The Greater Upper Valley of New Hampshire Habitat Blocks and Ecological Importance A Spatial Analysis

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PURPOSE

The purpose of this project is to expand the available educational materials used by the Linking Lands Alliance to the neighboring Greater Upper Valley region of New Hampshire. To do so, this project has adapted the spatial analysis model (as described by Linking Lands Alliance at - https://www.linkinglandsalliance.org/llamaps) performed in Vermont to this New Hampshire region. More information on the importance of habitat blocks to ecosystem functioning can be found in the *Vermont Habitat Blocks and Habitat Connectivity* report (VT Fish and Wildlife, 2014). The objectives of the project include:

- Identify habitat blocks using best-available Geographic Information Systems (GIS) data and accepted scientific methods.
- Rank the habitat blocks for their biological and conservation value (also called "ecological importance").

This report seeks to describe the methods used for the New Hampshire analysis and provide an overview of the results.

METHODS and RESULTS

The methods used for this analysis are modeled off those used in Vermont; however adaptations were made in order to perform the analysis in New Hampshire with available datasets. For example, instead of performing a cost grid analysis of habitat blocks, the New Hampshire model is informed by the prioritized areas identified in the 2015 New Hampshire Wildlife Action Plan.

For more information on the Vermont methodology, rationale, and results see the *Vermont Habitat Blocks and Habitat Connectivity* report (VT Fish and Wildlife, 2014).

This project methods and results section is organized into three areas. A rationale is provided where there is a significant change from the Vermont model.

1. The first describes how the habitat blocks were created in New Hampshire and displays the resulting areas.
2. The second describes how ten features, each related to specific ecosystem values, are collectively used to evaluate the relative ecological importance of habitat blocks. The resulting values for each feature are shown.
3. The third describes how the ten features were combined, and then habitat blocks ranked for their overall ecological importance. The resulting ranking is shown.

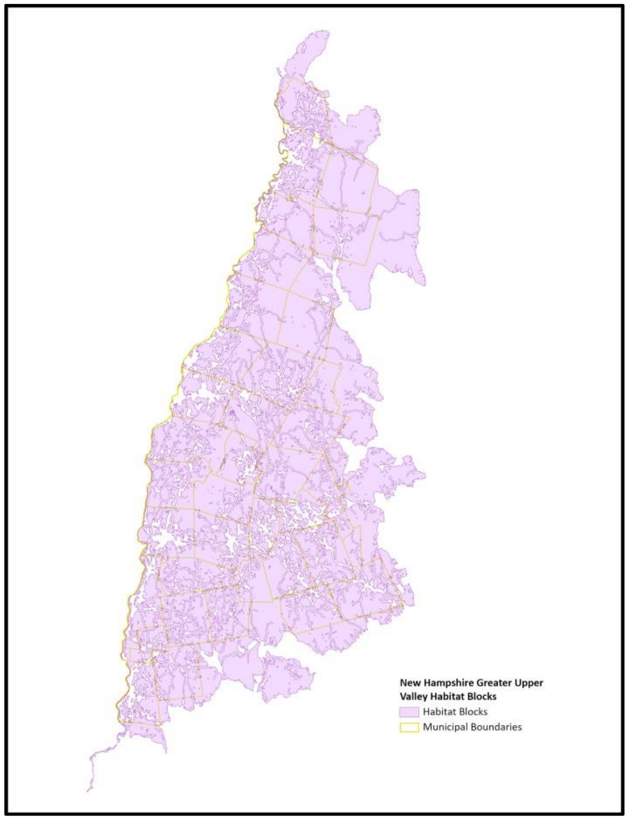
Identification of Habitat Blocks

This analysis relied upon land cover data from National Oceanic and Atmospheric Administration's (NOAA) Coastal Change Analysis Program (C-CAP), using the updated dataset from 2016. The C-CAP land cover types were classified by whether they should be included in habitat blocks or not, as follows:

