Maps to Help You Protect and Manage Lands: The Revised Wildlife Action Plan Maps

**Emily Preston,
Wildlife Biologist**

**Katie Callahan,
GIS specialist**

What is the Wildlife Action Plan?

Restore rare wildlife and habitats.   Keep common species common.

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2015 Revision: Species and Habitats

169 Species

Current status and threats were assessed for each one.

See Appendices A and B.

27 Habitats

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2015 Revision: Partners in Conservation Science
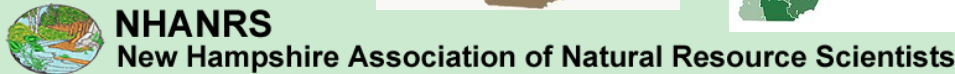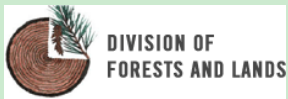
2015 Revision: Public Participation

Engagement Sessions

- 166 Participants

- 79 Communities

Online Survey

- 1,142 respondents

Public Comment Period

- 123 comments

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2015 Revision: Action!

There are actions for everyone to do

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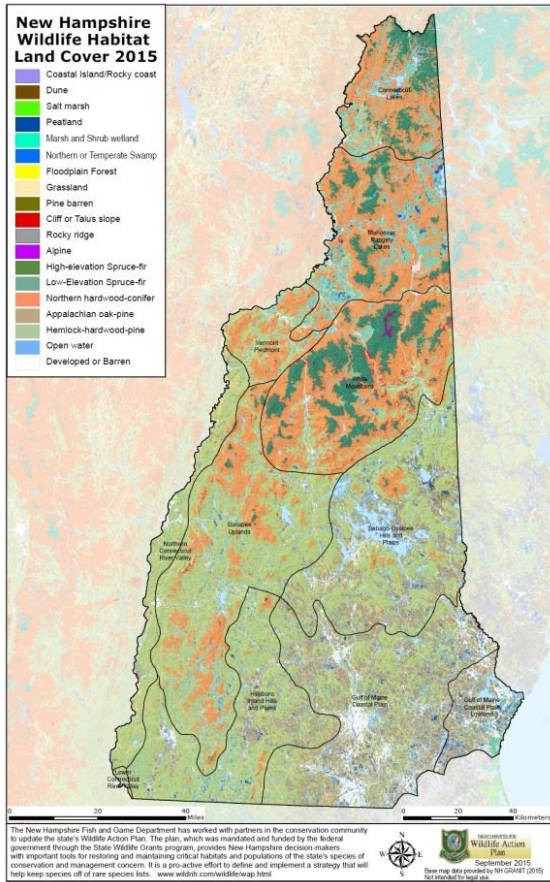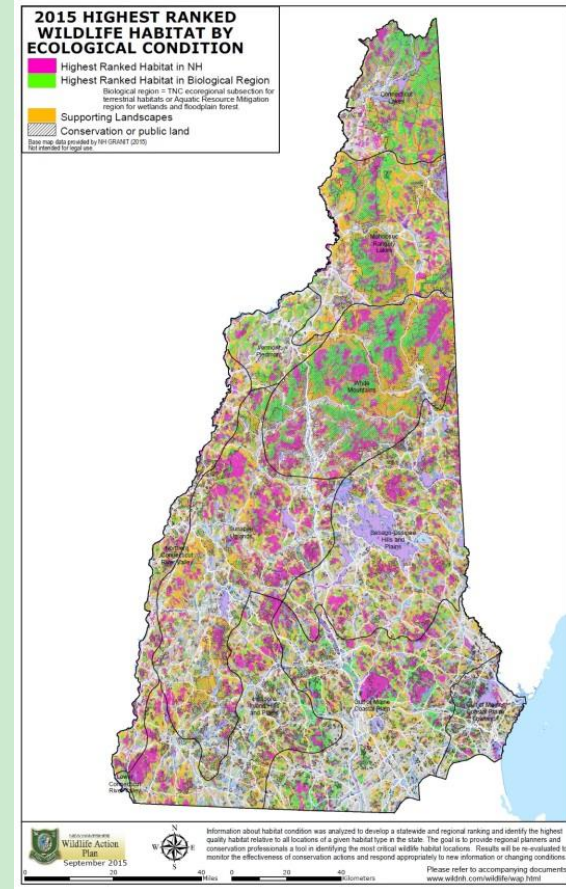FISH and GAME
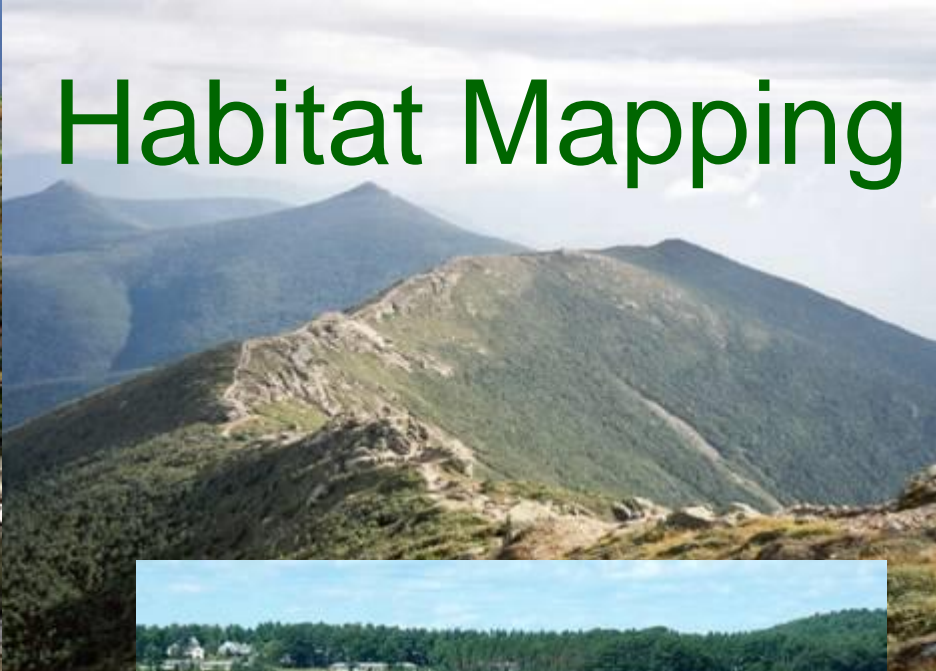
Wildlife Action Plan Maps

Wildlife Habitat Land Cover

Highest Ranked Wildlife Habitat by Ecological Condition

Habitat Mapping

2005
Potential

2015
Existing
Condition

Northeastern Terrestrial Habitat Classification System (TNC, 2015)

A flexible framework for characterizing wildlife habitat that works on two levels

1. **Habitat systems**
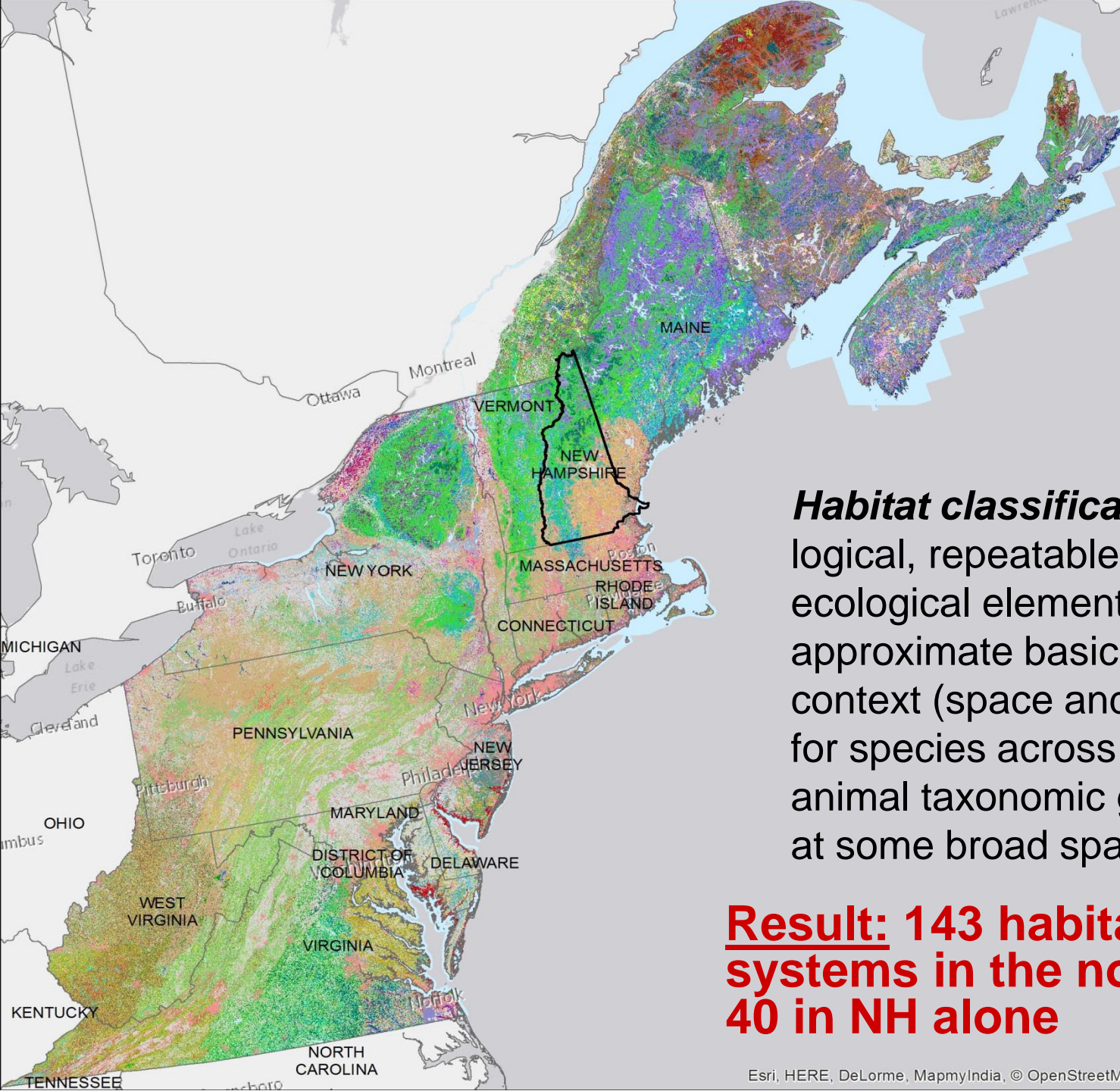2. **Structural modifiers**

Habitat system correspond to the *ecological system* units developed by NatureServe, with additional systems for altered habitats and land use types.

