

Iowa's Emerging Water Issues Contamination to Recreation

Session 1

Pre-Test – About 12 minutes

- Make a word cloud with Iowa Water in the center...
- Sketch a Water Cycle
- Who are the players and what are the issues surrounding Iowa's water?

Tiffany Morgan



- Iowa Public Broadcasting System
- Instructional Media Coordinator



Lead (Pb) in water

- EPA WIIN Grant
 - Lyn Jenkins -Education Program Consultant
 - Melissa Walker - Administrative Consultant of School Health
- <https://educate.iowa.gov/pk-12/operation-support/school-facilities/lead-testing>

- <https://sites.google.com/iowa.gov/wiin-grants/home>



Primary questions

How do lowan's view our Water, Today?

- Source of transportation
- Means of disposal
- Recreation
- Source of distress – Contamination, Flooding, Drought
- Possibly not at all, no connection..?



Water 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





Rivers Mystery to Mythology

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



George Catlin

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”

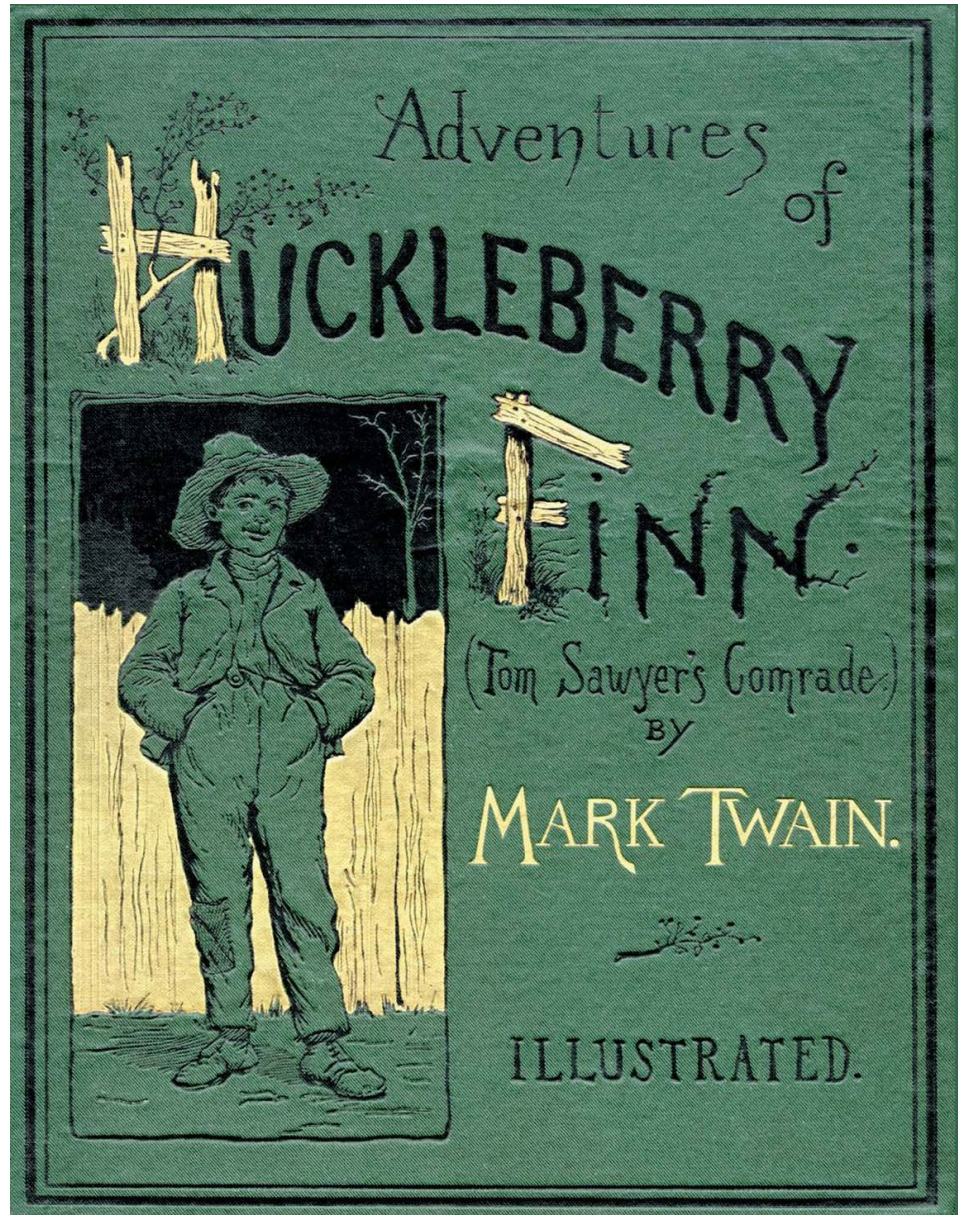


ONE ON ONE: LAUGHING RIVER



BISHOP BRIGGS
“River”

Literature, Novels and Poetry



Emily Dickinson

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

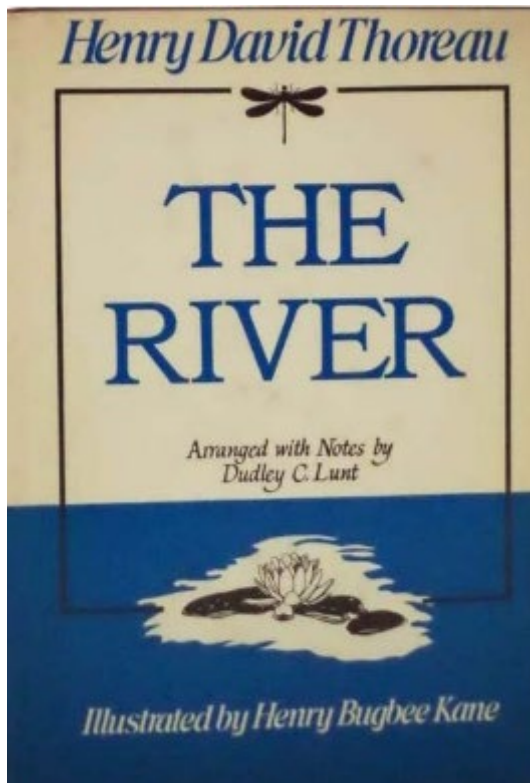
My River wait reply.
Oh Sea – look graciously!

I'll fetch thee Brooks
From spotted nooks –
Say Sea – take Me?

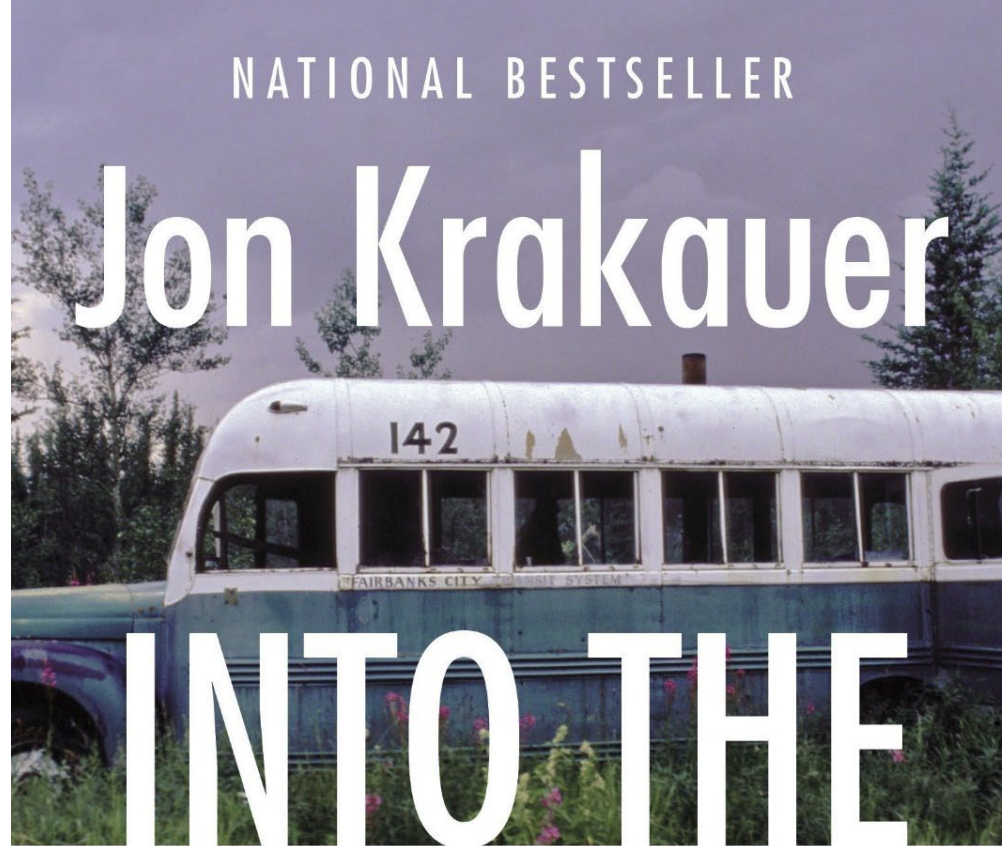
“The river is my own highway,
then only wild and unfenced
part of the world hereabouts.”

30 May 1852

Henry David Thoreau



Films

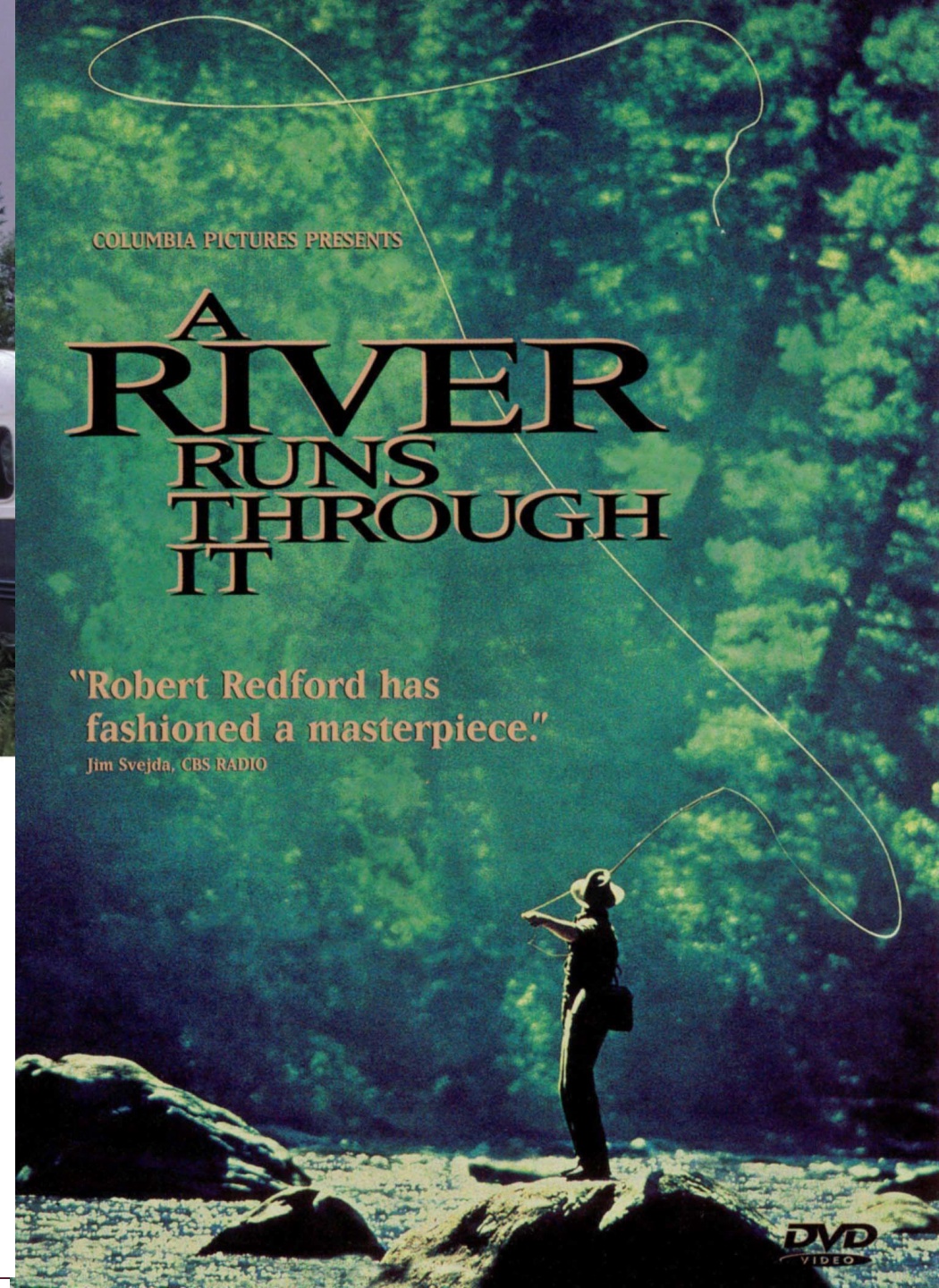


NATIONAL BESTSELLER

Jon Krakauer

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 heft been in Isa more as three or two times myself, and I heft 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’



