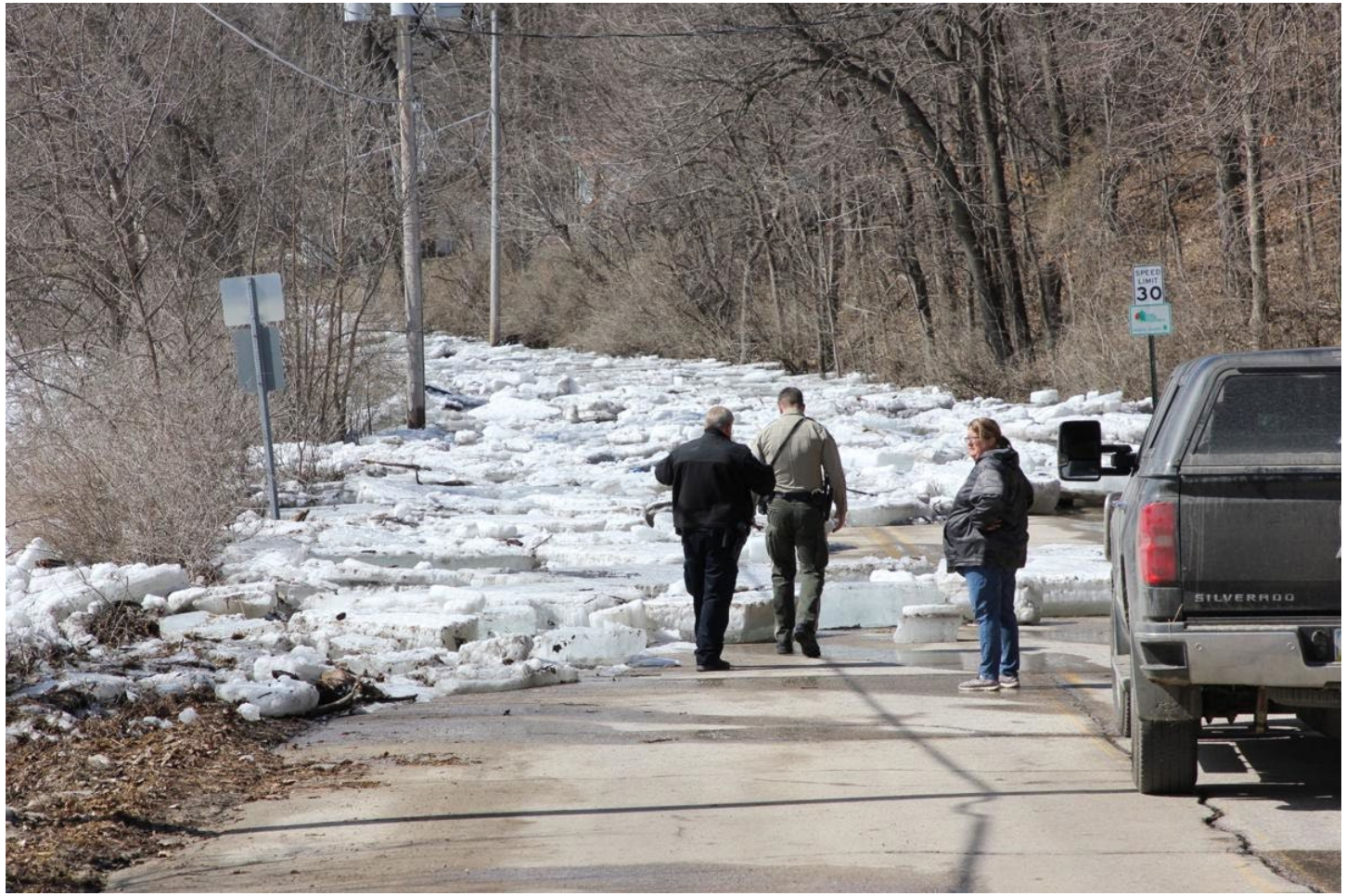
1845 George and Mary Hanna park their prairie schooner on the Cedar. Mary shouts “Boys don’t stop here! This seems to me to the River of live and over yonder is Canaan; let us cross over.”

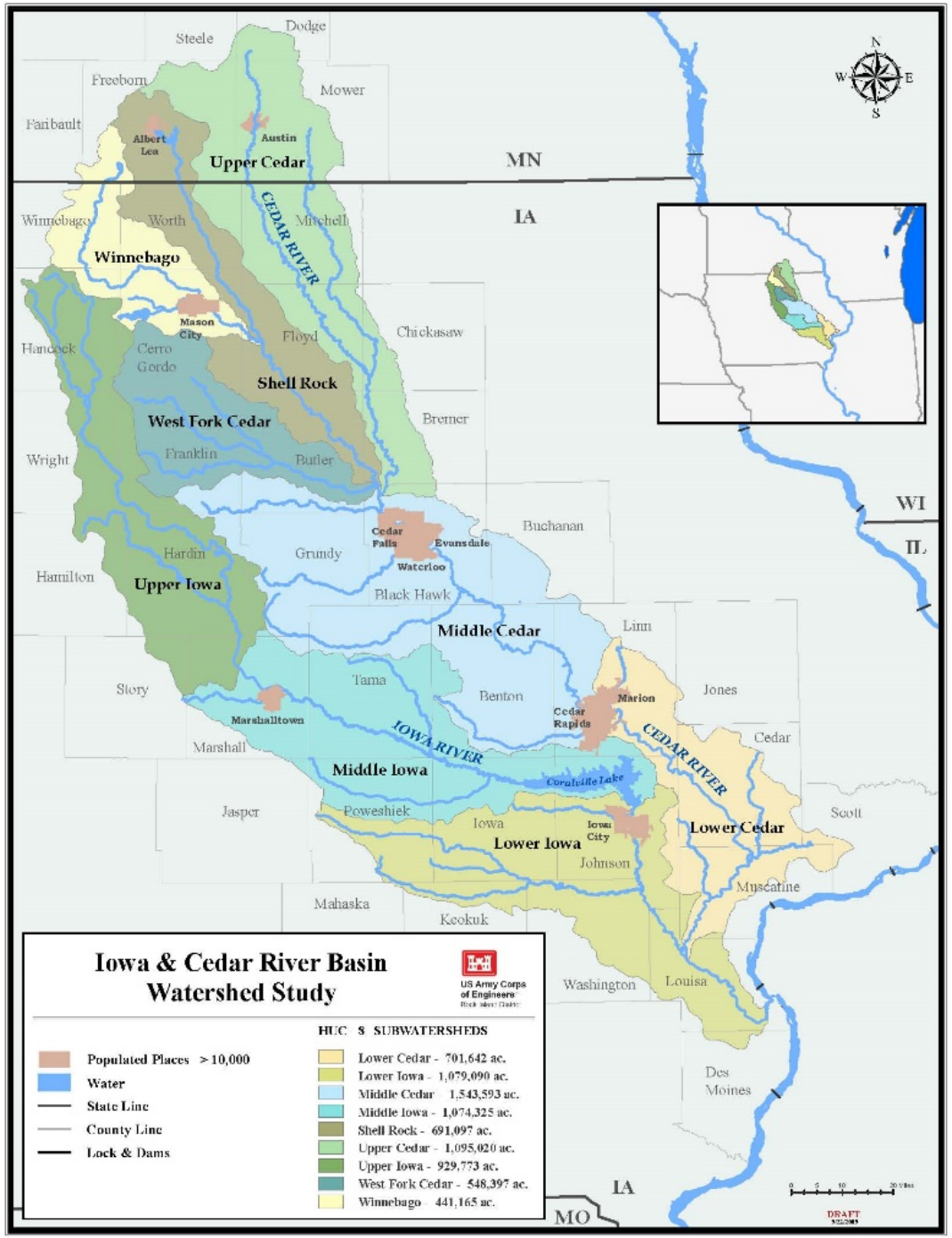
1853 On that site, George Hanna, Charles Mullan and G.W. Brooks founded Waterloo


