TOS SITE CHARACTERIZATION REPORT: DOMAIN 05

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See configuration management system for approval history.

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CHANGE RECORD

REVISION	DATE	ECO#	DESCRIPTION OF CHANGE
A	01/23/2017	ECO-04370	Initial Release
B	11/19/2018	ECO-05656	• Added Phenocam images • Added Sampling Season Section • Added soil pit information table • Added percent cover of bryophyte to the plant diversity table • Updated introduction language to the site information, biomass, and plant sections

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1 DESCRIPTION

1.1 Purpose

Domain and site-specific information collected and described here is used to inform the execution of protocols for the NEON Terrestrial Observation System (TOS), and complements the official NEON TOS data products generated from each site. In addition, the TOS spatial layout and plot allocation is described for each site within the domain.

1.2 Scope

This document includes any site specific characterization methods and the results of characterization efforts for each of the three sites in the Great Lakes domain. For more information about the sampling methods, reference the TOS Site Characterization Methods Document (RD[06]). The geographic coordinates for all TOS sampling locations can be found in the Reference Documents area of the NEON Data Portal and are provided with TOS data product downloads.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules and regulations.

AD[01]	NEON.DOC.004300	EHSS Policy, Program, and Management Plan
AD[02]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD[03]	NEON.DOC.000909	TOS Science Design for Ground Beetle Abundance and Diversity
AD[04]	NEON.DOC.000910	TOS Science Design for Mosquito Abundance, Diversity and Phenology
AD[05]	NEON.DOC.000912	TOS Science Design for Plant Diversity
AD[06]	NEON.DOC.000915	TOS Science Design for Small Mammal Abundance and Diversity
AD[07]	NEON.DOC.000914	TOS Science Design for Plant Biomass and Productivity
AD[08]	NEON.DOC.000001	NEON Observatory Design

2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.000913	TOS Science Design for Spatial Sampling
RD[04]	NEON.DOC.011058	TIS Site Characterization Report
RD[05]	NEON.DOC.002067	AIS Site Characterization Report
RD[06]	NEON.DOC.003885	TOS Site Characterization Methods
RD[07]	NEON.DOC.000481	TOS Protocol and Procedure: Small Mammal Sampling
RD[08]	NEON.DOC.014041	TOS Protocol and Procedure: Breeding Landbird Abundance and Diversity
RD[09]	NEON.DOC.014042	TOS Protocol and Procedure: Plant Diversity Sampling
RD[10]	NEON.DOC.000987	TOS Protocol and Procedure: Measurement of Vegetation Structure
RD[11]	NEON.DOC.014040	TOS Protocol and Procedure: Plant Phenology
RD[12]	NEON.DOC.001709	TOS Protocol and Procedure: Bryophyte Productivity

2.3 Acronyms

Acronym	Definition
BOLD	Barcode of Life Datasystems
NLCD	National Land Cover Database

3 DOMAIN 05 OVERVIEW: GREAT LAKES DOMAIN

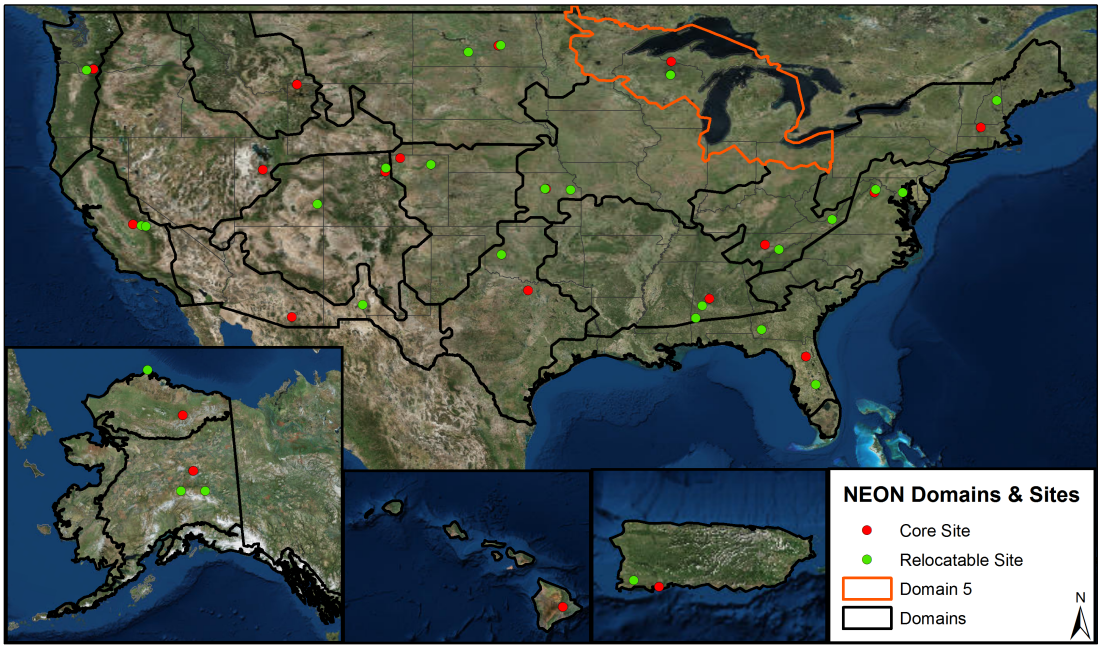

Figure 1: NEON project map with Domain 05 highlighted in red.

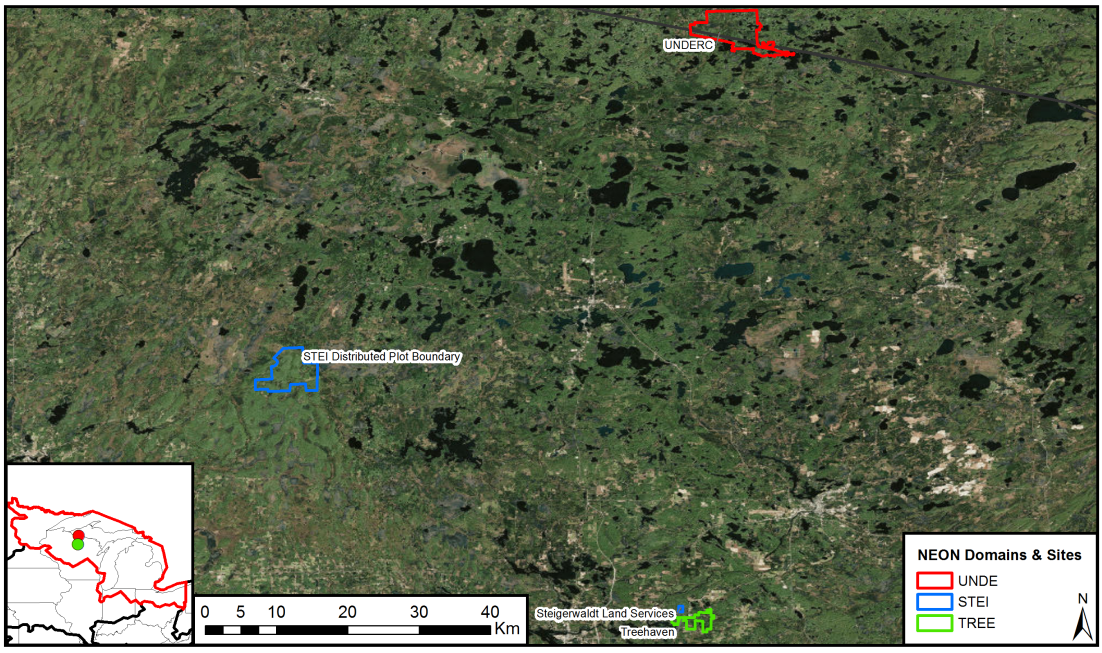

Figure 2: Site boundaries within Domain 05.

The Great Lakes Domain is a matrix of forest and water advancing NEON's ecohydrology theme to examine the connectivity between terrestrial and aquatic ecosystems. Landuse, focusing on forest management, is the main grand challenge theme for this Domain.

- States included in the domain: Illinois, Indiana, Michigan, Minnesota, Ohio, Pennsylvania,Wisconsin
- Core site: UNDERC
- Relocatable 1: Steigerwaldt
- Relocatable 2: Treehaven
- Science themes: Forest Management

4 CORE SITE- UNDERC (UNDE)

NEON's Domain 5 core site is located at the University of Notre Dame Environmental Research Center (UNDERC). Straddling the border between Northern Wisconsin and Michigan's Upper Peninsula, the UNDERC property comprises approximately 7,500 acres (30.35 km^2) and is maintained as an environmental education and research facility.

The UNDERC property represents a regenerating, minimally managed forest that is characteristic of the region. The UNDE site contrasts with the Treehaven and Steigerwaldt relocatable sites with respect to the intensity of forest management.

Figure 3: Phenocamera image for UNDE. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: University of Notre Dame Environmental Research Center
- Located in: Gogebic County, Michigan and Vilas County, Wisconsin
- Sampling Area: 29.39 km^2
- Plot Elevation: 500-540m

- Dominant vegetation type- The UNDERC property primarily includes second-growth Northern mesic forest with dominant species including, red and sugar maple (*Acer rubrum* and *A. saccharum*), aspen (*Populus tremuloides* and *P. grandidentata*)) and paper birch (*Betula papyrifera*). Evergreen forests are dominated by balsam fir (*Abies balsamea*) and may also include hemlock (*Tsuga canadensis*). In the numerous wet areas, cedar (*Thuja occidentalis*) and black spruce (*Picea mariana*) are common. Poorly drained soils on the site can give rise to open, acidic sphagnum bogs dotted with tamarack (*Larix laricina*), black spruce and Ericaceous shrubs.
- General management: Region-wide logging for pine in the late 1800s and early to mid-1900's led to clear cutting of most forested areas on the property. The main parcel was donated to the University in the 1930s. Timber harvest continued into the 1950s and later, leaving a mixture of successional forest re-growth. Since the 1970s, the site has been minimally managed to maintain access for recreational, educational and research goals.
- UNDERC also has 30 lakes comprising 1350 acres (5.46 km^2), including Crampton Lake, a NEON aquatics site. See the AIS site characterization report for more details (RD[05]).
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research.

4.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at UNDE according to a spatially balanced and stratified-random design (RD[3]). The 2006 National Land Cover Database (NLCD) was selected for stratification because of the consistent and comparable data availability across the United States. TOS Tower Plots were allocated according to a spatially balanced design in and around the NEON tower airshed (RD[03]). The maps below depict the plot locations for the first year of NEON sampling. Some plot locations may change over time due to logistics, safety, and science requirements.Please visit the NEON website (http://www.neonscience.org) for updated plot locations at each site.

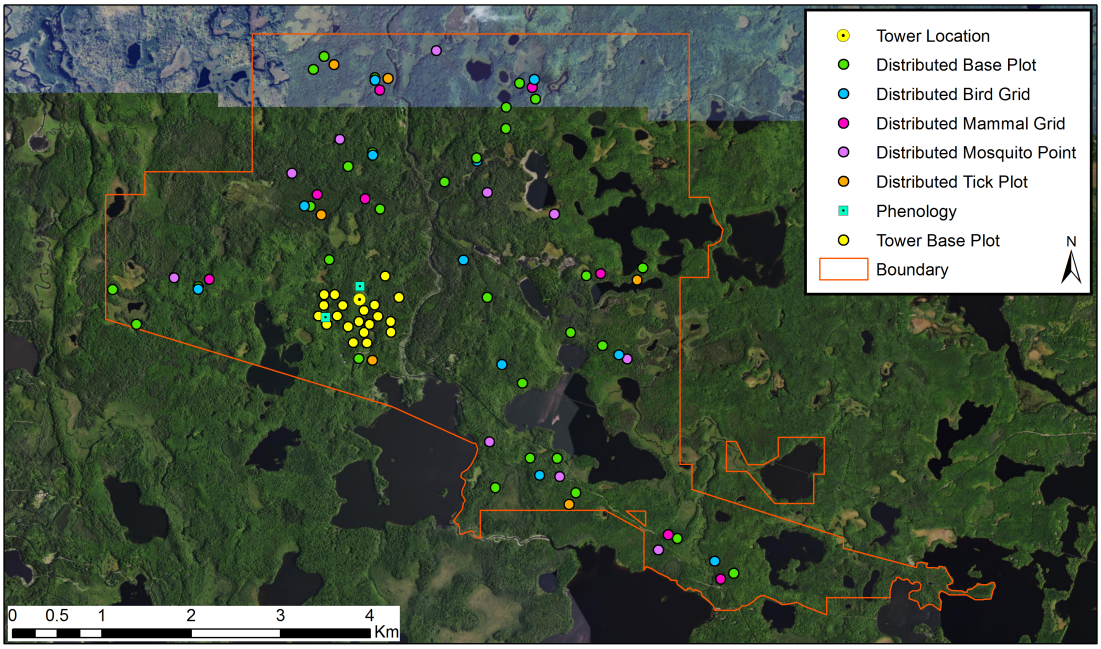

Figure 4: Map of TOS plot centroids within the NEON TOS sampling boundary at UNDE.

For a list of protocols associated with each plot see tables below; for additional spatial design information see RD[03].

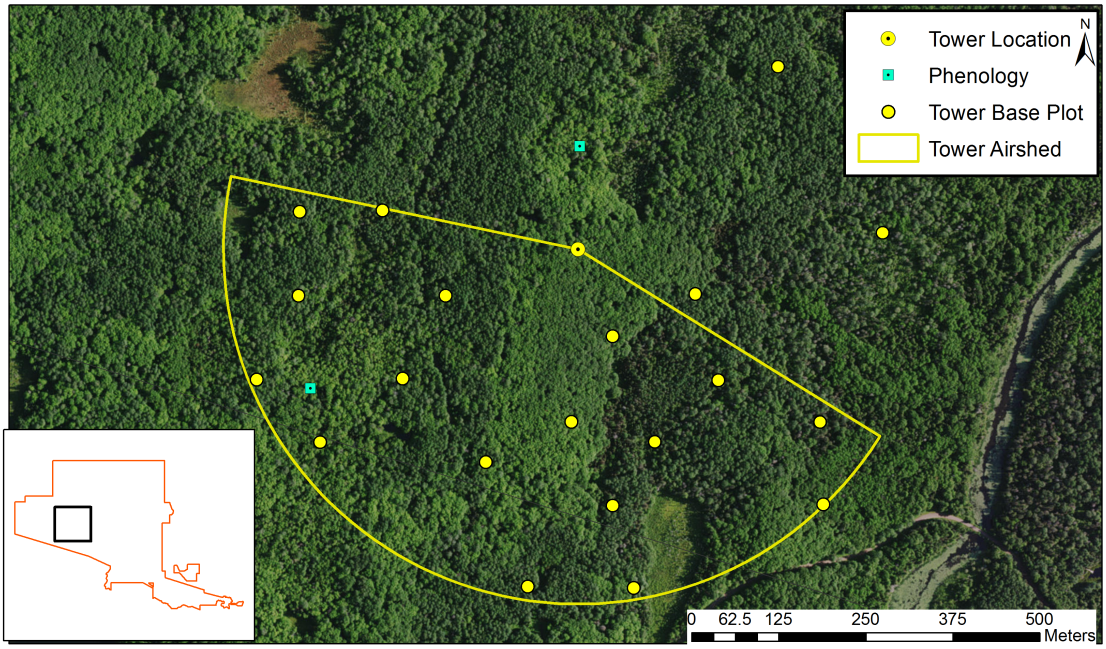

Figure 5: Map of the tower airshed and TOS centroids at UNDE.

More information about the tower airshed can be found in the FIU site characterization report (RD[04]).

Table 1: NLCD land cover classes and area within the TOS site boundary at UNDE.