Bordeaux, France



Batard

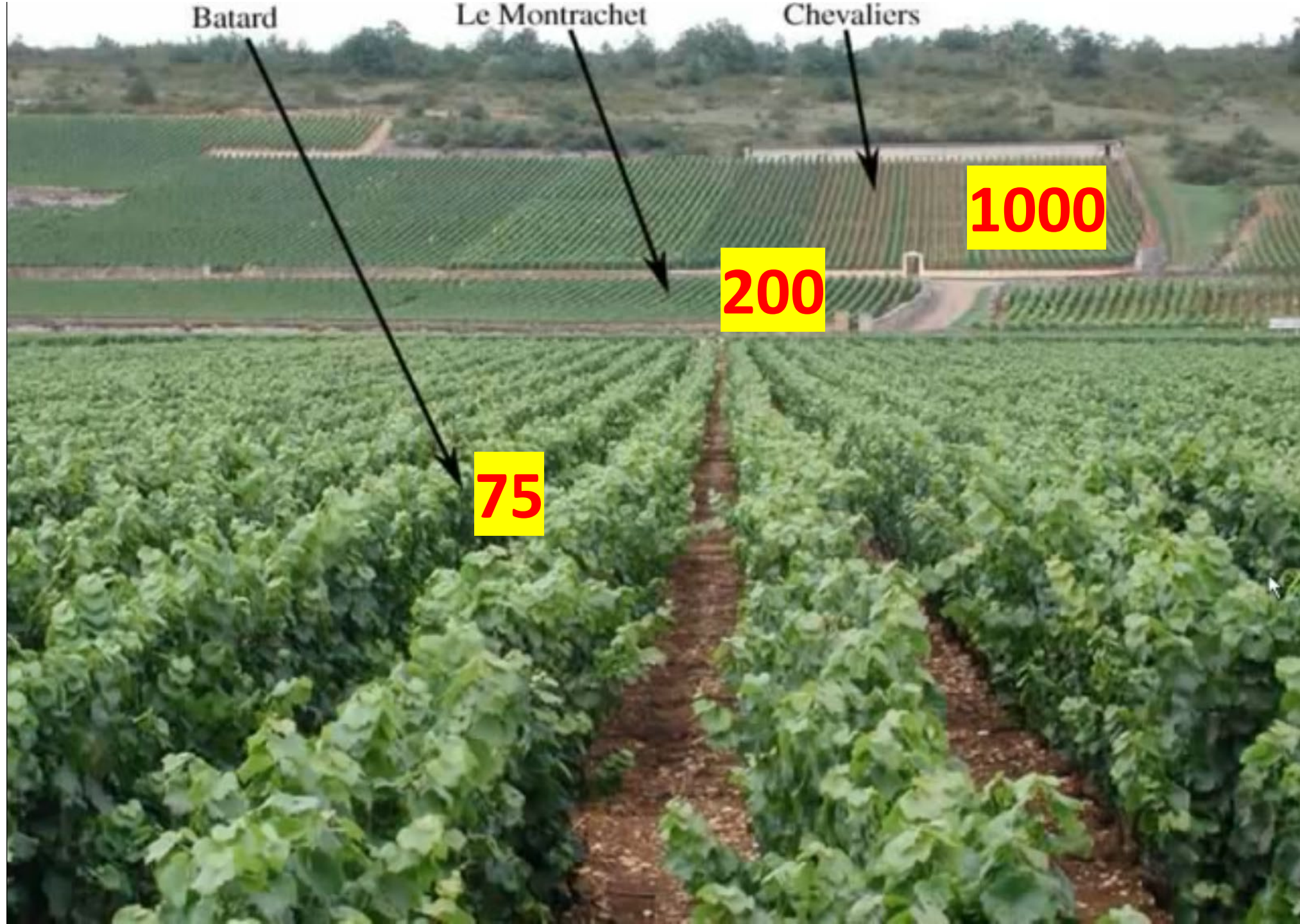
Le Montrachet

Chevaliers

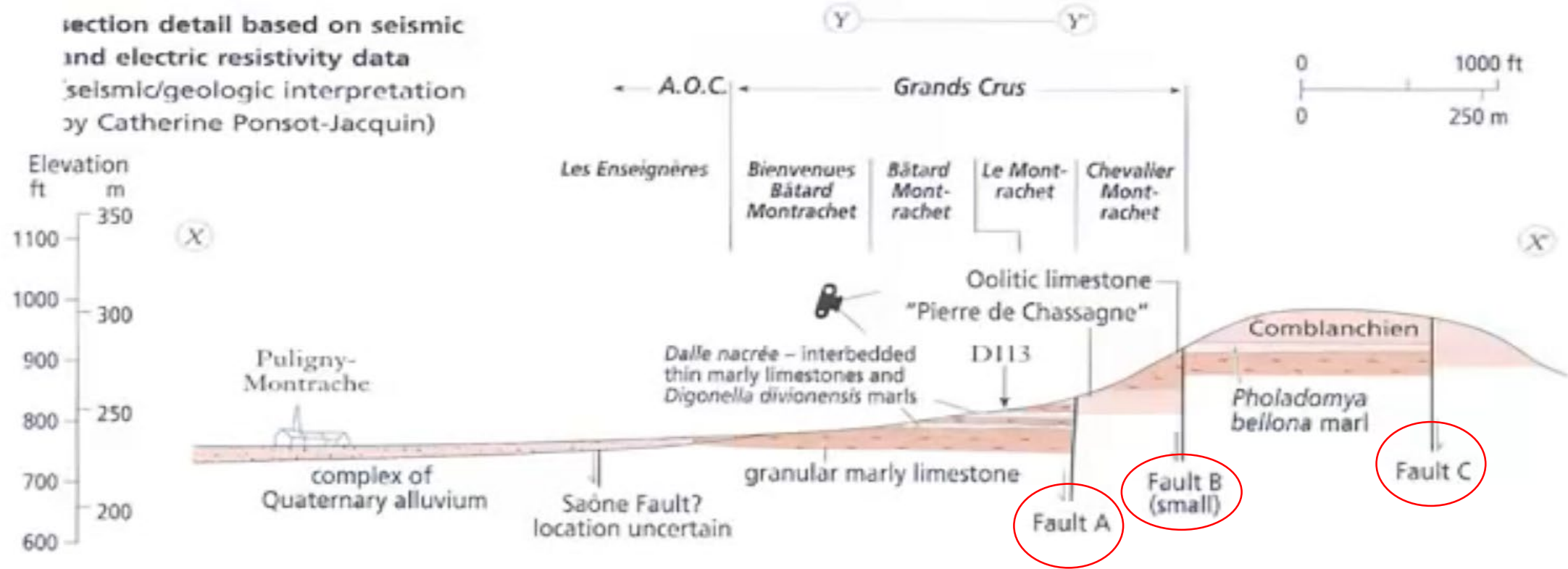
1000

200

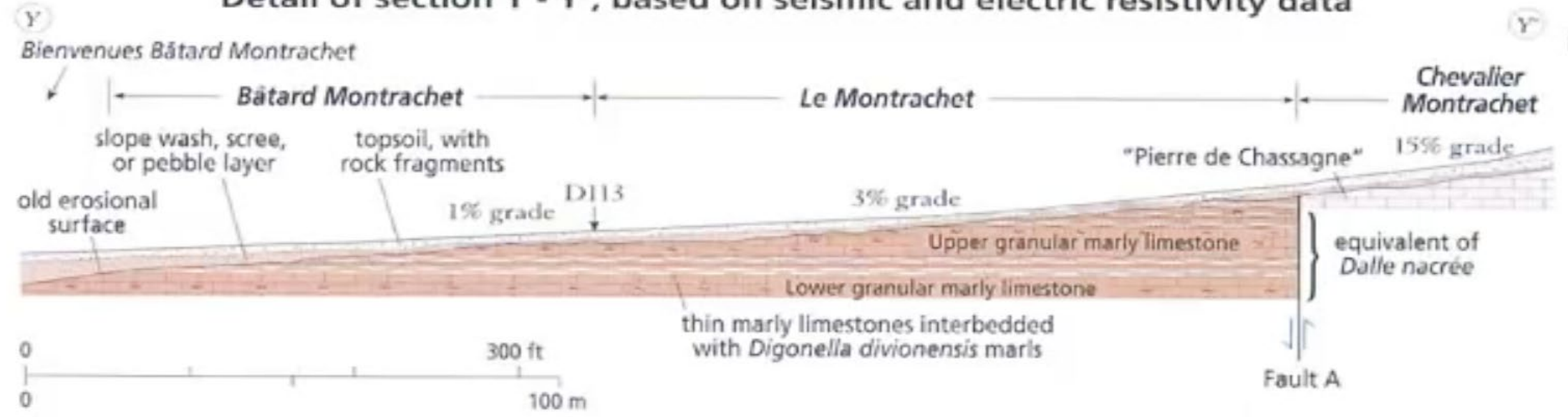
75



Section detail based on seismic and electric resistivity data (seismic/geologic interpretation by Catherine Ponsot-Jacquin)



Detail of section Y - Y', based on seismic and electric resistivity data



Understanding Iowa's Bedrock is important to understanding Iowa's Water issues.



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

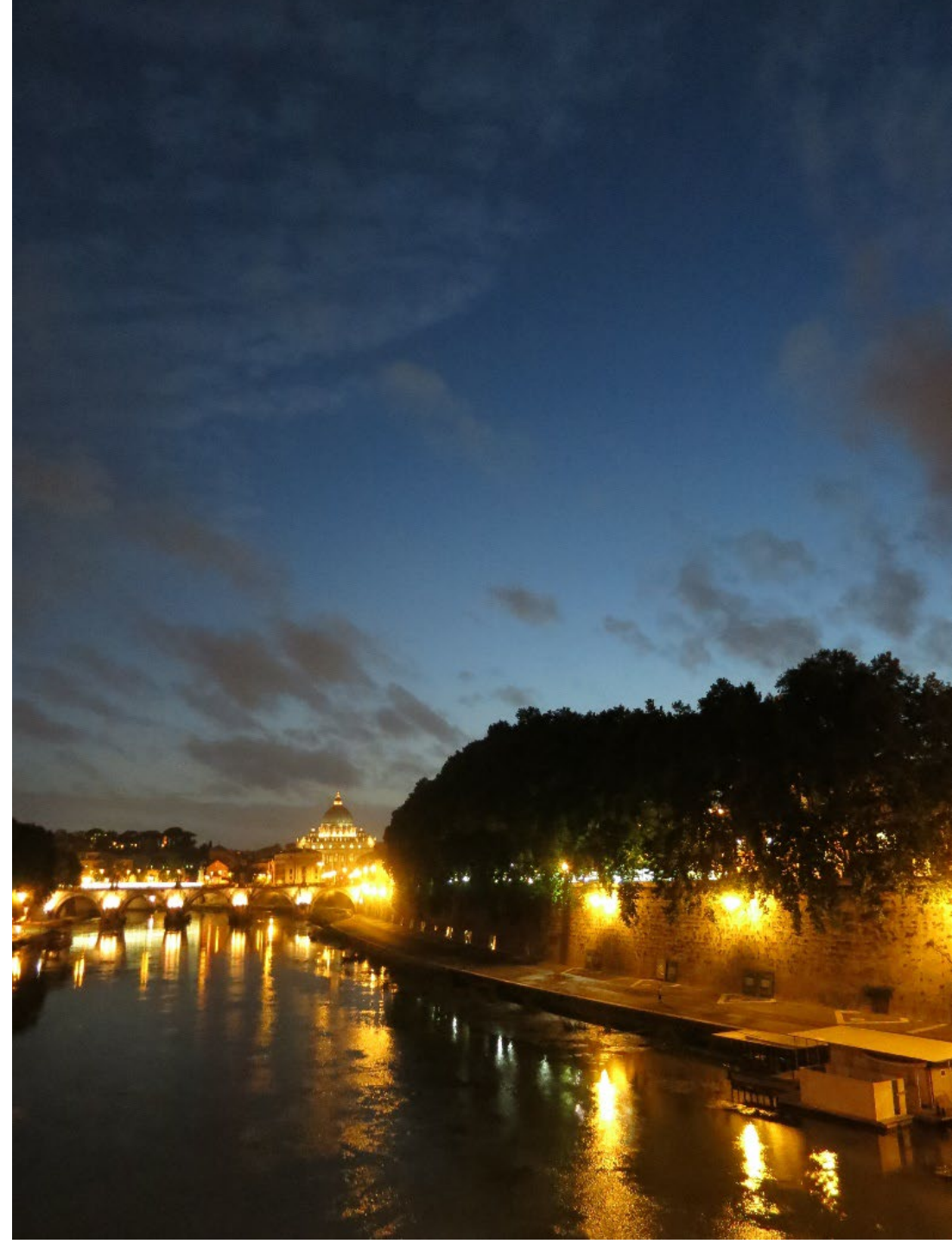


Tiber River

Expansion of Rome



Western Civilization



Fontana dei Quattro Fiumi





The Father of Waters

The Big Muddy



The course and watershed of the **Mississippi River**
The Father of Waters

200 Miles
400 Km

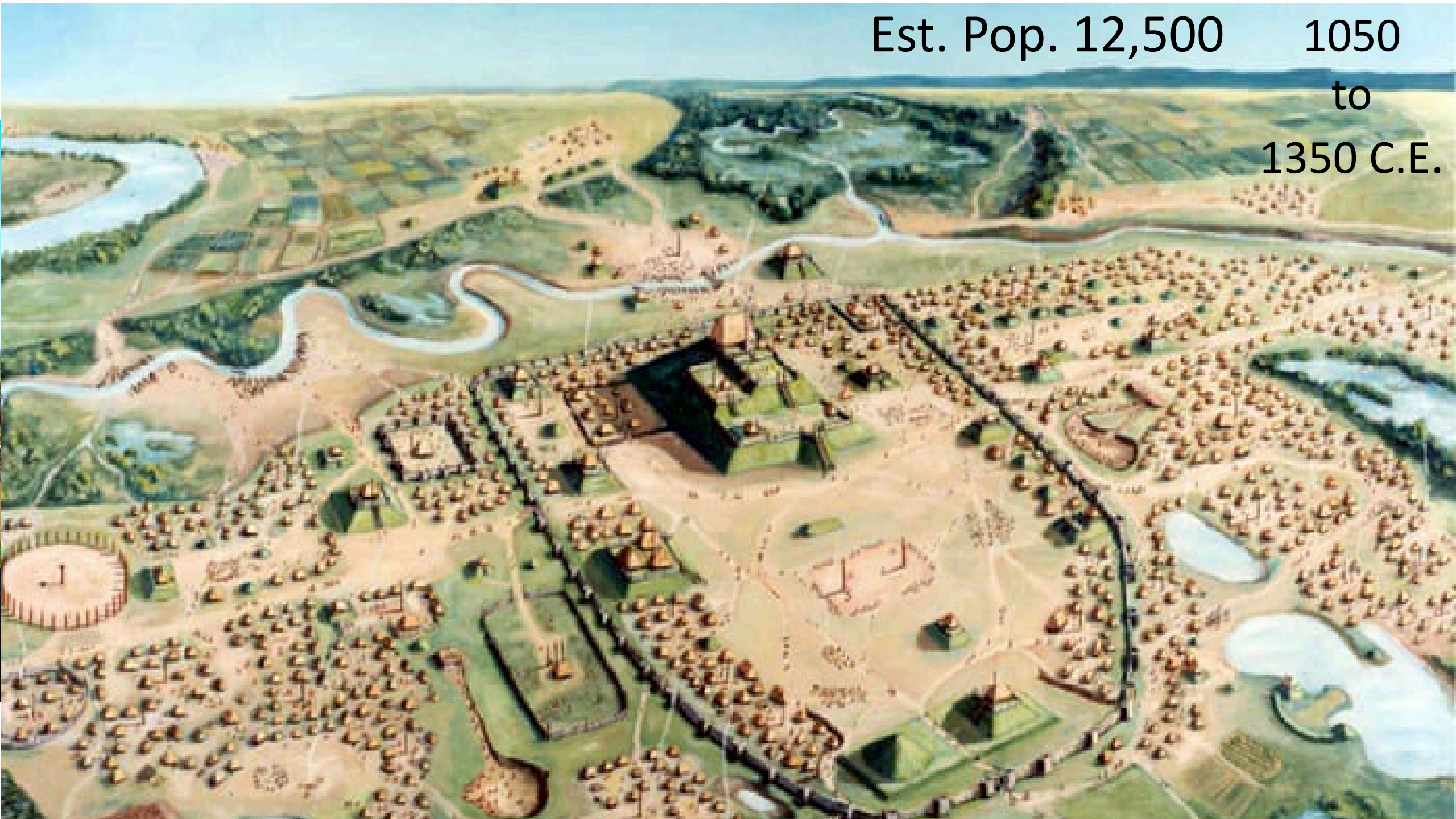


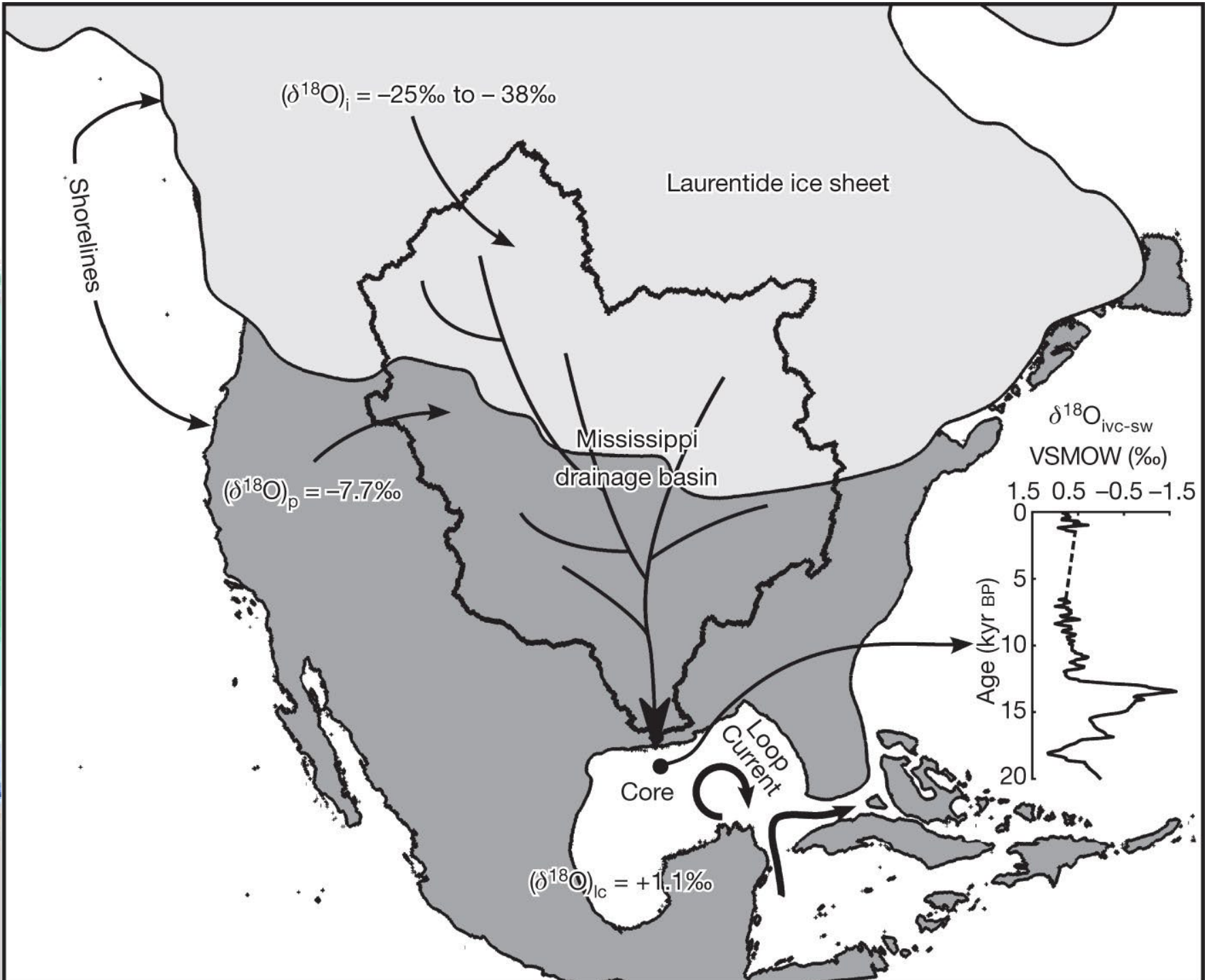
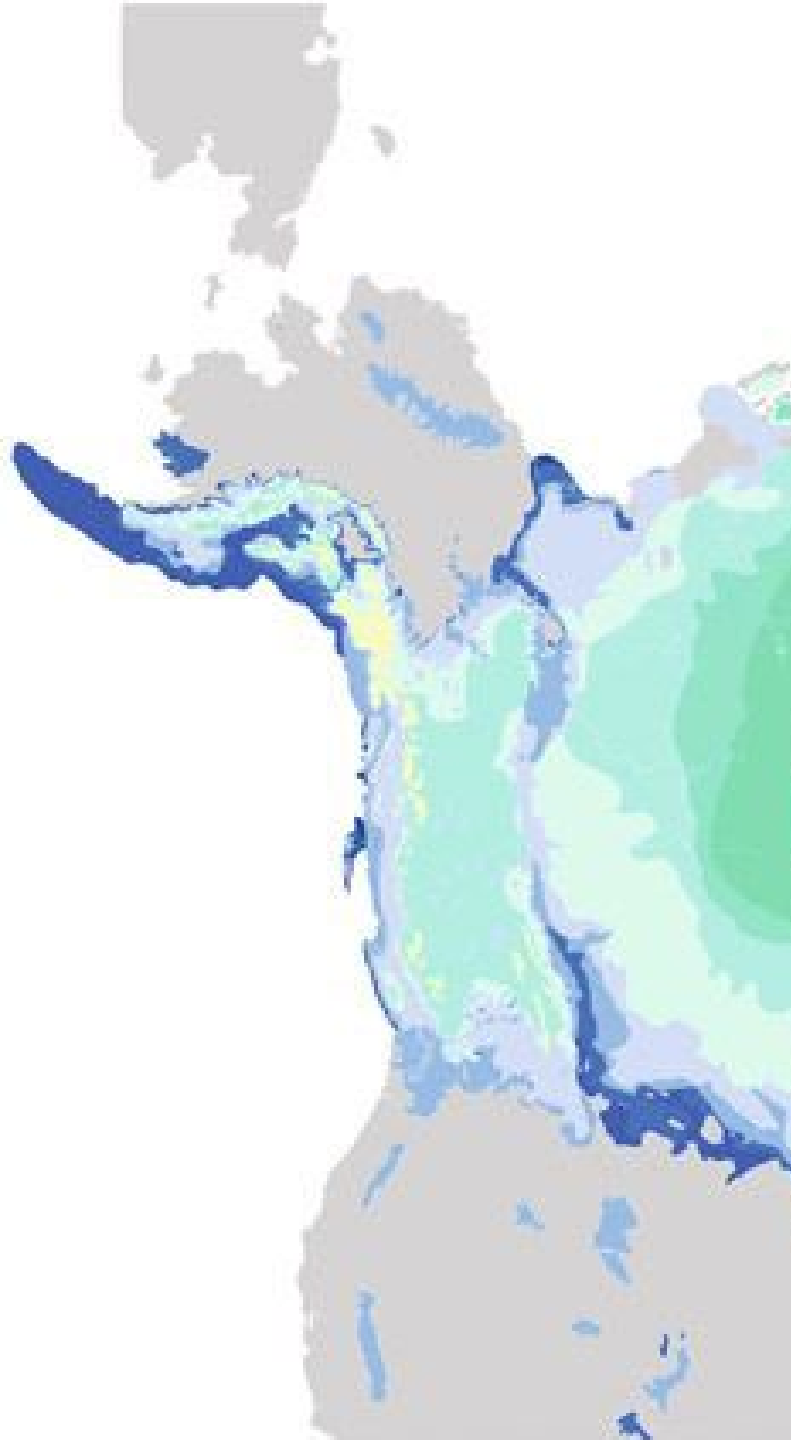
Est. Pop. 12,500

