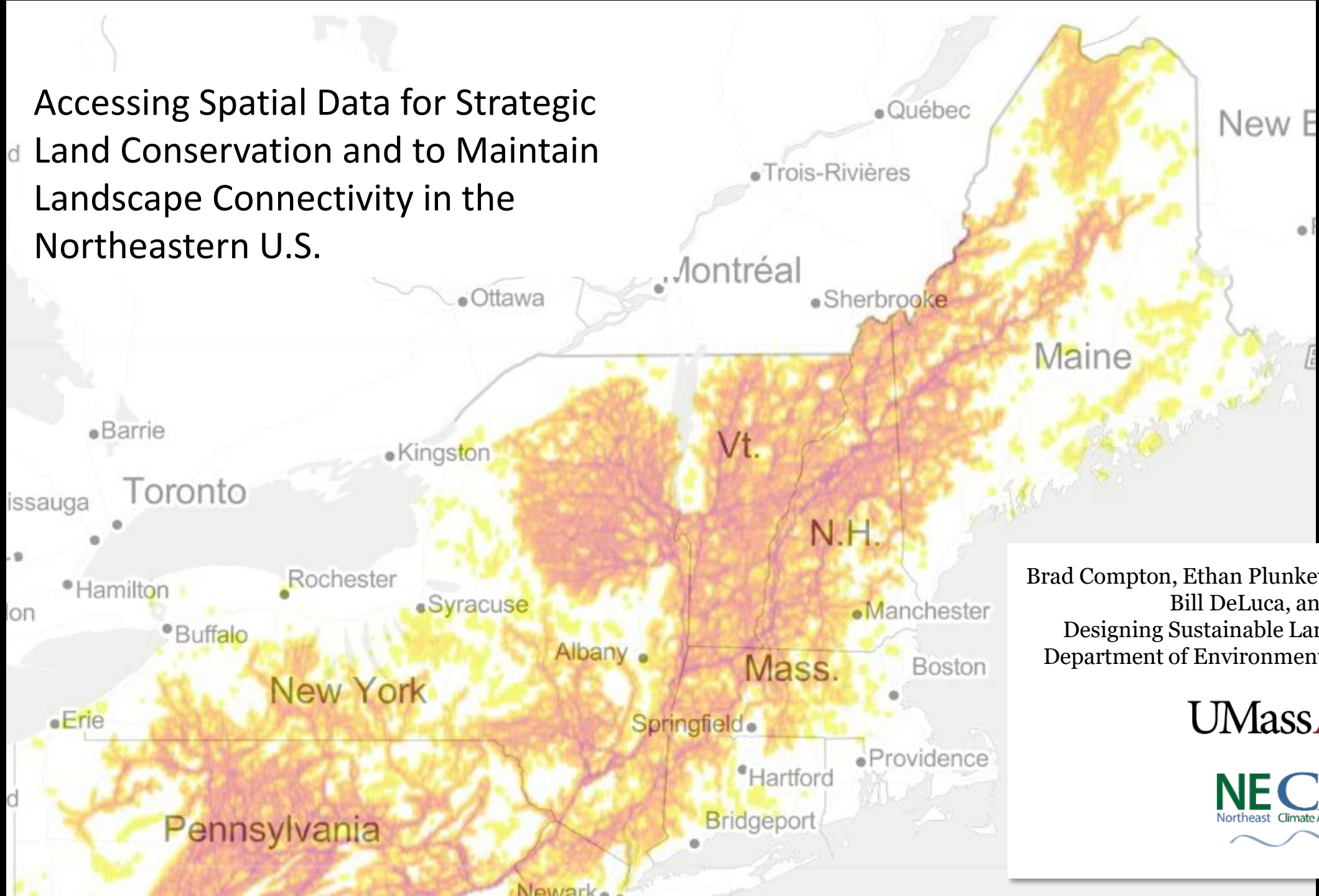
Accessing Spatial Data for Strategic Land Conservation and to Maintain Landscape Connectivity in the Northeastern U.S.

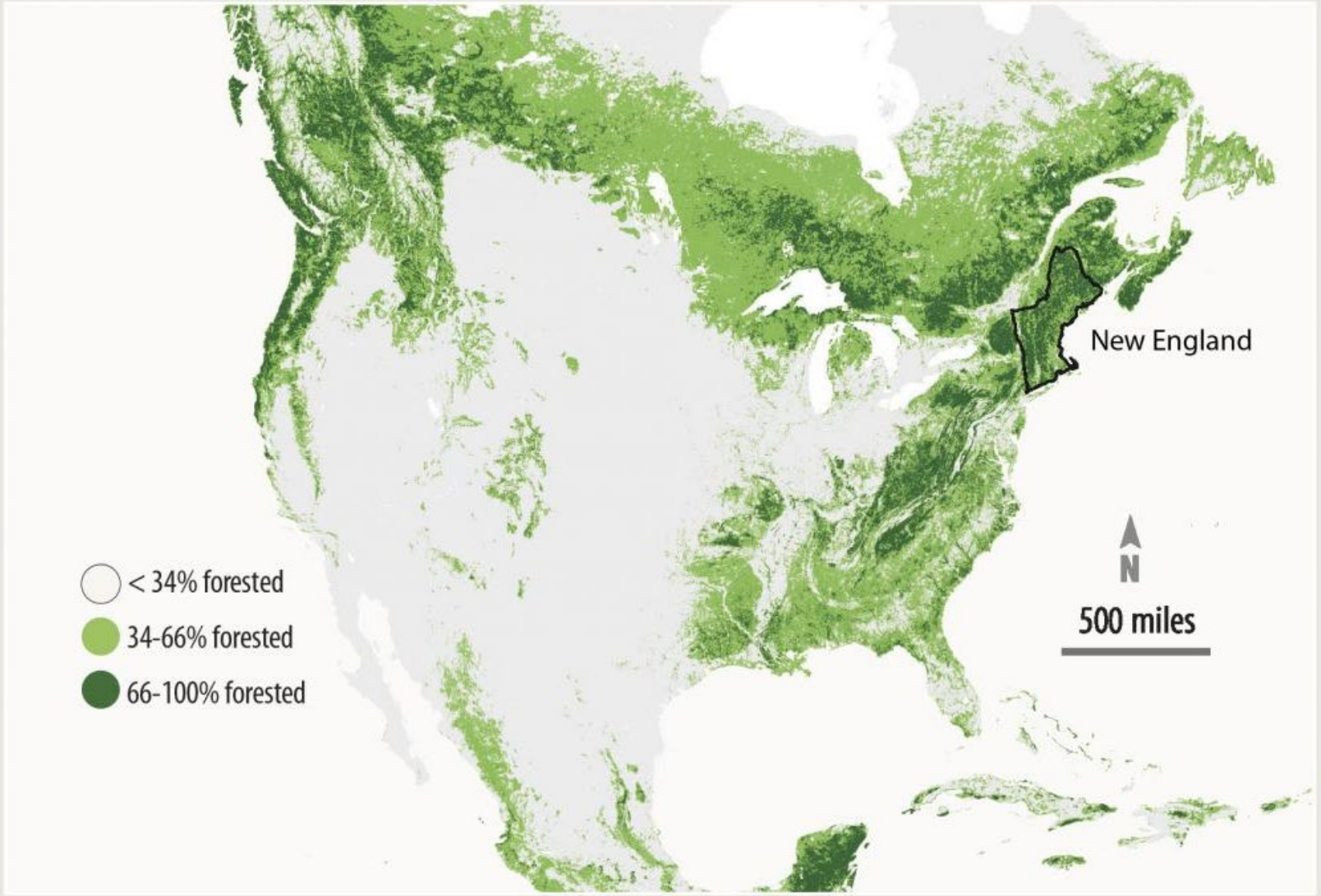


Brad Compton, Ethan Plunkett, Scott Jackson
Bill DeLuca, and Joanna Grand
Designing Sustainable Landscapes Project
Department of Environmental Conservation

UMass Amherst

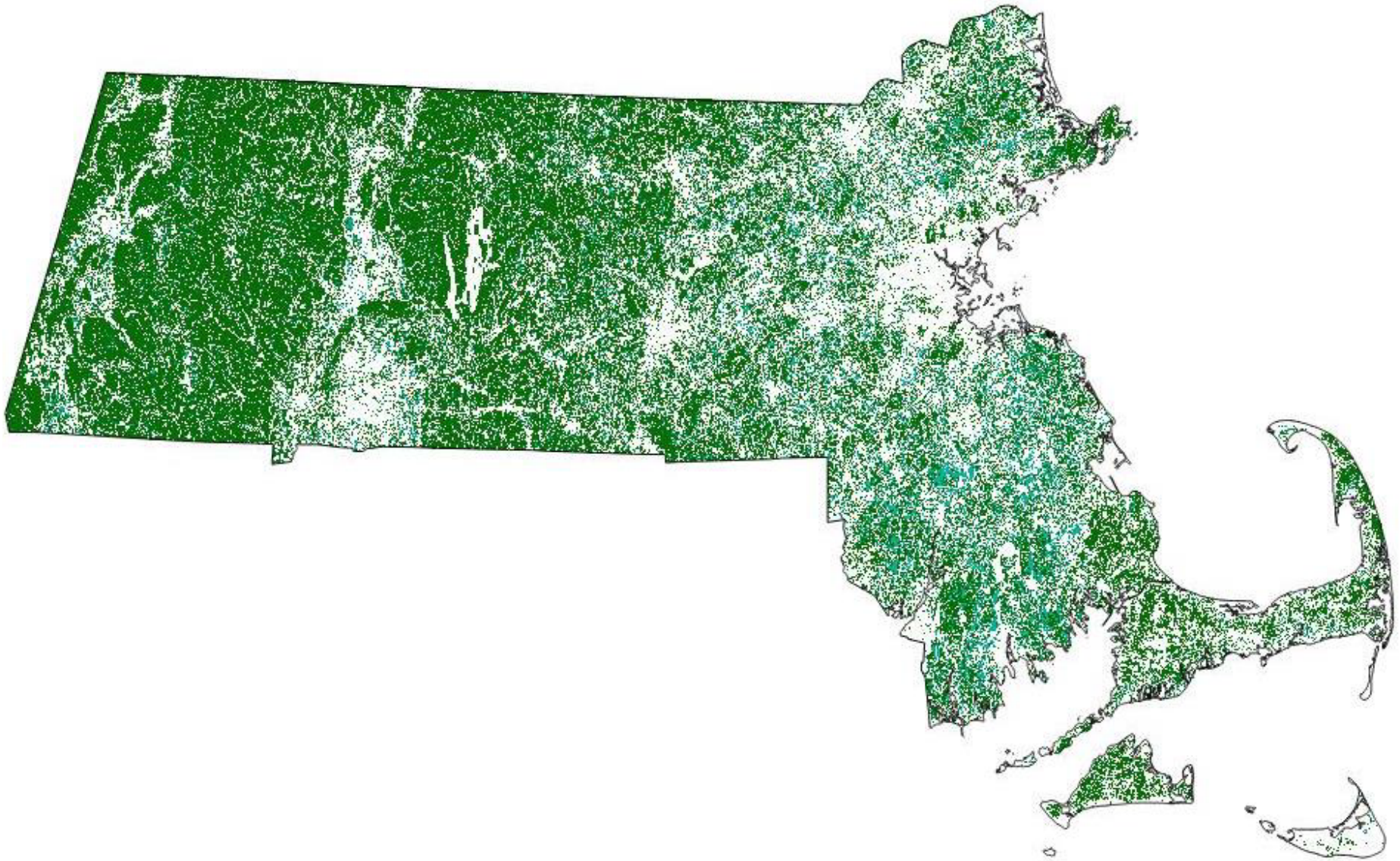
NE CASC
Northeast Climate Adaptation Science Center

New England Forests: A Globally Important Resource

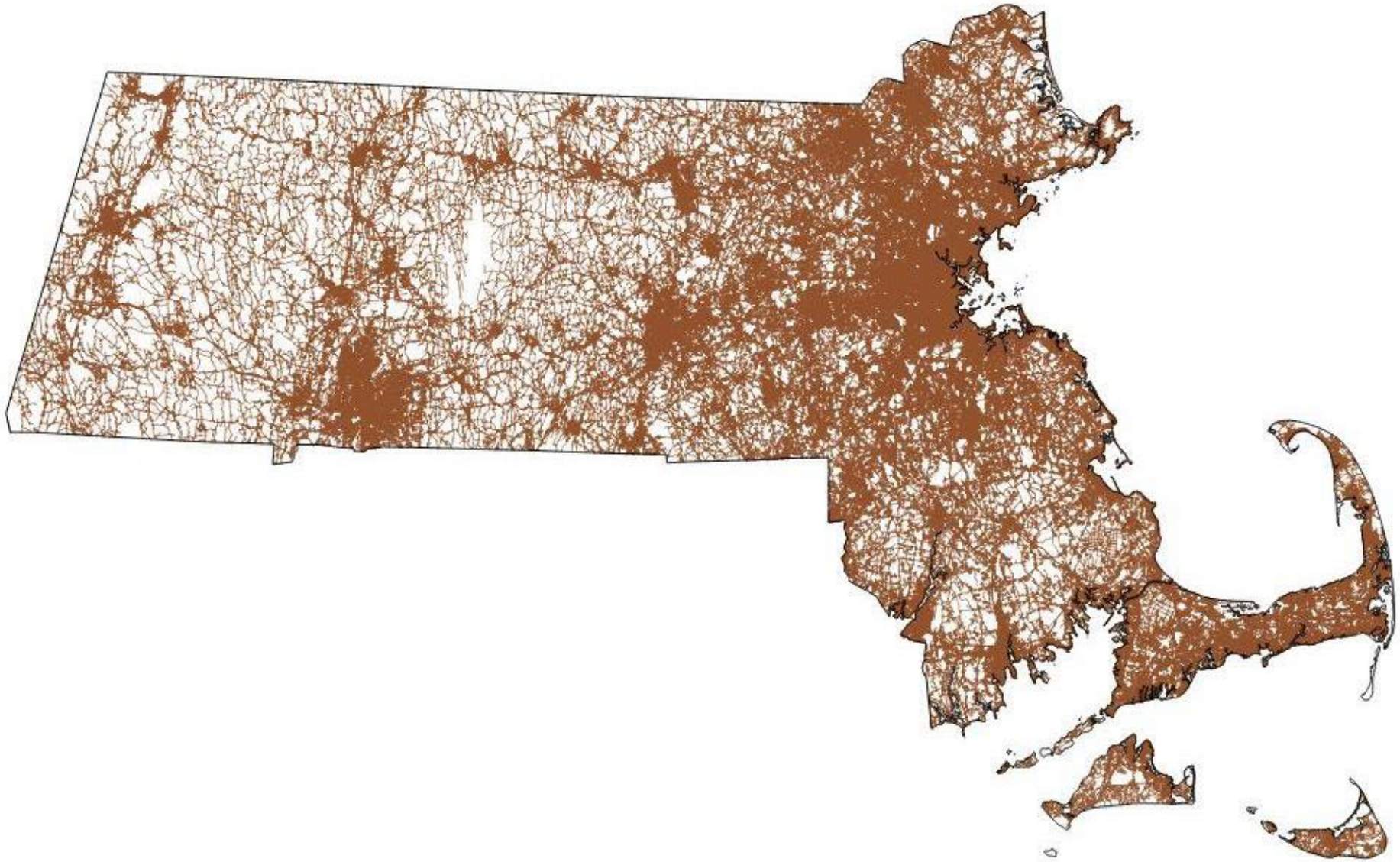


New England is one of the most heavily forested parts of the United States. Forested areas provide critical benefits to its population and an essential corridor for plant and animal movement between the southern Appalachians and the boreal forests of Canada in a time of climate change.

MA Forested Cover



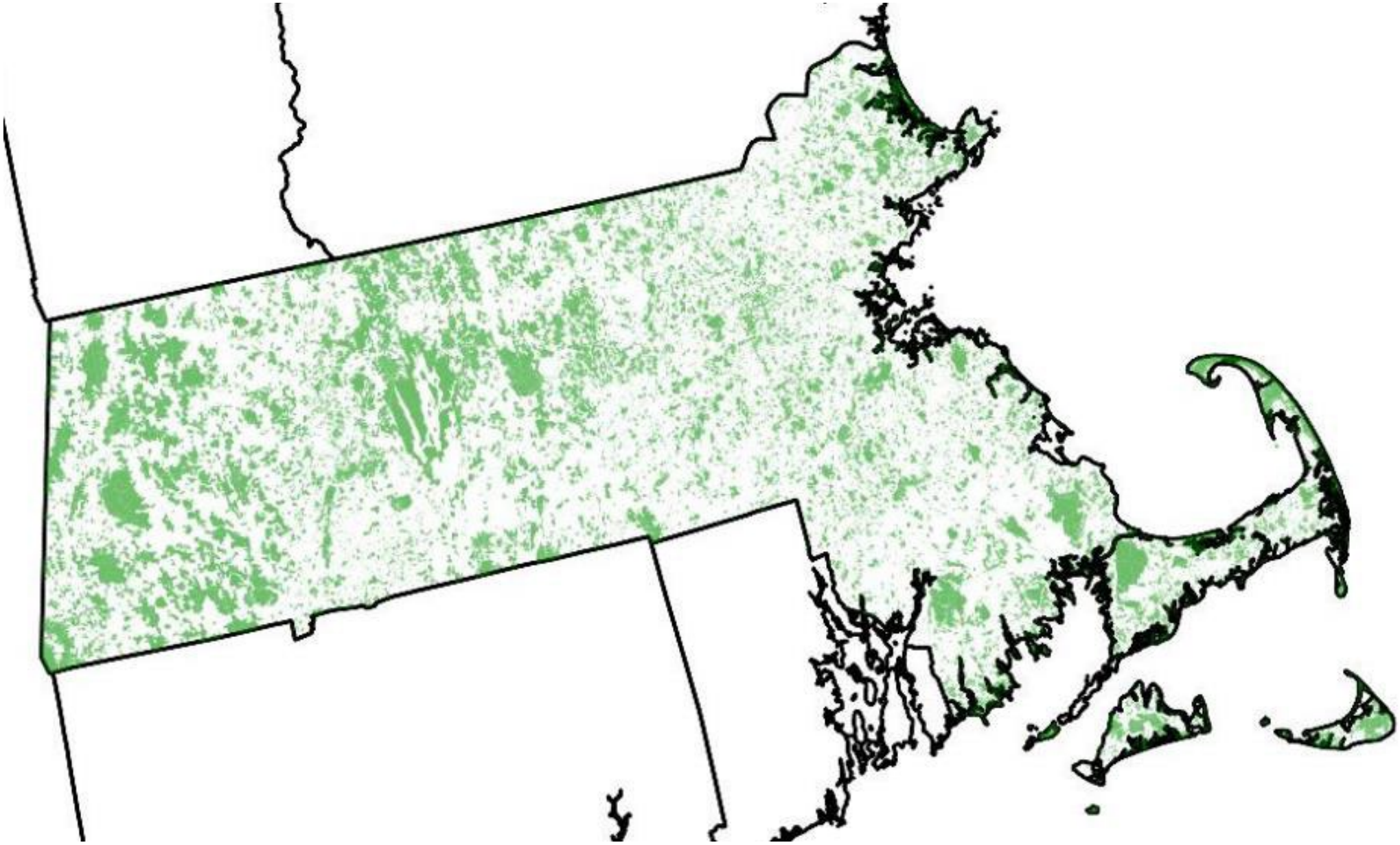
All Roads



Home range: 6,400 – 38,000 acres
Density: 1 bear per 1,400 acres

1 pair per 1,660 acres

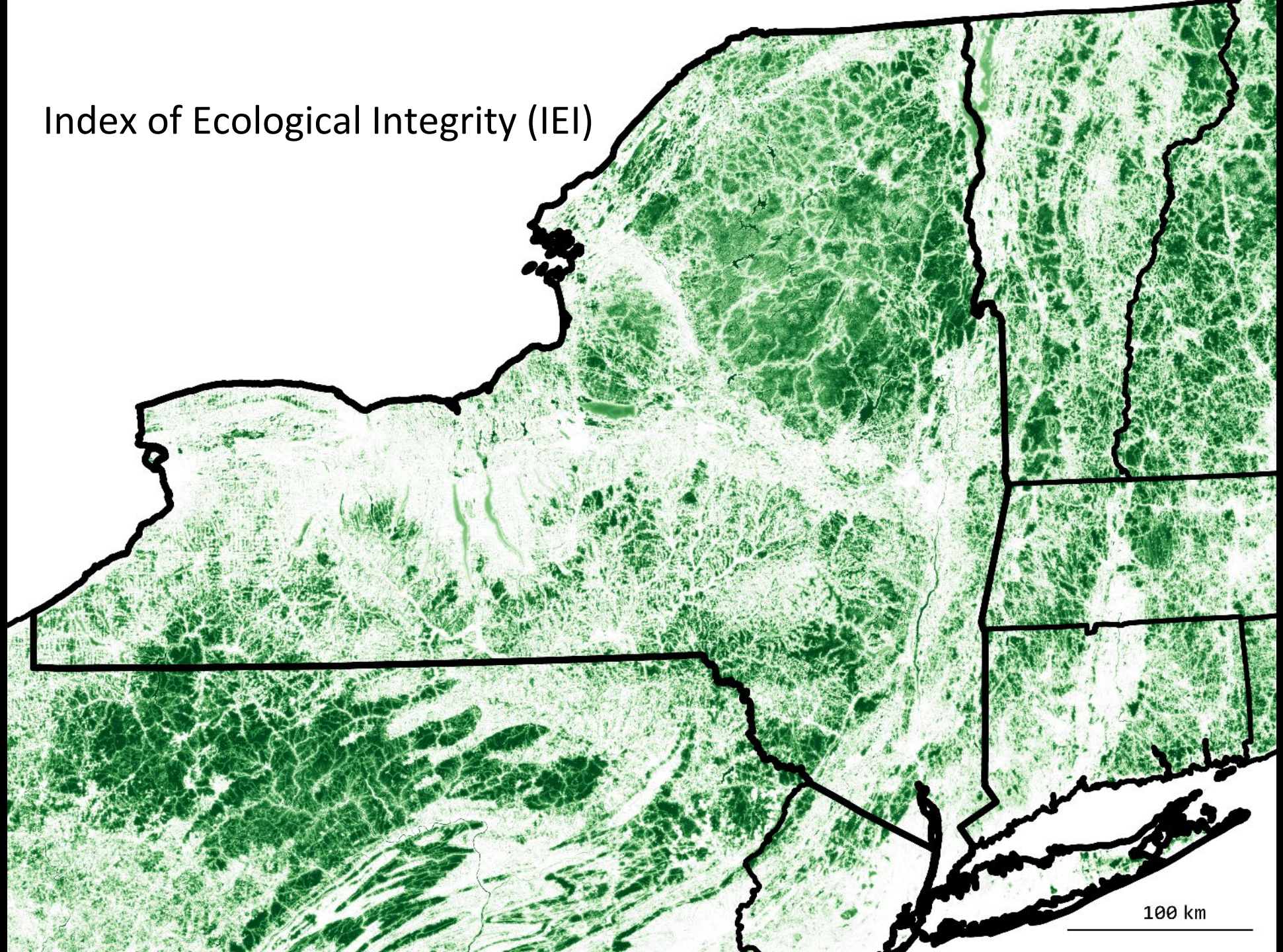
Home range: 8,000 – 24,500 acres
Density: 1 bobcat per 3,200 acres



