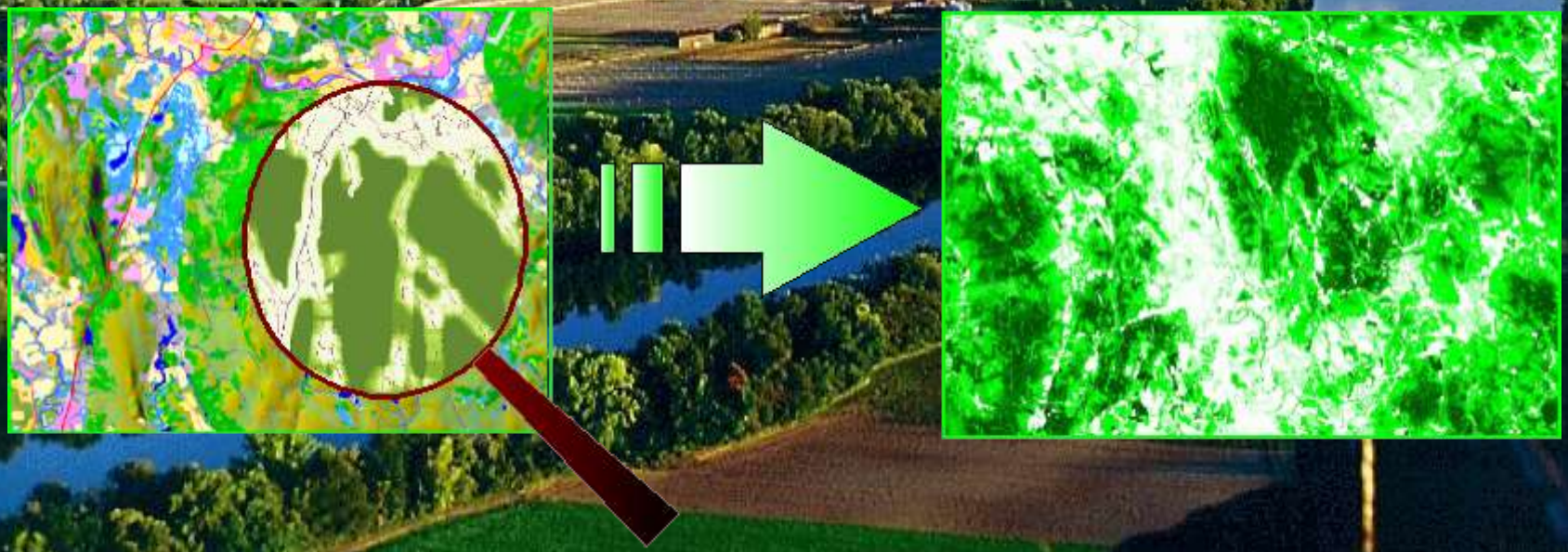
Designing Sustainable Landscapes in the Northeast

A project of the North Atlantic Landscape Conservation Cooperative & Northeast Climate Science Center

Landscape Conservation Design

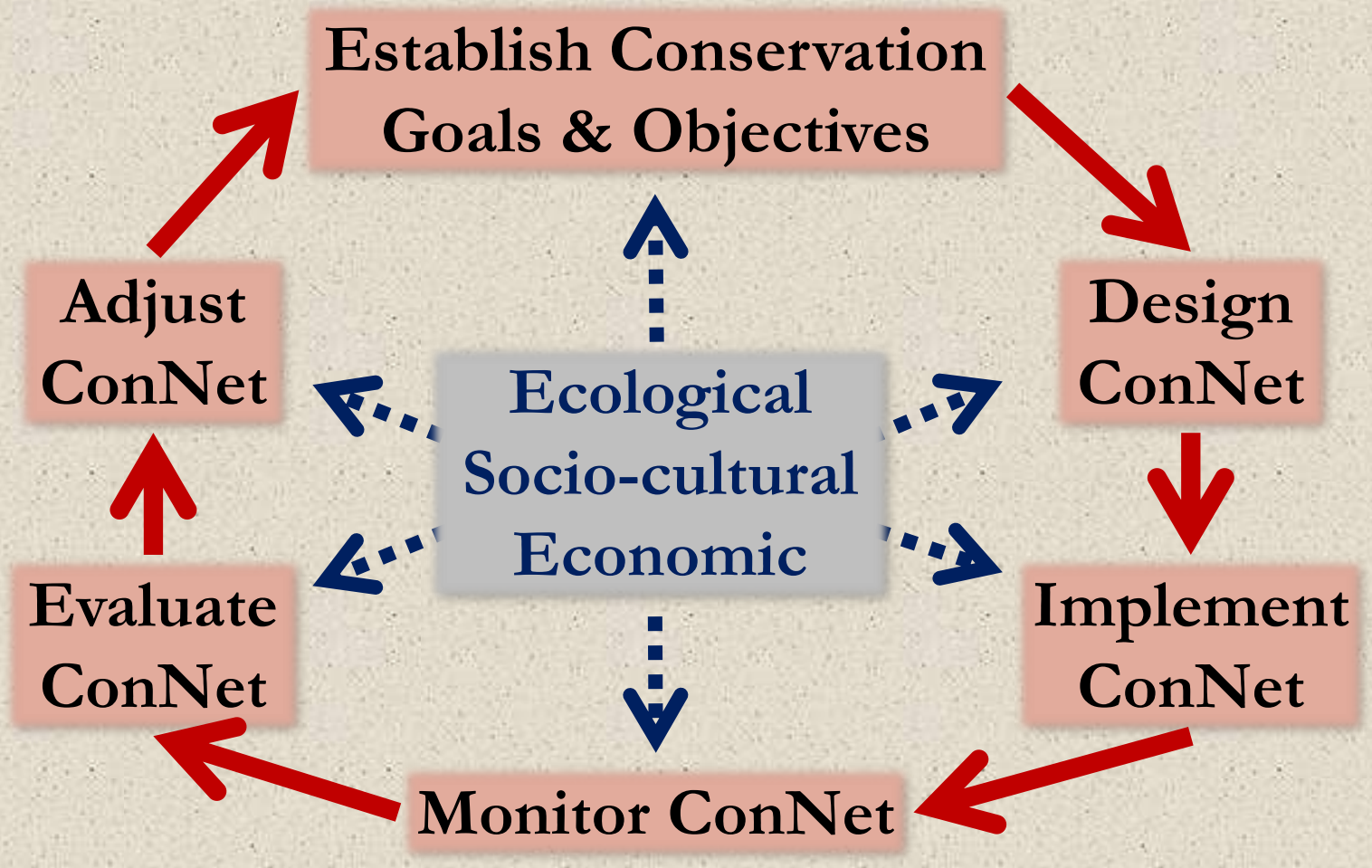
April, 2014



Landscape Conservation Design

Conceptual Framework

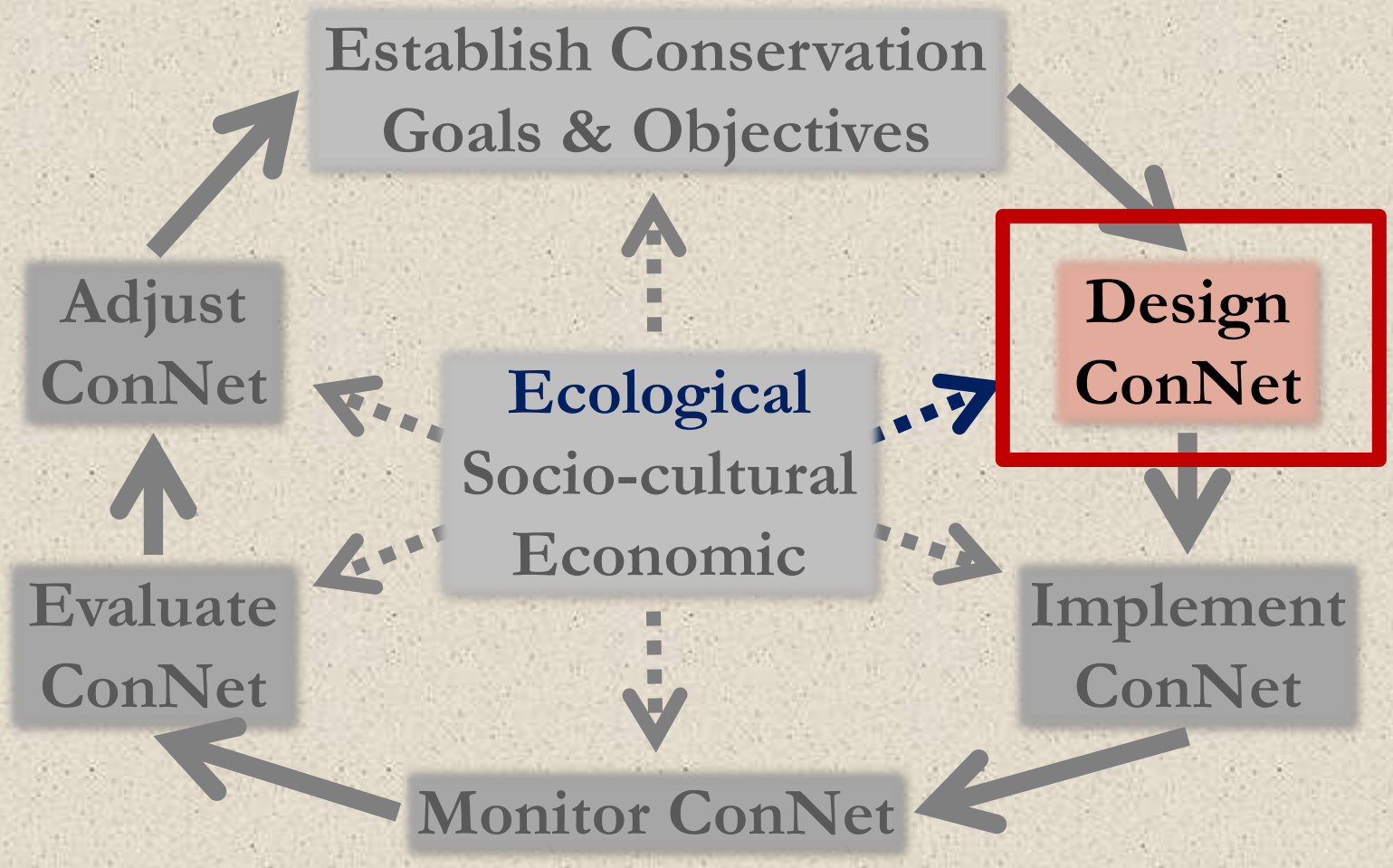
Adaptive Landscape Conservation Design



Landscape Conservation Design

Step 2: Design Conservation Network

Adaptive Landscape Conservation Design



Landscape Conservation Design

Step 2: Design Conservation Network

What is Landscape Design?

- A comprehensive spatial strategy outlining what *conservation actions* to take and where;
- Importantly, it is merely a hypothesis 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).

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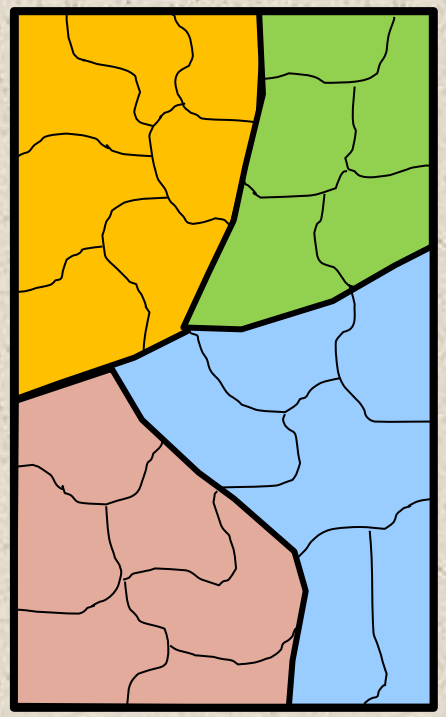
Step 2: Design Conservation Network

Multi-scale Framework:



Region: regional context;
connectivity

↓

Landscape: goals and objectives;
conservation targets;
conservation network;
monitoring & evaluation

↓

Focal scale

Sub-landscape: distribution of core areas

Landscape Conservation Design

Step 2: Design Conservation Network

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

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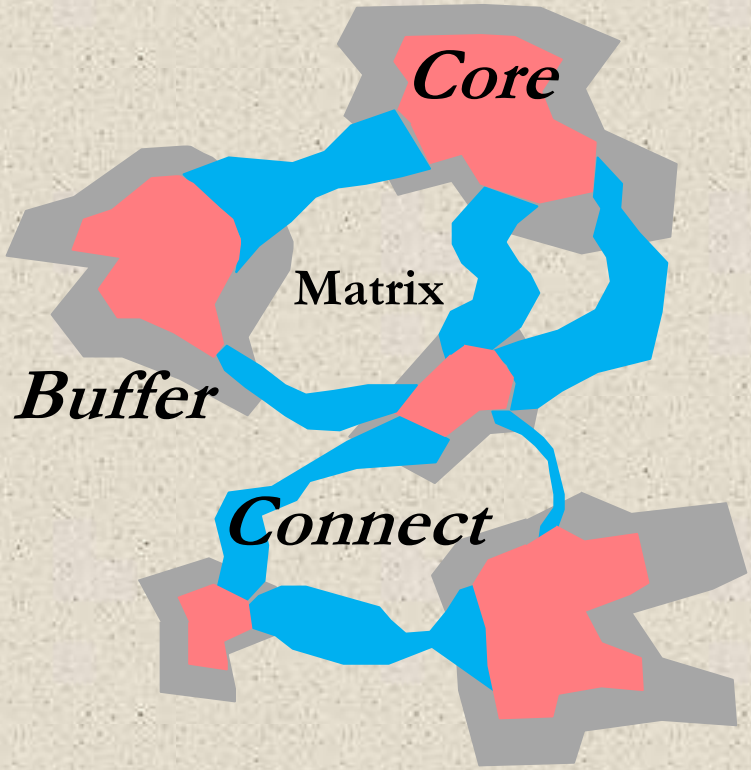
Step 2: Design Conservation Network

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



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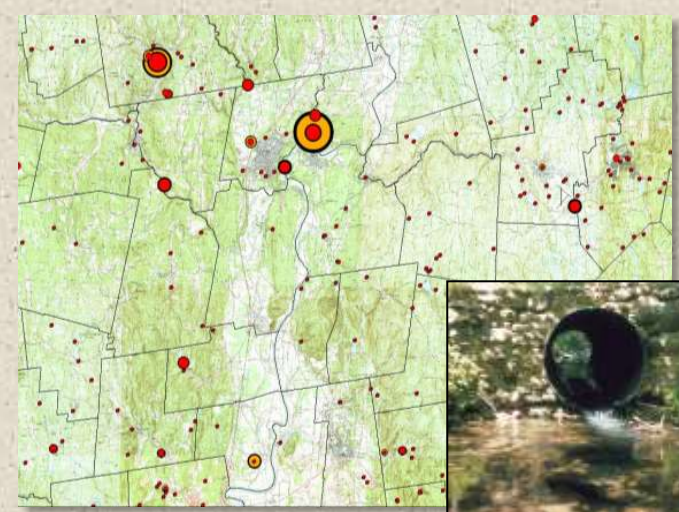
Step 2: Design Conservation Network

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



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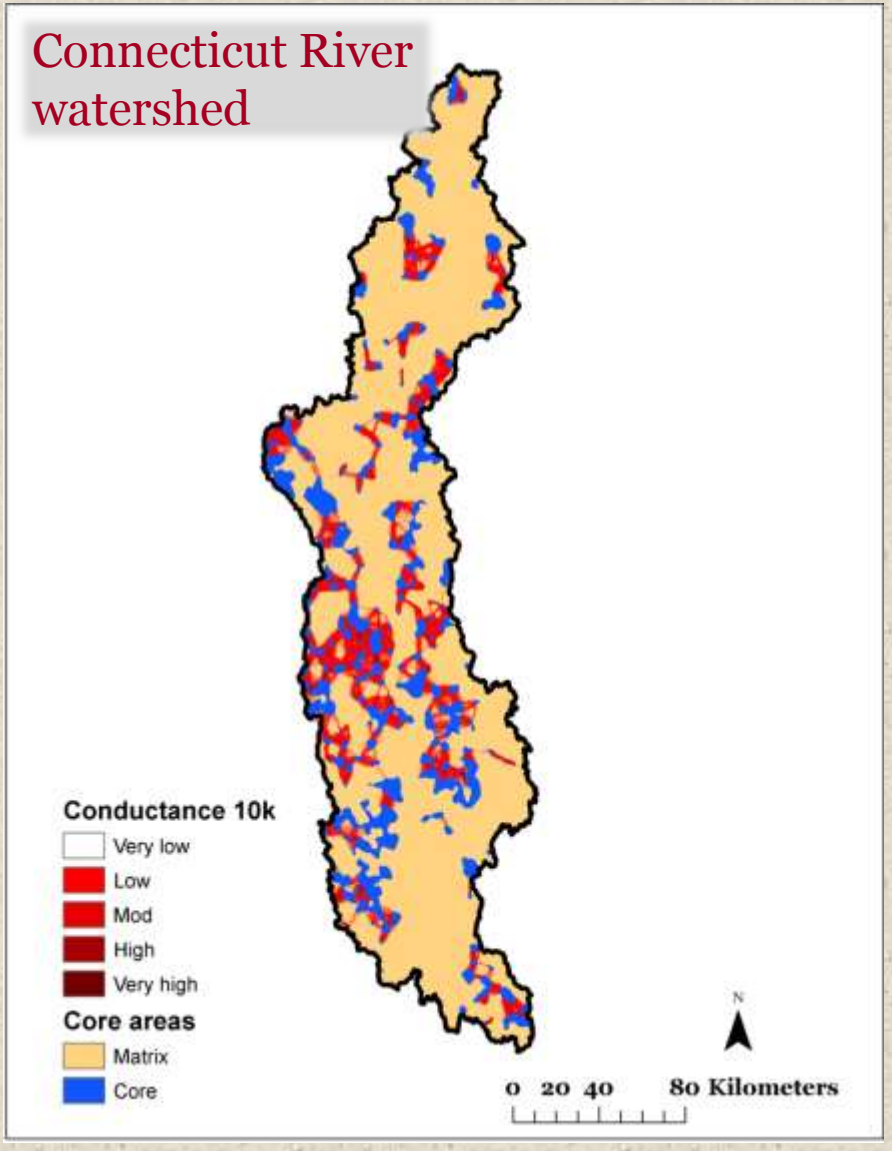
What does it look like?