Result: 143 habitat systems in the northeast, 40 in NH alone

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Northeast Terrestrial Habitat (NETH)
TNC 2015

Habitat classification is the logical, repeatable grouping of ecological elements that approximate basic cover and context (space and surroundings) for species across a range of animal taxonomic groups, usually at some broad spatial scale.
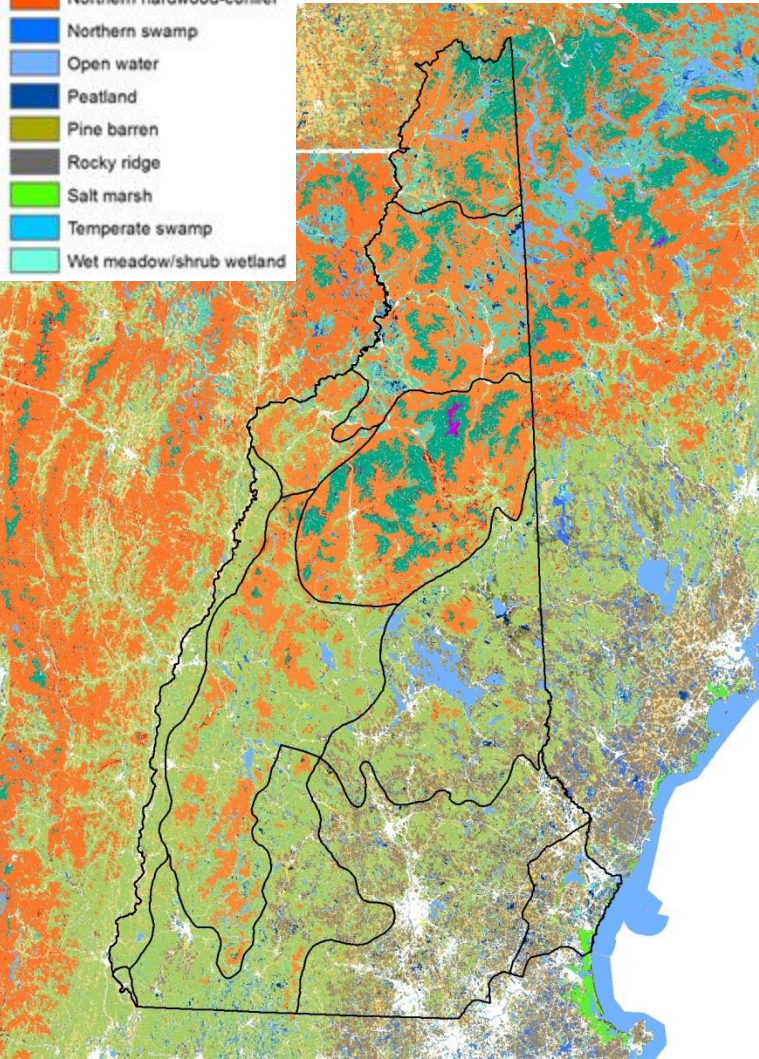
Result: 143 habitat systems in the northeast, 40 in NH alone

Crosswalk TNC Terrestrial habitat to NH WAP habitat

WAP_HAB
- Alpine
- Appalachian oak-pine
- Cliff and Talus
- Coastal island
- Dune
- Floodplain forest
- Grassland
- Hemlock-hardwood-pine
- High-elevation spruce-fir
- Lowland spruce-fir
- Northern hardwood-conifer
- Northern swamp
- Open water
- Peatland
- Pine barren
- Rocky ridge
- Salt marsh
- Temperate swamp
- Wet meadow/shrub wetland

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NATURAL HERITAGE BUREAU

TNC HABITAT	NH WAP
Open Water (NLCD-NHD open water)	Open Water
Atlantic Coastal Plain Beach and Dune	Dune
North Atlantic Coastal Plain Maritime Forest	Appalachian oak-pine
North Atlantic Coastal Plain Hardwood Forest	Appalachian oak-pine
North Atlantic Coastal Plain Tidal Salt Marsh	Salt marsh
Acadian Sub-boreal Spruce Flat	Lowland spruce-fir
Acadian-Appalachian Montane Spruce-Fir-Hardwood Forest	High-elevation spruce-fir
Acadian-Appalachian Alpine Tundra	Alpine
Acidic Cliff and Talus	Cliff and Talus
Calcareous Cliff and Talus	Cliff and Talus
Acidic Rocky Outcrop	Rocky ridge
Calcareous Rocky Outcrop	Rocky ridge
Acadian-North Atlantic Rocky Coast	Coastal island
Boreal-Laurentian-Acadian Acidic Basin Fen	Peatland
Laurentian-Acadian Alkaline Fen	Peatland
Laurentian-Acadian Large River Floodplain	Floodplain forest
Northeastern Interior Pine Barrens	Pine barren
Central Appalachian Dry Oak-Pine Forest	Appalachian oak-pine
Central Appalachian Pine-Oak Rocky Woodland	Rocky ridge
Acidic Cliff and Talus	Cliff and Talus
Central Appalachian Alkaline Glade and Woodland	Rocky ridge

27 Key Habitat Types

Forest
High Elevation Spruce-Fir Forest
Low Elevation Spruce-Fir Forest
Northern Hardwood-Conifer Forest
Hemlock-Hardwood-Pine Forest
Appalachian Oak-Pine Forest

Other Terrestrial Habitats
Pine Barrens
Grasslands
Shrublands ← Not mapped, but potential NLCD or LANDFIRE source
Alpine
Rocky Ridge, Cliff, and Talus
Cave Mines and Other Subterranean
Mapped, but sensitive habitat, Not distributed

Freshwater Wetland
Floodplain Forests
Vernal Pools ← Not mapped VT model using LiDAR?
Northern Swamps
Temperate Swamps
Peatlands
Marsh and Shrub Wetlands

Freshwater Aquatic
Large Warmwater Rivers
Warmwater Rivers and Streams
Coldwater Rivers and Streams
Warmwater Lakes and Ponds
Lakes and Pond with Coldwater Habitat

Coastal: Salt Marsh, Dunes, Coastal Islands, Estuarine, Marine

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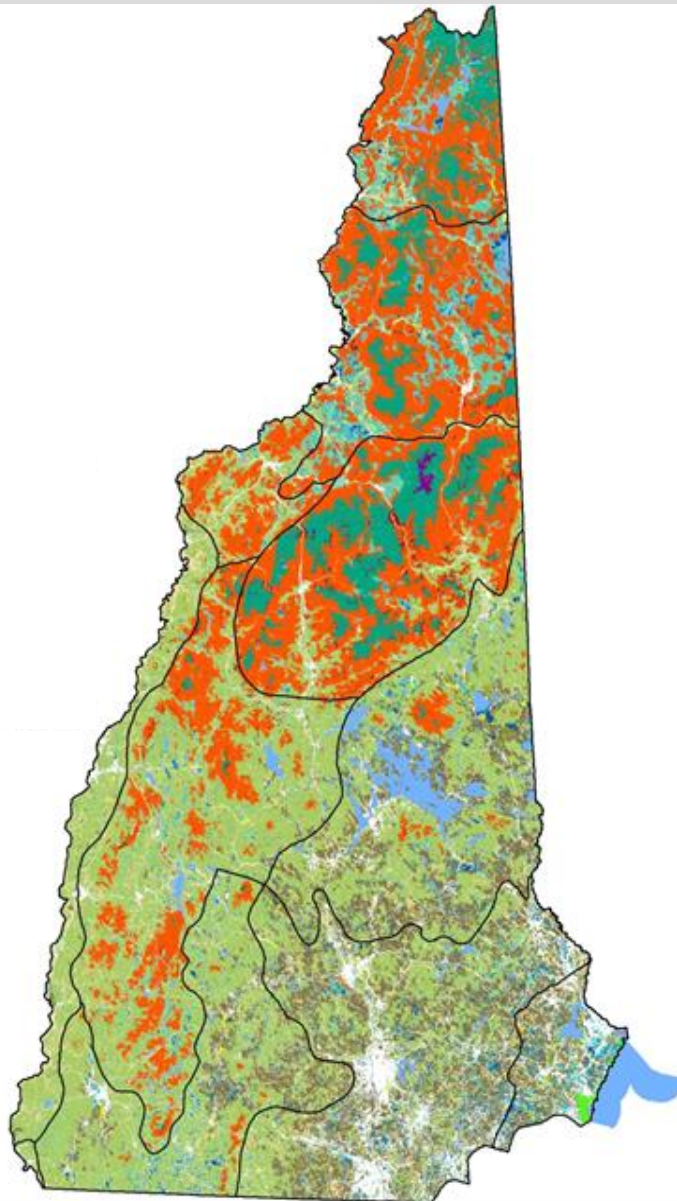Cooperative Extension

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Terrestrial Habitat Modifications

1. Add NWI updates in coastal and northern regions
2. Use 2005 Peatlands
3. Add SLAMM Salt Marsh
4. Add 2005 Dunes
5. Add 2005 Coastal islands
6. Incorporate large river swamps into floodplains
7. Add TNC pine barrens

