TOS SITE CHARACTERIZATION REPORT: DOMAIN 18

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See configuration management system for approval history.

The National Ecological Observatory Network is a project solely funded by the National Science Foundation and managed under cooperative agreement by Battelle. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

CHANGE RECORD

REVISION	DATE	ECO#	DESCRIPTION OF CHANGE
A	03/05/2018	ECO-05392	Initial Release
B	11/20/2018	ECO-05657	• Added percent cover of bryophyte to the plant diversity table • Added range of core depths to BARR Below-ground Biomass Tables

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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 two sites in the Tundra 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.011050	TIS Site Characterization Report
RD[05]	NEON.DOC.001671	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 18 OVERVIEW: TUNDRA DOMAIN

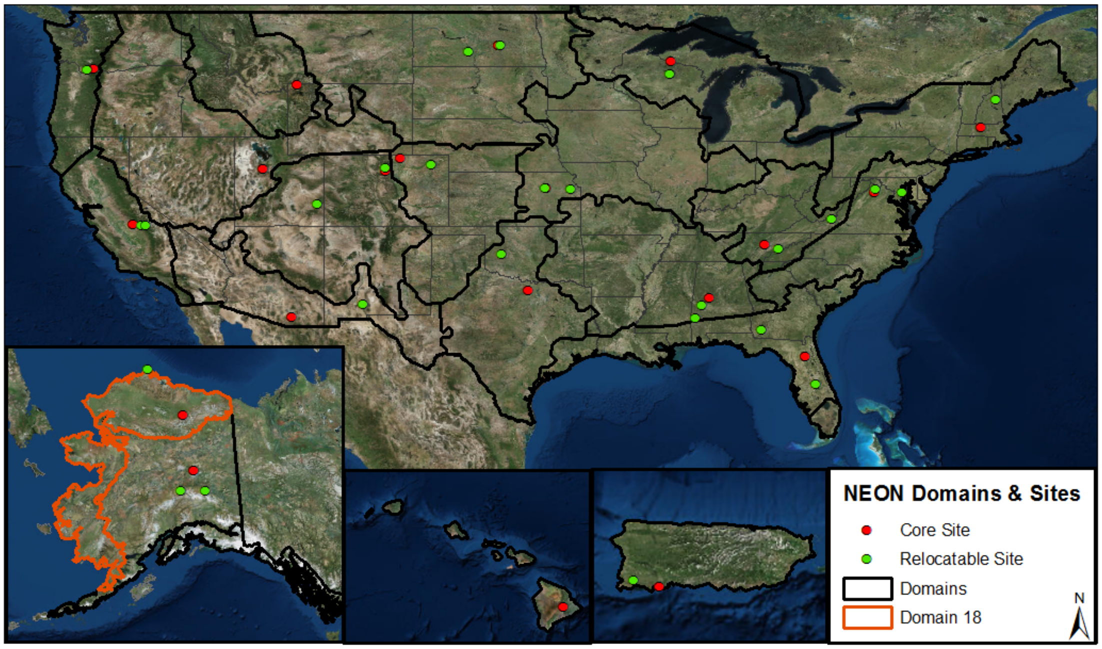

Figure 1: NEON project map with Domain 18 highlighted in red.

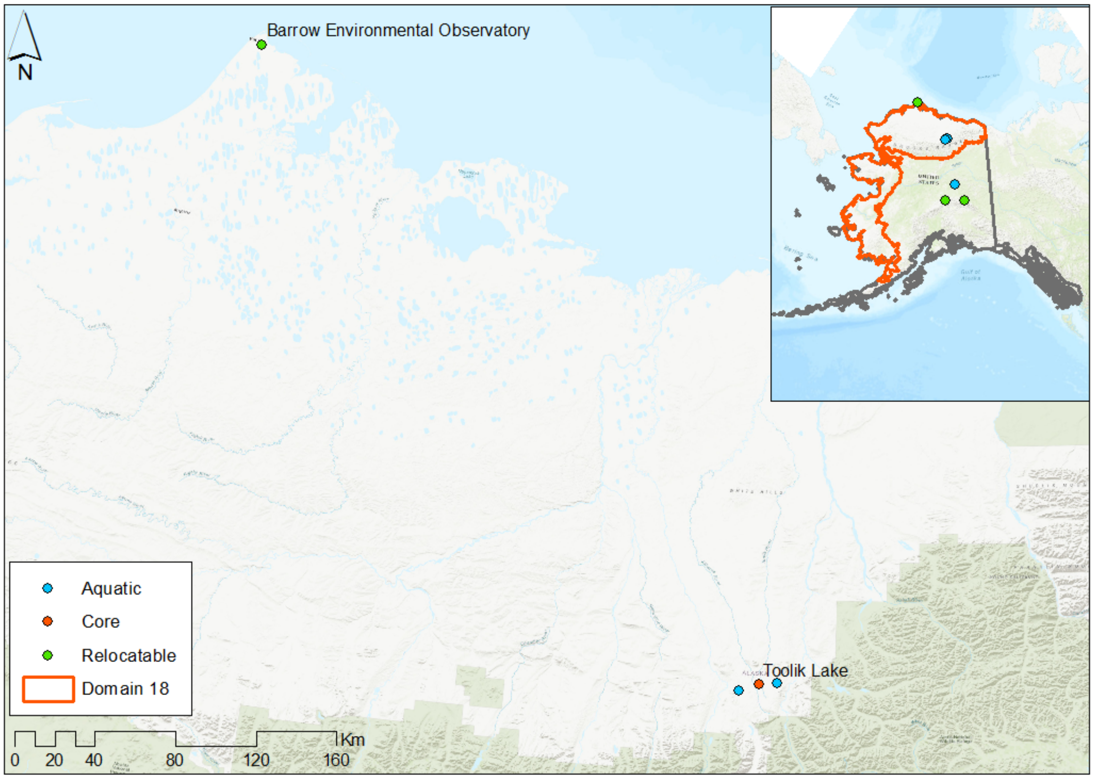

Figure 2: Site boundaries within Domain 18.

The arctic climate is changing and is expected to experience shifts in precipitation patterns and unprecedented increases in temperature (Serreze et al. 2000, New et al. 2001, Comiso 2003, ACIA 2005). The two D18 sites are located in the Alaskan tundra and represent a variety of physical and vegetative permafrost types. In addition, all TOS sampling boundaries overlap other research networks allowing opportunities for larger datasets and longer time series.

- States included in the domain: Alaska
- Core site: Toolik
- Relocatable 1: Barrow Environmental Observatory
- Science themes: Climate Impacts

4 CORE SITE- TOOLIK (TOOL)

TOOL is underlain by continuous permafrost, which exerts a major influence on hydrology and the distribution, structure, and function of terrestrial and aquatic ecosystems. Situated between the Brooks Range and the coastal plain, the vegetation and soils at TOOL are representative of much of the Alaskan foothills tundra (Site Description,2017).