Land Cover Type	Block	% Cover
Developed, High Intensity	No	0.12
Developed, Medium Intensity	No	0.69
Developed, Low Intensity	No	1.25
Developed, Open Space	No	0.74
Cultivated Crops	No	4.50
Pasture/Hay	No	10.38
Grassland/Herbaceous	Yes	0.35
Deciduous Forest	Yes	37.09
Evergreen Forest	Yes	14.66
Mixed Forest	Yes	19.29
Scrub/Shrub	Yes	2.43
Palustrine Forested Wetland	Yes	2.05
Palustrine Scrub/Shrub Wetland	Yes	0.94
Palustrine Emergent Wetland	Yes	0.38
Estuarine Emergent Wetland	Yes	0.00
Unconsolidated Shore	Yes	0.02
Bare Land	No	0.18
Open Water	Yes	4.90
Palustrine Aquatic Bed	Yes	0.02
		100

The classified C-CAP land cover data was refined to improve block delineations using several GIS layers, including roads, buildings, and block size.

- Building footprints and NH Federal, State, Local, and Recreational roads were considered block fragmenting features. Before fragmenting these features received a buffer of 330 feet all around. Unmaintained and Private roads were considered interior roads.
- Habitat blocks less than 20 acres were eliminated from the analysis.



<u>Ten Features to Inform Ecological Importance</u>

Ten features were used in the New Hampshire methodology to evaluate the relative ecological importance of habitat blocks. A full literature study to identify important and available datasets was not done as part of this analysis, thus this ten feature list should not be seen as exhaustive of important and available New Hampshire ecological data. The ten features included for this analysis are the following, each of which is further described in the subsequent pages:

1. Wildlife Action Plan Ranked Habitats
2. Ecological Landscape Unit Groups
3. Element Occurrence Count
4. Percent Core
5. Block Size
6. Density of Interior Roads
7. Percent Lakes and Ponds
8. Percent Wetlands
9. Order and Density of Stream
10. Percent TNC Matrix Block

Each feature has a value used for ranking. These values are classified into 10 categories using natural breaks (or jenks), unless otherwise noted in the feature description. These 10 categories are what inform its ranked position. This ranked position is then used to inform the habitat block's final ecological importance value, informed by its *factor weight*, provided for each feature under its feature description.

Feature 1 – Wildlife Action Plan Ranked Habitats

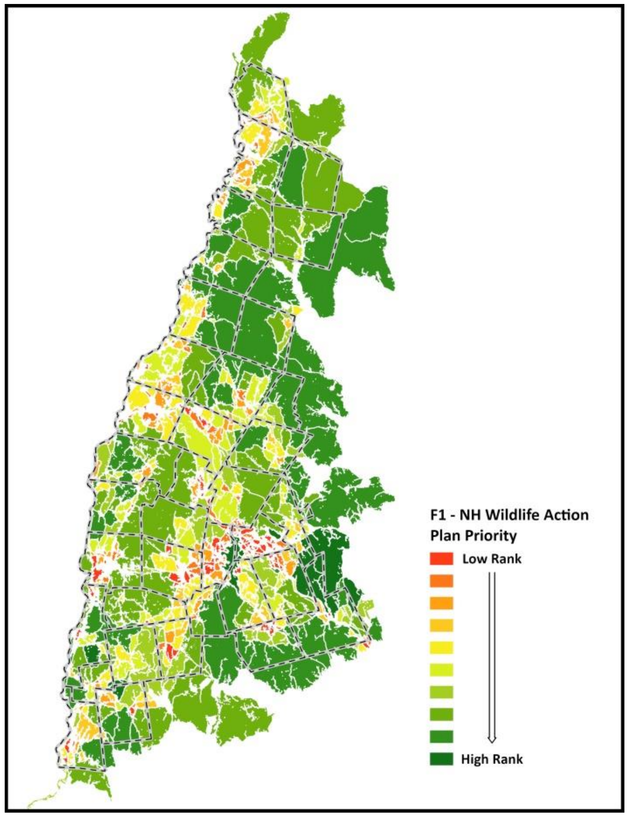
To evaluate a habitat block's contribution to ecological systems at a landscape level, the New Hampshire Wildlife Action Plan (WAP) tiers of priority were used (https://www.wildlife.state.nh.us/wildlife/wap.html). The WAP looked at habitat condition based on biological diversity, habitat type, landscape context (habitat patch interactions, microclimates, etc.), and human activity impacts. It also takes into account important aquatic features. The WAP ranked habitats in four levels:

