


Conservation Planning and Actions to Adapt to Climate Change and Land Use Change Impacts in the Northeast

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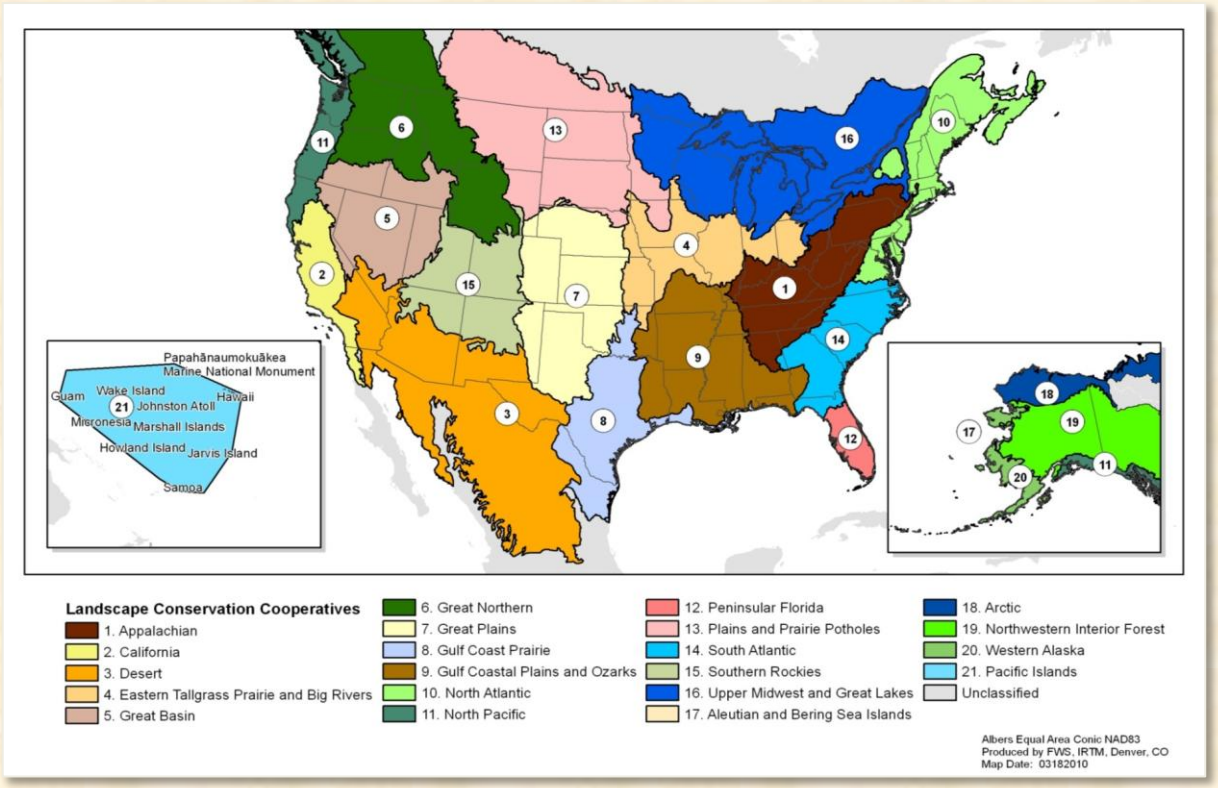
LANDSCAPE CONSERVATION COOPERATIVES

North Atlantic Landscape Conservation Cooperative

Landscape Conservation Cooperatives Geographic Areas and Objective

LCCs Fundamental Objective

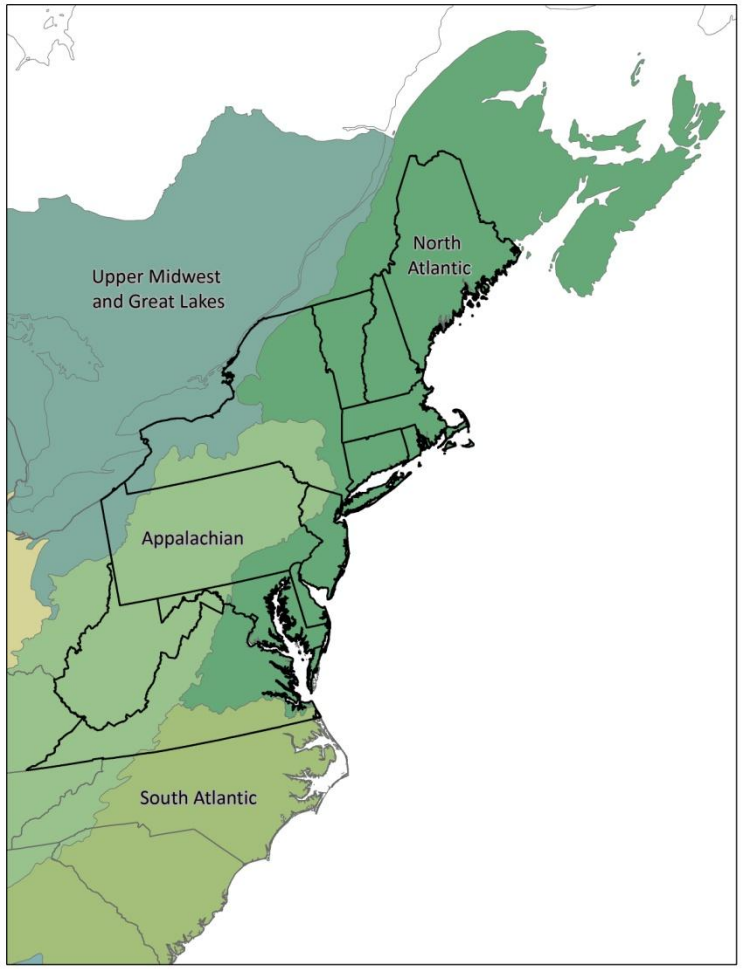
To define, design, and help partners deliver landscapes that can sustain natural and cultural resources at desired levels nationwide.



North Atlantic Landscape Conservation Cooperative

The North Atlantic Landscape Conservation Cooperative

- 33 federal, state, Canadian, tribal and NGO partners



North Atlantic Landscape Conservation Cooperative

North Atlantic LCC - Mission

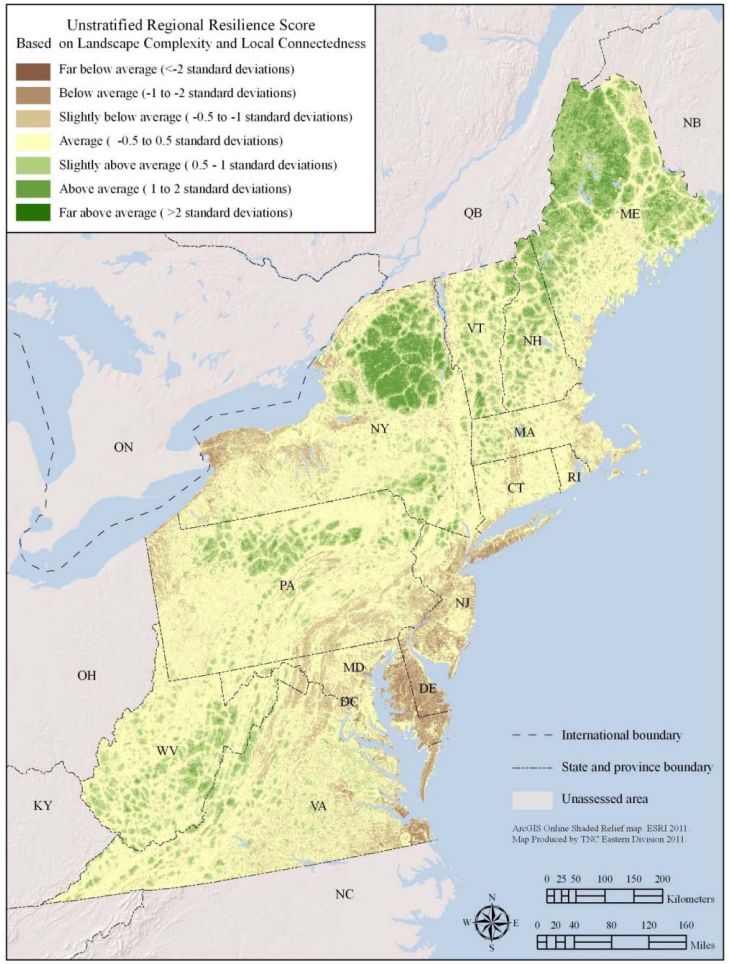
The North Atlantic Landscape Conservation Cooperative provides a partnership in which the conservation community works together to **address increasing land use pressures and widespread resource threats and uncertainties amplified by a rapidly changing climate.**

The partners and partnerships in the cooperative address these regional threats and uncertainties by agreeing on common goals and jointly developing the **scientific information and tools needed to prioritize and guide more effective conservation actions** by partners toward those goals.

Landscape Conservation Designs to Guide Decisions in the Face of Change

Models and maps (conservation designs) that prioritize conservation actions and guide conservation decisions under current and predicted future conditions e.g.