NLCD Class	Site Area (km^2)	Percent (%)
Woody Wetlands	13.36	45.37
Deciduous Forest	6.28	21.33
Open Water	4.17	14.17
Mixed Forest	2.57	8.72
Developed Open Space	1.36	4.63
Evergreen Forest	0.76	2.58
Emergent Herbaceous Wetlands	0.72	2.46
Shrub Scrub	0.19	0.64
Grassland Herbaceous	0.03	0.1

Note: Any NLCD land cover classes less than 5% will not be sampled. Additionally, no sampling will take place in Water, Developed, or Barren Land NLCD classes.

Table 2: NLCD land cover classes and TOS plot numbers at UNDE.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Deciduous Forest	10
Distributed	Base Plot	Mixed Forest	6
Distributed	Base Plot	Woody Wetlands	14
Distributed	Bird Grid	Deciduous Forest	2
Distributed	Bird Grid	Mixed Forest	1
Distributed	Bird Grid	Woody Wetlands	6
Distributed	Mammal Grid	Deciduous Forest	2
Distributed	Mammal Grid	Mixed Forest	2
Distributed	Mammal Grid	Woody Wetlands	3
Distributed	Mosquito Point	Deciduous Forest	3
Distributed	Mosquito Point	Mixed Forest	1
Distributed	Mosquito Point	Woody Wetlands	6
Distributed	Tick Plot	Deciduous Forest	2
Distributed	Tick Plot	Mixed Forest	1
Distributed	Tick Plot	Woody Wetlands	3
Tower	Base Plot	NA	20
Tower	phenology	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover types within the airshed are deciduous forest, mixed forest, and woody wetlands.

Table 3: Number of Distributed Base Plots per NLCD land cover class per protocol at UNDE.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Deciduous Forest	Beetles	3
Distributed	Base Plot	Mixed Forest	Beetles	1
Distributed	Base Plot	Woody Wetlands	Beetles	6
Distributed	Base Plot	Deciduous Forest	Canopy Foliage Chemistry	3
Distributed	Base Plot	Mixed Forest	Canopy Foliage Chemistry	1
Distributed	Base Plot	Woody Wetlands	Canopy Foliage Chemistry	6
Distributed	Base Plot	Deciduous Forest	Coarse Downed Wood	7
Distributed	Base Plot	Mixed Forest	Coarse Downed Wood	4
Distributed	Base Plot	Woody Wetlands	Coarse Downed Wood	9

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Deciduous Forest	Digital Hemispherical Photos for Leaf Area Index	7
Distributed	Base Plot	Mixed Forest	Digital Hemispherical Photos for Leaf Area Index	4
Distributed	Base Plot	Woody Wetlands	Digital Hemispherical Photos for Leaf Area Index	9
Distributed	Base Plot	Deciduous Forest	Herbaceous Biomass	7
Distributed	Base Plot	Mixed Forest	Herbaceous Biomass	4
Distributed	Base Plot	Woody Wetlands	Herbaceous Biomass	9
Distributed	Base Plot	Deciduous Forest	Plant Diversity	10
Distributed	Base Plot	Mixed Forest	Plant Diversity	6
Distributed	Base Plot	Woody Wetlands	Plant Diversity	14
Distributed	Base Plot	Deciduous Forest	Soil Biogeochemistry	2
Distributed	Base Plot	Mixed Forest	Soil Biogeochemistry	1
Distributed	Base Plot	Woody Wetlands	Soil Biogeochemistry	3
Distributed	Base Plot	Deciduous Forest	Soil Microbes	2
Distributed	Base Plot	Mixed Forest	Soil Microbes	1
Distributed	Base Plot	Woody Wetlands	Soil Microbes	3
Distributed	Base Plot	Deciduous Forest	Vegetation Structure	7
Distributed	Base Plot	Mixed Forest	Vegetation Structure	4
Distributed	Base Plot	Woody Wetlands	Vegetation Structure	12

Note: Distributed Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get total TOS Distributed Base Plot number.

Table 4: Number of Tower Plots per protocol at UNDE.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	20
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	20
Tower	Base Plot	Litterfall and Fine Woody Debris	20
Tower	Base Plot	Mat-Forming Bryophyte Production	20
Tower	Base Plot	Plant Belowground Biomass	20
Tower	Base Plot	Plant Diversity	3

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	20
Tower	Phenology	Plant Phenology	2

Note: Tower Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get the total TOS Tower Base Plot number.

4.2 Sampling Season Characterization: UNDE

For numerous TOS protocols, the length of the sampling season, the number of bouts, and when those bouts occur is dictated by the seasonal status of the plant community. By monitoring 'greenness' on a 16 day interval, the MODIS/Terra EVI phenology product provides consistent, reliable insight into plant community phenology and intensity at the continental scale. For those protocols for which timing is standardized by greenness transitions and/or peak green status, NEON has utilized these data as the primary means of guiding temporal aspects of TOS sampling at each site.

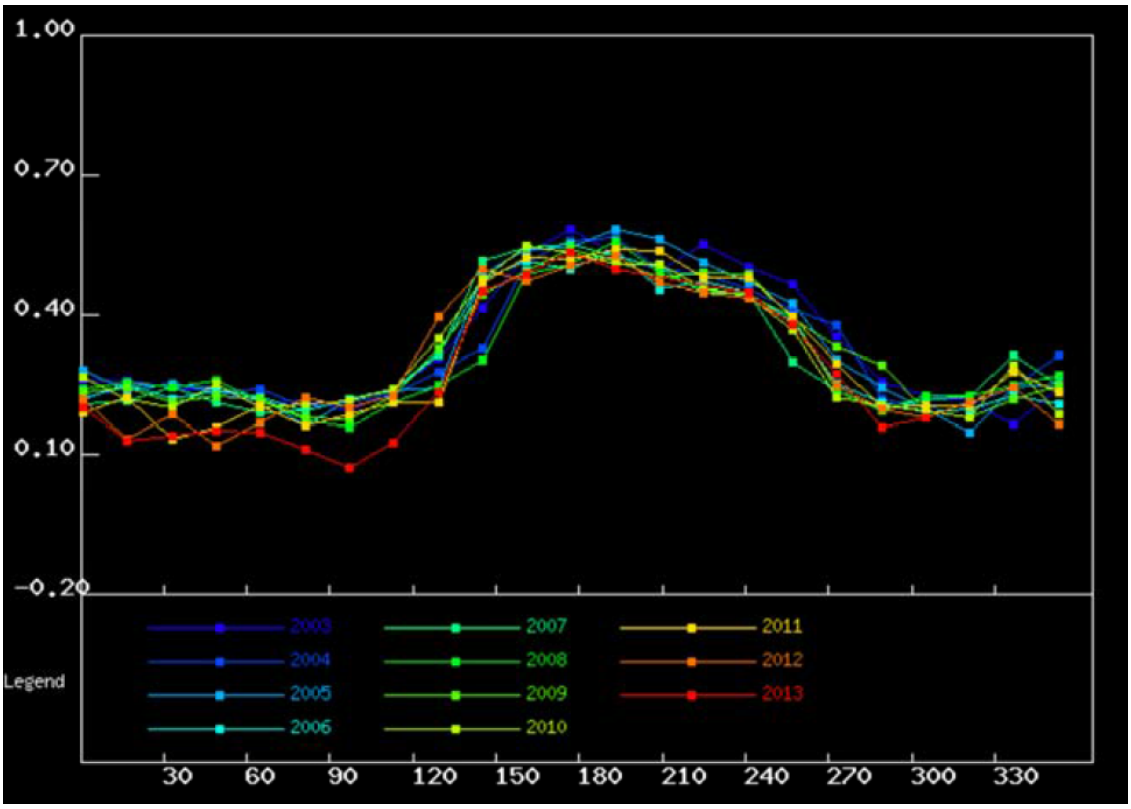

Figure 6: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON UNDE site.

Table 5: Average MODIS-EVI greenness dates for the NEON UNDE site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
120 (05/01)	170 (06/20)	215 (08/04)	285 (10/13)

MODIS Product Details

- Product: MODIS-EVI phenology product, 16 day interval, 250 m grid, data included from all pixels with acceptable quality within user-defined square that roughly overlaps the TOS site boundary.
- Date range: 2003-2013
- User selected area: 16.25 km x 16.25 km box, centroid: Latitude: 46.23388, Longitude: -89.53725 WGS84 datum

4.3 Belowground Biomass

4.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 200 cm by NEON staff in September 2013. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30 cm, the belowground biomass site characterization data are critical for scaling belowground biomass measurements to greater depths; see the TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index (AD[7]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Roots were sorted to two diameter size categories ($\leq$ 2 mm and 2-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to 30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

4.3.2 Results

Table 6: Soil Pit Information at UNDE.

Latitude	Longitude	Soil Family	Soil Order
46.14103	-89.3221	Coarse-loamy - mixed - superactive - frigid Argic Fragiaquods	Spodosol

Soil Profile was described by Natural Resource Conservation Service (NRCS).

Table 7: Fine root mass per depth increment (cm) at UNDE.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	4.59	1.82
10	20	1.21	0.71
20	30	0.41	0.3
30	40	0.26	0.19
40	50	0.97	1.53
50	60	0.04	0.04
60	70	0.02	0.01
70	80	0.03	0.02
80	90	0.17	0.21
90	100	0.15	0.18
100	120	0.11	0.16
120	140	0.14	0.09
140	160	0.03	0.02

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
160	180	0.01	0.02
180	200	0	0

Table 8: Cumulative fine root mass as a function of depth (cm) at UNDE.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	459.09	182.45
10	20	579.86	248.43
20	30	620.55	277.5
30	40	646.67	296.14
40	50	743.25	441.28
50	60	747.21	438.78
60	70	749.65	437.5
70	80	752.8	437.49
80	90	769.51	421.05
90	100	784.89	408.03
100	120	806.55	390.62
120	140	834.37	378.55
140	160	839.57	382.82
160	180	841.47	381.41
180	200	841.6	381.54

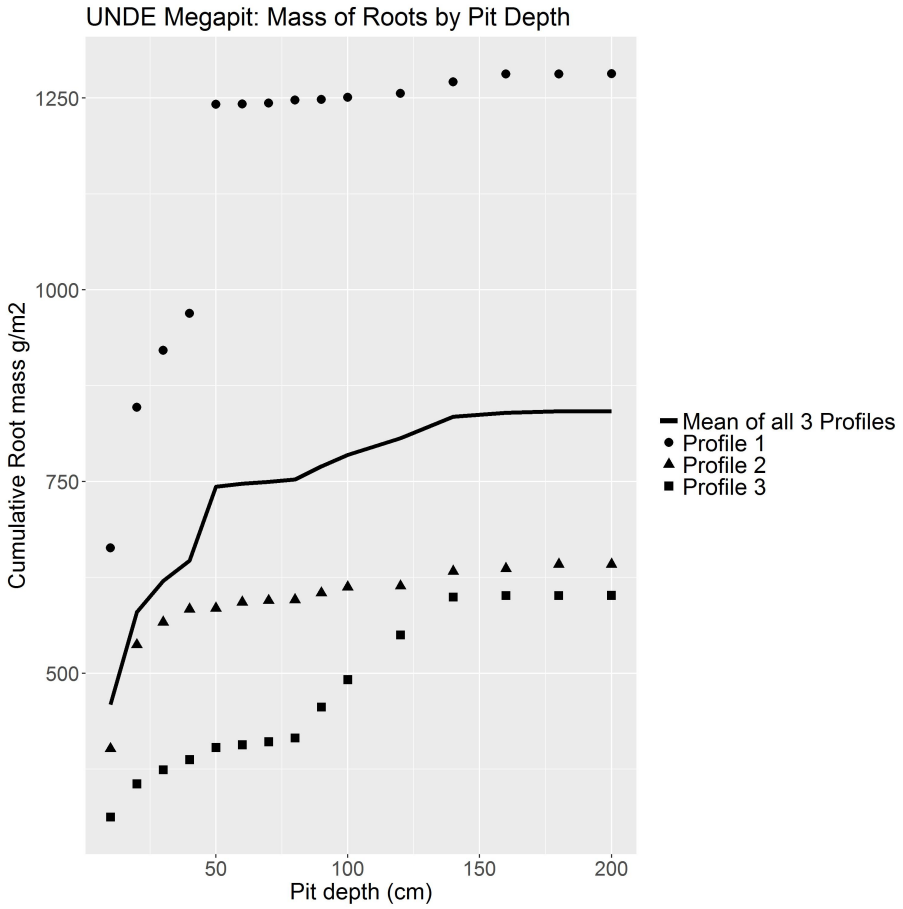

Figure 7: Cumulative root mass by pit depth at UNDE.

Table 9: Fine root biomass sampling summary data at UNDE.

Total Pit Depth (cm)	200
Total Mean Cumulative Mass at 30cm (g per m^2)	620.55
Total Mean Cumulative Mass at 100cm (g per m^2)	784.89
Total Mean Cumulative Mass (g per m^2)	841.6

4.4 Plant Characterization and Phenology Species Selection

4.4.1 Site-Specific Methods

Plant characterization data were collected by an external contractor during the summer of July 2013. Plant characterization data informs sampling procedures for plant phenology and plant productivity protocols.

The overall ranking ("Rank" in the table below) was calculated based on three separate measurements. Overall ranking weights are influenced by the number of species within each grouping.

1. Mean percent cover values were calculated based on species specific cover estimation for all plant species under 3m tall in eight 1m by 1m subplots per plot; see the TOS Protocol and Procedure: Plant Diversity Sampling (RD[09]) for more information.
2. Mean canopy area values were calculated based on all species specific shrub canopy diameter measurements within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.
3. Mean ABH (area at breast height) measurements were calculated based on diameter at breast height measurements for all woody vegetation with a diameter greater than 1cm at 130cm height within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.

