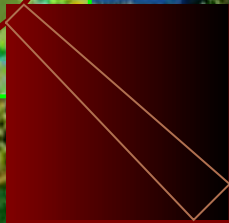
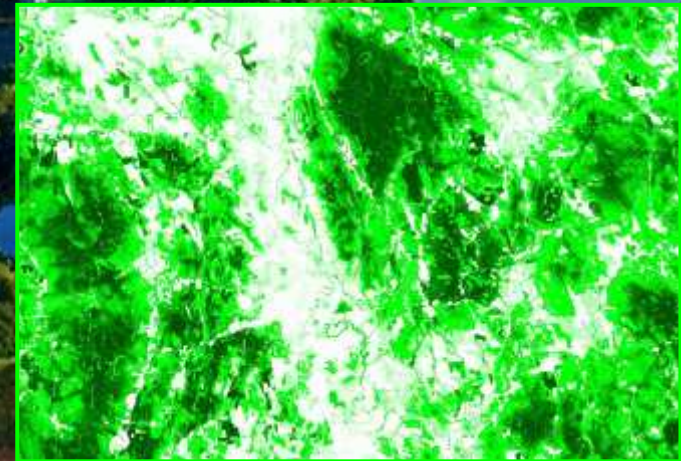
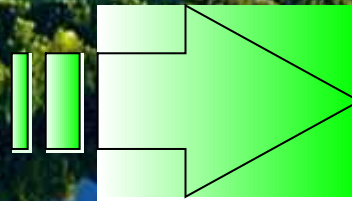
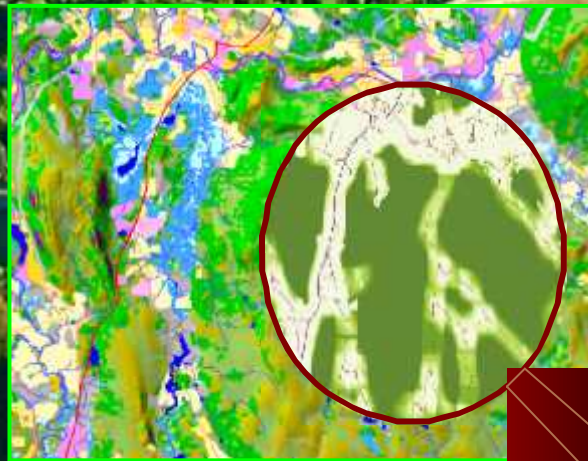


Designing Sustainable Landscapes in the Northeast

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

Landscape Conservation Design
April, 2013



Purpose & Need

The **purpose** of the Designing Sustainable Landscapes (DSL) project is to:

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

Landscape

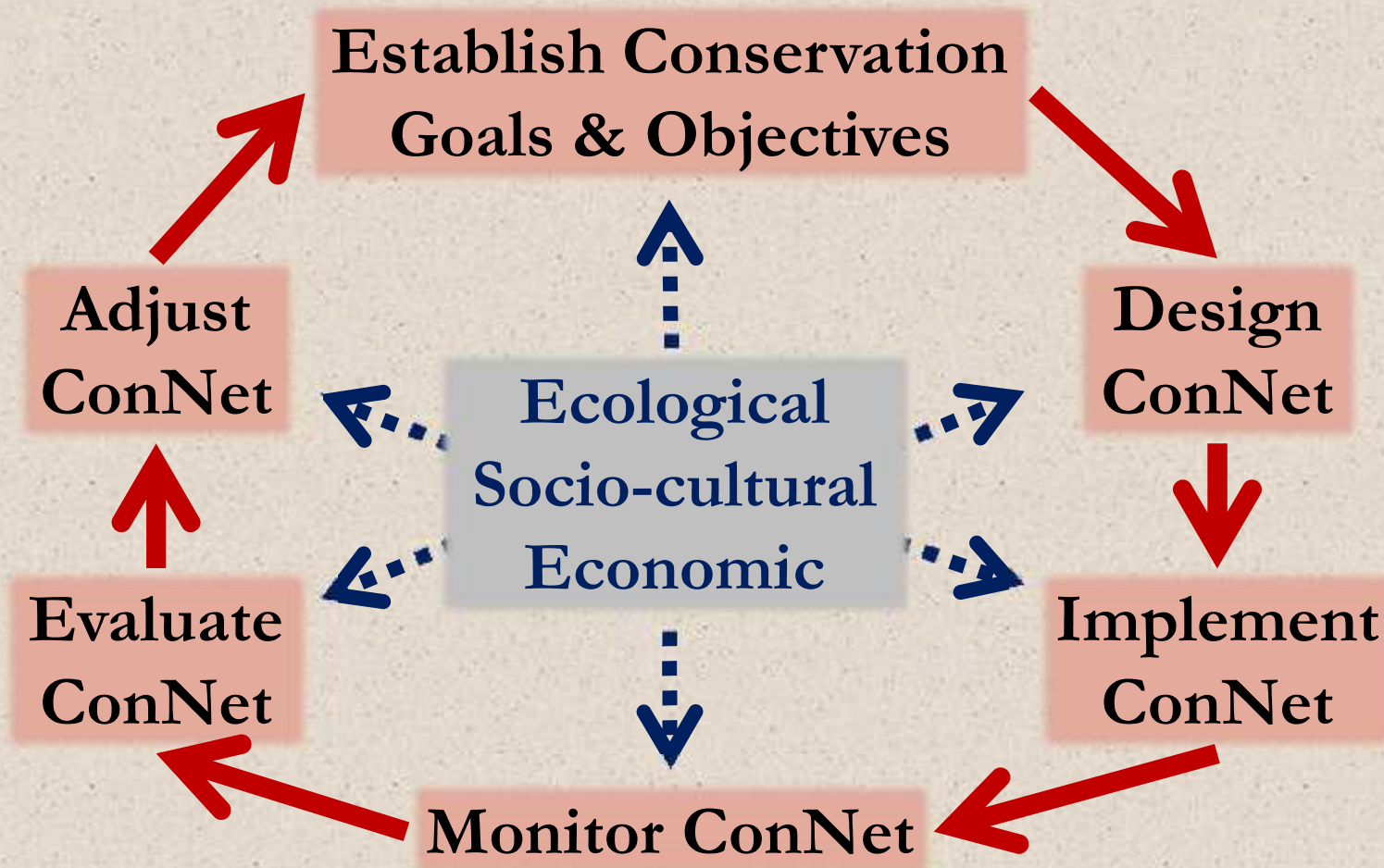
- **Change**
- **Assessment**
- **Design**

LCAD Model

Landscape Conservation Design

Conceptual Framework

Adaptive Landscape Conservation Design



Landscape Conservation Design

Generalized Approach

- **Establish Conservation Goals & Objectives**

Goals... broad statements about desired future conditions -- associated with the integrity of ecological systems and the performance of focal species' populations over the long term.

Objectives... SMART objectives pertaining to specific ecological functions and population performance measures.