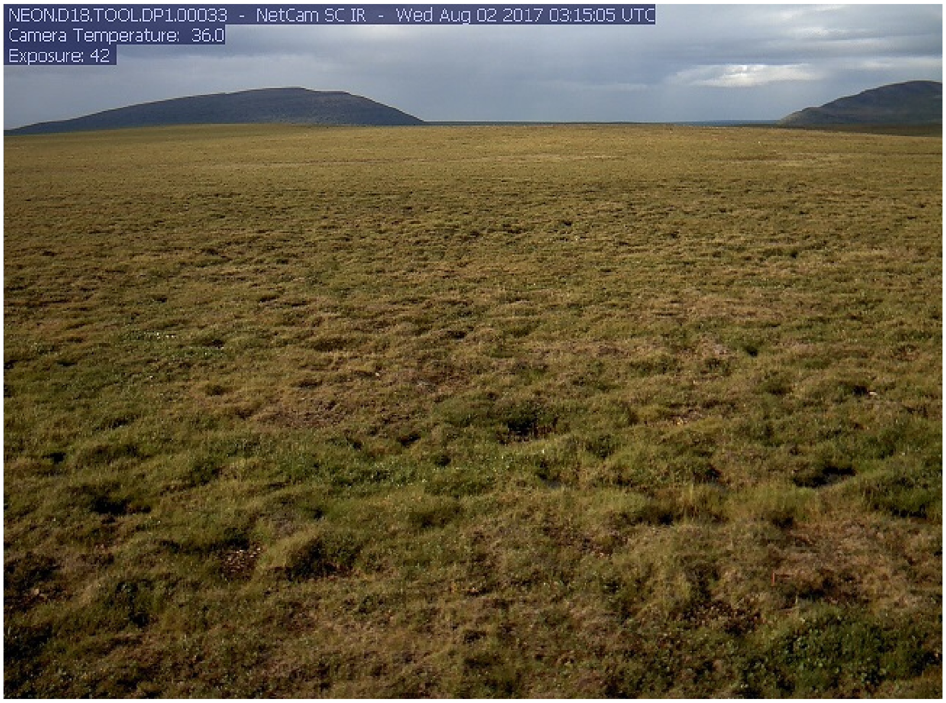

Figure 3: Phenocamera image for TOOL. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: Bureau of Land Management
- Located in: North Slope Borough, Alaska
- Sampling Area: 60 km^2
- Plot Elevation: 700-985m
- Dominant vegetation type: TOOL is dominated by tussock tundra, a vegetation type that covers some 80% of arctic Alaska. Bigelow Sedge (*Carex bigelowii*) and tussock cottongrass (*Eriophorum vaginatum*) are especially abundant. Low shrubs, including dwarf birch (*Betula nana*) and diamond-leaf willow (*Salix pulchra*), grow between the tussocks and along the streams (Site Description, 2017).
- General management: The Toolik Field Station (TFS) is operated and managed by the Institute of Arctic Biology at the University of Alaska Fairbanks (UAF) with cooperative agreement support from the Division of Polar Programs, Directorate for Geosciences at the National Science Foundation (NSF)(About Toolik,2017).
- NEON aquatic sites Oksrukuyik Creek and Toolik Lake are located near the TOS 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 TOOL according to a spatially balanced and stratified-random design (RD[3]). The 2001 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.

Due to logistical restrictions, plots that are sampled multiple times a year are constrained to an area 200m or less from roads or existing infrastructure while less frequently visited plots were allocated up to 1 km away. In order to decrease damage to the tundra ecosystem, boardwalks were placed in sensitive areas. The distinct parcels seen in Figure 4 are clustered around side roads or pull offs to avoid parking along the Dalton Highway. In order to determine if the logistical boundaries affected the sample design, NEON's plot proportions were compared to Upper Kuparuk River Region Vegetation and Upper Kuparuk River Region Glacial Geology maps (TAGA Maps, 2017) that were clipped to the TOOL permitted boundary. In both cases the proportional areas are adequately represented with the constraints in place (data not shown).

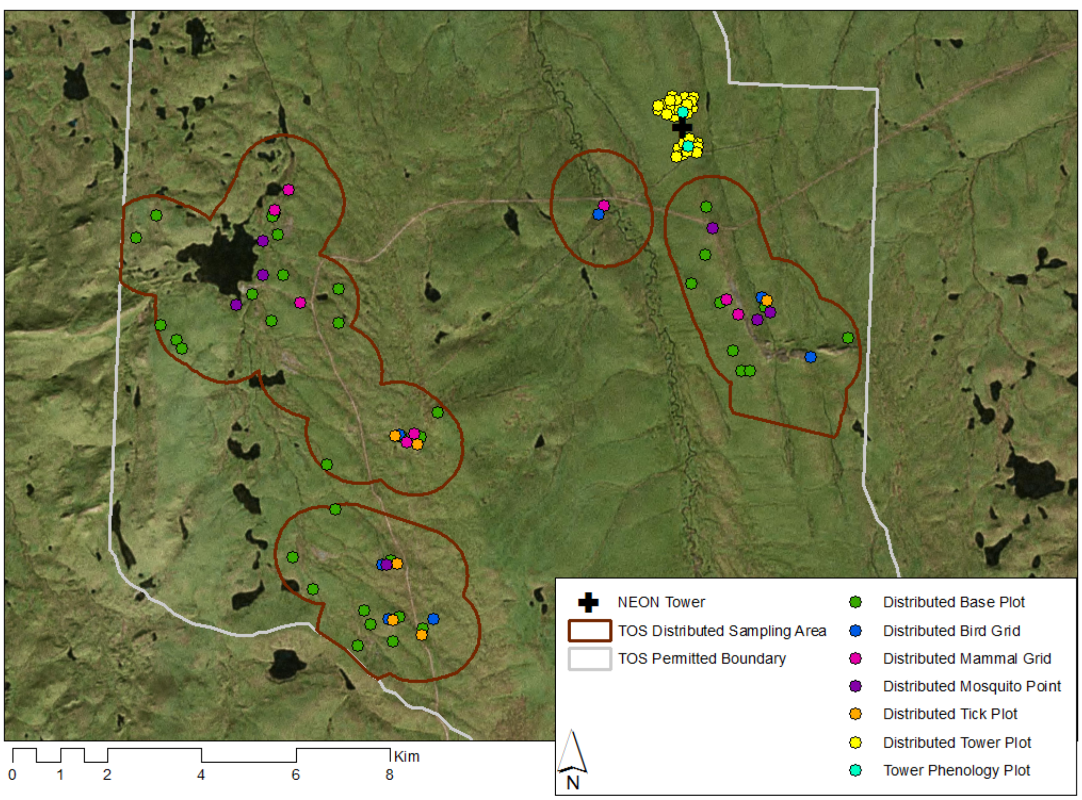

Figure 4: Map of TOS plot centroids within the NEON TOS sampling boundary at TOOL.

