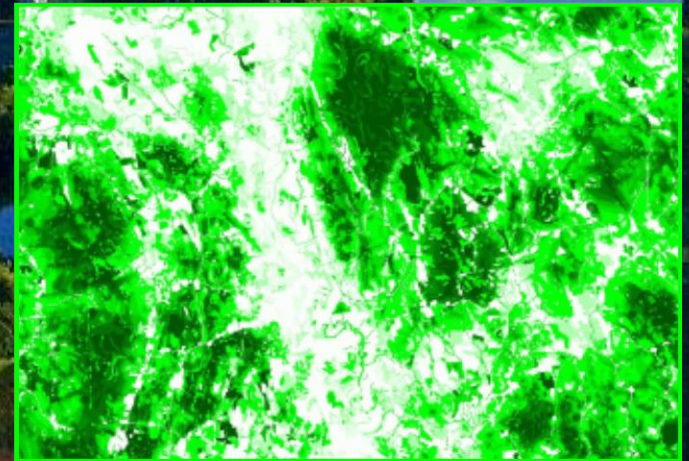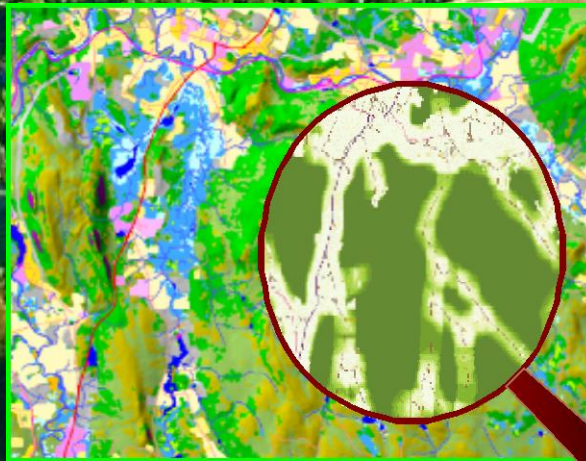# Designing Sustainable Landscapes in the Northeast
A project of the North Atlantic