

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

TOS SITE CHARACTERIZATION REPORT: DOMAIN 10

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<i>Title:</i> TOS Site Characterization Report: D10		<i>Date:</i> 09/29/2016
<i>NEON Doc. #:</i> NEON.DOC.003883	<i>Author:</i> R. Krauss	<i>Revision:</i> A

TABLE OF CONTENTS

1 RELATED DOCUMENTS AND ACRONYMS4

1.1 Applicable Documents 4

1.2 Reference Documents..... 4

1.3 Acronyms 4

2 INTRODUCTION5

3 DOMAIN 10 OVERVIEW- THE CENTRAL PLAINS5

4 CORE SITE- CENTRAL PLAINS EXPERIMENTAL RANGE (CPER)7

4.1 TOS Spatial Sampling Design..... 7

4.2 Belowground Biomass..... 11

4.2.1 Site-Specific Methods 11

4.2.2 Results..... 11

4.3 Plant Characterization and Phenology Species Selection 13

4.3.1 Site-Specific Methods 13

4.3.2 Results..... 13

4.4 Beetles..... 16

4.4.1 Site-Specific Methods 16

4.4.2 Results..... 16

4.5 Mosquitoes 20

4.5.1 Site-Specific Methods 20

4.5.2 Results..... 20

4.6 Ticks..... 22

4.6.1 Site-Specific Methods 22

4.7 Species Reference Lists 22

5 RELOCATABLE SITE 1- NORTH STERLING (STER).....24

5.1 TOS Spatial Sampling Design..... 25

5.2 Belowground Biomass..... 29

5.2.1 Site-Specific Methods 29

5.2.2 Results..... 29

5.3 Plant Characterization and Phenology Species Selection 31

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

5.3.1	Site-Specific Methods	31
5.3.2	Results	31
5.4	Beetles.....	32
5.4.1	Site-Specific Methods	32
5.4.2	Results	32
5.5	Mosquitoes	34
5.5.1	Site-Specific Methods	34
5.5.2	Results	35
5.6	Ticks.....	36
5.6.1	Site-Specific Methods	36
5.7	Species Reference Lists	36
6	REFERENCES	36
7	APPENDIX A: DATA PRODUCT NUMBERS.....	37

LIST OF TABLES AND FIGURES

Table 1.	NLCD Land Cover Classes and Area within the TOS site boundary at CPER.	9
Table 2.	NLCD Land Cover Classes and TOS plot numbers at CPER.	10
Table 3.	Number of Distributed Base Plots per NLCD Land Cover Class per protocol at CPER. Distributed Base Plots typically support more than one TOS protocol; ‘Number of Plots’ cannot be added to get total TOS Distributed Base Plot number.	10
Table 4.	Number of Tower Base Plots per protocol at CPER. Tower Base Plots typically support more than one TOS protocol; ‘Number of Plots’ cannot be added to get total TOS Tower Base Plot number. .	10
Table 5.	Domain 10 CPER fine root mass per depth increment (mg/cm ³)	11
Table 6.	Domain 10 CPER cumulative fine root mass as a function of depth (g/m ²).....	12
Table 7.	Domain 10 CPER fine root biomass sampling summary data.	13
Table 8.	Plant Characterization and Phenology Species Summary at CPER	13
Table 9.	Per Plot Breakdown of Plant Species Richness, Diversity, and Herbaceous Cover at CPER	15
Table 10.	CPER Beetle Trap Locations	16
Table 11.	CPER Beetle (Family Carabidae) Identification Results.....	17
Table 12.	NLCD Land Cover Classes and Area within the TOS site boundary at STER.	27
Table 13.	NLCD Land Cover Classes and TOS plot numbers at STER.	28
Table 14.	Number of distributed base plots per NLCD Land Cover Class per protocol at STER.....	28
Table 15.	Number of tower base plots per protocol at STER.	28
Table 16.	Domain 10 STER fine root mass per depth increment (mg/cm ³).....	29

<i>Title:</i> TOS Site Characterization Report: D10		<i>Date:</i> 09/29/2016
<i>NEON Doc. #:</i> NEON.DOC.003883	<i>Author:</i> R. Krauss	<i>Revision:</i> A

Table 17. Domain 10 STER cumulative fine root mass as a function of depth (g/m²) 30

Table 18. Domain 10 STER fine root biomass sampling summary data 31

Table 19. Per Plot Breakdown of species richness, Diversity, and Herbaceous Cover at STER 31

Table 20. STER Beetle (Family Carabidae) Identification Results 32

Table 21. STER Mosquito Trap Locations..... 35

Table 22. STER Mosquito (Family Culicidae, sub family Culicinae) Identification Results..... 35

Table 23. Data Product Numbers 37

Figure 1. NEON project map with Domain 10 highlighted in red. 5

Figure 2. Site boundaries within Domain 10..... 6

Figure 3. Map of TOS plot locations within the NEON TOS sampling boundary at CPER. 8

Figure 4. Map of the airshed area at CPER. 9

Figure 5. CPER Cumulative Root Mass by Pit Depth 12

Figure 6. Map of TOS plot locations within the NEON TOS sampling boundary at STER. 26

Figure 7. Map of the airshed area at STER. More information about the tower airshed can be found in the FIU site characterization reports (RD[04])..... 27

Figure 8. STER Cumulative Root Mass by Pit Depth 31

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

1 RELATED DOCUMENTS AND ACRONYMS

1.1 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.004316	Operations Field Safety and Security Plan
AD[03]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD[04]	NEON.DOC.000909	TOS Science Design for Ground Beetle Abundance and Diversity
AD[05]	NEON.DOC.000910	TOS Science Design for Mosquito Abundance, Diversity and Phenology
AD[06]	NEON.DOC.000912	TOS Science Design for Plant Diversity
AD[07]	NEON.DOC.000915	TOS Science Design for Small Mammal Abundance and Diversity
AD[08]	NEON.DOC.000914	TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index
AD[09]	NEON.DOC.000001	NEON Observatory Design

1.2 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 D10 Site Characterization Report
RD[05]	NEON.DOC.002056	AIS D10 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 & Diversity

1.3 Acronyms

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

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

2 INTRODUCTION

Information collected and described here is used to inform the execution of protocols for the NEON Terrestrial Observation System (TOS). In addition, the TOS spatial layout and plot allocation are described for each site. This document includes any site-specific characterization methods and the results of characterization efforts for each of the three sites in the Central Plains, NEON Domain 10. For more information about the detailed 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.

