TOS SITE CHARACTERIZATION REPORT: DOMAIN 10

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See configuration management system for approval history.

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CHANGE RECORD

REVISION	DATE	ECO#	DESCRIPTION OF CHANGE
A	04/19/2018	ECO-04085	Initial Release
B	04/19/2018	ECO-05560	• Added RMNP Section • Added Phenocam images • Added Sampling Season Section • Added soil pit information table • Added percent cover of bryophyte to the plant diversity table • Updated introduction language to the site information, biomass, and plant sections

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1 DESCRIPTION

1.1 Purpose

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

1.2 Scope

This document includes any site specific characterization methods and the results of characterization efforts for each of the three sites in the Central 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, Productivity, and Leaf Area Index
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.011025	TIS Site Characterization Report
RD[05]	NEON.DOC.002056	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 10 OVERVIEW: CENTRAL PLAINS DOMAIN

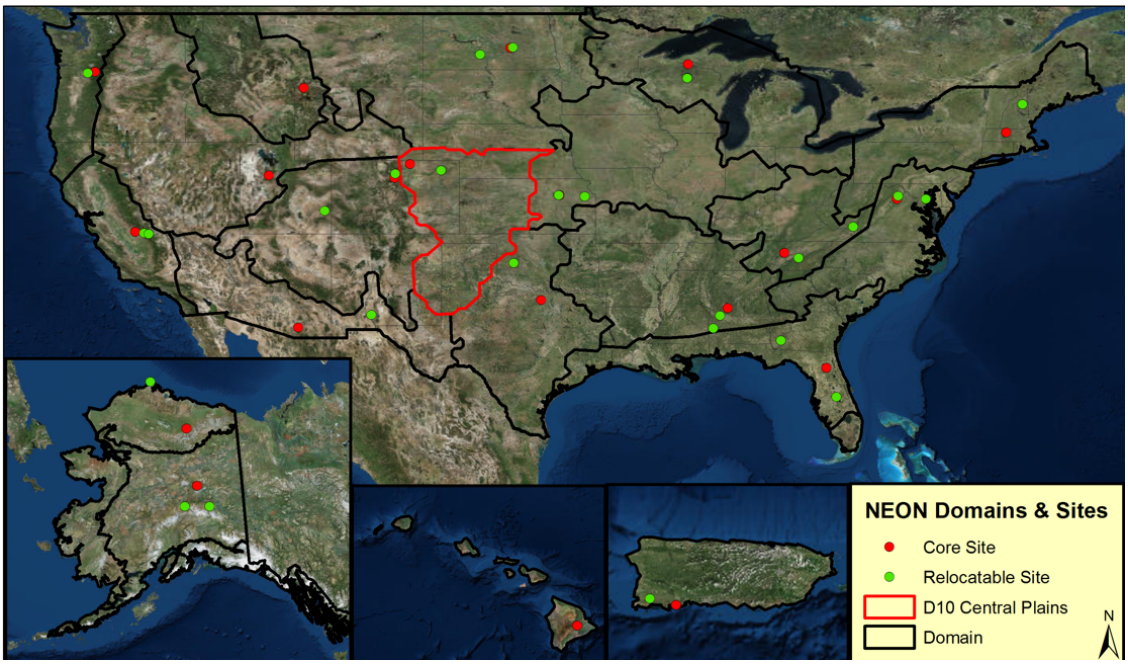

Figure 1: NEON project map with Domain 10 highlighted in red.

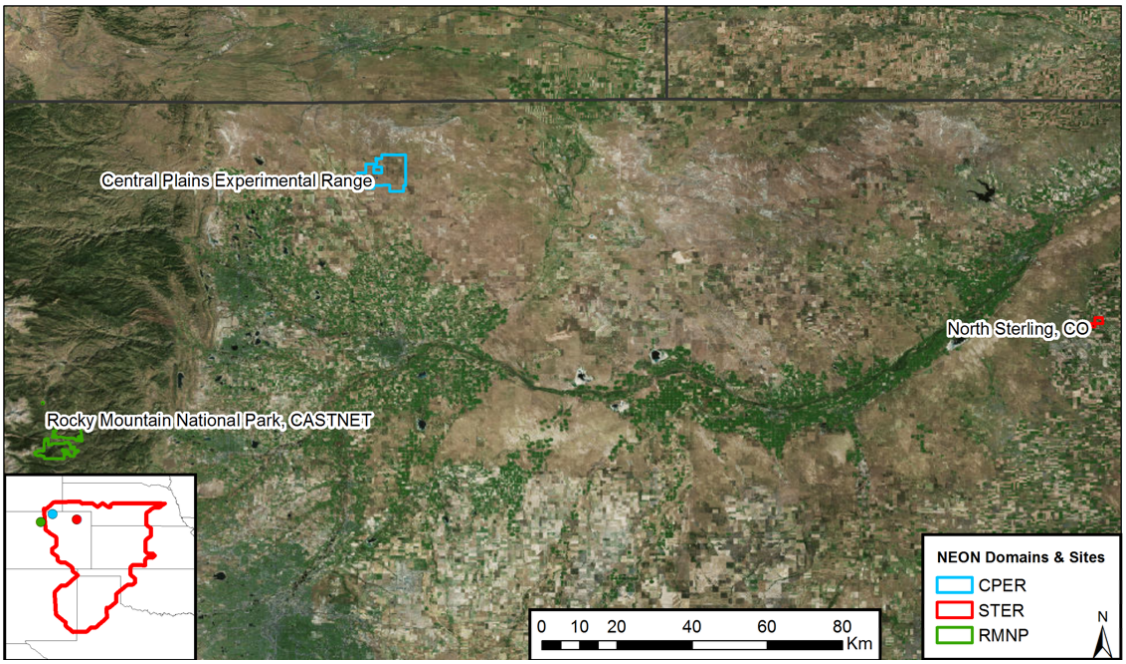

Figure 2: Site boundaries within Domain 10.

The Central Plains Domain is a patchwork of grassland, forest, agricultural, and mountain communities embedded in a matrix with an increasingly growing human population. Although not representative of the Central Plains, the RMNP site in the Rocky Mountain Foothills was selected to better understand transport of atmospheric N generated along the Front Range and dust deposition from across the west.

- States included in the domain: Colorado, Utah, Nevada, Arizona, New Mexico
- Core site: Central Plains Experimental Range
- Relocatable 1: North Sterling
- Relocatable 2: Rocky Mountain National Park, CASTNET
- Science themes: Agriculture, Climate Impacts

4 CORE SITE- CENTRAL PLAINS EXPERIMENTAL RANGE (CPER)

The Central Plains Experimental Range is located at the western edge of the Pawnee National Grasslands in Colorado, 120 kilometers north of Denver. Part of the shortgrass steppe prevalent in the area, CPER also hosts other research networks allowing opportunities for larger datasets and longer time series.

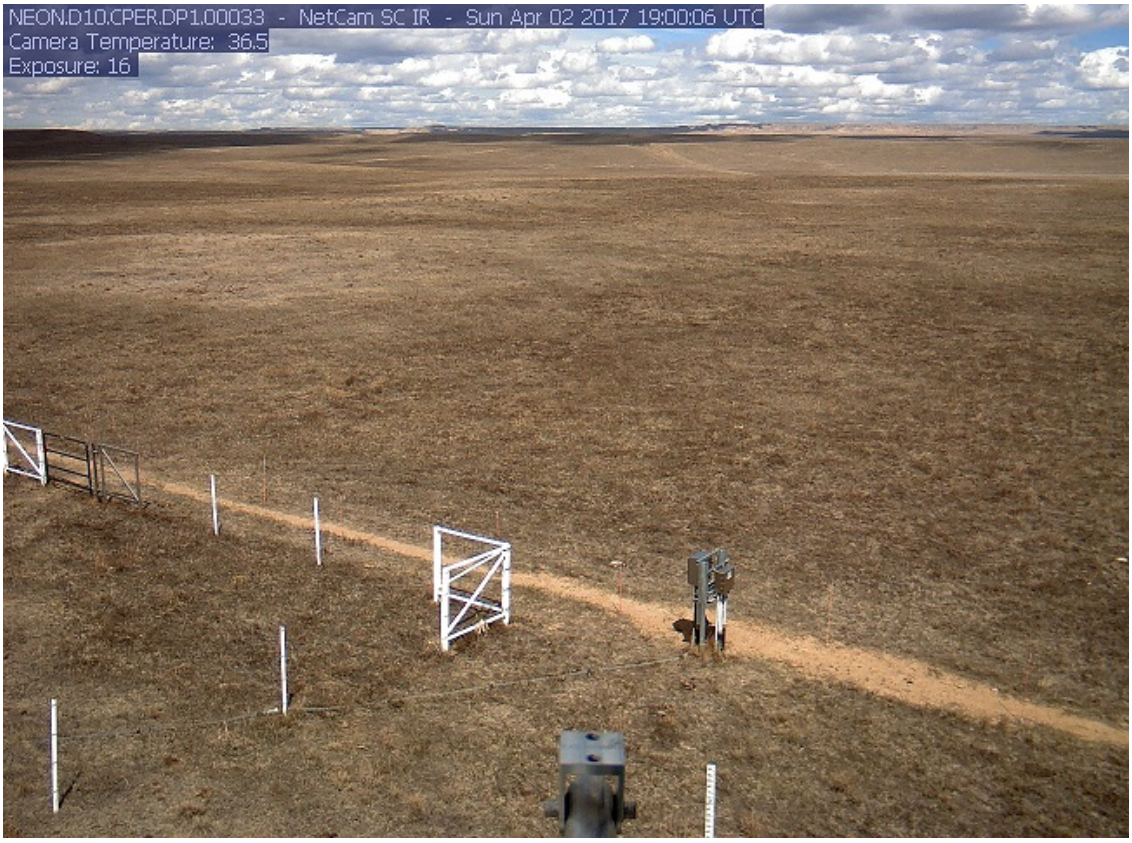

Figure 3: Phenocamera image for CPER. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: U.S. Department of Agriculture, Agriculture Research Service, LTER
- Located in: Weld County, Colorado
- Area: 65.4 km2
- Elevation: 1,500- 1,700m
- Dominant vegetation type: The dominant vegetation at CPER is moderately grazed Shortgrass steppe. Dominant plant species include Blue Grama (*Bouteloua gracilis*), Buffalograss (*Bouteloua dactyloides*), and Plains Prickly-pear cactus (*Opuntia polyacantha*).
- General management: CPER has a long history with research. Grazing and soil erosion studies started in the 1930s are still underway and CPER served as part of the of the Shortgrass Steppe LTER from 1982- 2014

(Central Plains Experimental Range, 2017). Cattle and burrowing animals such as the black-tailed prairie dog (*Cynomys ludovicianus*) play dominant roles in ecosystem function and maintenance.

- 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 CPER 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.

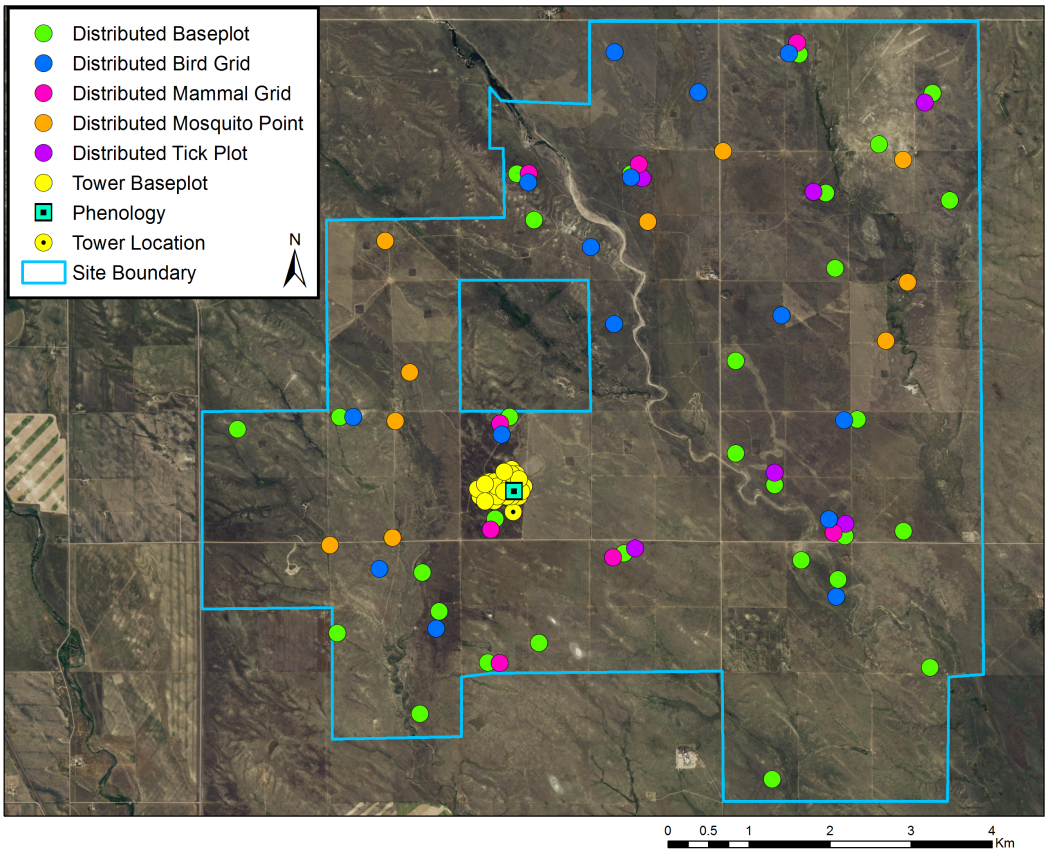

Figure 4: Map of TOS plot centroids within the NEON TOS sampling boundary at CPER.