Landscape Conservation Design

Generalized Approach

▪ Design Conservation Network

Network Criteria:

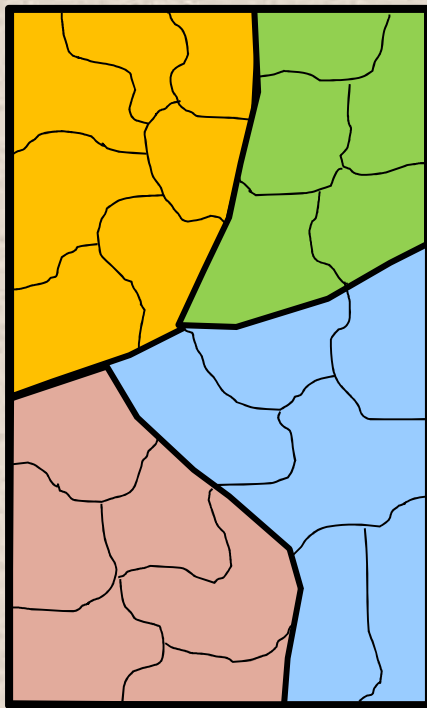
- *Diversity* – full suite of ecological systems and species
- *Redundancy* – within and among core areas
- *Ecological integrity* – high intactness, resiliency and adaptive capacity of ecological systems
- *Habitat-climate capability* – high likelihood of species occurrence
- *Connectivity* – facilitate ecological flows across scales
- *Configuration* – balance between aggregated and well-distributed core areas

Landscape Conservation Design

Generalized Approach

- **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

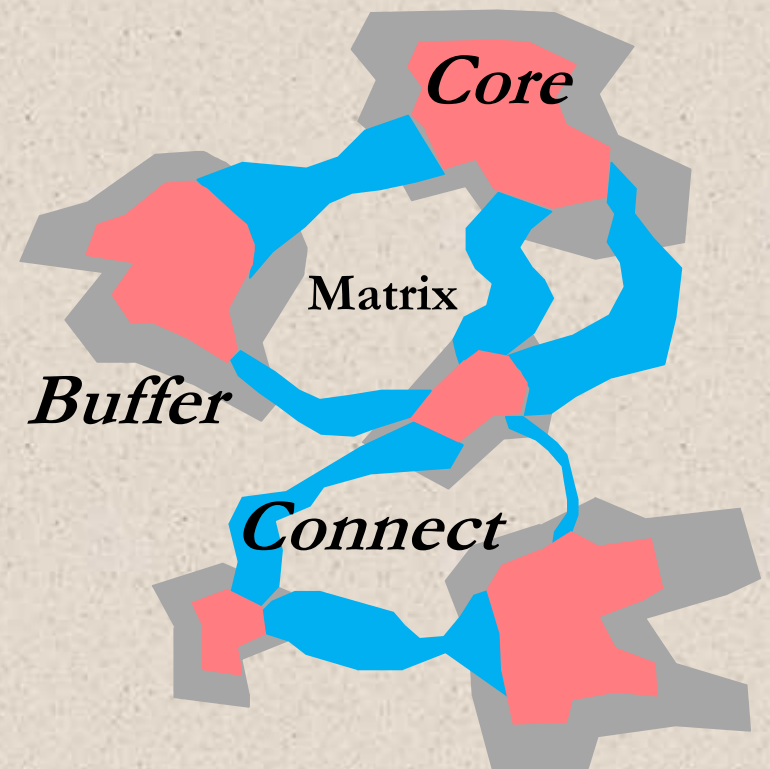
Generalized Approach

▪ Design Conservation Network

Spatial strategy:

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

How much, of what, where & Why



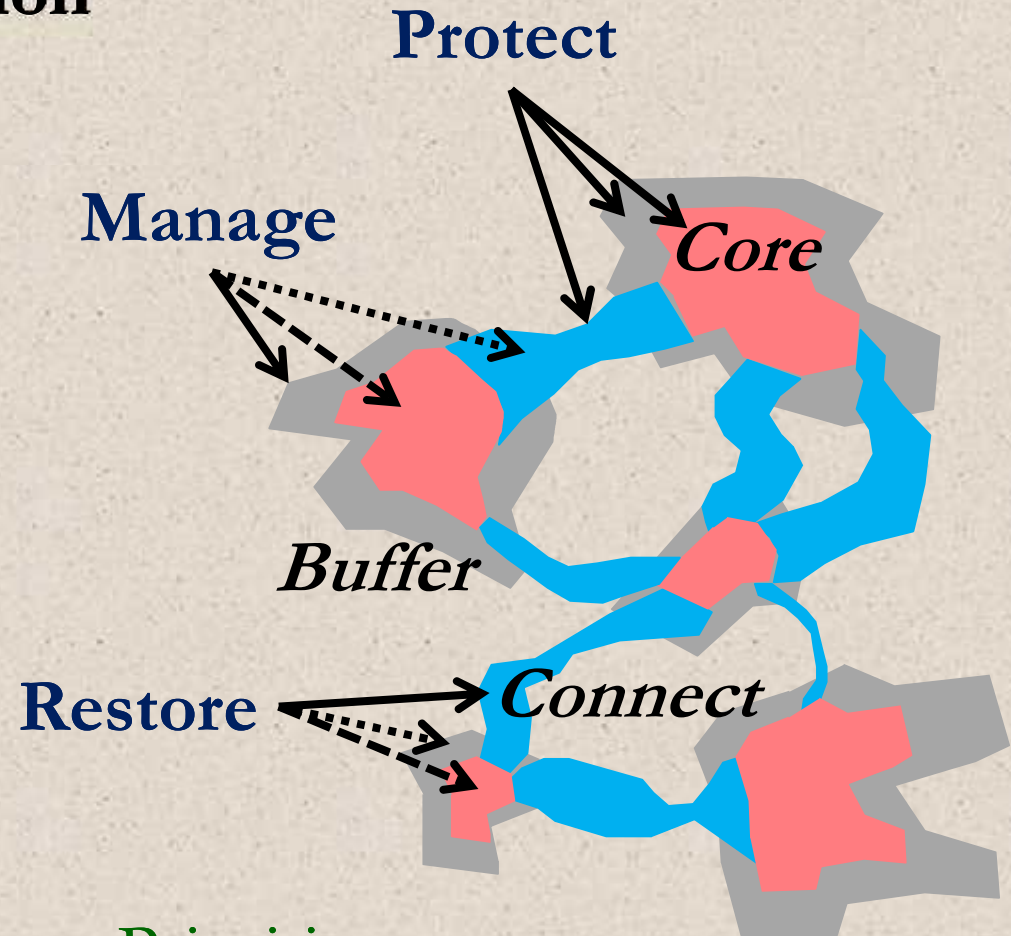
Landscape Conservation Design

Generalized Approach

▪ Implement Conservation Network

Tactics:

- **Protect...**
buy it
- **Manage...**
manipulate it
- **Restore...**
recreate it
- **Others...**



Priorities:

high → med ---> low>

Landscape Conservation Design

Generalized Approach

▪ Monitor Conservation Network

Types of monitoring:

- **Implementation...** were the conservation *targets* met (e.g., CBC acreage protected, managed, restored)?
- **Effectiveness...** were the conservation *objectives* met (e.g., measures of ecological function and species' population performance)?
- **Validation...** test assumptions about cause-effect relationships between the conservation targets and the conservation goals and objectives

Landscape Conservation Design

Generalized Approach

- **Evaluate Conservation Network**

- **Evaluation...** scientific analysis and summary of the data collected from monitoring; intended to quantitatively and qualitatively determine whether the conservation objectives (and thus the conservation goals) have been met and, if not, determine why not.