Landscape Conservation Cooperative
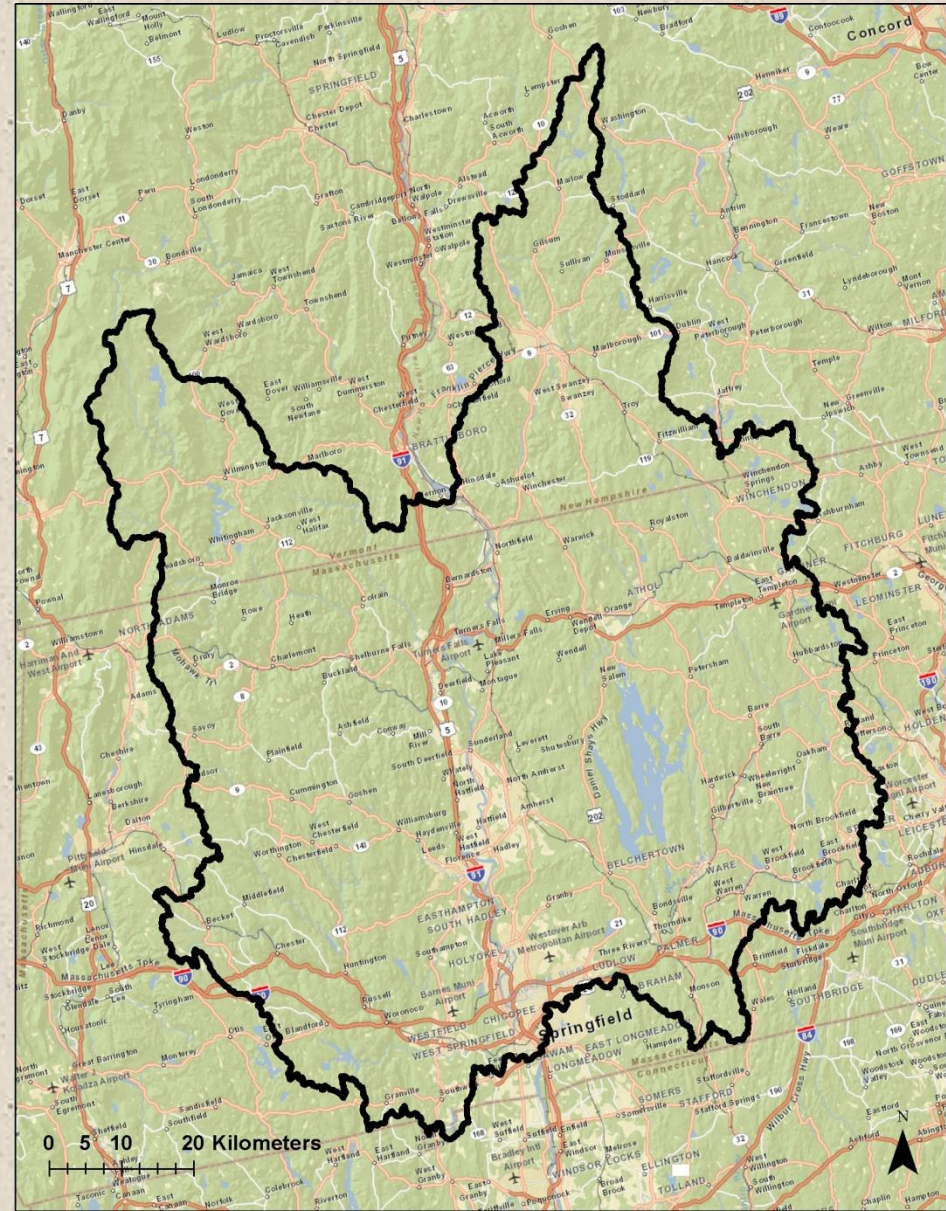
Integrating Stream Science Meeting
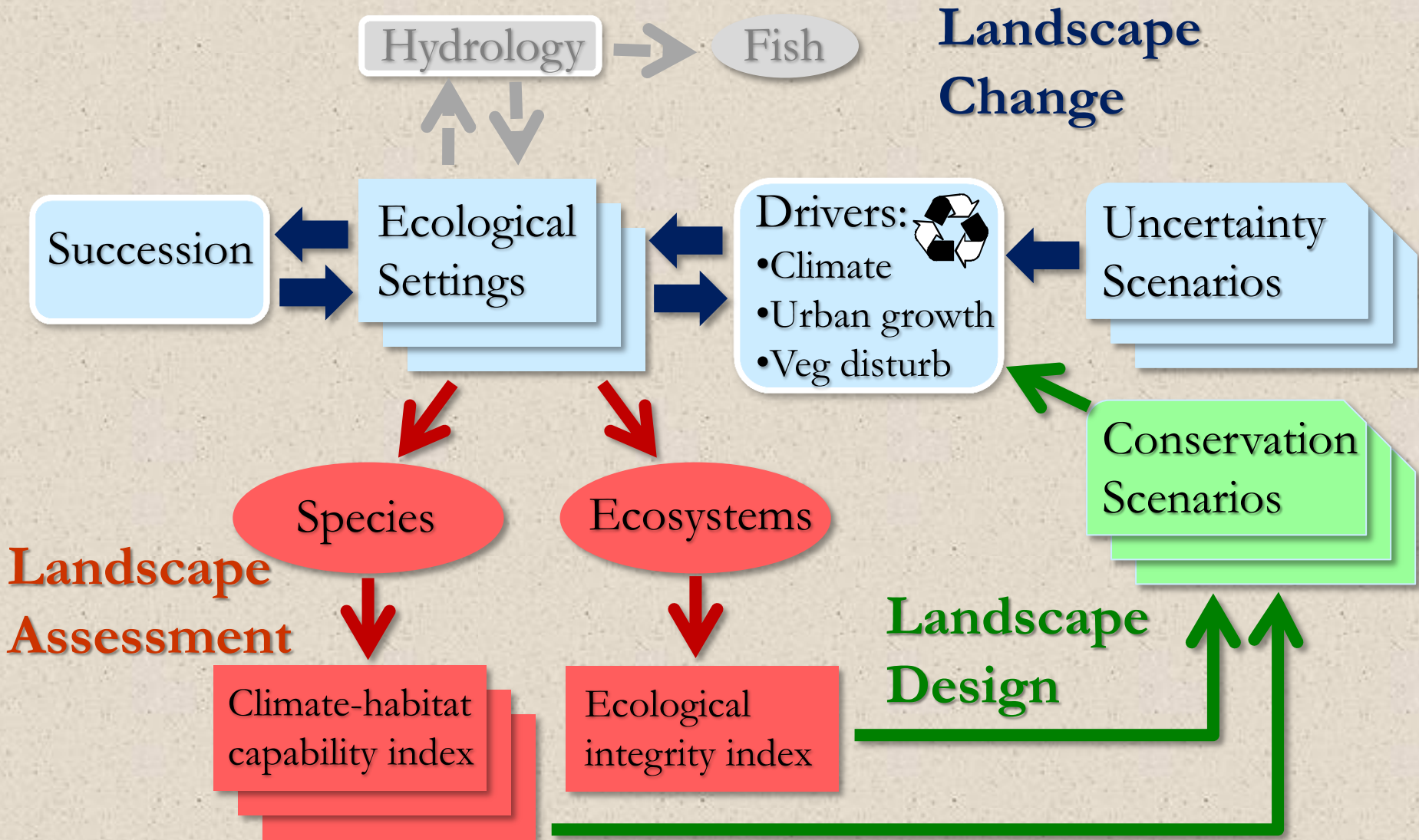March 14, 2013

