Landscape Conservation Design in the Connecticut River Watershed and Northeast Region

Scott Schwenk, Science Coordinator
## North Atlantic Landscape Conservation Cooperative

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What is Landscape Conservation Design?

- A planning process
  - a collaborative effort among partners, which includes agreeing on common priorities

- A product
  - a spatial plan for conservation decisions in an adaptive framework

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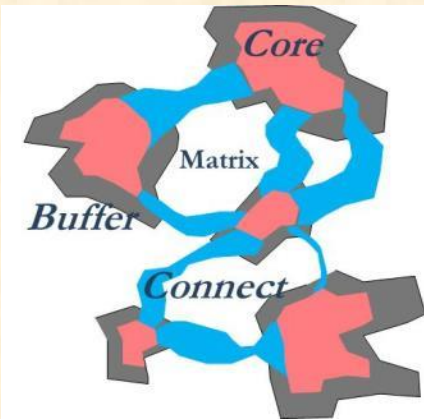
Why landscape-level conservation?

An **interconnected, resilient network** of lands and waterways has many benefits for society:

- Fish and wildlife populations
- Clean water
- Flood and erosion control
- Storm protection
- Forest and farm products
- Recreation and tourism
- Quality of life
- Employment

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Complementing and Integrating Past or Existing Efforts

Examples
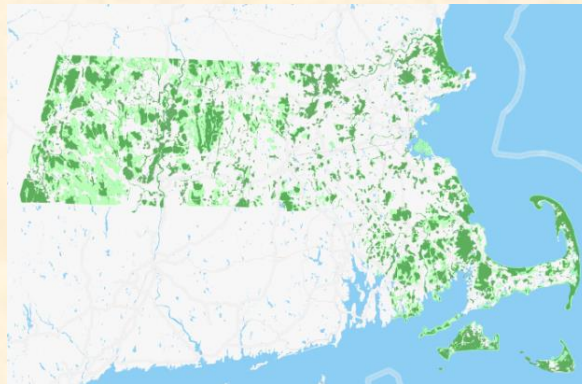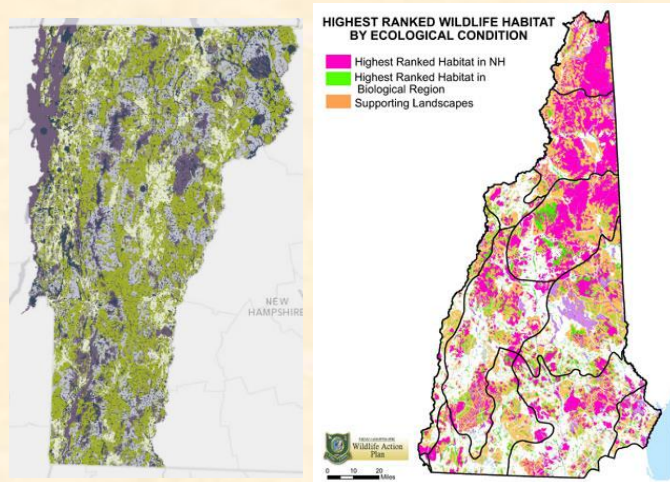
Complement or augment, <u>not</u> replace, existing planning and local knowledge

Why the Connecticut River Watershed?

FWS and LCC Objectives for Landscape Conservation Design Pilot

1. Collaboratively prioritize places, strategies, and actions to conserve ecosystems and the fish, wildlife, and plants they support

2. Establish a process for conducting landscape conservation design that can be applied and adopted elsewhere

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What are we designing conservation for?
Inclusive view of biodiversity and natural resources

- Species
  - Species that represent the needs of others (surrogate species)
  - Priority species not well-represented (e.g., rare)

- Ecosystems [habitat types]
  - Including the functions they perform and services they produce
    - Ecosystem integrity
    - Resiliency ("conserving the stage")

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Multi-species Multi-ecosystem
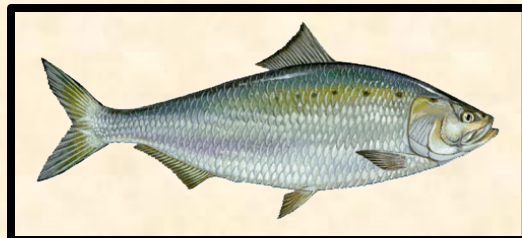
Proposed Starting Point:
Conservation Goals for the Watershed

1. The Connecticut River watershed sustains a diverse suite of intact, connected, and resilient ecosystems that provide important ecological functions that benefit society

2. The Connecticut River watershed sustains healthy and diverse populations of fish, wildlife, and plant species

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Key Questions to be answered by Landscape Conservation Design

- Where should we invest in land protection, and how much?

- How should we manage protected lands?

- Where should we invest in ecological restoration?

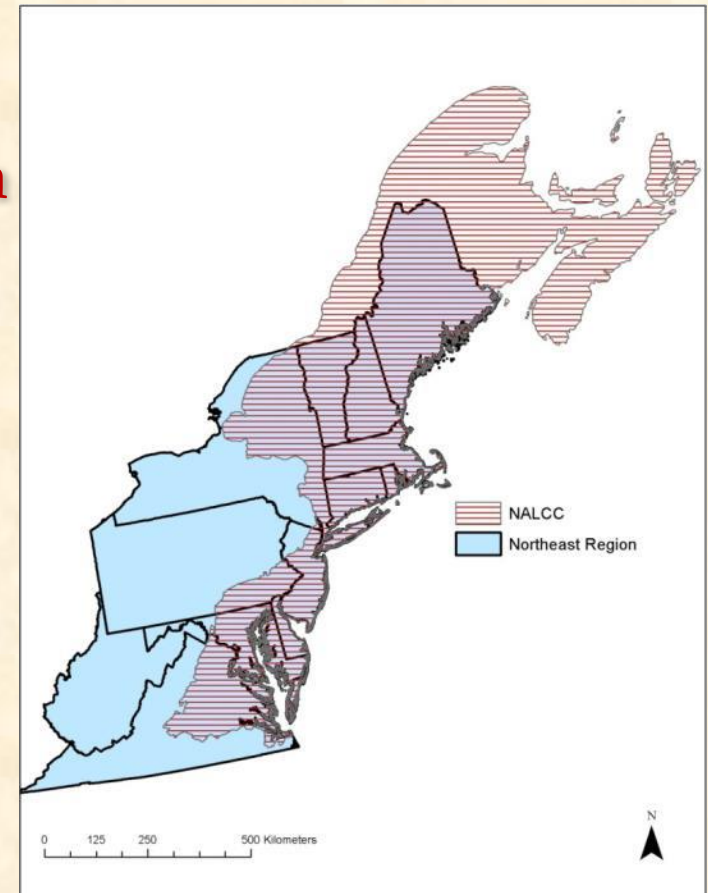- Where and how should we influence local land use / open space planning?

