Natural Solutions for Climate Change

Conservation Data & Tools to Mitigate & Adapt

Forest Service Eastern Region

Climate Change Coordinators Meeting

10 April 2019

Nick Miller, Director of Science & Strategy

The Nature Conservancy in Wisconsin

The Nature Conservancy

1. We can help nature adapt
2. Nature can help us adapt
3. Nature can reduce impacts

The Nature Conservancy
Protecting nature. Preserving life.™

Conserving Nature's Stage

Resilient and Connected Landscapes

Acknowledgements

Primary Funder:
Doris Duke Charitable Foundation

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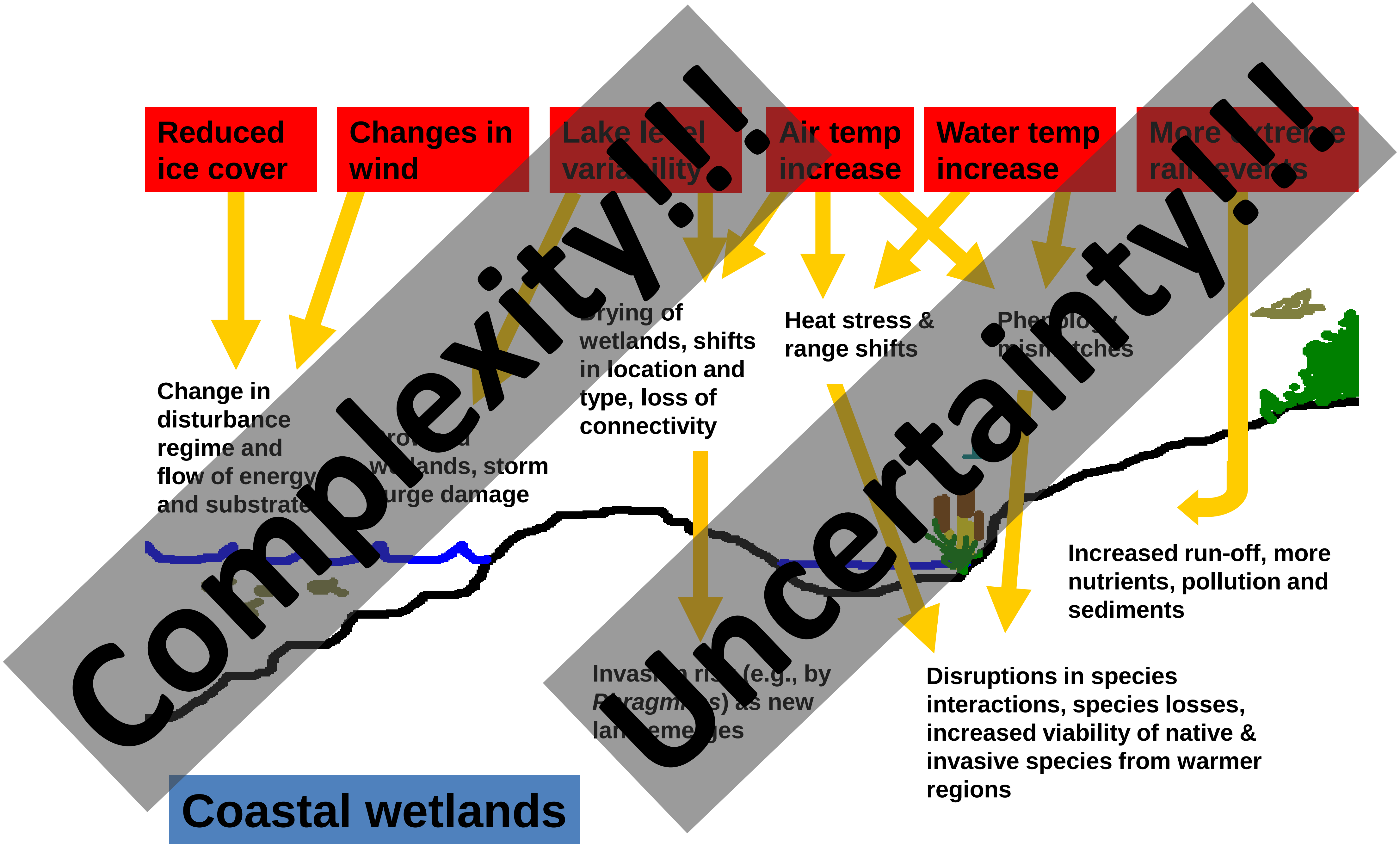
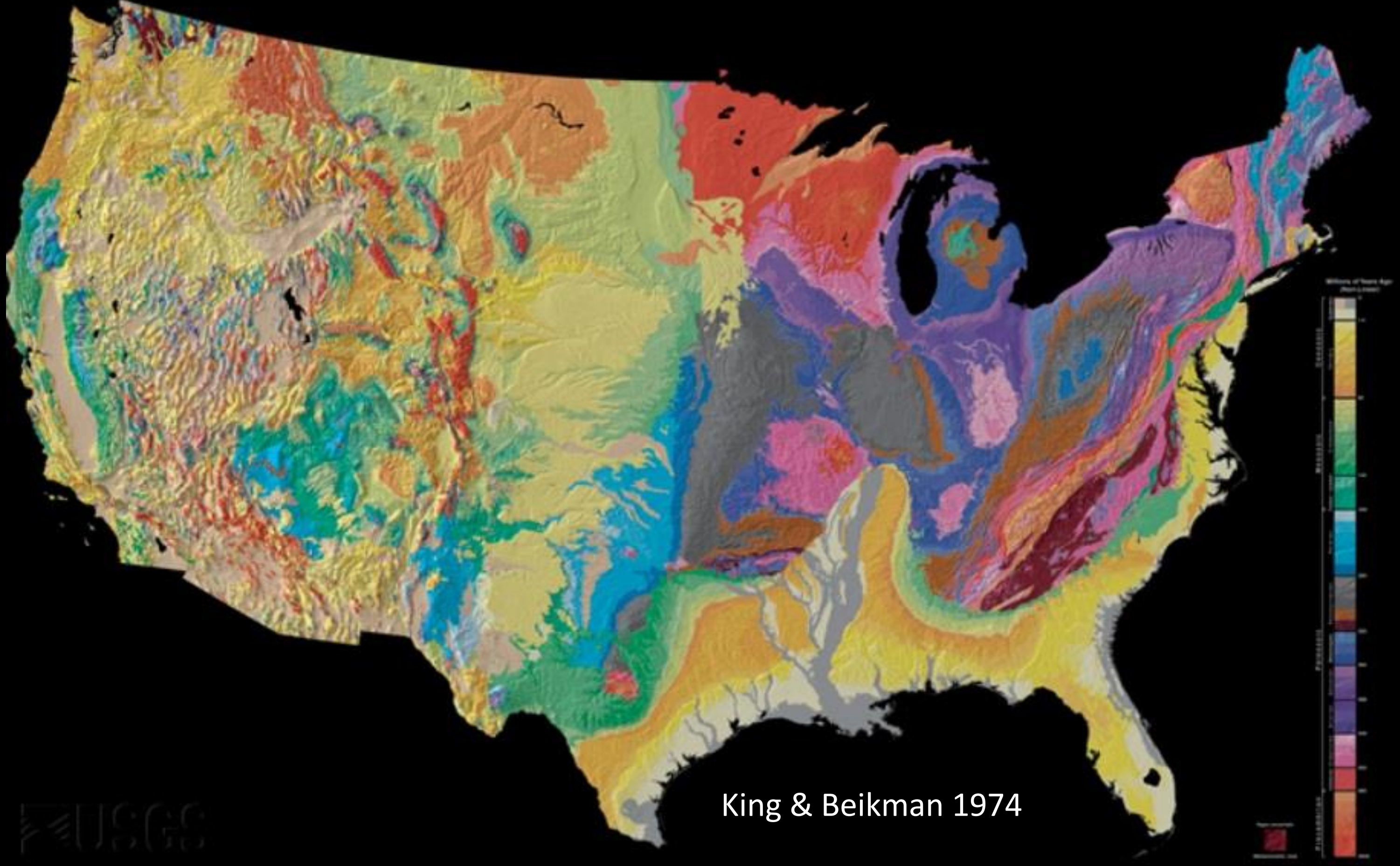

Reduced ice cover
Changes in wind
Lake
Air temp increase
Water temp increase
More
Complexity!!!
Uncertainty!!!
Change in disturbance regime and flow of energy and substrate
storm
surge damage
wetlands, shifts in location and type, loss of connectivity
Heat stress & range shifts
Increased run-off, more nutrients, pollution and sediments
Disruptions in species interactions, species losses, increased viability of native & invasive species from warmer regions
(e.g., by
new
Coastal wetlands

Geodiversity…. drives patterns of biodiversity



King & Beikman 1974

Resilient Sites

Highly Vulnerable

Disrupted function, low diversity

Few options

Generalist species

Highly Resilient

Sustain function and diversity

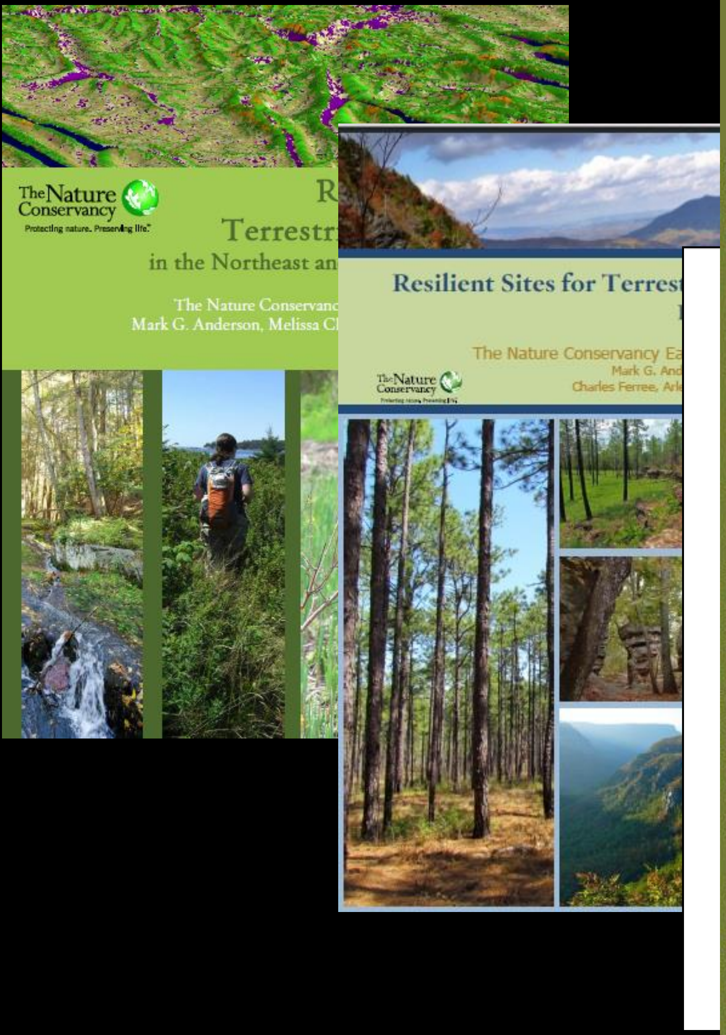
Many options

Specialist species

Site Resilience: the capacity of a site to maintain species diversity, productivity, and ecological function as the climate changes.

- Anderson et al. 2014

wed Papers



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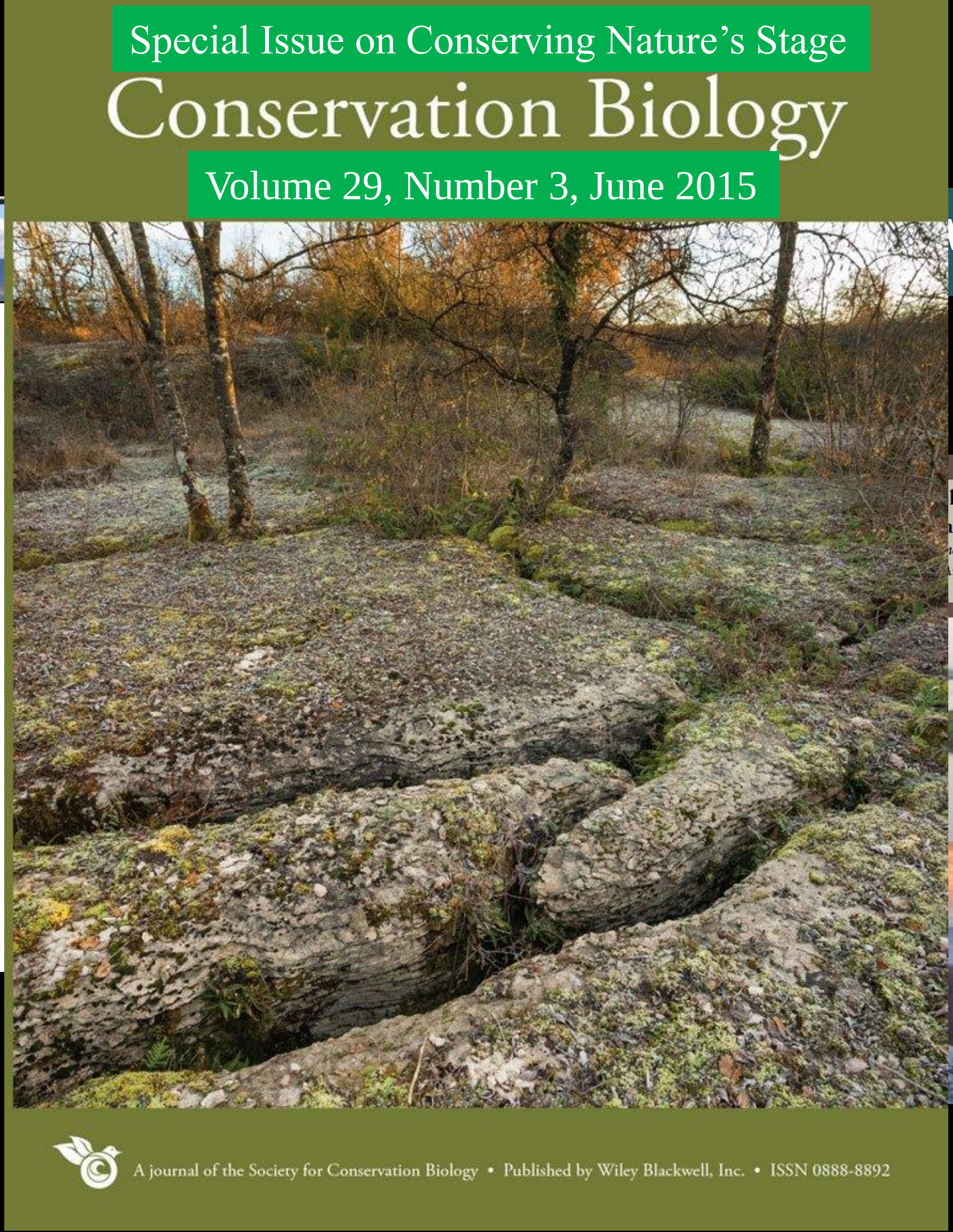
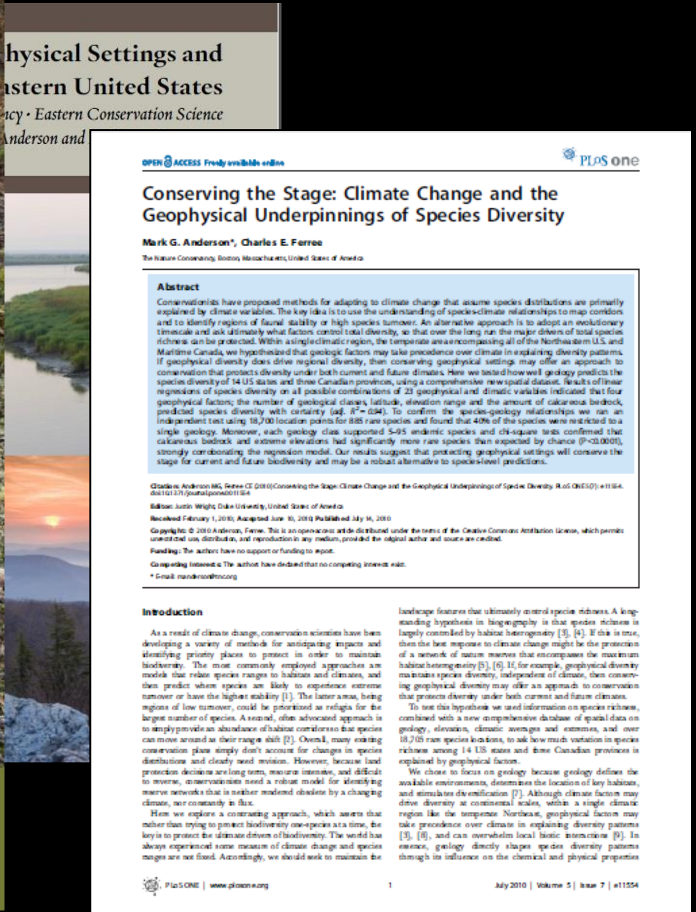
The Nature Conservanc
Mark G. Anderson, Melissa Cl
Resilient Sites for Terrest
The Nature Conservancy Ea
Mark G. And
Charles Ferree, Arl