3 DOMAIN 10 OVERVIEW- THE CENTRAL PLAINS

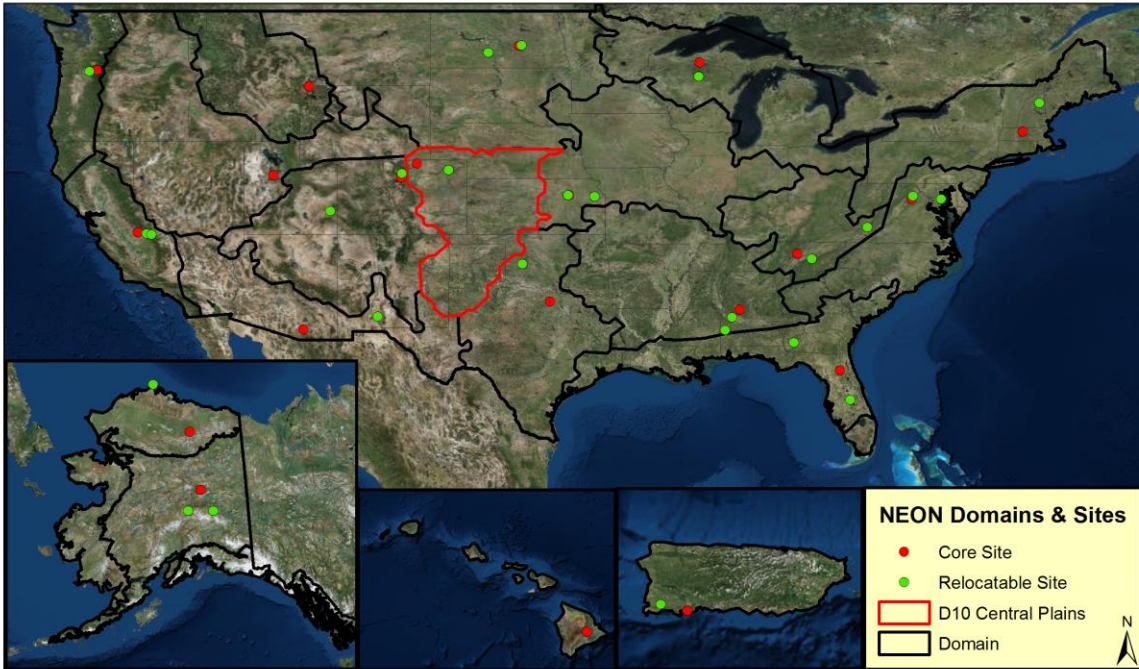


Figure 1. NEON project map with Domain 10 highlighted in red.

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

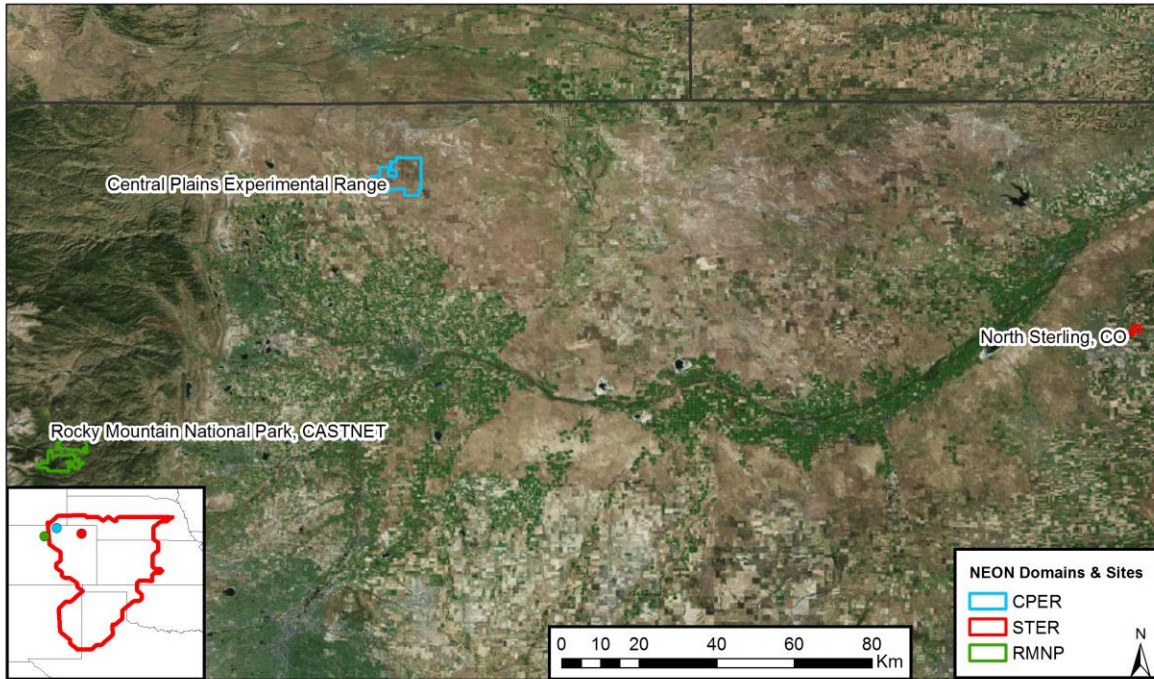


Figure 2. Site boundaries within Domain 10.

The Central Plains Domain is a patchwork of grassland, forest, agricultural, and mountain communities embedded in a matrix that is increasingly dominated by one of the fastest growing human populations on the continent.

- States in the domain: Colorado, Utah, Nevada, Arizona, New Mexico
- Core site: Central Plains Experimental Range (CPER)
- Relocatable 1: North Sterling
- Relocatable 2: Rocky Mountain National Park CASTNET (Clean Air Status and Trends Network)
- Science themes: Agriculture, Climate Impacts

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

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, 19 kilometers northeast of Nunn, Colorado.

As per the Observatory design (AD[09]), NEON collects a standard suite of data at each site, including CPER. Specifically, however, data collected at this site serve as a benchmark for exploring the causes and consequences of environmental change taking place throughout the grasslands of the Central Plains Domain, with results relevant to arid and semi-arid grassland ecosystems worldwide. Overall, the Front Range of Colorado is growing at three times the national average with the population expected to grow 87% between 2010-2050 (Front Range, 2016). Conversion of native vegetation to urban and suburban landscapes drastically alters biological diversity, reduces soil organic matter and alters the temporal and spatial distribution of plant biomass.