- Habitat maps and condition
- Projections of change
- Integrity of ecological systems
- Habitat suitability for wildlife
- Resiliency – geophysical and connectivity



North Atlantic Landscape Conservation

North Atlantic LCC
Designing Sustainable Landscapes
Purpose & Need

Assess the capability of current and potential future landscapes in the Northeast to provide integral ecosystems and suitable habitat and provide guidance for strategic conservation decisions

Design landscapes to ensure connectivity

Minimize forces of habitat degradation

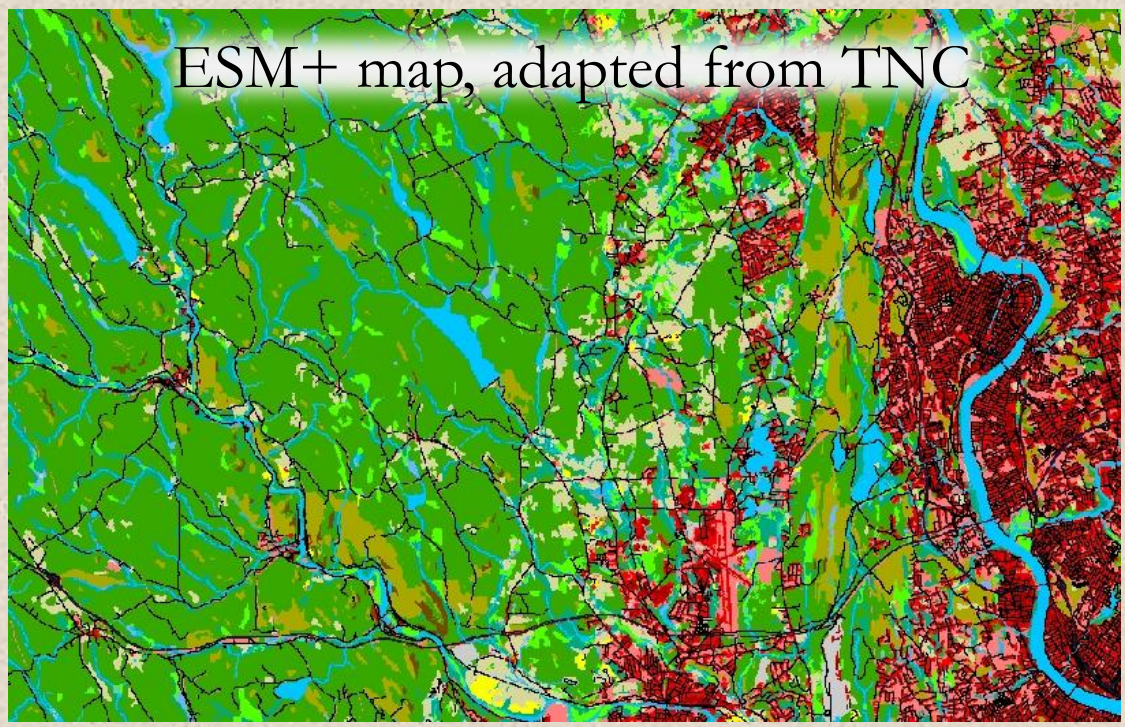
Protect, manage & restore habitat strategically

The Approach

Ecological Systems

"Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding" (Natureserve)

Appalachian hemlock-northern hardwood forest: typic



The Approach

Settings data

"GIS layers including a broad but parsimonious suite of biophysical variables representing the natural and anthropogenic environment at each location (cell) at each timestep"

Abiotic:

- Temperature (2)
- Energy (1)
- Moisture & hydrology (3)
- Chemical & physical substrate (3)
- Physical disturbance (2)

Vegetation:

- Potential dominant life form
- Above-ground biomass
- Tree diameter (qmd)
- Stem density

Anthropogenic:

- Traffic
- Development (2)
- Impervious
- Barriers (2)

The Approach

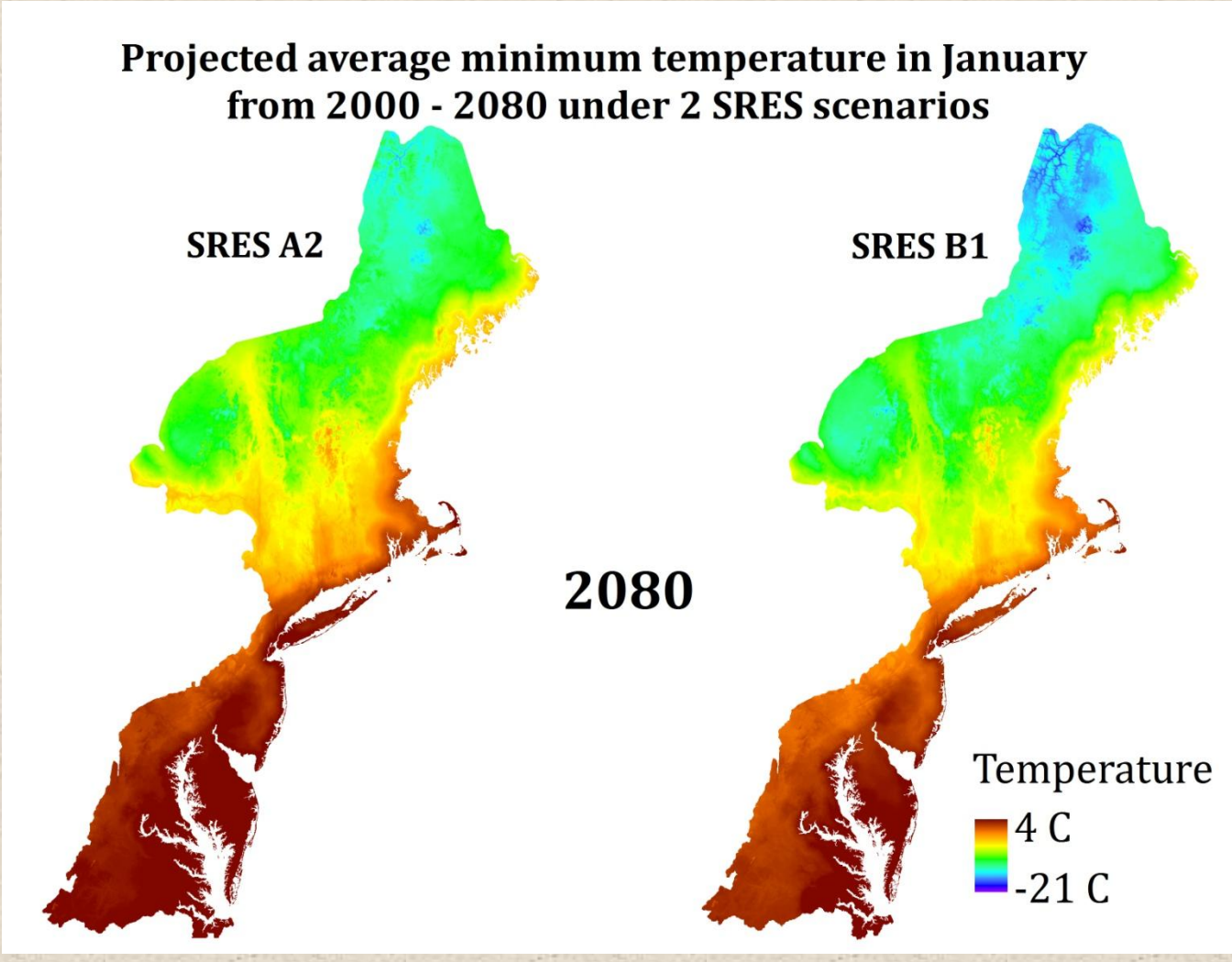
Landscape Change

Drivers

- Climate change scenarios

Climate change

- 3 SRES scenarios (B1, A1B, A2)
- Ensemble of 16 GCM's (36 total runs)
- Statistical (BCSD) downscaling (12 km)
- ΔPRISM (800 m)
- Resampled (30 m)
- GDD, Tmin, Pannual



