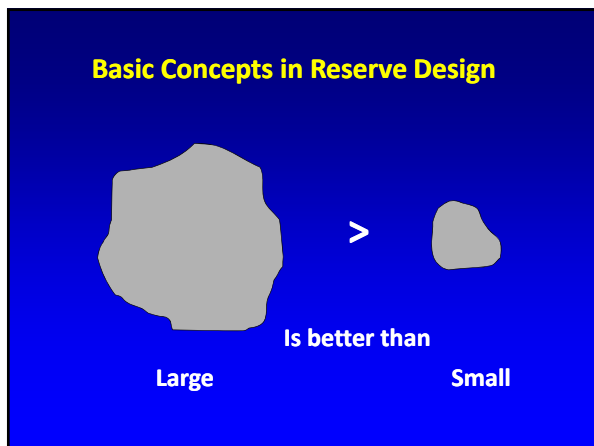
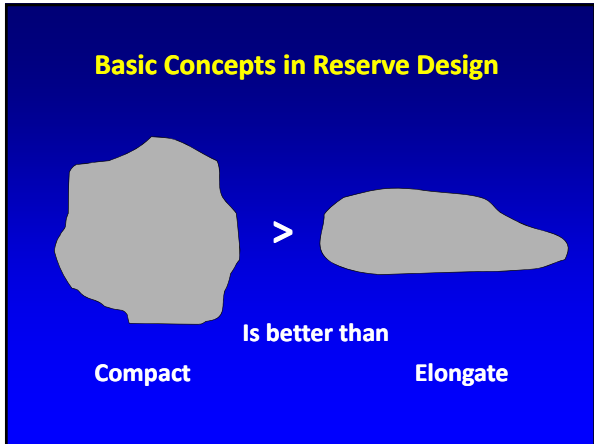
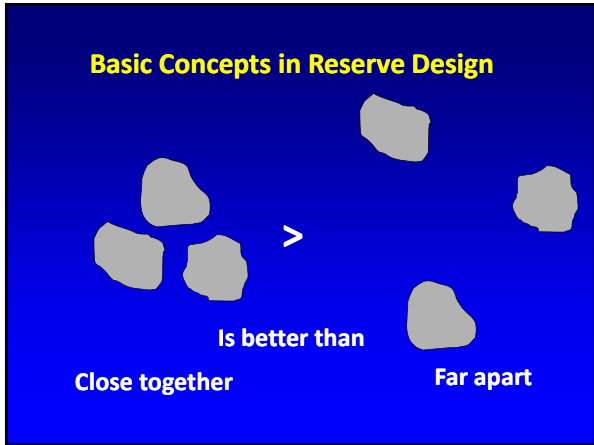
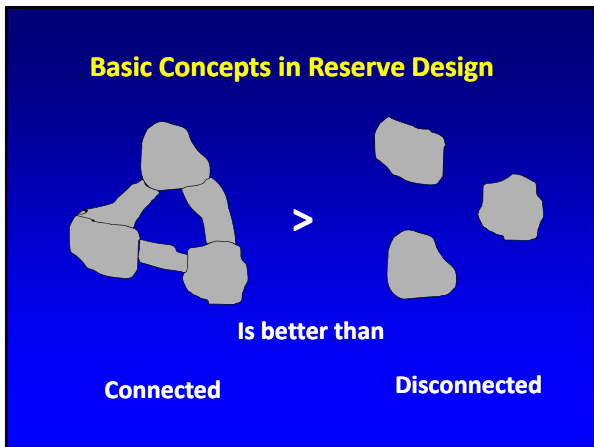


Data	Tools
<ul style="list-style-type: none"> • CAPS • BioMap2 • Critical Linkages • TNC Resilient & Connected Landscapes • DSL <ul style="list-style-type: none"> – Connect the Connecticut – Nature’s Network 	<ul style="list-style-type: none"> • MassAudubon MAPPR • MA Wildlife Climate Action Tool • Stream Crossing Explorer











Conservation Assessment & Prioritization System (CAPS)

Assessing ecological integrity and supporting decision-making for land conservation, habitat management, project review & permitting to protect biodiversity

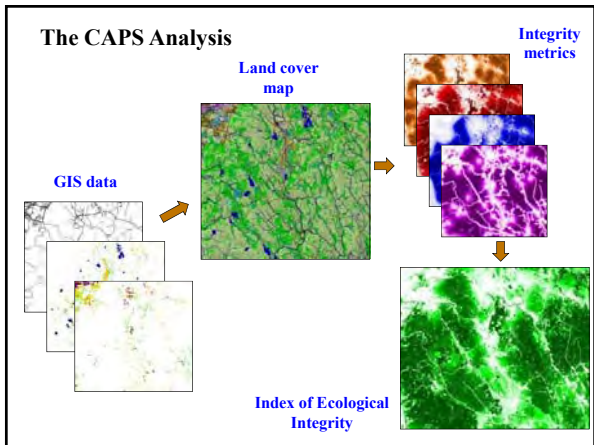
Landscape Ecology Lab

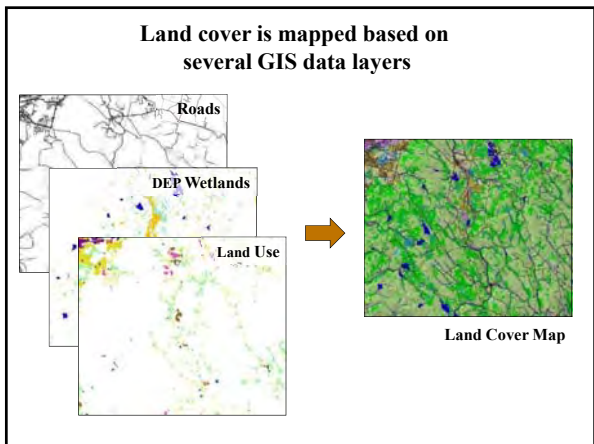
University of Massachusetts Amherst | UMass Extension

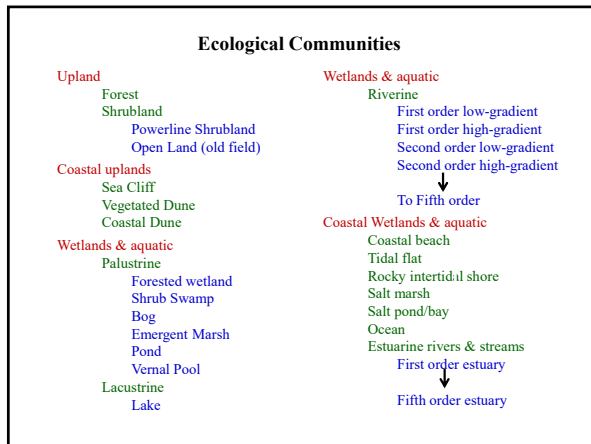
<http://www.umasscaps.org>

Ecological Community Approach







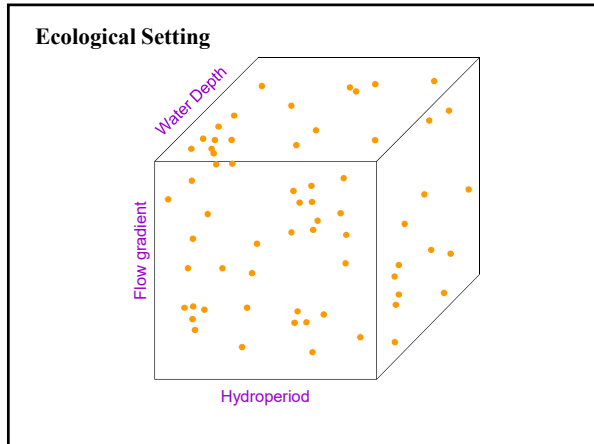


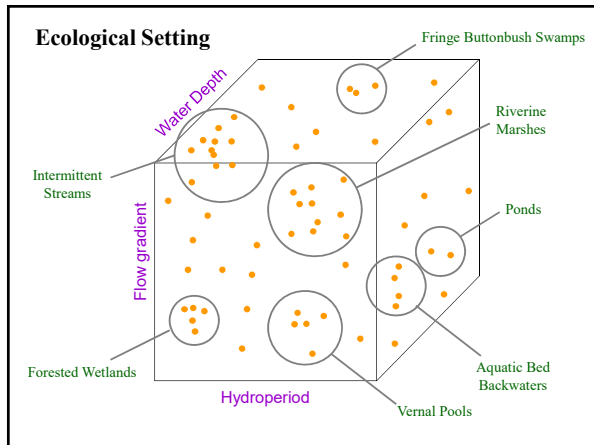


Ecological Setting

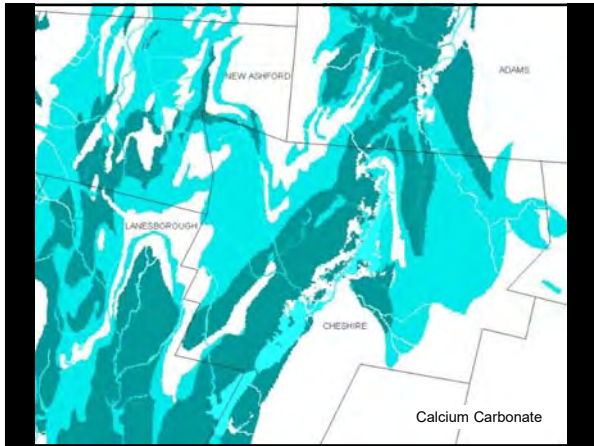
...refers to the principal physical and chemical characteristics at multiple scales that strongly influence the composition, structure and function of a particular point in the landscape over the long term and serve to describe and distinguish it ecologically.

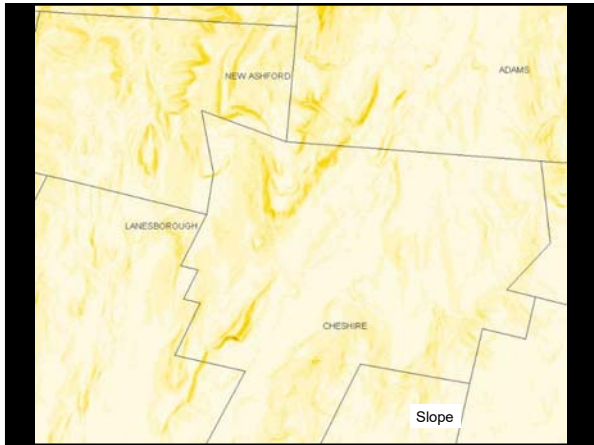
- Includes both local environmental conditions and landscape context
- Relatively static at relevant ecological time frames
- Ecological conditions may vary in response to natural and anthropogenic disturbances

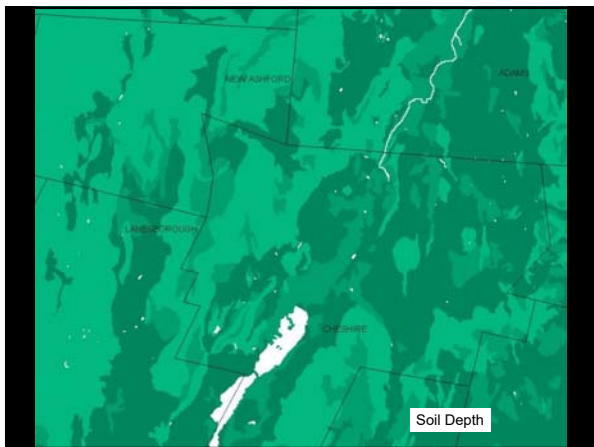


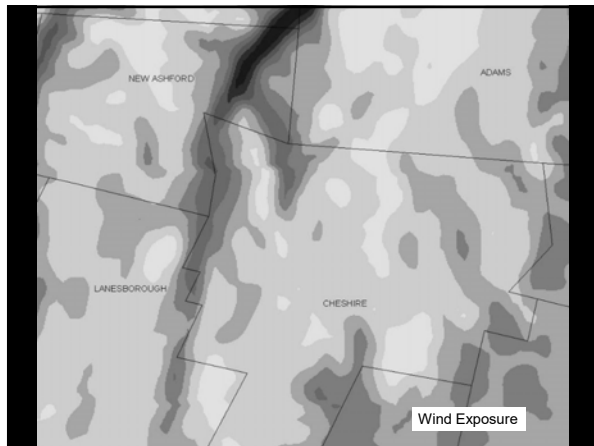


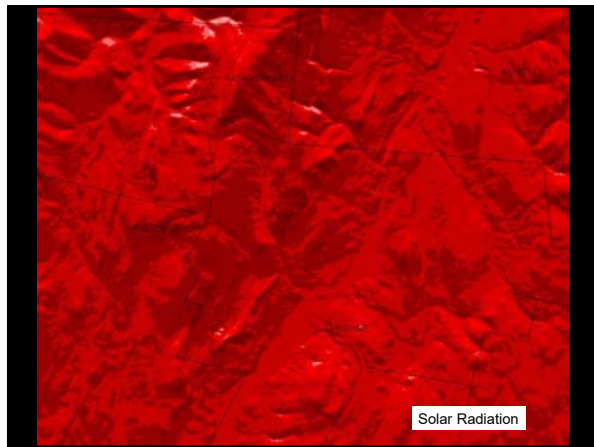
- Ecological Setting Variables**
- | | |
|--|---|
| <p>Temperature</p> <ul style="list-style-type: none"> • Growing season degree-days • Minimum winter temperature <p>Solar energy</p> <ul style="list-style-type: none"> • Incident solar radiation <p>Moisture</p> <ul style="list-style-type: none"> • Wetness/Soil moisture <p>Hydrology</p> <ul style="list-style-type: none"> • Flow gradient • Flow volume • Tidal regime <p>Physical Disturbance</p> <ul style="list-style-type: none"> • Wind exposure • Wave exposure • Steep slopes | <p>Chemical & physical substrate</p> <ul style="list-style-type: none"> • Soil pH • Soil depth • Soil texture • Substrate mobility • Water salinity • Water CaCO₃ content <p>Vegetation</p> <ul style="list-style-type: none"> • Vegetative structure <p>Development</p> <ul style="list-style-type: none"> • Developed • Traffic rate • Impervious • Aquatic barriers • Terrestrial barriers |
|--|---|

