TOS SITE CHARACTERIZATION REPORT: DOMAIN 09

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CHANGE RECORD

REVISION	DATE	ECO#	DESCRIPTION OF CHANGE
A	04/14/2017	ECO-04588	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

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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 Northern Plains 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.011056	TIS Site Characterization Report
RD[05]	NEON.DOC.001670	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 09 OVERVIEW: NORTHERN PLAINS DOMAIN

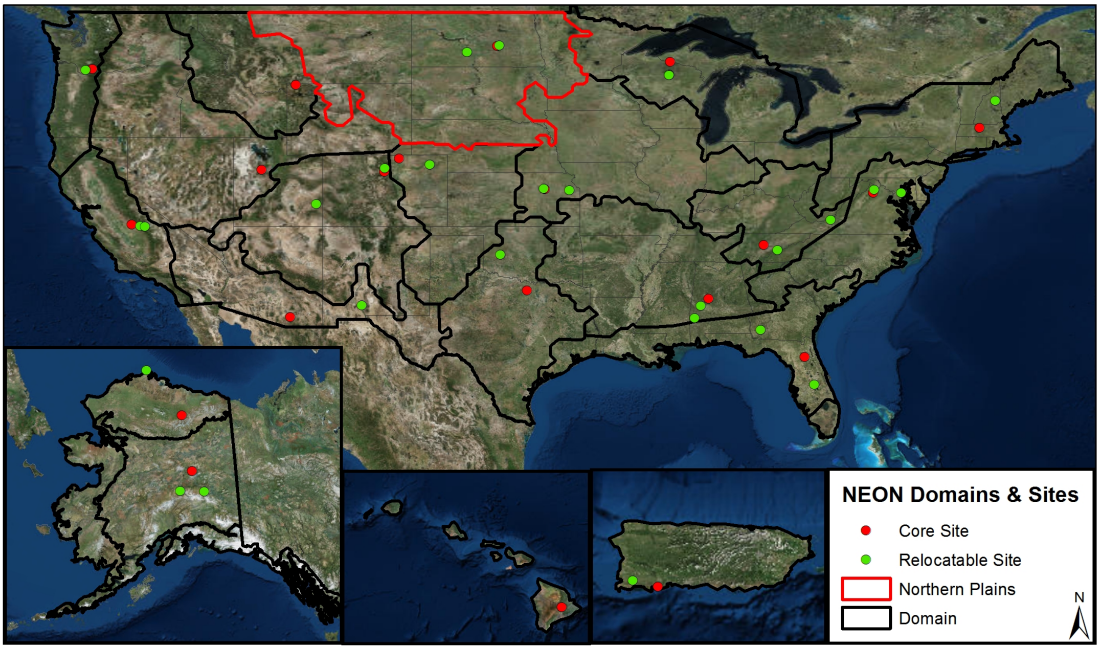

Figure 1: NEON project map with Domain 09 highlighted in red.

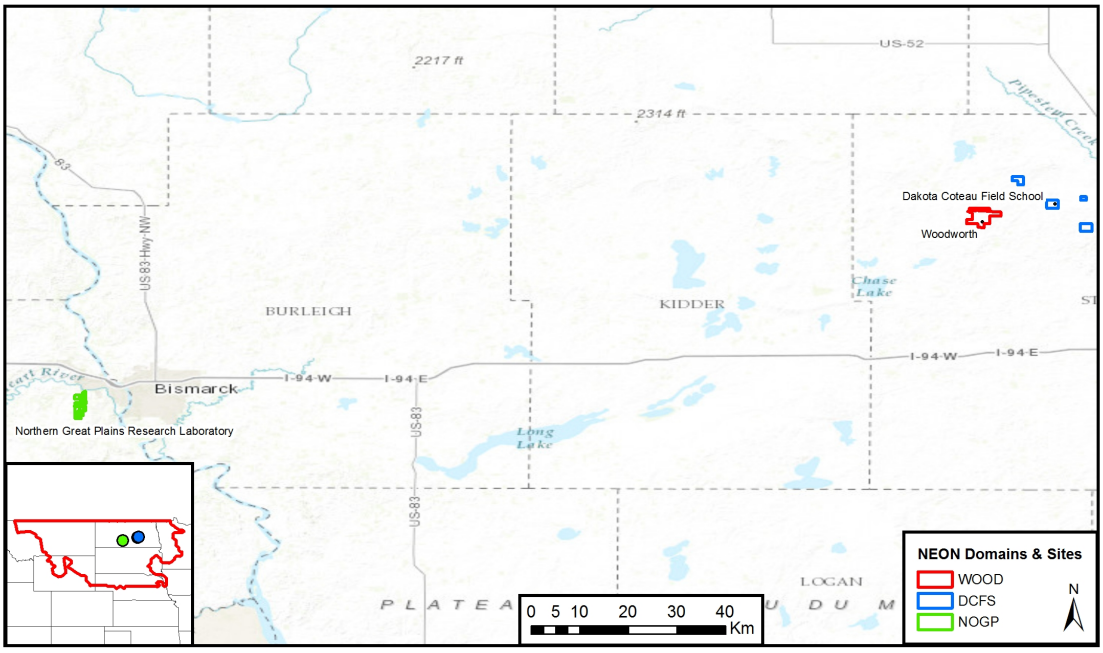

Figure 2: Site boundaries within Domain 09.

The Northern Plains Domain is a patchwork of grasslands, agricultural, and wetland/aquatic communities embedded in a matrix of small agrarian communities.

- States included in the domain: Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wyoming
- Core site: Woodworth
- Relocatable 1: Dakota Coteau Field School
- Relocatable 2: Northern Great Plains Research Laboratory
- Science themes: Agriculture

4 CORE SITE- WOODWORTH (WOOD)

The Northern Plains-Woodworth site is located ~100 miles northeast of Bismarck, ND. WOOD is a restored prairie in an undulating matrix of small lakes, ponds, and ephemeral prairie potholes.

Figure 3: Phenocamera image for WOOD. 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: U.S. Geological Survey and U.S. Fish and Wildlife Service. The site is part of the larger Chase Lake National Wildlife Refuge.
- Located in: Stutsman County, ND
- Sampling Area: 11 km^2
- Plot Elevation: 570-610m
- Dominant vegetation type: The prairie contains a combination of short- and mid-stature grasses and is dominated by blue grama (*Bouteloua gracilis*) and green needle grass (*Nassella viridula*). Tame grasses, legumes, and many species of wildflower are also present (Chase Lake National Wildlife Refuge, 2015).
- General management: The Chase Lake National Wildlife Refuge was established in 1908 as a reserve and breeding ground for native birds and is the fifteenth oldest refuge in the country (Chase Lake National

Wildlife Refuge, 2015). While the site has historically been tilled, cultivated, and grazed, current management is focused on re-seeding with native plant species. Light cattle grazing and prescribed burns also occur throughout the site to promote the growth of native species.

- The Prairie Pothole aquatic site is located within the WOOD TOS Sampling Boundary. 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 WOOD 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.

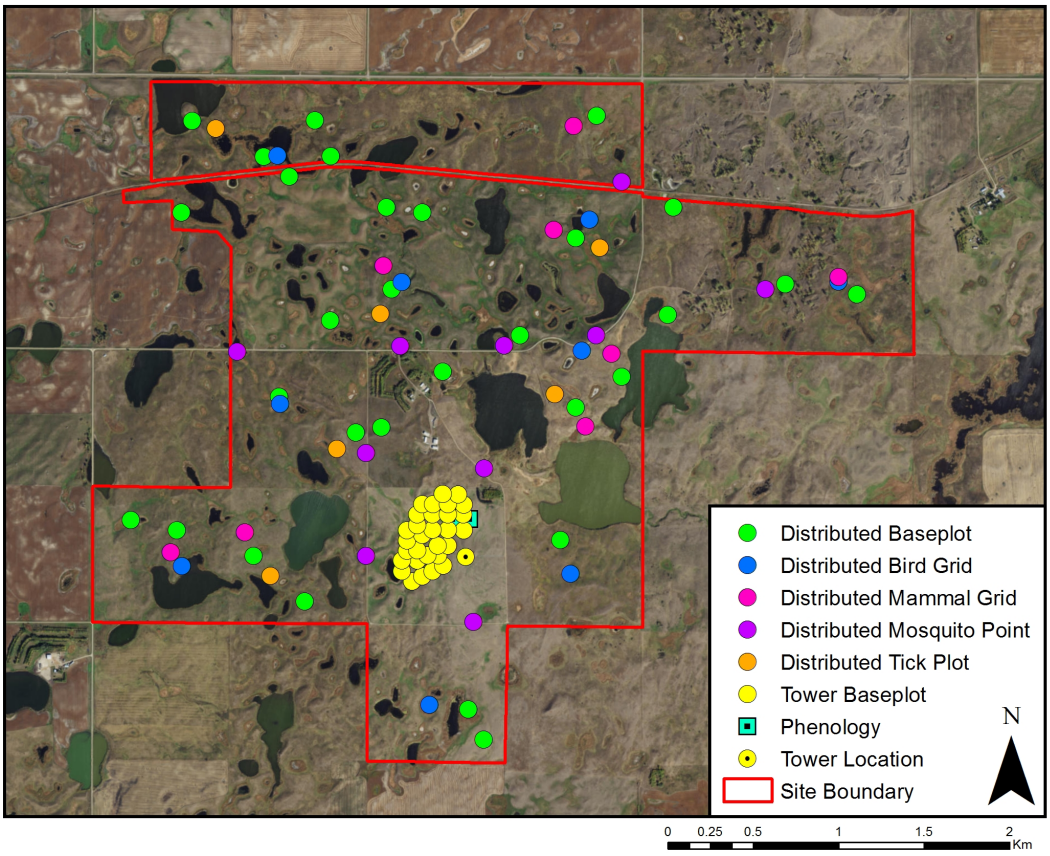

Figure 4: Map of TOS plot centroids within the NEON TOS sampling boundary at WOOD.