- Tier 1: Top 15% named "highest ranked in state", along with 100% of rare habitat and highest ranked aquatic habitats with buffers.
- Tier 2: Top 30% named "highest ranked in biological region" only terrestrial and wetland habitats.
- Tier 3: Top 50% of all habitats named "Supporting Landscapes".
- Tier 4: Remaining habitats did not receive a tier ranking.

For this project, tier percent coverage within a habitat block received a percent value based on its tier. Tier 1 received its full proportional value, Tier 2 received 75%, Tier 3 50%, and Tier 4 did not add to the rank. These adjusted values were than combined for each block to provide a relative "grade".

Factor weight: 15%

Rationale: The NH WAP is commonly used across the state as a guide for setting local, regional and state priorities for conservation. In part, the NH WAP takes the place of the Vermont model features on cost grid analysis and exemplary aquatic features.



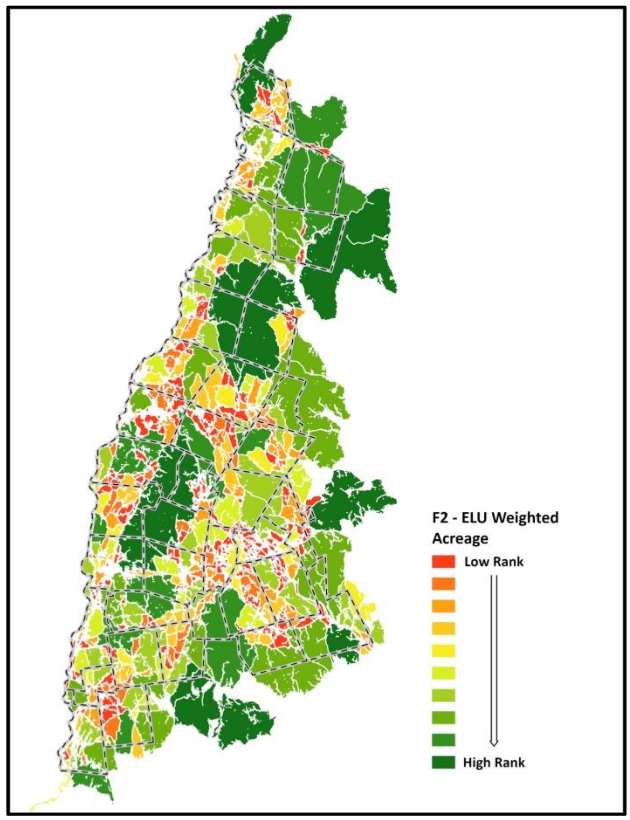
Feature 2 – Ecological Landscape Unit Groups

A classification of habitat blocks was developed based on Ecological Landscape Units (ELUs) and their relative abundance in each habitat block. ELUs were developed by The Nature Conservancy. Areas were reclassified using a simplified reclassification technique to that used in Vermont, using details of slope, aspect, elevation, and soil type. This resulted in nine ELU Groups representing physical landscape diversity.

