

WILDLIFE ACTION PLAN MAP ANALYSIS INFORMATION
New Hampshire Fish and Game Department: April 2020

Contents:

DETERMINING ECOLOGICAL CONDITION 2

 Overview..... 2

 Regional Datasets Used 2

 Analysis for Surface Waters 3

 Forests..... 3

 Wetlands and Floodplain Forests..... 4

RANKING HABITATS 4

ATTRIBUTES USED IN CONDITION FILTERS FOR SPECIFIC HABITATS..... 5

 Alpine..... 5

 Appalachian Oak Pine Forest – See Matrix Forests 5

 Coastal Habitats: Coastal Islands/Rocky Shore, Dunes, Salt Marsh 5

 Rocky Ridge, Cliff and Talus Slopes..... 6

 Floodplain Forest 6

 Grasslands 6

 Marsh and Shrub Wetlands and Peatlands..... 7

 Northern Swamps and Temperate Swamps 7

 Matrix Forest and Pine Barrens 8

 High Elevation Spruce Forest – See Matrix Forests..... 8

 Hemlock Hardwood Pine Forest – See Matrix Forests..... 8

 Lowland Spruce Forest – See Matrix Forests..... 8

 Northern Hardwood Conifer Forest – See Matrix Forests..... 8

 Pine Barrens – See Matrix Forests..... 8

 Rivers and Streams 9

Condition assessment completed by The Nature Conservancy..... 9

RANKING LEVELS FOR EACH HABITAT TYPE AND ADD-INS..... 9

OCCURRENCES USED TO ELEVATE HABITAT RANK..... 10

 Selected Rare Wildlife 10

 Top-Ranked Forest Blocks 12

 Selected Rare Plants and Natural Communities 12

DATA SOURCES FOR CONDITION ANALYSIS..... 12

DETERMINING ECOLOGICAL CONDITION

Overview

The ecological condition of habitats depends on a variety of factors, some of which can be assessed in GIS. Other elements of ecological condition must be determined through field work. This analysis used data available at a statewide level to assess the ecological condition of each of the mapped habitats in NH. The current assessment is the third iteration and uses several new datasets, including new underlying habitat land cover data.

Habitat condition was analyzed to develop statewide and regional rankings that identify the highest condition habitat relative to all polygons of a given habitat type in the state. The goal is to provide regional planners and conservation professionals with a tool to help identify the most ecologically intact wildlife habitat areas.

Using habitat types mapped in the NH Wildlife Habitat Land Cover dataset, plus streams, rivers, lakes and ponds, NHFG biologists developed condition filters to analyze which habitat patches are in the best relative ecological condition in the state. These filters are composed of GIS data that indicate to what degree a particular patch of habitat has good biological diversity (particularly in terms of rare species), is connected to other similar patches in the landscape, and is negatively impacted by humans. All data used was available as a statewide dataset, except some coastal data which covered the entirety of the specific coastal habitat. Some data is used in all habitat filters, and some is specific to a particular habitat type. Each filter includes biological, landscape, and human impact factors. These three types of data are combined into BIO, LAND and HUMAN scores and are shown in the attribute fields.

Each habitat type has different factors that may affect its condition, but there are some commonalities. Biological factors included rare species richness for animals, plants and exemplary natural communities. Landscape factors include area of habitat patch, local connectedness (TNC), landscape context (TNC), and other factors depending on the habitat type. Human impacts include data such as road density, and an Index of Ecological Integrity (UMass). Pages 3-8 outline the data used for each habitat type; the metadata for each habitat layer provide additional details. Examples of data types that were not used for all habitats included such things as vertebrate species richness for BIO, number of wetlands in each complex for LAND, and trails, impoundments or distance to nearest road for HUMAN. See details for each habitat below and in the metadata.

A set of available statewide data was collected for each of these three groups, with each individual score being on a 1-100 scale (percent rank). The BIO, LAND, and HUMAN scores were evenly weighted and combined come up with a single condition score (COND). This is a relative score, based on all habitats that occur in NH. Habitat patches were assessed as polygons except the five matrix forest types, which were assessed in raster format (see below).