The **purpose** of this project is to:

- Assess the capability of current and potential future landscapes in the Northeast to provide integral ecosystems and suitable habitat for a suite of representative species, and provide guidance for strategic habitat conservation
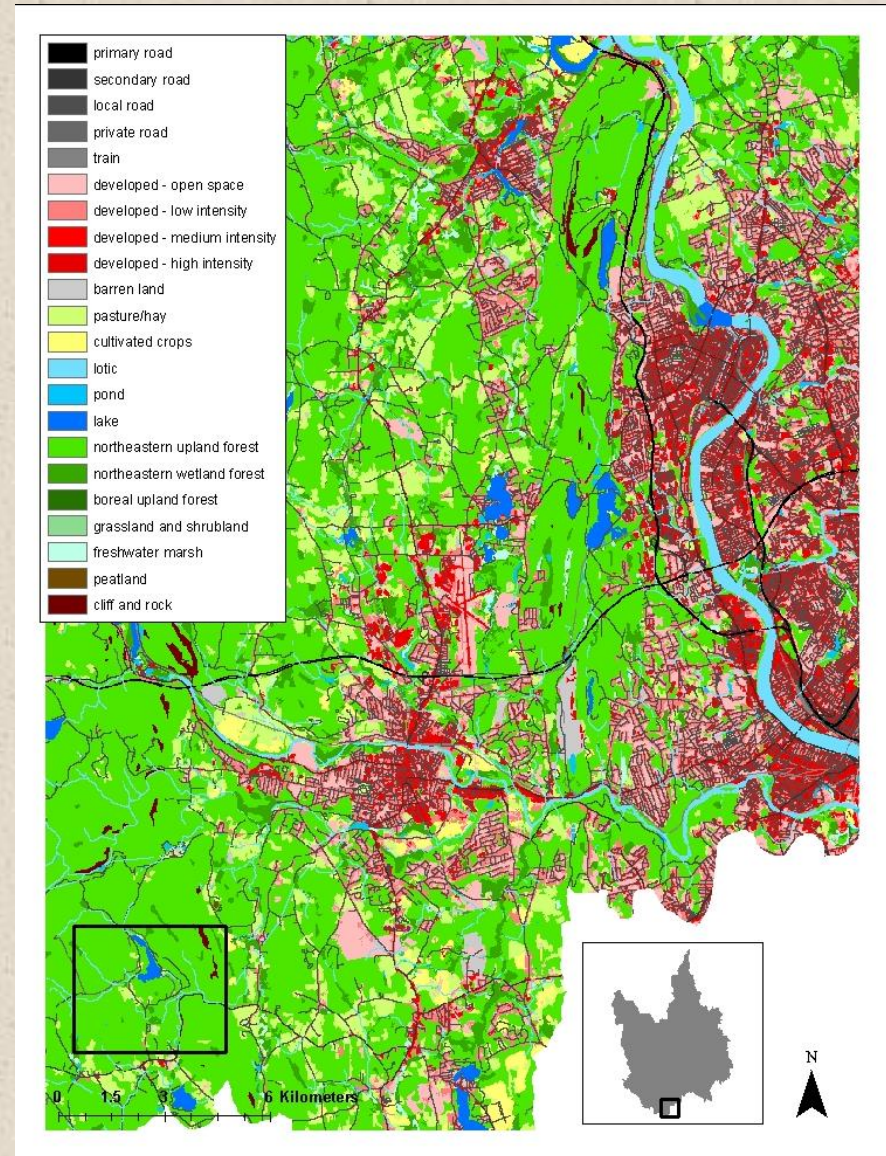
The LCAD Model

