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NEON Site Level Plot Summary
Treehaven (TREE)

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Site Background

Treehaven is a natural resources education, conference and research center in Lincoln, County, WI between the cities of Rhinelander and Tomahawk. This property encompasses 1,163 acres. Elevations range from 1,460 ft (445 m) to 1,601 ft (488 m) above msl. The entire site is in Major Land Resource Area (MLRA) 94D Northern Highland Sandy Drift.

Site Background

This area is within the Superior Upland Province of the Laurentian Upland. The bedrock consists primarily of Early Proterozoic metavolcanic rock with parts underlain by gneiss. Surficial materials consist of unsorted loamy till from the Wildcat Lake Member of the Copper Falls Formation and meltwater stream sediment from the Wisconsin Valley Lobe. The western portion of this property is characterized by ground moraines with parent materials dominantly being sandy loam to loamy sand till, with some areas having a outwash layer over the till. The eastern part of the property has pitted outwash and sand-dominated moraines with ice block depressions. The depressions contain acid bogs or lakes. The dominant parent material on this site is sandy outwash.

Plant communities at this site are dominated by intermixed conifers and hardwoods on the sandy outwash areas. The loamy mantled soils are predominantly northern hardwoods. There is also acid spruce and tamarack bogs, euic (high-base) cedar swamps, and drainageways dominated by tag alder, grasses and sedges. Climate for MLRA 94D is: Mean Annual Air Temp (MAAT) Low: 4°C, Mean: 5°C, High: 6°C; Mean Annual Precipitation (MAP) Low: 770 mm, Mean: 795 mm, High: 860 mm; Frost Free Days (FFD) Low: 100 d, Mean: 125 d, High: 140 d.

The majority of soils at this site classify as Spodosols with fewer Alfisols, Inceptisols, and Histosols. Various other diagnostic features present or absent in each individual soil determine its taxonomic classification and are noted within the soil descriptions for this project; relevant

ones for this site are: ochric epipedon, histic epipedon, albic horizon, spodic horizon, argillic horizon, glossic horizon, oxyaquic features, aquic features, episaturation, endosaturation, sapric, hemic, and fibric soil material, and lithologic discontinuity. The soils dominantly have particle size control section textures of Sandy with lesser proportions having Coarse-loamy, Coarse-loamy over sandy or sandy-skeletal, or Sandy or sandy-skeletal. Soil minerology at these sites is mixed.

Analysis of Plots for Sampling

Plots for the TREE site were selected to maximize the characterization coverage of the site, and return the most complete representation of the overall site based upon plot location within the mapunit delineation. The main selection criteria were map unit composition and geographic distribution of map units across the site. Map units were grouped for analysis based on drainage and parent materials to ensure that the full range in soil properties were represented. The number of plots sampled for a given map unit is proportional to the area of that map unit within the sites. Plots were also given consideration for sampling if they occurred on a map unit with limited occurrence but represented a soil that was not a component of adjacent mapunits.

Soils on the the TREE site consisted of 17 unique map units, of which 6 contained at least one pre-selected plot. Of the 30 plots on the site, 11 were selected for characterization and analysis. The plots not selected occurred near delineation boundaries, were difficult to access, or the soil was adequately represented in the selected plots.

Soils in the plots sampled represented approximately 81 percent of the TREE site's total map unit acres. Nineteen percent of the site's total map unit acres did not contain a pre-selectd plot. Regardless of extent, a minimum of one plot was selected for sampling in each unique map unit that contained one or more NEON plots.

Soil Map Unit Representation at Treehaven Site		
MUSYM	**Map Unit Name**	**Percent Total Acres (1163)**
VsC	Vilas-Sayner loamy sands, 6 to 15 percent slopes	28%
Lu	Lupton and Cathro soils, 0 to 1 percent slopes	23%
VsD	Vilas-Sayner loamy sands, 15 to 35 percent slopes	17%
VsB	Vilas-Sayner loamy sands, 1 to 6 percent slopes	8%
SbB	Sarwet sandy loam, 2 to 6 percent slopes	2%
CsB	Croswood loamy sand, 1 to 6 percent slopes	3%
	Total	**81%**

Plot Findings

The 11 described and sampled pedons occurred in six named soil map units. The major components of these map units are the Vilas, Sayner, Lupton, Cathro, Sarwet, and Croswood soils. Field description during sampling identitfied the following soils: Sayner, Padwood taxadjunct, Loxley, Cathro, Croswood, Croswell, and Moodig. A taxadjunct is a soil with properties outside the recognized soil series range by one or more differentiating characteristics, which means its classification would differ from the named series. Major soil interpretations, however, for use and management are similar to the named Series.

