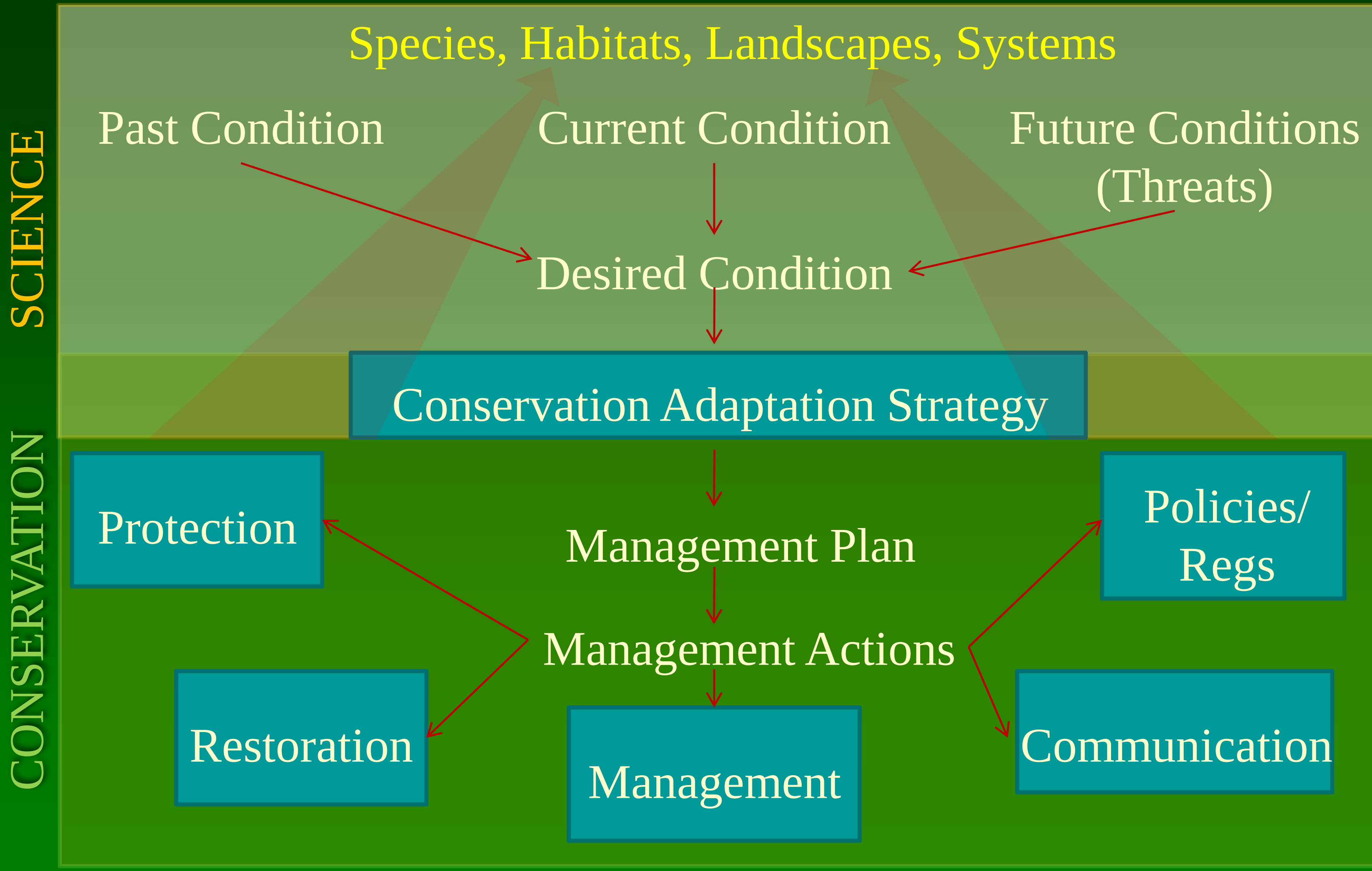
Conservation Adaptation Strategy: Framework and Tools



Initial 2010 LCC Projects

- NEAFWA Regional Climate Change Vulnerability Assessment
- Landscape Change & Decision Support Tools
  - Coastal
    - Sea level rise, beaches and piping plovers
  - Aquatic
    - Stream flow, temperature, and brook trout
  - Terrestrial
    - Species/habitat
    - Ecological integrity
    - Geophysical
    - Regional connectivity

Northeast Regional Species and Habitat Vulnerability Assessments

1. Applying an (expert-driven) model to categorize the vulnerabilities of habitats and their associated vertebrate species to climate change

2. Identifying appropriate indicator species and making recommendations for "climate-smart" monitoring

3. Identifying adaptation actions to enhance the resilience of habitats

4. Assessing capacity of the state fish and wildlife agencies to address climate change issues and facilitate the exchange of information across state boundaries.

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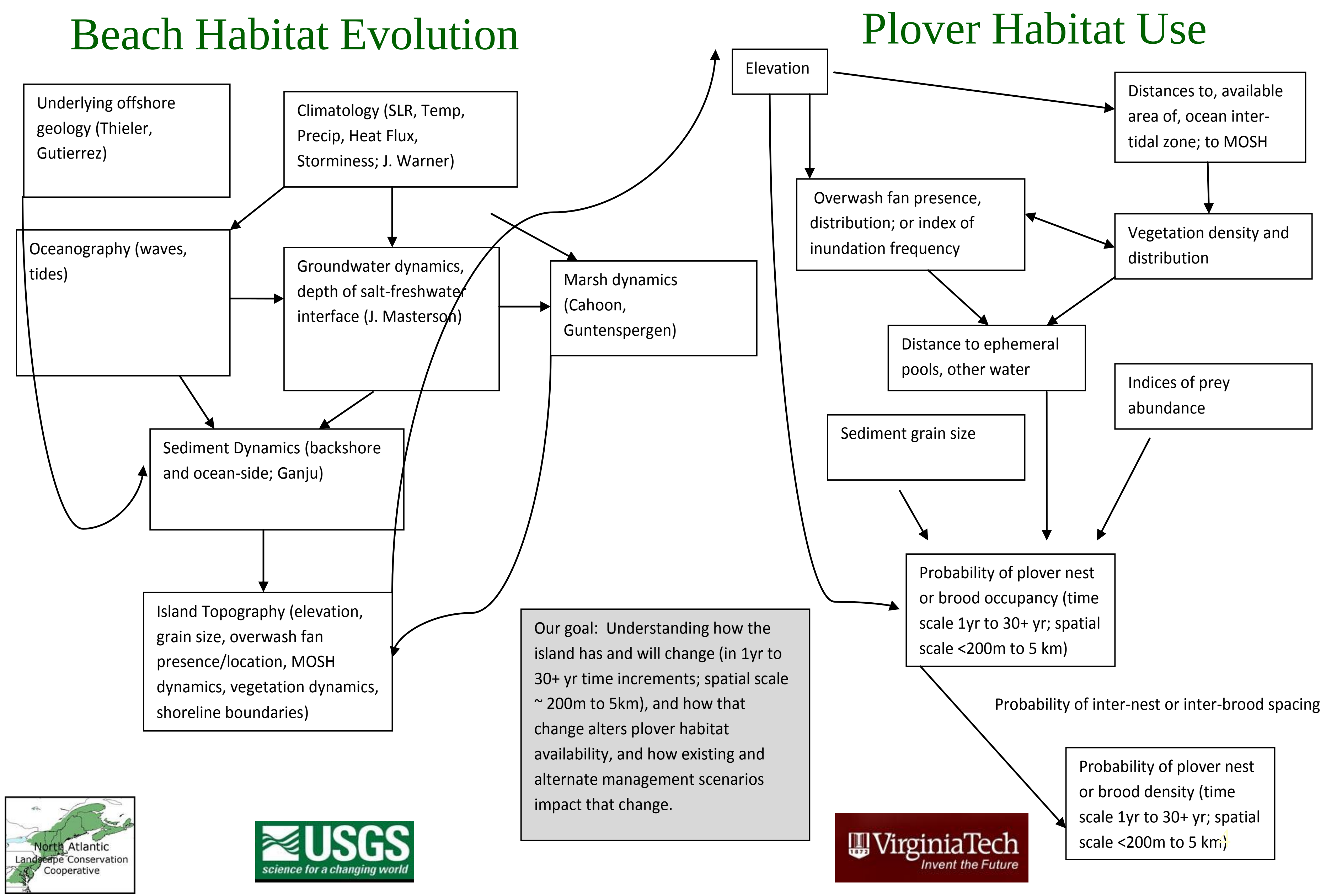
North Atlantic Landscape Conservation Cooperative

Forecast effects of accelerating sea-level rise on habitat of Atlantic Coast piping plovers and identify responsive conservation strategies