The standard field methods and ranking calculations are further outlined in TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

4.4.2 Results

Table 10: Site plant characterization and phenology species summary at UNDE.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
ACSA3	*Acer saccharum* Marshall	1	10	NA	8.3
ABBA	*Abies balsamea* (L.) Mill.	2	14	NA	0.84
ACRU	*Acer rubrum* L.	3	9	NA	3.98
POTR5	*Populus tremuloides* Michx.	4	<1	NA	4.46
POGR4	*Populus grandidentata* Michx.	5	<1	NA	4.21
COCO6	*Corylus cornuta* Marshall	6	5	NA	NA
PTAQ	*Pteridium aquilinum* (L.) Kuhn	7	4	NA	NA
ALINR	*Alnus incana* (L.) Moench ssp. *rugosa* (Du Roi) R.T. Clausen	8	3	NA	NA
OSCI	*Osmunda cinnamomea* L.	9	3	NA	NA
ATFI	*Athyrium filix-femina* (L.) Roth	10	3	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
OSVI	*Ostrya virginiana* (Mill.) K. Koch	11	3	NA	0.02
DRIN5	*Dryopteris intermedia* (Muhl. ex Willd.) A. Gray	12	2	NA	NA
FRNI	*Fraxinus nigra* Marshall	13	2	NA	0.46
PIGL	*Picea glauca* (Moench) Voss	14	<1	NA	1.21
PIMA	*Picea mariana* (Mill.) Britton, Sterns & Poggenb.	15	1	NA	0.5
COCA13	*Cornus canadensis* L.	16	2	NA	NA
LALA	*Larix laricina* (Du Roi) K. Koch	17	NA	NA	1.51
MACA4	*Maianthemum canadense* Desf.	18	2	NA	NA
RUID	*Rubus idaeus* L.	19	1	NA	NA
ILMU	*Ilex mucronata* (L.) Powell, Savolainen & Andrews	20	1	NA	NA
CACO7	*Carex communis* L.H. Bailey	21	1	NA	NA
CAPE6	*Carex pensylvanica* Lam.	22	<1	NA	NA
DIPA9	*Dirca palustris* L.	23	<1	NA	NA
PHCO24	*Phegopteris connectilis* (Michx.) Watt	24	<1	NA	NA
RUPU	*Rubus pubescens* Raf.	25	<1	NA	NA
BEPA	*Betula papyrifera* Marshall	26	NA	NA	0.39
LEGR	*Ledum groenlandicum* Oeder	27	<1	NA	NA
OSCL	*Osmorhiza claytonii* (Michx.) C.B. Clarke	28	<1	NA	NA
LYDE	*Lycopodium dendroideum* Michx.	29	<1	NA	NA
FRPE	*Fraxinus pennsylvanica* Marshall	30	<1	NA	0.03
ILVE	*Ilex verticillata* (L.) A. Gray	31	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
GYDR	*Gymnocarpium dryopteris* (L.) Newman	32	<1	NA	NA
TRBO2	*Trientalis borealis* Raf.	33	<1	NA	NA
VAMY	*Vaccinium myrtilloides* Michx.	34	<1	NA	NA
COAL2	*Cornus alternifolia* L. f.	35	<1	NA	NA
DOUM2	*Doellingeria umbellata* (Mill.) Nees	36	<1	NA	NA
LYAN2	*Lycopodium annotinum* L.	37	<1	NA	NA
ORAS	*Oryzopsis asperifolia* Michx.	37	<1	NA	NA
AMAR3	*Amelanchier arborea* (Michx. f.) Fernald	39	<1	NA	NA
PRSE2	*Prunus serotina* Ehrh.	40	<1	NA	0.07
CATU2	*Carex tuckermanii* Dewey	41	<1	NA	NA
THOC2	*Thuja occidentalis* L.	42	NA	NA	0.19
TIAM	*Tilia americana* L.	43	<1	NA	0.18
GAHI2	*Gaultheria hispidula* (L.) Muhl. ex Bigelow	44	<1	NA	NA
CADI6	*Carex disperma* Dewey	45	<1	NA	NA
CLBO3	*Clintonia borealis* (Aiton) Raf.	46	<1	NA	NA
PIST	*Pinus strobus* L.	47	<1	NA	0.16
BEAL2	*Betula alleghaniensis* Britton	48	<1	NA	0.14
OXMO	*Oxalis montana* Raf.	49	<1	NA	NA
LOCA7	*Lonicera canadensis* W. Bartram ex Marshall	50	<1	NA	NA
ONSE	*Onoclea sensibilis* L.	51	<1	NA	NA
ARTR	*Arisaema triphyllum* (L.) Schott	52	<1	NA	NA
CAREX	*Carex* sp.	53	<1	NA	NA
COTR2	*Coptis trifolia* (L.) Salisb.	54	<1	NA	NA
HIERA	*Hieracium* sp.	54	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
BRAR9	*Brachyelytrum aristosum* (Michx.) Trel.	56	<1	NA	NA
MIRE	*Mitchella repens* L.	57	<1	NA	NA
EQSY	*Equisetum sylvaticum* L.	58	<1	NA	NA
PYEL	*Pyrola elliptica* Nutt.	59	<1	NA	NA
RUFL	*Rubus flagellaris* Willd.	59	<1	NA	NA
PHME13	*Photinia melanocarpa* (Michx.) K.R. Robertson & Phipps	61	<1	NA	NA
CAAR3	*Carex arctata* Boott ex Hook.	62	<1	NA	NA
GAPR2	*Gaultheria procumbens* L.	62	<1	NA	NA
IRVE2	*Iris versicolor* L.	64	<1	NA	NA
ACRU2	*Actaea rubra* (Aiton) Willd.	65	<1	NA	NA
CAGR2	*Carex gracillima* Schwein.	65	<1	NA	NA
CAIN12	*Carex intumescens* Rudge	65	<1	NA	NA
GATR3	*Galium triflorum* Michx.	65	<1	NA	NA
ULRU	*Ulmus rubra* Muhl.	69	<1	NA	0.01
RIBES	*Ribes* sp.	70	<1	NA	NA
ARNU2	*Aralia nudicaulis* L.	71	<1	NA	NA
PRVI	*Prunus virginiana* L.	71	<1	NA	NA
VEOF2	*Veronica officinalis* L.	71	<1	NA	NA
PRPE2	*Prunus pensylvanica* L. f.	74	<1	NA	NA
SPAL2	*Spiraea alba* Du Roi	75	<1	NA	NA
CACA11	*Carex canescens* L.	76	<1	NA	NA
CAGY4	*Carex gynandra* Schwein.	76	<1	NA	NA
EUMA27	*Eurybia macrophylla* (L.) Cass.	76	<1	NA	NA
FRVI	*Fragaria virginiana* Duchesne	76	<1	NA	NA
LIBO3	*Linnaea borealis* L.	76	<1	NA	NA
PYCH	*Pyrola chlorantha* Sw.	76	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
RARE2	*Ranunculus recurvatus* Poir.	76	<1	NA	NA
VIRO2	*Viola rotundifolia* Michx.	76	<1	NA	NA
ACPA	*Actaea pachypoda* Elliott	84	<1	NA	NA
CLVU	*Clinopodium vulgare* L.	84	<1	NA	NA
GLST	*Glyceria striata* (Lam.) Hitchc.	84	<1	NA	NA
KAPO	*Kalmia polifolia* Wangenh.	84	<1	NA	NA
POCU6	*Polygonum cuspidatum* Siebold & Zucc.	84	<1	NA	NA
POSC3	*Polygonum scandens* L.	84	<1	NA	NA
PYROL	*Pyrola* sp.	84	<1	NA	NA
SYCI	*Symphyotrichum ciliolatum* (Lindl.) Á. Löve & D. Löve	84	<1	NA	NA
TAOF	*Taraxacum officinale* F.H. Wigg.	84	<1	NA	NA
ACSP2	*Acer spicatum* Lam.	93	<1	NA	NA
COSE16	*Cornus sericea* L.	94	<1	NA	NA
RHAL	*Rhamnus alnifolia* L'Hér.	95	<1	NA	NA
FRAM2	*Fraxinus americana* L.	96	<1	NA	NA
ANQU	*Anemone quinquefolia* L.	97	NA	NA	NA
CACA4	*Calamagrostis canadensis* (Michx.) P. Beauv.	97	NA	NA	NA
CALA11	*Carex lasiocarpa* Ehrh.	97	NA	NA	NA
CAMAI2	*Carex magellanica* Lam. ssp. *irrigua* (Wahlenb.) Hultén	97	NA	NA	NA
CATH2	*Caulophyllum thalictroides* (L.) Michx.	97	NA	NA	NA
CIAL	*Circaea alpina* L.	97	NA	NA	NA
CILA2	*Cinna latifolia* (Trevis. ex Goepp.) Griseb.	97	NA	NA	NA
CORNU	*Cornus* sp.	97	NA	NA	NA
CRATA	*Crataegus* sp.	97	NA	NA	NA
DILO	*Diervilla lonicera* Mill.	97	NA	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
EUGR5	*Euthamia graminifolia* (L.) Nutt.	97	NA	NA	NA
GALIU	*Galium* sp.	97	NA	NA	NA
GATI	*Galium tinctorium* (L.) Scop.	97	NA	NA	NA
GEMA4	*Geum macrophyllum* Willd.	97	NA	NA	NA
GEUM	*Geum* sp.	97	NA	NA	NA
LYOB	*Lycopodium obscurum* L.	97	NA	NA	NA
MAIAN	*Maianthemum* sp.	97	NA	NA	NA
MILIU	*Milium* sp.	97	NA	NA	NA
MOHY3	*Monotropa hypopithys* L.	97	NA	NA	NA
MOUN3	*Monotropa uniflora* L.	97	NA	NA	NA
OSCL2	*Osmunda claytoniana* L.	97	NA	NA	NA
POBI2	*Polygonatum biflorum* (Walter) Elliott	97	NA	NA	NA
SCLA2	*Scutellaria lateriflora* L.	97	NA	NA	NA
VIOLA	*Viola* sp.	97	NA	NA	NA

Note:Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov).

Table 11: Per plot breakdown of species richness, diversity, and herbaceous cover at UNDE.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
14694	26	2.4	52
UNDE_037	23	2.4	133
UNDE_038	22	1.49	73
UNDE_043	31	2.64	79
UNDE_044	23	2.63	56
UNDE_045	33	2.83	68
UNDE_047	15	2	62
UNDE_048	22	2.33	40
UNDE_049	37	2.74	149
UNDE_050	31	2.83	53

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
UNDE_052	27	2.02	69
UNDE_053	19	2.32	85
UNDE_054	11	1.61	60
UNDE_055	20	2.04	88
UNDE_056	26	2.56	38
UNDE_057	18	2.1	51
UNDE_058	24	2.34	75
UNDE_059	20	1.88	77
UNDE_060	27	2.86	54
UNDE_061	14	1.78	19

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot. Plot 14694 is no longer being sampled and was not assigned a UNDE plot ID.

According to AD[07], sites qualify for bryophyte productivity sampling when average bryophyte cover is $\geq$ 20% across all Tower plots. At UNDE, first year plant diversity data were used to quantify bryophyte cover because these data were not collected during characterization of this site. Across all Distributed Plots and the three Tower Plots measured for plant diversity, mean bryophyte cover was 24%. However, bryophyte productivity sampling was discontinued in 2018 and NEON no longer implements this protocol.

4.5 Beetles

4.5.1 Site-Specific Methods

Beetle site characterization was conducted in June 2013 by NEON staff following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Beetle site characterization data were collected to start site level teaching collections. All samples were pooled before being sent for identification. For DNA sequence data generated as a result of these efforts, visit the Barcode of Life Datasystems (BOLD) at http://www.boldsystems.org. For more information on this protocol and data product numbers see Appendix A.

4.5.2 Results

Table 12: Beetle identification results at UNDE.

Sample ID	Scientific Name
NEONTcarabid8107	*Poecilus lucublandus*
NEONTcarabid8109	*Pterostichus coracinus*
NEONTcarabid8108	*Sphaeroderus stenostomus lecontei*

Sample ID	Scientific Name
NEONTcarabid8106	*Pterostichus pensylvanicus*
NEONcarabid8105	*Pterostichus pensylvanicus*

4.6 Mosquitoes

4.6.1 Site-Specific Methods

Mosquito site characterization was conducted in June 2013 by NEON staff following the standard methods outlined in TOS Site Characterization Methods (RD[6]) to test protocol methods and start site level species lists. All samples were pooled before being sent for identification. No pathogen testing was performed. For DNA sequence data generated as a result of these efforts, visit the Barcode of Life Datasystems (BOLD) at http://www.boldsystems.org. For more information on this protocol and data product numbers see Appendix A.

4.6.2 Results

Table 13: Mosquito identification results at UNDE.

Vial ID	Scientific Name	sex	Individual Count
UNDE.June2013.SC.1	*Aedes canadensis canadensis*	female	74
UNDE.June2013.SC.1	*Aedes cinereus*	female	18
UNDE.June2013.SC.1	*Aedes provocans*	female	1
UNDE.June2013.SC.1	*Aedes spp.*	female	96
UNDE.June2013.SC.1	*Aedes spp.*	male	1
UNDE.June2013.SC.1	*Coquillettidia perturbans*	female	9
UNDE.June2013.SC.1	*Culex restuans*	female	1
UNDE.June2013.SC.2	*Aedes canadensis canadensis*	female	89
UNDE.June2013.SC.2	*Aedes cinereus*	female	12
UNDE.June2013.SC.2	*Aedes provocans*	female	3
UNDE.June2013.SC.2	*Aedes vexans*	female	1
UNDE.June2013.SC.2	*Aedes spp.*	female	84
UNDE.June2013.SC.2	*Coquillettidia perturbans*	female	7
UNDE.June2013.SC.2	*Culex restuans*	female	4
UNDE.June2013.SC.3	*Aedes canadensis canadensis*	female	78
UNDE.June2013.SC.3	*Aedes cinereus*	female	8

Vial ID	Scientific Name	sex	Individual Count
UNDE.June2013.SC.3	*Aedes excrucians*	female	5
UNDE.June2013.SC.3	*Aedes provocans*	female	9
UNDE.June2013.SC.3	*Aedes spp.*	female	90
UNDE.June2013.SC.3	*Aedes spp.*	male	2
UNDE.June2013.SC.3	*Anopheles punctipennis*	female	2
UNDE.June2013.SC.3	*Coquillettidia perturbans*	female	6
UNDE.June2013.SC.4	*Aedes canadensis canadensis*	female	82
UNDE.June2013.SC.4	*Aedes cinereus*	female	8
UNDE.June2013.SC.4	*Aedes excrucians*	female	2
UNDE.June2013.SC.4	*Aedes provocans*	female	5
UNDE.June2013.SC.4	*Aedes vexans*	female	1
UNDE.June2013.SC.4	*Aedes spp.*	female	83
UNDE.June2013.SC.4	*Coquillettidia perturbans*	female	17
UNDE.June2013.SC.4	*Culex restuans*	female	2
UNDE.June2013.SC.5	*Aedes canadensis canadensis*	female	90
UNDE.June2013.SC.5	*Aedes cinereus*	female	8
UNDE.June2013.SC.5	*Aedes excrucians*	female	2
UNDE.June2013.SC.5	*Aedes provocans*	female	2
UNDE.June2013.SC.5	*Aedes vexans*	female	1
UNDE.June2013.SC.5	*Aedes spp.*	female	85
UNDE.June2013.SC.5	*Coquillettidia perturbans*	female	10
UNDE.June2013.SC.5	*Culex restuans*	female	2

4.7 Ticks

4.7.1 Site-Specific Methods

Tick drags were conducted at UNDE in June 2013 by NEON staff to test protocol methods and calculate capture rates. No pathogen testing was performed. All samples were pooled before being sent for identification. For more information on this protocol and data product numbers see Appendix A.

4.7.2 Results

Table 14: Tick identification results at UNDE.

Sample ID	Scientific Name
20130625.SC.1	*Dermacentor variabilis*
20130625.SC.1	*Ixodes scapularis*

4.8 Species Reference Lists

A review of the literature for taxonomic lists of interest for each site was conducted prior to field work. In the case of vertebrates that NEON may capture (e.g., reptiles, amphibians, small mammals), these lists were often required to secure permits. Key references identified in this effort are listed below. Species lists and associated references for small mammals and breeding landbirds can be found in the appendices of the respective protocols (RD[07], RD[08]).

Bousquet, Y. 2012. Catalogue of Geadephaga (Coleoptera, Adephaga) of America, north of Mexico. ZooKeys, (245), 1-1722.

Centers for Disease Control and Prevention. (2015). *Geographic distribution of ticks that bite humans.* Retrieved from http://www.cdc.gov/ticks/geographic_distribution.html

Darsie Jr., R. F., and R. A. Ward. 2005. Identification and geographical distribution of the mosquitoes of North America, North of Mexico. University Press of Florida, Gainesville.

University of Notre Dame.(2016). *Plants* Retrived from http://underc.nd.edu/underc-east/the-environment/plant-species/

University of Notre Dame.(2016). *Vertebrates* Retrived from http://underc.nd.edu/underc-east/the-environment/vertebrate-species-lists/

5 RELOCATABLE SITE 1- STEIGERWALDT (STEI)

The Domain 5 relocatable terrestrial site Steigerwaldt consists of two separate properties that are not spatially connected. The site of NEON's tower and related field study plots is managed and owned by Steigerwaldt Land Services, Inc. and is located to the east of Tomahawk, WI, approximately 1 mile north of the Treehaven site. However, the property was too small for NEON's Distributed Plot activities. Consequently, NEON has established a separate set of Distributed Plots in the Park Falls District of the Chequamegon-Nicolet National Forest (CNNF), about 30 miles NW of the Steigerwaldt tower.