Wildlife Habitat Land Cover 2015
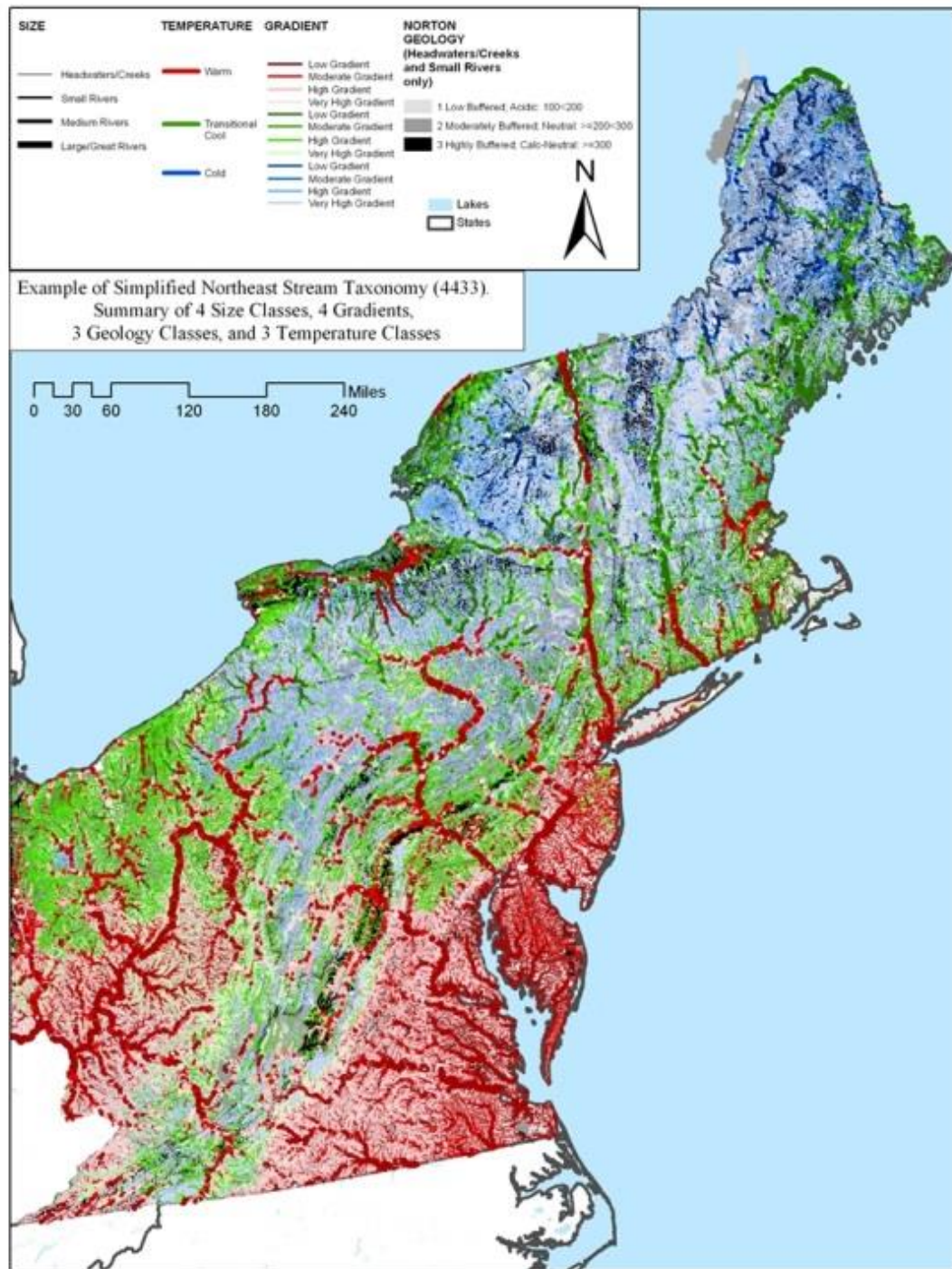
- Alpine
- Appalachian oak-pine
- Cliff and Talus
- Coastal island
- Dune
- Floodplain forest
- Grassland
- Hemlock-hardwood-pine
- High-elevation spruce-fir
- Lowland spruce-fir
- Northern hardwood-conifer
- Northern swamp
- Open water
- Peatland
- Pine barren
- Rocky ridge
- Salt marsh
- Temperate swamp
- Wet meadow/shrub wetland

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Terrestrial Wildlife Habitat

NEW HAMPSHIRE WILDLIFE HABITAT LAND COVER 2015

- Coastal Island/Rocky coast
- Dune
- Salt marsh
- Peatland
- Marsh and Shrub wetland
- Northern or Temperate Swamp
- Floodplain Forest
- Grassland
- Pine barren
- Cliff or Talus slope
- Rocky ridge
- Alpine
- High-elevation Spruce-fir
- Low-elevation Spruce-fir
- Northern hardwood-conifer
- Appalachian oak-pine
- Hemlock-hardwood-pine
- Open Water
- Developed or Barren (NLCD)
- Conservation or public land

TA

Freshwater Aquatic Habitat

Northeastern Aquatic Habitat Classification System

TNC: Eastern Div. new data coming end of 2015

Example of Simplified Northeast Stream Taxonomy (4433). Summary of 4 Size Classes, 4 Gradients, 3 Geology Classes, and 3 Temperature Classes

Preliminary Stream and River Classification (TNC 100k → NH 24k)

Stream Size

NAHCS Size Class	Description	Definition (upstream drainage area in sq.mi.)
1a	Headwaters	0<3.861
1b	Creeks	>=3.861<38.61
2	Small Rivers	>= 38.61<200
3a	Medium Tributary Rivers	>=200<1000
3b	Medium Mainstem Rivers	>=1000<3861
4	Large Rivers	>=3861<9653
5	Great Rivers	>=9653

Temperature

Temperature Classes	Name	Guidance for Threshold Between the Classes	Total Length in region (km)
1	cold	proportion of coldwater species likely >50%, proportion of habitat with temperatures supporting cold water species year round likely >50%	172973
2	transitional cool	increasing proportion of cool and warm species relative to coldwater species, decreasing proportion of habitat with temperatures supporting coldwater species year round	144945
3	transitional warm	increasing dominance of warm species relative to cool species, decreasing proportion of habitat with temperatures supporting cool species, unlikely to support resident coldwater species, (some cold water species may be able to temporarily pass through thi	102175
4	warm	proportion of warmwater species >75%, decreasing proportion of habitat supporting cool species, unlikely to support any resident cold water species, summer temperatures limit ability of cold water species to traverse through habitat	31243

Gradient

Gradient Class	Description	Definition (slope of the flow line (m/m) * 100	Total Length in region (km)
1	Very Low Gradient	<0.02 %	514
2	Low Gradient	>= 0.02 < 0.1%	212
3	Moderate-Low Gradient	>= 0.1 < 0.5 %	804
4	Moderate-High Gradient	>=0.5 < 2 %	1515
5	High Gradient	>=2 < 5 %	1030
6	Very High Gradient	>5%	436

Geology - buffering

Geology Class	Description	Definition (index based on total upstream geology)	Lengh Length in region (km)
1	Acidic, Low Buffered	100-174	103949
2	Neutral, Moderately Buffered	175-324	301751
3	Calc-Neutral, Highly Buffered	325-400	18992
0	Size 3, 4, 5 rivers, Assume Neutral	any	26570

NH Customization

Used a coldwater model created by NH Department of Environmental Services and NHFG fish species occurrence data to reclassify temperatures more suitable for our northern location.

Predicated Coldwater Fish Indicator Species Presence in New Hampshire Wadeable Streams

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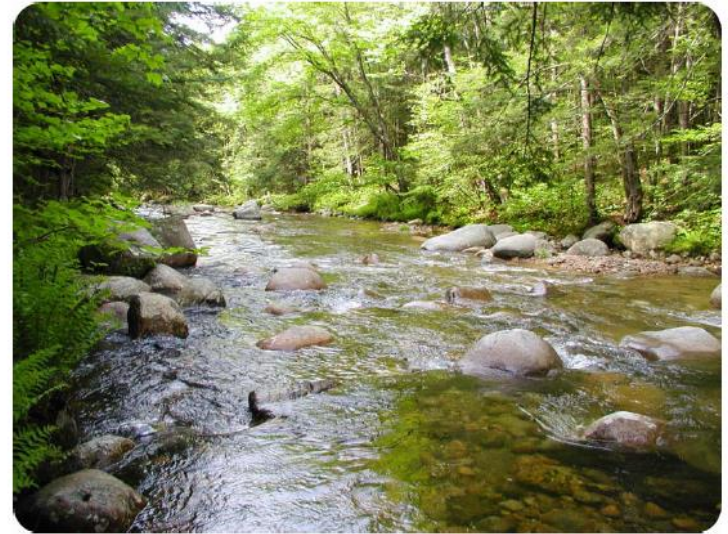
Preliminary Pond and Lake Classification (TNC 100k → NH 24k)

Table 12: Pond and Lake Size Classes

Size Class	Acres	Description	# in the 13 state region
1	<10 acres	ponds	19744
2	10-99 acres	small lakes	12951
3	100-999 acres	medium lakes	2227
4	1000-9999 acres	large lakes	310
5	10,000 acres +	very large lakes	31

NHFG cold water classification of lakes/ponds:
1. Lake Trout pond
2. Holdover EBT pond
3. Potential naturally reproducing EBT pond
4. Remote pond
5. Pond above 1900 ft elevation