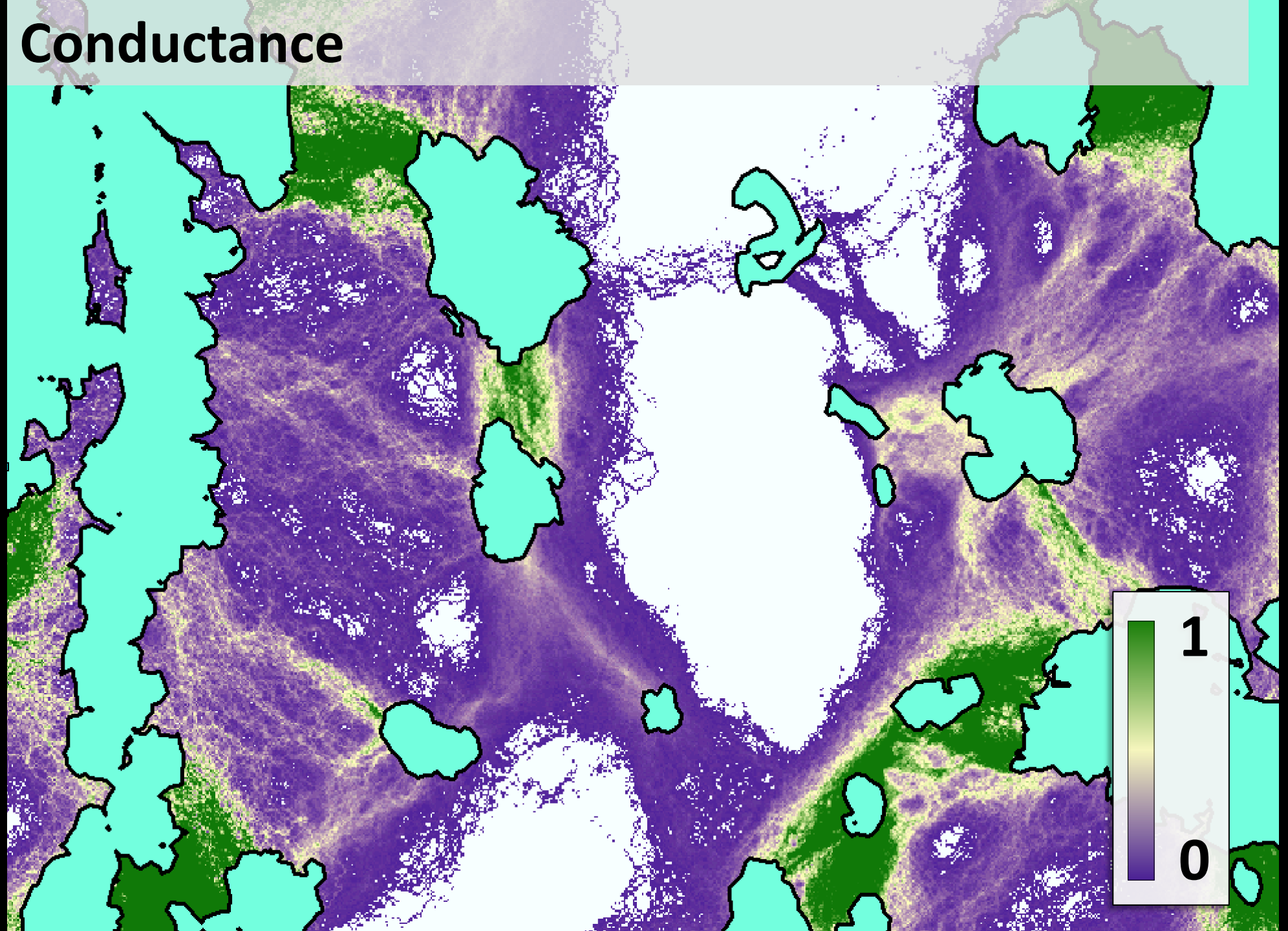
Protected Open Space

Ellesmere I.
Axel Heiberg I.
Greenland Ice Sheet
Brooks Range
Eglinton I.
Melville I.
Innuitian Ice Sheet
Queen Elizabeth Islands
Beaufort Sea
Devon I.
Banks I.
Baffin Bay
Alaska
Northwest margin
Victoria I.
POW I.
Baffin I.
northern Interior Plains
Yukon
Mackenzie Mountains
Southampton I.
Hudson Strait
Northwest Territories
Nunavut
Keewatin Dome
Transect C
Laurentide Ice Sheet
Quebec/Labrador Dome
Cordilleran Ice Sheet
Hudson Bay
Labrador
Pacific Ocean
British Columbia
Alberta
Sask.
Manitoba
Transect A
Hudson Bay Lowlands
Quebec
Newfoundland
Magdalen I.
Anticosti I.
Ontario
Atlantic Canada
N.S.
Cape Breton
Transect B
SLL
Rocky Mountains
Montana
N. Dakota
L. Superior
Great Lakes
New England
Massachusetts
Minnesota
Wisconsin
L. Michigan
Michigan
L. Huron
L. Erie
L. Ontario
New York
S. Dakota
Iowa
Pennsylvania
Nebraska
Illinois
Indiana
Ohio
Elevation (metres above sea level)
≤ 100
≤ 225
≤ 350
≤ 500
≤ 650
≤ 825
≤ 1025
≤ 1250
≤ 1450
≤ 1650
≤ 1900
≤ 2200
≤ 2500
≤ 3000
≤ 6000
N
0 225 450 675 900 Km

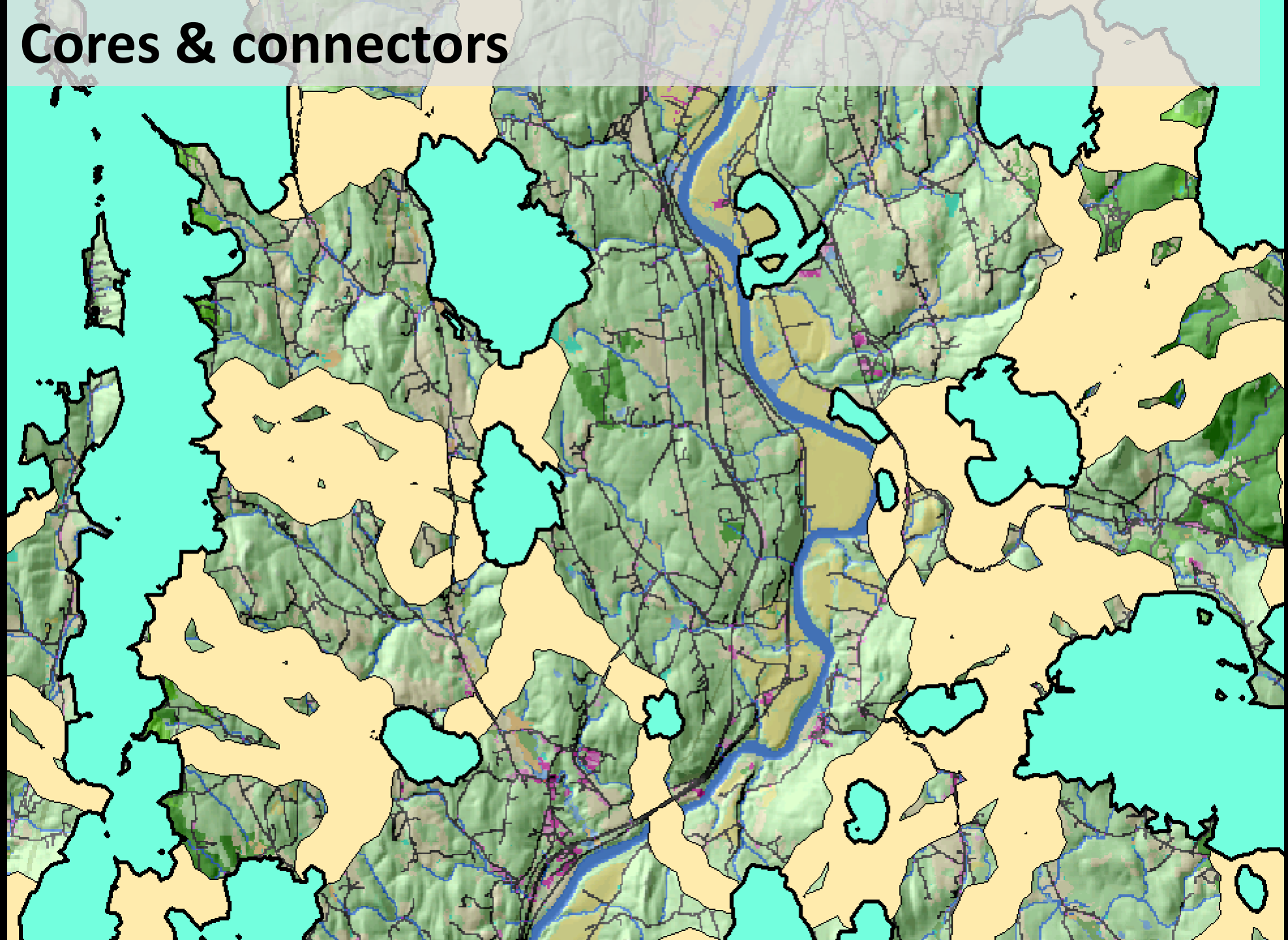
Index of Ecological Integrity (IEI)

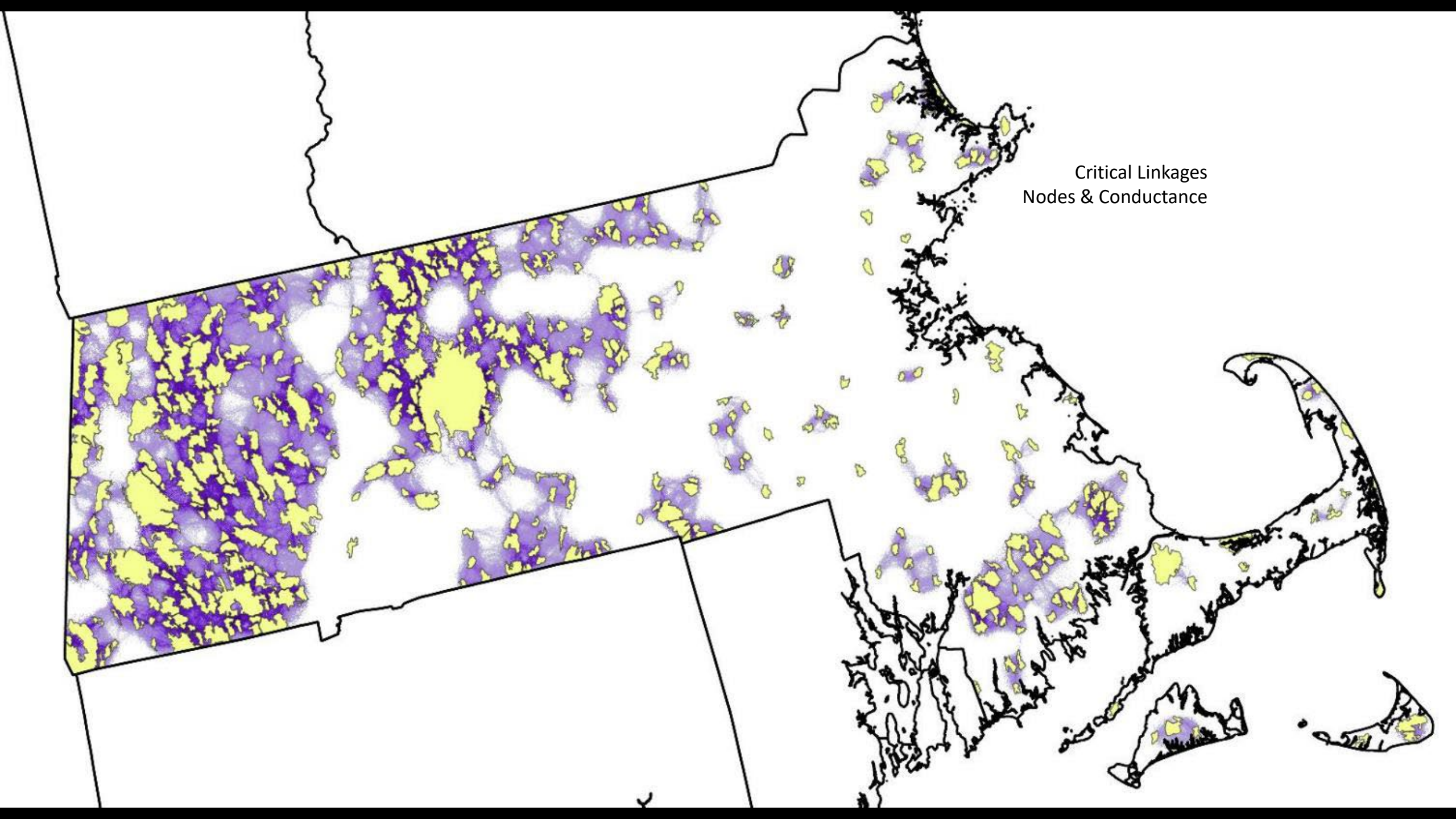


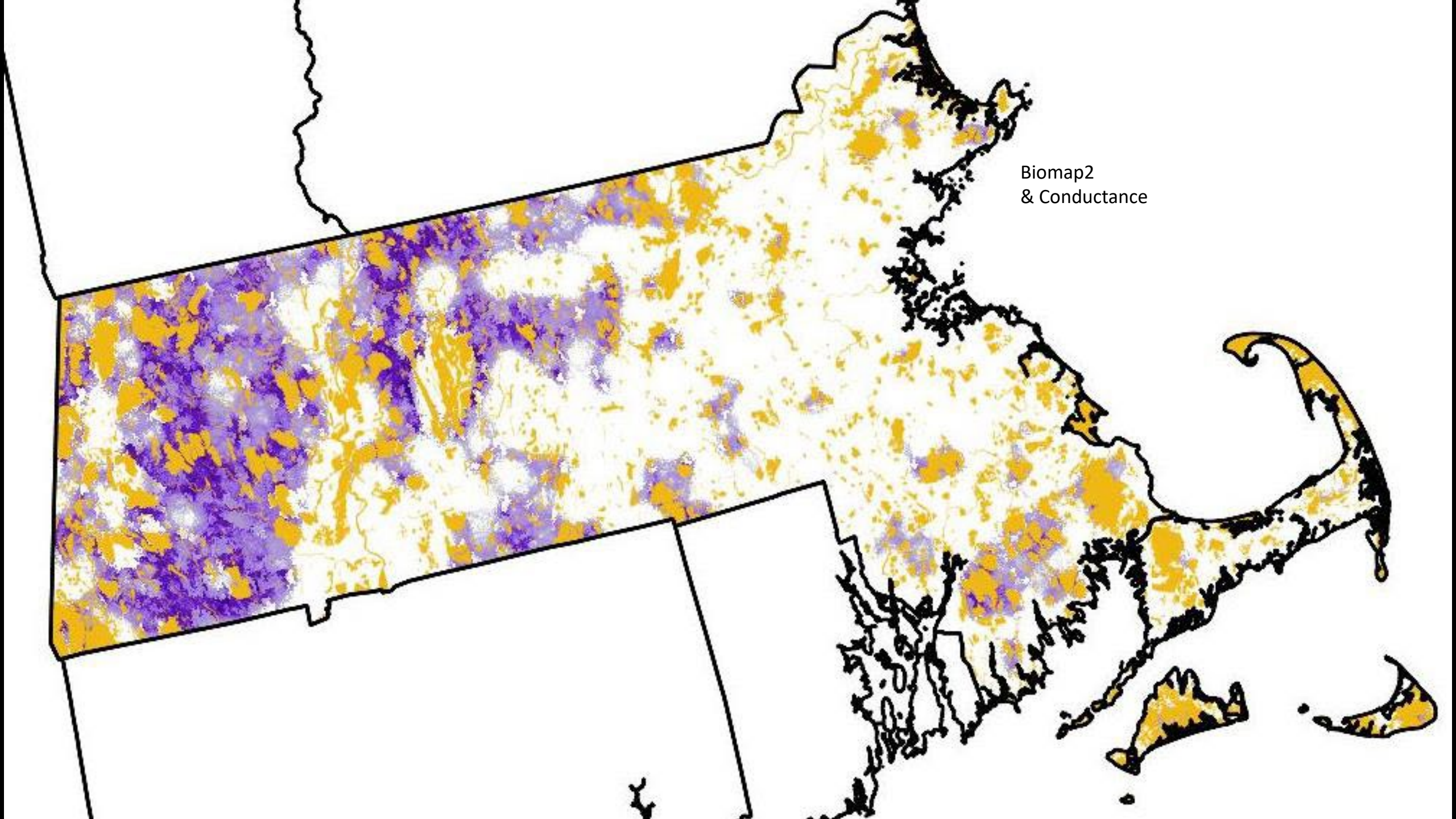
Conductance

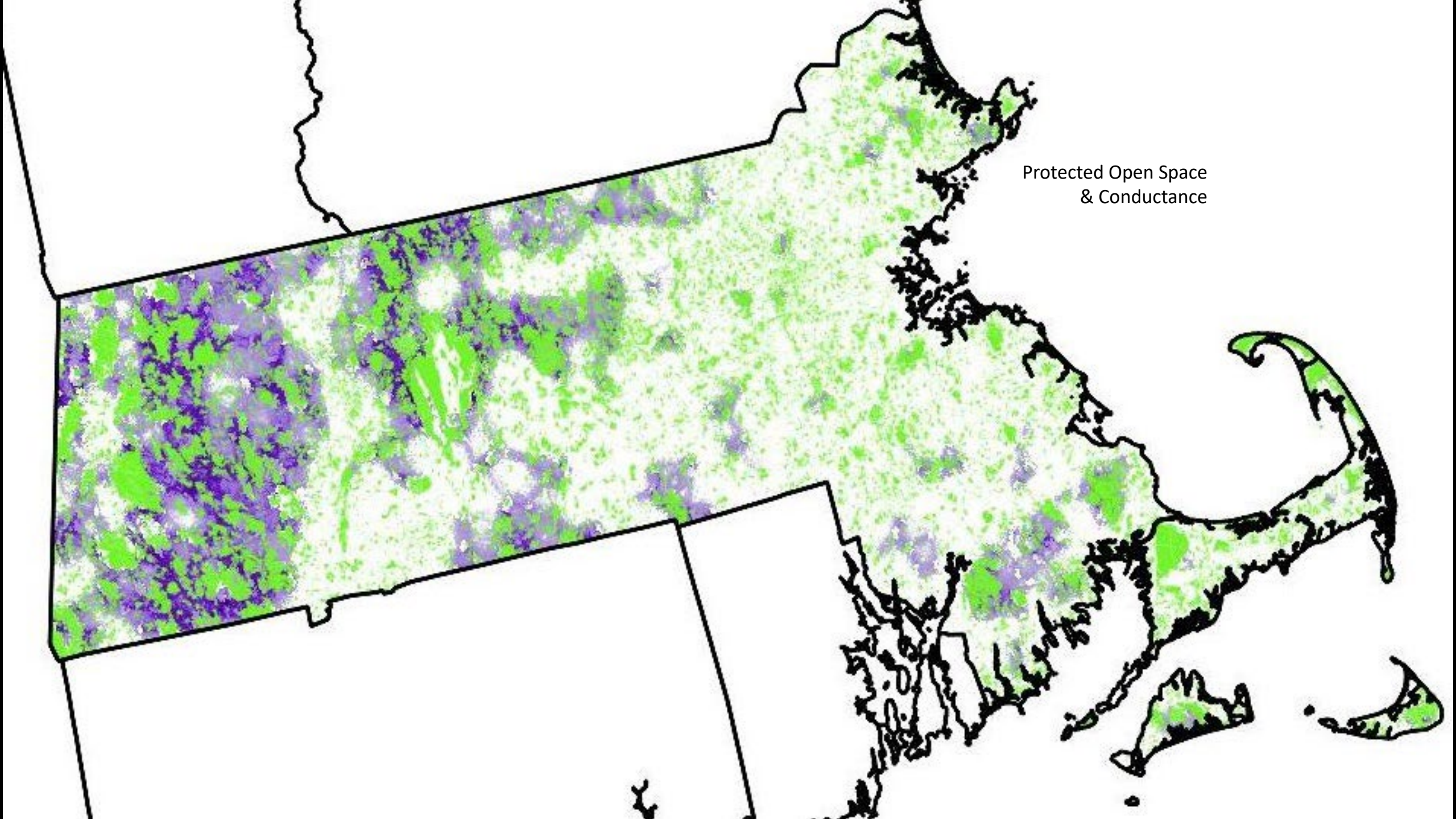


Cores & connectors




Critical Linkages
Nodes & Conductance


Biomap2
& Conductance

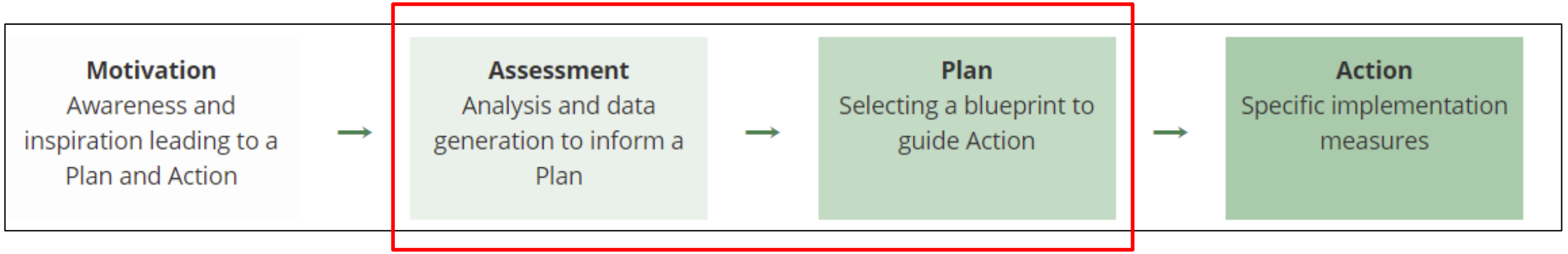

Protected Open Space
& Conductance

ecoConnect:
Regional ecosystem connectivity

1. Truly regional for the northeastern U.S.
2. Ecosystem-based
3. Independent of defined conservation cores
4. Multiple scales

UMass Amherst

NE CASC
Northeast Climate Adaptation Science Center



Assessments

- CAPS
- ecoConnect
- Critical Linkages
- TNC Resilient & Connected Landscapes
- Designing Sustainable Landscapes (DSL)

Plans

- BioMap
- TNC Resilient & Connected Network
- Connect the Connecticut
- Nature’s Network

DSL Data https://umassdsl.org

Describe → Assess → Plan

Land Cover
Temperature / Precipitation
Substrate (Soils)
Physical disturbance
Moisture
Hydrology
Vegetation
Development
Barriers (Dams, Culverts)
(Many more)

<u>Index of Ecological Integrity (4x)</u>
Integrity Metrics (20x)
<u>ecoConnect (4x)</u>
Habitat – 32 species:
  2x current
  5x projected for 2040, 2080
Sprawl (urban growth)
  Probability of development
  Projected landcover
Impact
Critical Linkages