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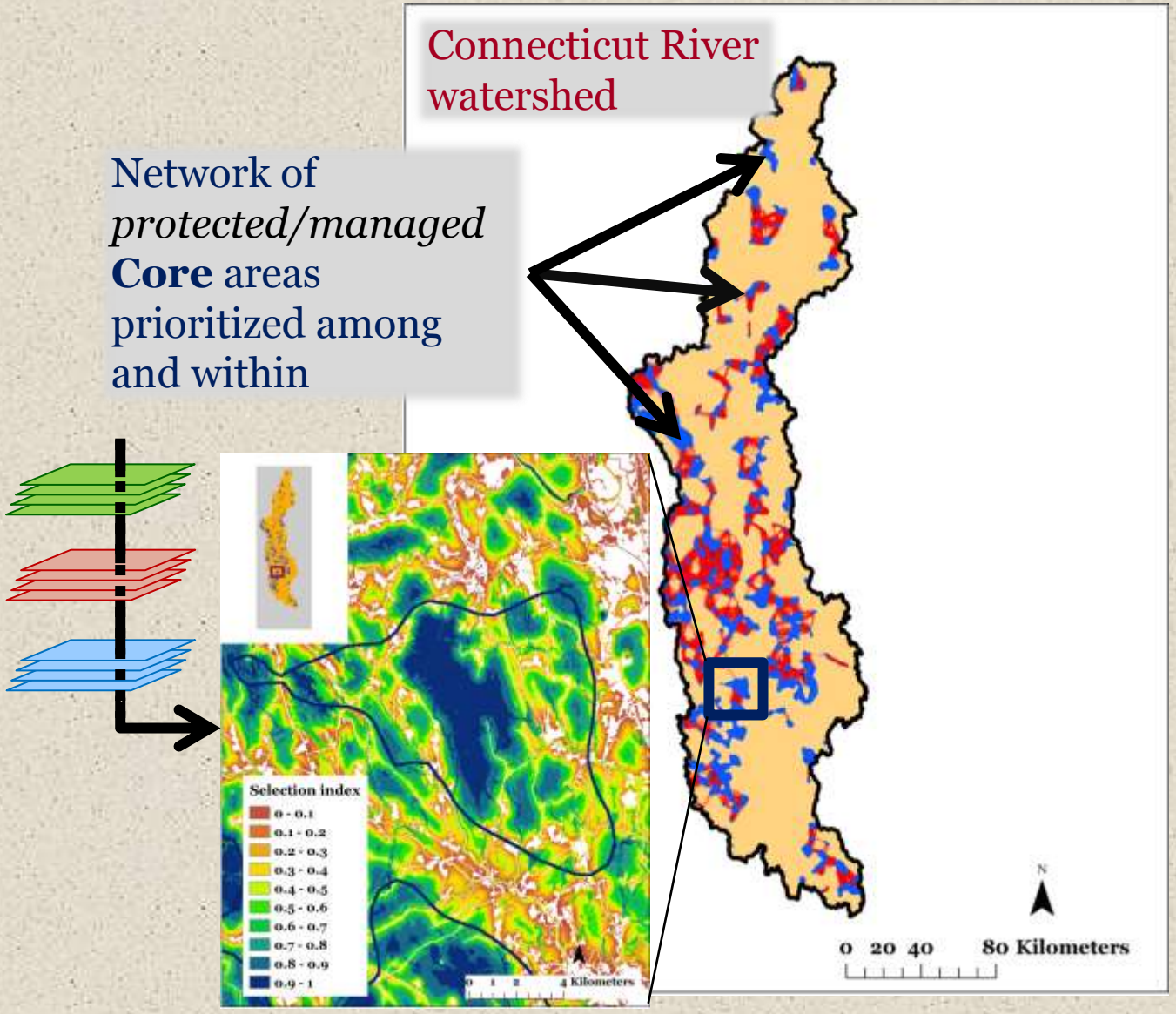

Landscape Conservation Design

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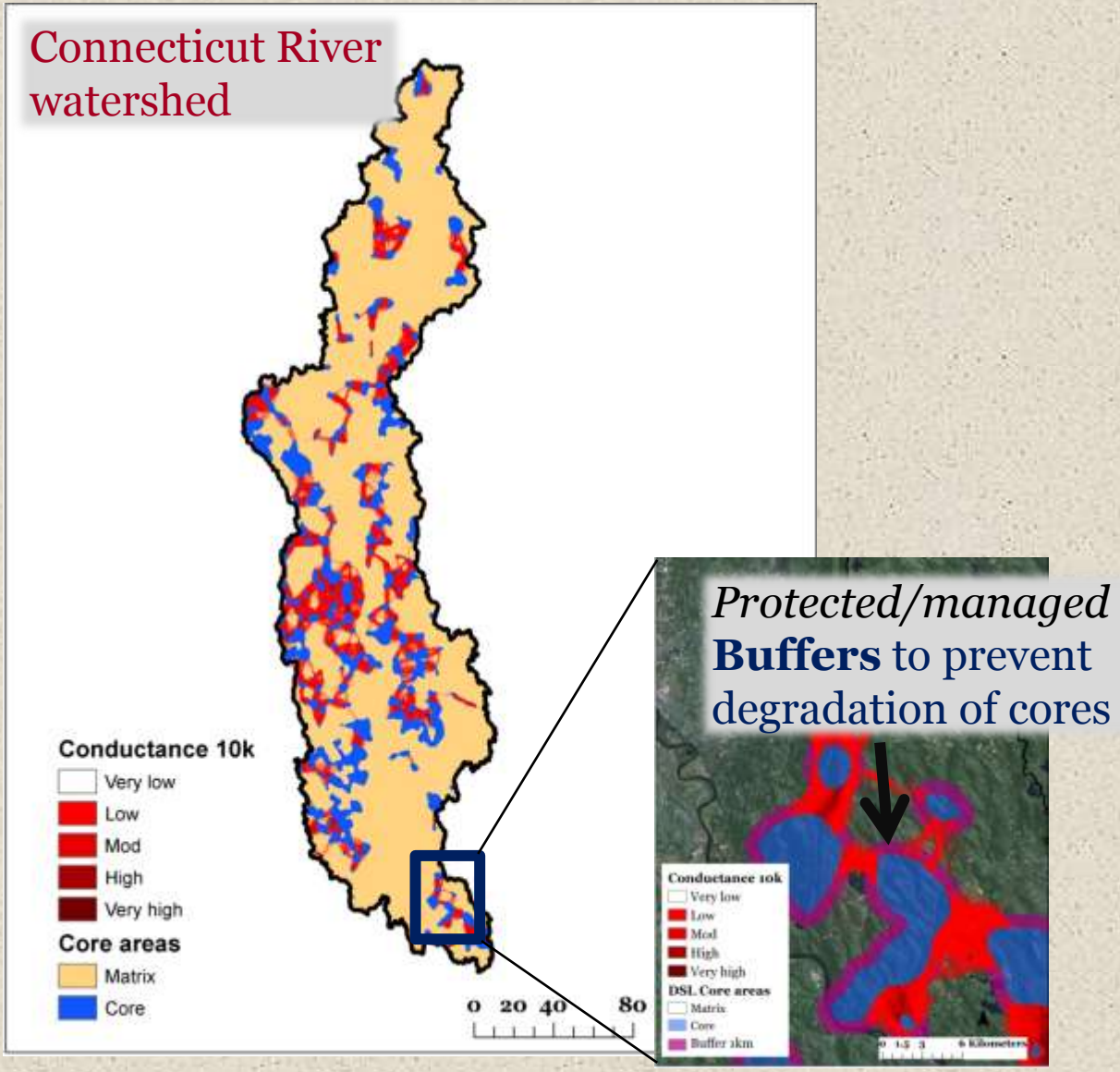
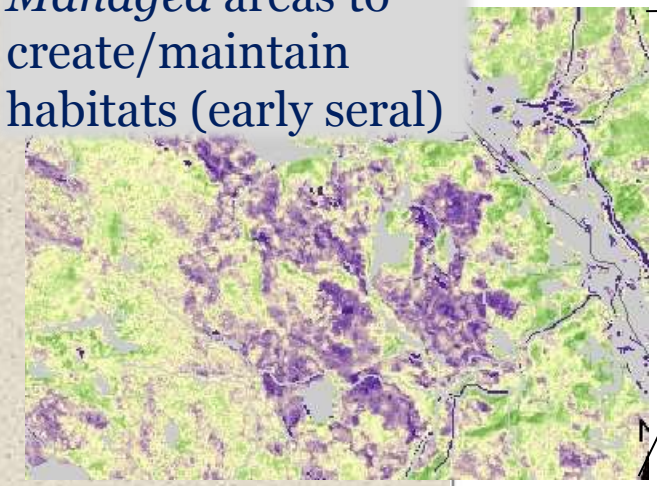
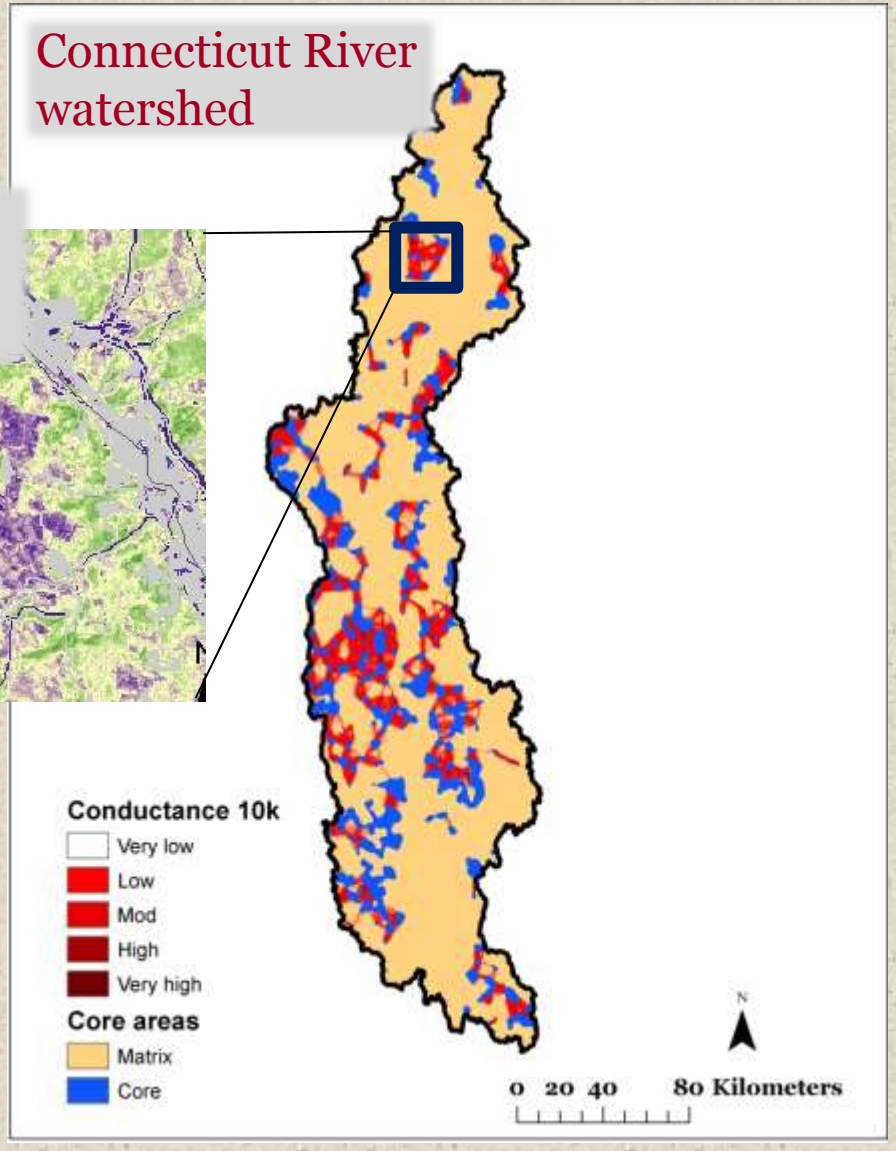


Landscape Conservation Design

What does it look like?

Managed areas to create/maintain habitats (early seral)





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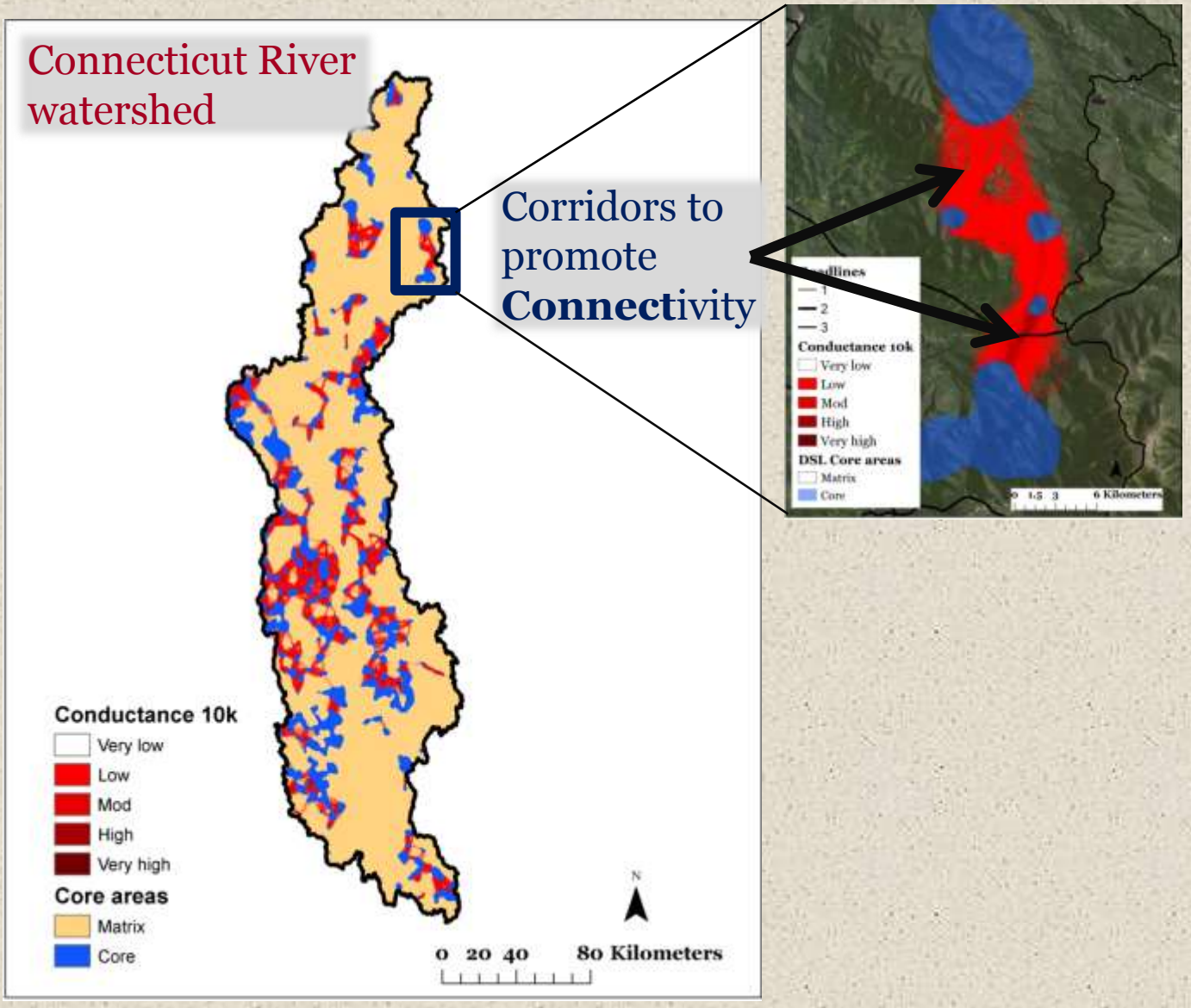
What does it look like?