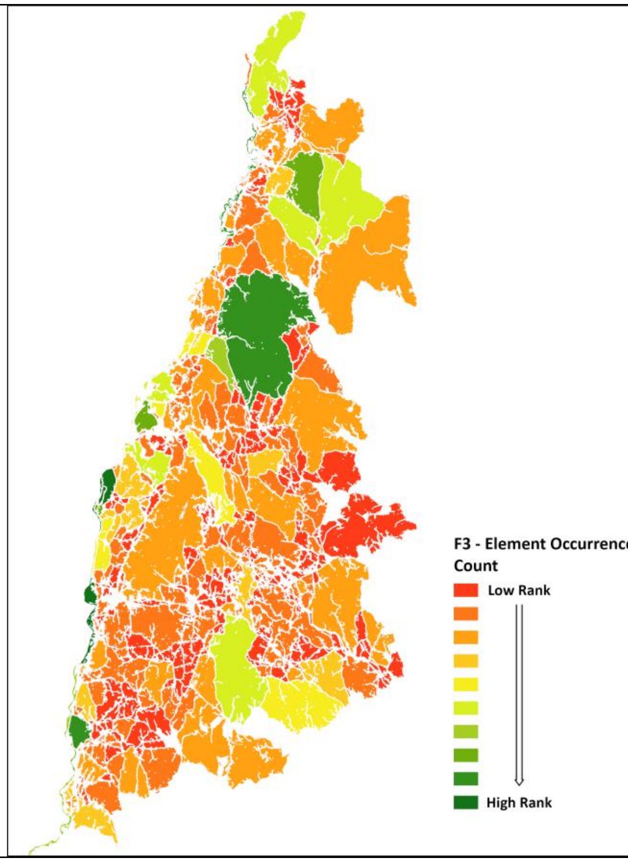
- acidic gentle hills;
- mid elevation acidic steep hills/mountains;
- upper elevation acidic steep hills/mountains;
- calcareous/moderately calcareous gentle hills;
- calcareous/moderately calcareous mid to upper elevation steep hills/mountains;
- coarse sediment flats;
- fine sediment flats;
- acidic low elevation steep hills with sediment flats;
- calcareous/moderately calcareous low elevation steep hills with sediment flats.

For each of the nine ELU groups, the percent landscape cover was calculated (ranging from 0.6% for calcereous gentle hills to 56.7% for mid elevation acidic steep hills) and the average ELU group's block size (ranging from 32 acres for coarse sediment flats to 1,046 acres for mid elevation acidic steep hills). A habitat block of a rare ELU group, larger than the average, ranks higher than a habitat block of a common ELU group that is larger than the average for its group.

Factor weight: 10%



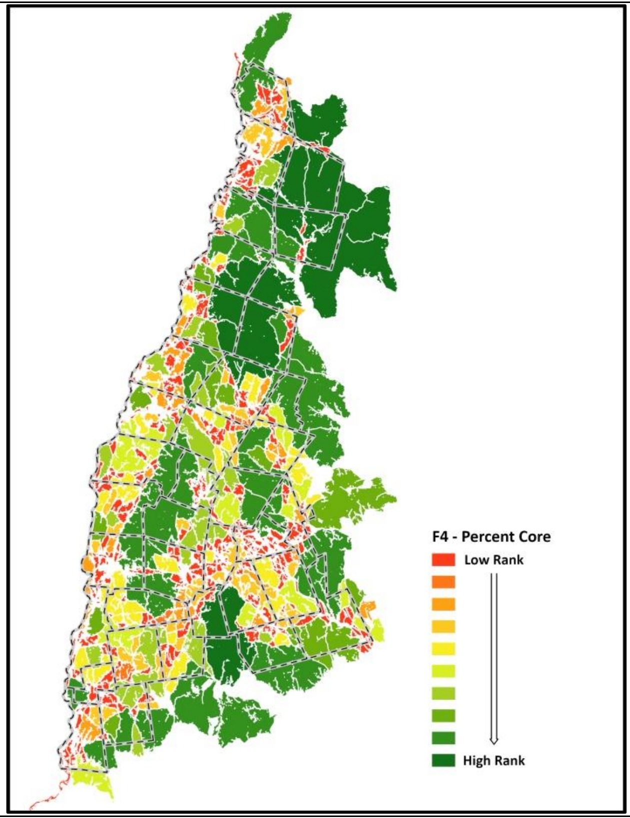
Feature 3 – Element Occurrence Count

An element occurrence is a place on the ground where there is a rare species or state-significant natural community that has been mapped by New Hampshire Natural Heritage Bureau within two square mile hexagon blocks. Conservation of rare species and state-significant natural communities is an important component of conserving biological diversity. Habitat blocks with more rare species or state-significant natural communities rank higher than blocks with fewer or no element occurrences. Factor weight: 10%	