Regional Datasets Used

Several datasets were brought together to create a regional analysis of habitat condition for the northeast, with information compiled in a report and associated dataset called Condition of the Northeast Territorial and Aquatic Habitats (Anderson et al 2013) that was created by the Nature

Conservancy under a funding by the Northeast Association of Fish and Wildlife Agencies Regional Conservation Needs Program and the North Atlantic Landscape Conservation Cooperative. Some of the data also created under funding by these sources, were authored by other entities such as the University of Massachusetts-Amherst (UMass). The report provides much more detail. Please see references at the end of this document.

LOCAL CONNECTEDNESS: Degree of permeability surrounding each cell which is a measure of landscape structure. This is actually measured conversely, as a degree of resistance. Cells are scored into 6 basic land cover classes: natural, barren, agricultural, low intensity development, high intensity development (includes medium intensity) with weighted resistance for each. Minor roads added more resistance. A resistant kernel algorithm was applied within a 3 km window.

LANDSCAPE COMPLEXITY: Estimate of number of microclimates in 100 acre circular area around each 30m cell. Data included variety of landforms (combinations of slope, land position, aspect and moisture into 11 features), range of elevations in the 100 acres, and wetland density (added only in flat areas). Landforms were weighted twice as high as elevation or wetlands. Results are relative and scored as standard deviation above or below the mean value for the region.

INDEX OF ECOLOGICAL INTEGRITY: To evaluate edge effects associated with fragmenting features on the landscape, such as the spread of contaminants from roads, noise, invasive plants, and changes in microclimate, UMass developed an Index of Ecological Integrity (IEI). IEI is a weighted linear combination of nineteen landscape metrics which are based on abiotic, biotic and anthropogenic “ecological settings” variables. IEI is a measure of relative intactness (i.e., freedom from human modifications and disturbance) and resiliency to environmental change (e.g., as caused by disturbance and climate change). Ecological integrity is defined as the ability of an area to sustain important ecological functions over the long term.

Analysis for Surface Waters

Surface waters were assessed a little differently than terrestrial habitats. 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,
- 3.) no active dams and upstream dam water storage less than 10% of mean annual flow, and
- 4.) low impervious surfaces (less than 2%).

Top-ranked Lakes and Ponds were also assessed for four attributes:

- 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

Forests

In the NH WAP, a matrix forest is a large contiguous area having the geo-physical conditions favorable to a particular suite of forest land cover classes. The matrix forest relative condition

was determined by evaluating the entire matrix as a seamless raster. This assigns a condition score to each 10 meter pixel in the forest habitat data. Pixels must be clustered into a patch of at least 100 acres to rank as highest in the state or biological region. In this method, only the portion of a forest patch meeting the condition threshold is assigned the highest rank rather than the entire polygon. Small clusters of highest-ranked pixels (less than 100 acres) were assigned Tier 3 Supporting landscapes.

Wetlands and Floodplain Forests

Wetlands were assessed in part as part of wetland complexes. Wetland complexes were created by grouping all freshwater wetlands that occurred within a 250-meter separation distance or less. Polygons from all wetland habitat types (marsh, peatlands, temperate swamps, northern swamps, and floodplain forests) were merged and then buffered by 125 meters to create preliminary groupings. The buffer areas were then split by major routes in the NH Dept. of Transportation road network, so that nearby wetlands occurring on opposite sides of a highway would be assigned to different wetland complexes.

RANKING HABITATS

Within each habitat type, the patches were ranked into one of four categories based on percentage of that habitat by area.

The four rankings are:

Tier 1 Highest Ranked in the State by Ecological Condition

Tier 2 Highest Ranked in the Biological Region by Ecological Condition

Tier 3 Supporting Landscapes

Not top ranked (all the rest)

The percentages of each habitat that are included in each rank are listed in the table on page 9. Coastal and alpine habitats are so rare that all patches are included in Tier 1 highest ranked habitat in the state; however the relative condition of salt marshes is available through the SLAMM model.