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

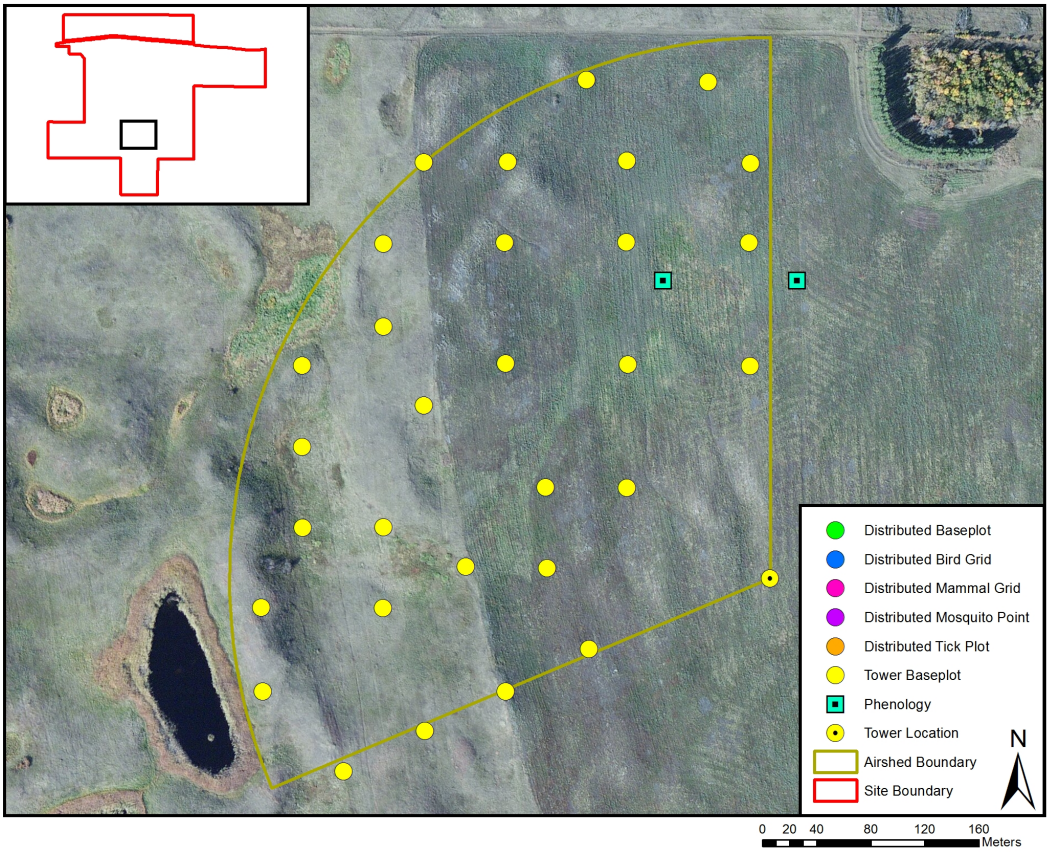

Figure 5: Map of the tower airshed and TOS plot centroids at WOOD.

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 WOOD.

NLCD Class	Site Area (km^2)	Percent (%)
Grassland Herbaceous	6.61	62.15
Emergent Herbaceous Wetlands	1.46	13.76
Open Water	1.32	12.39
Cultivated Crops	0.44	4.16
Pasture Hay	0.37	3.52
Developed Open Space	0.27	2.58
Deciduous Forest	0.12	1.14
Woody Wetlands	0.02	0.19
Developed Low Intensity	0.01	0.11

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 WOOD.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Emergent Herbaceous Wetlands	10
Distributed	Base Plot	Grassland Herbaceous	20
Distributed	Bird Grid	Emergent Herbaceous Wetlands	2
Distributed	Bird Grid	Grassland Herbaceous	7
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Emergent Herbaceous Wetlands	1
Distributed	Tick Plot	Grassland Herbaceous	5
Tower	Base Plot	NA	30
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 type within the airshed is grassland herbaceous.

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

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Emergent Herbaceous Wetlands	Beetles	2
Distributed	Base Plot	Grassland Herbaceous	Beetles	8

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Emergent Herbaceous Wetlands	Canopy Foliage Chemistry	3
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Coarse Downed Wood	7
Distributed	Base Plot	Grassland Herbaceous	Coarse Downed Wood	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Digital Hemispherical Photos for Leaf Area Index	7
Distributed	Base Plot	Grassland Herbaceous	Digital Hemispherical Photos for Leaf Area Index	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Herbaceous Biomass	7
Distributed	Base Plot	Grassland Herbaceous	Herbaceous Biomass	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Plant Diversity	10
Distributed	Base Plot	Grassland Herbaceous	Plant Diversity	20
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Biogeochemistry	1
Distributed	Base Plot	Grassland Herbaceous	Soil Biogeochemistry	5
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Microbes	1
Distributed	Base Plot	Grassland Herbaceous	Soil Microbes	5
Distributed	Base Plot	Emergent Herbaceous Wetlands	Vegetation Structure	7
Distributed	Base Plot	Grassland Herbaceous	Vegetation Structure	16

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 WOOD.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	30
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	30
Tower	Base Plot	Litterfall and Fine Woody Debris	30
Tower	Base Plot	Plant Belowground Biomass	30
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	30
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: WOOD

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.

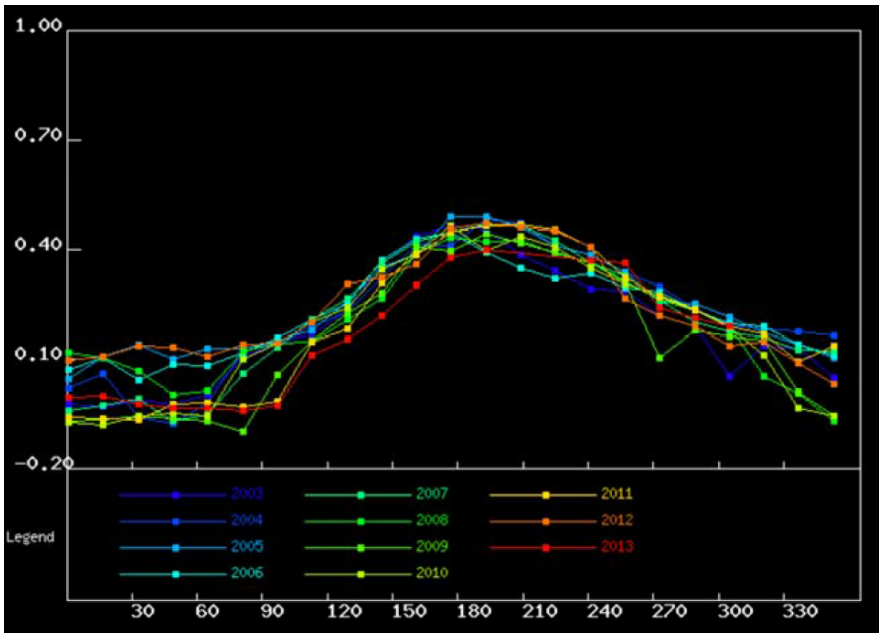

Figure 6: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON WOOD site.

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

Average Increase	Average Maximum	Average Decrease	Average Minimum
120 (05/01)	180 (06/30)	210 (07/30)	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: 47.128247, Longitude: -99.241246 (WGS84 datum)

4.3 Belowground Biomass

4.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 150 cm by NEON staff in September 2012. 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 WOOD.

Latitude	Longitude	Soil Family	Soil Order
47.12833	-99.23907	Coarse-loamy over sandy or sandy-skeletal - mixed - superactive - frigid Typic Haplustolls	Mollisol

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

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

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	7.5	7.22
10	20	0.77	0.24
20	30	0.51	0.01
30	40	0.2	0.09
40	50	0.72	0.69
50	60	0.21	0.11
60	70	0.08	0.05

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
70	80	0.06	0.06
80	90	0.15	0.21
90	100	0.08	0.05
100	110	0.01	0.01
110	130	0.03	0.02
130	150	0	0.01

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

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	749.75	722.32
10	20	827.03	703.67
20	30	878.41	704.42
30	40	898.45	704.48
40	50	970.08	704.49
50	60	990.66	694.61
60	70	998.36	699.38
70	80	1004.52	699.85
80	90	1019.22	720.74
90	100	1027.59	722.87
100	110	1028.88	723.82
110	130	1035.58	725.18
130	150	1036.51	726.65

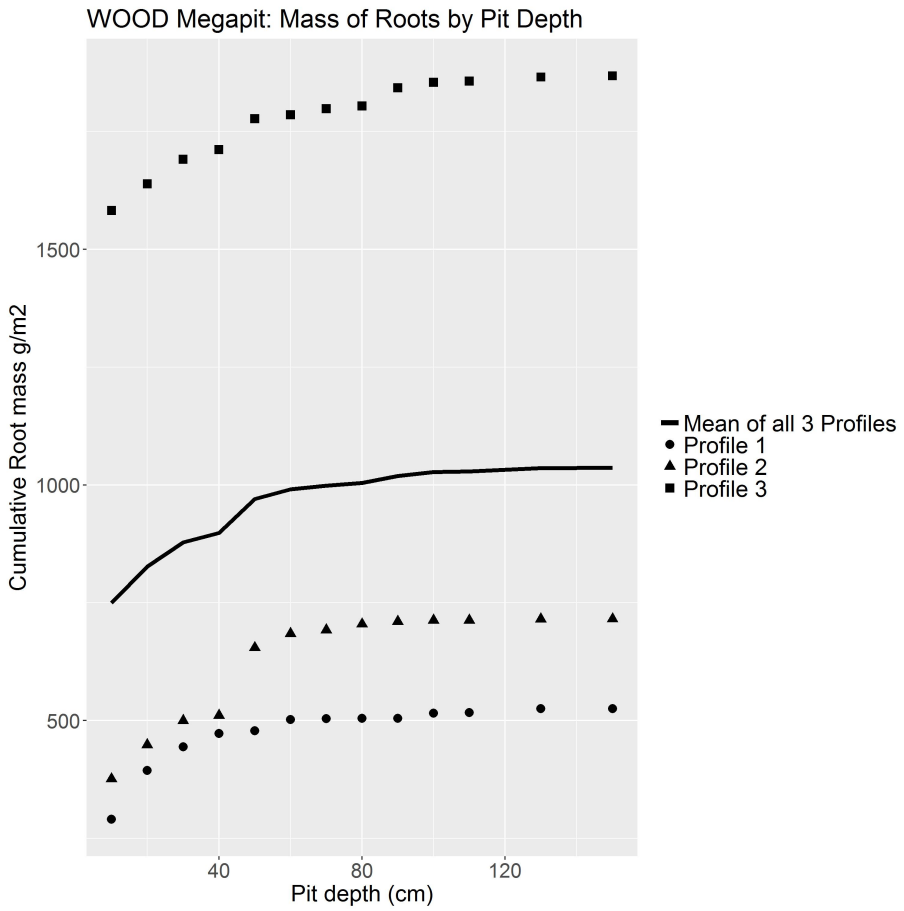

Figure 7: Cumulative root mass by pit depth at WOOD.

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

Total Pit Depth (cm)	150
Total Mean Cumulative Mass at 30cm (g per m^2)	878.41
Total Mean Cumulative Mass at 100cm (g per m^2)	1027.59
Total Mean Cumulative Mass (g per m^2)	1036.51