Landscape Conservation Design

Generalized Approach

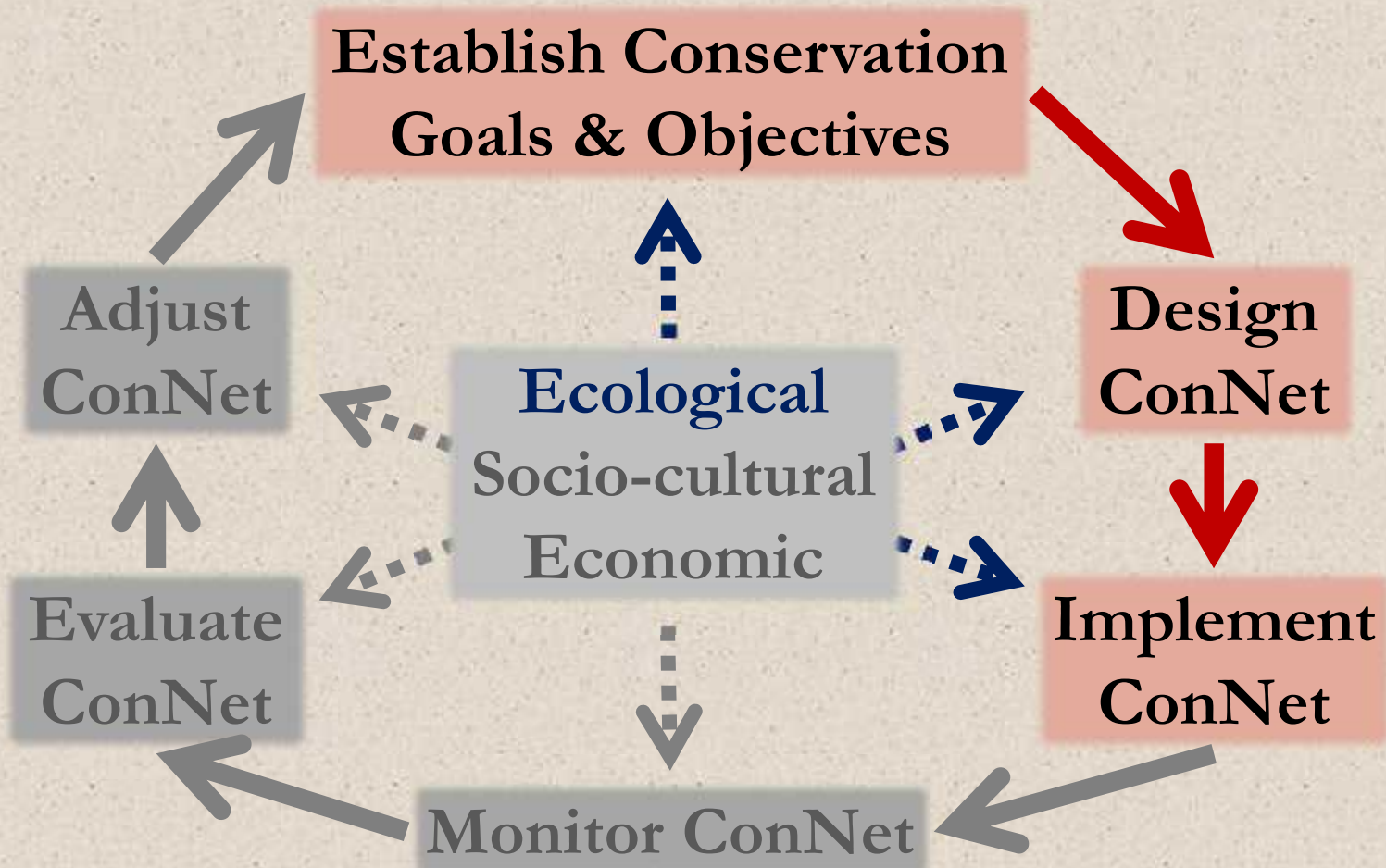
▪ Adjust Landscape Conservation Design

- **Adjustment...** adjust the conservation network based on the results of the monitoring and evaluation as needed to meet the conservation goals.
 - ✓ Modify conservation targets (e.g., increase core area, change weighting of ecosystems and species)
 - ✓ Modify tactics used in each CBC stage (e.g., increase restoration in cores, increase management of buffers)
 - ✓ Modify goals/objectives in light of monitoring results, scientific knowledge and socio-economic changes

Landscape Conservation Design

Detailed Approach

Adaptive Landscape Conservation Design



Landscape Conservation Design

Detailed Approach

- **Establish Conservation Goals & Objectives**

Goal 1: Ecological integrity

Maintain a diverse suite of *integral* ecological systems that, by definition, are capable of sustaining important ecological *functions* over the long term.

Objectives:

SMART objectives pertaining to specific ecological *functions* (tbd)



Landscape Conservation Design

Detailed Approach

- **Establish Conservation Goals & Objectives**

Goal 2: Focal species

Sustain populations of a specified suite of focal species within the current and future capability of the landscape and the limitations imposed by climate change.

Objectives:

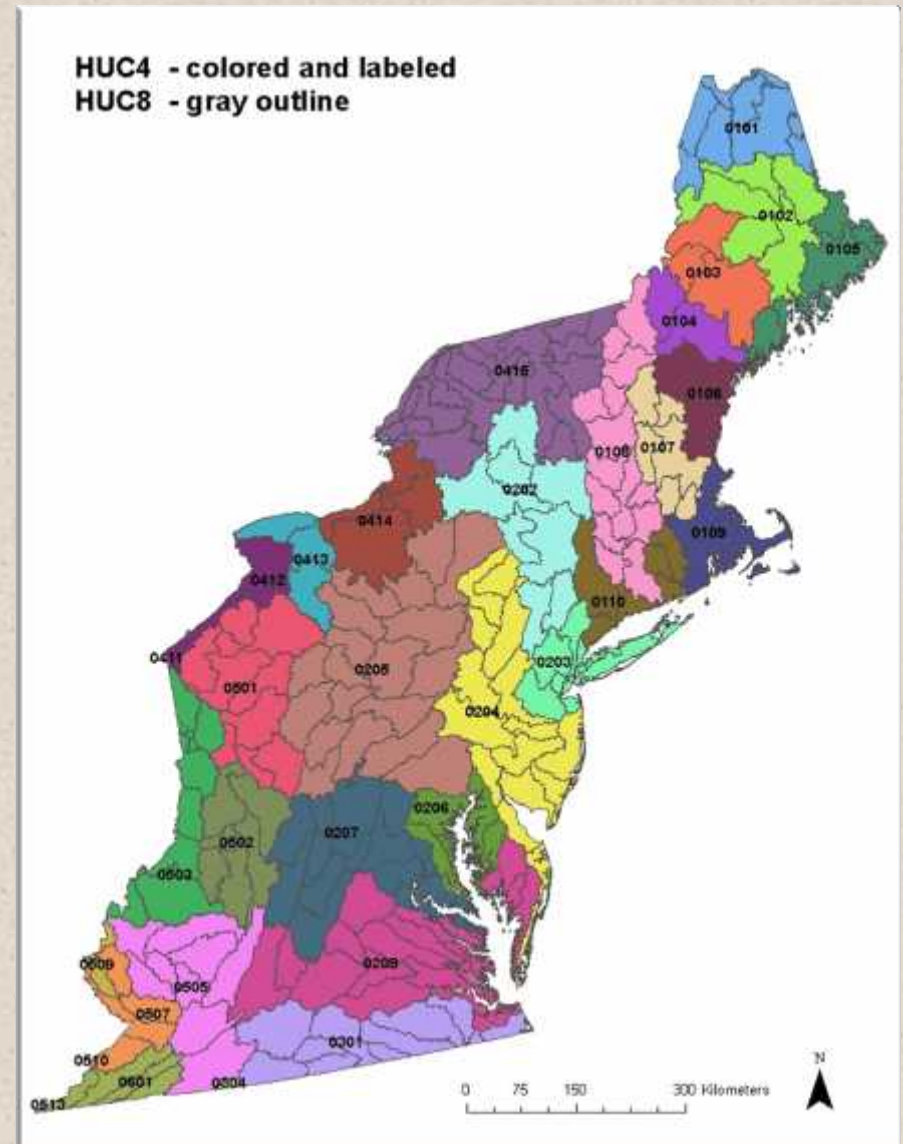
SMART objectives pertaining to focal species populations (tbd)



