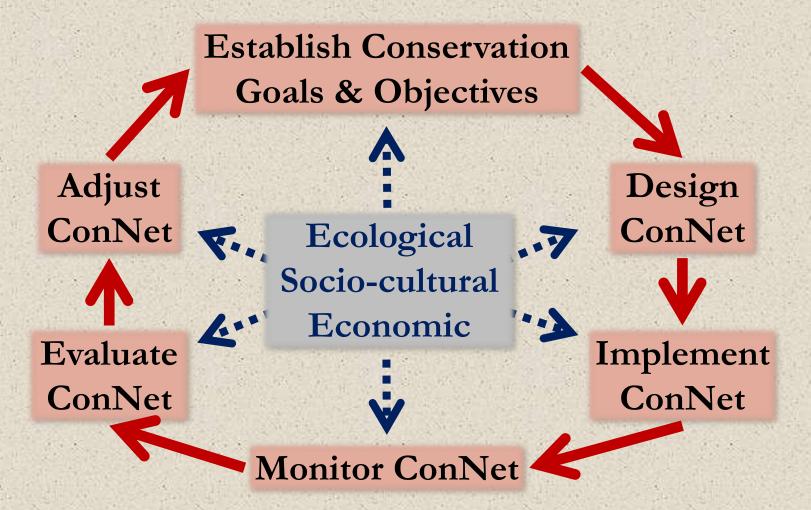
Designing Sustainable Landscapes in the Northeast A project of the North Atlantic Landscape Conservation Cooperative & Northeast Climate Science Center

> Landscape Conservation Design April, 2014

Landscape Conservation Design Conceptual Framework

Adaptive Landscape Conservation Design



Adaptive Landscape Conservation Design

Establish Conservation Goals & Objectives

Adjust ConNet ConNet Evaluate

ConNet

Ecological Socio-cultural Economic Design ConNet

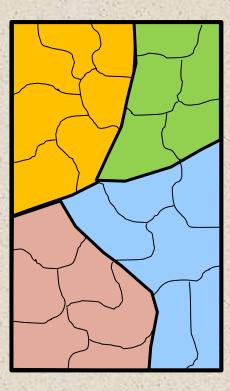
Implement ConNet

Monitor ConNet

What is Landscape Design?

- A comprehensive spatial <u>strategy</u> outlining what *conservation actions* to take and where;
- Importantly, it is merely a <u>hypothesis</u> about what conservation actions need to be taken and where for the objectives (and thus the goals) to be met;
- And thus its success can only be determined through objective-based monitoring (i.e., *monitoring* the measurable aspect of each SMART objective).

Multi-scale Framework:



Region: regional context; connectivity Landscape: goals and objectives; Focal scale
Focal conservation targets; conservation network; monitoring & evaluation

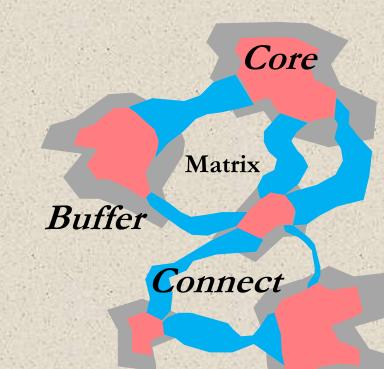
Sub-landscape: distribution of core areas

Design Criteria:

- Diversity... full suite of ecological settings and species
- **Redundancy...** within and among core areas
- Ecological integrity... high intactness, resiliency and adaptive capacity of ecological systems
- Species landscape capability... high capability of supporting focal species
- Connectivity... facilitate ecological flows across scales
- **Distribution...** well-distributed core areas throughout the landscape

Design Components:

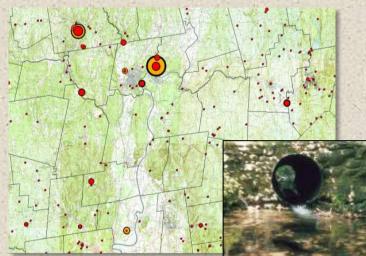
- Core areas... concentrated areas of high ecological value
- **Buffers...** around core areas to prevent future degradation
- **Connections...** linkages between core areas to facilitate connectivity