4.4 Plant Characterization and Phenology Species Selection

4.4.1 Site-Specific Methods

Plant characterization data were collected by an external contractor during July of 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 WOOD.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
POPR	*Poa pratensis* L.	1	52	NA	NA
ELRE4	*Elymus repens* (L.) Gould	2	8	NA	NA
BRIN2	*Bromus inermis* Leyss.	3	6	NA	NA
ARAB3	*Artemisia absinthium* L.	4	5	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)
ANGE	*Andropogon gerardii* Vitman	5	4	NA	NA
NAVI4	*Nassella viridula* (Trin.) Barkworth	6	3	NA	NA
MESA	*Medicago sativa* L.	7	3	NA	NA
DECE	*Deschampsia cespitosa* (L.) P. Beauv.	8	2	NA	NA
SCSC	*Schizachyrium scoparium* (Michx.) Nash	9	2	NA	NA
SOMI2	*Solidago missouriensis* Nutt.	10	2	NA	NA
POAM8	*Polygonum amphibium* L.	11	1	NA	NA
HECO26	*Hesperostipa comata* (Trin. & Rupr.) Barkworth	12	1	NA	NA
PASM	*Pascopyrum smithii* (Rydb.) Á. Löve	13	1	NA	NA
BOGR2	*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths	14	1	NA	NA
ELCO	*Elaeagnus commutata* Bernh. ex Rydb.	15	1	NA	NA
BOCU	*Bouteloua curtipendula* (Michx.) Torr.	16	1	NA	NA
PHAR3	*Phalaris arundinacea* L.	17	<1	NA	NA
GLLE3	*Glycyrrhiza lepidota* Pursh	18	<1	NA	NA
HOJU	*Hordeum jubatum* L.	19	<1	NA	NA
SYOC	*Symphoricarpos occidentalis* Hook.	20	<1	NA	NA
MEOF	*Melilotus officinalis* (L.) Lam.	21	<1	NA	NA
GABO2	*Galium boreale* L.	22	<1	NA	NA
CAREX	*Carex* sp.	23	<1	NA	NA
VICIA	*Vicia* sp.	24	<1	NA	NA
SOCA6	*Solidago canadensis* L.	25	<1	NA	NA
ACMI2	*Achillea millefolium* L.	26	<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)
HEVI4	*Heterotheca villosa* (Pursh) Shinners	26	<1	NA	NA
CIAR4	*Cirsium arvense* (L.) Scop.	28	<1	NA	NA
PEAR6	*Pediomelum argophyllum* (Pursh) J. Grimes	28	<1	NA	NA
LATAP	*Lactuca tatarica* (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung	30	<1	NA	NA
ARLU	*Artemisia ludoviciana* Nutt.	31	<1	NA	NA
CACA4	*Calamagrostis canadensis* (Michx.) P. Beauv.	32	<1	NA	NA
HEMA2	*Helianthus maximiliani* Schrad.	33	<1	NA	NA
ASOV	*Asclepias ovalifolia* Decne.	34	<1	NA	NA
ARFR4	*Artemisia frigida* Willd.	35	<1	NA	NA
DAPU5	*Dalea purpurea* Vent.	35	<1	NA	NA
RACO3	*Ratibida columnifera* (Nutt.) Woot. & Standl.	35	<1	NA	NA
VIAM	*Vicia americana* Muhl. ex Willd.	35	<1	NA	NA
SOAR2	*Sonchus arvensis* L.	39	<1	NA	NA
ASSY	*Asclepias syriaca* L.	40	<1	NA	NA
ROAR3	*Rosa arkansana* Porter	40	<1	NA	NA
COAR4	*Convolvulus arvensis* L.	42	<1	NA	NA
AMPS	*Ambrosia psilostachya* DC.	43	<1	NA	NA
ARCA12	*Artemisia campestris* L.	44	<1	NA	NA
ASTER	*Aster* sp.	44	<1	NA	NA
GAAR	*Gaillardia aristata* Pursh	44	<1	NA	NA
GETR	*Geum triflorum* Pursh	44	<1	NA	NA
PONO3	*Potentilla norvegica* L.	44	<1	NA	NA
SPHE	*Sporobolus heterolepis* (A. Gray) A. Gray	44	<1	NA	NA
CEAR4	*Cerastium arvense* L.	50	<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)
GRSQ	*Grindelia squarrosa* (Pursh) Dunal	50	<1	NA	NA
HEPA19	*Helianthus pauciflorus* Nutt.	50	<1	NA	NA
ANCA8	*Anemone canadensis* L.	53	<1	NA	NA
ANCY	*Anemone cylindrica* A. Gray	53	<1	NA	NA
ECAN2	*Echinacea angustifolia* DC.	53	<1	NA	NA
HELIA3	*Helianthus* sp.	53	<1	NA	NA
LILE3	*Linum lewisii* Pursh	53	<1	NA	NA
LIPU	*Liatris punctata* Hook.	53	<1	NA	NA
RUAQF	*Rumex aquaticus* L. var. *fenestratus* (Greene) Dorn	53	<1	NA	NA
THAR5	*Thlaspi arvense* L.	53	<1	NA	NA
TRDU	*Tragopogon dubius* Scop.	53	<1	NA	NA
CRCH	*Crataegus chrysocarpa* Ashe	62	<1	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 WOOD.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
10539	18	1.89	234
12587	18	2.31	242
13867	12	1.46	140
23863	21	1.72	174
2603	7	1.28	124
555	17	1.79	146
55863	9	1.56	128
5675	15	1.7	141
57899	15	1.49	114
59947	14	1.53	128
7723	20	1.95	158
8491	18	2.23	168

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
WOOD_042	11	1.84	124
WOOD_043	11	1.46	146
WOOD_047	9	1.35	138
WOOD_055	18	1.9	186
WOOD_057	21	1.74	261
WOOD_059	13	1.83	201
WOOD_069	20	2.11	167
WOOD_071	13	1.4	111

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot. Plots without "WOOD" in their Plot ID names are no longer being sampled, and were temporarily established for characterization purposes only. All plots listed above are within the WOOD tower airshed.

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. No bryophyte cover was recorded in WOOD Tower Base Plots.

4.5 Beetles

4.5.1 Site-Specific Methods

Beetle site characterization was conducted in September 2012 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 beetle specimens from the site were pooled before 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 WOOD.

Sample ID	Scientific Name
NEONTcarabid5994	*Harpalus herbivagus*
NEONTcarabid5996	*Harpalus herbivagus*
NEONTcarabid5995	*Harpalus herbivagus*
NEONcarabid5997	Carabidae spp.

Sample ID	Scientific Name
NEONTcarabid8006	*Agonum cupreum*
NEONTcarabid8003	*Agonum cupreum*
NEONTcarabid8005	*Agonum cupreum*
NEONTcarabid8008	*Agonum cupreum*
NEONcarabid8014	*Syntomus americanus*
NEONcarabid8017	*Syntomus americanus*
NEONcarabid8016	*Syntomus americanus*
NEONcarabid8019	*Syntomus americanus*
NEONcarabid8021	*Syntomus americanus*
NEONcarabid8018	*Syntomus americanus*
NEONcarabid8010	*Syntomus americanus*
NEONcarabid8024	*Syntomus americanus*
NEONcarabid8009	*Syntomus americanus*
NEONcarabid8015	*Syntomus americanus*
NEONcarabid8020	*Syntomus americanus*
NEONcarabid8011	*Syntomus americanus*
NEONcarabid8022	*Syntomus americanus*
NEONTcarabid5989	*Amara latior*
NEONcarabid8023	*Microlestes linearis*

Note: Taxonomic identifications below the family level determined via genetic analysis (CO1).

4.6 Mosquitoes

4.6.1 Site-Specific Methods

No mosquito site characterization took place at WOOD. For more information on this protocol and data product numbers see Appendix A.

4.7 Ticks

4.7.1 Site-Specific Methods

No tick site characterization took place at WOOD. For more information on this protocol and data product numbers see Appendix A.

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

Chase Lake National Wildlife Refuge. 2015, January 21. Department of the Interior. https://www.fws.gov/refuge/chase_lake.

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.

Ilsbury, M. M., J. E. Powell, F. Forcella, W. D. Woodson, S.A. Clay, and W. E. Riedell. 1998. Diversity and Dominant Species of Ground Beetle Assemblages (Coleoptera: Carabidae) in Crop Rotation and Chemical Input Systems for the Northern Great Plains. Ann. Entomol. Soc. Am. 91(5): 619-625.

Hanson, B.A., and G.A. Swanson. 1989. Coleoptera species inhabiting prairie wetlands of the Cottonwood Lake area, Stustmans county, North Dakota. The Prairie Naturalist. 21, 49-57.

Johnson, Sandra. 2015. Reptiles and Amphibians of North Dakota. North Dakota Game and Fish Department. https://gf.nd.gov/gnf/conservation/docs/amphibian-reptile-brochure.pdf

Meyer, Mavis I. 1985. Classification of native vegetation at the Woodworth Station, North Dakota. The Prairie Naturalist, 17:3, 165-167.

Williams, S.H., and J.E. Austin. 2014, Legacy data for a northern prairie grassland-Woodworth Study Area, North Dakota, 1963-89: U.S. Geological Survey Open-File Report 2014-1188, 85 p., http://dx.doi.org/10.3133/0fr20141188.

5 RELOCATABLE SITE 1- DAKOTA COTEAU FIELD SCHOOL (DCFS)

The Dakota Coteau Field School site is located ~100 miles northeast of Bismarck, ND and ~ 10 miles east of the Woodworth site. DCFS is a managed prairie in an undulating matrix of small lakes, ponds, and ephemeral prairie potholes. NEON sampling occurs across nonadjacent land parcels that are interspersed by private land.

Figure 8: Phenocamera image for NOGP. 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: State of North Dakota Land Trust
- Located in: Stutsman County, ND
- Sampling Area: 7.78 km^2
- Plot Elevation: 490-595m
- Dominant vegetation type: DCFS is characterized by rolling hills, rocky soils, and prairie potholes. Kentucky blue grass (*Poa pretensis* (L.)), silverberry (*Elaeagnus commutata*), and fireberry hawthorn (*Crataegus chrysocarpa*) are dominant species.
- General management: DCFS has no record of historical tilling and is moderately grazed throughout the year.

- The Prairie Lake aquatic site is located within the DCFS TOS Sampling Boundary. 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.

5.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at DCFS according to a spatially balanced and stratified-random design (RD[3]). The 2011 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.

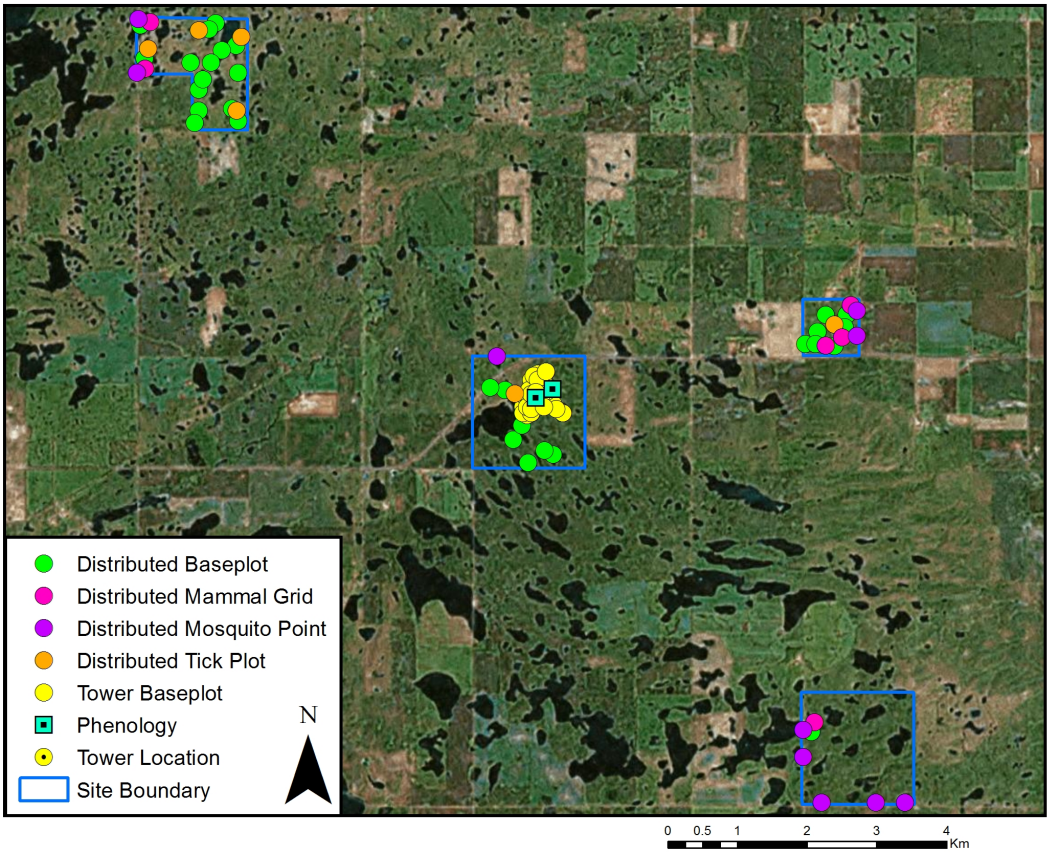

Figure 9: Map of TOS plot centroids within the NEON TOS sampling boundary at DCFS.