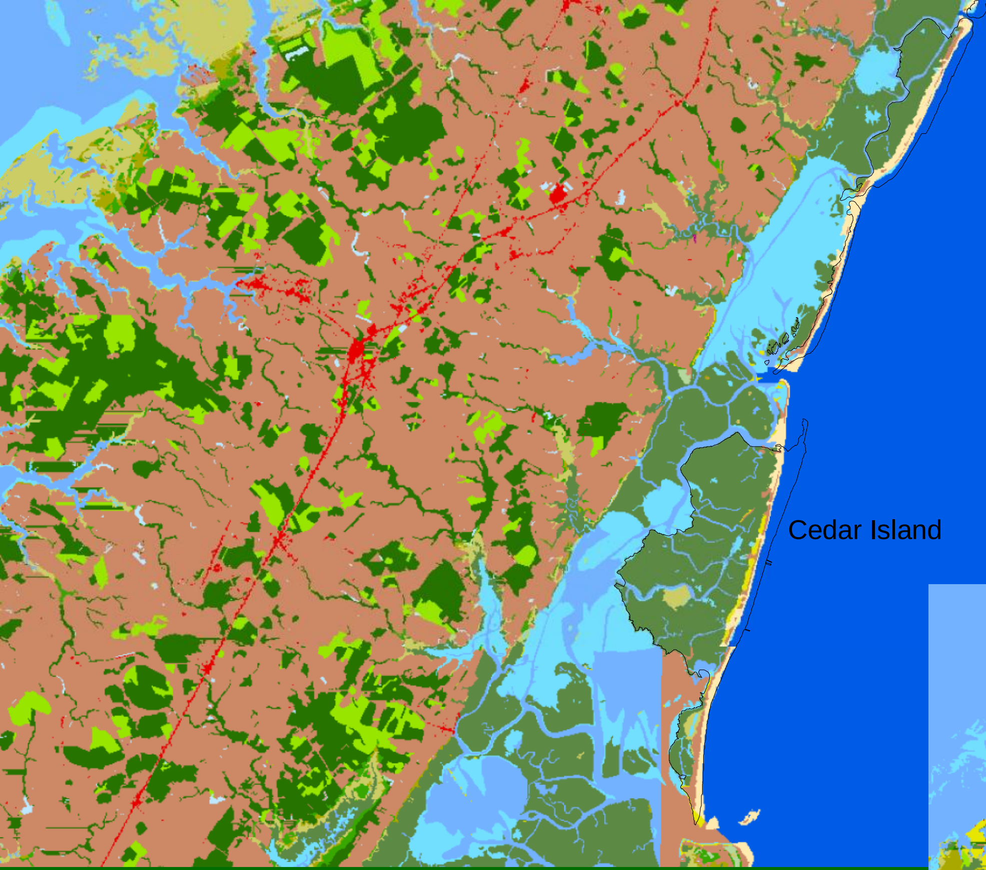
Coastal Impacts from Sea Level Rise

Our goal: Understanding how the island has and will change (in 1yr to 30+ yr time increments; spatial scale ~ 200m to 5km), and how that change alters plover habitat availability, and how existing and alternate management scenarios impact that change.

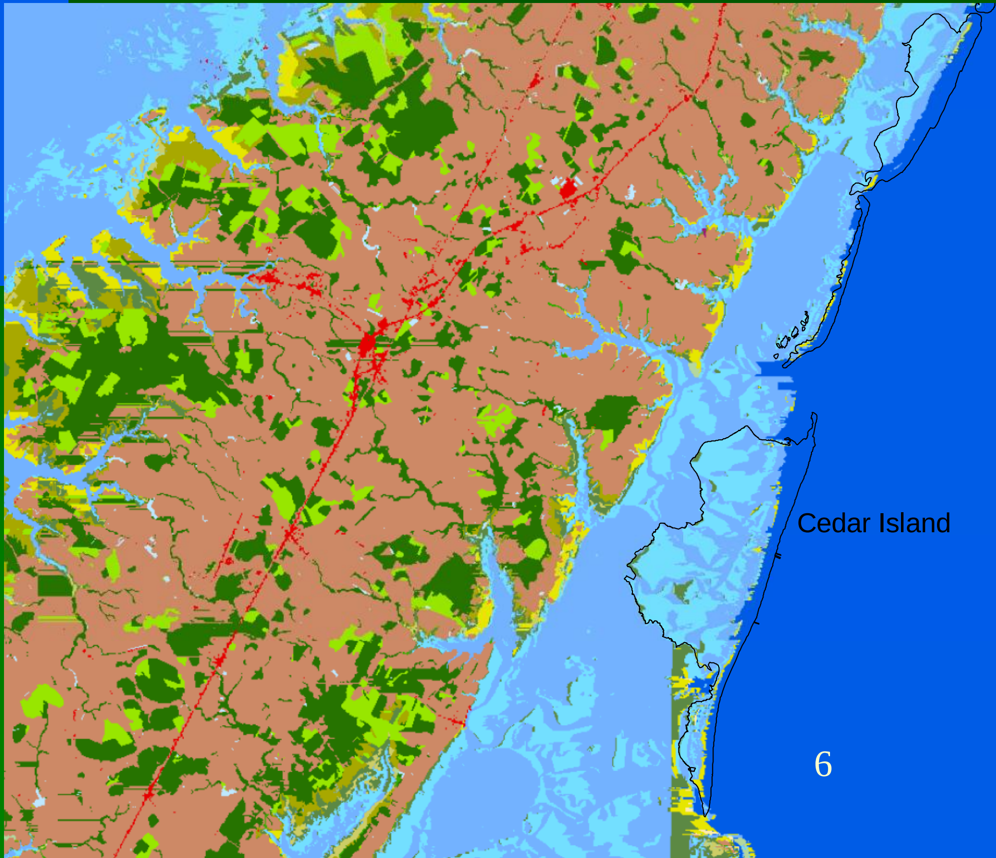
Sea Level Rise Models

Chincoteague National Wildlife Refuge

Initial Condition

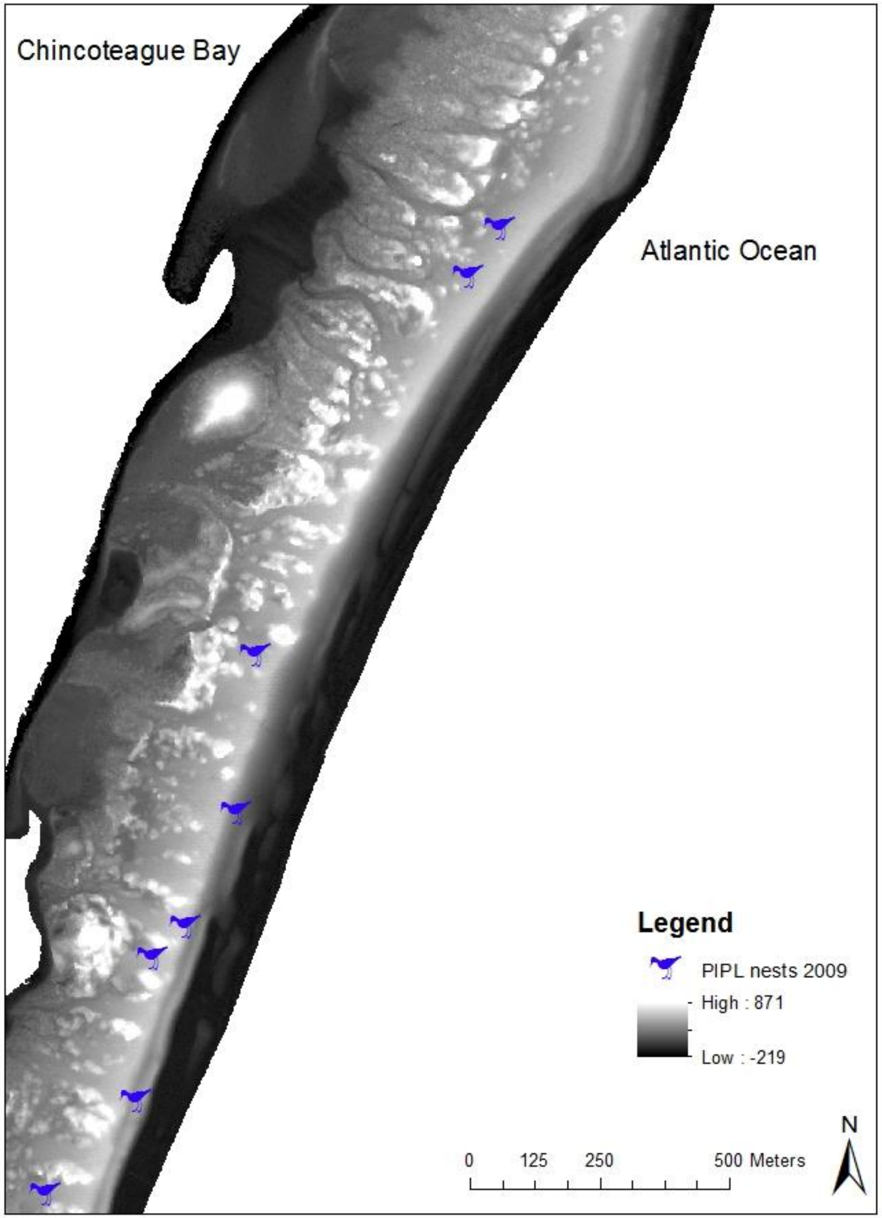


2100 1 Meter SLR



SLAMM Categories

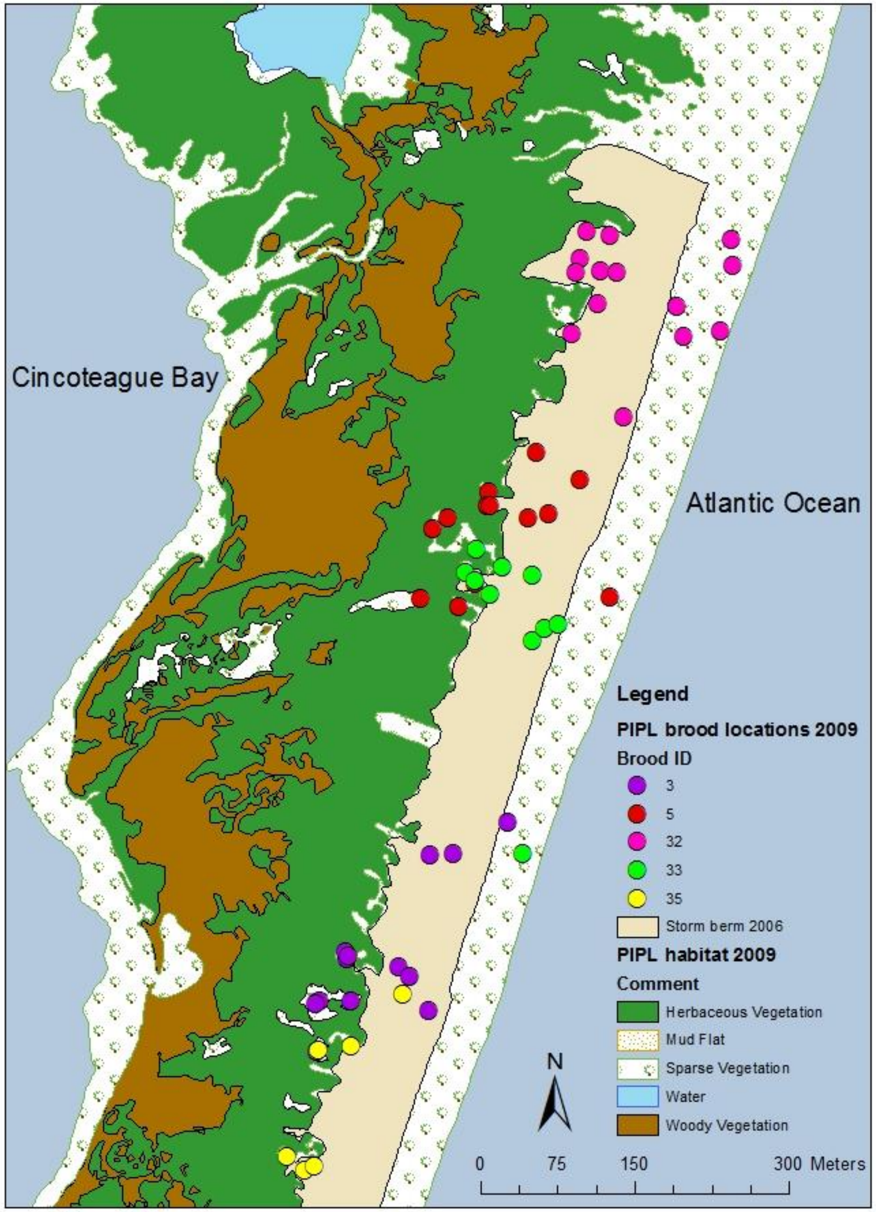
- Dev. Dry Land
- Undev. Dry Land
- Swamp
- Inland Fresh Marsh
- Tidal Fresh Marsh
- Trans. Salt Marsh
- Salt Marsh
- Estuarine Beach
- Tidal Flat
- Ocean Beach
- Rocky Intertidal
- Inland Open Water
- Riverine Tidal
- Estuarine Open Water
- Open Ocean
- Irreg. Flooded Marsh
- Inland Shore
- Tidal Swamp