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Habitat Mapping

Terrestrial

Freshwater

Wildlife Habitat Land Cover 2015

- Alpine
- Appalachian oak-pine
- Cliff and Talus
- Coastal island
- Dune
- Floodplain forest
- Grassland
- Hemlock-hardwood-pine
- High-elevation spruce-fir
- Lowland spruce-fir
- Northern hardwood-conifer
- Northern swamp
- Open water
- Peatland
- Pine barren
- Rocky ridge
- Salt marsh
- Temperate swamp
- Wet meadow/shrub wetland
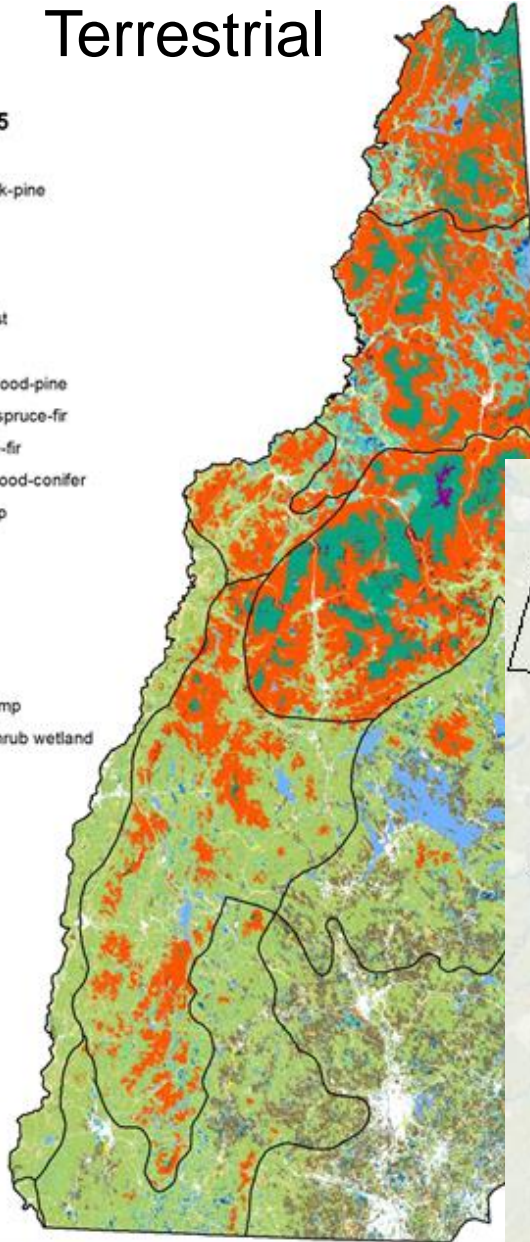
- Coldwater Lake
- Coldwater Pond
- Warm/cool Lake
- Warm/cool Pond
- Coldwater River or Stream
- Large Warmwater River
- Warm/cool River or Stream
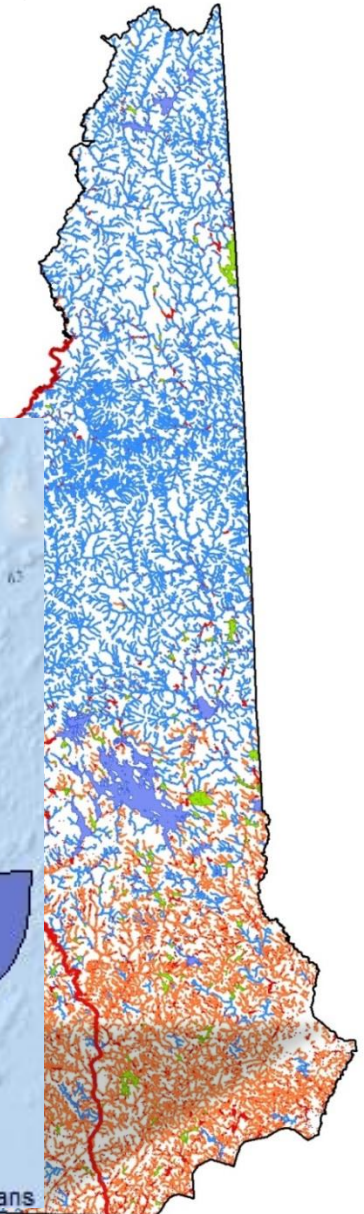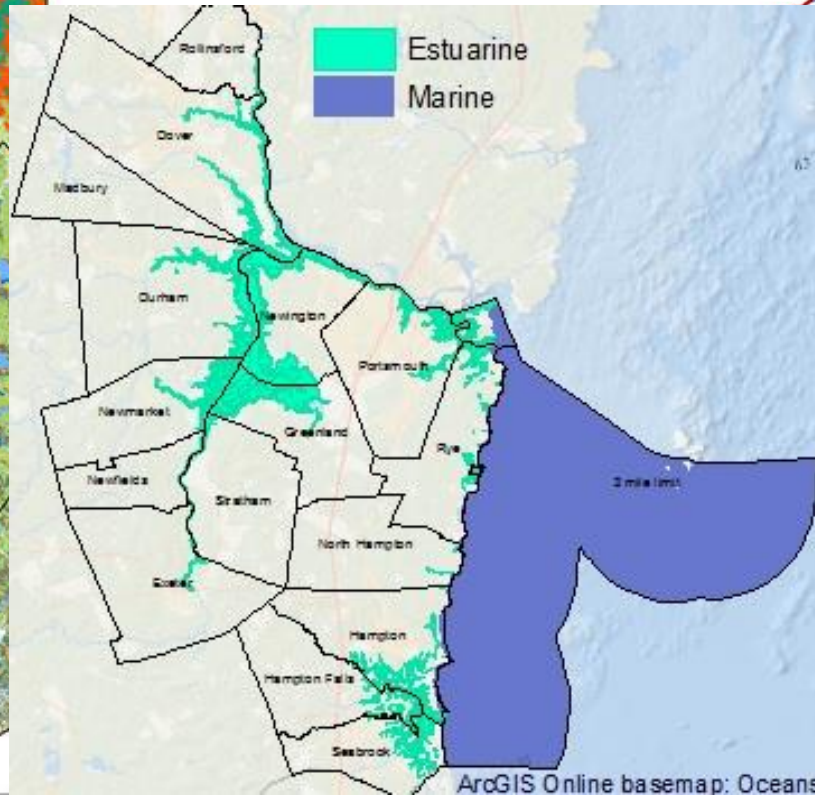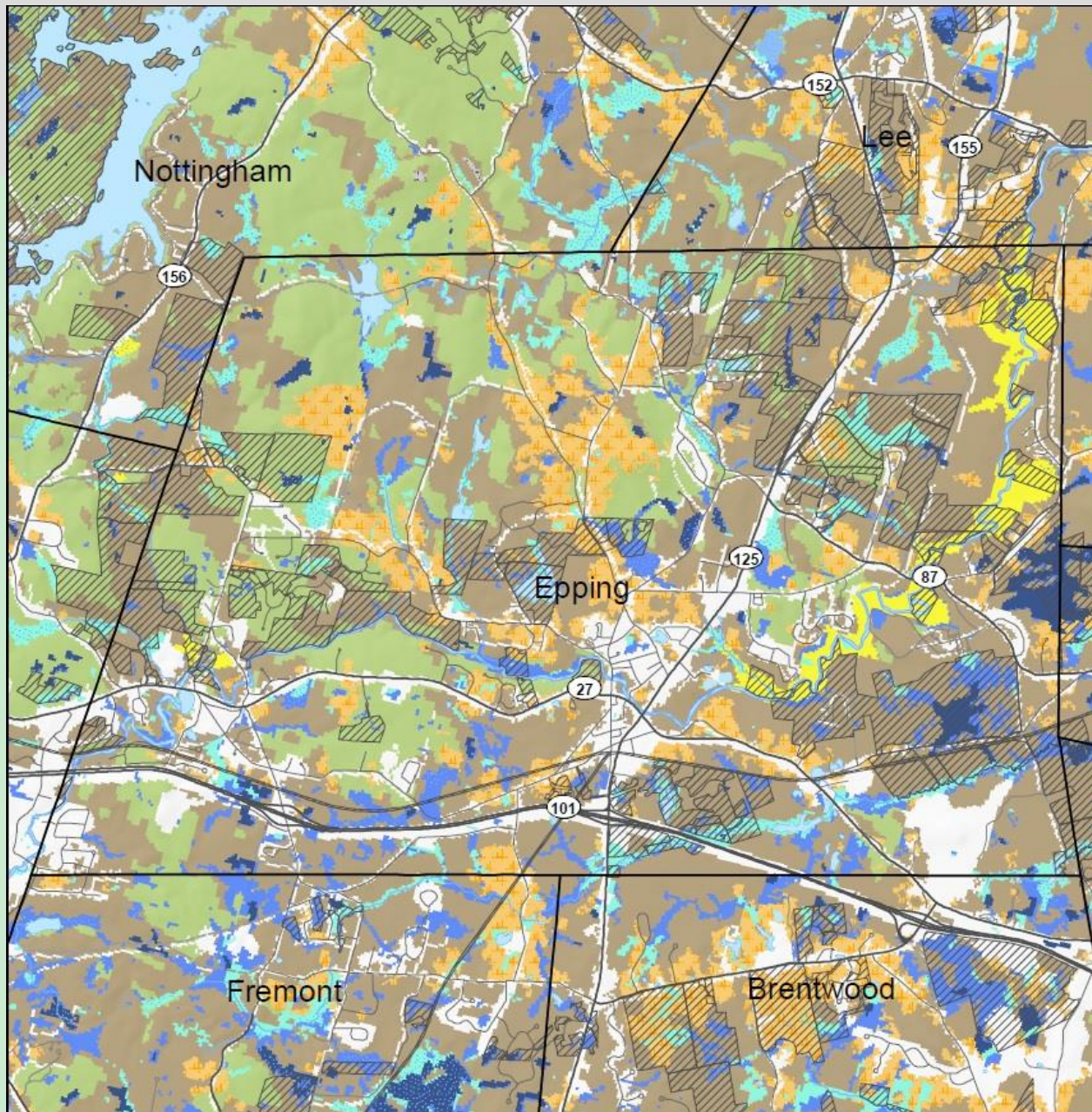
- Estuarine
- Marine

ArcGIS Online basemap: Oceans

NEW HAMPSHIRE WILDLIFE HABITAT LAND COVER 2015

- Coastal Island/Rocky coast
- Dune
- Salt marsh
- Peatland
- Marsh and Shrub wetland
- Northern or Temperate Swamp
- Floodplain Forest
- Grassland
- Pine barren
- Cliff or Talus slope
- Rocky ridge
- Alpine
- High-elevation Spruce-fir
- Low-elevation Spruce-fir
- Northern hardwood-conifer
- Appalachian oak-pine
- Hemlock-hardwood-pine
- Open Water
- Developed or Barren (NLCD)
- Conservation or public land

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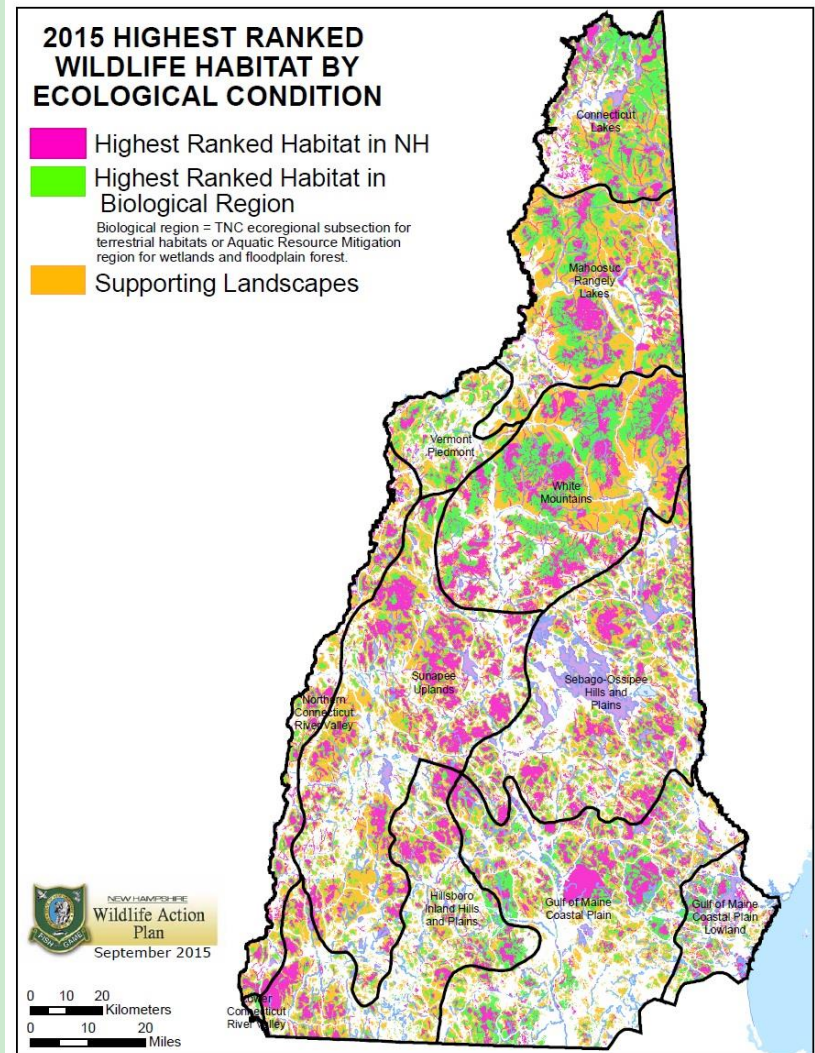FISH and GAME
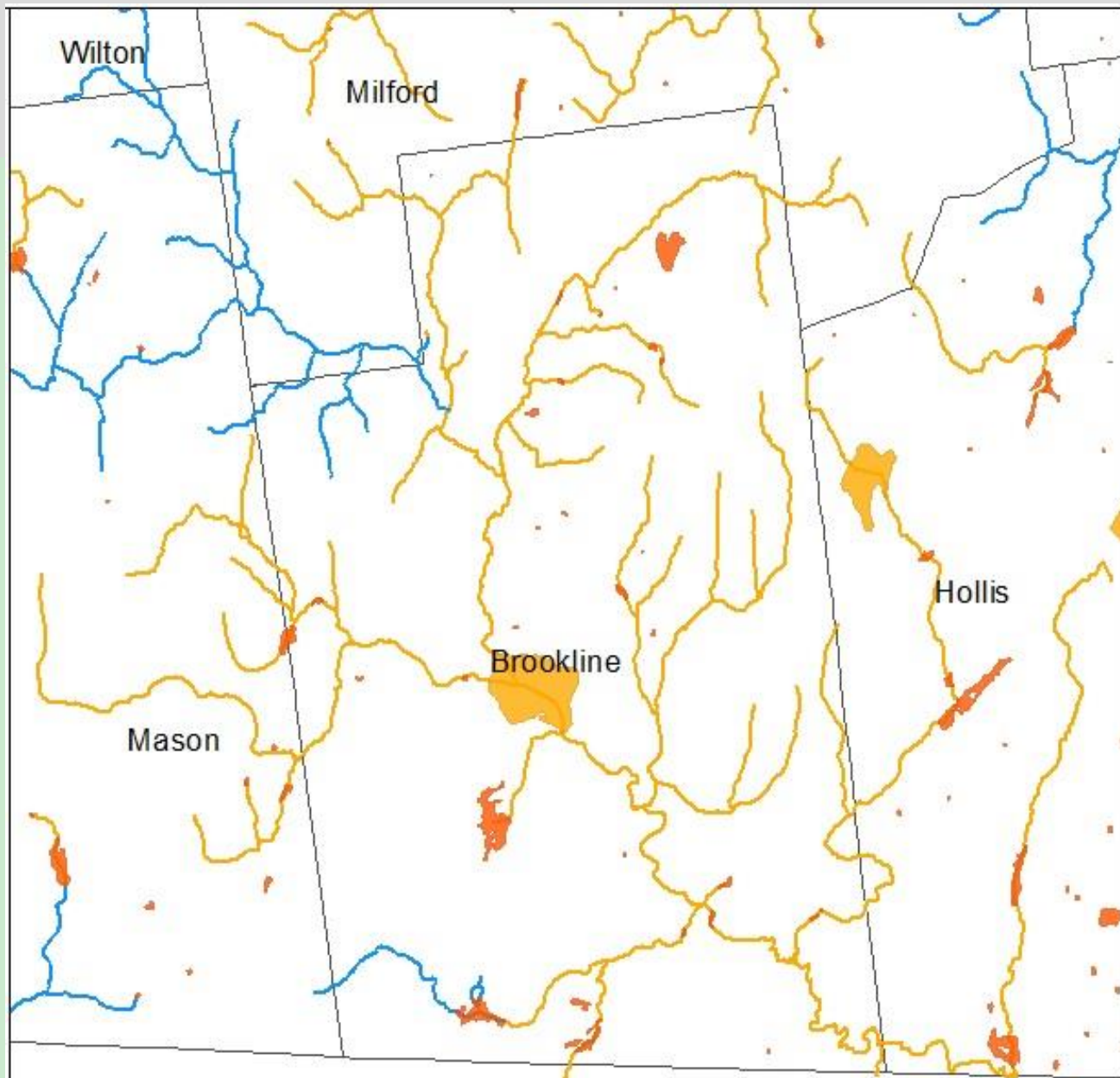
NEW HAMPSHIRE AQUATIC HABITAT