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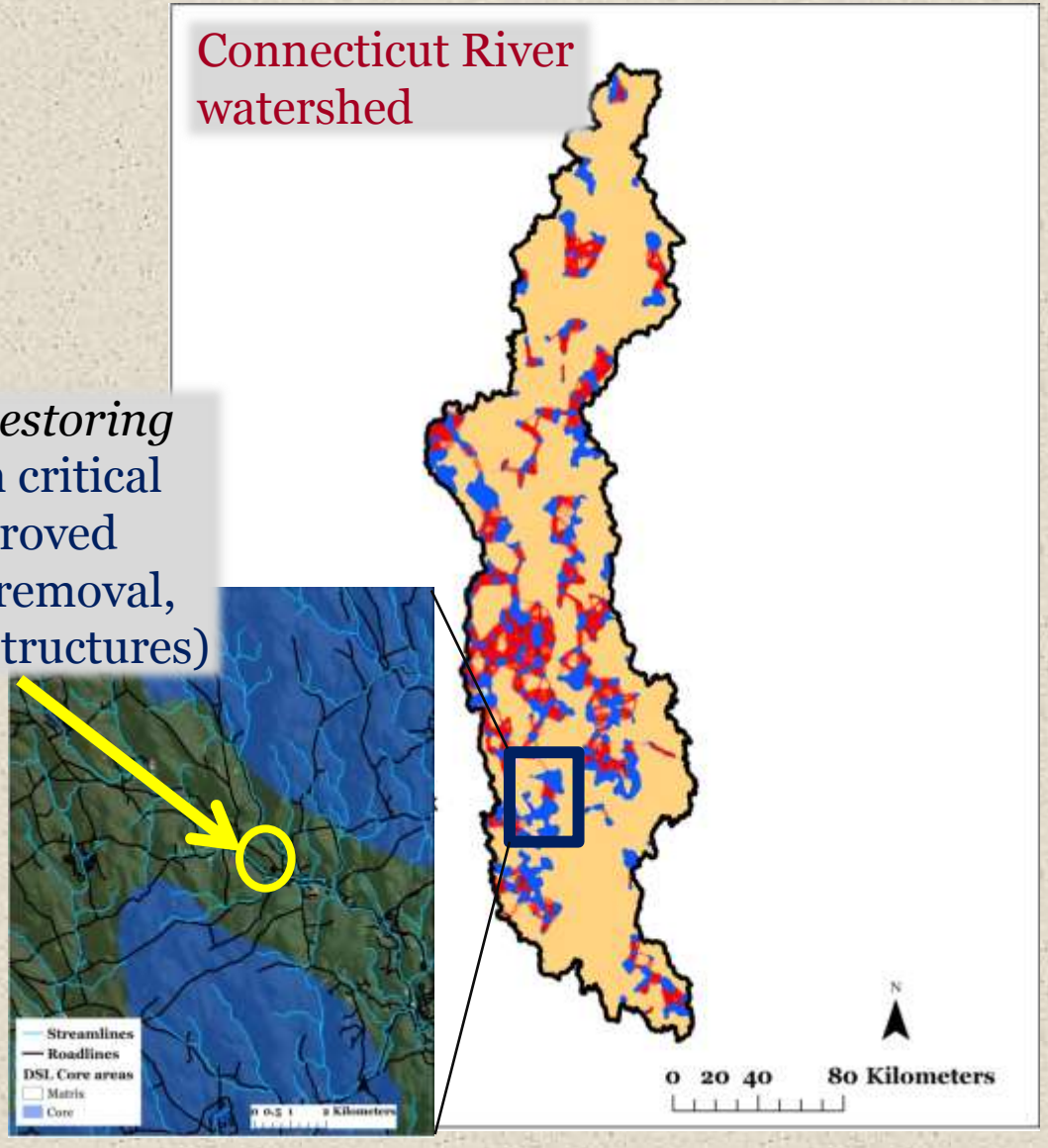
What does it look like?

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



Landscape Conservation Design

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

- Field verification at all steps
- Socio-cultural and economic considerations at all steps

Landscape Conservation Design

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

Landscape Conservation Design

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?

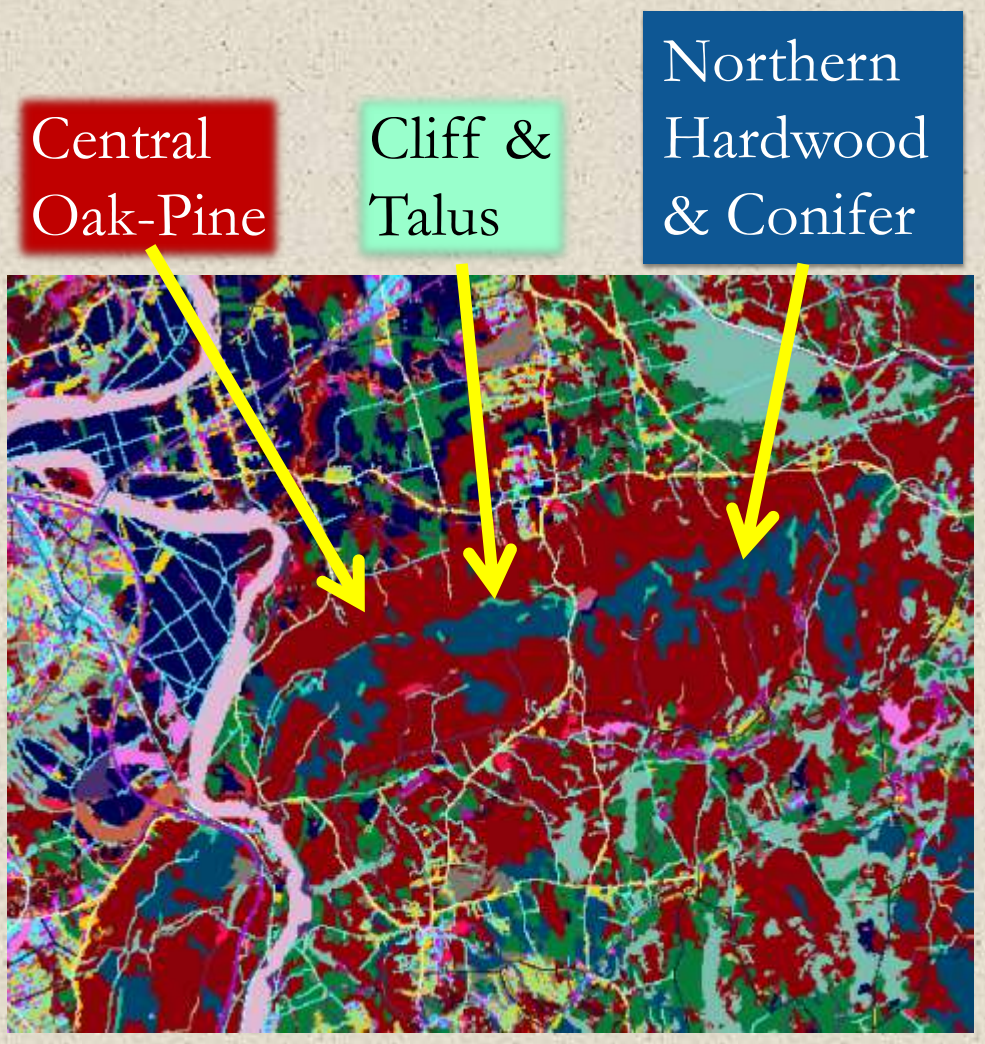
Landscape Conservation Design

Step 2: Design Conservation Network

1a) Weight ecological settings

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

More on this later



Landscape Conservation Design

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

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

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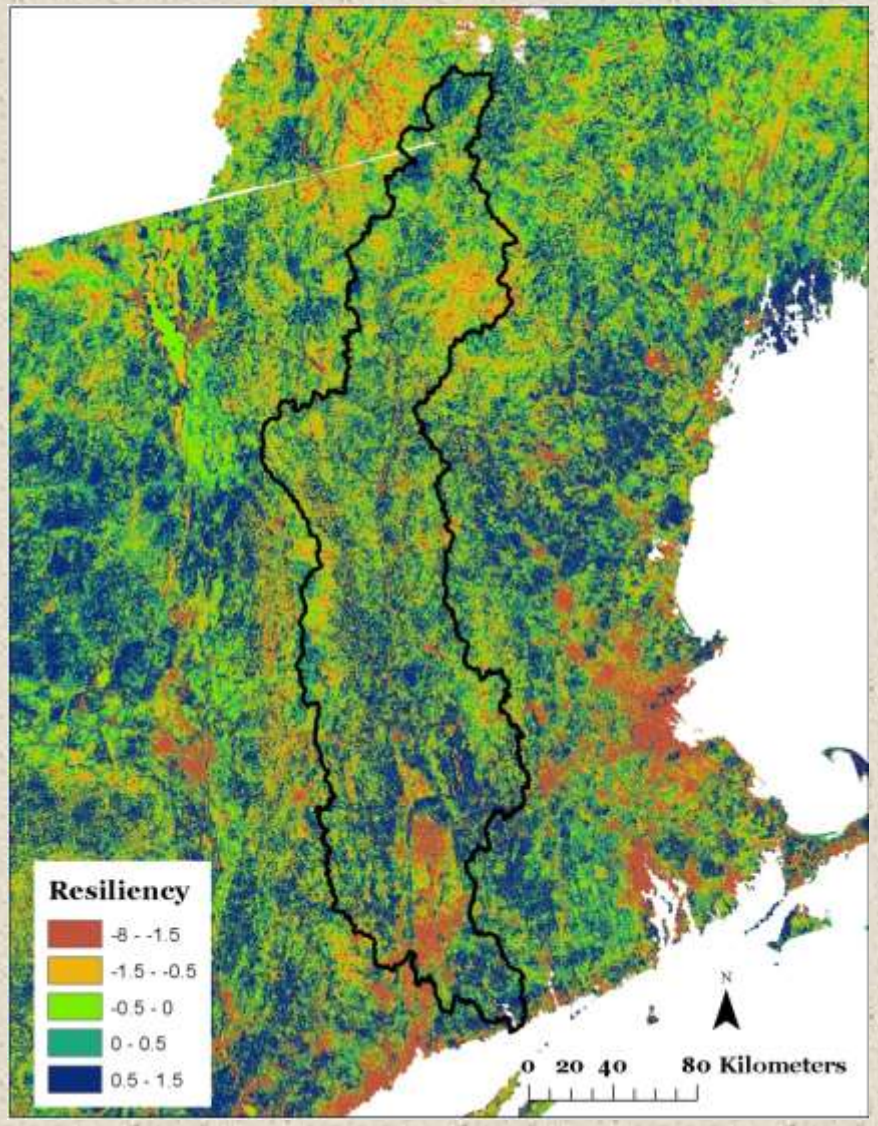
Step 2: Design Conservation Network

1b) Create selection index

- TNC Resiliency index
  - Scaled by geo-physical setting
  - 1,000 acre hexagons



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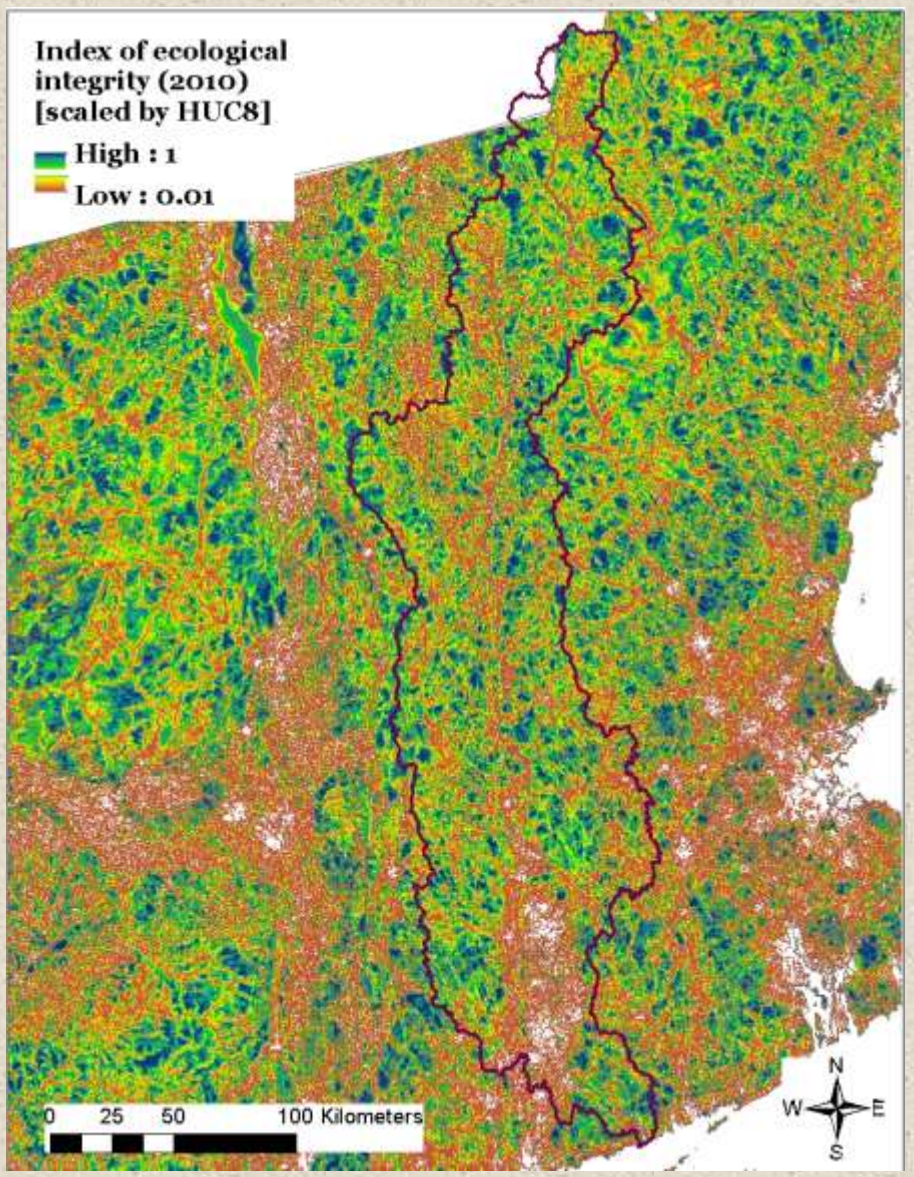
Step 2: Design Conservation Network