Landscape Conservation Design

Detailed Approach

- **Design:** Chose multi-scale framework
 - **Region...**
Northeast
 - **Landscapes...**
TNC ecoregions
(adopted from Bailey and Corner)
 - **Sub-landscapes...**
watersheds (HUC 8 level)



Landscape Conservation Design

Detailed Approach

■ Design: Establish Conservation Targets (for core areas)

1. **Weight ecological systems**
2. Establish targets for ecological systems
3. Weight focal species
4. Establish targets for focal species

How much of what?

Indices:

- Regional ubiquity
- Landscape ubiquity
- Landscape importance
- Index of ecological
- Other (expert opinion)



Landscape Conservation Design

Detailed Approach

■ Design: Establish Conservation Targets (for core areas)

1. Weight ecological systems
2. Establish targets for ecological systems
3. Weight focal species
4. Establish targets for focal species

How much of what?

- Proportion of the undeveloped landscape
- Adjust by weight for each ecological system

Landscape Conservation Design

Detailed Approach

■ Design: Establish Conservation Targets (for core areas)

1. Weight ecological systems
2. Establish targets for ecological systems
3. **Weight focal species** ←
4. Establish targets for focal species

How much of what?

Indices:

- Regional ubiquity
- Landscape ubiquity
- Landscape importance
- Climate vulnerability
- Landscape capability
- Zones of uncertainty
- Protected status
- Other (expert opinion)

Landscape Conservation Design

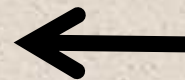
Detailed Approach

■ Design: Establish Conservation Targets (for core areas)

1. Weight ecological systems
2. Establish targets for ecological systems
3. Weight focal species
4. Establish targets for focal species

How much of what?

- Proportion of the undeveloped landscape
- Adjust by weight for each focal species



Landscape Conservation Design

Detailed Approach

▪ Design: Identify *core areas*

1. Create selection index based on coarse filter
2. Select core areas to meet coarse filter targets
3. Create selection index based on focal species
4. Select additional core areas to meet focal species targets

Where and why?

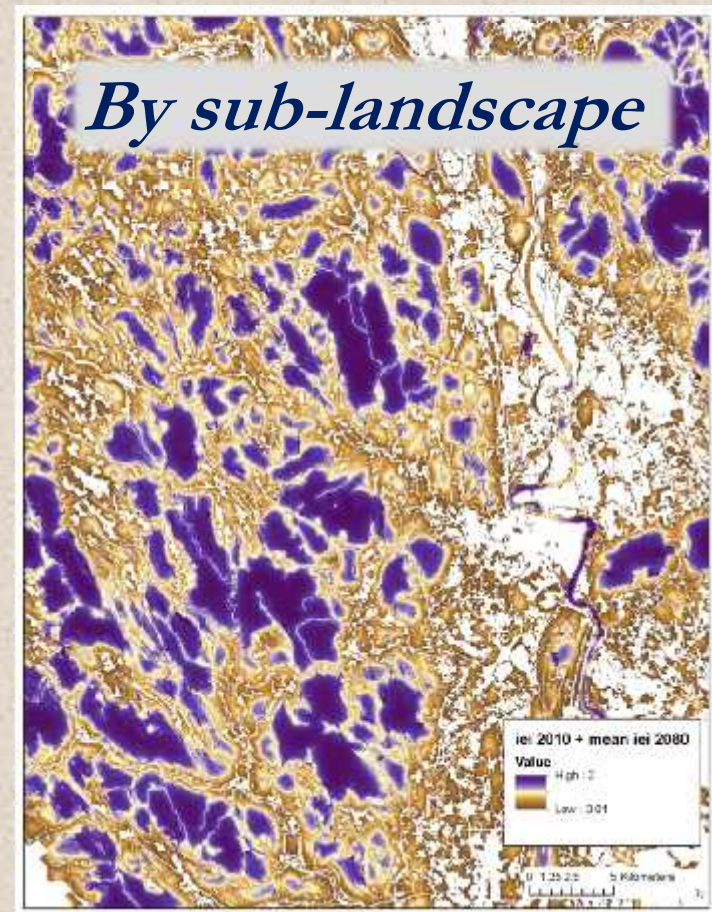
- Current IEI grid
 - Future IEI grid
 - Adaptive capacity grid
 - External products?
-
- Weighted mean
 - Quantile scale

Landscape Conservation Design

Detailed Approach

- **Design: Identify *core areas***
 1. Create selection index based on coarse filter
 2. **Select core areas to meet coarse filter targets**
 3. Create selection index based on focal species
 4. Select additional core areas to meet focal species targets

Where and why?



Landscape Conservation Design

Detailed Approach

▪ Design: Identify *core areas*

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Where and why?

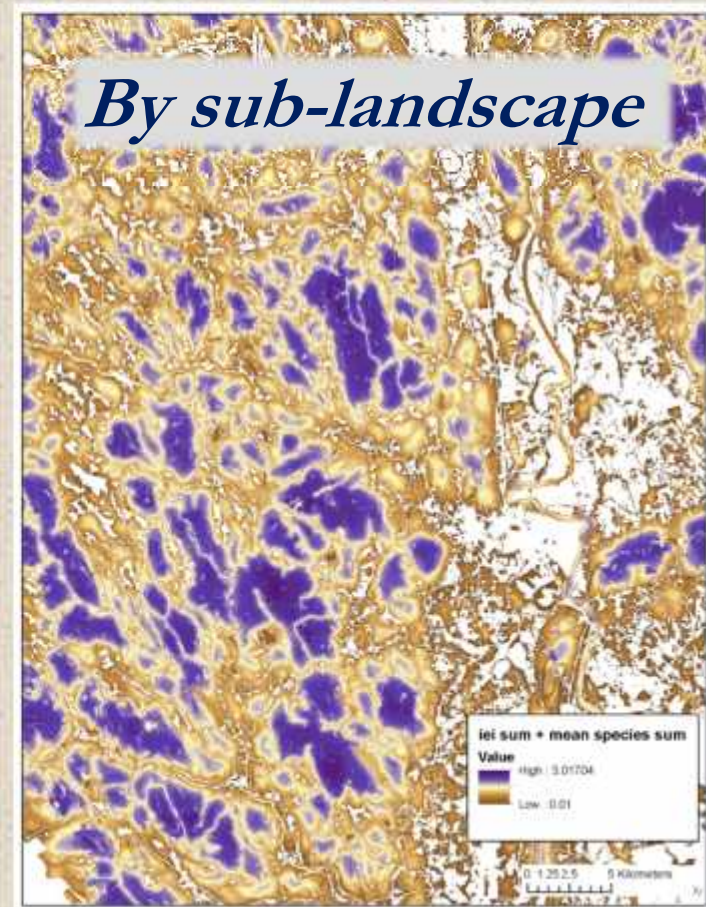
- Current COA grid
 - Zone of persistence grid
 - Zone of expansion grid
 - External products?
-
- Weighted mean
 - Quantile scale

Landscape Conservation Design

Detailed Approach

- **Design: Identify *core areas***
 1. Create selection index based on coarse filter
 2. Select core areas to meet coarse filter targets
 3. Create selection index based on focal species
 4. **Select additional core areas to meet focal species targets ***

Where and why?