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

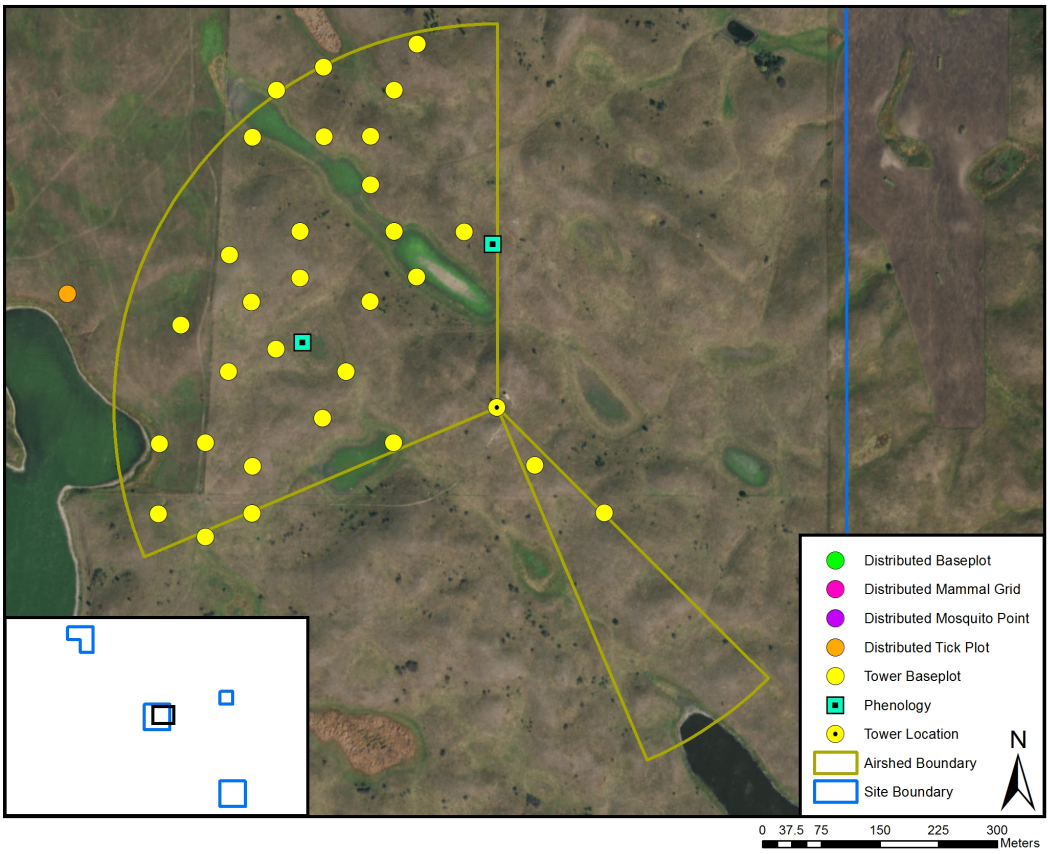

Figure 10: Map of the tower airshed and TOS plot centroids at DCFS.

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

Table 13: NLCD land cover classes and area within the TOS site boundary at DCFS.

NLCD Class	Site Area (km^2)	Percent (%)
Grassland Herbaceous	6.15	78.67
Open Water	0.92	11.82
Emergent Herbaceous Wetlands	0.3	3.87
Pasture Hay	0.18	2.27
Developed Open Space	0.13	1.65
Deciduous Forest	0.08	1.08
Developed Low Intensity	0.03	0.33
Cultivated Crops	0.01	0.17
Woody Wetlands	0.01	0.13

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 14: NLCD land cover classes and TOS plot numbers at DCFS.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland Herbaceous	30
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Grassland Herbaceous	6
Tower	Base Plot	NA	30
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 include: grassland herbaceous, emergent herbaceous wetlands, and shrub scrub.

Table 15: Number of Distributed Base plots per NLCD land cover class per protocol at DCFS.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Beetles	10
Distributed	Base Plot	Grassland Herbaceous	Birds	20
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	16
Distributed	Base Plot	Grassland Herbaceous	Coarse Downed Wood	20
Distributed	Base Plot	Grassland Herbaceous	Digital Hemispherical Photos for Leaf Area Index	20
Distributed	Base Plot	Grassland Herbaceous	Herbaceous Biomass	20
Distributed	Base Plot	Grassland Herbaceous	Plant Diversity	30
Distributed	Base Plot	Grassland Herbaceous	Soil Biogeochemistry	6
Distributed	Base Plot	Grassland Herbaceous	Soil Microbes	6
Distributed	Base Plot	Grassland Herbaceous	Vegetation Structure	20

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 16: Number of Tower Plots per protocol at DCFS.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Coarse Downed Wood	30
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	30
Tower	Base Plot	Litterfall and Fine Woody Debris	30
Tower	Base Plot	Plant Belowground Biomass	30
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	30
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: DCFS

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.

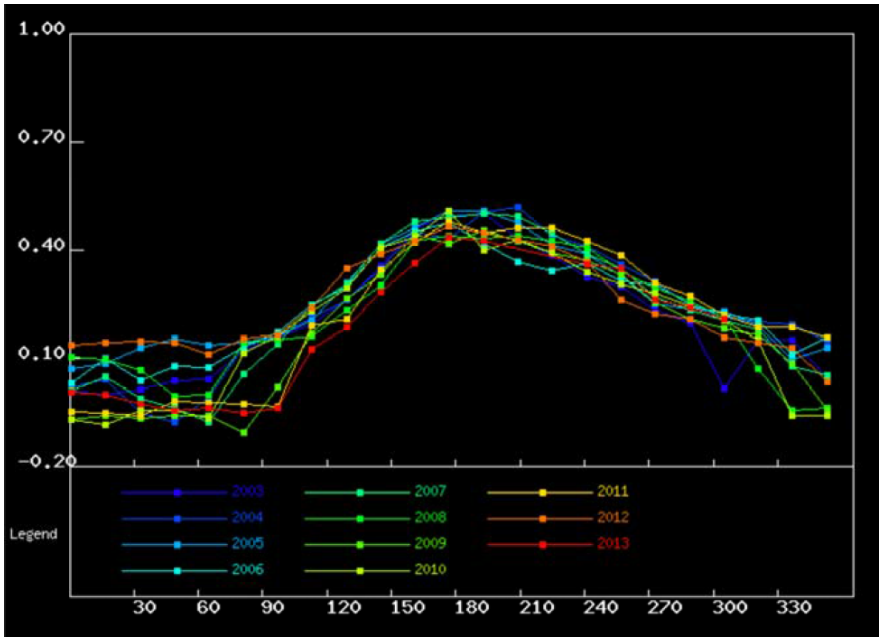

Figure 11: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON DCFS site.

Table 17: Average MODIS-EVI greenness dates for the NEON DCFS site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
120 (05/01)	180 (06/30)	205 (07/25)	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: 47.161603, Longitude: -99.106346 (WGS84)

5.3 Belowground Biomass

5.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 140 cm by NEON staff in September 2012. 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.

5.3.2 Results

Table 18: Soil Pit Information at DCFS.

Latitude	Longitude	Soil Family	Soil Order
47.15919	-99.11251	Fine-loamy - mixed - superactive - frigid Typic Haplustolls	Mollisol

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

Table 19: Fine root mass per depth increment (cm) at DCFS.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	4.24	0.85
10	20	0.6	0.19
20	30	0.48	0.14
30	40	0.42	0.26
40	50	0.33	0.27
50	60	0.21	0.14
60	70	0.2	0.18
70	80	0.12	0.08
80	90	0.09	0.07
90	100	0.09	0.03
100	120	0.03	0.01
120	140	0	0

Table 20: Cumulative fine root mass as a function of depth (cm) at DCFS.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	423.72	84.71
10	20	484.18	82.5

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
20	30	532.62	85.23
30	40	574.74	77.97
40	50	607.36	87.21
50	60	628.26	84.83
60	70	648.12	100.79
70	80	659.64	108.19
80	90	668.31	115.12
90	100	677.03	117.57
100	120	682.76	118.6
120	140	683.28	119.06

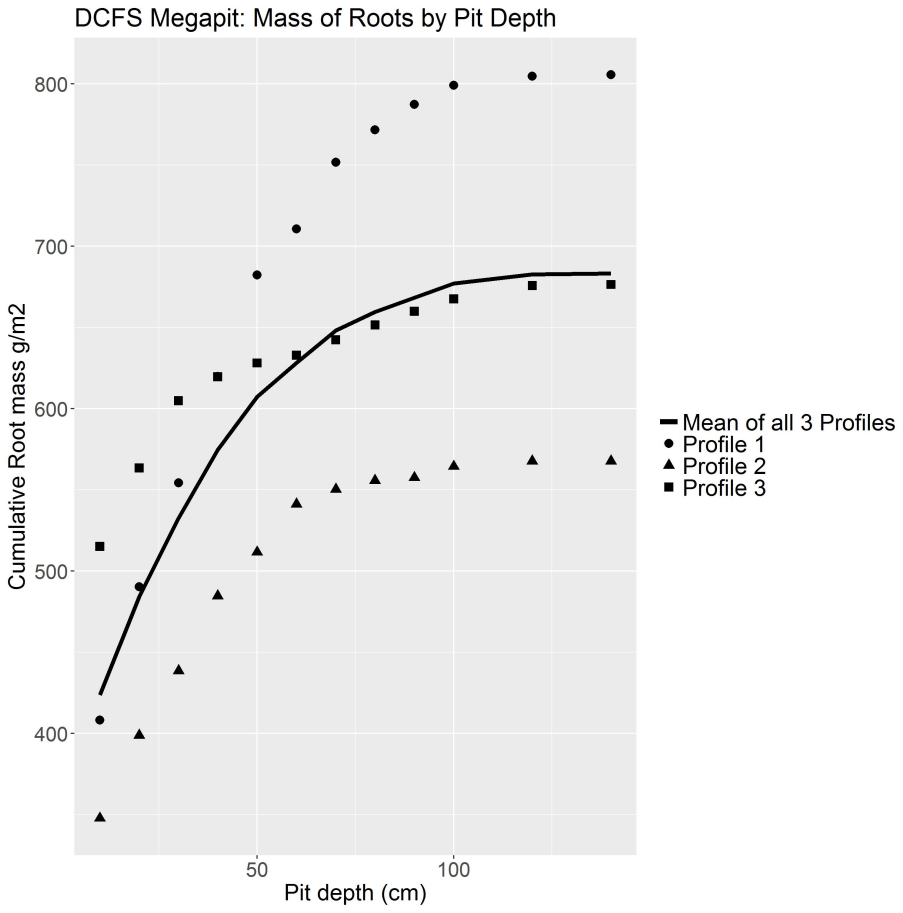

Figure 12: Cumulative root mass by pit depth at DCFS.