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

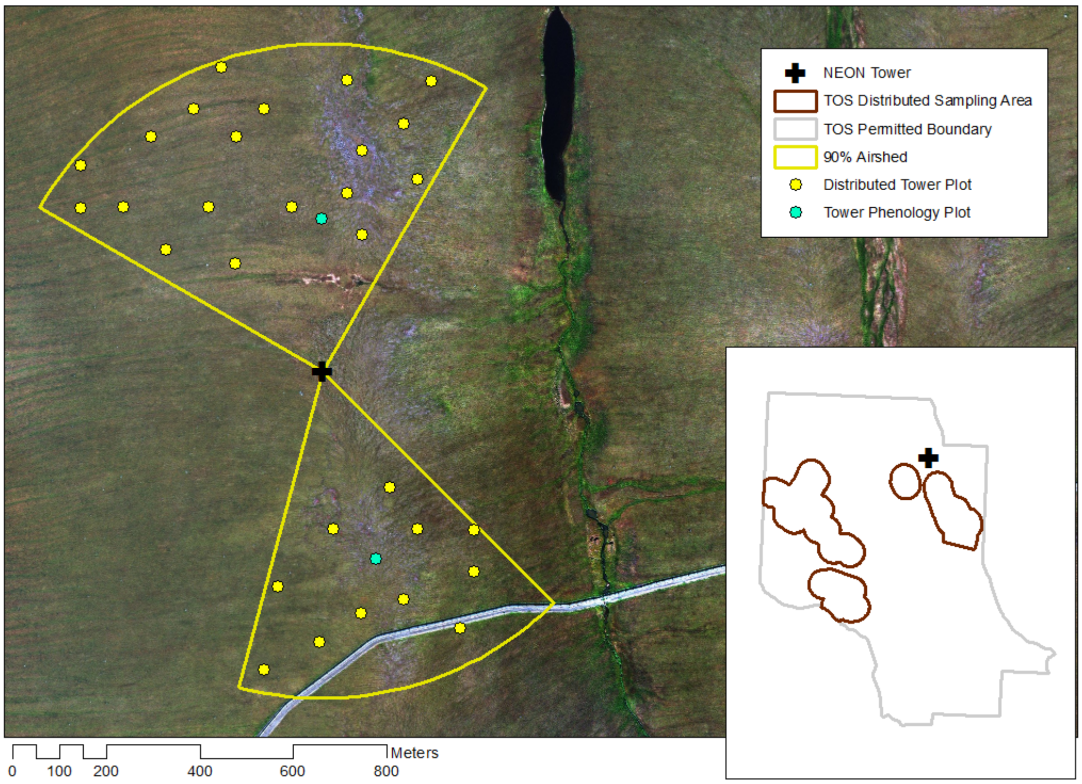

Figure 5: Map of the tower airshed and TOS plot centroids at TOOL.

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 TOOL.

NLCD Class	Site Area (km^2)	Percent (%)
Dwarf Scrub	42.53	77.09
Sedge Herbaceous	4.56	8.26
Shrub Scrub	4.26	7.71
Open Water	2.08	3.76
Developed Low Intensity	0.89	1.61
Barren Land	0.76	1.39
Emergent Herbaceous Wetlands	0.1	0.18

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 TOOL.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Dwarf Scrub	22
Distributed	Base Plot	Sedge Herbaceous	7
Distributed	Base Plot	Shrub Scrub	7
Distributed	Mammal Grid	Dwarf Scrub	5
Distributed	Mammal Grid	Sedge Herbaceous	2
Distributed	Mammal Grid	Shrub Scrub	1
Distributed	Mosquito Point	Dwarf Scrub	6
Distributed	Mosquito Point	Sedge Herbaceous	2
Distributed	Mosquito Point	Shrub Scrub	2
Distributed	Tick Plot	Dwarf Scrub	4
Distributed	Tick Plot	Sedge Herbaceous	1
Distributed	Tick Plot	Shrub Scrub	1
Tower	Base Plot	NA	30
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 type within the airshed is sedge herbaceous.

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

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Dwarf Scrub	Beetles	6
Distributed	Base Plot	Sedge Herbaceous	Beetles	2
Distributed	Base Plot	Shrub Scrub	Beetles	2
Distributed	Base Plot	Dwarf Scrub	Birds	16
Distributed	Base Plot	Sedge Herbaceous	Birds	2
Distributed	Base Plot	Shrub Scrub	Birds	2
Distributed	Base Plot	Dwarf Scrub	Canopy Foliage Chemistry	13
Distributed	Base Plot	Sedge Herbaceous	Canopy Foliage Chemistry	2
Distributed	Base Plot	Shrub Scrub	Canopy Foliage Chemistry	1
Distributed	Base Plot	Dwarf Scrub	Coarse Downed Wood	16
Distributed	Base Plot	Sedge Herbaceous	Coarse Downed Wood	2

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Shrub Scrub	Coarse Downed Wood	2
Distributed	Base Plot	Dwarf Scrub	Digital Hemispherical Photos for Leaf Area Index	16
Distributed	Base Plot	Sedge Herbaceous	Digital Hemispherical Photos for Leaf Area Index	2
Distributed	Base Plot	Shrub Scrub	Digital Hemispherical Photos for Leaf Area Index	2
Distributed	Base Plot	Dwarf Scrub	Herbaceous Biomass	16
Distributed	Base Plot	Sedge Herbaceous	Herbaceous Biomass	2
Distributed	Base Plot	Shrub Scrub	Herbaceous Biomass	2
Distributed	Base Plot	Dwarf Scrub	Plant Diversity	18
Distributed	Base Plot	Sedge Herbaceous	Plant Diversity	6
Distributed	Base Plot	Shrub Scrub	Plant Diversity	6
Distributed	Base Plot	Dwarf Scrub	Soil Biogeochemistry	4
Distributed	Base Plot	Sedge Herbaceous	Soil Biogeochemistry	1
Distributed	Base Plot	Shrub Scrub	Soil Biogeochemistry	1
Distributed	Base Plot	Dwarf Scrub	Soil Microbes	4
Distributed	Base Plot	Sedge Herbaceous	Soil Microbes	1
Distributed	Base Plot	Shrub Scrub	Soil Microbes	1
Distributed	Base Plot	Dwarf Scrub	Vegetation Structure	16
Distributed	Base Plot	Sedge Herbaceous	Vegetation Structure	2
Distributed	Base Plot	Shrub Scrub	Vegetation Structure	2

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 TOOL.

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	Mat-Forming Bryophyte Production	30
Tower	Base Plot	Plant Belowground Biomass	30

Plot Type	Plot Subtype	Protocols	Number of Plots
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: TOOL

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.

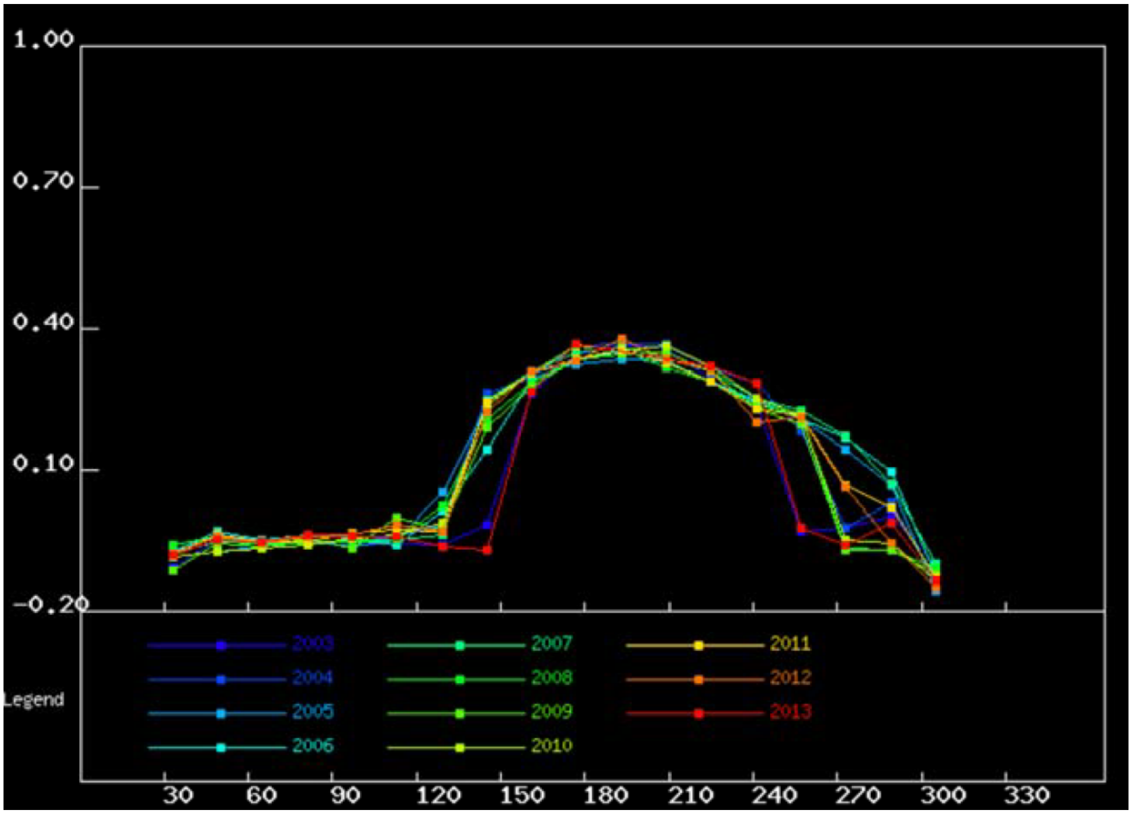

Figure 6: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON TOOL site.