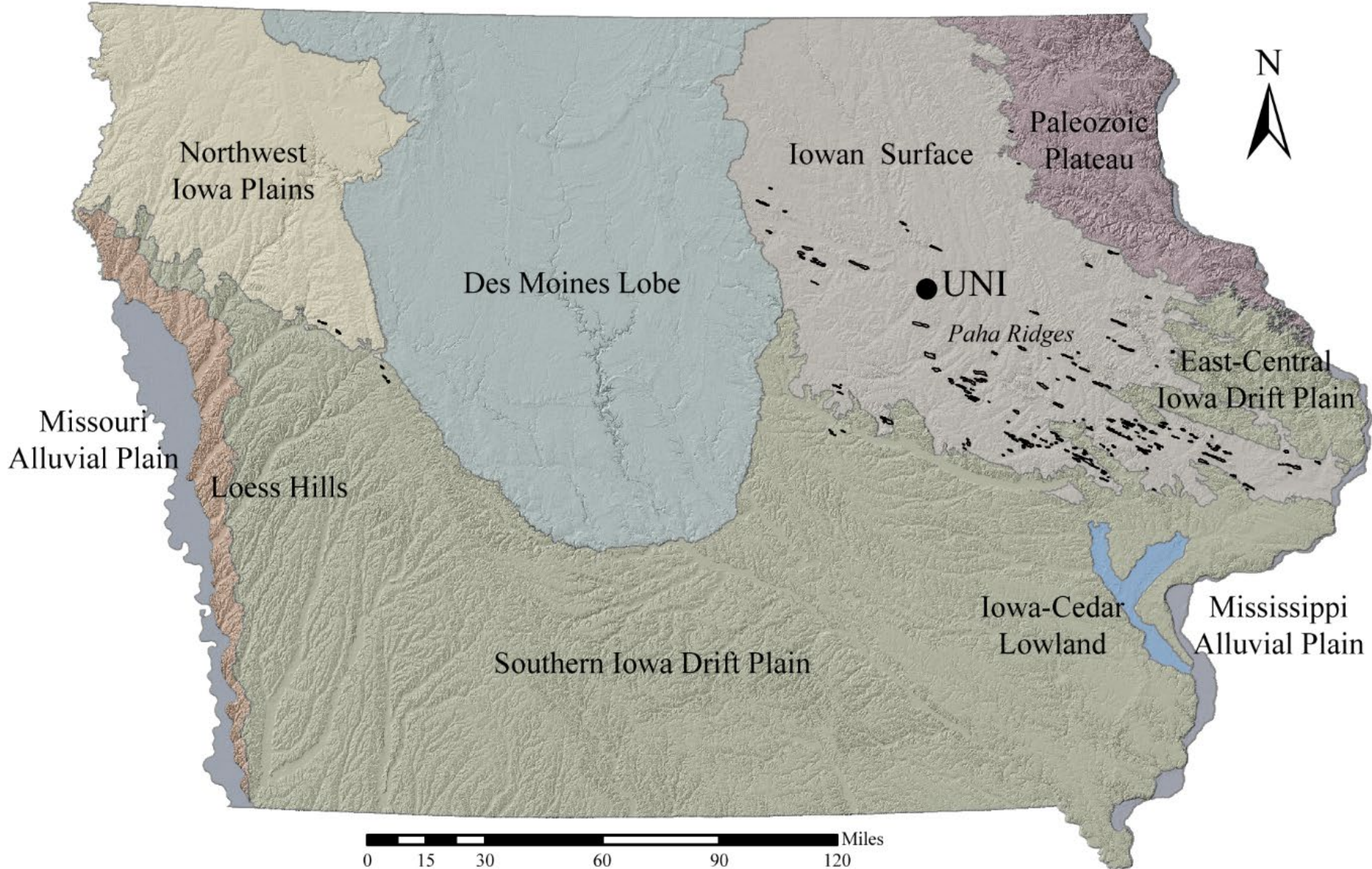
1050

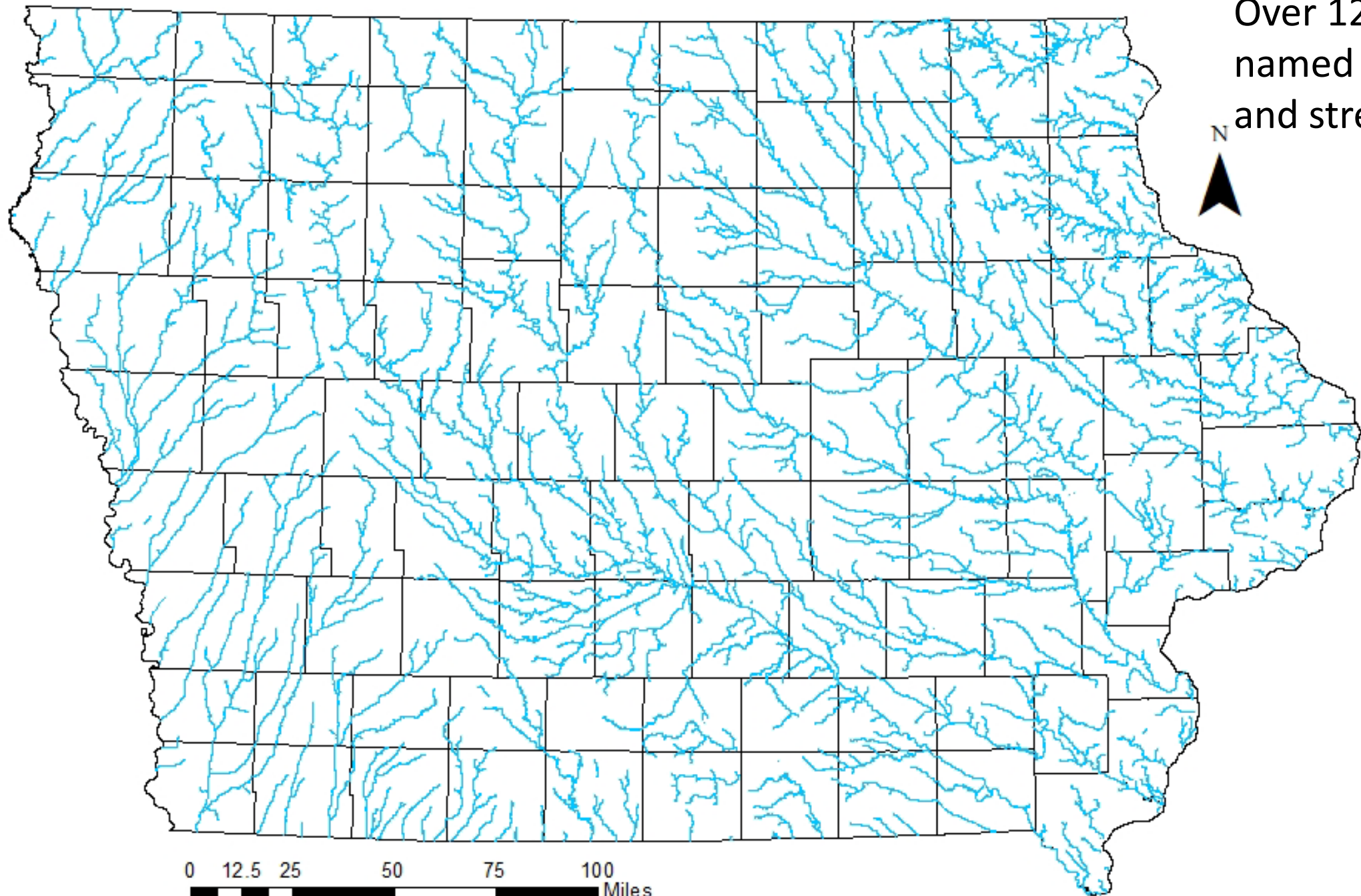
to

1350 C.E.







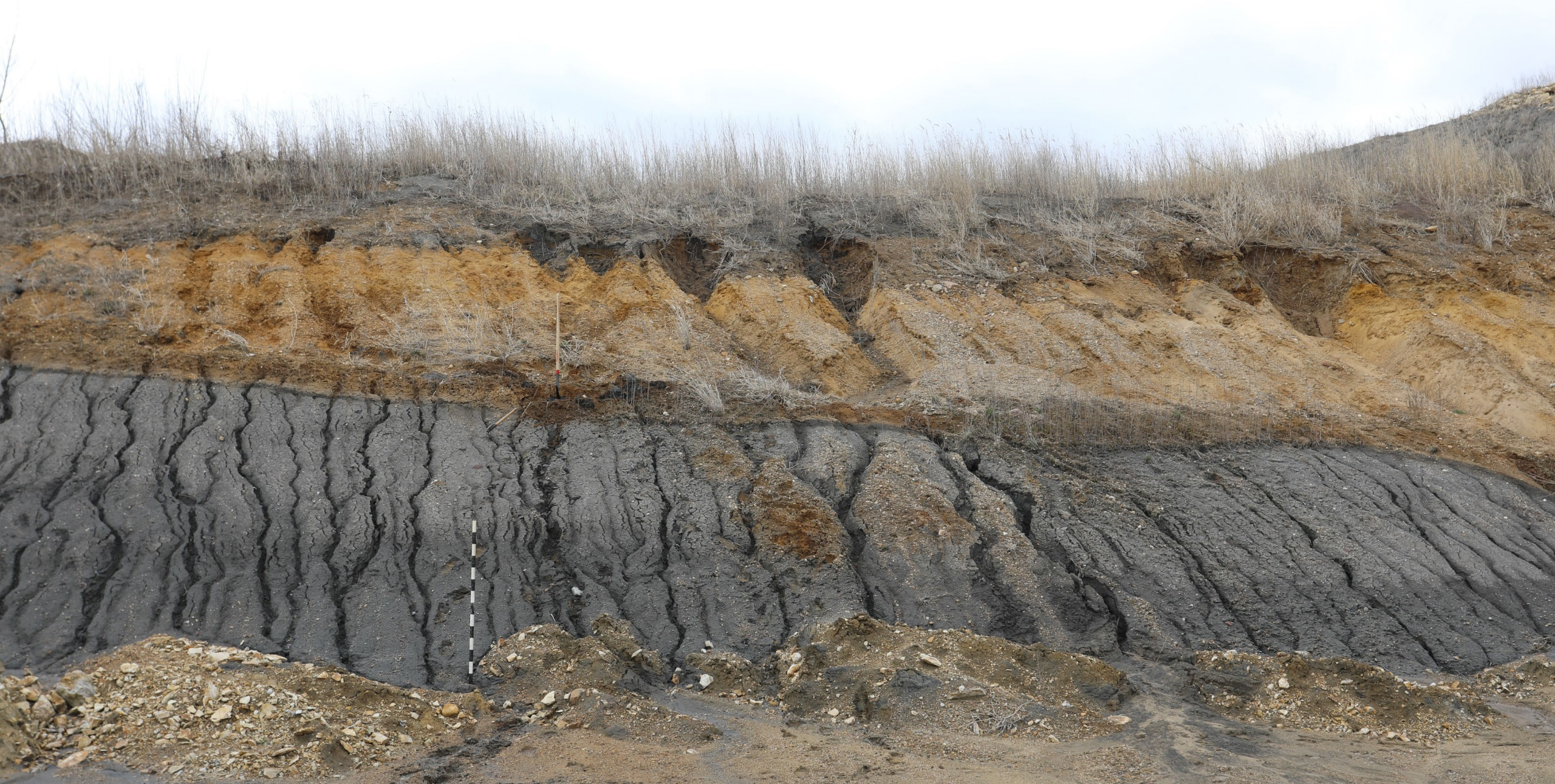


Over 1200
named Rivers
and streams

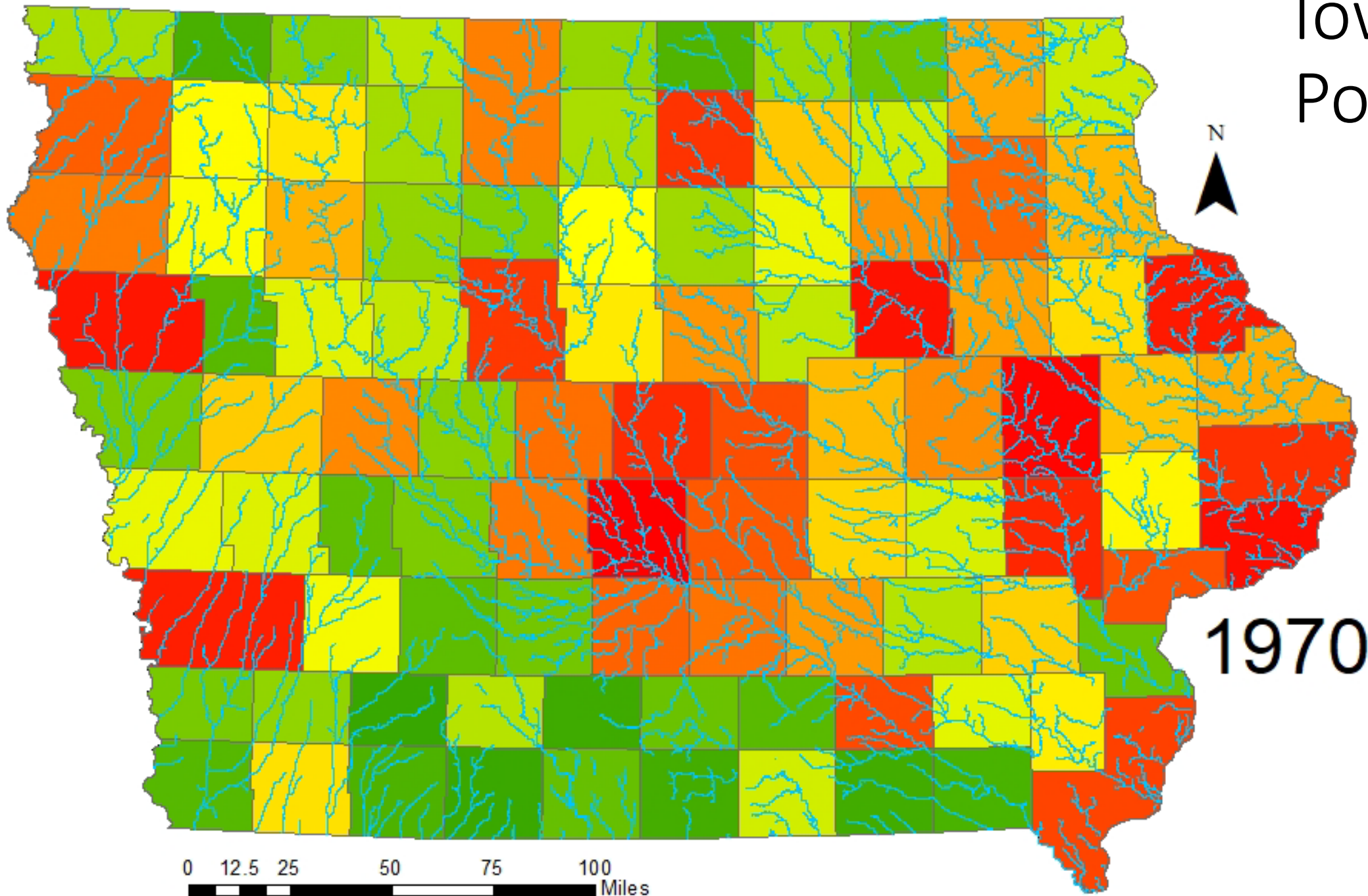


0 12.5 25 50 75 100 Miles

Understanding Iowa's Surficial Sediments is important to understanding Iowa's Water issues.



Iowa's Population



1970

0 12.5 25 50 75 100 Miles

Explorers, Pioneers and Steamboats

Rivers facilitated

Migration

Trade

Pelts

Grain

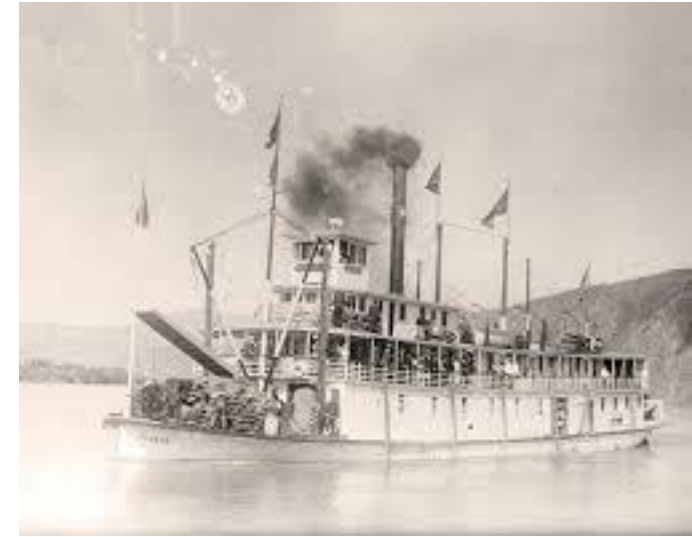
Wood

Ore

Gambling

Military

1823



Virginia

1860



Chippewa

1819

[Missouri pdf](#)

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>

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!