The Approach

Landscape Change

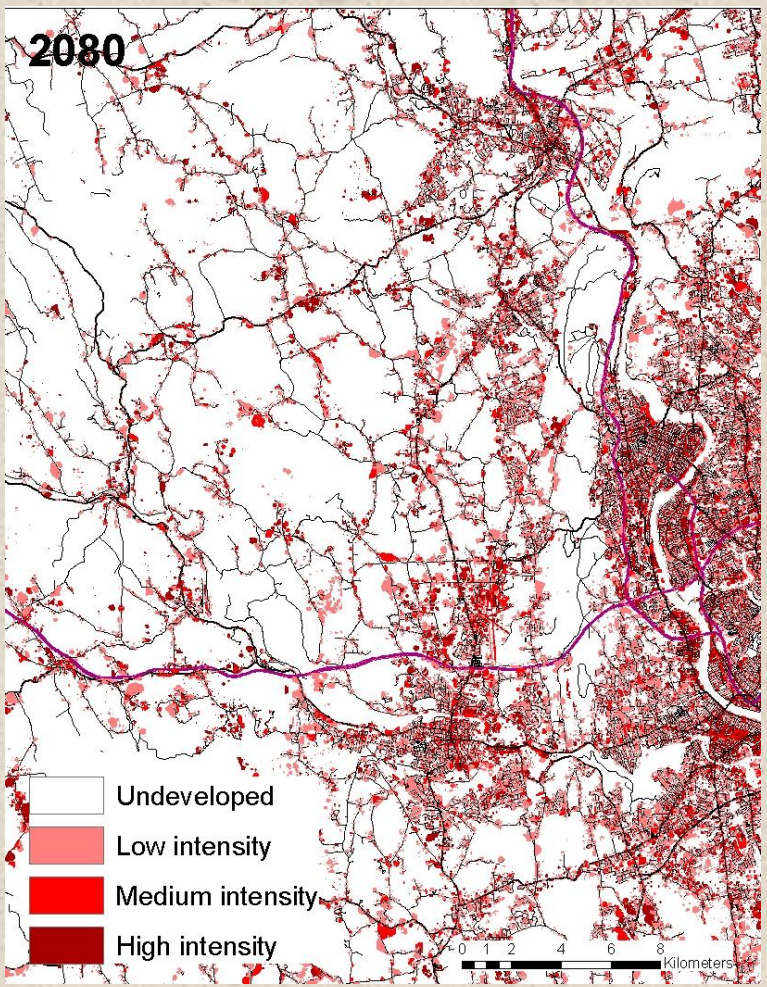
Drivers

- Urban growth scenarios

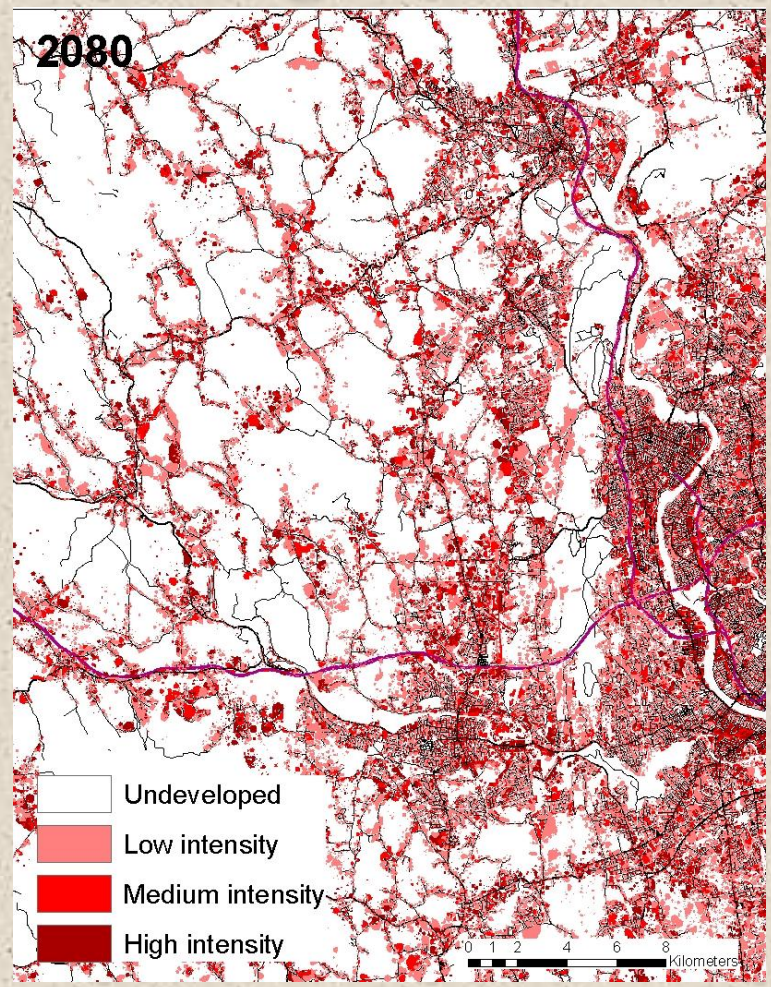
•Multi-stage statistical model

•User-defined scenarios to vary total amount and sprawliness of growth relative to historical patterns.

Baseline growth (1%)



Double growth (2%)



The Approach

Landscape Assessment

Coarse filter

Our coarse filter is based on the concept of *ecological integrity* applied to the suite of *ecological systems*

High Integrity

Low Integrity

- *Ecological integrity* refers to the capability of an area to sustain ecological functions over the long term, especially in the face of disturbance and stress.

The Approach

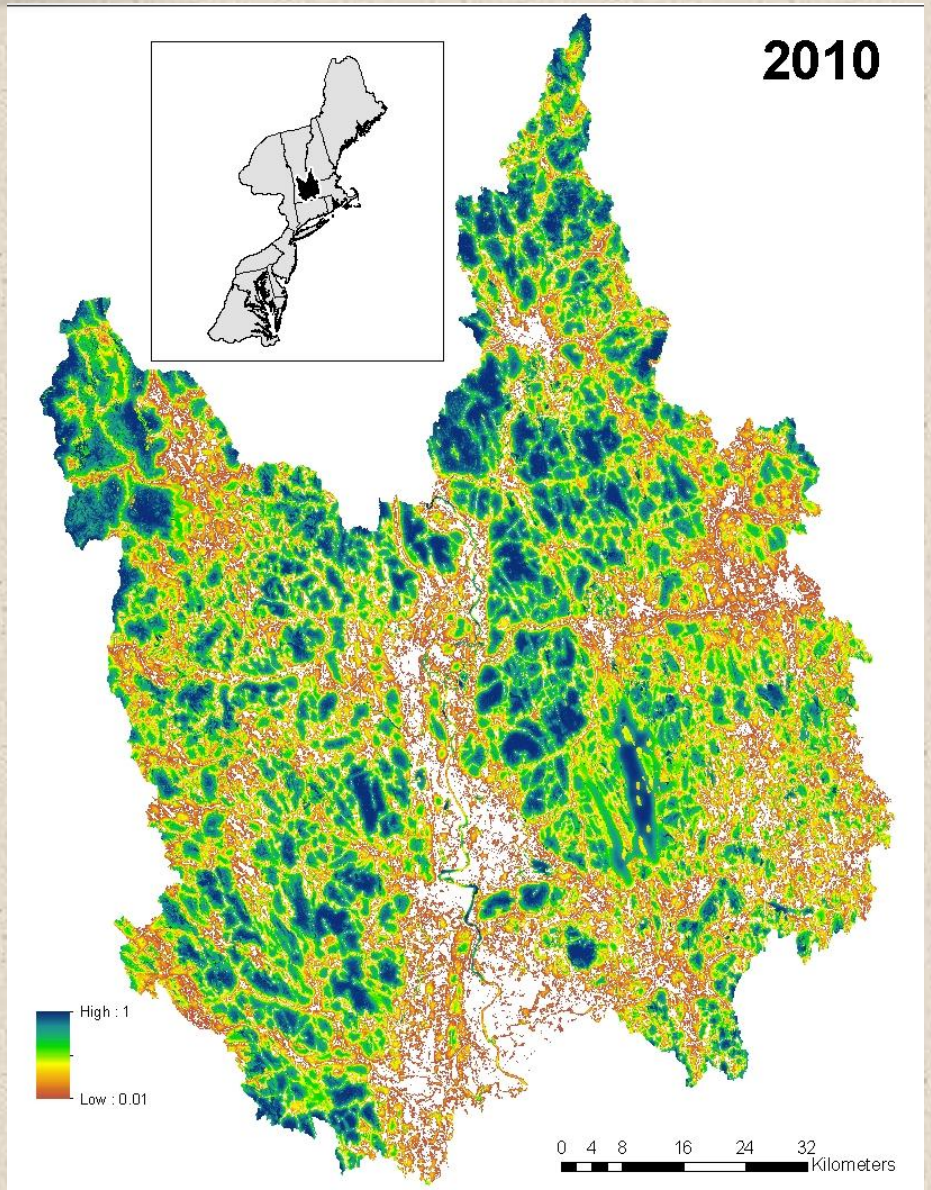
Landscape Assessment

Coarse filter

- **Local composite index of ecological *integrity***

What is the *overall ecological integrity* of the cell for a given time step?