Special Issue on Conserving Nature's Stage
Conservation Biology
Volume 29, Number 3, June 2015
A journal of the Society for Conservation Biology • Published by Wiley Blackwell, Inc. • ISSN 0888-8892



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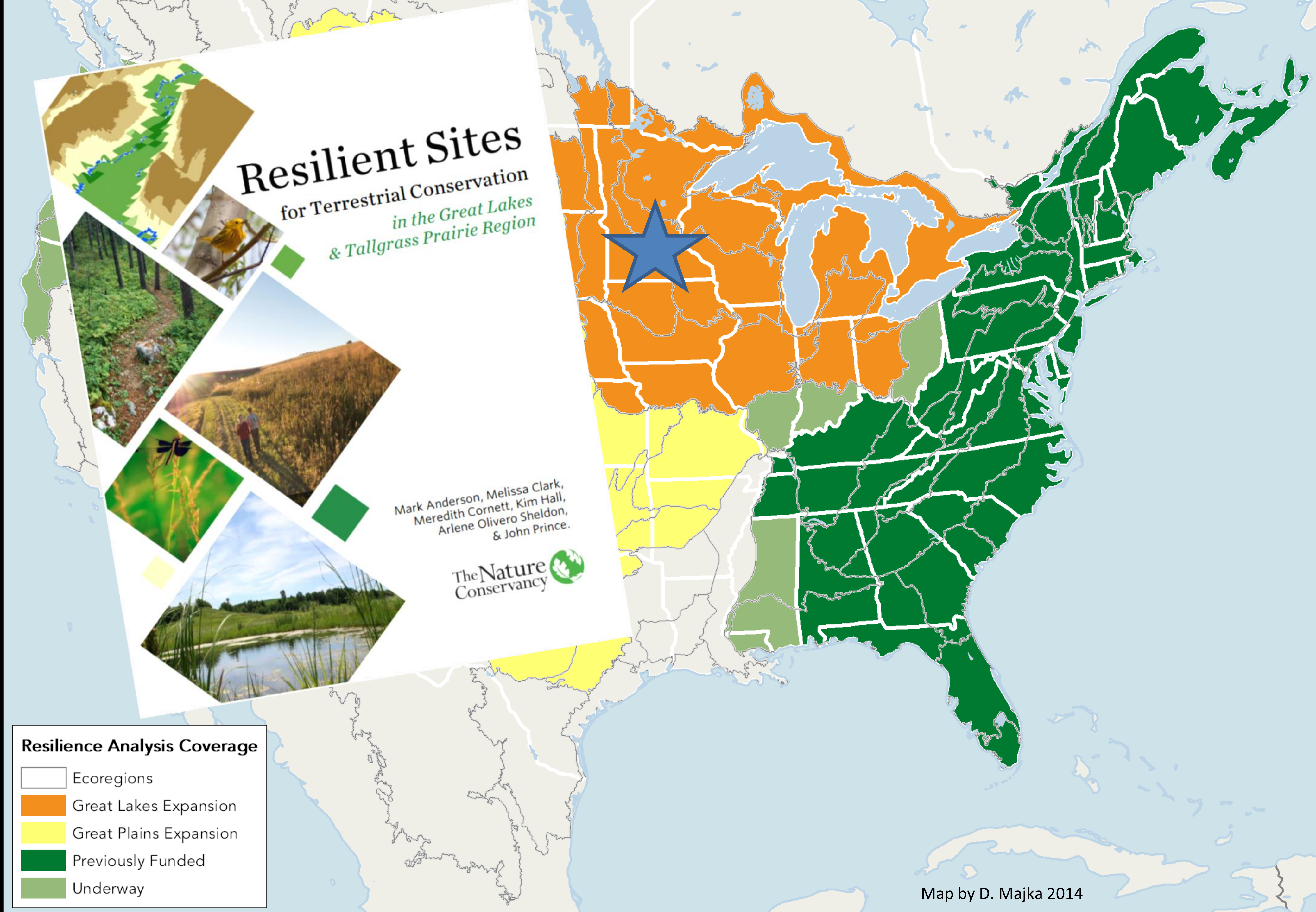
Anderson and
PLoS one
Conserving the Stage: Climate Change and the Geophysical Underpinnings of Species Diversity
Mark G. Anderson*, Charles E. Ferree
Abstract
Introduction



Resilient Sites
for Terrestrial Conservation
in the Great Lakes
& Tallgrass Prairie Region
Mark Anderson, Melissa Clark,
Meredith Cornett, Kim Hall,
Arlene Olivero Sheldon,
& John Prince.
The Nature Conservancy
Resilience Analysis Coverage
Ecoregions
Great Lakes Expansion
Great Plains Expansion
Previously Funded
Underway
Map by D. Majka 2014

