Landscape Conservation Design in the North Atlantic LCC
A Pilot Project in the Connecticut River Watershed

Maritza Mallek[1], Scott Schwenk[1], Andrew Milliken[1], Randy Dettmers[1], Jeff Horan[1], Nancy McGarigal[1], Andrew MacLachlan[1], Dave Perkins[1], John Warner[2], Kevin McGarigal[3], Bill DeLuca[3], Brad Compton[3], Joanna Grand[3], Ethan Plunkett[3]
[1]U.S. Fish and Wildlife Service, Regional Office, Hadley, MA; [2]U. S. Fish and Wildlife Service, New England Field Office, Concord, NH; [3]Department of Environmental Conservation, University of Massachusetts, Amherst, MA

Who?

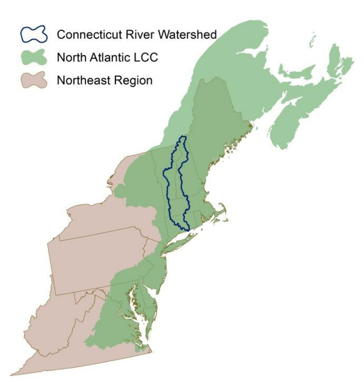
North Atlantic LCC
North Atlantic Landscape Conservation Cooperative

North Atlantic LCC
- 34 formal members,
- 14 agencies from Northeast states and Washington, D.C.
- Tribal representatives
- 9 federal agencies
- Canadian partners
- 8 nonprofit organizations

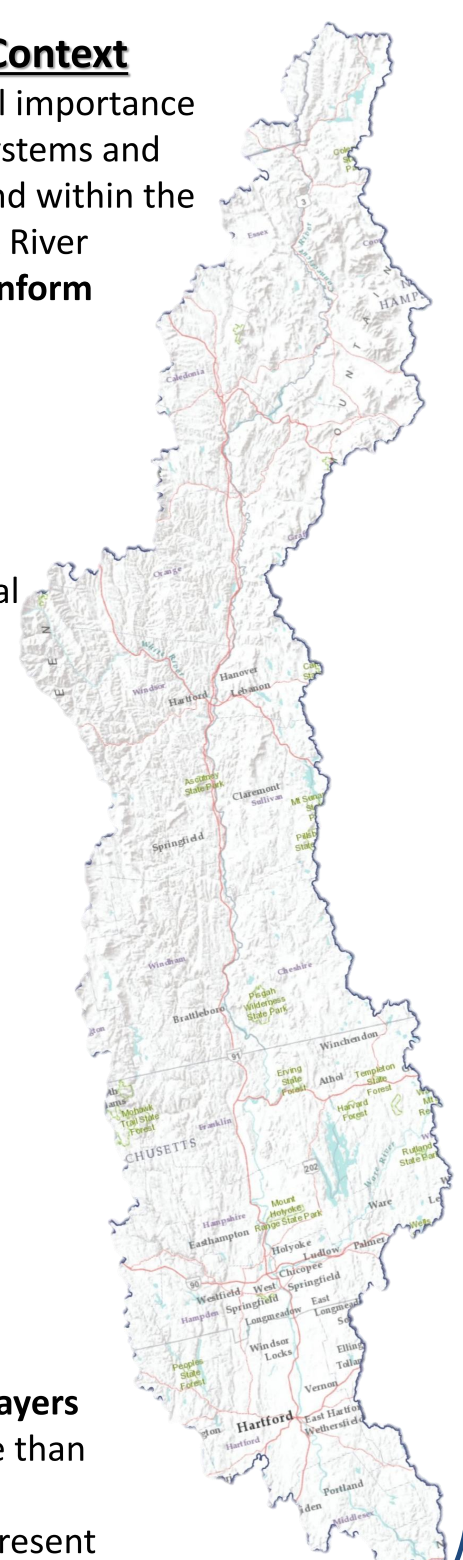
Designing Sustainable Landscapes Project
- Led by Professor Kevin McGarigal at the University of Massachusetts, Amherst
- Developing models that integrate species objectives, landscape conditions, and climate-change projections to help partners visualize and prioritize conservation decisions

Pilot Core Team
- Approximately 50 members
- Affiliated with federal agencies, state agencies, universities, and NGOs
- Two subteams were formed to make decisions necessary to guide the conservation design process.
- Core Team meets monthly; Terrestrial/Wetland and Aquatics subteams meet 2-4 times per month

Where?