ROTOR
VISUAL

Flooding

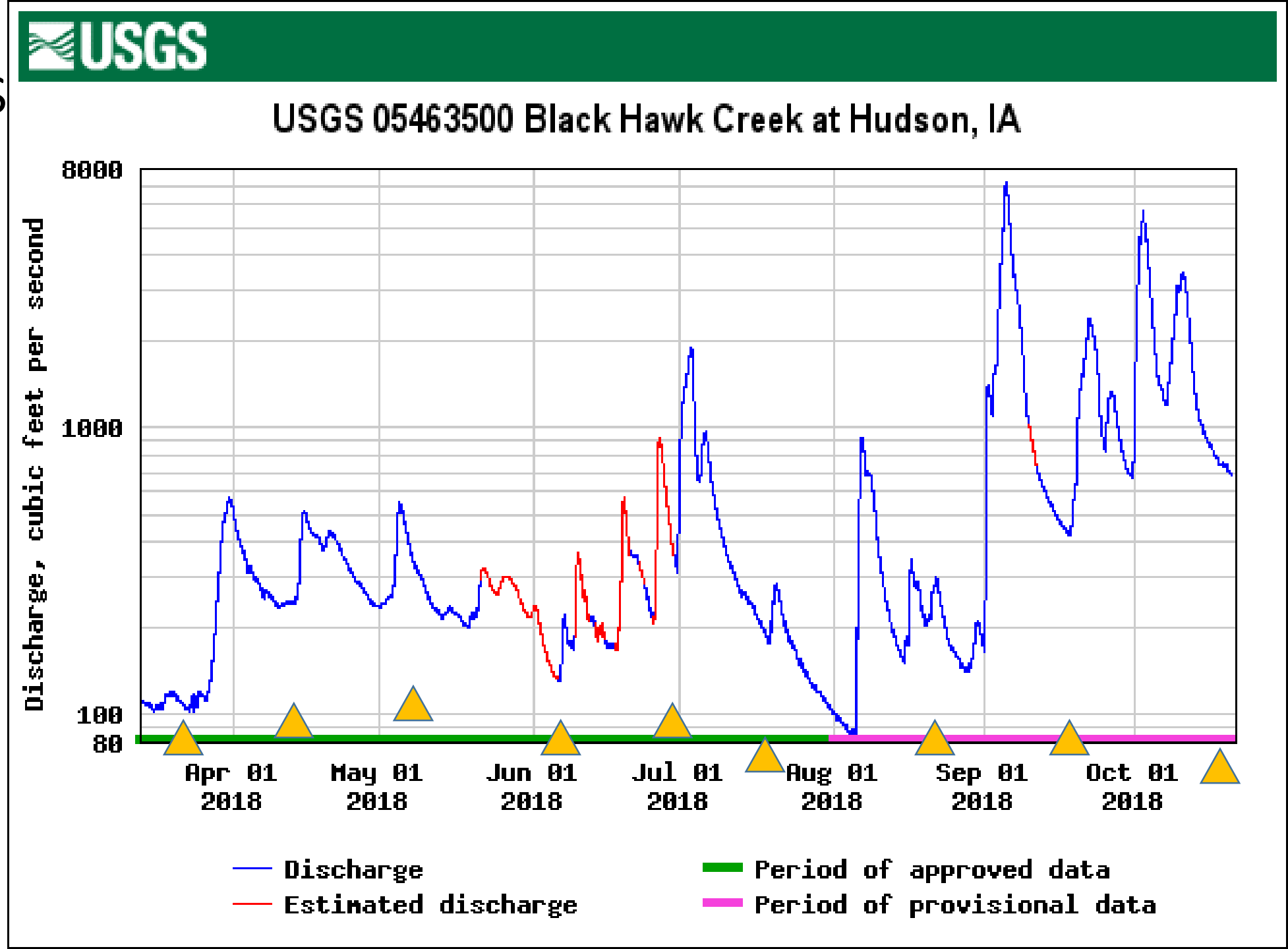
- Intense Rain falls
- Heavy snow packs
- Ice jams
- Urbanization