Hydrology → Fish

Landscape Change

Succession ⇄ Ecological Settings ⇄ Drivers: ♻
- Climate
- Urban growth
- Veg disturb

Uncertainty Scenarios →

Conservation Scenarios

Landscape Assessment

Species → Climate-habitat capability index

Ecosystems → Ecological integrity index

Landscape Design

GIS data development

- **Enhanced ecological systems (aka landcover) map**

  - Replace NLCD roads and spurious development with TIGER/OSM roads

  - Replace open water with NWI lentic, lotic, estuarine, marine

  - Add NHD streams

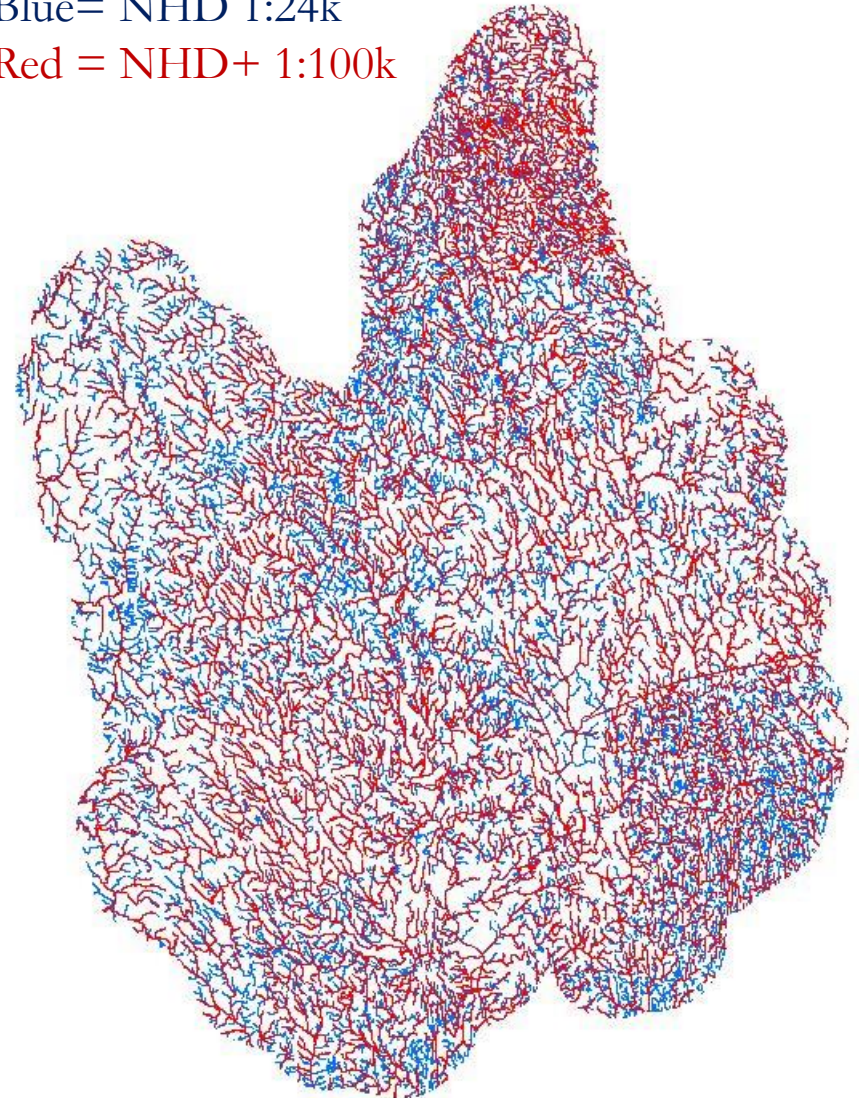 - Add 4 developed classes, barren and 2 agriculture classes from NLCD 06