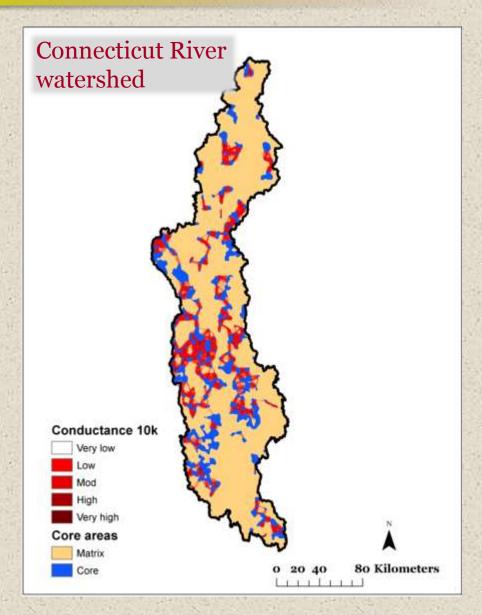


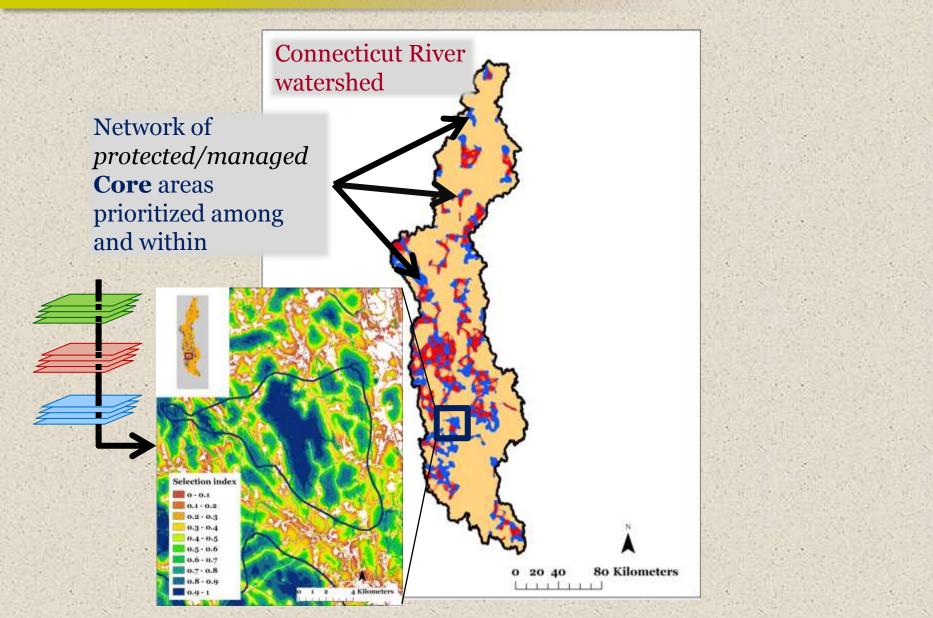
Design Components:

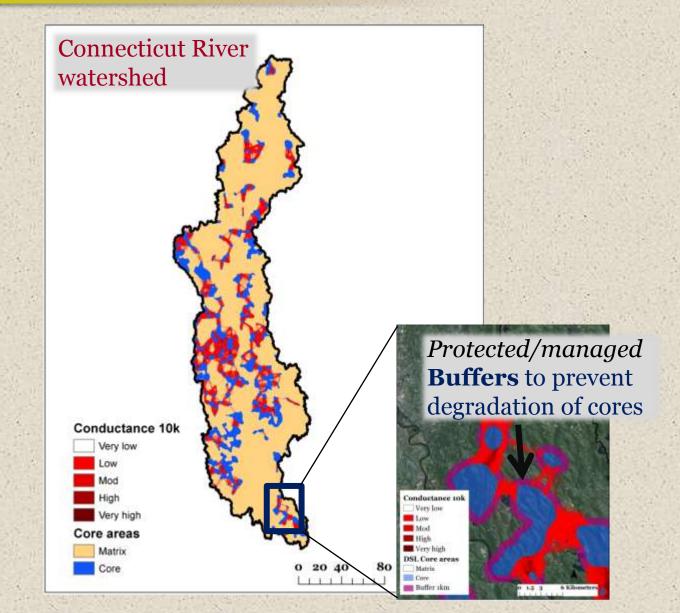
- Management... areas where active management is required to maintain critical ecological processes or habitats
- **Restoration...** opportunities to restore or improve connectivity in critical locations

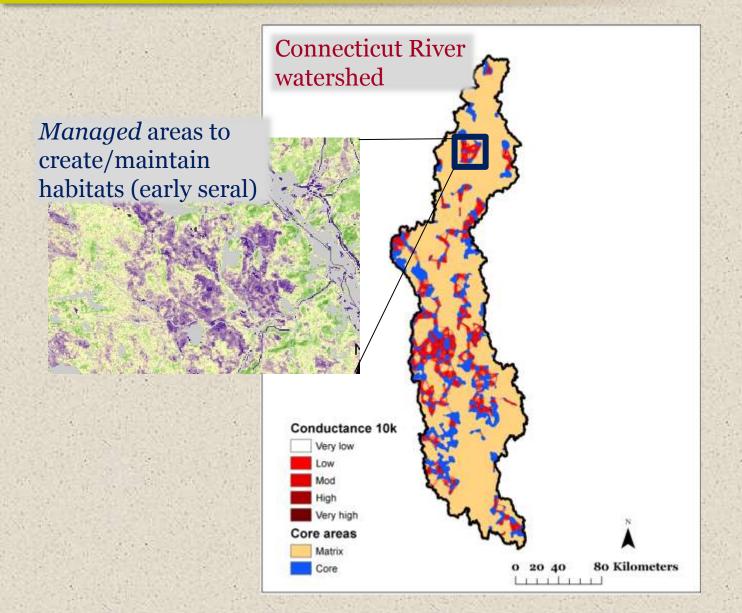


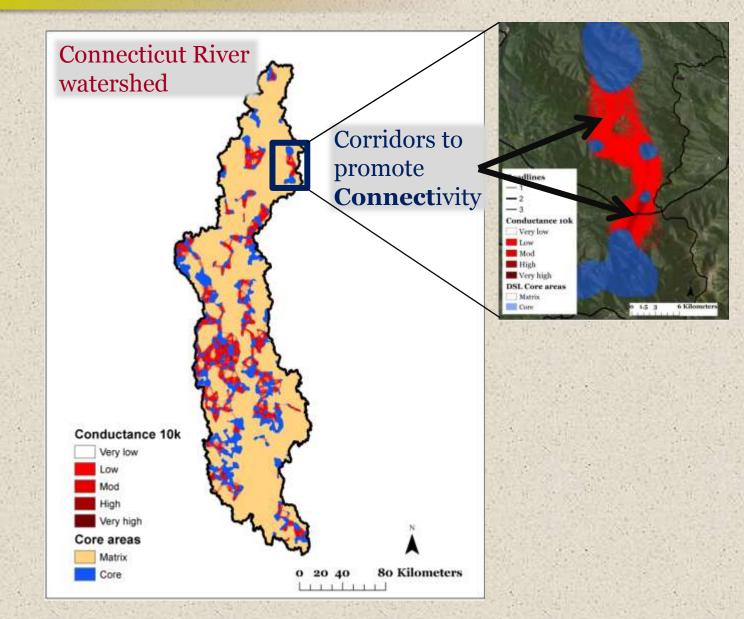






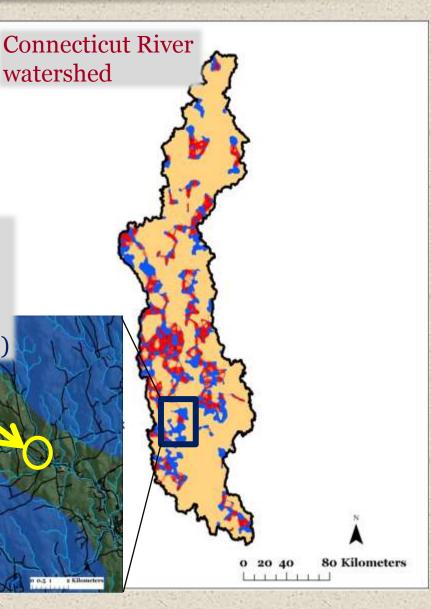






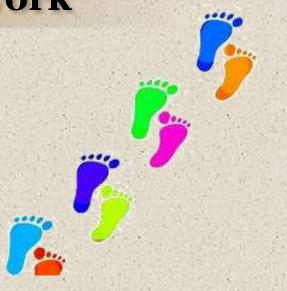
Priorities for *restoring* connectivity in critical locations (improved culverts, dam removal, road passage structures)