IEI



The Approach

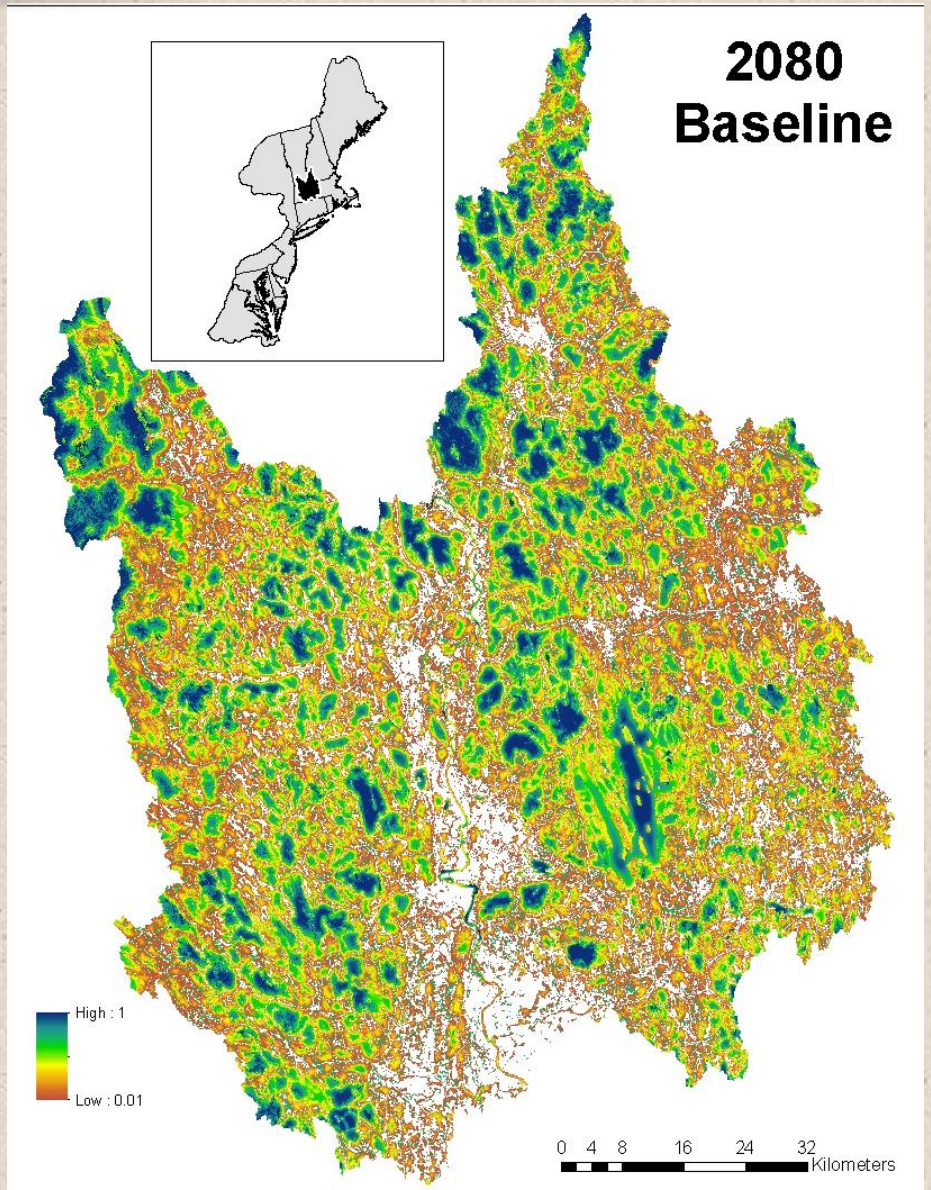
Landscape Assessment

Coarse filter

- **Local composite index of ecological *integrity***

What is the *overall ecological integrity* at each cell for a given time step under a particular scenario?

IEI



The Approach

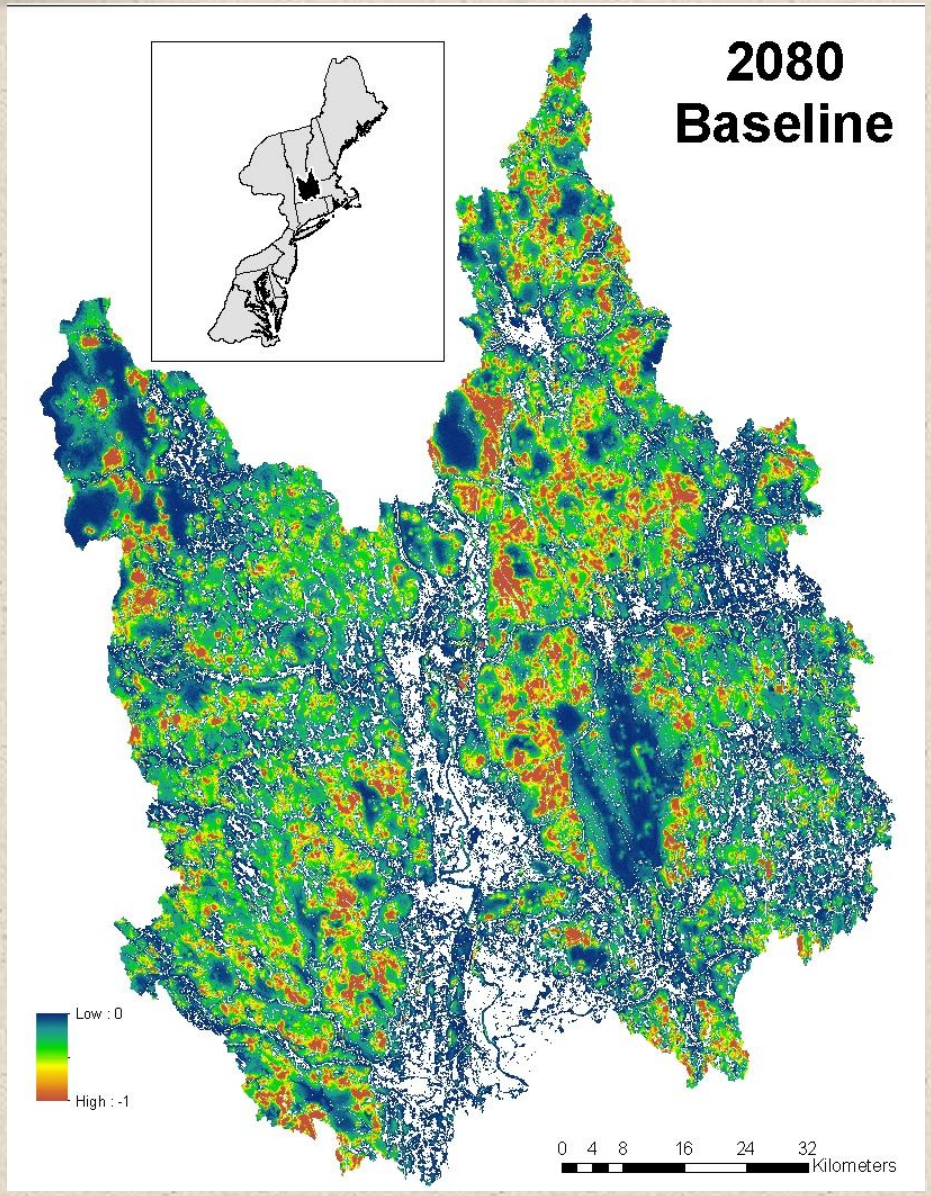
Landscape Assessment

Coarse filter

- **Local composite index of ecological *impact***

What is the magnitude of change (i.e., impact) in ecological integrity at each cell between current and a future time step under a particular scenario?

Impact



The Approach

Landscape Assessment

Fine filter

Our fine filter is based on the concept of *climate & habitat capability* applied to a suite of *representative species*

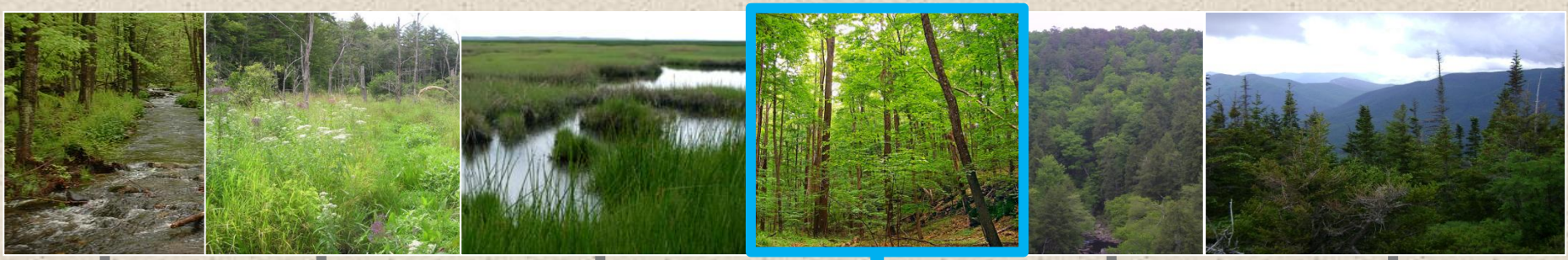
- *Habitat capability* refers to the ability of the environment to provide the local resources (e.g., food and cover) needed for survival and reproduction in sufficient quantity, quality and accessibility to meet the life history requirements of individuals and local populations.