Connect the Connecticut Natures Network

DSL Data https://umassdsl.org

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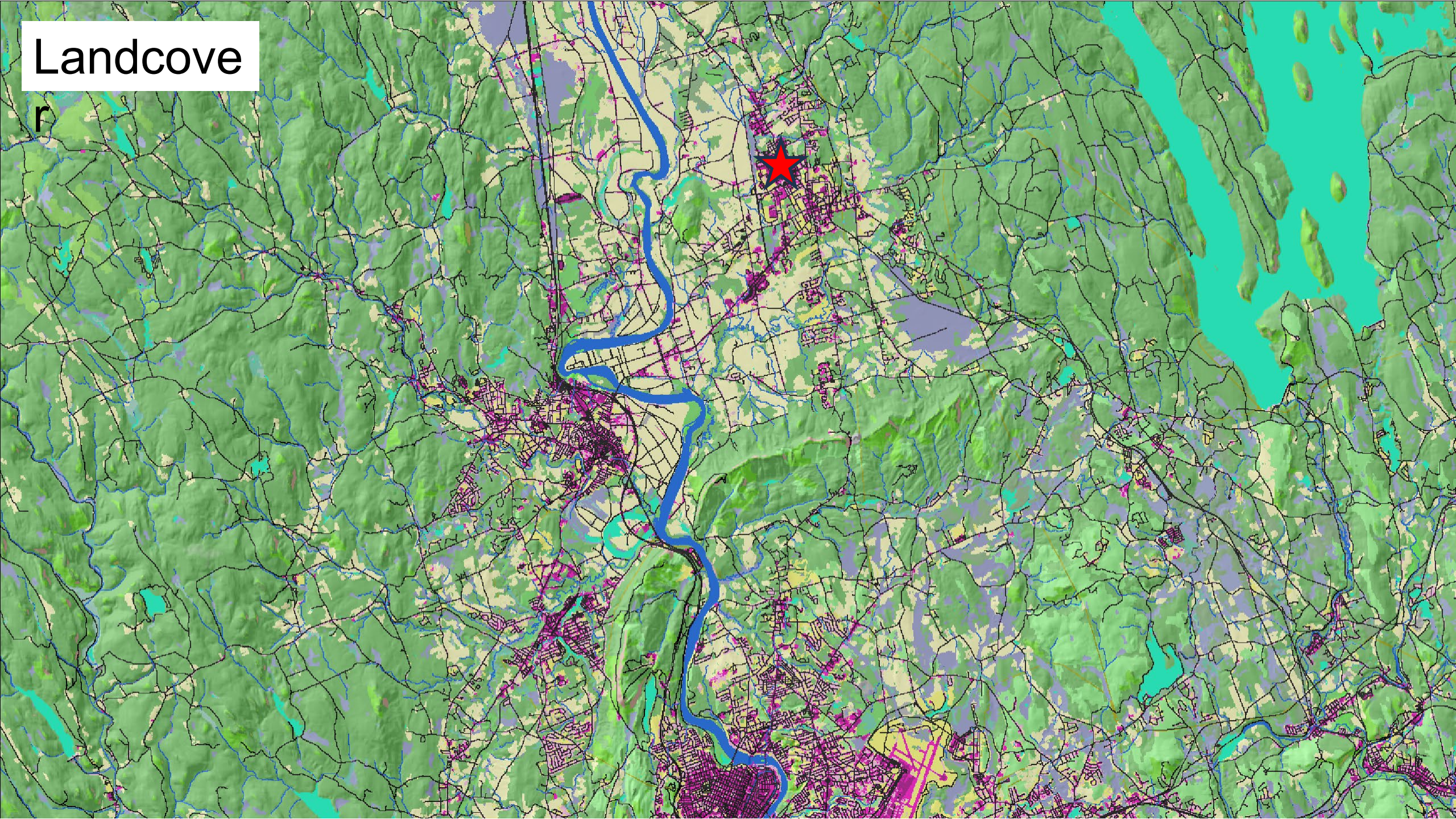
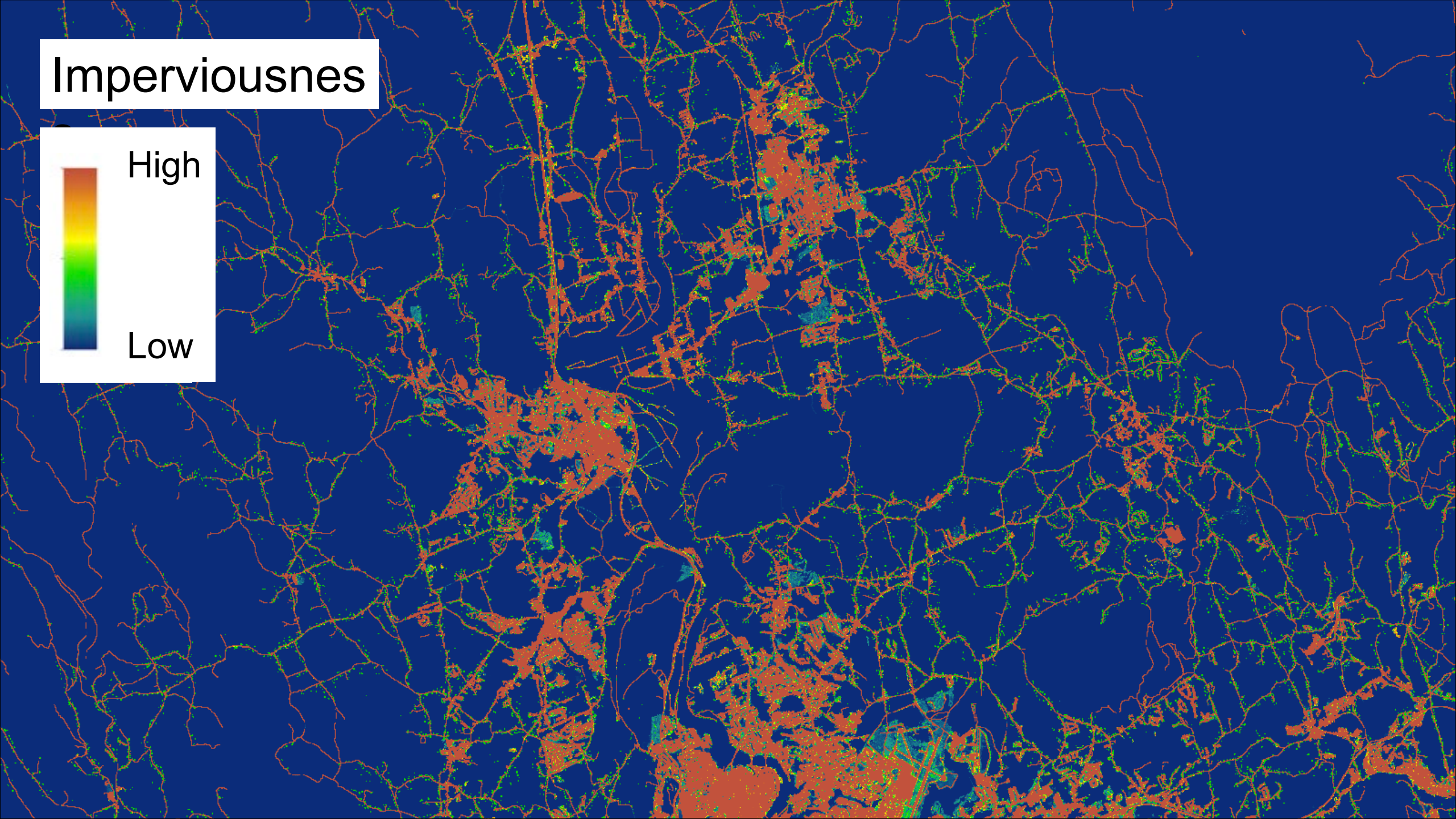
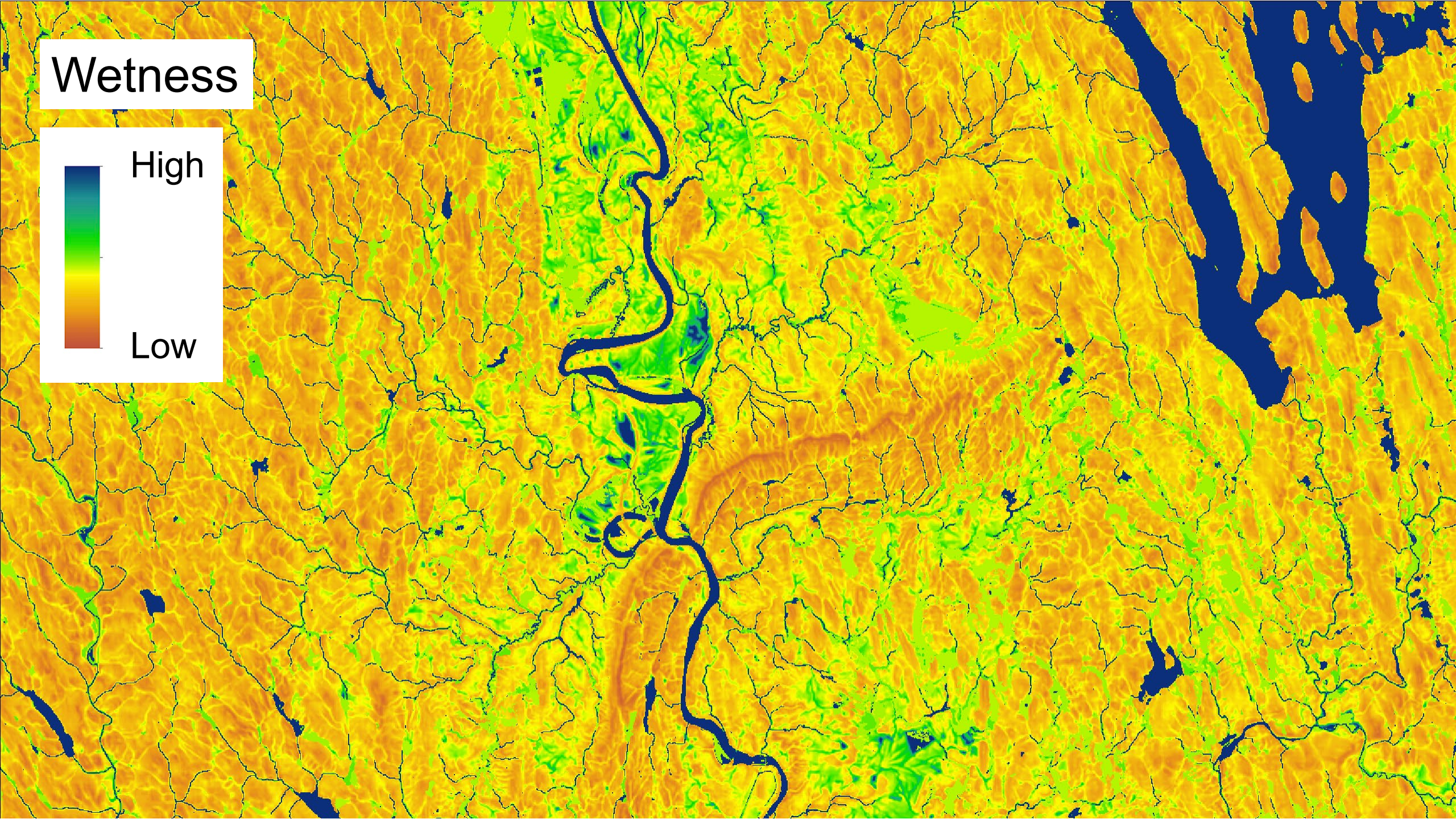
Impact
Critical Linkages

Connect the Connecticut Natures Network

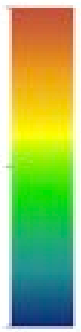
Northeast Region


Landcove
r


Imperviousnes
High
Low

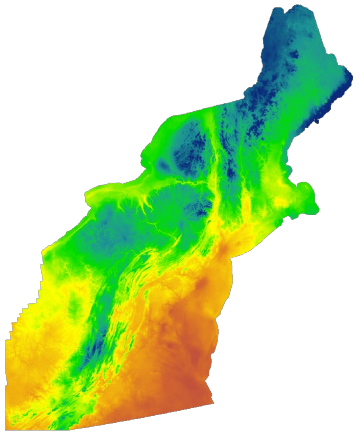

Wetness
High
Low

July Temperature



High

Low



DSL Data https://umassdsl.org

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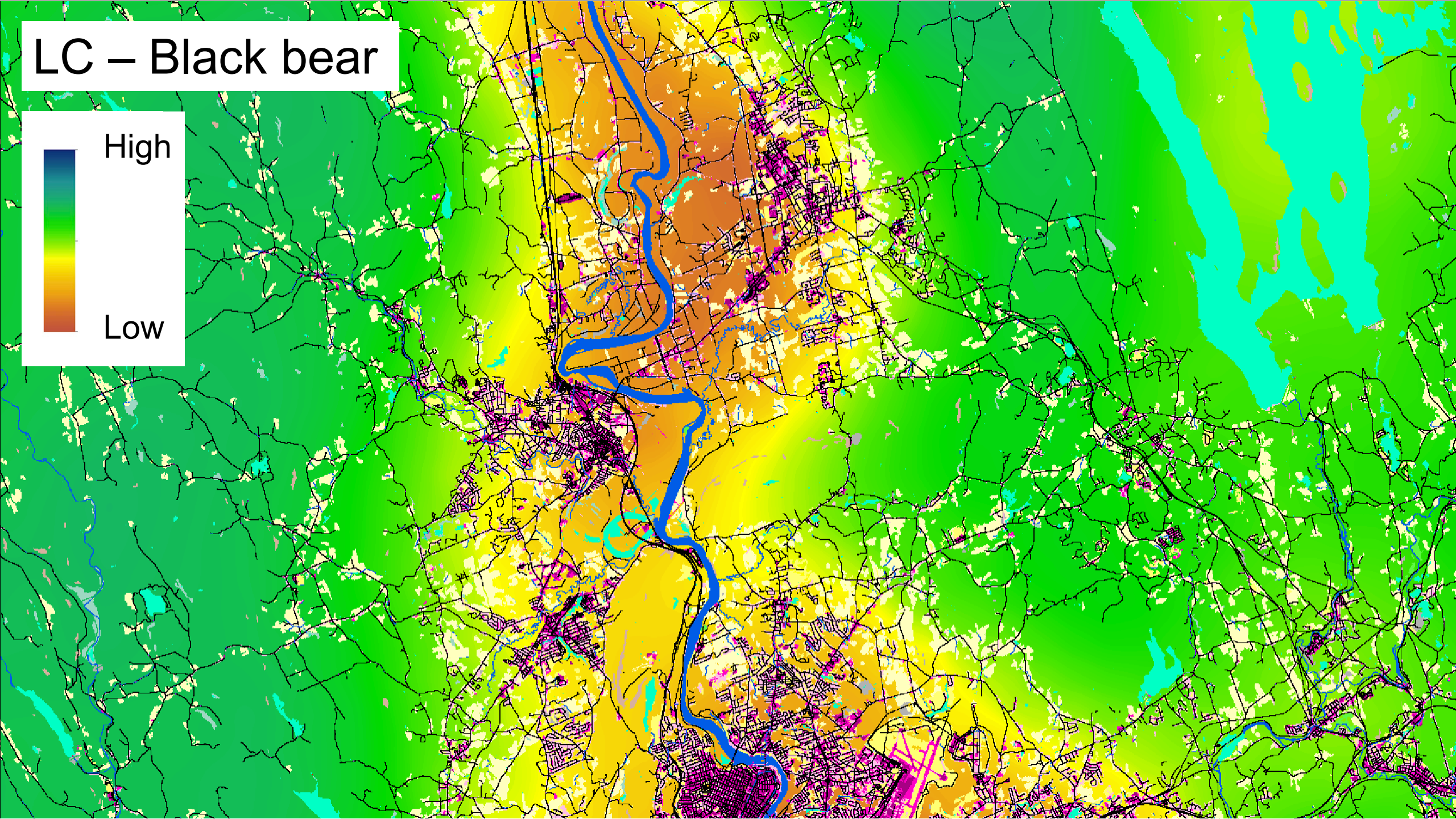
Impact
Critical Linkages