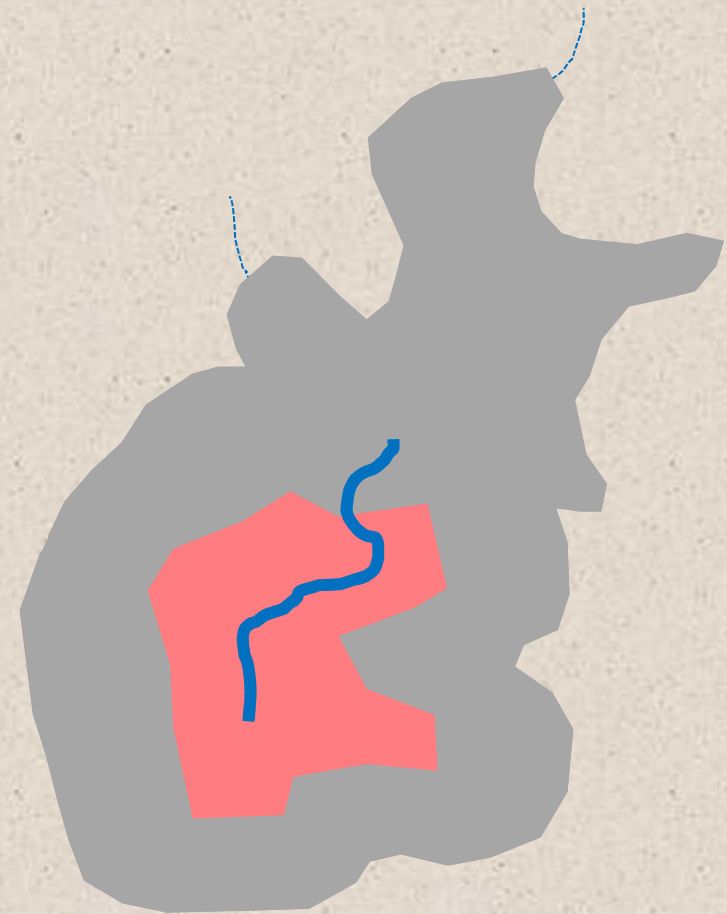


Landscape Conservation Design

Detailed Approach

■ Design: Create *Buffers*

1. Buffer terrestrial and wetland ecosystems within core areas
2. Buffer aquatic ecosystems within core areas
3. Combine buffers



