New Hampshire Fish & Game Department
Spatial Data Notes

DATA LAYER:	High-elevation spruce-fir habitats of New Hampshire
COVER NAME:	highelev_sprucefir
COVER CONTENTS:	High-elevation spruce-fir habitat polygons, scaling units
COVER TYPE:	Poly
SOURCE:	Vermont Institute of Natural Science (VINS: Lambert et al. in press) elevation threshold, which depicts the lower elevation limit of Bicknell's Thrush habitat, Hale's (in press) Bicknell's Thrush probability surface, NH Natural Heritage Bureau (NHB) exemplary high-elevation spruce-fir natural communities, and TNC matrix forest types.
SOURCE SCALE:	1:24,000 and 30-meter raster
SOURCE MEDIA:	digital
COORDINATE SYSTEM:	NH State Plane feet, horizontal datum NAD83
TILE:	State
AUTOMATED BY:	NH Fish & Game Department, GIS Program
STATUS:	Complete
LAST REVISION:	October 2008; attributes revised December 2009

General Description of the Data

- Development of this coverage provides general high-elevation spruce-fir habitat locations within the state of New Hampshire. Analysis was completed for incorporation into the New Hampshire Wildlife Action Plan. Funding for the Plan was provided by State Wildlife Grants administered by the US Fish & Wildlife Service.

- Generally speaking, the definition of known high-elevation spruce-fir habitat used in this analysis was areas above the VINS elevation threshold that was dominated by spruce-fir. The VINS elevation threshold was developed as part of a model to predict Bicknell's thrush presence/absence in a region from New York to Maine. The threshold descends with an increase in latitude (slope = -81.63 m/1°latitude) and refl ects climatic effects on forest composition and structure. The VINS Bicknell's thrush model used National Land Cover Dataset (NLCD) developed by the Multi-Resolution Land Characterization Consortium of governmental agencies to identify softwood cover above the elevation threshold for the region (Vogelmann et al. 2001). The most recent NLCD data available for this region is from 1992 and the data does not specifically identify spruce-fir cover. Instead, the more recent and more detailed NH Land Cover Assessment dataset was used in this mapping process to identify softwood cover above the elevation threshold in New Hampshire (CSRC 2001).

- 2001 NHLC grid value 422 (spruce-fir), within the VINS elevation mask

- The result was combined with Hale's (in press) Bicknell's thrush probability surface (deciles 0.10-0.60). Hale developed a model to predict Bicknell's thrush distribution within the White Mountain National Forest using image-derived data layers of dominant vegetation height and distance to nearest fir sapling cover type, a digital elevation model, and point count data to parameterize a multivariate logistic habitat model. The model proved accurate in predicting Bicknell's distribution within the decile range 0.10-0.60, but overestimated the number of BITH presence observations above 0.60. Estimates over 0.60 tended to occur at pixels in krummholz and the alpine zone, and therefore were disregarded. Also included were patches identified as fir sapling per Hale and Rock's (2003) land cover classification for the White Mountain National Forest. Areas identified by Hale's probability surface and fir sapling land cover, were included even if they fell below the VINS elevation threshold.

- The rasters from the above steps were combined, generalized, converted to polygons, and only polygons 5+ acres in size were retained as KNOWN high-elevation spruce-fir habitat.

- NHB's data depicting exemplary high-elevation spruce-fir communities were appended (as KNOWN locations) to ensure all high-elevation areas were captured to the extent possible. The selected NHB natural communities included:
    High-elevation spruce - fir forest
    High-elevation balsam fir forest
    Northern hardwood - spruce - fir forest (*POLYGONS BELOW ELEVATION MASK WERE EXCLUDED*)
    Montane landslide (*NO OCCURRENCES IN NHB DATA*)
These communities had been classified as being either diagnostic of high-elevation spruce-fir communities or peripheral/occasional and overlapped with the other data sources. Refer to "Natural Communities of New Hampshire" (Sperduto and Nichols 2004) for more information on these natural community types.