Connect the Connecticut Natures Network

LC - Ovenbird

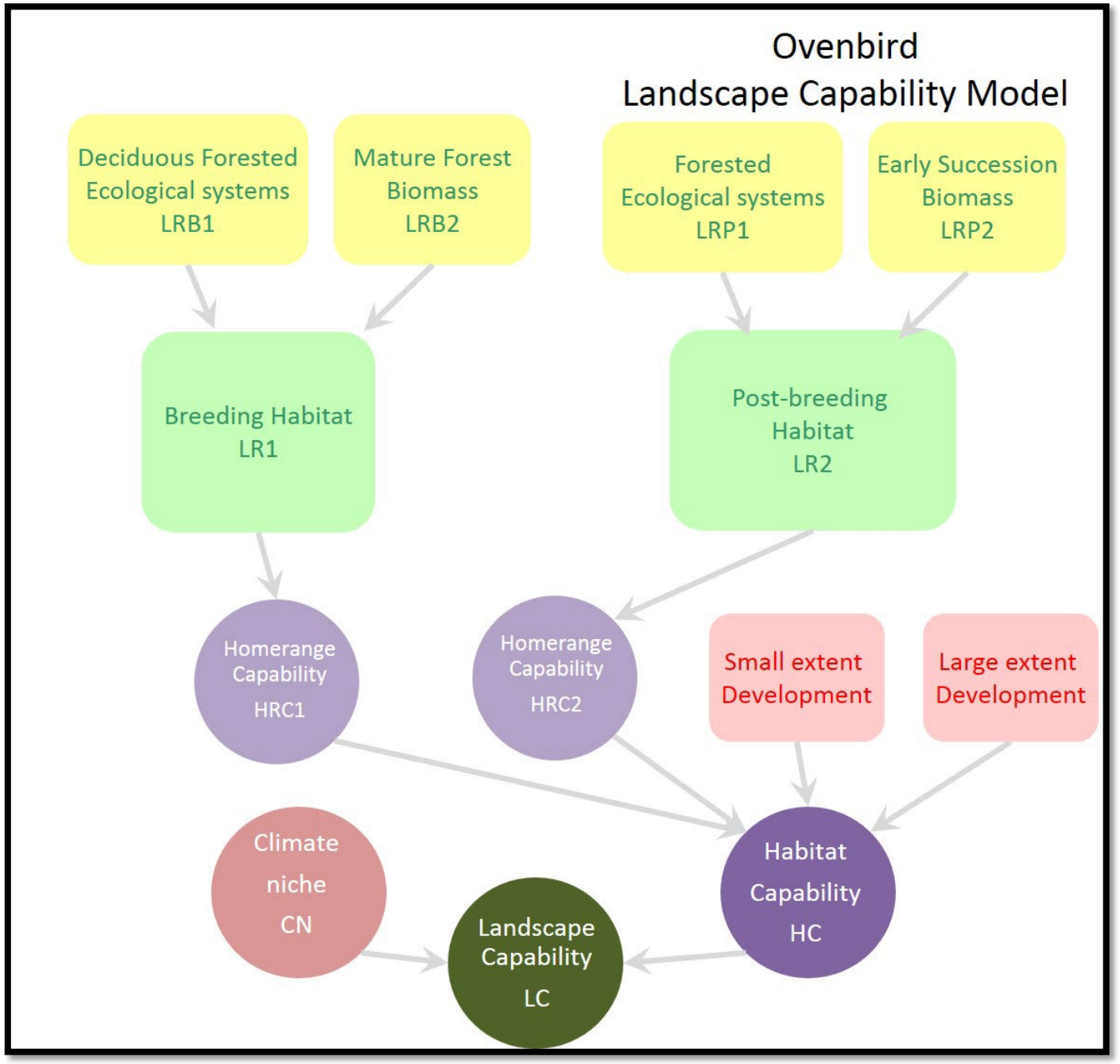
High

Low


LC – Black bear
High
Low

Assessment

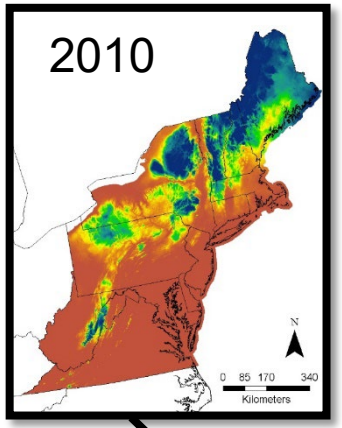
Ovenbird LC



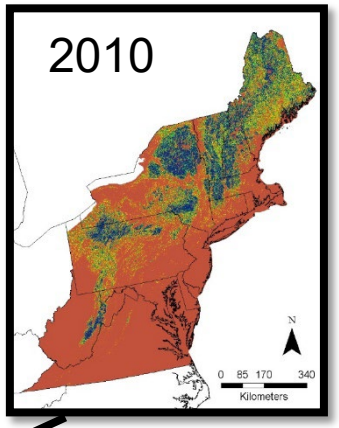
Blackburnian warbler

2020

Climate suitability

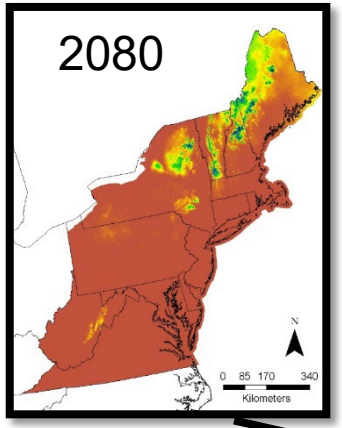


Habitat capability

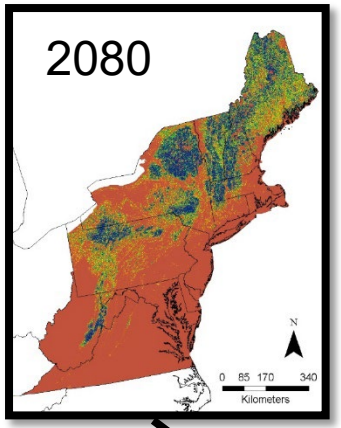


2080

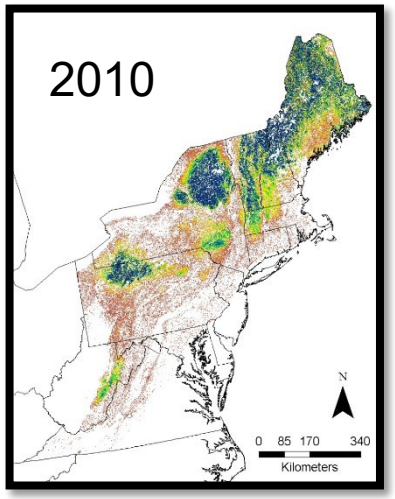
Climate suitability



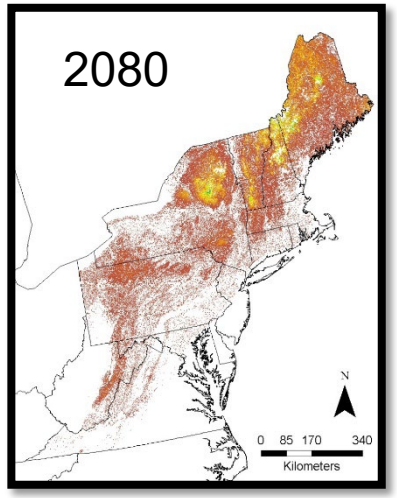
Habitat capability



Landscape Capability

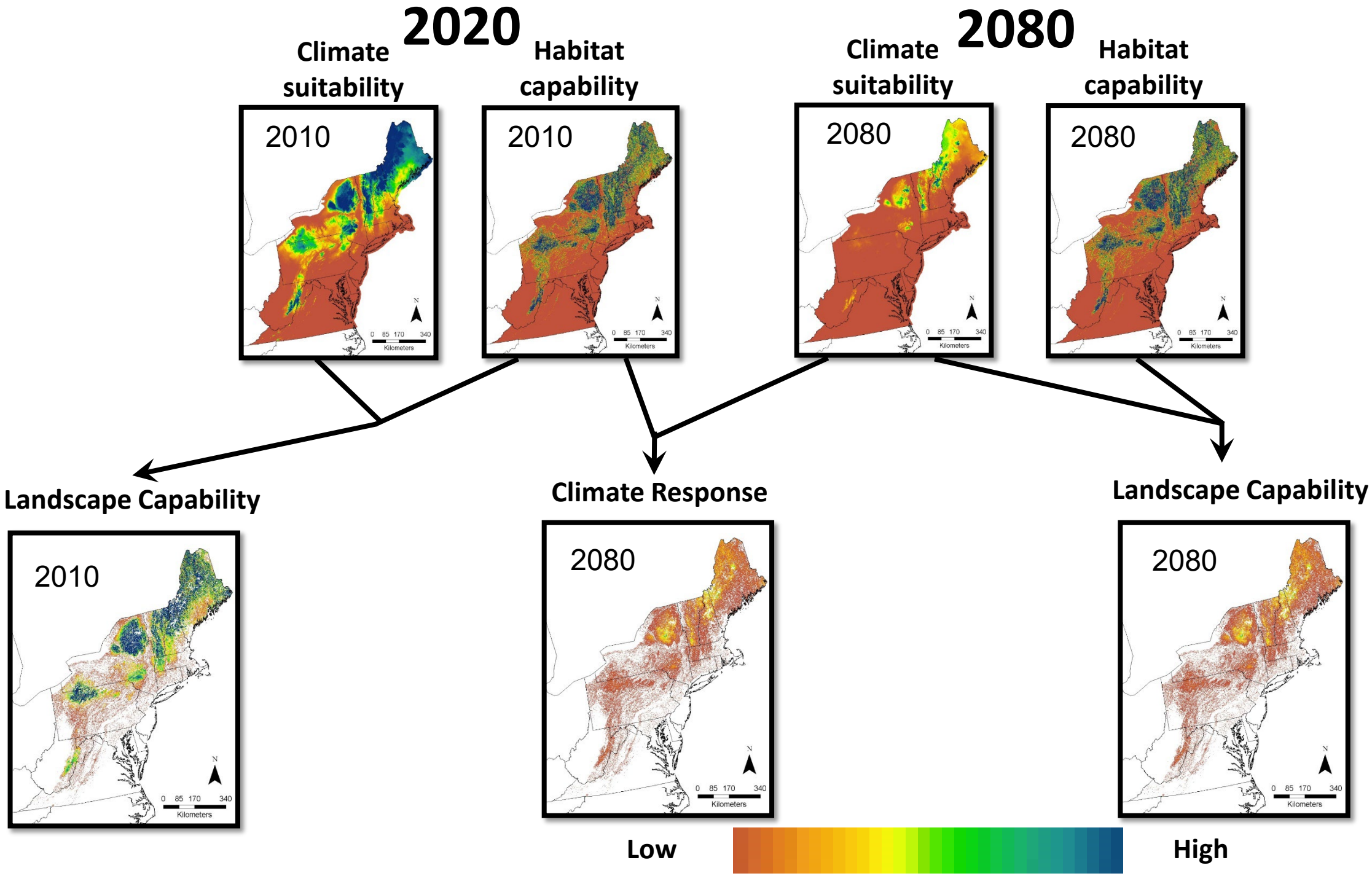


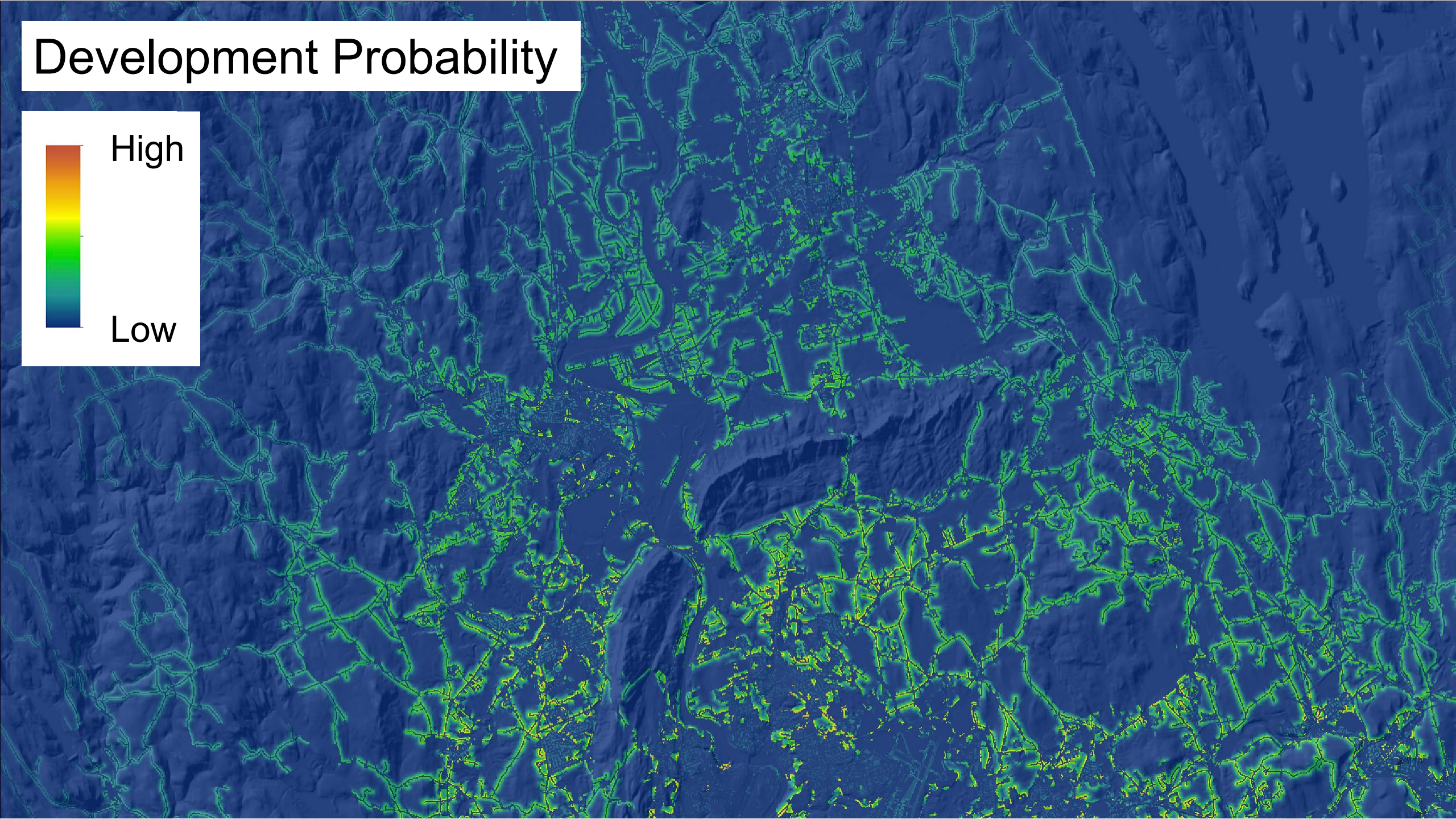
Landscape Capability

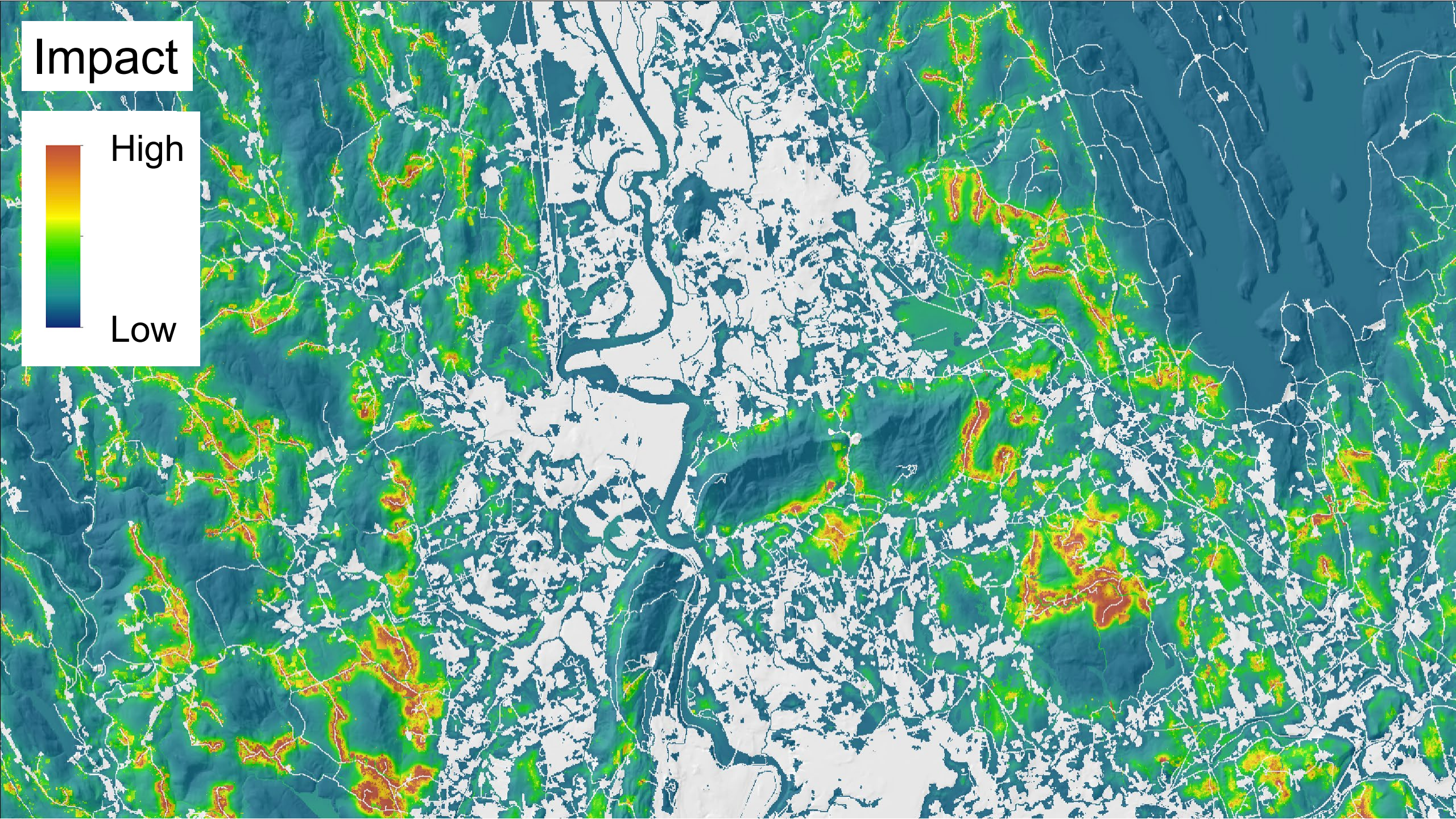


Low

High


2020
Climate suitability
Habitat capability
2080
Climate suitability
Habitat capability
2010
2010
2080
2080
Landscape Capability
Climate Response
Landscape Capability
2010
2080
2080
0 85 170 340
Kilometers
N
Low
High


Development Probability
High
Low


Impact
High
Low

DSL Data https://umassdsl.org

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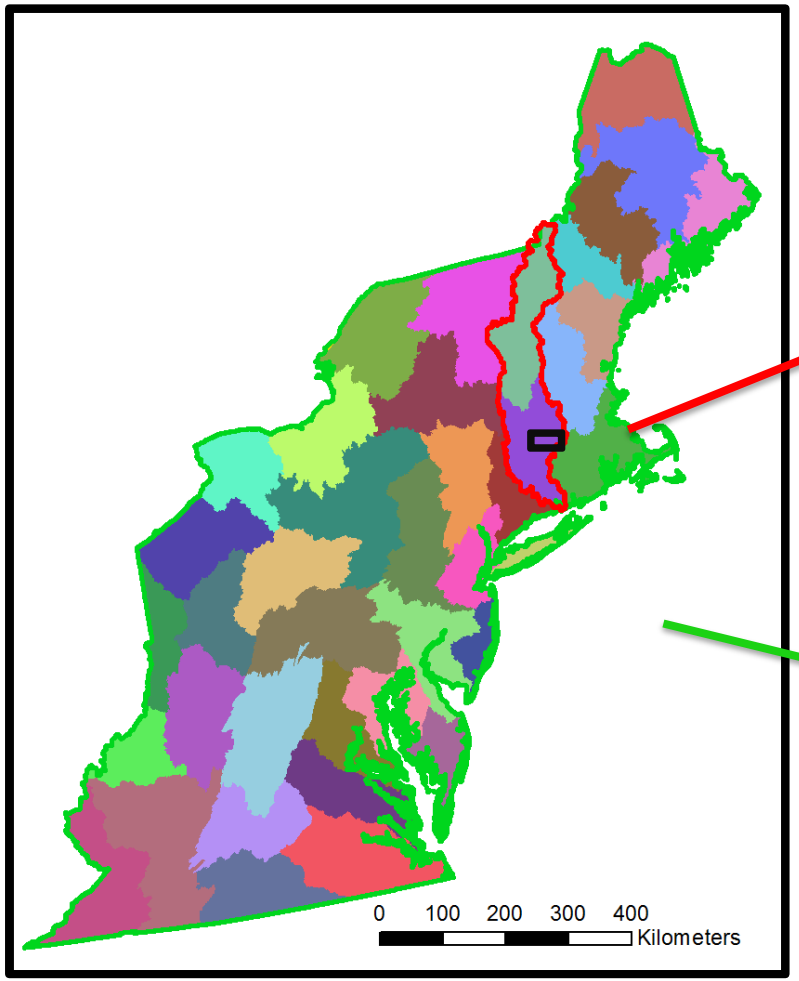
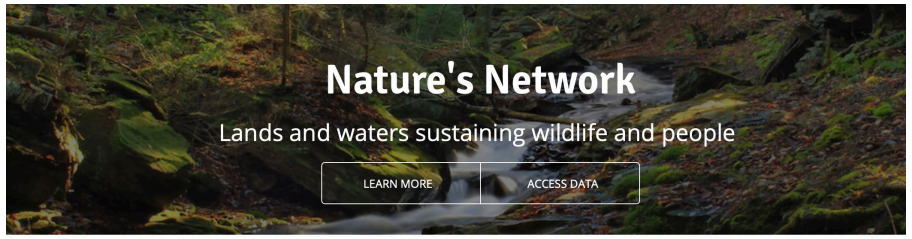
Impact
Critical Linkages

Connect the Connecticut Natures Network

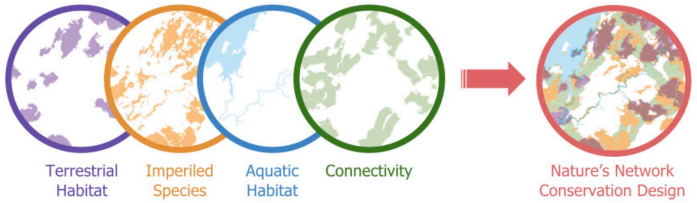
North Atlantic Landscape Conservation Cooperative



http://connecttheconnecticut.org

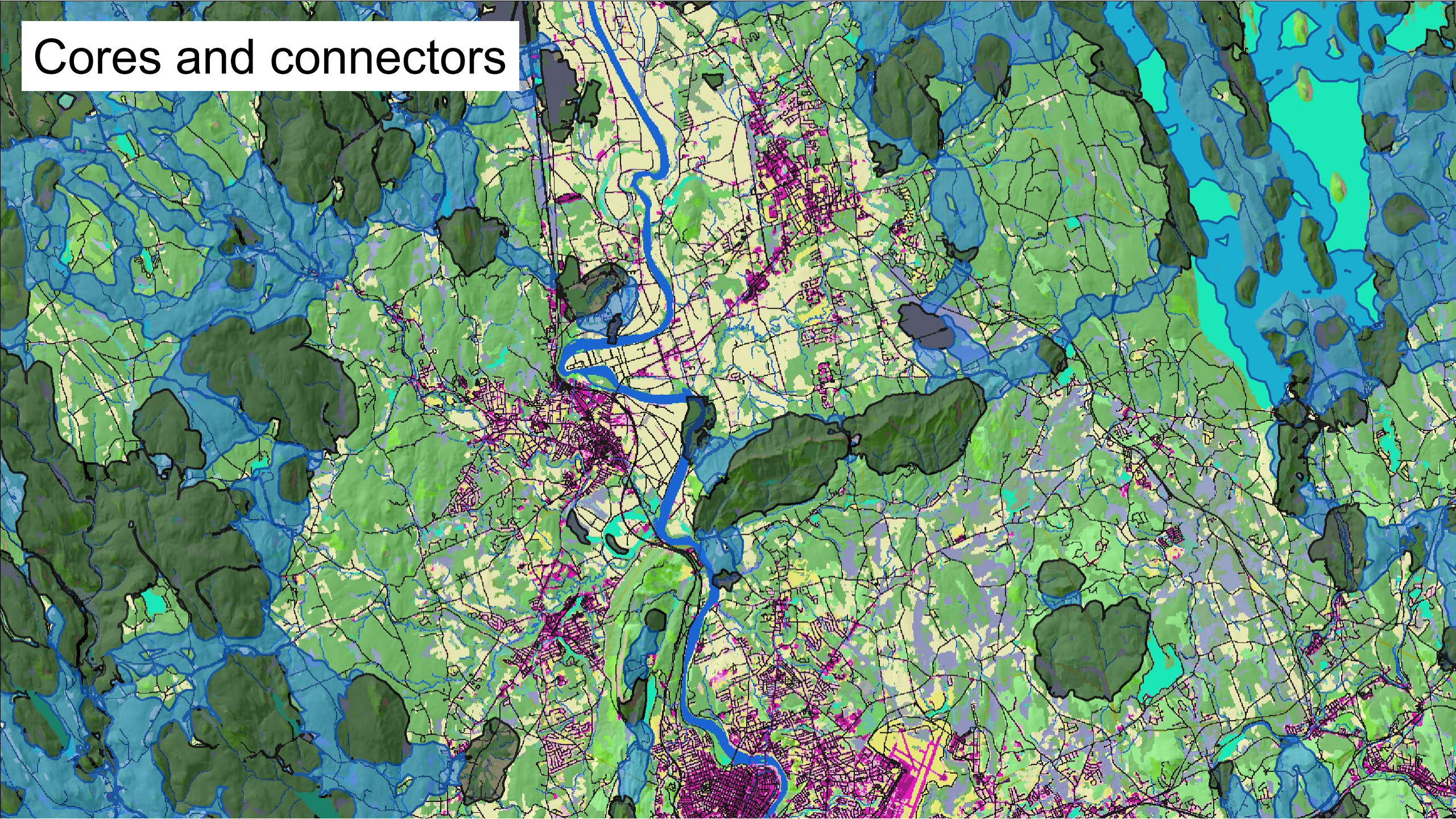


Nature's Network is a collaborative effort facilitated by the U.S. Fish and Wildlife Service Science Applications program that brings together partners from 13 states, federal agencies, nongovernmental organizations, and universities to identify the best opportunities for conserving and connecting intact habitats and ecosystems and supporting imperiled species to help ensure the future of fish and wildlife across the Northeast region.



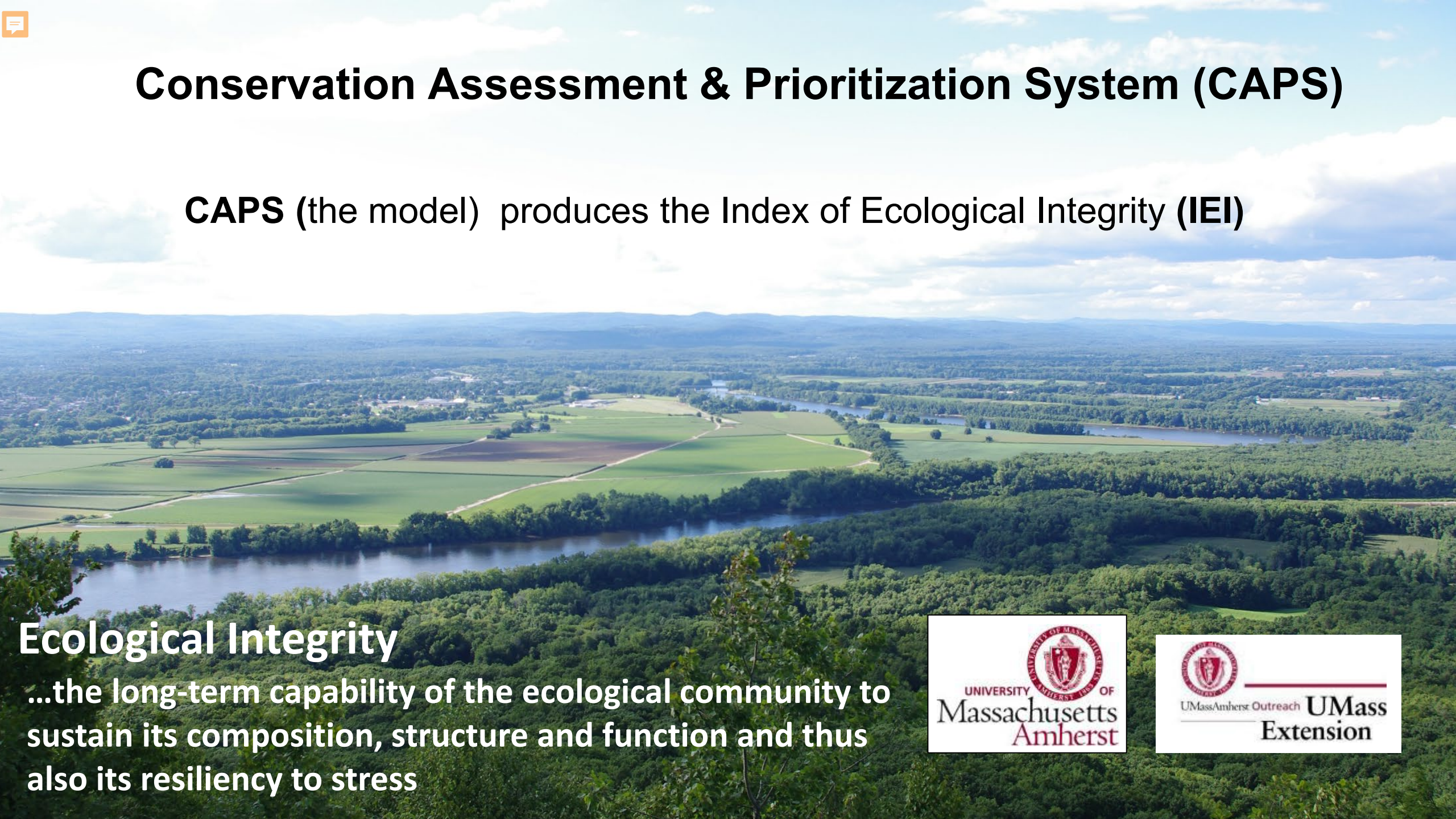
http://naturesnetwork.org

Cores and connectors



Conservation Assessment & Prioritization System (CAPS)

CAPS (the model) produces the Index of Ecological Integrity **(IEI)**



Ecological Integrity

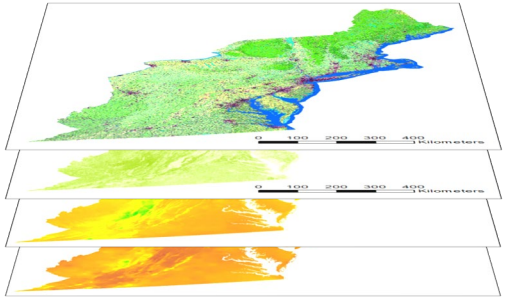
…the long-term capability of the ecological community to sustain its composition, structure and function and thus also its resiliency to stress