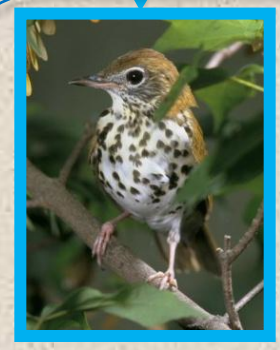
The Approach

Landscape Assessment

Fine filter

- Representative species approach





Species Assemblage

"A species whose habitat needs, ecosystem function, or management responses are similar to a group of other species." (USFWS)

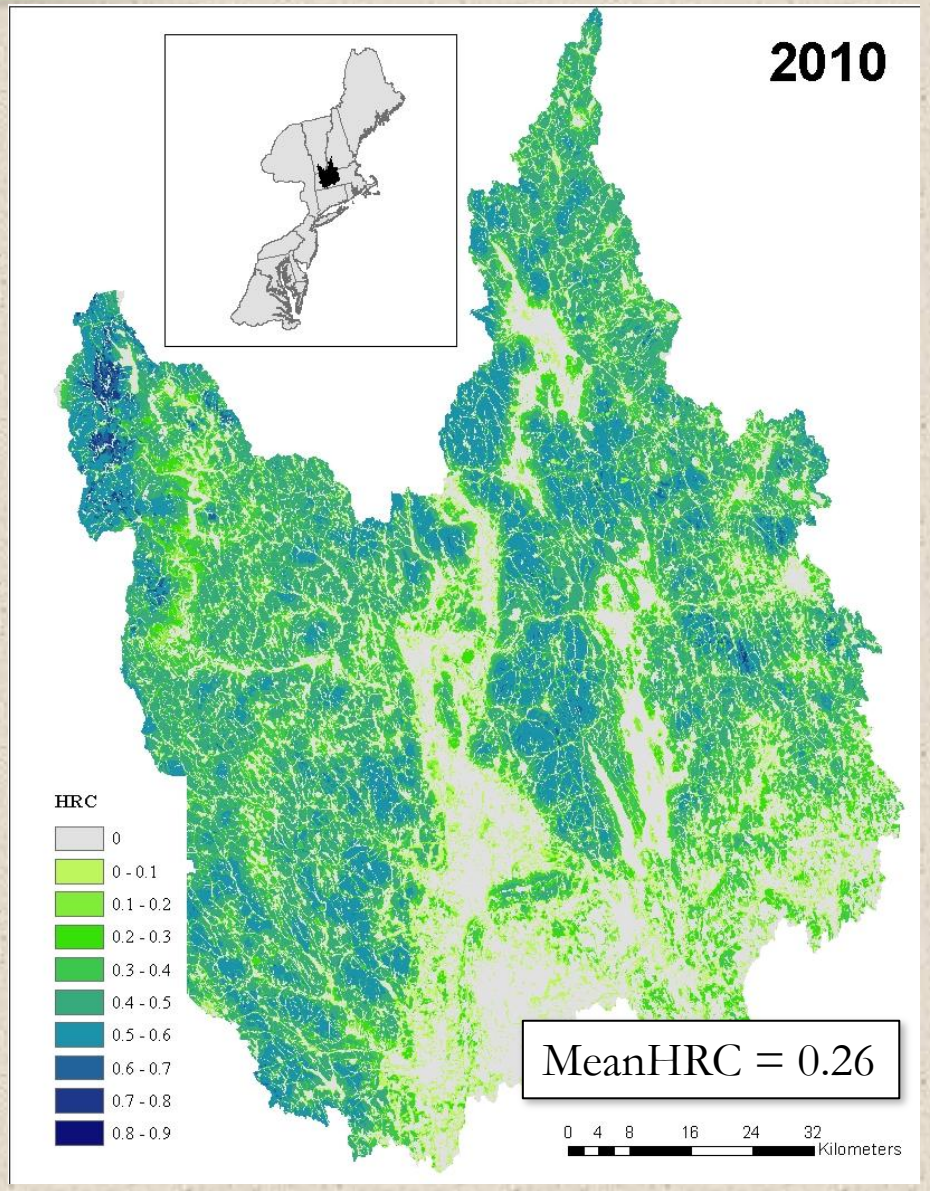
The Approach

Landscape Assessment

Fine filter

- **Habitat capability index (0-1)**
  - Spatially-explicit
  - Multi-level
  - Expert-derived
  - Statistically evaluated


Blackburnian warbler



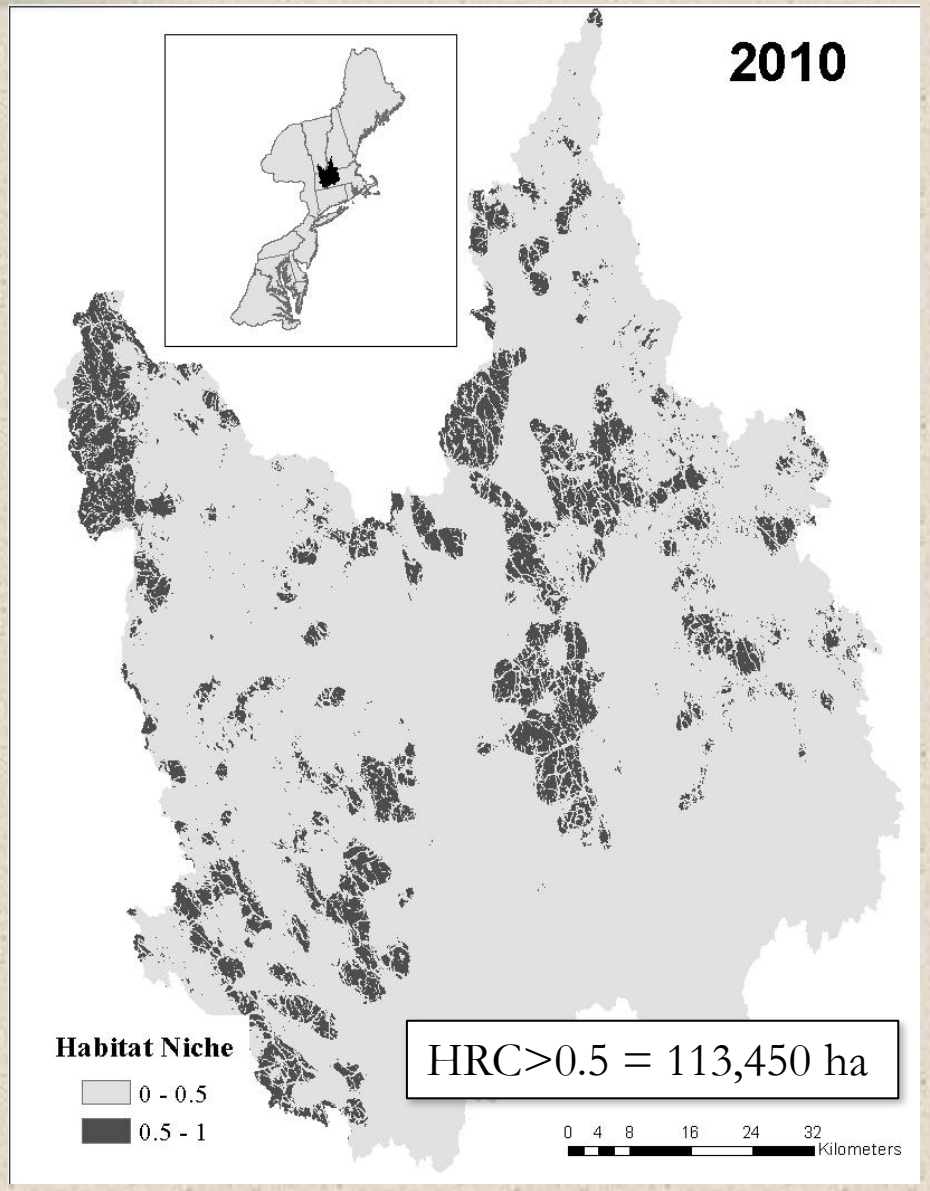
The Approach

Landscape Assessment

Fine filter

- **Habitat capability index (binary)**

Where is the most capable habitat (HRC>0.5)?