The Steigerwaldt tower location and surrounding Tower Plots are approximately 1 mile due north of the Treehaven tower and its surrounding plots. Because the sites are managed differently, the close proximity of the towers could help isolate the effect of management practices on carbon cycling dynamics.

Figure 8: Phenocamera image for STEI. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: Steigerwaldt Land Services and Chequamegon-Nicolet National Forest (CNNF)
- Located in: Lincoln and Price counties, Wisconsin
- Sampling Area: 23.4 km^2

- Plot Elevation: 460-530m
- Dominant vegetation type- The Steigerwaldt tower site is a young, even-aged stand, with aspen (*Populus tremuloides*), red maple (*Acer rubrum*), and balsam fir (*Abies balsamea*) among the most abundant tree species. The NEON study area in the CNNF Park Falls District encompasses a diversity of forest stands. The area includes pine, hemlock, aspen, northern hardwoods, including CCC-planted red and jack pine plantations.
- General management: The Steigerwaldt tower site is managed for timber production and recreation. The stand was cut in 2005, with some scattered oak and hemlock left for wildlife food and roost. Roads are planted with clover as additional food source for deer and ruffed grouse. Logging is active in the area, although different management systems may vary. The CNNF Park Falls District's timber program has recently been dominated by salvage timber projects following ice and hail damage, windstorms, tornadoes, and spruce decline, followed by a recent focus in over-mature aspen stands in both Price and Taylor County. Over the last several years, the District has been moving out of salvage mode with recently approved vegetation management and forest health projects in pine and hardwood management areas.
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research. The NEON study area in the CNNF is in close proximity to other research activities that have focused on land-atmosphere carbon interactions including the Chequamegon Ecosystem Atmosphere Study, or ChEAS.

5.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at STEI according to a spatially balanced and stratified-random design (RD[3]). The 2006 National Land Cover Database (NLCD) was selected for stratification because of the consistent and comparable data availability across the United States. TOS Tower Plots were allocated according to a spatially balanced design in and around the NEON tower airshed (RD[03]). The maps below depict the plot locations for the first year of NEON sampling. Some plot locations may change over time due to logistics, safety, and science requirements.Please visit the NEON website (http://www.neonscience.org) for updated plot locations at each site.

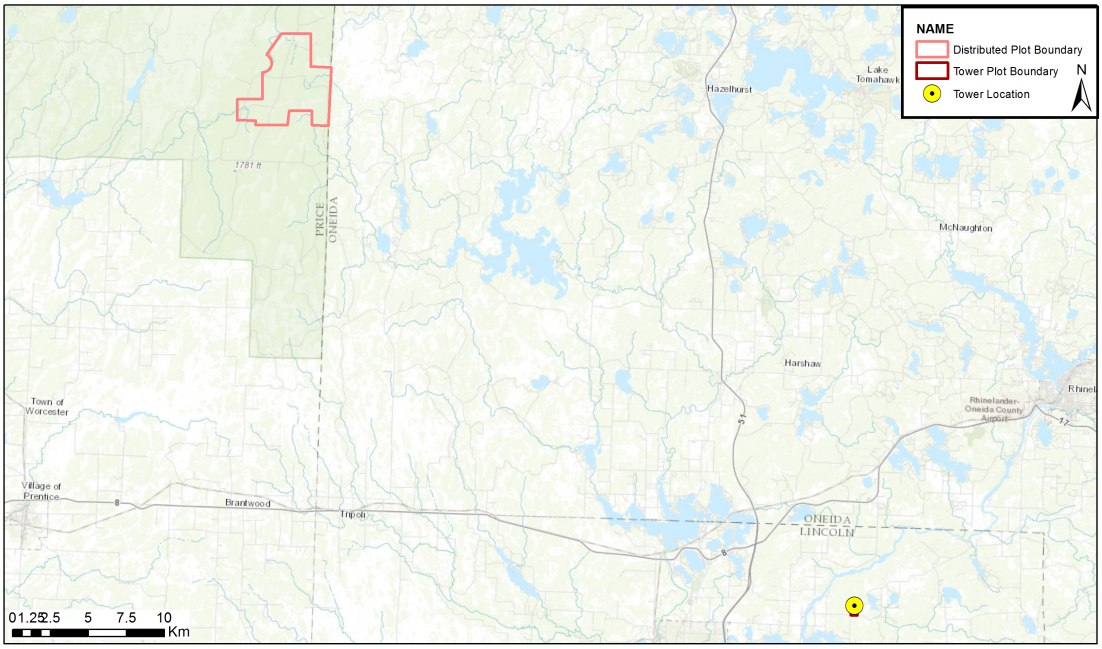

Figure 9: Map of tower and distributed sampling are boundaries at STEI.

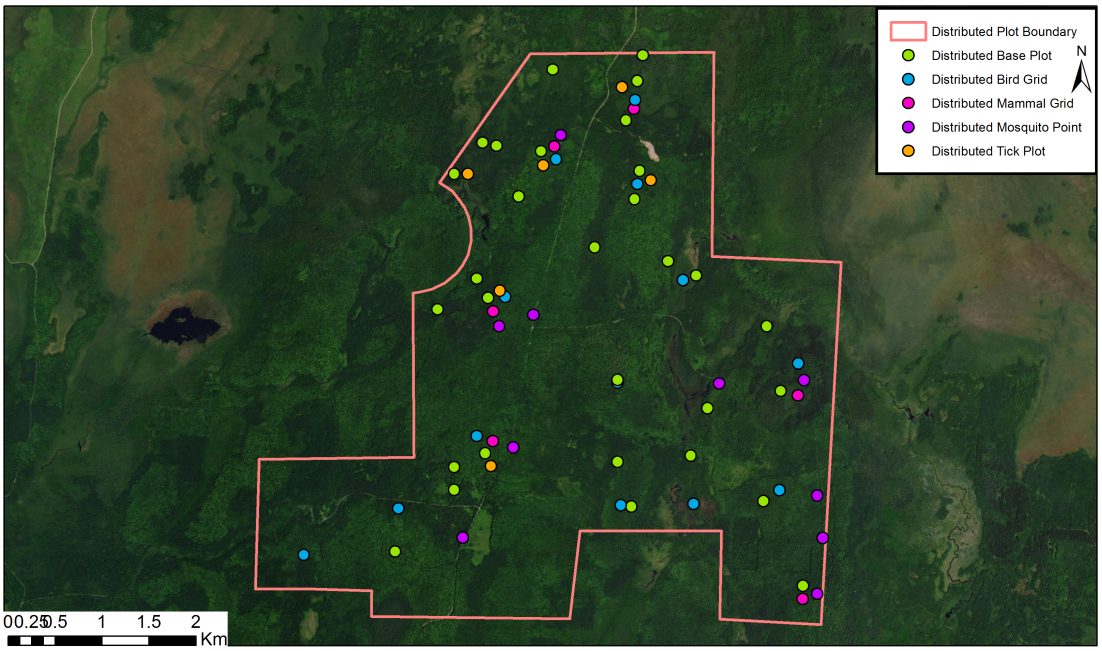

Figure 10: Map of distributed TOS plot centroids within the NEON TOS sampling boundary at STEI.

For a list of protocols associated with each plot see tables below; for additional spatial design information see

RD[03].

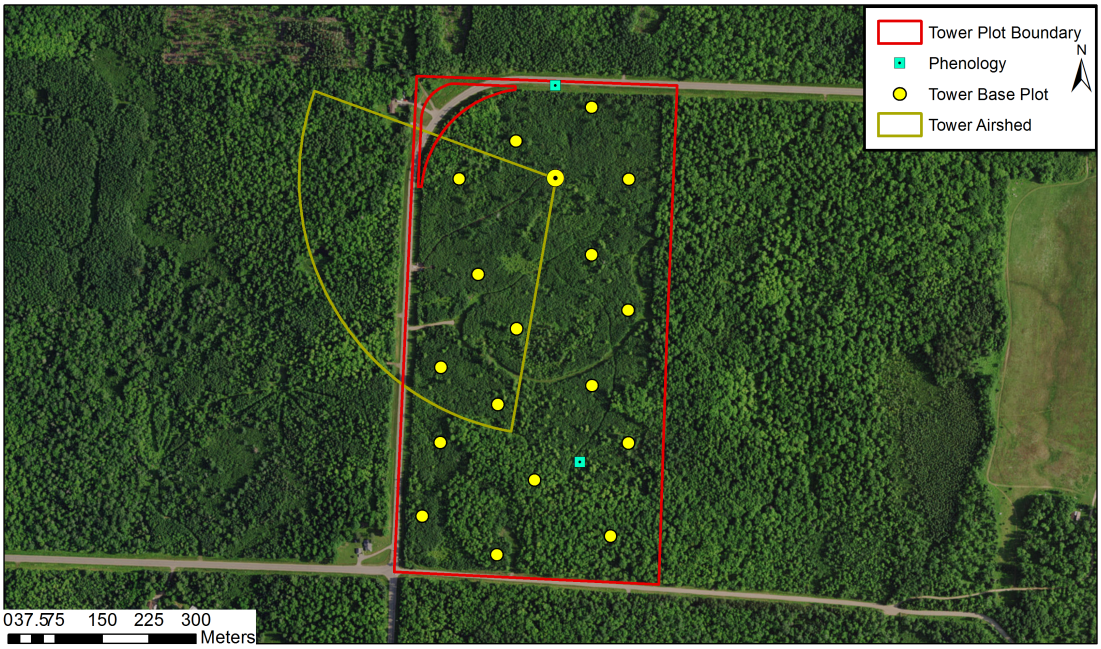

Figure 11: Map of the tower airshed and TOS centroids at STEI.

More information about the tower airshed can be found in the TIS site characterization report (RD[04]).

Table 15: NLCD land cover classes and area within the TOS site boundary at STEI.

NLCD Class	Site Area (km^2)	Percent (%)
Deciduous Forest	16.71	70.34
Woody Wetlands	3.17	13.34
Mixed Forest	2.35	9.89
Developed Open Space	0.61	2.56
Emergent Herbaceous Wetlands	0.43	1.82
Evergreen Forest	0.22	0.94
Grassland Herbaceous	0.13	0.56
Shrub Scrub	0.08	0.33
Open Water	0.04	0.17
Cultivated Crops	0.01	0.06

Note: Any NLCD land cover classes less than 5% will not be sampled. Additionally, no sampling will take place in Water, Developed, or Barren Land NLCD classes.

Table 16: NLCD land cover classes and TOS plot numbers at STEI.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Deciduous Forest	17
Distributed	Base Plot	Mixed Forest	6
Distributed	Base Plot	Woody Wetlands	7
Distributed	Bird Grid	Deciduous Forest	10
Distributed	Bird Grid	Mixed Forest	2
Distributed	Bird Grid	Woody Wetlands	3
Distributed	Mammal Grid	Deciduous Forest	4
Distributed	Mammal Grid	Mixed Forest	1
Distributed	Mammal Grid	Woody Wetlands	1
Distributed	Mosquito Point	Deciduous Forest	8
Distributed	Mosquito Point	Mixed Forest	1
Distributed	Mosquito Point	Woody Wetlands	1
Distributed	Tick Plot	Deciduous Forest	4
Distributed	Tick Plot	Mixed Forest	1
Distributed	Tick Plot	Woody Wetlands	1
Tower	Base Plot	NA	17
Tower	Phenology Plot	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover types within the airshed are deciduous forest and mixed forest.

Table 17: Number of Distributed Base plots per NLCD land cover class per protocol at STEI.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Deciduous Forest	Beetles	8
Distributed	Base Plot	Mixed Forest	Beetles	1
Distributed	Base Plot	Woody Wetlands	Beetles	1
Distributed	Base Plot	Deciduous Forest	Canopy Foliage Chemistry	8
Distributed	Base Plot	Mixed Forest	Canopy Foliage Chemistry	1
Distributed	Base Plot	Woody Wetlands	Canopy Foliage Chemistry	1
Distributed	Base Plot	Deciduous Forest	Coarse Downed Wood	16
Distributed	Base Plot	Mixed Forest	Coarse Downed Wood	2
Distributed	Base Plot	Woody Wetlands	Coarse Downed Wood	2

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Deciduous Forest	Digital Hemispherical Photos for Leaf Area Index	16
Distributed	Base Plot	Mixed Forest	Digital Hemispherical Photos for Leaf Area Index	2
Distributed	Base Plot	Woody Wetlands	Digital Hemispherical Photos for Leaf Area Index	2
Distributed	Base Plot	Deciduous Forest	Herbaceous Biomass	16
Distributed	Base Plot	Mixed Forest	Herbaceous Biomass	2
Distributed	Base Plot	Woody Wetlands	Herbaceous Biomass	2
Distributed	Base Plot	Deciduous Forest	Plant Diversity	17
Distributed	Base Plot	Mixed Forest	Plant Diversity	6
Distributed	Base Plot	Woody Wetlands	Plant Diversity	7
Distributed	Base Plot	Deciduous Forest	Soil Biogeochemistry	4
Distributed	Base Plot	Mixed Forest	Soil Biogeochemistry	1
Distributed	Base Plot	Woody Wetlands	Soil Biogeochemistry	1
Distributed	Base Plot	Deciduous Forest	Soil Microbes	4
Distributed	Base Plot	Mixed Forest	Soil Microbes	1
Distributed	Base Plot	Woody Wetlands	Soil Microbes	1
Distributed	Base Plot	Deciduous Forest	Vegetation Structure	16
Distributed	Base Plot	Mixed Forest	Vegetation Structure	2
Distributed	Base Plot	Woody Wetlands	Vegetation Structure	3

Note: Distributed Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get total TOS Distributed Base Plot number.

Table 18: Number of Tower Plots per protocol at STEI.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	17
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	17
Tower	Base Plot	Litterfall and Fine Woody Debris	17
Tower	Base Plot	Plant Belowground Biomass	17
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	17
Tower	Phenology	Plant Phenology	2

Note: Tower Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get total TOS Tower Base Plot number.

5.2 Sampling Season Characterization: STEI

For numerous TOS protocols, the length of the sampling season, the number of bouts, and when those bouts occur is dictated by the seasonal status of the plant community. By monitoring 'greenness' on a 16 day interval, the MODIS/Terra EVI phenology product provides consistent, reliable insight into plant community phenology and intensity at the continental scale. For those protocols for which timing is standardized by greenness transitions and/or peak green status, NEON has utilized these data as the primary means of guiding temporal aspects of TOS sampling at each site.

Due to the proximity of the STEI tower airshed and the TREE sampling boundary the same reference location was used to guide sampling season at both sites. In the future, MODIS data from the Chequamegon-Nicolet National Forest section will also be used.