Regional Context
The regional importance of the ecosystems and species found within the Connecticut River watershed **inform the design.**



The Connecticut River Watershed
- 7.2 million acres
- 4 states and Canada
- 4 Degrees of latitude
- 88 ecological systems, from coastal saltmarsh to alpine tundra
- Equivalent to the Silvio O. Conte National Fish and Wildlife Refuge (9 divisions, 9 units)
- 2 million (human) residents

The North Atlantic LCC
- 129.4 million acres
- 12 states, Washington, D.C., Canada
- 12.5 degrees of latitude
- 197 ecological systems
- 58 refuges
- 57.5 million (human) residents

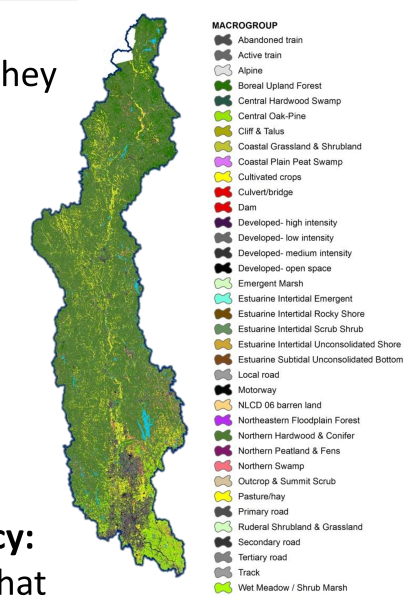
Our Steering Committee chose this geography because:
- **modeling tools and habitat data layers** were more complete and available than anywhere else in the region
- **strong existing partnerships** are present in the watershed

Our Approach

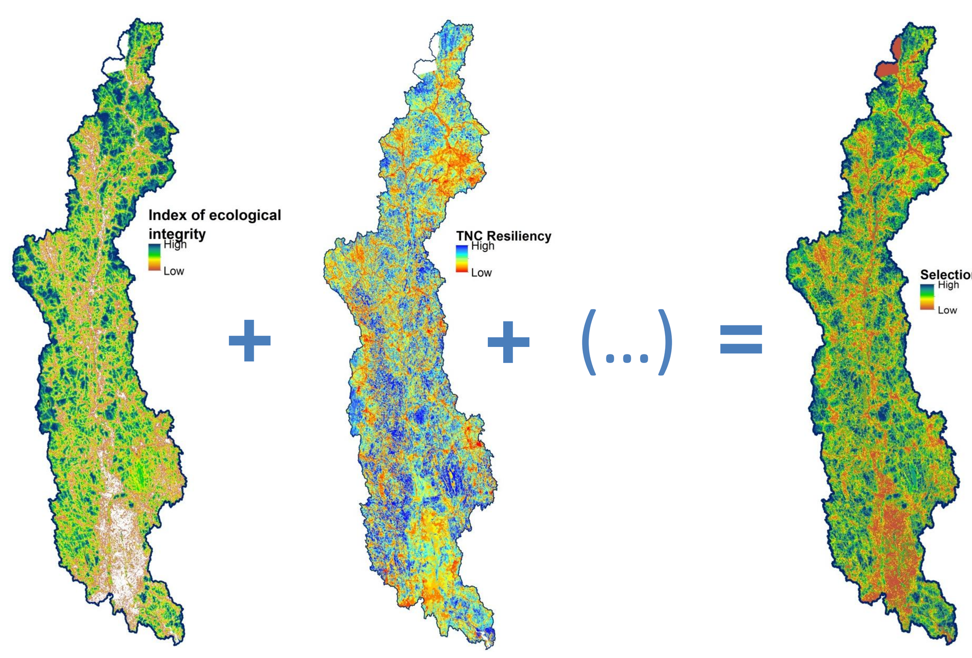
Objectives
1) **Collaboratively prioritize** places, taking into account multiple scales and **regional context**
   - Identify the **strategies and actions** necessary to conserve ecosystems and the fish, wildlife, and plants they support **into the future**
   - Generate a design that considers **changes to the landscape** from **climate change**, **urban growth**, **disturbance**, and **vegetation succession** over the long term
2) **Deliver information, maps, and tools**, with design options for prioritizing at scales and in formats needed by partners
3) **Establish a process** for conducting landscape conservation design that can be **applied and adopted** elsewhere in the region