1b) Create selection index

- DSL current Index of Ecological Integrity (IEI)
  - Scaled by macro-ecological system
  - 30 m resolution

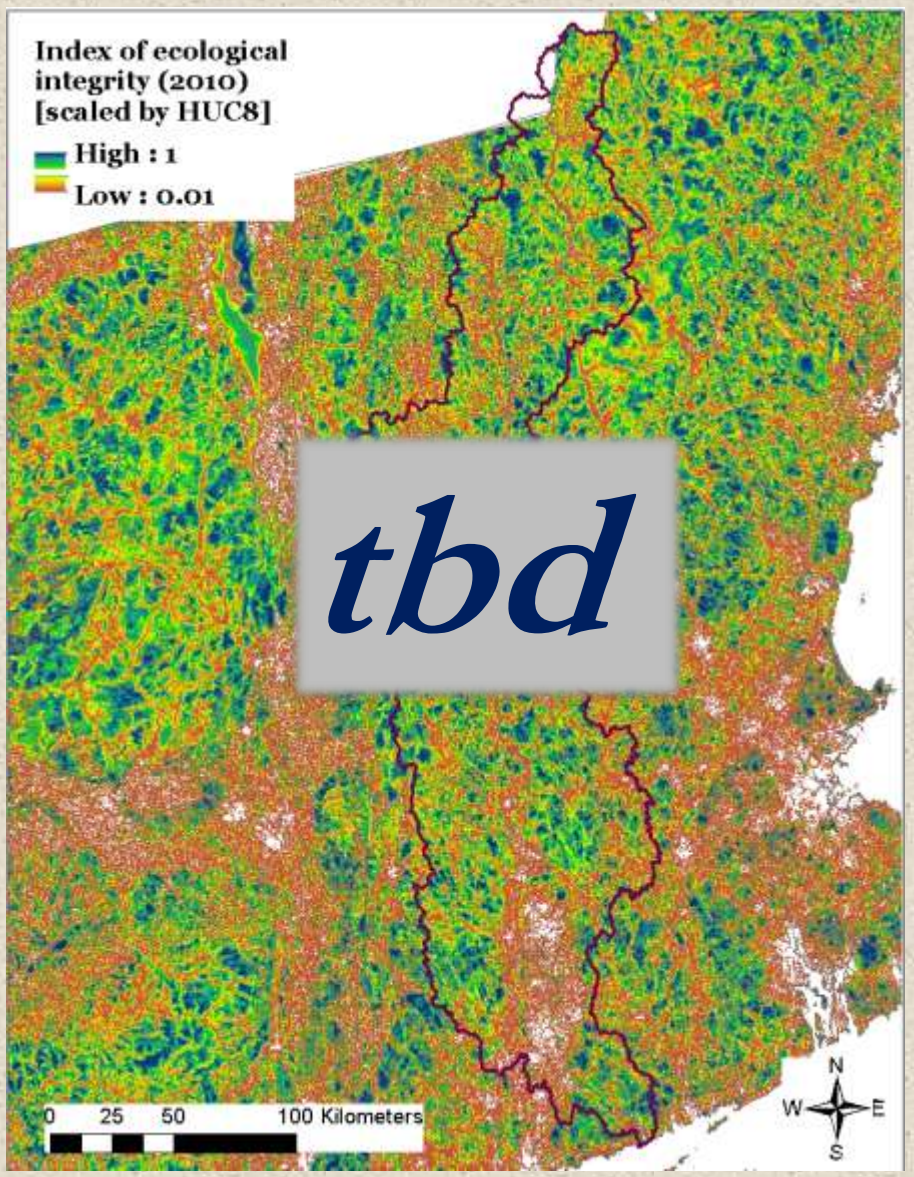


Landscape Conservation Design

Step 2: Design Conservation Network

1b) Create selection index

- DSL future Index of Ecological Impact (vulnerability)
  - Scaled by macro-ecological system
  - 30 m resolution



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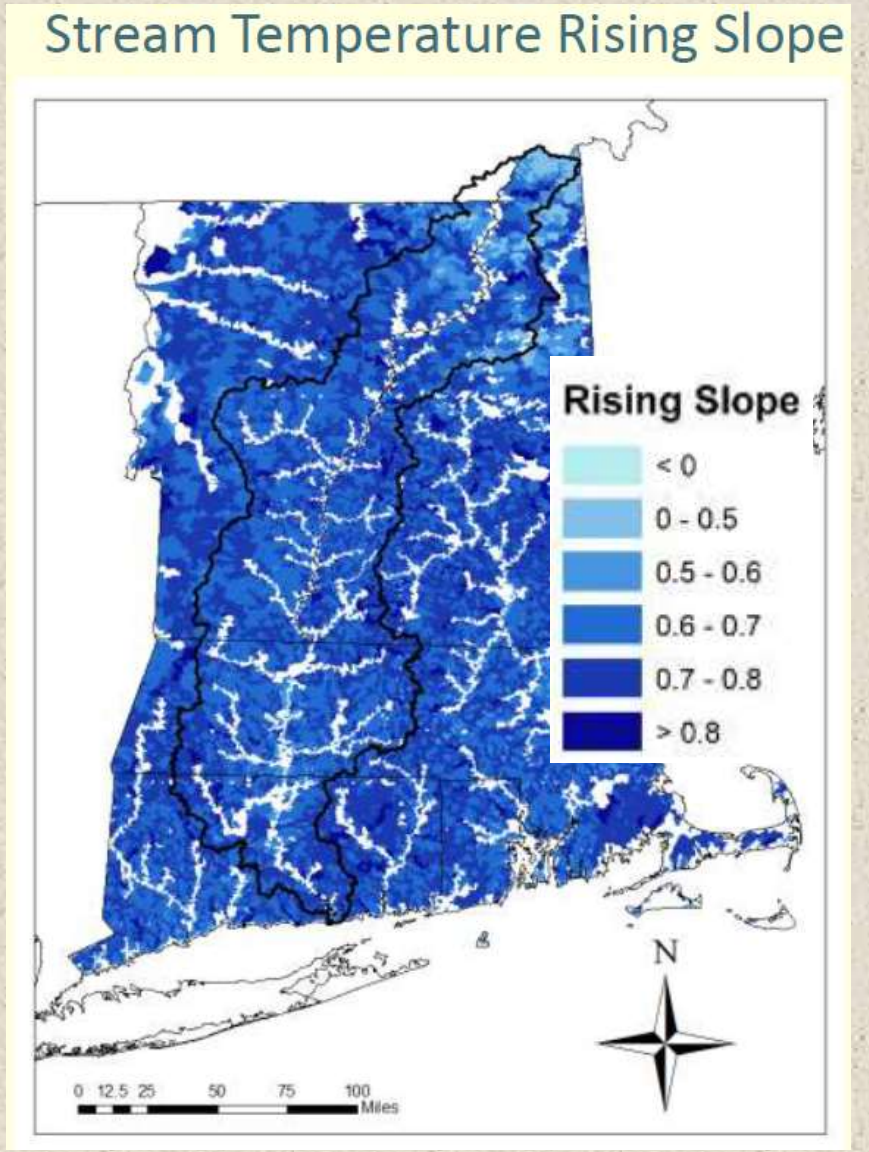
Step 2: Design Conservation Network

1b) Create selection index

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



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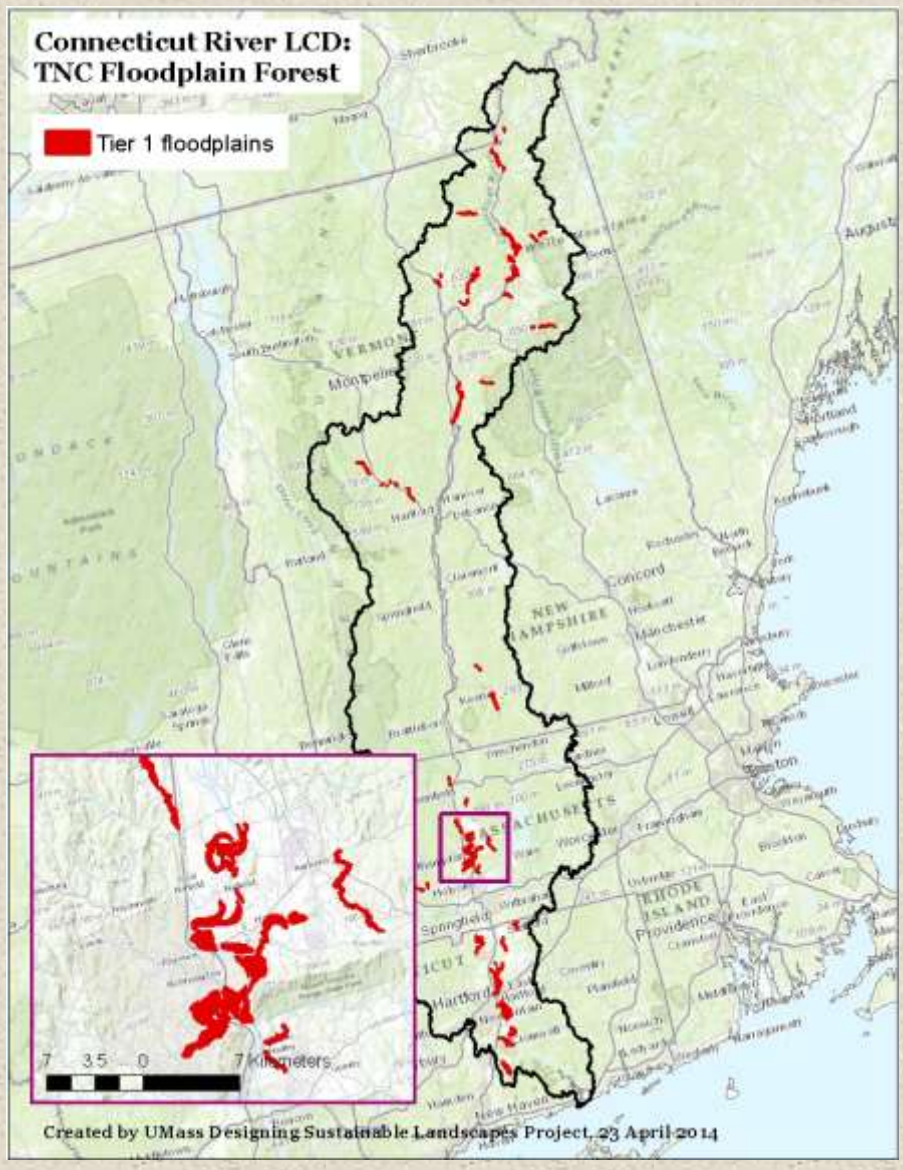
Step 2: Design Conservation Network

1b) Create selection index

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



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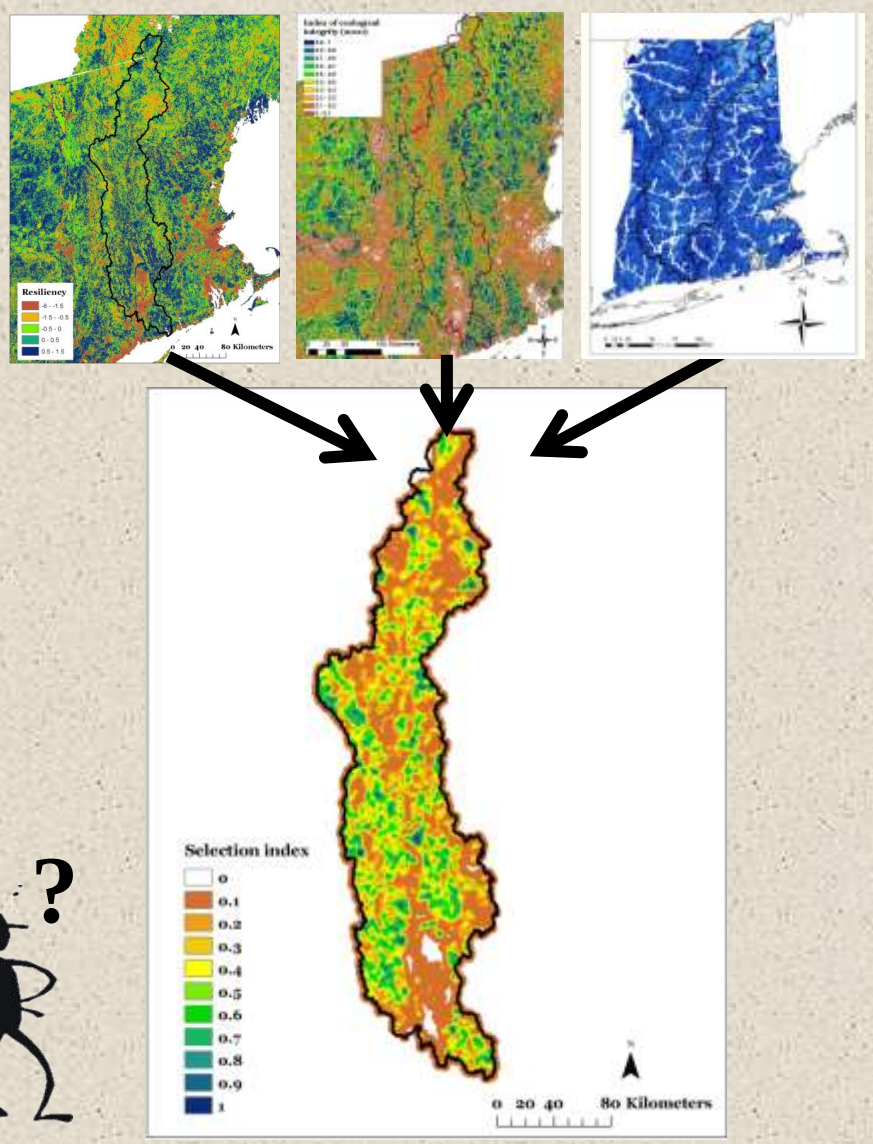
Step 2: Design Conservation Network

1b) Create selection index

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



Landscape Conservation Design

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

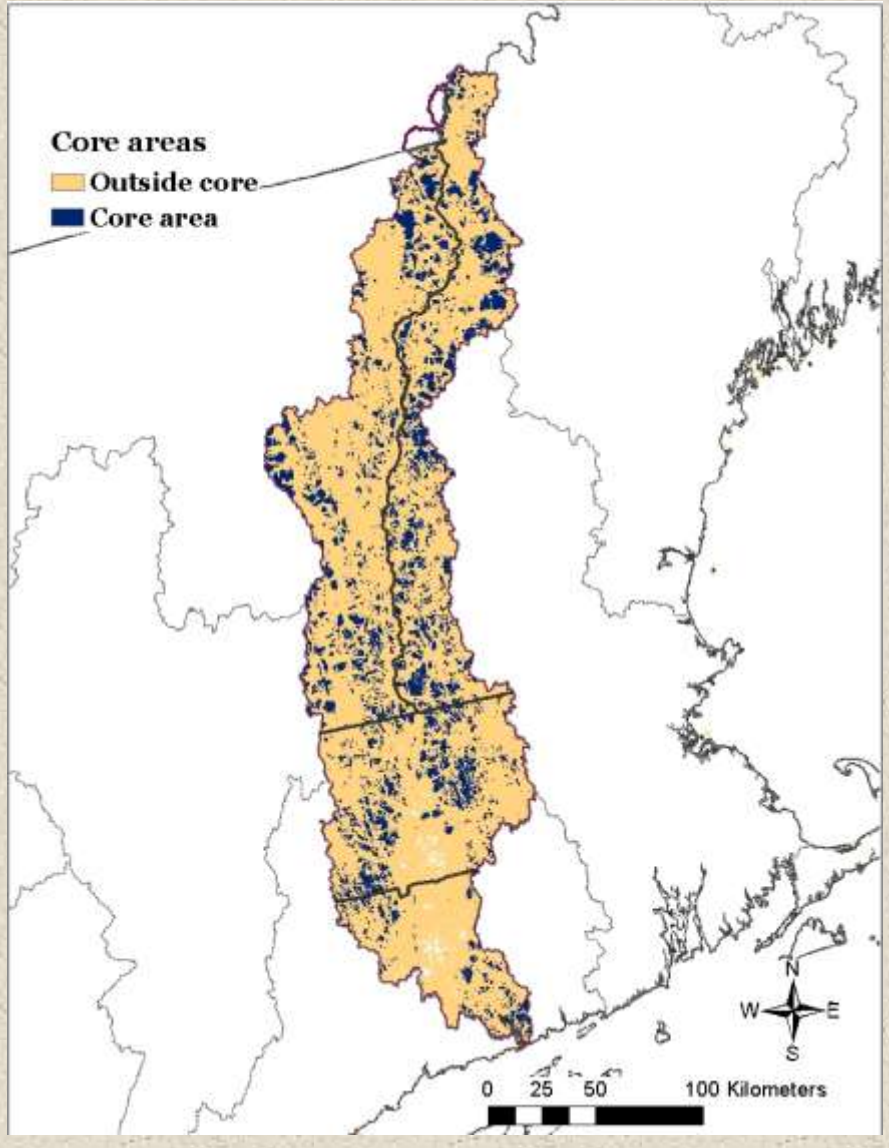
- What proportion of the undeveloped landscape do we want to include in core areas?