Highest Ranked in the State by Ecological Condition compares each habitat type regardless of where in the state it occurs. Since NH is ecologically diverse, habitats were ranked within their ecoregional subsection. Ecoregional subsections reflect broad regional patterns of geomorphology, stratigraphy, geologic origin, topography, regional climate, and dominant associations of potential natural vegetation. The Nature Conservancy has identified 9 ecoregions in New Hampshire. These were used to rank habitats as **Highest Ranked in the Biological Region by Ecological Condition**. Aquatic Resource Mitigation fund regions (based on HUC8 watersheds) defined the biological regions for wetland habitats.

The condition of a habitat patch will deteriorate if the surrounding landscape is degraded. A third ranking, **Supporting Landscapes**, consists of the remainder of the top 50% of each habitat type, and The Nature Conservancy's Resilient and Connected Network (February 2020).

In order to capture occurrences of specialist species with imperiled populations, a select set of wildlife Element Occurrences (areas known to support populations of rare species) from the Natural Heritage Bureau database was used either to elevate underlying habitat polygons to the highest rank in NH or to buffer locations within an already high ranked matrix forest. The same was done for significant ecological features identified by NH Natural Heritage Bureau, elevating them to Tier 2. Both additions are incorporated in the WAPTIERs data layer. A description of the species, plants and natural community add-ins begins on page 10.

Removing Small Isolated Patches:

A filtering process was run in ArcGIS software to remove small (< 1 acre) isolated areas of ranked habitat that were separated from contiguous habitat blocks due roads or development.

For more details on this work, see the metadata for the habitat land cover and waptiers layer.

ATTRIBUTES USED IN CONDITION FILTERS FOR SPECIFIC HABITATS

The following factors were quantified and combined to create a single score for each habitat polygon. These scores were used to rank habitat polygons or sections of forests. Habitats are listed alphabetically.

Alpine

Species richness of rare animals within their dispersal distances from the polygon (2020)

Species richness of rare animals within polygon (2020)

Species richness of rare plants in polygon (2020)

Richness of rare and exemplary natural communities in polygon (2020)

Area (hectares)

Local Connectedness

Landscape Complexity

Index of Ecological Integrity

Density of hiking trails in the unit (km/km²)

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)

LAND (HECTARES_R*.34) + (LC_{NN}_R*.33) + (LCPLX_R*.33)

HUMAN (IEI_R*.50) + (HIKEDENS_R*.50)

COND (BIO+LAND+HUMAN)/3 as defined above

Appalachian Oak Pine Forest – See Matrix Forests

Coastal Habitats: Coastal Islands/Rocky Shore, Dunes, Salt Marsh

Species richness of rare animals within their dispersal distances from the polygon (2020)

Species richness of rare animals within polygon (2020)

Species richness of rare plants in polygon (2020)

Richness of rare and exemplary natural communities in polygon (2020)

Area (hectares)

Local Connectedness

Index of Ecological Integrity

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)
 LAND (HECTARES_R*.5) + (LCONN_R*.5)
 HUMAN (IEI_R)
 COND (BIO+LAND+HUMAN)/3 as defined above

Rocky Ridge, Cliff and Talus Slopes

Species richness of rare animals within their dispersal distances from the polygon (2020)
 Species richness of rare animals within polygon (2020)
 Species richness of rare plants in polygon (2020)
 Richness of rare and exemplary natural communities in polygon (2020)
 Total Area (hectares)
 Local Connectedness
 Index of Ecological Integrity
 Recreational rock climbing (Y=yes, U=undetermined)
 Distance to nearest hiking trail (meters)
 Distance to nearest road (meters)

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)
 LAND (HECTARES_R*.5) + (LCONN_R*.5)
 HUMAN (IEI_R*.25) + (CLIMBED_R*.25) + (DISTHIKE_R*.25) + (DISTROAD_R*.25)
 COND (BIO+LAND+HUMAN)/3 as defined above