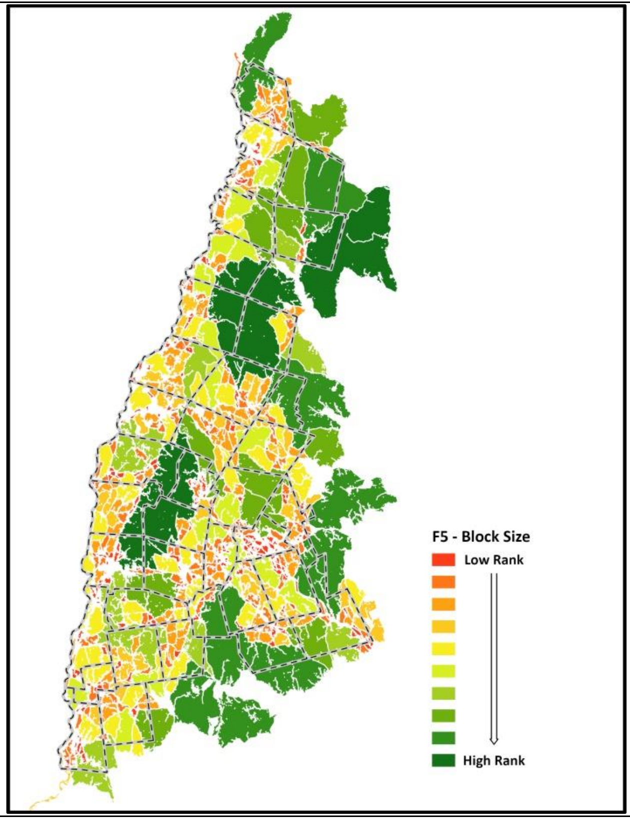
Feature 4 – Percent Core

Each habitat block with at least 250 acres of core (defined as the area at last 200 meters from the block edge) was ranked based on its ratio of core area to total block area.

Factor weight: 15%



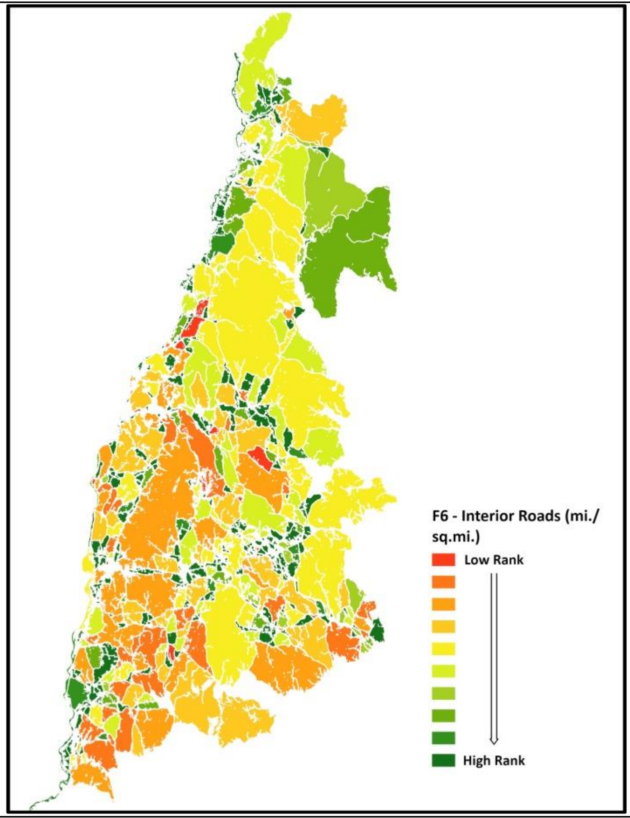
Feature 5 – Block Size

Larger blocks provide more interior forest habitat values, better support the needs of wide-ranging wildlife, and are most likely to include a diversity of physical and environmental conditions found in that biophysical region. Factor weight: 15%	