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

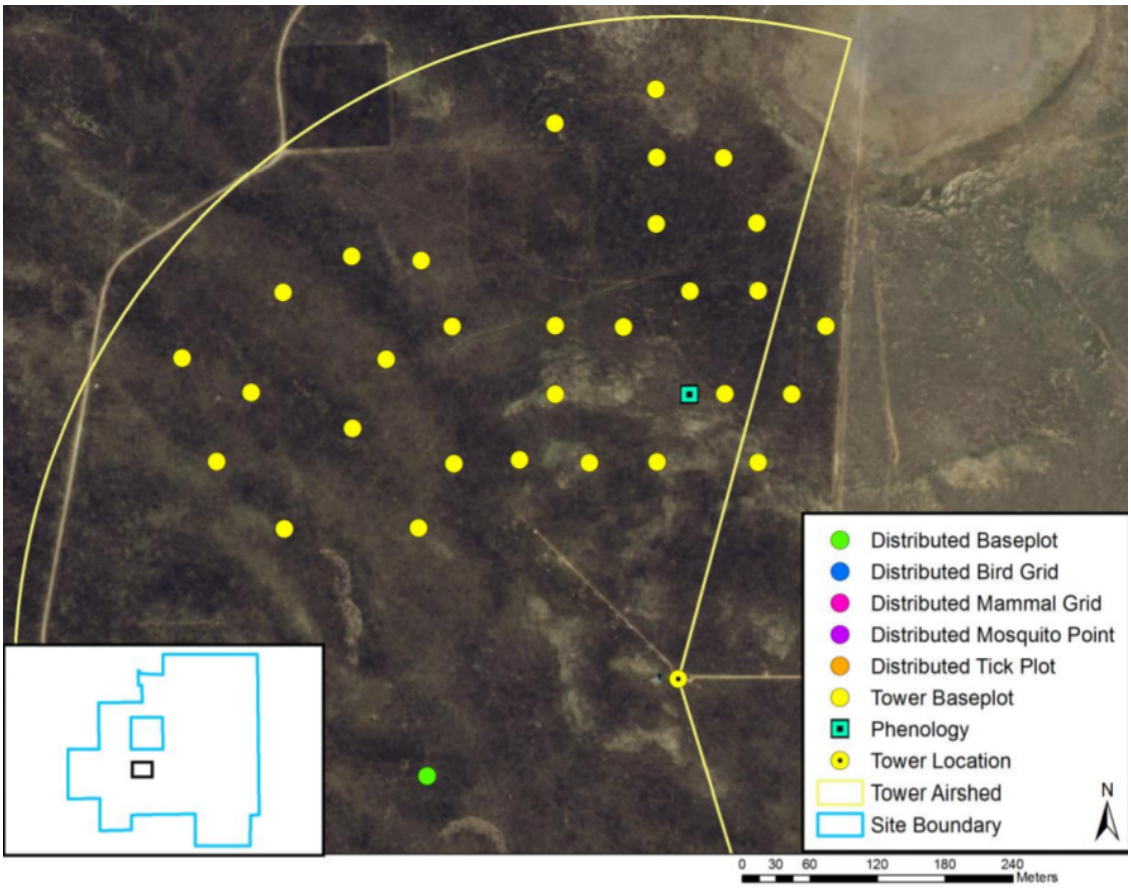

Figure 5: Map of the tower airshed and TOS plot centroids at CPER.

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 CPER.

NLCD Class	Site Area (km^2)	Percent (%)
Grassland Herbaceous	62.67	95.8
Developed Open Space	1.29	1.97
Cultivated Crops	1.24	1.89
Pasture Hay	0.18	0.27
Barren Land	0.02	0.03
Open Water	0.01	0.02
Woody Wetlands	0.01	0.01

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 CPER.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland Herbaceous	30
Distributed	Bird Grid	Grassland Herbaceous	10
Distributed	Mammal Grid	Grassland Herbaceous	8
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Grassland Herbaceous	6
Tower	Base Plot	NA	30
Tower	Phenology Plot	NA	1

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 CPER.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Beetles	10
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 4: Number of Tower Plots per protocol at CPER.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Below Ground Biomass Coring	30
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

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Herbaceous Biomass	30
Tower	Base Plot	Litterfall and Fine Woody Debris	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	1

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: CPER

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.

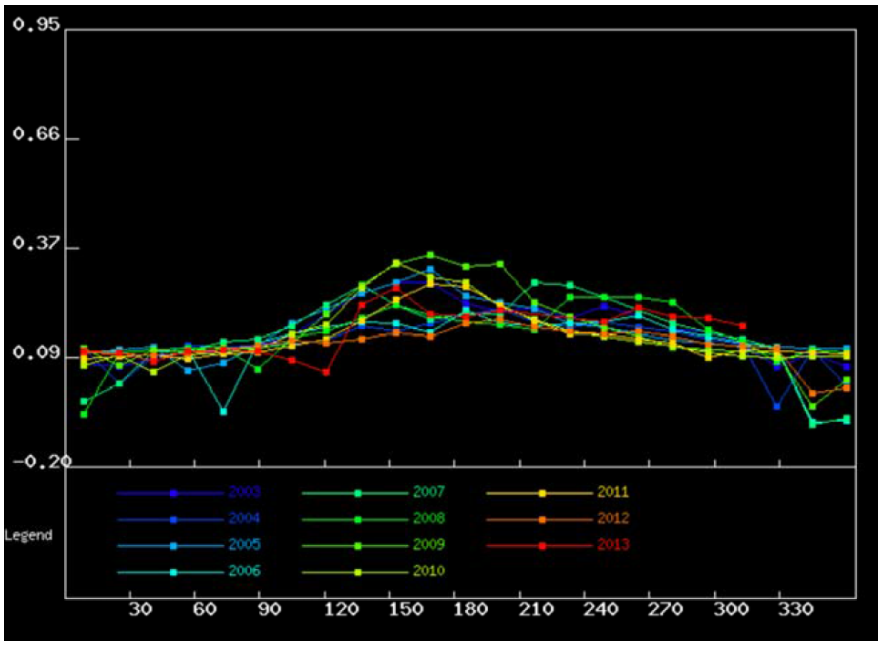

Figure 6: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON CPER site.

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

Average Increase	Average Maximum	Average Decrease	Average Minimum
90 (04/01)	165 (06/15)	210 (07/30)	350 (12/17)

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 lat: 40.81554, centroid long: -104.74543 (WGS84 datum)

4.3 Belowground Biomass

4.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 160 cm cm by NEON staff in August 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.

Note: Profile 1 at CPER did not have a sample at the 90-100cm depth. This was treated as a missing value rather than a 0 in all calculations.

4.3.2 Results

Table 6: Soil Pit Information at CPER.

Latitude	Longitude	Soil Family	Soil Order
40.81297	-104.74455	Fine-loamy - mixed - superactive - mesic Aridic Argiustolls	Mollisol

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

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

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	1.06	0.39
10	20	1.29	0.53
20	30	0.98	0.48
30	40	0.75	0.14
40	50	0.67	0.21
50	60	0.41	0.2
60	70	0.23	0.13
70	80	0.14	0.08
80	90	0.11	0.09
90	100	0.05	0.01
100	120	0.04	0.02
120	140	0.07	0.06
140	160	0.04	0.04

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

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	105.9	39.4
10	20	235	74.9
20	30	332.7	119.4
30	40	407.3	133.4
40	50	473.8	152.7
50	60	514.9	169.2
60	70	538.1	179.8
70	80	551.7	181.1
80	90	563.1	184.3
90	100	568.5	184.2
100	120	576.1	134.8
120	140	589.3	150.4
140	160	597.9	155.6

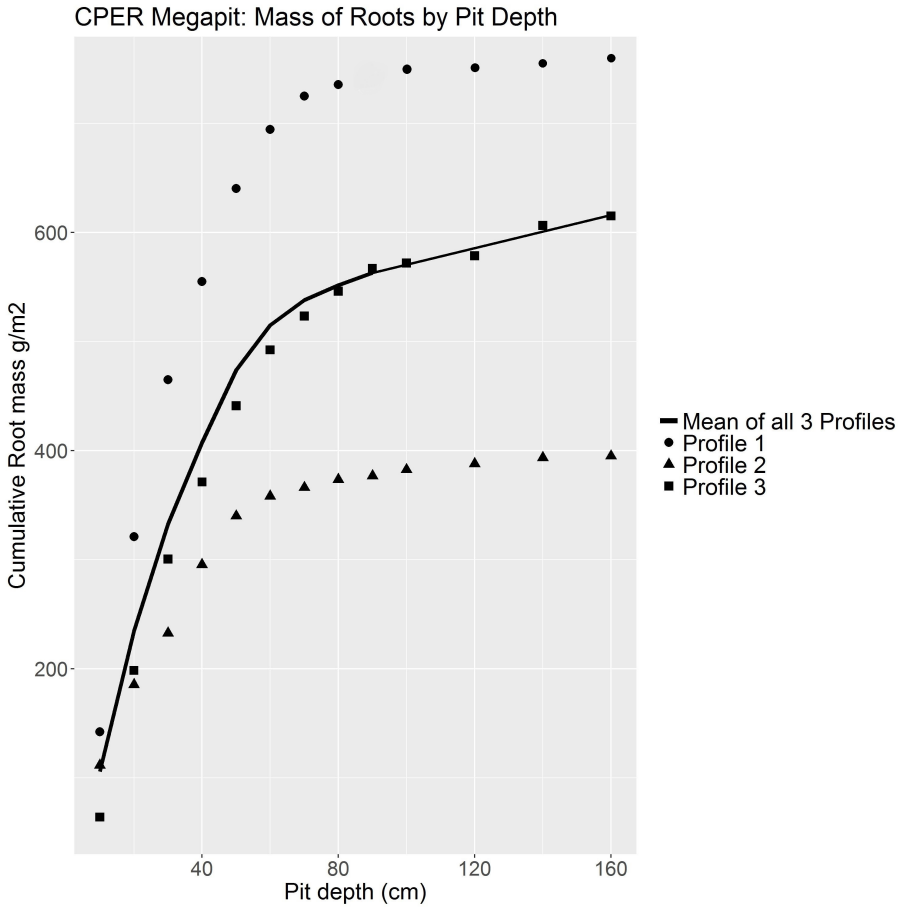

Figure 7: Cumulative root mass by pit depth at CPER.