LiDAR Map
More precise elevations

-nest elevation
-association with habitat variables

i.e. overwash fans, ephemeral pools etc.



Habitat Maps:

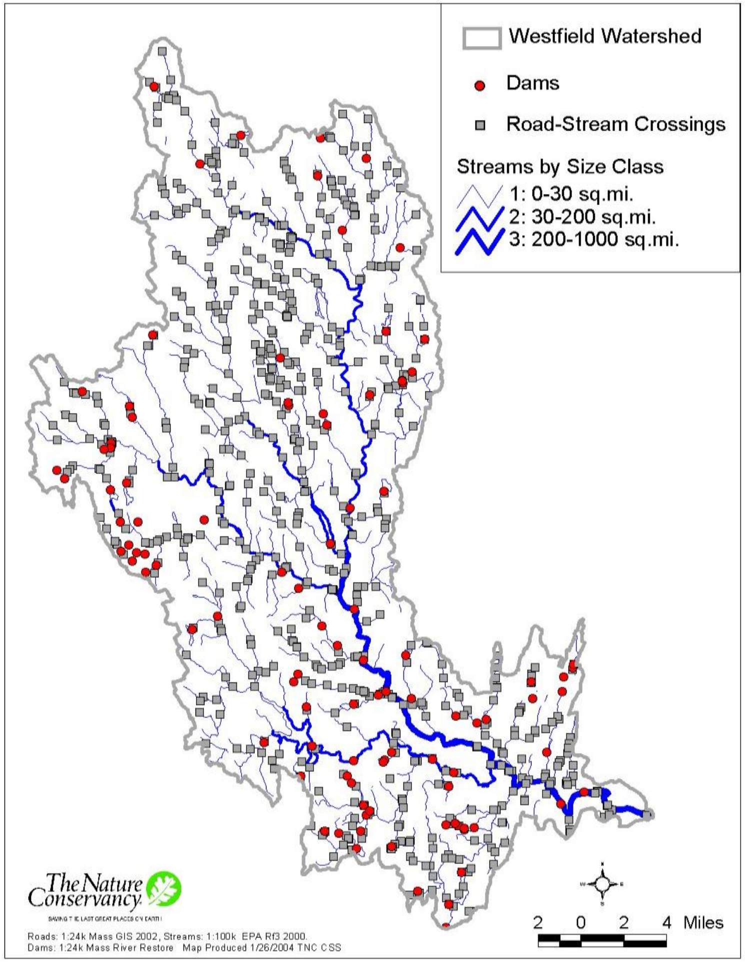
Nest
-location
-density

Brood
-movement
-density

associated with
habitat variables

Threats to Aquatic Habitats

- Habitat fragmentation/barriers
  - Isolated populations
- Water withdrawals
  - Seasonal effects of stream flow
- Land use/land change
  - Riparian buffer, impervious surfaces
- Climate change
  - Air temperature and precipitation affecting:
    - Stream flow and temperature
    - Seasonal patterns
- Interactions among threats



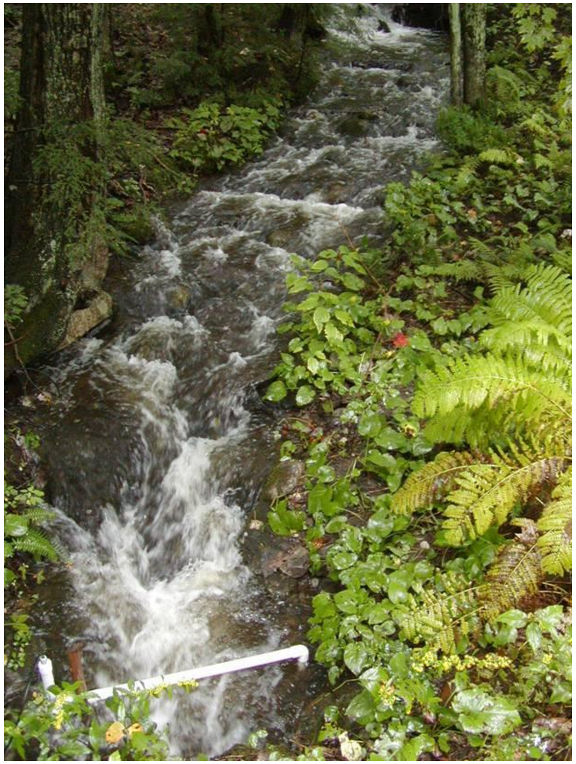
Ben Letcher

USGS, Conte Anadromous Fish Research Center, Turners Falls, MA

University of Massachusetts

Keith Nislow

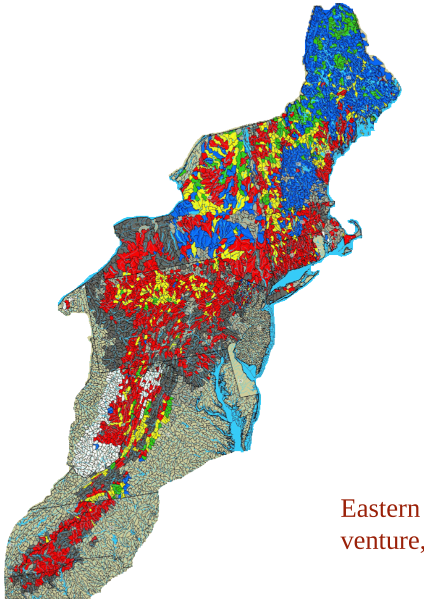
USFS, Northern Research Station, Amherst, MA



SALMONID (BROOK TROUT) POPULATION PERSISTENCE

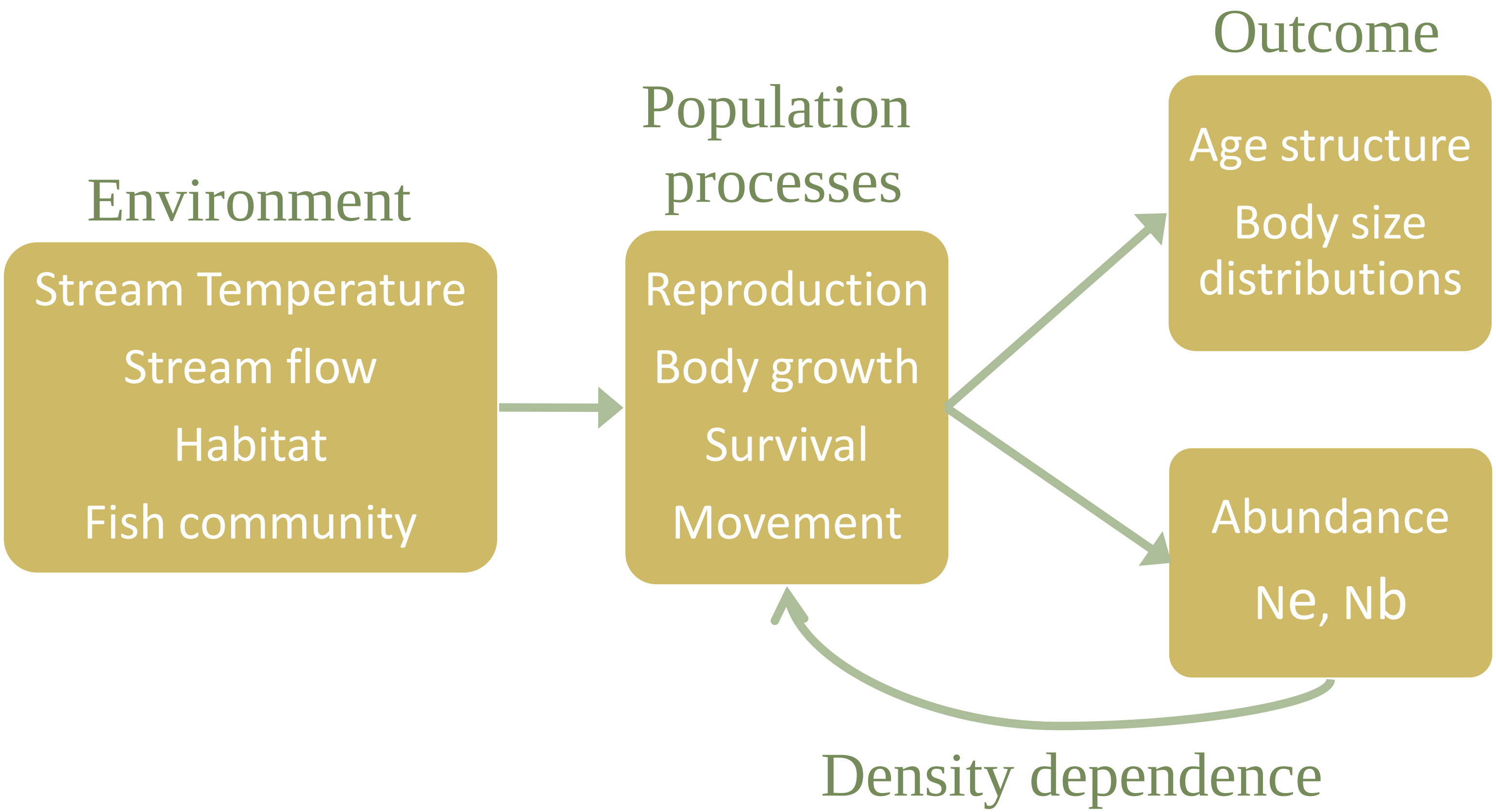
Overall goal

- Understand how populations work
- What affects local <u>population persistence?</u>
- Develop DSS tool for managers
  - Probability of population persistence under varying management scenarios