UNIVERSITY OF Massachusetts Amherst

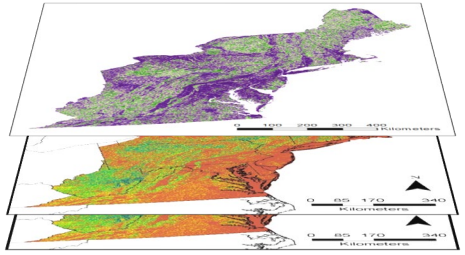
UMassAmherst Outreach UMass Extension

CAPS model

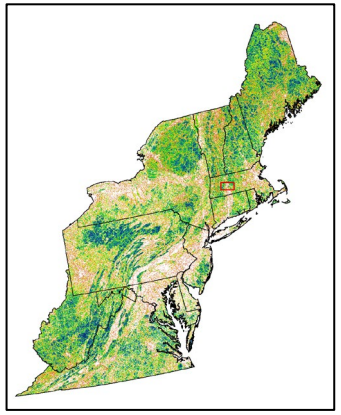
Environmental Settings (21x)



Metrics (20x)

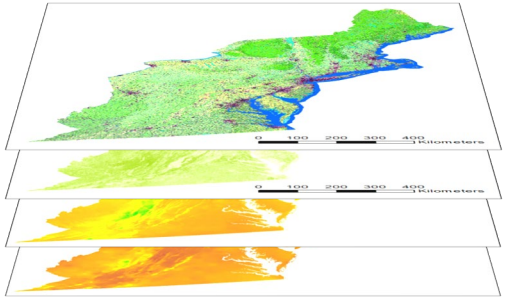


Index of Ecological Integrity

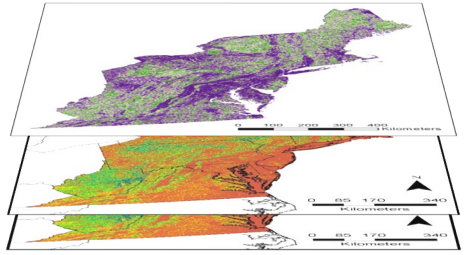


CAPS model

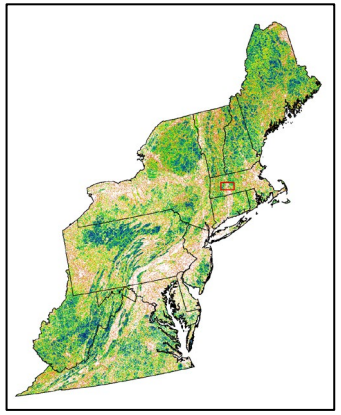
Environmental Settings (21x)



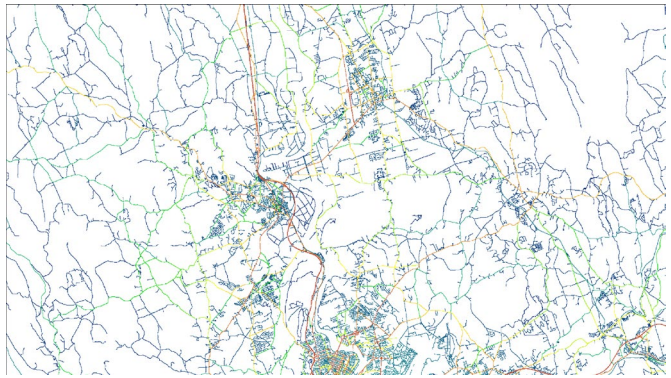
Metrics (20x)



Index of Ecological Integrity



Settings variables



Traffic

Temperature

Growing season degree-days
Minimum winter temperature
Heat Index 35
Stream temperature

Solar energy

Incident solar radiation

Chemical & physical substrate

Water salinity
Substrate mobility
CaCO3 content
Soil available water supply
Soil depth
Soil pH

Physical disturbance

Wind exposure
Slope

Moisture

Wetness

Hydrology

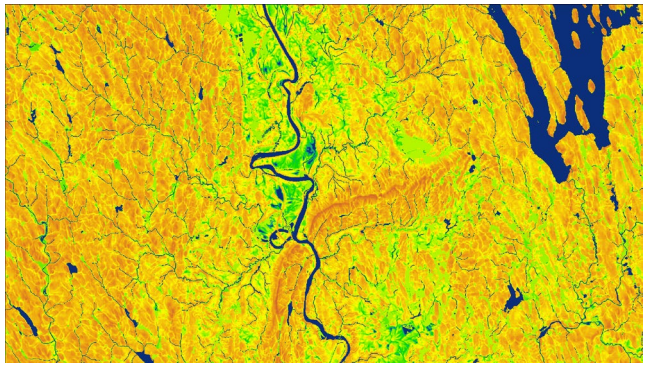
Flow gradient
Flow volume
Tidal regime

Vegetation

Dominant life form

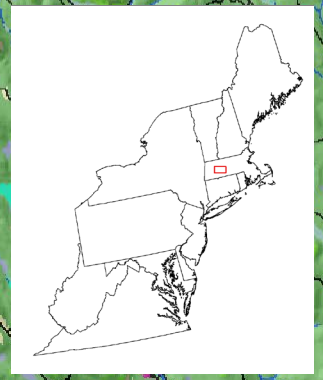
Development

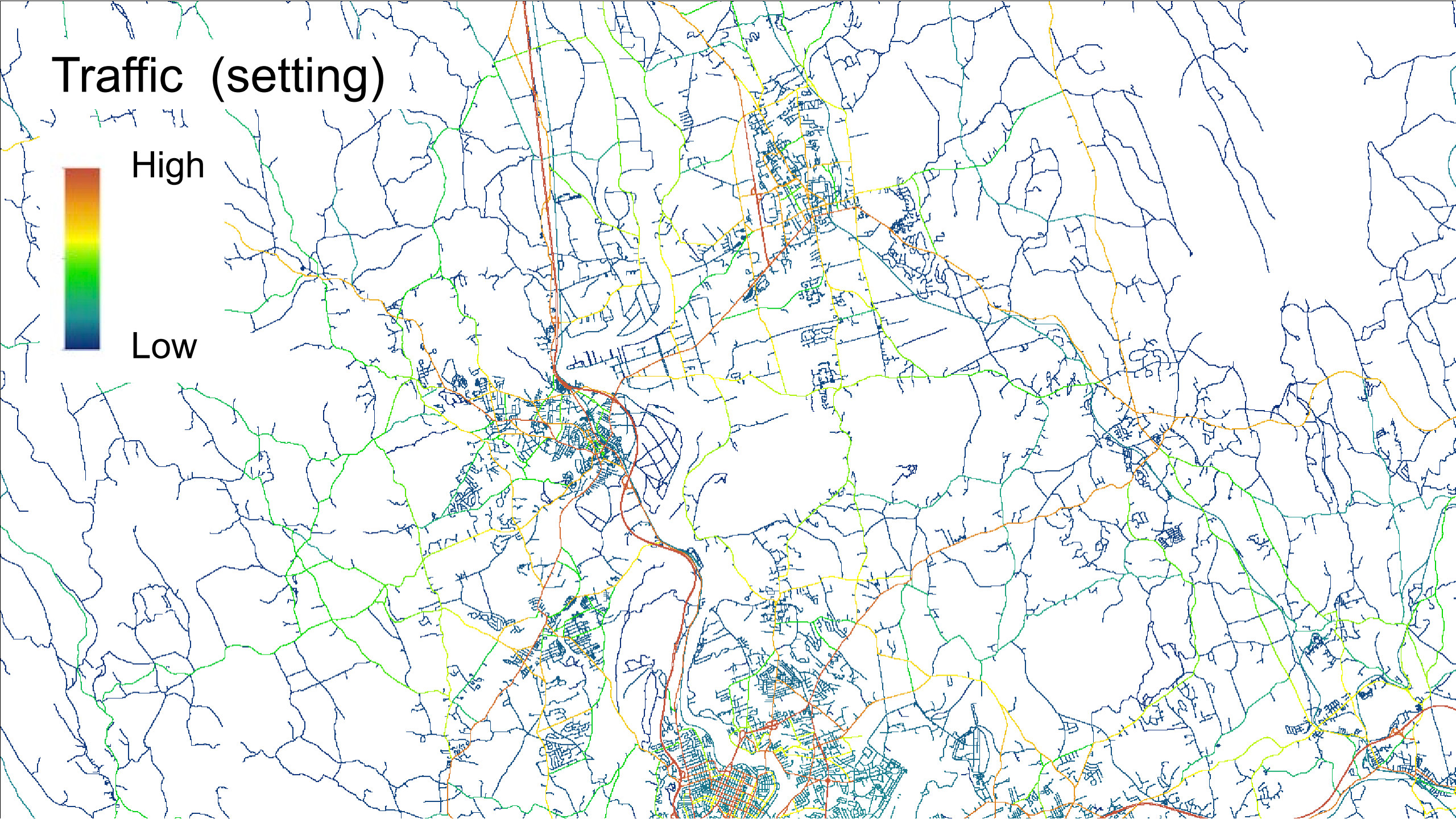
Developed
Hard development
Gibbs traffic rate
Impervious
Terrestrial barriers
Aquatic barriers

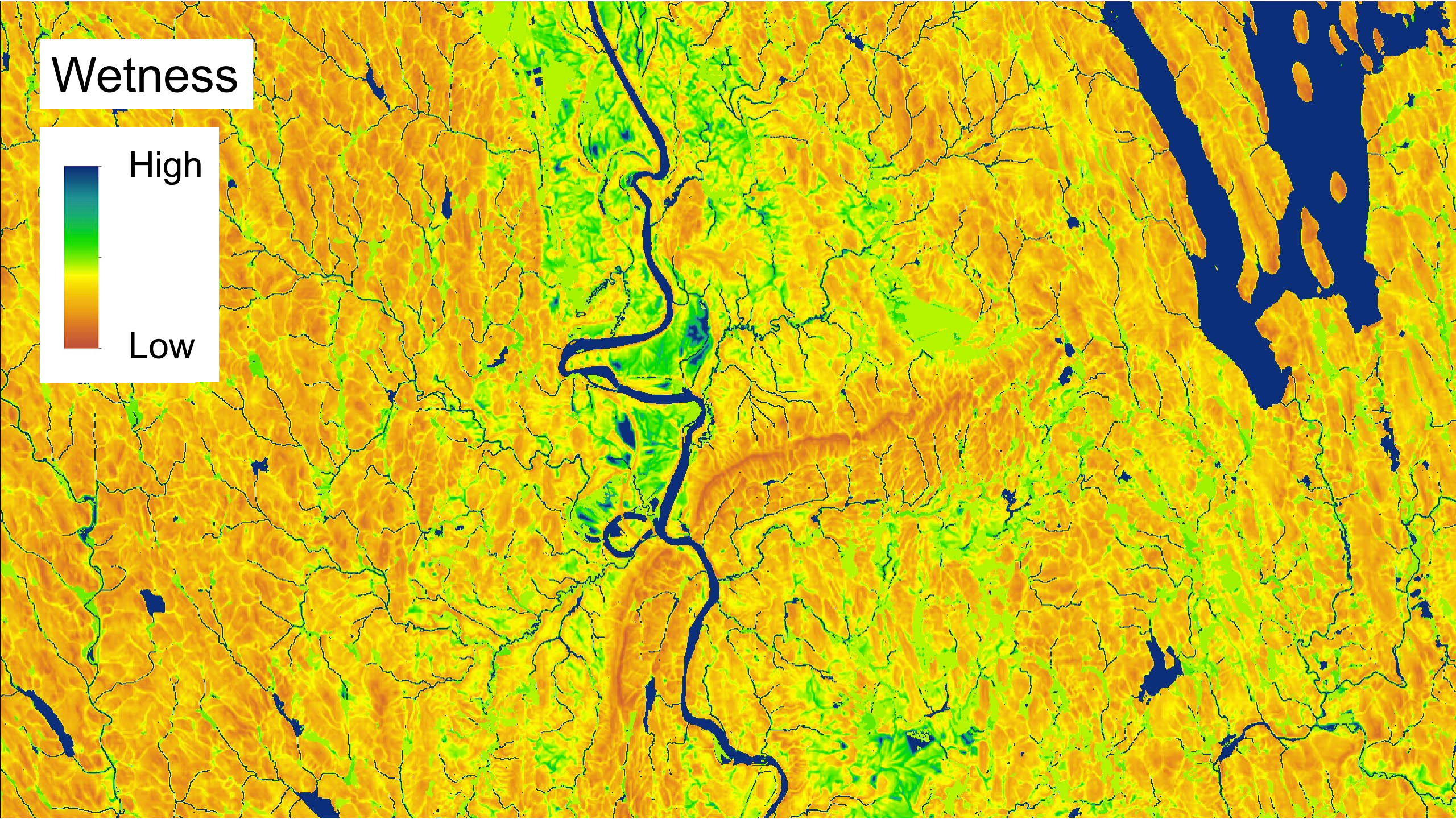


Wetness

Landcover

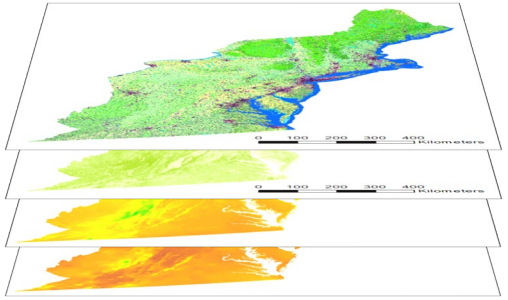



Traffic (setting)
High
Low

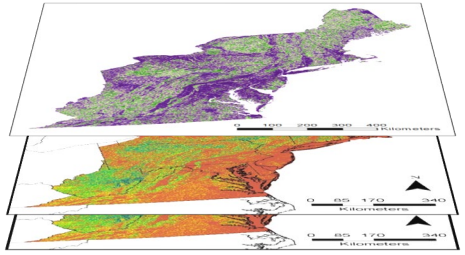

Wetness
High
Low

CAPS model

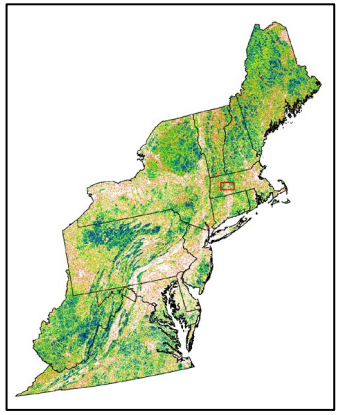
Environmental Settings (21x)



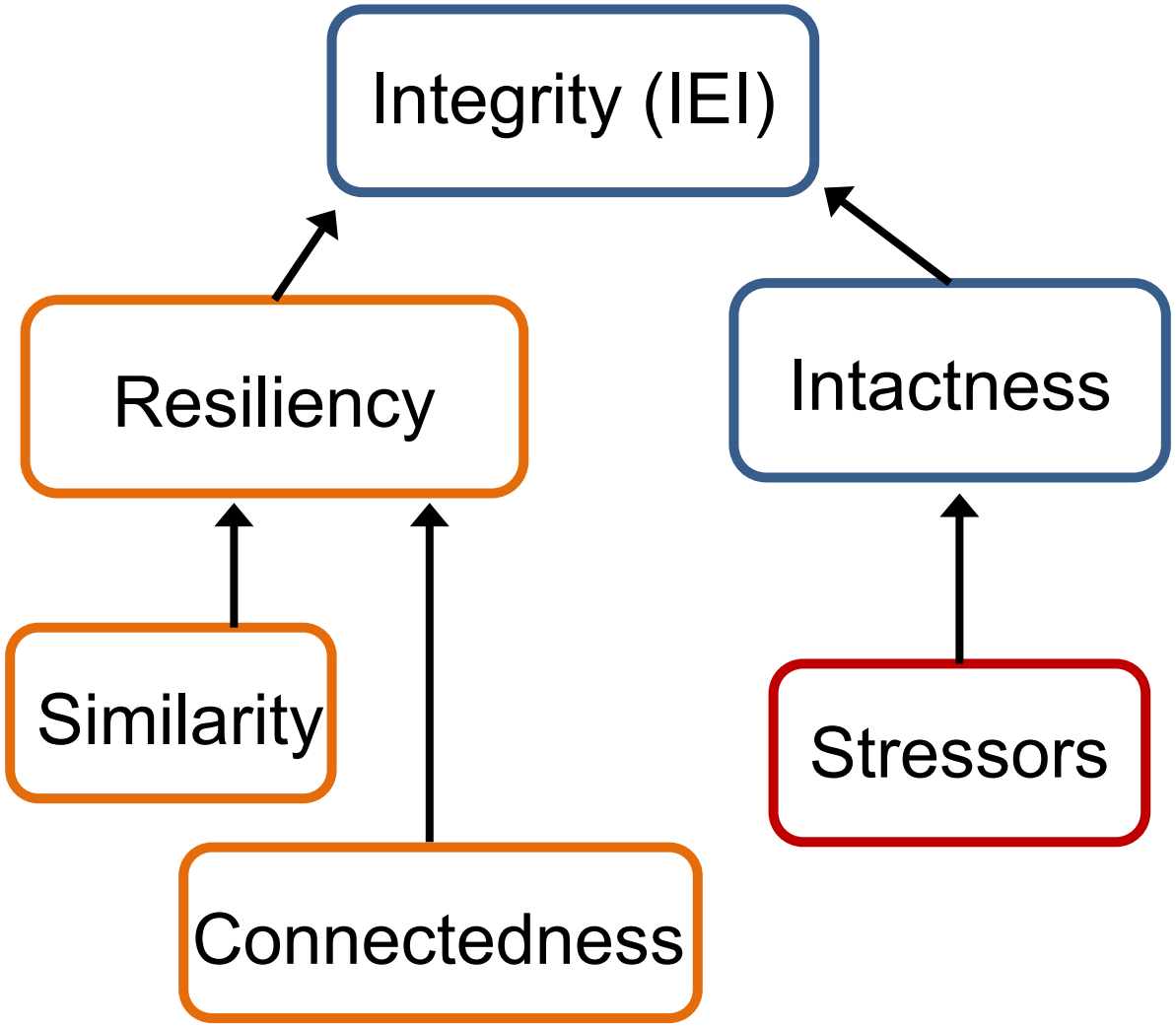
Metrics (20x)



Index of Ecological Integrity



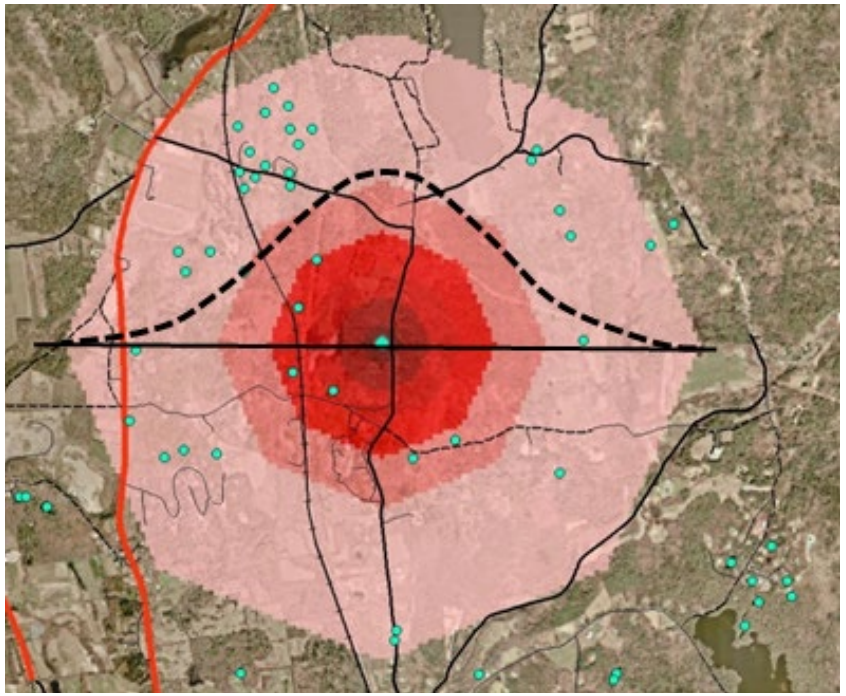
Index of Ecological Integrity



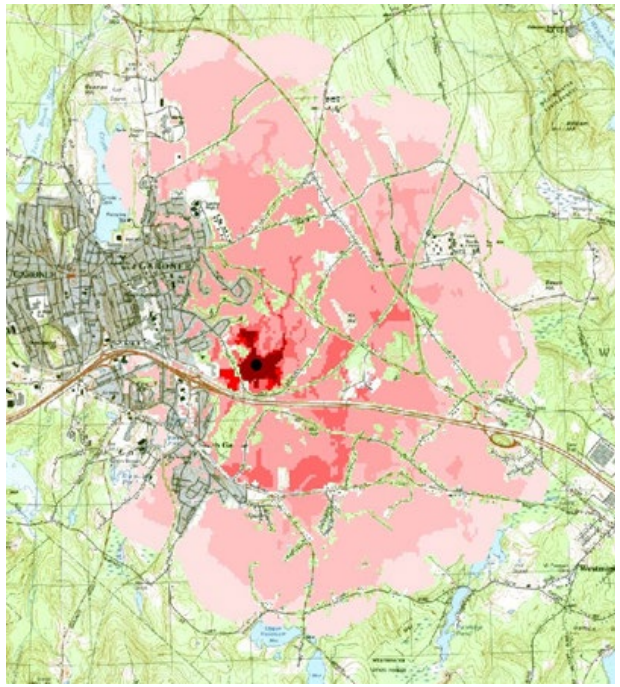
Metric group	Metric name
Development and Roads	Habitat loss
	Watershed habitat loss
	Road traffic
	Mowing & plowing
	Microclimate alterations
Pollution	Watershed road salt
	Watershed road sediment
	Watershed nutrient enrichment
Biotic Alterations	Domestic predators
	Edge predators
	Non-native invasive plants
	Non-native invasive earthworms
Climate	Climate stress
Hydrologic Alterations	Watershed imperviousness
	Dam intensity
	Sea level rise inundation
Coastal Metrics	Tidal restrictions
Resiliency	Similarity
	Connectedness
	Aquatic connectedness