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

Total Pit Depth (cm)	160
Total Mean Cumulative Mass at 30cm (g per m^2)	332.66
Total Mean Cumulative Mass at 100cm (g per m^2)	568.5
Total Mean Cumulative Mass (g per m^2)	597.9

4.4 Plant Characterization and Phenology Species Selection

4.4.1 Site-Specific Methods

Plant characterization data were collected by an external contractor during August of 2013. 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 10: Site plant characterization and phenology species summary at CPER.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
BOGR2	*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths	1	22	NA	NA
HECO26	*Hesperostipa comata* (Trin. & Rupr.) Barkworth	2	7	NA	NA
THFI	*Thelesperma filifolium* (Hook.) A. Gray	3	6	NA	NA
CADU6	*Carex duriuscula C.A.* Mey.	4	4	NA	NA
BODA2	*Bouteloua dactyloides* (Nutt.) J.T. Columbus	5	2	NA	NA
EREF	*Eriogonum effusum* Nutt.	6	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)
SPCR	*Sporobolus cryptandrus* (Torr.) A. Gray	7	1	NA	NA
VUOC	*Vulpia octoflora* (Walter) Rydb.	8	1	NA	NA
OPPO	*Opuntia polyacantha* Haw.	9	1	NA	NA
PASM	*Pascopyrum smithii* (Rydb.) Á. Löve	10	1	NA	NA
ARPU9	*Aristida purpurea* Nutt. Var	11	<1	NA	NA
PSTE5	*Psoralidium tenuiflorum* (Pursh) Rydb.	12	<1	NA	NA
SPCO	*Sphaeralcea coccinea* (Nutt.) Rydb.	12	<1	NA	NA
CRMI5	*Cryptantha minima* Rydb.	14	<1	NA	NA
ELEL5	*Elymus elymoides* (Raf.) Swezey	15	<1	NA	NA
ARFR4	*Artemisia frigida* Willd.	16	<1	NA	NA
GUSA2	*Gutierrezia sarothrae* (Pursh) Britton & Rusby	17	<1	NA	NA
CAFI	*Carex filifolia* Nutt.	18	<1	NA	NA
ERNAN5	*Ericameria nauseosa* (Pall. ex Pursh) G.L. Nesom & Baird var. *nauseosa*	18	<1	NA	NA
LIPU	*Liatris punctata* Hook.	20	<1	NA	NA
THME	*Thelesperma megapotamicum* (Spreng.) Kuntze	20	<1	NA	NA
EVNU	*Evolvulus nuttallianus* Schult.	22	<1	NA	NA
MILI3	*Mirabilis linearis* (Pursh) Heimerl	22	<1	NA	NA
PIOP	*Picradeniopsis oppositifolia* (Nutt.) Rydb. ex Britton	22	<1	NA	NA
LYJU	*Lygodesmia juncea* (Pursh) D. Don ex Hook.	25	<1	NA	NA
ASTRA	*Astragalus* sp.	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)
CHGE2	*Chamaesyce geyeri* (Engelm. & A. Gray) Small	27	<1	NA	NA
HEVI4	*Heterotheca villosa* (Pursh) Shinners	27	<1	NA	NA
OENOT	*Oenothera* sp.	27	<1	NA	NA
ALTE	*Allium textile A.* Nelson & J.F. Macbr.	30	NA	NA	NA
ATCA2	*Atriplex canescens* (Pursh) Nutt.	30	NA	NA	NA
ECVI2	*Echinocereus viridiflorus* Engelm.	30	NA	NA	NA
ESVI2	*Escobaria vivipara* (Nutt.) Buxbaum	30	NA	NA	NA
MAPI	*Machaeranthera pinnatifida* (Hook.) Shinners	30	NA	NA	NA
MUTO2	*Muhlenbergia torreyi* (Kunth) Hitchc. ex Bush	30	NA	NA	NA
GACO5	*Oenothera suffrutescens* (Ser.) W.L. Wagner & Hoch	30	NA	NA	NA
PEAL2	*Penstemon albidus* Nutt.	30	NA	NA	NA

Note:Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov). GAC05 is synonymous to OESU3. *Astragalus* sp. most likely includes ASMO7 (*A. mollissimus*).

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

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
CPER_045	20	2.7	17	0.03
CPER_046	14	2.33	14	0
CPER_047	21	2.8	17	0.02
CPER_048	13	2.39	11	0
CPER_049	23	2.86	23	0
CPER_050	17	2.62	17	0
CPER_051	12	2.27	11	0

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
CPER_052	22	2.97	23	0
CPER_053	16	2.55	18	0
CPER_054	15	2.43	13	0
CPER_055	13	2.29	13	0
CPER_056	11	1.88	21	0
CPER_057	22	2.98	19	0
CPER_058	19	2.65	16	0
CPER_059	20	2.73	19	0
CPER_060	22	2.75	24	0
CPER_061	12	2.15	13	0
CPER_062	15	2.45	15	0
CPER_063	18	2.73	14	0
CPER_064	18	2.85	17	0
CPER_065	19	2.75	17	0
CPER_066	15	2.52	14	0
CPER_067	14	2.26	15	0
CPER_068	13	2.28	13	0
CPER_069	14	2.42	10	0
CPER_070	17	2.68	17	0
CPER_071	14	2.34	11	0
CPER_072	19	2.57	22	0
CPER_073	10	1.89	13	0
CPER_074	15	2.36	13	0
Bryophyte Mean				0

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

Site characterization measurements are used to determine which sites will implement the Bryophyte Productivity Protocol. The protocol will occur at sites where bryophyte cover, for which annual growth is not distinguishable, is 20% or greater averaged across all sampled plots. See TOS Protocol and Procedure: Bryophyte Productivity (RD[12]) for more information.

4.5 Beetles

4.5.1 Site-Specific Methods

Beetle site characterization was conducted in August and 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. 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 12: Beetle trap locations at CPER.

Trap ID	Lat	Long
1	40.7858	-104.708
2	40.7972	-104.697
3	40.7989	-104.749
4	40.811	-104.729
5	40.8128	-104.697
6	40.816	-104.749
7	40.8185	-104.707
8	40.8258	-104.695
9	40.8381	-104.765
10	40.839	-104.725
11	40.846	-104.769
11	40.849	-104.743
12	40.8509	-104.7
13	40.858	-104.686
13	40.861	-104.746
14	40.862	-104.684
15	40.865	-104.694

Table 13: Beetle identification results at CPER.

Sample ID	Scientific Name	Collection Date	Trap Location
carabid2405	*Chlaenius tomentosus*	6/30/2011	1
carabid2498	*Amara carinata*	9/1/2011	1

Sample ID	Scientific Name	Collection Date	Trap Location
carabid2423	*Amara convexa*	7/14/2011	1
carabid2437	*Cyclotrachelus constrictus*	6/3/2011	1
carabid2403	*Chlaenius tomentosus*	6/3/2011	1
carabid2491	*Cyclotrachelus constrictus*	8/25/2011	1
carabid2446	*Harpalus opacipennis*	6/16/2011	1
carabid2393	*Chlaenius tomentosus*	6/10/2011	1
carabid2444	*Harpalus opacipennis*	7/21/2011	1
carabid2421	*Selenophorus* sp.	6/16/2011	2
carabid2427	*Cyclotrachelus constrictus*	6/3/2011	2
carabid2426	*Cyclotrachelus constrictus*	6/10/2011	2
carabid2434	*Amara convexa*	6/16/2011	2
carabid2397	*Selenophorus* sp.	6/23/2011	3
carabid2536	*Harpalus compar*	8/4/2011	3
carabid2402	*Harpalus desertus*	8/4/2011	3
carabid2438	*Cratacanthus dubius*	7/14/2011	3
carabid2412	*Cicindela punctulata*	8/4/2011	3
carabid2497	*Amara obesa*	9/1/2011	3
carabid2396	*Pterostichus* sp.	6/17/2011	4
carabid2493	*Amara* sp.	9/2/2011	4
carabid2408	*Chlaenius tomentosus*	7/29/2011	4
carabid2399	*Cyclotrachelus constrictus*	7/15/2011	4
carabid2495	*Cymindis interior*	8/26/2011	4
carabid2452	*Pasimachus elongatus*	7/15/2011	4
carabid2409	*Cicindela punctulata*	7/22/2011	4
carabid2407	*Chlaenius tomentosus*	7/22/2011	4
carabid2406	*Chlaenius tomentosus*	7/22/2011	4
carabid2424	*Cymindis planipennis*	8/12/2011	4
carabid2450	*Selenophorus* sp.	7/21/2011	5
carabid2401	Unknown Carabidae	8/4/2011	5
carabid2428	*Agonoleptus conjunctus*	6/2/2011	5
carabid2445	*Harpalus compar*	8/11/2011	5
carabid2442	*Euryderus grossus*	7/21/2011	5
carabid2451	*Harpalus fuscipalpis*	7/14/2011	5
carabid2535	*Harpalus compar*	8/11/2011	5

Sample ID	Scientific Name	Collection Date	Trap Location
carabid383	*Amara convexa*	8/4/2009	6
carabid301	*Euryderus grossus*	7/14/2009	6
carabid384	*Harpalus fuscipalpis*	8/4/2009	6
carabid1499	*Pasimachus elongatus*	7/21/2009	6
carabid547	*Cyclotrachelus constrictus*	8/4/2009	6
carabid291	*Pasimachus elongatus*	7/14/2009	6
carabid294	*Amara convexa*	7/14/2009	6
carabid306	*Amara convexa*	7/14/2009	6
carabid544	*Cyclotrachelus constrictus*	8/4/2009	6
carabid308	*Amara convexa*	7/14/2009	6
carabid1501	*Pasimachus elongatus*	8/4/2009	6
carabid549	*Cymindis planipennis*	8/4/2009	6
carabid284	*Harpalus fuscipalpis*	7/14/2009	6
carabid380	*Cicindela punctulata*	8/4/2009	6
carabid382	*Amara convexa*	8/4/2009	6
carabid387	*Cicindela punctulata*	8/4/2009	6
carabid1498	*Pasimachus elongatus*	7/21/2009	6
carabid376	*Philophuga caerulea*	8/4/2009	6
carabid290	*Pasimachus elongatus*	7/14/2009	6
carabid289	*Pasimachus elongatus*	7/14/2009	6
carabid293	*Pasimachus elongatus*	7/14/2009	6
carabid859	*Cyclotrachelus constrictus*	7/28/2009	6
carabid309	*Dyschirius globulosus*	7/14/2009	6
carabid548	*Amara convexa*	8/4/2009	6
carabid297	*Pasimachus elongatus*	7/14/2009	6
carabid1502	*Pasimachus elongatus*	7/28/2009	6
carabid388	*Amara convexa*	8/4/2009	6
carabid329	*Cymindis interior*	8/4/2009	6
carabid1500	*Pasimachus elongatus*	8/4/2009	6
carabid563	*Harpalus caliginosus*	7/21/2009	6
carabid303	*Bembidion rapidum*	7/14/2009	6
carabid307	*Harpalus fuscipalpis*	7/14/2009	6
carabid566	*Cymindis interior*	7/21/2009	6
carabid379	*Cicindela punctulata*	8/4/2009	6

Sample ID	Scientific Name	Collection Date	Trap Location
carabid546	*Euryderus grossus*	8/4/2009	6
carabid288	*Euryderus grossus*	7/14/2009	6
carabid687	*Harpalus compar*	7/28/2009	6
carabid572	*Cyclotrachelus constrictus*	7/21/2009	6
carabid310	*Amara obesa*	7/14/2009	6
carabid545	*Harpalus compar*	8/4/2009	6
carabid573	*Amara convexa*	7/21/2009	6
carabid686	*Harpalus caliginosus*	7/28/2009	6
carabid2413	*Agonoleptus conjunctus*	7/29/2011	7
carabid2447	*Harpalus opacipennis*	7/8/2011	7
carabid2456	*Pasimachus elongatus*	7/29/2011	7
carabid2492	*Harpalus fraternus*	9/2/2011	7
carabid2496	*Cymindis interior*	8/26/2011	7
carabid2410	*Cicindela punctulata*	7/29/2011	7
carabid2433	*Discoderus parallelus*	7/8/2011	7
carabid2416	*Philophuga viridis*	6/16/2011	7
carabid2448	*Harpalus opacipennis*	6/10/2011	7
carabid2395	*Cicindela purpurea*	6/16/2011	7
carabid2419	*Euryderus grossus*	7/22/2011	7
carabid2394	*Selenophorus* sp.	6/10/2011	8
carabid2430	*Euryderus grossus*	7/7/2011	8
carabid2436	*Discoderus parallelus*	7/28/2011	8
carabid2429	*Amara convexa*	7/7/2011	8
carabid2454	*Pasimachus elongatus*	6/3/2011	8
carabid2422	*Cyclotrachelus constrictus*	6/3/2011	8
carabid2449	*Harpalus desertus*	8/11/2011	8
carabid2432	*Agonoleptus conjunctus*	6/30/2011	8
carabid2425	*Agonoleptus conjunctus*	7/21/2011	8
carabid2415	*Euryderus grossus*	8/4/2011	8
carabid2418	*Cyclotrachelus constrictus*	7/21/2011	8
carabid2494	*Cymindis planipennis*	9/1/2011	9
carabid2455	*Pasimachus elongatus*	6/23/2011	9
carabid2500	*Harpalus desertus*	9/1/2011	9
carabid2440	*Harpalus fuscipalpis*	6/16/2011	9

Sample ID	Scientific Name	Collection Date	Trap Location
carabid2441	*Harpalus fuscipalpis*	6/10/2011	9
carabid617	*Cymindis* sp.	10/2/2008	10
carabid603	*Amara carinata*	10/2/2008	10
carabid597	*Harpalus opacipennis*	10/2/2008	10
carabid604	*Amara carinata*	10/17/2008	10
carabid613	*Cymindis* sp.	9/29/2008	11
carabid627	*Amara* sp.	9/29/2008	11
carabid624	*Amara* sp.	10/17/2008	11
carabid610	*Cymindis planipennis*	9/29/2008	11
carabid607	*Cyclotrachelus* sp.	9/29/2008	12
carabid615	*Cymindis interior*	10/17/2008	12
carabid609	*Cymindis planipennis*	10/17/2008	12
carabid2400	*Diplocheila* obtusa	7/15/2011	13
carabid2499	*Amara carinata*	9/2/2011	13
carabid2443	*Harpalus opacipennis*	8/12/2011	13
carabid606	*Selenophorus* sp.	10/17/2008	14
carabid622	*Harpalinae* sp.	10/17/2008	14
carabid626	*Amara* sp.	10/17/2008	14
carabid619	*Cymindis planipennis*	10/2/2008	14
carabid2435	*Amara convexa*	6/10/2011	14
carabid2420	*Euryderus grossus*	7/15/2011	14
carabid2398	*Amara obesa*	7/1/2011	14
carabid2453	*Pasimachus elongatus*	6/16/2011	14
carabid2411	*Cicindela punctulata*	8/12/2011	14
carabid2431	*Amara convexa*	6/24/2011	14
carabid2439	*Amara obesa*	8/5/2011	14
carabid2537	*Harpalus compar*	8/19/2011	14
carabid2414	*Agonoleptus conjunctus*	6/16/2011	14
carabid621	*Harpalus* sp.	10/2/2008	15
carabid611	*Cymindis planipennis*	10/2/2008	15
carabid618	*Cymindis planipennis*	10/17/2008	15

4.6 Mosquitoes

4.6.1 Site-Specific Methods

Mosquito site characterization was conducted in June and July 2010 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. 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.