> Streamlines — Roadlines DSL Core areas



Design Steps:

1. Select (tiered) core areas 2. Prioritize within/among cores 3. Create core area buffers 4. Delineate corridors among cores 5. Prioritize within/among corridors 6. Determine management needs 7. Identify restoration opportunities



• Field verification at all steps

 Socio-cultural and economic considerations at all steps

Step 2: Design Conservation Network

1. Select (tiered) core areas

Three scenarios:

• Ecosystem approach (coarse filter)... based solely on ecosystem conditions

Today!

- Species approach...
 based solely on focal species considerations
- Combined ecosystem-species approach... based on the complement of ecosystems and species

Step 2: Design Conservation Network

1. Select (tiered) core areas

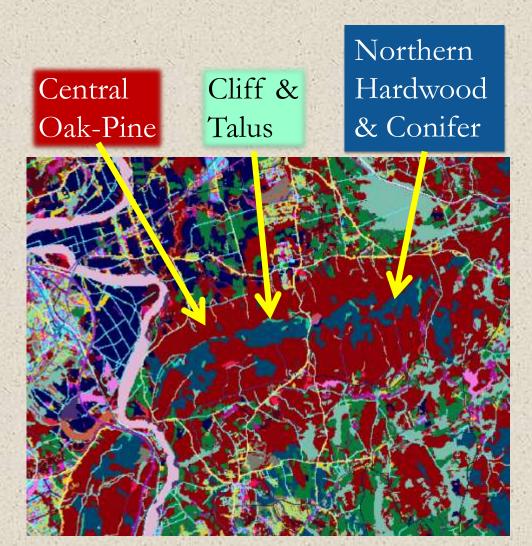
Ecosystem approach:

- a) Weight ecological settings
 b) Create selection index
 c) Select core areas to meet target
- How do we want to weight ecological settings? Proportional to their extent? Biased?



- 1a) Weight ecological settings
 - Weights = relative
 likelihood of a setting
 (e.g., ecological
 system) being
 included in the core
 areas





Step 2: Design Conservation Network

1. Select (tiered) core areas

Ecosystem approach:

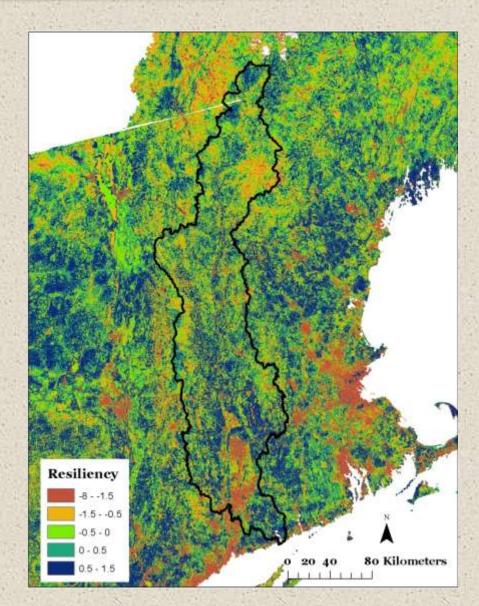
- a) Weight ecological settings
- b) Create selection indexc) Select core areas to
 - meet target

• Which products do we include and how do we weight them?



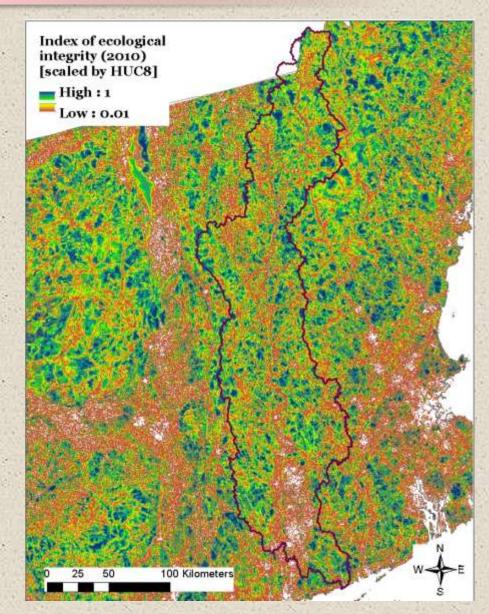
Step 2: Design Conservation Network

- TNC <u>Resiliency</u> index
 - Scaled by geophysical setting
 - 1,000 acre hexagons



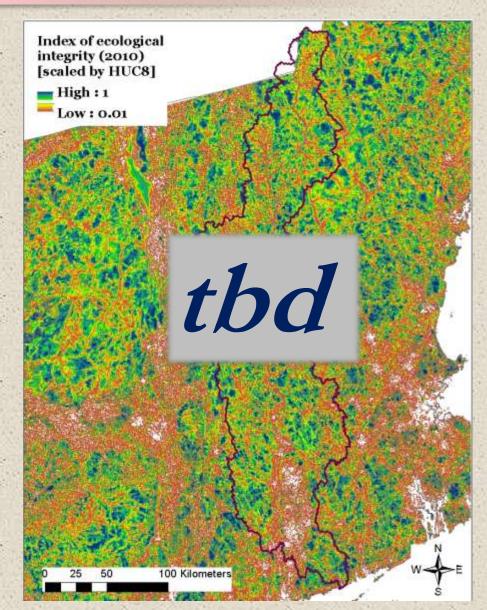
Step 2: Design Conservation Network

- DSL <u>current</u> Index of Ecological Integrity (IEI)
 - Scaled by macroecological system
 - 30 m resolution