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Designing Sustainable Landscapes in the Northeast
Kevin McGarigal, UMass Amherst

Project website:

www.umass.edu/landeco/research /dsl/dsl.html

Phase 1: pilot areas (2011-2012)
Phase 2: full Northeast (2012-2014)
  + Conn. River pilot watershed work

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The **purpose** of the Designing Sustainable Landscapes (DSL) project is to:

- Assess the capability of current and potential future landscapes to provide intact <u>ecosystems</u> and suitable habitat for a suite of <u>representative species</u>, and provide guidance for strategic habitat conservation

Landscape
- **C**hange
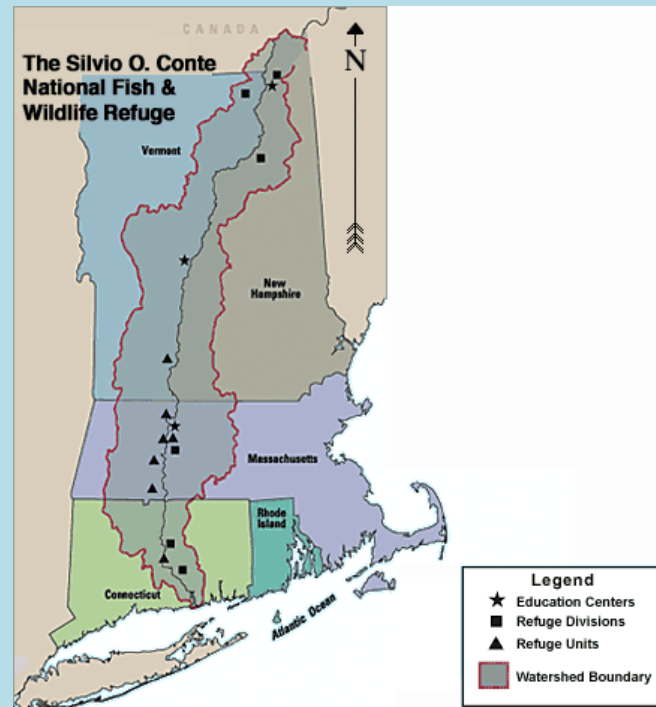- **A**ssessment
- **D**esign

Model

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Design scales

Large watershed or subregion (Conn. River)

Species

Ecosystems (services, functions)

The Silvio O. Conte National Fish & Wildlife Refuge

Canada
Vermont
New Hampshire
Massachusetts
Rhode Island
Connecticut
Atlantic Ocean
N

Legend
★ Education Centers
■ Refuge Divisions
▲ Refuge Units
Watershed Boundary

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Design scales

Large watershed

Today

Species

Ecosystems
(services, functions)

Future

Species

Ecosystems
(services, functions)

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Design scales

Large watershed

Today

Species

Ecosystems
(services, functions)

Future

Species

Ecosystems
(services, functions)

Urban growth
Climate change
Forest change

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Design scales

Northeast region

Large watershed

Today

Species

Ecosystems
(services, functions)

Future

Species

Ecosystems
(services, functions)

HUC4 - colored and labeled
HUC8 - gray outline

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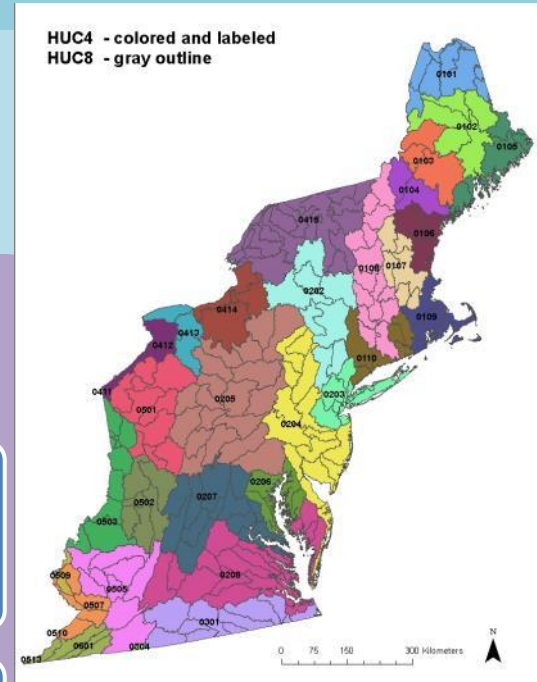
Design scales

Northeast region

Large watershed

Local

Today

Species

Ecosystems
(services, functions)

Future

Species

Ecosystems
(services, functions)

Westfield River subbasin

Core area selection index

0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

0   4   8   16 Kilometers

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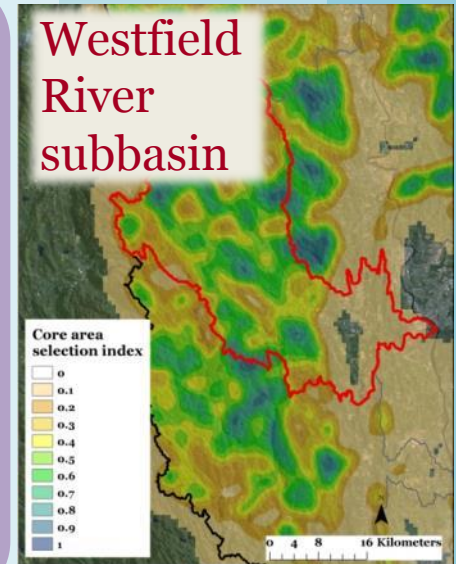
Initial Surrogate Species Models
(30 models in development)

Ecosystem/Habitat Types	Initial Set of Species
Deciduous forest, mature	Wood Thrush
Deciduous forest, young	American Woodcock, Ruffed Grouse
Forest, large blocks	Black Bear
Mixed (coniferous) forest	Moose, Blackburnian Warbler
Spruce-fir forest	Blackpoll Warbler
Grasslands	Eastern Meadowlark
Riparian and floodplain forest	Louisiana Waterthrush
Forested wetlands	Northern Waterthrush, Wood Duck
Streams (+ associated uplands)	Wood Turtle
Marshes	Marsh Wren

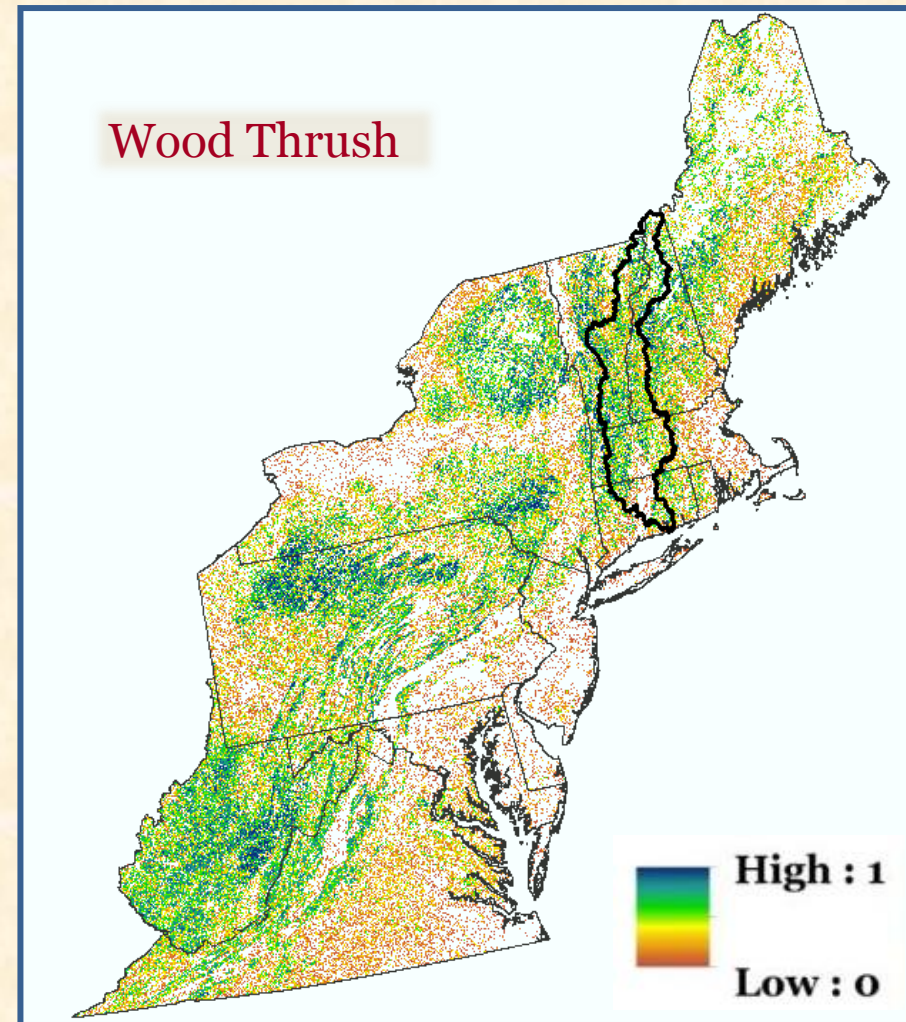North Atlantic Landscape Conservation Cooperative