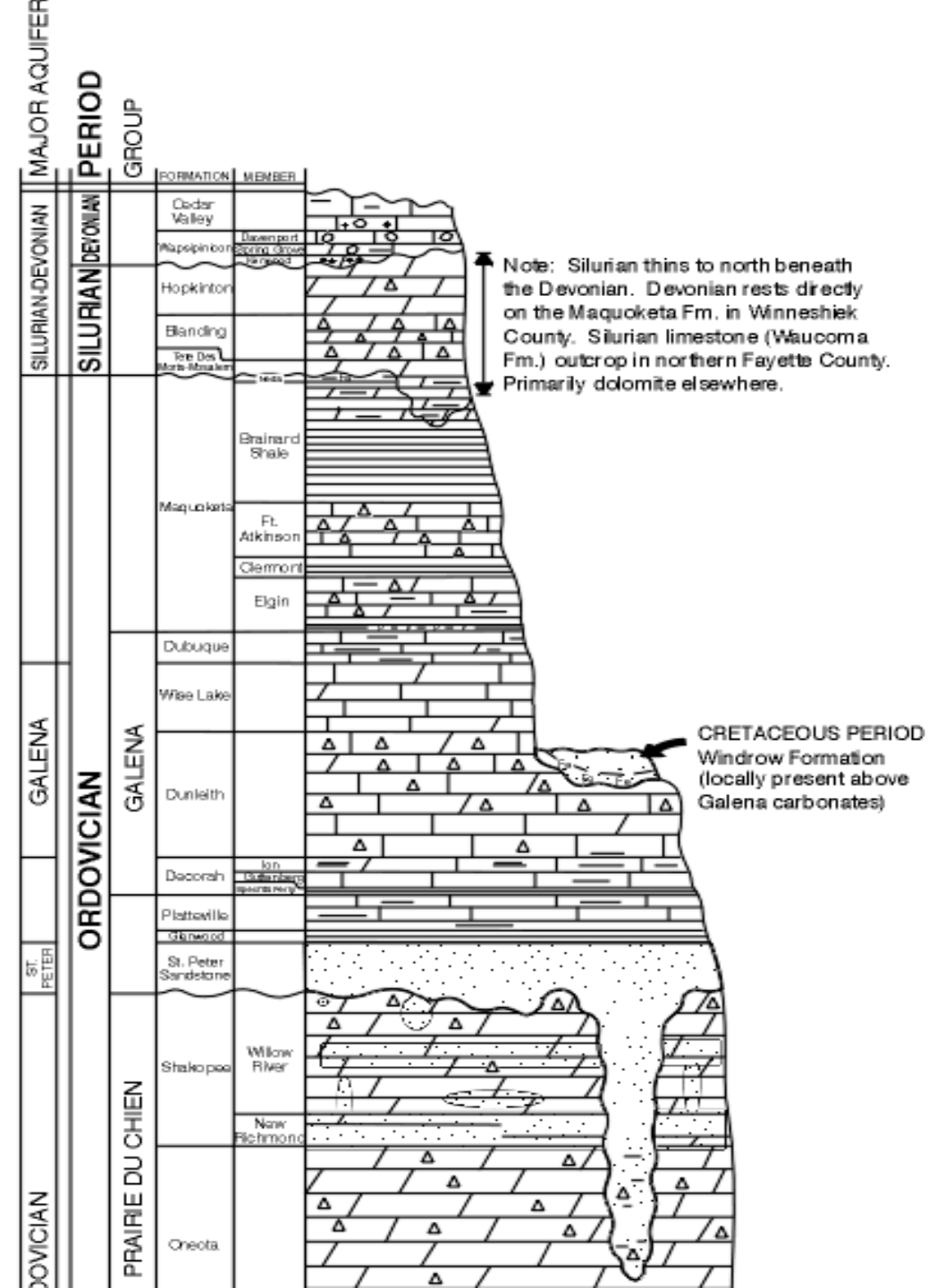
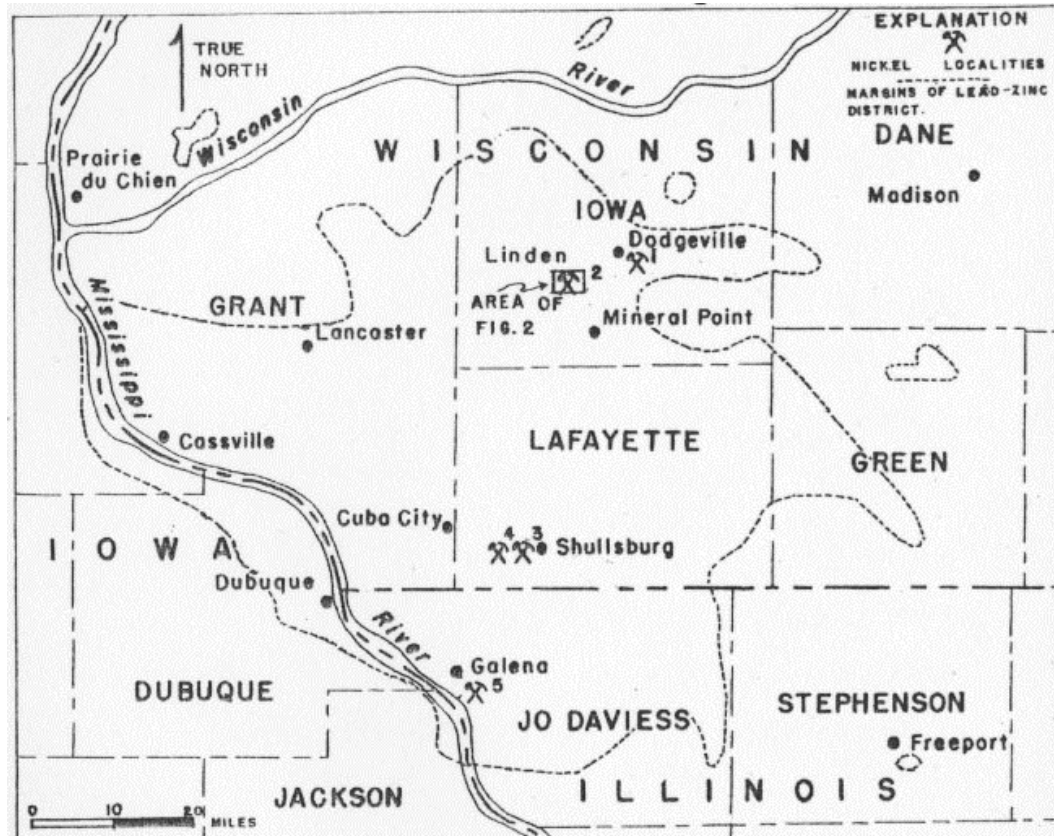
Roman Pig/Ingot of Lead



144lbs , 69Kg

Galena Group

- Dunleith, Wise Lake, and Dubuque Formations



Upper Mississippi Valley Zinc and Lead District

Continued Immigration into and through 1900

- Steamboat 'Bills of Lading' 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

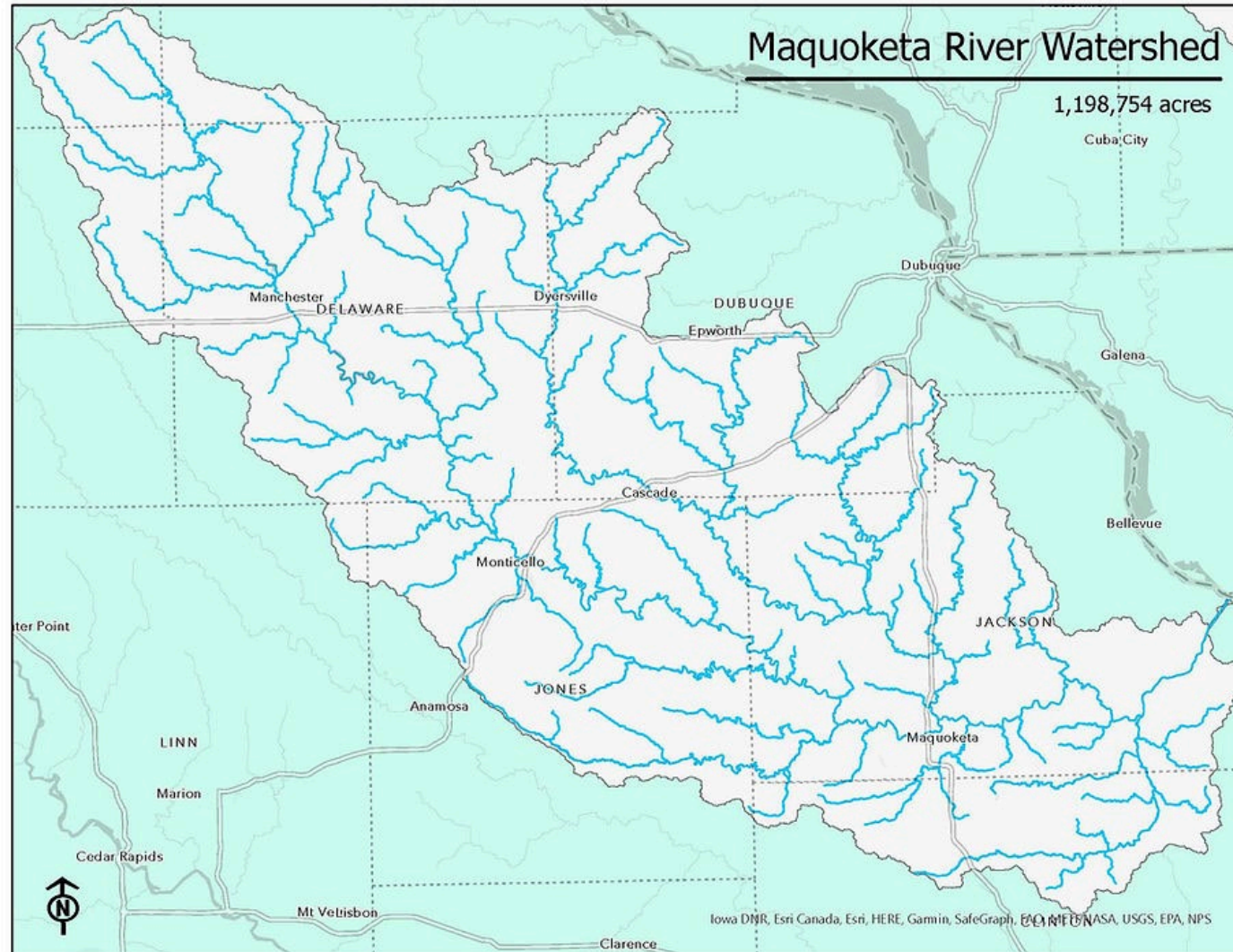
- 502 Gristmills

- 545 Sawmills



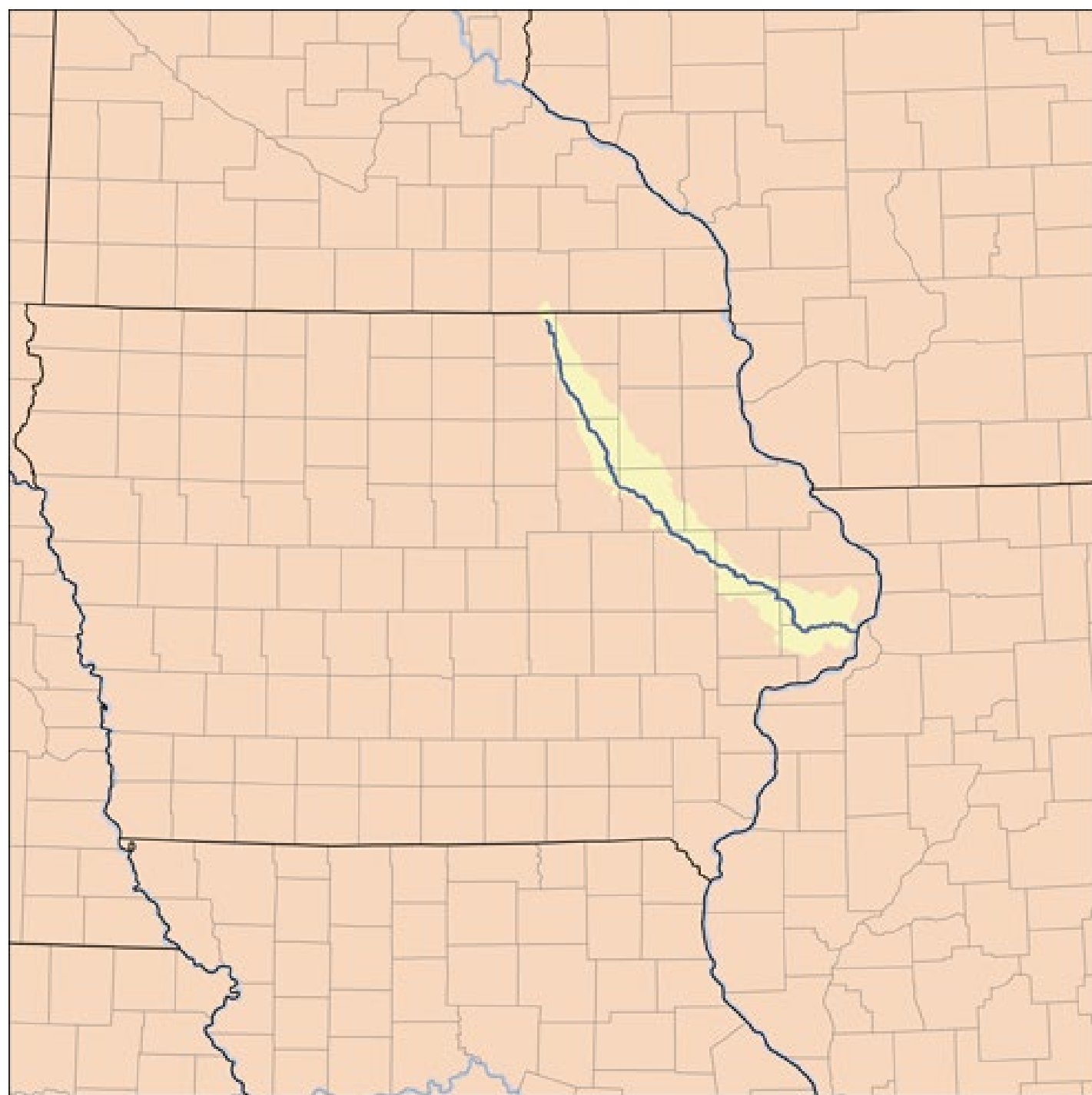
The Maquoketa River

- 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

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



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



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



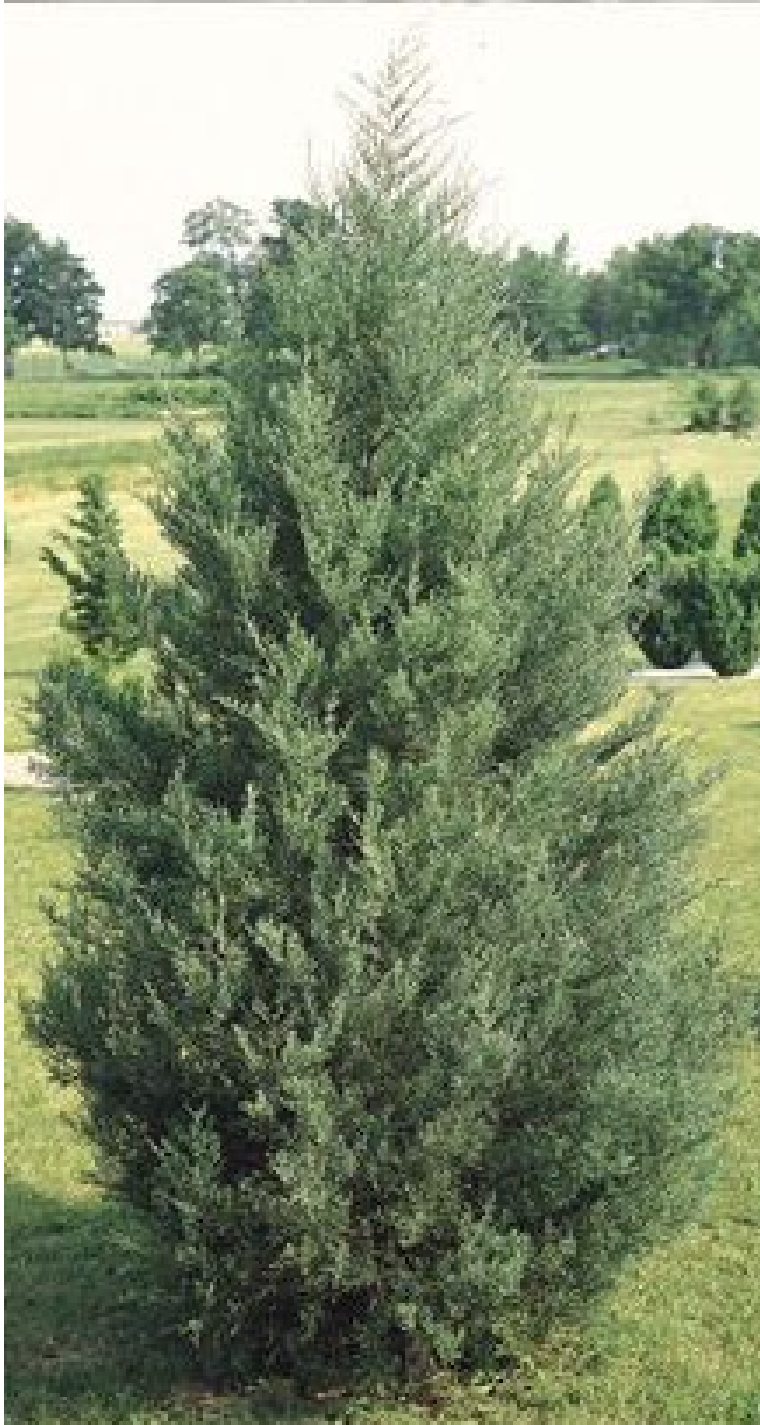
The Cedar River

“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 be the River of Life and over yonder is Canaan; let us cross over.”

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



Red Cedar (*Juniperus virginiana*)





 ROTOR
VISUAL



Middle Cedar Watershed Management Plan: HUC-12 Prioritization

Most populated of Iowa's 56 HUC 8 = 294,122

Factor Details

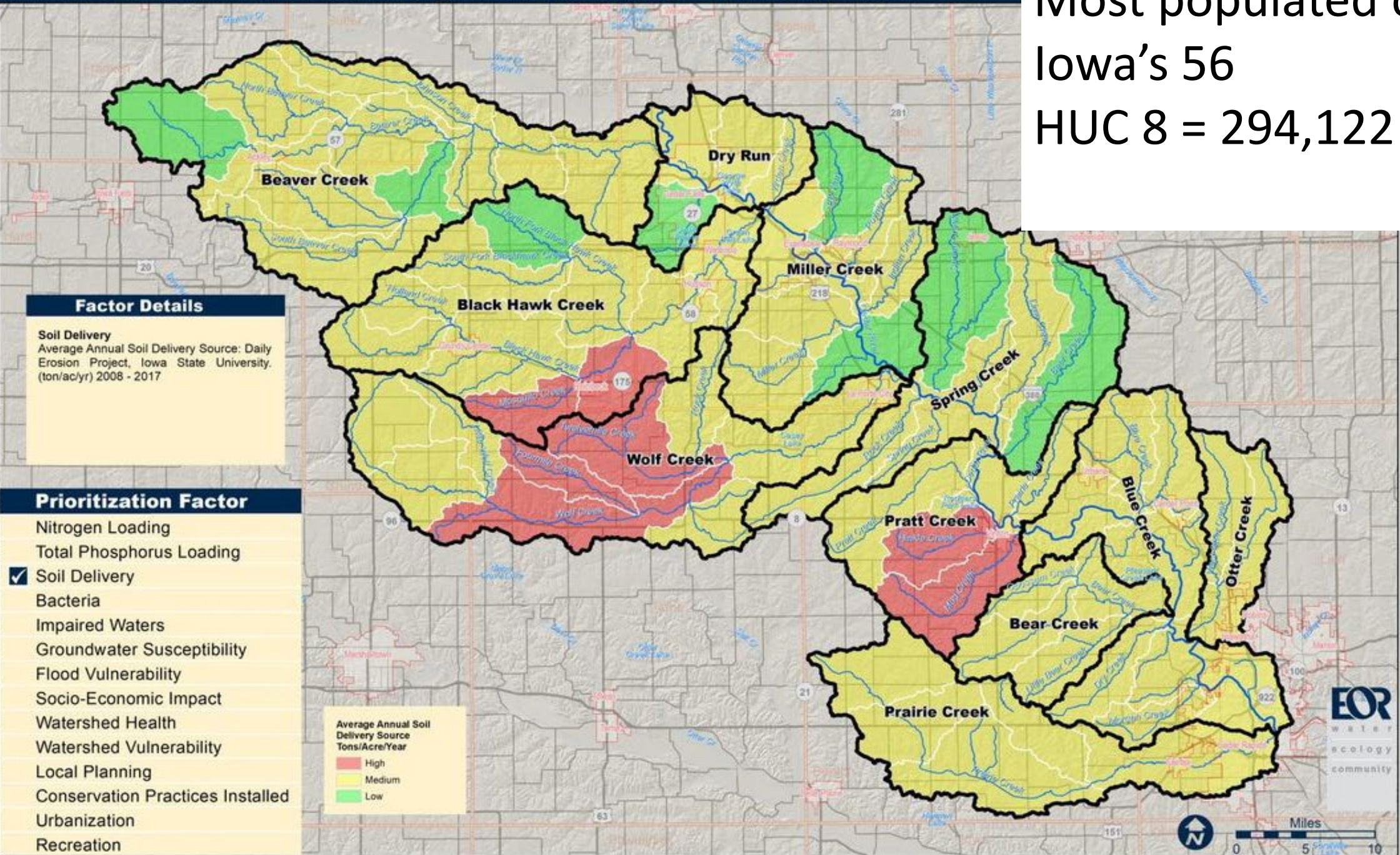
Soil Delivery
Average Annual Soil Delivery Source: Daily Erosion Project, Iowa State University. (ton/ac/yr) 2008 - 2017