Key Characteristics:

- Site Host: U.S. Department of Agriculture, Agriculture Research Service, LTER
- 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. The biotic communities of the Shortgrass steppe ecosystem are well adapted for drought; dominant plant species include the co-dominant graminoids Blue Grama (*Bouteloua gracilis*) and Buffalograss (*Bouteloua dactyloides*), and Plains Prickly-pear cactus (*Opuntia polyacantha*).
- General management: CPER includes 6,300 hectares of undulating rangeland. Large herbivores such as cattle (and, previously, bison), and burrowing animals such as the black-tailed prairie dog (*Cynomys ludovicianus*) play dominant roles in ecosystem function and maintenance. CPER retains most of the features representative of pre-settlement conditions, including large herbivores. CPER is influenced by contemporary land-use practices, such as agriculture and cattle grazing.
- 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 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 plots that are distributed throughout the site according to the spatial design are hereafter referred to as 'Distributed Plots'. TOS

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

plots that are randomly allocated within the airshed of the NEON Terrestrial Instrument System (TIS) tower to collect complementary data are not stratified by NLCD class; these plots are hereafter referred to as ‘Tower Plots’. 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.

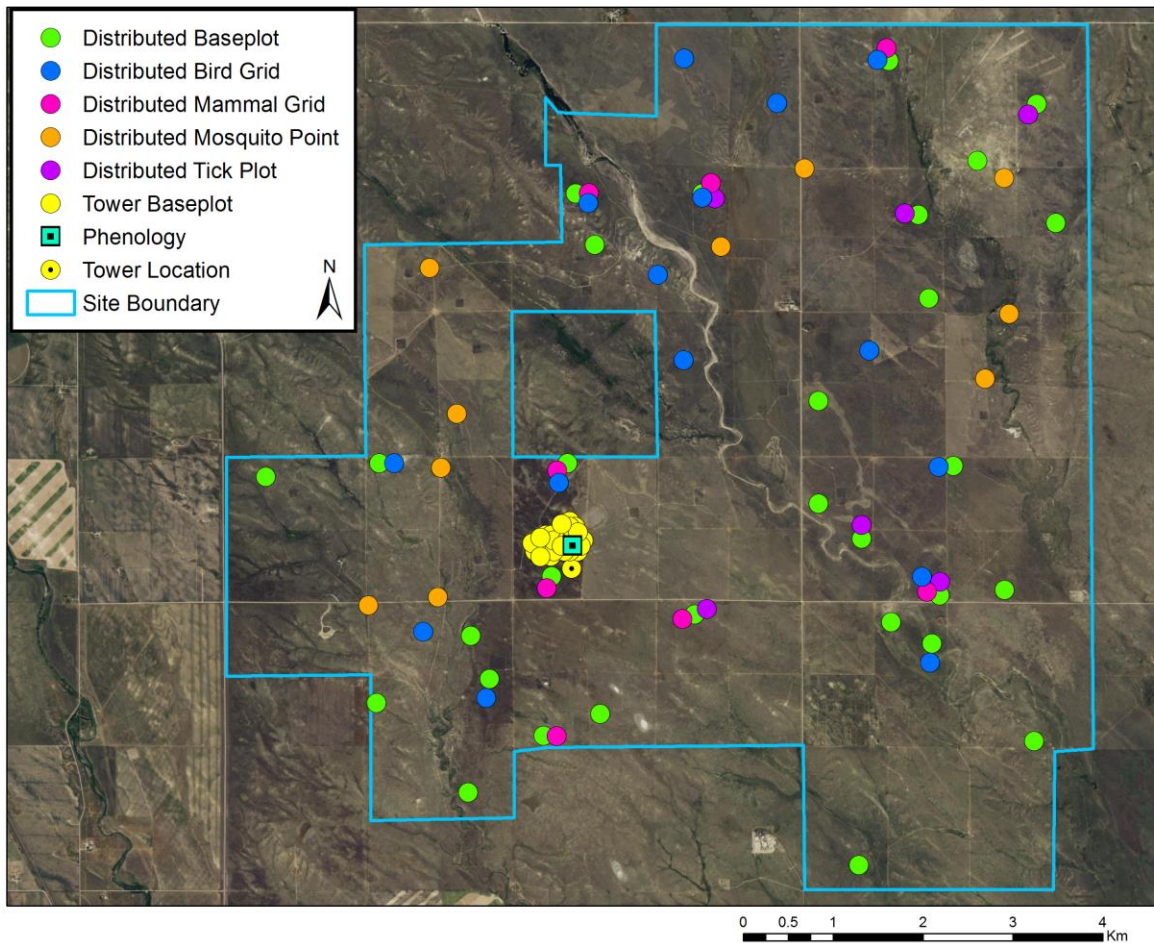


Figure 3. Map of TOS plot locations within the NEON TOS sampling boundary at CPER. See RD[03] for additional information about the sampling that occurs at each plot type.