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

Average Increase	Average Maximum	Average Decrease	Average Minimum
160 (06/10)	185 (07/05)	205 (07/25)	240 (08/29)

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: 40.25 km x 40.25 km box, centroid 68.661254, Longitude: -149.37023 (WGS84 datum)

4.3 Belowground Biomass

4.3.1 Site-Specific Methods

In order to decrease disturbance to the tundra, soil cores were collected during the winter when frozen conditions allowed equipment to be transported in D18. Due to rocky conditions no soil cores were collected at TOOL.

4.4 Plant Characterization and Phenology Species Selection

4.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during July of 2015. Plant characterization data inform 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 6: Site plant characterization and phenology species summary at TOOL.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
ERVA4	*Eriophorum vaginatum* L.	1	14	NA	NA
CAREX	*Carex* sp.	2	13	NA	NA
VAVI	*Vaccinium vitis-idaea* L.	3	8	NA	NA
BEGL/BENA	*Betula glandulosa* or *nana*	4	7	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)
BETUL	*Betula* sp.	4	7	NA	NA
ANPO	*Andromeda polifolia* L.	5	6	NA	NA
SAPU15	*Salix pulchra* Cham.	6	4	NA	NA
RUCH	*Rubus chamaemorus* L.	7	4	NA	NA
CATE11	*Cassiope tetragona* (L.) D. Don	8	3	NA	NA
VAUL	*Vaccinium uliginosum* L.	9	3	NA	NA
PEFR5	*Petasites frigidus* (L.) Fr.	10	2	NA	NA
SARE2	*Salix reticulata* L.	11	1	NA	NA
EMNI	*Empetrum nigrum* L.	12	1	NA	NA
POBI5	*Polygonum bistorta* L.	13	1	NA	NA
PELA	*Pedicularis labradorica* Wirsing	14	<1	NA	NA
LEPAD	*Ledum palustre* L. ssp. *decumbens* (Aiton) Hultén	15	<1	NA	NA
SAFU	*Salix fuscescens* Andersson	16	<1	NA	NA
CAST36	*Calamagrostis stricta* (Timm) Koeler	17	<1	NA	NA
ARRU	*Arctostaphylos rubra* (Rehder & Wilson) Fernald	18	<1	NA	NA
SAAR27	*Salix arctica Pall.* Salix arctica Pall.	18	<1	NA	NA
PELA14	*Pedicularis lanata* Cham. & Schltdl.	20	<1	NA	NA
DILA	*Diapensia lapponica* L.	21	<1	NA	NA
PYGR	*Pyrola grandiflora* Radius	22	<1	NA	NA
DRIN4	*Dryas integrifolia* Vahl	23	<1	NA	NA
POVI3	*Polygonum viviparum* L.	24	<1	NA	NA
LAMI6	*Lagotis minor* (Willd.) Standl.	25	<1	NA	NA
EQAR	*Equisetum arvense* L.	26	<1	NA	NA
ARAN2	*Arnica frigida C.A.* Mey. ex Iljin	27	<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)
ARLA2	*Arctagrostis latifolia* (R. Br.) Griseb.	27	<1	NA	NA
PECA2	*Pedicularis capitata* M.F. Adams	27	<1	NA	NA
CABE	*Cardamine bellidifolia* L.	30	<1	NA	NA
ARLE2	*Arnica lessingii* Greene	31	<1	NA	NA
SANE3	*Saxifraga nelsoniana* D. Don	31	<1	NA	NA
EQSC	*Equisetum scirpoides* Michx.	33	<1	NA	NA
SAAN3	*Saussurea angustifolia* (Willd.) DC.	33	<1	NA	NA
SARO2	*Salix rotundifolia* Trautv.	33	<1	NA	NA
POAR2	*Poa arctica* R. Br.	36	<1	NA	NA
ANPA	*Anemone parviflora* Michx.	37	<1	NA	NA
ARAL2	*Arctostaphylos alpina (L.)* Spreng.	38	<1	NA	NA
PYAS	*Pyrola asarifolia* Michx.	38	<1	NA	NA
FESTU	*Festuca L.* Festuca L.	40	<1	NA	NA
PELA4	*Pedicularis lapponica* L.	40	<1	NA	NA
CAMIB	*Cardamine microphylla* M.F. Adams ssp. *blaisdellii* (Eastw.) D.F. Murray & S. Kelso	43	<1	NA	NA
PEDIC	*Pedicularis* sp.	43	<1	NA	NA
POA	*Poa* sp.	43	<1	NA	NA
STLO2	*Stellaria longipes* Goldie	43	<1	NA	NA
TOPU	*Tofieldia pusilla* (Michx.) Pers.	43	<1	NA	NA

Note:Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov). SARO2 (*Salix rotundifolia*) likely includes SAPH (*S. phlebophylla*) since the two species frequently hybridize and are difficult to distinguish.

Table 7: Per plot breakdown of species richness, diversity, and herbaceous cover at TOOL.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
TOOL_041	25	2.69	97	20.62
TOOL_042	12	2.06	74	57.5
TOOL_043	11	2.08	94	63.75
TOOL_044	21	2.44	76	63.12
TOOL_045	19	2.62	82	41.25
TOOL_046	28	2.6	100	63.12
TOOL_047	23	2.26	66	61.25
TOOL_048	15	2.05	100	56.88
TOOL_049	14	2.1	89	56.88
TOOL_050	17	2.19	72	58.75
TOOL_051	14	2.12	68	55
TOOL_052	22	2.45	85	60
TOOL_053	15	2.14	102	65
TOOL_054	20	2.41	94	71.88
TOOL_055	24	2.4	93	62.5
TOOL_056	10	1.46	78	39.38
TOOL_057	15	1.78	75	46.25
TOOL_058	12	2.04	71	43.25
TOOL_059	12	2.08	78	76.25
TOOL_060	13	2.11	95	66.25
TOOL_061	15	2.11	100	44.67
TOOL_062	12	1.84	87	62.5
TOOL_063	24	2.41	86	61
TOOL_064	14	2.01	92	46.88
TOOL_065	24	2.41	122	55.62
TOOL_066	21	2.62	128	30.29
TOOL_067	26	2.78	118	53.86
TOOL_068	21	2.57	88	57.5
TOOL_069	18	2.02	75	23.62
TOOL_070	15	2.23	89	73.12
Bryophyte Mean				54.6

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot. According to AD[07], sites qualify for bryophyte productivity sampling when average bryophyte cover is $\geq$ 20% across all Tower plots. 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 of 2014 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. For DNA sequence data generated as a result of these efforts, visit the Barcode of Life Datasystems (BOLD) at http://www.boldsystems.org. All samples were pooled before identification. For more information on this protocol and data product numbers see Appendix A.

4.5.2 Results

Table 8: Beetle identification results at TOOL.