Prioritization Factor

- Nitrogen Loading
- Total Phosphorus Loading
- Soil Delivery
- Bacteria
- Impaired Waters
- Groundwater Susceptibility
- Flood Vulnerability
- Socio-Economic Impact
- Watershed Health
- Watershed Vulnerability
- Local Planning
- Conservation Practices Installed
- Urbanization
- Recreation

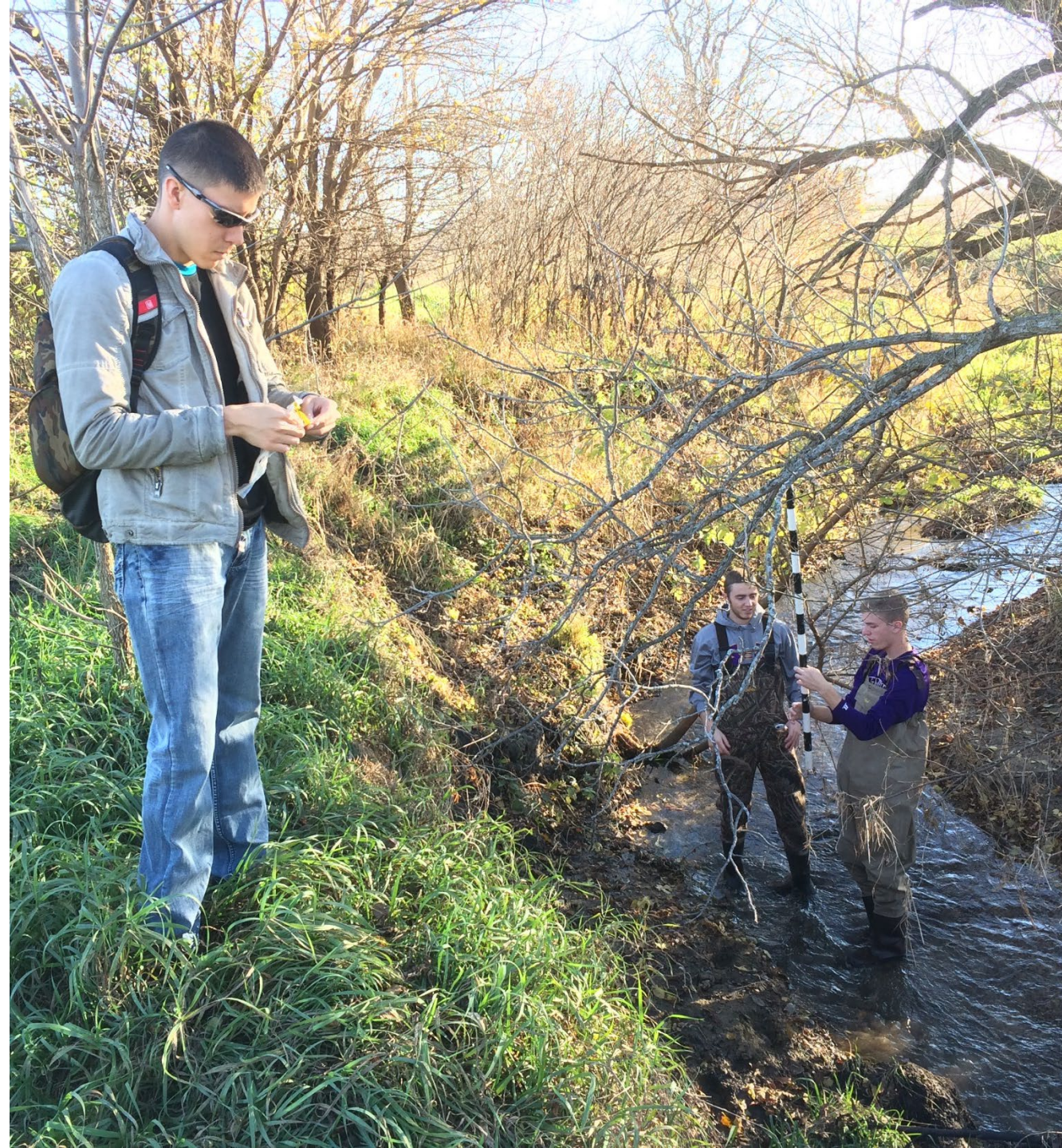
Average Annual Soil Delivery Source
Tons/Acre/Year

- High
- Medium
- Low



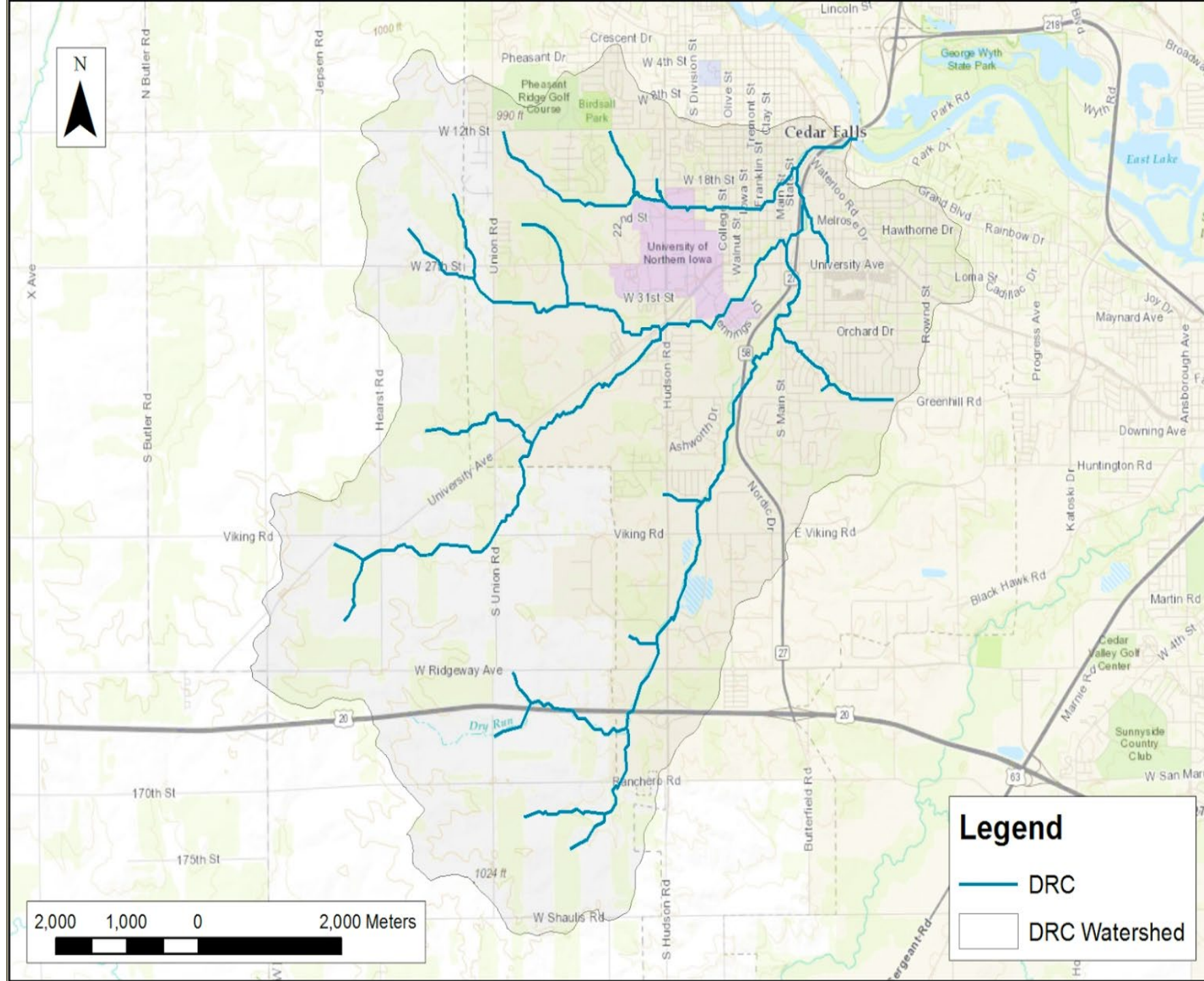
Dry Run Creek

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



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

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

Water concepts, tools and issues

- Field

- Lab

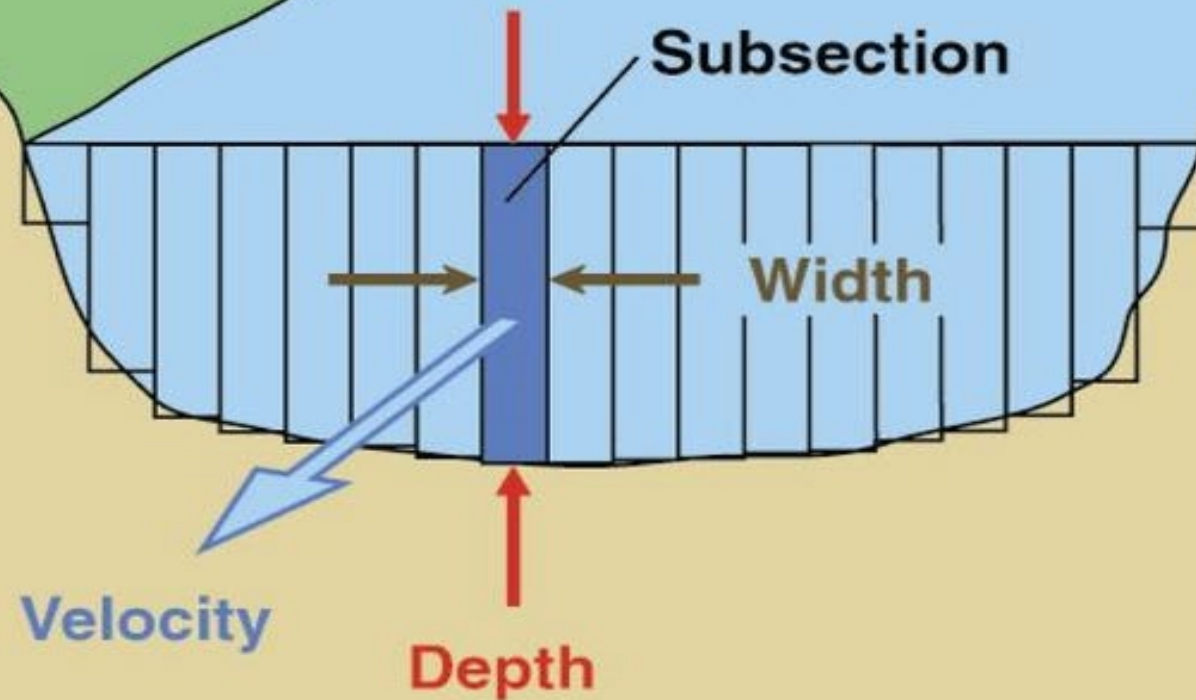
Communication, Education and Policy

Vocabulary

- Groundwater vs Surficial water
 - Tracking movement
- Recharge & Recharge Rate
 - Tracking storage
- Water New Year – Oct. 1
 - Tracking time
- Discharge
 - $Q = \text{Avg. } W * \text{Avg. } D * \text{Avg. } V$
- Residence time
 - $Tr = V/I [T]$

Discharge

$$Q = \text{Avg. } W * \text{Avg. } D * \text{Avg. } V$$



In each subsection:

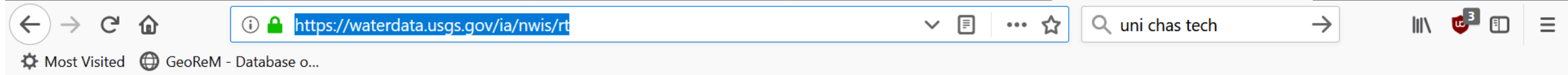
$$\text{Area} = \text{Depth} \times \text{Width}$$

$$\text{Discharge} = \text{Area} \times \text{Velocity}$$

Stream Flow Measurement

- Gauging stations
 - Distributed in rivers throughout the world
 - Monitor stream discharge, water surface level, and the amount of suspended sediment
 - Continuously or periodically
- Discharge = (Water Velocity * Channel Area)

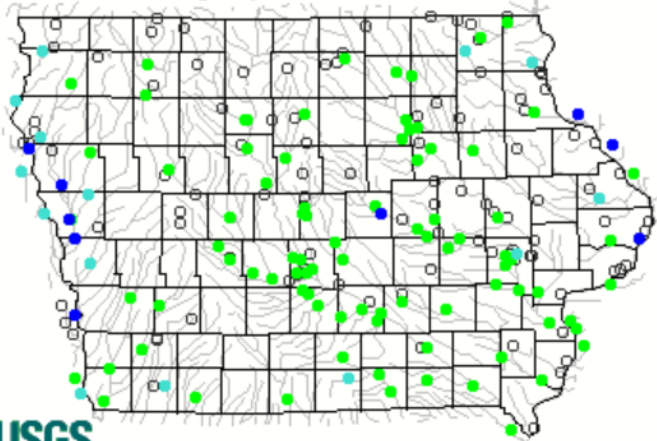




Daily Streamflow Conditions

Select a site to retrieve data and station information.

Friday, April 17, 2020 16:30ET



Explanation

- High
- > 90th percentile
- 76th - 90th percentile
- 25th - 75th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

The colored dots on this map depict streamflow conditions as a [percentile](#), which is computed from the period of record for the current day of the year. Only stations with at least 30 years of record are used.

The **gray circles** indicate other stations that were not ranked in percentiles either because they have fewer than 30 years of record or because they report parameters other than streamflow. Some stations, for example, measure stage only.

Statewide Streamflow Current Conditions Table

Real-time data typically are recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from real-time sites are relayed to USGS offices via satellite, telephone, and/or radio and are available for viewing within minutes of arrival.

All current conditions data are [provisional and subject to revision](#).

Build Current Conditions Table	Show a custom current conditions summary table for one or more stations.
Build Time Series	Show custom graphs or tables for a series of recent data for one or more stations.

Iowa Flood Information System

Browser navigation: https://ifis.iowafloodcenter.org/ifis/app/?c=State_of_Iowa&par=7*42.000000*-93.000000 | Search: uni chas tech

IFIS

Map controls: +, -, Location, Full Screen

Map Labels: Mankato, Rochester, Winona, La Crosse, Austin, Sioux Falls, Mitchell, Yankton, Norfolk, Columbus, Grand Island, York, Lincoln, Papillion, Omaha, Beatrice, Hastings, Kearney, Holdrege

FLOOD MAPS

- Current Conditions
- Community Scenarios
- Reservoir Releases
- State-wide Inundation

MAP RESOURCES

- Draft Flood Hazard Maps [↗](#)
- Flood Risk Management Maps [↗](#)

LEGEND

Snow | Drizzle | Light | Moderate | Heavy | Downpour

IFIS

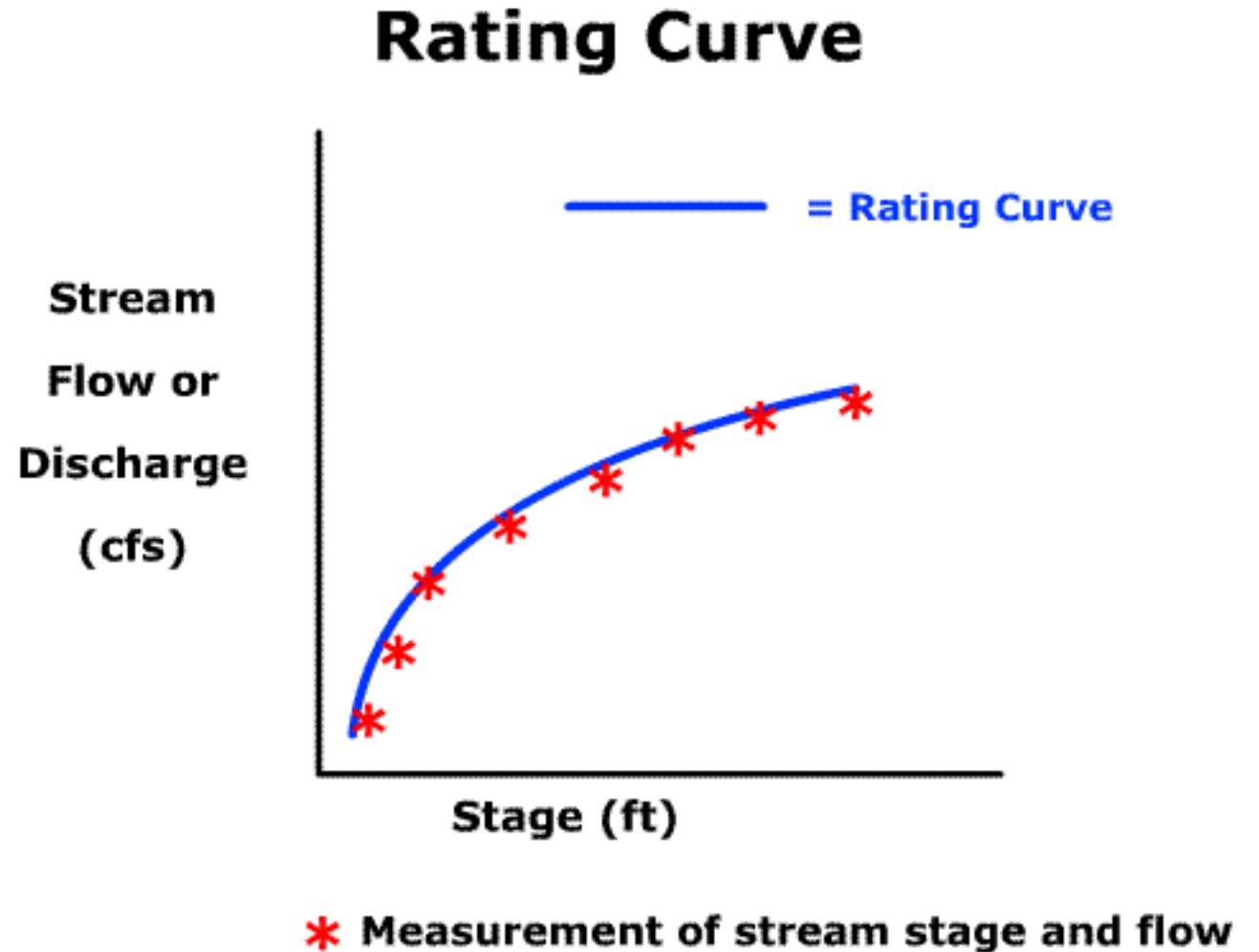
Map features: People icon, A icon, Satellite icon, Home icon, Cloud with rain icon, Briefcase icon, Red box with white cross icon, Earth icon, Mouse cursor icon