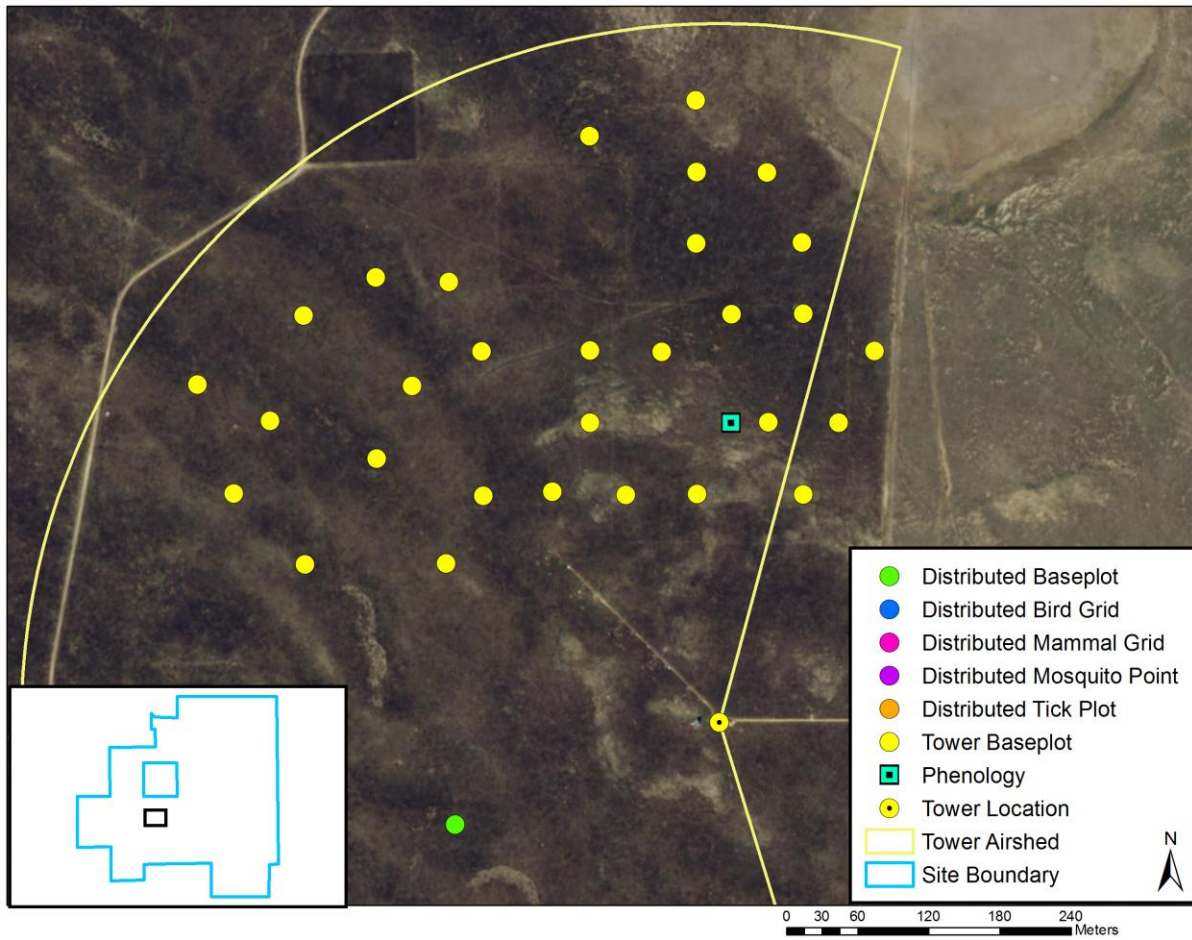


Figure 4. Map of the airshed area at CPER.

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.

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

NLCD Class	Site Area (km ²)	Percent (%)
Open Water	.014	.02
Developed, Open Space	1.29	1.97
Barren Land	.022	.03
Grassland/ Herbaceous	62.67	95.8
Pasture/ Hay	.18	.27
Cultivated Crops	1.24	1.89
Woody Wetlands	.0072	.01

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Table 2. NLCD Land Cover Classes and TOS plot numbers at CPER.

Note: NLCD land cover classes are not used to stratify Tower Plots.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland/ Herbaceous	30
Distributed	Bird Grid	Grassland/ Herbaceous	15
Distributed	Mammal Grid	Grassland/ Herbaceous	8
Distributed	Mosquito Point	Grassland/ Herbaceous	10
Distributed	Tick Plot	Grassland/ Herbaceous	6
Tower	Base Plot	N/A	30
Tower	Phenology	N/A	2

Table 3. Number of Distributed Base Plots per NLCD Land Cover Class per protocol at CPER. Distributed Base Plots typically support more than one TOS protocol; ‘Number of Plots’ cannot be added to get total TOS Distributed Base Plot number.

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

Table 4. Number of Tower Base Plots per protocol at CPER. Tower Base Plots typically support more than one TOS protocol; ‘Number of Plots’ cannot be added to get total TOS Tower Base Plot number.

Plot Type	Plot Subtype	Protocol	Number of Plots
Tower	Base Plot	Below Ground Biomass Coring	30
Tower	Base Plot	Biogeochemistry	4
Tower	Base Plot	Coarse Downed Debris	30
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	30
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Herbaceous Productivity	30
Tower	Base Plot	Litterfall and Fine Woody Debris	30

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Plot Type	Plot Subtype	Protocol	Number of Plots
Tower	Base Plot	Mat-Forming Bryophyte Production	30
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	30

4.2 Belowground Biomass

4.2.1 Site-Specific Methods

Belowground biomass characterization data were collected to a depth of 160 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 30cm, 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 (RD[8]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]), except a 5.08cm diameter bulk density soil corer, soil knife, and drill bit were all used to extract soil and test protocols methods at this site. The tables below summarize the belowground biomass site characterization work; more data and 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.

4.2.2 Results

Table 5. Domain 10 CPER fine root mass per depth increment (mg/cm³)

Upper Depth	Lower Depth	Mean mg/cm ³	mg/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	0.20
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 6. Domain 10 CPER cumulative fine root mass as a function of depth (g/m²)

Upper Depth	Lower Depth	Mean Cumulative g/m ²	Cumulative g/m ² std dev
0	10	105.9	39.4
10	20	235.0	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

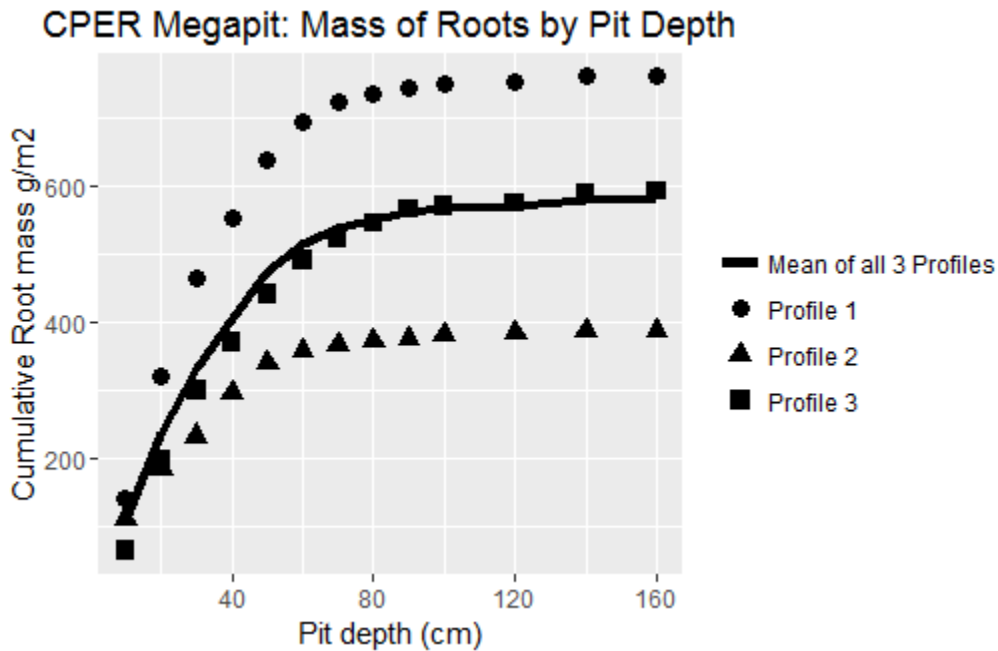


Figure 5. CPER Cumulative Root Mass by Pit Depth

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Table 7. Domain 10 CPER fine root biomass sampling summary data.