Step 2: Design Conservation Network

- DSL <u>future</u> Index of Ecological Impact (vulnerability)
 - Scaled by macroecological system
 - 30 m resolution

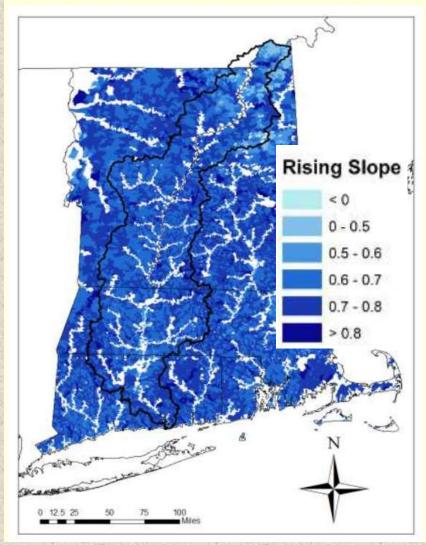


Step 2: Design Conservation Network

1b) Create selection index

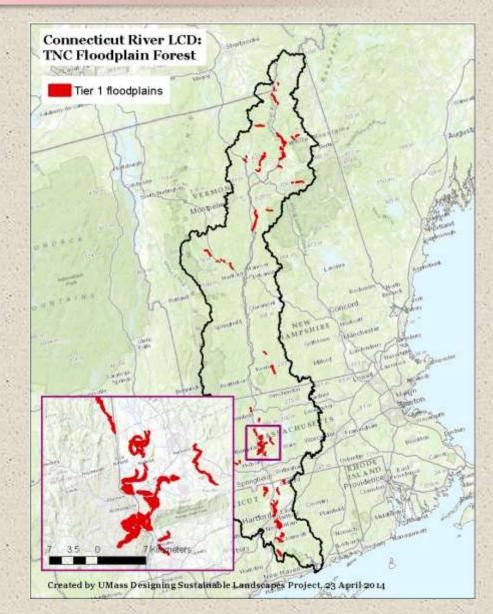
- USGS Stream temperature sensitivity index
 - Headwater streams only
 - Catchment resolution

Stream Temperature Rising Slope



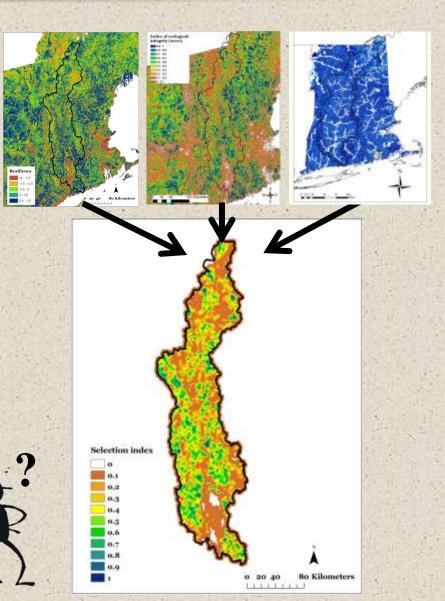
Step 2: Design Conservation Network

- TNC floodplain forests
 - Tier 1 sites (existing and restoration potential)
 - 30 m resolution



Step 2: Design Conservation Network

- Are there other products to include?
- How do we weight and combine them?



Step 2: Design Conservation Network

1. Select (tiered) core areas

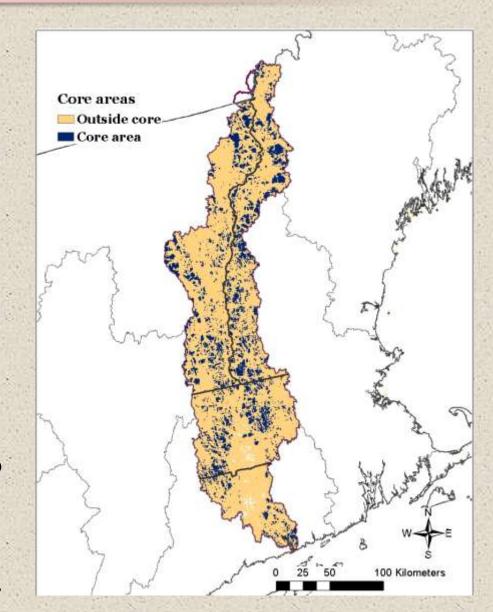
Ecosystem approach:

a) Weight ecological settings
b) Create selection index
c) Select core areas to meet target

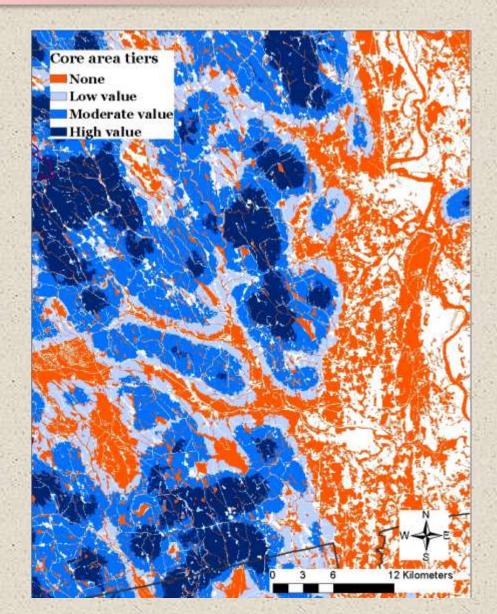
• What proportion of the <u>undeveloped</u> landscape do we want to include in core areas?