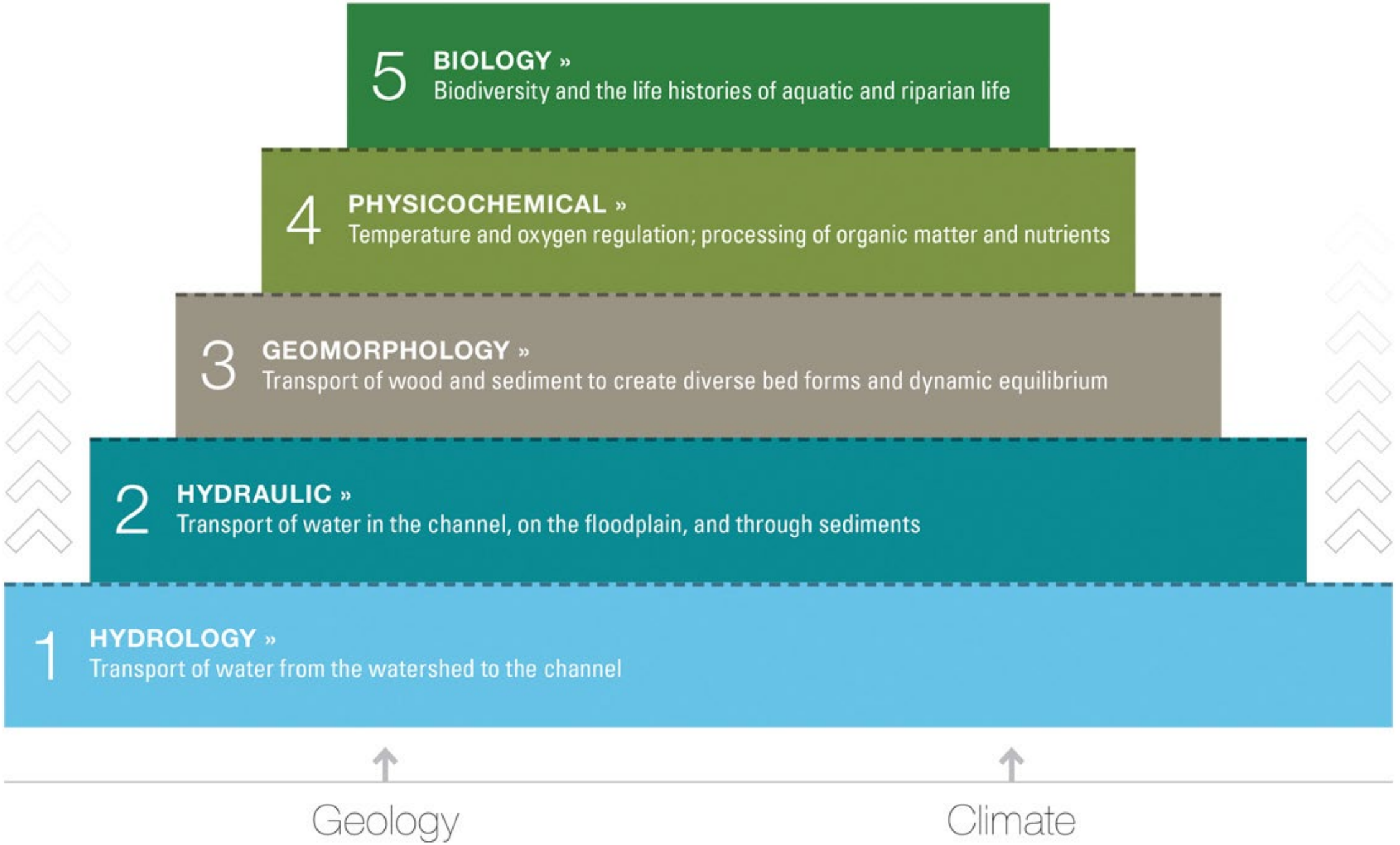

Steele
Dodge
Freeborn
Mower
Faribault
Albert Lea
Austin
Upper Cedar
MN
IA
CEDAR RIVER
Winnebago
Worth
Mitchell
Winnebago
Mason City
Floyd
Chickasaw
Hancock
Cerro Gordo
Shell Rock
West Fork Cedar
Bremer
Franklin
Butler
Wright
WI
IL
Buchanan
Cedar Falls
Evansdale
Waterloo
Hardin
Grundy
Hamilton
Upper Iowa
Black Hawk
Middle Cedar
Linn
Tama
Benton
Marion
Jones
Story
Cedar Rapids
Marshalltown
IOWA RIVER
CEDAR RIVER
Cedar
Marshall
Middle Iowa
Coralville Lake
Jasper
Poweshiek
Iowa
Iowa City
Lower Iowa
Lower Cedar
Scott
Johnson
Muscatine
Mahaska
Keokuk
Washington
Louisa
Des Moines
IA
MO
N
W
E
S
Iowa & Cedar River Basin
Watershed Study
US Army Corps of Engineers
Populated Places >10,000
Water
State Line
County Line
Lock & Dams
HUC 8 SUBWATERSHEDS
Lower Cedar - 701,642 ac.
Lower Iowa - 1,079,090 ac.
Middle Cedar 1,543,593 ac.
Middle Iowa - 1,074,325 ac.
Shell Rock - 691,097 ac.
Upper Cedar - 1,095,020 ac.
Upper Iowa - 929,773 ac.
West Fork Cedar - 548,397 ac.
Winnebago 441,165 ac.
DRAFT

Red Cedar (*Juniperus virginiana*)

Hydrographs

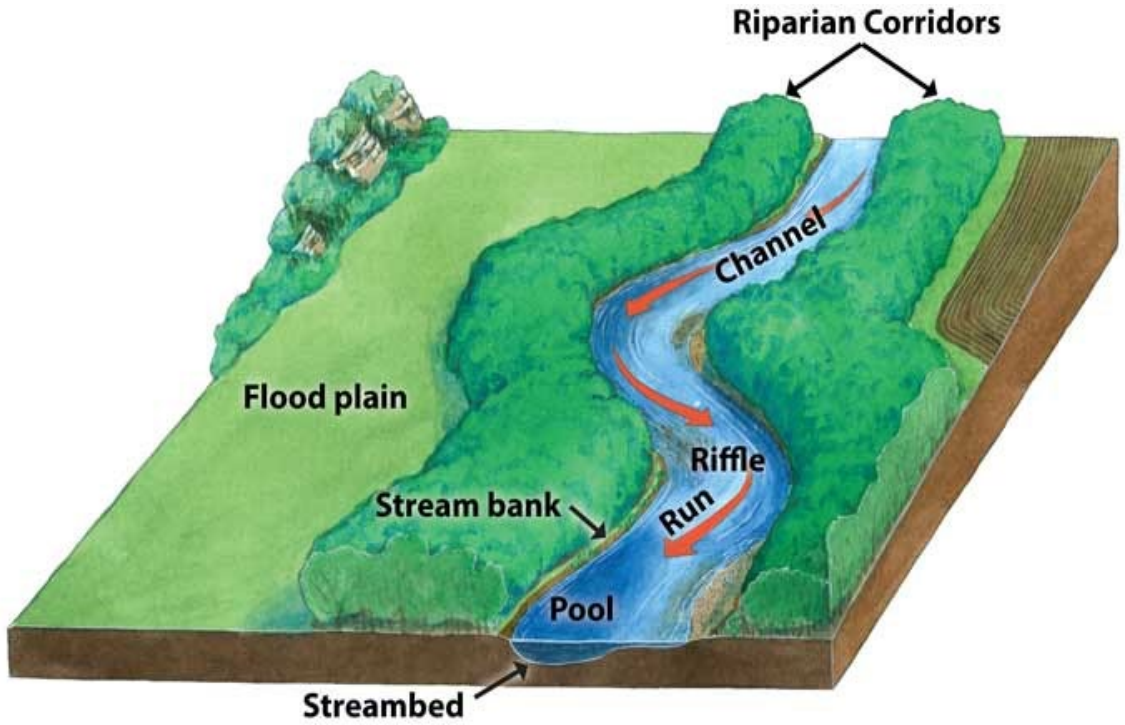


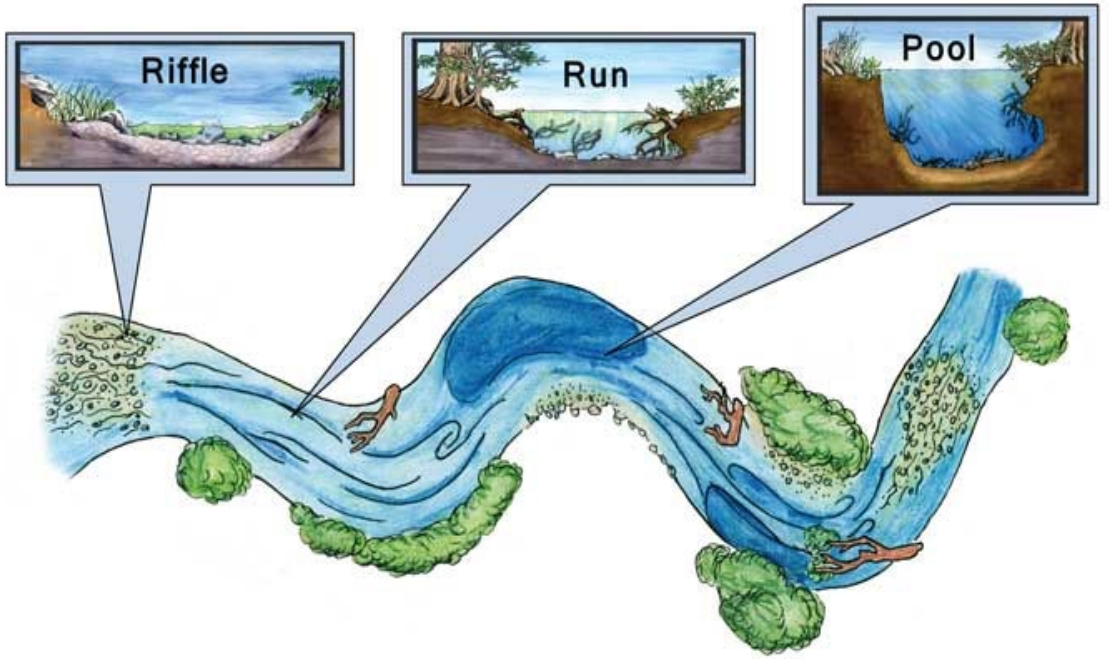
Stream Function Pyramid



Healthy Streams

- Stable form
- Limited erosion
- Water quality
- Diverse aquatic habitat

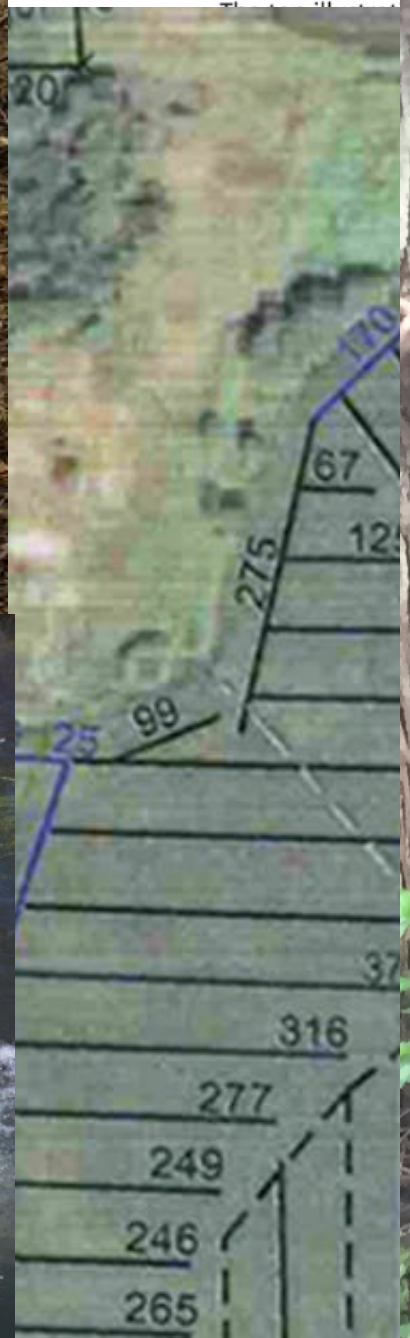




Black Hawk Creek

- Sites = 23
- Length = 40 miles
- Avg. width = 18.9 meters
- Avg. depth = 85.17 centimeters
- Avg. temp. = 19.48° C
- Avg. pH = 8.16
- Avg. TDS = 450 ppm