4.6.2 Results

Table 14: Mosquito trap locations at CPER.

Trap ID	Lat	Long	Elevation (m)
BD01	40.81283	-104.697	1620
BD01	40.81283	-104.697	1620
BD03	40.79716	-104.697	1631
BD04	40.78583	-104.708	1605
BD05	40.81103	-104.729	1651
BD06	40.79892	-104.749	1646
BD07	40.83812	-104.765	1671
BD08	40.86198	-104.684	1646
BD09	40.85095	-104.7	1639
BD11	40.81854	-104.707	1624
BD20	40.8258	-104.695	1627

Table 15: Mosquito identification results at CPER.

Sample ID	Scientific Name	Collection Date	Trap Location
culicid500001	*Aedes vexans*	5/26/2011	BD01
culicid2477	*Aedes dorsalis*	6/7/2011	BD01
culicid2472	*Aedes melanimon*	6/29/2011	BD01
culicid2488	*Psorophora signipennis*	6/29/2011	BD01
culicid2480	*Aedes dorsalis*	6/14/2011	BD03
culicid2486	*Aedes nigromaculis*	6/14/2011	BD03
culicid2464	*Culiseta inornata*	6/14/2011	BD03
culicid2502	*Aedes melanimon*	7/27/2011	BD04

Sample ID	Scientific Name	Collection Date	Trap Location
culicid2507	*Psorophora discolor*	7/12/2011	BD04
culicid2508	*Psorophora discolor*	7/12/2011	BD04
culicid2509	*Psorophora discolor*	7/6/2011	BD04
culicid2510	*Psorophora discolor*	7/6/2011	BD04
culicid2511	*Psorophora discolor*	7/6/2011	BD04
culicid2512	*Psorophora discolor*	7/6/2011	BD04
culicid2514	*Psorophora discolor*	7/6/2011	BD04
culicid2513	*Psorophora discolor*	7/6/2011	BD04
culicid2515	*Psorophora discolor*	7/6/2011	BD04
culicid2516	*Psorophora discolor*	7/6/2011	BD04
culicid2469	*Aedes dorsalis*	6/22/2011	BD04
culicid2471	*Aedes nigromaculis*	6/7/2011	BD04
culicid2463	*Aedes nigromaculis*	6/21/2011	BD04
culicid2467	*Aedes nigromaculis*	6/29/2011	BD04
culicid2461	*Aedes trivittatus*	6/29/2011	BD04
culicid2481	*Aedes melanimon*	6/29/2011	BD05
culicid2476	*Aedes nigromaculis*	6/15/2011	BD05
culicid2478	*Aedes vexans*	6/29/2011	BD05
culicid2505	*Aedes trivittatus*	7/12/2011	BD06
culicid2485	*Aedes dorsalis*	6/15/2011	BD06
culicid2458	*Aedes melanimon*	6/29/2011	BD06
culicid2462	*Aedes melanimon*	6/29/2011	BD06
culicid2482	*Culex tarsalis*	6/29/2011	BD06
culicid2489	*Psorophora signipennis*	6/29/2011	BD07
culicid2501	*Aedes melanimon*	7/12/2011	BD07
culicid2465	*Aedes nigromaculis*	6/22/2011	BD07
culicid2470	*Aedes melanimon*	6/29/2011	BD08
culicid2474	*Aedes melanimon*	6/29/2011	BD08
culicid2466	*Aedes nigromaculis*	6/7/2011	BD08
culicid2473	*Aedes vexans*	6/7/2011	BD08
culicid2483	*Culex tarsalis*	6/29/2011	BD08
culicid2460	*Culiseta inornata*	5/24/2011	BD08
culicid2503	*Aedes melanimon*	7/27/2011	BD09
culicid2459	*Aedes nigromaculis*	6/28/2011	BD09

Sample ID	Scientific Name	Collection Date	Trap Location
culicid2490	*Psorophora signipennis*	6/22/2011	BD11
culicid2475	*Aedes nigromaculis*	6/29/2011	BD11
culicid2457	*Aedes vexans*	6/7/2011	BD11
culicid2504	*Aedes melanimon*	7/26/2011	BD20
culicid2506	*Aedes trivittatus*	7/27/2011	BD20
culicid2484	*Aedes dorsalis*	6/29/2011	BD20
culicid2479	*Aedes nigromaculis*	6/14/2011	BD20
culicid2468	*Culex tarsalis*	6/14/2011	BD20
culicid2487	*Culiseta inornata*	6/29/2011	BD20

4.7 Ticks

4.7.1 Site-Specific Methods

No tick site characterization work was done at CPER. 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

Central Plains Experimental Range, 2017. United States Department of Agriculture: Rangeland Resources and Systems Research. Retrieved from: https://www.ars.usda.gov/plains-area/fort-collins-co/center-for-agricultural-resources-research/rangeland-resources-systems-research/docs/rrsr/central-plains-experimental-research-location/

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.

Harmston, F. C., and S. A. Sanitarian. 1949. An Annotated List of Mosquito Records From Colorado. The Great Basin Naturalist 9, 65-75.

Kumar, R., R.J. Lavigne, J.E. Lloyd, and R.E. Pfadt. 1976. Insects of the Central Plains Experiment Range, Pawnee National Grassland. University of Wyoming, Agricultural Experiment Station. Science Monograph 32:1-74.

Kumar, R., Lavigne, R. J., Lloyd, J. E. & Pfadt, R. E. Macroinvertebrates of the Pawnee Site. (University of Wyoming, 1975).

Shoop, M., C.H. Wasser, & A. Engel. "Species lists of plants." Species Lists-Shortgrass Steppe- Long Term Ecological Research (SGS-LTER.) Colorado State University. 3 January 2007. Web. 18 July 2016.

"Species lists of arthropods." Species Lists-Shortgrass Steppe- Long Term Ecological Research (SGS-LTER.) Colorado State University. 3 January 2007. Web. 18 July 2016.

Stapp, Paul. "SGS-LTER Live arthropod pitfall trapping across a double catena on the Central Plains Experimental Range, Nunn, Colorado, USA, 1995-1998". Data-Shortgrass Steppe- Long Term Ecological Research(SGS-LTER). 3 January 2007. Web. 18 July 2016.

5 RELOCATABLE SITE 1- NORTH STERLING (STER)

The North Sterling site is located 200 kilometers north east of Denver and was selected to represent agricultural land and practices in eastern Colorado.

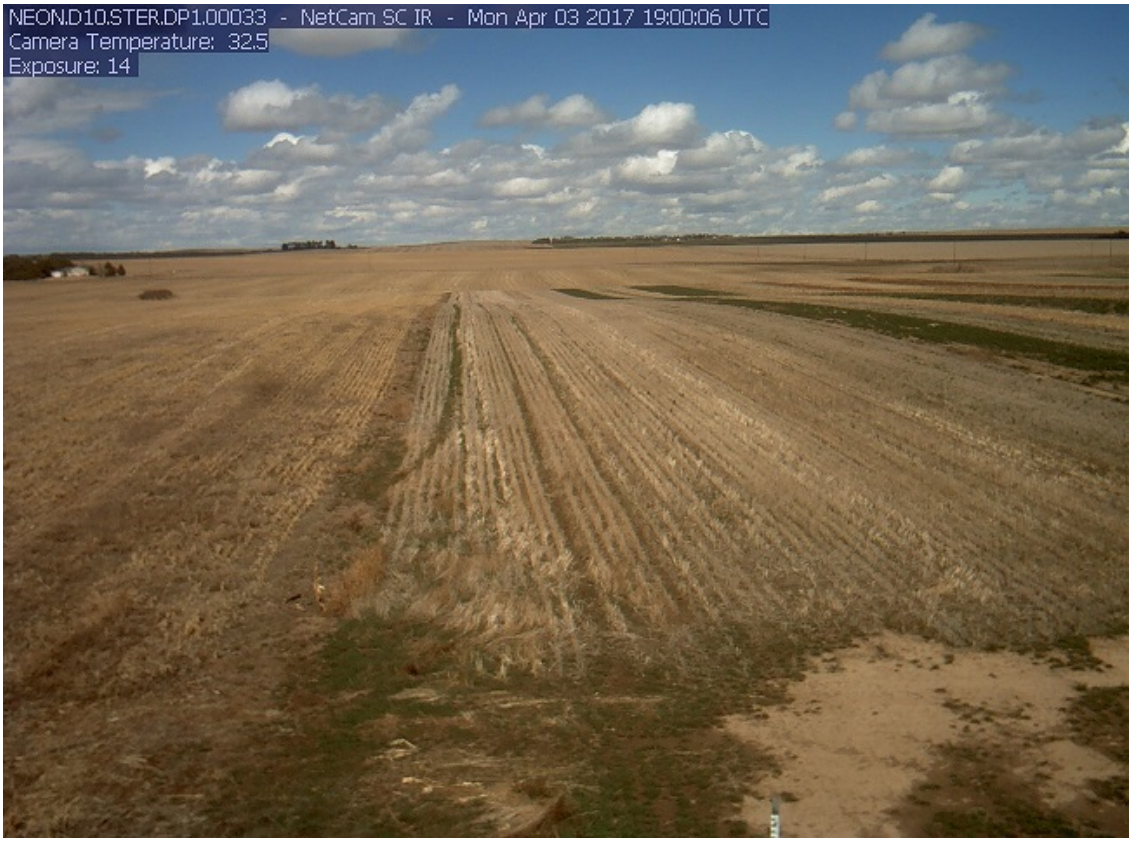

Figure 8: Phenocamera image for STER. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: Private land owner
- Located in: Logan County, Colorado
- Area: 3.23 km^2
- Elevation: 1,350-1,370m
- Dominant vegetation type: Cropping systems under no-till management were initiated in 1985 at STER. Possible crops include: winter wheat, winter wheat-maize, millet, maize, sorghum, winter wheat, forage millet, and sunflower.
- General Management: The site is at the edge of a non-tilled experimental field that is used for the long-term sustainable Dryland Agroecosystems Project (DAP), which was initiated in 1985 at three sites in eastern Colorado (Sterling, Stratton, and Walsh) to evaluate the effects of cropping intensity on production,

water use efficiency and selected soil chemical and physical properties. The DAP site was established in 1985 and was chosen because of representative soils present. Before establishment of the no-till cropping systems, the site was under conventional tillage since it was taken from native sod in about 1910. Conventional tillage from 1910 to 1985 ranged from moldboard plowing in the early years to sweep tillage in the later years. The primary crop was winter wheat grown in a wheat-fallow rotation. Proso millet also had been grown occasionally during a few years before 1985.

- Plot Selection: NEON TOS Plots were allocated across the site following our standard criteria and avoiding existing research. Due to active agriculture management, markers cannot be left in the ground at STER. NEON field crew use high resolution, handheld GPS units to navigate to sampling locations.