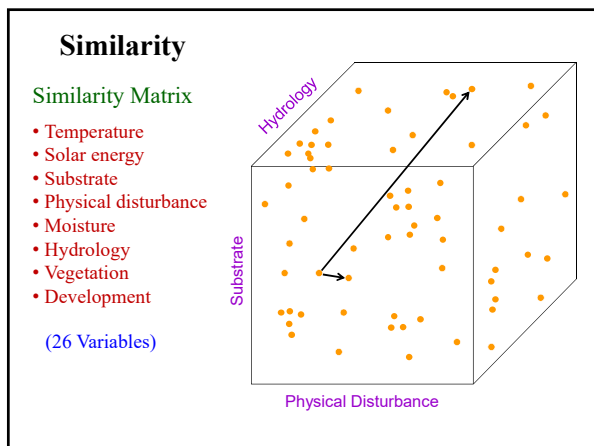


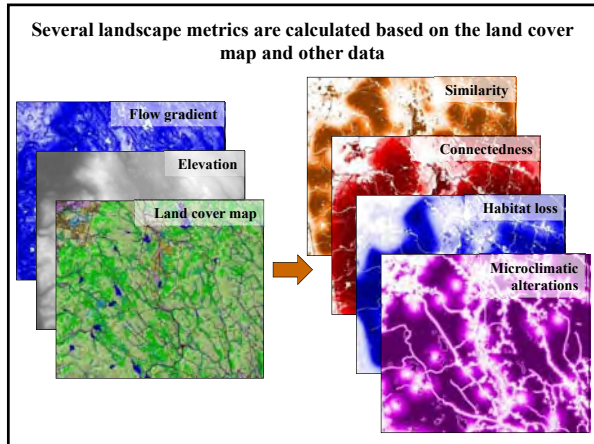


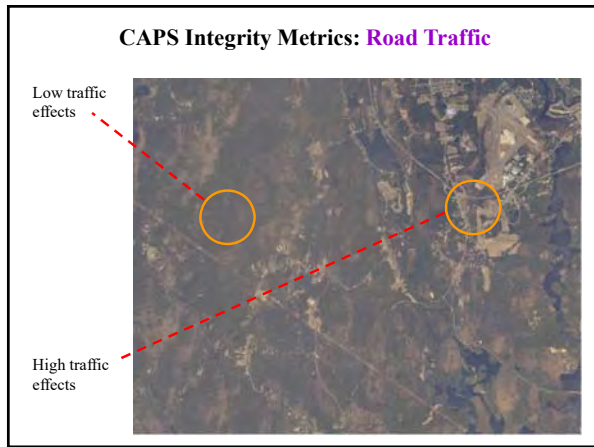


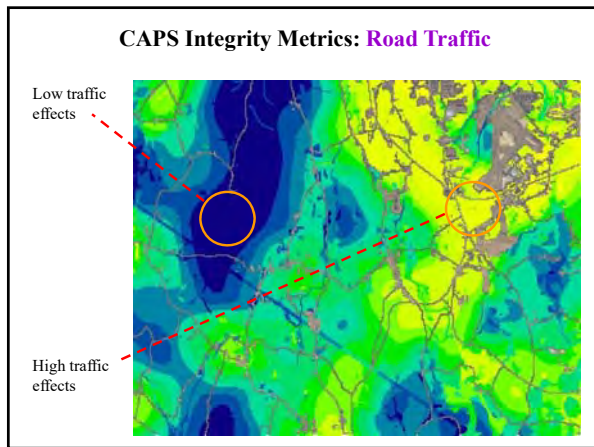


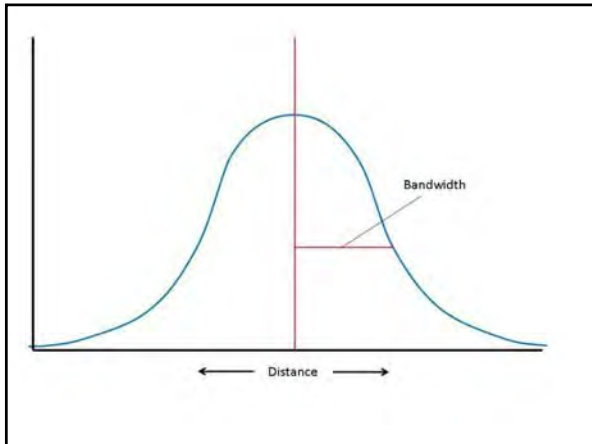


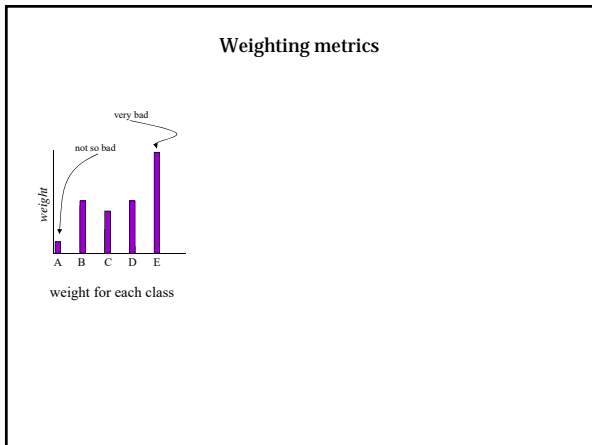


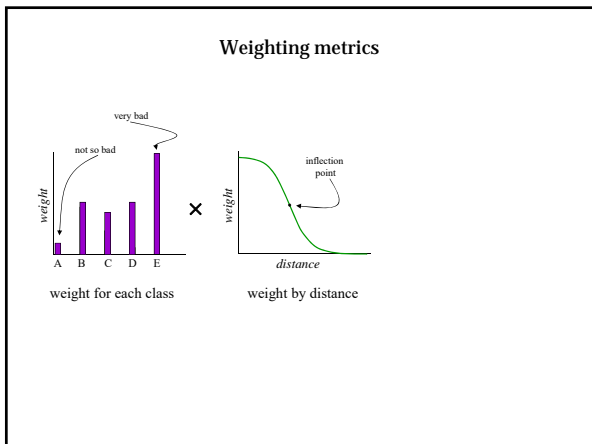


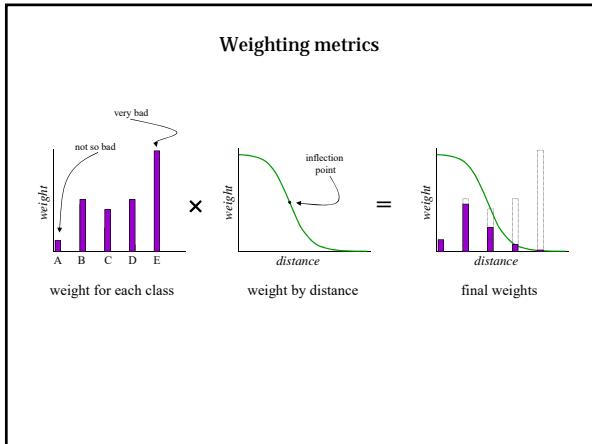


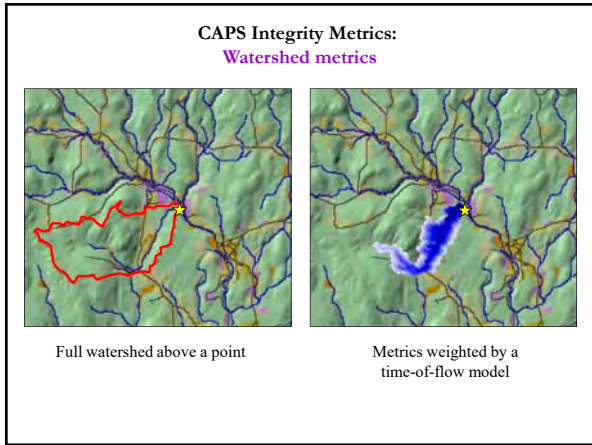














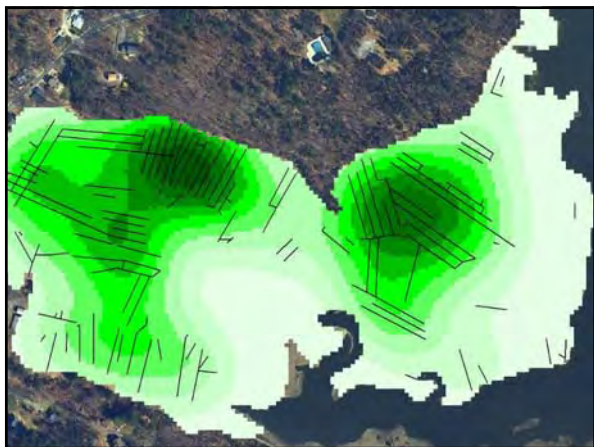


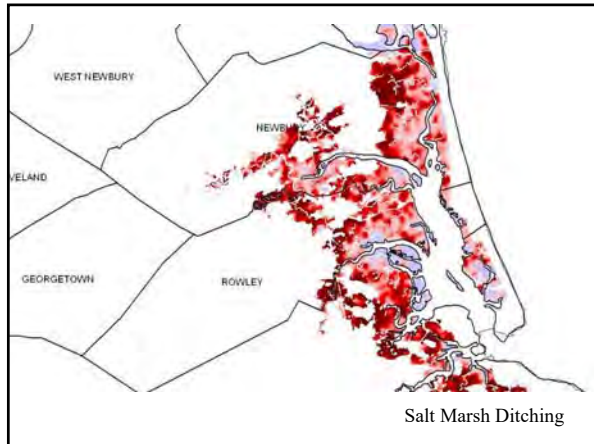


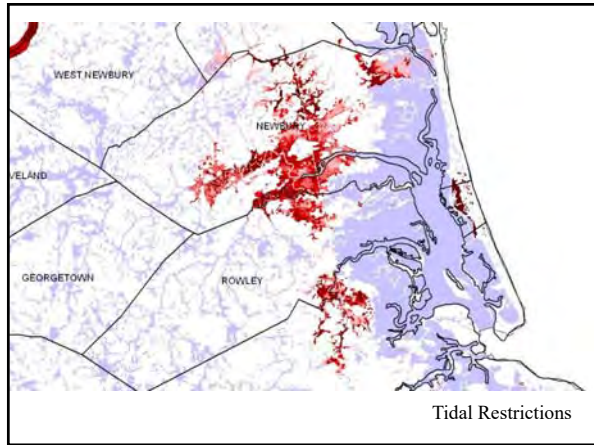
CAPS Integrity Metrics	
Stressor metrics	Watershed-based stressor metrics
Road Traffic	Road salt
Habitat loss	Road sediment
Microclimatic alterations	Nutrient enrichment
Mowing & plowing intensity	Dam intensity
Domestic predators	Watershed habitat loss
Edge predators	Imperviousness
Non-native invasive plants	Hydrological alterations
Non-native invasive earthworms	Impounded
Wetland buffer insults	Percent impounded
Tidal restrictions	Altered stream geomorphology
Salt marsh ditching	Stream temperature alteration
Coastal structures	
Beach pedestrian traffic	Resiliency metrics
Beach ORVs	Similarity
Boat traffic intensity	Connectedness
Emissions intensity	Aquatic connectedness

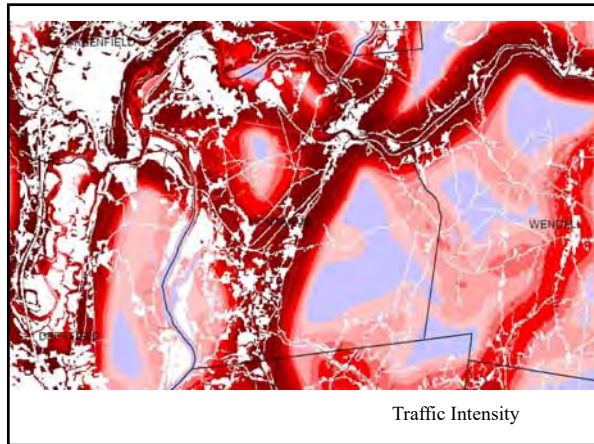




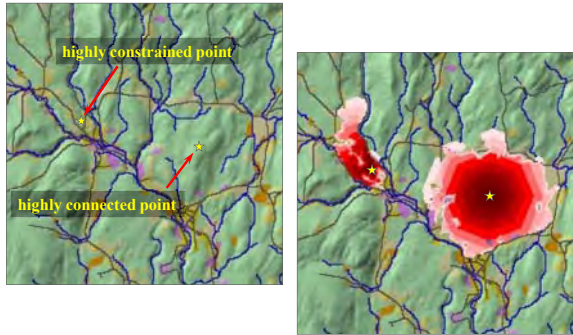








**CAPS Integrity Metrics:
Resistant Kernel Analysis**

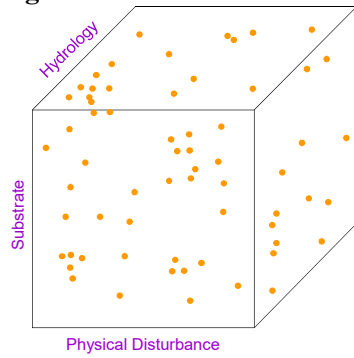


Ecological Setting

Similarity Matrix

- Temperature
- Solar energy
- Substrate
- Physical disturbance
- Moisture
- Hydrology
- Vegetation
- Development

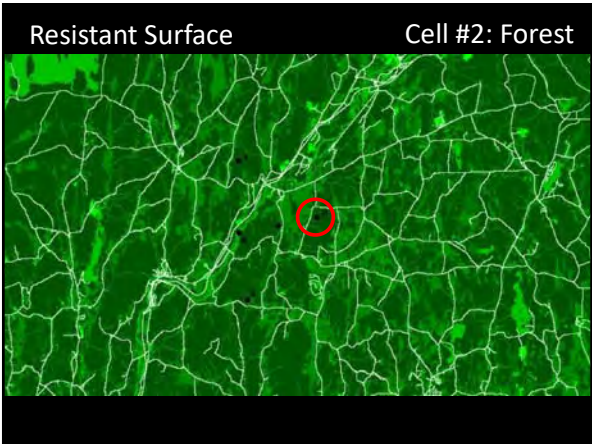
(26 Variables)