Sample ID	Scientific Name	Sex
NEONcarabid8796	*Agonum quinquepunctatum*	F
NEONcarabid8797	*Agonum quinquepunctatum*	F
NEONcarabid8801	*Agonum quinquepunctatum*	F
NEONcarabid8799	*Agonum quinquepunctatum*	F
NEONcarabid8798	*Agonum quinquepunctatum*	F
NEONcarabid8802	*Agonum quinquepunctatum*	M
NEONcarabid8800	*Agonum quinquepunctatum*	M
NEONcarabid8757	*Agonum quinquepunctatum*	F
NEONcarabid8720	*Amara alpina*	F
NEONcarabid8710	*Amara alpina*	F
NEONcarabid8718	*Amara alpina*	F
NEONcarabid8724	*Amara alpina*	F
NEONcarabid8716	*Amara alpina*	F
NEONcarabid8713	*Amara alpina*	F
NEONcarabid8712	*Amara alpina*	F
NEONcarabid8717	*Amara alpina*	F
NEONcarabid8719	*Amara alpina*	F
NEONcarabid8723	*Amara alpina*	F

Sample ID	Scientific Name	Sex
NEONcarabid8722	*Amara alpina*	F
NEONcarabid8721	*Amara alpina*	F
NEONcarabid8685	*Carabus chamissonis*	M
NEONcarabid8686	*Carabus chamissonis*	M
NEONcarabid8684	*Carabus chamissonis*	F
NEONcarabid8681	*Carabus chamissonis*	F
NEONcarabid8682	*Carabus chamissonis*	F
NEONcarabid8683	*Carabus chamissonis*	F
NEONcarabid8626	*Carabus truncaticollis*	F
NEONcarabid8669	*Carabus truncaticollis*	F
NEONcarabid8594	*Carabus truncaticollis*	F
NEONcarabid8664	*Carabus truncaticollis*	F
NEONcarabid8624	*Carabus truncaticollis*	F
NEONcarabid8652	*Carabus truncaticollis*	M
NEONcarabid8675	*Carabus truncaticollis*	M
NEONcarabid8602	*Carabus truncaticollis*	F
NEONcarabid8604	*Carabus truncaticollis*	F
NEONcarabid8632	*Carabus truncaticollis*	F
NEONcarabid8622	*Carabus truncaticollis*	F
NEONcarabid8600	*Carabus truncaticollis*	F
NEONcarabid8588	*Carabus truncaticollis*	M
NEONcarabid8596	*Carabus truncaticollis*	F
NEONcarabid8666	*Carabus truncaticollis*	F
NEONcarabid8592	*Carabus truncaticollis*	F
NEONcarabid8654	*Carabus truncaticollis*	M
NEONcarabid8614	*Carabus truncaticollis*	F
NEONcarabid8610	*Carabus truncaticollis*	M
NEONcarabid8644	*Carabus truncaticollis*	F
NEONcarabid8646	*Carabus truncaticollis*	F
NEONcarabid8616	*Carabus truncaticollis*	M
NEONcarabid8598	*Carabus truncaticollis*	M
NEONcarabid8671	*Carabus truncaticollis*	F
NEONcarabid8634	*Carabus truncaticollis*	F
NEONcarabid8677	*Carabus truncaticollis*	F

Sample ID	Scientific Name	Sex
NEONcarabid8618	*Carabus truncaticollis*	F
NEONcarabid8606	*Carabus truncaticollis*	M
NEONcarabid8623	*Carabus truncaticollis*	M
NEONcarabid8608	*Carabus truncaticollis*	F
NEONcarabid8630	*Carabus truncaticollis*	F
NEONcarabid8660	*Carabus truncaticollis*	F
NEONcarabid8668	*Carabus truncaticollis*	M
NEONcarabid8637	*Carabus truncaticollis*	F
NEONcarabid8639	*Carabus truncaticollis*	F
NEONcarabid8648	*Carabus truncaticollis*	F
NEONcarabid8658	*Carabus truncaticollis*	M
NEONcarabid8662	*Carabus truncaticollis*	M
NEONcarabid8620	*Carabus truncaticollis*	F
NEONcarabid8628	*Carabus truncaticollis*	M
NEONcarabid8636	*Carabus truncaticollis*	M
NEONcarabid8642	*Carabus truncaticollis*	F
NEONcarabid8595	*Carabus truncaticollis*	M
NEONcarabid8633	*Carabus truncaticollis*	F
NEONcarabid8656	*Carabus truncaticollis*	F
NEONcarabid8612	*Carabus truncaticollis*	M
NEONcarabid8673	*Carabus truncaticollis*	M
NEONcarabid8590	*Carabus truncaticollis*	M
NEONcarabid8650	*Carabus truncaticollis*	F
NEONcarabid8679	*Carabus truncaticollis*	M
NEONcarabid8760	*Diacheila polita*	M
NEONcarabid8690	*Pterostichus ventricosus*	F
NEONcarabid8734	*Pterostichus ventricosus*	F
NEONcarabid8753	*Pterostichus ventricosus*	F
NEONcarabid8751	*Pterostichus ventricosus*	F
NEONcarabid8687	*Pterostichus ventricosus*	F
NEONcarabid8693	*Pterostichus ventricosus*	F
NEONcarabid8707	*Pterostichus ventricosus*	F
NEONcarabid8764	*Pterostichus ventricosus*	M
NEONcarabid8777	*Pterostichus ventricosus*	M

Sample ID	Scientific Name	Sex
NEONcarabid8739	*Pterostichus ventricosus*	F
NEONcarabid8759	*Pterostichus ventricosus*	F
NEONcarabid8778	*Pterostichus ventricosus*	F
NEONcarabid8696	*Pterostichus ventricosus*	M
NEONcarabid8729	*Pterostichus ventricosus*	F
NEONcarabid8743	*Pterostichus ventricosus*	F
NEONcarabid8768	*Pterostichus ventricosus*	F
NEONcarabid8714	*Pterostichus ventricosus*	F
NEONcarabid8776	*Pterostichus ventricosus*	M
NEONcarabid8700	*Pterostichus ventricosus*	F
NEONcarabid8754	*Pterostichus ventricosus*	M
NEONcarabid8747	*Pterostichus ventricosus*	F
NEONcarabid8782	*Pterostichus ventricosus*	M
NEONcarabid8758	*Pterostichus ventricosus*	M
NEONcarabid8728	*Stereocerus haematopus*	M
NEONcarabid8803	*Stereocerus haematopus*	M
NEONcarabid8794	*Pterostichus* sp.	U
NEONcarabid8793	*Pterostichus* sp.	U
NEONcarabid8763	*Pterostichus* sp.	U
NEONcarabid8786	*Pterostichus* sp.	U
NEONcarabid8790	*Pterostichus* sp.	U
NEONcarabid8788	*Pterostichus* sp.	U

4.6 Mosquitoes

4.6.1 Site-Specific Methods

Mosquito site characterization was conducted in June of 2014 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. All samples were pooled before identification. For more information on this protocol and data product numbers see Appendix A.

4.6.2 Results

Table 9: Mosquito identification results at TOOL.

Sample ID	Scientific Name	Count
TOOL.27June2014.SC.1	*Aedes communis*	13
TOOL.27June2014.SC.1	*Aedes nigripes*	222
TOOL.27June2014.SC.1	*Aedes* spp.	61
TOOL.27June2014.SC.1	*Culiseta alaskaensis*	3
TOOL.27June2014.SC.2	*Aedes communis*	8
TOOL.27June2014.SC.2	*Aedes nigripes*	133
TOOL.27June2014.SC.2	*Aedes* spp.	159
TOOL.28June2014.SC.1	*Aedes nigripes*	331
TOOL.28June2014.SC.1	*Aedes* spp.	42
TOOL.28June2014.SC.2	*Aedes nigripes*	295
TOOL.28June2014.SC.2	*Aedes* spp.	205

4.7 Ticks

4.7.1 Site-Specific Methods

No tick drags were conducted at TOOL due to rainfall and wet sampling conditions. 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]).