Landscape Conservation Design

Step 2: Design Conservation Network

1c) **Select core areas to meet target**

- How much area do we include?



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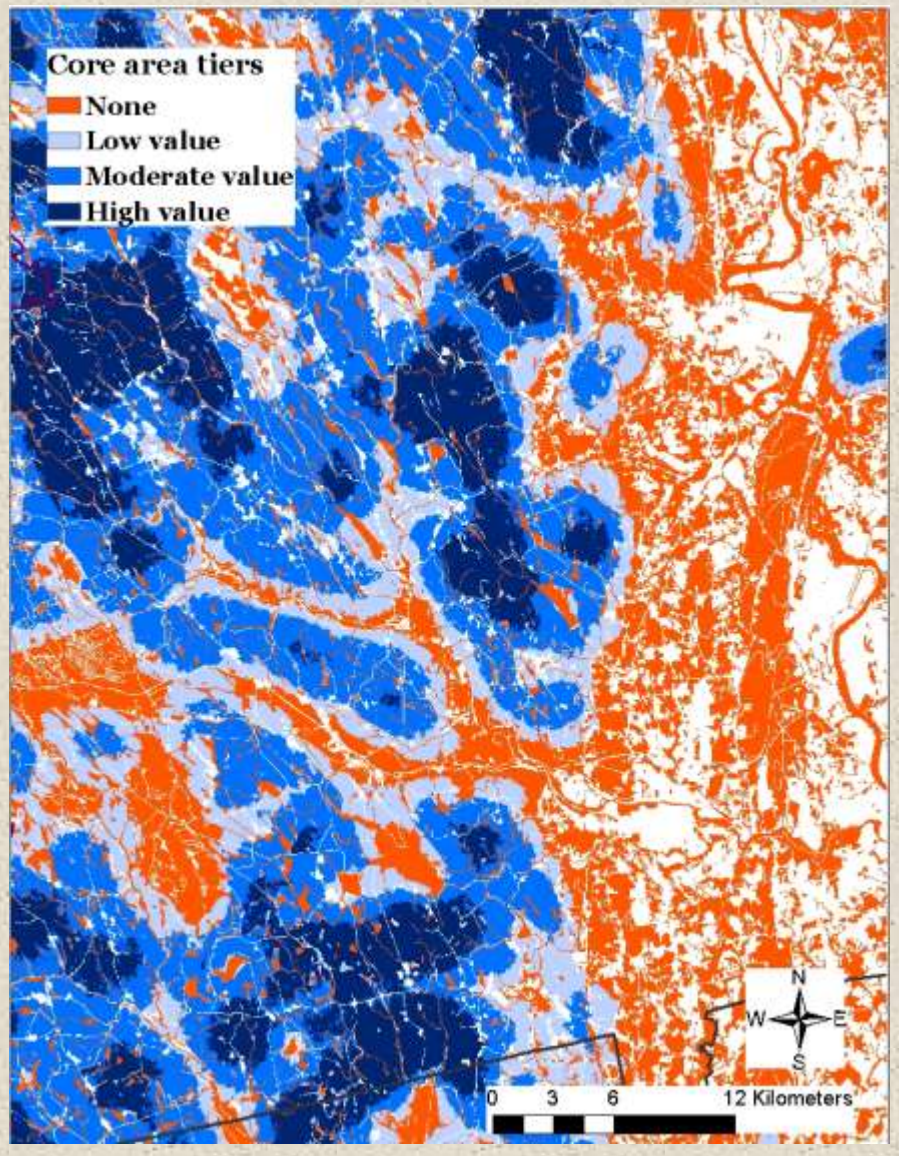
Step 2: Design Conservation Network

1c) **Select core areas to meet target**

- Should we depict tiers of ecological importance?



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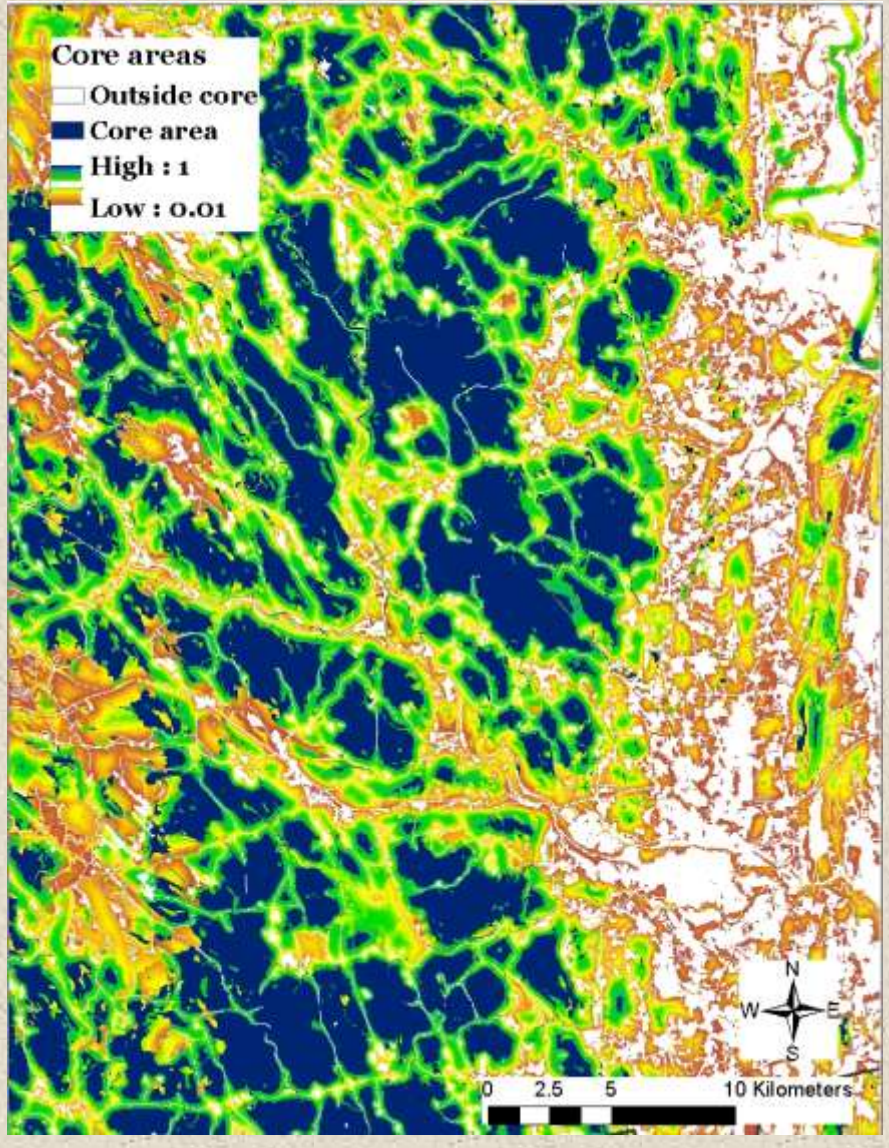
Step 2: Design Conservation Network

1c) **Select core areas to meet target**

- Should we enforce a minimum size for core areas?



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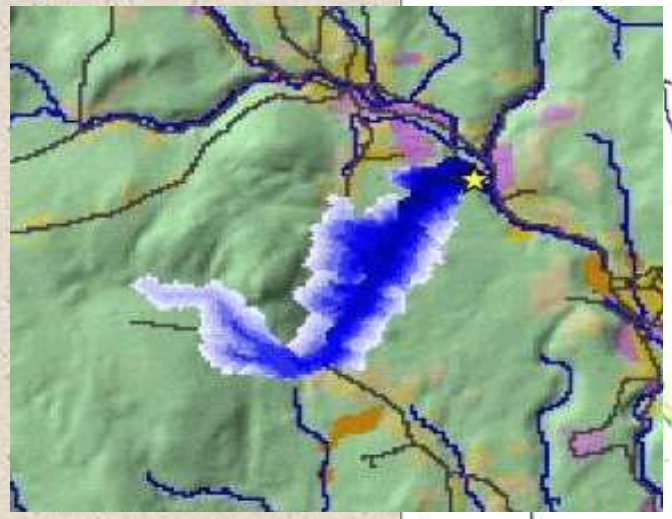
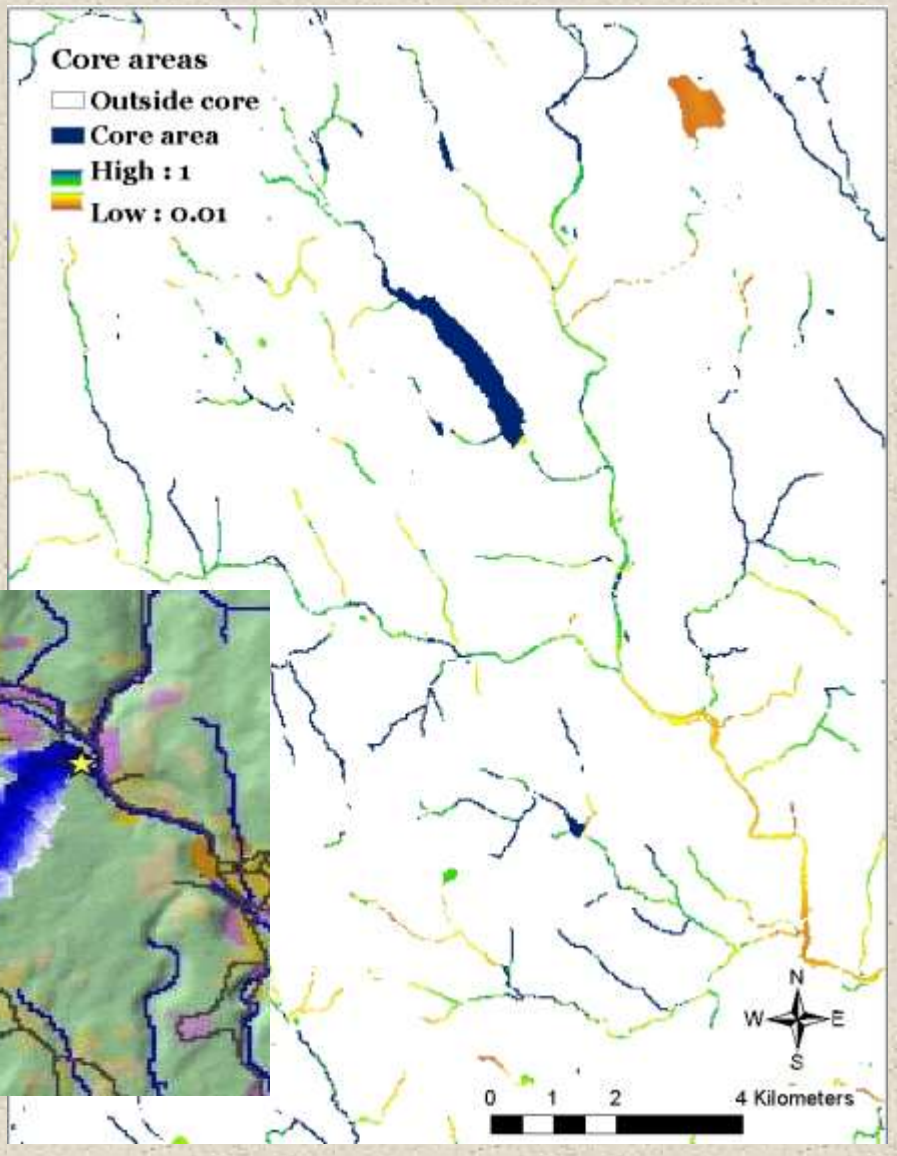
Step 2: Design Conservation Network

1c) **Select core areas to meet target**

- How do we delineate core areas for aquatics?





Landscape Conservation Design

Step 2: Design Conservation Network

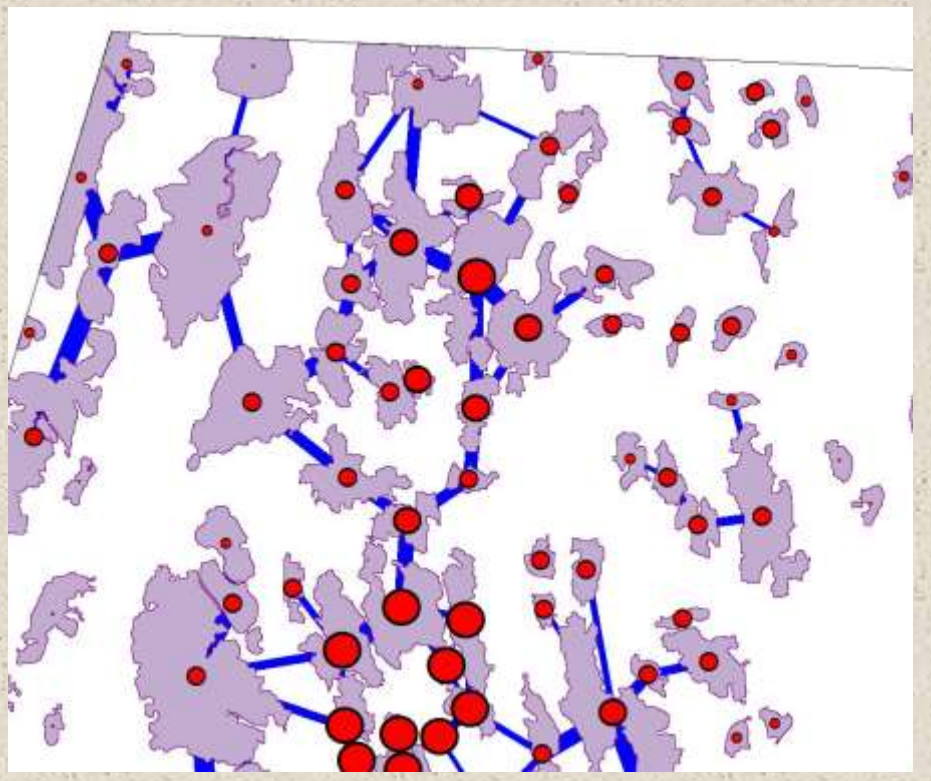
2. Prioritize *core areas*

a) Prioritize among core areas

b) Prioritize within core areas

- Based on importance to regional connectivity
- Other considerations?