Depth of pit	160cm
Total biomass at 30cm (g/m ²)	332.7
Total biomass at 1m (g/m ²)	568.5
Total biomass of pit (g/m ²)	597.9

4.3 Plant Characterization and Phenology Species Selection

4.3.1 Site-Specific Methods

Plant Characterization data were collected by an external contractor. Plant diversity data were collected in July 2013 by NEON technicians. For more information about the methods, reference the TOS Site Characterization Methods (RD[6]). For more information and data product numbers, see Appendix A.

4.3.2 Results

Table 8. Plant Characterization and Phenology Species Summary at CPER

Note: Mean canopy area is collected for shrubs. Mean at breast height (ABH) diameter is collected for trees. Taxon IDs and scientific names are based on the USDA Plants database (plants.usda.gov).

Taxon ID	Scientific Name	Rank	Mean % Cover	Mean Canopy Area (M ²) per M ²	Mean ABH cm ² per M ²
BOGR2	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths	1	22	N/A	N/A
HECO26	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth	2	7	N/A	N/A
THFI	<i>Thelesperma filifolium</i> (Hook.) A. Gray	3	6	N/A	N/A
CAINH2	<i>Carex inops</i> L.H. Bailey ssp. heliophila (Mack.) Crins	4	4	N/A	N/A
BODA2	<i>Bouteloua dactyloides</i> (Nutt.) J.T. Columbus	5	2	N/A	N/A
EREF	<i>Eriogonum effusum</i> Nutt.	6	1	N/A	N/A
SPCR	<i>Sporobolus cryptandrus</i> (Torr.) A. Gray	7	1	N/A	N/A
VUOC	<i>Vulpia octoflora</i> (Walter) Rydb.	8	1	N/A	N/A
OPPO	<i>Opuntia polyacantha</i> Haw.	9	1	N/A	N/A
PASM	<i>Pascopyrum smithii</i> (Rydb.)	10	1	N/A	N/A
ARPUL	<i>Aristida purpurea</i> Nutt. var.	11	<1	N/A	N/A

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Taxon ID	Scientific Name	Rank	Mean % Cover	Mean Canopy Area (M ²) per M ²	Mean ABH cm ² per M ²
	<i>longiseta</i> (Steud.) Vasey				
PSTE5	<i>Psoralidium tenuiflorum</i> (Pursh) Rydb.	12	<1	N/A	N/A
SPCO	<i>Sphaeralcea coccinea</i> (Nutt.) Rydb.	12	<1	N/A	N/A
CRMI5	<i>Cryptantha minima</i> Rydb.	14	<1	N/A	N/A
ELEL5	<i>Elymus elymoides</i> (Raf.) Swezey	15	<1	N/A	N/A
ARFR4	<i>Artemisia frigida</i> Willd.	16	<1	N/A	N/A
GUSA2	<i>Gutierrezia sarothrae</i> (Pursh) Britton & Rusby	17	<1	N/A	N/A
CAFI	<i>Carex filifolia</i> Nutt.	18	<1	N/A	N/A
ERNA10	<i>Ericameria nauseosa</i> (Pall. ex Pursh) G.L. Nesom & Baird	18	<1	N/A	N/A
LIPU	<i>Liatris punctata</i> Hook.	20	<1	N/A	N/A
THME	<i>Thelesperma megapotamicum</i> (Spreng.) Kuntze	20	<1	N/A	N/A
EVNU	<i>Evolvulus nuttallianus</i> Schult.	22	<1	N/A	N/A
MILI3	<i>Mirabilis linearis</i> (Pursh) Heimerl	22	<1	N/A	N/A
PIOP	<i>Picradeniopsis oppositifolia</i> (Nutt.) Rydb. ex Britton	22	<1	N/A	N/A
LYJU	<i>Lygodesmia juncea</i> (Pursh) D. Don ex Hook.	25	<1	N/A	N/A
ASTRA	<i>Astragalus</i> sp.	26	<1	N/A	N/A
CHGE2	<i>Chamaesyce geyeri</i> (Engelm. & A. Gray) Small	27	<1	N/A	N/A
HEVI4	<i>Heterotheca villosa</i> (Pursh) Shinnars	27	<1	N/A	N/A
OENOT	<i>Oenothera</i> sp.	27	<1	N/A	N/A
ALLIU	<i>Allium</i> sp.	30	0	N/A	N/A
ATCA2	<i>Atriplex canescens</i> (Pursh) Nutt.	30	0	N/A	N/A
ECVI2	<i>Echinocereus viridiflorus</i> Engelm.	30	0	N/A	N/A
ESVI2	<i>Escobaria vivipara</i> (Nutt.) Buxbaum	30	0	N/A	N/A
GACO5	<i>Gaura coccinea</i> Nutt. ex Pursh	30	0	N/A	N/A
MAPI	<i>Machaeranthera pinnatifida</i> (Hook.) Shinnars	30	0	N/A	N/A
MUTO2	<i>Muhlenbergia torreyi</i> (Kunth) Hitchc. ex Bush	30	0	N/A	N/A

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Taxon ID	Scientific Name	Rank	Mean % Cover	Mean Canopy Area (M ²) per M ²	Mean ABH cm ² per M ²
PEAL2	<i>Penstemon albidus</i> Nutt.	30	0	N/A	N/A

Table 9. Per Plot Breakdown of Plant Species Richness, Diversity, and Herbaceous Cover at CPER

Plot ID	Species Richness	Shannon Diversity Index	% Total Herbaceous Cover
CPER_045	26	2.95	17
CPER_046	22	2.71	16
CPER_047	35	3.32	22
CPER_048	19	2.78	13
CPER_049	36	3.23	26
CPER_050	31	3.14	21
CPER_051	22	2.92	15
CPER_052	43	3.61	29
CPER_053	28	3.15	21
CPER_054	25	3.00	17
CPER_055	18	2.66	12
CPER_056	25	2.66	24
CPER_057	42	3.59	26
CPER_058	29	3.22	18
CPER_059	32	3.26	22
CPER_060	33	3.11	22
CPER_061	21	2.71	16
CPER_062	20	2.72	15
CPER_063	28	3.19	18
CPER_064	34	3.37	22
CPER_065	34	3.40	22
CPER_066	26	3.00	18
CPER_067	23	2.82	17
CPER_068	22	2.77	16
CPER_069	20	2.82	13
CPER_070	36	3.36	23
CPER_071	23	2.92	15
CPER_072	33	3.14	25

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Plot ID	Species Richness	Shannon Diversity Index	% Total Herbaceous Cover
CPER_073	21	2.74	16
CPER_074	19	2.63	14

4.4 Beetles

4.4.1 Site-Specific Methods

Beetle site characterization was conducted by NEON periodically from 2008-2011 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 NEON technicians. For sequencing data generated as a result of these efforts, visit the Barcode of Life Datasystems (BOLD) <http://www.boldsystems.org/>. For more information and associated data product numbers, see Appendix A.