Conserving Nature’s Stage: Resilience

Core Concepts

- Geophysical Setting
- Landform Diversity
- Local Connectedness

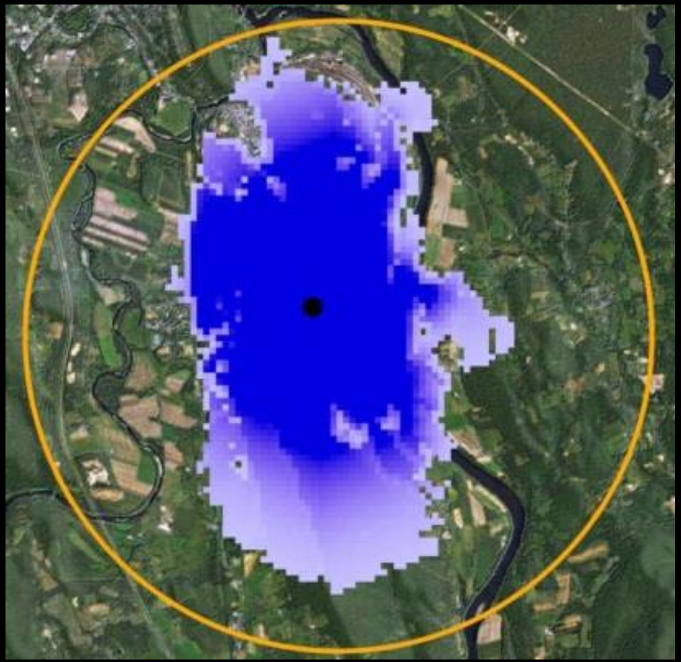
Photo © TNC/D. Shaw

Conserving Nature's Stage: *Resilience*

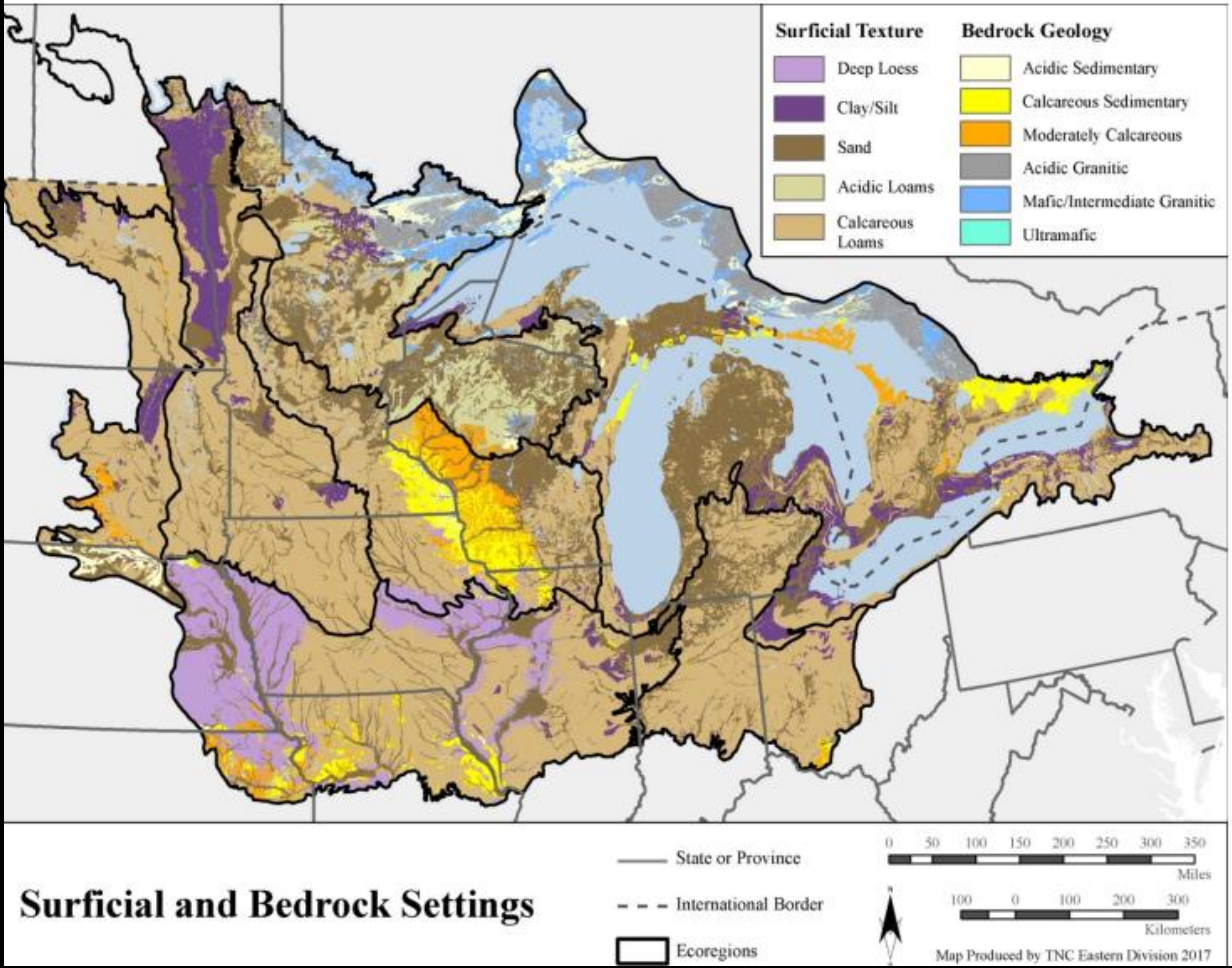
Three Core Concepts

Geophysical Setting
The Stage

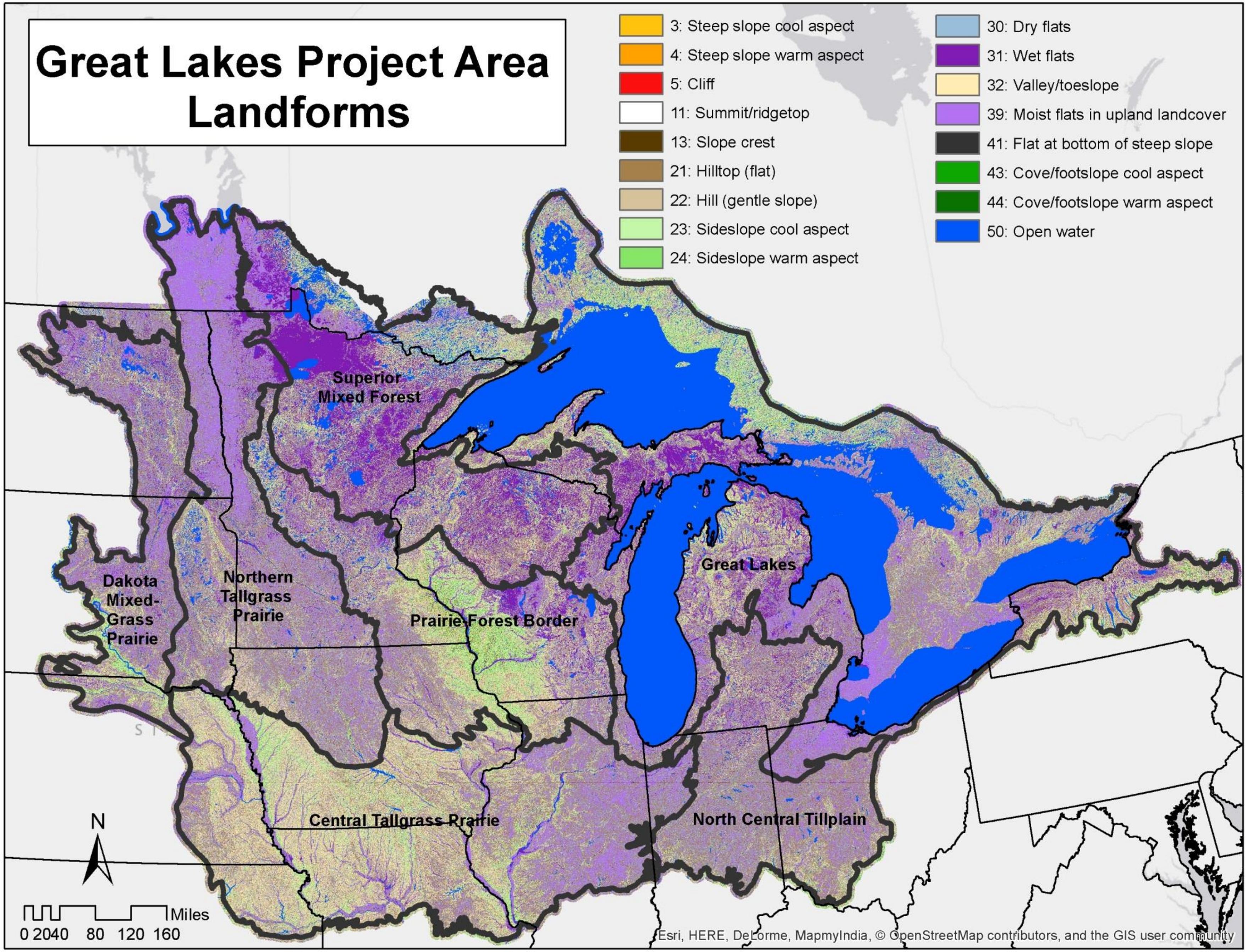
Landform Diversity
Niches

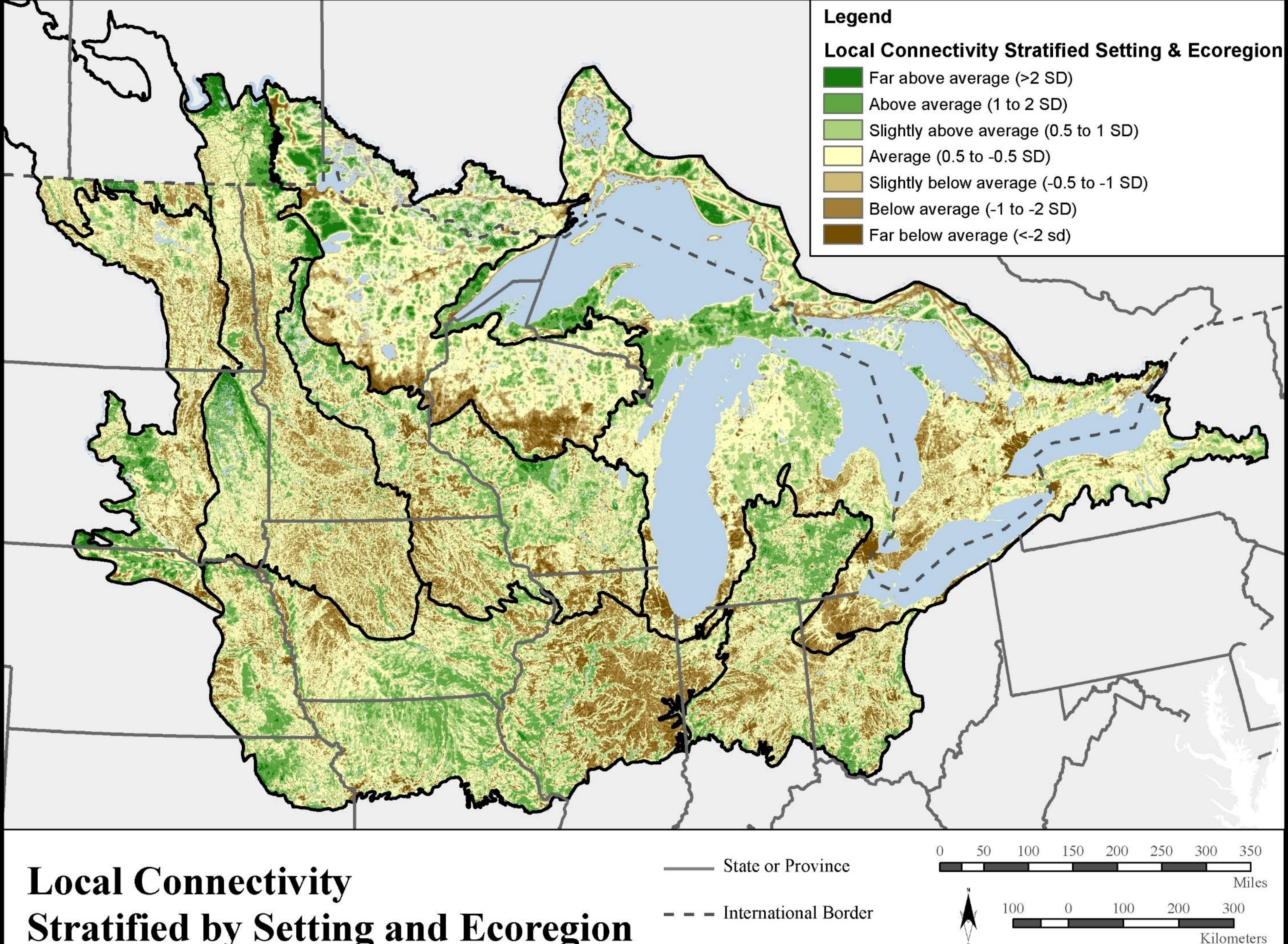


Local Connectedness
Access to Niches

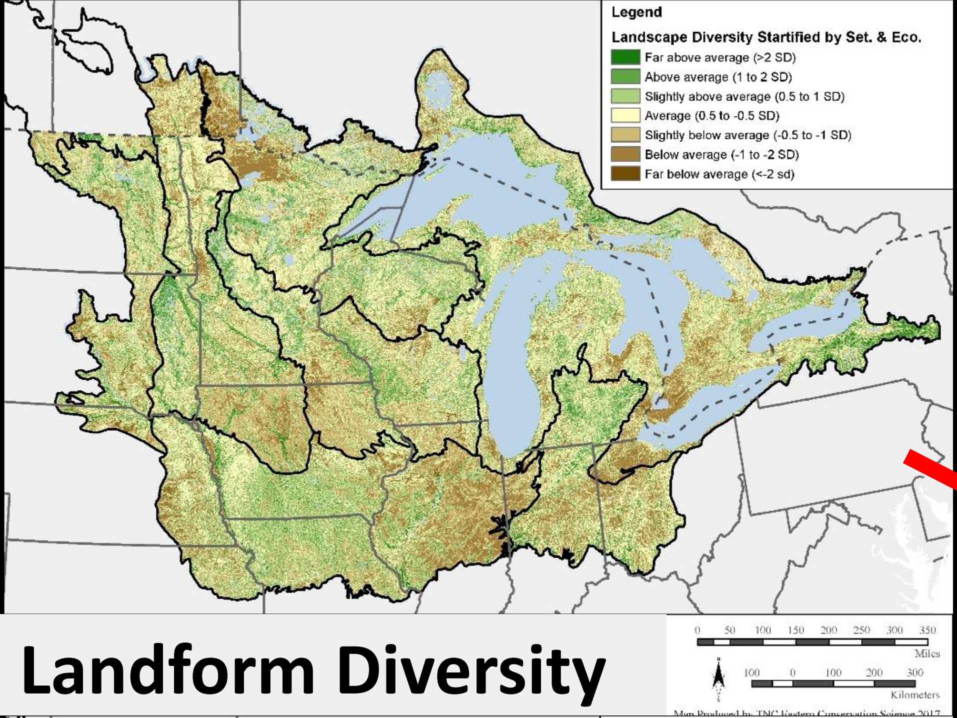


Surficial and Bedrock Settings

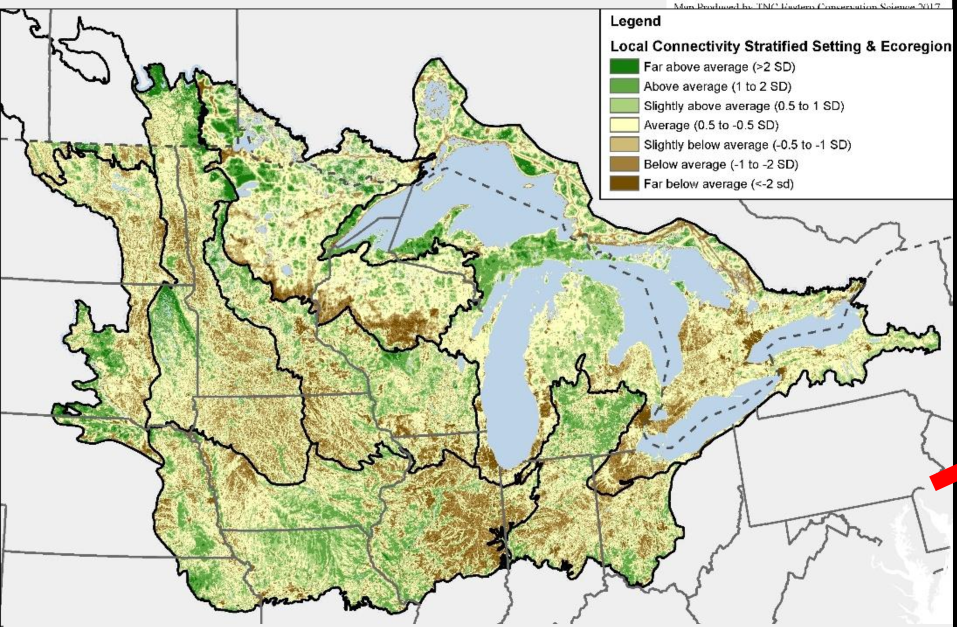

Great Lakes Project Area Landforms
3: Steep slope cool aspect
4: Steep slope warm aspect
5: Cliff
11: Summit/ridgetop
13: Slope crest
21: Hilltop (flat)
22: Hill (gentle slope)
23: Sideslope cool aspect
24: Sideslope warm aspect
30: Dry flats
31: Wet flats
32: Valley/toeslope
39: Moist flats in upland landcover
41: Flat at bottom of steep slope
43: Cove/footslope cool aspect
44: Cove/footslope warm aspect
50: Open water
Superior Mixed Forest
Dakota Mixed-Grass Prairie
Northern Tallgrass Prairie
Prairie-Forest Border
Great Lakes
Central Tallgrass Prairie
North Central Tillplain
N
Miles
0 20 40 80 120 160
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community



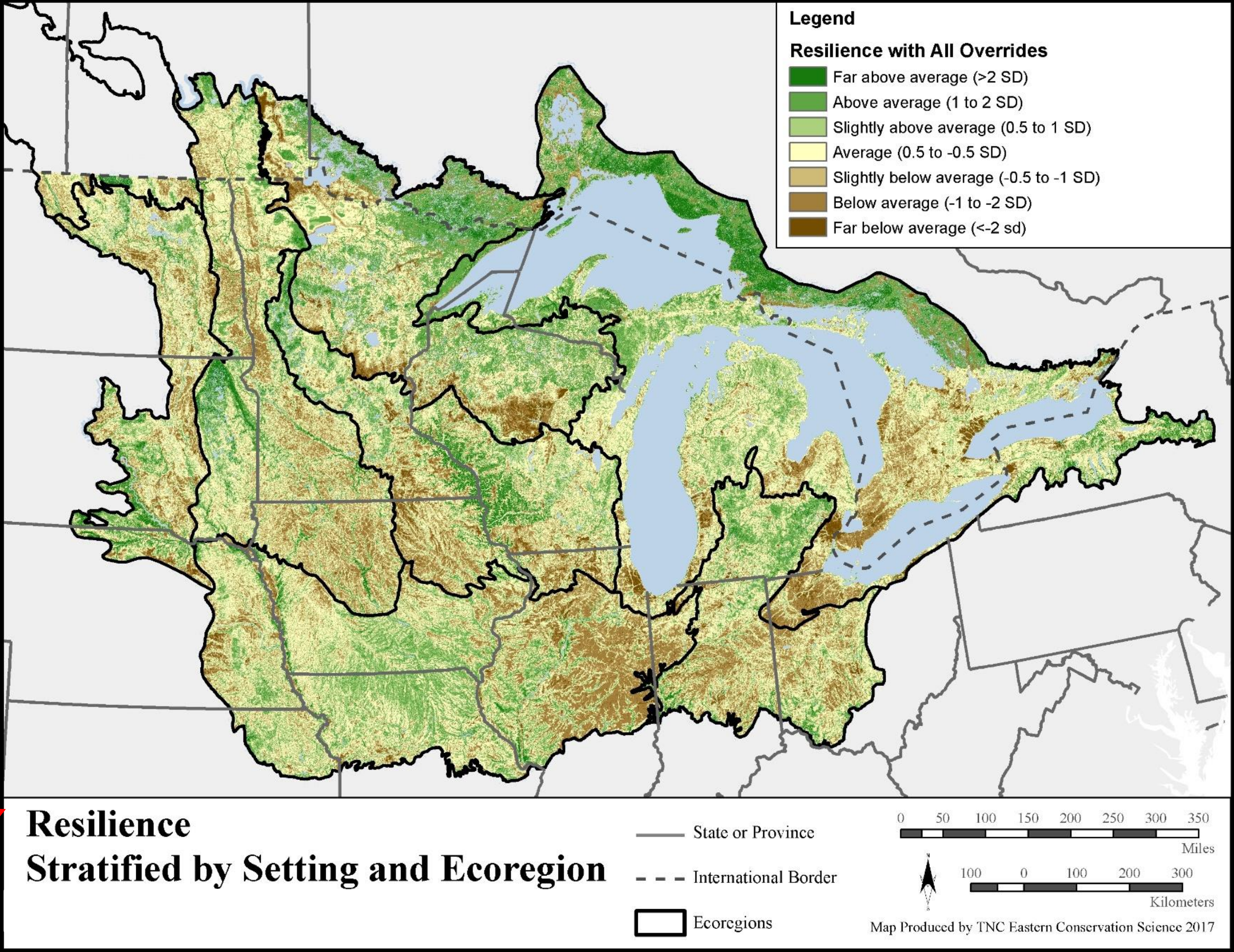
Local Connectivity Stratified by Setting and Ecoregion