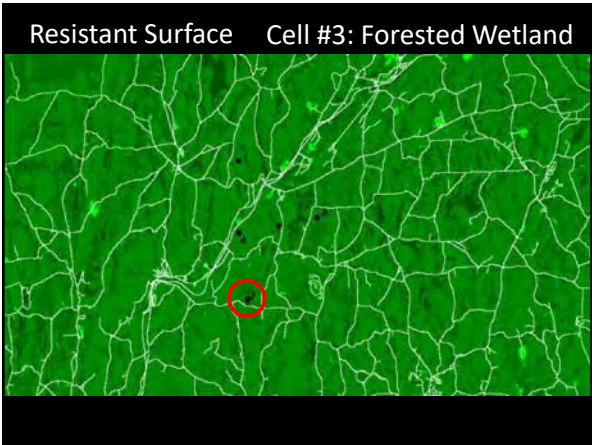


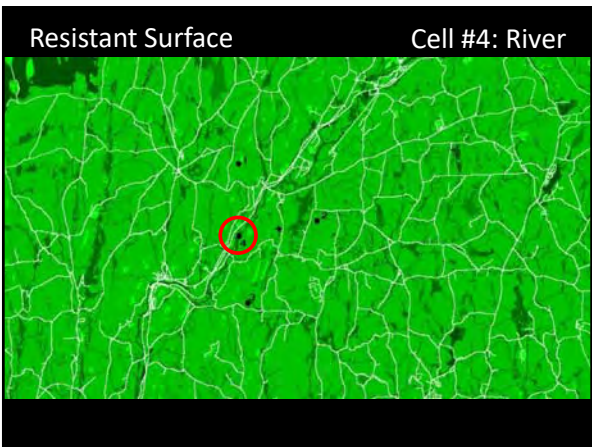
Resistant Surface

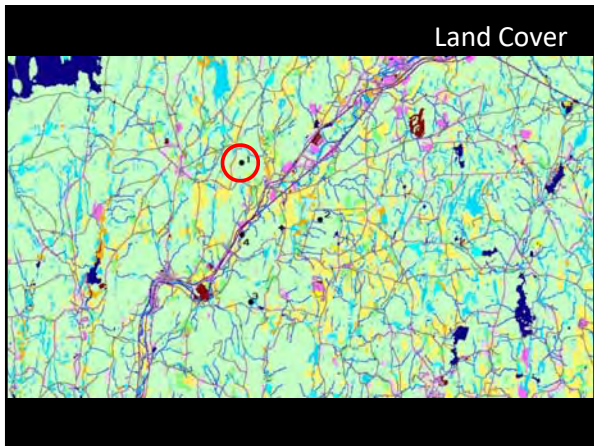
Cell #1: Forest

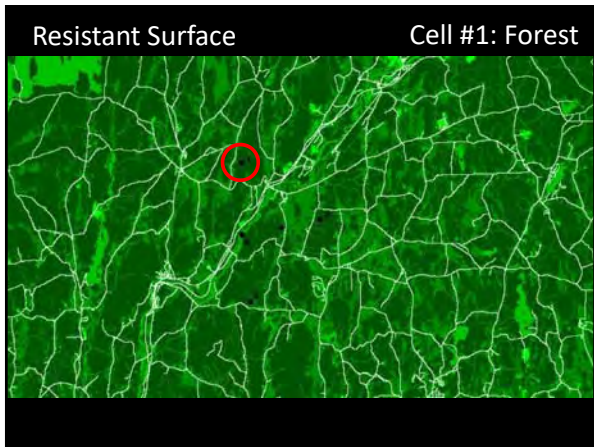


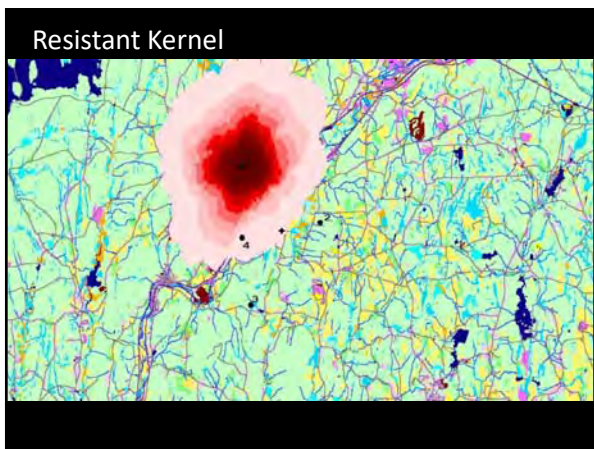






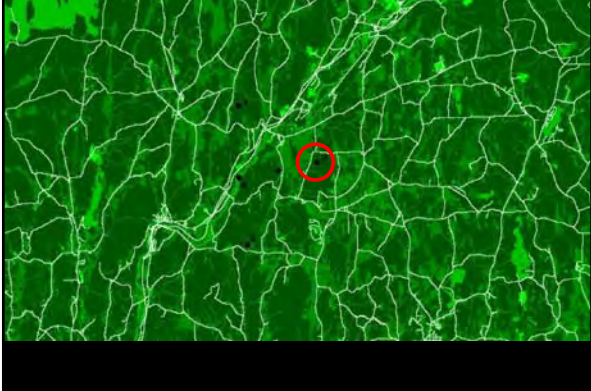




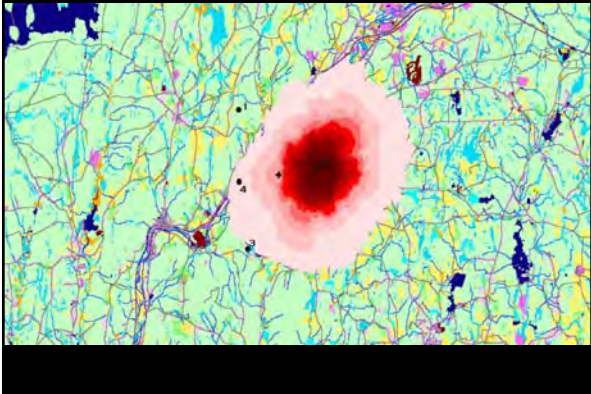


Resistant Surface

Cell #2: Forest



Resistant Kernel

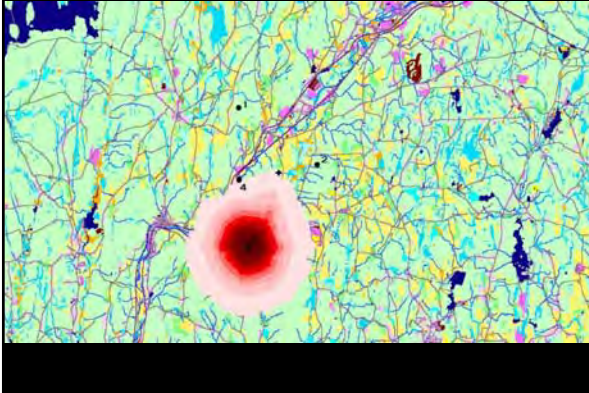


Resistant Surface

Cell #3: Forested Wetland

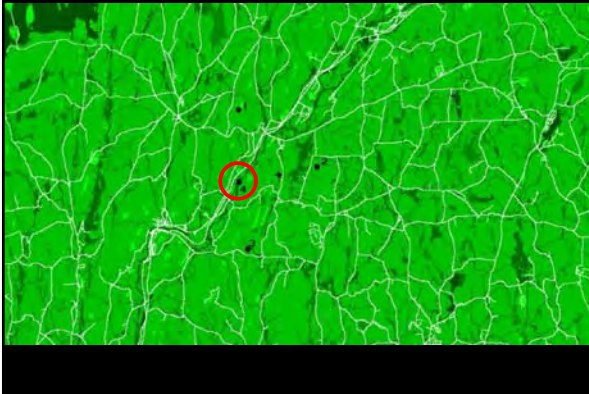


Resistant Kernel

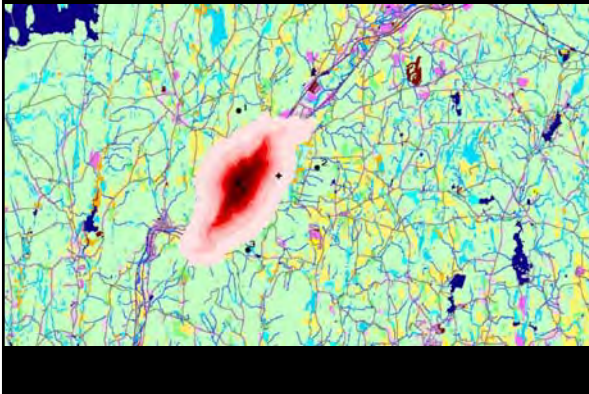


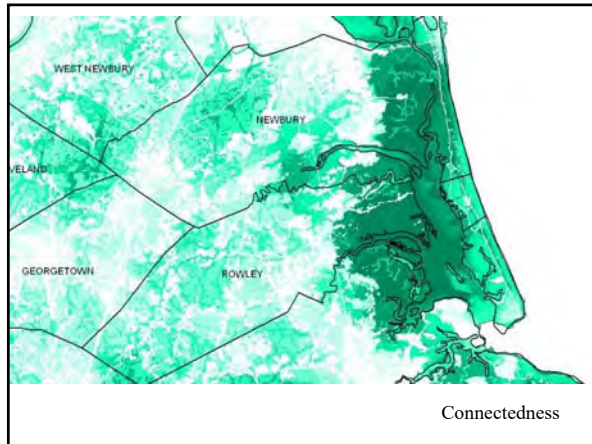
Resistant Surface

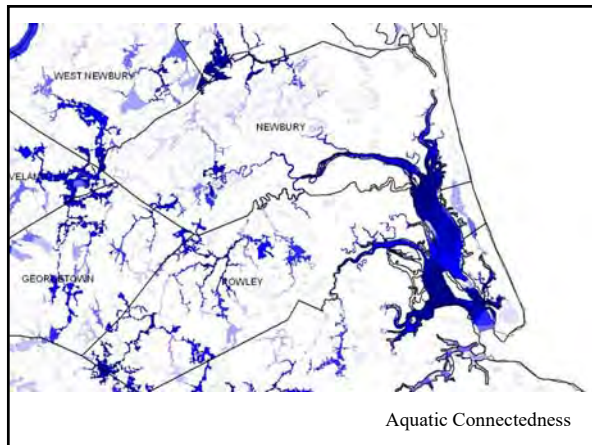
Cell #4: River

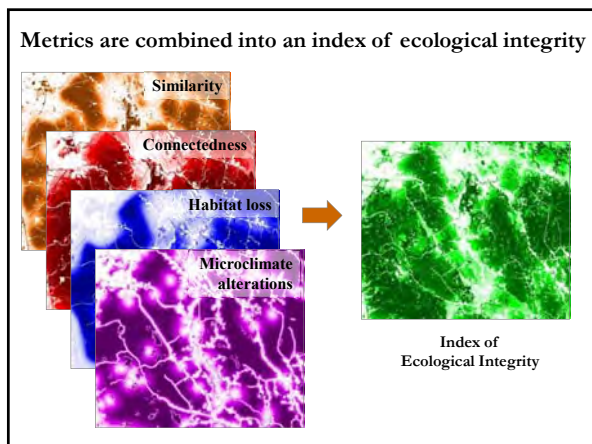


Resistant Kernel









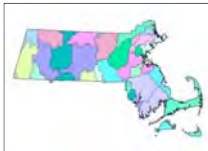
**Identifying Areas of Statewide and Regional
Significance for Ecological Integrity**



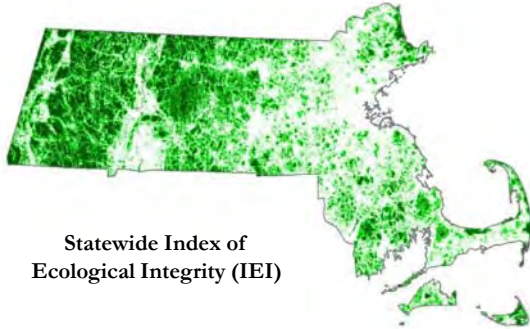
Statewide



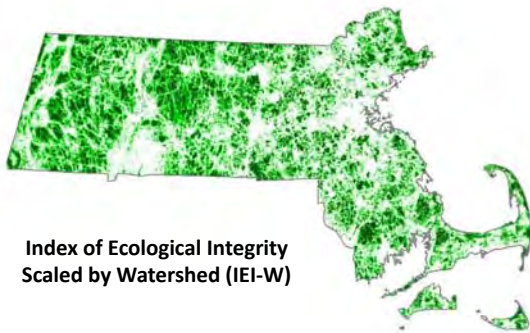
Ecoregions



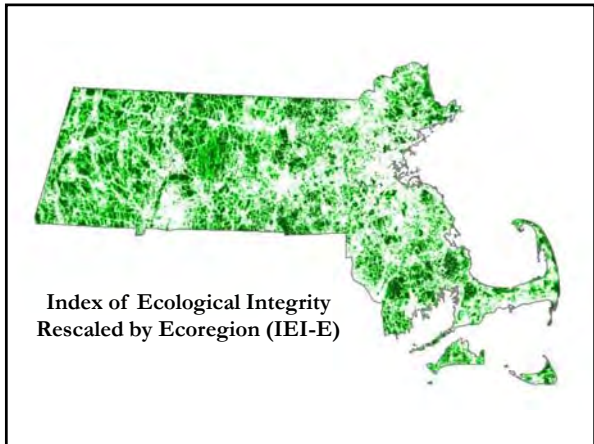
Watersheds

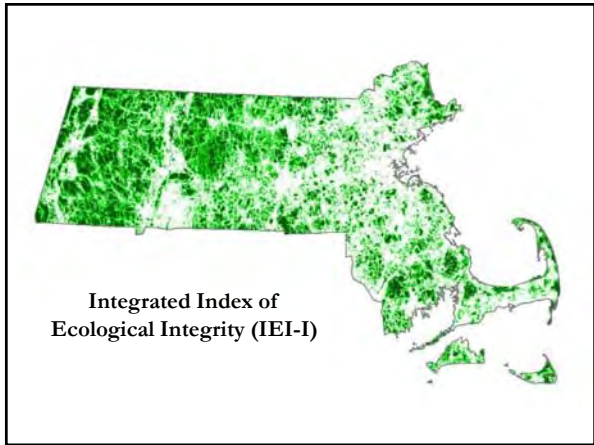


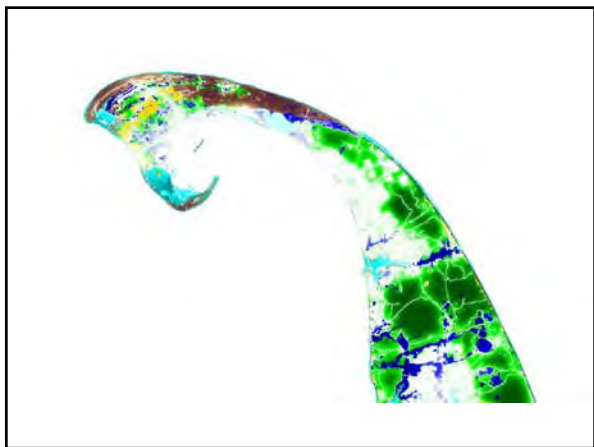
**Statewide Index of
Ecological Integrity (IEI)**

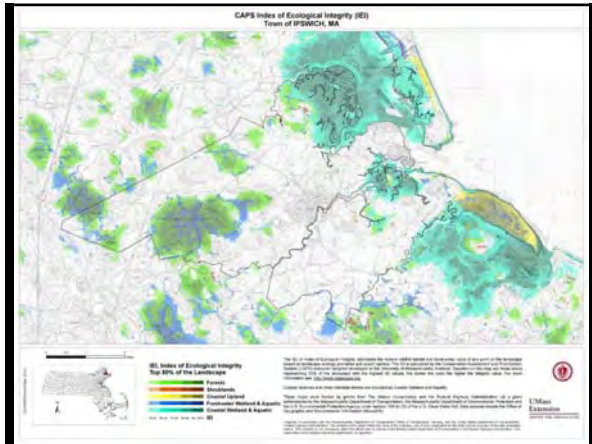


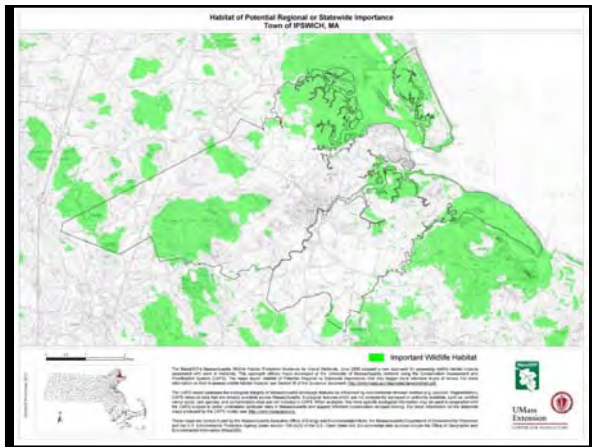
**Index of Ecological Integrity
Scaled by Watershed (IEI-W)**











BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World

Henry Woolsey, Natural Heritage & Endangered Species Program
 Andy Finton, The Nature Conservancy
 James DeNormandie, Mass Audubon, Ecological Extension Service
 Jessica Dyson, The Nature Conservancy
 Sarah Haggerty, Natural Heritage & Endangered Species Program

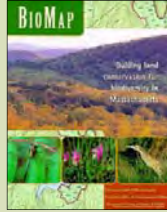
BioMap2 : What is it?

BioMap2 is designed to **guide strategic biodiversity conservation** in Massachusetts by focusing land protection and stewardship on the areas that are most critical for ensuring the **long-term persistence** of rare and other native **species and their habitats, exemplary natural communities, and a diversity of ecosystems.**



Why BioMap2?

- 2001: BioMap - MA Natural Heritage
 - Influence public and private decisions/funding, at scale
- 2001-2010: 170,000 acres protected by all entities
 - 117,000 acres (~70%) was in BioMap
 - Priorities adopted by state agencies, NGOs land trusts, municipalities, public and private funders, etc.



Why BioMap2?

- **Update** the information:
 - Integrate *BioMap* (2001) & *Living Waters* (2003)
 - Account for recent protection & development
 - Incorporate new species & natural community data
- **Enhance** the scope to include:
 - MA Wildlife Action Plan (2005): Species & Habitats
 - Intact Ecosystems and Landscapes
 - Resilient in the face of climate change



Conservation Targets

- **Species** (Fine filter)
 - MESA-listed Species of Conservation Concern
 - Non-listed Species of Conservation Concern from the State Wildlife Action Plan (SWAP)
- **Habitats** (Fine/Coarse filter)
 - Coastal habitats
 - Wetlands
 - Rivers, streams, lakes, & ponds
 - Grasslands, shrublands, & barrens
 - Forests
- **Landscapes** (Coarse filter)

Conservation Targets – Examples in Presentation

- **Species** (Fine filter)
 - MESA-listed Species of Conservation Concern
 - Non-listed Species of Conservation Concern from the State Wildlife Action Plan (SWAP)
- **Habitats** (Fine/Coarse filter)
 - Coastal habitats
 - Wetlands
 - Rivers, streams, lakes, & ponds
 - Grasslands, shrublands, & barrens
 - Forests
- **Landscapes** (Coarse filter)

Climate Adaptation Approaches

Conserving Biodiversity in the Face of Climate Change
Heller and Zavaleta, 2009, Lawler 2009

- **Resistance:** *Keep it the same*
 - The ability to withstand a disturbance
- **Resilience:** *Maintain ecosystem function*
 - The ability to recover from a disturbance and return to a functional state
- **Transition:** *New cast, new regimes*
 - The ability to change to another ecological state



BioMap2: Climate Adaptation Strategies for Resistance, Resilience, & Transition

Sufficient Size

Connectivity

Representation

Ecological Process

Limit Stressors

Replication

Species of Conservation Concern

- 256 Plant species
- 111 Invertebrates
- 7 Amphibians
- 15 Reptiles
- 17 Fish
- 50 Birds
- 9 Mammals

Eacles imperialis

Eacles imperialis habitat

SWAP Habitats	
Small Scale SWAP Habitats	Vernal Pools Peatlands and Associated Habitats Marshes and Wet Meadows Rocky Coastlines Rock Cliffs, Ridgetops, Talus Slopes, and Similar Habitats
Medium Scale SWAP Habitats	Small Streams Shrub Swamps Forested Swamps Lakes and Ponds Salt Marsh Coastal Dunes, Beaches and Small Islands Grasslands Young Forests and Shrublands Riparian Forest
Large Scale Habitats	Large and Mid Sized Rivers Marine and Estuarine Habitats Upland Forest Large Unfragmented Landscape Mosaic Pitch Pine/Scrub oak

BioMap2 Goal: Resilient Wetlands

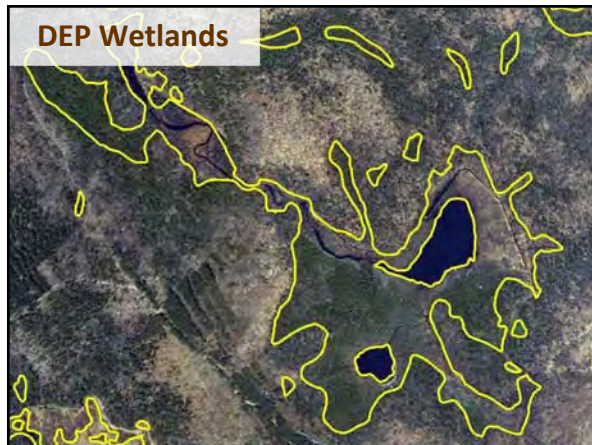
- Resilient
 - Large, intact, representative, minimally fragmented, etc.