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5 RELOCATABLE SITE 1- BARROW ENVIRONMENTAL OBSERVATORY (BARR)

Three hundred miles north of the Arctic Circle, the BARR landscape is representative of the polygon tundra and lake systems across the northern extent of the North Slope. The topography is flat, with a micro-topography relief of approximately 15 to 30 cm between polygons (Britton 1957, Billings and Peterson 1980, Jorgenson and Shur 2007).

Figure 7: Phenocamera image for BARR. 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: Barrow Environmental Observatory
- Located in: North Slope Borough, Alaska
- Sampling Area: 50 km^2
- Plot Elevation: 0-15m
- Dominant vegetation type: The BARR site is extremely flat, poorly drained, and almost entirely underlain by permafrost from a few centimeters to a few meters below the surface. Dominant plants include the tussock-forming cottongrass (*Eriophorum vaginatum*), tundra grass (*Dupontia fisheri*), and *Carex aquatilis* in the wet meadows.

- General management: The Barrow Environmental Observatory (BEO) has supported science for over 70 years including many long term research projects.
- 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 BARR according to a spatially balanced and stratified-random design (RD[3]). The 2001 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.

Due to logistical restrictions, plots that are sampled multiple times a year are constrained to an area 200m or less from roads or existing infrastructure while less frequently visited plots were allocated up to 1.5 km away. In order to decrease damage to the tundra ecosystem, boardwalks were placed in sensitive areas. Exclusion zones were made around areas of existing research, infastructure, and sensitive wildlife and plant populations. Plot locations were allocated with feedback from local scientists and field teams to ensure the layout did not miss important habitat types.

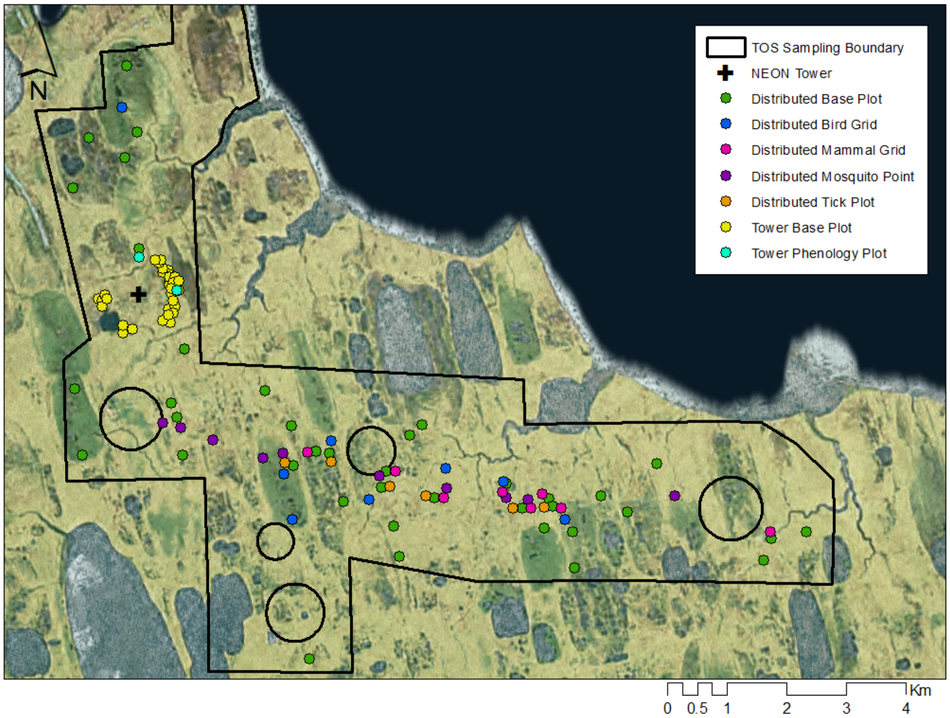

Figure 8: Map of TOS plot centroids within the NEON TOS sampling boundary at BARR.

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

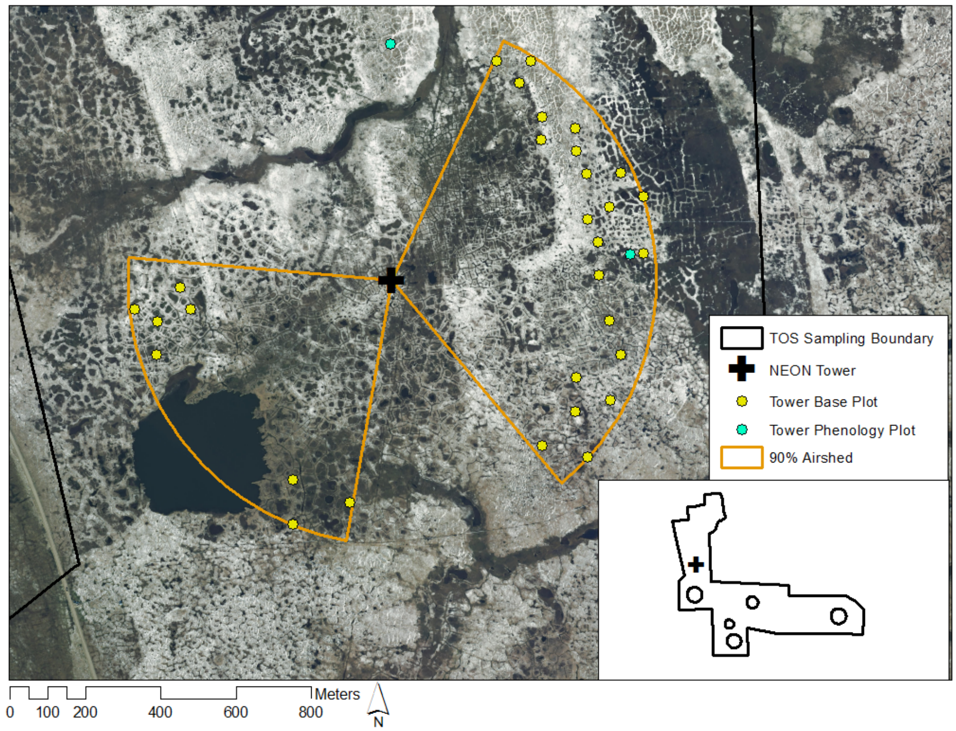

Figure 9: Map of the tower airshed and TOS plot centroids at BARR.

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

Table 10: NLCD land cover classes and area within the TOS site boundary at BARR.

NLCD Class	Site Area (km^2)	Percent (%)
Sedge Herbaceous	36.47	72.82
Emergent Herbaceous Wetlands	10.42	20.8
Open Water	1.92	3.84
Perennial Ice Snow	0.55	1.1
Barren Land	0.39	0.78
Developed Medium Intensity	0.17	0.34
Developed Low Intensity	0.14	0.28
Developed Open Space	0.01	0.03

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 11: NLCD land cover classes and TOS plot numbers at BARR.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Emergent Herbaceous Wetlands	10
Distributed	Base Plot	Sedge Herbaceous	29
Distributed	Bird Grid	Emergent Herbaceous Wetlands	2
Distributed	Bird Grid	Sedge Herbaceous	5
Distributed	Mammal Grid	Sedge Herbaceous	6
Distributed	Mosquito Point	Emergent Herbaceous Wetlands	2
Distributed	Mosquito Point	Sedge Herbaceous	8
Distributed	Tick Plot	Emergent Herbaceous Wetlands	1
Distributed	Tick Plot	Sedge Herbaceous	5
Tower	Base Plot	NA	30
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 include emergent herbaceous wetlands and sedge herbaceous.