Plots sampled were dominantly forested with intermixed conifers and hardwoods being the most common upland cover type for sandy outwash soils. The plots on loamy till parent materials typically had Northern hardwoods. One acid bog was sampled, which had a relatively productive stand of tamarack (larch) and black spruce. The euic swamp plot was dominated by alder cover with grasses and sedges.

Parent material – Plots TREE_001, 017, 020, 021, 024, and 050 were soils formed in sandy and/or sandy and gravelly outwash. Plot TREE_019 was a soil formed in sandy outwash over loamy till. Plot TREE_006 was a soil formed in loamy glaciofluvial deposits over loamy till. Plot TREE_041 was a soil formed in loamy till over water-worked sandy till. Plot TREE_011 was a soil formed in herbaceous organic material over loamy till. Plot TREE_009 was a soil formed in a thin layer of mossy organic material over herbaceous organic material over woody organic material.

Summary of Soils

Soils at the TREE site were primarily mapped as excessively drained sandy outwash such as the Vilas-Sayner loamy sands map units. Sampling these sites revealed that several were underlain by coarse-loamy till at approximately 1 meter. Due to the slightly higher bulk density of the till, and the contrasting porosity between parent materials, these soils also showed redoximorphic features indicating a seasonal perched water table. This condition typically means slightly higher productivity in some tree species, while lacking the indicator species present on richer sites. Another notable observation was the thin loamy mantle over the outwash on several sites. While this is slightly outside the range in characteristics for the Vilas or Sayner soil series, this did not alter the taxonomic classification. Effects of this condition are a less droughty site, with slightly greater productivity.

Three plots (TREE_017, 019, and 050) were identified as the Croswood soil series. TREE_017 was located within a Vilas-Sayner loamy sands, 6 to 15 percent slopes map unit, TREE_019 was located within a Croswood loamy sand, 1 to 6 percent slopes map unit, and TREE_050 was located within a Sarwet sandy loam, 2 to 6 percent slopes map unit. In plot TREE_017 nearly the entire upper meter of the soil profile was within the range of the named Vilas soil series. The

lower portion of the pit revealed sandy loam and loamy sandy till with the formation of lamellae which are thin illuvial horizons containing accumulation of silicate clay. The combination of the higher bulk density of the till parent material, and the lamellae, were causing a perched water table typical in the Croswood soil series. This plot was located within approximately 50 meters of a pure glacial till map unit, so it is not out of the ordinary for there to be a transitional area. The Lincoln County, WI soil survey manuscript also lists "soils with loamy till at a depth of 40-60 in." as a common inclusion within this map unit. In plot TREE_019 the soil described fit the named Croswood soil series within the map unit. This soil was slightly outside the range in characteristics for the series due to the thin (9 cm thick) sandy loam surface described. Croswood soils generally have either a loamy sand or sand surface texture. The higher silt and clay content in the upper portion of this profile is likely due to either slope alluvium from adjacent loamy mantled uplands, or it received a thin loess deposit. Another factor to consider is the typically higher organic matter content in the A horizons which can feel like silts or clays when hand texturing. This pedon also differed from the series because the till parent material was observed at a depth of 84 cm where it is typically found between 100 to 150 cm. In plot TREE_050 the Croswood soil described did not fit the named Sarwet component within the Sarwet sandy loam, 2 to 6 percent slopes map unit. The soil described had 89 cm of outwash overlying the till and also lacked the formation of an argillic horizon. The soil survey manuscript lists "areas where the surface soil is sandy and droughty" as an inclusion that is typically found within this map unit.