Eastern brook trout joint venture, 2007

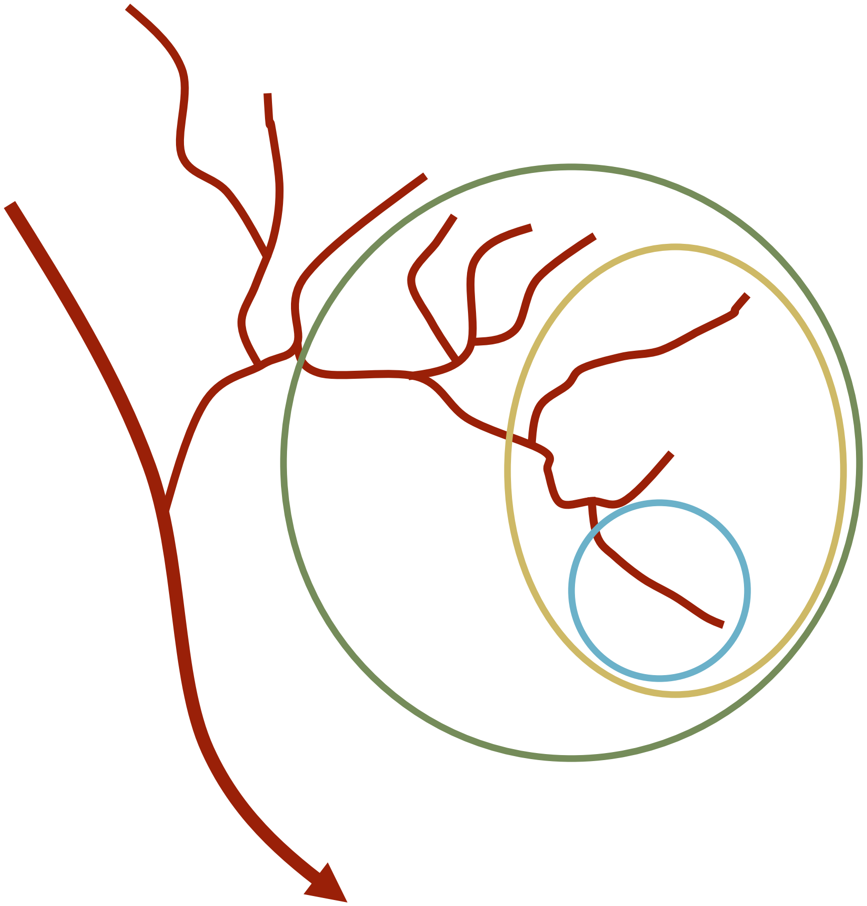
Approach



Catchment scale model (< 1 Km)

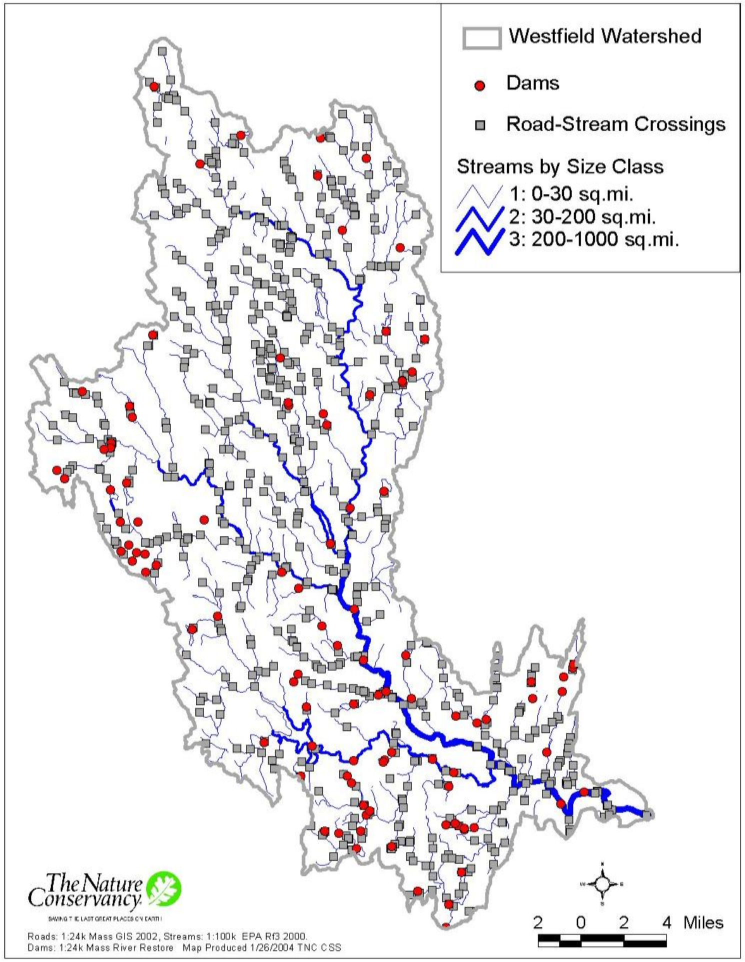
Approach – working across scales

- Hierarchical models
  - Scale up
  - Propagate error
- Watershed
  - Sub-watershed
    - Catchment
- Among-watershed
  - Multiple study sites



What questions can we address?

- Habitat fragmentation
  - Which barriers do we prioritize for removal/repair/fish passage?
- Water withdrawal
  - How much water can be extracted?
- Importance of water source
  - How does extent of groundwater input affect persistence?
- Climate change forecasts
  - What are the effects of variation in stream flow, temperature?
- Interactions
  - Where are the most resilient populations likely to occur



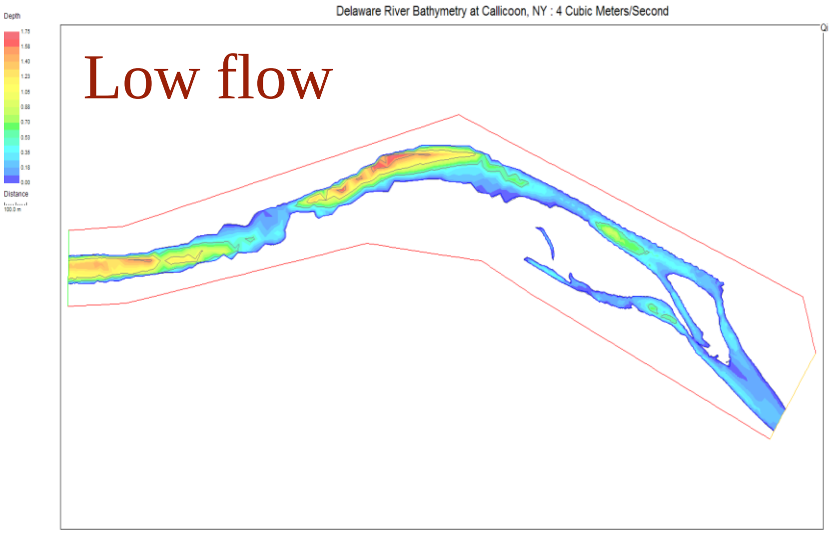
Freshwater Mussel Component

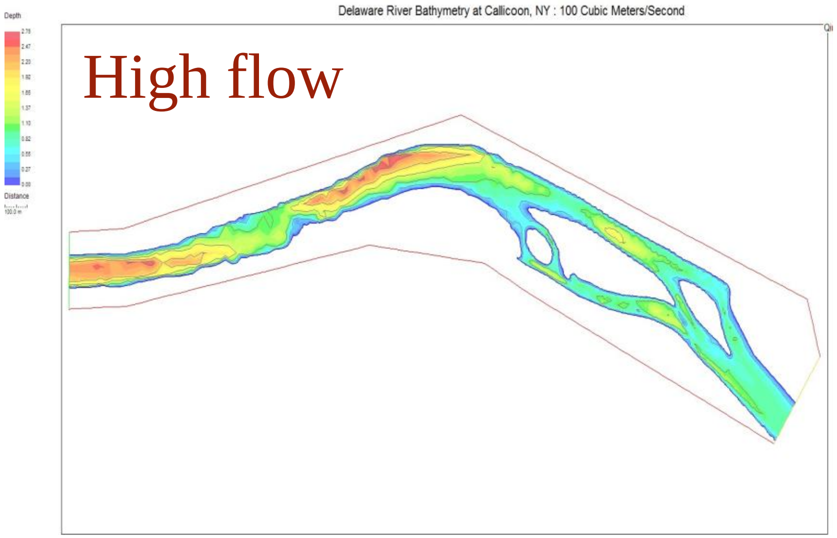
Goal: Determine if brook trout represent the broader coldwater community.