Legend:
- primary road
- secondary road
- local road
- private road
- train
- developed - open space
- developed - low intensity
- developed - medium intensity
- developed - high intensity
- barren land
- pasture/hay
- cultivated crops
- lotic
- pond
- lake
- northeastern upland forest
- northeastern wetland forest
- boreal upland forest
- grassland and shrubland
- freshwater marsh
- peatland
- cliff and rock

GIS data development

- **Corrected hydrology**

  - Connect isolated stream segments to main hydro network and close all gaps in the network

  - Remove pipelines and coastlines

  - Remove salt marsh ditches

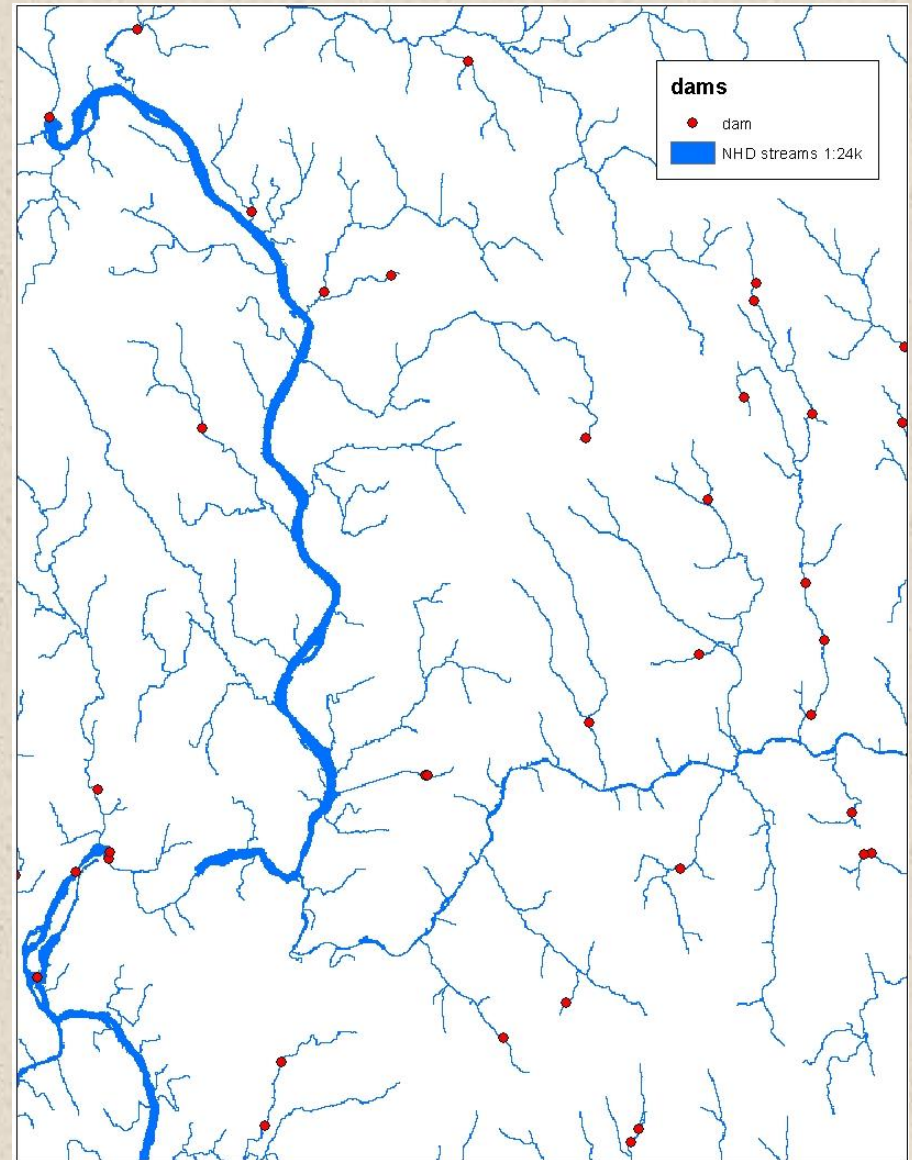 - Fix flow reversals

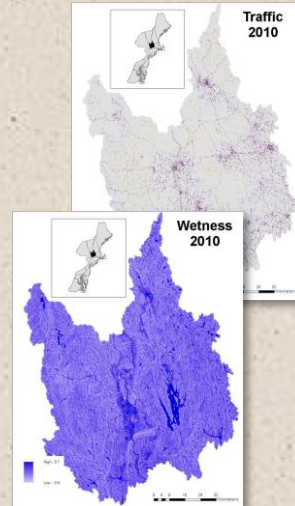 - Fix flow loops

Blue= NHD 1:24k
Red = NHD+ 1:100k