Agricul

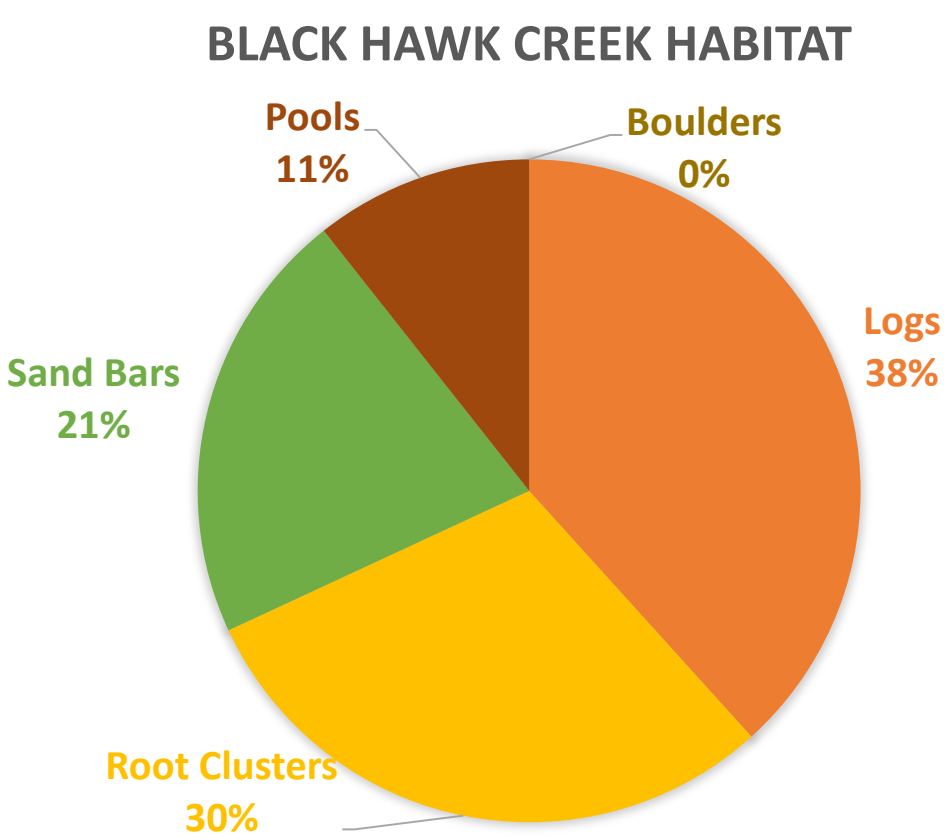


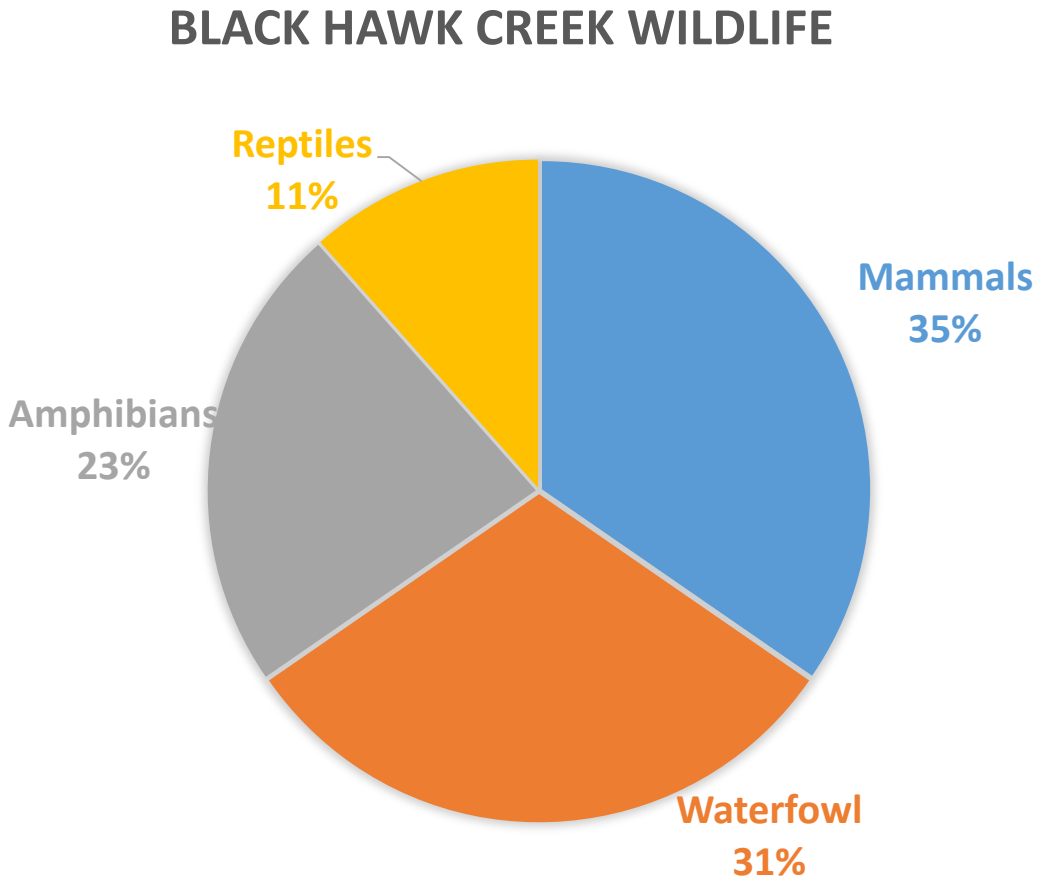
UNI STEM

STEM
University of Northern Iowa

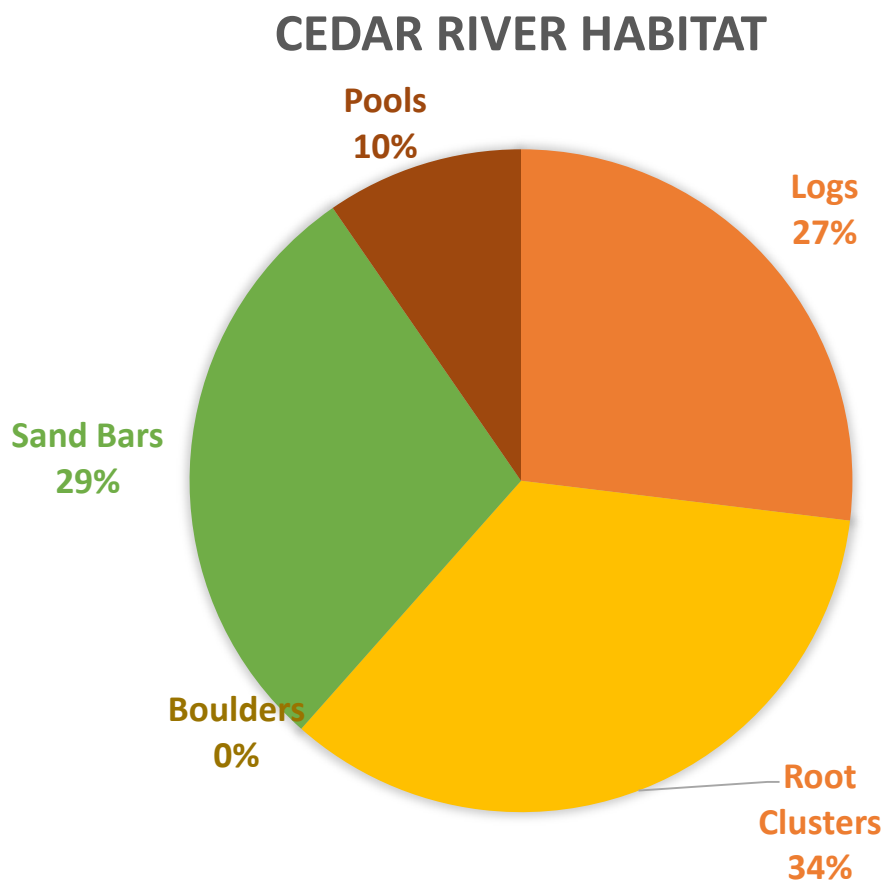
aeop
ARMY EDUCATIONAL
OUTREACH PROGRAM