Floodplain Forest

Species richness of rare animals within their dispersal distances from the polygon (2020)
 Species richness of rare animals within polygon (2020)
 Species richness of rare plants in polygon (2020)
 Richness of rare and exemplary natural communities in polygon (2020)
 Area (hectares) of largest floodplain forest patch in the wetland complex
 Number of floodplain forest patches in the complex
 Local Connectedness
 Landscape Complexity
 Index of Ecological Integrity
 Road density within 250 meters of the wetland complex
 Distance to nearest road (meters)
 Percent impounded
 Distance to nearest dam (meters)

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)
 LAND (LGFFHA_R*.25) + (NUM_FF_R*.25) + (LCONN_R*.25) + (LCPLX_R*.25)
 HUMAN (IEI_R*.2) + (ROADDENS_R*.2) + (DISTROAD_R*.2) + (IMPONDED_R*.2) + (DISTDAM_R*.2)
 COND (BIO+LAND+HUMAN)/3 as defined above

Grasslands

Species richness of rare animals within their dispersal distances from the polygon (2020)
 Species richness of rare animals within polygon (2020)
 Species richness of rare plants in polygon (2020)
 Richness of rare and exemplary natural communities in polygon (2020)
 Area (hectares)
 Similarity (amount of grassland within 1km)
 Percent hydric soil

Road density

Distance to nearest road

Eastern Meadowlark landscape capability model (UMass)

Grasslands (*continued*)

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)

LAND (HECTARES_R*.5) + (SIMILARITY_R*.5)

HUMAN (ROADDENS_R*.34) + (DISTROAD_R*.33) + (EAME_R*.33)

COND (BIO+LAND+HUMAN)/3 as defined above

Marsh and Shrub Wetlands and Peatlands

Species richness of rare animals within their dispersal distances from the polygon (2020)

Species richness of rare animals within polygon (2020)

Species richness of rare plants in polygon (2020)

Richness of rare and exemplary natural communities in polygon (2020)

Area of largest marsh in the complex (hectares)

Number of marsh polygons in the complex

Number of dominant NWI vegetation classes in the complex

Local Connectedness

Landscape Complexity

Index of Ecological Integrity

Road density within 250m of the complex

Distance to nearest road (meters)

NHDES Landscape Level Wetlands Assessment score for Water Quality degradation

NHDES Landscape Level Wetlands Assessment score for Human Activity within 500 feet

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)

LAND (LGMARSHHA_R*.2) + (NUM_MARSH_R*.2) + (VEG_RICH_R*.2) + (LCONN_R*.2) + (LCPLX_R*.2)

HUMAN (IEI_R*.2) + (ROADDENS_R*.2) + (DISTROAD_R*.2) + (DESEI_WQ_R*.2) + (DESEI_HU_R*.2)

COND (BIO+LAND+HUMAN)/3 as defined above

Northern Swamps and Temperate Swamps

Species richness of rare animals within their dispersal distances from the polygon (2020)

Species richness of rare animals within polygon (2020)

Species richness of rare plants in polygon (2020)

Richness of rare and exemplary natural communities in polygon (2020)

Area of largest swamp in the complex (hectares)

Number of swamp polygons in the complex

Number of dominant NWI vegetation classes in the complex

Local Connectedness

Landscape Complexity

Index of Ecological Integrity

Road density within 250m of the complex

Distance to nearest road (meters)

BIO (A_RICH_BUF_R*.25) + (A_RICH_POL_R*.25) + (P_RICH_POL_R*.25) + (C_RICH_POL_R*.25)

LAND (LGSWAMPHA_R*.2) + (NUM_SWAMP_R*.2) + (VEG_RICH_R*.2) + (LCONN_R*.2) + (LCPLX_R*.2)

HUMAN (IEI_R*.34) + (ROADDENS_R*.33) + (DISTROAD_R*.33)
 COND (BIO+LAND+HUMAN)/3 as defined above

Matrix Forest and Pine Barrens

Species richness of rare animals within their dispersal distances (2020)
 Richness of rare and exemplary natural communities (2020)
 Species richness of rare plants by landform and elevation zone (2020)
 Vertebrate species richness (VT/NH GAP Analysis)
 Local Connectedness
 Landscape Complexity
 Similarity of habitat
 Size of unfragmented block within which matrix forest is located (minor blocks, TNC)
 Index of Ecological Integrity