5.1 TOS Spatial Sampling Design

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

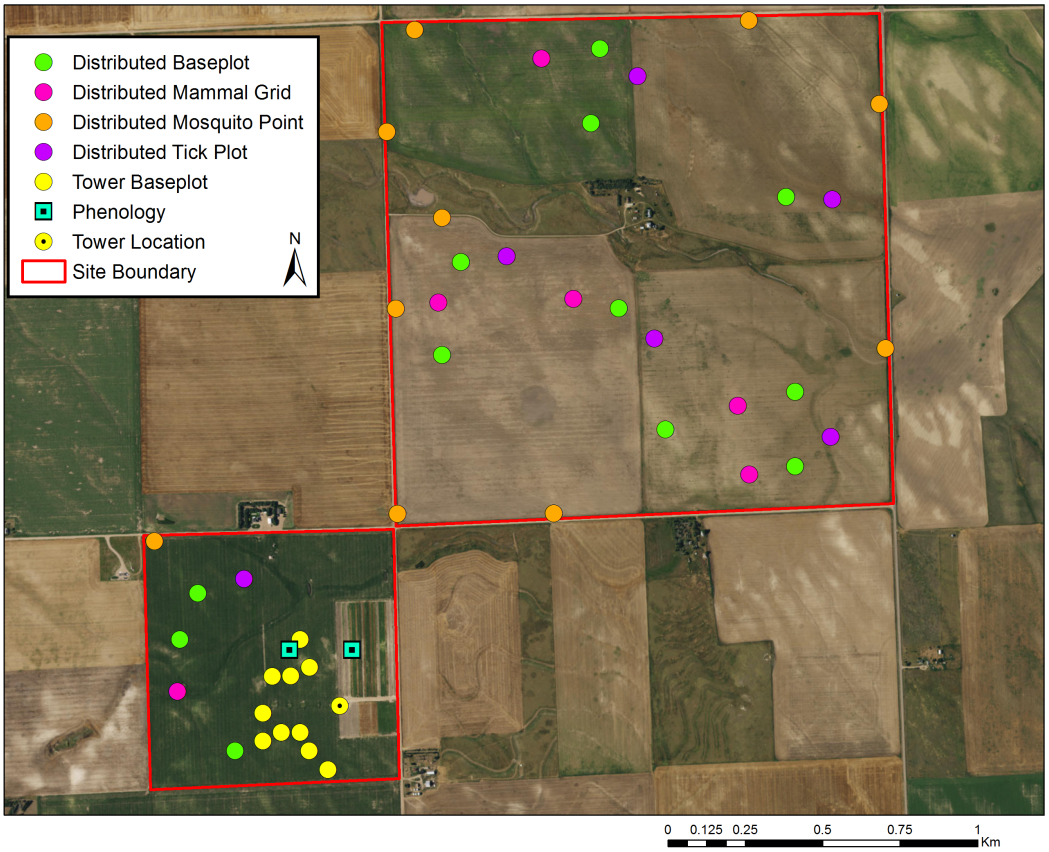

Figure 9: Map of TOS plot centroids within the NEON TOS sampling boundary at STER.

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

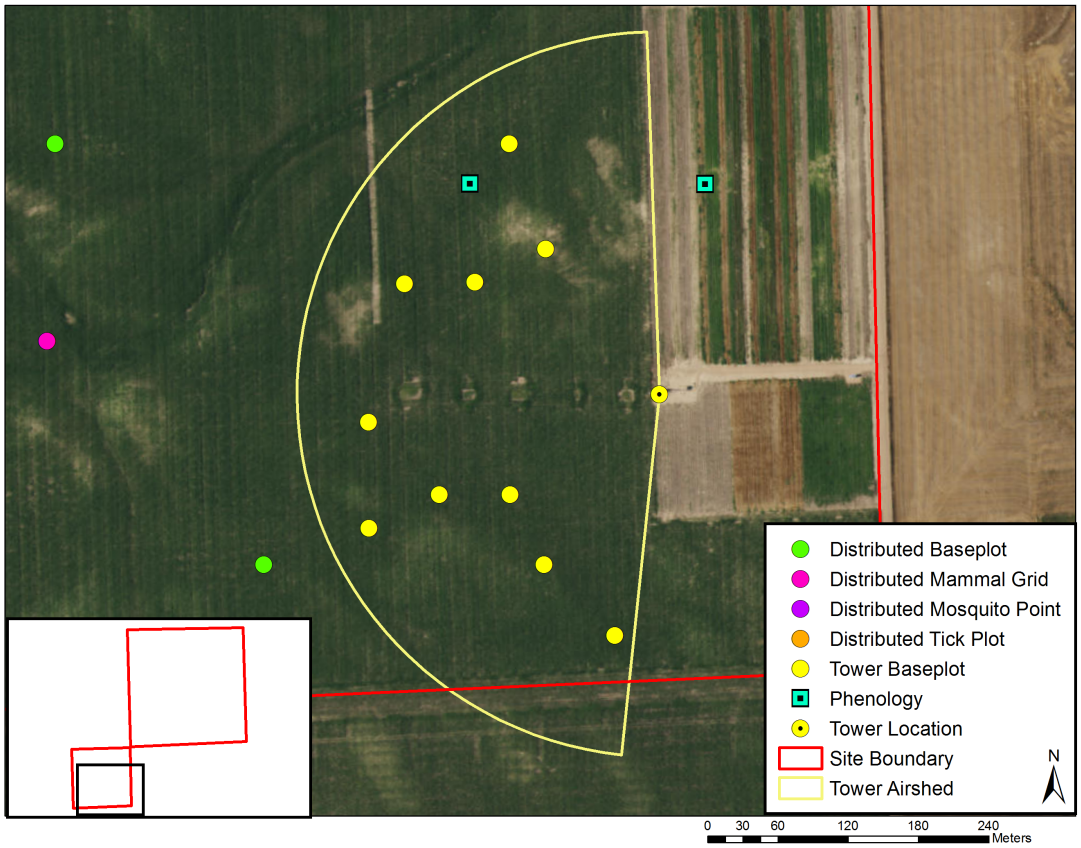

Figure 10: Map of the tower airshed and TOS plot centroids at STER.

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

Table 16: NLCD land cover classes and area within the TOS site boundary at STER.

NLCD Class	Site Area (km^2)	Percent (%)
Cultivated Crops	2.77	85.53
Grassland Herbaceous	0.29	8.86
Developed Open Space	0.17	5.33
Deciduous Forest	0.01	0.22

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. While the NLCD classifies 8% of the TOS boundary at the site as grassland herbaceous, a large percentage of that area was not available for sampling according to the Land Use Agreement. The remaining area was less than 5% of the site and not targeted for sampling.

Table 17: NLCD land cover classes and TOS plot numbers at STER.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Cultivated Crops	12
Distributed	Mammal Grid	Cultivated Crops	6
Distributed	Mosquito Point	Cultivated Crops	10
Distributed	Tick Plot	Cultivated Crops	6
Tower	Base Plot	NA	10
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 cultivated crops.

Table 18: Number of Distributed Base plots per NLCD land cover class per protocol at STER.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Cultivated Crops	Beetles	10
Distributed	Base Plot	Cultivated Crops	Birds	9
Distributed	Base Plot	Cultivated Crops	Canopy Foliage Chemistry	12
Distributed	Base Plot	Cultivated Crops	Coarse Downed Wood	12
Distributed	Base Plot	Cultivated Crops	Digital Hemispherical Photos for Leaf Area Index	12
Distributed	Base Plot	Cultivated Crops	Herbaceous Biomass	12
Distributed	Base Plot	Cultivated Crops	Plant Diversity	7
Distributed	Base Plot	Cultivated Crops	Soil Biogeochemistry	6
Distributed	Base Plot	Cultivated Crops	Soil Microbes	6
Distributed	Base Plot	Cultivated Crops	Vegetation Structure	12

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

Table 19: Number of Tower Plots per protocol at STER.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Below Ground Biomass Coring	10
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	10
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Herbaceous Biomass	10
Tower	Base Plot	Litterfall and Fine Woody Debris	10
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	10
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: STER

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. In addition to greenness, the timing of sampling events at STER is heavily influenced by management decisions, specifically planting and harvest dates.

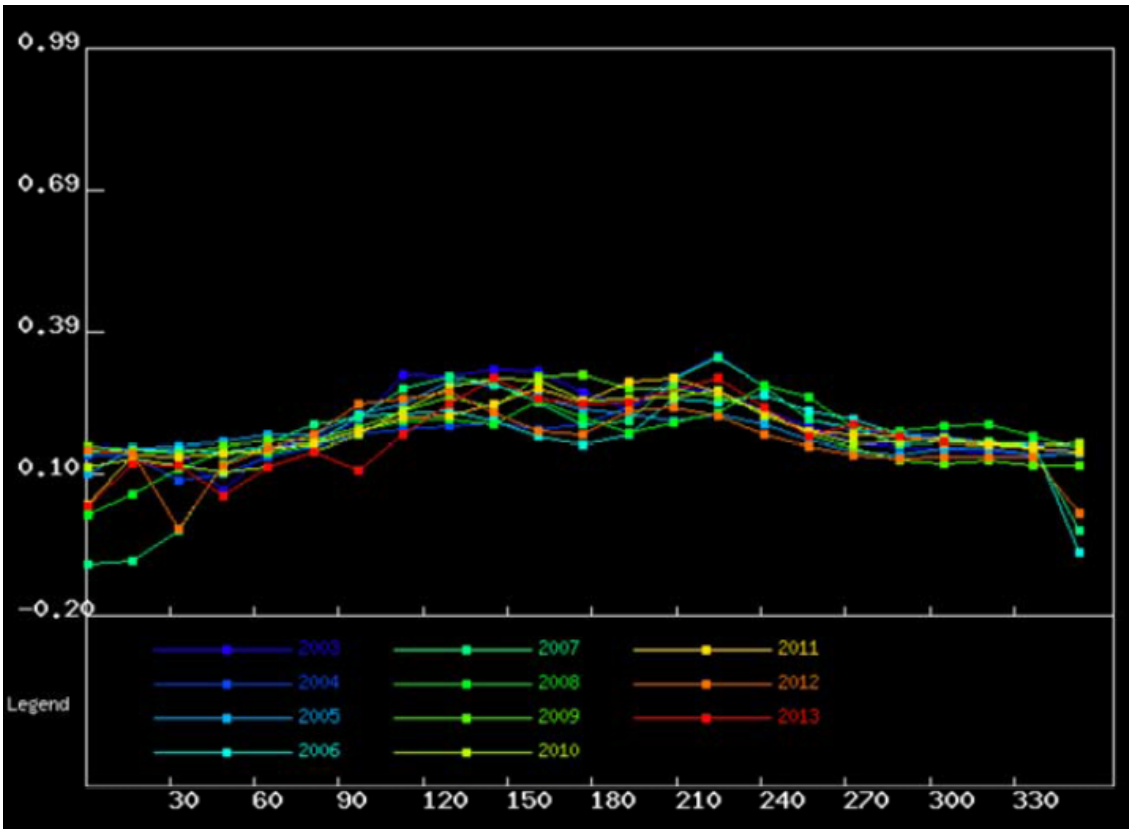

Figure 11: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON STER site.

Table 20: Average MODIS-EVI greenness dates for the NEON STER site, based on data from 2003-2013 (DOY, with MM/DD in parentheses).

Average Increase	Average Maximum	Average Decrease	Average Minimum
90 (04/01)	150 (05/31)	190 (07/10)	270 (09/28)

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 lat: 40.461903, centroid long: -103.02929 (WGS84 datum)

5.3 Belowground Biomass

5.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 160 cm by NEON staff in April 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 ($\leq$ 4 mm and 4-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to 30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

5.3.2 Results

Table 21: Soil Pit Information at STER.

Latitude	Longitude	Soil Family	Soil Order
40.45984	-103.03008	Fine-silty - mixed - superactive - mesic Pachic Argiustolls	Mollisol

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

Table 22: Fine root mass per depth increment (cm) at STER.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	0.1	0.05
10	20	0.06	0.04
20	30	0.06	0.02
30	40	0.05	0.02
40	50	0.01	0
50	60	0.02	0.01
60	70	0.04	0.04
70	80	0.03	0.02
80	90	0.03	0.03
90	100	0.01	0.01
100	120	0.01	0.01
120	140	0	0
140	160	0	0

Table 23: Cumulative fine root mass as a function of depth (cm) at STER.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	9.74	4.77
10	20	15.69	8.74
20	30	22.13	10.64
30	40	26.71	12.61
40	50	27.81	12.54
50	60	29.71	13.14
60	70	34.15	15.86
70	80	37.08	17.22
80	90	39.6	20.45
90	100	40.77	21.23
100	120	42.13	22.25
120	140	42.36	22.19
140	160	42.52	22.11

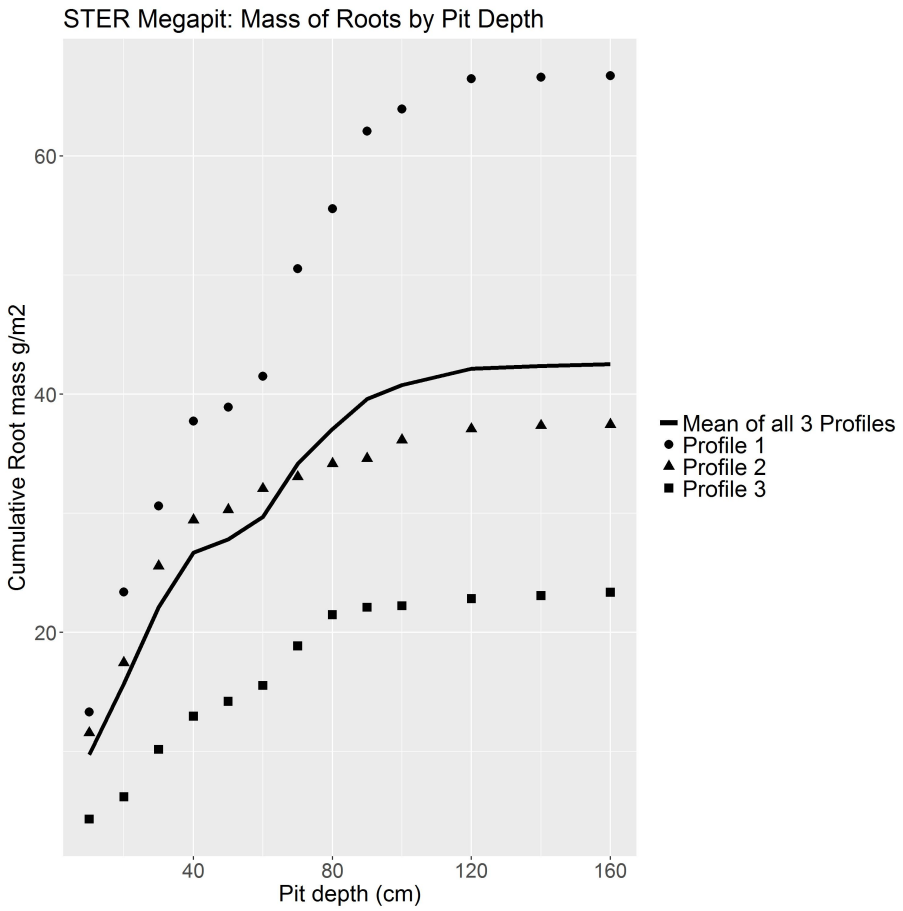

Figure 12: Cumulative root mass by pit depth at STER.