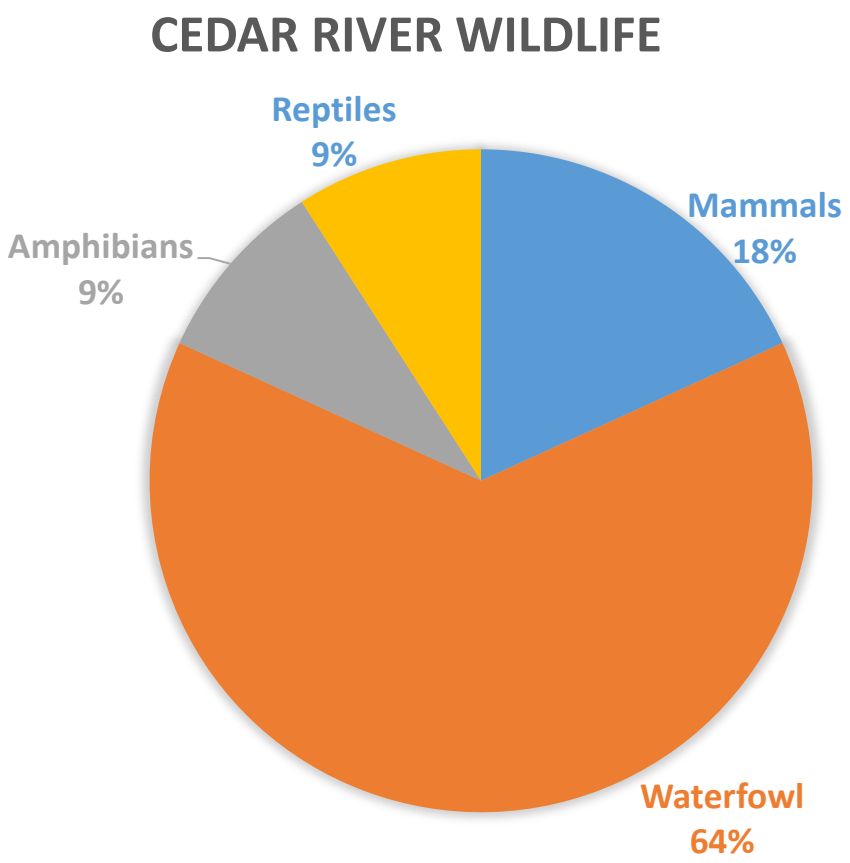
Black Hawk Creek





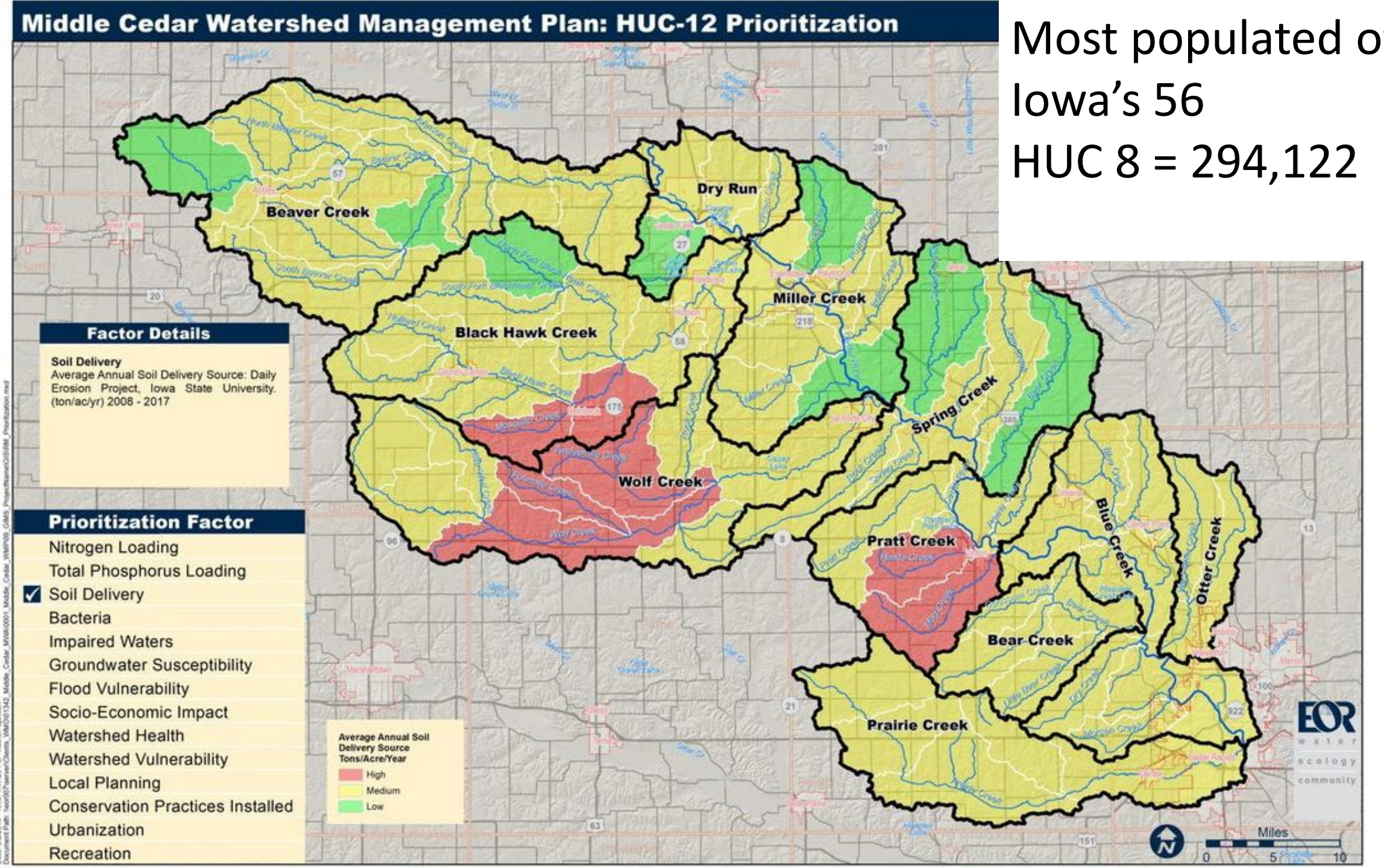
Cedar River


CEDAR RIVER HABITAT
Pools
10%
Logs
27%
Sand Bars
29%
Boulders
0%
Root
Clusters
34%