Three plots (TREE_001, 020, and 021) were identified as the Sayner soil series which all fit a named major component within the soil map unit. TREE_001 and 020 plots were found in separate delineations of the Vilas-Sayner loamy sands, 15 to 35 percent slopes map unit and TREE_021 was located within a Vilas-Sayner loamy sands, 6 to 15 percent slopes map unit. The Sayner series was used for these soils, as opposed to the similar Vilas series, due to a horizon within the series control section having >= 15% coarse fragments by volume. This 15% break for coarse fragments is somewhat arbitrary, but gravel content does influence properties such as available water capacity, bulk density, and saturated hydraulic conductivity. Sayner soils are commonly found on steep sided ridges on outwash plains and sandy moraines where fast moving glacial melt water deposited coarser materials such as gravels.

One plot (TREE_024) was identified as the Croswell soil series. This plot occurred within the Vilas-Sayner loamy sands, 1 to 6 percent slopes map unit. Croswell is listed as a dissimilar inclusion within this map unit in the soil survey manuscripts. The soil described at this site is formed in the same sandy and gravelly outwash as the named Sayner major component with the main difference being the presence of redoximorphic features indicating an apparent water table above 1 meter depth. The low chroma redox features observed within this zone indicate that the soil is saturated for a long enough duration for iron to be reduced. This condition is classified as the Oxyaquic subgroup.

One plot (TREE_006) was identified as a taxadjunct to the Padwood soil series. This plot occurred within the Vilas-Sayner loamy sands, 6 to 15 percent slopes. Taxadjuncts have properties outside the range of any recognized series and are outside higher category class limits by one or more differentiating characteristics of the series. The differences in properties are

small so that major interpretations are not affected. This soil is considered a taxadjunct due to the presence of lamellae and the absence of an argillic horizon. The Padwood series differs from the Vilas and Sayner named components by having a sandy loam mantle and the presence of loamy till at a depth of 60-100 cm.

One plot (TREE_041) was identified as the Moodig soil series. This was a tower plot located within the Sarwet sandy loam, 2 to 6 percent slopes map unit. The Moodig series is listed as an inclusion within this map unit in the Lincoln, County soil survey manuscript. The Moodig and Sarwet soils both formed in the same sandy loam till parent material. The Moodig component exists on footslopes or slightly concave areas where the seasonal perched water table typically exists at depths of 15 to 60 cm, as opposed to the named Sarwet component that exists on linear to convex summits with a seasonal perched water table typically at depths ranging from 60 to 100 cm. The pedon sampled had both high and low chroma redoximorphic features present at a depth of 36 cm.

One plot (TREE_011) was identified as the Cathro soil series. This plot was located within the Lupton and Cathro soils, 0 to 1 percent slopes map unit. Cathro is a named major component within this undifferentiated group map unit. An undifferentiated group consists of two or more taxa components that are not consistently associated geographically and, therefore, do not always occur together in the same map delineation. These taxa are included as the same named map unit because use and management are the same or very similar for common uses. The concept of this map unit is varying thicknesses of organic material where the Cathro component typically has 41 to 130 cm of dominantly sapric organic material, and the Lupton component has >130 cm of dominantly sapric organic material. It is likely that the organic material thickness is variable within this delineation and both components exist. The soil described had 13 cm of hemic material over 71 cm of sapric organic material over a cobbly sandy loam till substratum.

One plot (TREE_009) was identified as the Loxley soil series. This plot was located within the Lupton and Cathro soils, 0 to 1 percent slopes map unit. The Loxley soil is a named minor component within this map unit, with its composition ranging from 0-10%. The Loxley soil is more similar to the Lupton major component in that they both formed in >130 cm of dominantly sapric organic material. The difference between these two soils is the pH. Lupton has a Euic reaction class (pH of 4.5 or greater in one or more layers of organic material within the control section), as opposed to the Loxley series which has a Dysic reaction class (pH less than 4.5). The pH of the soil was not measured in the field, but can generally be inferred by presence or absence of indicator plant species. In this instance plant species that indicated acidic conditions were sphagnum moss, leatherleaf, cranberry, black spruce, and tamarack. The black spruce and tamarack on this plot were not stunted as is common in a closed depressional bog. This plot was not in a closed depression and resembled a broad drainageway between two upland areas. The higher productivity of the site can likely be attributed to some mineral enriched groundwater flow through. The characterization data will confirm the pH values, but it is probable this soil straddles the 4.5 pH break between reaction classes.