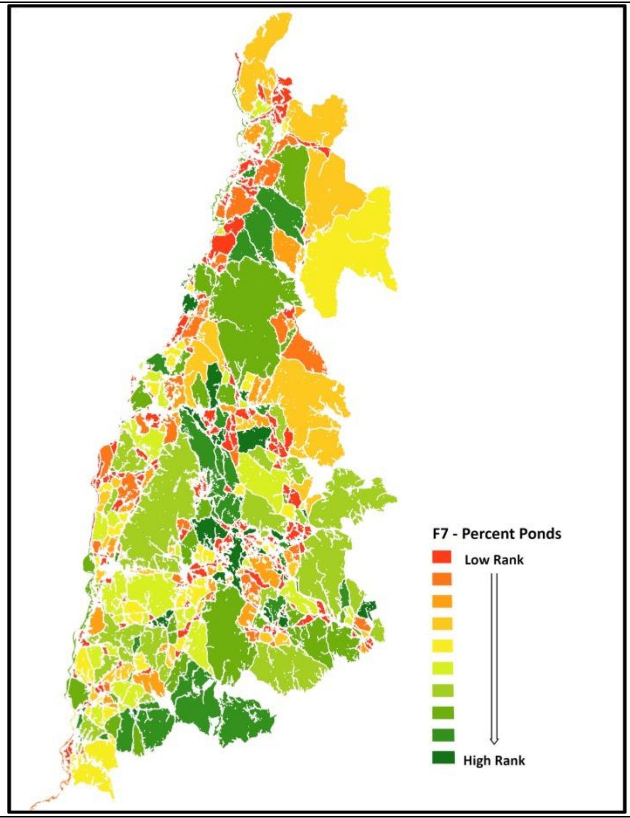
Feature 6 – Density of Interior roads

Habitat blocks with higher densities of Unmaintained and Private roads included within their boundaries rank lower than blocks with fewer interior roads. This feature ranked blocks based on its interior roads density, or average miles of interior road for every square mile. Instead of using natural breaks, The ranking of this ratio used a modified version of the natural breaks method, simply merging a few of the low ranking categories and splitting a few of the high ranking categories.

Factor weight: 10%



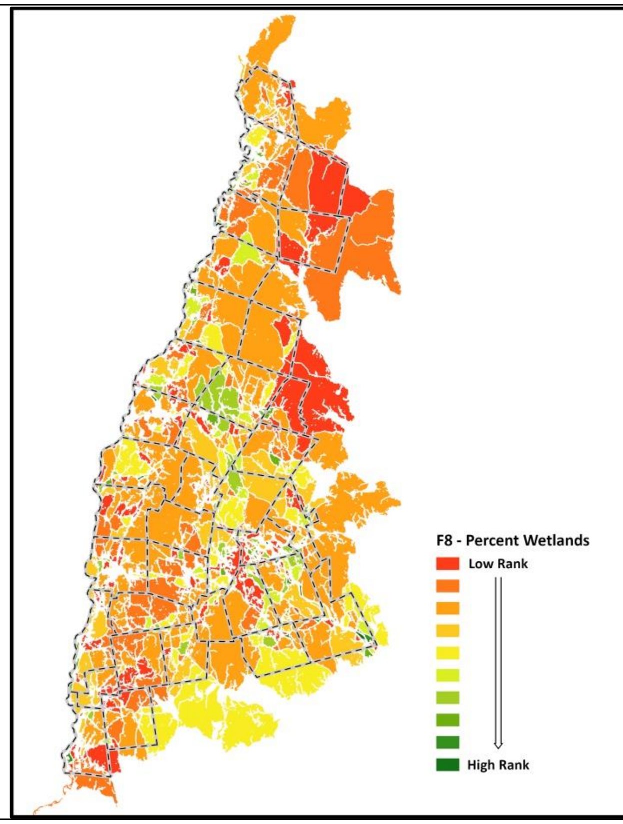
Feature 7 – Percent Lakes and Ponds

Habitat blocks are ranked by the ratio of lake pond surface area to overall block size. Habitat blocks that include a high percentage of lakes and ponds rank higher than habitat blocks without. Instead of using natural breaks, the ranking of this ratio used the quantile distribution. Factor weight: 6%	

Feature 8 – Percent Wetlands

Habitat blocks are ranked by the ratio of wetland area to overall block size. Habitat blocks that include a higher percentage of wetlands rank higher than habitat blocks with a small percentage of wetlands.