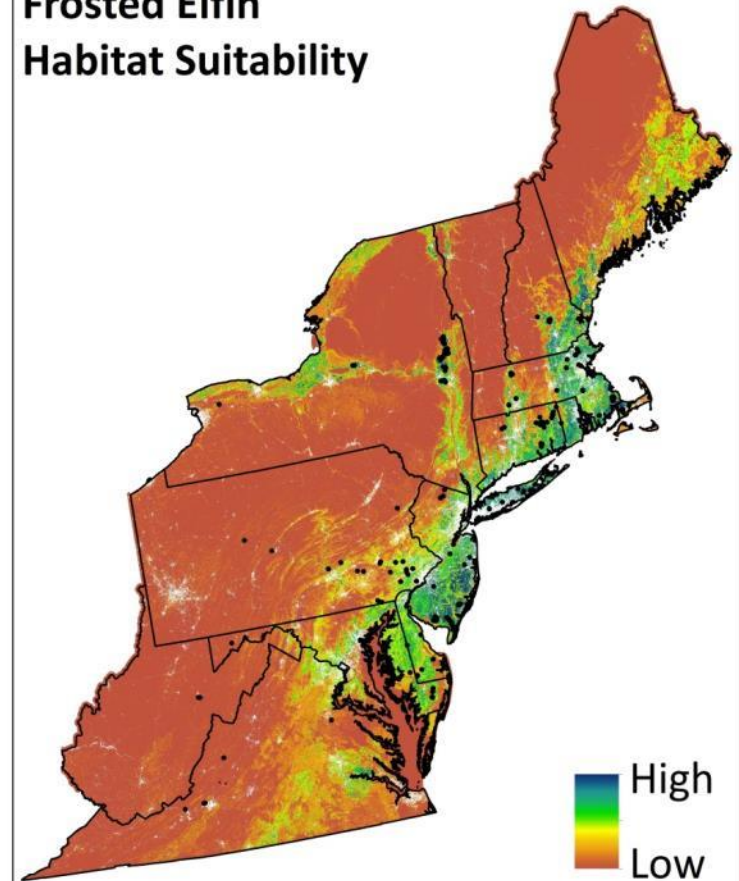# Representative (Surrogate) Species

Wood Thrush

Habitat capability models based on:
- Known habitat associations and effects of stressors

+

- Actual field data (e.g., Breeding Bird Survey routes) where available

High : 1
Low : 0

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Rare species and others not well-represented

Frosted Elfin
Habitat Suitability

High

Low

E.g., "Species of Greatest Conservation Need"

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Ecological Integrity (UMass)

Intactness

Resiliency

Adaptive capacity

Ecological Integrity

Diversity

Connectivity

Index of ecological integrity

IEI

☐	0
■	0.1
■	0.2
■	0.3
■	0.4
■	0.5
■	0.6
■	0.7
■	0.8
■	0.9
■	1

0   35   70   140 Kilometer

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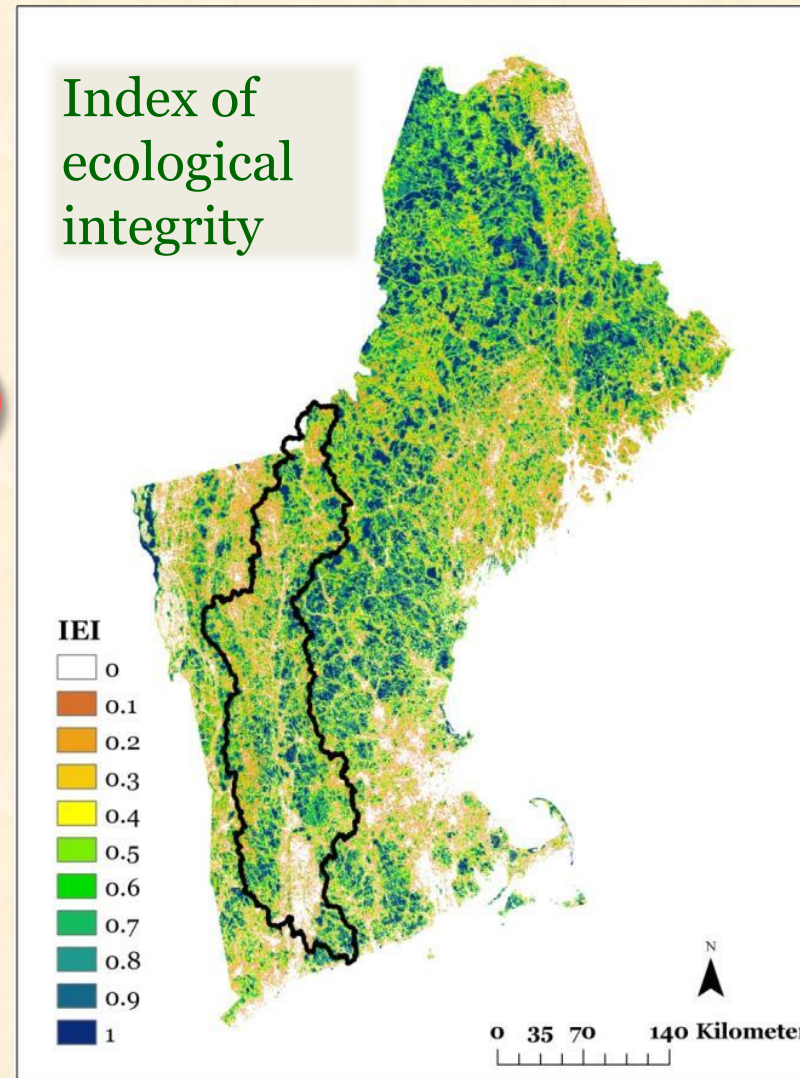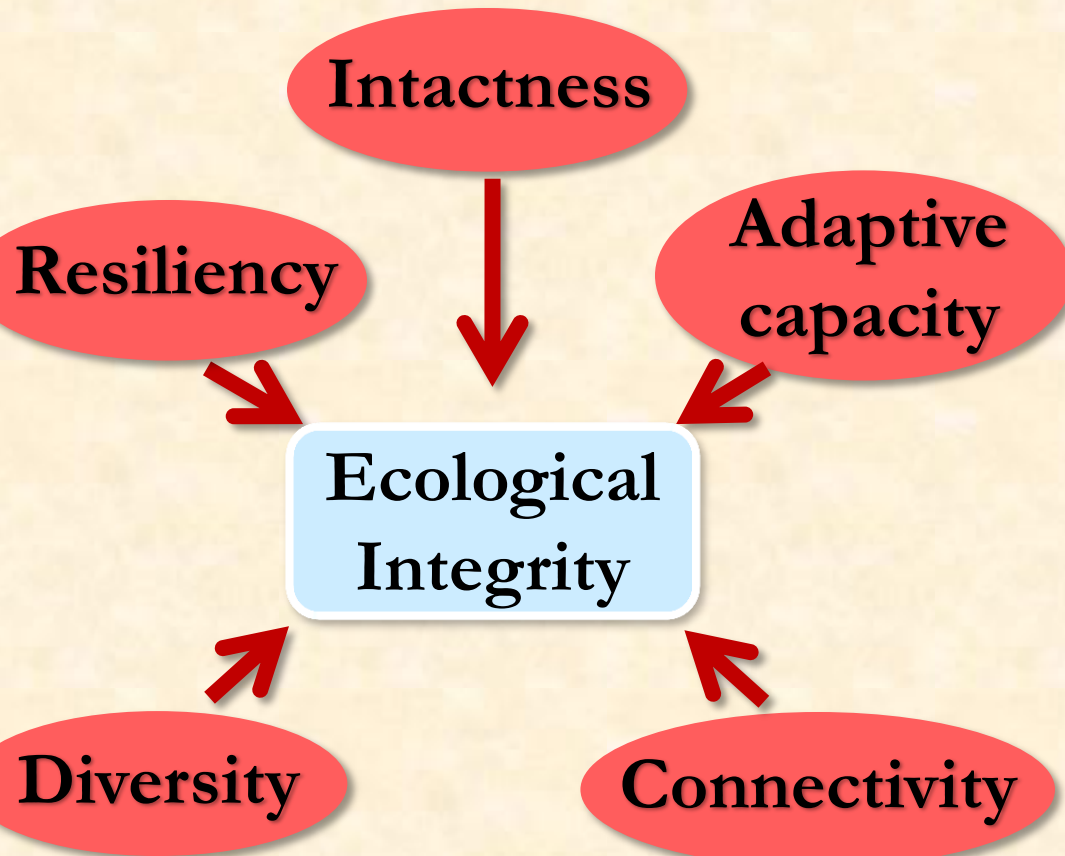
Terrestrial Resiliency
(The Nature Conservancy)