Table 24: Fine root biomass sampling summary data at STER.

Total Pit Depth (cm)	160
Total Mean Cumulative Mass at 30cm (g per m^2)	22.13
Total Mean Cumulative Mass at 100cm (g per m^2)	40.77
Total Mean Cumulative Mass (g per m^2)	42.52

5.4 Plant Characterization and Phenology Species Selection

5.4.1 Site-Specific Methods

Since STER is an agriculture site no plant characterization data were collected. For more information about the methods reference the TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

5.5 Beetles

5.5.1 Site-Specific Methods

Beetle site characterization was conducted in August and 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. 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.

5.5.2 Results

Table 25: Beetle identification results at STER.

Sample ID	Scientific Name
NEONTcarabid673	*Pasimachus elongatus*
NEONTcarabid672	*Elaphropus anceps*
NEONTcarabid864	*Poecilus scitulus*
NEONTcarabid110	*Cyclotrachelus torvus*
NEONTcarabid863	*Poecilus scitulus*
NEONTcarabid683	*Cratacanthus dubius*
NEONTcarabid50	*Harpalus amputatus*
NEONTcarabid678	*Anisodactylus rusticus*
NEONTcarabid693	*Agonum placidum*
NEONTcarabid34	*Cyclotrachelus torvus*
NEONTcarabid145	*Poecilus scitulus*
NEONTcarabid524	*Cratacanthus dubius*
NEONTcarabid698	*Cymindis interior*
NEONTcarabid330	*Harpalus opacipennis*
NEONTcarabid677	*Anisodactylus rusticus*
NEONTcarabid73	*Harpalus reversus*
NEONTcarabid125	*Harpalus reversus*
NEONTcarabid675	*Pasimachus elongatus*
NEONTcarabid144	*Harpalus pensylvanicus*
NEONTcarabid340	*Amara latior*
NEONTcarabid688	*Harpalus pensylvanicus*
NEONTcarabid119	*Anisodactylus carbonarius*

Sample ID	Scientific Name
NEONTcarabid680	*Cratacanthus dubius*
NEONTcarabid342	*Amara latior*
NEONTcarabid866	*Poecilus scitulus*
NEONTcarabid684	*Cratacanthus dubius*
NEONTcarabid875	*Amara carinata*
NEONTcarabid676	*Pasimachus elongatus*
NEONTcarabid860	*Cyclotrachelus constrictus*
NEONTcarabid533	*Pasimachus elongatus*
NEONTcarabid689	*Harpalus pensylvanicus*
NEONTcarabid344	*Amara latior*
NEONTcarabid35	*Harpalus amputatus*
NEONTcarabid106	*Cyclotrachelus torvus*
NEONTcarabid446	*Agonum placidum*
NEONTcarabid538	*Cicindela punctulata*
NEONTcarabid77	*Pasimachus elongatus*
NEONTcarabid111	*Cyclotrachelus torvus*
NEONTcarabid679	*Anisodactylus* sp.
NEONTcarabid118	*Poecilus scitulus*
NEONTcarabid155	*Poecilus scitulus*
NEONTcarabid173	*Cyclotrachelus torvus*
NEONTcarabid674	*Pasimachus elongatus*
NEONTcarabid395	*Cicindela punctulata*
NEONTcarabid512	*Cicindela punctulata*
NEONTcarabid121	*Harpalus amputatus*
NEONTcarabid879	*Amara* sp.
NEONTcarabid59	*Amara carinata*
NEONTcarabid149	*Harpalus amputatus*
NEONTcarabid177	*Poecilus scitulus*
NEONTcarabid135	*Amara carinata*
NEONTcarabid861	*Poecilus lucublandus*
NEONTcarabid28	*Amara carinata*
NEONTcarabid17	*Bembidion rapidum*
NEONTcarabid410	*Cratacanthus dubius*
NEONTcarabid692	*Agonum placidum*

Sample ID	Scientific Name
NEONTcarabid409	*Cratacanthus dubius*
NEONTcarabid682	*Cratacanthus dubius*
NEONTcarabid30	*Anisodactylus carbonarius*
NEONTcarabid72	*Harpalus amputatus*
NEONTcarabid100	*Harpalus reversus*
NEONTcarabid146	*Harpalus pensylvanicus*
NEONTcarabid92	*Amara carinata*
NEONTcarabid27	*Amara carinata*
NEONTcarabid690	*Harpalus reversus*
NEONTcarabid542	*Poecilus lucublandus*
NEONTcarabid876	*Amara latior*
NEONTcarabid874	*Amara carinata*
NEONTcarabid58	*Harpalus pensylvanicus*
NEONTcarabid685	*Harpalus caliginosus*
NEONTcarabid1	*Agonoleptus conjunctus*
NEONTcarabid126	*Amara latior*
NEONTcarabid78	*Pasimachus elongatus*
NEONTcarabid416	*Harpalus caliginosus*
NEONTcarabid539	*Poecilus lucublandus*
NEONTcarabid862	*Poecilus scitulus*
NEONTcarabid64	*Poecilus scitulus*
NEONTcarabid1496	*Galerita janus*
NEONTcarabid1495	*Harpalus* sp.
NEONTcarabid88	*Harpalus reversus*
NEONTcarabid691	*Agonum placidum*

5.6 Mosquitoes

5.6.1 Site-Specific Methods

Mosquito site characterization was conducted in June and July 2010 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. 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.

5.6.2 Results

Table 26: Mosquito identification results at STER.

BOLD Sample ID	Scientific Name
NEONTculicid855	*Psorophora signipennis*
NEONTculicid850	*Aedes trivittatus*
NEONTculicid857	*Aedes vexans*
NEONTculicid848	*Culex tarsalis*
NEONTculicid845	*Aedes nigromaculis*
NEONTculicid766	*Psorophora signipennis*
NEONTculicid846	*Aedes nigromaculis*
NEONTculicid847	*Culex tarsalis*
NEONTculicid767	*Aedes dorsalis*
NEONTculicid854	*Psorophora signipennis*
NEONTculicid763	*Aedes trivittatus*
NEONTculicid840	*Aedes dorsalis*
NEONTculicid841	*Aedes dorsalis*
NEONTculicid765	*Psorophora signipennis*
NEONTculicid764	*Aedes trivittatus*
NEONTculicid844	*Aedes nigromaculis*
NEONTculicid852	*Aedes dorsalis*
NEONTculicid839	*Aedes vexans*
NEONTculicid849	*Culex tarsalis*
NEONTculicid842	*Aedes nigromaculis*
NEONTculicid858	*Aedes dorsalis*
NEONTculicid768	*Aedes trivittatus*
NEONTculicid851	*Psorophora signipennis*
NEONTculicid856	*Aedes vexans*
NEONTculicid843	*Aedes nigromaculis*
NEONTculicid853	*Aedes trivittatus*

5.7 Ticks

5.7.1 Site-Specific Methods

No tick site characterization work was done at STER. For more information about the methods reference the TOS Site Characterization Methods (RD[6]). 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]).

"Appendix B: Wildlife Species List." North Sterling State Park, Park Management Plan 2009-2019. Colorado State Parks. September 2009

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.

Harmston, F. C. & Sanitarian, S. A. An Annotated List of Mosquito Records from Colorado. The Great Basin Naturalist 9, 65-75 (1949).

6 RELOCATABLE SITE 2- ROCKY MOUNTAIN NATIONAL PARK, CASTNET (RMNP)

Seventy kilometers northwest of Denver, the RMNP site includes National Park and Forest Service land in the foothills of Colorado. As a mid-elevation site (2,750 m) on the east side of the Continental Divide, the site is aptly situated to investigate the chemical climate (i.e., pollution) generated along the Front Range as well as dust deposition produced and transported from the Great Basin to higher elevations.

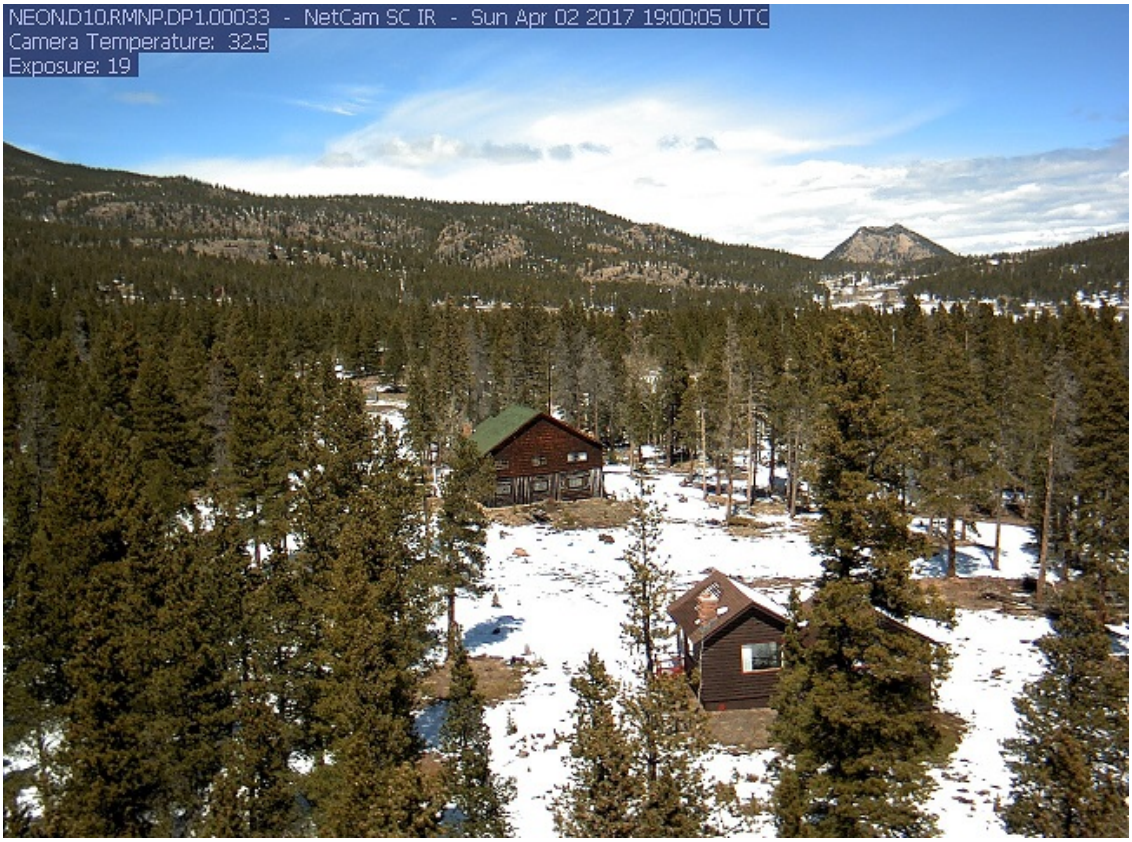

Figure 13: Phenocamera image for RMNP. The phenocamera is located at the top of the NEON tower and faces north. Phenocamera images are available at https://phenocam.sr.unh.edu/webcam/network/table/.