Table 21: Fine root biomass sampling summary data at DCFS.

Total Pit Depth (cm)	140
Total Mean Cumulative Mass at 30cm (g per m^2)	532.62
Total Mean Cumulative Mass at 100cm (g per m^2)	677.03
Total Mean Cumulative Mass (g per m^2)	683.28

5.4 Plant Characterization and Phenology Species Selection

5.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during August of 2015. 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 22: Site plant characterization and phenology species summary at DCFS.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
ELCO	*Elaeagnus commutata* Bernh. ex Rydb.	1	<1	<1	NA
POPR	*Poa pratensis* L.	2	12	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)
CRCH	*Crataegus chrysocarpa* Ashe	3	<1	<1	NA
SYOC	*Symphoricarpos occidentalis* Hook.	4	4	NA	NA
BRIN2	*Bromus inermis* Leyss.	5	3	NA	NA
ELAC	*Eleocharis acicularis* (L.) Roem. & Schult.	6	3	NA	NA
GLGR	*Glyceria grandis* S. Watson	7	2	NA	NA
GLLE3	*Glycyrrhiza lepidota* Pursh	8	1	NA	NA
GABO2	*Galium boreale* L.	9	1	NA	NA
ANCA8	*Anemone canadensis* L.	10	<1	NA	NA
DIOLS	*Dichanthelium oligosanthes* (Schult.) Gould var. *scribnerianum* (Nash) Gould	11	<1	NA	NA
ELRE4	*Elymus repens* (L.) Gould	12	<1	NA	NA
SOCA6	*Solidago canadensis* L.	13	<1	NA	NA
OLRI	*Oligoneuron rigidum* (L.) Small	14	<1	NA	NA
SPPE	*Spartina pectinata* Bosc ex Link	15	<1	NA	NA
CIFL	*Cirsium flodmanii* (Rydb.) Arthur	16	<1	NA	NA
COUM	*Comandra umbellata* (L.) Nutt.	17	<1	NA	NA
LATAP	*Lactuca tatarica* (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung	17	<1	NA	NA
ARLU	*Artemisia ludoviciana* Nutt.	19	<1	NA	NA
RUCR	*Rumex crispus* L.	20	<1	NA	NA
PRVI	*Prunus virginiana* L.	21	<1	NA	NA
ACMI2	*Achillea millefolium* L.	22	<1	NA	NA
RAMA2	*Ranunculus macounii* Britton	23	<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)
AMCA6	*Amorpha canescens* Pursh	24	<1	NA	NA
BESY	*Beckmannia syzigachne* (Steud.) Fernald	25	<1	NA	NA
SCSC	*Schizachyrium scoparium* (Michx.) Nash	26	<1	NA	NA
MELU	*Medicago lupulina* L.	27	<1	NA	NA
PEAR6	*Pediomelum argophyllum* (Pursh) J. Grimes	27	<1	NA	NA
ANCY	*Anemone cylindrica* A. Gray	29	<1	NA	NA
ARAB3	*Artemisia absinthium* L.	29	<1	NA	NA
ROAR3	*Rosa arkansana* Porter	31	<1	NA	NA
NAVI4	*Nassella viridula* (Trin.) Barkworth	32	<1	NA	NA
TORA2	*Toxicodendron radicans* (L.) Kuntze	32	<1	NA	NA
ONBEO	*Onosmodium bejariense* DC. ex A. DC. var. *occidentale* (Mack.) B.L. Turner	34	<1	NA	NA
SOAR2	*Sonchus arvensis* L.	35	<1	NA	NA
CAAT2	*Carex atherodes* Spreng.	36	<1	NA	NA
TYLA	*Typha latifolia* L.	37	<1	NA	NA
CIAR4	*Cirsium arvense* (L.) Scop.	39	<1	NA	NA
HEVI4	*Heterotheca villosa (Pursh)* Shinners	40	<1	NA	NA
HEPA19	*Helianthus pauciflorus* Nutt.	41	<1	NA	NA
VIPE2	*Viola pedatifida* G. Don	42	<1	NA	NA
ARAN7	*Argentina anserina* (L.) Rydb.	43	<1	NA	NA
EUES	*Euphorbia esula* L.	44	<1	NA	NA
MEAR4	*Mentha arvensis* L.	45	<1	NA	NA
SECO2	*Senecio congestus* (R. Br.) DC.	45	<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)
SOMI2	*Solidago missouriensis* Nutt.	45	<1	NA	NA
SYLA6	*Symphyotrichum lanceolatum* (Willd.) G.L. Nesom	48	<1	NA	NA
BOGR2	*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths	49	<1	NA	NA
HOJU	*Hordeum jubatum* L.	50	<1	NA	NA
PASM	*Pascopyrum smithii* (Rydb.) Á. Löve	51	<1	NA	NA
SYER	*Symphyotrichum ericoides* (L.) G.L. Nesom	51	<1	NA	NA
GETR	*Geum triflorum* Pursh	53	<1	NA	NA
ASSY	*Asclepias syriaca* L.	54	<1	NA	NA
ANNE	*Antennaria neglecta* Greene	55	<1	NA	NA
ASAG2	*Astragalus agrestis* Douglas ex G. Don	56	<1	NA	NA
LYAS	*Lycopus asper* Greene	57	<1	NA	NA
PHHE5	*Physalis heterophylla* Nees	57	<1	NA	NA
AMAR2	*Ambrosia artemisiifolia* L.	59	<1	NA	NA
SCPU10	*Schoenoplectus pungens* (Vahl) Palla	59	<1	NA	NA
STPI6	*Stachys pilosa* Nutt.	59	<1	NA	NA
ASSP	*Asclepias speciosa* Torr.	62	<1	NA	NA
PONO3	*Potentilla norvegica* L.	62	<1	NA	NA
JUARL	*Juncus arcticus* Willd. ssp. *littoralis* (Engelm.) Hultén	64	<1	NA	NA
LIAS	*Liatris aspera* Michx.	65	<1	NA	NA
TAOF	*Taraxacum officinale* F.H. Wigg.	66	<1	NA	NA
ECAN2	*Echinacea angustifolia* DC.	67	<1	NA	NA
LIIN2	*Lithospermum incisum* Lehm.	68	<1	NA	NA
POPA2	*Poa palustris* L.	68	<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)
RUMA4	*Rumex maritimus* L.	68	<1	NA	NA
POAME	*Polygonum amphibium* L. var. *emersum* Michx.	71	<1	NA	NA
CYOF	*Cynoglossum officinale* L.	72	<1	NA	NA
MEOF	*Melilotus officinalis* (L.) Lam.	73	<1	NA	NA
PLMA2	*Plantago major* L.	73	<1	NA	NA
TRDU	*Tragopogon dubius* Scop.	75	<1	NA	NA
CARO2	*Campanula rotundifolia* L.	76	<1	NA	NA
RACO3	*Ratibida columnifera* (Nutt.) Woot. & Standl.	77	<1	NA	NA
RUHI2	*Rudbeckia hirta* L.	77	<1	NA	NA
ZIAU	*Zizia aurea* (L.) W.D.J. Koch	77	<1	NA	NA
ARTEM	*Artemisia L.* Artemisia L.	80	<1	NA	NA
BODA2	*Bouteloua dactyloides* (Nutt.) J.T. Columbus	80	<1	NA	NA
PEES	*Pediomelum esculentum* (Pursh) Rydb.	80	<1	NA	NA
ALST	*Allium stellatum* Fraser ex Ker Gawl.	83	<1	NA	NA
ANGE	*Andropogon gerardii* Vitman	83	<1	NA	NA
CHAL7	*Chenopodium album* L.	83	<1	NA	NA
ELTRS	*Elymus trachycaulus* (Link) Gould ex Shinners ssp. *subsecundus* (Link) Á. Löve & D. Löve	83	<1	NA	NA
CAPE42	*Carex pellita* Muhl. ex Willd.	87	<1	NA	NA
DAPU5	*Dalea purpurea* Vent.	87	<1	NA	NA
RANUNCSPP	Ranunculaceae sp.	87	<1	NA	NA
RAOR3	*Ranunculus orthorhynchus* Hook.	87	<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)
SYLAG	*Symphyotrichum laeve* (L.) Á. Löve & D. Löve var. *geyeri* (A. Gray) G.L. Nesom	87	<1	NA	NA
VIAM	*Vicia americana* Muhl. ex Willd.	87	<1	NA	NA
POAR7	*Potentilla arguta* Pursh	93	<1	NA	NA
ALAR	*Alopecurus arundinaceus* Poir.	94	<1	NA	NA
ANROR	*Antennaria rosea* Greene ssp. *rosea*	94	<1	NA	NA
CAREXSPP	*Carex* sp.	94	<1	NA	NA
ELCA	*Elatine californica* A. Gray	94	<1	NA	NA
RORIPSPP	*Rorippa* sp.	94	<1	NA	NA
CAINH2	*needleleaf sedge* needleleaf sedge	99	<1	NA	NA
ERAGRSPP	*Eragrostis* sp.	99	<1	NA	NA
KOMA	*Koeleria macrantha* (Ledeb.) Schult.	99	<1	NA	NA
VEST	*Verbena stricta* Vent.	99	<1	NA	NA
ORLI	*Orogenia linearifolia* S. Watson	103	<1	NA	NA
HECO26	*Hesperostipa comata* (Trin. & Rupr.) Barkworth	104	<1	NA	NA
MUCU3	*Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb.	105	<1	NA	NA
ARFR4	*Artemisia frigida* Willd.	107	<1	NA	NA
CAVU2	*Carex vulpinoidea* Michx.	107	<1	NA	NA
ERST3	*Erigeron strigosus* Muhl. ex Willd.	107	<1	NA	NA
LICA12	*Lithospermum canescens* (Michx.) Lehm.	107	<1	NA	NA
PUPAM	*Pulsatilla patens* (L.) Mill. ssp. *multifida* (Pritz.) Zamels	107	<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)
SPCOC2	*Sporobolus compositus* (Poir.) Merr. var. *compositus*	107	<1	NA	NA
ATSU2	*Atriplex subspicata* (Nutt.) Rydb.	113	<1	NA	NA
OLAL2	*Oligoneuron album* (Nutt.) G.L. Nesom	113	<1	NA	NA
PRRAM2	*Prenanthes racemosa* Michx. var. *multiflora* (Cronquist) Dorn	113	<1	NA	NA
RUMEXSPP	*Rumex* sp.	113	<1	NA	NA
SUCA2	*Suaeda calceoliformis* (Hook.) Moq.	113	<1	NA	NA
ASTRASPP	*Astragalus* sp.	118	<1	NA	NA
SIMO2	*Sisyrinchium montanum* Greene	118	<1	NA	NA
ASCR2	*Astragalus crassicarpus* Nutt.	120	<1	NA	NA
ASFL2	*Astragalus flexuosus* Douglas ex G. Don	120	<1	NA	NA
ASMI10	*Astragalus missouriensis* Nutt.	120	<1	NA	NA
BOCU	*Bouteloua curtipendula* (Michx.) Torr.	120	<1	NA	NA
CIUN	*Cirsium undulatum* (Nutt.) Spreng.	120	<1	NA	NA
EQUISSPP	*Equisetum* sp.	120	<1	NA	NA
GRSQ	*Grindelia squarrosa* (Pursh) Dunal	120	<1	NA	NA
LAMIACSPP	Lamiaceae sp.	120	<1	NA	NA
LOSP	*Lobelia spicata* Lam.	120	<1	NA	NA
PEAL2	*Penstemon albidus* Nutt.	120	<1	NA	NA
RAMI2	*Ranunculus micranthus* Nutt.	120	<1	NA	NA
VIOLACSPP	Violaceae sp.	120	<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)
AGCR	*Agropyron cristatum* (L.) Gaertn.	132	<1	NA	NA
ANOC2	*Androsace occidentalis* Pursh	132	<1	NA	NA
ARDR4	*Artemisia dracunculus* L.	132	<1	NA	NA
ASVE	*Asclepias verticillata* L.	132	<1	NA	NA
BUAR3	*Buglossoides arvensis* (L.) I.M. Johnst.	132	<1	NA	NA
ELAM3	*Elatine americana* (Pursh) Arn.	132	<1	NA	NA
EQAR	*Equisetum arvense* L.	132	<1	NA	NA
LIPU	*Liatris punctata* Hook.	132	<1	NA	NA
LOUNU	*Lotus unifoliolatus* (Hook.) Benth. var. *unifoliolatus*	132	<1	NA	NA
LYJU	*Lygodesmia juncea* (Pursh) D. Don ex Hook.	132	<1	NA	NA
OXCO	*Oxalis corniculata* L.	132	<1	NA	NA
OXLA3	*Oxytropis lambertii* Pursh	132	<1	NA	NA
PEPR7	*Pedicularis procera* A. Gray	132	<1	NA	NA
POPE8	*Potentilla pensylvanica* L.	132	<1	NA	NA
PORI3	*Potentilla rivalis* Nutt.	132	<1	NA	NA
SCIRPSPP	*Scirpus* sp.	132	<1	NA	NA
SEIN2	*Senecio integerrimus* Nutt.	132	<1	NA	NA
VEHA2	*Verbena hastata* L.	132	<1	NA	NA
VIPE	*Viola pedata* L.	132	<1	NA	NA
VISO	*Viola sororia* Willd.	132	<1	NA	NA
ZIEL2	*Zigadenus elegans* Pursh	132	<1	NA	NA