Node importance index



Landscape Conservation Design

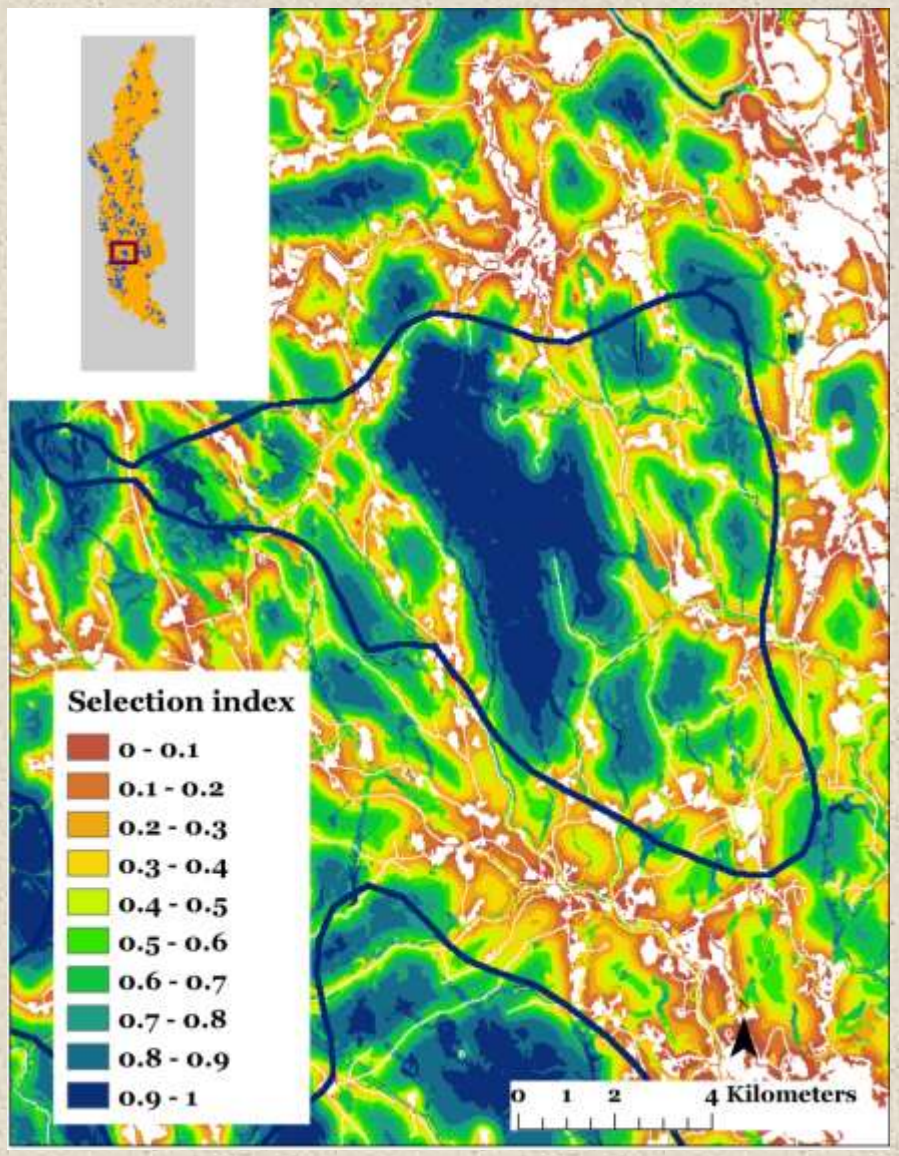
Step 2: Design Conservation Network

2. Prioritize *core areas*

a) Prioritize among core areas

b) Prioritize within core areas

- Based on core area selection index
- Other considerations?



Landscape Conservation Design

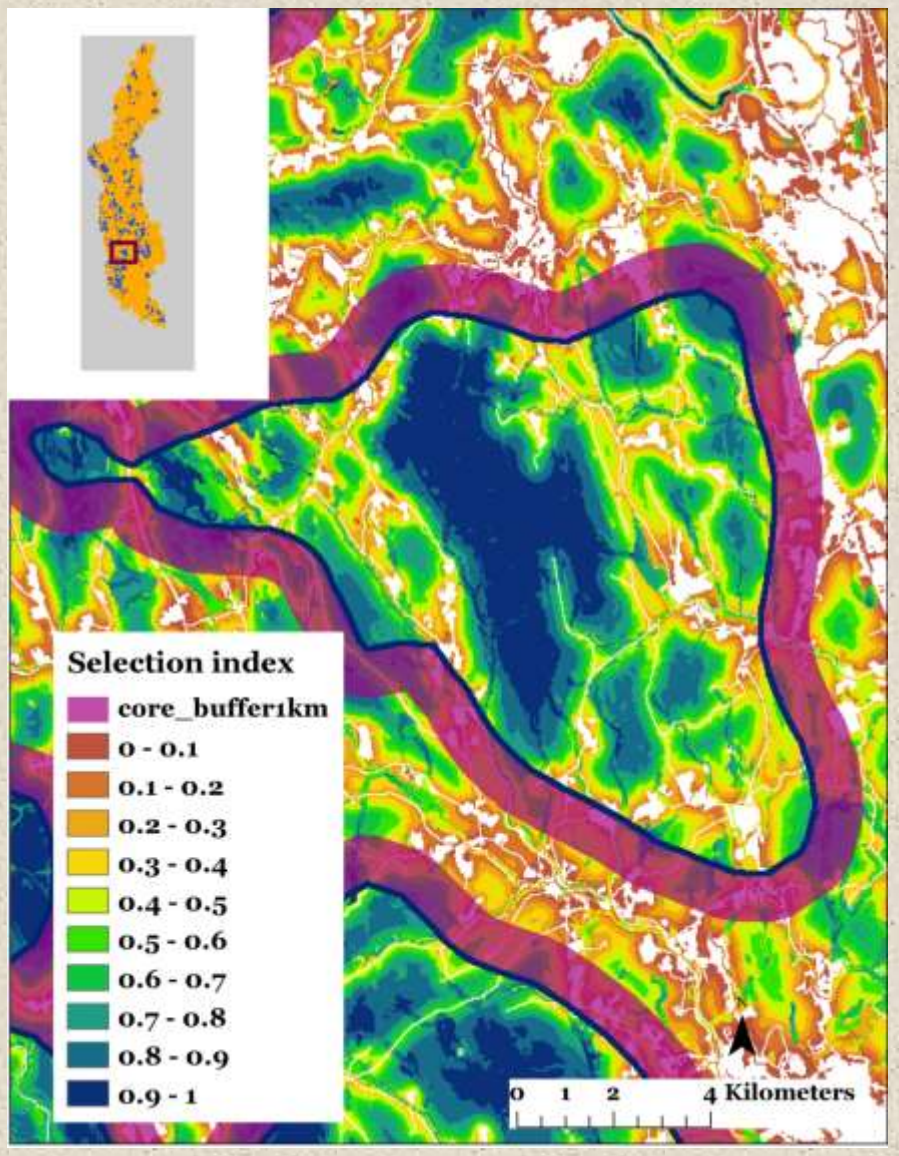
Step 2: Design Conservation Network

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?



Landscape Conservation Design

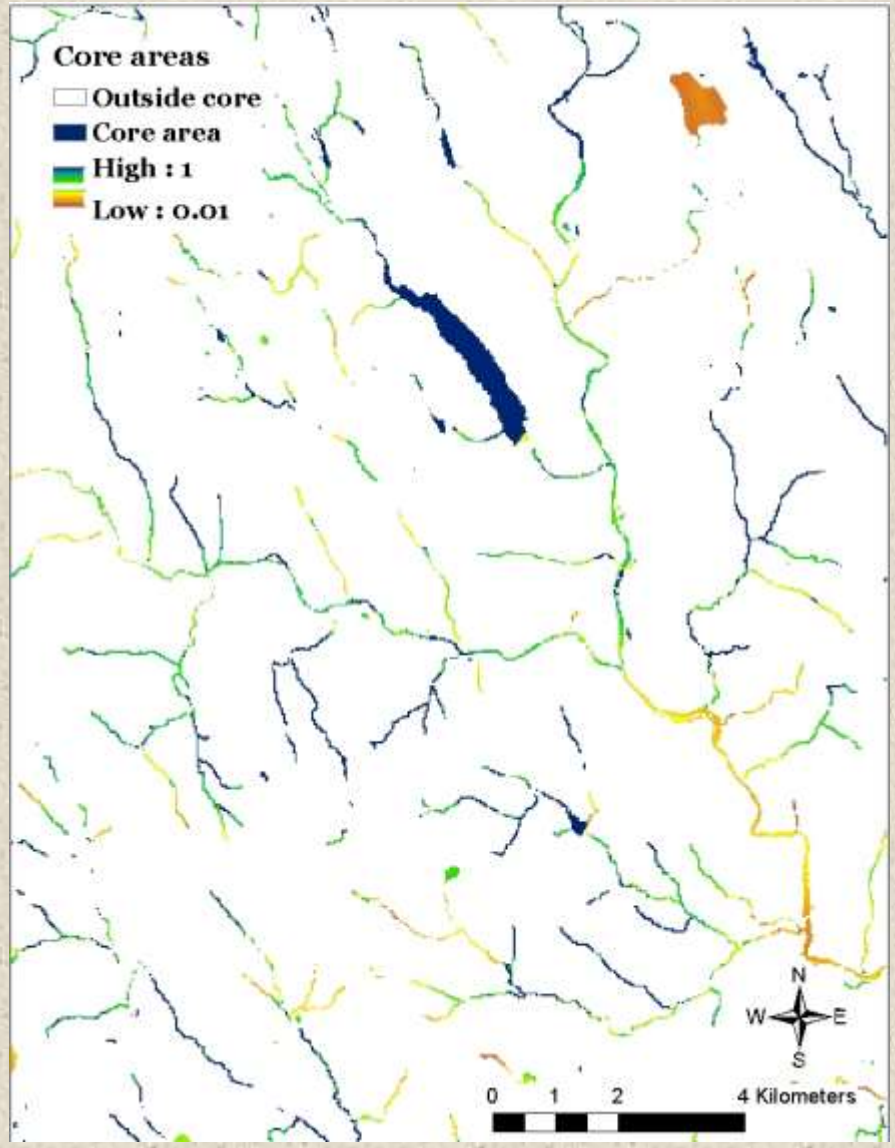
Step 2: Design Conservation Network

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?



Landscape Conservation Design

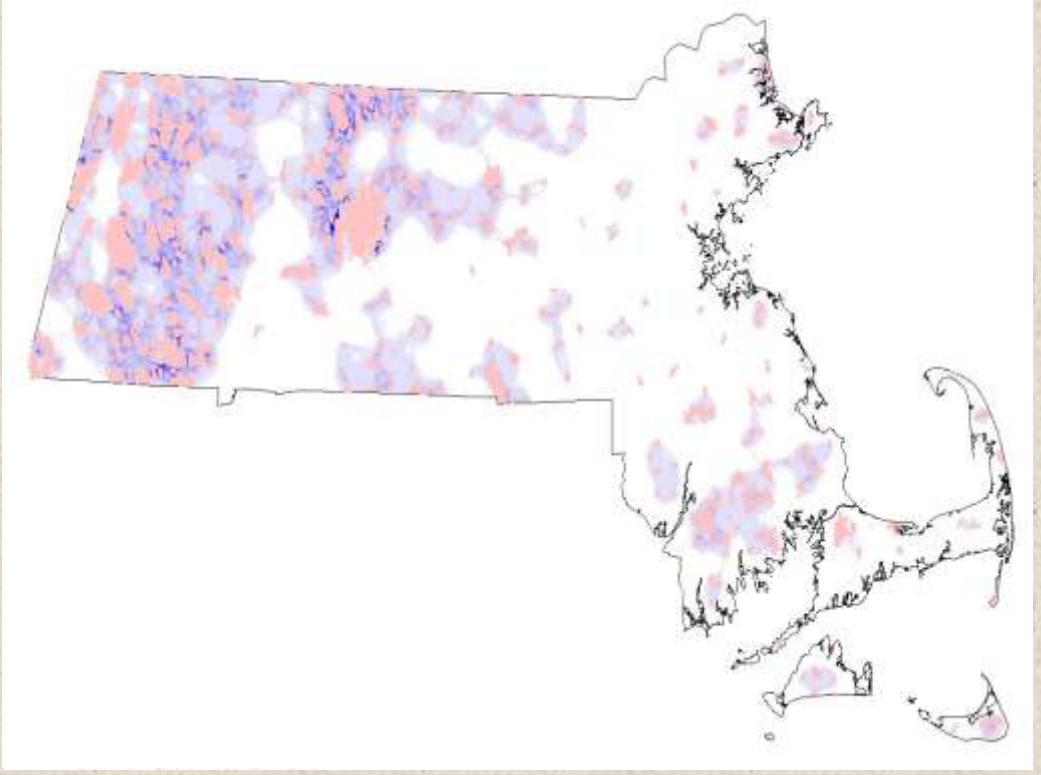
Step 2: Design Conservation Network

4. Delineate *Corridors*

a) Find links between core areas (random low-cost paths)

b) Compute conductance index

c) Delineate corridors



Landscape Conservation Design

Step 2: Design Conservation Network

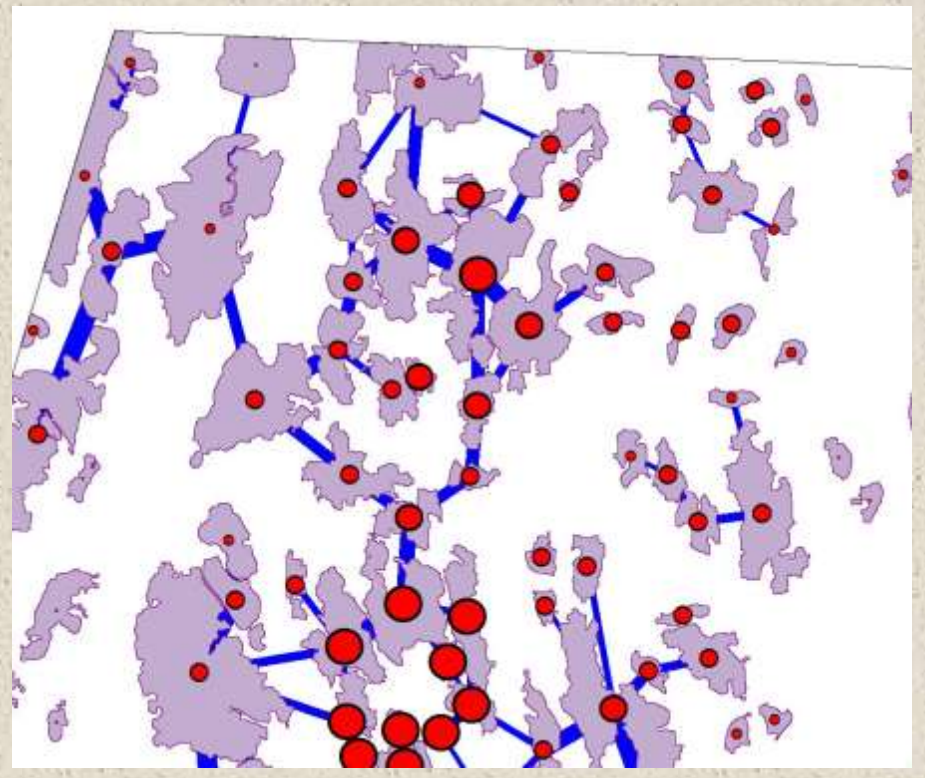
5. Prioritize *Corridors*

a) Prioritize among corridors

b) Prioritize within corridors

- Based on importance to regional connectivity
- Other considerations?

Link importance index



Landscape Conservation Design

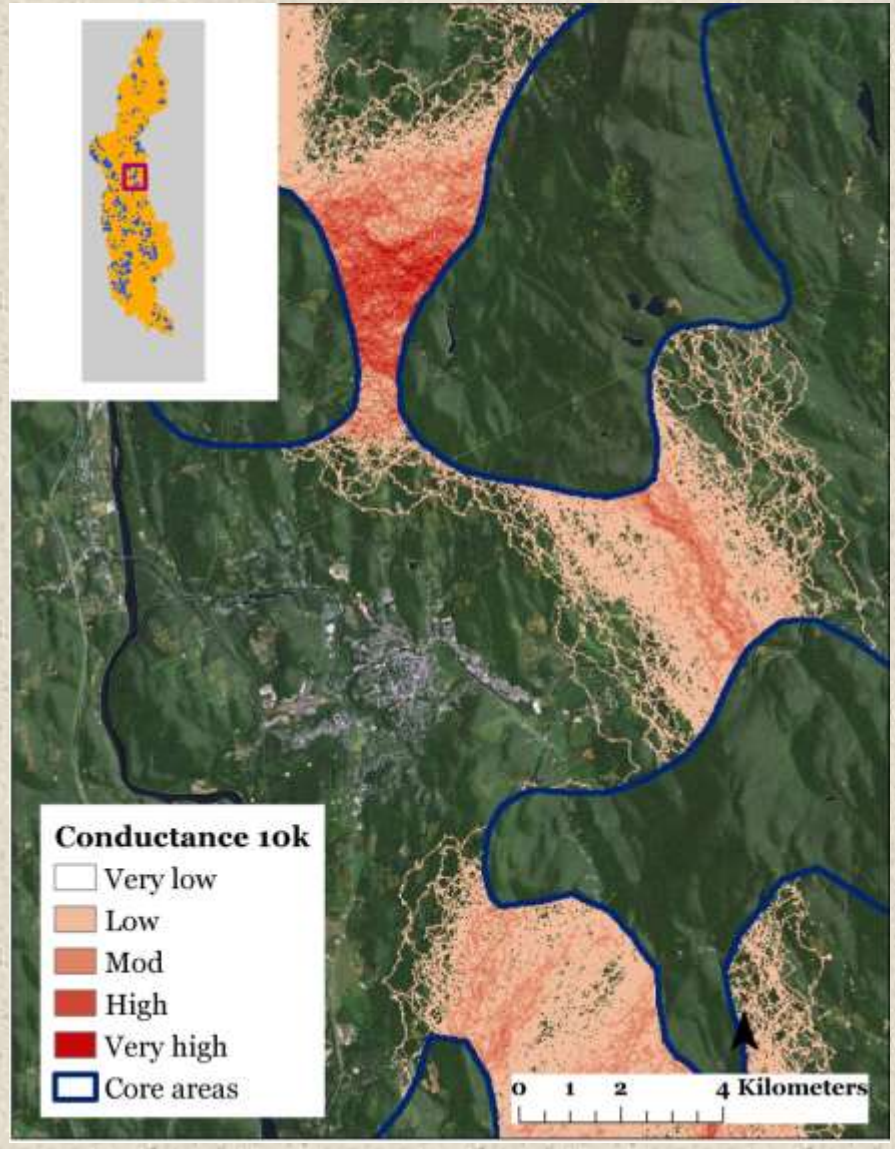
Step 2: Design Conservation Network

5. Prioritize *Corridors*

a) Prioritize among corridors

b) Prioritize lands within corridors

- Based on local conductance index
- Other considerations?