Rating curves

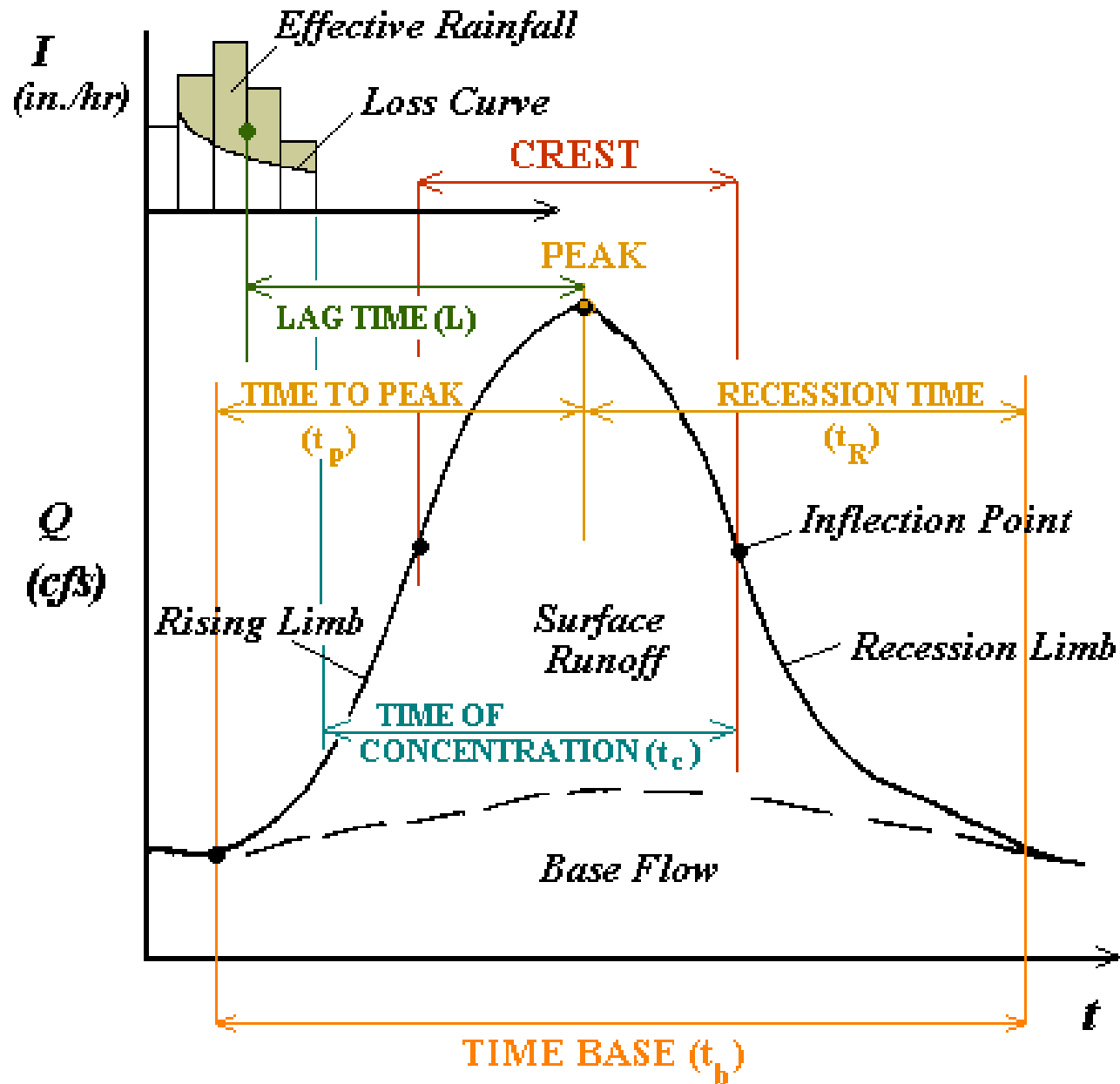
- Once the discharge is determined for a variety of rainfall events, a rating curve may be produced.

Then

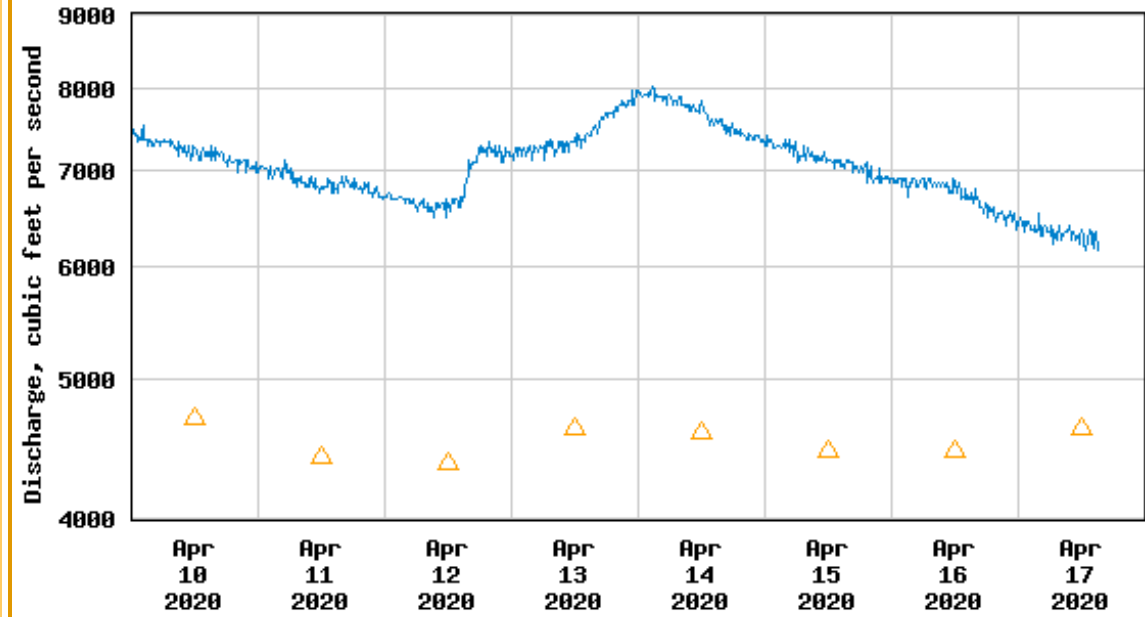
- Discharge may be determined by simply measuring the water surface



Properties of Hydrographs



USGS 05464000 Cedar River at Waterloo, IA

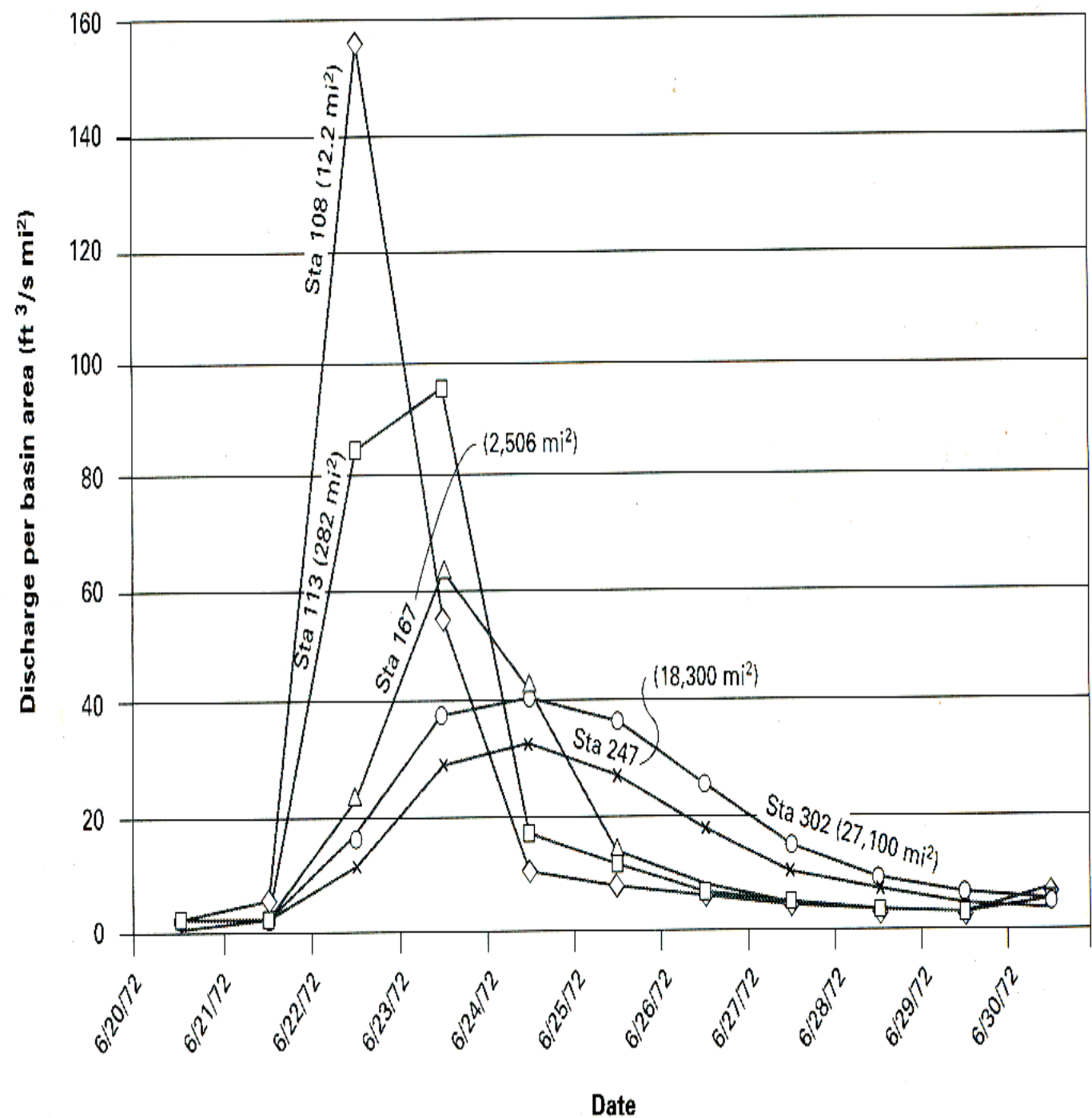


----- Provisional Data Subject to Revision -----

△ Median daily statistic (79 years) — Discharge

Hydrographs

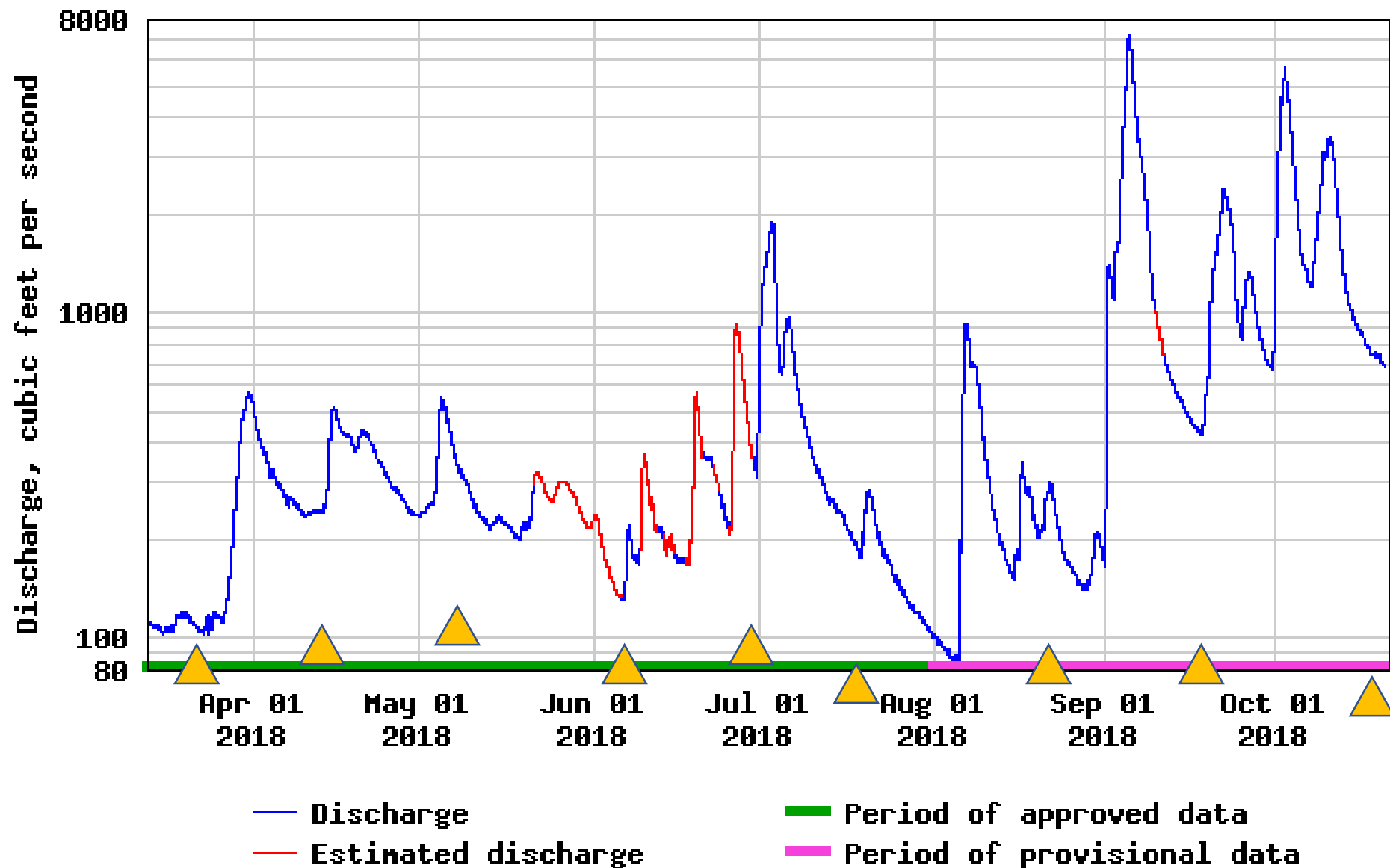
- Low-ordered streams will appear 'flashy'
- High-ordered stream will appear 'gradual'



Hydrographs



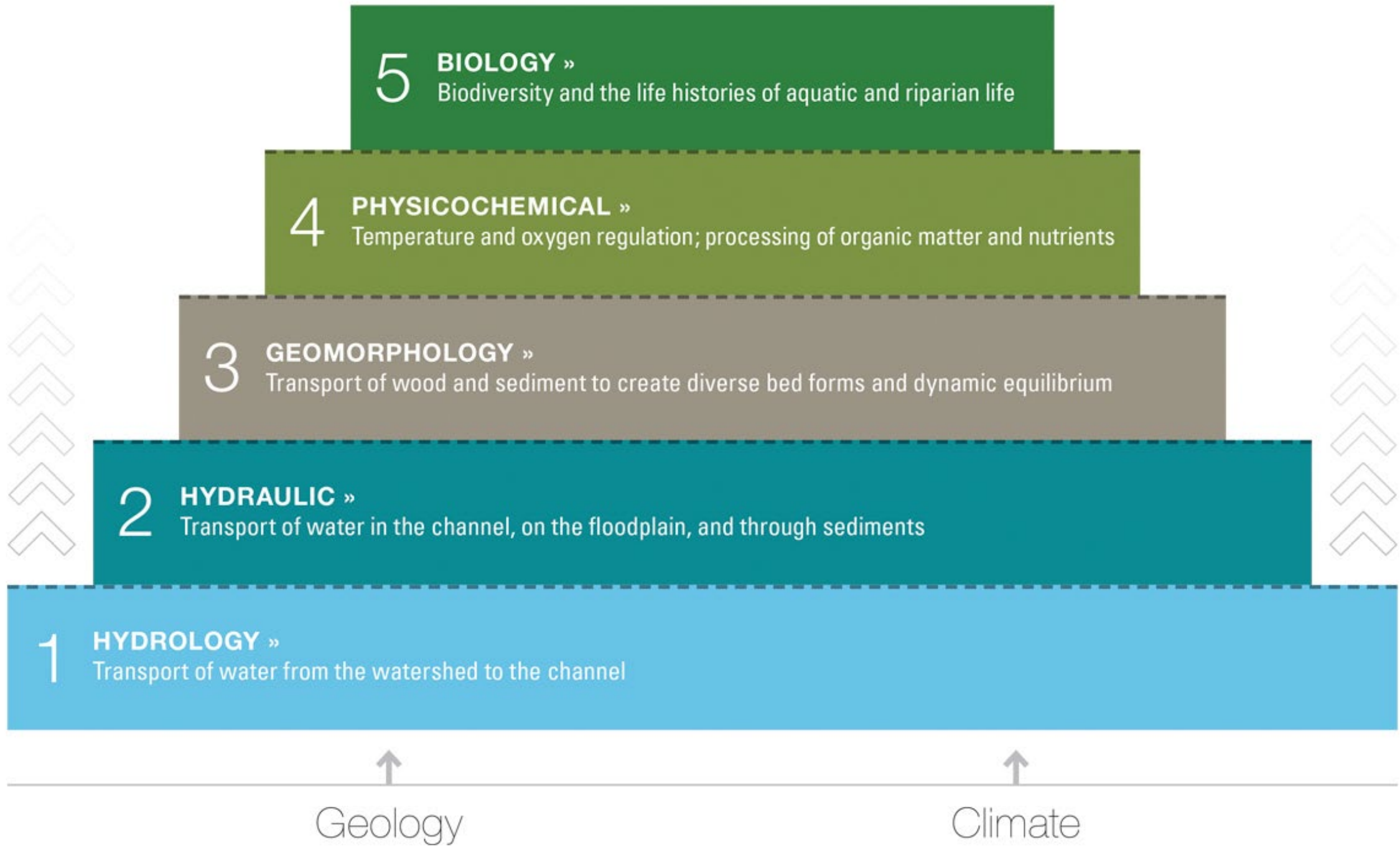
USGS 05463500 Black Hawk Creek at Hudson, IA