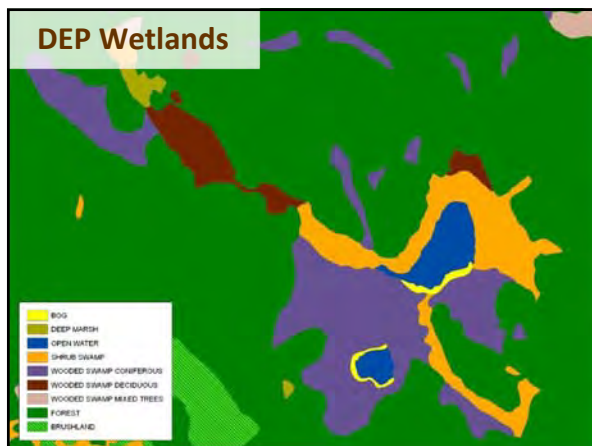
Limit Stressors Ecological Process Connectivity

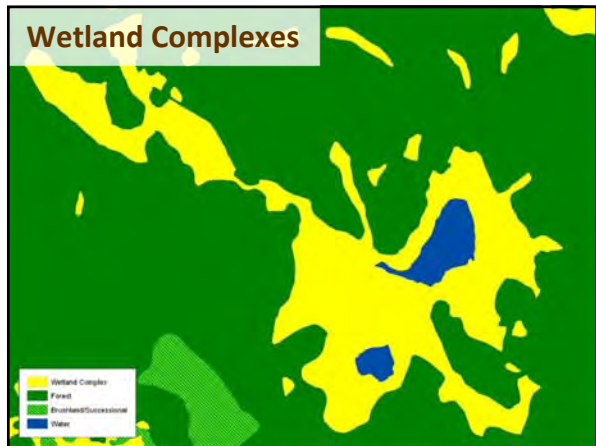


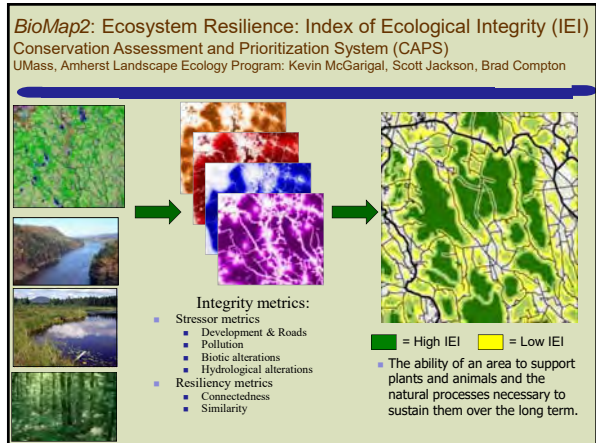
Yes

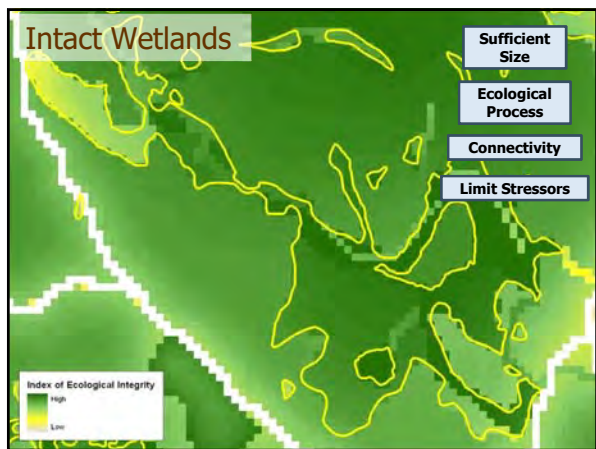
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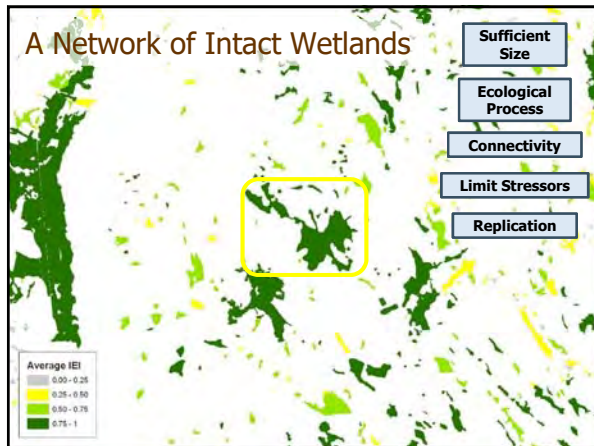


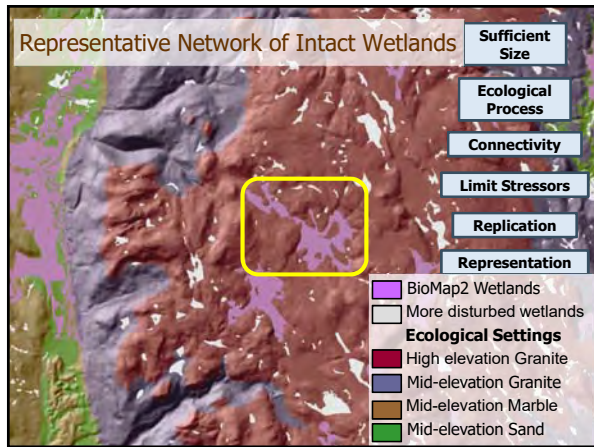


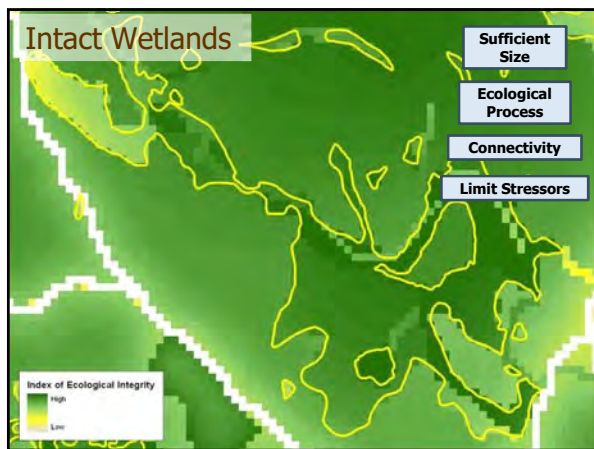


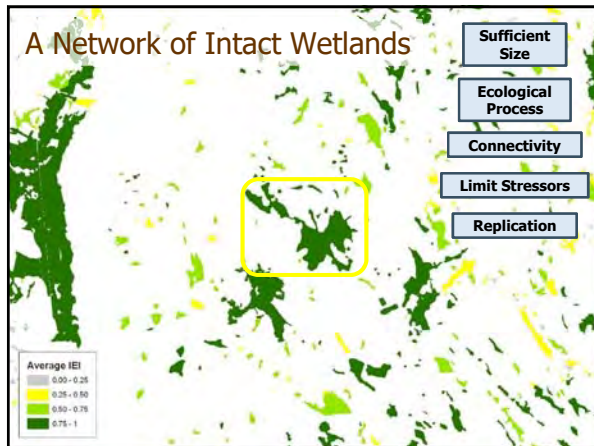


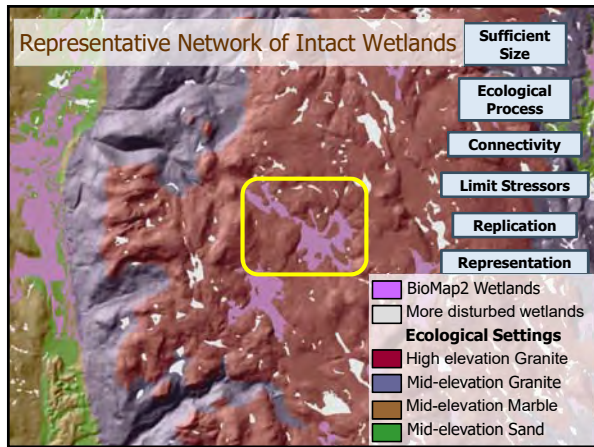
















Protecting the Arena

- 32 teams in the league
- Players changes over time – but teams remain functional**
- Enduring Features: Resilience of league requires functional teams represented by a variety of arenas

Protecting the Arena

- 20 physical settings in MA: Drivers of species composition
 - High elevation granite
 - Low elevation marble
- Species composition changes over time, but wetlands remain functional
- Enduring Features: Resilience of network requires wetlands in a variety of settings.

Resilient Wetlands:

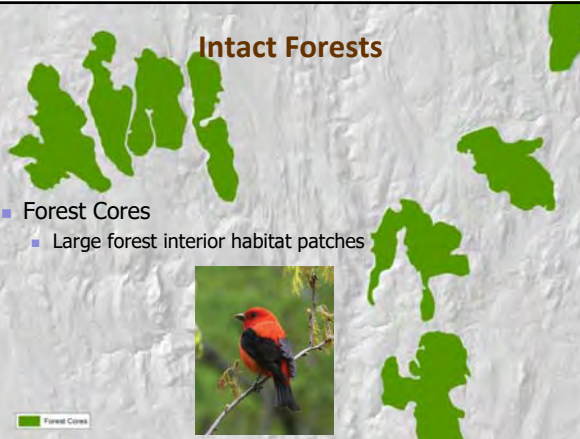

- Large, buffered, connected Wetland Cores
- Representative and replicated
- "Protecting the Stage/Arena"
 - Selected across physical settings



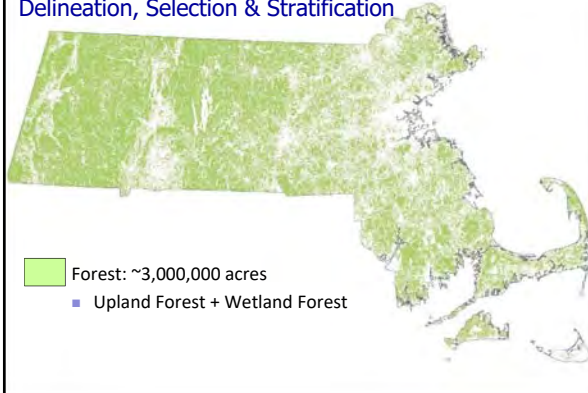


Intact Forests

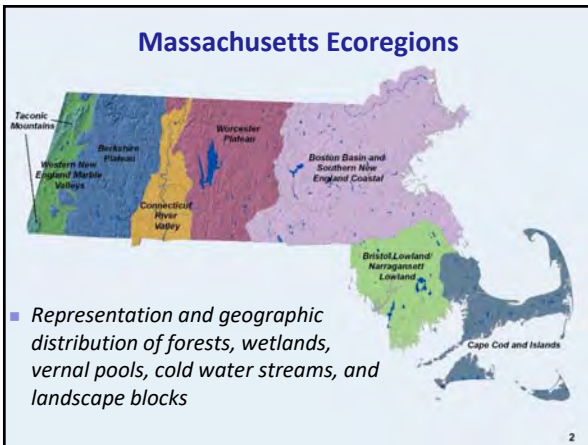
- Forest Cores
 - Large forest interior habitat patches

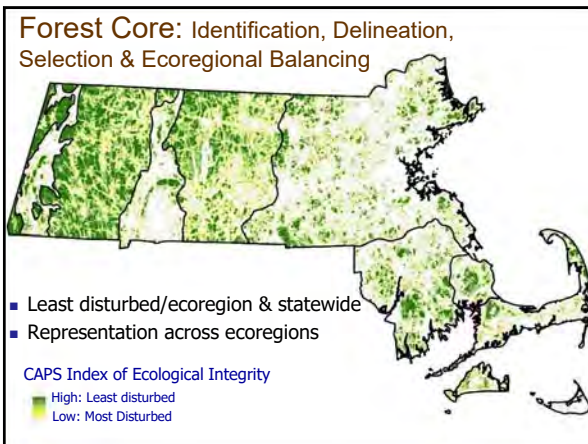
Forest Core: Identification, Delineation, Selection & Stratification

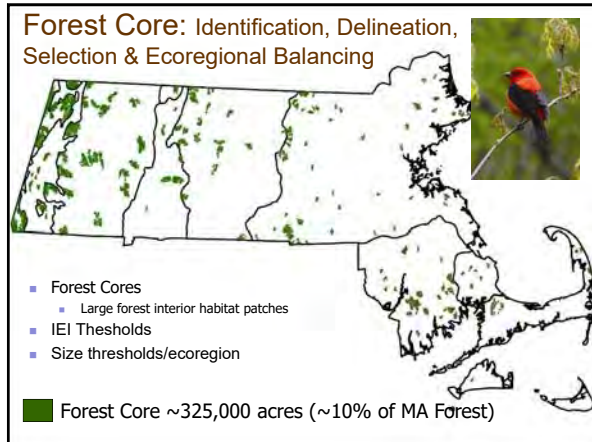


Massachusetts Ecoregions

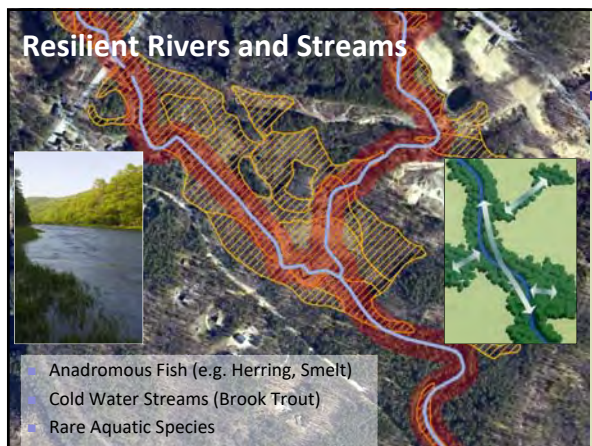


Forest Core: Identification, Delineation, Selection & Ecoregional Balancing









Coastal Ecosystems

- Coastal Natural Communities
- Rare Species Habitats
- Upland buffers

BioMap2 Core Habitat

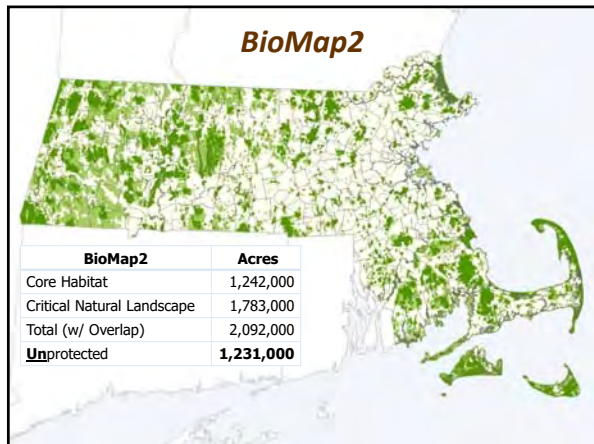
Core Habitat - 1.2 million acres
 Unprotected - 680,000 acres