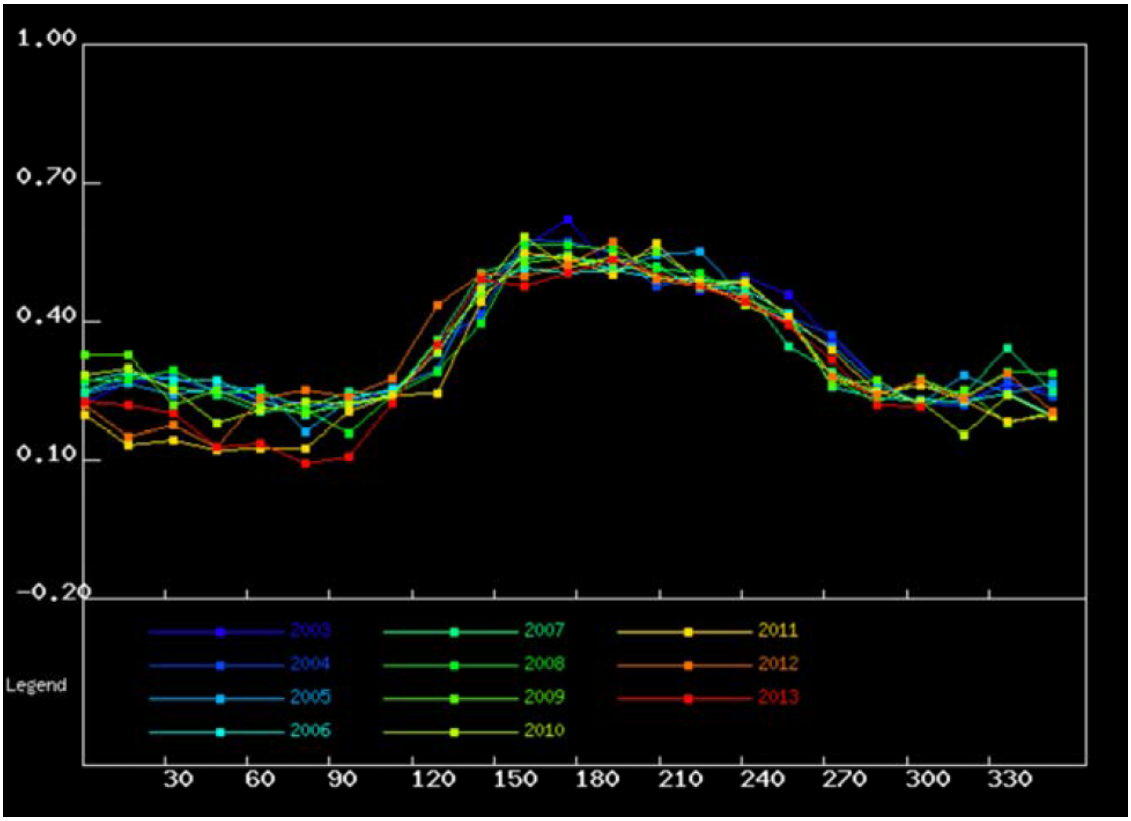

Figure 12: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON STEI site.

Table 19: Average MODIS-EVI greenness dates for the NEON STEI site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
120 (05/01)	165 (06/15)	215 (08/04)	290 (10/18)

MODIS Product Details

- Product: MODIS-EVI phenology product, 16 day interval, 250 m grid, data included from all pixels with acceptable quality within user-defined square that roughly overlaps the TOS site boundary.
- Date range: 2003-2013
- User selected area: 10.25 km x 10.25 km box, centroid Latitude: 45.494583, Longitude: -89.585266

5.3 Belowground Biomass

5.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 200 cm by NEON staff in June 2015. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30 cm, the belowground biomass site characterization data are critical for scaling belowground biomass measurements to greater depths; see the TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index (AD[7]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Roots were sorted to two diameter size categories ($\leq$ 4 mm and 4-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to 30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

5.3.2 Results

Table 20: Soil Pit Information at STEI.

Latitude	Longitude	Soil Family	Soil Order
45.51011	-89.5844	Coarse-loamy - mixed - superactive - frigid Alfic Epiaquods	Spodosol

Soil Profile was described by Natural Resource Conservation Service (NRCS).

Table 21: Fine root mass per depth increment (cm) at STEI.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	5.71	2.07
10	20	1.91	0.42
20	30	1.43	0.81
30	40	1.52	1.28
40	50	0.55	0.5
50	60	0.17	0.05
60	70	0.09	0.1
70	80	0.06	0.07
80	90	0.01	0.02
90	100	0	0
100	120	0.05	0.07
120	140	0	0.01
140	160	0.05	0.08

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
160	180	0	0
180	200	0.01	0.01

Table 22: Cumulative fine root mass as a function of depth (cm) at STEI.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	571.03	206.79
10	20	762.51	216.62
20	30	905.68	297.26
30	40	1058.06	413.93
40	50	1112.83	457.46
50	60	1129.67	462.49
60	70	1139.07	471.87
70	80	1144.7	478.31
80	90	1146.08	480.32
90	100	1146.41	480.3
100	120	1157.18	472.04
120	140	1157.91	473.07
140	160	1167.27	463.44
160	180	1167.39	463.46
180	200	1169.62	464.88

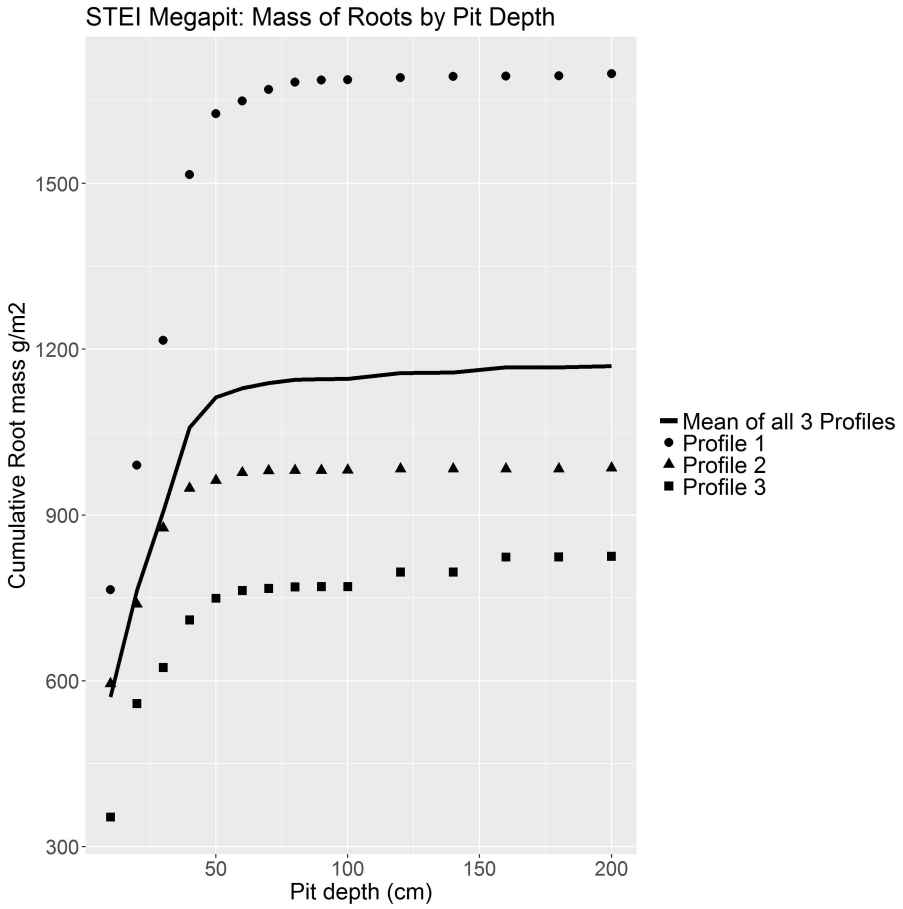

Figure 13: Cumulative root mass by pit depth at STEI.

Table 23: Fine root biomass sampling summary data at STEI.

Total Pit Depth (cm)	200
Total Mean Cumulative Mass at 30cm (g per m^2)	905.68
Total Mean Cumulative Mass at 100cm (g per m^2)	1146.41
Total Mean Cumulative Mass (g per m^2)	1169.62

5.4 Plant Characterization and Phenology Species Selection

5.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during the summer of June 2013. Plant characterization data informs sampling procedures for plant phenology and plant productivity protocols.

The overall ranking ("Rank" in the table below) was calculated based on three separate measurements. Overall ranking weights are influenced by the number of species within each grouping.

1. Mean percent cover values were calculated based on species specific cover estimation for all plant species under 3m tall in eight 1m by 1m subplots per plot; see the TOS Protocol and Procedure: Plant Diversity Sampling (RD[09]) for more information.
2. Mean canopy area values were calculated based on all species specific shrub canopy diameter measurements within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.
3. Mean ABH (area at breast height) measurements were calculated based on diameter at breast height measurements for all woody vegetation with a diameter greater than 1cm at 130cm height within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.

The standard field methods and ranking calculations are further outlined in TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

5.4.2 Results

Table 24: Site plant characterization and phenology species summary at STEI.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
POTR5	*Populus tremuloides* Michx.	1	<1	0.05	5.1
ABBA	*Abies balsamea* (L.) Mill.	2	3	0.01	1.31
ACRU	*Acer rubrum* L.	3	<1	0.11	1.39
TSCA	*Tsuga canadensis* (L.) Carriére	4	<1	NA	1.93
CACA18	*Carpinus caroliniana* Walter	5	<1	<1	<1
ILVE	*Ilex verticillata* (L.) A. Gray	6	<1	<1	<1
PTAQ	*Pteridium aquilinum* (L.) Kuhn	7	4	NA	NA
PIGL	*Picea glauca* (Moench) Voss	8	<1	NA	0.13
COCA13	*Cornus canadensis* L.	9	4	NA	NA
FRPE	*Fraxinus pennsylvanica* Marshall	10	<1	<1	0.01
CAPE6	*Carex pensylvanica* Lam.	11	3	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
FRNI	*Fraxinus nigra* Marshall	12	<1	NA	0.06
QURU	*Quercus rubra* L.	14	<1	<1	0.45
CAIN12	*Carex intumescens* Rudge	15	2	NA	NA
ACSA3	*Acer saccharum* Marshall	16	<1	NA	0.32
MACA4	*Maianthemum canadense* Desf.	17	1	NA	NA
RUID	*Rubus idaeus* L.	18	1	NA	NA
DOUM2	*Doellingeria umbellata* (Mill.) Nees	19	1	NA	NA
PIST	*Pinus strobus* L.	20	<1	NA	0.22
FRAM2	*Fraxinus americana* L.	21	<1	<1	0.01
POGR4	*Populus grandidentata* Michx.	22	<1	NA	0.17
ORAS	*Oryzopsis asperifolia* Michx.	23	<1	NA	NA
CACA4	*Calamagrostis canadensis* (Michx.) P. Beauv.	24	<1	NA	NA
RUPU	*Rubus pubescens* Raf.	25	<1	NA	NA
LOCA7	*Lonicera canadensis* W. Bartram ex Marshall	26	<1	NA	NA
OSCI	*Osmunda cinnamomea* L.	27	<1	NA	NA
COCO6	*Corylus cornuta* Marshall	28	<1	NA	NA
BRAR9	*Brachyelytrum aristosum* (Michx.) Trel.	29	<1	NA	NA
ALINR	*Alnus incana* (L.) Moench ssp. *rugosa* (Du Roi) R.T. Clausen	30	NA	0.01	<1
CAGR2	*Carex gracillima* Schwein.	31	<1	NA	NA
HIAU	*Hieracium aurantiacum* L.	32	<1	NA	NA
TRBO2	*Trientalis borealis* Raf.	33	<1	NA	NA
LALA	*Larix laricina* (Du Roi) K. Koch	34	<1	NA	0.04
VAMY	*Vaccinium myrtilloides* Michx.	35	<1	NA	NA
TIAM	*Tilia americana* L.	36	<1	NA	0.08

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
OSCL	*Osmorhiza claytonii* (Michx.) C.B. Clarke	37	<1	NA	NA
LUAC	*Luzula acuminata* Raf.	38	<1	NA	NA
CACR6	*Carex crinita* Lam.	39	<1	NA	NA
CAAR3	*Carex arctata* Boott ex Hook.	40	<1	NA	NA
DRIN5	*Dryopteris intermedia* (Muhl. ex Willd.) A. Gray	40	<1	NA	NA
OSVI	*Ostrya virginiana* (Mill.) K. Koch	42	<1	NA	NA
CADE9	*Carex deweyana* Schwein.	43	<1	NA	NA
PYEL	*Pyrola elliptica* Nutt.	44	<1	NA	NA
SALIX	*Salix* sp.	45	NA	NA	NA
VEOF2	*Veronica officinalis* L.	46	<1	NA	NA
DRCA11	*Dryopteris carthusiana* (Vill.) H.P. Fuchs	47	<1	NA	NA
MIRE	*Mitchella repens* L.	48	<1	NA	NA
SCMI2	*Scirpus microcarpus* J. Presl & C. Presl	49	<1	NA	NA
FRVI	*Fragaria virginiana* Duchesne	50	<1	NA	NA
LYAN2	*Lycopodium annotinum* L.	51	<1	NA	NA
ULAM	*Ulmus americana* L.	52	<1	NA	0.03
ANQU	*Anemone quinquefolia* L.	53	<1	NA	NA
AMELA	*Amelanchier* sp.	54	<1	NA	NA
ONSE	*Onoclea sensibilis* L.	55	<1	NA	NA
RUOC	*Rubus occidentalis* L.	56	<1	NA	NA
CACA11	*Carex canescens* L.	57	<1	NA	NA
SOLID	*Solidago* sp.	57	<1	NA	NA
CABR15	*Carex brunnescens* (Pers.) Poir.	59	<1	NA	NA
IRVE2	*Iris versicolor* L.	60	<1	NA	NA
FRVE	*Fragaria vesca* L.	61	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
ARTR	*Arisaema triphyllum* (L.) Schott	62	<1	NA	NA
CAPR9	*Carex projecta* Mack.	63	<1	NA	NA
COTR2	*Coptis trifolia* (L.) Salisb.	63	<1	NA	NA
PRSE2	*Prunus serotina* Ehrh.	63	<1	NA	NA
PHCO24	*Phegopteris connectilis* (Michx.) Watt	66	<1	NA	NA
ATFI	*Athyrium filix-femina* (L.) Roth	67	<1	NA	NA
CIAR4	*Cirsium arvense* (L.) Scop.	67	<1	NA	NA
FRAXI	*Fraxinus* sp.	67	<1	NA	NA
OSCL2	*Osmunda claytoniana* L.	67	<1	NA	NA
POPR	*Poa pratensis* L.	67	<1	NA	NA
RUAL	*Rubus allegheniensis* Porter	67	<1	NA	NA
SABE2	*Salix bebbiana* Sarg.	73	NA	NA	0.01
EQSY	*Equisetum sylvaticum* L.	74	<1	NA	NA
RUHI	*Rubus hispidus* L.	74	<1	NA	NA
VIRA	*Viburnum rafinesqueanum* Schult.	76	<1	NA	NA
ILMU	*Ilex mucronata* (L.) Powell, Savolainen & Andrews	77	<1	NA	NA
TAOFO	*Taraxacum officinale* F.H. Wigg. ssp. *officinale*	77	<1	NA	NA
CACA14	*Carex careyana* Torr. ex Dewey	79	<1	NA	NA
PRVI	*Prunus virginiana* L.	79	<1	NA	NA
SCPU	*Schizachne purpurascens* (Torr.) Swallen	81	<1	NA	NA
DILO	*Diervilla lonicera* Mill.	82	<1	NA	NA
EQFL	*Equisetum fluviatile* L.	82	<1	NA	NA
MATR4	*Maianthemum trifolium* (L.) Sloboda	82	<1	NA	NA
CLBO3	*Clintonia borealis* (Aiton) Raf.	85	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
LYDE	*Lycopodium dendroideum* Michx.	85	<1	NA	NA
POCI	*Polygonum cilinode* Michx.	85	<1	NA	NA
SYLA4	*Symphyotrichum lateriflorum* (L.) Á. Löve & D. Löve	85	<1	NA	NA
BEAL2	*Betula alleghaniensis* Britton	89	<1	NA	NA
CAREX	*Carex* sp.	89	<1	NA	NA
COAL2	*Cornus alternifolia* L. f.	89	<1	NA	NA
COCO13	*Conoclinium coelestinum* (L.) DC.	89	<1	NA	NA
GAPR2	*Gaultheria procumbens* L.	89	<1	NA	NA
GATR3	*Galium triflorum* Michx.	89	<1	NA	NA
POPA5	*Polygala paucifolia* Willd.	89	<1	NA	NA
RUAC3	*Rumex acetosella* L.	89	<1	NA	NA
RUBUS	*Rubus* sp.	89	<1	NA	NA
VIBUR	*Viburnum* sp.	89	<1	NA	NA
VIOLA	*Viola* sp.	89	<1	NA	NA
ARNU2	*Aralia nudicaulis* L.	100	<1	NA	NA
BRPU6	*Bromus pubescens* Muhl. ex Willd.	100	<1	NA	NA
CHCA4	*Chenopodium capitatum* (L.) Asch.	100	<1	NA	NA
CHGL2	*Chelone glabra* L.	100	<1	NA	NA
CILA2	*Cinna latifolia* (Trevis. ex Goepp.) Griseb.	100	<1	NA	NA
EQPA	*Equisetum palustre* L.	100	<1	NA	NA
GATR2	*Galium trifidum* L.	100	<1	NA	NA
JUEF	*Juncus effusus* L.	100	<1	NA	NA
JUFI	*Juncus filiformis* L.	100	<1	NA	NA
LACA	*Lactuca canadensis* L.	100	<1	NA	NA
MATR	*Magnolia tripetala* (L.) L.	100	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
MIMI22	*Mimosa microphylla* Dryand.	100	<1	NA	NA
MOUN3	*Monotropa uniflora* L.	100	<1	NA	NA
POA	*Poa* sp.	100	<1	NA	NA
POACEA	Poaceae sp.	100	<1	NA	NA
PRAL2	*Prenanthes alba* L.	100	<1	NA	NA
PRVU	*Prunella vulgaris* L.	100	<1	NA	NA
RIAM2	*Ribes americanum* Mill.	100	<1	NA	NA
RICY	*Ribes cynosbati* L.	100	<1	NA	NA

Note: Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov).