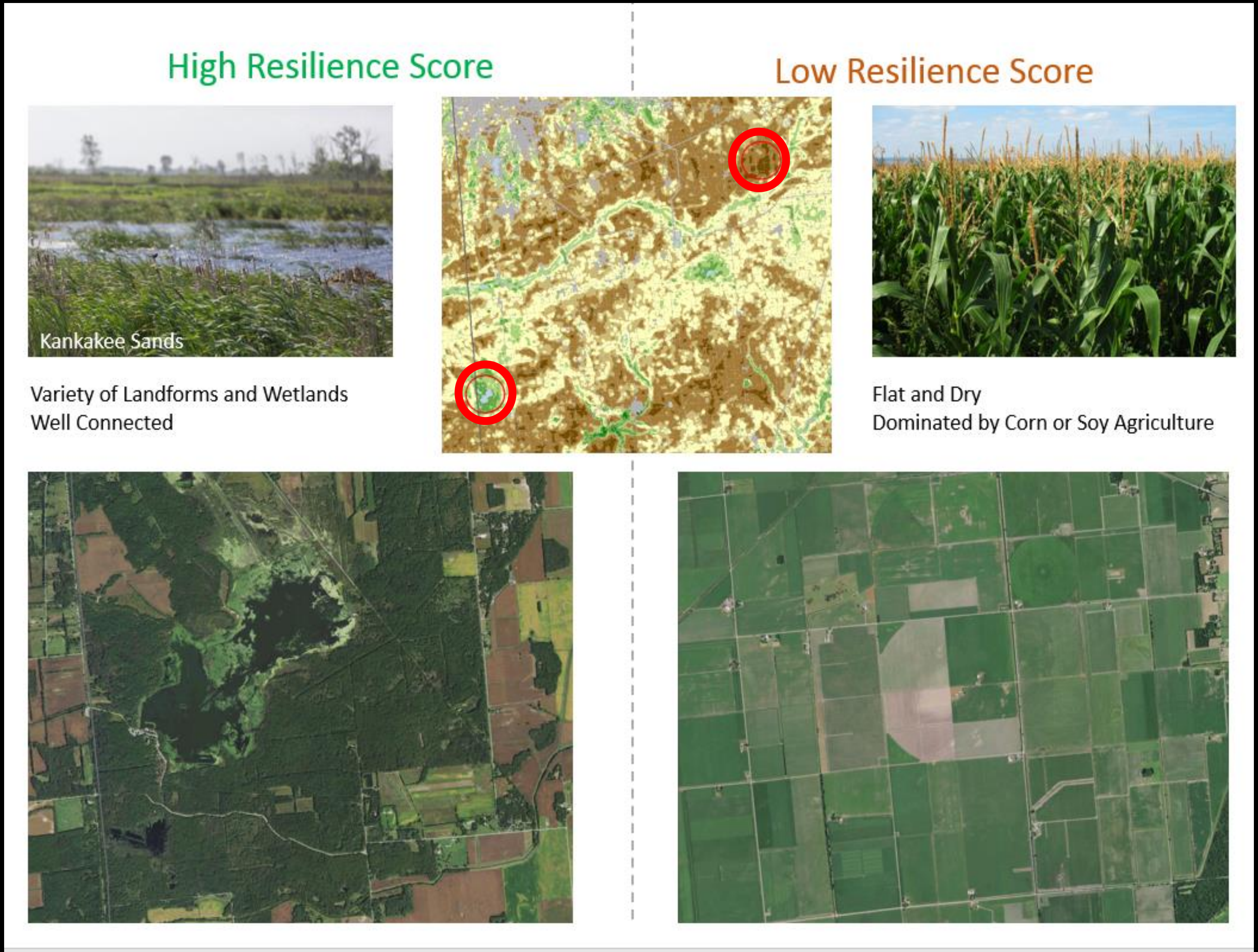
Landform Diversity



Local Connectedness

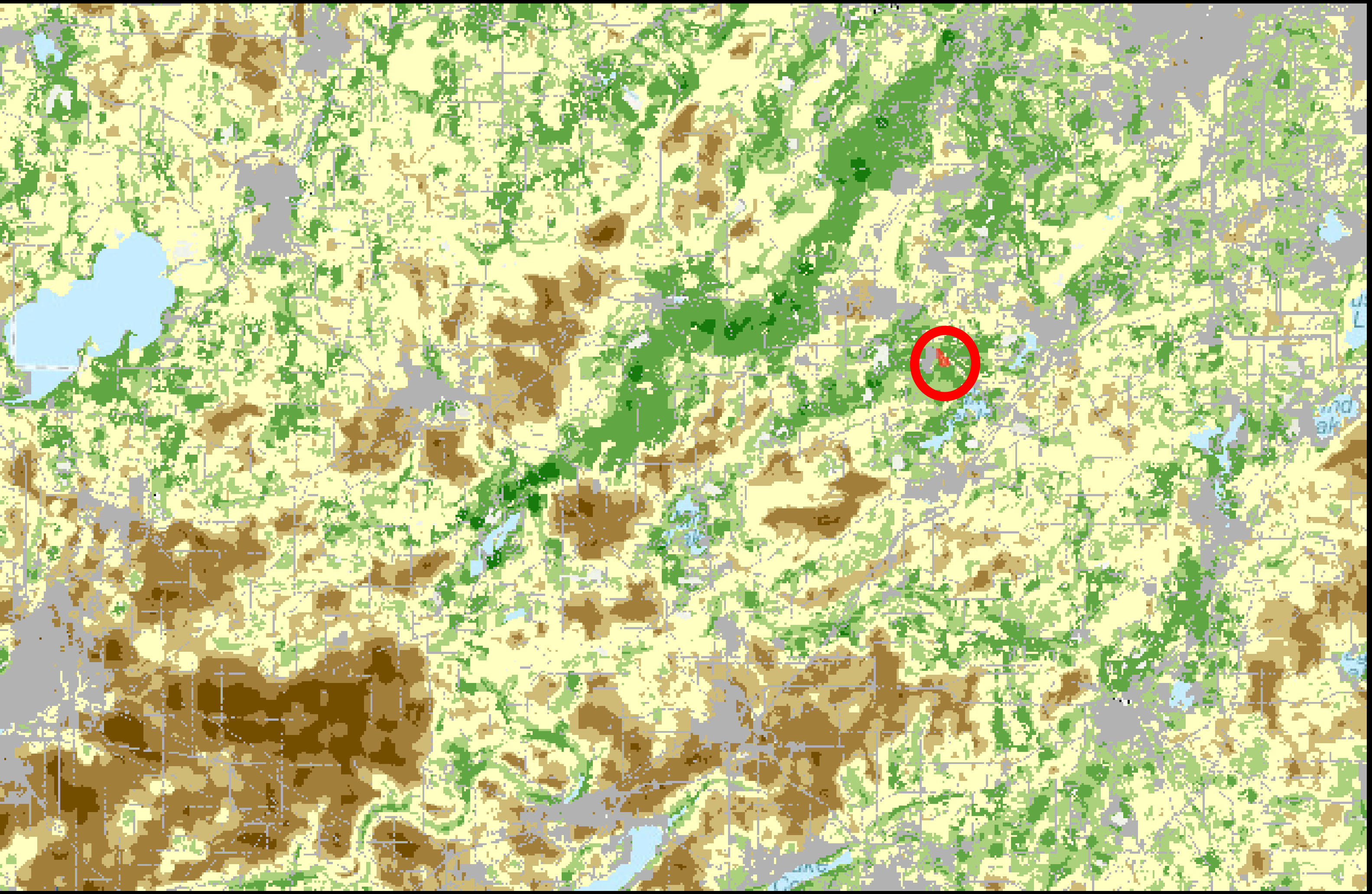


Conserving Nature’s Stage: *Resilience*

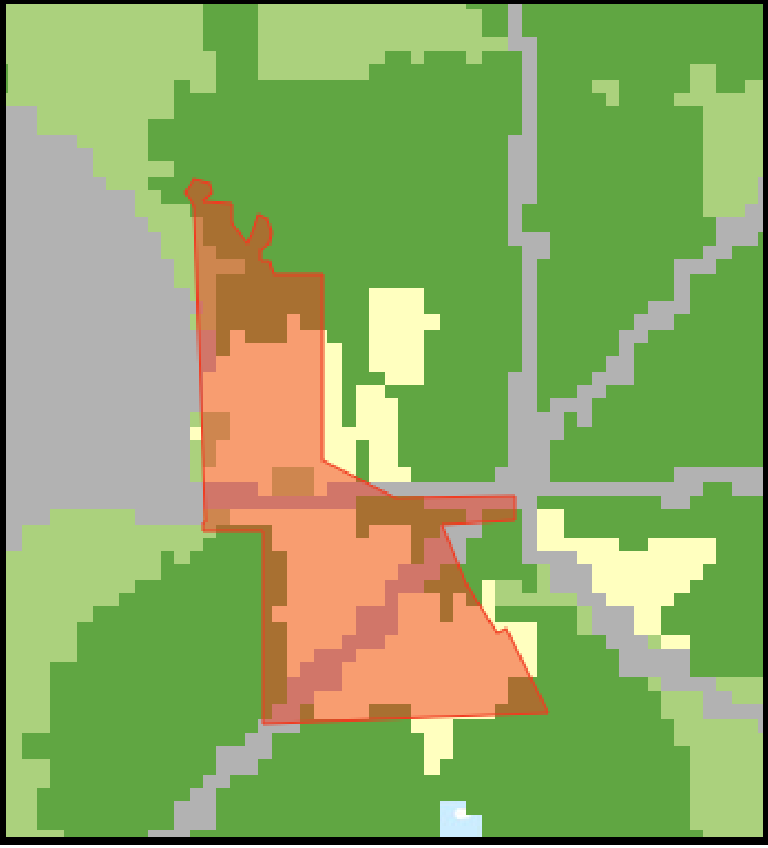


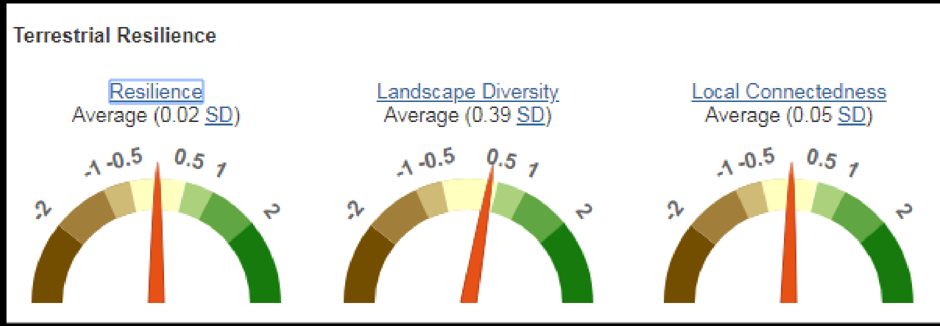
Conserving Nature's Stage: *Resilience*

Regional Scale

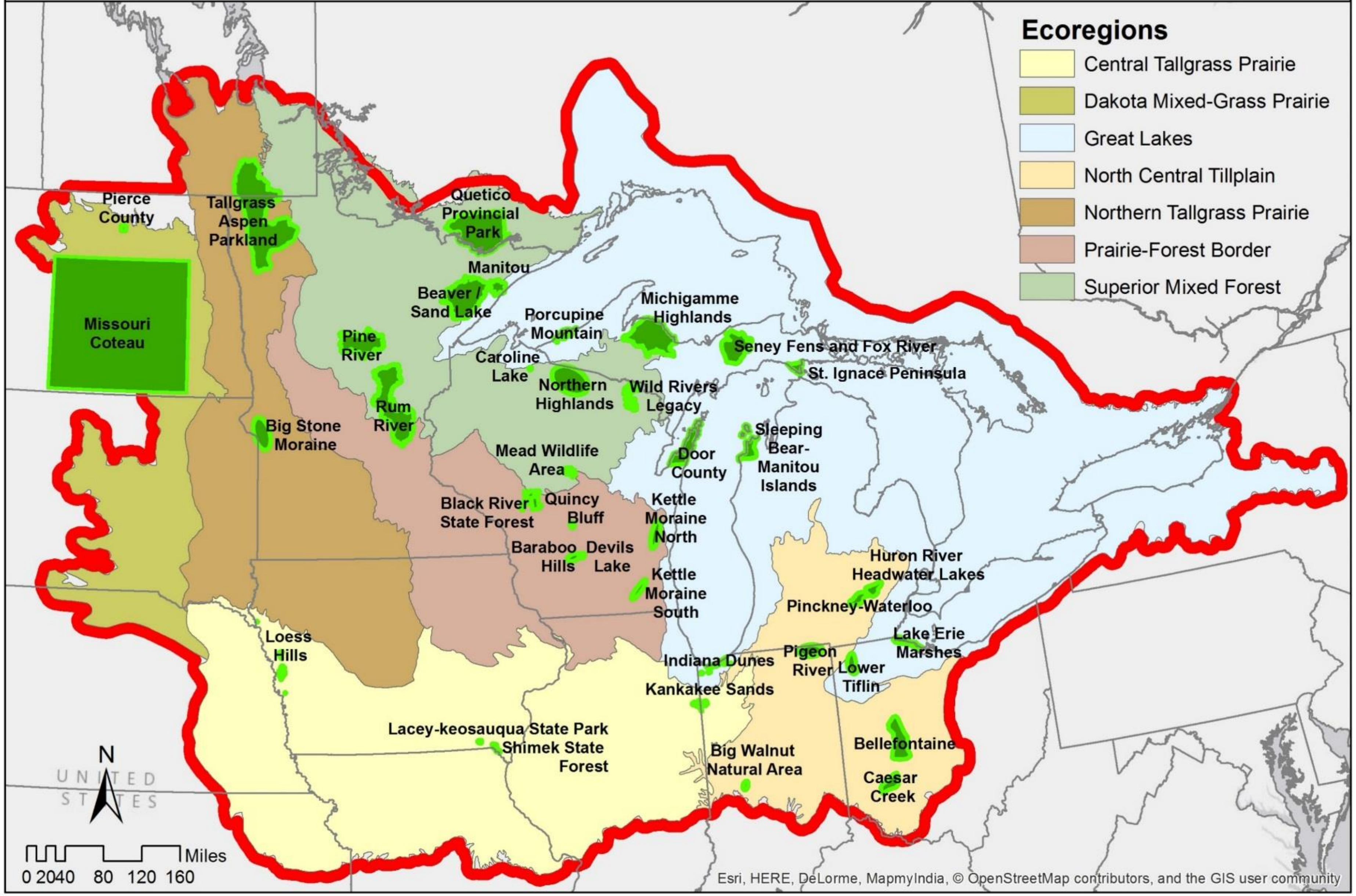


Site Scale

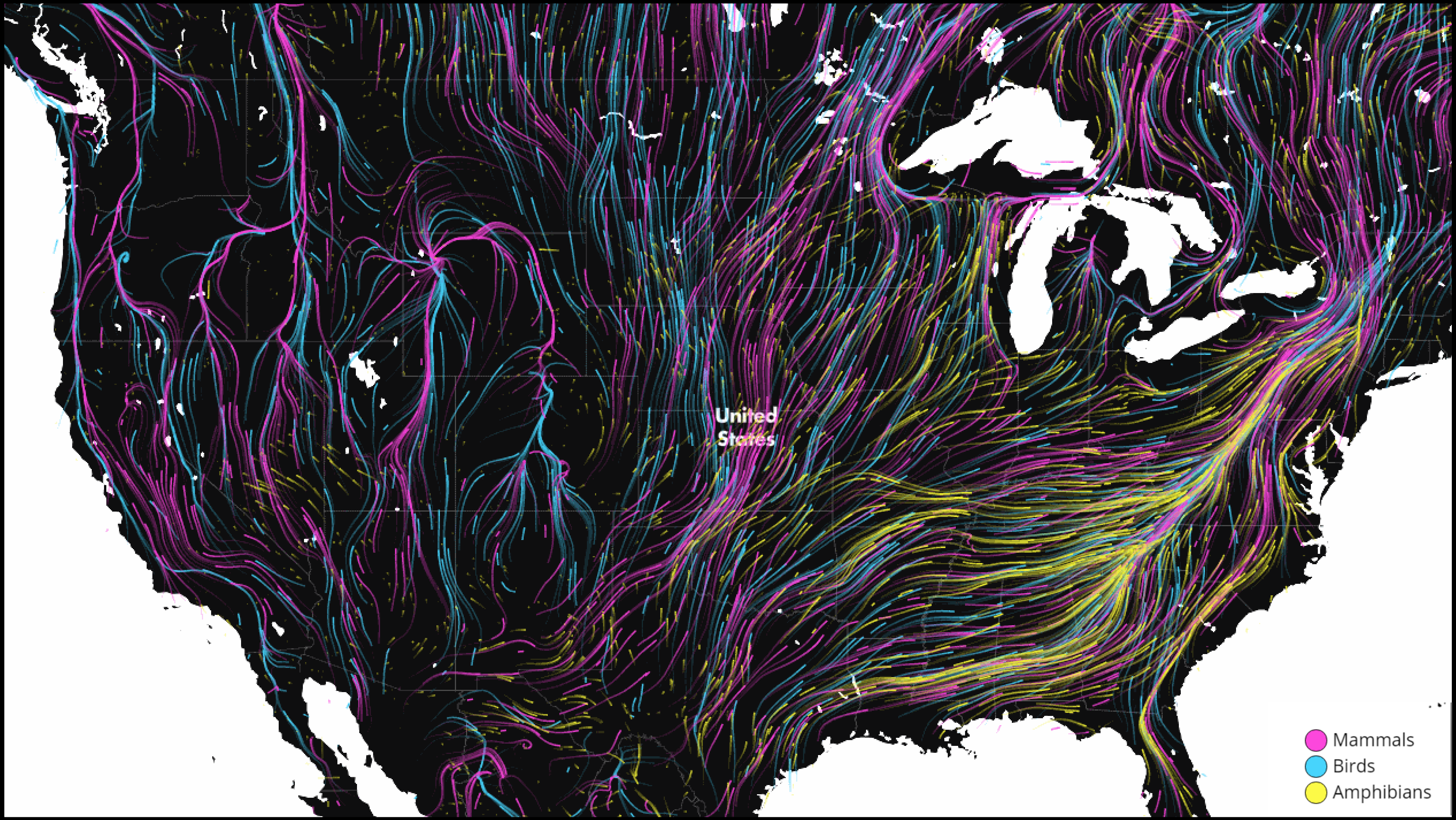




Test Sites for Great Lakes Terrestrial Resilience Project

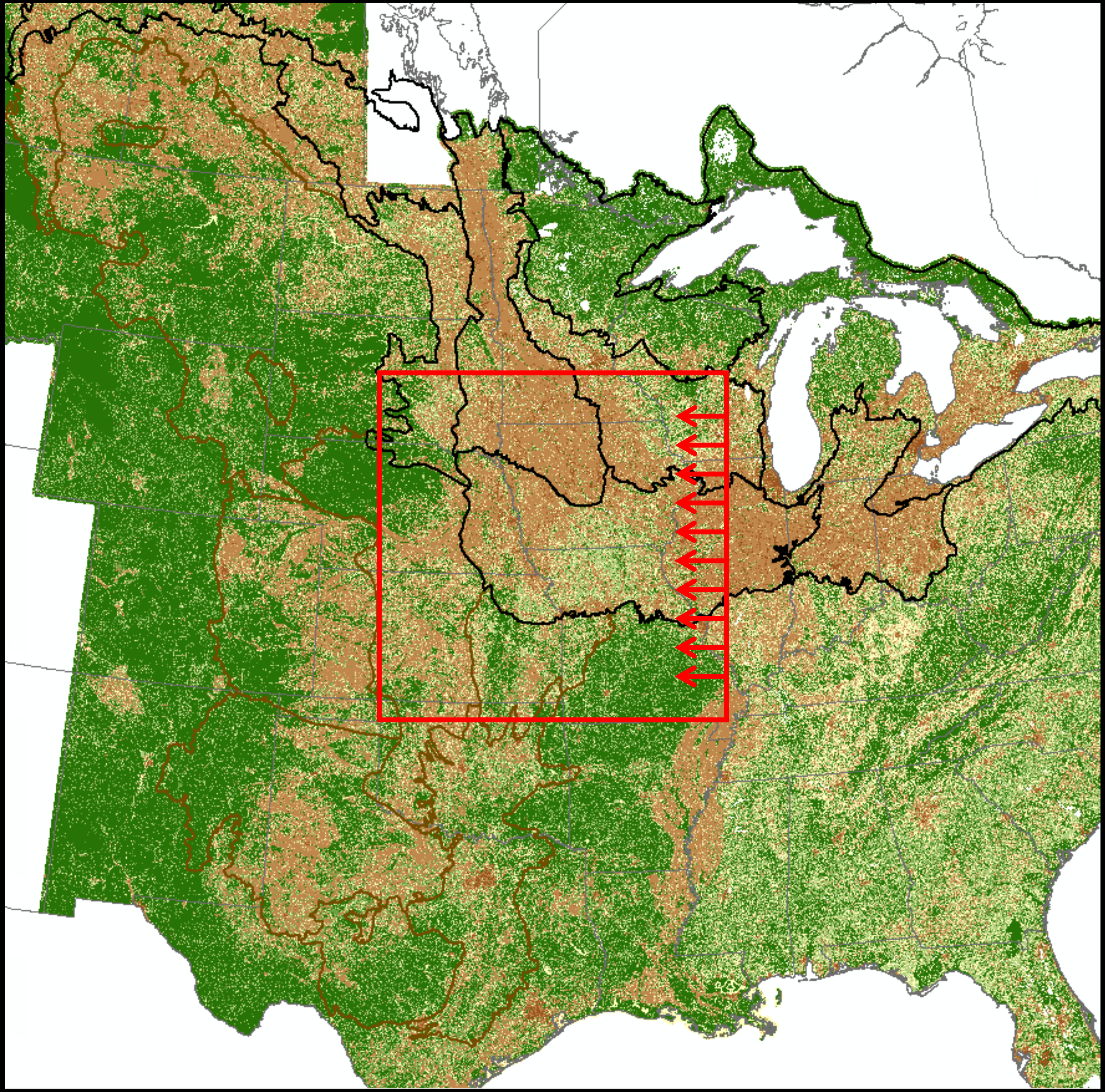