1. Conduct vulnerability assessment of T&E mussels to changes in water flow and temperature

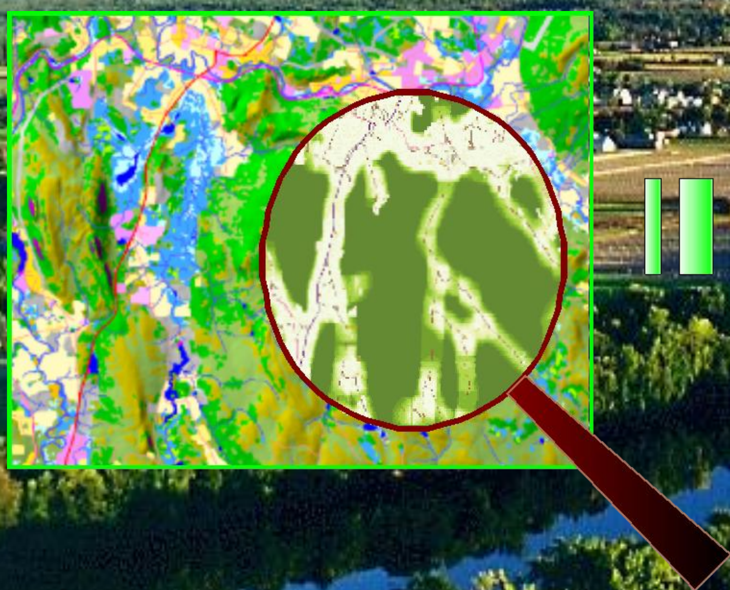
2. Model shifts in mussel and host fish community composition with land use and climate change.

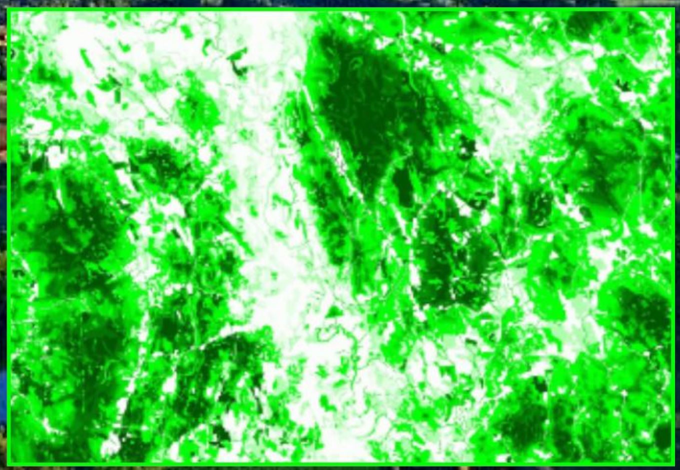
3. Model projected changes in ecosystem services with shifts in freshwater mussel communities.





Designing Sustainable Landscapes for Wildlife
Decision-Support Tools for Conservation





North Atlantic Landscape Conservation Cooperative

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Objective is to enhance the ability of programs and partners to make informed conservation decisions for sustaining biodiversity at the landscape scale under current and predicted future conditions.

- Design landscapes to ensure connectivity

- Minimize forces of habitat degradation

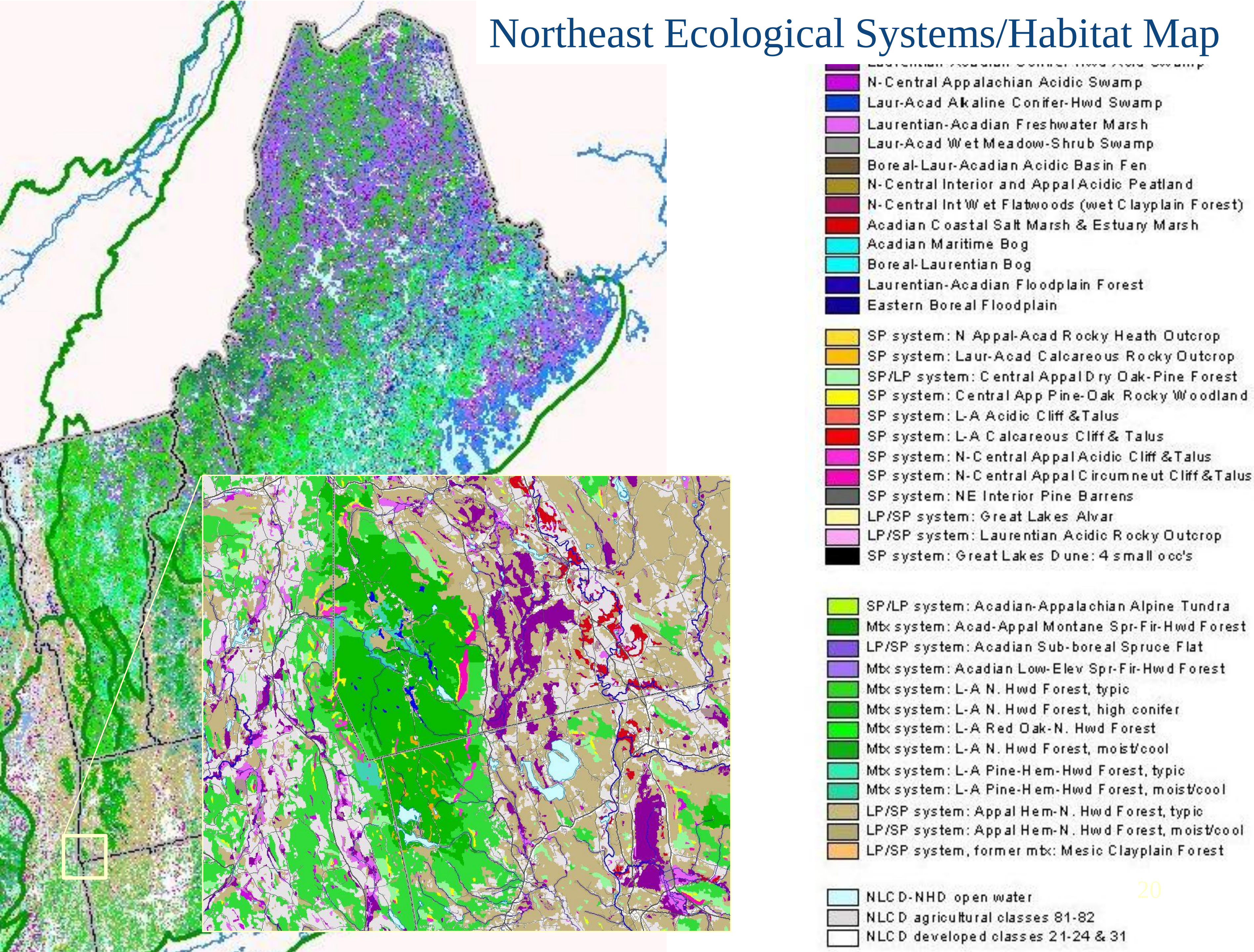
- Protect, manage & restore habitat in the right places

Utilizing complementary **fine-** and **coarse-filtered approaches**

Fine filter is based on the concept of *habitat capability* (and population persistence where feasible) applied to a suite of designated *representative species*

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

Northeast Ecological Systems/Habitat Map



Representative Species

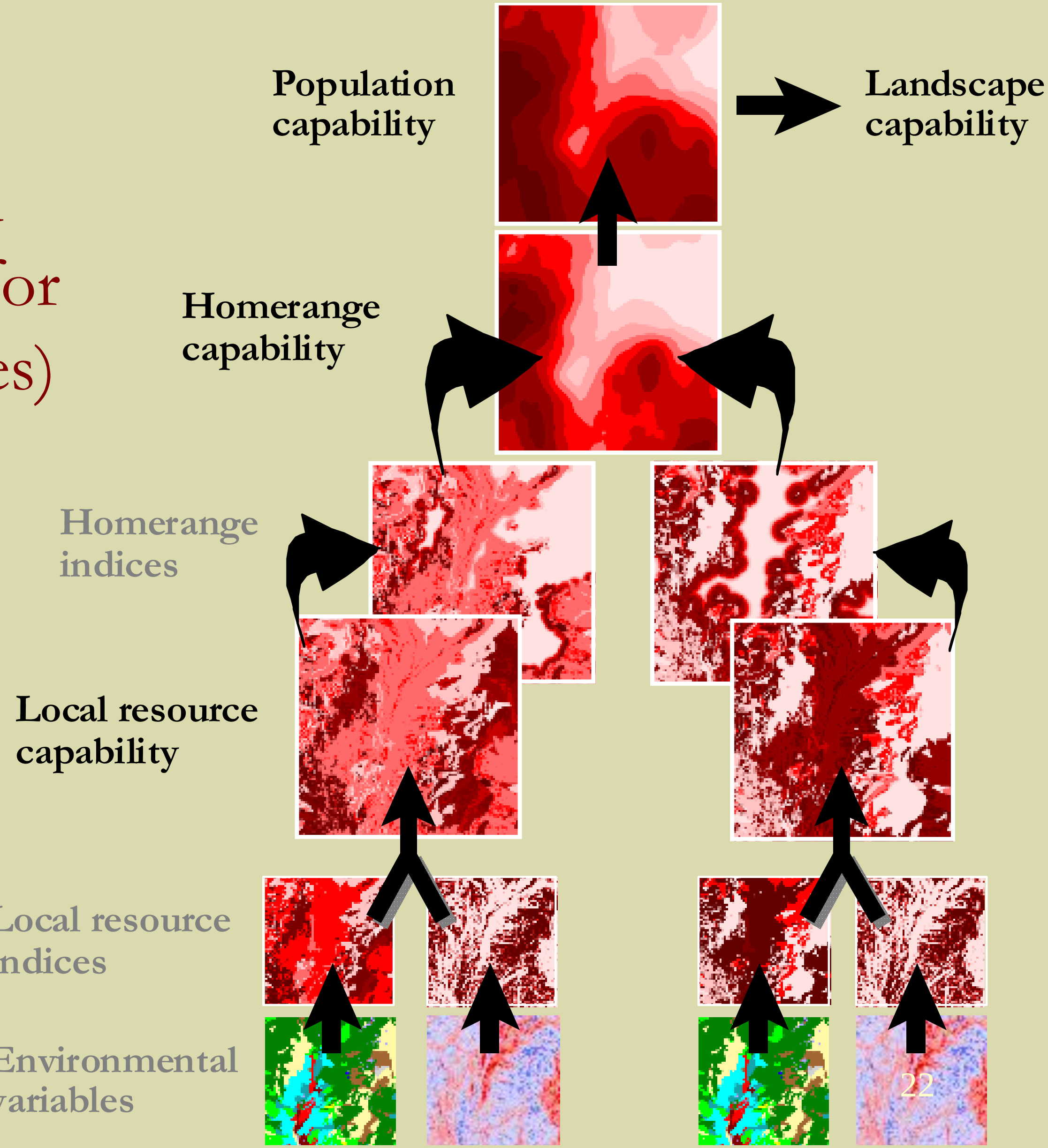
GOAL: Identify a list of representative species for designing conservation & management strategies that will most effectively sustain the identified fish and wildlife populations in the face of land use change, climate change, and other stressors occurring within the North Atlantic LCC.

