A Terrestrial Habitat Map for the Northeastern United States

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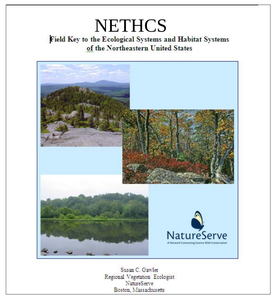
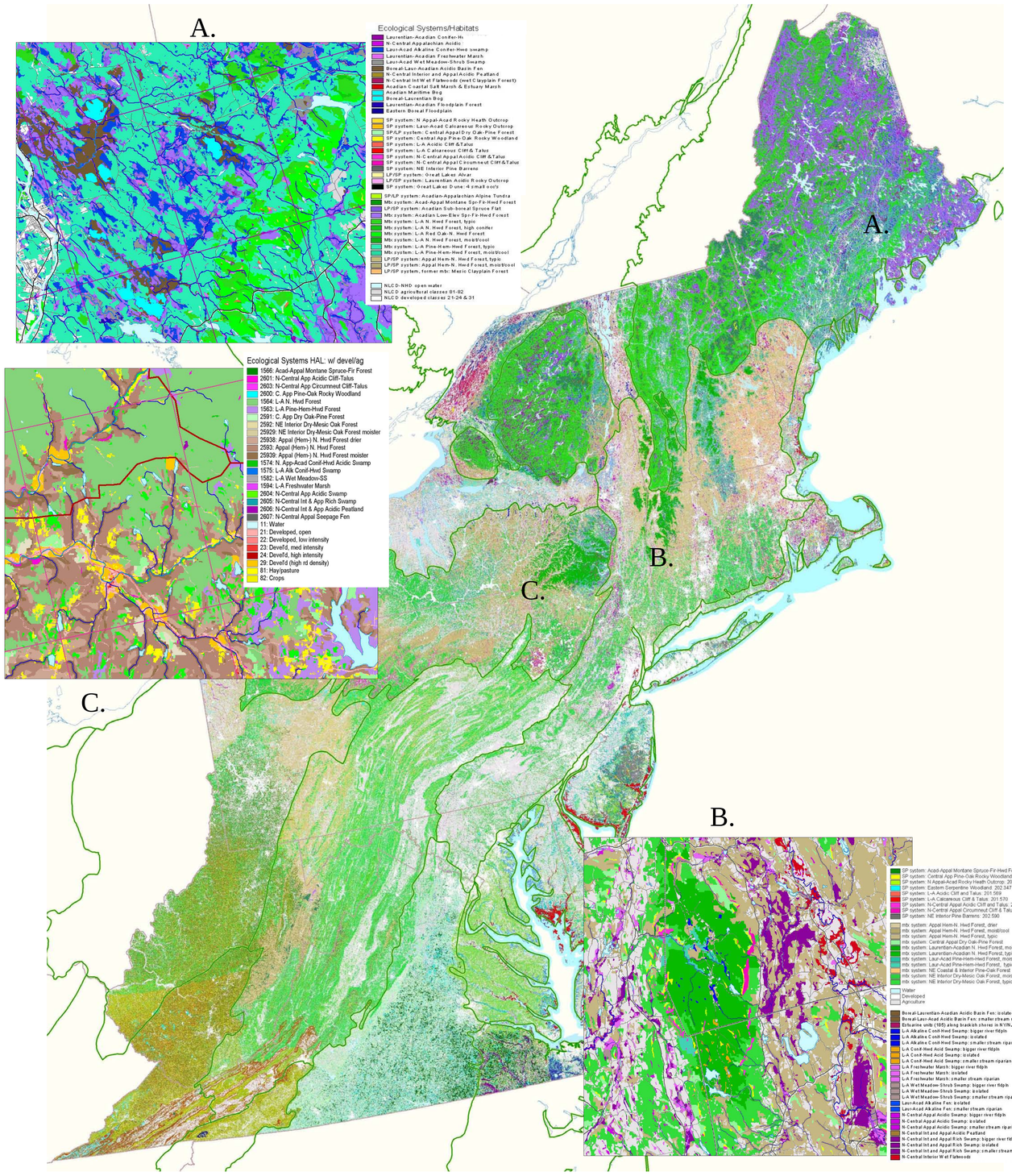
Objective

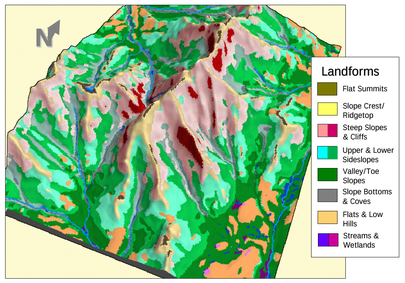
Produce a map of wildlife habitats/ecological systems for the Northeast, including all states from Maine to Virginia, west to New York, Pennsylvania and West Virginia. The map will consist of a spatially comprehensive GIS grid of 30 meter pixels with a legend portraying the Northeastern Terrestrial Habitat Classification System (NETHCS). The NETHCS is based on NatureServe's Ecological Systems Classification, augmented with additional information from individual state wildlife classifications and other information specific to wildlife managers.