BIO (A_RICH_BUF_R*.25) + (C_RICH_POL_R*.25) + (P_RICH_LF_R*.25) + (GAPVERTMAX *.25)
 LAND (LCONN_R*.25) + (LCPLX_R*.25) + (SIMILARITY_R*.25) + (MINORBLOCK_R*.25)
 HUMAN (IEI_R)
 COND (BIO+LAND+HUMAN)/3 as defined above

High Elevation Spruce Forest – See Matrix Forests

Hemlock Hardwood Pine Forest – See Matrix Forests

Lakes and Ponds

Local Condition (200m shoreline buffer) Categories

1	buffer >=90% natural/ no dams/ nearest road or trail is >1 mi
2	buffer >=90% natural/ no dams/ nearest road or trail is .5 – 1 mile
3	buffer >=90% natural/ no dams/ nearest road 500m -.5 mile
4	buffer >= 90% natural/no dams/ nearest road < 500m
5	buffer < 90% natural/no dams/ any remoteness
6	Dams

Watershed (HUC12) Condition Categories

1	HUC12 Watershed Very Intact: >= 90% Natural Cover
2	HUC12 Watershed Lightly Impacted: 80-90% Natural Cover and <10% developed
3	HUC12 Watershed Impacted: All Others

Average Aquatic Index of Ecological Integrity (UMass)
 Size (hectares)

Lowland Spruce Forest – See Matrix Forests

Northern Hardwood Conifer Forest – See Matrix Forests

Pine Barrens – See Matrix Forests

Rivers and Streams

Condition assessment completed by The Nature Conservancy

River and Stream Reaches in each of four Very High Quality categories (HIGHQUAL = 1)

Minimum Linear Connectivity Length met: Functional Network Length \geq 10 miles for all systems except for tidal headwaters and creeks which have naturally small network lengths and any functional network length was acceptable. (QRYNET = 1)

Low Riparian Development and Agriculture Impacts: Riparian index score \leq 25 (QRYRIP = 1)

No dam on reach and upstream dam water storage volume as percent of mean annual flow $<$ 10% (QRYDAM = 1)

Low Impervious surface $<$ 2% (QRYIMP = 1)

RANKING LEVELS FOR EACH HABITAT TYPE AND ADD-INS

Tier 1 = Habitats of Highest Relative Rank by Ecological Condition in New Hampshire

Tier 2 = Habitats of Highest Relative Rank by Ecological Condition in Biological Region

Tier 3 = Supporting Landscapes

Habitat already ranked as Tier 1 counts towards the percentages for Tier 2, but only those not already Tier 1 will be designated as Tier 2. This is also the same for Tier 3.

HABITAT	TIER	% USED FOR EACH RANK
High-Elevation Spruce-fir	1	Top 15% in NH by area
	2	Top 100%
	3	Top 50% in Subsection by area
Low-Elevation Spruce-fir	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Northern Hardwood-Conifer	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Appalachian Oak-Pine	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Hemlock-Hardwood-Pine	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Pine Barrens	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Cliff/Talus/Rocky Ridges	1	Top 15% in NH by area
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Grassland	1	Top 15% in NH by area.
	2	Top 30% in Subsection by area
	3	Top 50% in Subsection by area
Wet Meadow/Shrub Wetland	1	Top 15% in NH by area
	2	Top 30% in ARM Region by area
	3	Top 50% in Subsection by area

Peatland	1	Top 15% in NH by area
	2	Top 30% in ARM Region by area
	3	Top 50% in Subsection by area
Temperate & Northern Swamps	1	Top 15% in NH by area
	2	Top 30% in ARM Region by area
	3	Top 50% in Subsection by area
Floodplain Forest	1	Top 15% in NH by area
	2	100% in Watershed Group
Rivers/Streams	1	TNC High Quality stream reaches, 100 meter buffer
Lakes/Ponds	1	Top 25 most intact lakes, by lake class, plus 200 meter buffer
Salt marsh	1	100%
Coastal Islands	1	100%
Dunes	1	100%
Alpine	1	100%
TNC Resilient Network	3	New England Resilient & Connected Network, The Nature Conservancy (Feb. 2020)
Animal occurrences	1-3	Occurrences of selected endangered, threatened or special concern species. (Feb. 2020) See notes.
Ecological features (NHB)	2	High Priority natural communities ranked by NH Natural Heritage Bureau. (Feb. 2020) See notes.