4.4.2 Results

Table 10. CPER Beetle Trap Locations

Trap Location	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

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Table 11. CPER Beetle (Family Carabidae) Identification Results

BOLD Sample ID	Subfamily name	Species name	Collection date	Trap Location
carabid2405	Harpalinae	<i>Chlaenius tomentosus</i>	6/30/2011	1
carabid2498	Harpalinae	<i>Amara carinata</i>	9/1/2011	1
carabid2423	Harpalinae	<i>Amara convexa</i>	7/14/2011	1
carabid2437	Harpalinae	<i>Cyclotrachelus constrictus</i>	6/3/2011	1
carabid2403	Harpalinae	<i>Chlaenius tomentosus</i>	6/3/2011	1
carabid2491	Harpalinae	<i>Cyclotrachelus constrictus</i>	8/25/2011	1
carabid2446	Harpalinae	<i>Harpalus opacipennis</i>	6/16/2011	1
carabid2393	Harpalinae	<i>Chlaenius tomentosus</i>	6/10/2011	1
carabid2444	Harpalinae	<i>Harpalus opacipennis</i>	7/21/2011	1
carabid2427	Harpalinae	<i>Cyclotrachelus constrictus</i>	6/3/2011	2
carabid2426	Harpalinae	<i>Cyclotrachelus constrictus</i>	6/10/2011	2
carabid2434	Harpalinae	<i>Amara convexa</i>	6/16/2011	2
carabid2421	Harpalinae	unknown	6/16/2011	2
carabid2536	Harpalinae	<i>Harpalus compar</i>	8/4/2011	3
carabid2402	Harpalinae	<i>Harpalus desertus</i>	8/4/2011	3
carabid2438	Harpalinae	<i>Cratacanthus dubius</i>	7/14/2011	3
carabid2412	Cicindelinae	<i>Cicindela punctulata</i>	8/4/2011	3
carabid2497	Harpalinae	<i>Amara obesa</i>	9/1/2011	3
carabid2397	Harpalinae	unknown	6/23/2011	3
carabid2408	Harpalinae	<i>Chlaenius tomentosus</i>	7/29/2011	4
carabid2399	Harpalinae	<i>Cyclotrachelus constrictus</i>	7/15/2011	4
carabid2495	Harpalinae	<i>Cymindis interior</i>	8/26/2011	4
carabid2452	Scaritinae	<i>Pasimachus elongatus</i>	7/15/2011	4
carabid2396	Harpalinae	unknown	6/17/2011	4
carabid2409	Cicindelinae	<i>Cicindela punctulata</i>	7/22/2011	4
carabid2407	Harpalinae	<i>Chlaenius tomentosus</i>	7/22/2011	4
carabid2406	Harpalinae	<i>Chlaenius tomentosus</i>	7/22/2011	4
carabid2424	Harpalinae	<i>Cymindis planipennis</i>	8/12/2011	4
carabid2493	Harpalinae	unknown	9/2/2011	4
carabid2428	Harpalinae	<i>Agonoleptus conjunctus</i>	6/2/2011	5
carabid2445	Harpalinae	<i>Harpalus compar</i>	8/11/2011	5
carabid2442	Harpalinae	<i>Euryderus grossus</i>	7/21/2011	5
carabid2401	unknown	unknown	8/4/2011	5
carabid2451	Harpalinae	<i>Harpalus fuscipalpis</i>	7/14/2011	5
carabid2535	Harpalinae	<i>Harpalus compar</i>	8/11/2011	5
carabid2450	Harpalinae	unknown	7/21/2011	5

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

BOLD Sample ID	Subfamily name	Species name	Collection date	Trap Location
carabid383	Harpalinae	<i>Amara convexa</i>	8/4/2009	6
carabid301	Harpalinae	<i>Euryderus grossus</i>	7/14/2009	6
carabid384	Harpalinae	<i>Harpalus fuscipalpis</i>	8/4/2009	6
carabid1499	Scaritinae	<i>Pasimachus elongatus</i>	7/21/2009	6
carabid547	Harpalinae	<i>Cyclotrachelus constrictus</i>	8/4/2009	6
carabid291	Scaritinae	<i>Pasimachus elongatus</i>	7/14/2009	6
carabid294	Harpalinae	<i>Amara convexa</i>	7/14/2009	6
carabid306	Harpalinae	<i>Amara convexa</i>	7/14/2009	6
carabid544	Harpalinae	<i>Cyclotrachelus constrictus</i>	8/4/2009	6
carabid308	Harpalinae	<i>Amara convexa</i>	7/14/2009	6
carabid1501	Scaritinae	<i>Pasimachus elongatus</i>	8/4/2009	6
carabid549	Harpalinae	<i>Cymindis planipennis</i>	8/4/2009	6
carabid284	Harpalinae	<i>Harpalus fuscipalpis</i>	7/14/2009	6
carabid380	Cicindelinae	<i>Cicindela punctulata</i>	8/4/2009	6
carabid382	Harpalinae	<i>Amara convexa</i>	8/4/2009	6
carabid387	Cicindelinae	<i>Cicindela punctulata</i>	8/4/2009	6
carabid1498	Scaritinae	<i>Pasimachus elongatus</i>	7/21/2009	6
carabid376	Harpalinae	<i>Philophuga caerulea</i>	8/4/2009	6
carabid290	Scaritinae	<i>Pasimachus elongatus</i>	7/14/2009	6
carabid289	Scaritinae	<i>Pasimachus elongatus</i>	7/14/2009	6
carabid293	Scaritinae	<i>Pasimachus elongatus</i>	7/14/2009	6
carabid859	Harpalinae	<i>Cyclotrachelus constrictus</i>	7/28/2009	6
carabid309	Scaritinae	<i>Dyschirius globulosus</i>	7/14/2009	6
carabid548	Harpalinae	<i>Amara convexa</i>	8/4/2009	6
carabid297	Scaritinae	<i>Pasimachus elongatus</i>	7/14/2009	6
carabid1502	Scaritinae	<i>Pasimachus elongatus</i>	7/28/2009	6
carabid388	Harpalinae	<i>Amara convexa</i>	8/4/2009	6
carabid329	Harpalinae	<i>Cymindis interior</i>	8/4/2009	6
carabid1500	Scaritinae	<i>Pasimachus elongatus</i>	8/4/2009	6
carabid563	Harpalinae	<i>Harpalus caliginosus</i>	7/21/2009	6
carabid303	Trechinae	<i>Bembidion rapidum</i>	7/14/2009	6
carabid307	Harpalinae	<i>Harpalus fuscipalpis</i>	7/14/2009	6
carabid566	Harpalinae	<i>Cymindis interior</i>	7/21/2009	6
carabid379	Cicindelinae	<i>Cicindela punctulata</i>	8/4/2009	6
carabid546	Harpalinae	<i>Euryderus grossus</i>	8/4/2009	6
carabid288	Harpalinae	<i>Euryderus grossus</i>	7/14/2009	6
carabid687	Harpalinae	<i>Harpalus compar</i>	7/28/2009	6