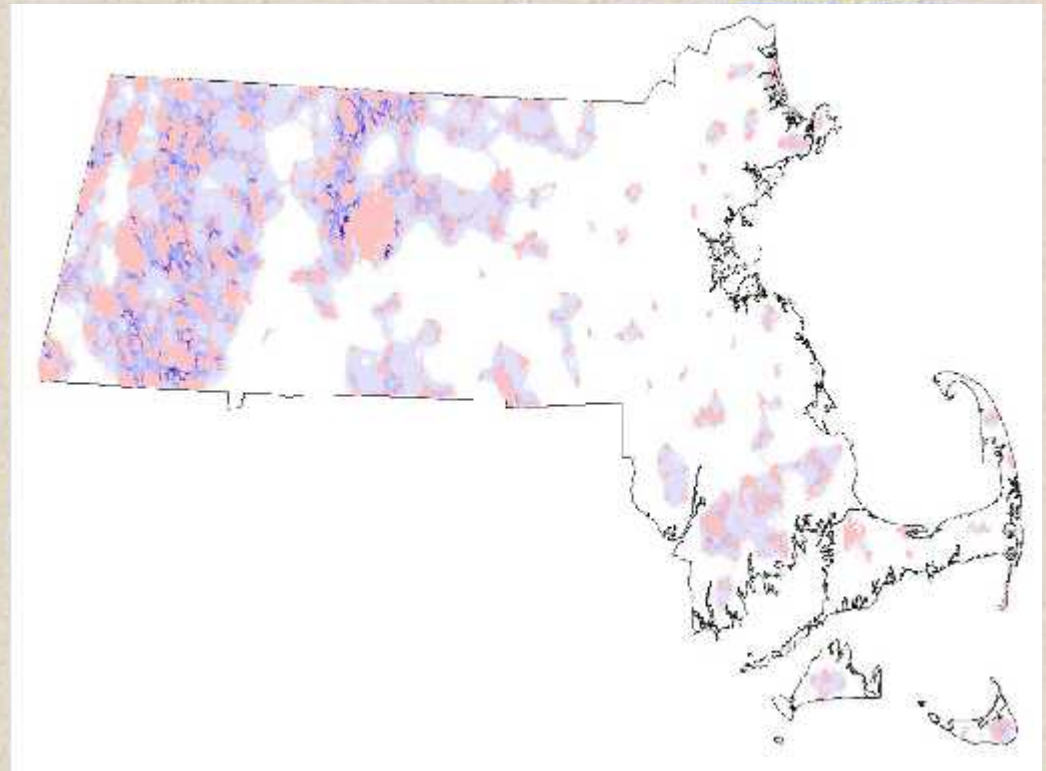
Core  Buffer 

Landscape Conservation Design

Detailed Approach

▪ Design: Delineate *Corridors*

1. Find links between core areas (random low-cost paths)
2. Compute conductance index
3. Delineate corridors



Landscape Conservation Design

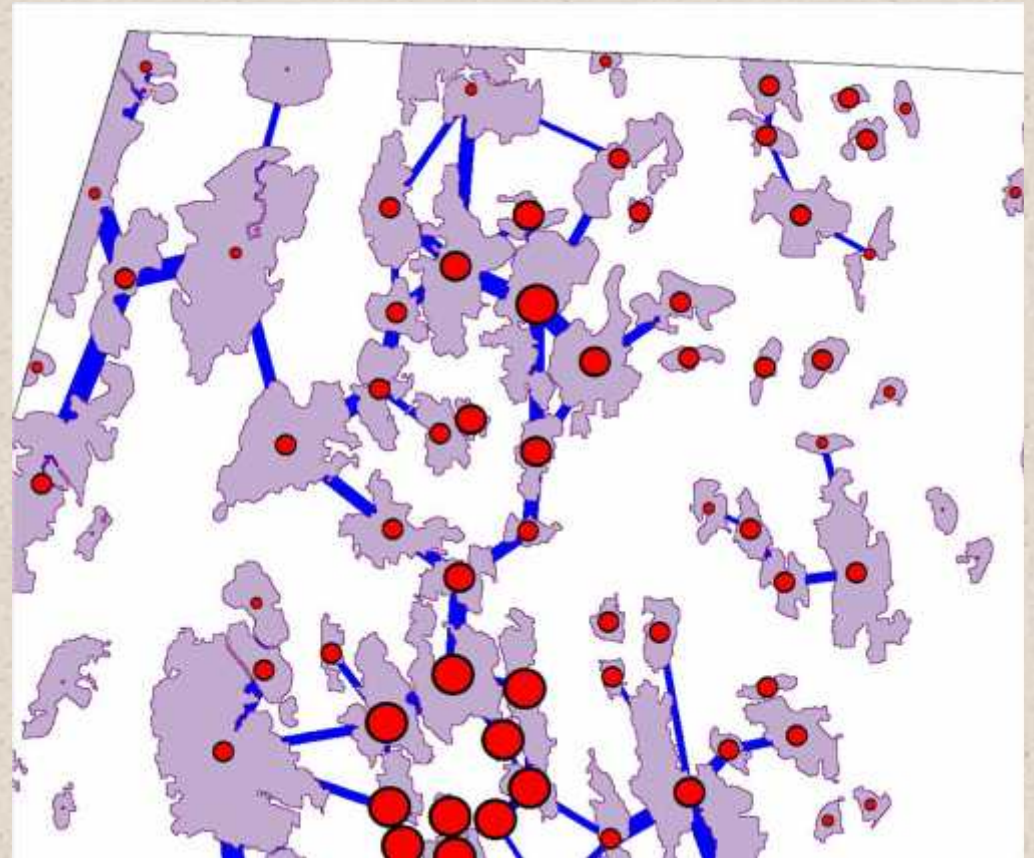
Detailed Approach

- Implement: *Land Protection*

- Core Areas

1. Prioritize core areas
2. Prioritize lands within core areas

Node importance index



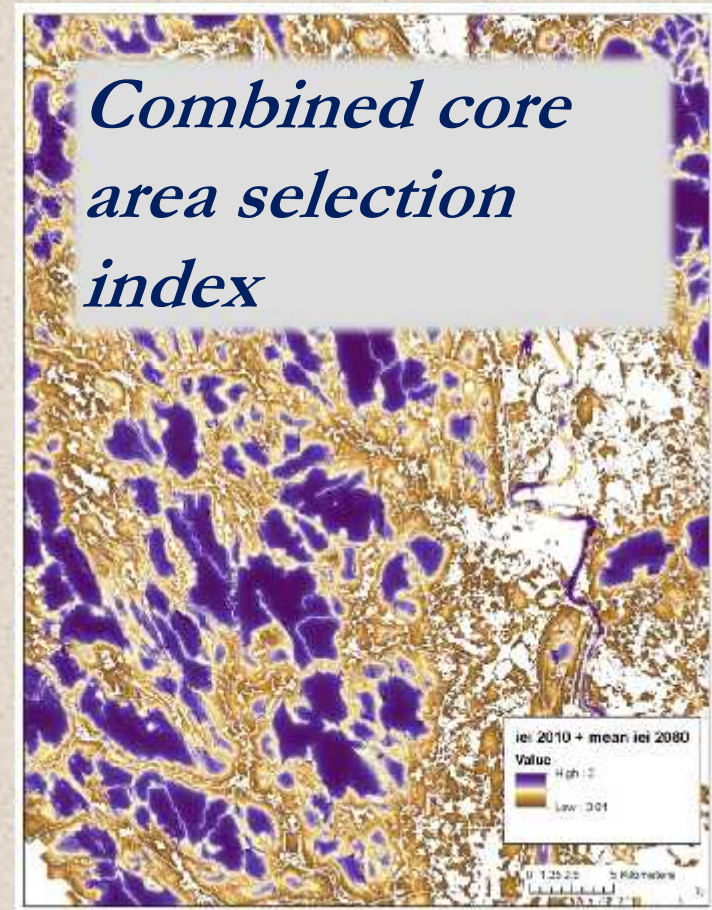
Landscape Conservation Design

Detailed Approach

▪ Implement: *Land Protection*

• Core Areas

1. Prioritize core areas
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Landscape Conservation Design

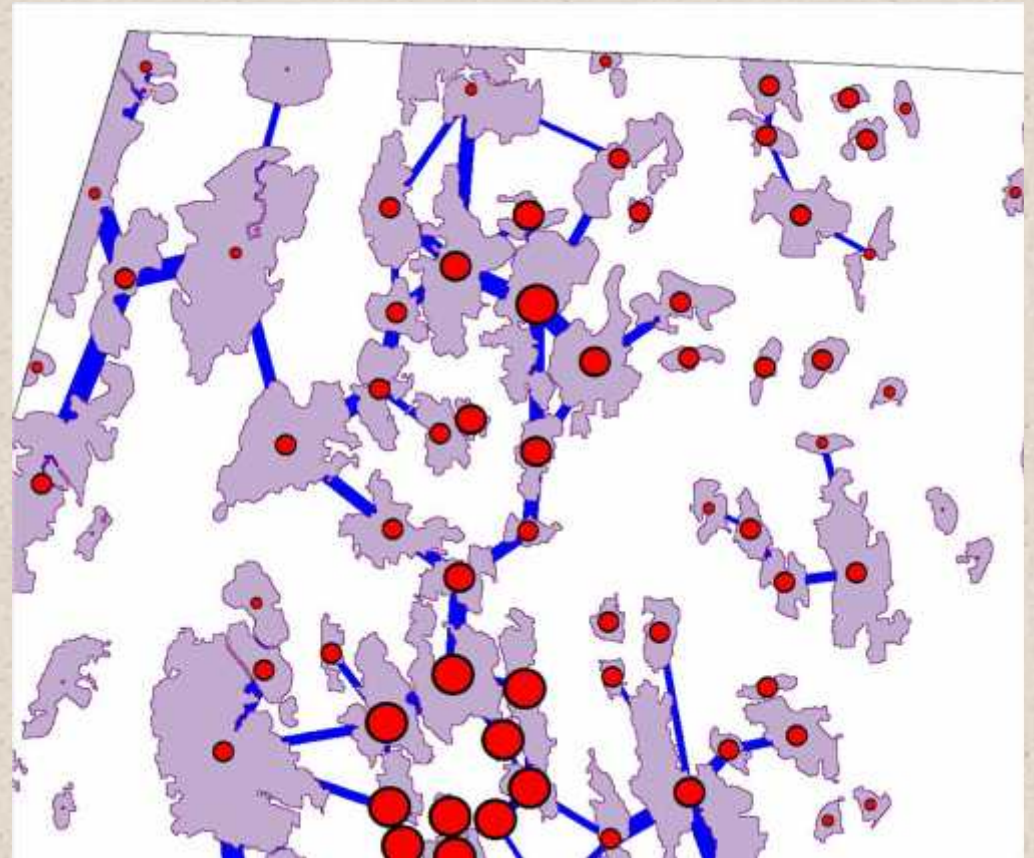
Detailed Approach

- Implement: *Land Protection*

- Corridors

1. Prioritize corridors
2. Prioritize lands within corridors

Link importance index



Landscape Conservation Design

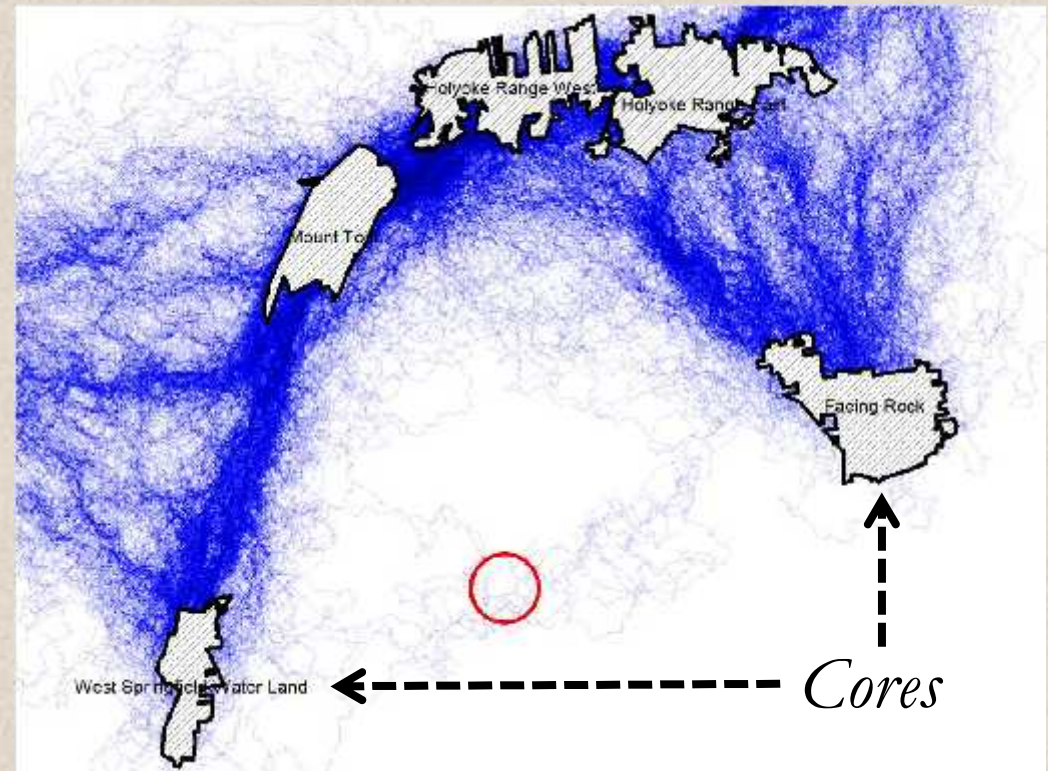
Detailed Approach

- Implement: *Land Protection*

- Corridors

1. Prioritize corridors
2. **Prioritize lands within corridors**

Conductance index



Landscape Conservation Design

Detailed Approach

▪ Implement: *Land Management*

- Climate vulnerability index
 - Landscape capability indices
(Current, none, shift, contract)
 - Zones of uncertainty indices
(persist, contract, expand)
 - Protected status index
-
- Core area persistence index
 - Core area importance index

Prioritizing focal species for management in the landscape or within individual core areas/buffers