"Conserving the Stage" Approach

Landform Variety

Elevation Range

Wetland Density

Landscape Complexity

Connectedness

Resiliency

TNC Resiliency

Resiliency
- -8 - -1.5
- -1.5 - -0.5
- -0.5 - 0
- 0 - 0.5
- 0.5 - 1.5

0 20 40   80 Kilometers

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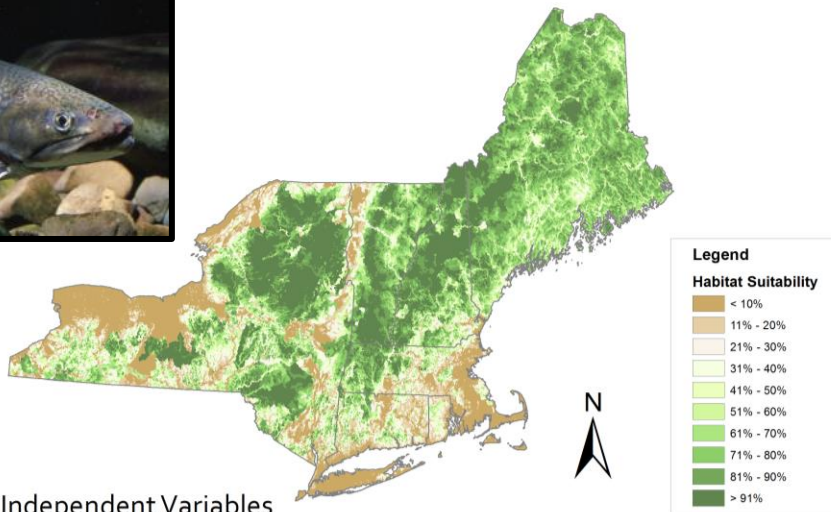
22
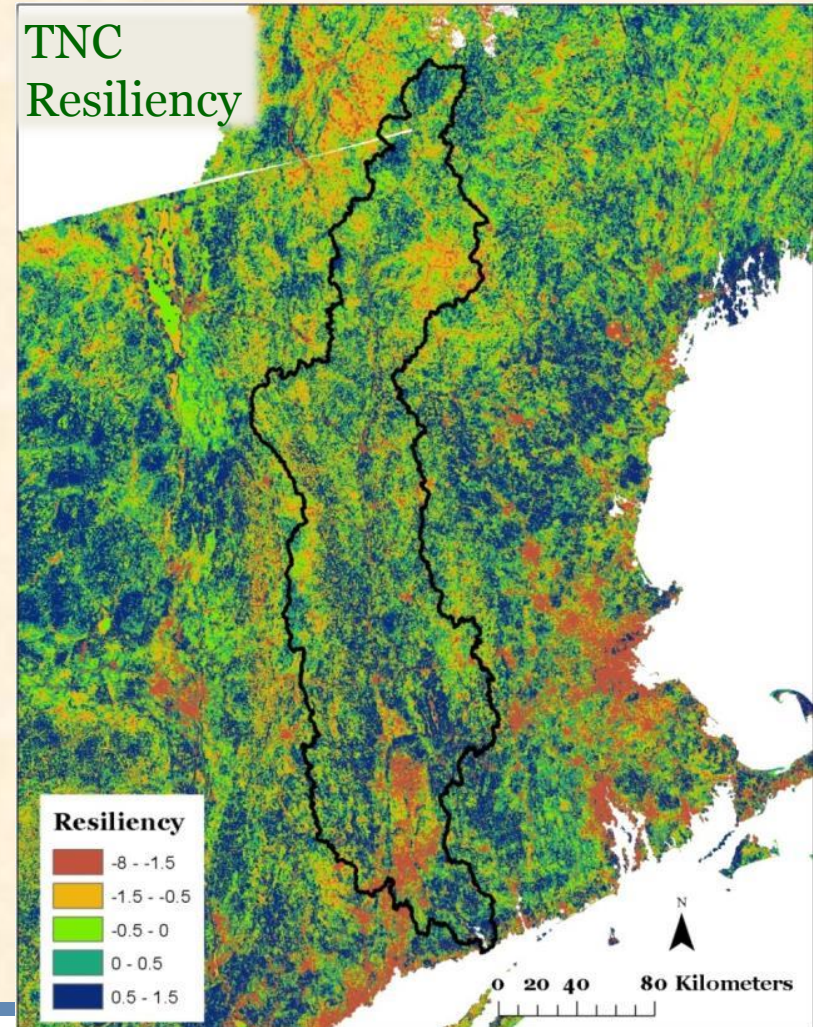
Aquatic Counterparts to *Designing Sustainable Landscapes:*
Examples from USGS Forecasting Changes in Aquatic Systems and Brook Trout

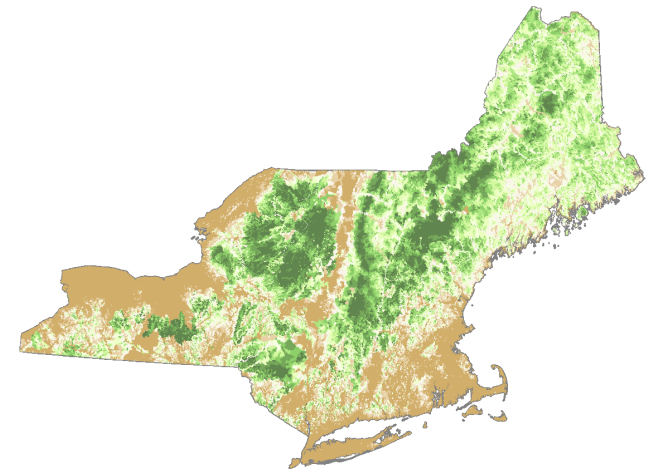**Brook Trout Occupancy Under Current Conditions**

Independent Variables
- Drainage Area
- Soil Drainage Class
- Stream Channel Slope
- % Forest*
- Annual Precip*
- Minimum Annual Temp*

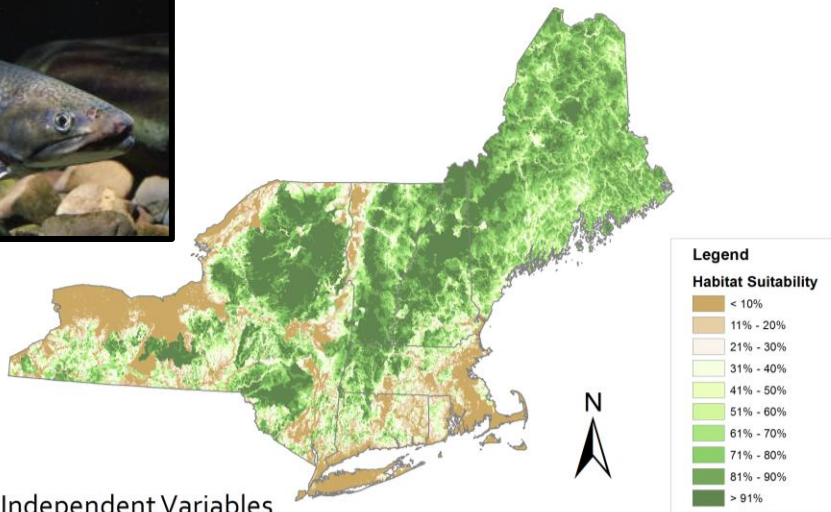* Modeled impacts of variable changes are available from the authors