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

BOLD Sample ID	Subfamily name	Species name	Collection date	Trap Location
carabid572	Harpalinae	<i>Cyclotrachelus constrictus</i>	7/21/2009	6
carabid310	Harpalinae	<i>Amara obesa</i>	7/14/2009	6
carabid545	Harpalinae	<i>Harpalus compar</i>	8/4/2009	6
carabid573	Harpalinae	<i>Amara convexa</i>	7/21/2009	6
carabid686	Harpalinae	<i>Harpalus caliginosus</i>	7/28/2009	6
carabid2413	Harpalinae	<i>Agonoleptus conjunctus</i>	7/29/2011	7
carabid2447	Harpalinae	<i>Harpalus opacipennis</i>	7/8/2011	7
carabid2456	Scaritinae	<i>Pasimachus elongatus</i>	7/29/2011	7
carabid2492	Harpalinae	<i>Harpalus fraternus</i>	9/2/2011	7
carabid2496	Harpalinae	<i>Cymindis interior</i>	8/26/2011	7
carabid2410	Cicindelinae	<i>Cicindela punctulata</i>	7/29/2011	7
carabid2433	Harpalinae	<i>Discoderus parallelus</i>	7/8/2011	7
carabid2416	Harpalinae	<i>Philophuga viridis</i>	6/16/2011	7
carabid2448	Harpalinae	<i>Harpalus opacipennis</i>	6/10/2011	7
carabid2395	Cicindelinae	<i>Cicindela purpurea</i>	6/16/2011	7
carabid2419	Harpalinae	<i>Euryderus grossus</i>	7/22/2011	7
carabid2430	Harpalinae	<i>Euryderus grossus</i>	7/7/2011	8
carabid2436	Harpalinae	<i>Discoderus parallelus</i>	7/28/2011	8
carabid2429	Harpalinae	<i>Amara convexa</i>	7/7/2011	8
carabid2454	Scaritinae	<i>Pasimachus elongatus</i>	6/3/2011	8
carabid2422	Harpalinae	<i>Cyclotrachelus constrictus</i>	6/3/2011	8
carabid2394	Harpalinae	unknown	6/10/2011	8
carabid2449	Harpalinae	<i>Harpalus desertus</i>	8/11/2011	8
carabid2432	Harpalinae	<i>Agonoleptus conjunctus</i>	6/30/2011	8
carabid2425	Harpalinae	<i>Agonoleptus conjunctus</i>	7/21/2011	8
carabid2415	Harpalinae	<i>Euryderus grossus</i>	8/4/2011	8
carabid2418	Harpalinae	<i>Cyclotrachelus constrictus</i>	7/21/2011	8
carabid2494	Harpalinae	<i>Cymindis planipennis</i>	9/1/2011	9
carabid2455	Scaritinae	<i>Pasimachus elongatus</i>	6/23/2011	9
carabid2500	Harpalinae	<i>Harpalus desertus</i>	9/1/2011	9
carabid2440	Harpalinae	<i>Harpalus fuscipalpis</i>	6/16/2011	9
carabid2441	Harpalinae	<i>Harpalus fuscipalpis</i>	6/10/2011	9
carabid603	Harpalinae	<i>Amara carinata</i>	10/2/2008	10
carabid597	Harpalinae	<i>Harpalus opacipennis</i>	10/2/2008	10
carabid604	Harpalinae	<i>Amara carinata</i>	10/17/2008	10
carabid617	Harpalinae	unknown	10/2/2008	10
carabid613	Harpalinae	unknown	9/29/2008	11

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

BOLD Sample ID	Subfamily name	Species name	Collection date	Trap Location
carabid627	Harpalinae	unknown	9/29/2008	11
carabid624	Harpalinae	unknown	10/17/2008	11
carabid610	Harpalinae	<i>Cymindis planipennis</i>	9/29/2008	11
carabid615	Harpalinae	<i>Cymindis interior</i>	10/17/2008	12
carabid607	Harpalinae	unknown	9/29/2008	12
carabid609	Harpalinae	<i>Cymindis planipennis</i>	10/17/2008	12
carabid2499	Harpalinae	<i>Amara carinata</i>	9/2/2011	13
carabid2443	Harpalinae	<i>Harpalus opacipennis</i>	8/12/2011	13
carabid2400	Harpalinae	unknown	7/15/2011	13
carabid619	Harpalinae	<i>Cymindis planipennis</i>	10/2/2008	14
carabid606	Harpalinae	unknown	10/17/2008	14
carabid622	Harpalinae	unknown	10/17/2008	14
carabid626	Harpalinae	unknown	10/17/2008	14
carabid2435	Harpalinae	<i>Amara convexa</i>	6/10/2011	14
carabid2420	Harpalinae	<i>Euryderus grossus</i>	7/15/2011	14
carabid2398	Harpalinae	<i>Amara obesa</i>	7/1/2011	14
carabid2453	Scaritinae	<i>Pasimachus elongatus</i>	6/16/2011	14
carabid2411	Cicindelinae	<i>Cicindela punctulata</i>	8/12/2011	14
carabid2431	Harpalinae	<i>Amara convexa</i>	6/24/2011	14
carabid2439	Harpalinae	<i>Amara obesa</i>	8/5/2011	14
carabid2537	Harpalinae	<i>Harpalus compar</i>	8/19/2011	14
carabid2414	Harpalinae	<i>Agonoleptus conjunctus</i>	6/16/2011	14
carabid611	Harpalinae	<i>Cymindis planipennis</i>	10/2/2008	15
carabid618	Harpalinae	<i>Cymindis planipennis</i>	10/17/2008	15
carabid621	Harpalinae	unknown	10/2/2008	15