OCCURRENCES USED TO ELEVATE HABITAT RANK

Data for rare species and exemplary natural communities used in these analyses were subset as follows:

- For animals: restricted to endangered, threatened, special concern and S1-S2 species with precise location information (precision = “seconds”) observed within the last **25 years**
- For plants: restricted to populations with precise location information (precision = “seconds”) that were observed within the last **25 years**
- For natural communities: restricted to those observed within the last **40 years**

For important background information on NH Natural Heritage Bureau data, see *Important Background Information for Interpreting Species Richness Counts based on NH Natural Heritage Bureau Data*.

Selected Rare Wildlife

Animal occurrence records were extracted from the NH Natural Heritage Bureau database and overlaid on the WAP habitats. Only geographically precise data recorded within the last 25 years were used. For some species, known core populations, population models or reproductive data were used to refine locations to core populations. Except where noted, the presence of these species elevated the habitat patch to Tier 1: Highest Ranking by Ecological Condition in New Hampshire. Species whose populations were already well covered by the basic condition rankings were not included.

Criteria used to select species:

- Endangered or threatened in NH
- Limited populations known or likely to occur
- Isolated or restricted in NH
- Point specific sensitive information
- Provides critical habitat for state's population which his not already highly ranked

Selected Element Occurrences (EO) 1995-to-2020, excluding “general” precision locations:

Birds:

Peregrine - nests (natural sites) elevated cliff/talus/rocky ridge habitats
 Bald eagle – 300m around nesting and 200m around roosting habitat
 Golden Eagle - no breeding records of golden eagle in NH
 Common nighthawk - habitat surrounding non-rooftop nest sites
 Pied-billed grebe - elevated marsh habitat
 Common loon - productive nests (productivity .5 or greater) elevated Lakes and Ponds.
 Northern harrier - elevated grassland, marshes and peatlands within 400 meters of nest
 Upland sandpiper - elevated grasslands
 Grasshopper sparrow - elevated grasslands
 Piping plover, roseate tern, common tern, least tern – all occur on tier 1 coastal habitats.
 Red knot – no breeding records
 Cliff swallow, Purple martin – no additional habitat mapped (nests are all structures)
 Cerulean warbler – forest block associated with occurrences
 Eastern meadowlark – grassland associated with occurrences

Mammals:

New England cottontail: focal areas and unfragmented blocks within 1km of occurrences
 Bat hibernacula - surrounding forest block within 1km of occurrences
 Small-footed bat - forest, talus/rock, wetlands within 500m of occurrences
 Tri-colored bat – no occurrences
 Little brown bat – forest and wetlands within 250m of occurrences
 Northern long-eared bat - forest and wetlands within 250m of occurrences
 Canada lynx – focal area derived from occupancy score > 0.5 (based on field detections)
 Gray wolf – no breeding records in NH

Reptiles and Amphibians:

Fowler's toad – habitats within 250m buffer of occurrences, excluding development
 Habitat of sensitive snake sites.
 Eastern hognose snake - elevated habitats within 500 meters of occurrences
 Northern black racer - focal areas delineated, forest within 1km, other habitats within 500m
 Marbled salamander - elevated whole forest blocks within 300m of occurrences
 Blanding's turtle - core areas plus sand/gravel, marshes, peatlands 500m from occurrences
 Spotted turtle - elevated sand/gravel, marshes and peatlands 500 meters from occurrences.
 Wood turtle – 300m buffer of high priority river reaches excluding impervious surfaces
 Eastern box turtle – known populations and surrounding habitat within 500 meters

Invertebrates:

Hessel's hairstreak – elevate cedar swamp around occurrences
 Karner blue butterfly, persius duskywing skipper, pine pinion moth, frosted elfin - elevate pine barrens habitat.