Legend
Habitat Suitability
- < 10%
- 11% - 20%
- 21% - 30%
- 31% - 40%
- 41% - 50%
- 51% - 60%
- 61% - 70%
- 71% - 80%
- 81% - 90%
- > 91%

N

Occupancy Under 2°C Temperature Increase

Data Collection, Ecological Models, and Map Creation by
Dr. Ben Letcher, Dr. Yoichiro Kanno, Ana Rosner, and Kyle O'Neil
USGS Conte Anadromous Fish Research Center
Funding by the North Atlantic Landscape Conservation Cooperative

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Aquatic Counterparts to *Designing Sustainable Landscapes:*

Brook Trout Occupancy Under Current Conditions

Legend
Habitat Suitability
< 10%
11% - 20%
21% - 30%
31% - 40%
41% - 50%
51% - 60%
61% - 70%
71% - 80%
81% - 90%
> 91%

N

Independent Variables

Drainage Area
Soil Drainage Class
Stream Channel Slope
% Forest*
Annual Precip*
Minimum Annual Temp*

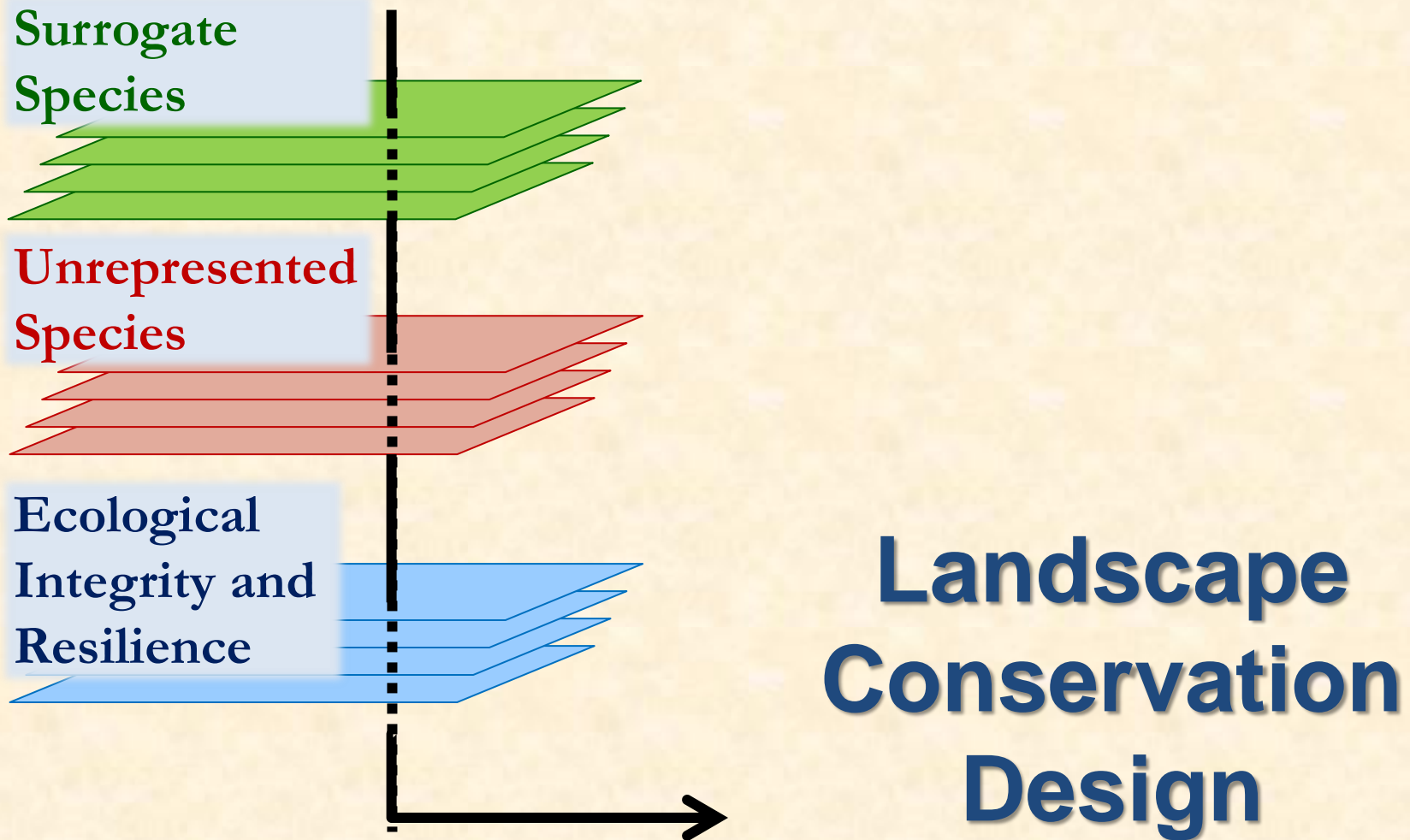* Modeled impacts of variable changes are available from the authors

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Other Tools Include The Nature Conservancy's Analyses of *Freshwater Resilience Analysis* and *Stream Connectivity*

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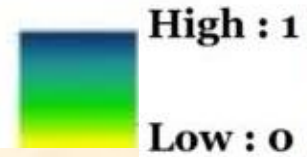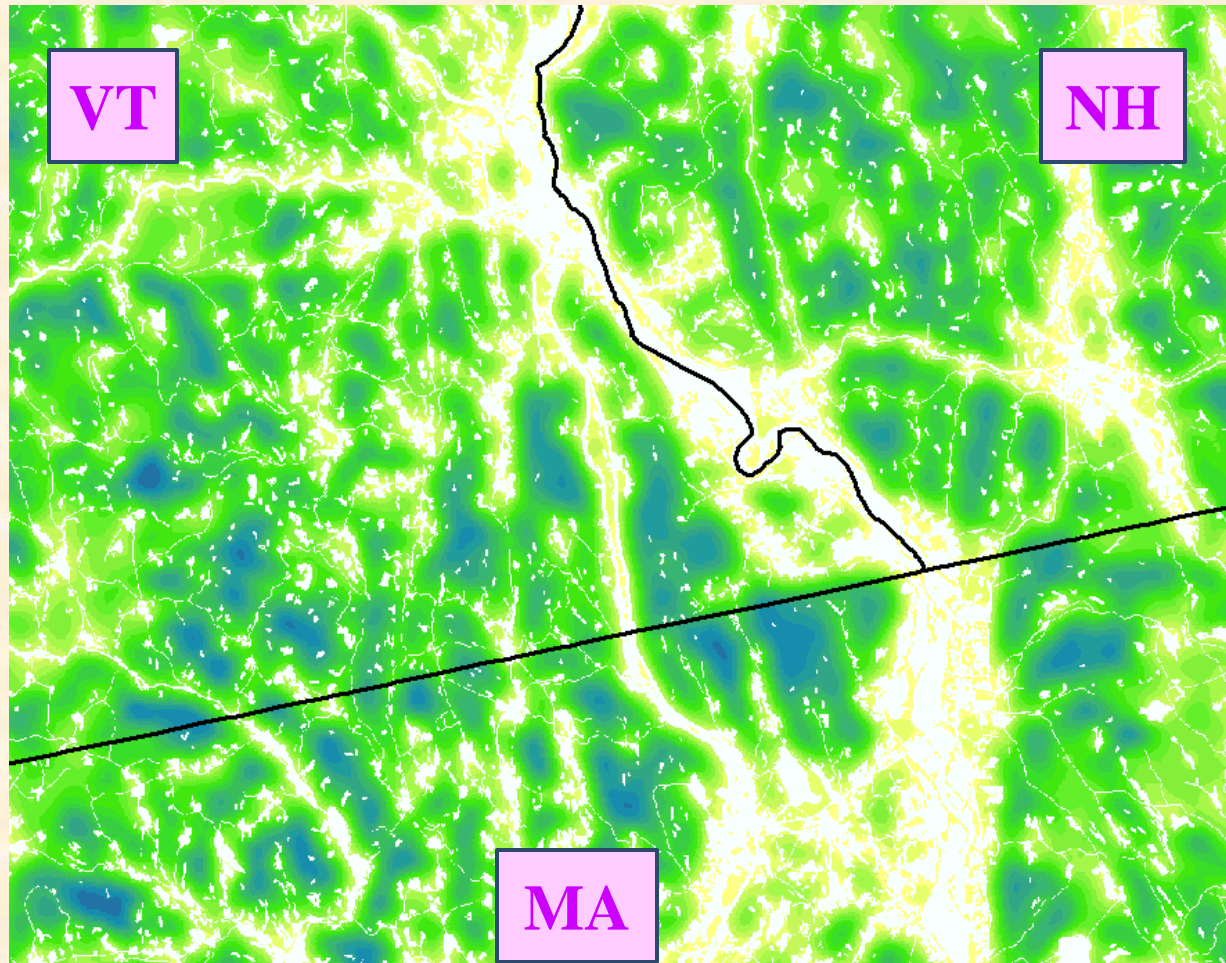## Integrating the Elements