Ecosystems

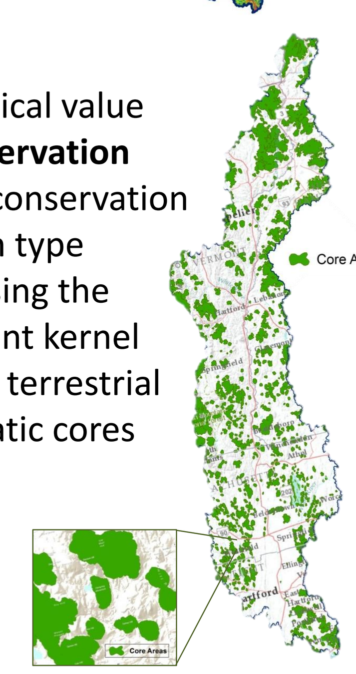
Focus is on **habitat** types, the functions they perform, and the services they produce now and in the future

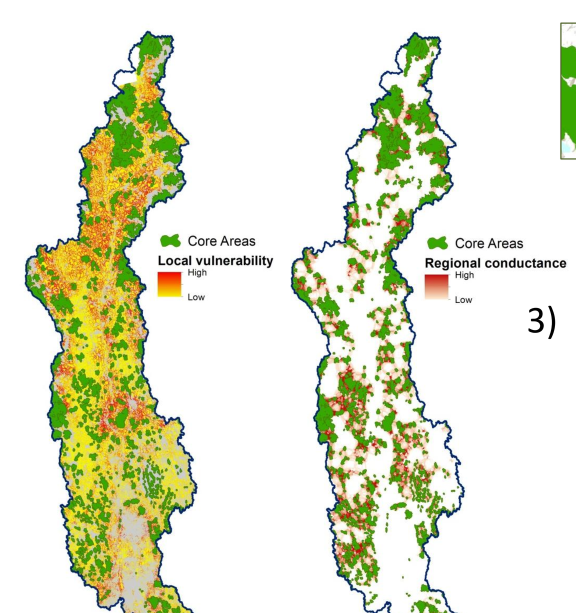


1) Choose **inputs**
   - **Index of Ecological Integrity:** capability of an area to sustain ecological functions over the long term, especially in the face of disturbance and stress
   - **The Nature Conservancy Resiliency:** "conserving the stage" approach that combines landscape complexity with connectedness
   - **Others as needed** (e.g. stream temperature sensitivity)



2) Model algorithm generates **core areas**
   - Core areas are places of high ecological value that form the **basic unit of the conservation design** and are **primary targets** for conservation
   - Start with top 5% of each ecosystem type
   - **Build core areas** out from top 5% using the selection index surface and a resistant kernel
   - Growth occurs **across landscape** for terrestrial cores; **up and downstream** for aquatic cores





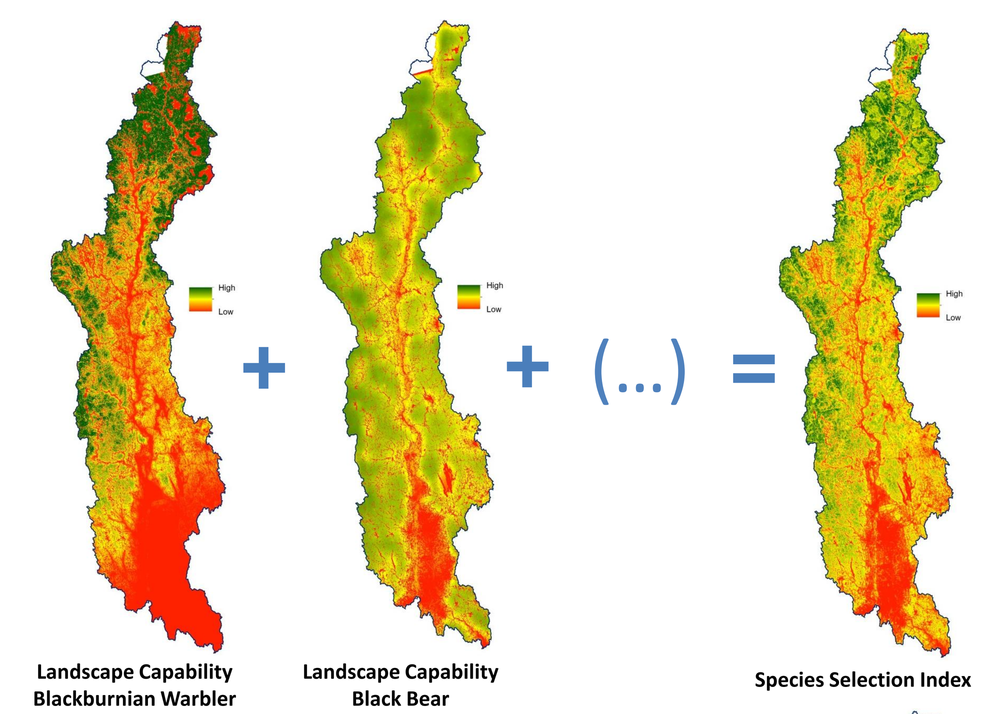
Species

Focus is on surrogate/representative species, and the landscape's continuing capability to support them