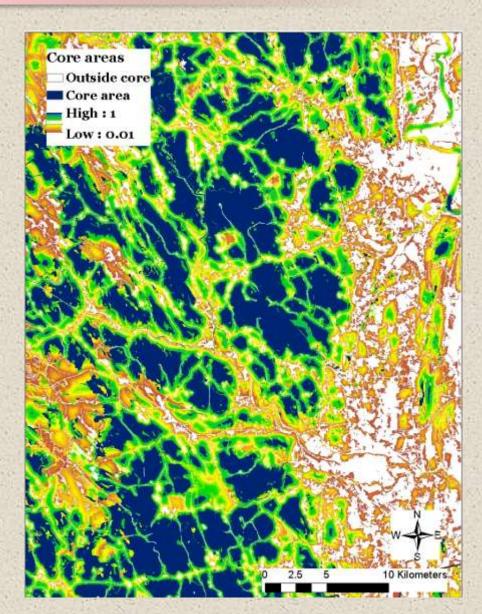
- 1c) Select core areas to meet target
 - How much area do we include?



- 1c) Select core areas to meet target
 - Should we depict tiers of ecological importance?



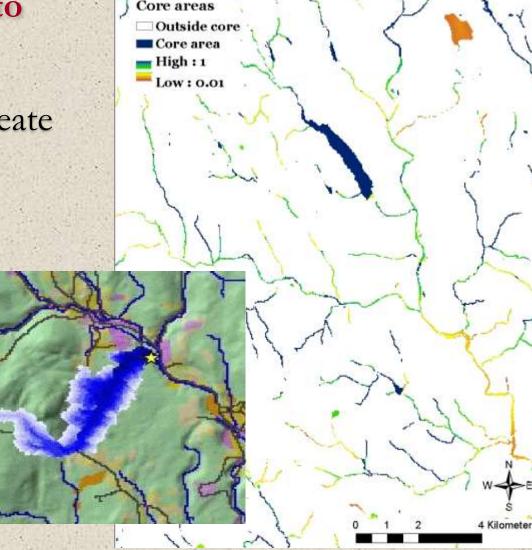
- 1c) Select core areas to meet target
 - Should we enforce a minimum size for core areas?





- 1c) Select core areas to meet target
 - How do we delineate core areas for aquatics?



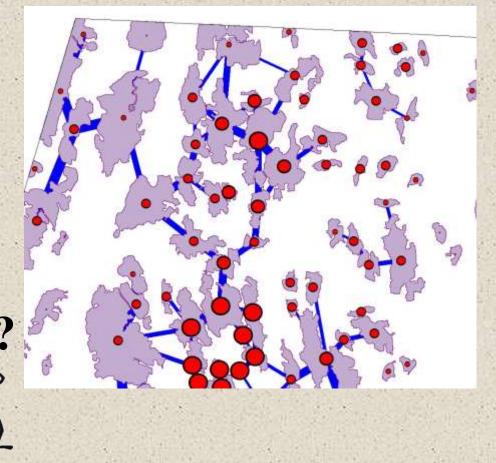


Step 2: Design Conservation Network

2. Prioritize core areas

- a) Prioritize among core areas
- b) Prioritize within core areas
- Based on importance to regional connectivity
- Other considerations?

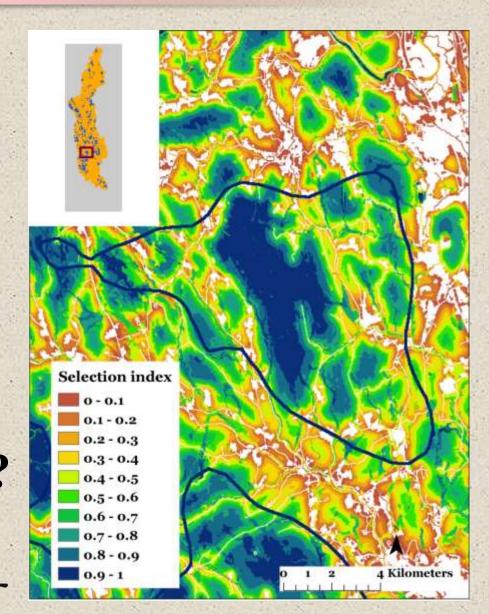
Node importance index



Step 2: Design Conservation Network

2. Prioritize core areas

- a) Prioritize among core areas
 b) Prioritize within core areas
- Based on core area selection index
- Other considerations?

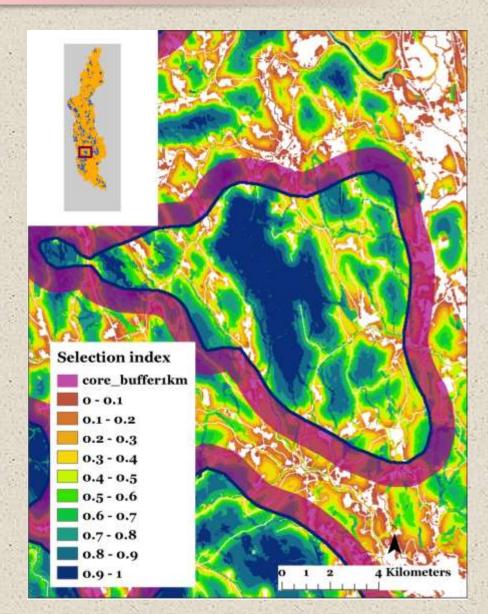


Step 2: Design Conservation Network

- 3. Create core area *Buffers*
 - a) Buffer terrestrial and wetland ecosystems within core areas
 b) Buffer aquatic
 - ecosystems within core areas



• Perhaps the buffer = 2nd tier core?