- Coldwater river or stream
- Warm/cool river or stream
- Large warmwater river
- Coldwater Lake
- Coldwater Pond
- Warm/cool Lake
- Warm/cool Pond
- Estuarine
- Marine

Wilton
Milford
Hollis
Brookline
Mason

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Habitat Condition Analysis

Changes are due to

- Different underlying habitat layer

- More data on rare wildlife occurrences

- Use of better condition data

2015 HIGHEST RANKED WILDLIFE HABITAT BY ECOLOGICAL CONDITION

- Highest Ranked Habitat in NH
- Highest Ranked Habitat in Biological Region
  Biological region = TNC ecoregional subsection for terrestrial habitats or Aquatic Resource Mitigation region for wetlands and floodplain forest.
- Supporting Landscapes

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Habitat Condition

Biological Diversity

Landscape Integrity

Minimum Human Impact

COND = (BIO + LAND + HUMAN) / 3

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What is a Biological Region?
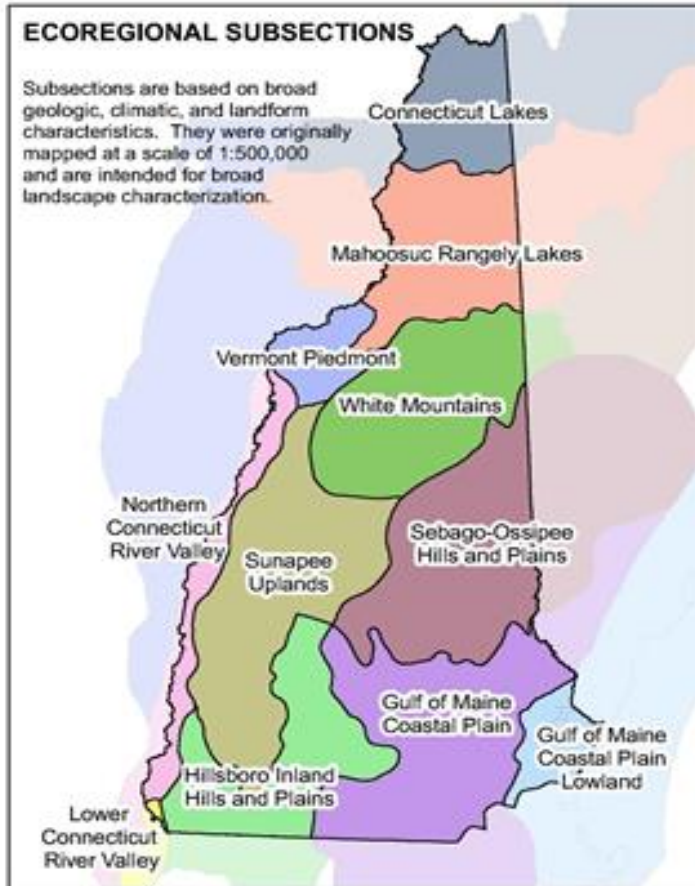
Matrix forest and small/patch habitats
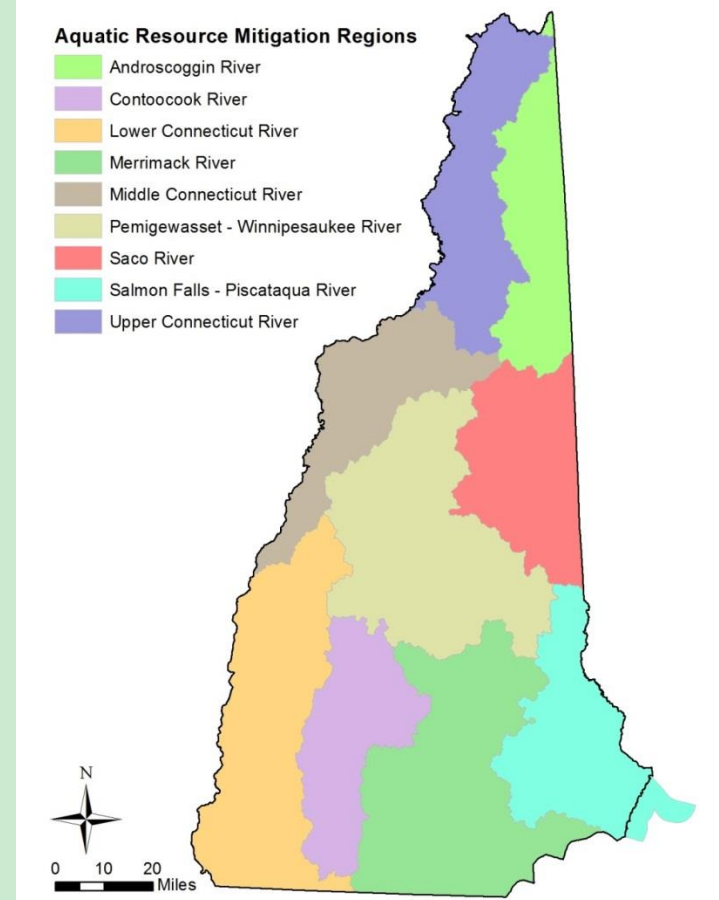
Wetlands and floodplain forest

BIO Biological Diversity

Species richness of rare animals within polygon

Species richness of rare animals within their dispersal distances from the polygon

Species richness of rare plants in polygon

Richness of rare and exemplary natural communities in polygon

Vertebrate species richness (VT/NH GAP Analysis)

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Regional Geospatial Condition

Shared Metrics
Securement
Local connectedness
Landscape context index
Predicted loss to
development

Terrestrial
Stand age
Patch size
Landscape complexity
Core area

Freshwater
Impervious surface
Riparian landcover
Dam types and density
Risk of flow alteration
Network size
Road stream crossings
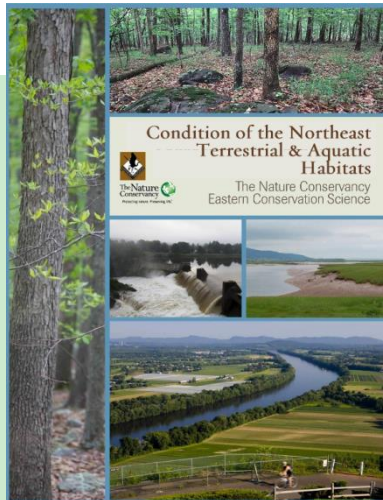
Data is available for other analyses at a northeast regional scale or any smaller scale.

www.conservationgateway.org

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LAND Landscape Integrity

Area (size of patch in hectares)

Local Connectedness (TNC)

Landscape Complexity (TNC)

Similarity

Unfragmented block size

Number of wetlands in complex
Largest wetland in the complex
Vegetative richness (# dominant NWI veg classes)

Local Connectedness (TNC 2013)

An estimate of the degree of permeability surrounding each cell in the region.

TNC summarized this metric into a habitat connectedness index, as **a measure of landscape structure**: the hardness of barriers, the connectedness of natural land cover, and the arrangement of land uses. A simplified land cover map, aggregated to a 90m cell size, was assigned resistance weights, lowest weight to natural land cover and highest weight to developed land. Roads were overlaid and added 10 points of resistance.

A resistant kernel algorithm was applied (introduced by Compton et al. 2007)

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Local Connectedness (TNC 2013)

Land cover and Roads

A = Highly Constrained

B = Constrained

C = Somewhat Connected

D = Most Connected.