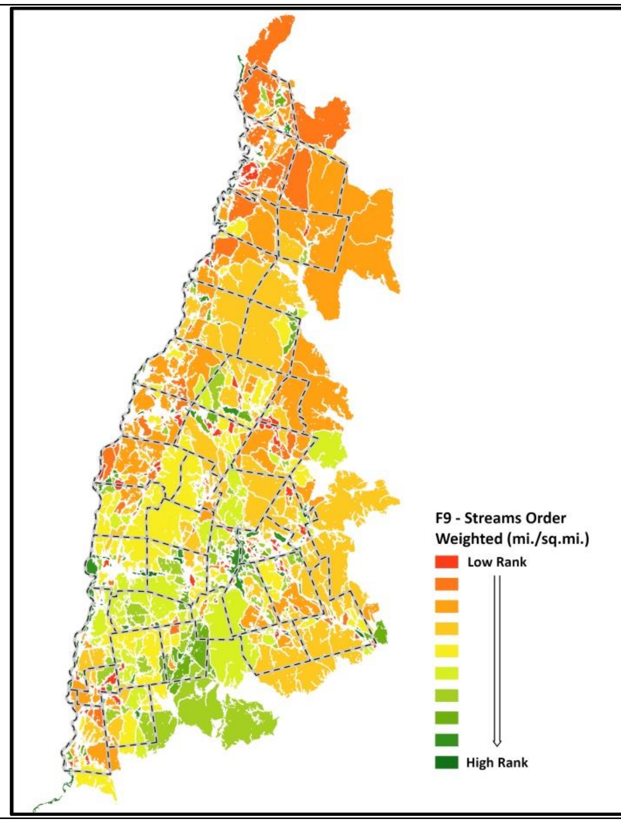
Factor weight: 7%



Feature 9 – Order and Density of Streams

To account for the high aquatic habitat value of streams and the connectivity benefits of riparian corridors, habitat blocks are ranked by the length and size (also known as the order) of streams and rivers contained within them. A habitat block receives a score for the length of stream and separately the size of streams. These two scores are then combined with equal weight and ranked for habitat blocks. So a block traversed by 0.5 mile of the Sugar River ranks higher than an upper elevation block with 0.5 mile of first order streams.