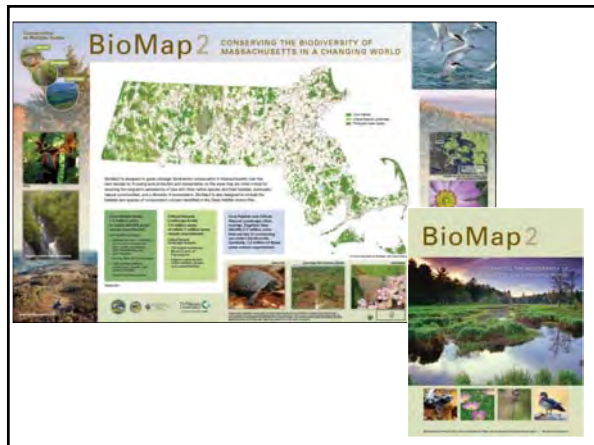
Ingredients:
 Rare, vulnerable, or uncommon species
 Priority Natural Communities
 Intact forest ecosystems
 Intact wetlands
 Vernal pool clusters
 Aquatic/riparian habitat

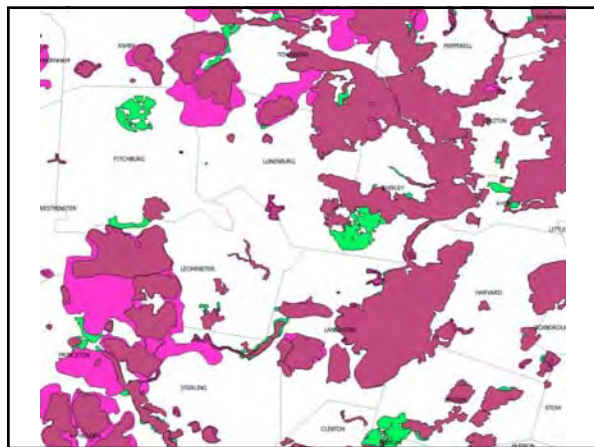
BioMap2 Critical Natural Landscape

CNL 1.8 million acres
 Unprotected 1 million acres

Ingredients:
 Landscape Blocks
 Uplands buffers (wetland, rivers, and coastal habitats)









Connectedness
 A CAPS metric that measures the value land attains from being *locally connected** to land in similar settings.

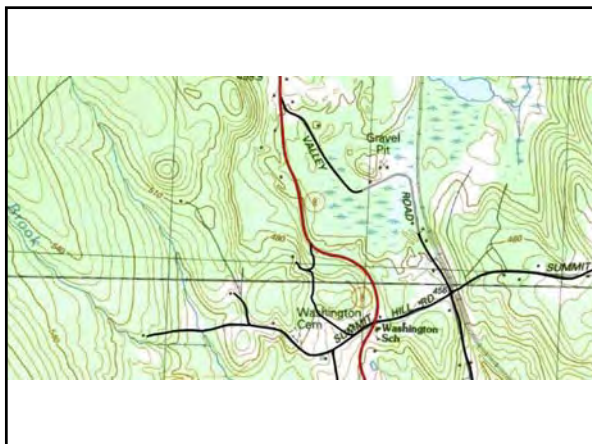
Critical Linkages I
 Assesses the increase in local connectedness (aquatic or terrestrial) from single infrastructure upgrades (culvert replacement, dam removal, road passage structures).

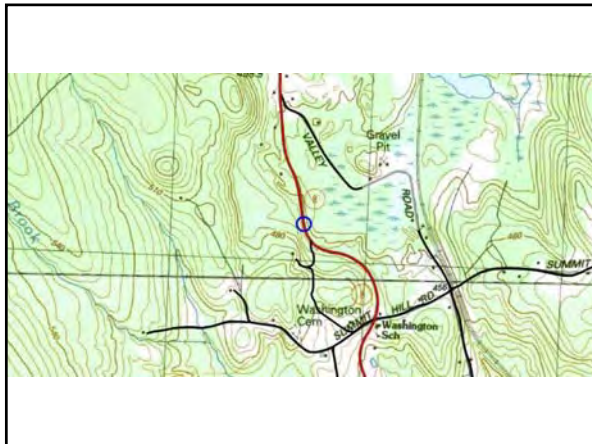
Critical Linkages II
 Assesses the effect of multiple landscape changes on *regional connectivity***.

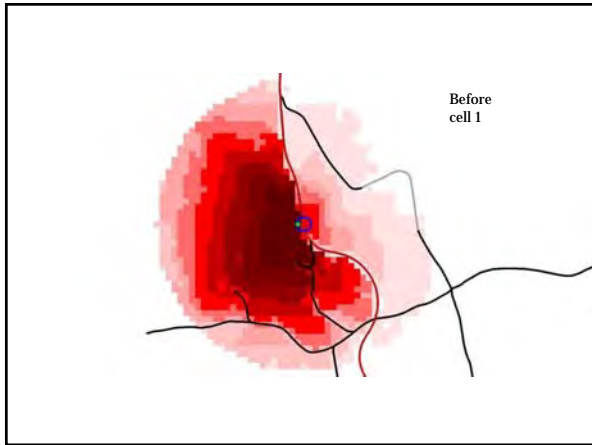
- Measures the increase in regional connectivity from multiple infrastructure upgrades (road passage structures) → identify best set of sites for passages.
- Measures the loss in regional connectivity from the development of multiple parcels → identify critical parcels for land protection.

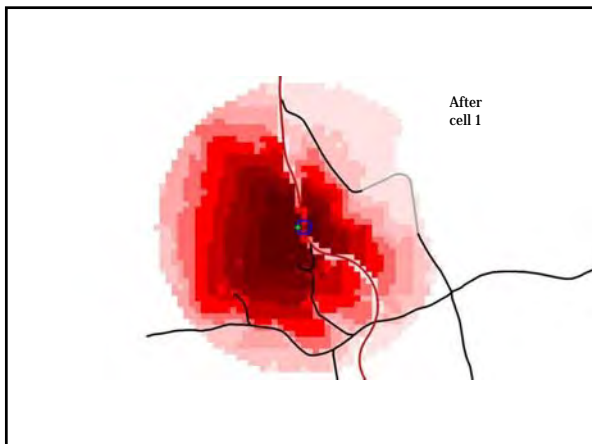
* Local connectivity = homerange, dispersal
 ** Regional connectivity = multi-generation dispersal, gene flow, range expansion/contraction