Conserving Nature's Stage: *Regional Connectivity*

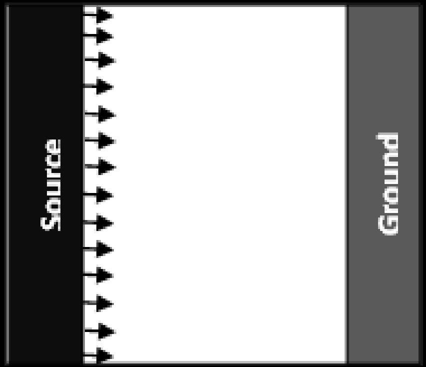


Data source: Lawler et al. 2013; Animation by Dan Majka, TNC

Conserving Nature's Stage: *Regional Connectivity*



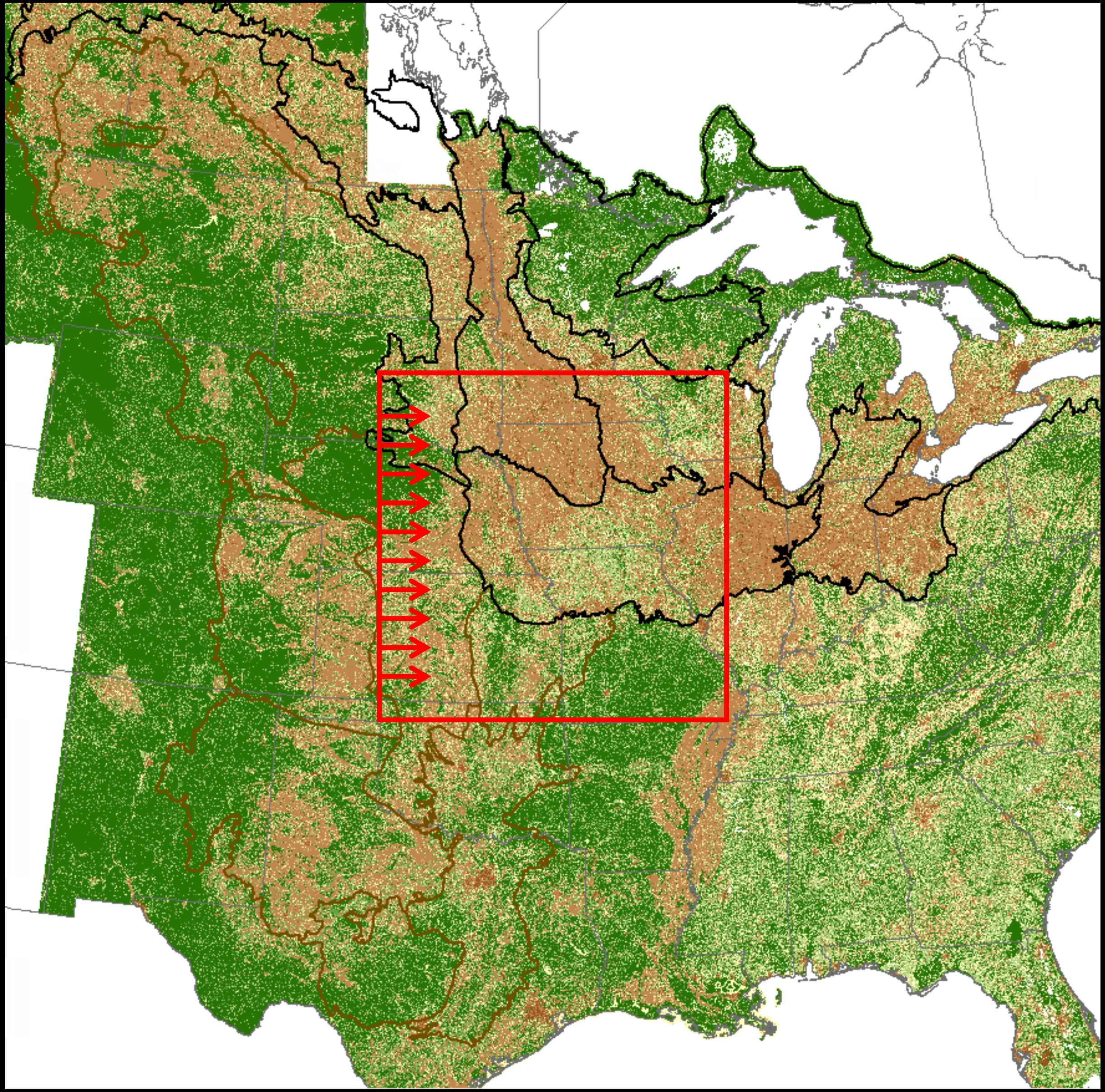
CIRCUITSCAPE



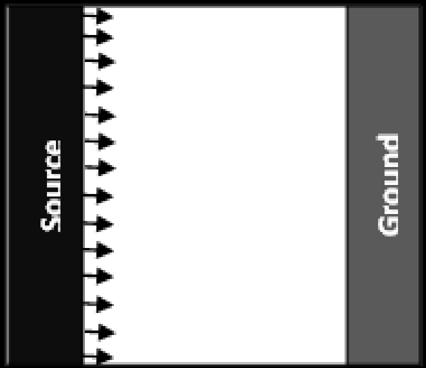
1 Completely Natural

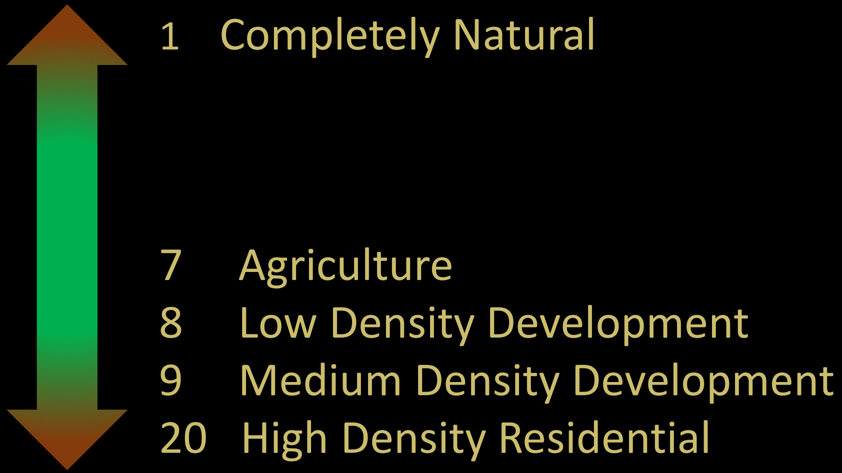
7 Agriculture
8 Low Density Development
9 Medium Density Development
20 High Density Residential