Table 12: Number of Distributed Base plots per NLCD land cover class per protocol at BARR.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Sedge Herbaceous	Beetles	10
Distributed	Base Plot	Emergent Herbaceous Wetlands	Canopy Foliage Chemistry	4
Distributed	Base Plot	Sedge Herbaceous	Canopy Foliage Chemistry	12
Distributed	Base Plot	Emergent Herbaceous Wetlands	Coarse Downed Wood	4
Distributed	Base Plot	Sedge Herbaceous	Coarse Downed Wood	16
Distributed	Base Plot	Emergent Herbaceous Wetlands	Digital Hemispherical Photos for Leaf Area Index	4
Distributed	Base Plot	Sedge Herbaceous	Digital Hemispherical Photos for Leaf Area Index	16
Distributed	Base Plot	Emergent Herbaceous Wetlands	Herbaceous Biomass	4
Distributed	Base Plot	Sedge Herbaceous	Herbaceous Biomass	16
Distributed	Base Plot	Emergent Herbaceous Wetlands	Plant Diversity	10
Distributed	Base Plot	Sedge Herbaceous	Plant Diversity	20
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Biogeochemistry	1
Distributed	Base Plot	Sedge Herbaceous	Soil Biogeochemistry	5
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Microbes	1

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Sedge Herbaceous	Soil Microbes	5
Distributed	Base Plot	Emergent Herbaceous Wetlands	Vegetation Structure	4
Distributed	Base Plot	Sedge 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 13: Number of Tower Plots per protocol at BARR.

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	Mat-Forming Bryophyte Production	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: BARR

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.

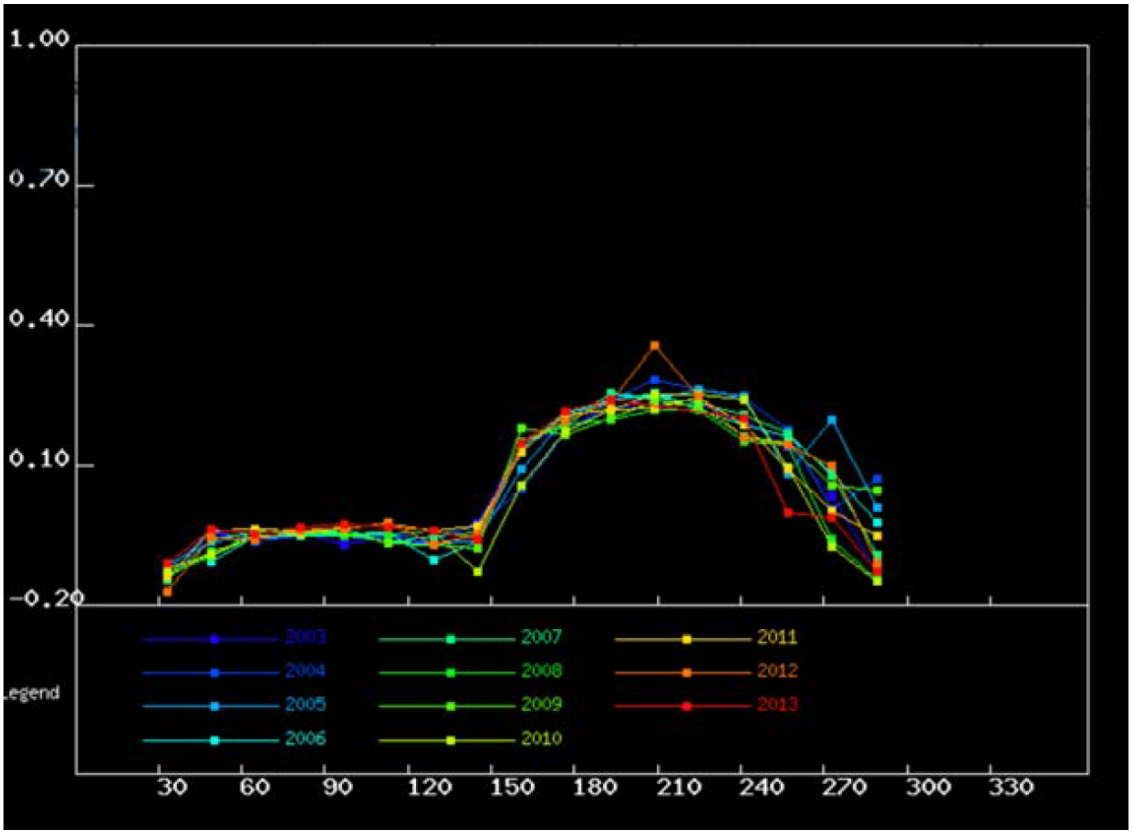

Figure 10: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON BARR site.

Table 14: Average MODIS-EVI greenness dates for the NEON BARR site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
175 (06/25)	195 (07/15)	210 (07/30)	220 (08/09)

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 71.281912, Longitude: -156.6192 (WGS84 datum)

5.3 Belowground Biomass

5.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 86 cm by NEON staff in May 2016. 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.

Belowground biomass sampling in the arctic tundra presented a unique set of challenges, and deviations from the standard sampling workflow are outlined below.

Field: In order to decrease disturbance to the tundra, soil cores were collected during the winter when frozen conditions allowed equipment to be transported. A coring machine was used to ensure that soil was not mixed while extracted. Three cores were taken to a maximum depth of 86cm. The cores were kept frozen until they could be processed. BARR cores were taken at Latitude 71.28171, Longitude -156.65022.

Processing Cores: Cores were split while frozen into 10cm depth increments using a handsaw and chisel. After the samples were thawed it was discovered that 0-10 depth layer also included above ground plant matter and litter. To maintain consistency with the other soil pits, the depth increments were shifted for the entire core so that “0” indicates where the soil started and not the upper limit of the soil core. For example, for BARR core 2-1 what was initially called the “0-10” layer was in fact 0-5cm above ground plant material and 5-10cm soil. Subsequent depth increments were shifted so 10-20 cm became 5-15cm, 20-30 cm became 15-25 cm, etc.

Due to the extremely high density of fine roots, core samples were divided length-wise into quarters for per depth increment, and a random subsample was selected for sieving and sorting. Because the majority of the samples were dense with fine roots and roots were relatively homogeneously distributed, we are confident that subsampling did not affect final root dry mass values.

Sieving: We had low confidence in out ability to distinguish live vs. dead roots isolated from arctic tundra soils. To maintain consistency with the standard sampling workflow, roots that could not be confidently parsed were assumed to be ‘live.’ Additionally, distinguishing roots from other plant material was challenging, due to the fact that some dominant tundra species (e.g., *Eriophorum vaginatum*) have thin, flat roots with no branching patterns, and thus have a root morphology that mimics small graminoid leaf litter. There are also moss skeleton structures that are difficult to distinguish from roots. To ensure consistent sorting given these challenges, a list of morphological criteria was developed, and this checklist was used for all samples.