Corrected Dams

- Snapped dams to NHD streams

- Series of automated and manual GIS steps to accomplish the task

Ecological Settings Data

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

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

Abiotic:
- Temperature (3)
- Energy (1)
- Moisture & hydrology (3)
- Chemical & physical substrate (6)
- Physical disturbance (2)

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

Ecological Settings Data

- **Aquatic-relevant settings layers**

  - Flow gradient (S)
  - Flow volume (D)
  - Water temperature (D)
  - CaCO3 content (S)
  - Salinity (S)
  - Developed (D)
  - Imperviousness (D)
  - Aquatic barriers (S)

  S = static; D = dynamic
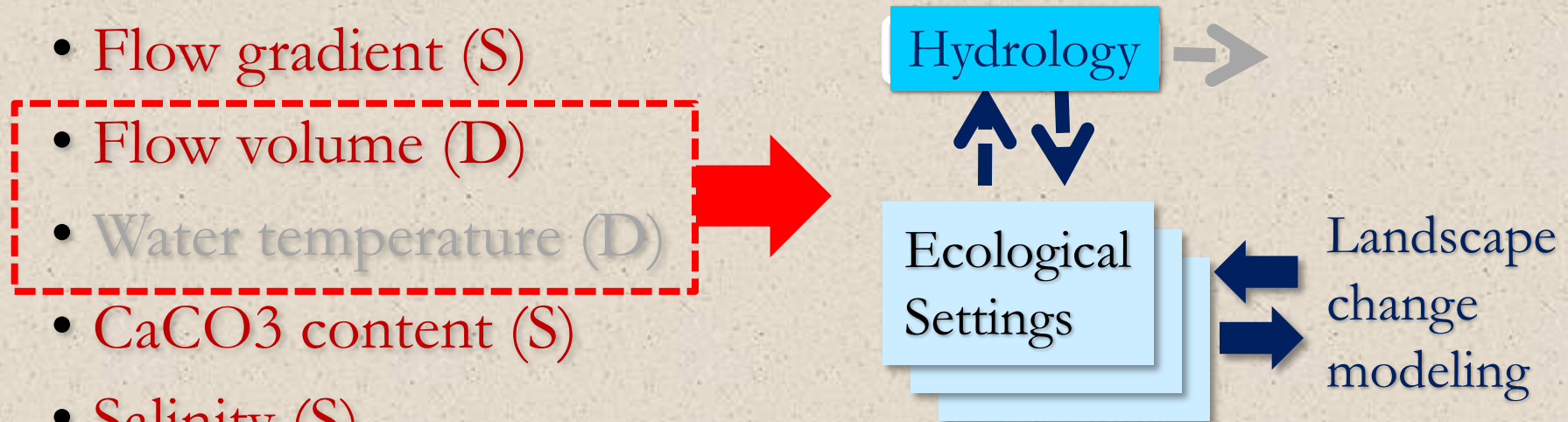
Ecological Integrity Metrics