Key Characteristics:

- Site host: National Park Service (Tower Airshed Area) and U.S. Forest Service (Distributed Plots)
- Located in: Boulder and Larimer counties
- Area: 46.48 km^2
- Elevation: 2,450- 3,045m
- Dominant vegetation type: NEON plots in lower elevation areas are characteristic of the lower montane ecosystem and include an open canopy of ponderosa pine (*Pinus ponderosa*), juniper (*Juniperus* sp.), and douglas fir (*Pseudotsuga menziesii*). Higher elevation plots switch to a tighter canopy dominated by douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta* var.*latifolia*). Stands of quaking aspen (*Populus tremuloides*) are scattered through the landscape, including areas surrounding the NEON tower.
- General management: The NEON tower and corresponding TOS plots are located in a property that is owned by the National Park Service but outside of Rocky Mountain National Park's core boundaries. TOS distributed plots are located within the Roosevelt National Forest. The area is a popular destination for hiking, camping, shooting, and other recreational activities.
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research. Due the limited sampling space around the tower the primary phenology loop was

allocated to USFS land 10km south of the tower.

6.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at RMNP 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.

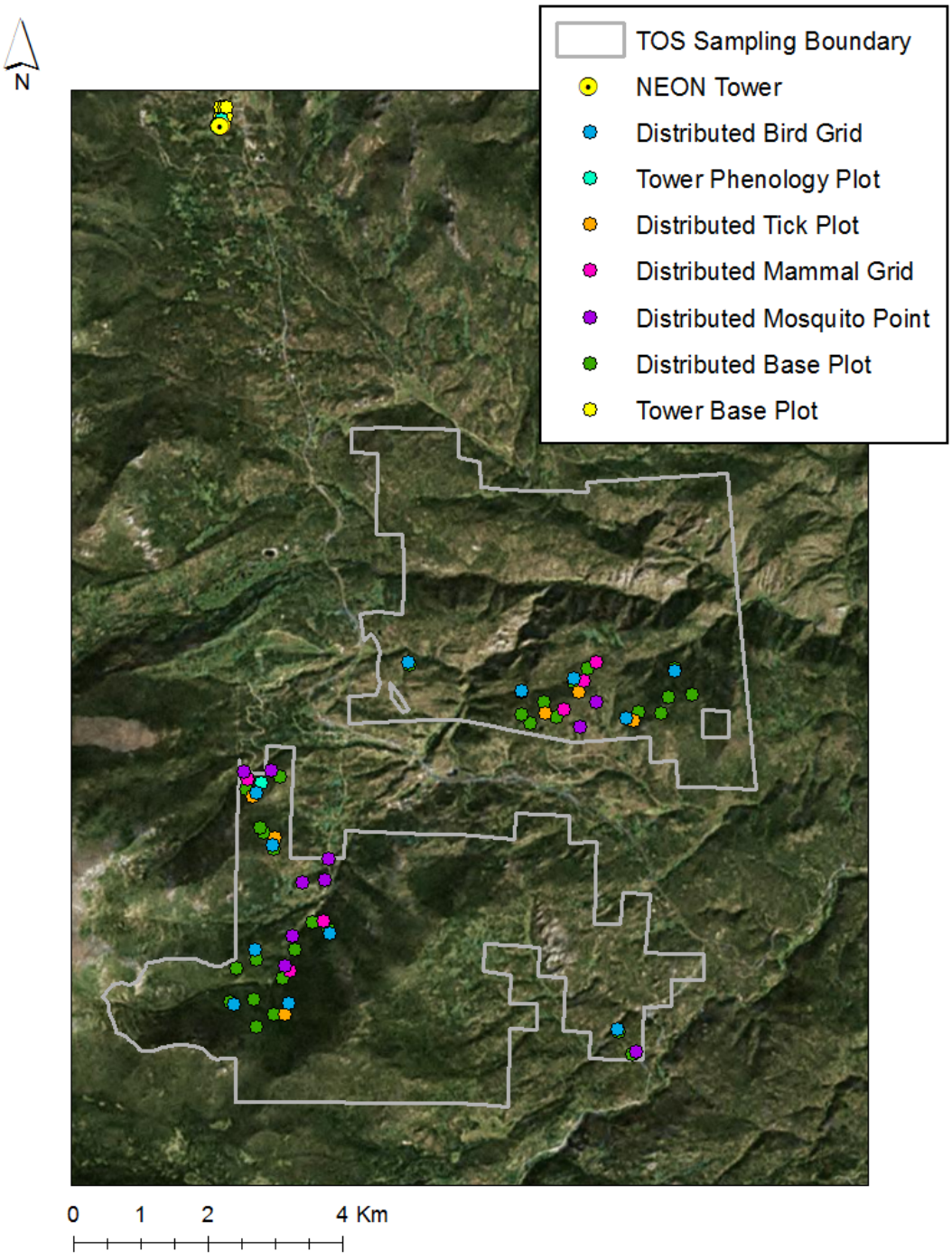

Figure 14: Map of TOS plot centroids within the NEON TOS sampling boundary at RMNP.

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

RD[03].

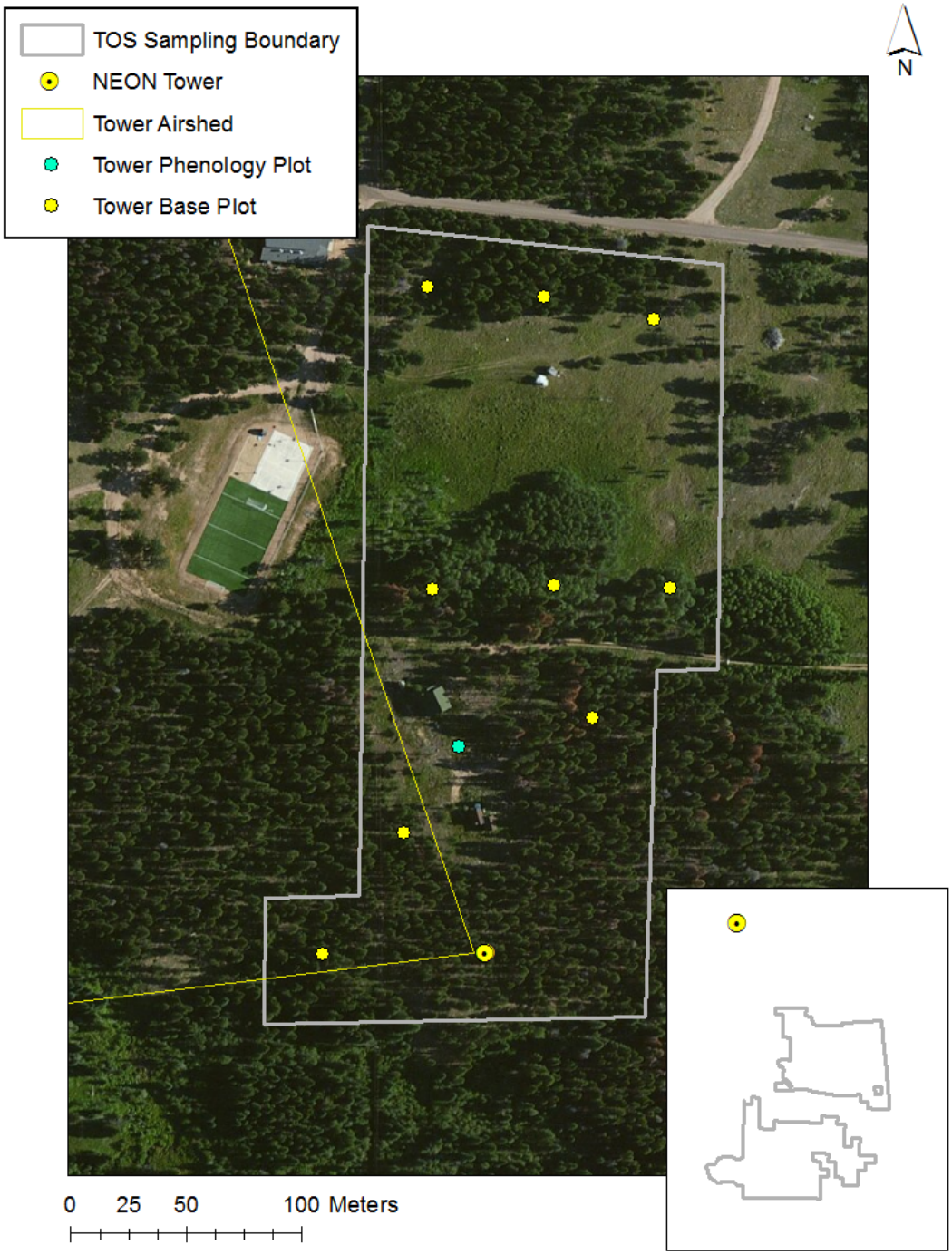

Figure 15: Map of the tower airshed and TOS plot centroids at RMNP.

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

Table 27: NLCD land cover classes and area within the TOS site boundary at RMNP.

NLCD Class	Site Area (km^2)	Percent (%)
Evergreen Forest	71.28	90.25
Shrub Scrub	3.13	3.96
Grassland Herbaceous	2.46	3.12
Deciduous Forest	1.09	1.38
Woody Wetlands	0.52	0.66
Developed Open Space	0.2	0.26
Perennial Ice Snow	0.14	0.17
Mixed Forest	0.06	0.08
Barren Land	0.04	0.05
Developed Low Intensity	0.03	0.04
Open Water	0.02	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 28: NLCD land cover classes and TOS plot numbers at RMNP.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Evergreen Forest	30
Distributed	Bird Grid	Evergreen Forest	10
Distributed	Mammal Grid	Evergreen Forest	6
Distributed	Mosquito Point	Evergreen Forest	10
Distributed	Tick Plot	Evergreen Forest	6
Tower	Base Plot	NA	9
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: evergreen forest, mixed forest, and deciduous forest.

Table 29: Number of Distributed Base plots per NLCD land cover class per protocol at RMNP.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Evergreen Forest	Beetles	10

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Evergreen Forest	Canopy Foliage Chemistry	10
Distributed	Base Plot	Evergreen Forest	Coarse Downed Wood	20
Distributed	Base Plot	Evergreen Forest	Digital Hemispherical Photos for Leaf Area Index	20
Distributed	Base Plot	Evergreen Forest	Herbaceous Biomass	20
Distributed	Base Plot	Evergreen Forest	Plant Diversity	30
Distributed	Base Plot	Evergreen Forest	Soil Biogeochemistry	6
Distributed	Base Plot	Evergreen Forest	Soil Microbes	6
Distributed	Base Plot	Evergreen Forest	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 30: Number of Tower Plots per protocol at RMNP.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Below Ground Biomass Coring	9
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	9
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	3
Tower	Base Plot	Herbaceous Biomass	9
Tower	Base Plot	Litterfall and Fine Woody Debris	9
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Soil Biogeochemistry	4
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	9
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: RMNP

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.

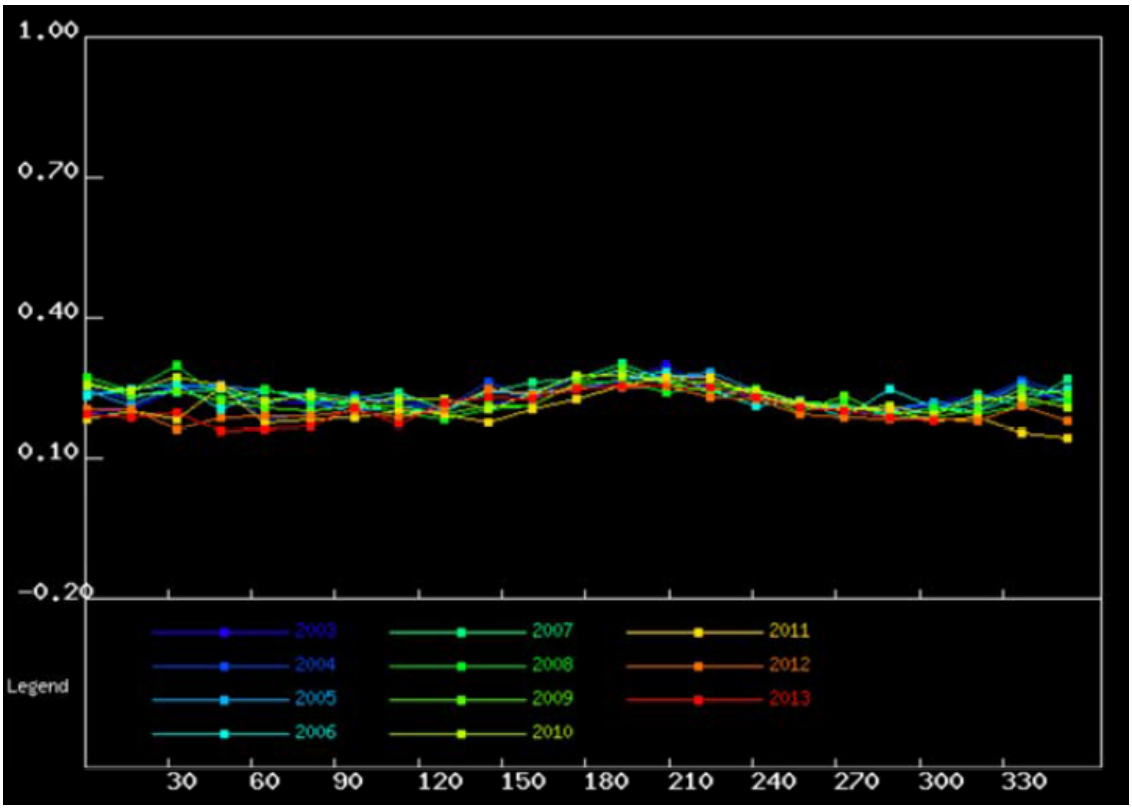

Figure 16: MODIS-EVI greenness (y-axis = EVI ratio) as a function of time (x-axis = DOY) for the years 2003-2013 at the NEON RMNP site.