The Approach

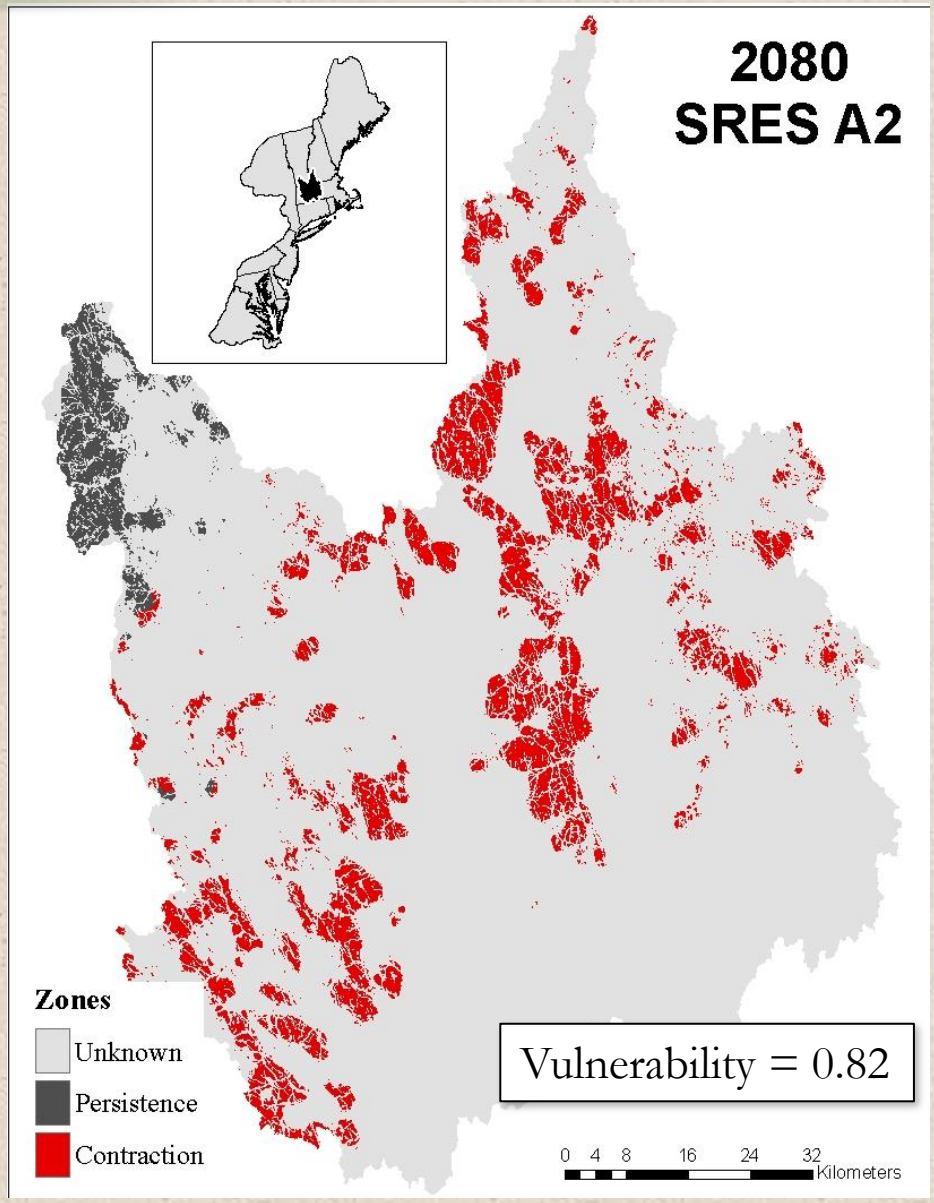
Landscape Assessment

Fine filter

- **Habitat-Climate uncertainty**

  Zone of Persistence = Persistent future habitat and climate within the species' current range.

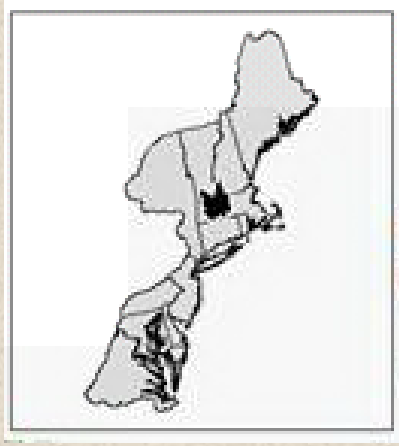
  Zone of Contraction = Persistent future habitat but no longer suitable climate within the species' current range.

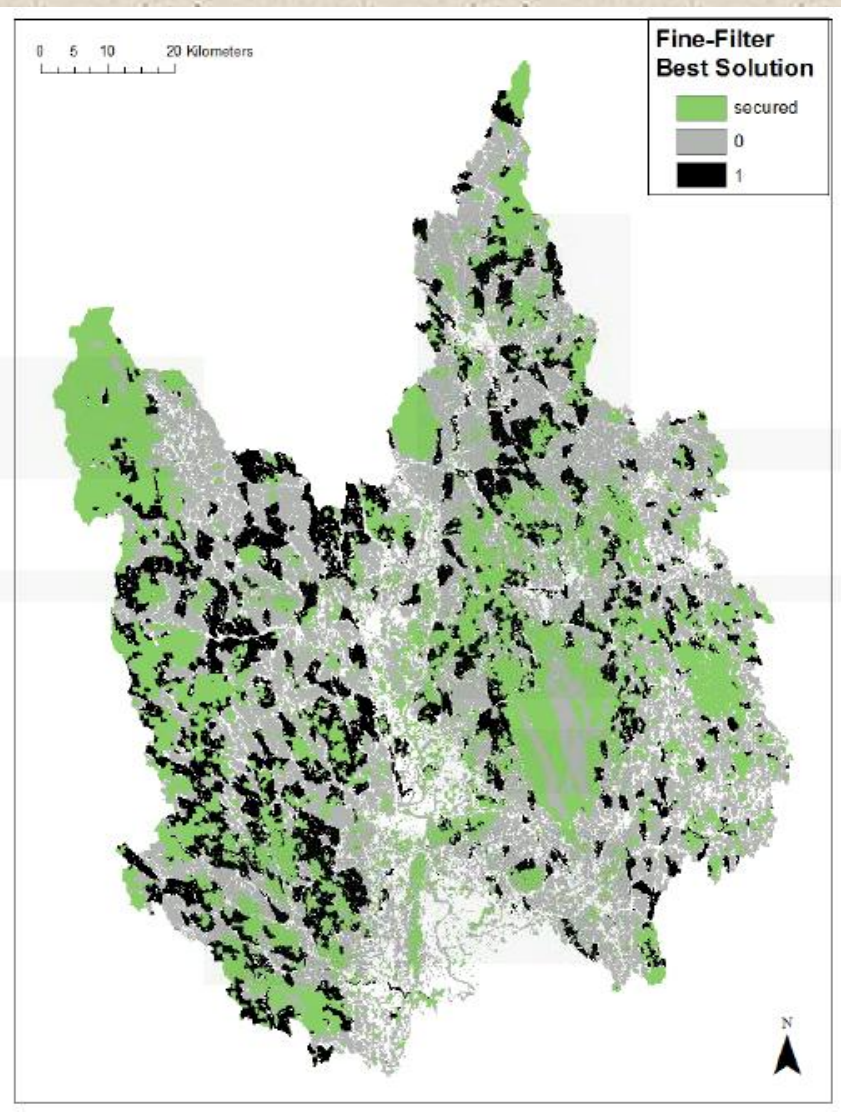


Application: Multi-species Landscape **Design** Using Representative Species

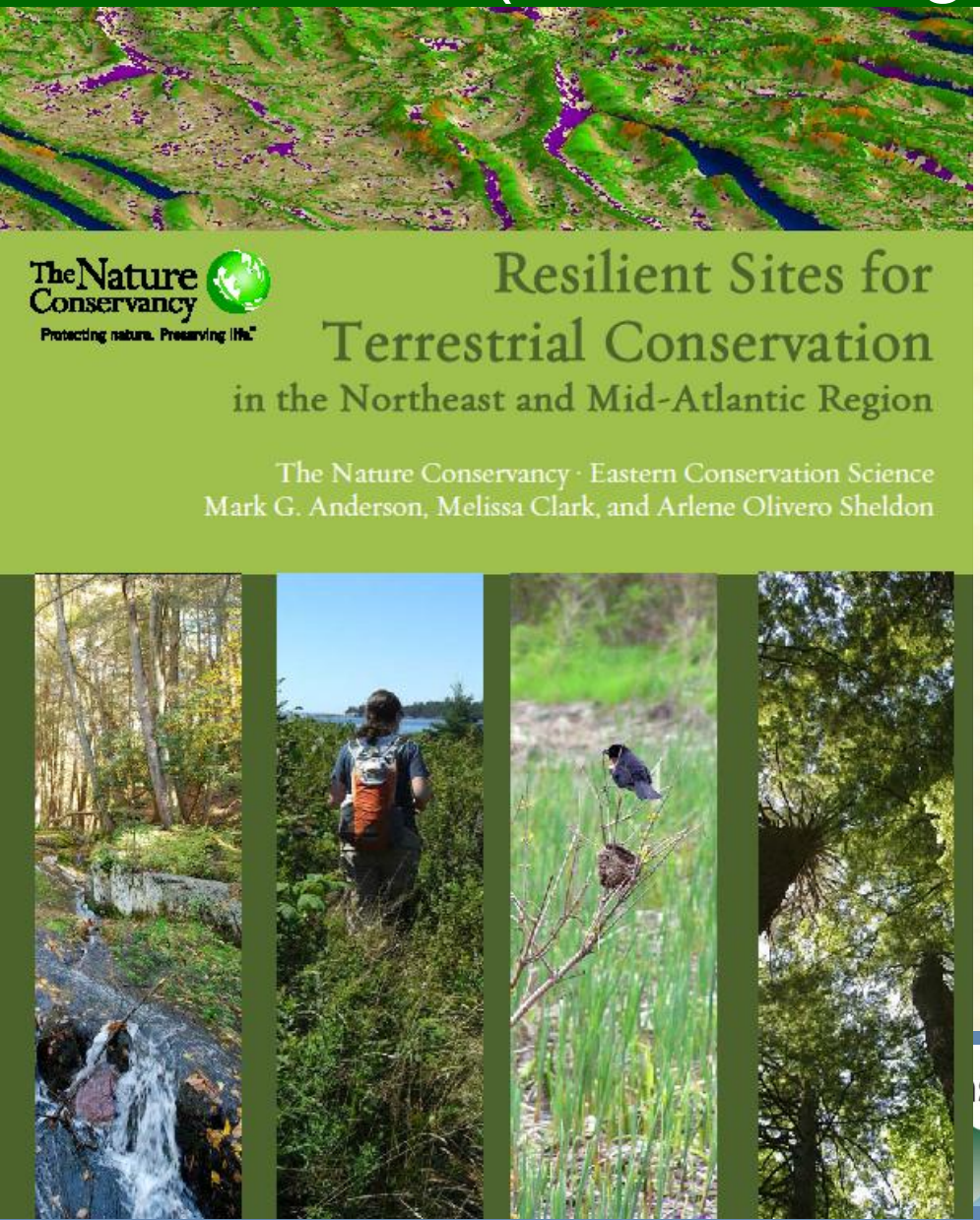
Example:

Based on information from multiple representative species, what unsecured areas of the landscape are of highest conservation priority?