Table 25: Per plot breakdown of species richness, diversity, and herbaceous cover at STEI.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
STEI_046	31	2.92	66	1.44
STEI_047	49	3.27	115	3
STEI_048	35	2.94	128	2.31
STEI_049	34	2.9	112	0.56
STEI_050	42	2.67	166	2.44
STEI_051	29	3.06	46	4.69
STEI_052	39	2.91	102	3.5
STEI_053	41	2.57	129	0.75
STEI_054	32	2.96	70	1.88
STEI_055	30	2.82	72	0.31
STEI_056	24	2.11	108	1
STEI_057	33	2.89	118	2.38
STEI_058	31	2.93	51	0.56
STEI_059	36	2.62	71	1.83
STEI_060	38	2.99	88	2.08
STEI_061	33	2.52	104	14.81
STEI_062	33	2.71	99	0.69
Bryophyte Mean				2.6

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot.

Bryophyte percent cover data were used to determine which sites qualify for implementation of the Bryophyte Productivity protocol. However, bryophyte productivity sampling was discontinued in 2018 and NEON no longer implements this protocol.

5.5 Beetles

5.5.1 Site-Specific Methods

Beetle site characterization was not conducted at STEI. For more information on this protocol and data product numbers see Appendix A.

5.6 Mosquitoes

5.6.1 Site-Specific Methods

Mosquito site characterization was not conducted at STEI. For more information on this protocol and data product numbers see Appendix A.

5.7 Ticks

5.7.1 Site-Specific Methods

No tick drags were conducted at STEI. For more information on this protocol and data product numbers see Appendix A.

5.8 Species Reference Lists

A review of the literature for taxonomic lists of interest for each site was conducted prior to field work. In the case of vertebrates that NEON may capture (e.g., reptiles, amphibians, small mammals), these lists were often required to secure permits. Key references identified in this effort are listed below. Species lists and associated references for small mammals and breeding landbirds can be found in the appendices of the respective protocols (RD[07], RD[08]).

Bousquet, Y. 2012. Catalogue of Geadephaga (Coleoptera, Adephaga) of America, north of Mexico. ZooKeys, (245), 1-1722.

Centers for Disease Control and Prevention.(2015). *Geographic distribution of ticks that bite humans.* Retrieved from http://www.cdc.gov/ticks/geographic_distribution.html

Darsie Jr., R. F., and R. A. Ward. 2005. Identification and geographical distribution of the mosquitoes of North America, North of Mexico. University Press of Florida, Gainesville.

University of Wisconsin-Stevens Point.*Treehaven 2012 Plant List.* Retrieved from https://www.uwsp.edu/cnr-ap/treehaven/Documents/2012_SummerSessionPlantList.pdf.

Watermolen, D.J. and M.D. Murrell. 2001. *Checklists of Wisconsin Vertebrates*. Pub-SS-964. Bureau of Integrated Science Services, Wisconsin Department of Natural Resources, Madison, WI.

Wisconsin Department of Natural Resources National Heritage Conversation Program.(2004). *Wisconsin Endangered and Threatened Species Laws & List.* Retrieved from http://dnr.wi.gov/files/PDF/pubs/er/ER001.pdf.

Wisconsin Department of Natural Resources National Heritage Conversation Program.*Wisconsin Amphibian & Reptile Checklist*. Retrieved from http://dnr.wi.gov/files/PDF/pubs/er/ER0110.pdf.

6 RELOCATABLE SITE 2- TREEHAVEN (TREE)

Treehaven, situated between Rhinelander and Tomahawk, WI, is one of two relocatable sites located in NEON's Great Lakes Domain. The Treehaven property spans 1400 acres (5.67 km^2) and is owned and operated by the University of Wisconsin-Stevens Point (UWSP), College of Natural Resources.

The Treehaven tower location and surrounding Tower Plots are approximately 1 mile due south of the Steigerwaldt tower and its surrounding plots. Because the sites are managed differently, the close proximity of the towers could help isolate the effect of management practices on carbon cycling dynamics.

Figure 14: Phenocamera image for TREE. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: University of Wisconsin-Stevens Point (UWSP), College of Natural Resources and a Private Landownwer
- Located in: Lincoln county, Wisconsin
- Sampling Area: 5.67 km^2
- Plot Elevation: 445-485m

- Dominant vegetation type- Most of the forests on the property are second growth forests which naturally regenerated after extensive fires and grazing were excluded from the site; however, there are a few, isolated, large diameter trees that pre-date the period of heavy timber harvest. Lowland areas consist of black spruce (*Picea mariana*)/tamarack (*Larix laricina*) and non-forested acid bog environments, along with a mix of sedge, shrub, hardwood and cedar wetlands. Upland sites are primarily composed of aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), and red maple (*Acer rubrum*), with a lesser area of mixed red pine (*Pinus resinosa*), white pine (*Pinus strobus*), white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*). Red pines planted under the 1956 management plan are prominent along roads throughout the property. A minor component of northern hardwoods and hemlock hardwoods are also present, especially on the western edge of the property.
- General management: From the mid 1800's until about 1930, the land was heavily harvested and burned with extensive cutovers and destructive wildfires. Farming was attempted on the cutover land and the open areas were subsequently grazed and mowed until the mid 1950s. In the 1950's the property came under new ownership and a management plan was developed calling for reforestation, sustainable timber harvest, and timber stand improvements. In 1979, 850 acres were donated to the University of Wisconsin-Stevens Point, and the university has since expanded to 1400 acres through additional purchases and donations. Since acquiring the land in 1979, UWSP students and staff have used the site to study forest vegetation, fire history ,watersheds, and soils, In addition, forest improvement practices (timber harvest, thinning, and planting) have occurred on nearly 500 acres. Management activities in the proximity of NEON's tower currently are geared to the promotion of sugar maple.
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research.

6.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at TREE according to a spatially balanced and stratified-random design (RD[3]). The 2006 National Land Cover Database (NLCD) was selected for stratification because of the consistent and comparable data availability across the United States. At Treehaven, some of the grassland and shrubland areas were erroneously classified as emergent herbaceous wetland by the NLCD. Due to this uncertainty, these parts of landscape will not be sampled initially. The emergent herbaceous wetland pixels will be reclassified with data from NEON's remote sensing platform and there will be a slight reallocation of sampling effort to facilitate observation of all target components of the landscape. TOS Tower Plots were allocated according to a spatially balanced design in and around the NEON tower airshed (RD[03]). The maps below depict the plot locations for the first year of NEON sampling. Some plot locations may change over time due to logistics, safety, and science requirements. Please visit the NEON website (http://www.neonscience.org) for updated plot locations at each site.

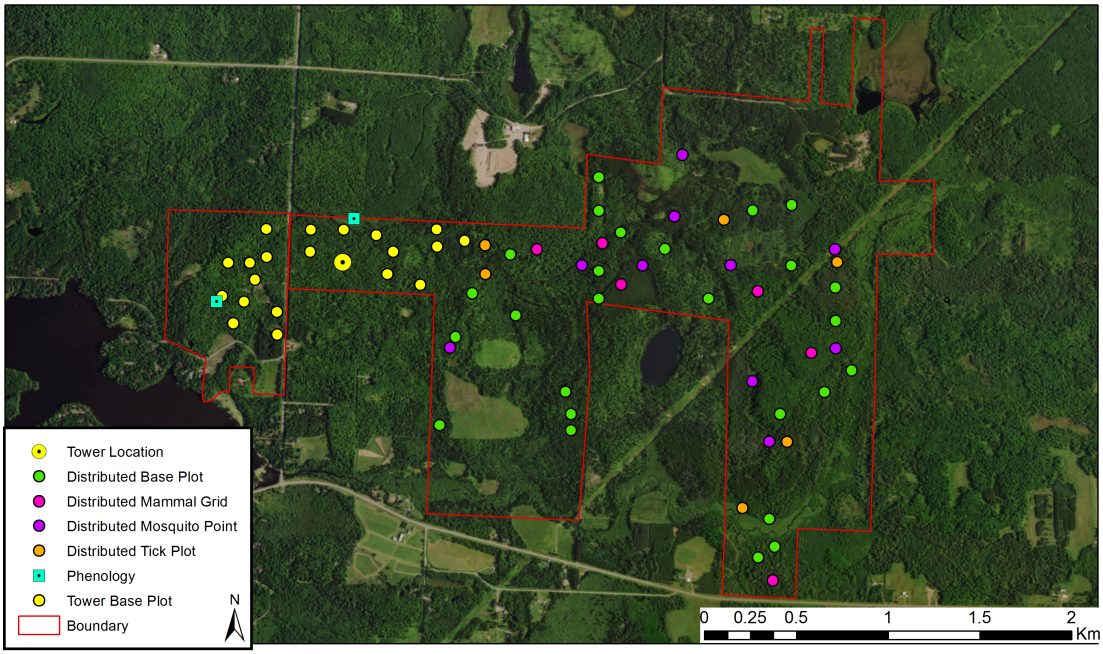

Figure 15: Map of TOS plot centroids within the NEON TOS sampling boundary at TREE.

For a list of protocols associated with each plot see tables below; for additional spatial design information see RD[03].

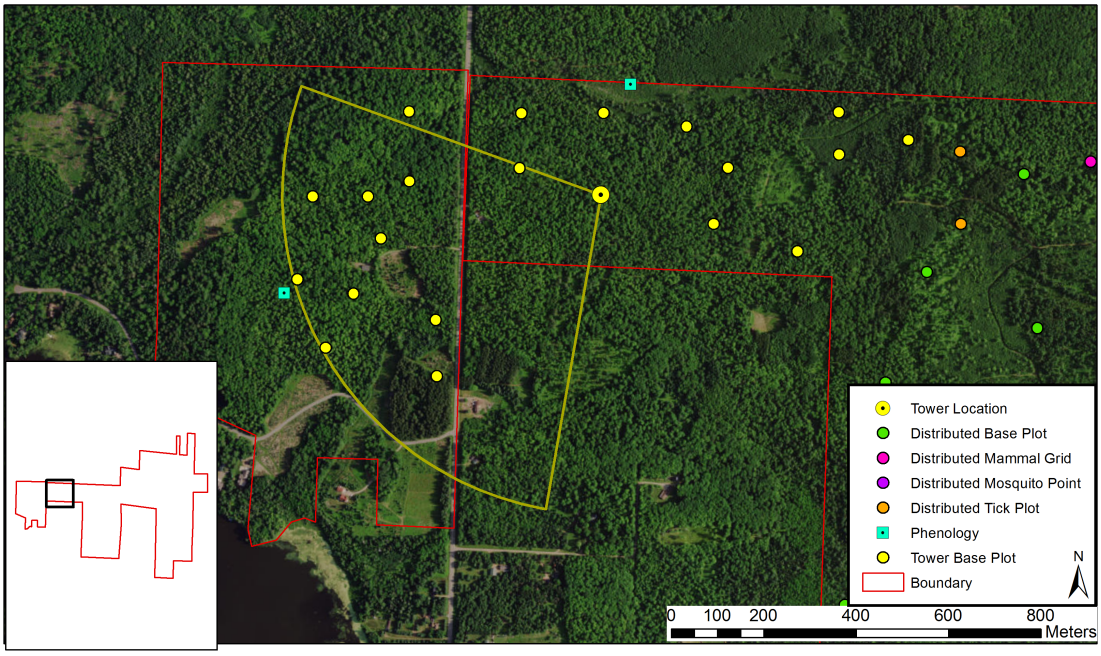

Figure 16: Map of the tower airshed and TOS centroids at TREE.

More information about the tower airshed can be found in the TIS site characterization report (RD[04]).

Table 26: NLCD land cover classes and area within the TOS site boundary at TREE.

NLCD Class	Site Area (km^2)	Percent (%)
Woody Wetlands	1.46	30.86
Mixed Forest	1.15	24.37
Deciduous Forest	0.98	20.66
Evergreen Forest	0.42	8.89
Emergent Herbaceous Wetlands	0.39	8.3
Grassland Herbaceous	0.2	4.19
Developed Open Space	0.09	1.94
Open Water	0.02	0.32
Shrub Scrub	0.01	0.25
Developed Low Intensity	0.01	0.21

Note: Any NLCD land cover classes less than 5% will not be sampled. Additionally, no sampling will take place in Water, Developed, or Barren Land NLCD classes.

Table 27: NLCD land cover classes and TOS plot numbers at TREE.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Mixed Forest	7
Distributed	Base Plot	Woody Wetlands	8
Distributed	Base Plot	Evergreen Forest	4
Distributed	Base Plot	Emergent Herbaceous Wetlands	4
Distributed	Base Plot	Deciduous Forest	7
Distributed	Mammal Grid	Mixed Forest	2
Distributed	Mammal Grid	Woody Wetlands	2
Distributed	Mammal Grid	Deciduous Forest	2
Distributed	Mosquito Point	Mixed Forest	3
Distributed	Mosquito Point	Woody Wetlands	3
Distributed	Mosquito Point	Evergreen Forest	2
Distributed	Mosquito Point	Emergent Herbaceous Wetlands	0
Distributed	Mosquito Point	Deciduous Forest	2
Distributed	Tick Plot	Mixed Forest	2
Distributed	Tick Plot	Evergreen Forest	1
Distributed	Tick Plot	Woody Wetlands	1
Distributed	Tick Plot	Deciduous Forest	2
Tower	Base Plot	NA	20
Tower	Phenology Plot	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover types within the airshed are deciduous forest, mixed forest, and woody wetlands.