Conserving Nature’s Stage: *Regional Connectivity*



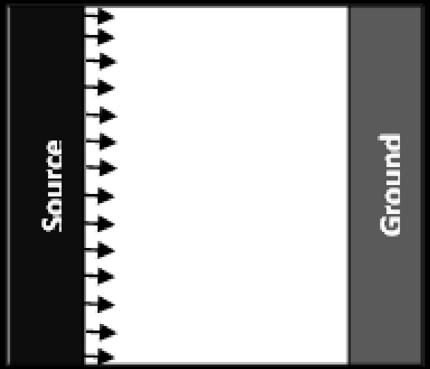
CIRCUITSCAPE

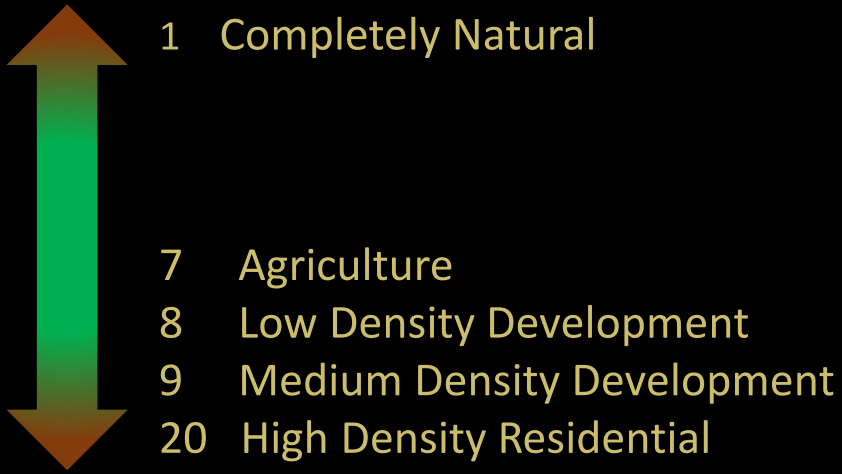




Conserving Nature's Stage: *Regional Connectivity*

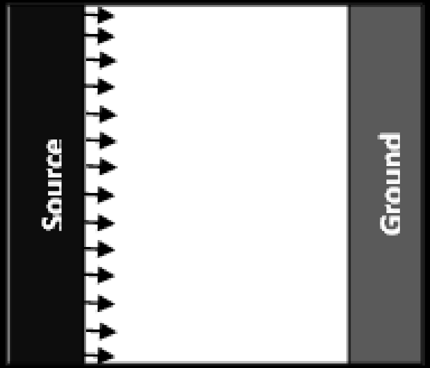
CIRCUITSCAPE





Conserving Nature's Stage: *Regional Connectivity*

CIRCUITSCAPE



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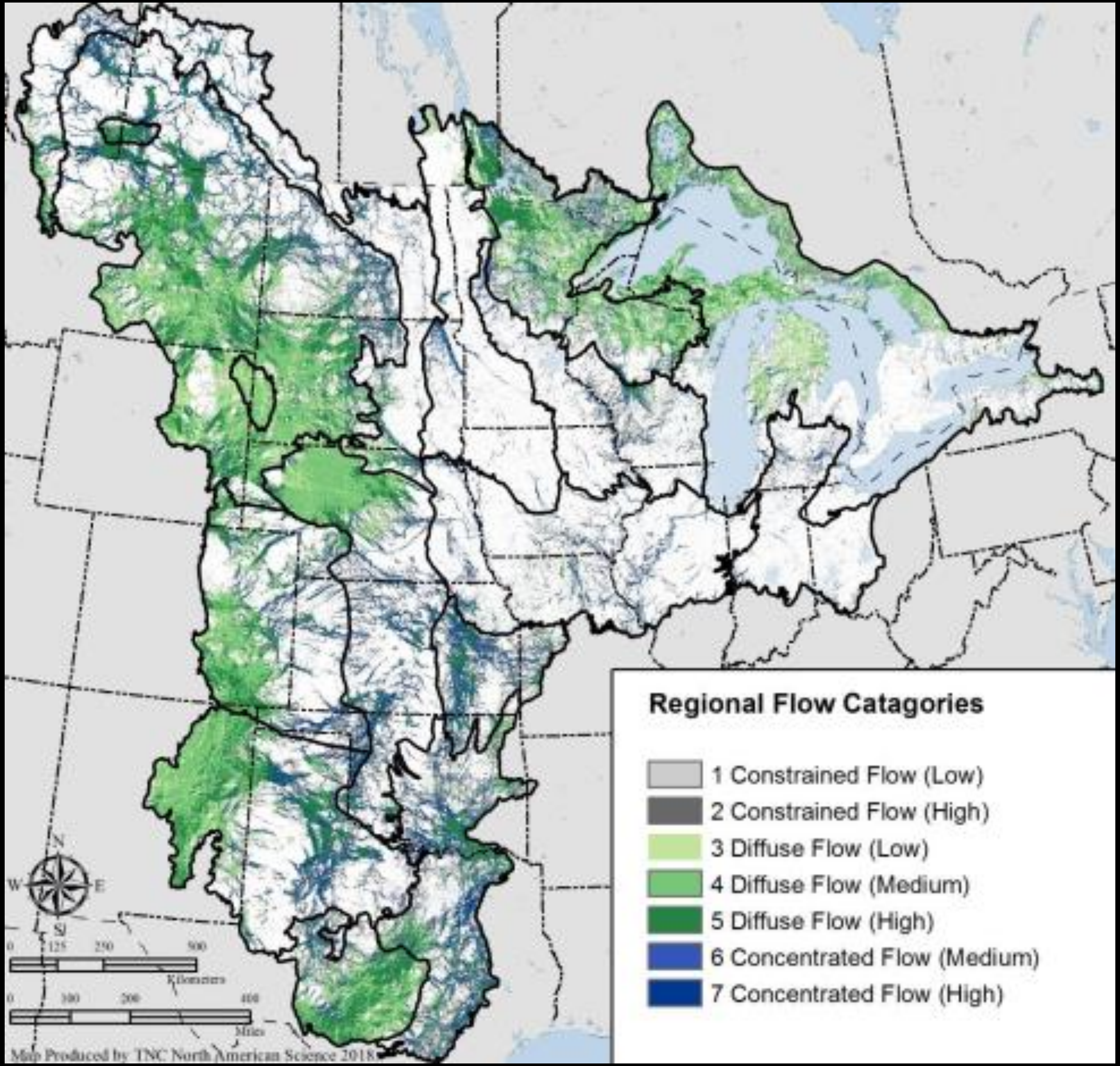
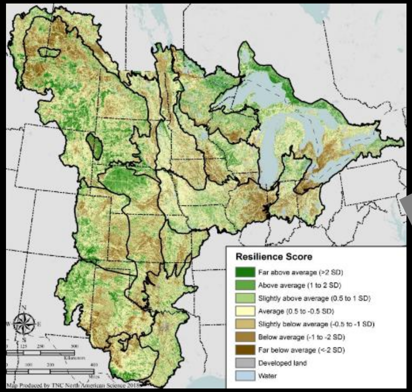
Conserving Nature's Stage: *Regional Connectivity*

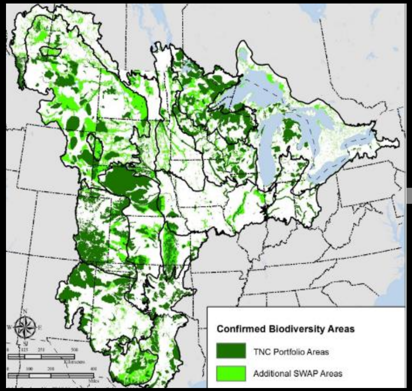


Conserving Nature's Stage: *Resilient* AND *Connected*

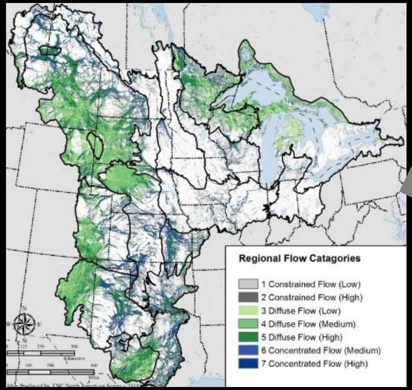
Resilience

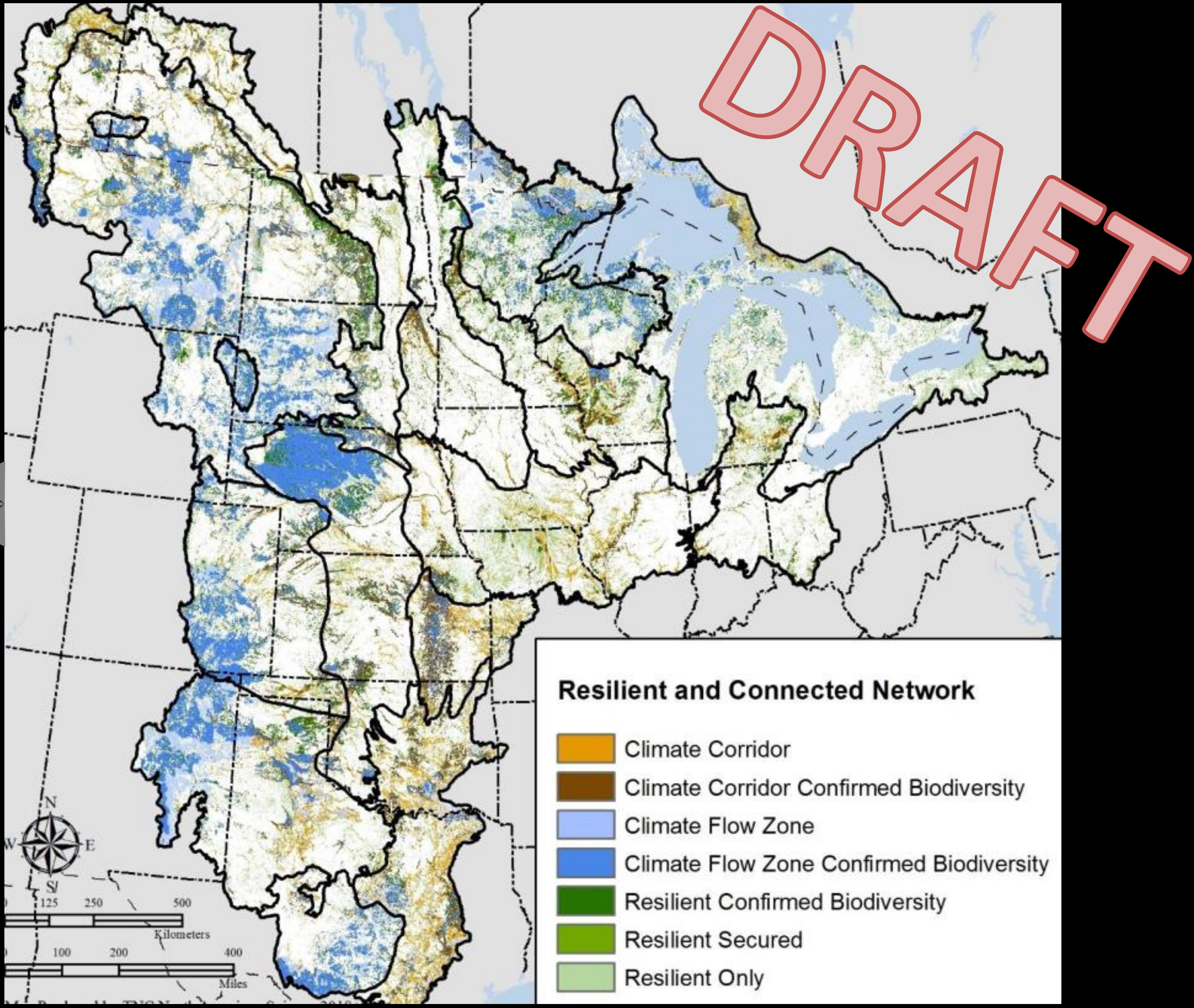


Diversity



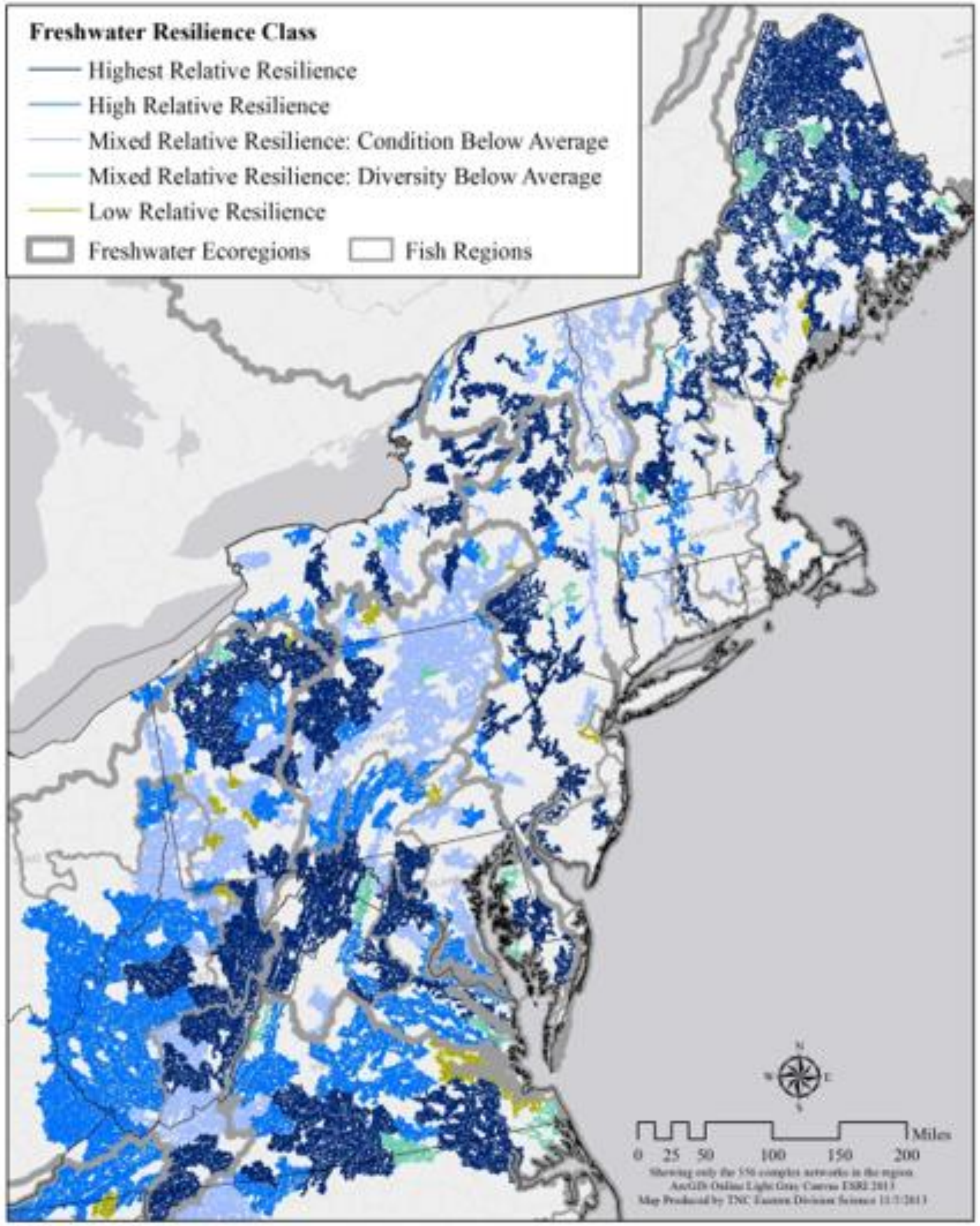
Flow





Next step…

Conserving Nature’s Stage
Freshwater Resilience



Regional Freshwater Resilience Class
Stratified by Fish Region and Freshwater Ecoregion