All cells at once = local connectedness

Value

High Connectvity

Low Connectivity

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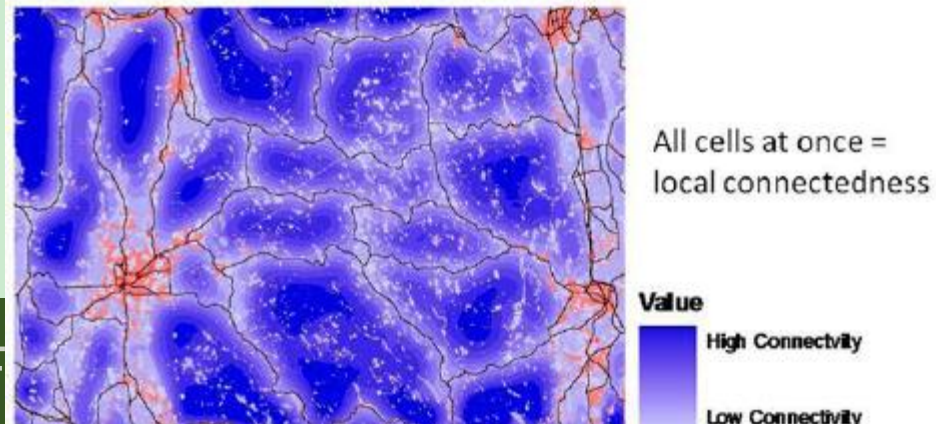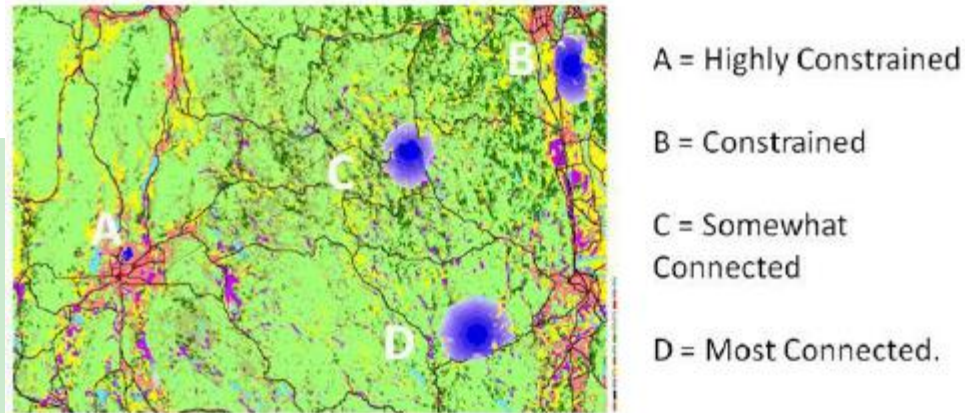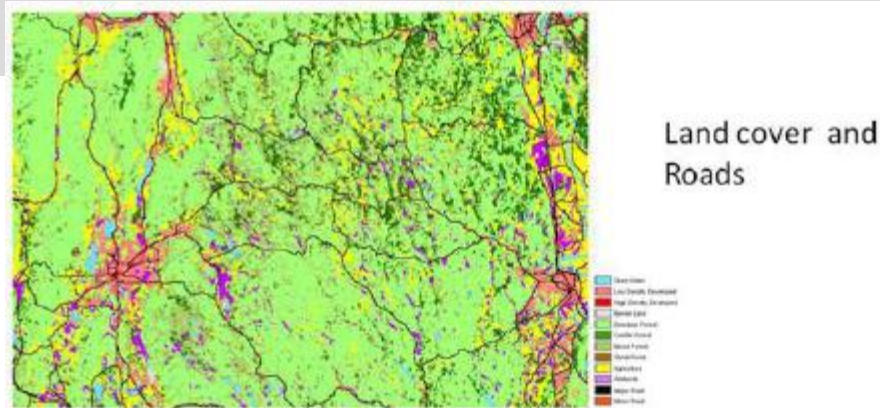
Local Connectedness (TNC 2013)
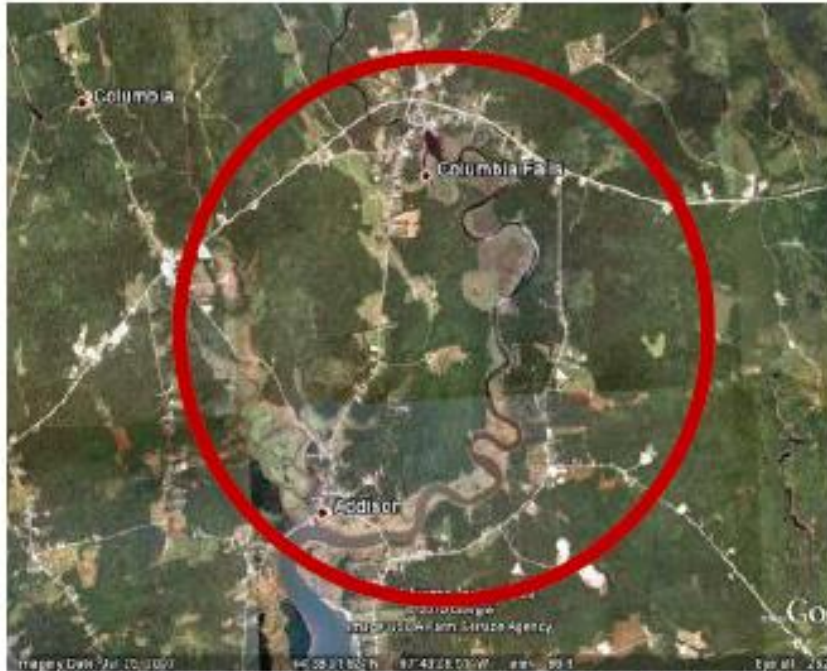
Area under the circle has an average score of:

23   **43**

A pristine area would score 100

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Local connectedness

- 0 - 15 (Low Local Connectedness)
- 15 - 30
- 30 - 50
- 50 - 75
- 75 - 100 (High Local Connectedness)

— — — International boundary

········· State and province boundary

ArcGIS Online Shaded Relief map. ESRI 2011.
Map Produced by TNC Eastern Division 2011.

0 20 40   80   120   160
Kilometers

0   20   40   80   120   160
Miles

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Landscape Complexity (TNC 2013)

An estimate of the number of micro-climates in a 100 acre area surrounding each cell of habitat, based on variety of landforms, the elevation range, and the density of wetlands. The variety of landforms was the factor most directly related to the number of microclimates based on the current literature, and twice the weight was given to this factor in the combined score:

Landscape Complexity=
Flats (2*LV + 1* ER + 1 WD)/4) + Slopes (2*LV + 1* ER/3)

Where LV = landform variety, ER = elevation range, and WD = wetland density.

Landscape Complexity (TNC 2013)

Fig. 2: Landforms in Pawtuckaway State Park, NH

Flats:

A		Sideslope N-facing
B		Slope crest
C		Cliff
D		Cove slope S-facing
E		Hill (gentle slope)
F		Valley/toe slope
G		Wet flats
		Dry flats
H		Cove; bottom of steep slope
I		Flat summit/ridgetop
J		Sideslope S-facing
K		Cove; bottom of steep slope
		Cove slope N-facing
L		Steep slope
M		Slope crest
N		Cove slope S-facing
O		Valley/toe slope
P		Hilltop (flat)
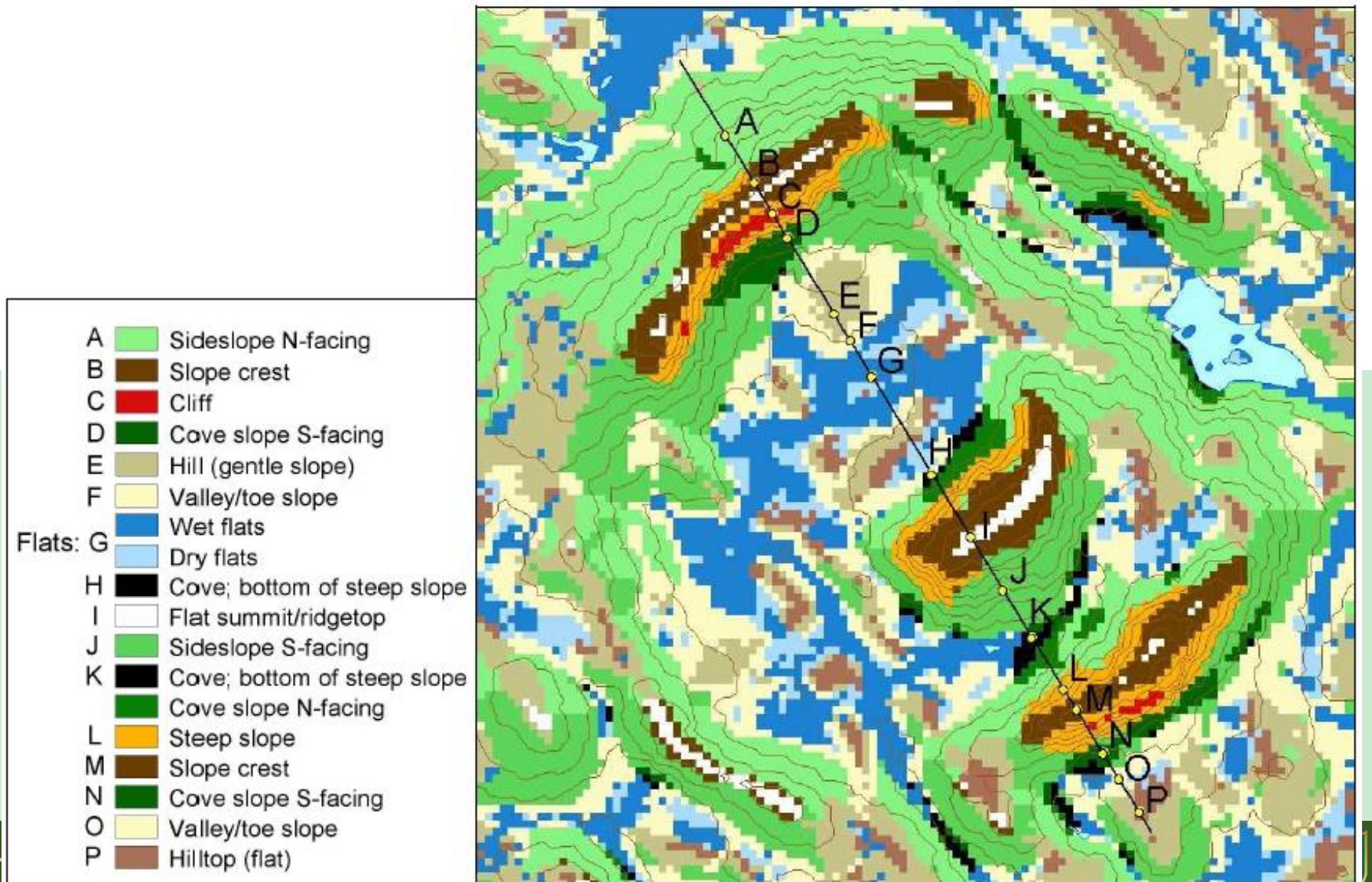
HUMAN Human Impacts

Index of Ecological Integrity (UMass)

Road density, distance to nearest road/trail

EAME (UMass Eastern Meadowlark Landscape Capability)

Ecological Integrity scores (NHDES wetland assessment)
    water quality degradation
    human activity

Percent of drainage area that is impounded
Distance to nearest dam

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Index of Ecological Integrity (UMass 2015)

The ability of an area to sustain ecological functions over the long term.