Table 28: Number of Distributed Base plots per NLCD land cover class per protocol at TREE.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Deciduous Forest	Beetles	2
Distributed	Base Plot	Evergreen Forest	Beetles	1
Distributed	Base Plot	Mixed Forest	Beetles	3
Distributed	Base Plot	Woody Wetlands	Beetles	4
Distributed	Base Plot	Deciduous Forest	Birds	6
Distributed	Base Plot	Evergreen Forest	Birds	2
Distributed	Base Plot	Mixed Forest	Birds	5

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Woody Wetlands	Birds	4
Distributed	Base Plot	Deciduous Forest	Canopy Foliage Chemistry	2
Distributed	Base Plot	Evergreen Forest	Canopy Foliage Chemistry	1
Distributed	Base Plot	Mixed Forest	Canopy Foliage Chemistry	3
Distributed	Base Plot	Woody Wetlands	Canopy Foliage Chemistry	4
Distributed	Base Plot	Deciduous Forest	Coarse Downed Wood	5
Distributed	Base Plot	Evergreen Forest	Coarse Downed Wood	2
Distributed	Base Plot	Mixed Forest	Coarse Downed Wood	6
Distributed	Base Plot	Woody Wetlands	Coarse Downed Wood	7
Distributed	Base Plot	Deciduous Forest	Digital Hemispherical Photos for Leaf Area Index	5
Distributed	Base Plot	Evergreen Forest	Digital Hemispherical Photos for Leaf Area Index	2
Distributed	Base Plot	Mixed Forest	Digital Hemispherical Photos for Leaf Area Index	6
Distributed	Base Plot	Woody Wetlands	Digital Hemispherical Photos for Leaf Area Index	7
Distributed	Base Plot	Deciduous Forest	Herbaceous Biomass	5
Distributed	Base Plot	Evergreen Forest	Herbaceous Biomass	2
Distributed	Base Plot	Mixed Forest	Herbaceous Biomass	6
Distributed	Base Plot	Woody Wetlands	Herbaceous Biomass	7
Distributed	Base Plot	Deciduous Forest	Plant Diversity	7
Distributed	Base Plot	Evergreen Forest	Plant Diversity	4
Distributed	Base Plot	Mixed Forest	Plant Diversity	7
Distributed	Base Plot	Woody Wetlands	Plant Diversity	8
Distributed	Base Plot	Deciduous Forest	Soil Biogeochemistry	1
Distributed	Base Plot	Evergreen Forest	Soil Biogeochemistry	1
Distributed	Base Plot	Mixed Forest	Soil Biogeochemistry	2
Distributed	Base Plot	Woody Wetlands	Soil Biogeochemistry	2
Distributed	Base Plot	Deciduous Forest	Soil Microbes	1
Distributed	Base Plot	Evergreen Forest	Soil Microbes	1
Distributed	Base Plot	Mixed Forest	Soil Microbes	2
Distributed	Base Plot	Woody Wetlands	Soil Microbes	2
Distributed	Base Plot	Deciduous Forest	Vegetation Structure	5
Distributed	Base Plot	Evergreen Forest	Vegetation Structure	2

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Mixed Forest	Vegetation Structure	6
Distributed	Base Plot	Woody Wetlands	Vegetation Structure	7

Note: Distributed Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get total TOS Distributed Base Plot number.

Table 29: Number of Tower Plots per protocol at TREE.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	20
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	20
Tower	Base Plot	Litterfall and Fine Woody Debris	20
Tower	Base Plot	Plant Belowground Biomass	20
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	20
Tower	Phenology	Plant Phenology	2

Note: Tower Base Plots typically support more than one TOS protocol; 'Number of Plots' cannot be added to get total TOS Tower Base Plot number.

6.2 Sampling Season Characterization: TREE

For numerous TOS protocols, the length of the sampling season, the number of bouts, and when those bouts occur is dictated by the seasonal status of the plant community. By monitoring 'greenness' on a 16 day interval, the MODIS/Terra EVI phenology product provides consistent, reliable insight into plant community phenology and intensity at the continental scale. For those protocols for which timing is standardized by greenness transitions and/or peak green status, NEON has utilized these data as the primary means of guiding temporal aspects of TOS sampling at each site.

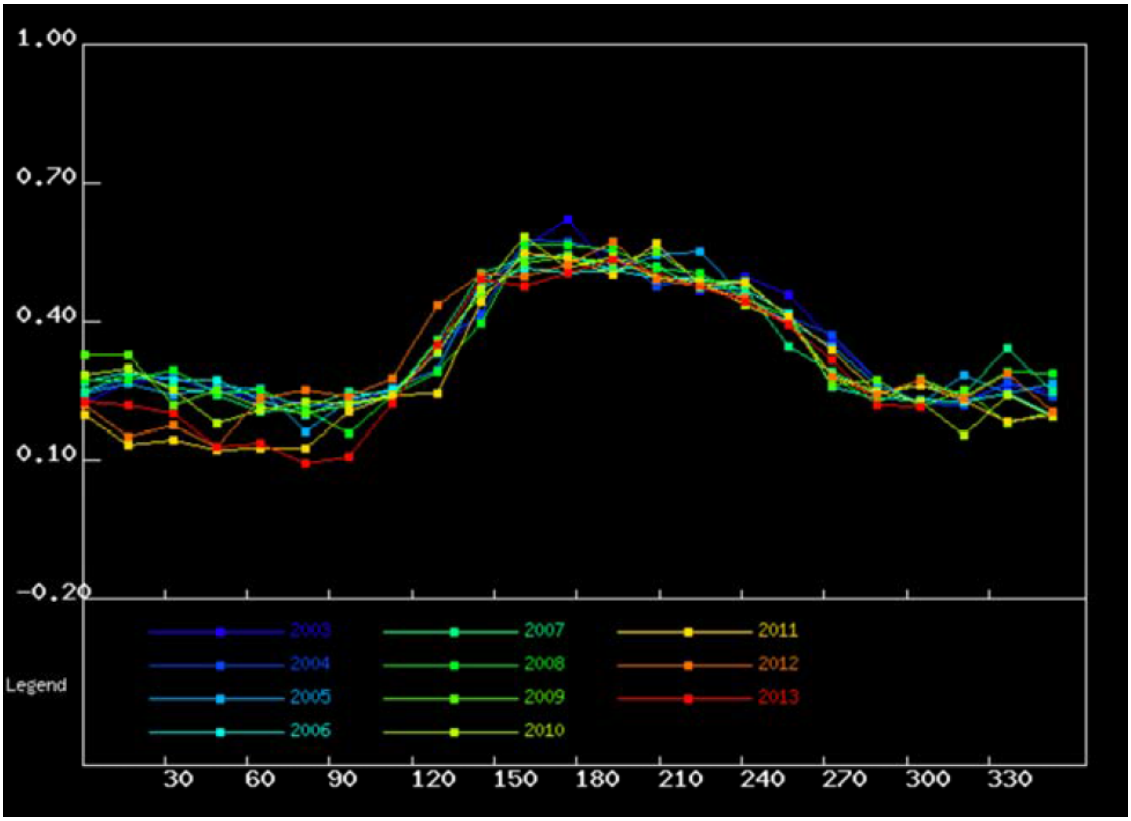

Figure 17: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON TREE site.

Table 30: Average MODIS-EVI greenness dates for the NEON TREE site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
120 (05/01)	165 (06/15)	215 (08/04)	290 (10/18)

MODIS Product Details

- Product: MODIS-EVI phenology product, 16 day interval, 250 m grid, data included from all pixels with acceptable quality within user-defined square that roughly overlaps the TOS site boundary.
- Date range: 2003-2013
- User selected area: 10.25 km x 10.25 km box, centroid Latitude: 45.494583, Longitude: -89.585266

6.3 Belowground Biomass

6.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 200 cm by NEON staff in June 2015. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30 cm, the belowground biomass site characterization data are critical for scaling belowground biomass measurements to greater depths; see the TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index (AD[7]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Roots were sorted to two diameter size categories ($\leq$ 4 mm and 4-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to 30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

6.3.2 Results

Table 31: Soil Pit Information at TREE.

Latitude	Longitude	Soil Family	Soil Order
45.49255	-89.584079	Coarse-loamy - mixed - superactive - frigid Alfic Haplorthods	Spodosol

Soil Profile was described by Natural Resource Conservation Service (NRCS).

Table 32: Fine root mass per depth increment (cm) at TREE.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	22.49	2.17
10	20	8.04	3.35
20	30	4.01	1.13
30	40	1.57	1.01
40	50	1.36	1.13
50	60	0.93	1.36
60	70	0.41	0.33
70	80	0.29	0.15
80	90	0.04	0.02
90	100	0.01	0.01
100	120	0.08	0.13
120	140	0.04	0.07
140	160	0.02	0.03

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
160	180	0.4	0.05
180	200	0.05	0.07

Table 33: Cumulative fine root mass as a function of depth (cm) at TREE.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	2248.63	217.33
10	20	3052.47	547.94
20	30	3453.82	619.24
30	40	3610.65	705.34
40	50	3746.55	817.97
50	60	3839.66	926.39
60	70	3880.41	941.26
70	80	3909.73	932
80	90	3913.44	931
90	100	3914.69	932.21
100	120	3929.92	951.62
120	140	3938.19	961.32
140	160	3941.9	965.98
160	180	4021.48	959.63
180	200	4031.47	970.99

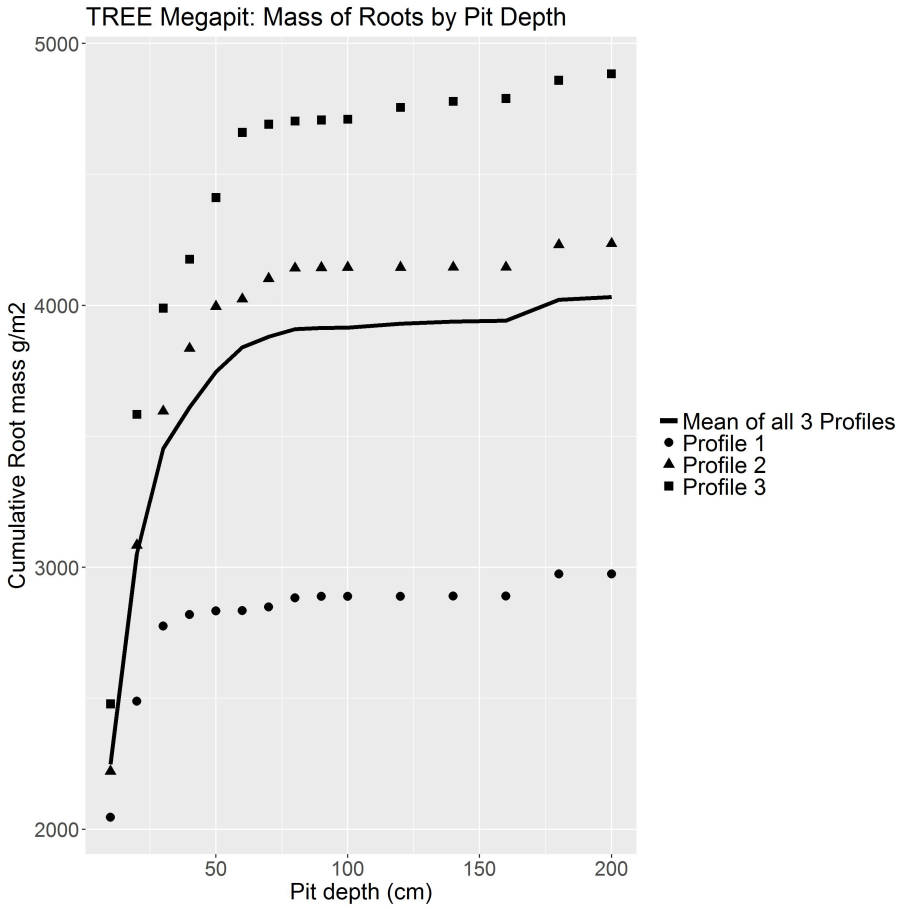

Figure 18: Cumulative root mass by pit depth at TREE.

Table 34: Fine root biomass sampling summary data at TREE.

Total Pit Depth (cm)	200
Total Mean Cumulative Mass at 30cm (g per m^2)	3453.82
Total Mean Cumulative Mass at 100cm (g per m^2)	3914.69
Total Mean Cumulative Mass (g per m^2)	4031.47

6.4 Plant Characterization and Phenology Species Selection

6.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during the summer of June 2013. Plant characterization data informs sampling procedures for plant phenology and plant productivity protocols.

The overall ranking ("Rank" in the table below) was calculated based on three separate measurements. Overall ranking weights are influenced by the number of species within each grouping.

1. Mean percent cover values were calculated based on species specific cover estimation for all plant species under 3m tall in eight 1m by 1m subplots per plot; see the TOS Protocol and Procedure: Plant Diversity Sampling (RD[09]) for more information.
2. Mean canopy area values were calculated based on all species specific shrub canopy diameter measurements within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.
3. Mean ABH (area at breast height) measurements were calculated based on diameter at breast height measurements for all woody vegetation with a diameter greater than 1cm at 130cm height within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.

The standard field methods and ranking calculations are further outlined in TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

6.4.2 Results

Table 35: Site plant characterization and phenology species summary at TREE.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
ACSA3	*Acer saccharum* Marshall	1	1	NA	6.51
ACRU	*Acer rubrum* L.	2	1	0.02	4.67
ALINR	*Alnus incana* (L.) Moench ssp. *rugosa* (Du Roi) R.T. Clausen	3	<1	0.06	0.07
ABBA	*Abies balsamea* (L.) Mill.	4	2	NA	1.95
CAPE6	*Carex pensylvanica* Lam.	5	9	NA	NA
PIGL	*Picea glauca* (Moench) Voss	6	<1	NA	1.12
TSCA	*Tsuga canadensis* (L.) Carriére	7	<1	NA	1.25
ILVE	*Ilex verticillata* (L.) A. Gray	8	<1	0.03	0.02
POTR5	*Populus tremuloides* Michx.	10	<1	0.01	0.38
LALA	*Larix laricina* (Du Roi) K. Koch	11	NA	NA	0.61