CEDAR RIVER WILDLIFE
Reptiles
9%
Mammals
18%
Amphibians
9%
Waterfowl
64%

Dry Run Creek

- Problem scale
  - Large
  - Small
- Regulations & enforcement
  - Voluntary
  - Mandatory
- Education & awareness

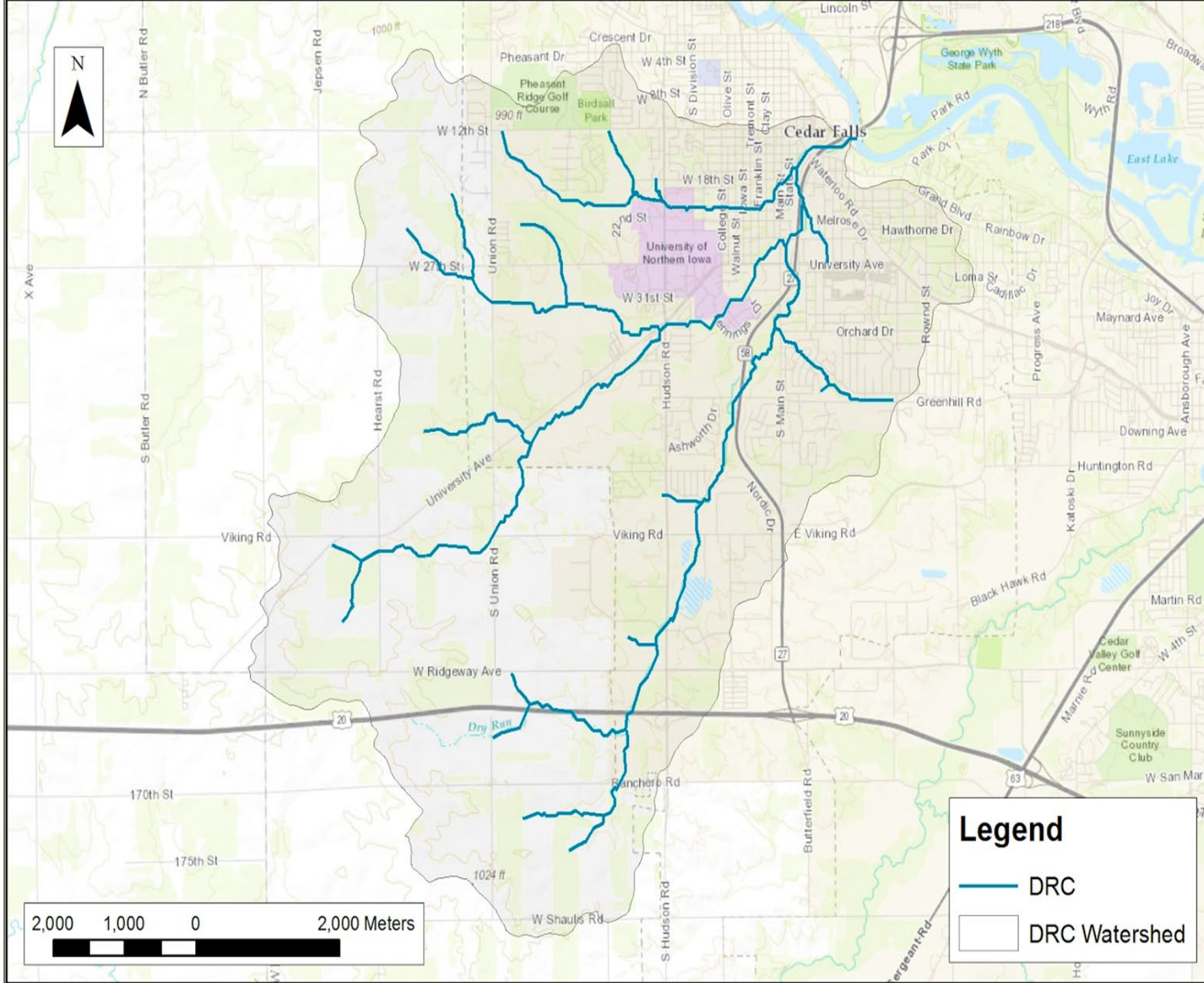


Most populated of Iowa's 56

HUC 8 = 294,122

By the numbers

- 15,177 acres
- Four main branches
- 30 miles total
  - 14 urban
  - 16 rural
- Max. Relief = 150 ft



Impairment history & Goals

1. Install Best Management Practices
   a. Reduce runoff
   b. Increase infiltration
2. Water monitoring
3. Education and outreach

- 1996 - Reported fish kill
- 2002 - Biological Impairment
- 2004 - BHSWCD pursues funds
- 2005 - DRCWIP begins
- 2005 - UNI Stream Assessment
- 2008 - Bacterial Impairment
- 2009 - Stressor Identification Report
- 2010 - Watershed Management Plan
- 2011 - TMDL Report
- 2015 - Josh Balk as PC
- 2016-2017 - Watershed Assessments
- 2018 - WMP Draft Revision submitted

UNI - Geomorphology

Stream Orders	1	2	3	4
Segments	23	6	2	1
∑ Lengths (ft / miles)	107328.3 / 20.33	59082.23 / 11.19	32438.98 / 6.14	6824.35 / 1.29
∑ Area (sq. ft / sq. mile)	351,748,853.40 / 12.62	462,130,703.08 / 16.58	532,115,736.44 / 19.09	662,984,015.83 / 23.78
Basin Shape (range)	0.33 to 3.75	0.29 tp 3.97	0.46 to 3.75	14.24

Stream Orders	1st : 2nd	2nd :3rd	3rd : 4th	∑ Basin
Length Ratio $R_L = L_0/L_{0+1}$	1.8 : 1	1.8 : 1	4.8 : 1	
Bifurcation Ratio $R_B = N_0/N_{0+1}$	4.3 : 1	3.0 : 1	2.0 : 1	
Basin shape Rf = A0/LB^2 =Area/Length^2				0.73
Drainage Density D = ∑L/A				1.38 miles
Relief Ratio $R_h = H/L_0$				= 180 /42600 = 0.0004
Ruggedness # R = DH				= 1.38 * 0.03 = 0.47

Undergraduate Student Research

- Land use
- Point source runoff
- Channel bedload
- Bank sediment
- Turbidity
- In-Stream habitat
- Bank height
- Stream width & depth
- Canopy cover