Surrogate Species

Unrepresented Species

Ecological Integrity and Resilience

Landscape Conservation Design
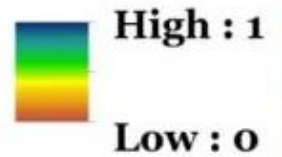
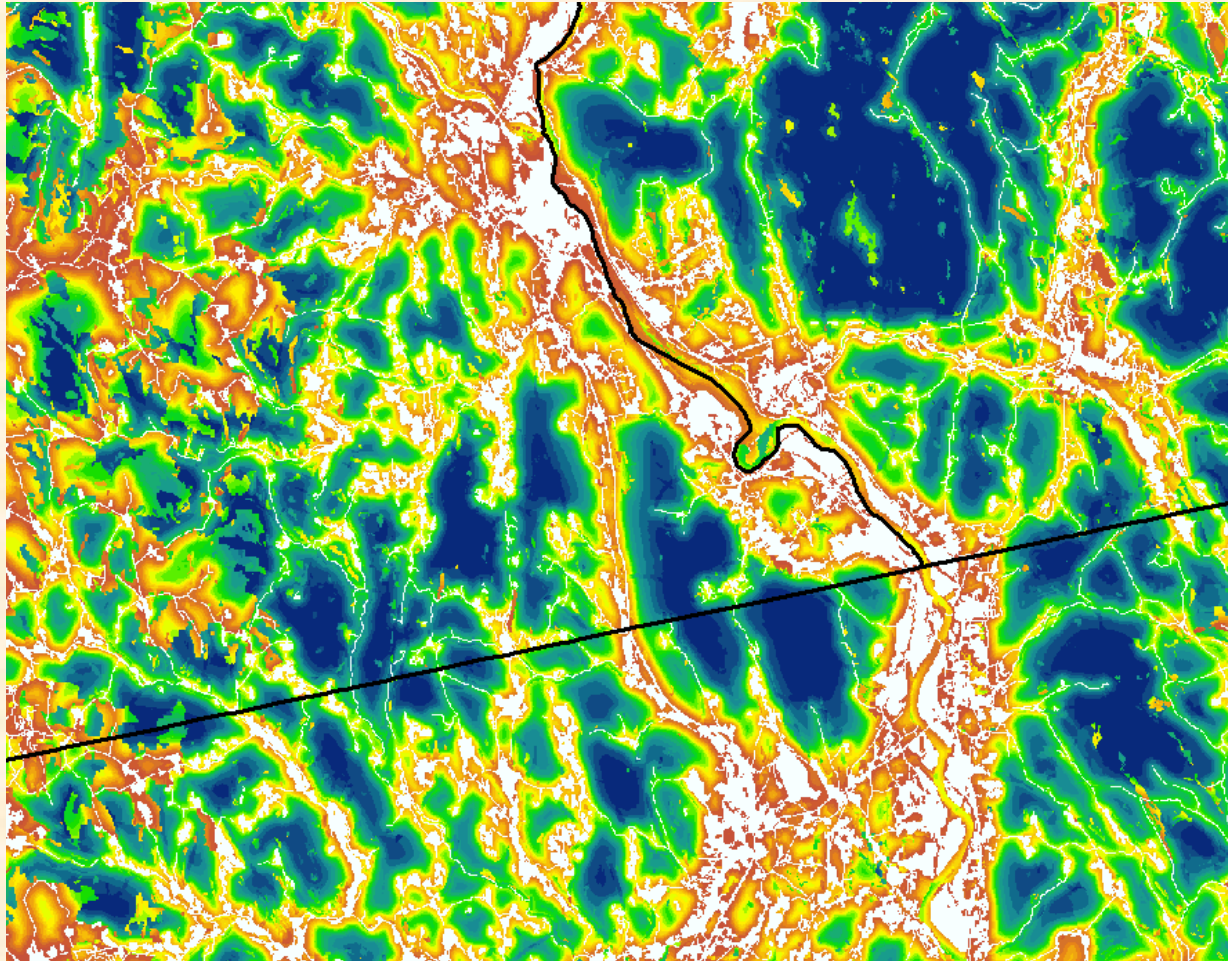North Atlantic Landscape Conservation Cooperative

Wood Thrush Habitat Capability

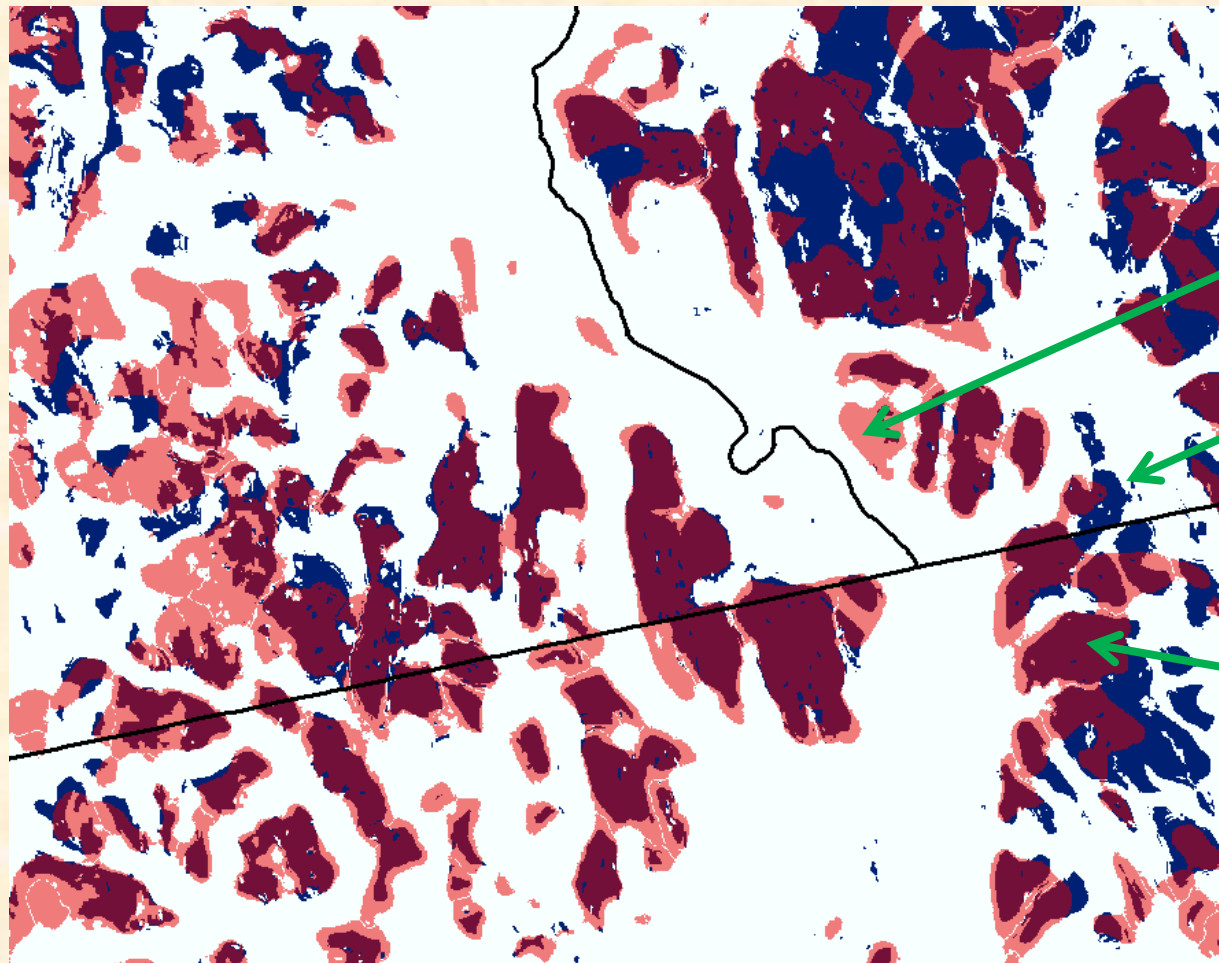# Wood Thrush – possible application to prioritize conservation action by starting with highest quality habitat