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
PIMA	*Picea mariana* (Mill.) Britton, Sterns & Poggenb.	12	<1	NA	0.57
FRPE	*Fraxinus pennsylvanica* Marshall	13	<1	<1	0.53
PIST	*Pinus strobus* L.	14	<1	NA	0.41
TIAM	*Tilia americana* L.	15	<1	NA	0.37
PIRE	*Pinus resinosa* Aiton	16	NA	NA	0.36
ILMU	*Ilex mucronata* (L.) Powell, Savolainen & Andrews	17	<1	0.01	NA
PTAQ	*Pteridium aquilinum* (L.) Kuhn	18	2	NA	NA
OSVI	*Ostrya virginiana* (Mill.) K. Koch	19	<1	<1	0.23
MACA4	*Maianthemum canadense* Desf.	20	1	NA	NA
FRNI	*Fraxinus nigra* Marshall	21	<1	NA	0.22
BEPA	*Betula papyrifera* Marshall	22	NA	NA	0.22
COCA13	*Cornus canadensis* L.	23	<1	NA	NA
TRBO2	*Trientalis borealis* Raf.	24	<1	NA	NA
VAMY	*Vaccinium myrtilloides* Michx.	25	<1	NA	NA
ORAS	*Oryzopsis asperifolia* Michx.	26	<1	NA	NA
OSCL2	*Osmunda claytoniana* L.	27	<1	NA	NA
DRCA11	*Dryopteris carthusiana* (Vill.) H.P. Fuchs	28	<1	NA	NA
RUPU	*Rubus pubescens* Raf.	28	<1	NA	NA
COCO6	*Corylus cornuta* Marshall	31	<1	<1	NA
ANQU	*Anemone quinquefolia* L.	32	<1	NA	NA
BEAL2	*Betula alleghaniensis* Britton	33	<1	NA	0.08
DRIN5	*Dryopteris intermedia* (Muhl. ex Willd.) A. Gray	34	<1	NA	NA
RUAL	*Rubus allegheniensis* Porter	35	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
OSCL	*Osmorhiza claytonii* (Michx.) C.B. Clarke	36	<1	NA	NA
POGR4	*Populus grandidentata* Michx.	37	NA	<1	0.03
ACSA3	*Acer saccharinum* Marshall	38	1	NA	6.51
CAIN12	*Carex intumescens* Rudge	39	<1	NA	NA
CABR15	*Carex brunnescens* (Pers.) Poir.	40	<1	NA	NA
DIPA9	*Dirca palustris* L.	41	NA	<1	<1
ONSE	*Onoclea sensibilis* L.	42	<1	NA	NA
MATR4	*Maianthemum trifolium* (L.) Sloboda	44	<1	NA	NA
RUOC	*Rubus occidentalis* L.	45	<1	NA	NA
CAGR2	*Carex gracillima* Schwein.	46	<1	NA	NA
RUID	*Rubus idaeus* L.	47	<1	NA	NA
CAAR3	*Carex arctata* Boott ex Hook.	48	<1	NA	NA
CAREX	*Carex* sp.	48	<1	NA	NA
IMCA	*Impatiens capensis* Meerb.	48	<1	NA	NA
RHAL	*Rhamnus alnifolia* L'Hér.	51	<1	NA	NA
ARNU2	*Aralia nudicaulis* L.	53	<1	NA	NA
COTR2	*Coptis trifolia* (L.) Salisb.	54	<1	NA	NA
LUAC	*Luzula acuminata* Raf.	55	<1	NA	NA
POCI	*Polygonum cilinode* Michx.	55	<1	NA	NA
PHCO24	*Phegopteris connectilis* (Michx.) Watt	57	<1	NA	NA
BRAR9	*Brachyelytrum aristosum* (Michx.) Trel.	58	<1	NA	NA
LONIC	*Lonicera* sp.	58	<1	NA	NA
DOUM2	*Doellingeria umbellata* (Mill.) Nees	60	<1	NA	NA
VEOF2	*Veronica officinalis* L.	61	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
MIRE	*Mitchella repens* L.	62	<1	NA	NA
OSCI	*Osmunda cinnamomea* L.	62	<1	NA	NA
OXMO	*Oxalis montana* Raf.	64	<1	NA	NA
ATFI	*Athyrium filix-femina* (L.) Roth	65	<1	NA	NA
LYAN2	*Lycopodium annotinum* L.	66	<1	NA	NA
LYDE	*Lycopodium dendroideum* Michx.	66	<1	NA	NA
FRVI	*Fragaria virginiana* Duchesne	68	<1	NA	NA
TRPR2	*Trifolium pratense* L.	69	<1	NA	NA
PRSE2	*Prunus serotina* Ehrh.	70	<1	NA	<1
CLBO3	*Clintonia borealis* (Aiton) Raf.	71	<1	NA	NA
PYEL	*Pyrola elliptica* Nutt.	71	<1	NA	NA
ARTR	*Arisaema triphyllum* (L.) Schott	73	<1	NA	NA
BRER2	*Brachyelytrum erectum* (Schreb. ex Spreng.) P. Beauv.	73	<1	NA	NA
CATR10	*Carex trisperma* Dewey	75	<1	NA	NA
GATR3	*Galium triflorum* Michx.	75	<1	NA	NA
SOLID	*Solidago* sp.	75	<1	NA	NA
VIOLACSPP	Violaceae sp.	78	<1	NA	NA
CACA18	*Carpinus caroliniana* Walter	79	NA	NA	0.01
AMELA	*Amelanchier* sp.	80	<1	NA	NA
COPE80	*Comptonia peregrina* (L.) J.M. Coult.	81	<1	NA	NA
CACR6	*Carex crinita* Lam.	82	<1	NA	NA
CAST5	*Carex stipata* Muhl. ex Willd.	82	<1	NA	NA
HENOO	*Hepatica nobilis* Schreb. var. *obtusa* (Pursh) Steyerm.	82	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
OSRE	*Osmunda regalis* L.	82	<1	NA	NA
SCPU	*Schizachne purpurascens* (Torr.) Swallen	82	<1	NA	NA
EQFL	*Equisetum fluviatile* L.	87	<1	NA	NA
HIAU	*Hieracium aurantiacum* L.	87	<1	NA	NA
POPR	*Poa pratensis* L.	87	<1	NA	NA
TAOFO	*Taraxacum officinale* F.H. Wigg. ssp. *officinale*	87	<1	NA	NA
OXDI2	*Oxalis dillenii* Jacq.	91	<1	NA	NA
SCMI2	*Scirpus microcarpus* J. Presl & C. Presl	91	<1	NA	NA
SOAM3	*Sorbus americana* Marshall	91	<1	NA	NA
TRGR4	*Trillium grandiflorum* (Michx.) Salisb.	91	<1	NA	NA
CADE9	*Carex deweyana* Schwein.	95	<1	NA	NA
CHFAF	*Chamaecrista fasciculata* (Michx.) Greene var. *fasciculata*	95	<1	NA	NA
EQPA	*Equisetum palustre* L.	95	<1	NA	NA
LEGR	*Ledum groenlandicum* Oeder	95	<1	NA	NA
CAPR9	*Carex projecta* Mack.	99	<1	NA	NA
LILIUSPP	*Lilium* sp.	99	<1	NA	NA
PRVU	*Prunella vulgaris* L.	99	<1	NA	NA
EQSY	*Equisetum sylvaticum* L.	102	<1	NA	NA
ACMI2	*Achillea millefolium* L.	103	<1	NA	NA
CACA4	*Calamagrostis canadensis* (Michx.) P. Beauv.	103	<1	NA	NA
CALE10	*Carex leptalea* Wahlenb.	103	<1	NA	NA
CASC11	*Carex scoparia* Schkuhr ex Willd.	103	<1	NA	NA
CILA2	*Cinna latifolia* (Trevis. ex Goepp.) Griseb.	103	<1	NA	NA
COAL2	*Cornus alternifolia* L. f.	103	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
EUMA27	*Eurybia macrophylla* (L.) Cass.	103	<1	NA	NA
LYUN	*Lycopus uniflorus* Michx.	103	<1	NA	NA
POPU4	*Polygonatum pubescens* (Willd.) Pursh	103	<1	NA	NA
PRVI	*Prunus virginiana* L.	103	<1	NA	NA
THOC2	*Thuja occidentalis* L.	103	<1	NA	NA
TRCE	*Trillium cernuum* L.	103	<1	NA	NA
VAMA	*Vaccinium macrocarpon* Aiton	103	<1	NA	NA
ACSP2	*Acer spicatum* Lam.	118	<1	NA	NA
RARE2	*Ranunculus recurvatus* Poir.	118	<1	NA	NA
RIBES	*Ribes* sp.	118	<1	NA	NA
ACRU2	*Actaea rubra* (Aiton) Willd.	121	<1	NA	NA
AQVU	*Aquilegia vulgaris* L.	121	<1	NA	NA
CACO7	*Carex communis* L.H. Bailey	121	<1	NA	NA
CAEC	*Carex echinata* Murray	121	<1	NA	NA
CAGR6	*Carex grayi* × intumescens [unnamed hybrid]	121	<1	NA	NA
CAPA	*Calla palustris* L.	121	<1	NA	NA
CAPA5	*Caltha palustris* L.	121	<1	NA	NA
COTR18	*Corallorhiza trifida* Chatelain	121	<1	NA	NA
FESU3	*Festuca subverticillata* (Pers.) Alexeev	121	<1	NA	NA
GYDR	*Gymnocarpium dryopteris* (L.) Newman	121	<1	NA	NA
HICA10	*Hieracium caespitosum* Dumort.	121	<1	NA	NA
MARA7	*Maianthemum racemosum* (L.) Link	121	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area m^2 per m^2	Mean ABH (cm^2 per m^2)
POA	*Poa* sp.	121	<1	NA	NA
POACEA	Poaceae sp.	121	<1	NA	NA
POAR6	*Polygonum arifolium* L.	121	<1	NA	NA
POBI2	*Polygonatum biflorum* (Walter) Elliott	121	<1	NA	NA
ACTAE	*Actaea* sp.	137	<1	NA	NA
CACA11	*Carex canescens* L.	137	<1	NA	NA
CAREXSPP	*Carex* sp.	137	<1	NA	NA
CEFO2	*Cerastium fontanum* Baumg.	137	<1	NA	NA
CHCA2	*Chamaedaphne calyculata* (L.) Moench	137	<1	NA	NA
FRAXI	*Fraxinus* sp.	137	<1	NA	NA
FRVE	*Fragaria vesca* L.	137	<1	NA	NA
GATR2	*Galium trifidum* L.	137	<1	NA	NA
JUEF	*Juncus effusus* L.	137	<1	NA	NA
POPA5	*Polygala paucifolia* Willd.	137	<1	NA	NA
POPR5	*Potamogeton praelongus* Wulfen	137	<1	NA	NA
PRAL2	*Prenanthes alba* L.	137	<1	NA	NA
RAAC3	*Ranunculus acris* L.	137	<1	NA	NA
SCLA2	*Scutellaria lateriflora* L.	137	<1	NA	NA
ULTH	*Ulmus thomasii* Sarg.	137	<1	NA	NA
VACCI	*Vaccinium* sp.	137	<1	NA	NA
VEOF	*Verbena officinalis* L.	137	<1	NA	NA
VIBUR	*Viburnum* sp.	137	<1	NA	NA

Note:Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov).

Table 36: Per plot breakdown of species richness, diversity, and herbaceous cover at TREE.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
TREE_025	32	3.1	48	0.88
TREE_039	31	3.01	54	3.12

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
TREE_040	22	2.32	50	17.31
TREE_041	26	2.19	82	1.42
TREE_042	18	1.91	42	0.31
TREE_043	39	2.87	102	1.94
TREE_044	27	2.96	73	1.31
TREE_045	32	3.01	88	2.62
TREE_046	20	2.16	56	4.67
TREE_047	22	1.89	105	0.88
TREE_048	23	2.01	101	42.25
TREE_049	17	2.34	119	0.67
TREE_050	33	2.61	90	1.31
TREE_051	35	2.74	82	0.75
TREE_052	43	2.85	98	5.06
TREE_053	26	2.51	44	0.5
TREE_054	24	2.14	73	1.22
TREE_055	30	2.11	131	0.22
TREE_056	35	2.61	102	0.25
TREE_057	28	2.5	80	2.88
Bryophyte Mean				4.48

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot.

Bryophyte percent cover data were used to determine which sites qualify for implementation of the Bryophyte Productivity protocol. However, bryophyte productivity sampling was discontinued in 2018 and NEON no longer implements this protocol.

6.5 Beetles

6.5.1 Site-Specific Methods

Beetle site characterization was not conducted at TREE. For more information on this protocol and data product numbers see Appendix A.

6.6 Mosquitoes

6.6.1 Site-Specific Methods

Mosquito site characterization was not conducted at TREE. For more information on this protocol and data product numbers see Appendix A.

6.7 Ticks

6.7.1 Site-Specific Methods

No tick drags were conducted at TREE. For more information on this protocol and data product numbers see Appendix A.

6.8 Species Reference Lists

A review of the literature for taxonomic lists of interest for each site was conducted prior to field work. In the case of vertebrates that NEON may capture (e.g., reptiles, amphibians, small mammals), these lists were often required to secure permits. Key references identified in this effort are listed below. Species lists and associated references for small mammals and breeding landbirds can be found in the appendices of the respective protocols (RD[07], RD[08]).

Additional references from the Wisconsin Department of Natural Resources are listed in the Steigerwaldt species reference list section.

Bousquet, Y. 2012. Catalogue of Geadephaga (Coleoptera, Adephaga) of America, north of Mexico. ZooKeys, (245), 1-1722.

Bresee, M.K., J. Le Moine, S. Mather, K.D. Brosofske, J. Chen, T.R. Crow, and J. Rademacher, 2004. Disturbance and landscape dynamics in the Chequamegon National Forest, Wisconsin, USA, from 1972 to 2001, Landscape Ecology, 19 (1), 291-309.

Brosofske, K.D., J. Chen, and T.R. Crow, 2001. Understory Vegetation and Site Factors: Implications for a Managed Wisconsin Landscape, Forest Ecology and Management, 146, 75-87.

Centers for Disease Control and Prevention. (2015). *Geographic distribution of ticks that bite humans.* Retrieved from http://www.cdc.gov/ticks/geographic_distribution.html

Darsie Jr., R. F., and R. A. Ward. 2005. Identification and geographical distribution of the mosquitoes of North America, North of Mexico. University Press of Florida, Gainesville.

7 REFERENCES

Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, *PE&RS*, Vol. 77(9):858-864.

USDA, NRCS. 2016. The PLANTS Database (http://plants.usda.gov, 1 August 2016). National Plant Data Team, Greensboro, NC 27401-4901 USA.

8 APPENDIX A: DATA PRODUCT NUMBERS

For more information on the sampling protocols and the latest observatory data visit http://data.neonscience.org/data-product-catalog and search by name or code number.

Table 37: NEON data product names and descriptions.

Name	Description	Identification Code
Root sampling (megapit)	Fine root biomass in 10cm increments (first 1m depth) and 20cm increments (from 1m to 2m depth) from soil pit sampling	NEON.DOM.SITE.DP1.10066
Soil physical properties (Megapit)	Soil taxonomy, horizon names, horizon depths, as well as soil bulk density, porosity, texture (sand, silt, and clay content) in the <= 2 mm soil fraction for each soil horizon. Data were derived from a sampling location expected to be representative of the area where the Instrumented Soil Plots per site are located and were collected once during site construction. Also see distributed soil data products.	NEON.DOM.SITE.DP1.00096
Soil chemical properties (Megapit)	Total content of a range of chemical elements, pH, and electrical conductivity in the <= 2 mm soil fraction for each soil horizon. Data were derived from a sampling location expected to be representative of the area where the Instrumented Soil Plots per site are located and were collected once during site construction. Also see distributed soil data products.	NEON.DOM.SITE.DP1.00097
Woody plant vegetation structure	Structure measurements, including height, canopy diameter, and stem diameter, as well as mapped position of individual woody plants	NEON.DOM.SITE.DP1.10098
Plant presence and percent cover	Plant species presence as observed in multi-scale plots: species and associated percent cover at 1-m2 and plant species presence at 10-m2, 100-m2 and 400-m2	NEON.DOM.SITE.DP1.10058
Plant phenology observations	Phenophase status and intensity of tagged plants	NEON.DOM.SITE.DP1.10055

Name	Description	Identification Code
Plant foliar stable isotopes	Field collection metadata describing the sampling of sun-lit canopy foliar tissues for stable isotope compositions. Also includes raw data returned from the laboratory.	NEON.DOM.SITE.DP1.10053
Plant foliar physical and chemical properties	Plant sun-lit canopy foliar physical (e.g., leaf mass per area) and chemical properties reported at the level of the individual.	NEON.DOM.SITE.DP1.10026
Non-herbaceous perennial vegetation structure	Field measurements of individual non-herbaceous perennial plants (e.g. cacti, ferns)	NEON.DOM.SITE.DP1.10045.
Ground beetles sampled from pitfall traps	Taxonomically identified ground beetles and the plots and times from which they were collected.	NEON.DOM.SITE.DP1.10022
Ground beetle sequences DNA barcode	CO1 DNA sequences from select ground beetles	NEON.DOM.SITE.DP1.10020
Mosquitoes sampled from CO2traps	Taxonomically identified mosquitoes and the plots and times from which they were collected	NEON.DOM.SITE.DP1.10043
Mosquito-borne pathogen status	Presence/absence of a pathogen in a single mosquito sample (pool)	NEON.DOM.SITE.DP1.10041
Mosquito sequences DNA barcode	CO1 DNA sequences from select mosquitoes	NEON.DOM.SITE.DP1.10038
Ticks sampled using drag cloths	Abundance and density of ticks collected by drag and/or flag sampling (by species and/or lifestage)	NEON.DOM.SITE.DP1.10093
Tick-borne pathogen status	Presence/absence of a pathogen in each single tick sample	NEON.DOM.SITE.DP1.10092