An ecosystem-based assessment of ecological integrity, which is a measurement of relative **intactness** (the freedom from human impairment or anthropogenic stressors), and **resiliency** to environmental change (the capacity to recover from or adapt to disturbance and stress). The IEI is a composite of 19 different landscape metrics, and has been scaled to reflect relative ecological integrity within New Hampshire.

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Index of Ecological Integrity (UMass 2015)

Habitat loss

Watershed habitat loss

Traffic

Mowing & Plowing

Edges (microclimate altered)

Salt application (watershed)

Sediment (road class)

Nutrients (land use class)

Cats (domestic predators)

Edge predators

Badplants (non-native, invasive)

Worms (non-native earthworms)

Imperviousness (watershed)

Dam intensity (watershed)

Similarity (of neighbor cells)

Connectedness (surrounding cells)

Aquatic connectedness

Sea rise (USGS Woods Hole)

Climate alteration

Index of Ecological Integrity (UMass 2015)
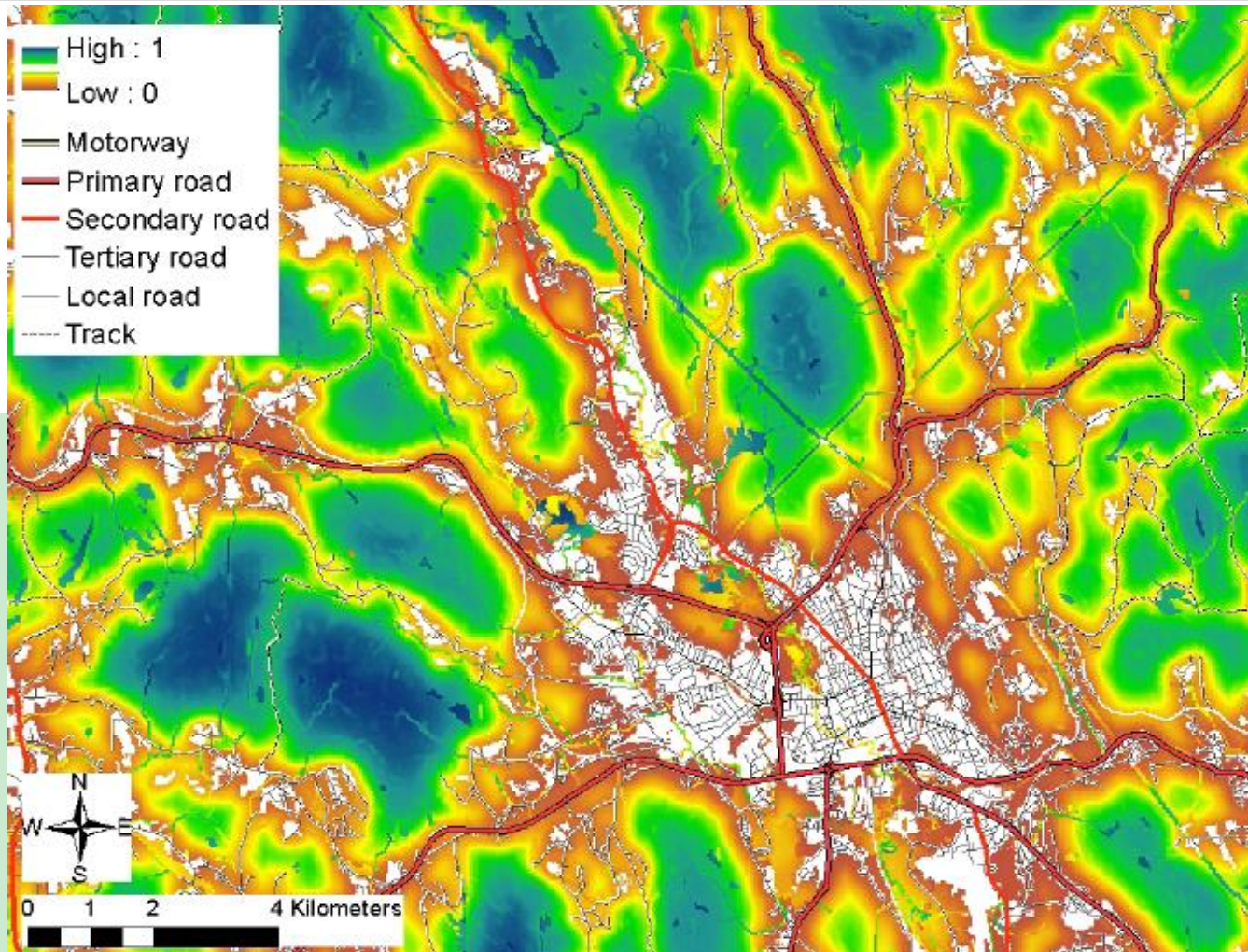
Habitat Condition - Aquatic

High Quality Streams and Rivers were identified by The Nature Conservancy and based on four attributes:

1.) linear connectivity (length of functional stream network)

2.) low riparian development and agriculture (100m)

3.) no active dams, and upstream dam water storage less than 10% of mean annual flow

4.) low impervious surfaces (less than 2%).

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Habitat Condition - Aquatic

Top-ranked Lakes and Ponds were also assessed by NHF&G for four attributes (based on TNC 2005 parameters):

1.) Local condition (200 meter shoreline buffer): percent natural land cover, no dams, distance to nearest road or trail

2.) Watershed condition (HUC12): intactness based on percent natural cover

3.) Index of Ecological Integrity (UMass)

4.) Size of the water body

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Highest Ranked Wildlife Habitat By Relative Ecological Condition

Condition score

+

Rare element occurrences

Tier 1 = top 15% in NH

Tier 2 = top 30% in biological region

Tier 3 = top 50% in biological region

With exceptions
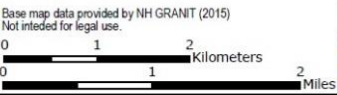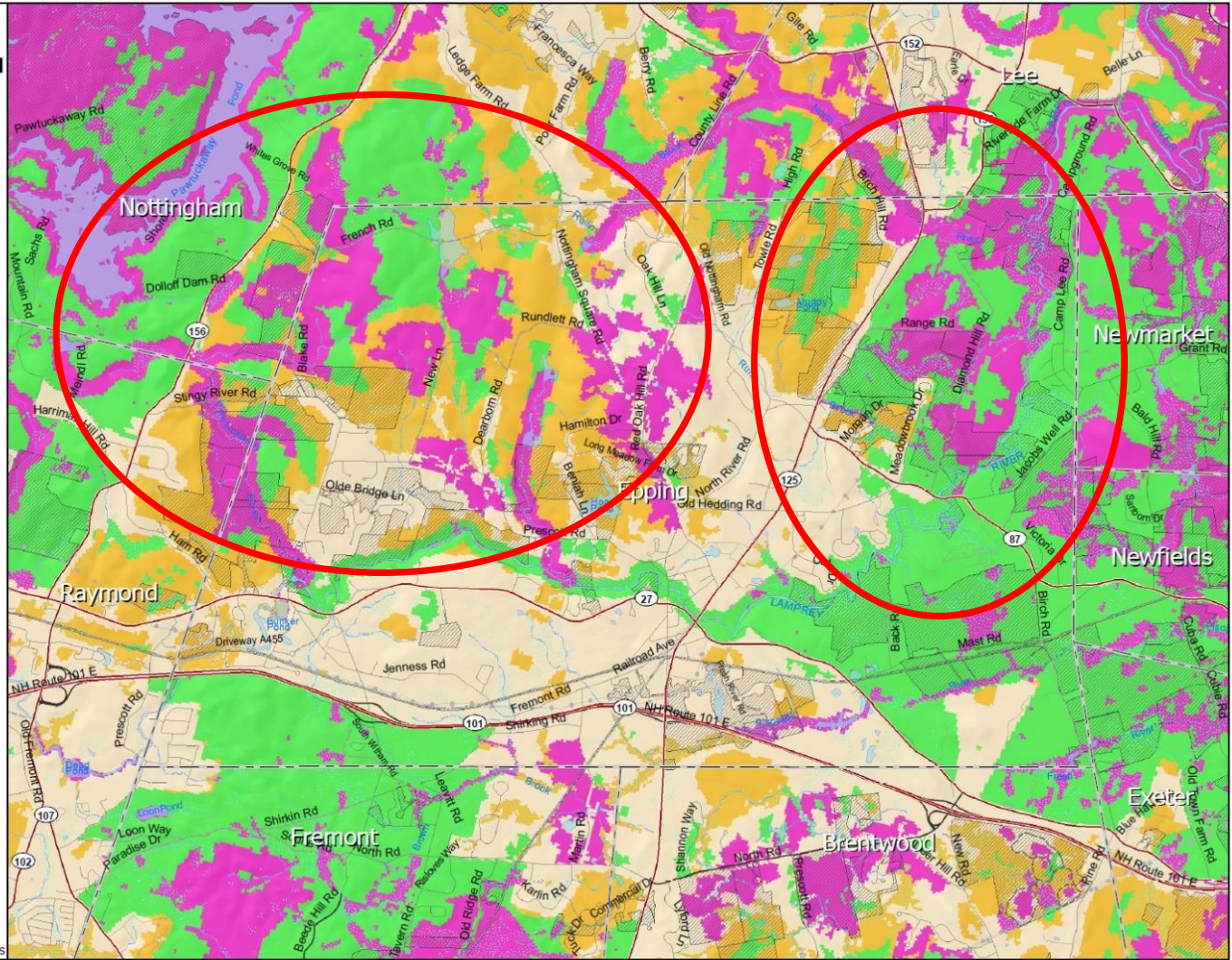

2015 HIGHEST RANKED WILDLIFE HABITAT BY ECOLOGICAL CONDITION

Highest Ranked Habitat in NH

Highest Ranked Habitat in Biological Region
Biological region = TNC ecoregional subsection for terrestrial habitats or Aquatic Resource Mitigation region for wetlands and floodplain forest.

Supporting Landscapes

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What attributes come with the habitat land cover?

It is a raster dataset including:

- Attributes produced in the regional dataset

- Crosswalk to NH Wildlife Action plan habitats

Coastal Island/Rocky coast
Dune
Salt marsh
Peatland
Marsh and Shrub wetland
Northern or Temperate Swamp
Floodplain Forest
Grassland
Pine barren
Cliff or Talus slope
Rocky ridge
Alpine
High-elevation Spruce-fir
Low-elevation Spruce-fir
Northern hardwood-conifer
Appalachian oak-pine
Hemlock-hardwood-pine
Open Water
Developed or Barren (NLCD)

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What attributes come with the Condition Analysis (WAPTiers)?

- Habitat type
- Tier for each habitat type
- Whether there was an add-in, but not which kind

NOTE: You cannot find exactly what made a spot highest ranked as it is a **combination of all these factors** unless it is just an add-in.