Table 31: Average MODIS-EVI greenness dates for the NEON RMNP 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)	285 (10/13)

MODIS Product Details

- Product: MODIS-EVI phenology product, 16 day interval, 250 m grid, data included from all pixels with acceptable quality within user-defined square that roughly overlaps the TOS site boundary.
- Date range: 2003-2013
- User selected area: 30.25 km x 30.25 km box, centroid lat: 40.27591, centroid long: -105.54592 (WGS84 datum)

6.3 Belowground Biomass

6.3.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 120 cm by NEON staff in June 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 32: Soil Pit Information at RMNP.

Latitude	Longitude	Soil Family	Soil Order
40.27707	-105.54524	Loamy-skeletal - mixed - superactive Ustic Haplocryolls	Mollisol

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

Table 33: Fine root mass per depth increment (cm) at RMNP.

Upper Depth	Lower Depth	Mean (mg per cm^3)	Std Dev
0	10	3.34	2.42
10	20	0.6	0.05
20	30	0.84	0.42
30	40	0.54	0.2
40	50	0.58	0.73
50	60	0.2	0.15
60	70	0.25	0.26
70	80	0.17	0.21
80	90	0.22	0.36
90	100	0.42	0.71
100	120	0.11	0.14

Table 34: Cumulative fine root mass as a function of depth (cm) at RMNP.

Upper Depth	Lower Depth	Mean Cumulative (g per m^2)	Cumulative Std Dev
0	10	334.04	241.63
10	20	393.87	240.7
20	30	478.3	237.76
30	40	532.6	249.9
40	50	590.84	288.25
50	60	610.52	303.36
60	70	635.25	324.35
70	80	652.26	337.2
80	90	673.91	301.29
90	100	716.01	230.23
100	120	737.18	242.7

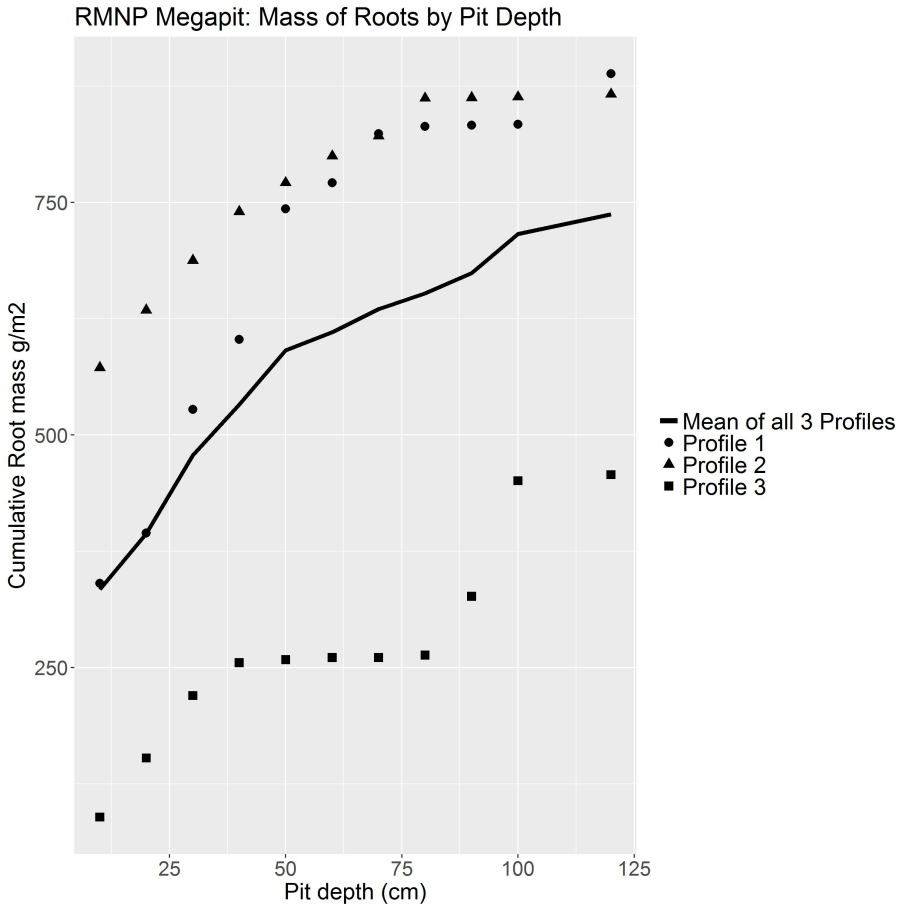

Figure 17: Cumulative root mass by pit depth at RMNP.

Table 35: Fine root biomass sampling summary data at RMNP.

Total Pit Depth (cm)	120
Total Mean Cumulative Mass at 30cm (g per m^2)	478.3
Total Mean Cumulative Mass at 100cm (g per m^2)	716.01
Total Mean Cumulative Mass (g per m^2)	737.18

6.4 Plant Characterization and Phenology Species Selection

6.4.1 Site-Specific Methods

Plant characterization data were collected by NEON staff. Plant diversity data were collected in July and August of 2017 and vegetation structure data were collected in October of 2017. 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.

6.4.2 Results

Table 36: Site plant characterization and phenology species summary at RMNP.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
PICOL	*Pinus contorta* Douglas ex Loudon var. *latifolia* Engelm. ex S. Watson	1	<1	<1	<1
ABLAL	*Abies lasiocarpa* (Hook.) Nutt. var. *lasiocarpa*	2	<1	<1	<1
PSME	*Pseudotsuga menziesii* (Mirb.) Franco	3	<1	<1	<1
JUCOD	*Juniperus communis* L. var. *depressa* Pursh	4	<1	0.01	<1
PIEN	*Picea engelmannii* Parry ex Engelm.	5	<1	<1	<1
POTR5	*Populus tremuloides* Michx.	6	<1	<1	<1
VASC/VAMY2	*Vaccinium scoparium* Leiberg ex Coville / *Vaccinium myrtillus* L. whortleberry	7	<1	<1	<1

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
PIPOS	*Pinus ponderosa* Lawson & C. Lawson var. *scopulorum* Engelm.	8	<1	<1	<1
MARE11	*Mahonia repens* (Lindl.) G. Don	10	<1	<1	<1
CHUM	*Chimaphila umbellata* (L.) W.P.C. Barton	11	<1	<1	<1
CAGE2	*Carex geyeri* Boott	12	<1	<1	<1
PIFL2	*Pinus flexilis* James	13	<1	<1	<1
THDI4	*Thermopsis divaricarpa* A. Nelson	14	<1	<1	<1
LIBO3	*Linnaea borealis* L.	15	<1	<1	<1
ORSE	*Orthilia secunda* (L.) House	16	<1	<1	<1
SOSI3	*Solidago simplex* Kunth	16	<1	<1	<1
ERSP4	*Erigeron speciosus* (Lindl.) DC.	18	<1	<1	<1
ROWO	*Rosa woodsii* Lindl.	19	<1	<1	<1
PINACE	Pinaceae sp.	20	<1	<1	<1
ACGL	*Acer glabrum* Torr.	21	<1	<1	<1
ARCO9	*Arnica cordifolia* Hook.	21	<1	<1	<1
CYPERASPP	Cyperaceae spp.	21	<1	<1	<1
CYPERA	Cyperaceae sp.	24	<1	<1	<1
GABO2	*Galium boreale* L.	24	<1	<1	<1
GOOB2	*Goodyera oblongifolia* Raf.	24	<1	<1	<1
ANTEN	*Antennaria* sp.	27	<1	<1	<1
EREX4	*Erigeron eximius* Greene	27	<1	<1	<1
HIAL2	*Hieracium albiflorum* Hook.	27	<1	<1	<1
MARAA	*Maianthemum racemosum* (L.) Link ssp. *amplexicaule* (Nutt.) LaFrankie	27	<1	<1	<1
POCO	*Poa compressa* L.	27	<1	<1	<1
JAAM	*Jamesia americana* Torr. & A. Gray	32	<1	<1	<1

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m^2 per m^2)	Mean ABH (cm^2 per m^2)
ACMI2	*Achillea millefolium* L.	33	<1	<1	<1
ARLU	*Artemisia ludoviciana* Nutt.	33	<1	<1	<1
BRLA6	*Bromus lanatipes* (Shear) Rydb.	33	<1	<1	<1
CHANC	*Chamerion angustifolium* (L.) Holub ssp. *circumvagum* (Mosquin) Hoch	33	<1	<1	<1
ERCA14	*Erysimum capitatum* (Douglas ex Hook.) Greene	33	<1	<1	<1
LEKI2	*Leucopoa kingii* (S. Watson) W.A. Weber	33	<1	<1	<1
PAFE4	*Packera fendleri* (A. Gray) W.A. Weber & Á. Löve	33	<1	<1	<1
PONEI2	*Poa nemoralis* L. ssp. *interior* (Rydb.) W.A. Weber	33	<1	<1	<1
POPR	*Poa pratensis* L.	33	<1	<1	<1
POARA4	*Potentilla arguta* Pursh ssp. *arguta*	33	<1	<1	<1
PSMO	*Pseudocymopterus montanus* (A. Gray) J.M. Coult. & Rose	33	<1	<1	<1
PYCH	*Pyrola chlorantha* Sw.	33	<1	<1	<1

Note: Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov). *Cyperaceae* sp. most likely includes CAR05 (*Carex rossii*).

Table 37: Per plot breakdown of species richness, diversity, and herbaceous cover at RMNP.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
RMNP_004	11	1.93	66	4.31
RMNP_007	16	2.37	47	2.56
RMNP_010	20	1.57	122	1
RMNP_023	11	1.77	27	0.8

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover	Bryophyte Percent Cover
RMNP_029	11	2.08	24	0.93
Bryophyte Mean				1.92

Note: Percent herbaceous cover was measured by species and then added together to calculate the percent total herbaceous cover for each plot. Due to the location of the primary phenology plot outside of the tower airshed, plant diversity data were collected at five Distributed Base Plots instead of the standard collection at Tower Base Plots. In order to inform which dominant species to select for phenology sampling the Distributed Base Plots that matched the elevation, soil, and vegetation type of the phenology plot were selected.

Site characterization measurements are used to determine which sites will implement the Bryophyte Productivity Protocol. The protocol will occur at sites where bryophyte cover, for which annual growth is not distinguishable, is 20% or greater averaged across all sampled plots. See TOS Protocol and Procedure: Bryophyte Productivity (RD[12]) for more information.

6.5 Beetles

6.5.1 Site-Specific Methods

No beetle site characterization work was done at RMNP. For more information about the methods reference the TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

6.6 Mosquitoes

6.6.1 Site-Specific Methods

No mosquito site characterization work was done at RMNP. For more information about the methods reference the TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

6.7 Ticks

6.7.1 Site-Specific Methods

No tick site characterization work was done at RMNP. For more information about the methods reference the TOS Site Characterization Methods (RD[6]). For more information on this protocol and data product numbers see Appendix A.

6.8 Species Reference Lists

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

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7 REFERENCES

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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 38: 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

Name	Description	Identification Code
Non-herbaceous perennial vegetation structure	Field measurements of individual non-herbaceous perennial plants (e.g. cacti, ferns)	NEON.DOM.SITE.DP1.10045.
Ground beetles sampled from pitfall traps	Taxonomically identified ground beetles and the plots and times from which they were collected.	NEON.DOM.SITE.DP1.10022
Ground beetle sequences DNA barcode	CO1 DNA sequences from select ground beetles	NEON.DOM.SITE.DP1.10020
Mosquitoes sampled from CO2traps	Taxonomically identified mosquitoes and the plots and times from which they were collected	NEON.DOM.SITE.DP1.10043
Mosquito-borne pathogen status	Presence/absence of a pathogen in a single mosquito sample (pool)	NEON.DOM.SITE.DP1.10041
Mosquito sequences DNA barcode	CO1 DNA sequences from select mosquitoes	NEON.DOM.SITE.DP1.10038
Ticks sampled using drag cloths	Abundance and density of ticks collected by drag and/or flag sampling (by species and/or lifestage)	NEON.DOM.SITE.DP1.10093
Tick-borne pathogen status	Presence/absence of a pathogen in each single tick sample	NEON.DOM.SITE.DP1.10092