- Results of species-habitat cluster analysis (UMass)
- Expert opinion at workshops (Spring 2011)
  - How representative within LCC?
  - Sensitivity to climate & habitat changes
  - How practical to monitor?
  - Availability of baseline data

Fine filter assessment

- Capability models

Each grid cell is evaluated for its habitat capability (for each representative species) based on its composition & landscape context (and summarized for the landscape)

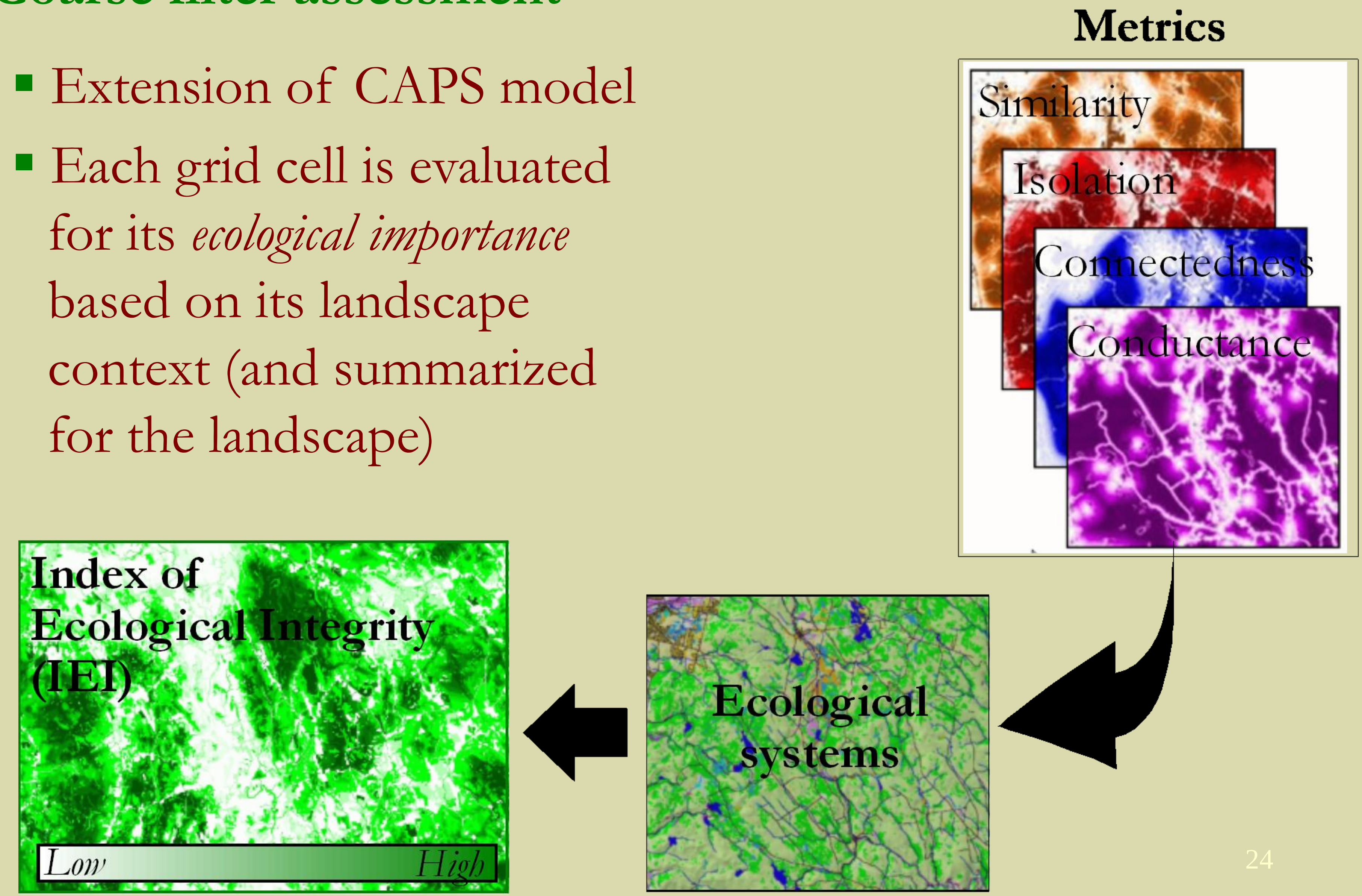


Coarse filter is based on the concept of *ecological integrity* applied to a suite of designated *ecological systems*

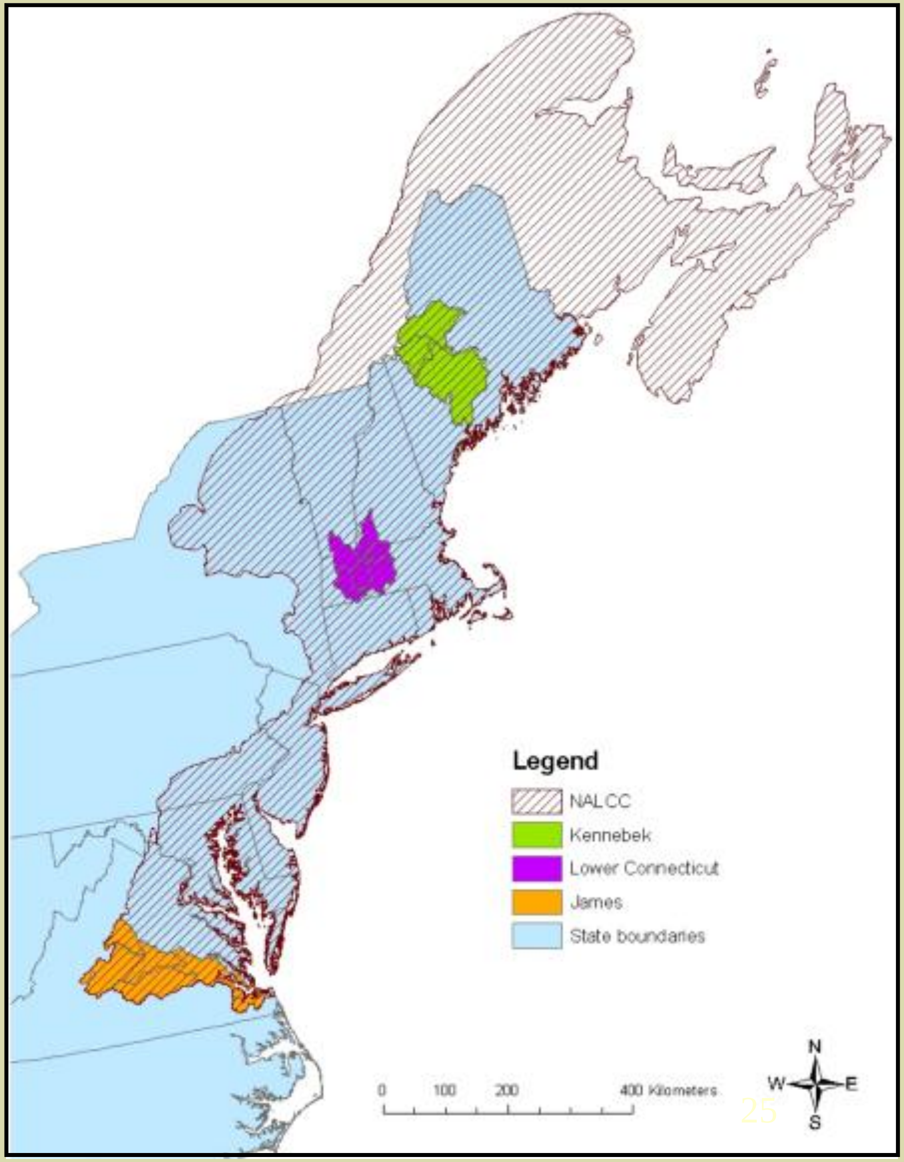
- *Ecological integrity* refers to the capability of an area to sustain ecological functions over the long term; in particular, the ability to support biodiversity and the ecosystem processes necessary to sustain biodiversity over the long term in the face of disturbance and stress

Coarse filter assessment

- Extension of CAPS model
- Each grid cell is evaluated for its *ecological importance* based on its landscape context (and summarized for the landscape)



Now building a **landscape change model** to predict changes in *ecological integrity* and *habitat capability* driven by urban growth, climate change and other anthropogenic (e.g. timber harvest) and natural disturbances (e.g., fire)

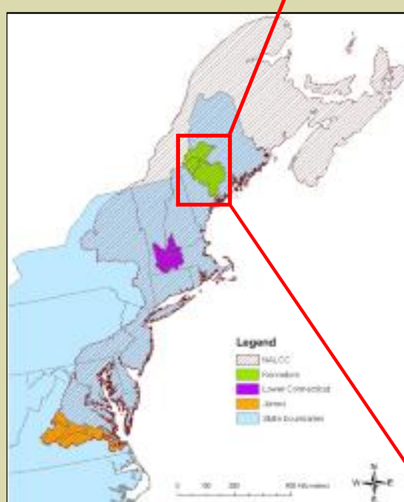


Piloted in 3 watersheds:

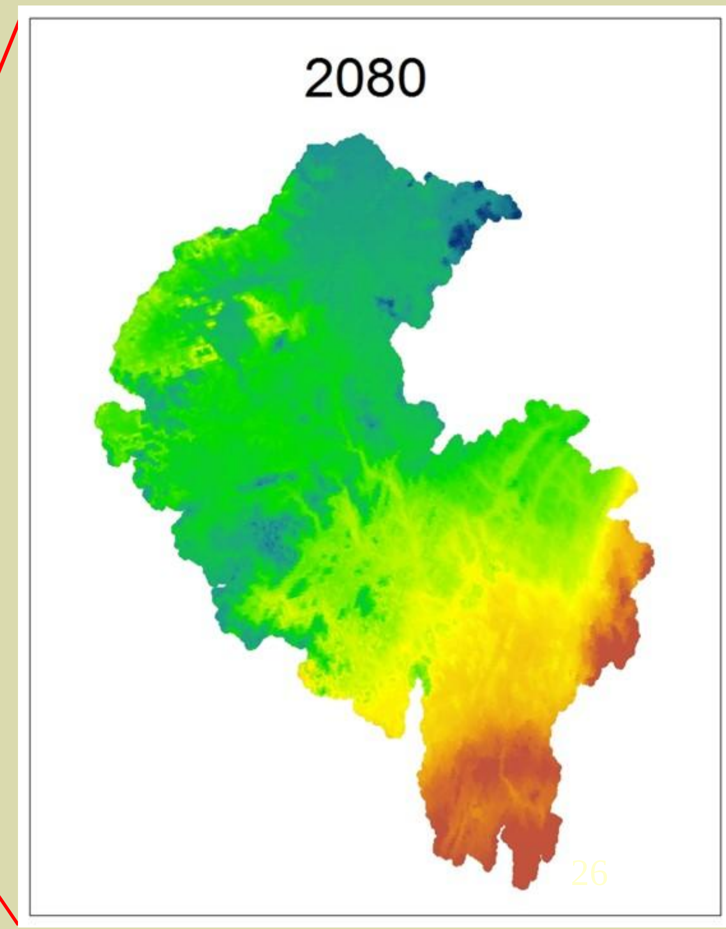
- Kennebec (15,264 km^2)
- Lower Connecticut (8,579 km^2)
- James (16,747 km^2)

Climate change module

- 3 SRES scenarios (B1, A1B, A2)
- Ensemble of 16 GCM's (36 total runs)
- Statistical (BCSD) downscaling to 12 km
- ΔPRISM (800 m)
- Resampled (30 m)
  - Growing deg days
  - Min Jan temp
  - Annual precip



Projected min January temp, Kennebec watershed, SRES A2 scenario

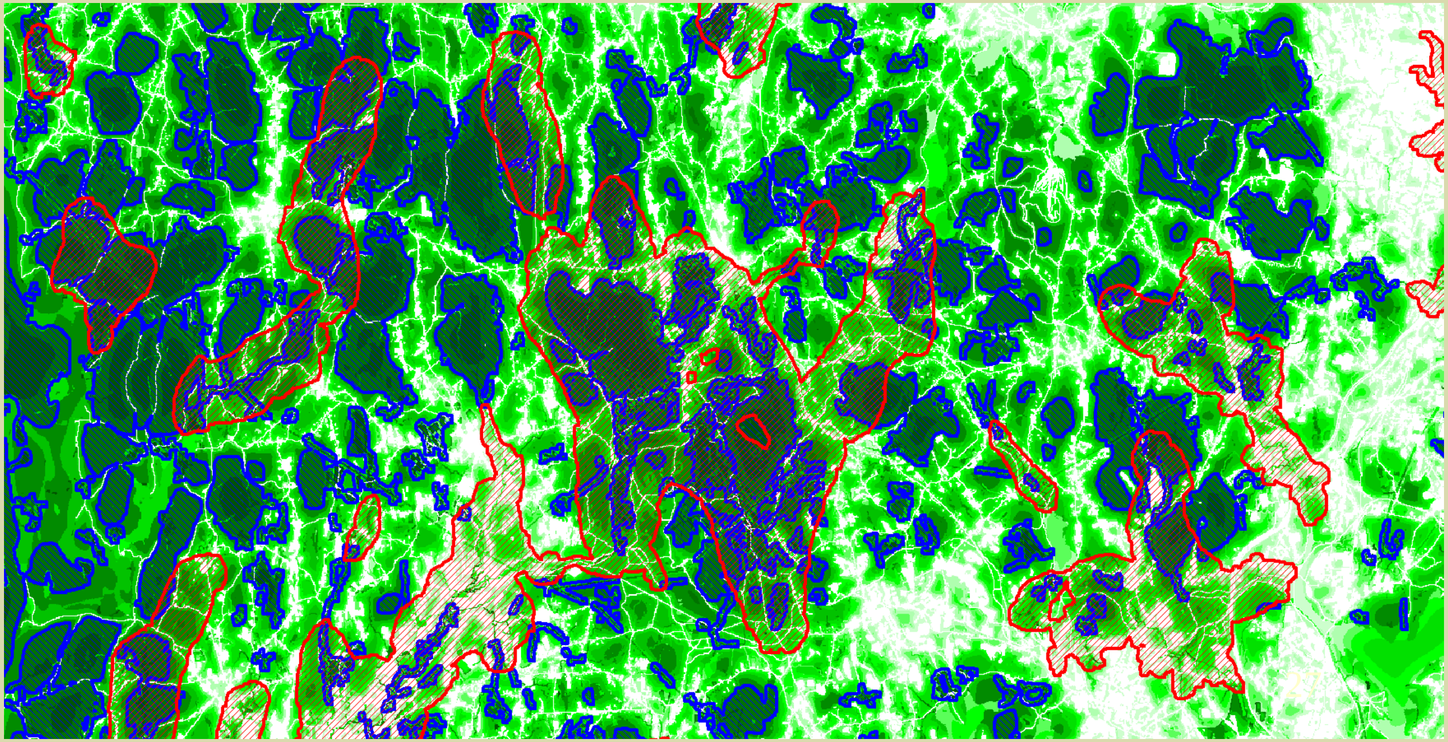


Model outcomes: *Coarse-fine filter* evaluation

- Identify a strategy for maximizing the complementarity of the coarse and fine filters

Top 20% (plus buffer) wood turtle habitat

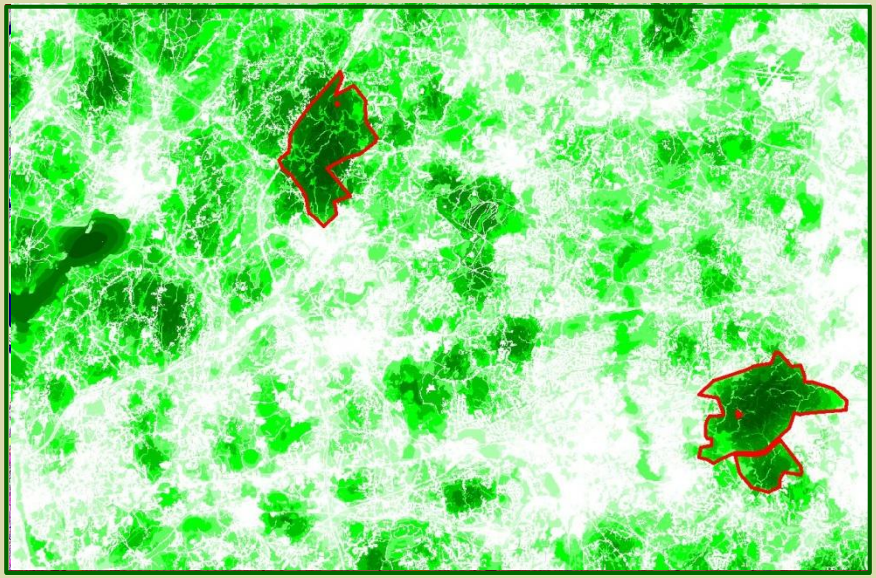
Top 20% ecological integrity



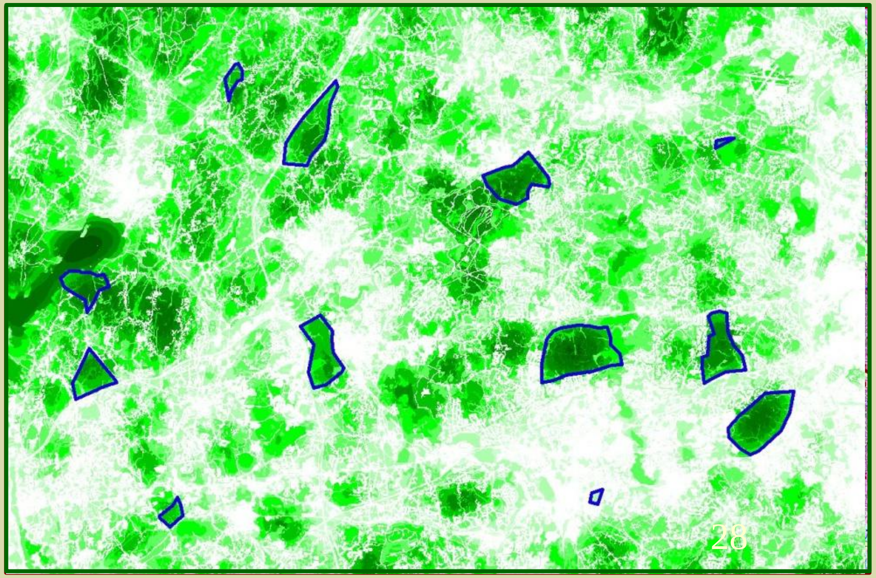
Model outcomes: Land *protection* priorities