1. We can help nature adapt
2. Nature can help us adapt
3. Nature can reduce impacts

2. Nature Can Help Us Adapt

The Nature Conservancy

WISCONSIN DEPT. OF NATURAL RESOURCES

CSG conservation strategies group

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Wetland Services

Flood abatement

Water quality

- Nitrogen reduction
- Phosphorus reduction
- Sediment reduction

Shoreline protection

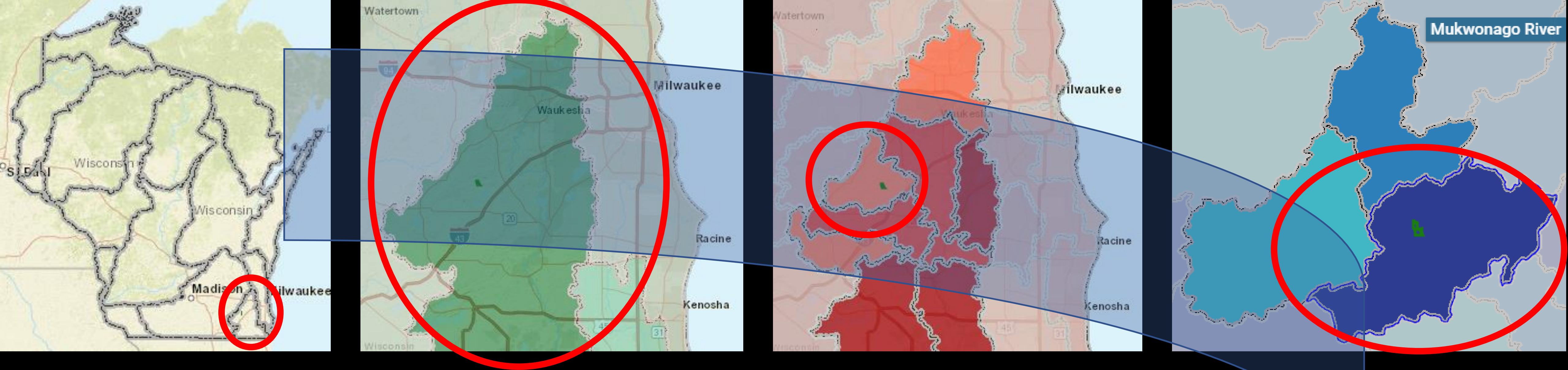
Fish & aquatic habitat

Surface water supply

Carbon storage

Floristic integrity

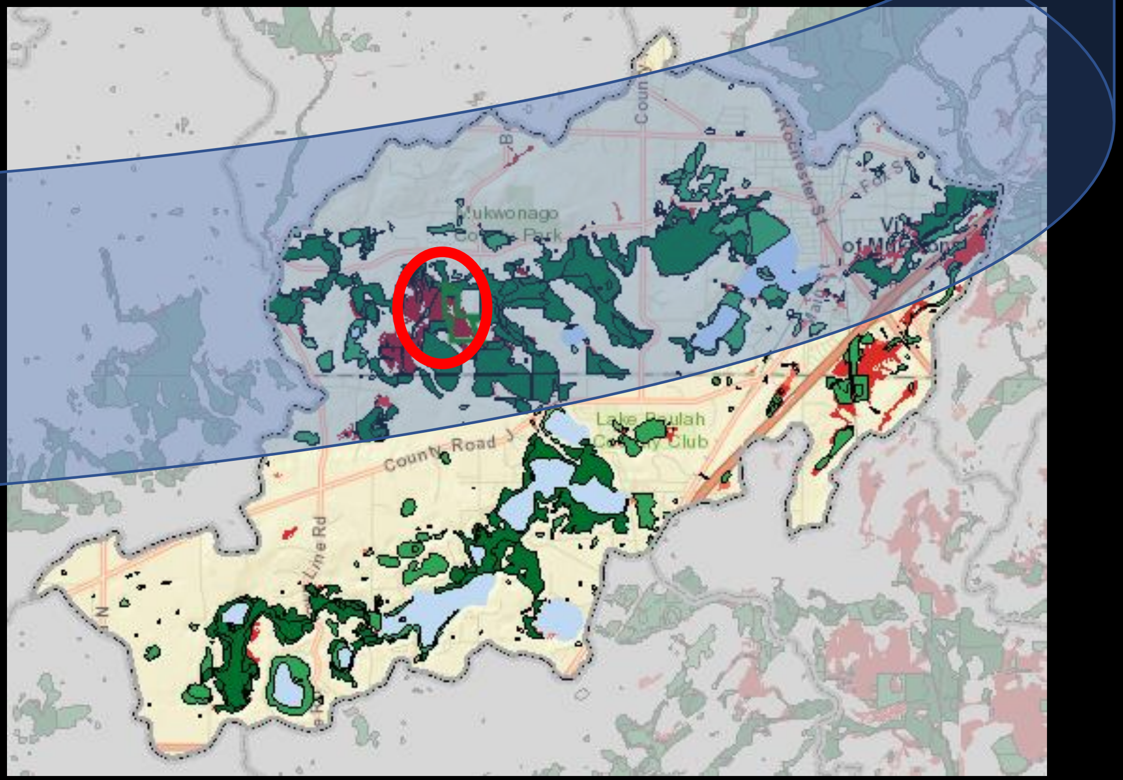
Wildlife habitat

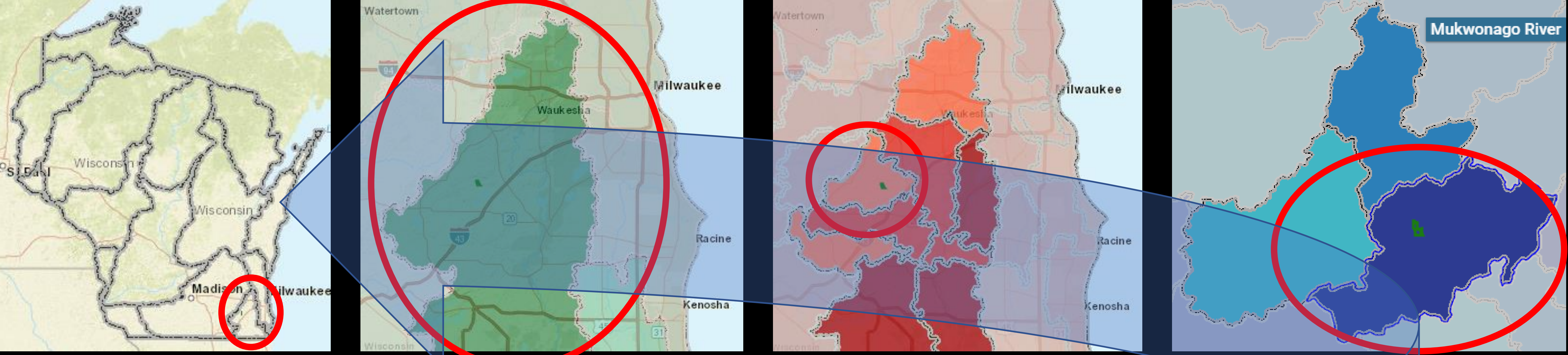


Wetlands By Design

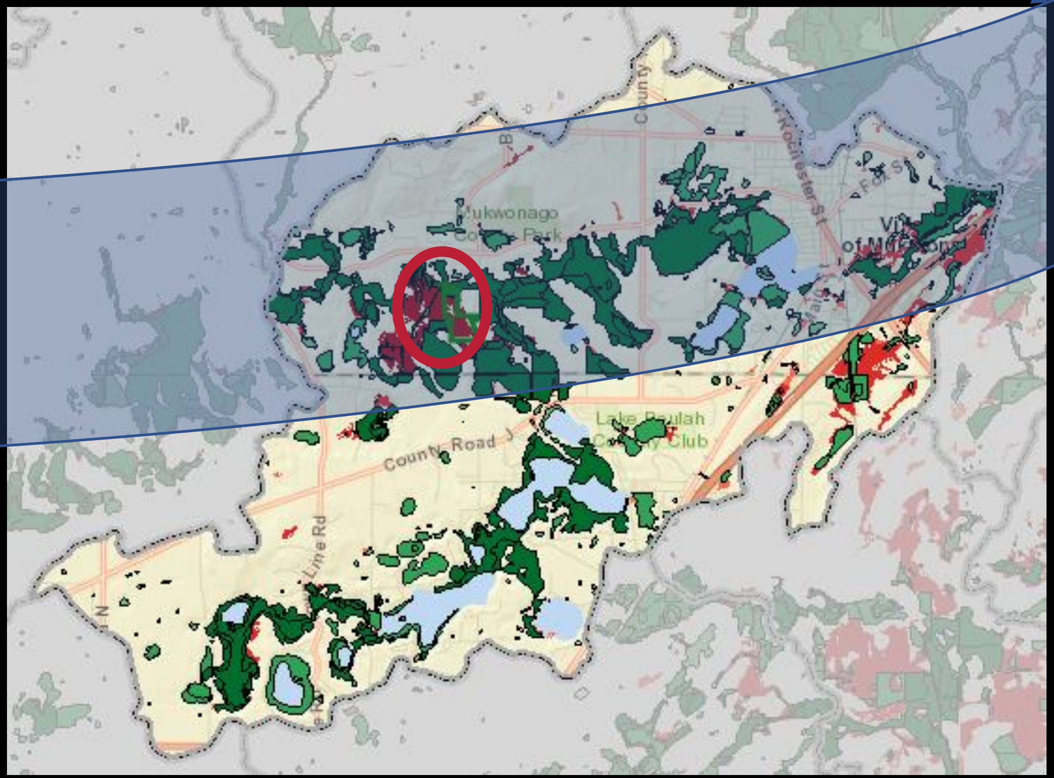
Top-tier site for

- Flood Abatement
- Fish & Aquatic Habitat
- Water Quality (N reduction)
- Surface Water Supply