Hydrographs

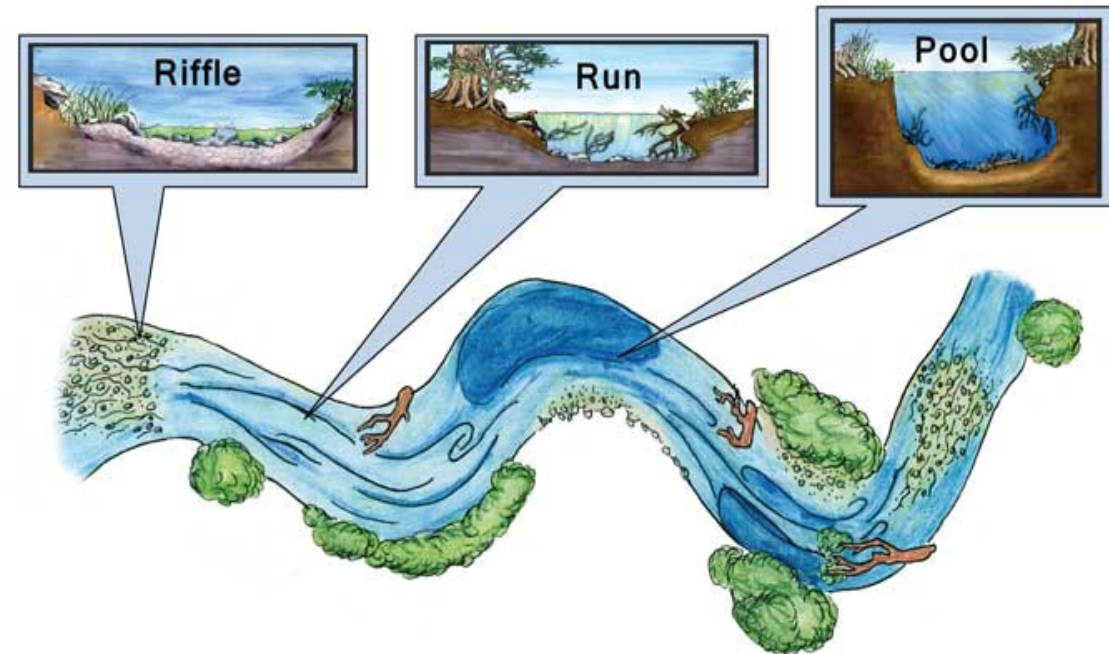
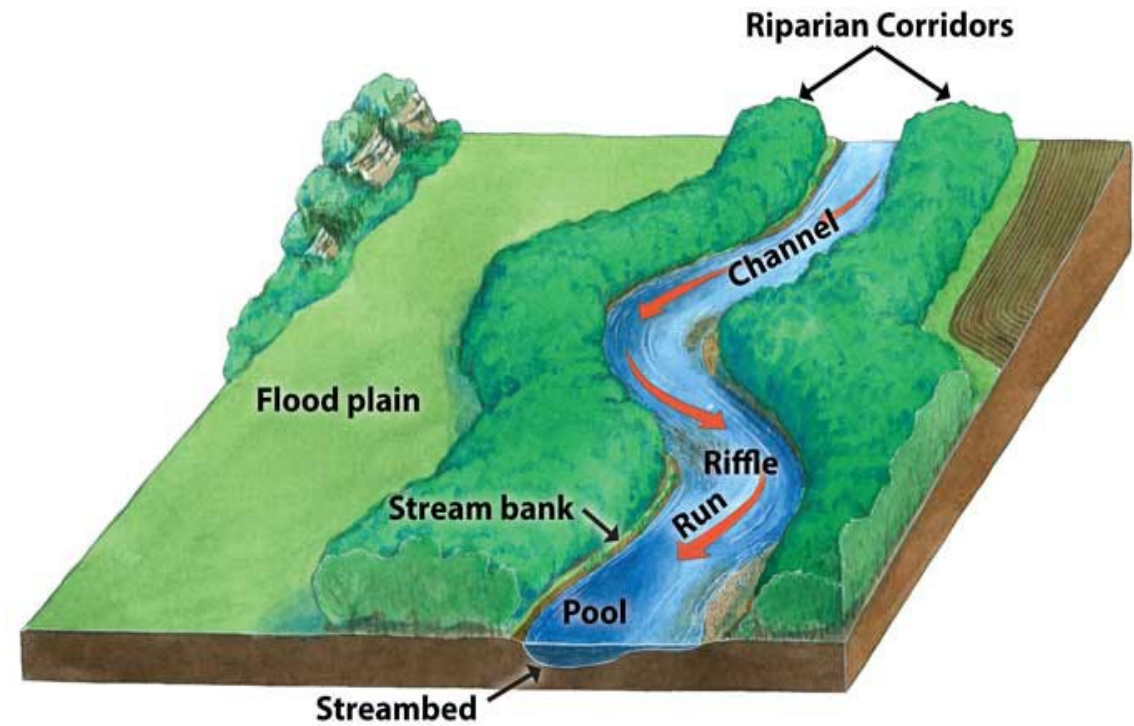
- Plot Discharge vs. Time
- By connecting the two low points on a hydrograph it is possible to separate baseflow (groundwater) and storm surge from a rainfall event.
- Helpful in determining flood crests as well as contaminate plum migration

Stream Function Pyramid



Healthy Streams

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



Student Research

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



No child left inside?

Iowa one of the most altered landscapes on Earth

- Wetlands drained,
- Streams straightened and diverted,
- Habitats shrunk or altered
- 99.9% of Iowa's native prairies plowed under



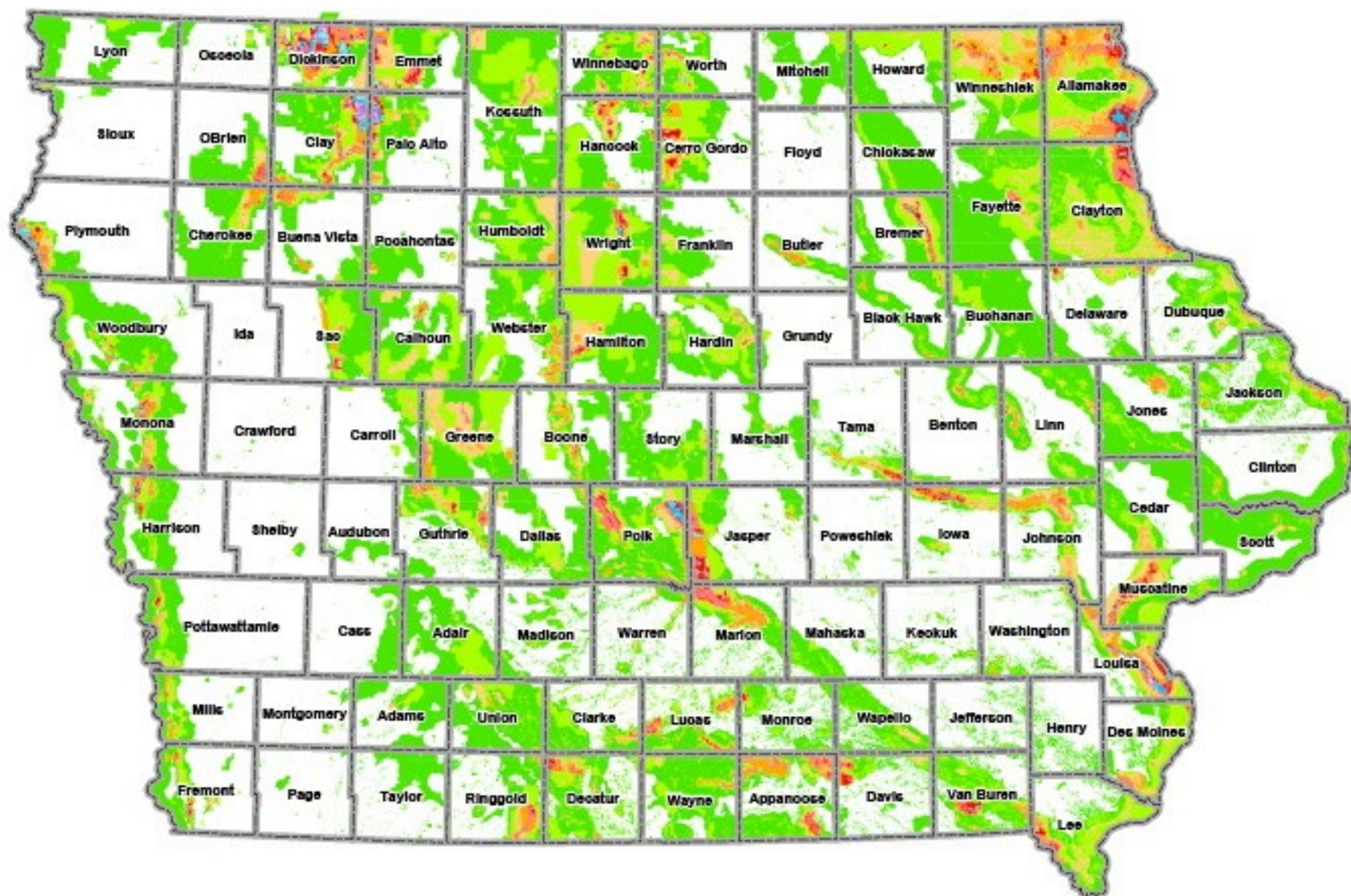


• Most of Iowa's landscape --
-- more than 90 percent --- is
privately owned and used
for agricultural production.

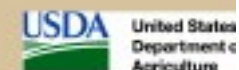
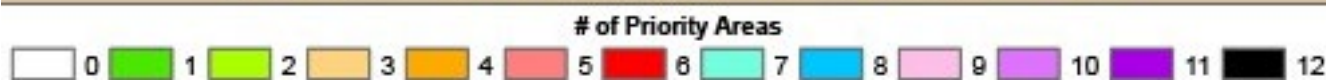


All public lands = 2%

DNR lands = less than 1%



High Opportunity Area for Cooperative Conservation Actions as Identified in the Iowa Wildlife Action Plan



USDA-NRCS GIS Office
Des Moines, Iowa
December 2017



Iowa water issues to explore...

- Water Careers
- Education and Recreation
- Erosion, sedimentation, muddy water
- Contamination
 - Lead
 - Nutrient Loads, Nitrates
 - Fecal/Bacteria
 - PFAS
 - Pharmaceutical waste
 - Plastic
- Aging water infrastructure
 - Rural to urban
- Environmental equity and justice
- Water and Natural Resources in Politics
- **Climate change (swings)**
 - **Unpredictability**

Urbanization

Cedar Falls, Iowa

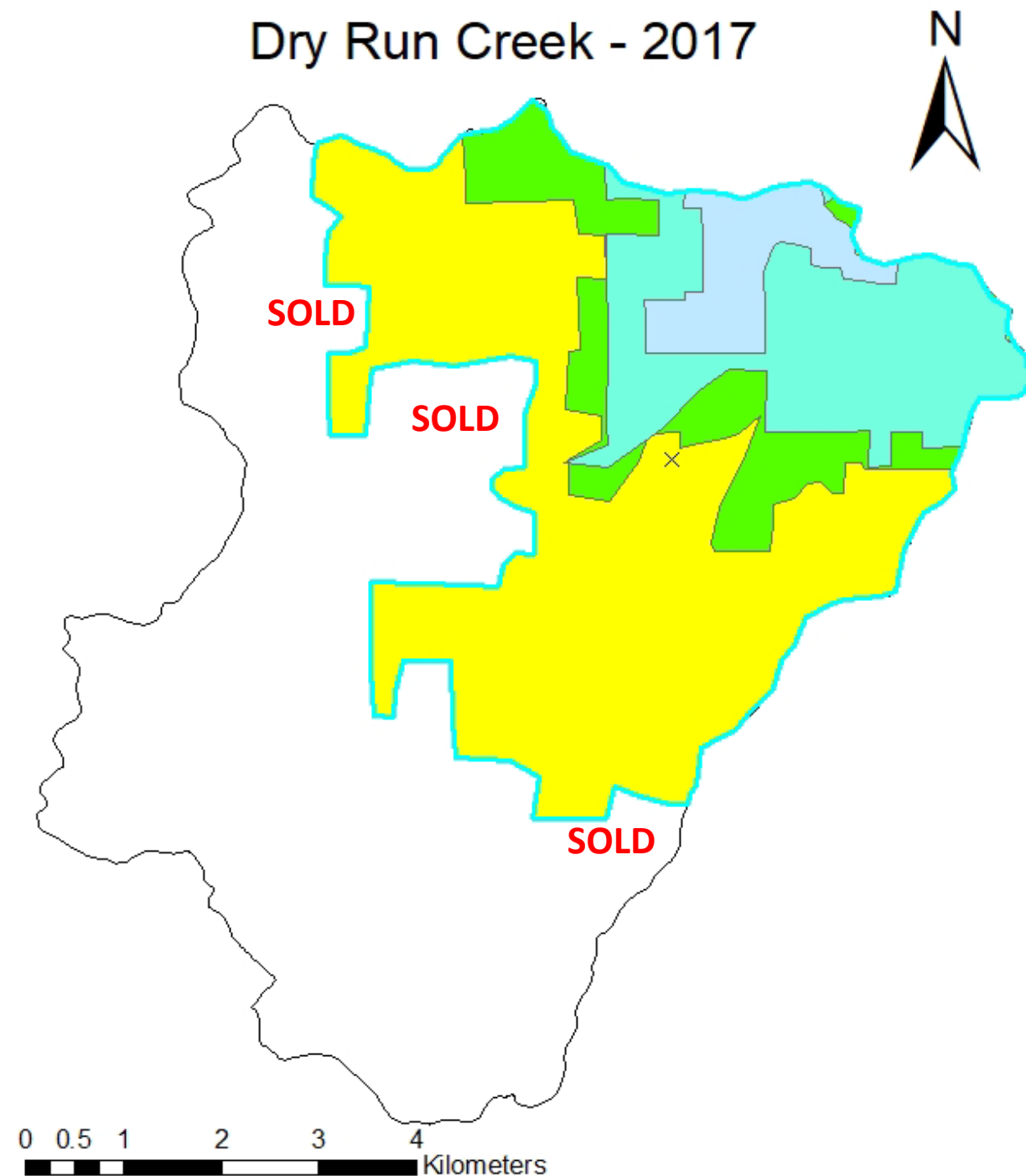
2017 – 41,570

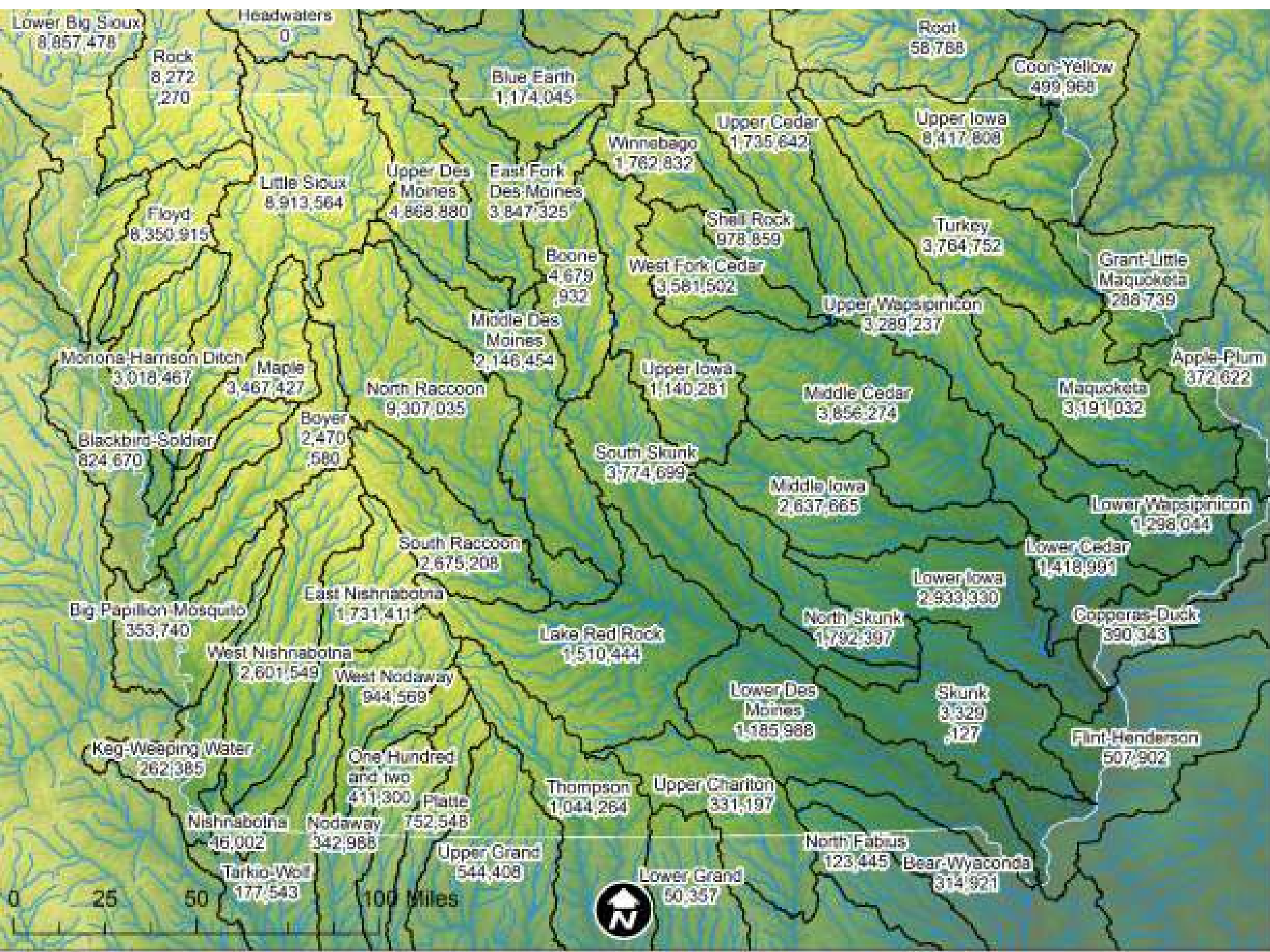
1990 – 34,298

1960 – 21,195

1930 - 7,632

Dry Run Creek - 2017





Black Hawk Co.
 Population
 294,122
 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.