Stressors

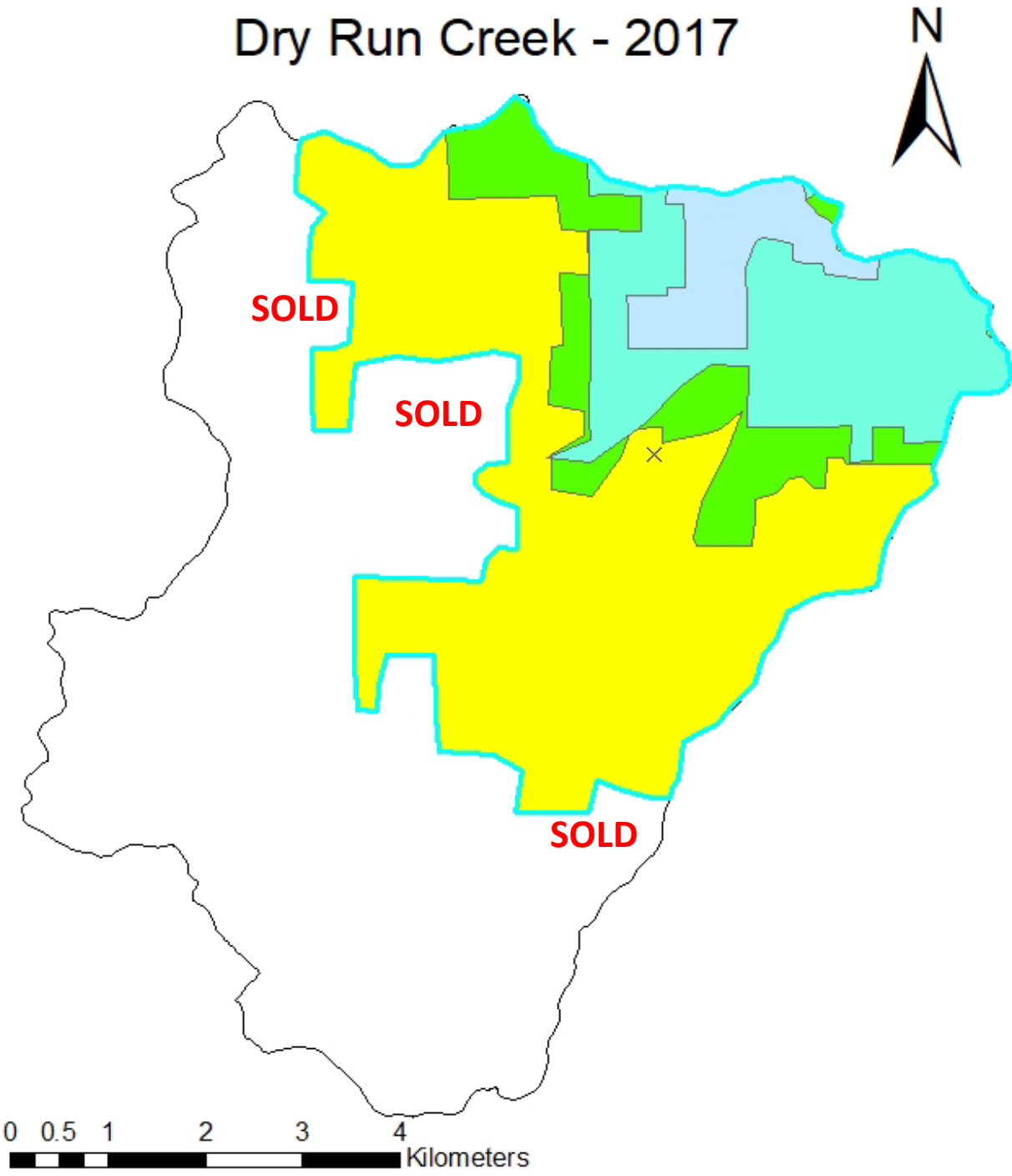
Urbanization of Cedar Falls, Iowa

2017 – 41,570

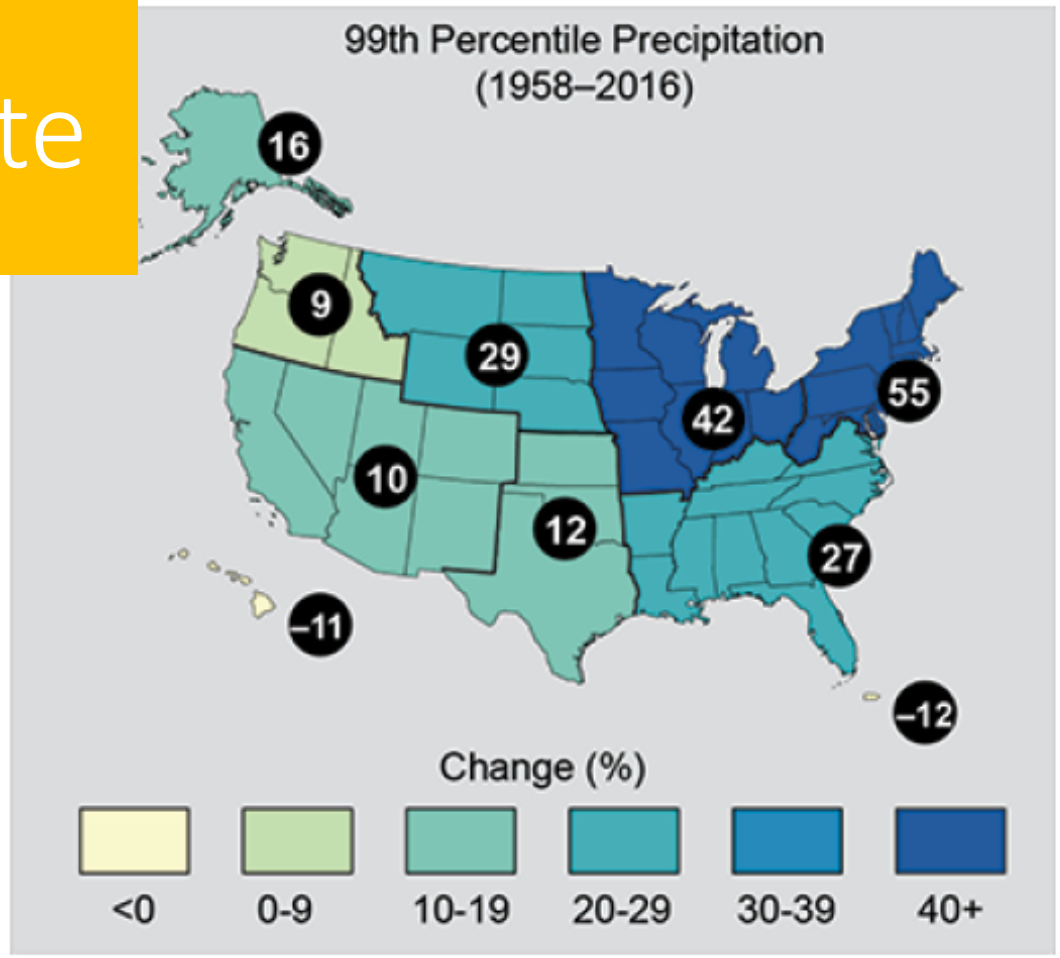
1990 – 34,298

1960 – 21,195

1930 - 7,632



Climate



Observed change in heavy precipitation (the heaviest 1%) between 1958 and 2016. Figure taken from The Climate Science Special Report (Easterling et al. 2017) (https://science2017.globalchange.gov/).

Date	*Grundy Center* ppt (inches)
7/10/2000	5.91
4/25/2008	4.35
8/29/2015	*4.11*
9/4/2018	*3.98*
8/6/2018	*3.76*
5/30/2013	*3.56*
9/11/2006	3.36
7/27/1990	3.22
7/1/2018	*3.17*
9/13/1991	3.16

Date	*Vinton* ppt (inches)
8/12/2016	*6.04*
5/30/2008	4.15
6/15/1982	3.98
6/12/2015	*3.8*
11/4/2003	3.49
7/1/2014	*3.33*
7/9/1993	3.29
6/17/1990	3.25
8/8/1991	3.18
4/18/2013	*2.93*