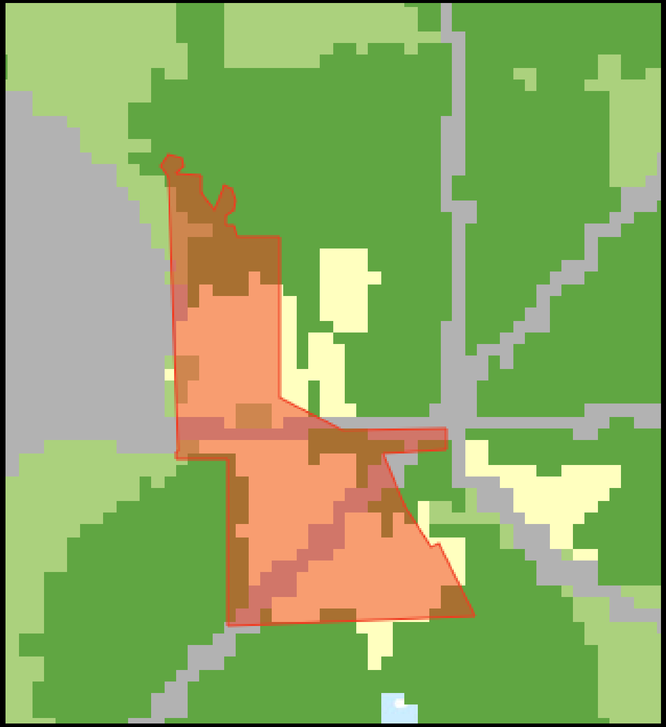
Wetlands By Design



Combining Data

We help nature adapt AND nature helps us adapt

Conserving Nature's Stage



maps.tnc.org/resilientland

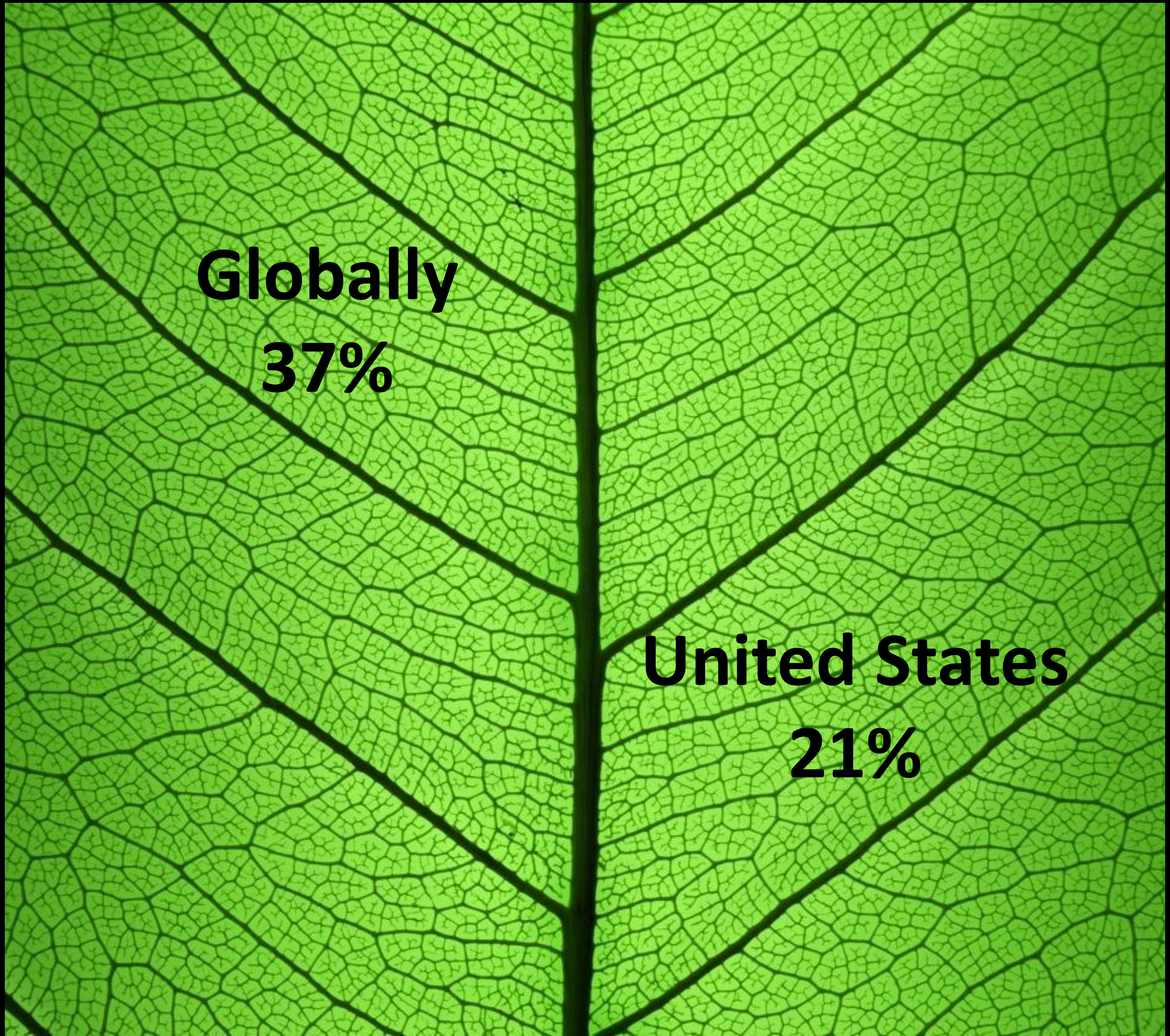
Wetlands by Design

www.WetlandsByDesign.org

Top-tier site for…

- Flood Abatement
- Fish & Aquatic Habitat
- Water Quality (N reduction)
- Surface Water Supply
- Total # of Services

3. Nature Can Reduce Impacts



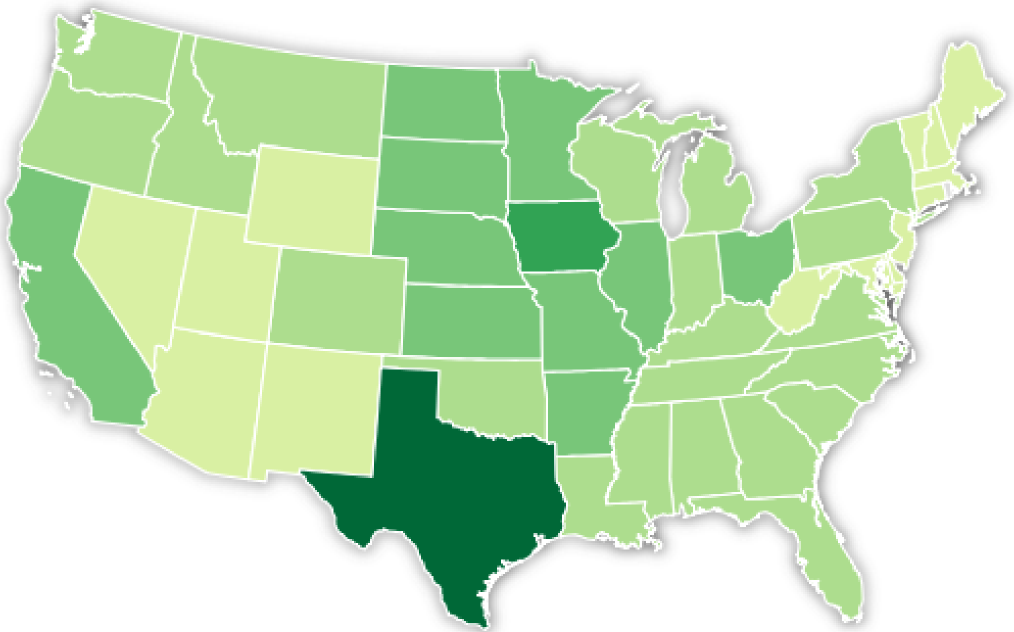
… of emissions reductions needed to stabilize warming

Natural Climate Solutions for the U.S.

National | State

770
Mitigation potential
Million tons CO_2e per year

5,795
2016 net emissions (U.S.)
Million tons CO_2e per year



Mitigation Pathways

Marginal Abatement Cost
$ per ton of CO_2e

Pathway					
Reforestation	Off	$10	$50	$100	Max
Avoided Forest Conversion	Off	$10	$50	$100	Max
Fire Management	Off	$10	$50	$100	Max
Urban Reforestation	Off	$10	$50	$100	Max
Avoided Grassland Conversion	Off	$10	$50	$100	Max
Grassland Restoration	Off	$10	$50	$100	Max
Alley Cropping	Off	$10	$50	$100	Max
Cover Crops	Off	$10	$50	$100	Max
Cropland Nutrient Management	Off	$10	$50	$100	Max
Improved Manure Management	Off	$10	$50	$100	Max
Improved Rice Cultivation	Off	$10	$50	$100	Max

State	NCS Mitigation (Mt CO_2 per year)	Area Available (million acres)
Texas	52.1	26.1
Iowa	35.1	22.6
South Dakota	33	20.9
Kansas	29.9	21.6
Missouri	29.7	15.8
North Dakota	28.6	20.6
Illinois	28.2	21.3
Minnesota	27.5	19.7
California	26.2	32.2
Ohio	24.7	12.4
Nebraska	24.6	18.5

Natural Climate Solutions for the U.S.

National | State

18
Mitigation Potential
(Million tons CO_2e per year)

64
2014 net emissions
Million tons CO_2e per year

0 — 18 (Max NCS potential)

Wisconsin's Selected NCS Potential

Mitigation Pathways

Marginal Abatement Cost
$ per ton of CO_2e

Pathway	Off	$10	$50	$100	Max
Reforestation	Off	$10	$50	$100	Max
Avoided Forest Conversion	Off	$10	$50	$100	Max
Fire Management	Off	$10	$50	$100	Max
Urban Reforestation	Off	$10	$50	$100	Max
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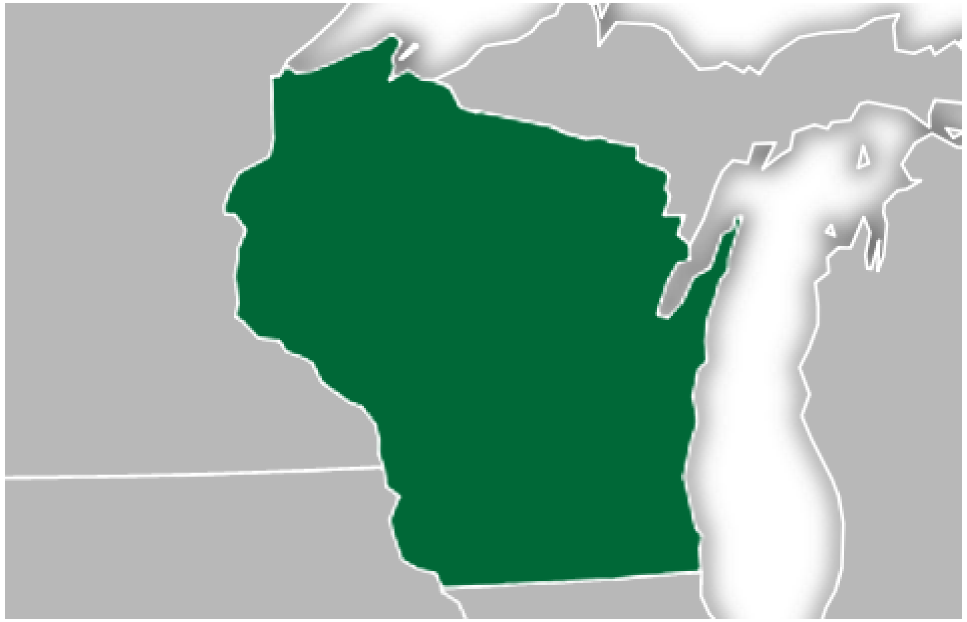
Alley Cropping	Off	$10	$50	$100	Max
Cover Crops	Off	$10	$50	$100	Max
Cropland Nutrient Management	Off	$10	$50	$100	Max
Improved Manure Management	Off	$10	$50	$100	Max
Improved Rice Cultivation	Off	$10	$50	$100	Max

Wisconsin

Full Extent   Click map to select state



Pathway	NCS Mitigation (Mt CO_2 per year)	Area Available (million acres)
Reforestation	6.8	2.64
Avoided Grassland Conversion	4.02	0.05
Cover Crops	2.57	5.41
Alley Cropping	2.03	0.94
Cropland Nutrient Management	1.36	N/A
Urban Reforestation	0.33	0.14
Grassland Restoration	0.33	0.14
Avoided Forest Conversion	0.28	0.05
Improved Manure Management	0.21	N/A
Fire Management	N/A	N/A
Improved Rice Cultivation	N/A	N/A

Natural Climate Solutions for the U.S.

National | State

4
Mitigation Potential
(Million tons CO_2e per year)

64
2014 net emissions
Million tons CO_2e per year

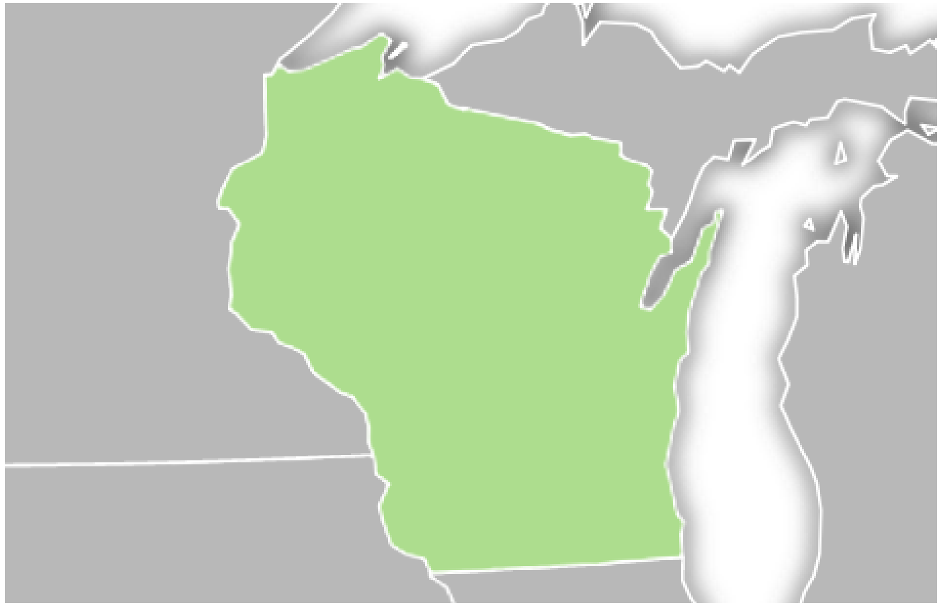
0 — 18 (Max NCS potential)

Wisconsin's Selected NCS Potential

Wisconsin

Full Extent

Click map to select state



Mitigation Pathways

Marginal Abatement Cost
$ per ton of CO_2e

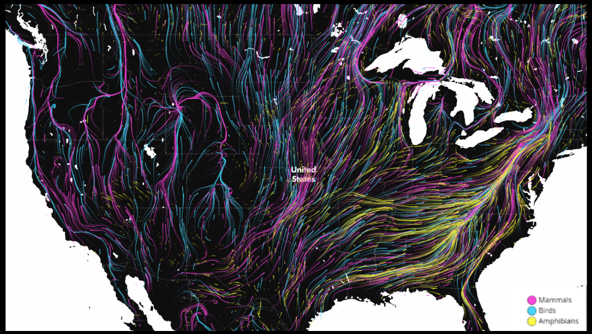
Pathway					
Reforestation	Off	$10	$50	$100	Max
Avoided Forest Conversion	Off	$10	$50	$100	Max
Fire Management	Off	$10	$50	$100	Max
Urban Reforestation	Off	$10	$50	$100	Max
Avoided Grassland Conversion	Off	$10	$50	$100	Max
Grassland Restoration	Off	$10	$50	$100	Max
Alley Cropping	Off	$10	$50	$100	Max
Cover Crops	Off	$10	$50	$100	Max
Cropland Nutrient Management	Off	$10	$50	$100	Max
Improved Manure Management	Off	$10	$50	$100	Max
Improved Rice Cultivation	Off	$10	$50	$100	Max

Pathway	NCS Mitigation (Mt CO_2 per year)	Area Available (million acres)
Cover Crops	2.49	5.24
Cropland Nutrient Management	0.85	N/A
Avoided Forest Conversion	0.27	0.05
Reforestation	0.24	0.09
Avoided Grassland Conversion	0.17	0.01
Alley Cropping	0.1	0.05
Improved Manure Management	0.06	N/A
Grassland Restoration	0.01	0
Urban Reforestation	0	0
Fire Management	N/A	N/A
Improved Rice Cultivation	N/A	N/A

Natural Solutions for Climate Change

Nature can reduce impacts

https://nature4climate.org/u-s-carbon-mapper



We can help nature adapt

maps.tnc.org/resilientland

Nature can help us adapt

www.WetlandsByDesign.org

Floodplain Explorer