- Evaluate effectiveness of *alternative* land protection scenarios

Scenario 1

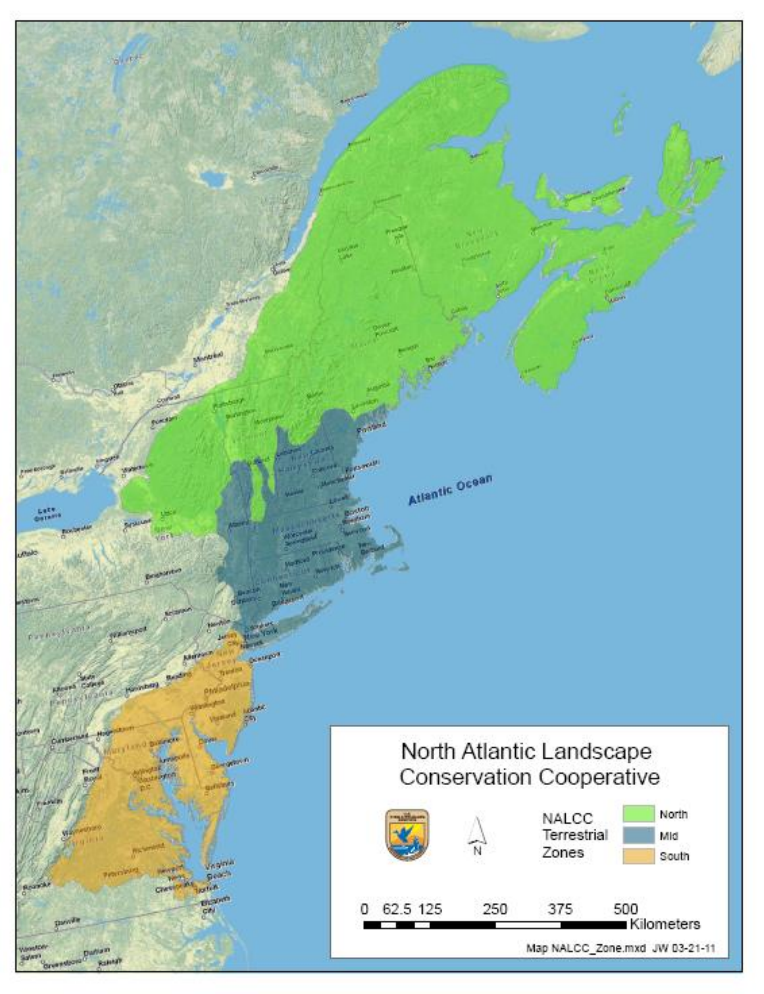


Scenario 2



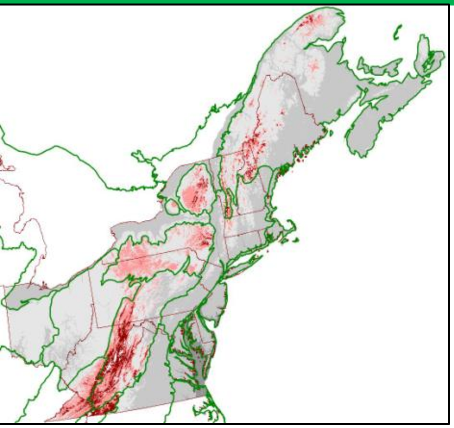
Project outlook

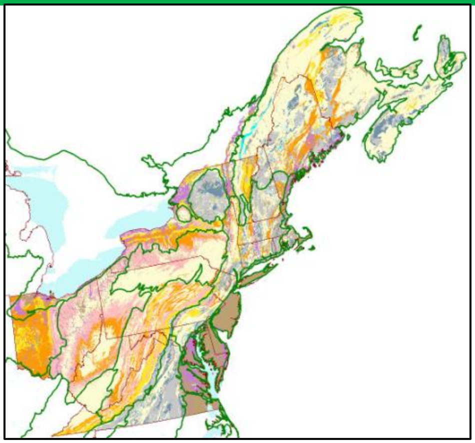
- Pilot study complete May 2012
- Next steps:
  - Expand to full NALCC
  - Develop additional modules (drivers)
  - Upgrade wildlife models to occupancy/population
  - Sustainable landscape design algorithms (scenario analysis)

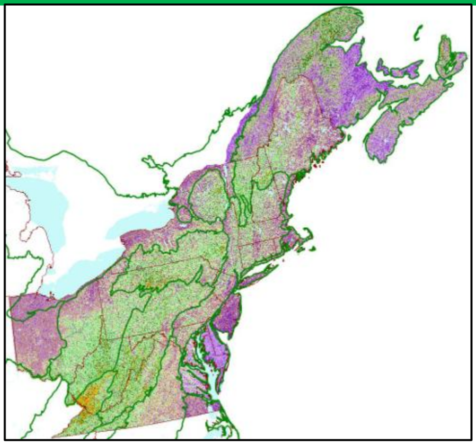


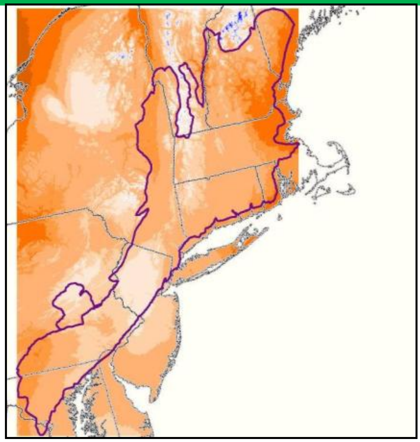
- **www.umass.edu/landeco/research/nalcc/nalcc.html**
- **www.fws.gov/northeast/science/nalcc.html**

Physical and Climatic Factors









Elevation
Max
Min
Range

Area
Latitude

# of Geology classes
Amount of each:
Sedimentary
Shale
Calcareous
Mod Calc
Granite
Mafic
Ultramafic
Coarse sand
Fine silt

# of Landforms
Amount of each:
Cliff
Upper slope
Summit
Side slope
Cove
Valley
Wet flat
Dry flat

Mean diurnal temp. range,
Mean annual temp. range,
Mean annual temp.
Mean annual precip.
Precip. warmest quarter,
Min temp. coldest month,
Mean temp. coldest quarter.

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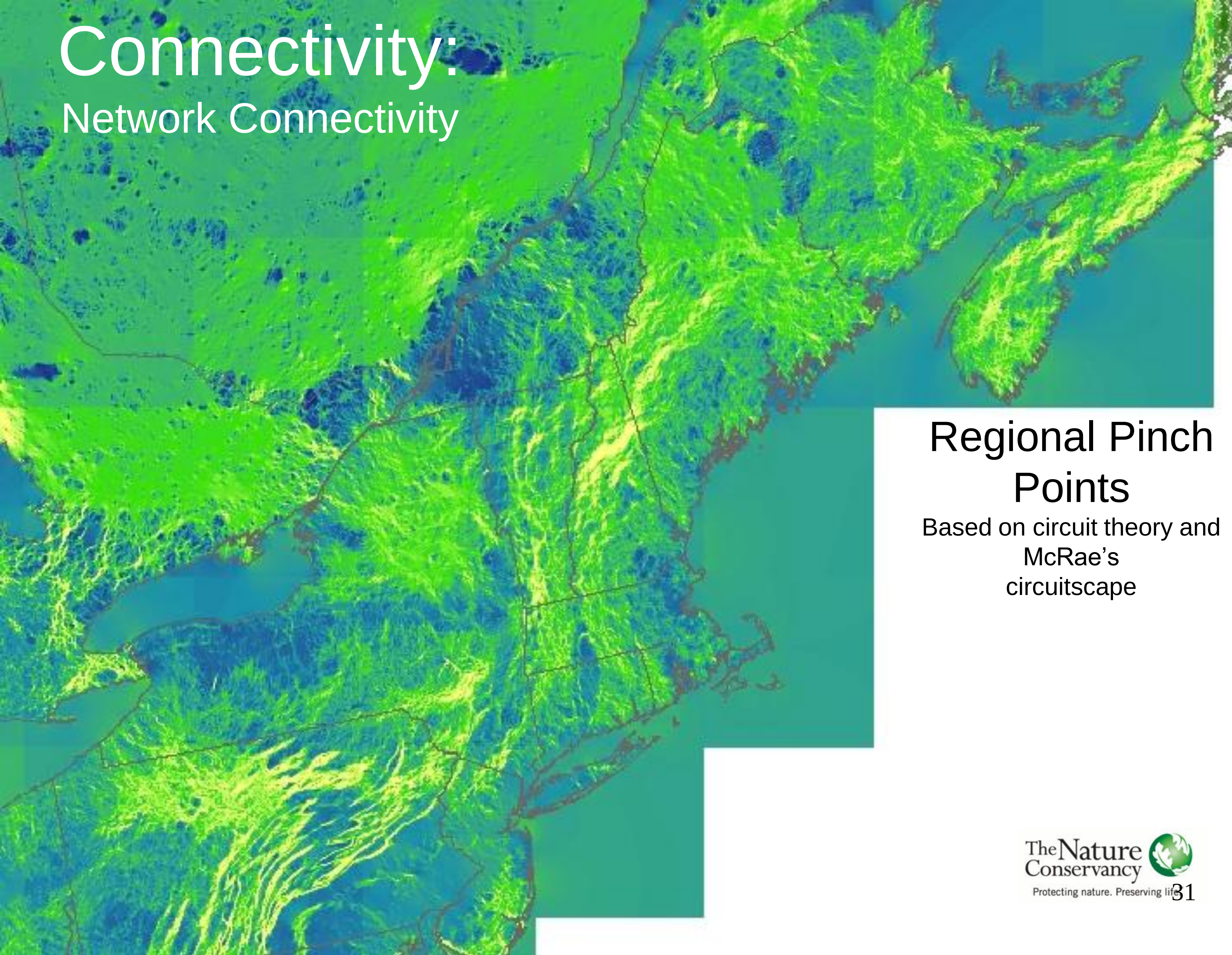
Connectivity:

Network Connectivity



Regional Pinch Points

Based on circuit theory and McRae's circuitscape

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Complementary Approaches

- Expert driven (and subsequent data-driven) assessments of vulnerable species and habitats
- Species-habitat based approaches
  - Consistent habitat maps
  - Species-habitat models
  - Projections of changes to habitats and capability of supporting populations
- Coarse Filter/Ecological integrity
  - Landscape context
- Geophysical approaches to resiliency (TNC)
- Connectivity (Umass/TNC)