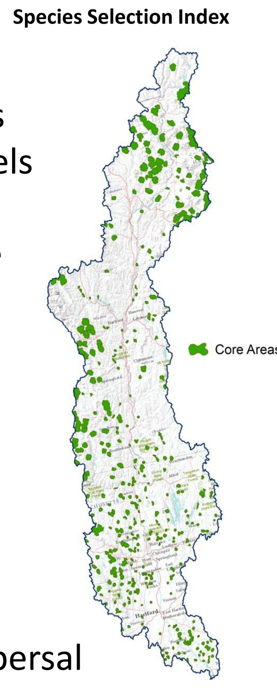
1) Identify **species** that can **represent** the habitat needs and management responses of a larger group of species

Species	Habitat Guild	Species	Habitat Guild
American Woodcock	Young forest w/openings	Moose	Large tracts of mixed forest w/wetlands
Black Bear	Large tracts of forest	Northern Waterthrush	Forested wetlands
Blackburnian Warbler	Mature mixed forest	Prairie Warbler	Shrublands and savannahs
Blackpoll Warbler	Spruce-fir forest	Ruffed Grouse	Young forest
Brook Trout	Headwater creeks	Wood Duck	Swamps & floodplain forest
Eastern Meadowlark	Pastures & grasslands	Wood Thrush	Mature deciduous forest
Louisiana Waterthrush	Riparian forest	Wood Turtle	Forested streams & adjacent uplands
Marsh wren	Freshwater & tidal marshes		

- **Habitat models** for these species are used to produce **habitat capability maps**, representing **current and future** habitat and incorporating **vulnerability analyses**
- These are combined to form a **selection index,** used in the next step



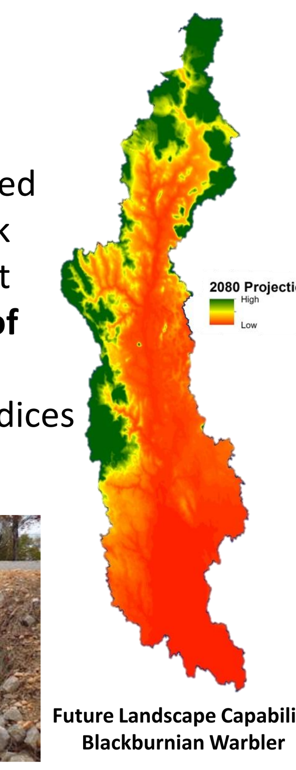
2) Pseudo-**optimization** to generate core areas
   - Seeks to **minimize total area**; uses kernels
   - Iteration
     > Uses highest-value cell on landscape (from selection index layer) to build one core area
     > Recalculates selection index
     > Repeats until all species' targets or until area in cores threshold is met



3) Assess **connectivity** among cores
   - **Local** scale: direct interaction of organisms with landscape, e.g. dispersal
   - **Regional** scales: indirect interaction of populations with landscape, e.g. gene flow
   - Integrate the probability of local or regional **flow through the landscape** with the **concentration of possible paths** between cores
   - Combine to create a corridor-like **gradient of connectivity**
   - Examine connectivity among **different approaches** to core area creation

Next Steps

Finalize Design



- Combine ecosystem- and species-based core areas into one core area network
- Integrate existing and in-development tools for understanding the **impacts of climate change** and the **influence of future development** into selection indices
- Delineate areas for restoration

Distribute Decision Support Tools

- Add to existing **repository of GIS data** available on the North Atlantic LCC and Conservation Planning Atlas websites
- Develop **workshops and training** to **assist stakeholders** in using the design in local planning efforts

Communicate Results
- Rollout of the final design
- Develop an **analysis of the process** to complement the design itself
- "Design the Design" – select display options that are **user-friendly, interpretable, and useful**

Implement and Apply to New Landscapes

- LCC Steering Committee to review feasibility of **using methods developed during the Pilot** for other Landscape Conservation Design products
- Use Pilot to inform Silvio O. Conte National Wildlife Refuge **Comprehensive Conservation Planning process**

For More Information
- Connecticut River Pilot Webpage: northatlanticlcc.org/groups/connecticut-river-watershed-pilot
- North Atlantic LCC Conservation Planning Atlas: nalcc.databasin.org/
- UMass Landscape Ecology Lab Website: www.umass.edu/landeco/research/dsl/dsl.html