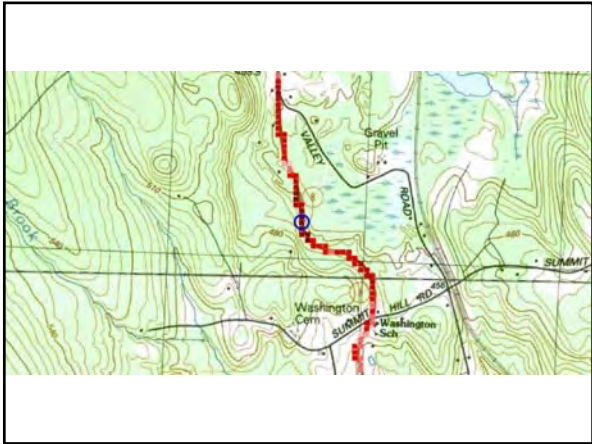
107

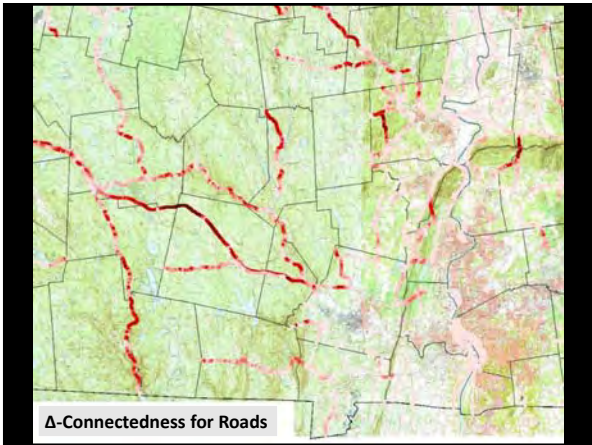


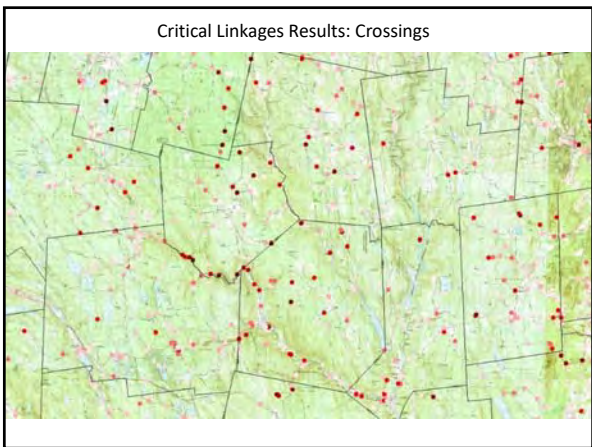


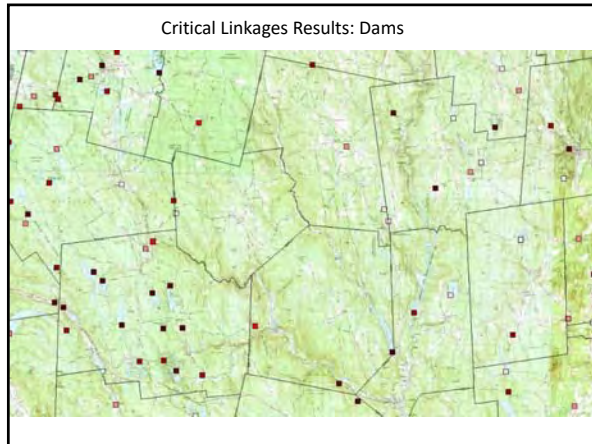


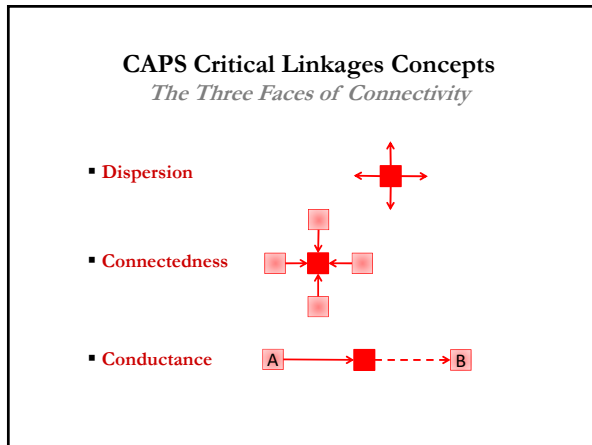


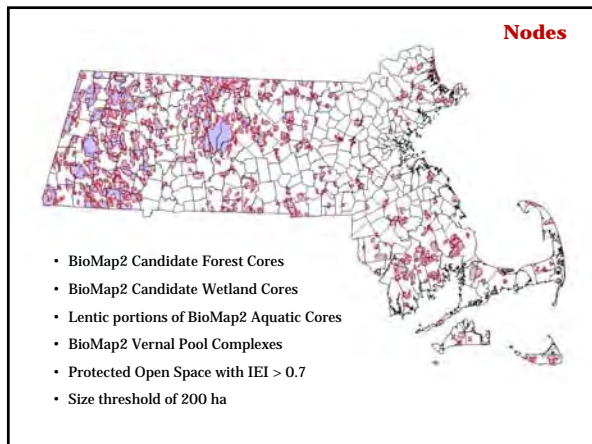


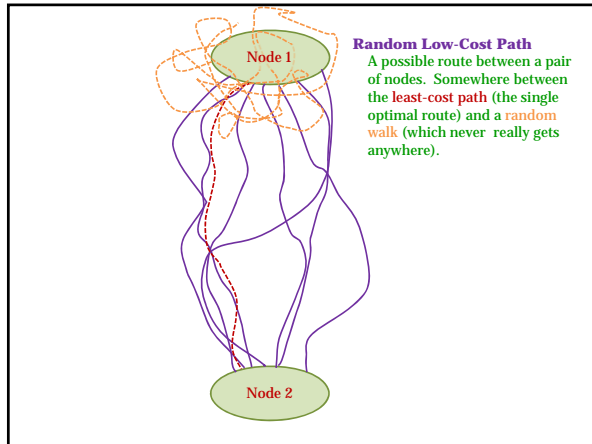


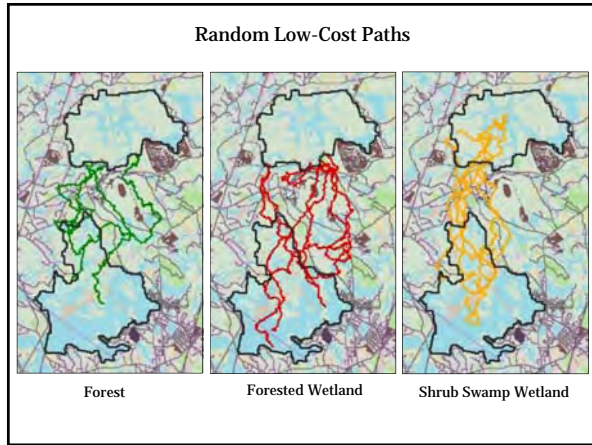


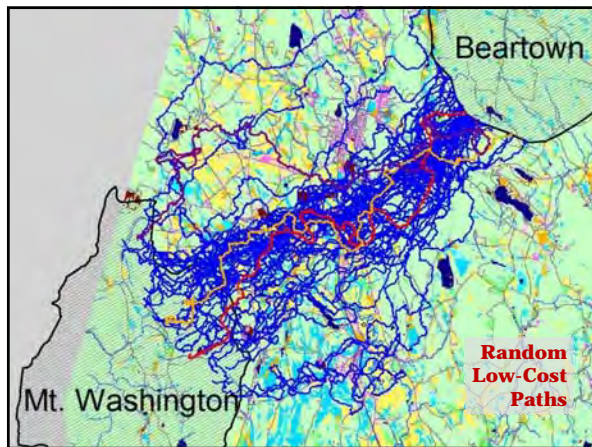


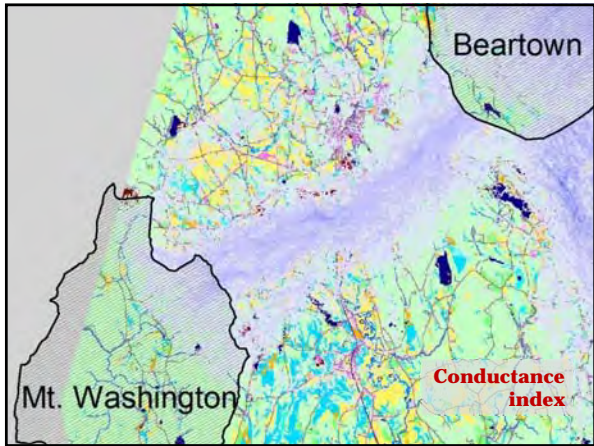


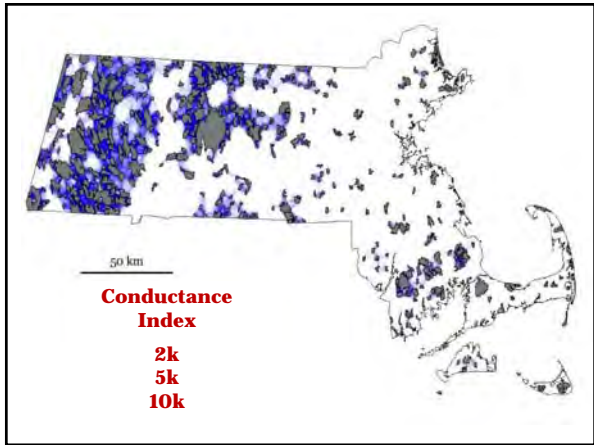


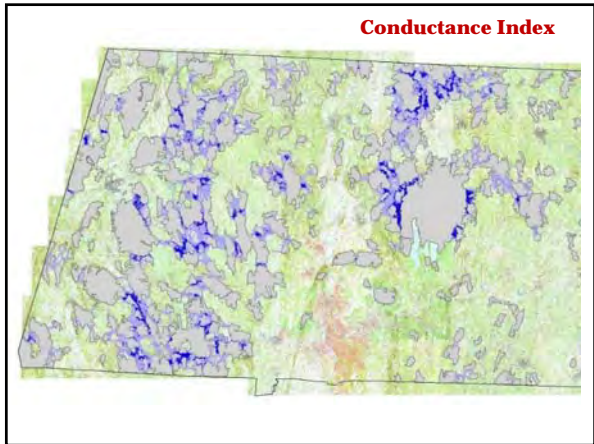


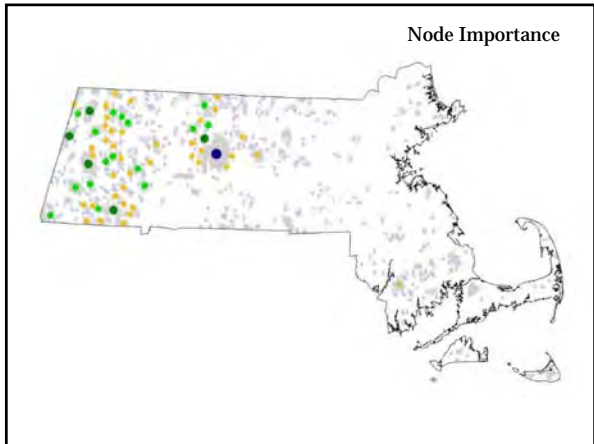


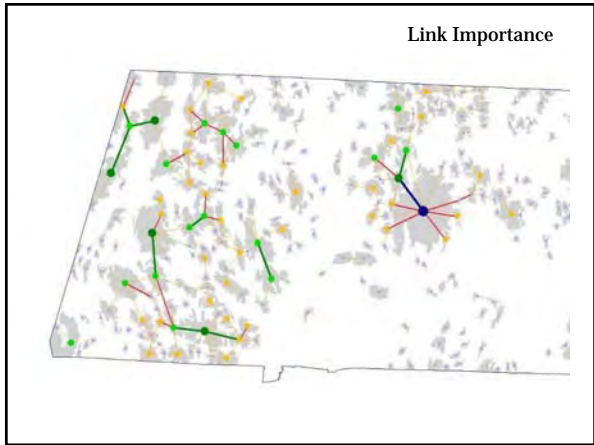


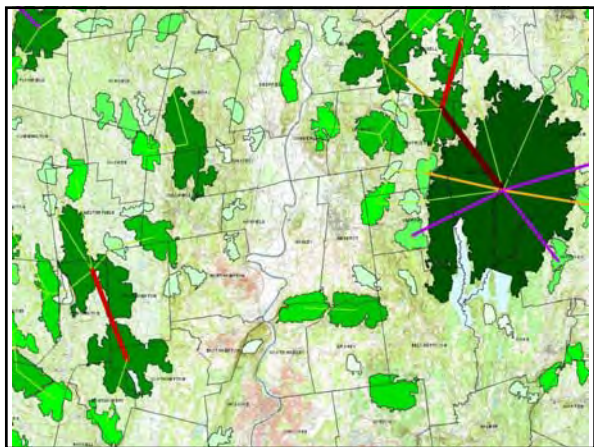


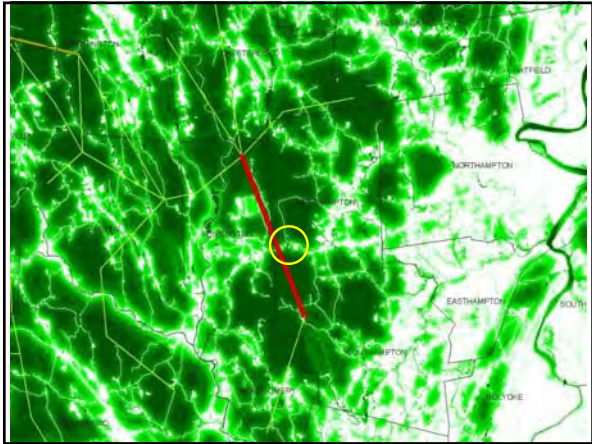


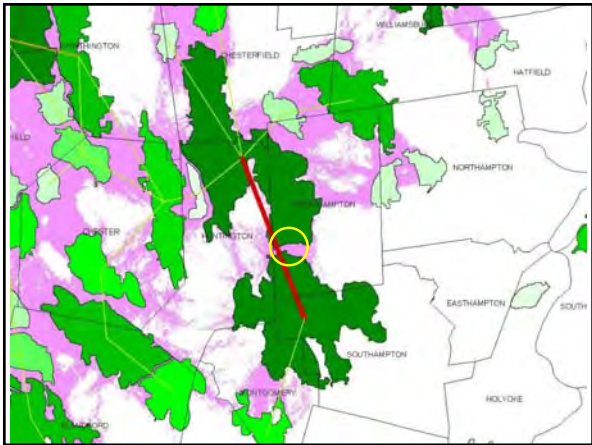




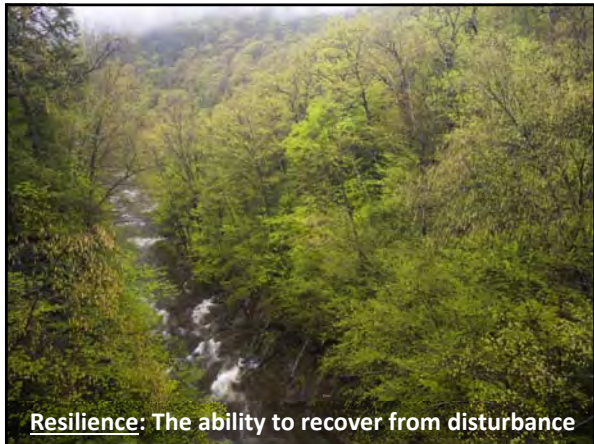















Resilient Sites
Options: Conserve diverse and connected places

Landscape Diversity

- How many microclimates?

Landscape Connectivity

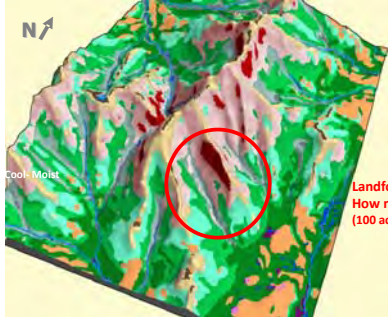
- How permeable is the landscape?



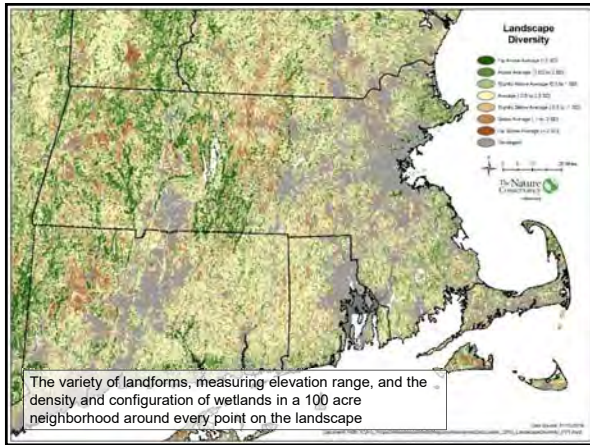
Westfield River, MA

Landscape Diversity

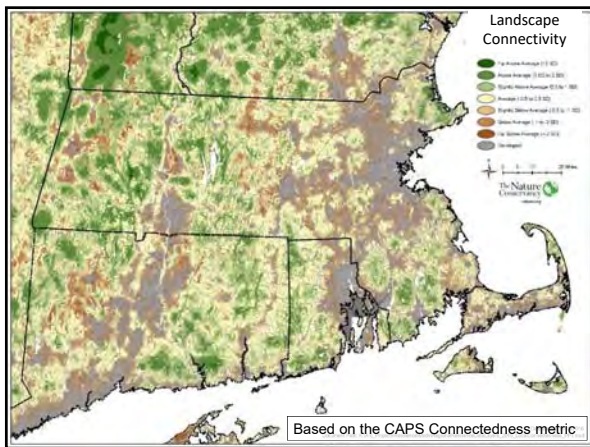
Microclimates = Options for Species



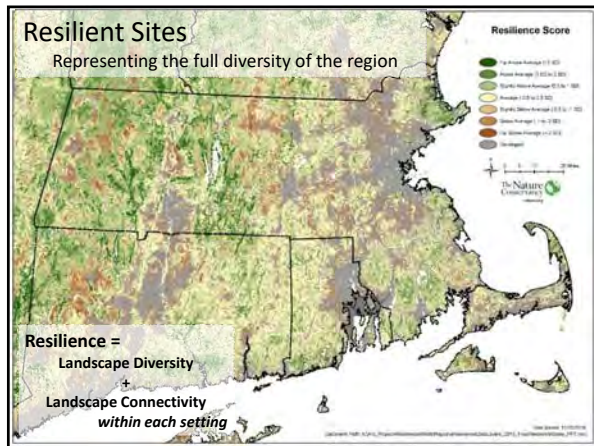
Landform Variety:
How many landforms in an area
(100 acres around a 30m grid cell)

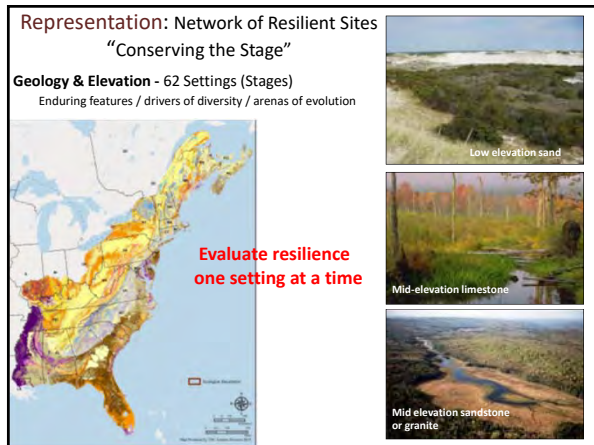


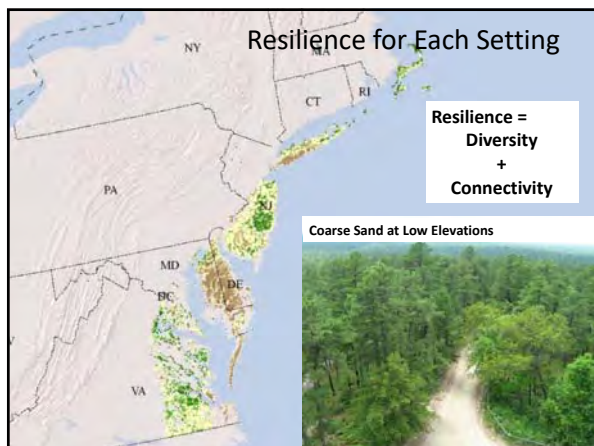
The variety of landforms, measuring elevation range, and the density and configuration of wetlands in a 100 acre neighborhood around every point on the landscape



Based on the CAPS Connectedness metric



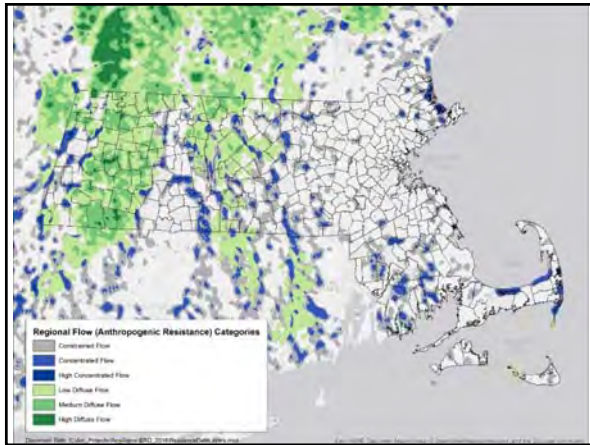




Flow (Regional Connectivity)

Maintaining a landscape that facilitates range shifts for terrestrial species

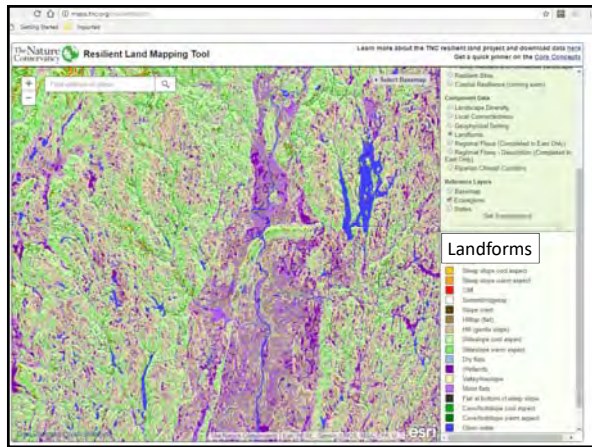


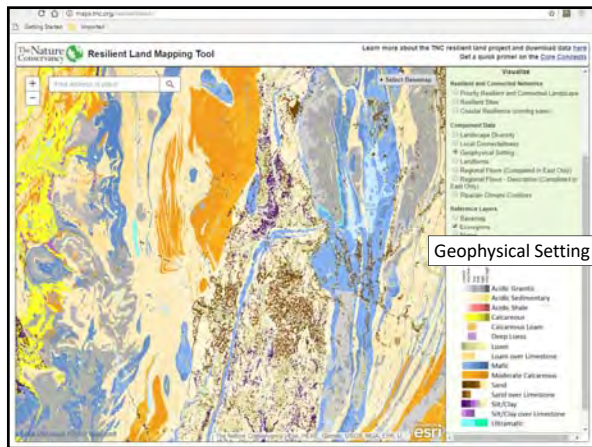


Resilient Sites for Conservation

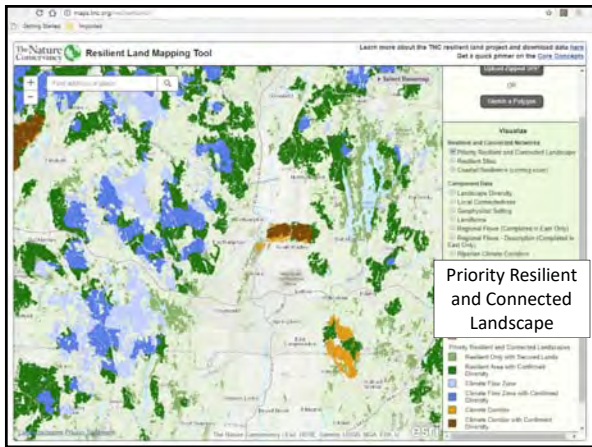
<http://nature.ly/TNCResilience>

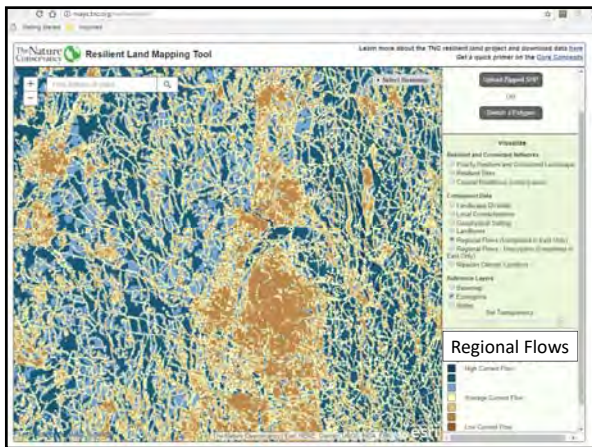


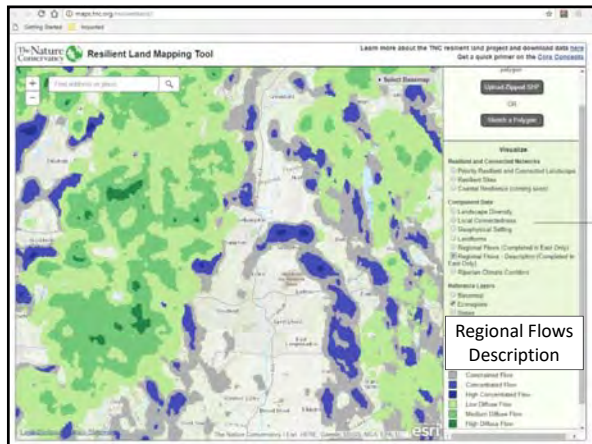




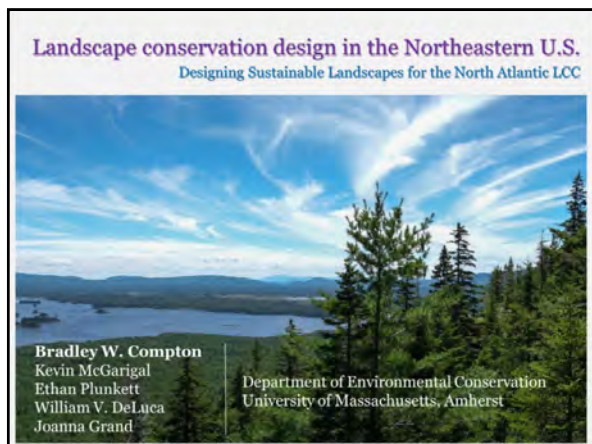













Designing Sustainable Landscapes: Project Executive Summary
A project of the University of Massachusetts Landscape Ecology Lab