■ **Intactness metrics**
1. Habitat loss (2)
3. Road traffic
4. Mowing and plowing
5. Microclimate alterations
6. Road salt
7. Road sediment
8. Nutrient enrichment
9. Domestic predators
10. Edge predators
11. Non-native plants
12. Non-native earthworms
13. Imperviousness

■ **Resiliency metrics**
14. Similarity
15. Connectedness
16. Aquatic connectedness

■ **Composite metric**
17. Index of ecological integrity (IEI)

Ecological Integrity Metrics

- **Aquatic connectedness**

  - Resistant kernel applied to every aquatic cell

  - Kernel spread scaled by time-of-flow model

  - Resistance based on ecological dissimilarity (from settings variables) and passability scores for culverts and dams
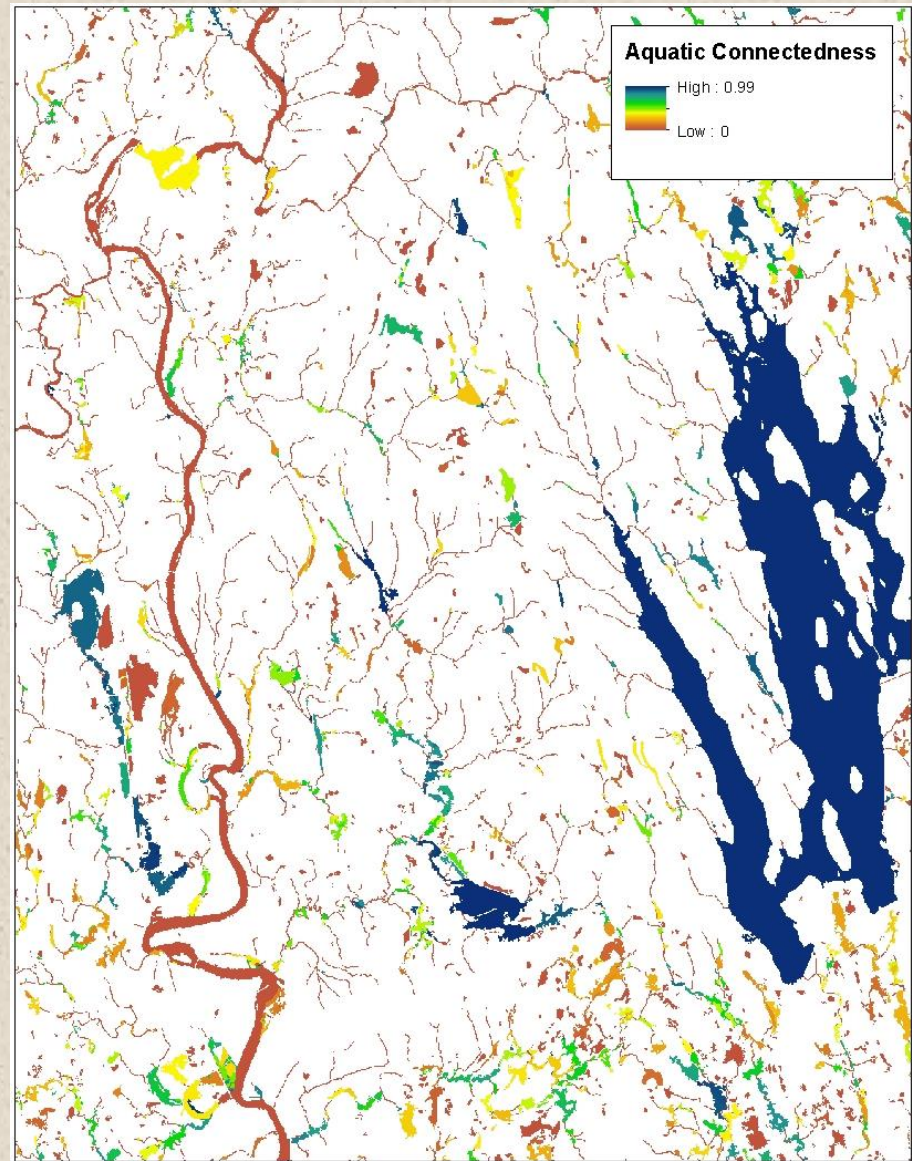
Ecological Integrity Metrics