Antonio Arenas

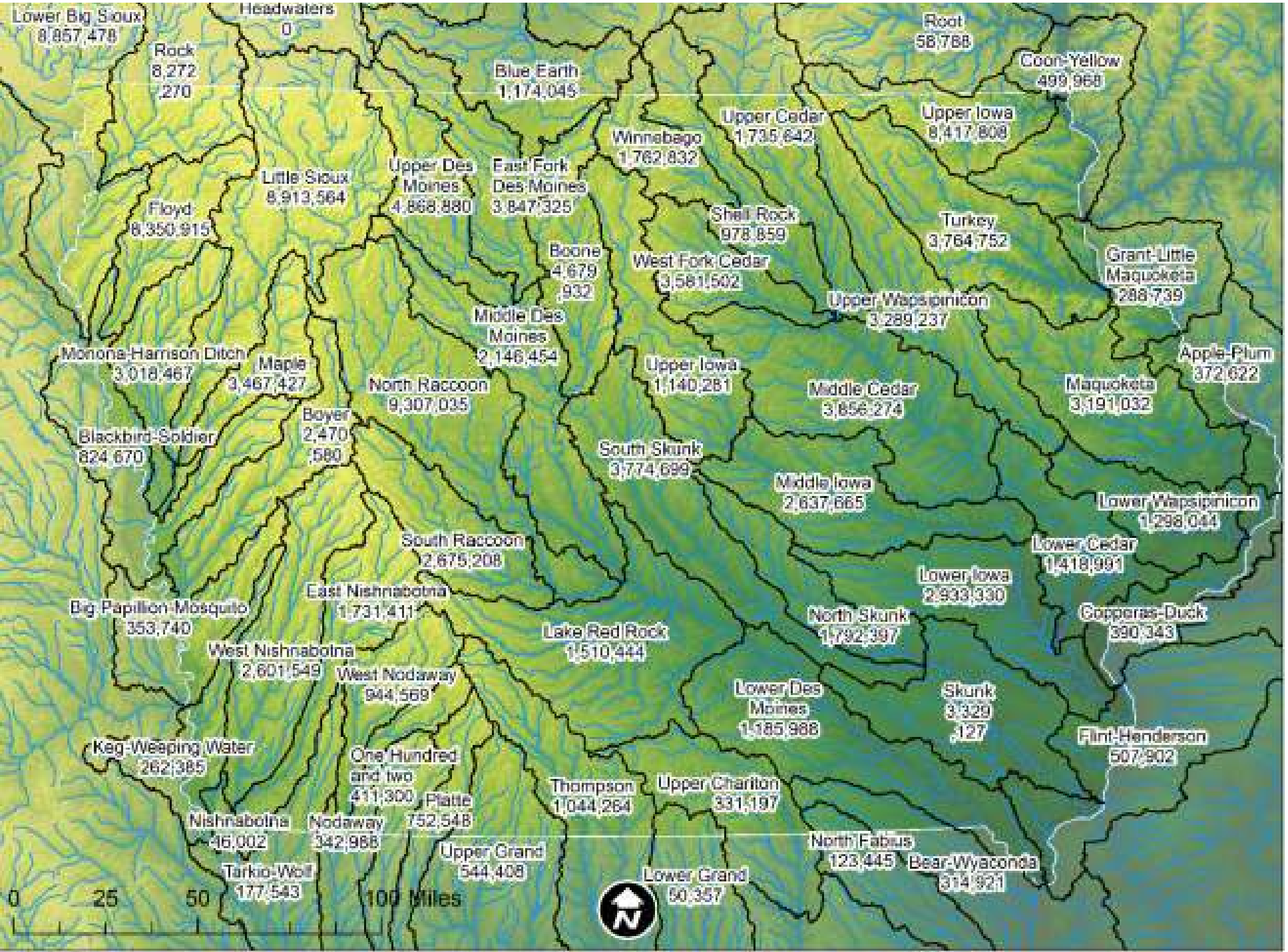
U. Iowa IIHR

Date	*Cedar Rapids* ppt (inches)
6/17/1990	4.42
8/12/2016	*4.14*
7/17/2007	3.85
6/12/2015	*3.75*
4/18/2013	*3.66*
6/10/2018	*3.36*
8/26/1987	3.28
4/14/2014	*3.16*
6/15/1982	3.11
7/18/1982	3.1

(Data source: http://www.prism.oregonstate.edu/)

IIHR Hydroscience & Engineering

Iowa Flood Center



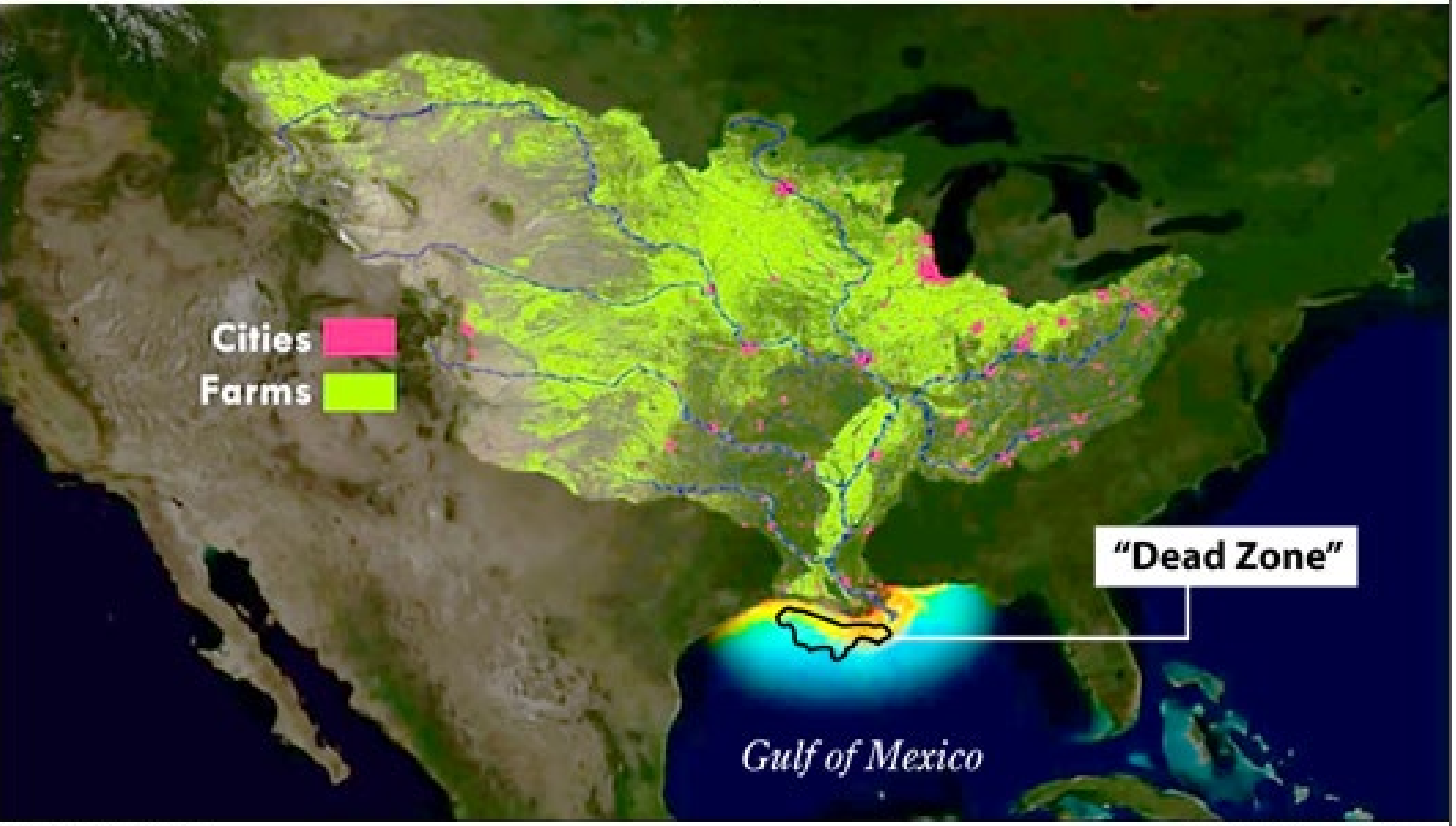
Population, from
294,122
to with animals
3,289,237

Statewide
24 million pigs
3 million people
8:1

Chris Jones
U Of Iowa
IIHR

Gulf 'Dead Zone' Chokes Marine Life

The Gulf of Mexico at the Mississippi River Delta experiences a seasonal *hypoxia*, or "dead zone," where there is not enough oxygen in the water to sustain marine life.



SOURCE: NOAA

InsideClimate News

Nitrate equivalents

2019 – may surpass previous record due to record flooding

Chris Jones

U Of Iowa
IIHR

CEDAR FALLS OXBOW WETLAND RESTORATION

- Subwatershed 5
- 2.6 acre drainage area
- 13,950 ft^2 of wetland
- 3 tons of sediment annually
- 4 lbs. of Phosphorus annually
- Construction fall 2018
- $28,843 The Nature Conservancy

Best Management Practices