- The Nature Conservancy's matrix forest model of high-elevation spruce-fir was then added by converting their polygon data to a grid (NHLC 2001 extent and 93.5 ft pixel size). The grid was then generalized using FOCALMAJORITY (with a 3x3 rectangle and DATA option), followed by BOUNDARYCLEAN (ascend twoway). The results were converted back to polygons and flagged as POTENTIAL high-elevation spruce-fir. Generally speaking, this represents all spruce-fir land cover (2001 NH Land Cover Assessment) that is above 2500 feet elevation, but was not represented in the VINS/Hale results.

Item definitions for HIGHELEV_SPRUCEFIR polygon attributes:

ITEM NAME	DESCRIPTION
FGID	(*unique, sequential ID number*)
UNITNAME	Name of planning unit
ACRES	area (acres)
HECTARES	area (hectares)
DHSKIHA	Area of downhill ski operation (NHFGD 2005)
DENSHIKE	Density of hiking trails in the unit (km/km2)
DENSROADS	Density of roads
IFESMEAN	Mean IFES score (Integrated Fragmentation Effects Surface, TNC; Zankel, 2005)
POP00SQMI	Population density in 2000 (persons per square mile)
HU00SQMI	Housing units density in 2000 (houses per square mile)
PROXINDEX	Proximity index (1km distance)
WETPCT	Percent of polygon that is wetland (NWI palustrine)
ELU30VAR	Variety of Ecological Land Units (ELU30 = elevation, substrate, landform)
HG_TOT	average total deposition of mercury (wet [precipitation + cloud water interception] + dry [GEM + RGM + aerosol]) (Miller et al, 2005)
CA_INDEX	avg deposition index, rate of cation depletion per ha/per year (Miller et al, 2005)
MILLERPCT	Percent matching Miller forest types (listed below)
KNOWNPCT	Percent KNOWN high-elevation spruce-fir (description above)
GAPVERTMAX	Vertebrate species maximum (VT/NH GAP Analysis)
A_RICH_BUF	Species richness of rare animals within their dispersal distances (2009)
A_RICH_POL	Species richness of rare animals within polygon (2009)
P_RICH_POL	Species richness of rare plants in polygon (2009)
C_RICH_POL	Richness of rare and exemplary natural communities in polygon (2009)
ECOSUB	Ecoregional subsection
CONS_AC	Conservation (acres)
CONS_PCT	Conservation (percent)
FORBLOCK	TNC forest block size (acres)

NOTES:

Condition of all matrix forest habitats was evaluated using a single, seamless matrix forest condition raster. This raster was used to select areas, or neighborhoods, of each forest type that are at least 100 acres in size, meeting original thresholds (below). If the contiguous area of top-ranked HESF matrix forest habitat was less than 100 acres it was designated Tier 2.

Tier 1 Top-ranked in NH = Top 15% in NH (by area, for each forest habitat type)
Tier 2 Top-ranked in biological region = Top 100% (high-elevation spruce-fir)

PLEASE REFER TO THE DOCUMENT "MATRIX_FOREST_datanotes.pdf" for explanation.

The list above represents the complete set of attributes developed for the WAP habitat data layer. Only select attributes are distributed in the public release version WAP data layers. For more information, please contact the NH Fish and Game Department, Wildlife Division, 11 Hazen Dr, Concord NH 03301 Phone: (603) 271-2461 E-mail: wildlife@wildlife.nh.gov

The fields: A_RICH_BUF, A_RICH_POL, P_RICH_POL and C_RICH_POL, provide species richness counts (number of different species potentially present in the habitat polygon) from the NH Natural Heritage Bureau as of December 2008. Care must be taken in interpreting these counts as most areas of NH have never been surveyed for biodiversity elements. See *Important Background Information for Interpreting Species Richness Counts based on NH Natural Heritage Bureau Data* for details.

Digital data describing atmospheric deposition of mercury were provided by Ecosystems Research Group, Ltd. using the methods described in Miller et al. (2005). Digital data describing the risk of calcium and other base cation depletion and limitation in forested ecosystems provided by Ecosystems Research Group, Ltd. using methods described in Miller (2005).