Kernels

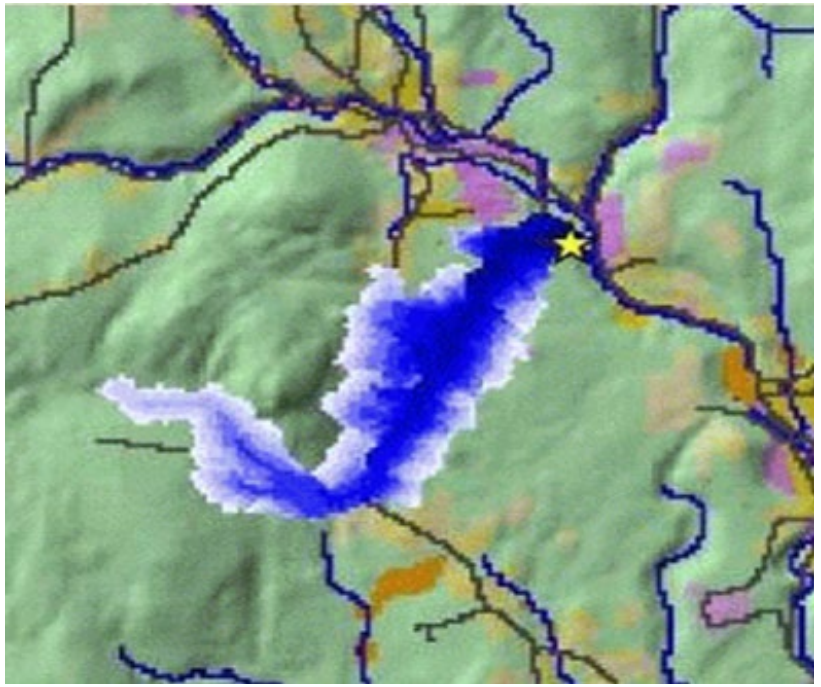
Gaussian

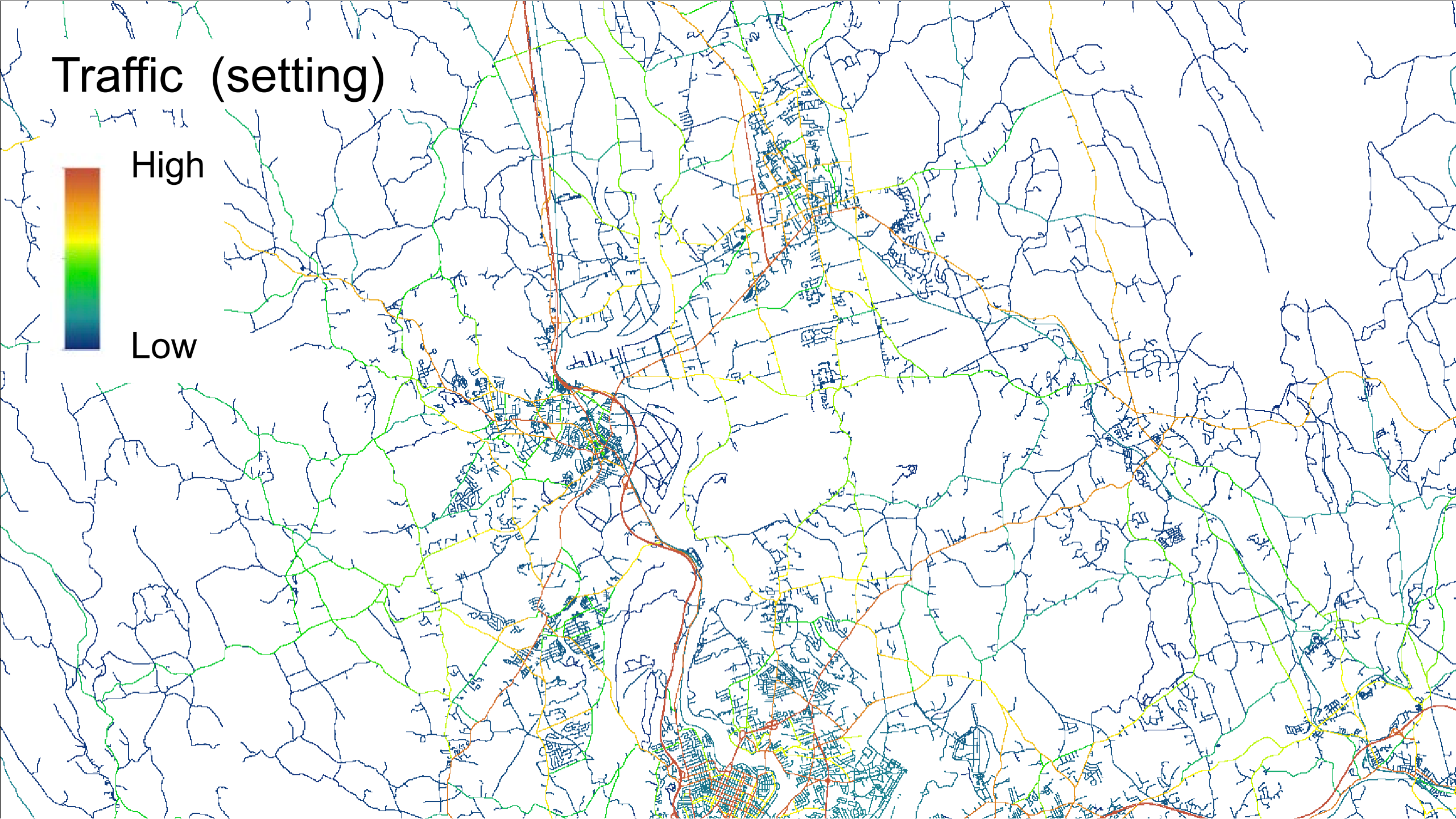


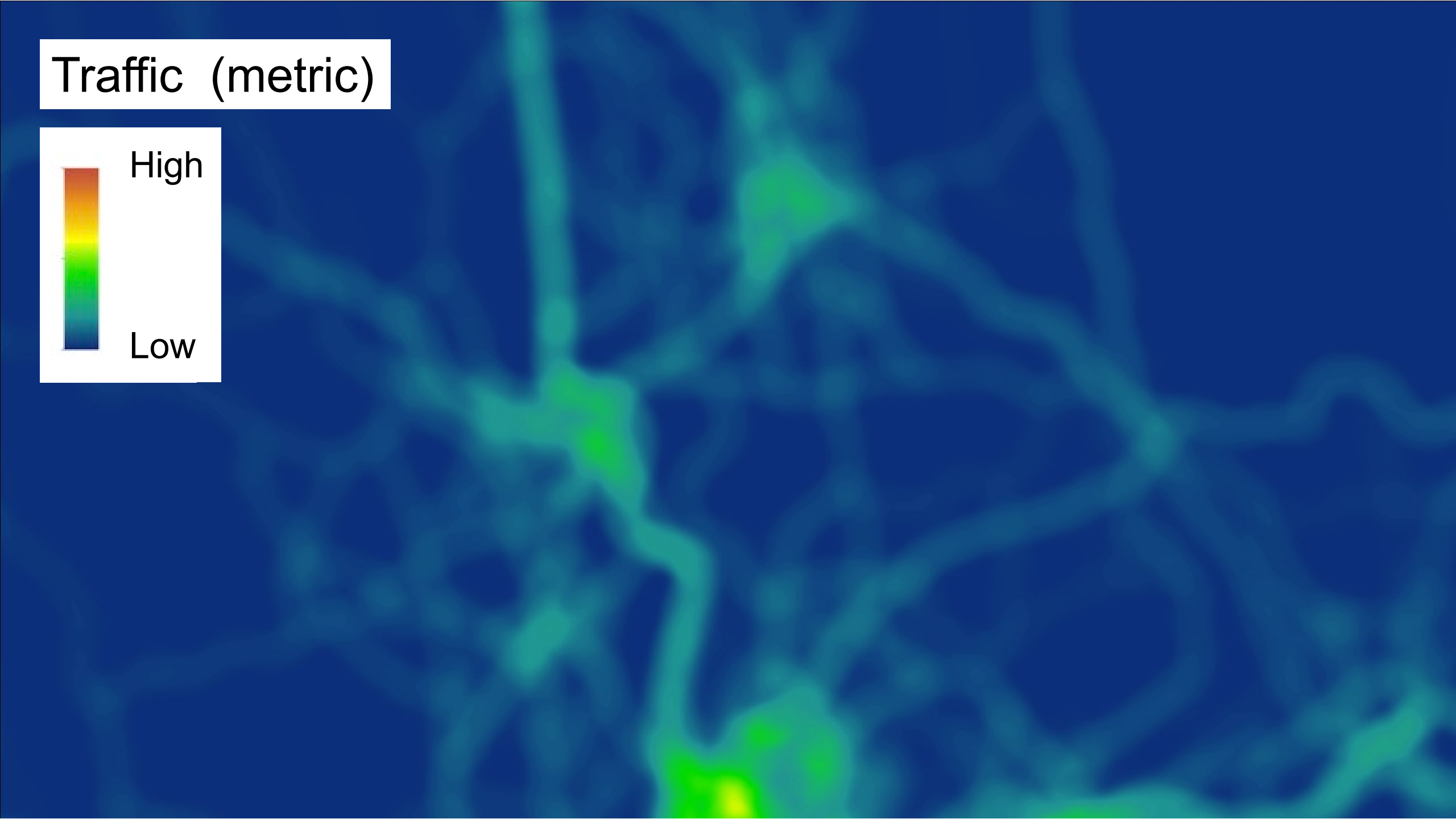
Resistant

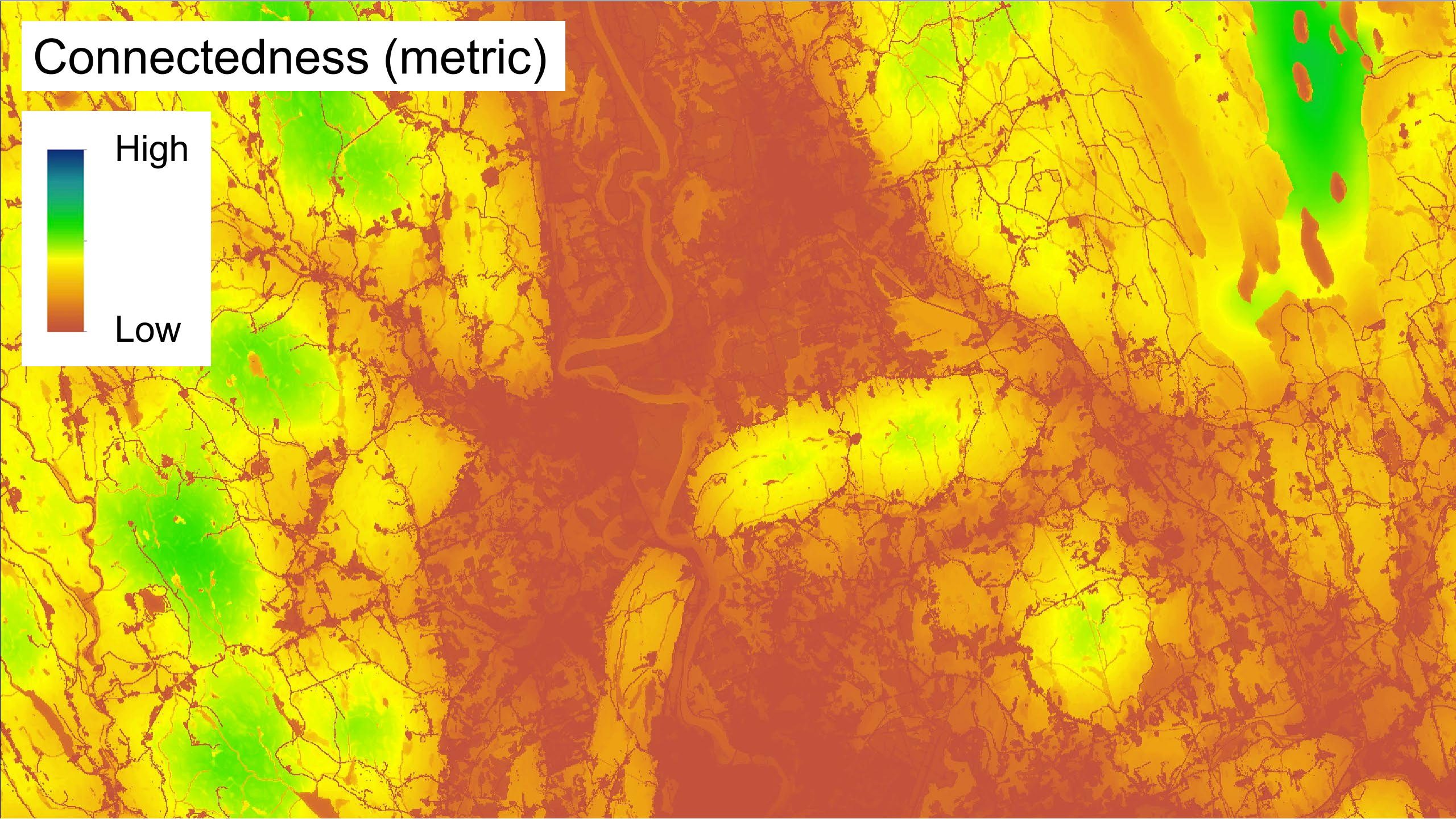


Time of flow



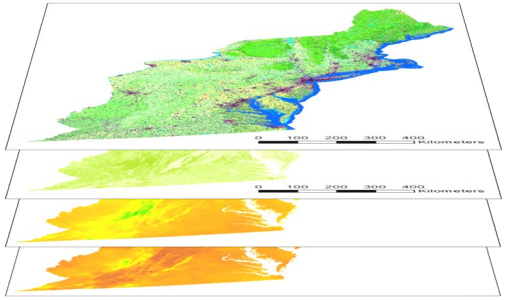

Traffic (setting)
High
Low


Traffic (metric)
High
Low

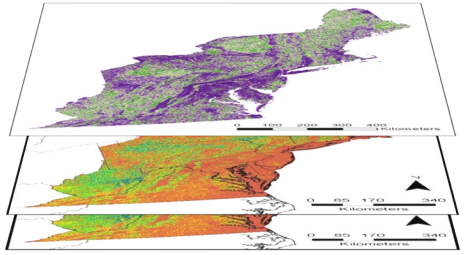

Connectedness (metric)
High
Low

CAPS model

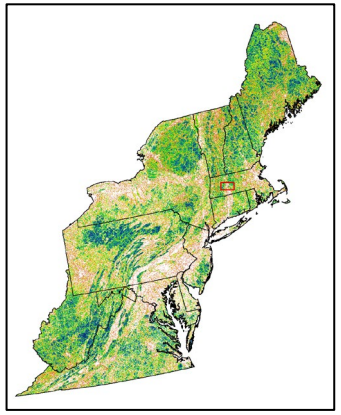
Environmental Settings (21x)



Metrics (20x)

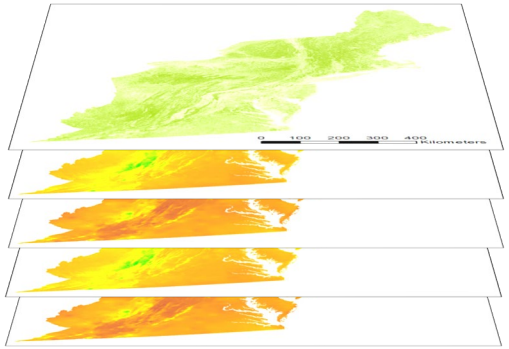


Index of Ecological Integrity

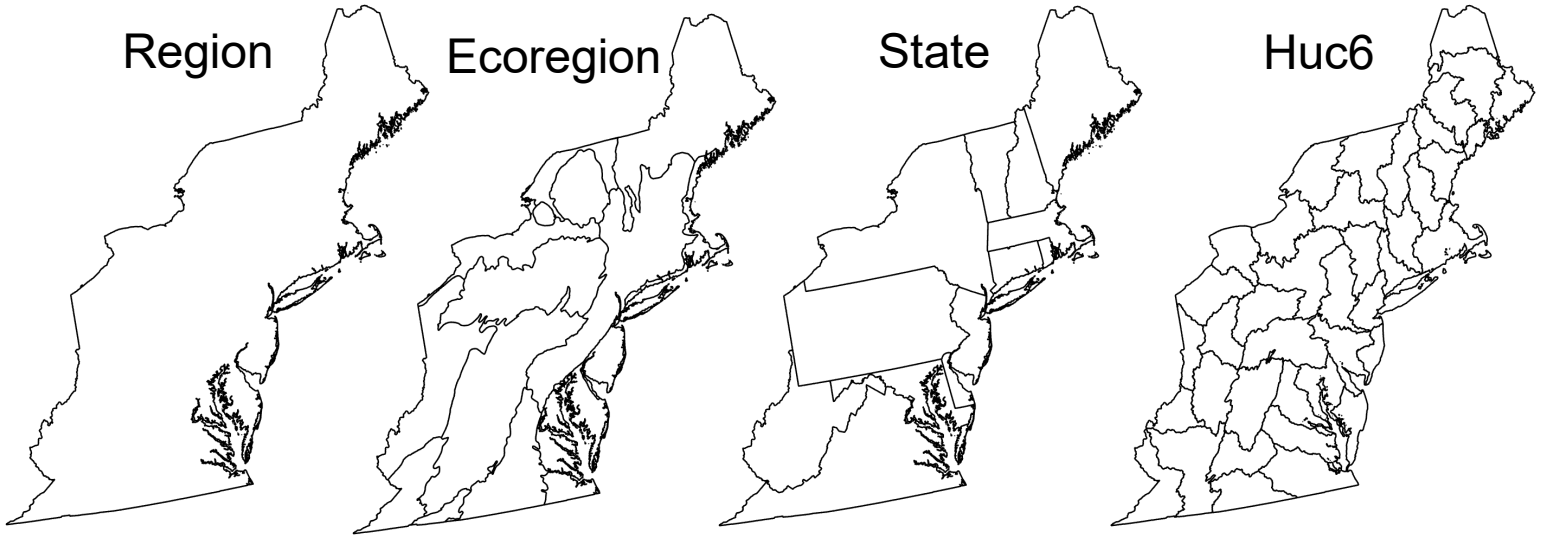


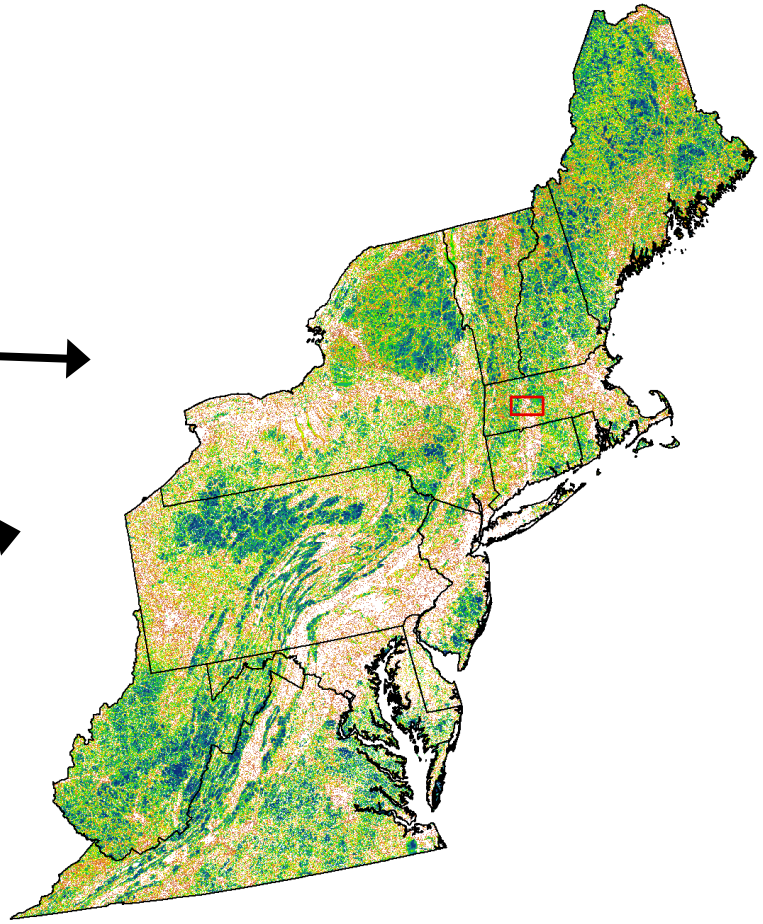
Calculating IEI

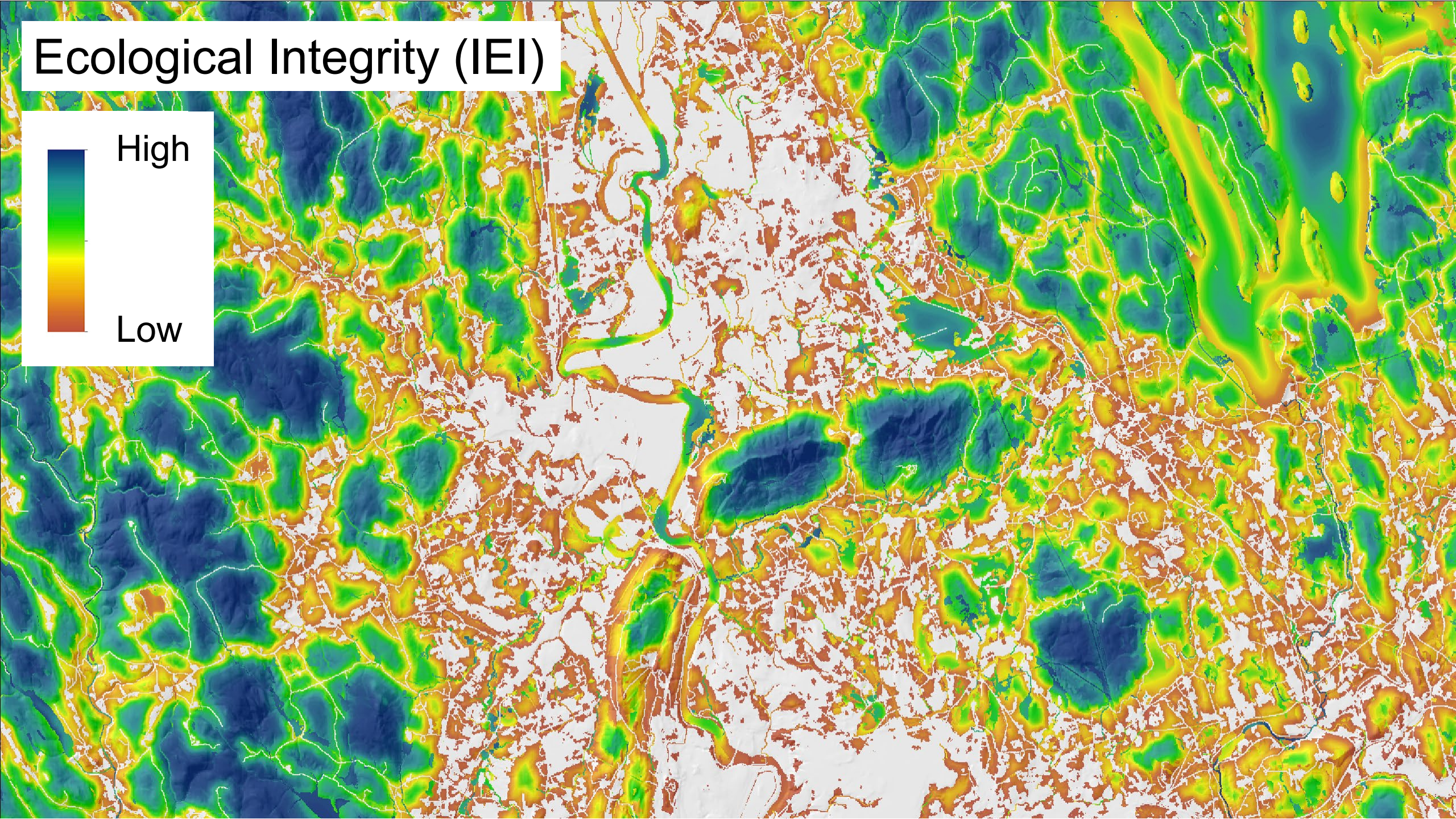
Metrics (20)