Step 2: Design Conservation Network

6. Determine *management* needs

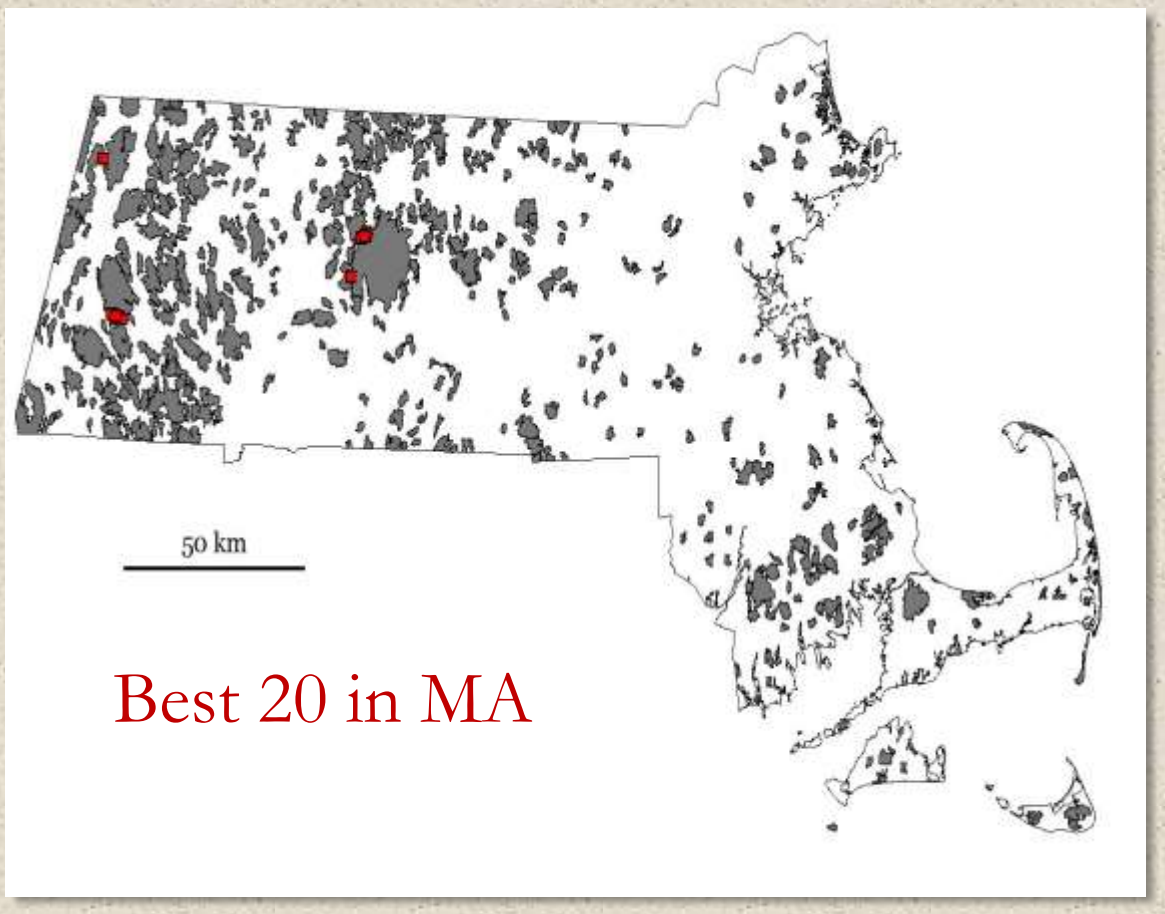
- Are there coarse-filter management needs for particular ecosystems?
- If so, what are they?
- Is this best handled outside of the conservation design?

Landscape Conservation Design

Step 2: Design Conservation Network

7. Identify *restoration* opportunities

- Road passage structures
- Road-stream crossings
- Dams
- Wetland restoration?



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Step 2: Design Conservation Network

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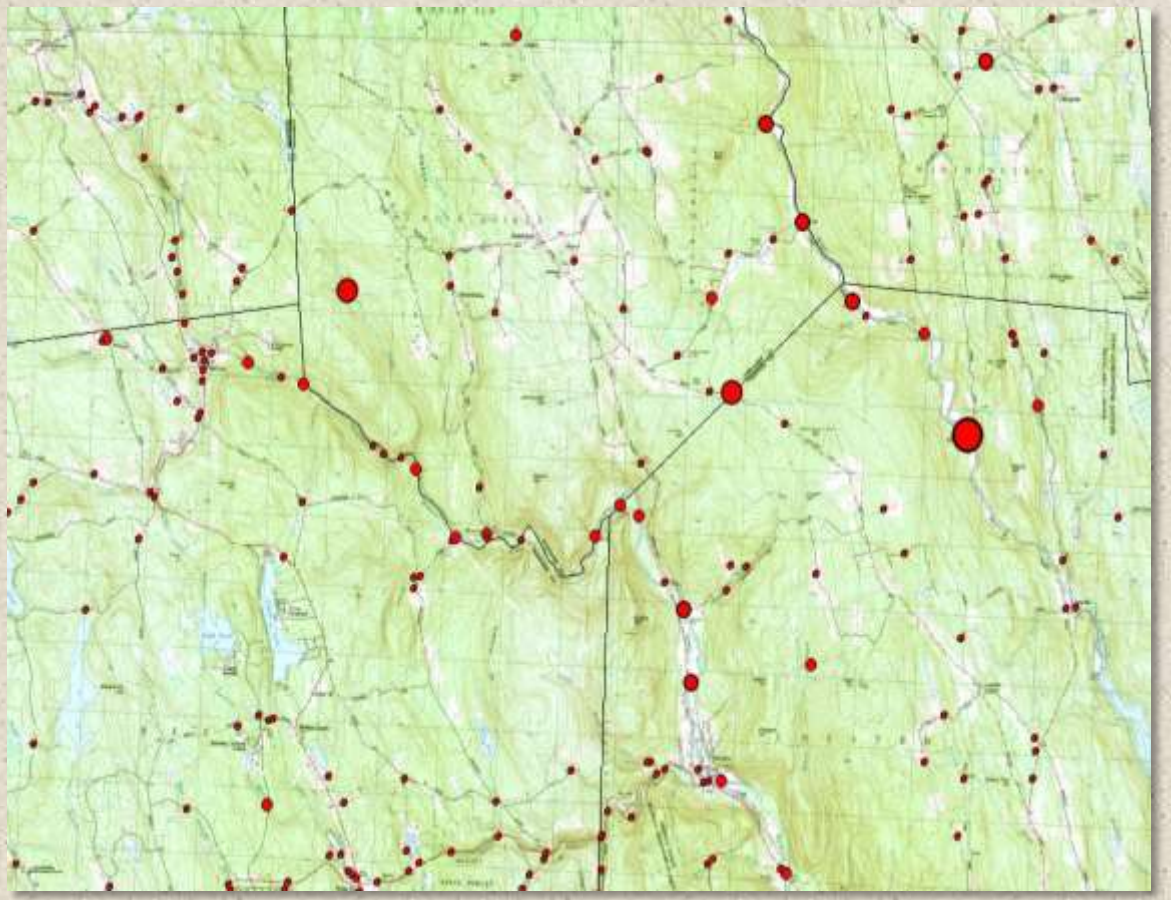

Landscape Conservation Design

Step 2: Design Conservation Network

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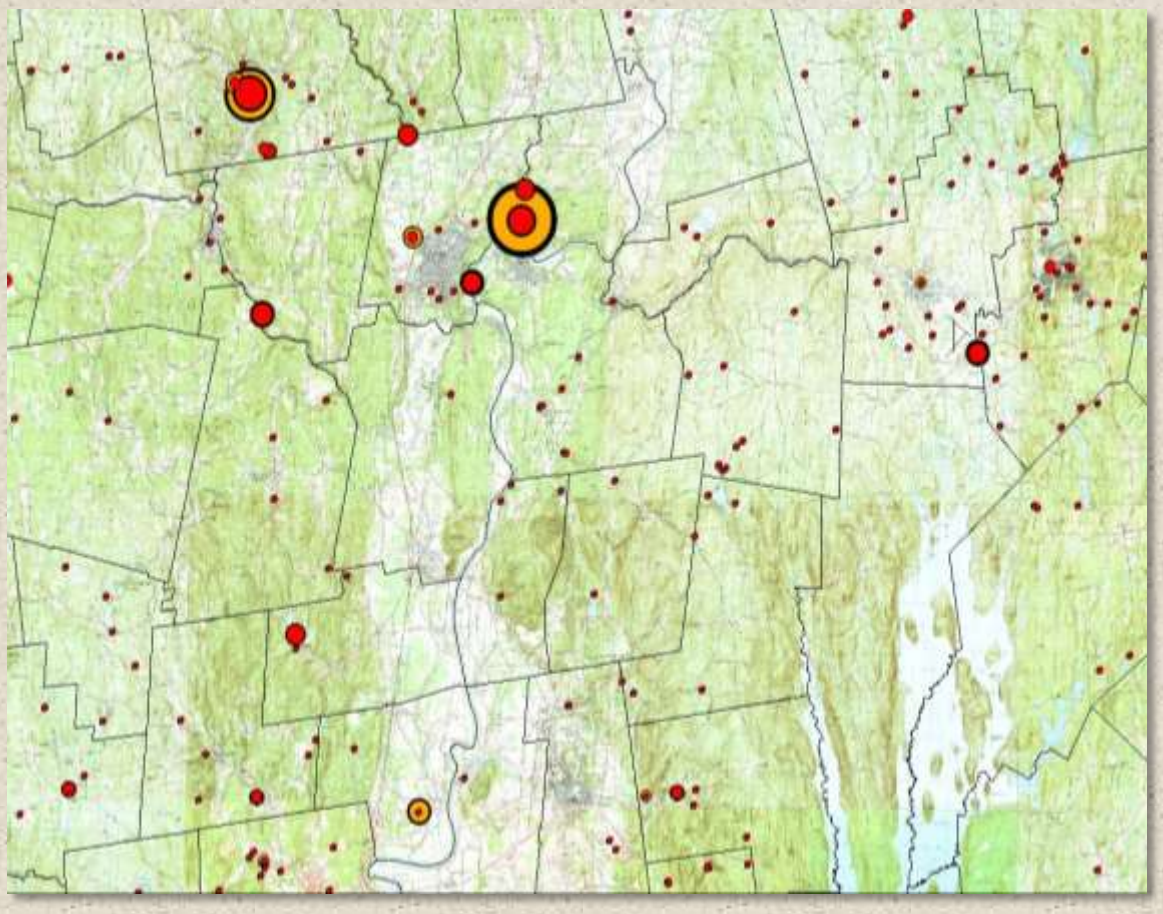

Landscape Conservation Design

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

Landscape Conservation Design

Step 2: Design Conservation Network

Key Decisions:

1. Select sub-landscape scale to ensure distribution
2. Weight macro-ecological systems (for IEI) **Today!**
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

Landscape Conservation Design

Step 2: Design Conservation Network

Macro-ecological systems:

Formation	Macrogroup
Freshwater Marsh	Emergent 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

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Step 2: Design Conservation Network

Weight ecological settings:

Based on current (2010) conditions:

- Extent… area (ha) of the region and landscape comprised of each macro-ecological system
- Landscape importance… percent of each macro-ecological system contained within the landscape
- Protected status… percent of each macro-ecological system currently protected within the region and landscape

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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
- Others (expert opinion)?

Not yet available

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Step 2: Design Conservation Network

Weight ecological settings:

Macro-group	Extent (ha) NE	Extent (ha) CTR	Importance (%)	Protected Status NE	Protected Status CTR	Vulnerability (2080) Total Impact NE	Vulnerability (2080) Total Impact CTR	Vulnerability (2080) Average Impact NE	Vulnerability (2080) Average Impact 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	**?**
…	…	…	…	…	…	…	…	…	…	…

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

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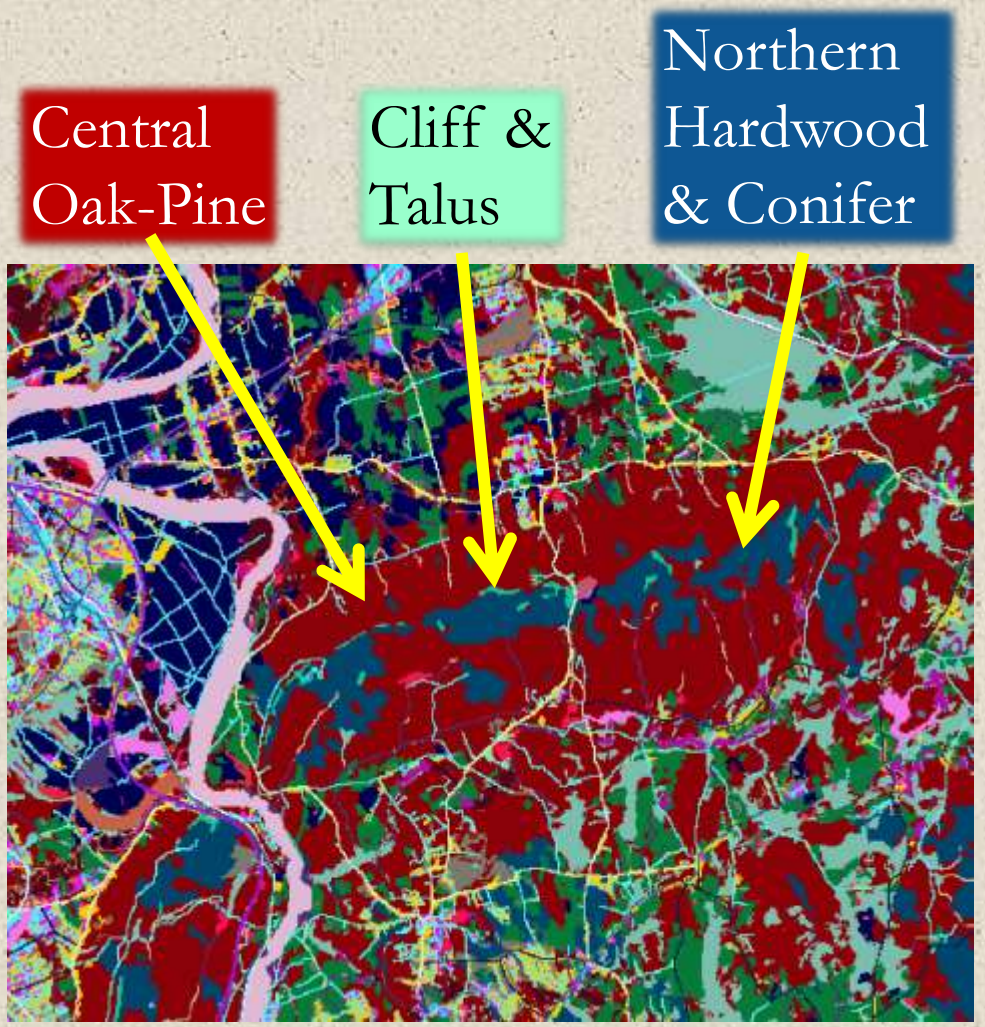
Step 2: Design Conservation Network