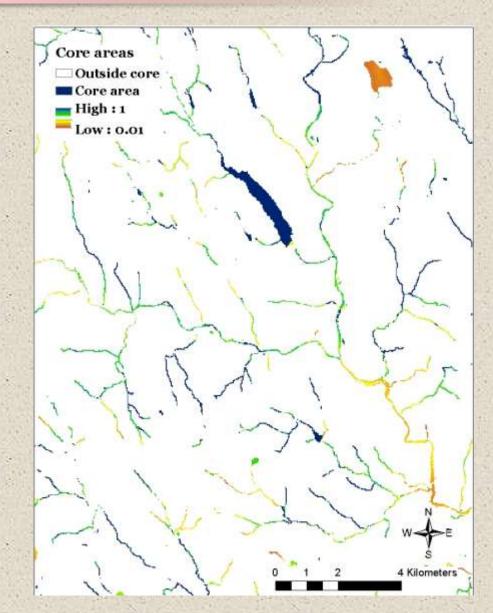


Step 2: Design Conservation Network

- 3. Create core area *Buffers*
 - a) Buffer terrestrial and wetland ecosystems within core areas
 b) Buffer aquatic ecosystems within core areas



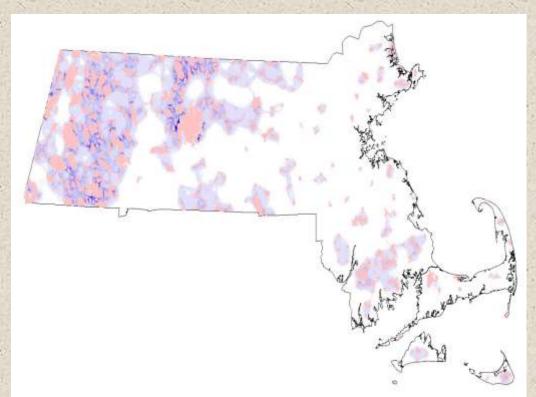
• Perhaps the buffer = core for aquatics?



Step 2: Design Conservation Network

4. Delineate Corridors

a) Find links between core areas (random low-cost paths)
b) Compute conductance index
c) Delineate corridors

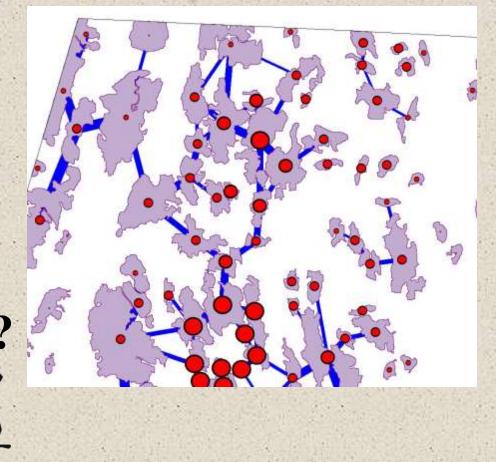


Step 2: Design Conservation Network

5. Prioritize Corridors

- a) Prioritize among corridors
- b) Prioritize within corridors
- Based on importance to regional connectivity
- Other considerations?

Link importance index

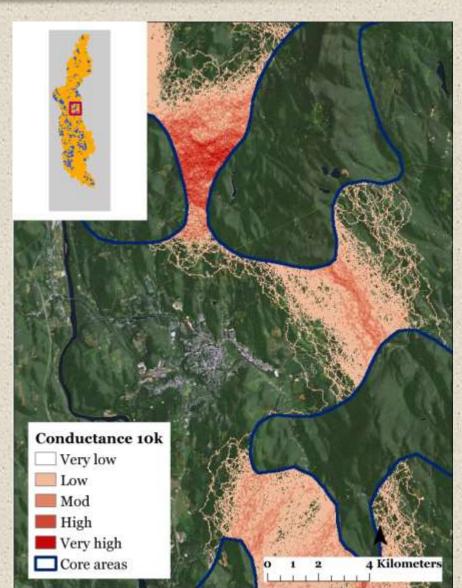


Step 2: Design Conservation Network

5. Prioritize Corridors

- a) Prioritize among corridors
- b) Prioritize lands within corridors
- Based on local conductance index
- Other considerations?



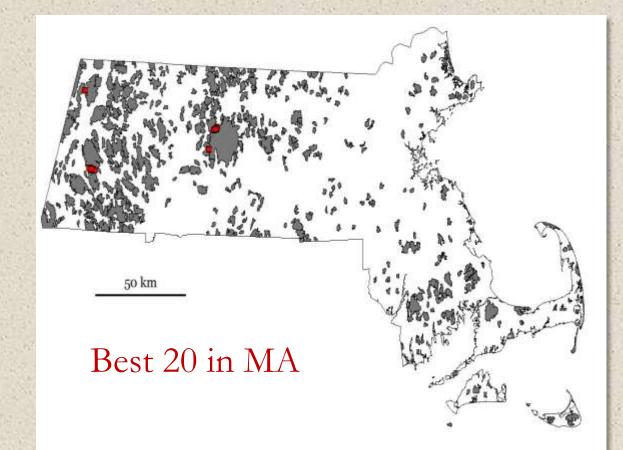


- 6. Determine *management* needs
 - Are there <u>coarse-filter</u> management needs for particular ecosystems?
 - If so, what are they?
 - Is this best handled outside of the conservation design?





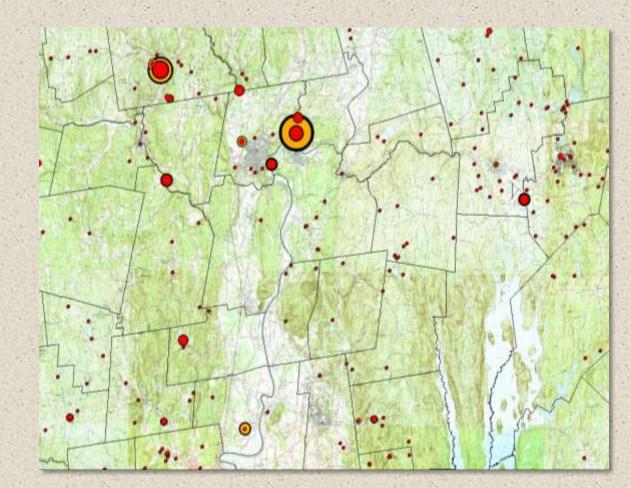
- 7. Identify *restoration* opportunities
 - Road passage structures
 - Road-stream crossings
 - Dams
 - Wetland restoration?



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Step 2: Design Conservation Network

Design Steps:

1. Select (tiered) core areas 2. Prioritize within/among cores 3. Create core area buffers 4. Delineate corridors among cores 5. Prioritize within/among corridors 6. Determine management needs 7. Identify restoration opportunities

Step 2: Design Conservation Network

Key Decisions:

- 1. Select sub-landscape scale to ensure distribution
- 2. Weight macro-ecological systems (for IEI)
- 3. Weight geo-physical settings (for Resiliency)
- 4. Weight components of core area selection index
- 5. How much land area to allocate to core areas
- 6. Should we designate tiered core areas
- 7. Should there be a minimum core area size
- 8. How to delineate core area for aquatics
- 9. How to identify management priorities



Today!