Principal:

- Terrie Morgan, Professor
- Neal Hamilton, Research Scientist
- John Pickett, Research Associate
- Bill Miller, Research Associate
- James Lynch, Research Associate

Field Support Staff:

- North Atlantic Landscape Conservation Cooperative (NALCC) Wildlife Science, Northeast Region
- Northeast Climate Change Science (NECCS)
- University of Massachusetts, Amherst




Report date: 17 March 2017

Address:
 100 College St., Room 2100, Amherst, MA 01003-0210, USA
 neal.hamilton@umass.edu, james.lynch@umass.edu, terrie.morgan@umass.edu
 Conservation Cooperative, NALCC and Wildlife Science, Northeast Region

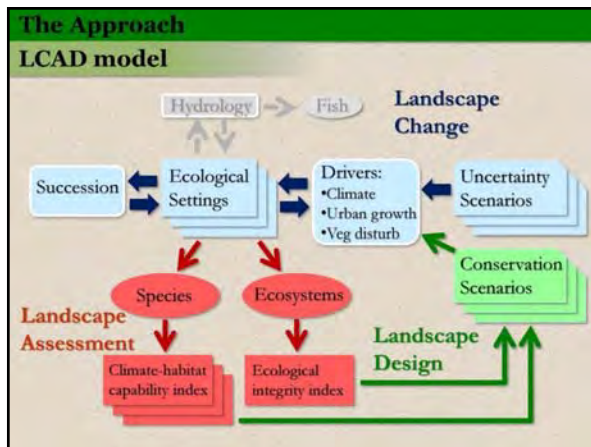
Designing Sustainable Landscapes (DSL)

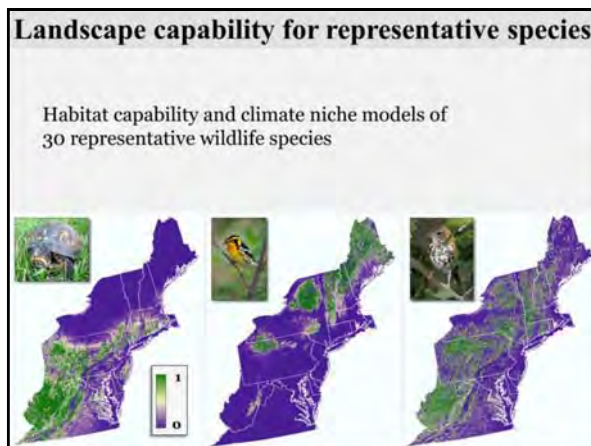
- CAPS IEI
- Critical Linkages
- Habitat for Representative Species
- Landscape Change Scenarios
 - Urban growth
 - Ecological succession
 - Vegetation disturbance
 - Climate change

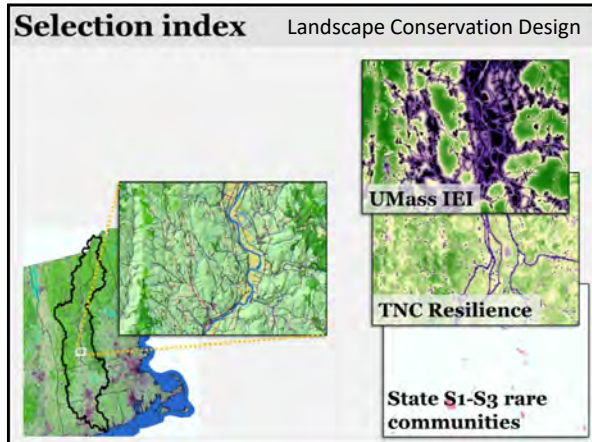


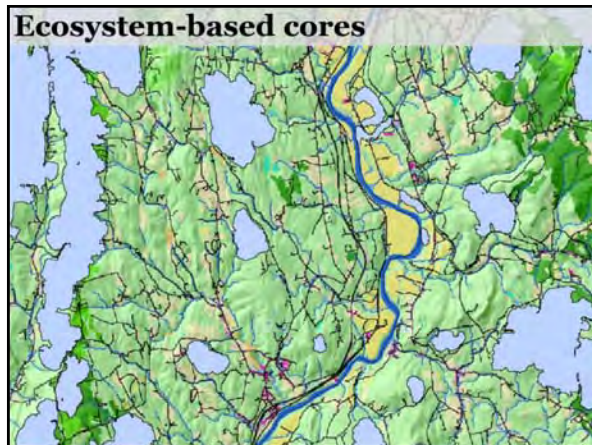
Landscape Conservation Design

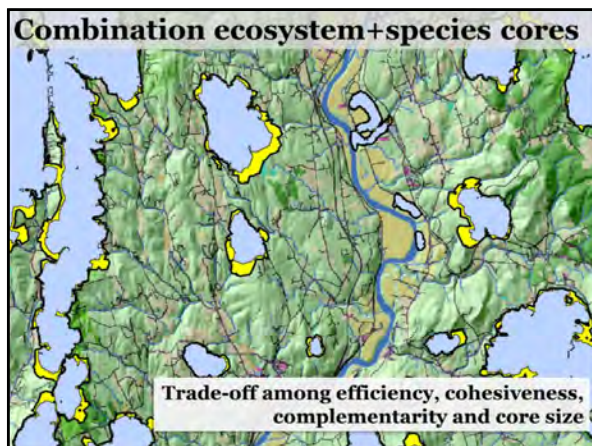
- Connect the Connecticut
- Nature's Network

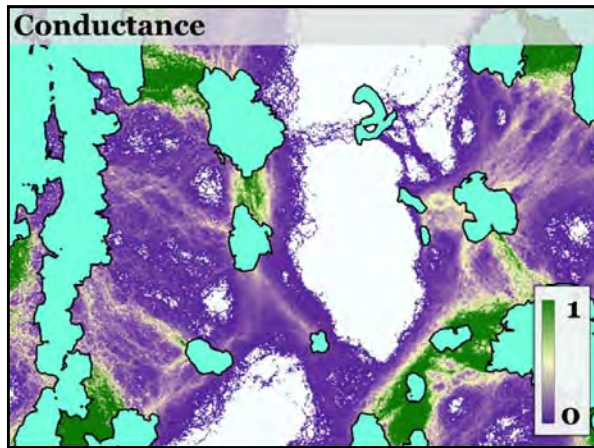


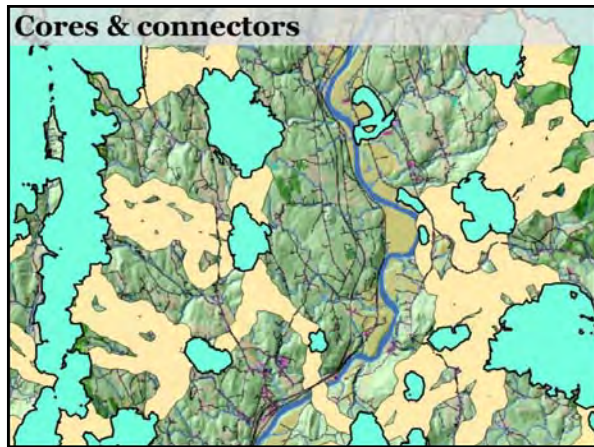


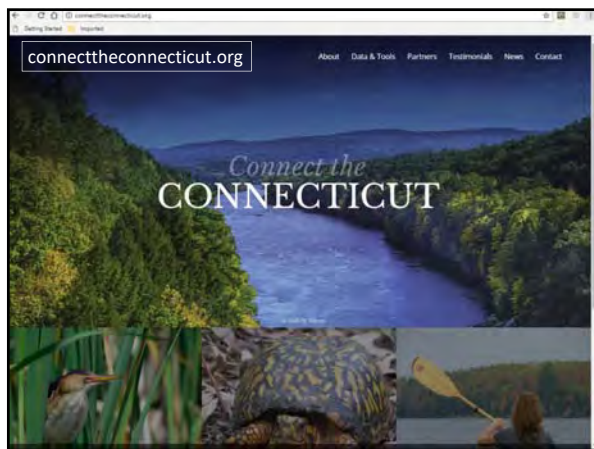


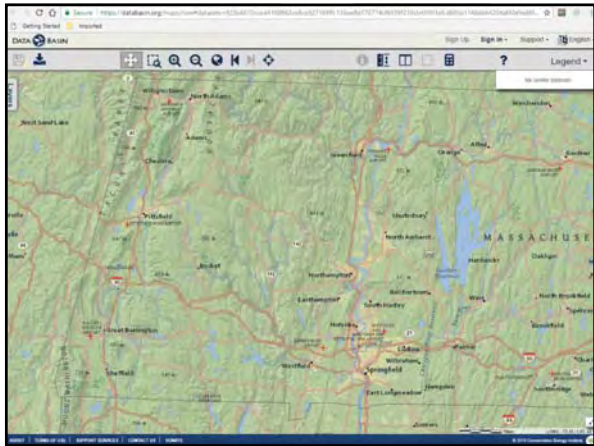


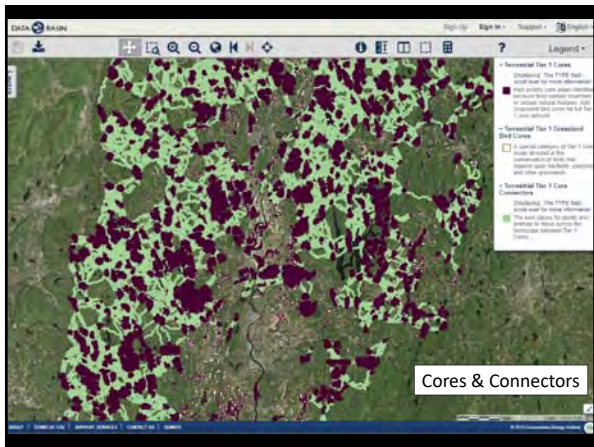


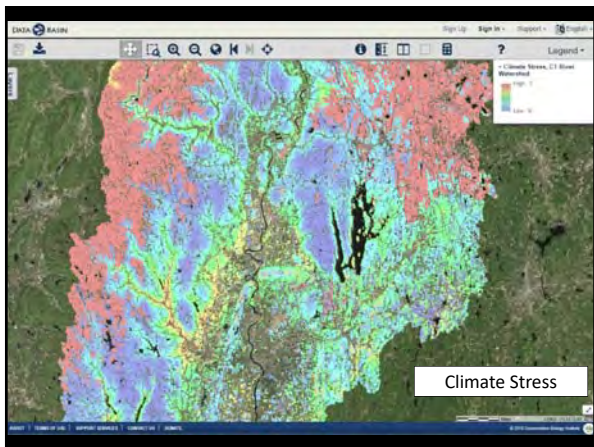


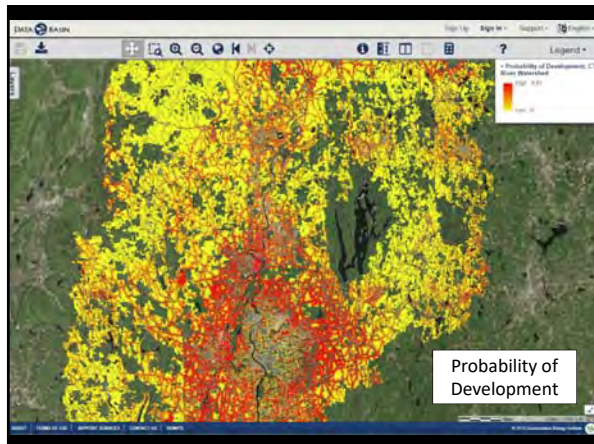




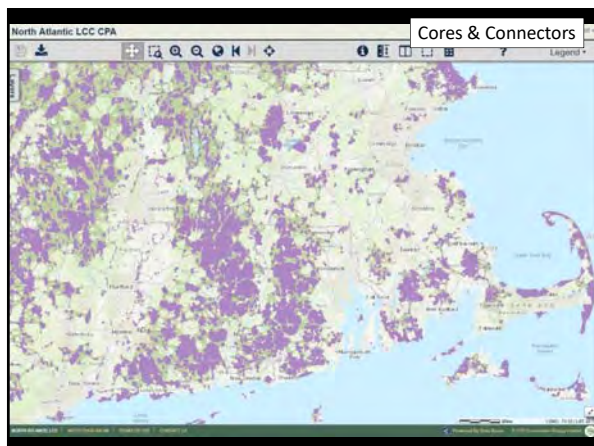









A screenshot of the Nature's Network website. The header includes the URL 'naturesnetwork.org' and navigation links: 'Home', 'About', 'Data & Tools', 'Learning', 'In Action', 'Resources', and 'Contact'. The main heading is 'Nature's Network' with the tagline 'Lands and waters sustaining wildlife and people'. Below this are buttons for 'LEARN MORE' and 'ACCESS DATA'. A paragraph describes the network as a collaborative effort. A diagram shows four overlapping circles labeled 'Terrestrial Habitat', 'Imperiled Species', 'Aquatic Habitat', and 'Connectivity', with an arrow pointing to a larger circle labeled 'Nature's Network Conservation Design'. A small text block at the bottom provides additional details about the network's goals and species.



Mass Audubon MAPPR (Mapping and Prioritizing Parcels for Resilience)

 [Get Outdoors](#) [Get Involved](#) [Learn](#) [Conservation](#) [News & Events](#) [About](#) [JOB](#) [DONATE](#)

Home / Our Conservation Work / February / Shaping the Future of Forest - Career Program / MAPPR Project / MAPPR Tool

OUR CONSERVATION WORK

MAPPR Tool 2.0

MAPPR 2.0 has been enhanced to evaluate properties that include prime farmland as well as parcels critical to surface water supplies and wellhead protection zones. In addition, all open space and parcel data was updated to the September 2016 version. Finally, we added the following new study areas for analysis: Small Woodland Forests and Grasslands/Open Space.

Mapping and Prioritizing Parcels for Resilience (MAPPR) allows land conservationists to identify the parcels within an area of interest that are the highest priorities for protection based on habitat quality, climate change resiliency, and other metrics such as parcel size and adjacency to existing protected parcels. The higher the number, and larger the area, the more critical that parcel is for conservation based on selected inputs. Click on a parcel to learn why it received that score - maps input is sorted as it did not sort top 10, so it may be important for this input. Note: scores are relative based on the scope of the search - they're not searched for by people; however, the numbers are absolute for each input.