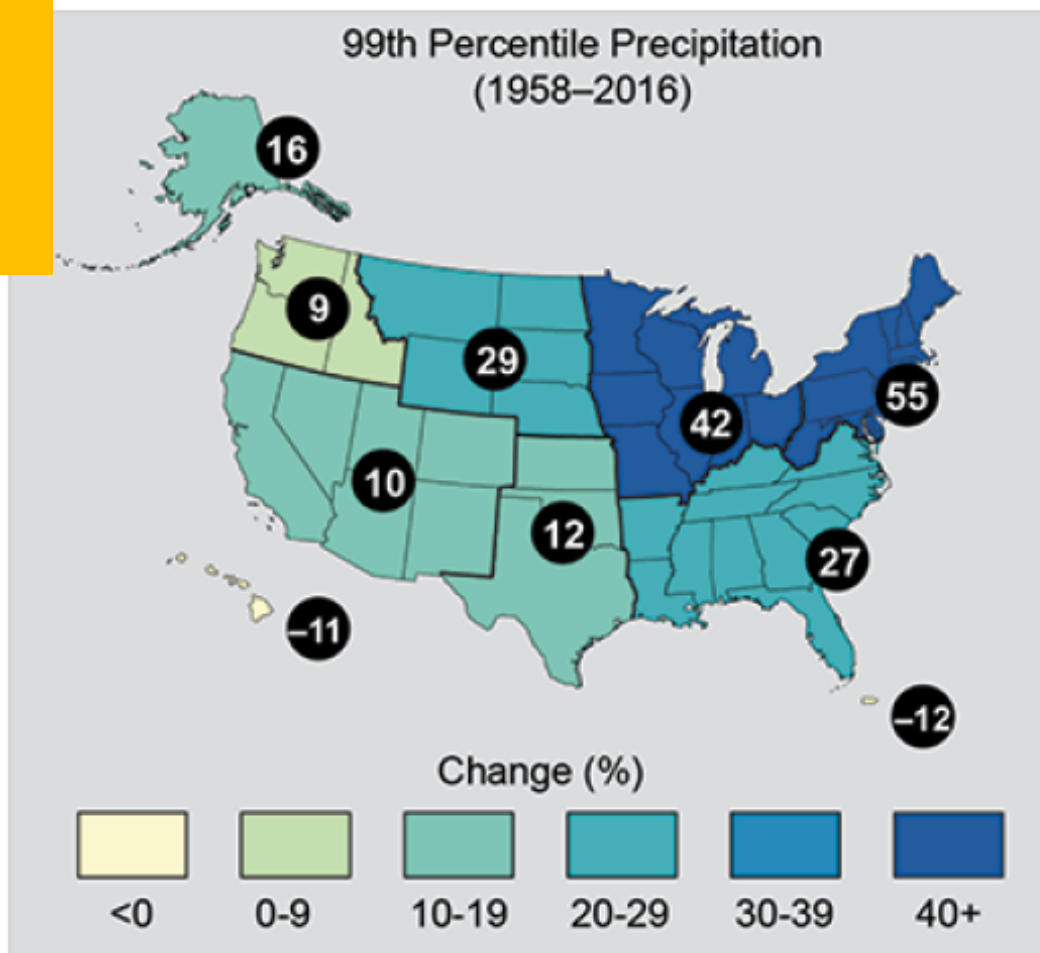
Nitrate
equivalents

2019 – may surpass
previous record due
to record flooding

Chris Jones

U Of Iowa
IIHR

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)	Date	Vinton ppt (inches)
7/10/2000	5.91	8/12/2016	6.04
4/25/2008	4.35	5/30/2008	4.15
8/29/2015	4.11	6/15/1982	3.98
9/4/2018	3.98	6/12/2015	3.8
8/6/2018	3.76	11/4/2003	3.49
5/30/2013	3.56	7/1/2014	3.33
9/11/2006	3.36	7/9/1993	3.29
7/27/1990	3.22	6/17/1990	3.25
7/1/2018	3.17	8/8/1991	3.18
9/13/1991	3.16	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/>)

Map released: Thurs. February 29, 2024

Data valid: February 27, 2024 at 7 a.m. EST

Intensity

-  None
-  D0 (Abnormally Dry)
-  D1 (Moderate Drought)
-  D2 (Severe Drought)
-  D3 (Extreme Drought)
-  D4 (Exceptional Drought)
-  No Data

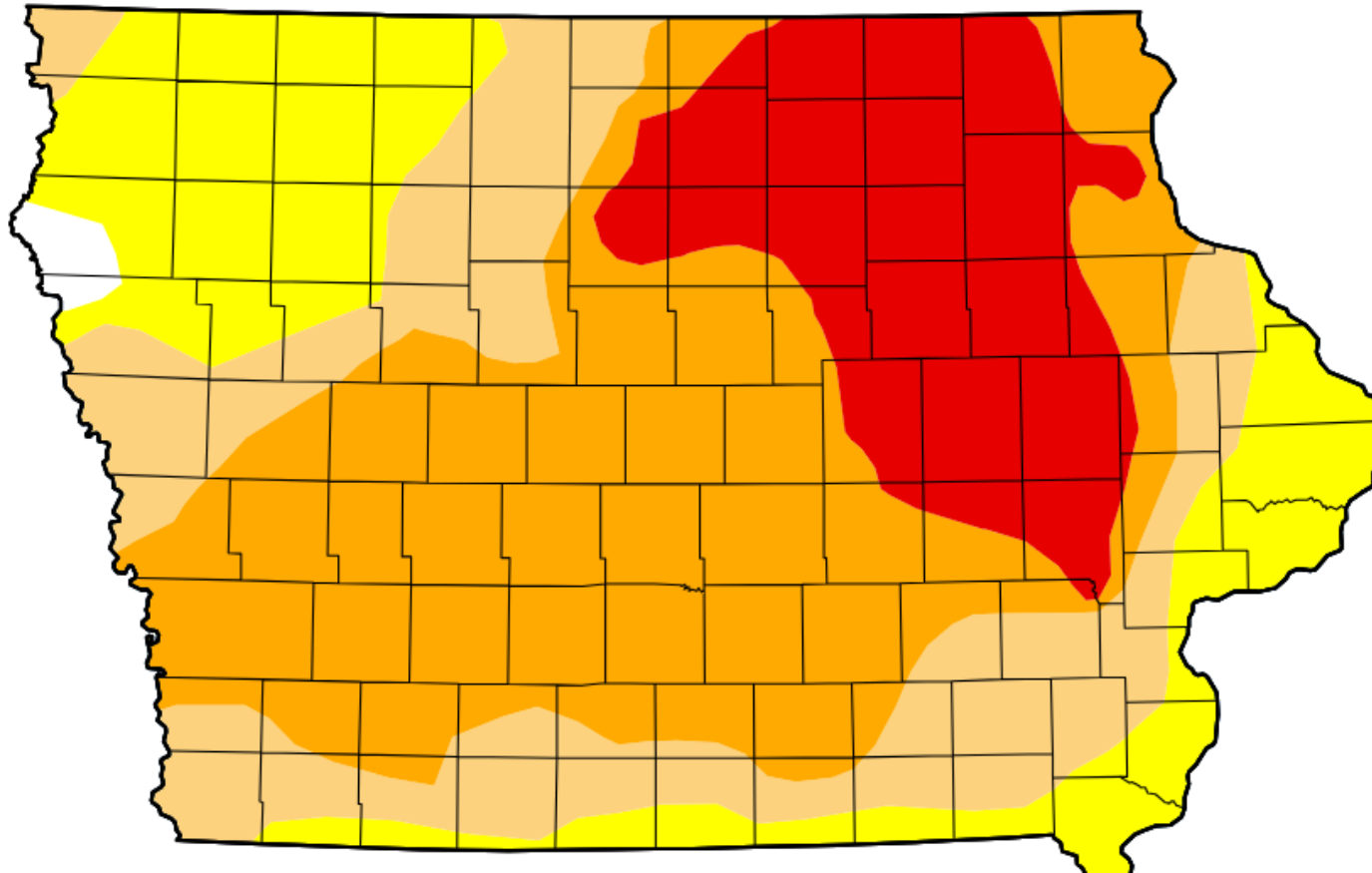
Authors

United States and Puerto Rico Author(s):

[Richard Heim](#), NOAA/NCEI

Pacific Islands and Virgin Islands Author(s):

[Denise Gutzmer](#), National Drought Mitigation Center

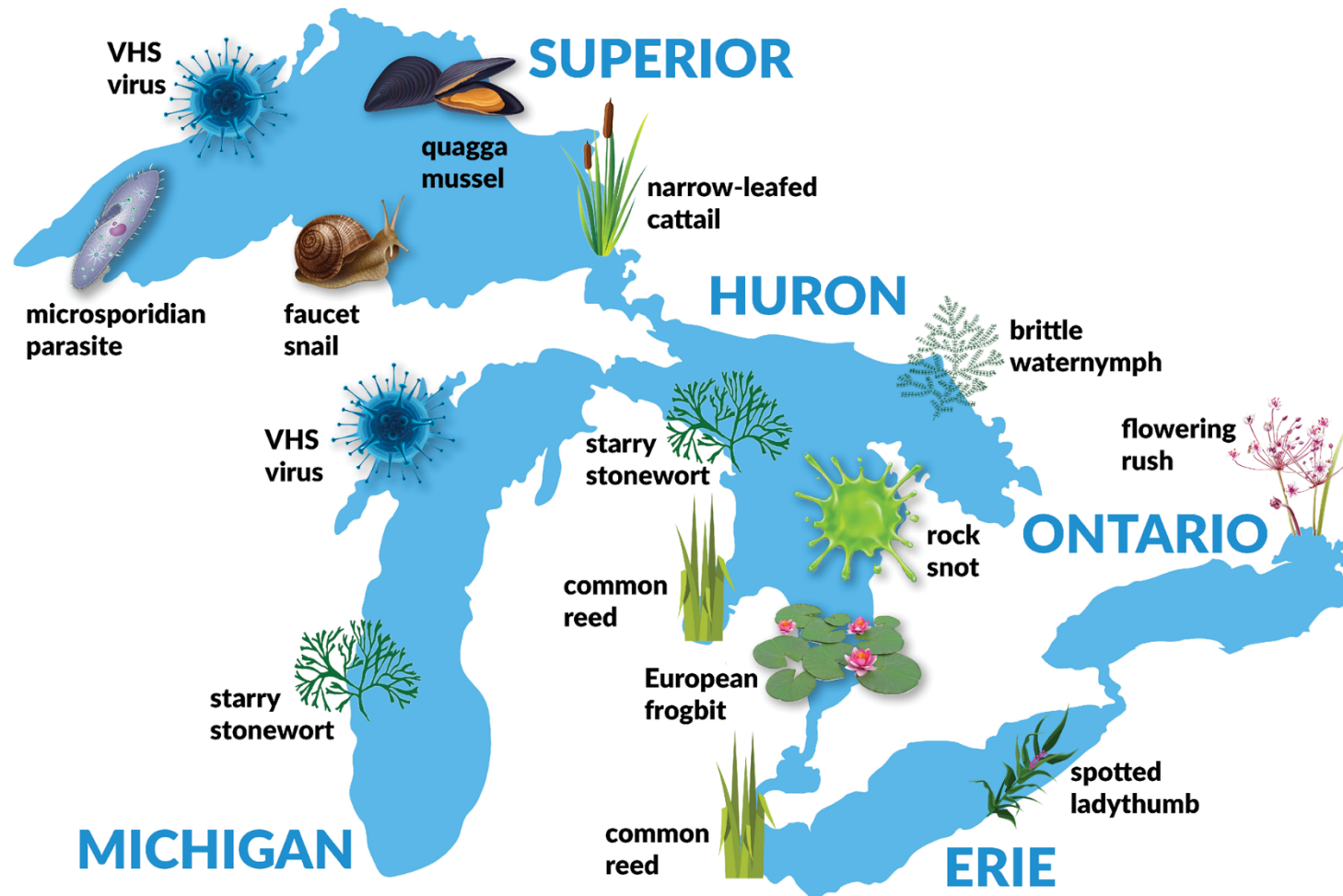


Invasive species



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

CEDAR FALLS OXBOW WETLAND RESTORATION

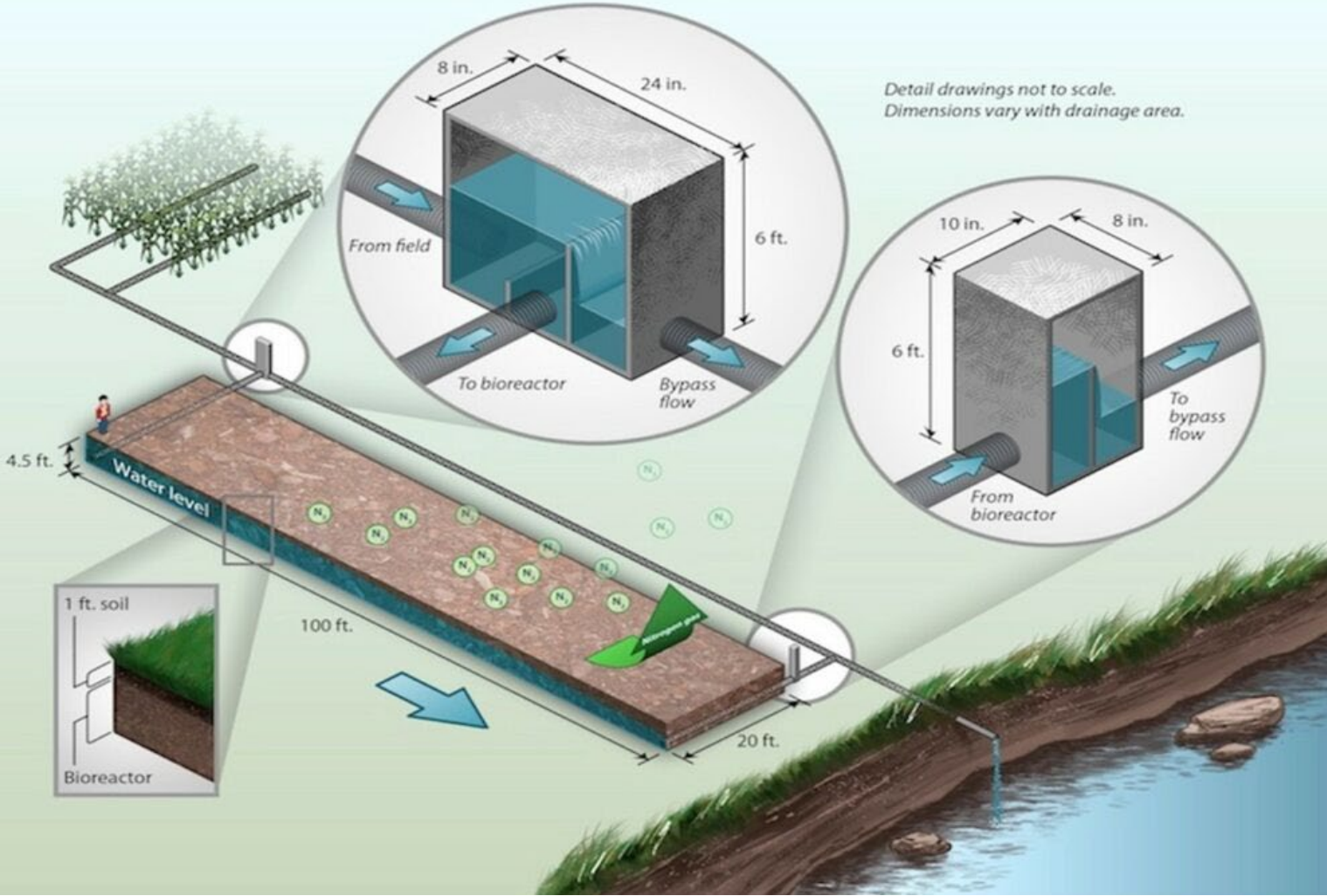
Best
Management
Practices



- Subwatershed 5
- 2.6 acre drainage area
- 13,950 ft² of wetland
- 3 tons of sediment annually
- 4 lbs. of Phosphorus annually
- Construction fall 2018
- \$28,843 The Nature Conservancy



Bioreactor



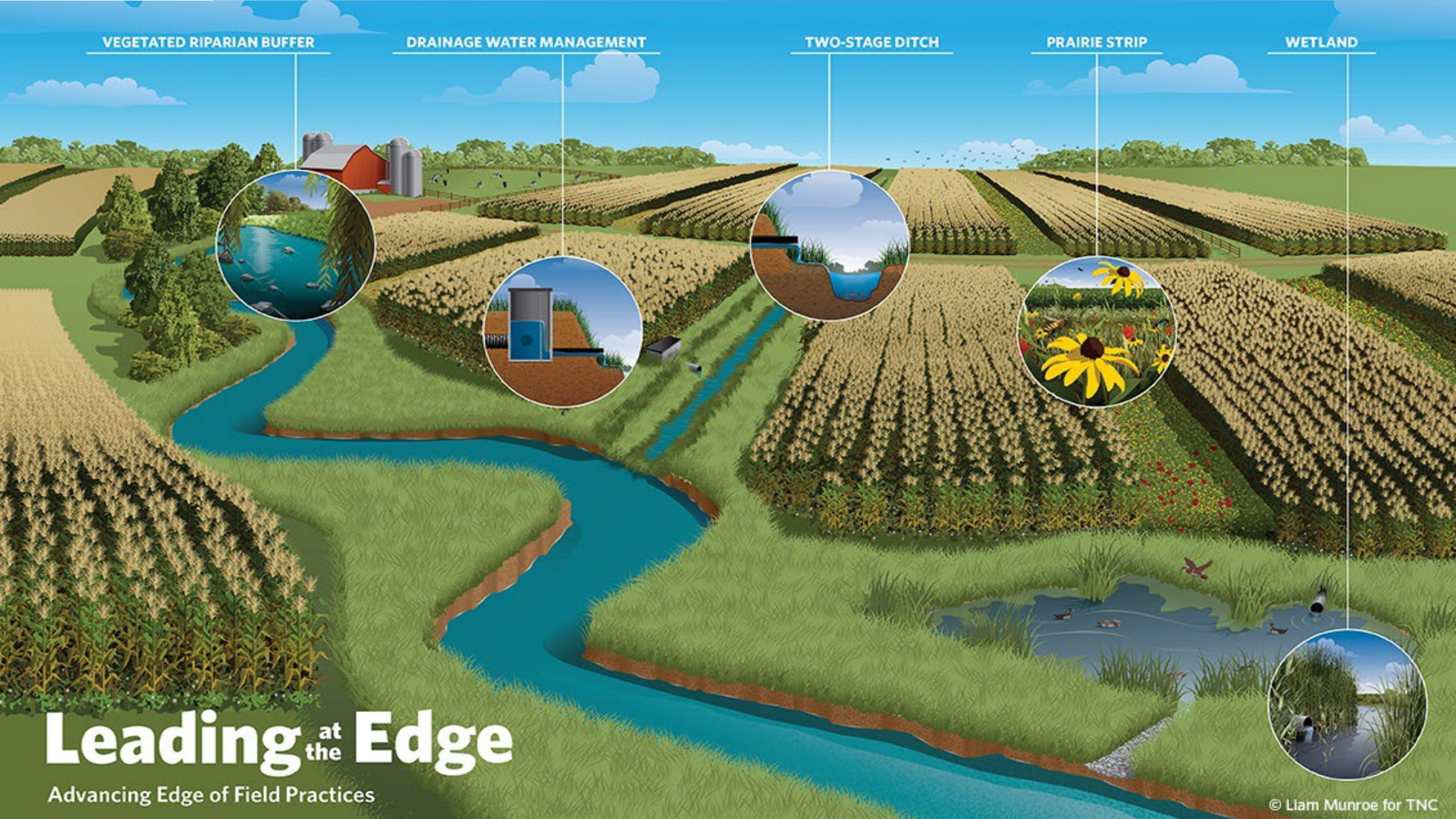
VEGETATED RIPARIAN BUFFER

DRAINAGE WATER MANAGEMENT

TWO-STAGE DITCH

PRAIRIE STRIP

WETLAND



Leading at the Edge

Advancing Edge of Field Practices



DMACC Dallas County Farm

Resources

- Iowa Groundwater Association
 - <https://www.igwa.org/>
- Isaak Walton League of America – Iowa
 - <https://www.iwla.org/water/regional/iowa#>
- Maquoketa WMA Info.
 - <https://www.limestonebluffsrcd.org/general-8>
- Iowa Agriculture Water Alliance
 - <https://www.iaagwater.org/>
- Global water summary
 - https://www.ideo.columbia.edu/~martins/climate_water/lectures/hcycle.htm