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

Table 23: Per plot breakdown of species richness, diversity, and herbaceous cover at DCFS.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
DCFS_061	34	2.32	195	0
DCFS_062	37	3.05	78	0
DCFS_063	35	2.89	106	2.88
DCFS_064	29	2.79	70	1.2
DCFS_065	37	3.12	76	0
DCFS_066	19	2.2	69	4
DCFS_067	47	3.53	81	0
DCFS_068	23	2.79	47	0
DCFS_069	31	2.52	62	0
DCFS_070	35	2.87	74	0
DCFS_071	51	2.73	151	0
DCFS_072	42	3.48	93	0
DCFS_073	29	2.83	35	0
DCFS_074	23	2.66	54	0
DCFS_075	42	3	135	0
DCFS_076	28	2.89	51	0
DCFS_077	24	2.82	61	0
DCFS_078	34	2.77	120	0
DCFS_079	17	2.34	61	0
DCFS_080	32	2.91	60	0
DCFS_081	40	3	78	0
DCFS_082	42	3.21	63	0
DCFS_083	28	2.49	90	1.9
DCFS_084	26	2.7	38	0
DCFS_085	37	2.85	124	0
DCFS_086	38	3.21	93	0
DCFS_087	45	3.03	127	0
DCFS_088	32	2.84	73	0
DCFS_089	48	3.4	106	0
DCFS_090	33	2.71	103	0
Bryophyte Mean				0.33

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 conducted in 2012 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 beetle specimens from the site were pooled before identification. For more information on this protocol and data product numbers see Appendix A.

5.5.2 Results

Table 24: Beetle identification results at DCFS.

Sample ID	Scientific Name
NEON8001	*Brachinus cyanochroaticus*
NEON8002	*Brachinus cyanochroaticus*
NEON5995	*Harpalus herbivagus*
NEON5996	*Harpalus herbivagus*
NEON5994	*Harpalus herbivagus*
NEON8003	*Agonum cupreum*
NEON8004	*Agonum cupreum*
NEON8005	*Agonum cupreum*
NEON8006	*Agonum cupreum*
NEON8008	*Agonum cupreum*
NEON5979	*Pterostichus pensylvanicus*
NEON8007	*Pterostichus femoralis*
NEON8117	*Poecilus lucublandus*
NEON5987	*Poecilus lucublandus*
NEON5980	*Poecilus lucublandus*
NEON5990	*Poecilus lucublandus*
NEON5991	*Poecilus lucublandus*

Sample ID	Scientific Name
NEON5992	*Poecilus lucublandus*
NEON5981	*Poecilus lucublandus*
NEON5988	*Poecilus lucublandus*
NEON5978	*Poecilus lucublandus*
NEON5993	*Poecilus lucublandus*
NEON5983	*Poecilus lucublandus*
NEON5984	*Poecilus lucublandus*
NEON5985	*Poecilus lucublandus*
NEON5986	*Poecilus lucublandus*
NEON5998	*Amara angustata*
NEON5999	*Amara angustata*
NEON5989	*Amara latior*
NEON8000	*Amara cupreolata*

5.6 Mosquitoes

5.6.1 Site-Specific Methods

No mosquito site characterization took place at DCFS. For more information on this protocol and data product numbers see Appendix A.

5.7 Ticks

5.7.1 Site-Specific Methods

No tick site characterization took place at DCFS. 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]). See the WOOD species reference list section for statewide resources.

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.

6 RELOCATABLE SITE 2- NORTHERN GREAT PLAINS RESEARCH LABORATORY (NOGP)

NOGP is located ~6 miles west of Bismark, ND. NOGP is a grazed site and is one of the Agricultural Research Service (ARS) facilities in the United States.

Figure 13: Phenocamera image for NOGP. 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: U.S. Department of Agriculture, Agricultural Research Service
- Located in: Morton, ND
- Sampling Area: 5.86 km^2
- Plot Elevation: 515-595m
- Dominant vegetation type: NOGP contains a mix of native grasslands, tame grasses,legumes, and many species of wildflowers. Around the NEON tower smooth brome (*Bromus inermis* L) and Kentucky bluegrass (*Poa pretensis* (L.)) are common. Depending on the type of research, various crop species are planted as well.
- General management: The Northern Great Plains Research Laboratory's mission is to "develop adaptive and integrative practices for sustainable crop, livestock, and rangeland systems" (National Resource Man-

agement Research, 2016).

- 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 NOGP 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.

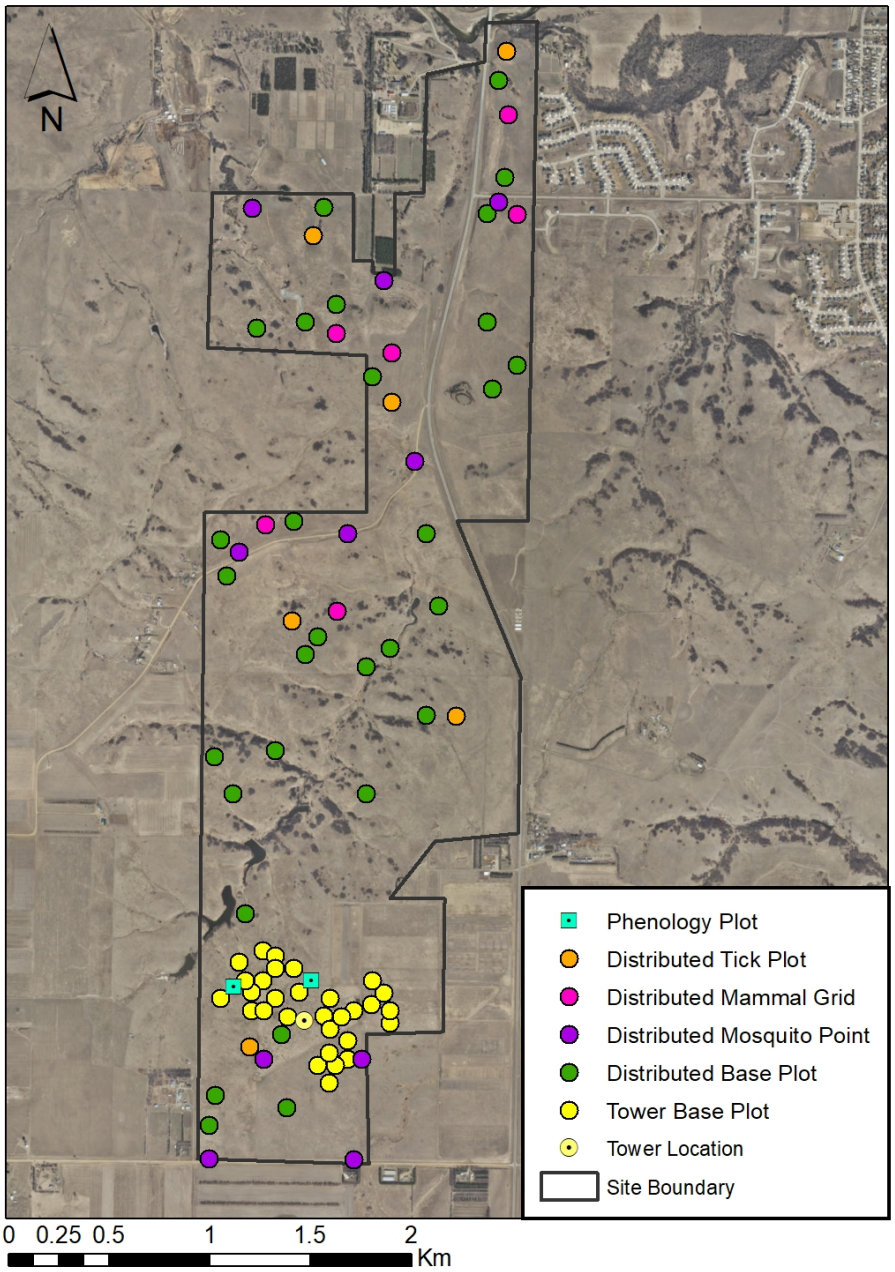

Figure 14: Map of TOS plot centroids within the NEON TOS sampling boundary at NOGP.

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

RD[03].