The diagram consists of a central text box on the right side of the slide. Two arrows point towards this box: one from the top left and one from the bottom left. The top-left arrow originates from the top of the list of indices and points down into the top of the text box. The bottom-left arrow originates from the bottom of the list of indices and points up into the bottom of the text box. The text box itself is a light red color with a thin black border.

Landscape Conservation Design

Detailed Approach

▪ Implement: *Land Management*

- **Landscape capability indices...** based on sum of species' prob(occur) values across cells within the *region* or *landscape* under different climate change assumptions

			Species Response to Climate Change					
			None		Immediate Range Contraction		Immediate Range Shift	
Species	Statistic	2010 (ha)	2030	2080	2030	2080	2030	2080
blbw	mean	184,281	1.01	1.01	0.87	0.21	0.87	0.21
	min		1.01	1.00	0.83	0.12	0.83	0.12
	max		1.01	1.01	0.90	0.32	0.90	0.32
woth	mean	398,441	1.00	0.99	1.00	0.99	1.00	0.99
	min		1.00	0.98	1.00	0.98	1.00	0.99
	max		1.00	0.99	1.00	0.99	1.00	1.00

Landscape Conservation Design

Detailed Approach

- **Implement: Land *Management***
- **Landscape capability indices...** based on sum of species' prob(occur) values across cells within the *region* or *landscape* under different climate change assumptions

Most vulnerable



Least vulnerable

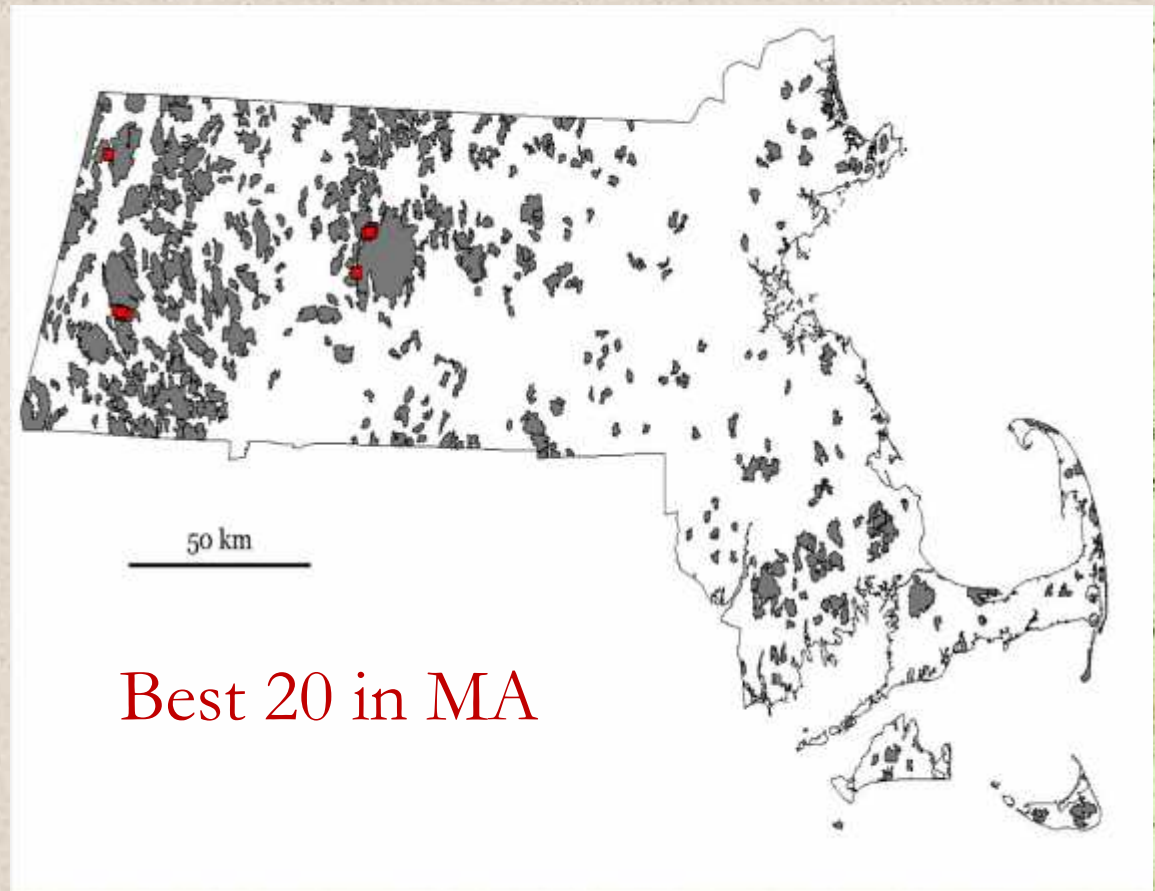
Species	LC (ha)		Range Shift
	2010	2080	
blbw	184,281	0.21	
blpw	943	0.48	
nowa	14,734	0.54	
oven	424,205	0.98	
lowa	16,651	0.99	
woth	398,441	0.99	
rsha	182,978	1.01	
mawr	3,633	1.28	