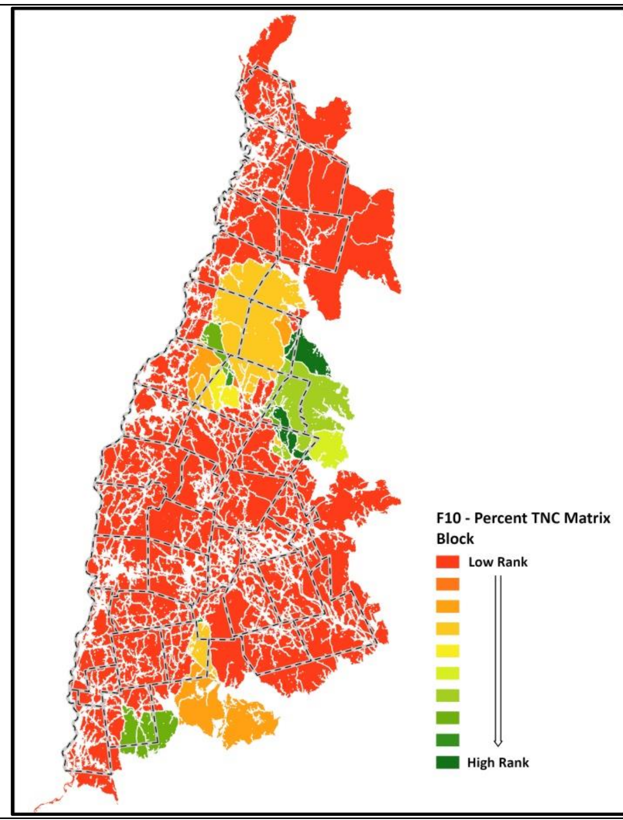
Factor weight: 7%



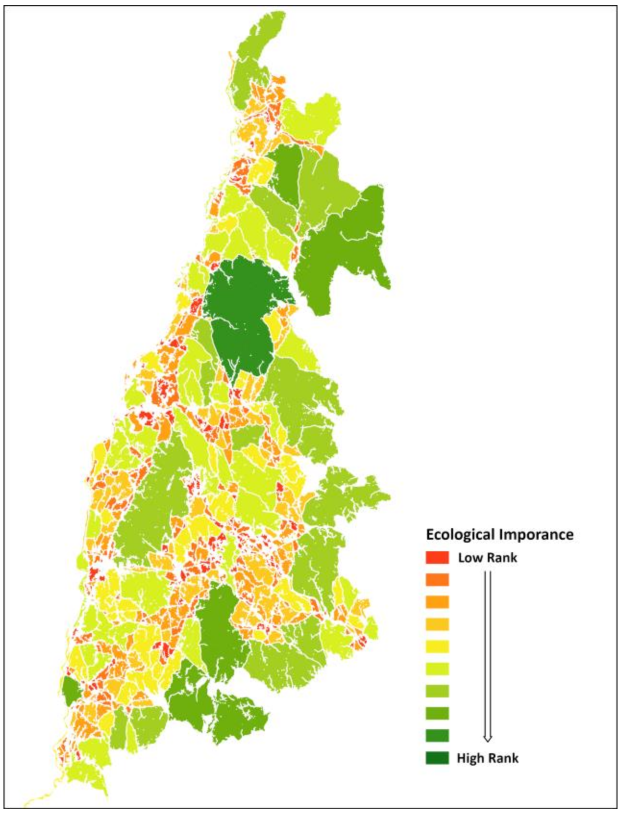
Feature 10 – Percent TNC Matrix Block

Habitat blocks are ranked by the percent of a block that falls within a matrix block designated as Tier 1 by The Nature Conservancy (TNC) through their ecoregional planning process. TNC matrix blocks are large areas with minimal fragmentation by roads that were selected across ecoregions as the best locations for conservation of the "matrix" forest natural community types that are included in these blocks. This factor identifies a few habitat blocks that are likely to have regional significance (See Anderson et al. 2006 for description of TNC matrix blocks for the Northern Appalachian ecoregion).

Factor weight: 5%

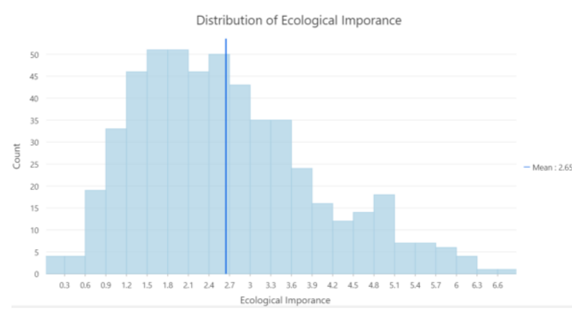


Ranking Habitat Blocks for Ecological Importance



The ten features were combined by their factor weight, as described in the above section *Ten Features to Inform Ecological Importance*. Once combined, the overall ecological importance for habitat blocks in the New Hampshire study area is provided.

On a scale from zero to nine, values ranged from a low of zero to a high of 6.92, with an average of 2.65. The distribution is shown in the graph below. In contrast for VT state ecological importance, values ranged from a low of 0.8 to a high of 8.3, with an average of 3.49. This distribution of higher values is largely driven by the Vermont value forest blocks of large protected areas, while New Hampshire's large protected areas, such as the White Mountains, are not a part of this 36 town analysis.



For the ecological importance ranking the same classes were used as those in Vermont, shown below.