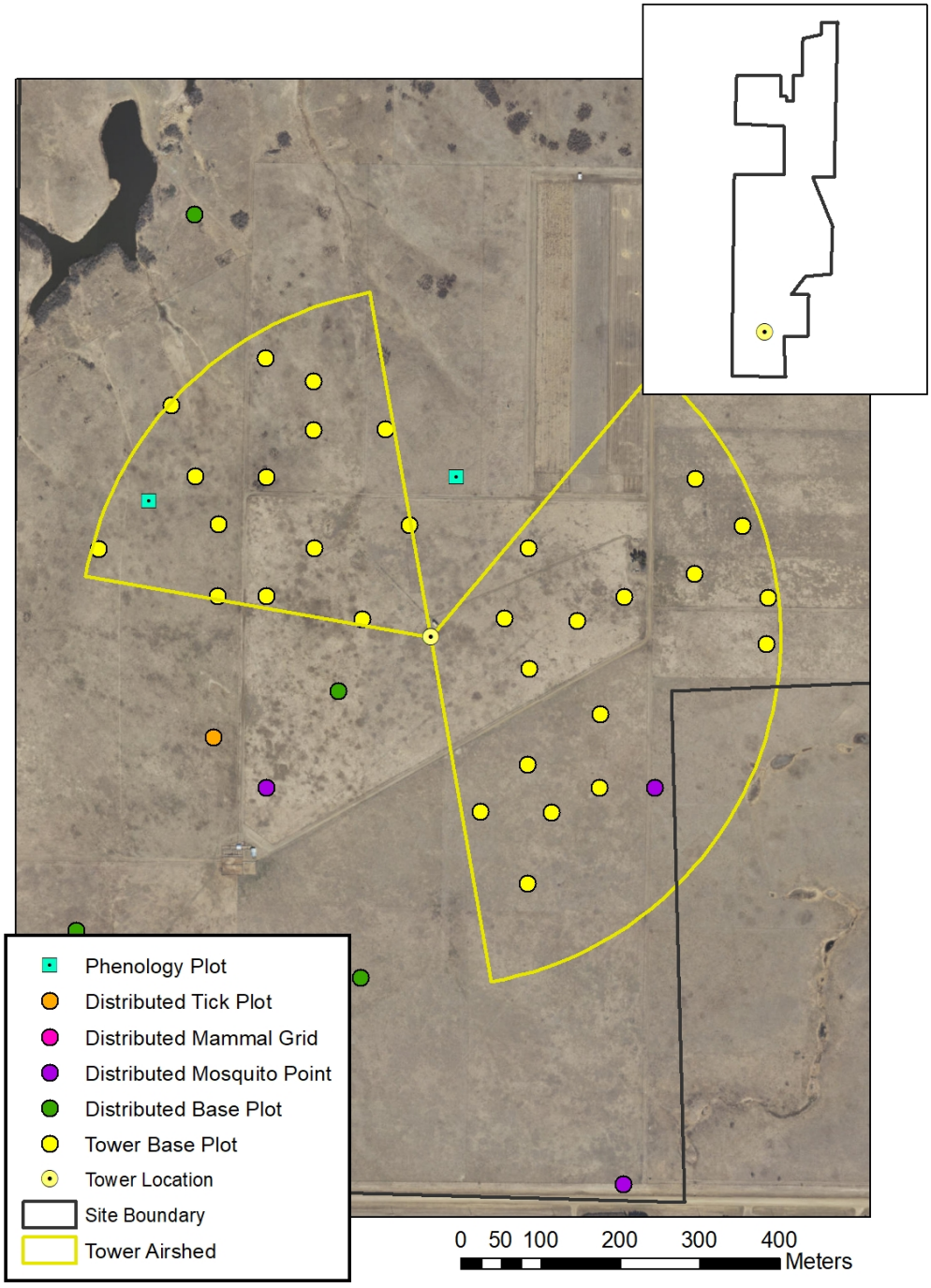

Figure 15: Map of the tower airshed and TOS plot centroids at NOGP.

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

Table 25: NLCD land cover classes and area within the TOS site boundary at NOGP.

NLCD Class	Site Area (km^2)	Percent (%)
Grassland Herbaceous	5.4	92.27
Developed Open Space	0.2	3.37
Emergent Herbaceous Wetlands	0.12	2.01
Woody Wetlands	0.08	1.32
Open Water	0.03	0.58
Deciduous Forest	0.01	0.2
Developed Low Intensity	0.01	0.15
Barren Land	0.01	0.09

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 26: NLCD land cover classes and TOS plot numbers at NOGP.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland Herbaceous	30
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Grassland Herbaceous	6
Tower	Base Plot	NA	30
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 include: grassland herbaceous and shrub scrub.

Table 27: Number of Distributed Base plots per NLCD land cover class per protocol at NOGP.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Beetles	10
Distributed	Base Plot	Grassland Herbaceous	Birds	20
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	16
Distributed	Base Plot	Grassland Herbaceous	Coarse Downed Wood	20

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Digital Hemispherical Photos for Leaf Area Index	20
Distributed	Base Plot	Grassland Herbaceous	Herbaceous Biomass	20
Distributed	Base Plot	Grassland Herbaceous	Plant Diversity	30
Distributed	Base Plot	Grassland Herbaceous	Soil Biogeochemistry	6
Distributed	Base Plot	Grassland Herbaceous	Soil Microbes	6
Distributed	Base Plot	Grassland Herbaceous	Vegetation Structure	20

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 28: Number of Tower Plots per protocol at NOGP.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	30
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	30
Tower	Base Plot	Litterfall and Fine Woody Debris	30
Tower	Base Plot	Plant Belowground Biomass	30
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	30
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: NOGP

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.

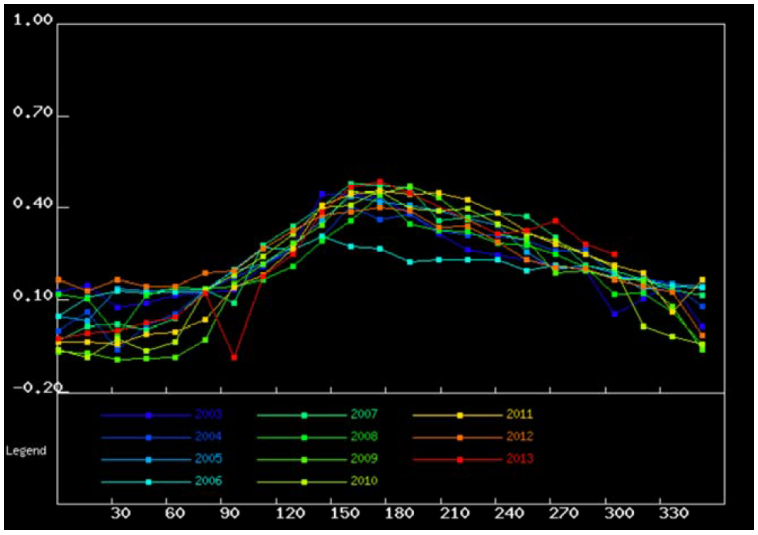

Figure 16: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON NOGP site.

Table 29: Average MODIS-EVI greenness dates for the NEON NOGP site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
115 (04/26)	170 (06/20)	200 (07/20)	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: 46.769968, Longitude: -100.91541 (WGS84 datum)

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 July 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.

6.3.2 Results

Table 30: Soil Pit Information at NOGP.

Latitude	Longitude	Soil Family	Soil Order
46.76846	-100.91832	Fine-loamy - mixed - superactive - frigid Typic Argiustolls	Mollisol

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

Table 31: Fine root mass per depth increment (cm) at NOGP.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	10.02	2.01
10	20	2.03	1.3
20	30	1.53	1.14
30	40	0.9	0.21
40	50	0.41	0.23
50	60	0.38	0.21
60	70	0.32	0.16
70	80	0.21	0.05
80	90	0.12	0.05
90	100	0.07	0.05
100	120	0.05	0
120	140	0.04	0.01
140	160	0.04	0.02
160	180	0.02	0.01
180	200	0.02	0.01

Table 32: Cumulative fine root mass as a function of depth (cm) at NOGP.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	1001.93	200.7

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
10	20	1204.5	329.84
20	30	1357.05	443.65
30	40	1447.5	461.78
40	50	1488.79	484.23
50	60	1526.31	501.37
60	70	1558.27	508.51
70	80	1578.83	510.9
80	90	1590.54	512.28
90	100	1597.91	511.57
100	120	1608.31	510.98
120	140	1617.24	508.13
140	160	1625.35	510.98
160	180	1629.41	509.8
180	200	1633.21	510.87

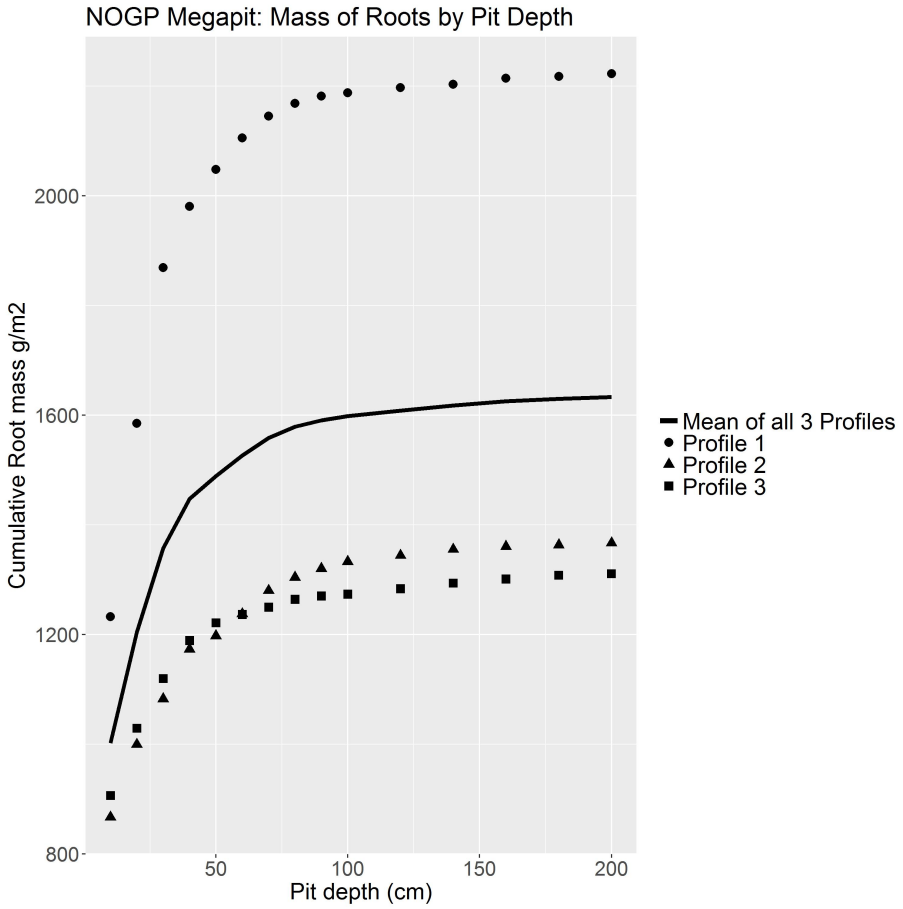

Figure 17: Cumulative root mass by pit depth at NOGP.

Table 33: Fine root biomass sampling summary data at NOGP.