Landscape Conservation Design

Detailed Approach

▪ Implement: Ecological *Restoration*

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

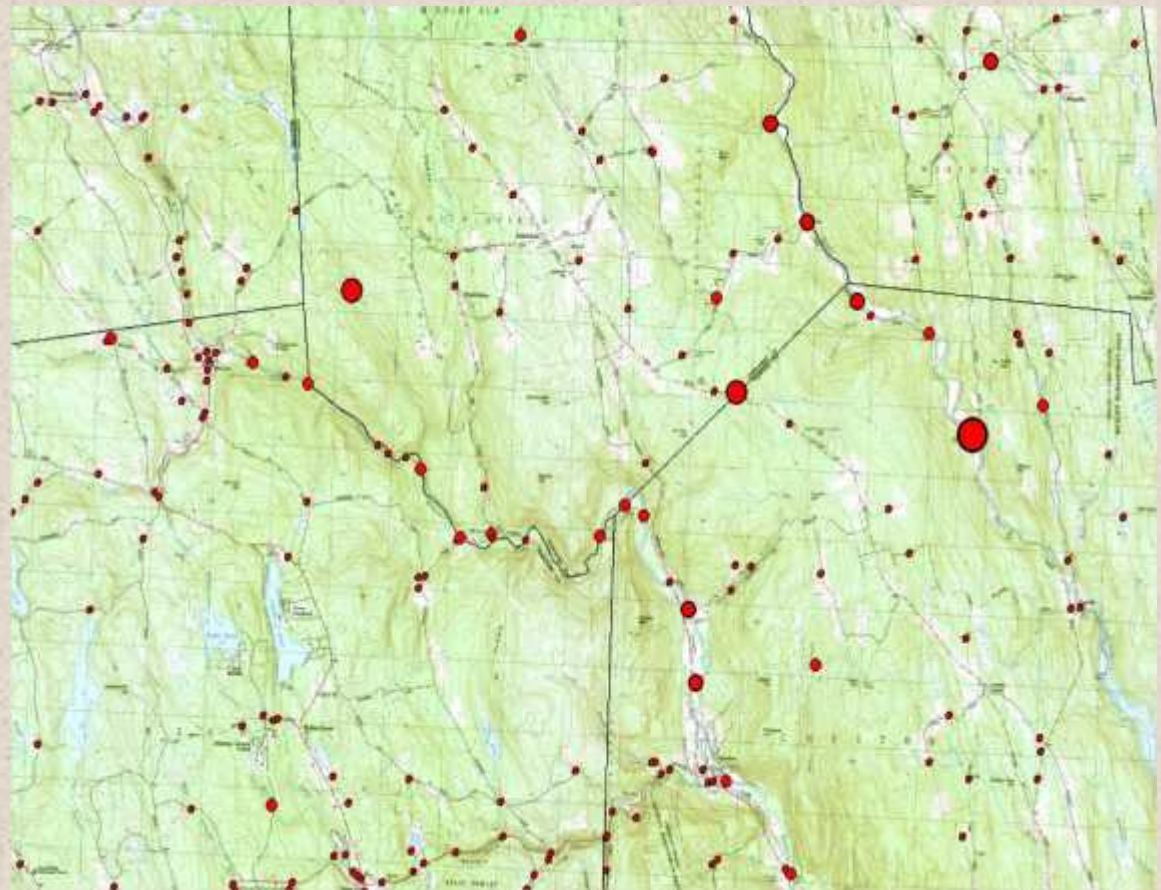


Landscape Conservation Design

Detailed Approach

▪ Implement: Ecological *Restoration*

- Road passage structures
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- Dams
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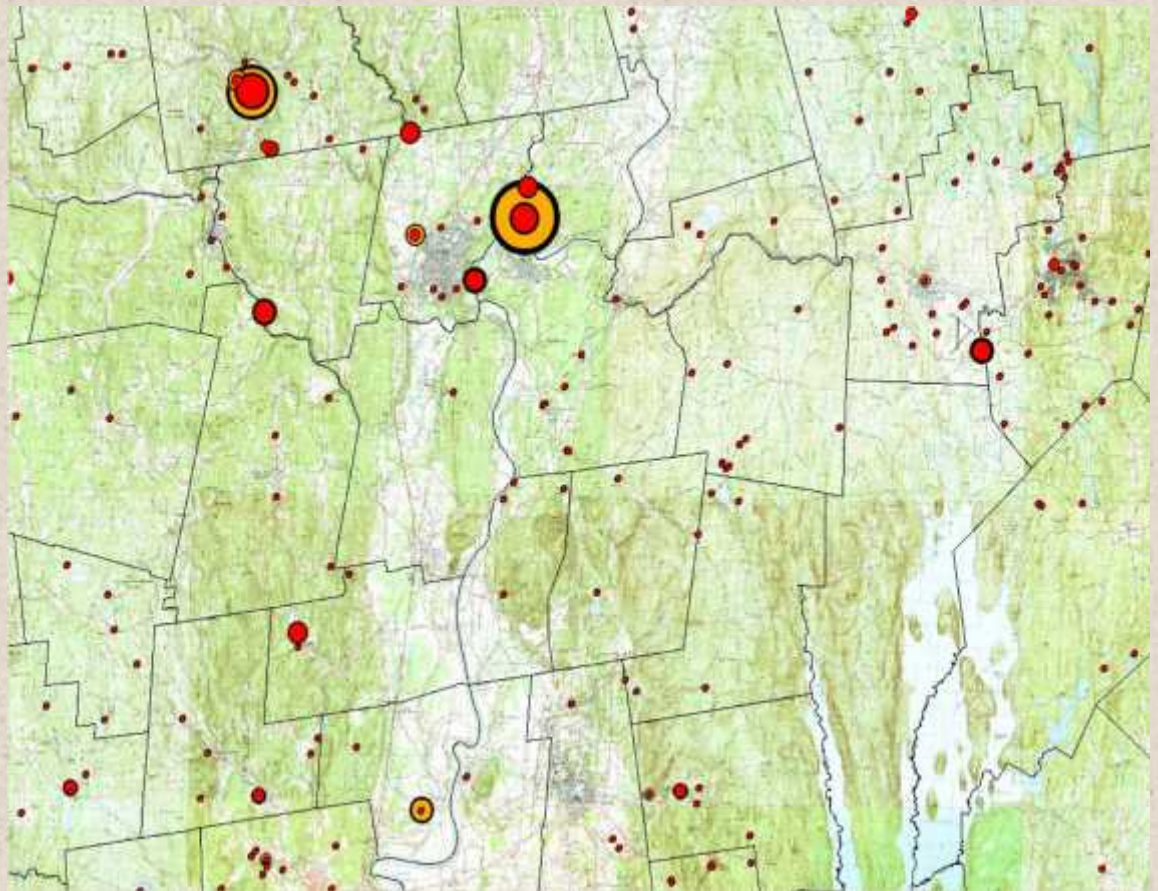


Landscape Conservation Design

Detailed Approach

▪ Implement: *Ecological Restoration*

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



Landscape Conservation Design

Detailed Approach

Adaptive Landscape Conservation Design