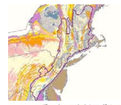
Region Wide Grids of Ecological Information

We began by assembling regional spatial datasets on bedrock and surficial geology, elevation, slope and aspect, waterbodies and streams, wetlands, land position and landform, topographic rugosity, climate, solar influx, and landcover and canopy cover. About 60 variables were derived for use in the analysis. The landform model was developed from a 30 meter DEM using land position, slope, and flow accumulation (below).



Examples of framework data for the Lower New England / Northern Piedmont Ecoregion


Elevation


Geology


Land cover


Solar radiation


Precipitation


NWI Wetland


Canopy closure


Landforms


Rugosity


Categorical Aspect


Transformed Aspect

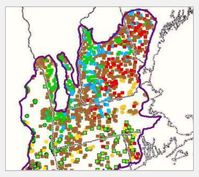
Landform Model

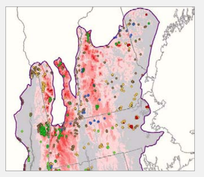
Confirming Points

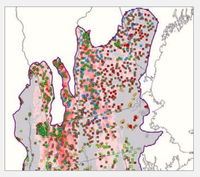
Natural Heritage Community Element Occurrences and Plot Data: The State Natural Heritage Programs (NHPs) track the locations of rare and unusual communities and the best examples of common communities. State occurrences were cross-walked and tagged to an ecological system type by state ecologists, in conjunction with NatureServe and TNC ecologists. In addition, many NHPs have extensive sets of plots taken during the course of ecological inventories, and these were put to a similar use. Accuracy of the habitat/system tags was evaluated by attributing confirming points and polygons with basic environmental information and viewing them in a GIS. Over 50,000 occurrences and plots were provided by the Heritage programs for use in this project.

Vegetation Maps: Detailed vegetation and natural community maps were available in many parts of the region. These were converted into points and tagged to the appropriate ecological system types by Natural Heritage and NatureServe ecologists in conjunction with TNC scientists.

Forest Inventory and Analysis Points: We received over 21,000 actual-location FIA plots from the USDA-Forest Service for the states in our region. These forest stands are sampled by Forest Service staff in perennial inventories. The points were filtered to removed highly altered stands, then classified into homogenous vegetation units based on their tree composition and ecological settings using a cluster analysis. The homogenous units were then cross-walked to the regional ecosystem units by TNC scientists in consultation with NatureServe Ecologists.


Natural Heritage Occurrences


Community Maps

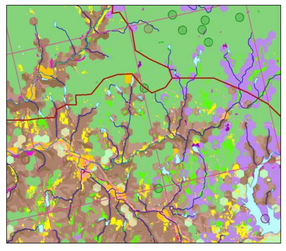

Forest Inventory & Analysis Plots

Models for Matrix-forming and Patch Communities

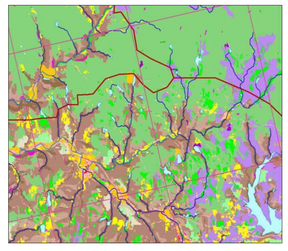
Matrix-forming Forest Systems: We proceeded through the project area ecoregion by ecoregion. Matrix forest types for each ecoregion were modeled using RandomForest-generated classifications, with 100 acre hexagons as the basic analytical units. First, hexagons constructed around each confirmed location of a specific forest habitat type were attributed with the ecological information described above (solar radiation, land cover, topography, etc). The RandomForest algorithm uses this information to construct models for each of the matrix forest types. Hundreds of thousands of hexagons covering the ecoregion in a tessellated pattern were attributed in the same way, and every hexagon was classified to the most probable ecological system type by running it through the RandomForest-built decision trees.

Patch Communities: Patch communities and wetlands for each ecoregion were modeled individually, based on locations of known occurrences of each habitat/system type that occur in the region, and on NatureServe-published descriptions of and ecological criteria for those types. Information on habitat ranges, elevation limits, edaphic/geologic factors, landcover and canopy cover, topographic factors like exposure, solar influx, and surface roughness, and other landscape characteristics, all played important parts in patch model construction.

Image showing Hexagon Units



Data transferred to Landscape Units



A final step in the mapping process was to transfer the hexagon-based habitat information onto natural topographic units. Thematic segmentation software was used to break large "landscape units" based on simplified landforms into smaller discrete shapes. Next, we identified the 100-acre hexagon that each of the discrete landscape units was within (or mostly within). We then wrote a set of decision rules to assign each landscape unit to a given ecological system type, based on the RandomForest-assigned system for its parent hexagon. For example, low hills or cool slopes associated with a hexagon classified to the more mesic oak forest system would get that system assignment, while a warm upper slope or ridgetop associated with that same hexagon would "flip" to the dry oak-pine system. The RandomForest-generated probabilities for the matrix forest systems within each hexagon helped guide this information transfer.