Total Pit Depth (cm)	200
Total Mean Cumulative Mass at 30cm (g per m^2)	1357.05
Total Mean Cumulative Mass at 100cm (g per m^2)	1597.91
Total Mean Cumulative Mass (g per m^2)	1633.21

6.4 Plant Characterization and Phenology Species Selection

6.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during July of 2015. 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 34: Site plant characterization and phenology species summary at NOGP.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
ELAN	*Elaeagnus angustifolia* L.	1	<1	NA	0.01
POPR	*Poa pratensis* L.	2	14	NA	NA
SYOC	*Symphoricarpos occidentalis* Hook.	3	3	NA	NA
BRIN2	*Bromus inermis* Leyss.	4	1	NA	NA
MEOF	*Melilotus officinalis* (L.) Lam.	5	<1	NA	NA
ARLU	*Artemisia ludoviciana* Nutt.	6	<1	NA	NA
PEAR6	*Pediomelum argophyllum* (Pursh) J. Grimes	7	<1	NA	NA
ROAR3	*Rosa arkansana* Porter	8	<1	NA	NA
NAVI4	*Nassella viridula* (Trin.) Barkworth	9	<1	NA	NA
OLRI	*Oligoneuron rigidum* (L.) Small	10	<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)
LATAP	*Lactuca tatarica* (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung	11	<1	NA	NA
PASM	*Pascopyrum smithii* (Rydb.) Á. Löve	12	<1	NA	NA
CIFL	*Cirsium flodmanii* (Rydb.) Arthur	13	<1	NA	NA
ANGE	*Andropogon gerardii* Vitman	14	<1	NA	NA
ANCY	*Anemone cylindrica* A. Gray	15	<1	NA	NA
AGCR	*Agropyron cristatum* (L.) Gaertn.	16	<1	NA	NA
LOUNU	*Lotus unifoliolatus* (Hook.) Benth. var. *unifoliolatus*	17	<1	NA	NA
SYER	*Symphyotrichum ericoides* (L.) G.L. Nesom	18	<1	NA	NA
GACO5	*Gaura coccinea* Nutt. ex Pursh	19	<1	NA	NA
CIAR4	*Cirsium arvense* (L.) Scop.	20	<1	NA	NA
TAOF	*Taraxacum officinale* F.H. Wigg.	21	<1	NA	NA
HEPA19	*Helianthus pauciflorus* Nutt.	22	<1	NA	NA
PUPAM	*Pulsatilla patens* (L.) Mill. ssp. *multifida* (Pritz.) Zamels	22	<1	NA	NA
ECAN2	*Echinacea angustifolia* DC.	24	<1	NA	NA
PRVI	*Prunus virginiana* L.	25	<1	NA	NA
BOGR2	*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths	26	<1	NA	NA
SCSC	*Schizachyrium scoparium* (Michx.) Nash	26	<1	NA	NA
DAPU5	*Dalea purpurea* Vent.	28	<1	NA	NA
CAINH2	*Carex inops* L.H. Bailey ssp. *heliophila* (Mack.) Crins	29	<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)
AMCA6	*Amorpha canescens* Pursh	30	<1	NA	NA
SOMI2	*Solidago missouriensis* Nutt.	30	<1	NA	NA
VIPE2	*Viola pedatifida* G. Don	32	<1	NA	NA
ANMI3	*Antennaria microphylla* Rydb.	33	<1	NA	NA
VIAM	*Vicia americana* Muhl. ex Willd.	34	<1	NA	NA
SOCA6	*Solidago canadensis* L.	35	<1	NA	NA
HESP11	*Hesperostipa spartea* (Trin.) Barkworth	36	<1	NA	NA
DICHA2	*Dichanthelium (Hitchc. &* Chase) Gould	37	<1	NA	NA
RACO3	*Ratibida columnifera* (Nutt.) Woot. & Standl.	37	<1	NA	NA
LIPU	*Liatris punctata* Hook.	39	<1	NA	NA
ARFR4	*Artemisia frigida* Willd.	40	<1	NA	NA
SOAR2	*Sonchus arvensis* L.	40	<1	NA	NA
HECO26	*Hesperostipa comata* (Trin. & Rupr.) Barkworth	42	<1	NA	NA
LICA12	*Lithospermum canescens* (Michx.) Lehm.	42	<1	NA	NA
ACMI2	*Achillea millefolium* L.	44	<1	NA	NA
COUM	*Comandra umbellata* (L.) Nutt.	45	<1	NA	NA
ASCR2	*Astragalus crassicarpus* Nutt.	46	<1	NA	NA
GRSQ	*Grindelia squarrosa* (Pursh) Dunal	48	<1	NA	NA
TRDU	*Tragopogon dubius* Scop.	48	<1	NA	NA
POAR7	*Potentilla arguta* Pursh	50	<1	NA	NA
KOMA	*Koeleria macrantha* (Ledeb.) Schult.	51	<1	NA	NA
COCA5	*Conyza canadensis* (L.) Cronquist	52	<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)
ELTRS	*Elymus trachycaulus* (Link) Gould ex Shinners ssp. *subsecundus* (Link) Á. Löve & D. Löve	52	<1	NA	NA
DACA7	*Dalea candida* Michx. ex Willd.	54	<1	NA	NA
HECUO2	*Heliotropium curassavicum* L. var. *obovatum* DC.	54	<1	NA	NA
LYJU	*Lygodesmia juncea* (Pursh) D. Don ex Hook.	54	<1	NA	NA
ARMI2	*Arctium minus* Bernh.	57	<1	NA	NA
OXCO	*Oxalis corniculata* L.	57	<1	NA	NA
PEFRP	*Petasites frigidus* (L.) Fr. var. *palmatus* (Aiton) Cronquist	57	<1	NA	NA
ARAB3	*Artemisia absinthium* L.	60	<1	NA	NA
CAFI	*Carex filifolia* Nutt.	61	<1	NA	NA
CYOF	*Cynoglossum officinale* L.	61	<1	NA	NA
EUES	*Euphorbia esula* L.	61	<1	NA	NA
MELU	*Medicago lupulina* L.	61	<1	NA	NA
PEES	*Pediomelum esculentum* (Pursh) Rydb.	61	<1	NA	NA
POAL4	*Polygala alba* Nutt.	61	<1	NA	NA
POPUP5	*Potamogeton pusillus* L. ssp. *pusillus*	61	<1	NA	NA
ASAG2	*Astragalus agrestis* Douglas ex G. Don	68	<1	NA	NA
ASVE	*Asclepias verticillata* L.	68	<1	NA	NA
PHHE5	*Physalis heterophylla* Nees	68	<1	NA	NA
BOCU	*Bouteloua curtipendula* (Michx.) Torr.	71	<1	NA	NA
HEHI	*Hedeoma hispida* Pursh	71	<1	NA	NA
LIIN2	*Lithospermum incisum* Lehm.	71	<1	NA	NA
POAR3	*Poa arida* Vasey	71	<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)
THAR5	*Thlaspi arvense* L.	71	<1	NA	NA
BODA2	*Bouteloua dactyloides* (Nutt.) J.T. Columbus	76	<1	NA	NA
HOJU	*Hordeum jubatum* L.	76	<1	NA	NA
SPCOC2	*Sporobolus compositus* (Poir.) Merr. var. *compositus*	76	<1	NA	NA
PEGR5	*Penstemon gracilis* Nutt.	79	<1	NA	NA
VEBR	*Verbena bracteata* Cav. ex Lag. & Rodr.	79	<1	NA	NA
ARPU9	*Aristida purpurea* Nutt.	81	<1	NA	NA
CALO	*Calamovilfa longifolia* (Hook.) Scribn.	81	<1	NA	NA
CIUN	*Cirsium undulatum* (Nutt.) Spreng.	81	<1	NA	NA
ELRE4	*Elymus repens* (L.) Gould	81	<1	NA	NA
HERI	*Heuchera richardsonii* R. Br.	81	<1	NA	NA
LACA	*Lactuca canadensis* L.	81	<1	NA	NA
LICA2	*Ligusticum canbyi* (J.M. Coult. & Rose) J.M. Coult. & Rose	81	<1	NA	NA
OENU	*Oenothera nuttallii* Sweet	81	<1	NA	NA
SIAL2	*Sisymbrium altissimum* L.	81	<1	NA	NA
VINE	*Viola nephrophylla* Greene	81	<1	NA	NA

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

Table 35: Per plot breakdown of species richness, diversity, and herbaceous cover at NOGP.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
NOGP_061	10	1.69	21	0
NOGP_062	28	2.61	65	0
NOGP_063	18	1.8	48	0

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
NOGP_064	24	2.4	51	0
NOGP_065	23	2.25	38	0
NOGP_066	20	2.31	23	0.25
NOGP_067	25	2.42	63	0
NOGP_068	23	2.41	45	0
NOGP_069	37	3.29	50	0
NOGP_070	23	1.64	59	0
NOGP_071	14	1.85	20	0
NOGP_072	29	2.61	38	0
NOGP_073	25	1.81	57	0
NOGP_074	13	1.13	43	0
NOGP_075	24	2.86	28	0
NOGP_076	26	2.58	40	0
NOGP_077	21	1.98	54	0
NOGP_078	28	2.46	58	0
NOGP_079	12	1.8	13	0.5
NOGP_080	35	3.03	65	0
NOGP_081	26	2.85	62	0
NOGP_082	27	2.33	72	0
NOGP_083	30	2.88	55	0
NOGP_084	35	2.98	76	0
NOGP_085	20	1.98	39	0
NOGP_086	27	2.68	65	0
NOGP_087	24	2.66	36	0
NOGP_088	10	1.5	19	0
NOGP_089	23	2.49	49	0
NOGP_090	15	2.24	19	0
Bryophyte Mean				0.02

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 conducted in July 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 beetle samples were pooled before 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.

6.5.2 Results

Table 36: Beetle identification results at NOGP.

Sample ID	Scientific Name
NEONTcarabid8117	*Poecilus lucublandus*
NEONcarabid8110	*Syntomus americanus*
NEONcarabid8114	*Syntomus americanus*
NEONcarabid8116	*Syntomus americanus*
NEONcarabid8112	*Syntomus americanus*
NEONcarabid8115	*Syntomus americanus*
NEONcarabid8113	*Syntomus americanus*
NEONcarabid8111	*Syntomus americanus*

6.6 Mosquitoes

6.6.1 Site-Specific Methods

Mosquito site characterization was conducted in July 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. No pathogen testing was performed and all samples were pooled before identification. For more information on this protocol and data product numbers see Appendix A. See the WOOD species reference list section for statewide resources.

6.6.2 Results

Table 37: Mosquito identification results at NOGP.

Sample ID	Scientific Name	Count
NOGP.July2013.SC.1	*Aedes dorsalis*	153
NOGP.July2013.SC.1	*Aedes flavescens*	20
NOGP.July2013.SC.1	*Aedes nigromaculis*	2
NOGP.July2013.SC.1	*Aedes vexans*	41
NOGP.July2013.SC.1	*Aedes* spp.	31
NOGP.July2013.SC.1	*Culex tarsalis*	154
NOGP.July2013.SC.1	*Culex* spp.	2
NOGP.July2013.SC.1	*Culiseta inornata*	21
NOGP.July2013.SC.1	Culicidae spp.	71

6.7 Ticks

6.7.1 Site-Specific Methods

Tick drags were conducted at NOGP in July 2013 to test protocol methods and calculate capture rates. No pathogen testing was performed and all ticks were pooled before identification. For more information on this protocol and data product numbers see Appendix A.

6.7.2 Results

Table 38: Tick identification results at NOGP.

Sample ID	Scientific Name	Number of Adult Males	Number of Adult Females
NOGP.000.20130712.SC.1	*Dermacentor variabilis*	4	2

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]). See the WOOD species reference list section for statewide resources.

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.

Natural Resource Management Research. 2016. United States Department of Agriculture: Agricultural Research Service. https://www.ars.usda.gov/plains-area/mandan-nd/ngprl/.

Sanderson, M.A., M.A. Liebig, J.R. Hendrickson, S.L. Kronberg, D. Toledo, J.D. Derner, and J.L. Reeves. 2015. Long-term agroecosytem research on northern Great Plains mixed-grass prairie near Mandan, North Dakota. Can. J. Plant Sci.95: 1101-1116.

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.

Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354

National Resource Management Research. 2016. United States Department of Agriculture: Agricultural Research Service. https://www.ars.usda.gov/plains-area/mandan-nd/ngprl

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 39: 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

Name	Description	Identification Code
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
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

Name	Description	Identification Code
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