Ecological Integrity

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Areas of Highest Ecological Integrity

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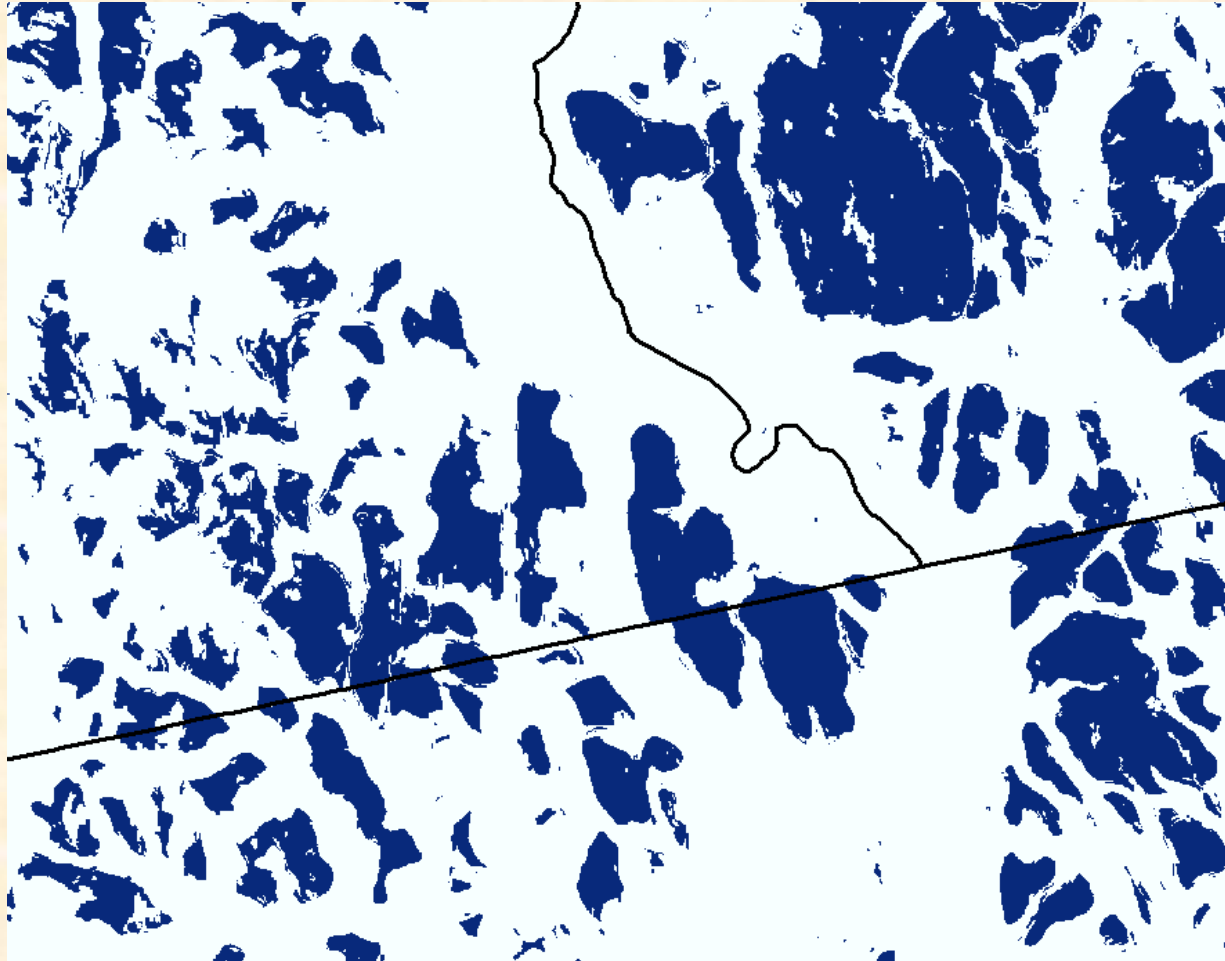
Overlap: Highest Quality Wood Thrush Habitat and Ecological Integrity

Wood Thrush (pink)

Ecological Integrity (blue)

both (purple)