Scaling






Ecological Integrity (IEI)
High
Low

Connectivity is important

Regional connectivity is important

Especially given climate change

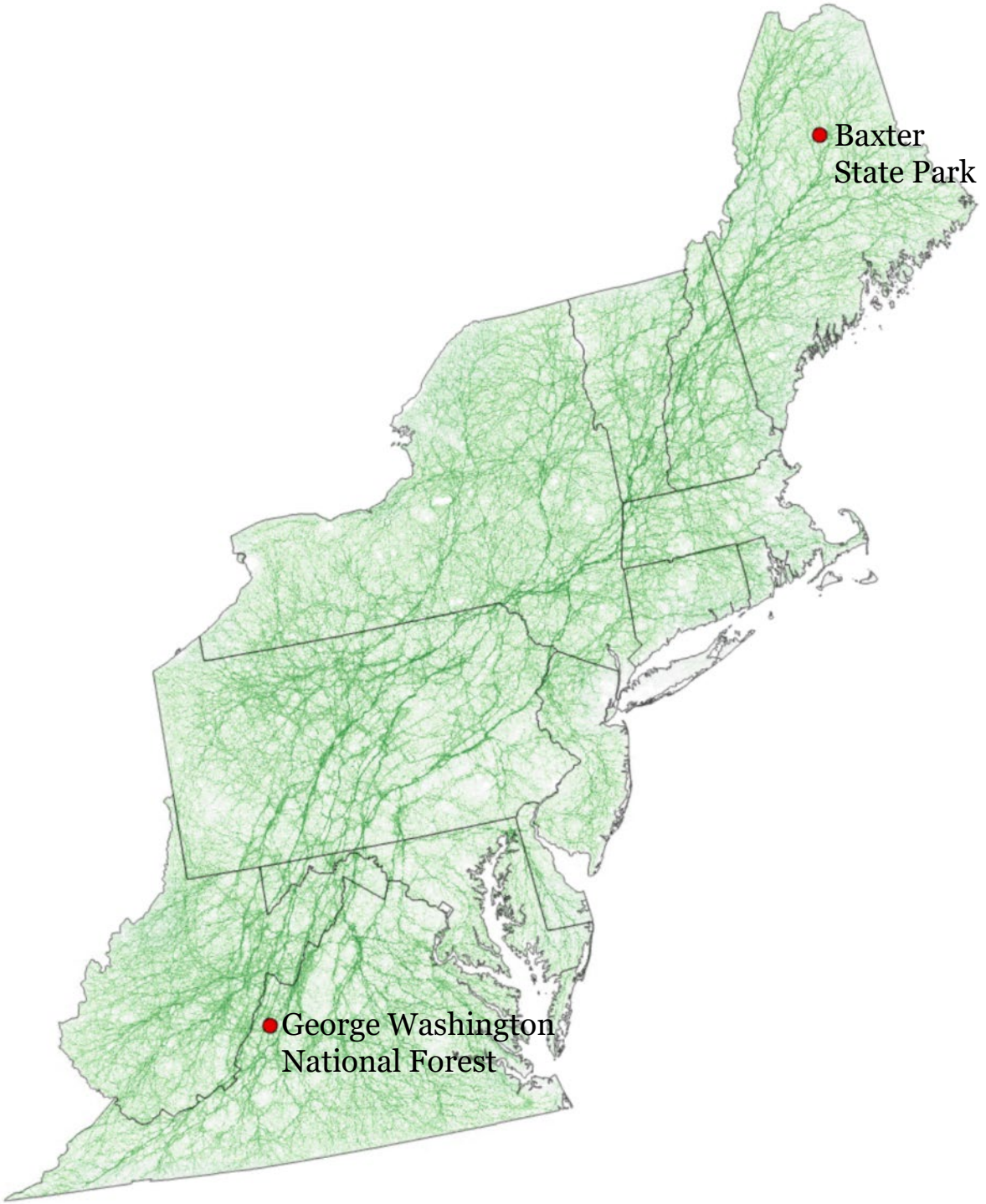
ecoConnect:
Regional ecosystem connectivity

1. Truly regional for the northeastern U.S.
2. Ecosystem-based
3. Independent of defined conservation cores
4. Multiple scales

UMass Amherst

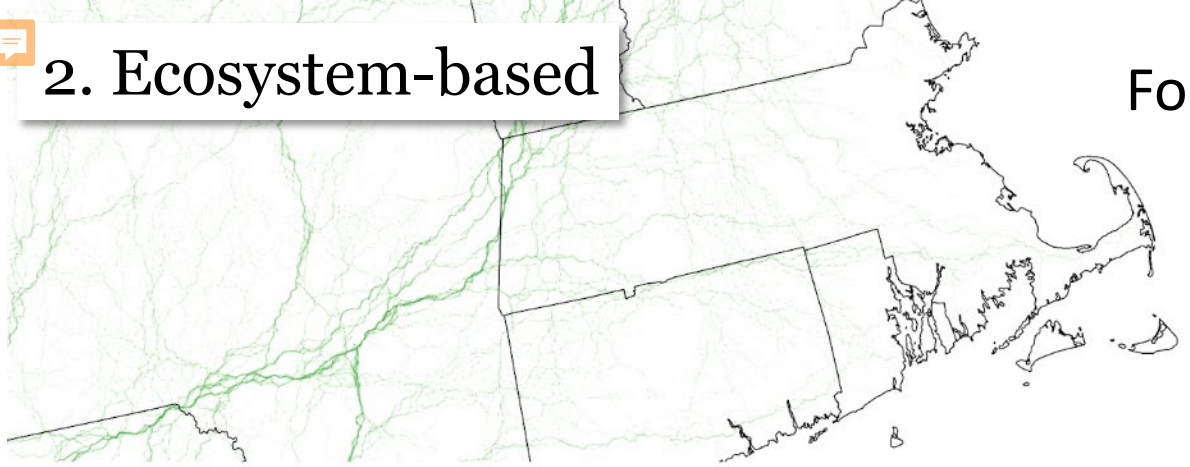
NE CASC
Northeast Climate Adaptation Science Center