Resilient Sites for Conservation ("Conserving the Stage")



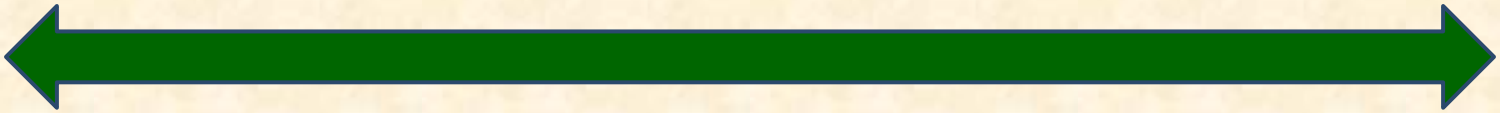
- Mark Anderson, TNC Eastern Regional Science Director,PI
- Many contributors and a steering committee
- Funding from the
  - Doris Duke Foundation,
  - The NE Association of Fish & Wildlife Agencies,
  - North Atlantic LCC
  - The Nature Conservancy

Vulnerability and Resilience

Resilience: Definition

The capacity for renewal in a dynamic environment

- Gunderson 2000



Highly Vulnerable
Limited capacity to adapt
Disrupted function, low diversity

Highly Resilient:
Large capacity to adapt
Sustain function and high species diversity

OBJECTIVE: To identify the most resilient network of sites in the Northeast and Mid-Atlantic that will collectively and individually sustain biodiversity even as the changing climate and land use alters current distribution patterns. *(and plan in the face of uncertainty)*

North Atlantic Landscape Conservation Cooperative

So, a Resilient **Network** should include some of all Physical Habitats (land forms)

Flats and gentle slopes (Fores

Summits

Coves

Steep slopes \ Cliffs

Riparian

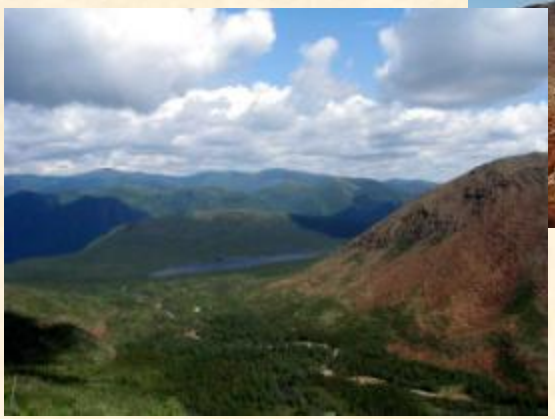
Tidal marsh & Beach

Rivers & Stream

Freshwater wetlands

And some of all geophysical settings (geology, elevation)

e.g. summits of all types



Sedimentary

Granite

Mixed

Mafic -low

Granite

Intermediate (mafic)

Sedimentary: Quartzite

What Factors Increase the Resilience of a **Site**?

1. Landscape Complexity

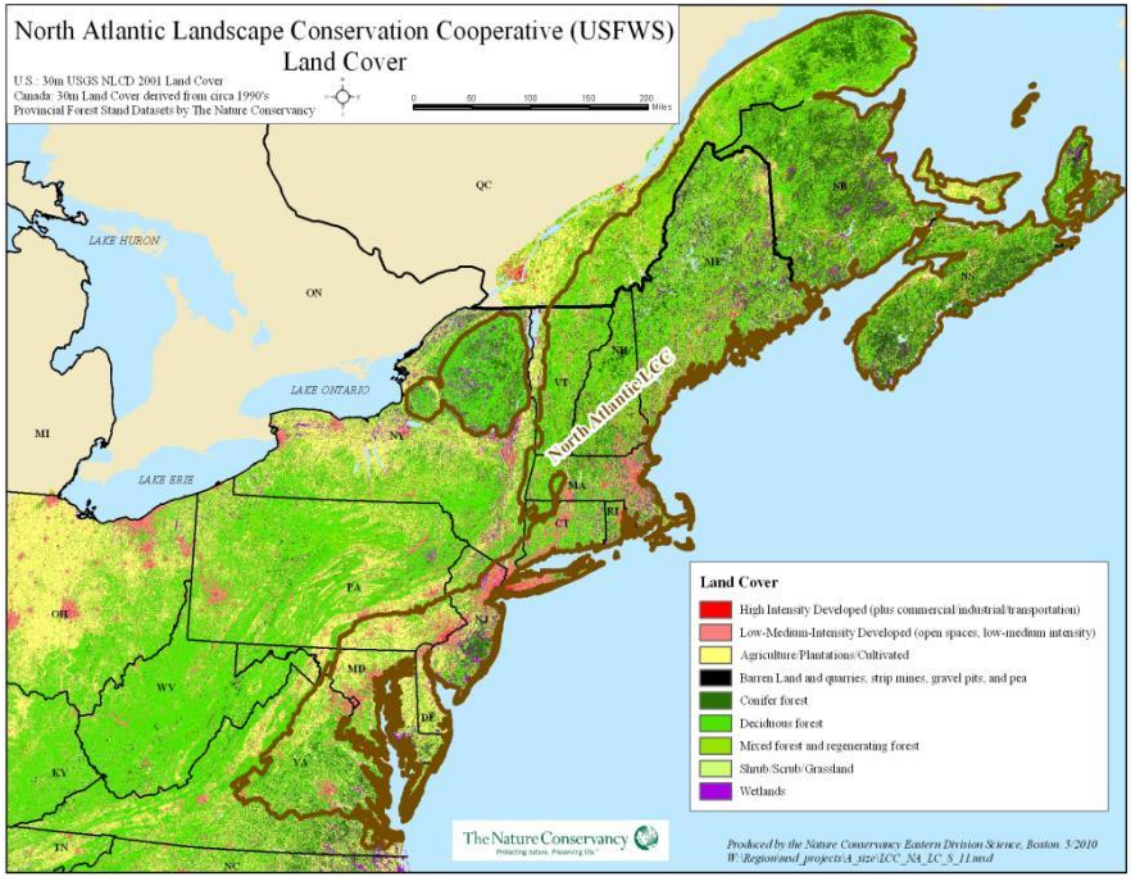
Landforms control the distribution of moisture, nutrients and climatic effects and **create "microclimate buffering"**

More Heterogeneity = More options for species to find suitable habitat at a given site as conditions change

What Factors Increase the Resilience of a **Site**?
2. Permeability (Connectedness)

Model Based on **Arrangement** and **Contrasts** of land uses.