Miller Forest Type:	Description
B-NHW	beech, northern hardwoods
SM-NHW	sugar maple, northern hardwoods
NHW	northern hardwoods
BF-RS-WP-HEM	balsam fir, red spruce, white pine, hemlock
NHW-BF-RS-HEM-WP	northern hardwoods, balsam fir, red spruce, hemlock, white pine
NHW-BF-RS	northern hardwoods, balsam fir, red spruce
BF-RS-B	balsam fir, red spruce, beech
BF-RS	balsam fir, red spruce

DATA SOURCES:

Complex Systems Research Center. 2001. *New Hampshire land cover assessment – 2001.* 30m raster data. Available from GRANIT,University of New Hampshire.
Complex Systems Research Center, based on US Geological Survey and NH Dept. of Environmental Services data. 2004. *Surface Water Bodies.* 1:24,000 vector data. Available from GRANIT, University of New Hampshire.
Complex Systems Research Center, based on Natural Resources Conservation Service data. 2003. *Soil Units.* 1:24,000 vector data. Available from GRANIT, University of New Hampshire.

Hale, S.R. In press. Using satellite imagery to model distribution and abundance of Bicknell's thrush (Catharus bicknelli) in New Hampshire's White Mountains.

Hale, S.R., and B.N. Rock. 2003. Impact of topographic normalization on land-cover classification accuracy. Photogrammetric Engineering & Remote Sensing 69:785–791.

Lambert, J.D., K.P. McFarland, C.C. Rimmer, S.D. Faccio, and J.L. Atwood. In press. *A practical model of Bicknell's thrush distribution in the Northeastern United States.*

New Hampshire Natural Heritage Bureau. January 2005*. Exemplary Natural Community Data.* Scale varies, vector data. Available with permission from the NH Natural Heritage Bureau.

NH Natural Heritage Bureau BIOTICS database January 21, 2009 (species/community richness)

Nichols, William F. 2005. *Significant Biodiversity Features in the CT Lakes Headwaters Natural Areas.* The NH Natural Heritage Bureau and The Nature Conservancy.

Sperduto, D.D. and W.F. Nichols. 2004. *Natural communities of New Hampshire.* The NH Natural Heritage Bureau and The Nature Conservancy. 229pp.

The Nature Conservancy, Conservation Science Support. 2008. *Ecological Land Units.* 30m raster data. Available from TNC, Eastern Resource Office, Boston, MA.

The Nature Conservancy (J. Tollefson). 2005. GAP Status Assessment of NH Conservation Lands. Unpublished report to the NH Fish and Game Department.

The Nature Conservancy. 2006. NH Forest Block Model.

United States Geological Survey. Date varies, complete by 2003. *National Elevation Dataset.* 30m raster data. Projected by Complex Systems Research Center in January 2005, available from GRANIT, University of New Hampshire.

V-LATE 1.1 Vector-based Landscape Analysis Tools (Extension for ArcGIS 9). Dirk Tiede, Stefan Lang, Hermann Klug, Tobias Langanke. The development of V-LATE has been financed by the EU project SPIN (Spatial Indicators for European Nature Conservation, Contract No. EVG2-2000-0512, 2001-2004)

Vogelmann, J.E., S.M. Howard, L. Yang, C.R. Larson, B.K. Wylie, and N. Van Driel. 2001. Completion of the 1990s National Land Cover Data Set for the conterminous United States from Landsat Thematic Mapper data and ancillary data sources. Photogrammetric Engineering and Remote Sensing 67:650-662.

Wind power raster data provided by Massachusetts Technology Collaborative (data finalized June 2003). Developed by TrueWind Solutions, LLC under contract to AWS Scientific, Inc as part of a project jointly funded by the Connecticut Clean Energy Fund, Mass. Technology Collaborative, and Northeast Utilities System.

Zankel, M. 2005. Integrated Fragmentation Surface for the State of New Hampshire. The Nature Conservancy, Concord NH. Unpublished report to NH Fish and Game Department.