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Wildlife Habitat Condition

State

Biological Region

Identify	
Identify from:	<Top-most layer>

Location: 1,970,007.460 2,582,953.112 Meters
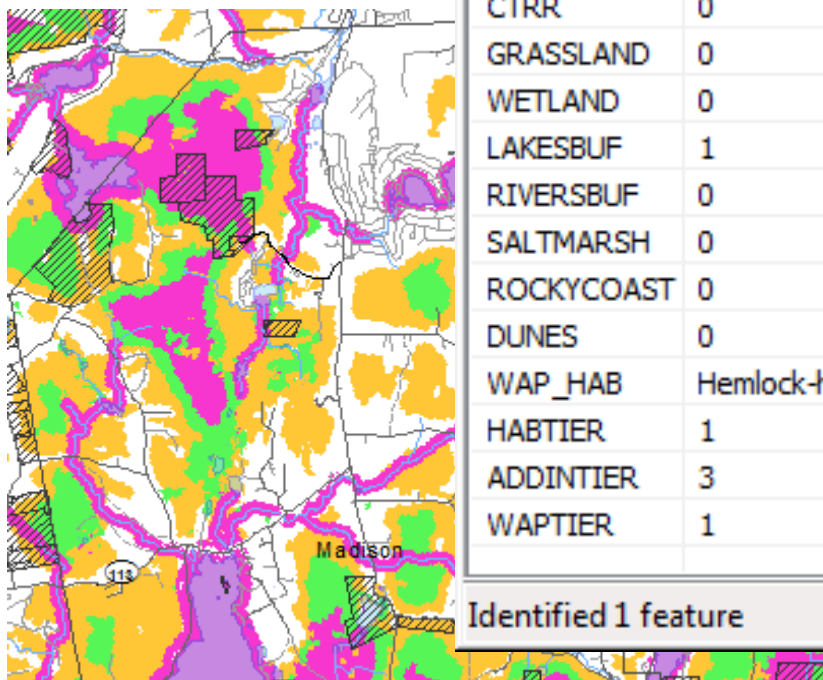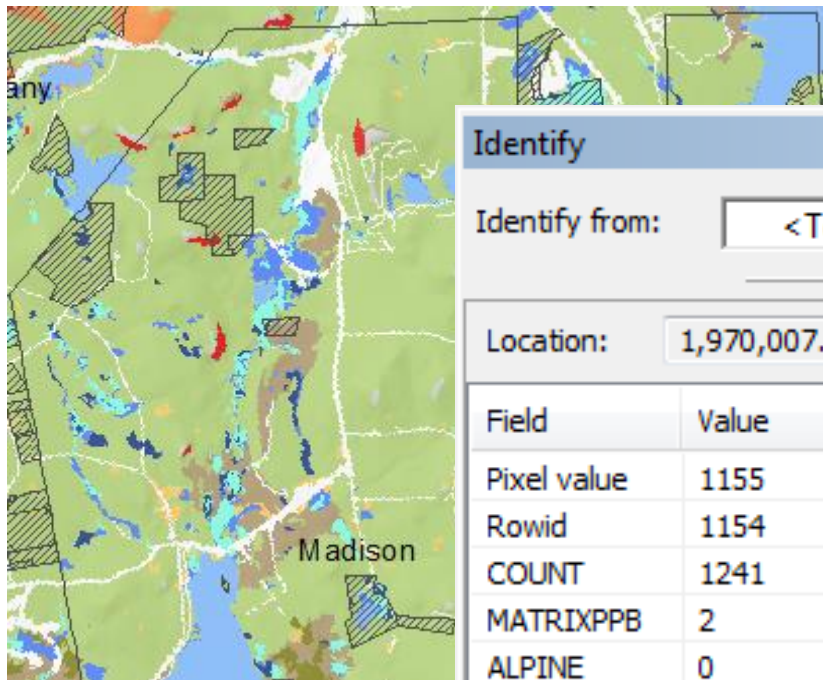
Field	Value	
Pixel value	1155	
Rowid	1154	
COUNT	1241	
MATRIXPPB	2	
ALPINE	0	
CTRR	0	
GRASSLAND	0	
WETLAND	0	
LAKESBUF	1	
RIVERSBUF	0	
SALTMARSH	0	
ROCKYCOAST	0	
DUNES	0	
WAP_HAB	Hemlock-hardwood-pine	
HABTIER	1	
ADDINTIER	3	
WAPTIER	1	

Identified 1 feature

Miles
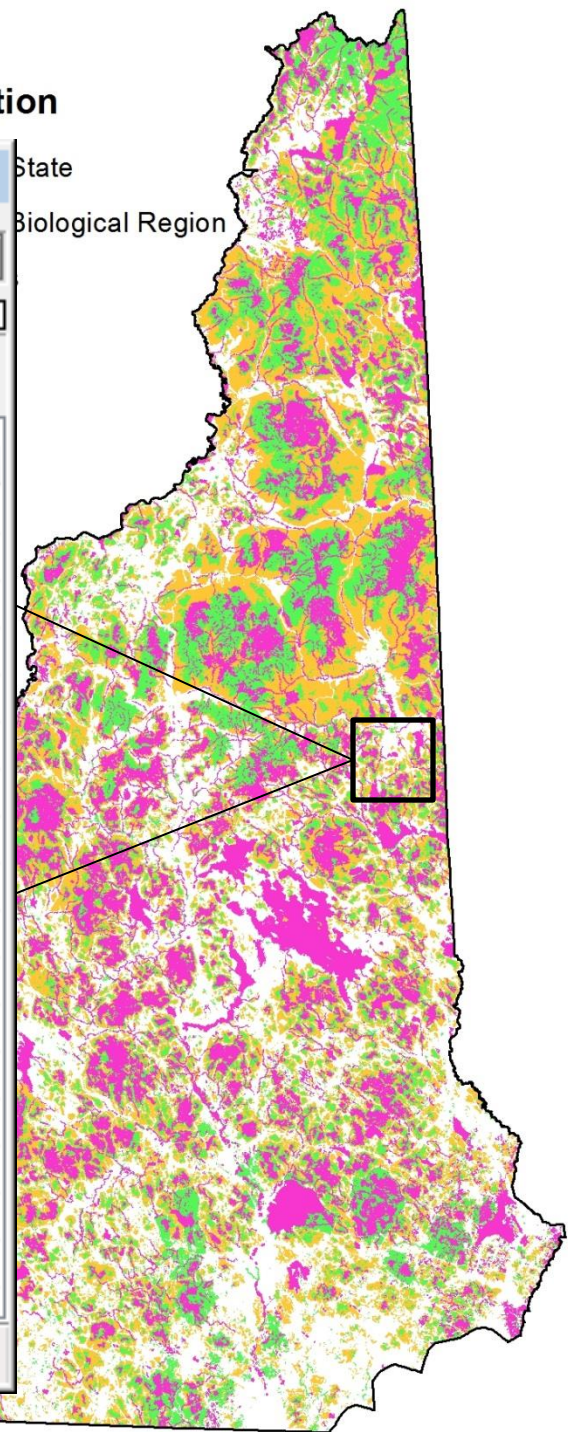
Action!

Landowners

Communities

Land Trusts

NHACC

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Cooperative Extension

FISH and GAME

Action!

Make Habitat Happen

Action!

- How are habitats arranged on your land?

- What are the potential wildlife species?

- How would you manage for these habitats and/or species?

➢ **Next step – go out and look at what is there**
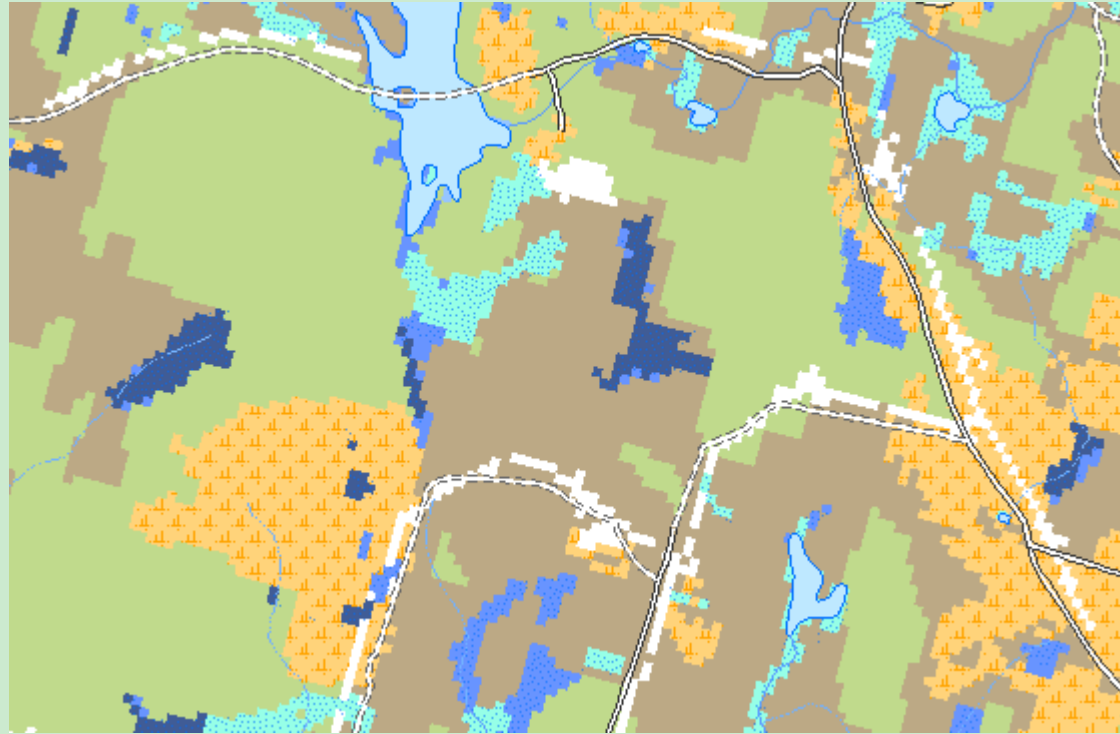
takingactionforwildlife.org

Good Forestry in the Granite State
http://extension.unh.edu/goodforestry

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Plan for Wildlife

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New Hampshire WILDLIFE HABITAT LAND COVER 2015

Action!

2015 HIGHEST RANKED WILDLIFE HABITAT BY ECOLOGICAL CONDITION

Action!

Know Your Wildlife

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Explore Outdoors and Educate Others

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Consider Conservation

NH LAND TRUSTS
GEOGRAPHIC COVERAGE

Resources

Resources

Resources

Entire Wildlife Action Plan (PDF)
Descriptions of habitat mapping

More to come: pages on species, habitats, risks and actions!

www.wildnh.com/wildlife/wap.html

GIS Data available on GRANIT and GRANITView II

For more information on regional datasets:

www.conservationgateway.org

www.umass.edu/landeco

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