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Creating Core Areas

Surrogate Species

Unrepresented Species

Ecological Integrity and Resilience

Core area network

Matrix
Core

0 20 40   80 Kilometers

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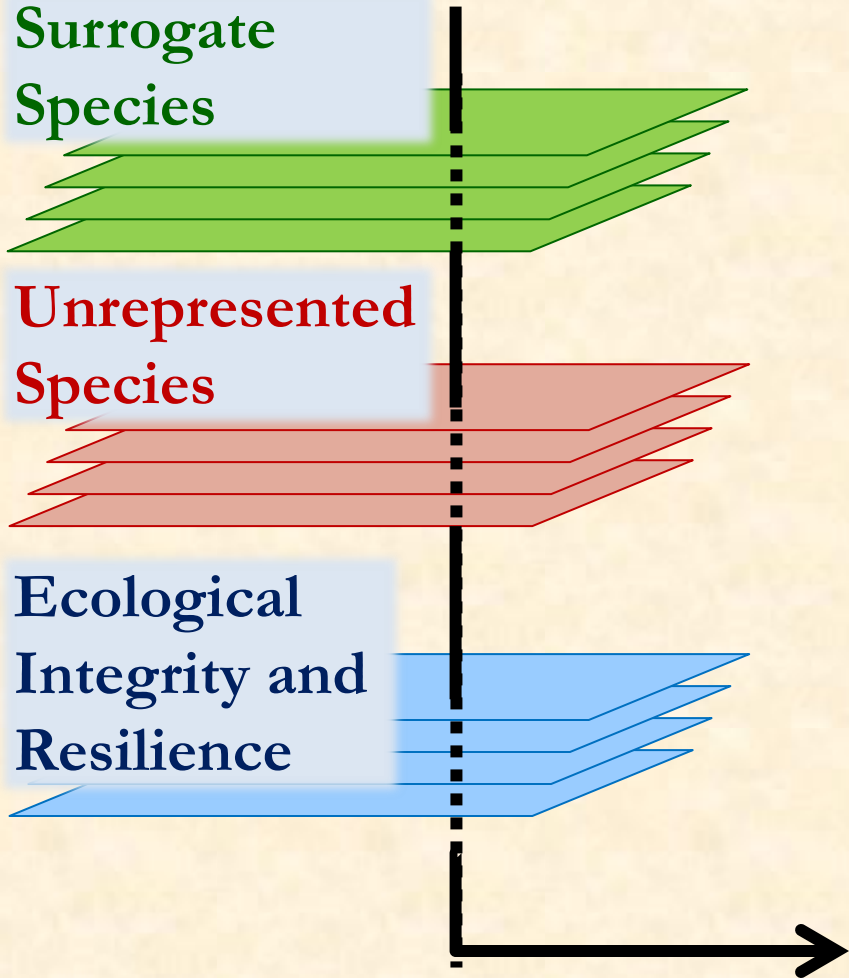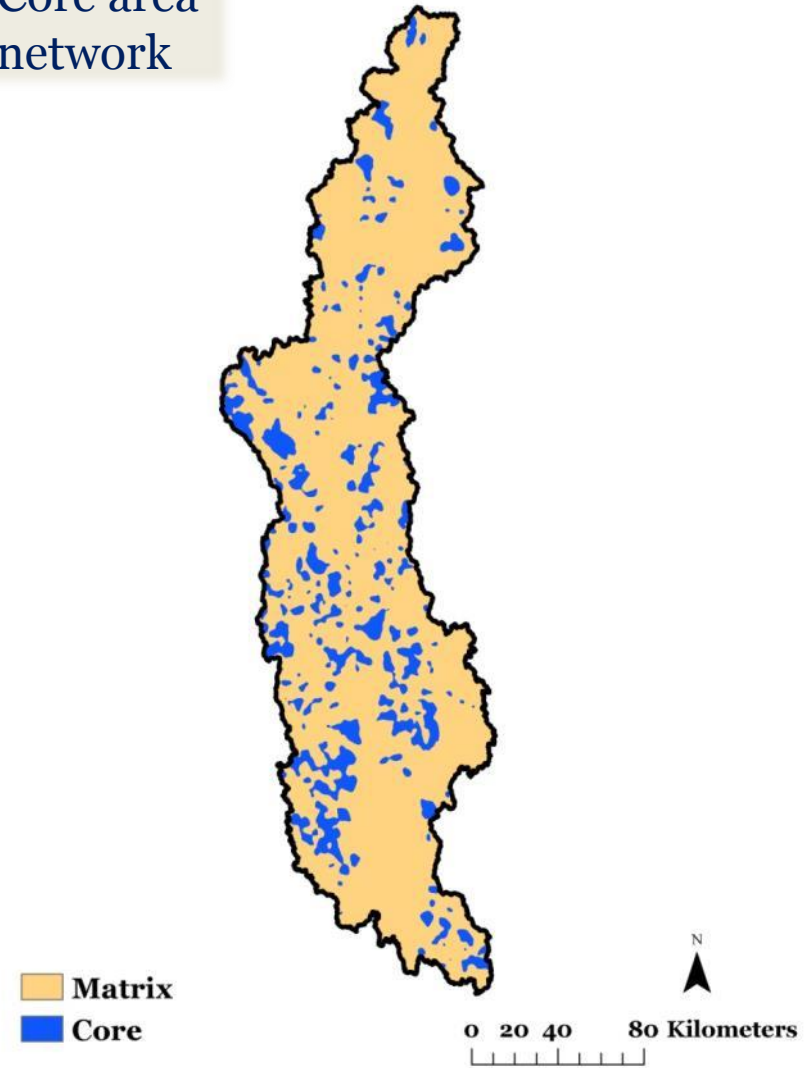
Proof of concept: What does it look like?

Connecticut River watershed

Network of protected core areas

Corridors to promote connectivity

Road passage structures and improved culverts to restore connectivity in critical locations

Managed buffers to prevent degradation of cores

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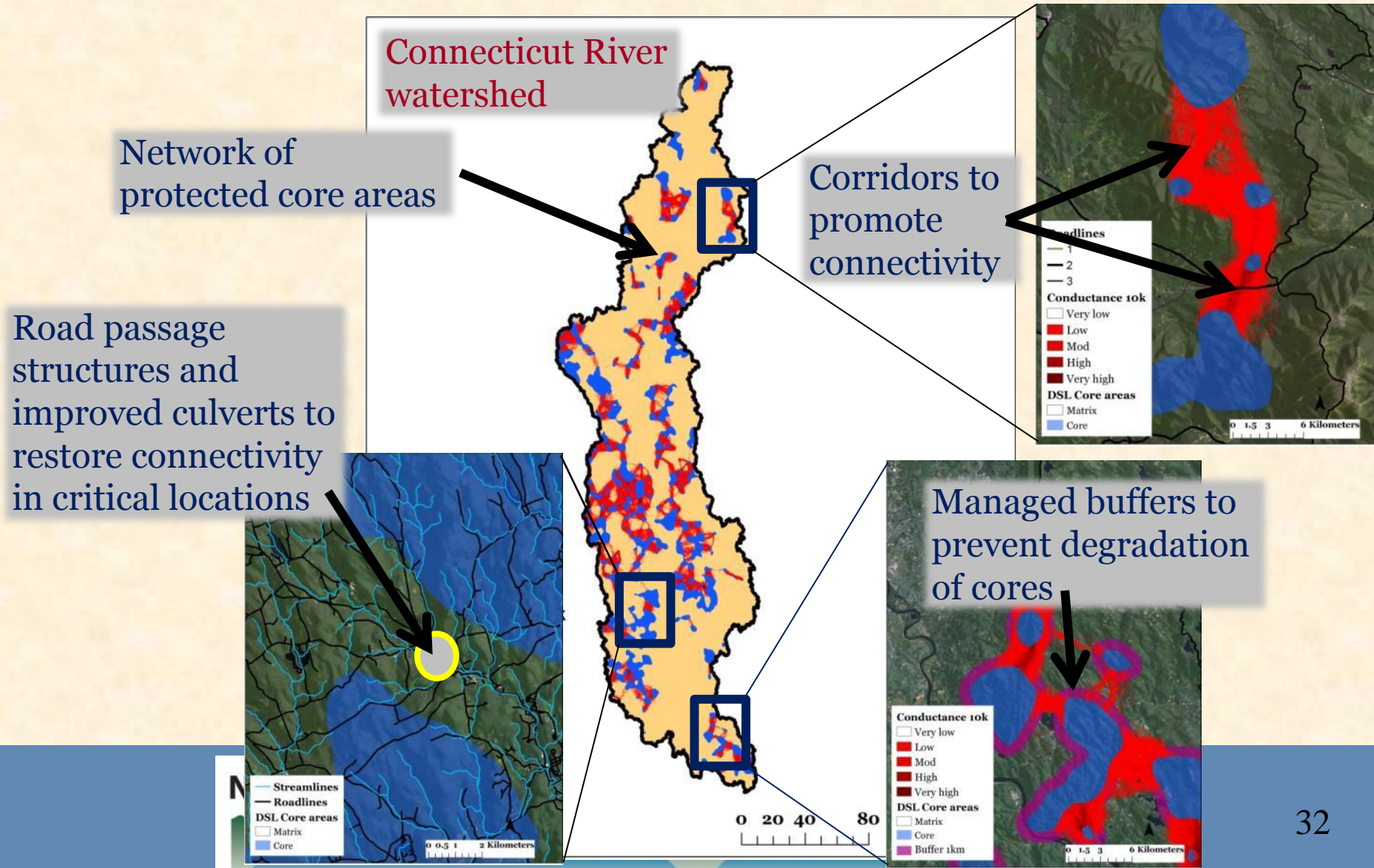
Relating Design Back to Benefits

Conductance 10k
- Very low
- Low
- Mod
- High
- Very high

Core areas
- Matrix
- Core

0 20 40 80 Kilometers

N

An **interconnected, resilient network** of lands and waterways has many benefits for society:

- Fish and wildlife populations
- Clean water
- Flood and erosion control
- Storm protection
- Forest and farm products
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Partnership - Major Decision Points

- Establishing conservation goals & objectives
- Weighting ecosystems and species, reflecting regional and watershed priorities
- How far in future to consider
- Determining strategic priorities for the conservation network
- Deciding on what other socio-cultural and economic factors to consider

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