5.3.2 Results

Table 15: Fine root mass per depth increment (cm) at BARR.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	3-6	26.67	16.91
3-6	13-16	13.43	8.2
13-16	23-26	7.44	5.78
23-26	33-36	8.37	9.5
33-36	43-46	2.54	3.56
43-46	53-56	4.61	5.79
53-56	63-66	4.72	3.62
63-66	73-76	3.21	1.34
73-76	83-86	1.87	1.62

Table 16: Cumulative fine root mass as a function of depth (cm) at BARR.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	3-6	1289.09	969.56
3-6	13-16	2632.23	1778.71
13-16	23-26	3375.99	1961.17
23-26	33-36	4213.38	2904.97
33-36	43-46	4467.77	2747.09
43-46	53-56	4928.82	2555.63
53-56	63-66	5401.05	2791.42
63-66	73-76	5721.61	2719.86
73-76	83-86	5908.18	2561.34

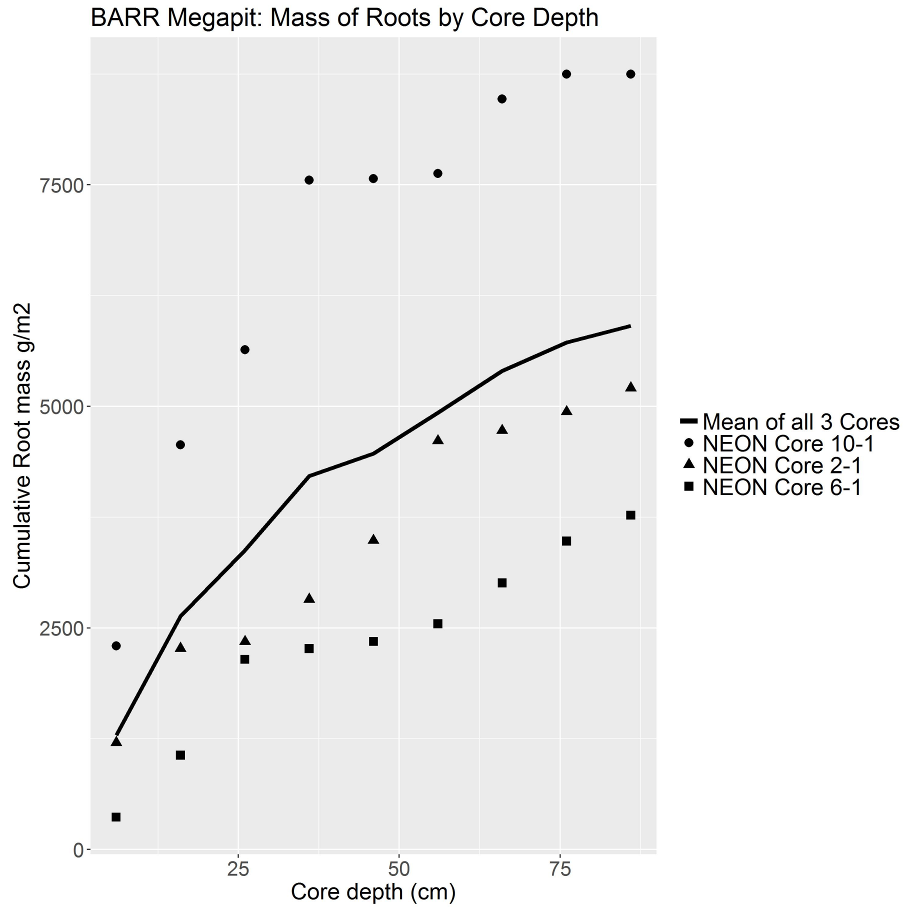

Figure 11: Cumulative root mass by core depth at BARR.

Table 17: Fine root biomass sampling summary data at BARR.

Total Mean Core Depth (cm)	86
Total Mean Cumulative Mass at 26cm (g per m^2)	3375.99
Total Mean Cumulative Mass at 100cm (g per m^2)	NA
Total Mean Cumulative Mass (g per m^2)	5908.18

5.4 Plant Characterization and Phenology Species Selection

5.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during June of 2015. Plant characterization data inform 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 18: Site plant characterization and phenology species summary at BARR.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
CAAQ	*Carex aquatilis* Wahlenb.	1	39	NA	NA
DUFI	*Dupontia fisheri* R. Br.	2	2	NA	NA
PEFR5	*Petasites frigidus* (L.) Fr.	3	2	NA	NA
ERVA4	*Eriophorum vaginatum* L.	4	2	NA	NA
LUAR9	*Luzula arctica* Blytt	5	2	NA	NA
SARO2	*Salix rotundifolia* Trautv.	6	<1	NA	NA
SAPU15	*Salix pulchra* Cham.	7	<1	NA	NA
ARFU2	*Arctophila fulva* (Trin.) Rupr. ex Andersson	8	<1	NA	NA
RAPA2	*Ranunculus pallasii* Schltdl.	9	<1	NA	NA
SAFO4	*Saxifraga foliolosa* R. Br.	10	<1	NA	NA
RANI	*Ranunculus nivalis* L.	11	<1	NA	NA
SACE2	*Saxifraga cernua* L.	12	<1	NA	NA
SAAR27	*Salix arctica* Pall.	13	<1	NA	NA
CATE11	*Cassiope tetragona* (L.) D. Don	14	<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)
PESU	*Pedicularis sudetica* Willd.	15	<1	NA	NA
SAHI5	*Saxifraga hieraciifolia* Waldst. & Kit. ex Willd.	15	<1	NA	NA
SANEN	*Saxifraga nelsoniana* D. Don ssp. *nelsoniana*	17	<1	NA	NA
SAFU	*Salix fuscescens* Andersson	18	<1	NA	NA
VACCI	*Vaccinium* sp.	19	<1	NA	NA
ERICAC	Ericaceae sp.	20	<1	NA	NA
STCR	*Stellaria crassifolia* Ehrh.	20	<1	NA	NA

Note: Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov). ERVA4 (*Eriophorum vaginatum*) likely includes other common *Eriophorum* species including ERRU2 (*E. russeolum*), ERSC2 (*E. scheuchzeri*), and ERANT (*E. angustifolium* ssp. *triste*) . LUAR9 (*Luzula arctica*) also likely includes LUCO5 (*L. confusa*) since the two species are difficult to distinguish. STCR (*Stellaria crassifolia*) likely includes misidentified STLOL7 (*Stellaria longipes* subsp *longipes*) and/or CEBE2 (*Cerastium beeringianum*).

Table 19: Per plot breakdown of species richness, diversity, and herbaceous cover at BARR.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
BARR_051	11	1.5	52	30.5
BARR_052	8	1.41	108	43.12
BARR_053	9	1.23	45	79.38
BARR_054	5	0.73	75	48.12
BARR_055	7	1.28	52	84.5
BARR_056	6	0.5	52	77.25
BARR_057	14	1.65	91	27.25
BARR_058	13	1.4	98	20.25
BARR_059	9	1.35	107	53.75
BARR_060	11	1.09	44	54.5
BARR_061	5	1.07	52	65
BARR_062	8	0.84	70	76
BARR_063	15	1.87	74	32.88
BARR_064	7	0.75	67	78.75

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
BARR_065	12	1.69	114	71
BARR_066	9	1.41	64	40
BARR_067	7	0.93	58	83.75
BARR_068	11	1.06	72	33.88
BARR_069	10	1.45	61	48.75
BARR_070	5	0.32	53	81.88
BARR_071	9	1.26	94	61.5
BARR_072	5	0.62	44	69.38
BARR_073	14	1.53	77	50.75
BARR_074	11	1.19	55	33.25
BARR_075	7	0.64	54	59
BARR_076	6	0.66	62	42.5
BARR_077	5	0.44	59	79.25
BARR_078	10	0.63	66	48.62
BARR_079	10	1.28	47	47.5
BARR_080	6	0.83	35	98.75
Bryophyte Mean				57.37

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

According to AD[07], sites qualify for bryophyte productivity sampling when average bryophyte cover is $\geq$ 20% across all Tower plots. However, bryophyte productivity sampling was discontinued in 2018 and NEON no longer implements this protocol.

5.5 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]).

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7 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 20: 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
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

Name	Description	Identification Code
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