WILDLIFE ACTION PLAN MAP ANALYSIS INFORMATION

New Hampshire Fish and Game Department: August 2015

Contents:

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).

New Regional Datasets Used

Several datasets were brought together to create a regional analysis of habitat condition for the 13 northeast states, 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 was also created under funding by these sources, but also were authored by other entities such as Kevin McGarigal of UMASS Amherst. The report provides much more detail. Please see references at the end of this document.

LOCAL CONNECTEDNESS: Degree of permeability (ease of animal movement across that type pf landscape) 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 elements: natural, barren, agricultural, low intensity development, high intensity development (includes medium intensity) with weighted resistance for each. Minor roads added more resistance. Resistance is measured out to 3 km.

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.

New 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 30 meter pixel (0.22 acre) 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 could 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:

Highest Ranked in the State by Ecological Condition
Highest Ranked in the Biological Region by Ecological Condition
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 some very intact forest blocks.

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.

For more details on this work, see the metadata for the habitat landcover 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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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	$(HECTARES_R*.34) + (LCONN_R*.33) + (LCPLX_R*.33)$
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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
Area (hectares)

Similarity (amount of grassland within 1km)
Percent hydric soil
Road density
Distance to nearest road
Eastern Meadowlark landscape capability model (UMass)

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	(ROADDENSR*.34) + (DISTROADR*.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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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 (2015)
Species richness of rare animals within polygon (2015)
Species richness of rare plants in polygon (2015)
Richness of rare and exemplary natural communities in polygon (2015)
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 (2015)
Richness of rare and exemplary natural communities (2015)
Species richness of rare plants by landform and elevation zone (2015)
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 >= 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 <= 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%
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 Harwood-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 top forest blocks	3	TNC forest blocks top-ranked in ELU Group and/or Ecoregion Subsection (2005)
Animal occurrences	1-3	Occurrences of selected endangered, threatened or special concern species. (2015) See notes.
Ecological features (NHB)	2	High Priority natural communities ranked by NHNHB. (2015) 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") that were observed within the last 20 years
- For plants: restricted to populations with precise location information (precision = "seconds") that were observed within the last 20 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 20 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) (2004-to-2014 and excluding "general" precision) and core populations included:

Birds:

Peregrine nests (natural sites) elevated cliff/talus/rocky ridge habitats
Bald eagle nesting and wintering habitat (buffered)
Golden Eagle (there are no breeding records of golden eagle in NH.)
Common nighthawk (non-urban nest sites)
Pied-billed grebe sites elevated marsh habitat
Sedge wren sites elevated marsh or peatland habitat
American three-toed woodpecker elevated forest habitats.
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 occur on tier 1 coastal habitats.

Mammals:

New England cottontail: known sites with surrounding unfragmented blocks (within 1km dispersal distance) as supporting landscape
Known bat hibernacula with portions of surrounding forest block
Small-footed bat sites, buffered by 4.2 km supporting landscape
American marten occur on high-elevation spruce-fir already top-ranked
(There are no breeding records of Canada lynx or Eastern wolf in NH).

Reptiles and Amphibians:

Habitat of sensitive snake sites.
Eastern hognose snake, elevated habitats within 500 meters
Northern black racer focal areas delineated, plus habitats within 500 meters
Marbled salamander elevated whole forest blocks
Blanding's turtle core areas and marshes and peatlands within core areas
Spotted turtle elevated marshes and peatlands within 500 meters.
Wood turtle buffer of high priority river reaches

Invertebrates:

Karner blue butterfly, persius duskywing skipper, pine pinion moth, frosted elfin were used to elevate PINE BARREN habitat.
Ringed boghaunter elevated habitats within 500 meters
White mountain fritillary and White mountain arctic are within tier 1 Alpine habitat

Aquatic Species:

Cobblestone tiger beetle elevated habitat within large rivers
American brook lamprey elevated a buffer of river/stream reaches
Bridle shiner focal areas delineated

Brook Floater and Dwarf Wedge Mussels elevated stream buffers upstream and downstream to 1km, stopping at dams.

Shortnose sturgeon occurrences are historic only and were not used.

Top-Ranked Forest Blocks

TNC high-ranked forest blocks (2005) were 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 PROJECTION Albers NAD83 meters

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

McGarigal, K. 2014. Designing Sustainable Landscapes project: Index of Ecological Integrity. http://www.umass.edu/landeco/research/dsl/products/dsl_products.html

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

NH Department of Transportation. 2015. Roads spatial data obtained from NH GRANIT (www.granit.unh.edu), University of New Hampshire. Accessed July 2015.

NH Fish & Game and NH Office of Energy and Planning. 2015. Hiking trails (spatial data)

NH Natural Heritage Bureau. 2015. Rare animal, rare plant and natural communities. Spatial data accessed July 2015.

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