- **Index of ecological integrity (IEI)**

  - Composite of stressor and resiliency metrics
  - Quantile-scaled (0-1) by ecosystem & extent

IEI streams
High : 1
Low : 0.01
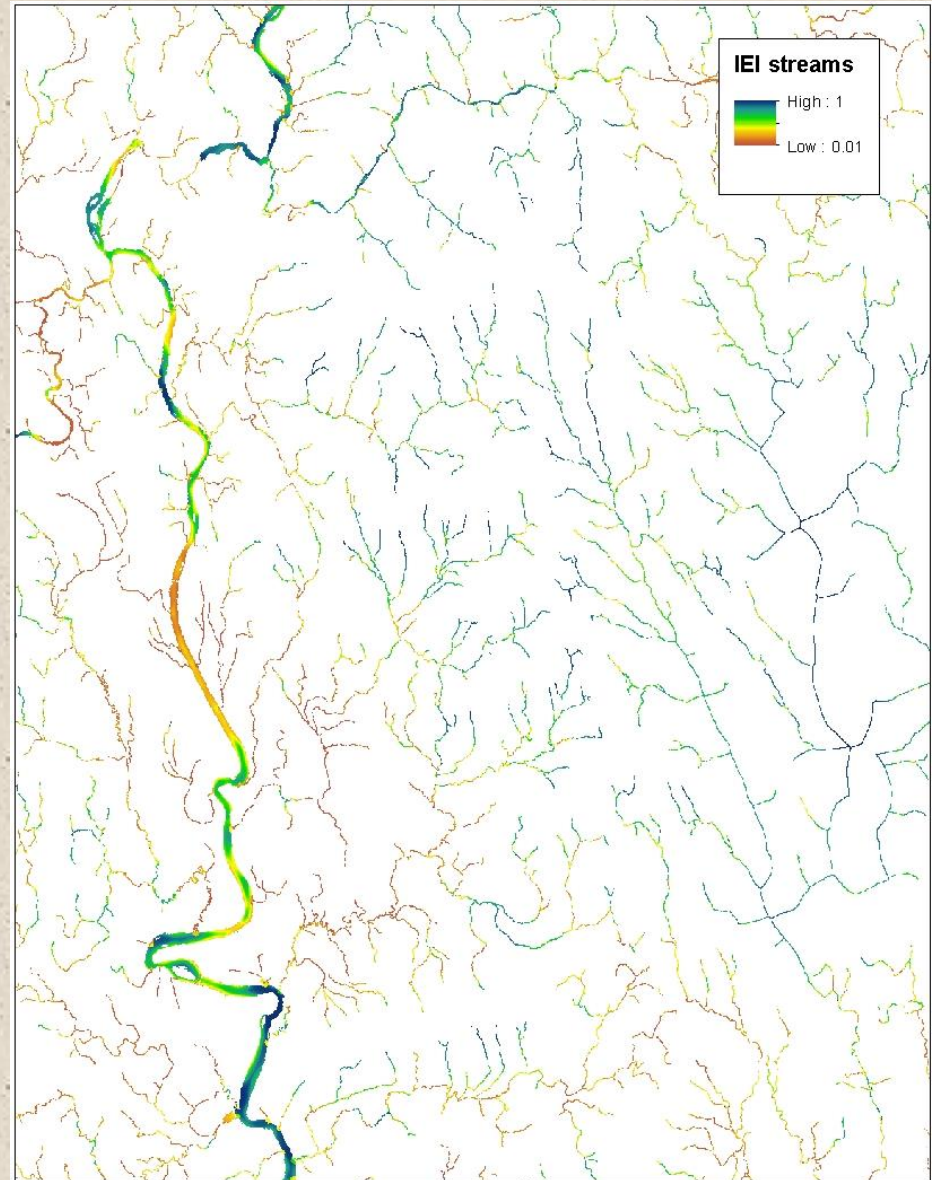
For More Information

- **Project website:**

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

- **Personal contact:**

  **mcgarigalk@
  eco.umass.edu
  413-577-0655**

Links to documents:

- **Overview**
- **Technical docs**

Feedback:

- **Manager online survey**