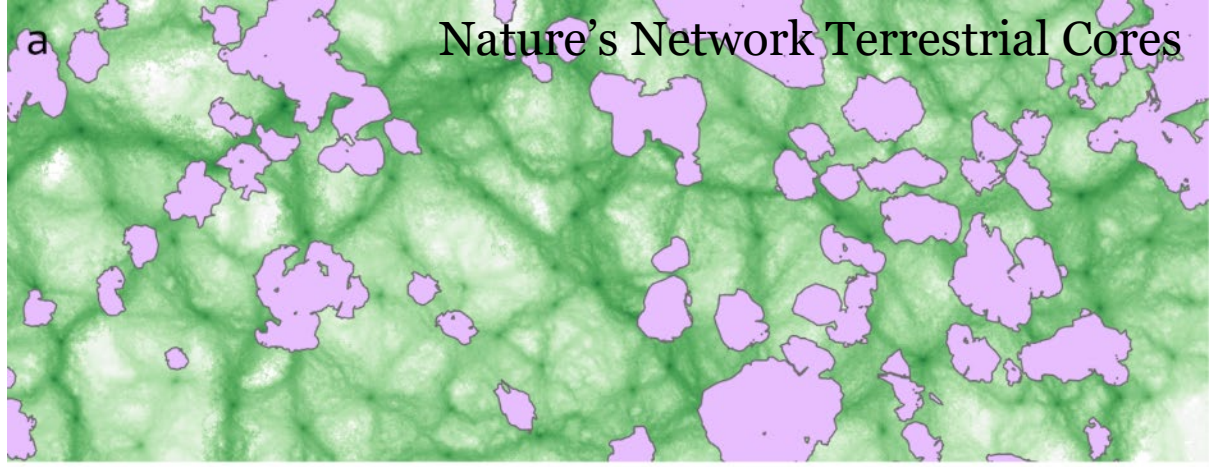
1. Truly regional



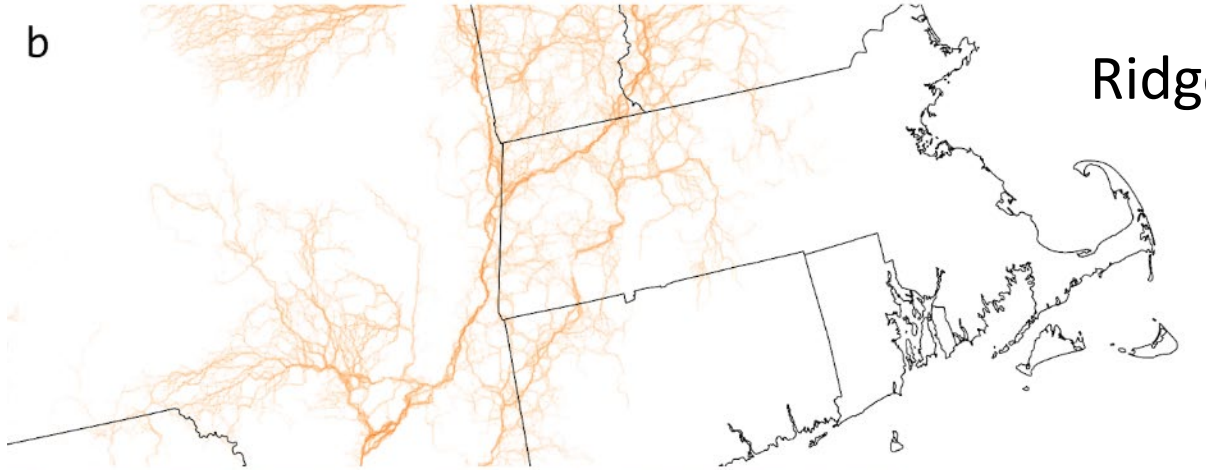
2. Ecosystem-based

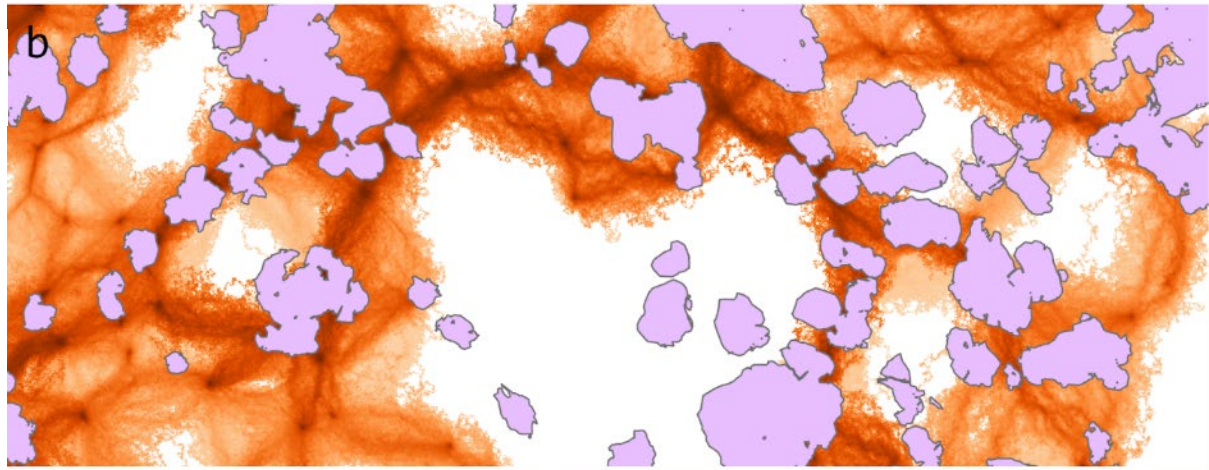
Forest



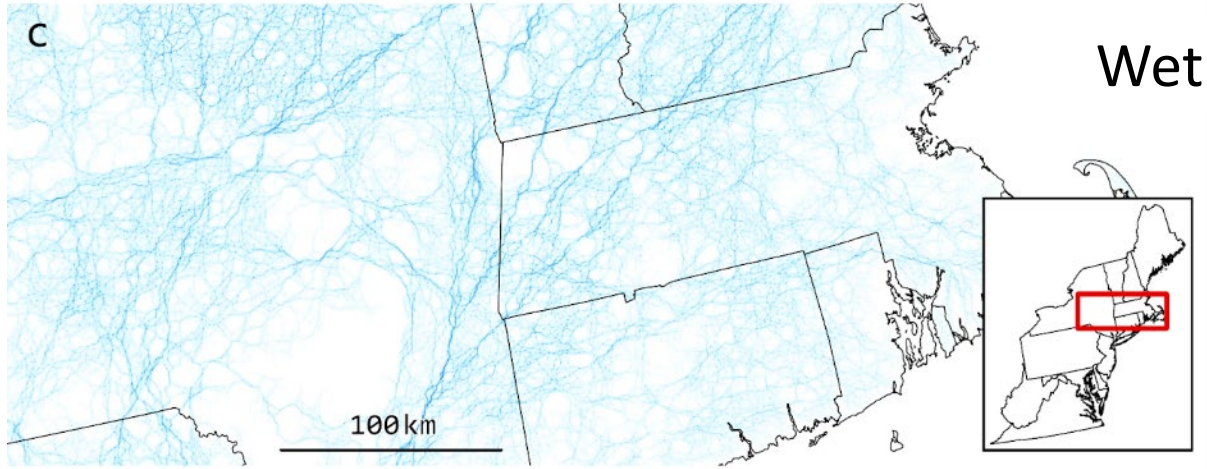


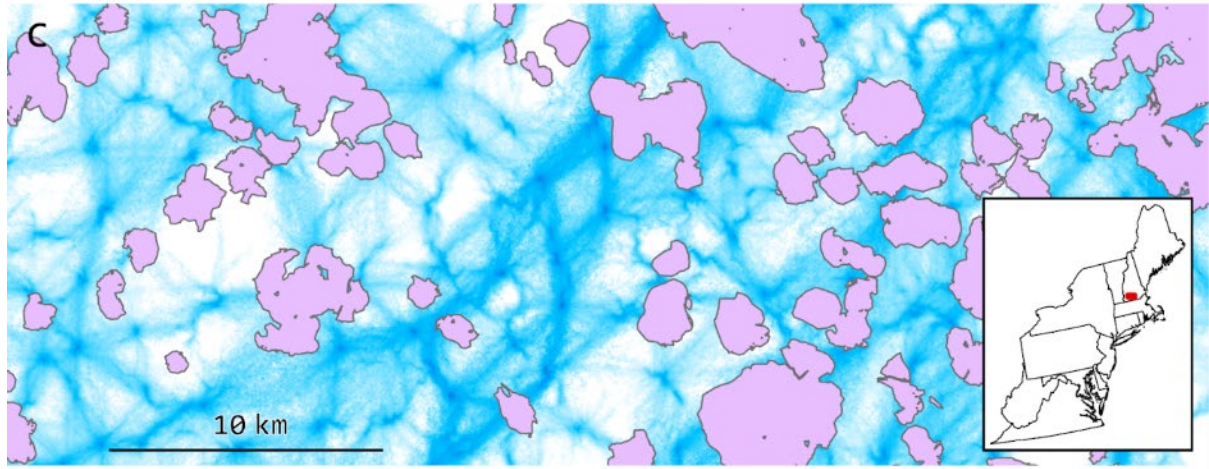
Ridgetop



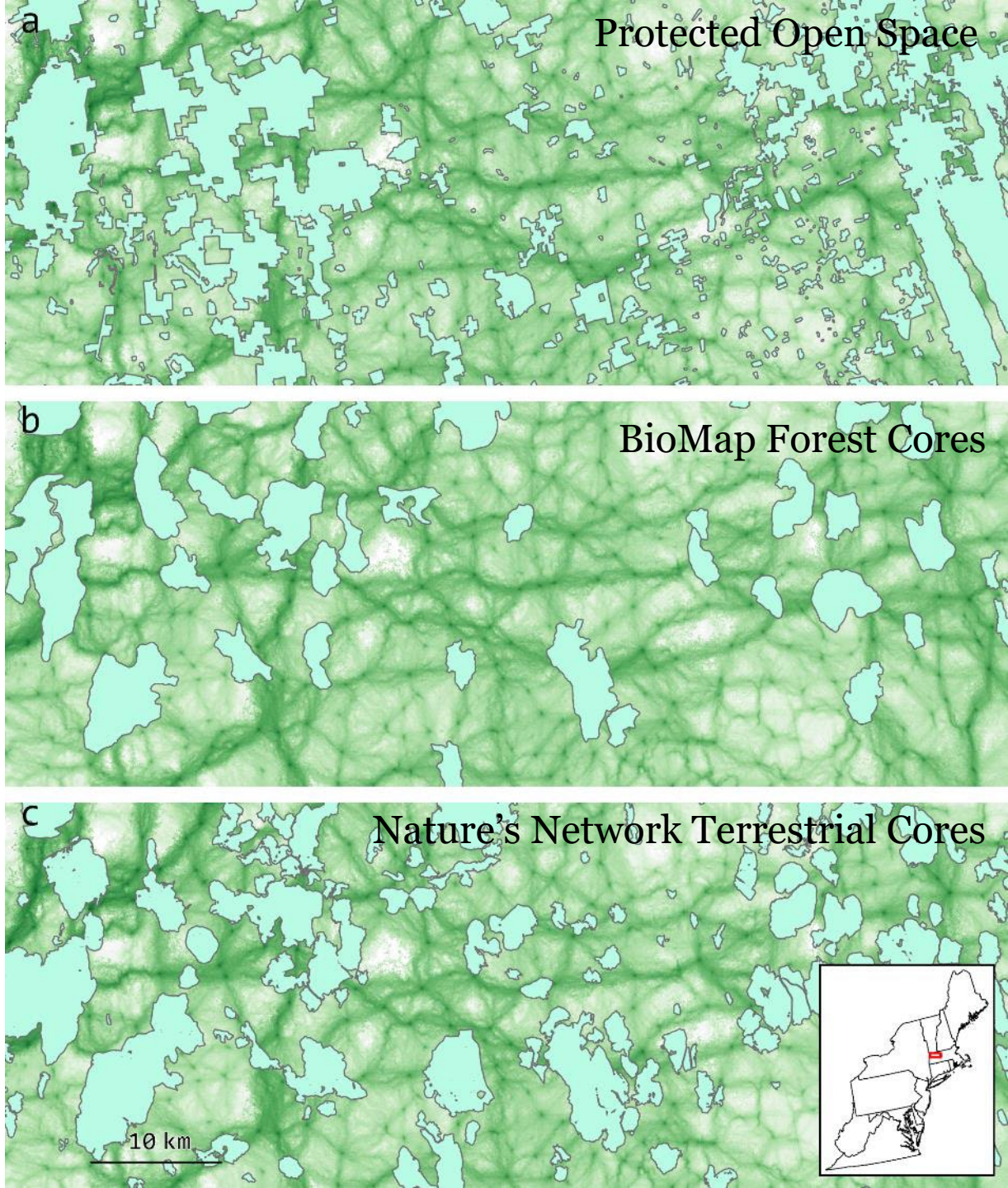


Wetland

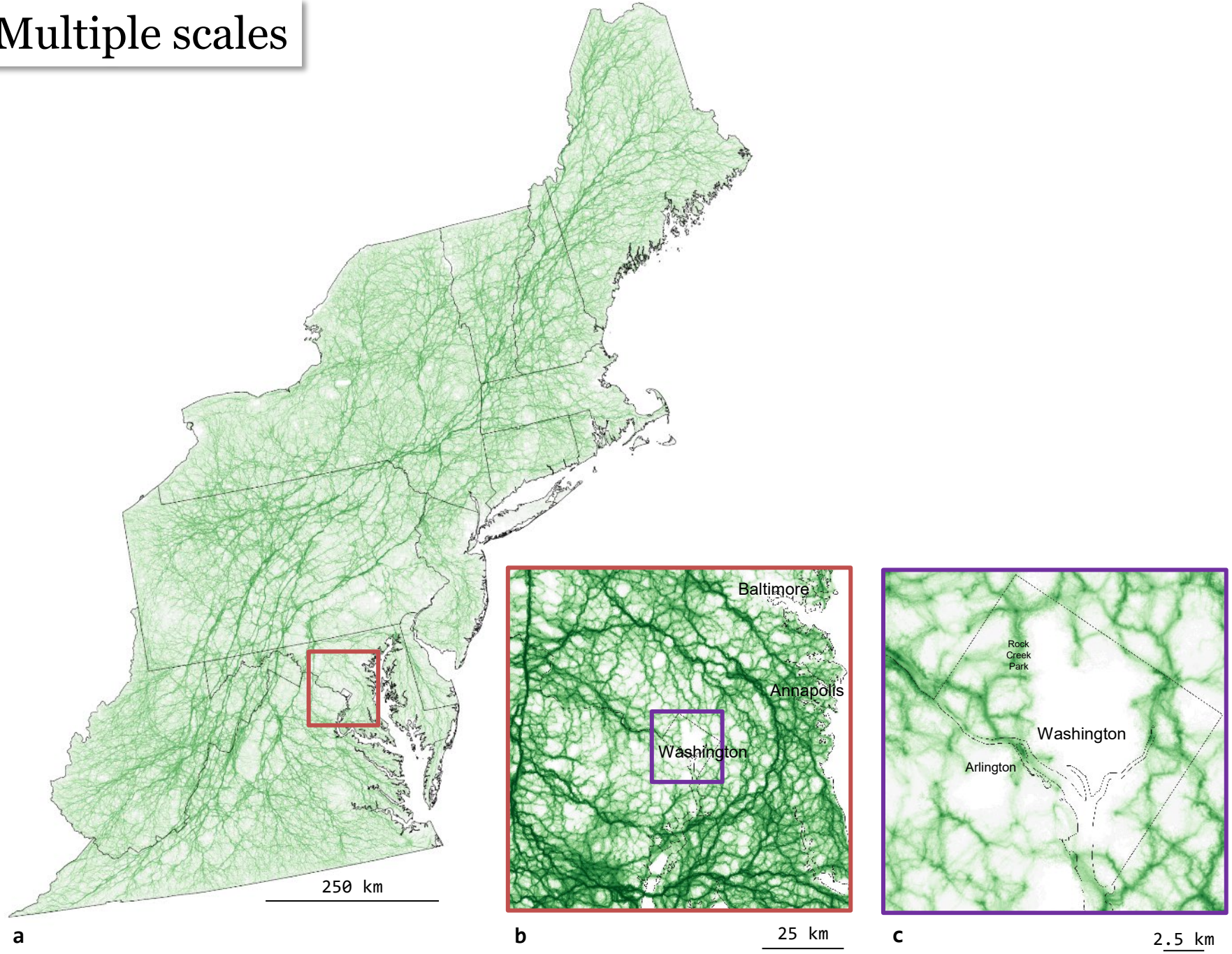


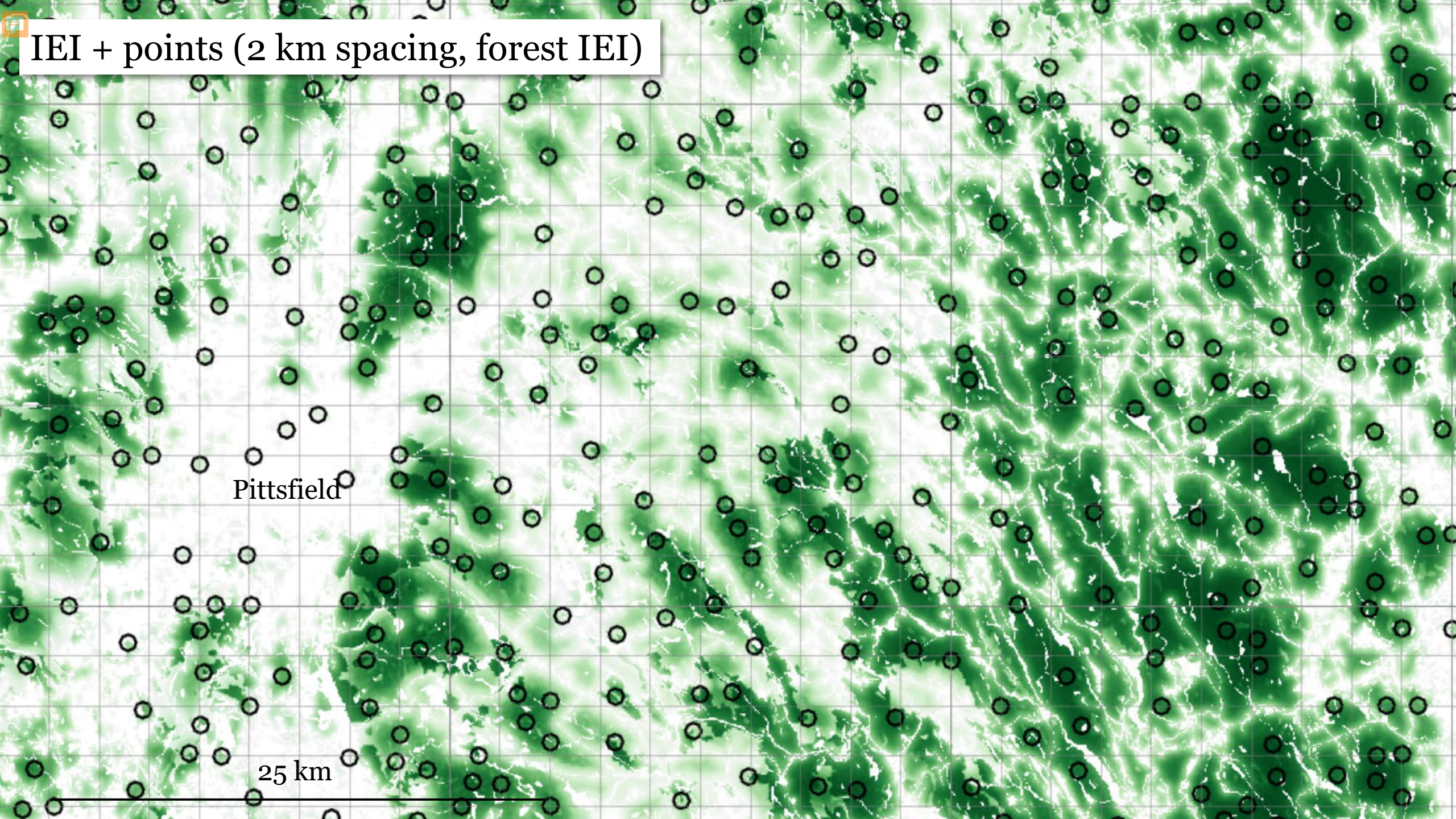


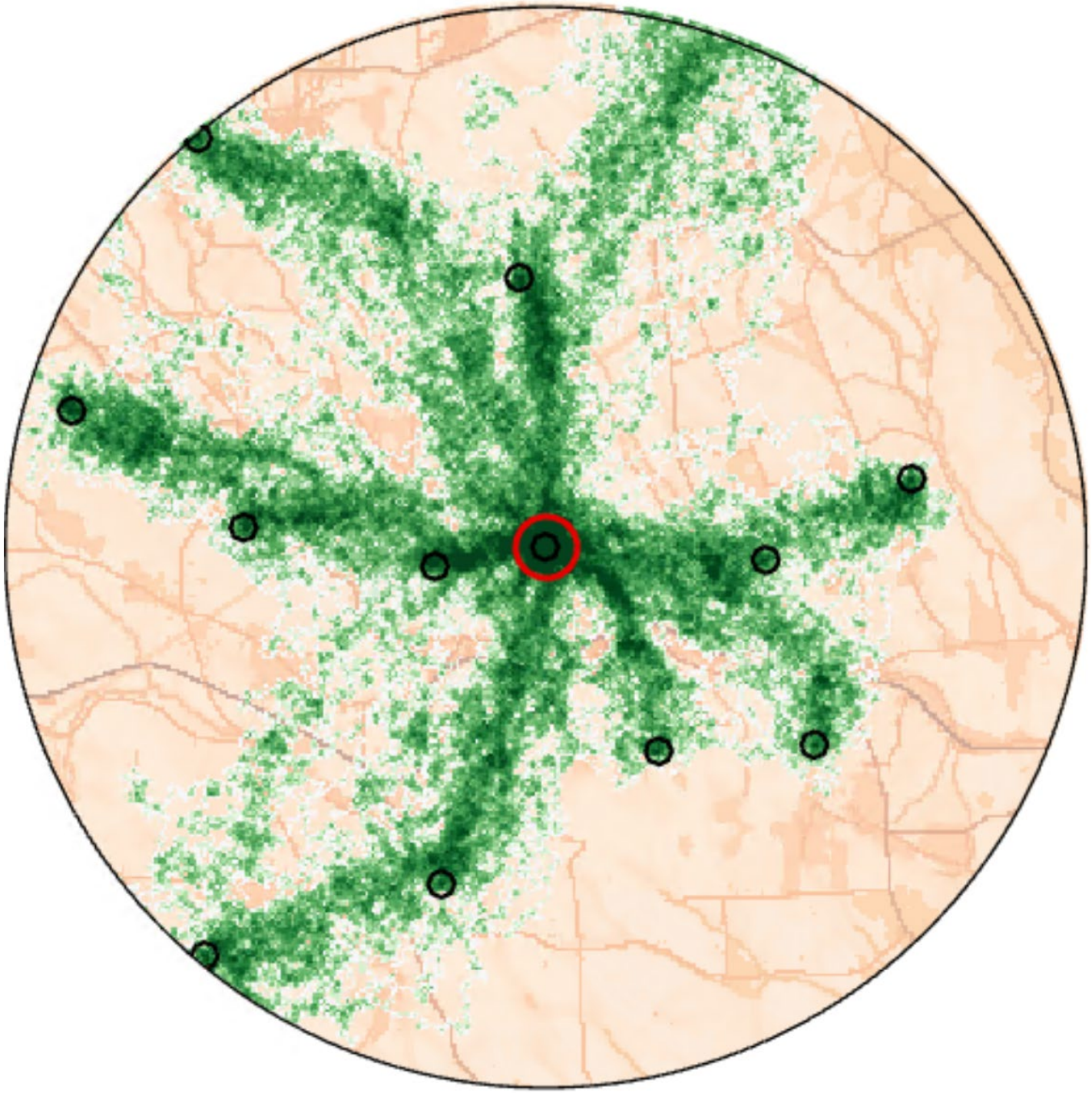
3. Core-independent



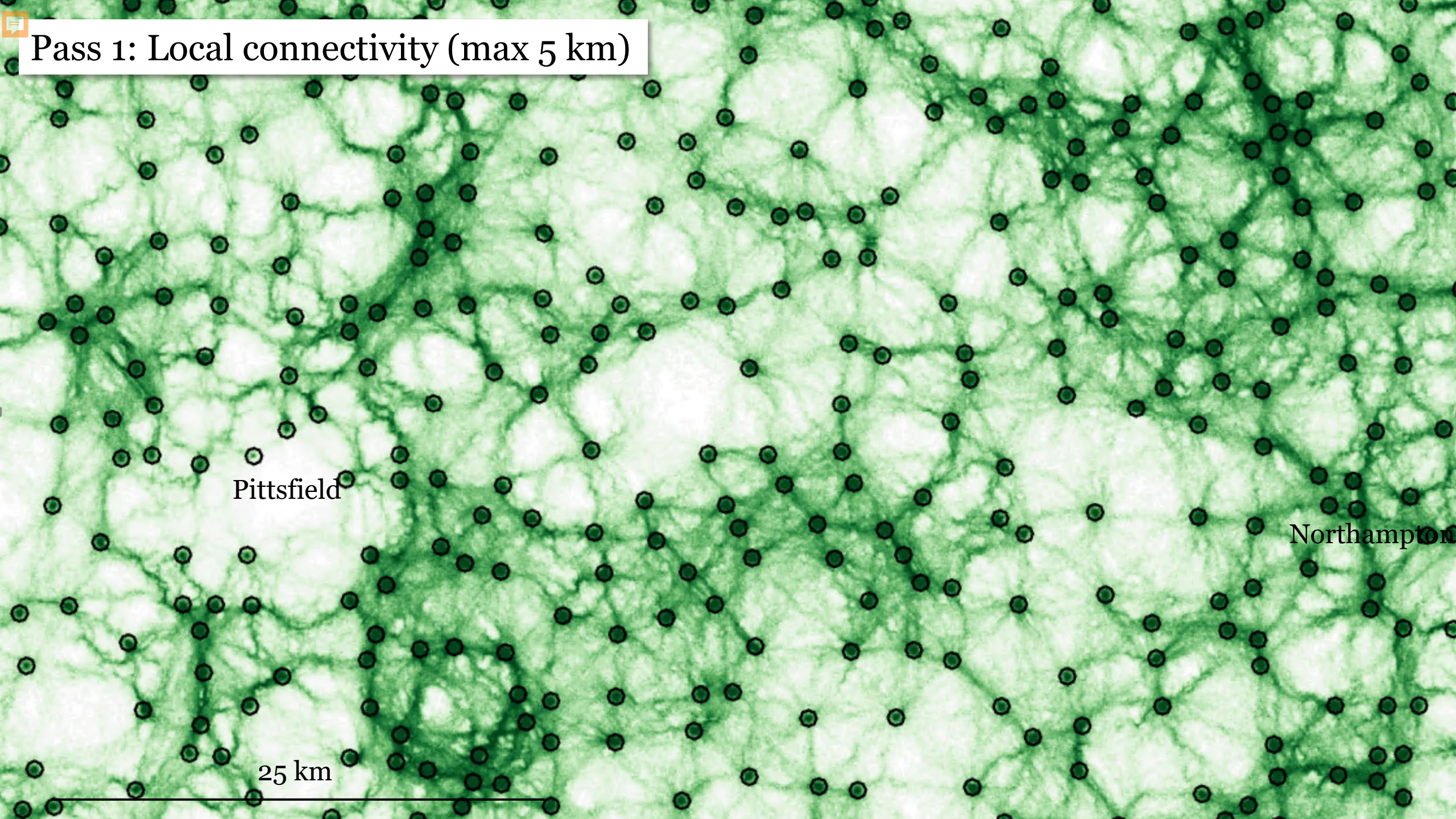
4. Multiple scales



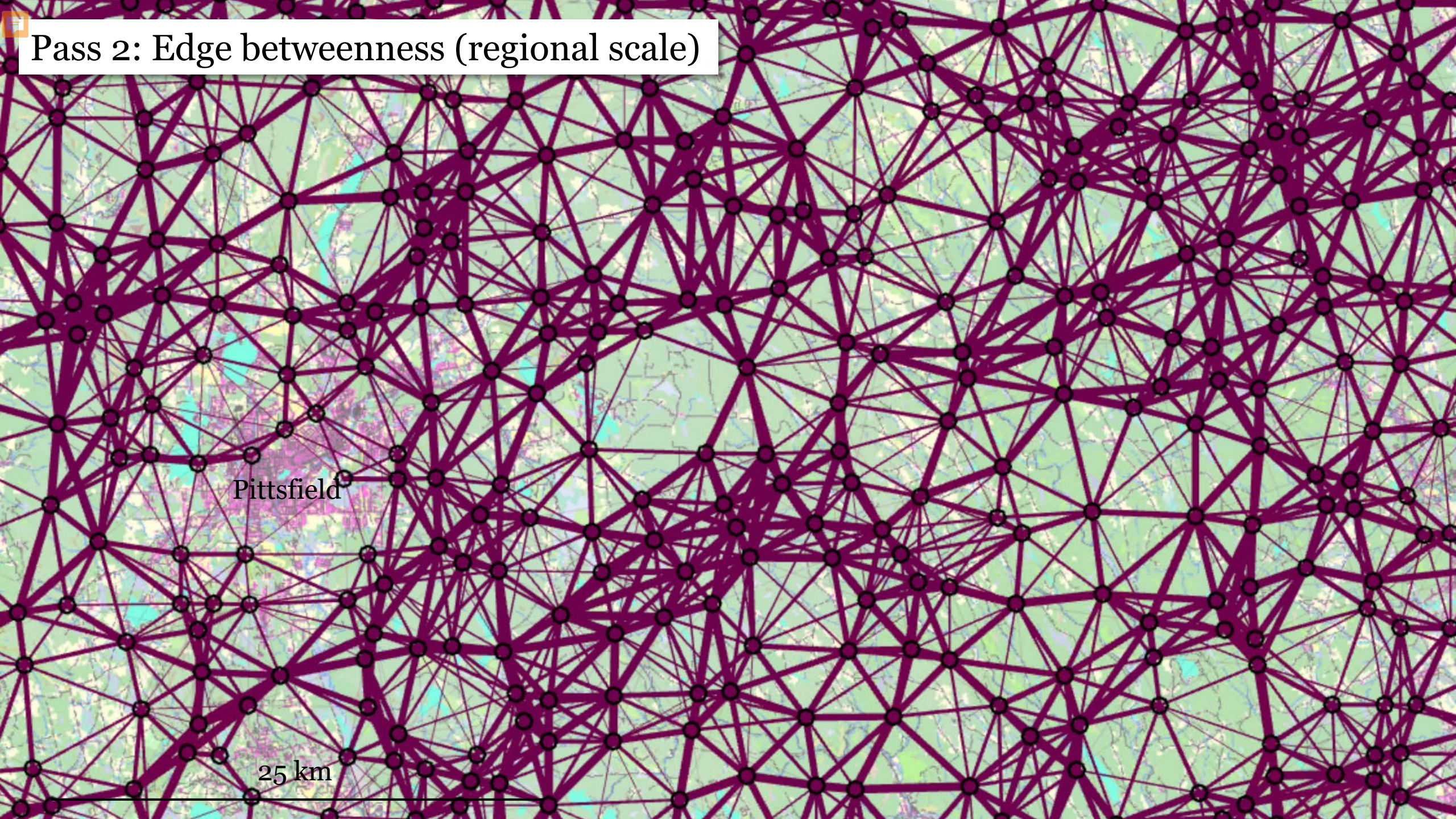

IEI + points (2 km spacing, forest IEI)
Pittsfield
25 km

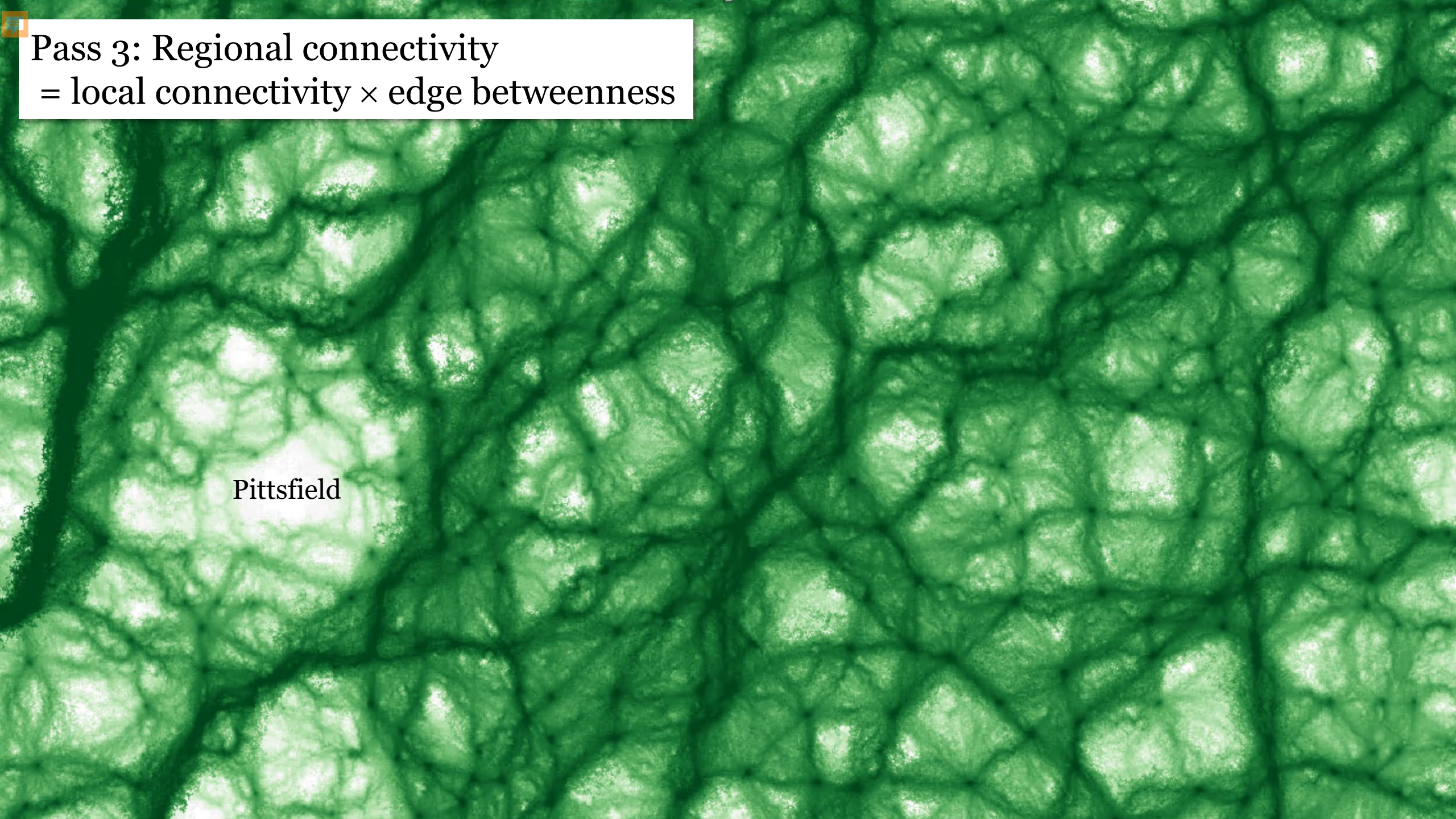


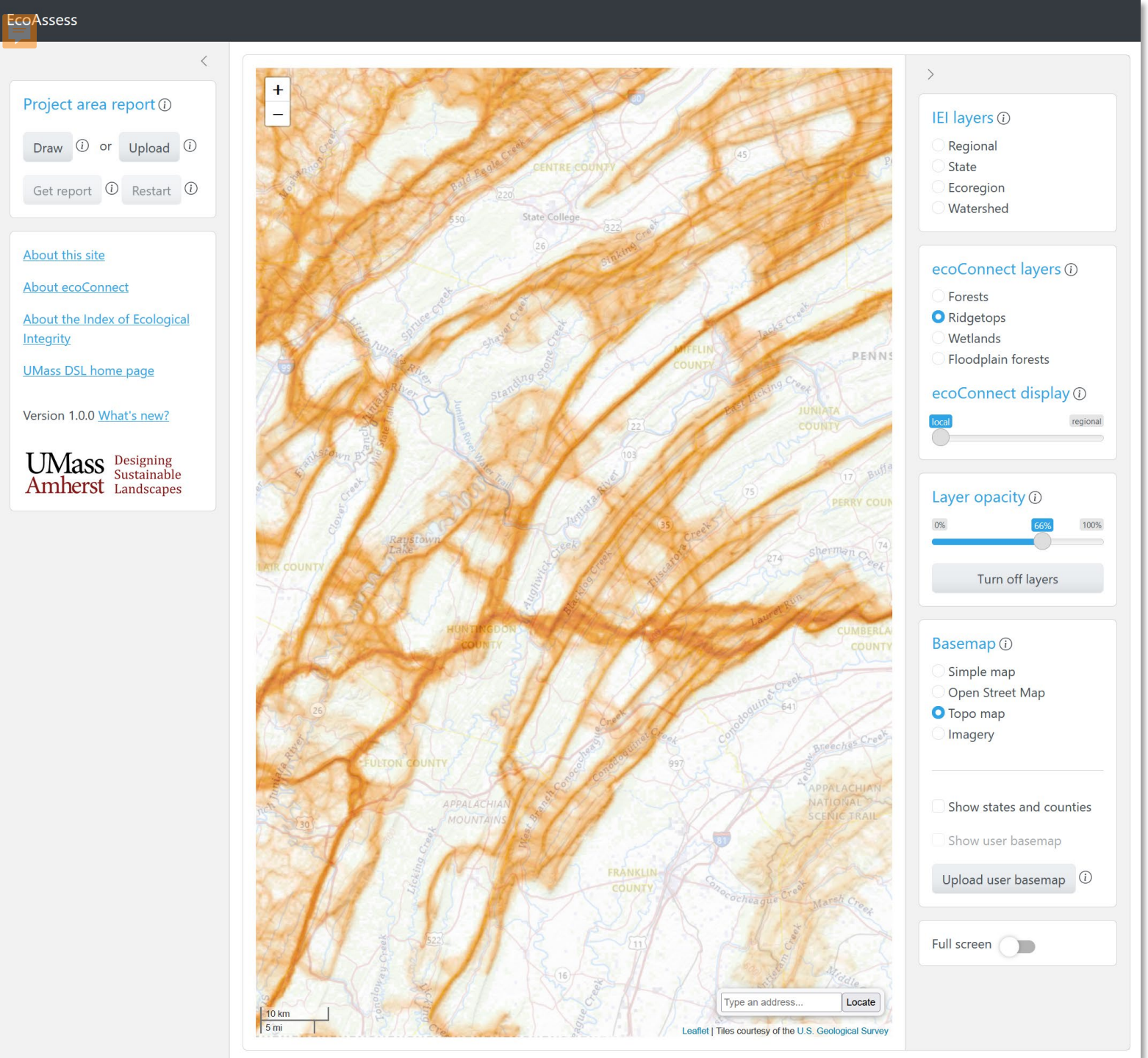
30 random low-cost paths to each neighboring point


Pass 1: Local connectivity (max 5 km)
Pittsfield
Northampton
25 km

Pass 2: Edge betweenness (regional scale)




Pass 3: Regional connectivity
= local connectivity × edge betweenness
Pittsfield



umassdsl.shinyapps.io/EcoAssess

Thanks to our beta testers!

Tim Abbott
Housatonic Valley Association
Stacy Deming
Housatonic Valley Association
Jessica Dietrich
MA TNC
Andy Finton
MA TNC
Lee Halasz
Kestrel Land Trust
Laura Marx
MA TNC
Aaron Nelson
Mount Grace Land Conservation Trust
Nick Rossi
MA DCR
Amy Trevvett
East Quabbin Land Trust
Bob Wilber
MA Division of Conservation Services

umassdsl.shinyapps.io/EcoAssess

2024 RCP Network Gathering, 14 Nov 2024
UMass DSL EcoAssess app

This page: tinyurl.com/ecoassess

UMass Amherst Designing Sustainable Landscapes

https://umassdsl.org/data/ecoConnect

EcoAssess app
umassdsl.shinyapps.io/ecoassess

Sample parcels
landeco.umass.edu/web/nov/sample_parcels_rcp.zip

Connecting to UMass Wifi

1. In the WiFi settings on your phone/computer/tablet select the UMASS network
2. Open up a web browser (IT suggests using Safari or Firefox)
3. Manually type in the address bar: http://login.wireless.umass.edu (or **scan the QR code**)
4. Either a page telling you that this site is unsecure will present itself OR the UMass wireless login page will appear
5. If it is a page telling you the website is unsecure, click “More Details” or “Advanced” at the bottom and click on the link to visit the page anyway
6. You should then be on the UMass wireless network login page
7. Enter the credentials below
   - Username: 78456876
   - Password: 58861667

EcoAssess

Project area report

Draw or Upload

Get report Restart

About this site

About ecoConnect

About the Index of Ecological Integrity

UMass DSL home page

Version 1.0.0 What's new?

UMass Amherst Designing Sustainable Landscapes

IEI layers

- Regional
- State
- Ecoregion
- Watershed

ecoConnect layers

- Forests
- Ridgetops
- Wetlands
- Floodplain forests

ecoConnect display

local — regional

Layer opacity

0% — 60% — 100%

Turn off layers

Basemap

- Simple map
- Open Street Map
- Topo map
- Imagery

Show states and counties

Show user basemap

Upload user basemap

Full screen

umassdsl.shinyapps.io/EcoAssess

Regional Conservation Partnership NETWORK

2024 RCP NETWORK Gathering

to fill out the

SESSION EVALUATION FORM