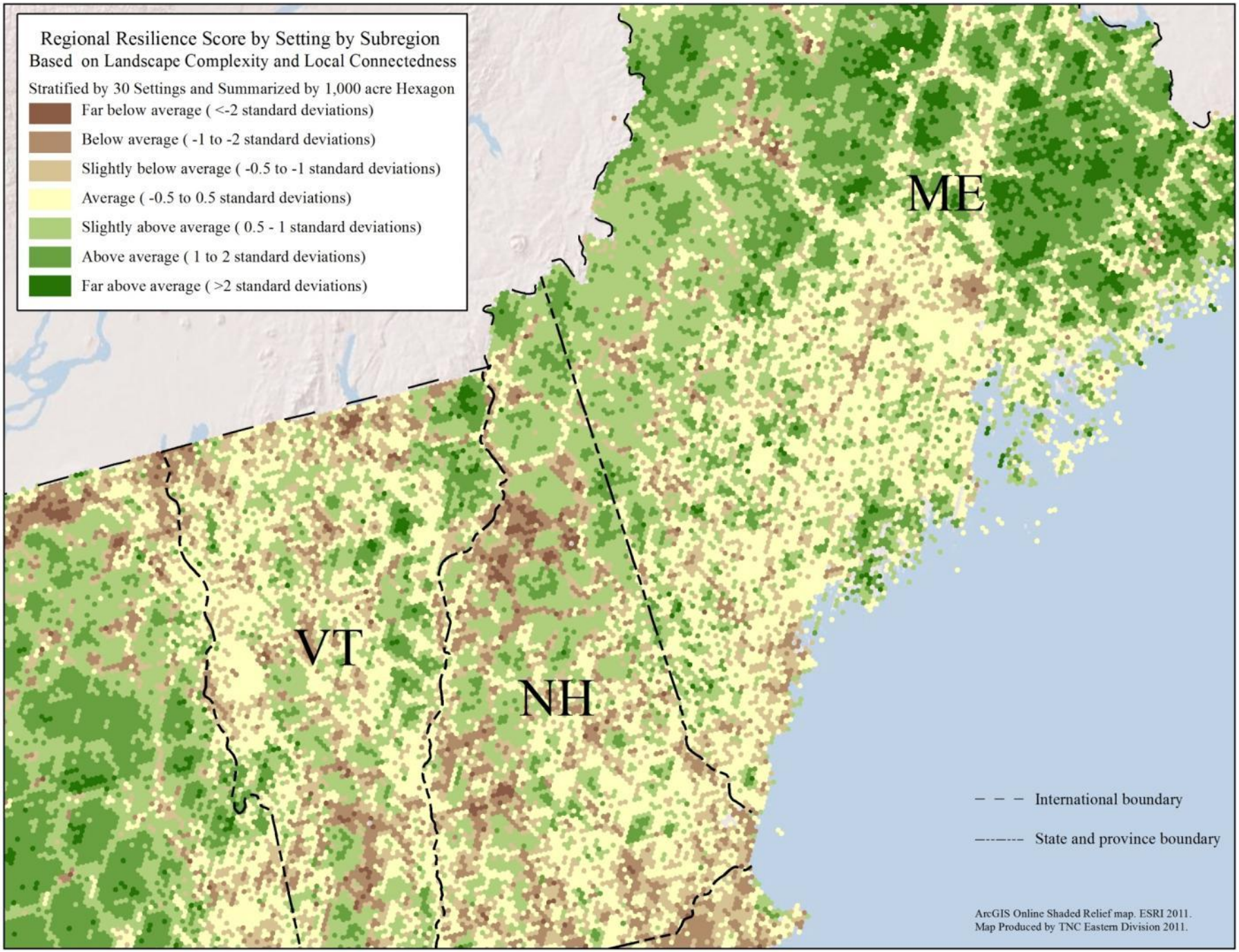
Developed/Roads — Agriculture — Water — Forest

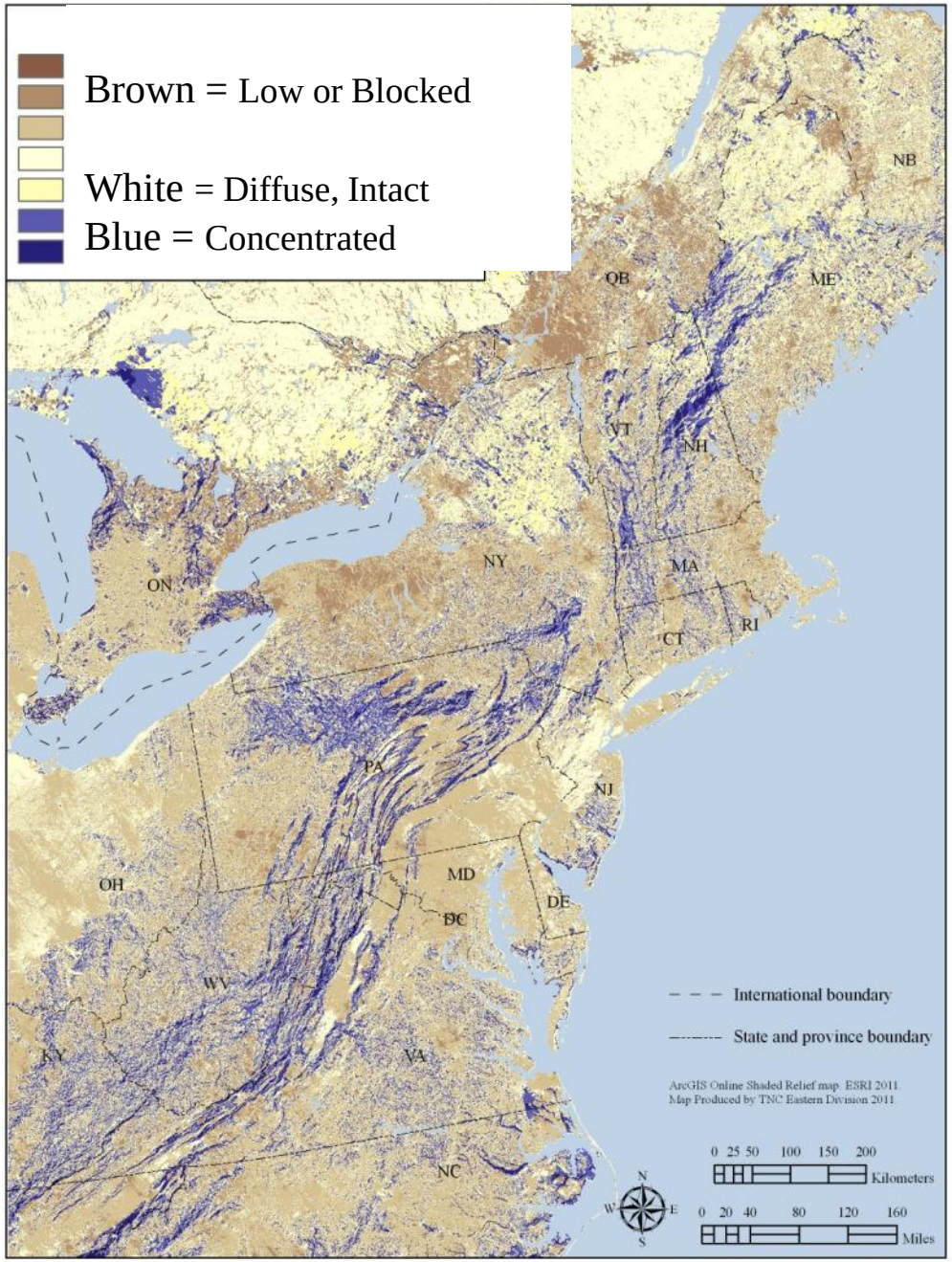


Reveals areas likely to support more species that need to *move*

<u>and</u>

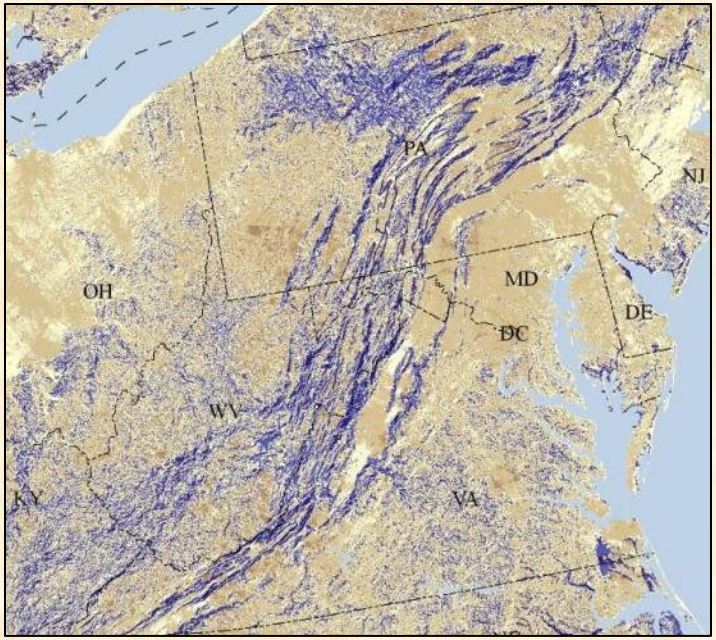
where ***natural processes*** may remain ***functional***


Regional Resilience Score by Setting by Subregion
Based on Landscape Complexity and Local Connectedness
Stratified by 30 Settings and Summarized by 1,000 acre Hexagon
Far below average (<-2 standard deviations)
Below average (-1 to -2 standard deviations)
Slightly below average (-0.5 to -1 standard deviations)
Average (-0.5 to 0.5 standard deviations)
Slightly above average (0.5 - 1 standard deviations)
Above average (1 to 2 standard deviations)
Far above average (>2 standard deviations)
ME
VT
NH
International boundary
State and province boundary
ArcGIS Online Shaded Relief map. ESRI 2011.
Map Produced by TNC Eastern Division 2011.



Regional Flow Concentrations

This tells us when the location of site is key to maintaining **larger, regional** flow patterns.



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Landscape Conservation Designs to Guide Decisions in the Face of Change

- Landscape Change, Assessment and Design
  - Landscape Change
    - Climate change
    - Land use change
  - Current and Future Assessments
    - Habitat capability for wildlife
    - Ecological Integrity
  - Landscape Design Decision Support Tools
- Resiliency
  - Represent all geophysical expressions in the Network
  - Conserve sites with more landscape complexity and local connectedness
  - Ensure all components are functionally connected