Analysis is based on open space data and stream parcel data available through MassGIS as of September 2016. As a result, ownership information and protection status may be inaccurate for some parcels. Check with your town selection for the most up-to-date information; please email any comments to mapper@massaudubon.org.

Choose a pre-calculated model
Or
Create your own

Pre-calculated Models

- Balanced Model
- Resilience Model
- Aquatic Model
- Biological Model

Assign Model Values

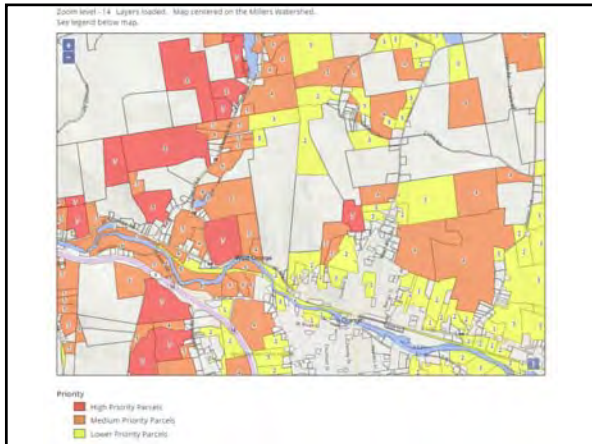
Resilient Sites for Conservation **Ref Layer**

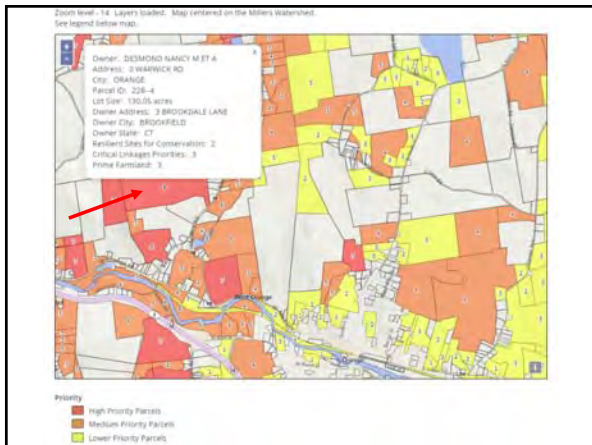
Critical Linkages Priorities

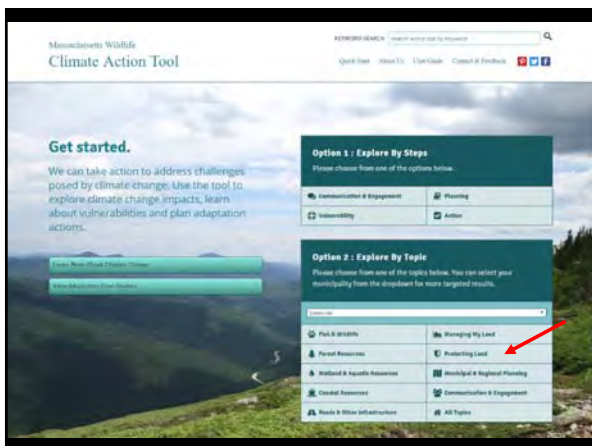
- BioMap2 Core Habitat
 - BioMap2 Priority Natural Communities
 - BioMap2 Forest Cores
 - BioMap2 Vernal Pool Cores
 - BioMap2 Wetland Cores
 - BioMap2 Aquatic Cores
- BioMap2 Species of Conservation Concern
- BioMap2 Critical Natural Landscape
 - BioMap2 Landscape Blocks
 - BioMap2 Coastal Adaptation
- Prime Farmland
- Surface Water Protection Zones
- Wellhead Protection Areas
- Parcel Size

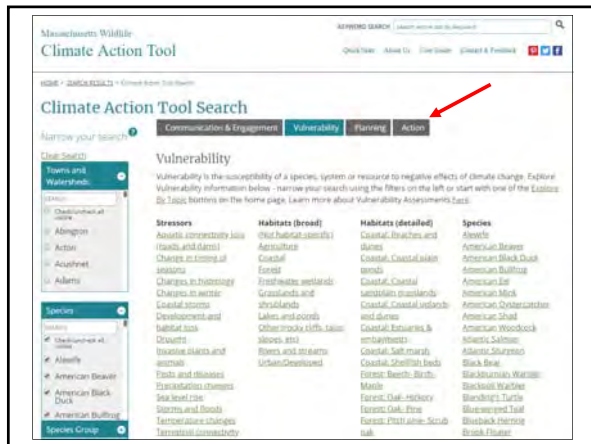
Assign Model Values

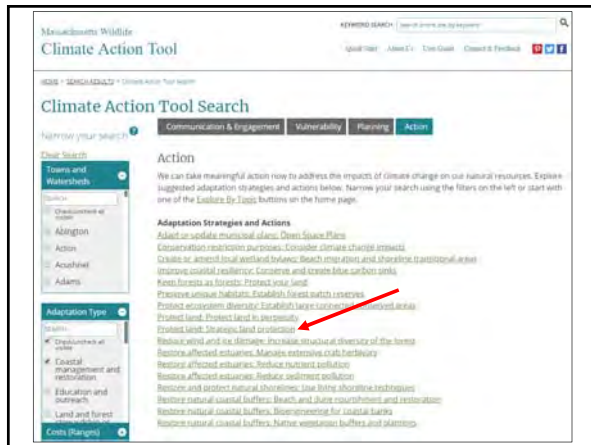
- Resilient Sites for Conservation
- Critical Linkages Priorities
- BioMap2 Core Habitat
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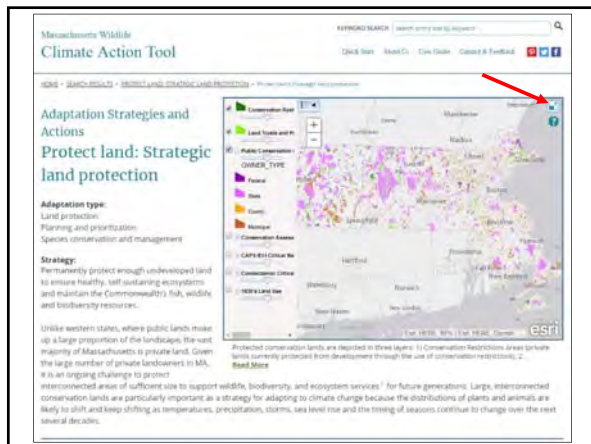


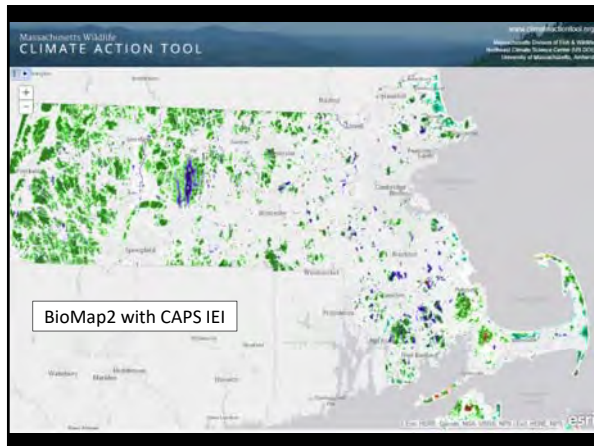


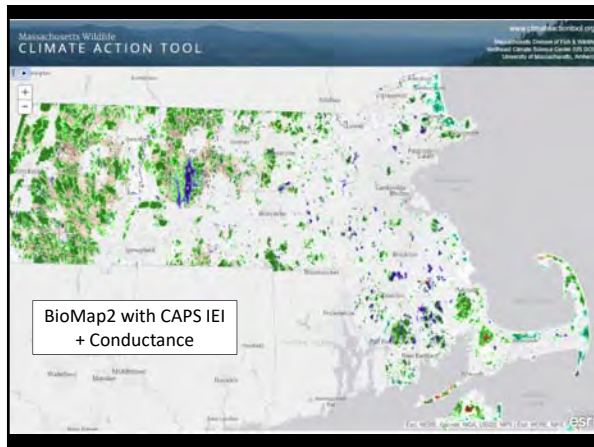


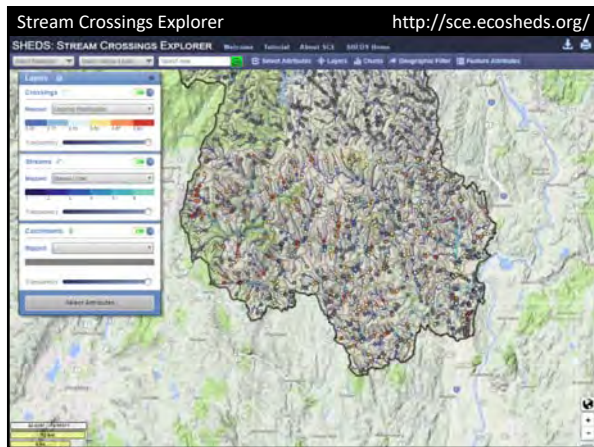


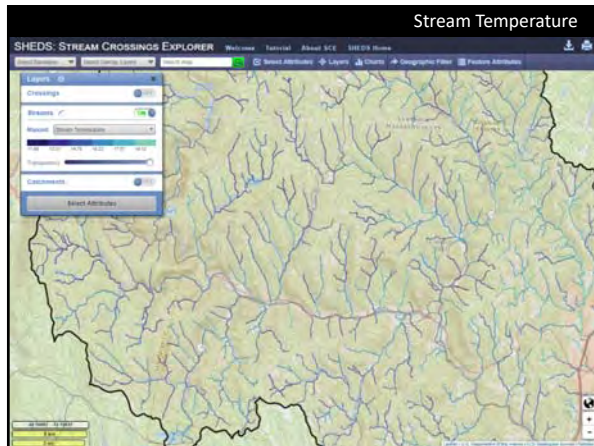


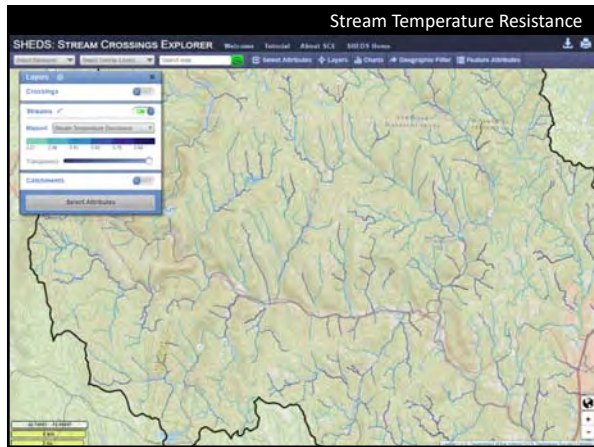


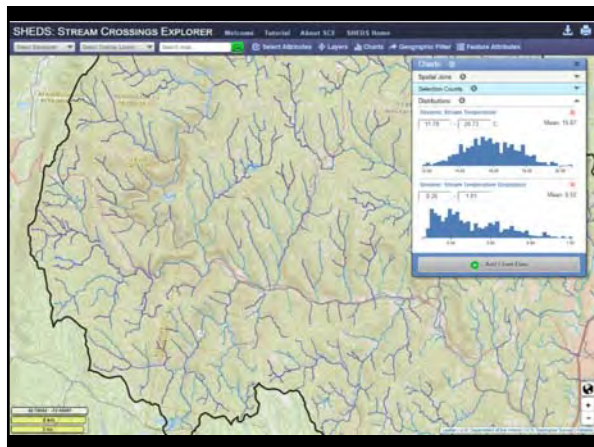


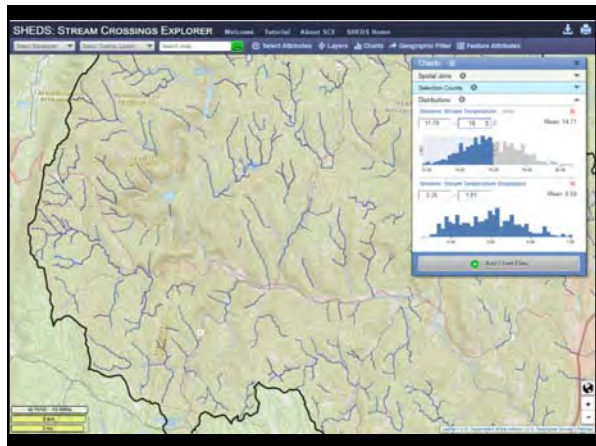


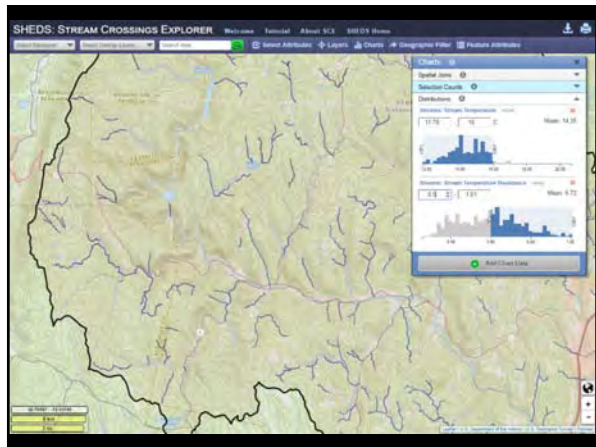


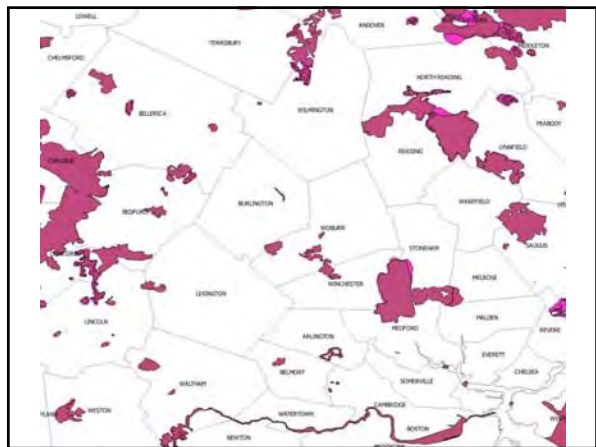


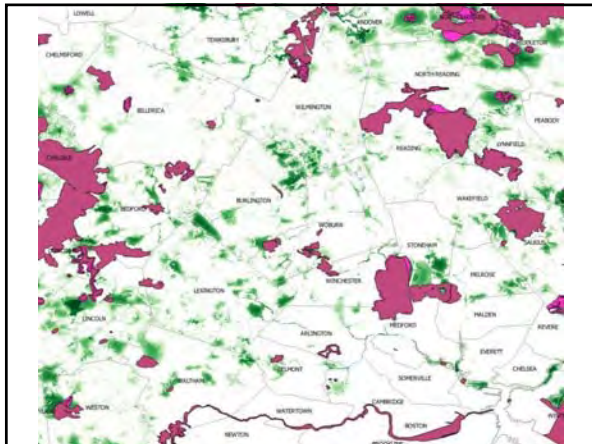













**PROTECTING BIODIVERSITY
IN A CHANGING CLIMATE**



TUESDAY, JUNE 12, 2018
9:30AM - 4:00PM
BISHAM HILL COMMUNITY FARM
37 WHEELER ROAD, GRAFTON, MA
COST: \$20
LUNCH WILL BE PROVIDED

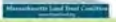


Are you looking to...

- Build climate resilience into your priorities?
- Learn where plants & animals can adapt in a changing climate?
- Gain experience with online mapping tools to help prepare for changes?

Then this workshop is for you!
Bring one of your real life challenges to discuss.
Please RSVP by June 6th to kcampbell@massland.org

Presenters and Facilitators:

Emily Watkinson, Land Trust Alliance	Allison Weinberg, Open Space Institute
Andy Finley, The Nature Conservancy	Stephanie Cowley, Mass Audubon
Jessica Distach, The Nature Conservancy	Sarah Wicks, Mount Grace Land Conservation Trust

Program sponsored by Massachusetts Land Trust Coalition, Land Trust Alliance, The Nature Conservancy and Open Space Institute
 Contact: Kate Campbell, Outreach Coordinator, Massachusetts Land Trust Coalition
kcampbell@massland.org, 918-843-2291