Step 2: Design Conservation Network

Macro-ecological systems:



Formation	Macrogroup					
Freshwater	Emergent Marsh					
Marsh	Wet Meadow / Shrub Marsh					
Peatland	Northern Peatland & Fens					
Lotic	By size and gradient (8 or 10 classes)					
Lake	Lake					
Pond	Pond					
Estuarine Intertidal	Emergent (salt marsh)					
	Rocky shore					
	Scrub shrub					
	Unconsolodated shore					
Marine Intertidal	Rocky shore					

Formation	Macrogroup				
Alpine	Alpine				
Cliff & Talus	Cliff & Talus				
Grassland & Shrubland	Glade, Barren & Savanna Outcrop & Summit Scrub Ruderal Shrubland & Grassland				
Coastal Grassland & Shrubland	Coastal Grassland & Shrubland				
Boreal Upland Forest	Boreal Upland Forest				
Northeastern Upland Forest	Northern Hardwood & Conifer				
	Central Oak-Pine				
Northeastern Wetland Forest	Central Hardwood Swamp				
	Coastal Plain Peat Swamp				
	Northeastern Floodplain Forest Northern Swamp				

Step 2: Design Conservation Network

Weight ecological settings:

Based on current (2010) conditions:

- Extent... area (ha) of the <u>region</u> and <u>landscape</u> comprised of each macro-ecological system
- Landscape importance... percent of each macroecological system contained within the <u>landscape</u>
- Protected status... percent of each macro-ecological system currently protected within the <u>region</u> and <u>landscape</u>

Step 2: Design Conservation Network

Weight ecological settings:

Based on predicted change in ecological condition:

- Vulnerability... total and average *index of ecological impact* of each macro-ecological system within the region and landscape
 Not vet
- Others (expert opinion)?

Not yet available

Step 2: Design Conservation Network

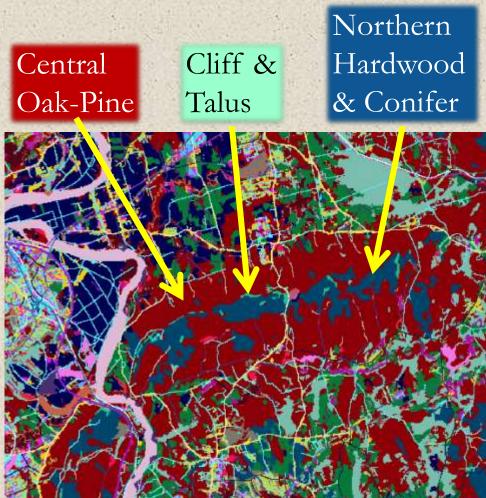
			-	Vulnerability (2080)						
	Extent (ha)		nce (%	»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»<l< td=""><td colspan="2">Total Impact</td><td colspan="2">Average Impact</td><td></td></l<>		Total Impact		Average Impact		
Macro- group	NE	CTR	Importance (%)	NE	CTR	NE	CTR	NE	CTR	Weight
Boreal Upland Forest	3,165,009	168,956	5.34	33.96	58.24	tbd	tbd	tbd	tbd	?
Northern Hardwood & Conifer	16,345,122	1,755,098	10.74	25.74	28.26	tbd	tbd	tbd	tbd	?
	/010/	,,,	, , I	0 /1						

- R.
- Default weight =1 (proportional representation)
- Need to do the same for Mark's geo types

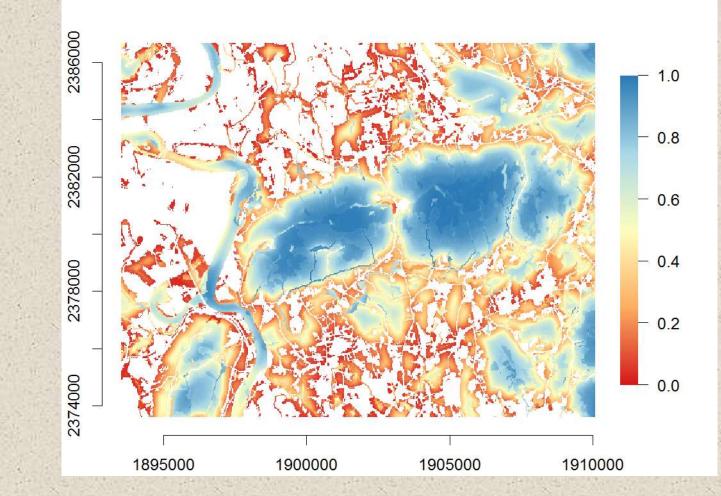
Step 2: Design Conservation Network

Weight ecological settings:

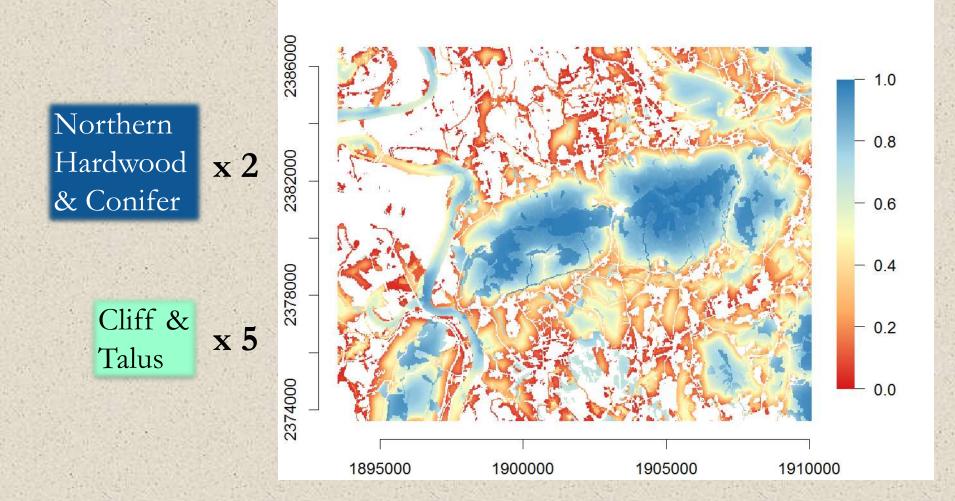
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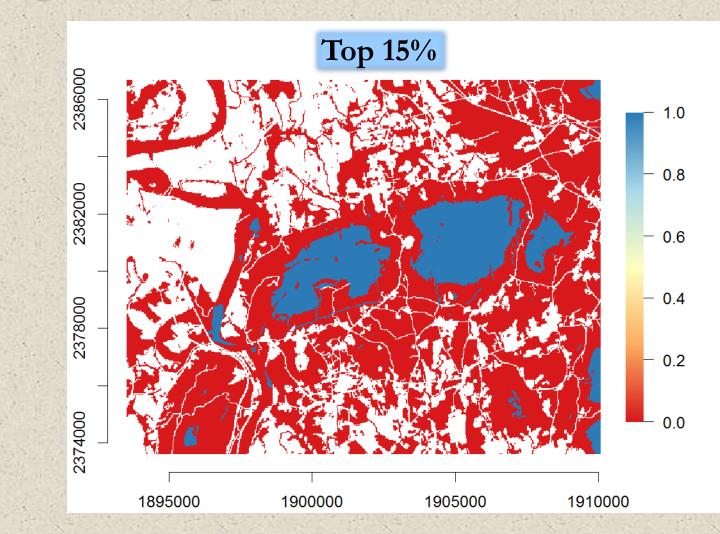
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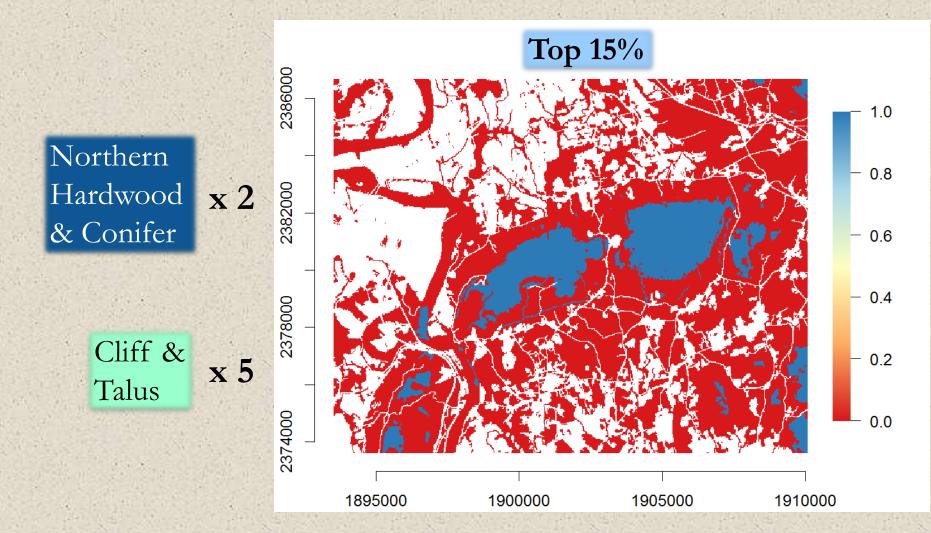
Step 2: Design Conservation Network



Step 2: Design Conservation Network



Step 2: Design Conservation Network



For More Information

Project website:

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

CAPS



1054 Documentation DSt Presentations DSI. Products

Landscapes project, or DSE for short) is to assess the capability of current and potential fiture. landscapes, currently within the extent of the Northeast (13 states), to provide integral ecosystems FRAGSTATS and suitable habitat for a suite of focal (e.g., representative) species, and provide guidance for strategic habitat conservation. To meet this goal, we are developing a Landscape Change, Assessment and Design (LCAD) model, as described in the documentation. This project is supported primarily by the North Atlantic Landscape Conservation Cooperative (NALCC) with HABIT additional support from the Northeast Climate Science Center (NECSC) and the University of Massachusetts - Anheest RMLands

Links to products: Overview Technical docs Presentations Results

Feedback:

Manager online survey

North Atlantic Landscape Conservation Cooperative Designing Sustainable Landscapes (DSL) Project

Mitheous Id' Wiley and Alaska David. philade cambridge fronting (ab. given Mothesia mad)

Manager Feedback and Questionaire

wir prinzele für gentaturele of the sole-regional vanladinge hang held with partnere of the Narth Allentic Landician Conservables review the results and provide herditack on phase I of the Dili, project, Although any NKUT, partner a veikame to provide herditack Secificale, the discurrent includes a set of questions pored to partners concerning how test to participe the budgage design information resulting from the candidgine change. Automatient and Design (CAUL) model applied to Be write Hardware II phase 2.

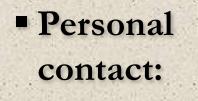
Criteria for Feedback

The DSL project area to provide reptinuly conserver information pertaining to blatternity or the set in most if a process to recepture the following criteria altern privating feedback. 17 471750 data privaters must be regional (i.e., itself-ead) in when There are lety of data that would be unleft to (240) for ananyte digitar prevalent use treng data. If they were available account the iterational, but on an empirical to the use of digital data that are considered account for interfaced. (1) Approaches for modeling indicators (datas), assessment and design must be technicaly busite provide and and animal computing mount as there may be also approaches that we are complicationals inside priminalities data and/or computing inscissions

General topics

() When the (CHD model's extended to the write furtheast in place), what is the best set of group splits the (unit) for resulting or inspectively thy and warmanitariting the model results?

- TO BY STREET
- By watershed Darkoted areleved HUC level in the comment has helped
- By ecoregine indicated preferred ecoregics (basilication and local in the comment that behavior
- 1 Other (describe alternative thing achieves in the convenient time below).



mcgarigalk(a) eco.umass.edu 413-577-0655