Ringed boghaunter - elevate habitats within 500 meters
White mountain fritillary and White mountain arctic are within Tier 1 Alpine habitat
Rusty patched bumblebee – no mapped occurrences

Aquatic Species:

Eastern pond mussel – elevate ponds with occurrences
Cobblestone tiger beetle - delineated cobble bars within 500m upstream and downstream
American brook lamprey - buffer of stream reaches identified by NHFG Inland Fisheries
Bridle shiner - focal areas delineated by NHFG Inland Fisheries
Brook Floater and Dwarf Wedge Mussels - elevated 100m stream buffers 1 km upstream and downstream of occurrences, stopping at dams.
Round whitefish – elevate water bodies with occurrences
Atlantic sturgeon – elevate water body
Shortnose sturgeon - occurrences are historic only and were not used.

TNC Resilient Network

New England Resilient & Connected Network used to elevate habitat to Tier 3 (supporting).

Selected Rare Plants and Natural Communities

Natural communities are recurring assemblages of plants and animals found in particular physical environments. Three characteristics distinguish natural communities: 1) plant species composition, 2) vegetation structure (e.g., forest, shrubland, or grassland), and 3) a specific combination of physical conditions (e.g., water, light, nutrient levels, and climate).

Exemplary natural communities are the best remaining examples of New Hampshire’s natural community types. Exemplary status is assigned based on a combination of the rarity of the natural community type and the quality rank of a given occurrence. Quality ranks are a measure of the ecological integrity of a community relative to other examples of that particular type based on size, ecological condition, and landscape context. The NH Natural Heritage Bureau (NHNHB) provided spatial data identifying NHNHB-priority sites not covered by habitat polygons meeting “highest quality” tiers based on condition filters. NHNHB developed a simple method to identify high priority natural communities based on element rarity and occurrence condition. All natural community and natural community system EOs that met the following criteria were considered “high” priority for conservation (see NHNHB for details):

- 1) High quality: Any “A” ranked element occurrence, regardless of rarity.
- 2) Rare elements: Any “B” ranked element occurrence for rare (S1 or S2) community types.

DATA SOURCES FOR CONDITION ANALYSIS

Anderson, M.G., M. Clark, C.E. Ferree, A. Jospe, and A. Olivero Sheldon. 2013. Condition of the Northeast Terrestrial and Aquatic Habitats: a geospatial analysis and tool set. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.
<https://easterndivision.s3.amazonaws.com/Geospatial/ConditionoftheNortheastTerrestrialandAquaticHabitats.pdf>

Coastal Change Analysis Program (C-CAP) Regional Land Cover Database. Sept. 2019.
National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management.
Data accessed at <https://coast.noaa.gov/digitalcoast/data/ccapregional.html>

McGarigal, K. 2018. Designing Sustainable Landscapes project: Index of Ecological Integrity. http://www.umass.edu/landeco/research/dsl/products/dsl_products.html

National Wetlands Inventory version 2 (U.S. Fish & Wildlife Service, Jan. 2020)

NH Department of Environmental Services. 2013. Landscape Level Wetlands Assessment.

NH Department of Environmental Services. 2016. Dams.

NH Fish & Game and NH Office of Energy and Planning. 2020. Recreational trails.

NH Natural Heritage Bureau. 2020. Rare animal, rare plant and natural communities. Spatial data accessed March 2020.

NH Department of Transportation. 2020. Roads spatial data obtained from NH GRANIT (www.granit.unh.edu), University of New Hampshire. Accessed January 2020.

The Nature Conservancy. 2020. New England Resilient and Connected Network (NED_RCN_2_17.gdb provided by TNC NH office)

U.S. Department of Agriculture. 2013. Soil Survey Geographic (SSURGO) database for New Hampshire, copy obtained from NH GRANIT.

University of Vermont. 2005. Draft vertebrate distributions in VT/NH Gap Analysis