Weight ecological settings:

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



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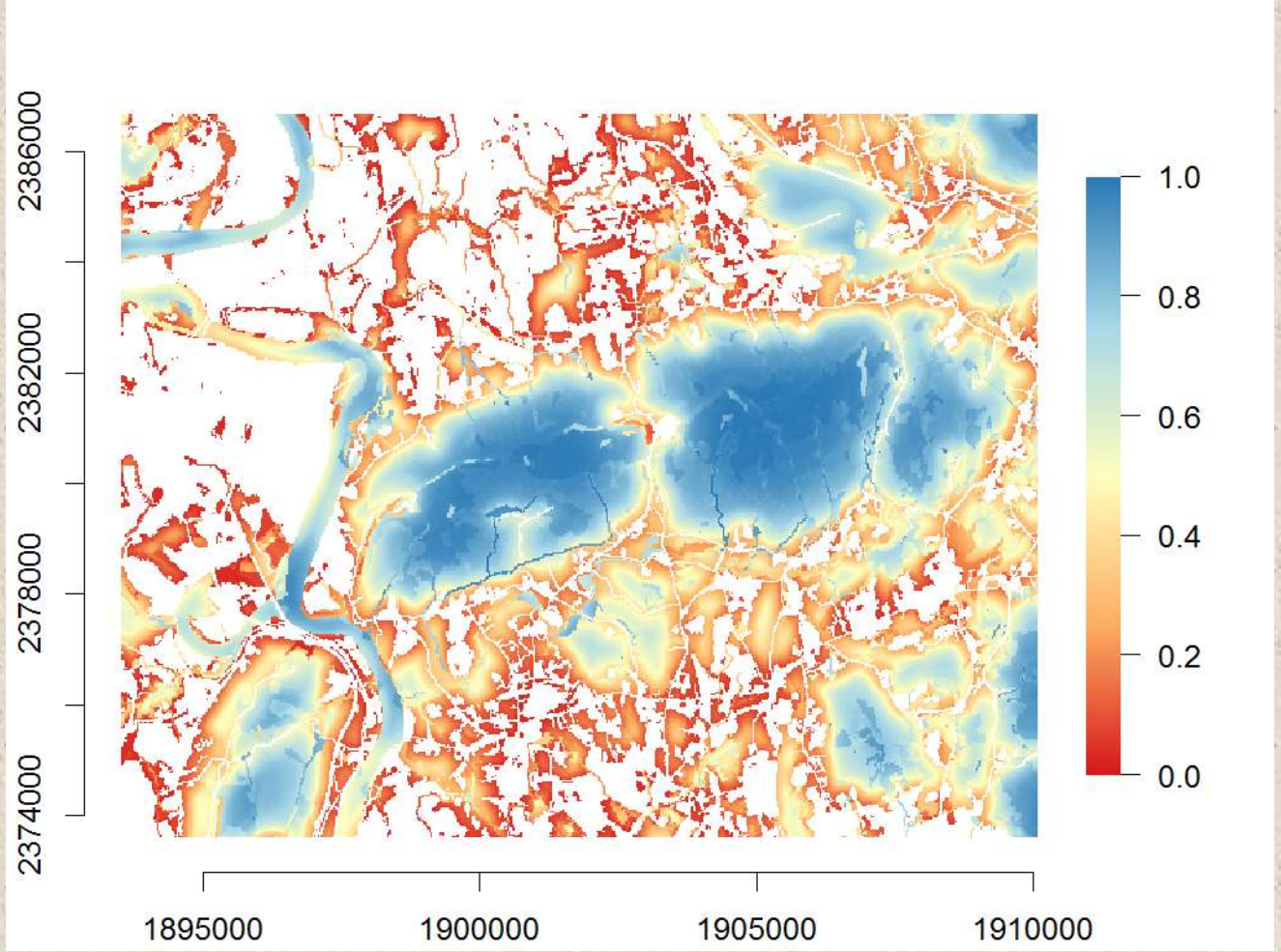
Step 2: Design Conservation Network

Weight ecological settings:



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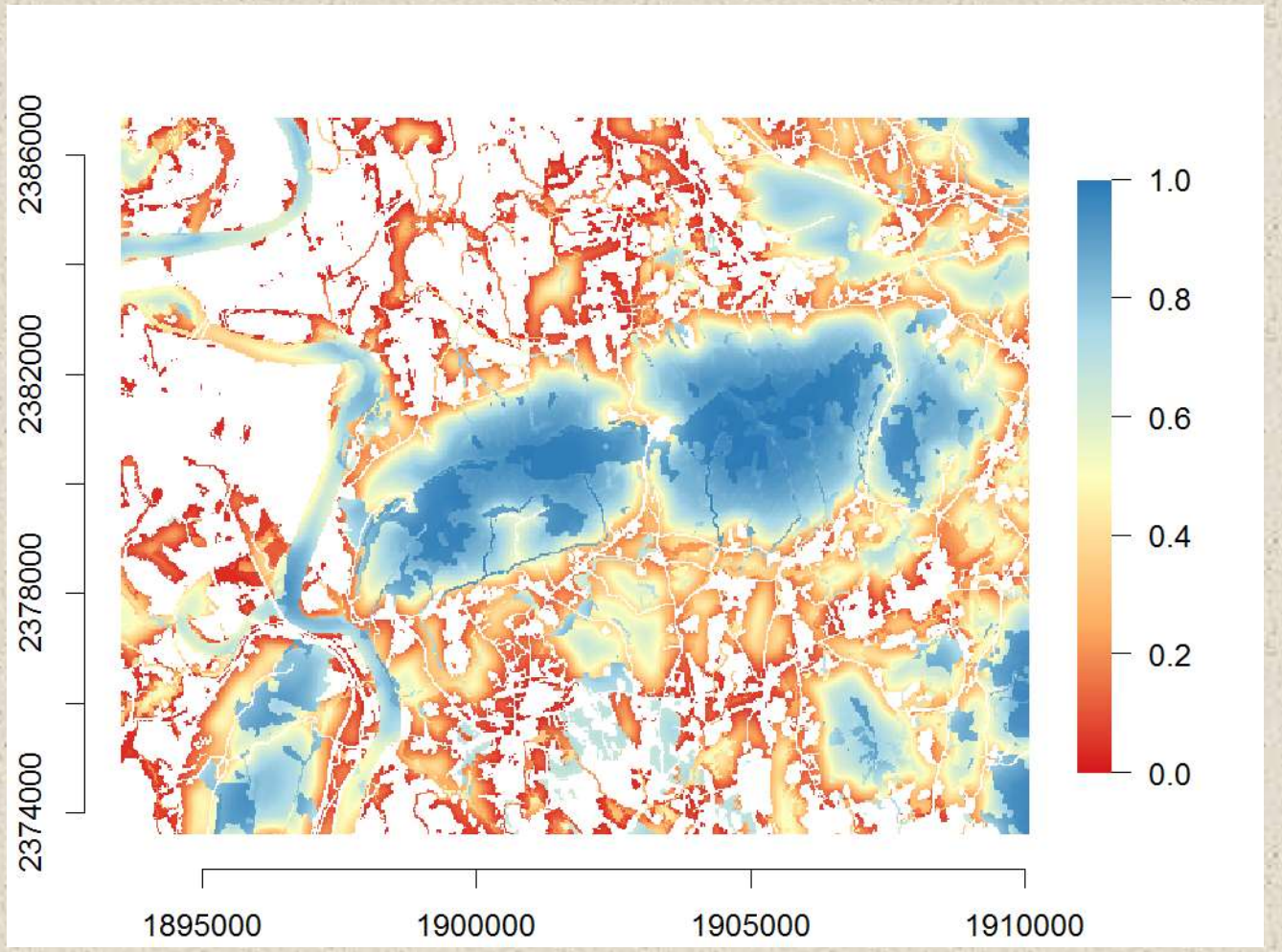
Step 2: Design Conservation Network

Weight ecological settings:

Northern Hardwood & Conifer x 2

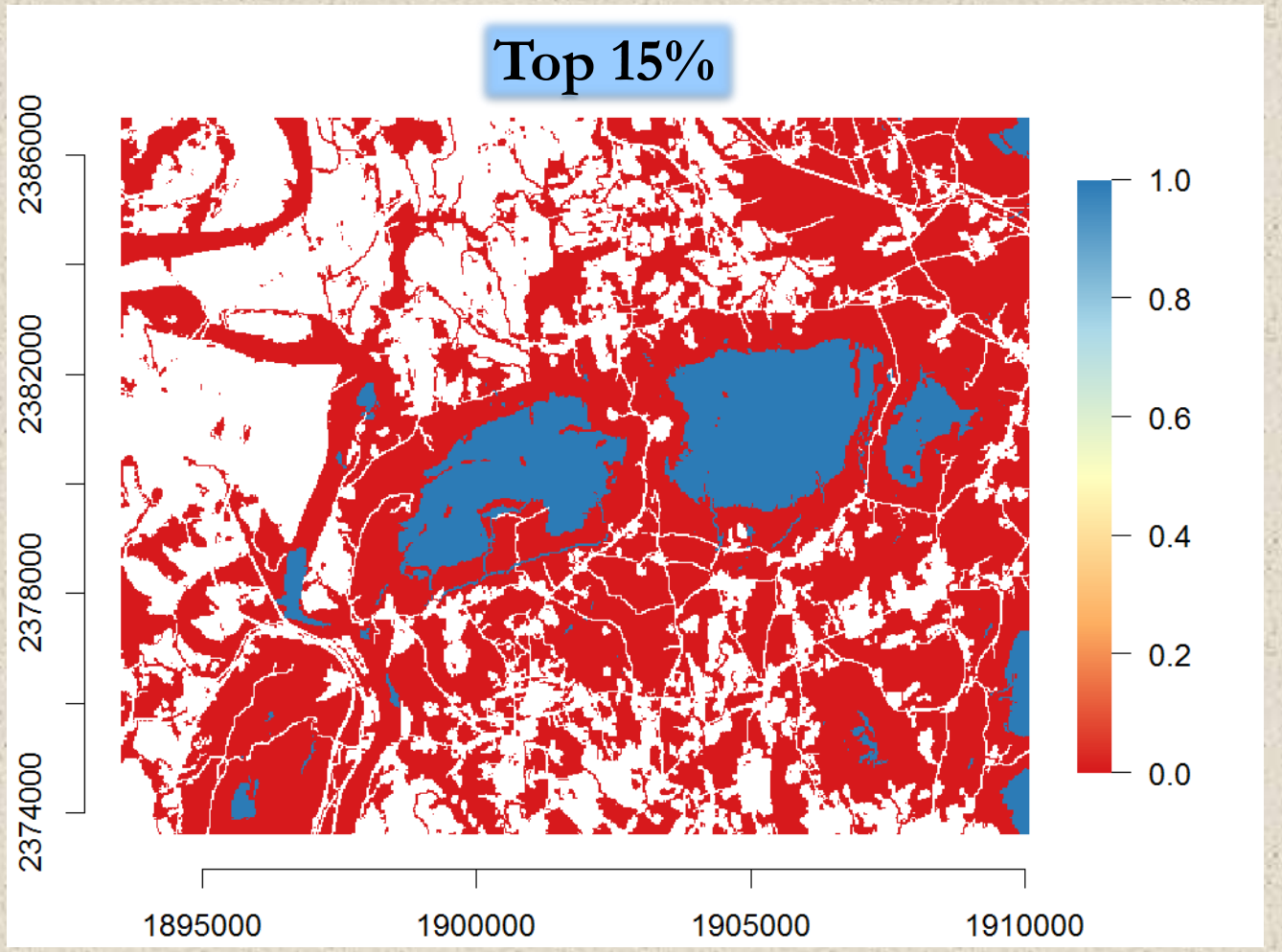
Cliff & Talus x 5



Landscape Conservation Design

Step 2: Design Conservation Network

Weight ecological settings:



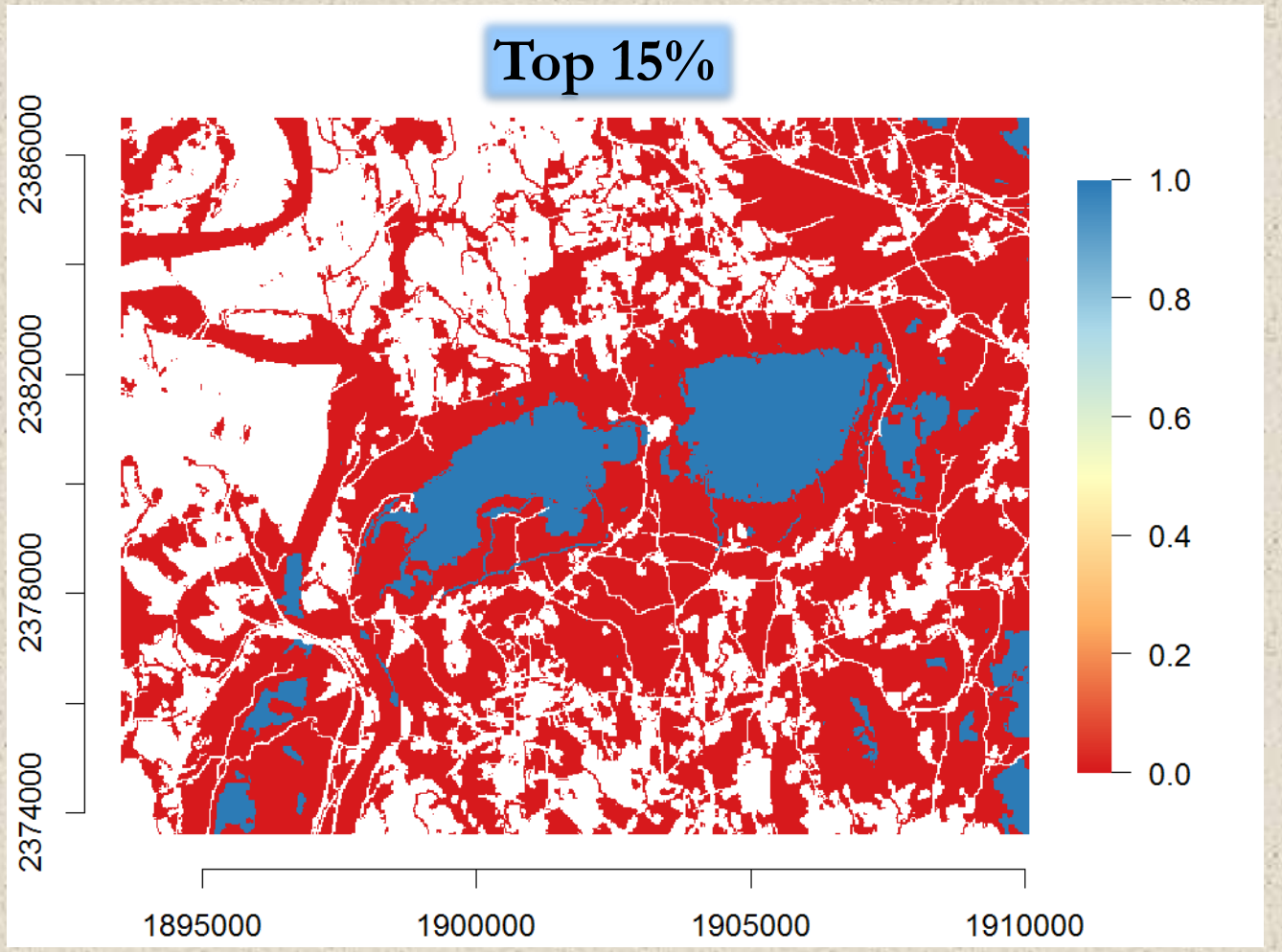
Landscape Conservation Design

Step 2: Design Conservation Network

Weight ecological settings:

Northern Hardwood & Conifer x 2

Cliff & Talus x 5



For More Information

- **Project website:**

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

Feedback:

- Manager online survey

Links to products:

- Overview
- Technical docs
- Presentations
- Results

- **Personal contact:** mcgarigalk@eco.umass.edu 413-577-0655