4.5 Mosquitoes

4.5.1 Site-Specific Methods

Mosquito site characterization was conducted by NEON staff from May-July 2011 following standard collection methods (RD[06]) to test protocol methods and start site-level species lists. Mosquitoes collected were sent to a taxonomist for identification. No pathogen testing was conducted. For more information on this protocol and data product numbers see Appendix A.

4.5.2 Results

Table 9. Trap Locations for CPER mosquito site characterization.

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Plot	Latitude	Longitude	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 10. Taxonomic Identifications for CPER mosquito site characterization samples.

Unique ID	Collection Date	Plot	Genus	Species
culicid500001	5/26/2011	BD01	<i>Aedes</i>	<i>vexans</i>
culicid2477	6/7/2011	BD01	<i>Aedes</i>	<i>dorsalis</i>
culicid2472	6/29/2011	BD01	<i>Aedes</i>	<i>melanimon</i>
culicid2488	6/29/2011	BD01	<i>Psorophora</i>	<i>signipennis</i>
culicid2480	6/14/2011	BD03	<i>Aedes</i>	<i>dorsalis</i>
culicid2486	6/14/2011	BD03	<i>Aedes</i>	<i>nigromaculis</i>
culicid2464	6/14/2011	BD03	<i>Culiseta</i>	<i>inornata</i>
culicid2502	7/27/2011	BD04	<i>Aedes</i>	<i>melanimon</i>
culicid2507	7/12/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2508	7/12/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2509	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2510	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2511	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2512	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2514	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2513	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2515	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2516	7/6/2011	BD04	<i>Psorophora</i>	<i>discolor</i>
culicid2469	6/22/2011	BD04	<i>Aedes</i>	<i>dorsalis</i>
culicid2471	6/7/2011	BD04	<i>Aedes</i>	<i>nigromaculis</i>
culicid2463	6/21/2011	BD04	<i>Aedes</i>	<i>nigromaculis</i>
culicid2467	6/29/2011	BD04	<i>Aedes</i>	<i>nigromaculis</i>
culicid2461	6/29/2011	BD04	<i>Aedes</i>	<i>trivittatus</i>

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Unique ID	Collection Date	Plot	Genus	Species
culicid2481	6/29/2011	BD05	<i>Aedes</i>	<i>melanimon</i>
culicid2476	6/15/2011	BD05	<i>Aedes</i>	<i>nigromaculis</i>
culicid2478	6/29/2011	BD05	<i>Aedes</i>	<i>vexans</i>
culicid2505	7/12/2011	BD06	<i>Aedes</i>	<i>trivittatus</i>
culicid2485	6/15/2011	BD06	<i>Aedes</i>	<i>dorsalis</i>
culicid2458	6/29/2011	BD06	<i>Aedes</i>	<i>melanimon</i>
culicid2462	6/29/2011	BD06	<i>Aedes</i>	<i>melanimon</i>
culicid2482	6/29/2011	BD06	<i>Culex</i>	<i>tarsalis</i>
culicid2489	6/29/2011	BD07	<i>Psorophora</i>	<i>signipennis</i>
culicid2501	7/12/2011	BD07	<i>Aedes</i>	<i>melanimon</i>
culicid2465	6/22/2011	BD07	<i>Aedes</i>	<i>nigromaculis</i>
culicid2470	6/29/2011	BD08	<i>Aedes</i>	<i>melanimon</i>
culicid2474	6/29/2011	BD08	<i>Aedes</i>	<i>melanimon</i>
culicid2466	6/7/2011	BD08	<i>Aedes</i>	<i>nigromaculis</i>
culicid2473	6/7/2011	BD08	<i>Aedes</i>	<i>vexans</i>
culicid2483	6/29/2011	BD08	<i>Culex</i>	<i>tarsalis</i>
culicid2460	5/24/2011	BD08	<i>Culiseta</i>	<i>inornata</i>
culicid2503	7/27/2011	BD09	<i>Aedes</i>	<i>melanimon</i>
culicid2459	6/28/2011	BD09	<i>Aedes</i>	<i>nigromaculis</i>
culicid2490	6/22/2011	BD11	<i>Psorophora</i>	<i>signipennis</i>
culicid2475	6/29/2011	BD11	<i>Aedes</i>	<i>nigromaculis</i>
culicid2457	6/7/2011	BD11	<i>Aedes</i>	<i>vexans</i>
culicid2504	7/26/2011	BD20	<i>Aedes</i>	<i>melanimon</i>
culicid2506	7/27/2011	BD20	<i>Aedes</i>	<i>trivittatus</i>
culicid2484	6/29/2011	BD20	<i>Aedes</i>	<i>dorsalis</i>
culicid2479	6/14/2011	BD20	<i>Aedes</i>	<i>nigromaculis</i>
culicid2468	6/14/2011	BD20	<i>Culex</i>	<i>tarsalis</i>
culicid2487	6/29/2011	BD20	<i>Culiseta</i>	<i>inornata</i>

4.6 Ticks

4.6.1 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.

4.7 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., herptiles, small mammals), these lists were

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

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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Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

5 RELOCATABLE SITE 1- NORTH STERLING (STER)

The North Sterling site, located outside of the town of Sterling in Northeastern Colorado, is characterized by flat terrain and represents an agronomic site within urban and formerly urban areas.

This site provides a baseline understanding of the regional effects of climate change and chemical climate, including dust and Front Range pollution, to understand and contrast ecological process with other within- and cross-domain analyses. NEON collects a standard suite of data at North Sterling; however, data from this particular location provides a baseline for evaluating changes due to invasive species and infectious disease along a rural wildland, suburban fringe, urban gradient in time or space. Overall, the Front Range of Colorado is growing at three times the national average with the population expected to grow 87% between 2010-2050 (Front Range, 2016). This relocatable site is designed to represent economic and agronomic decisions typically found in farming practices in eastern Colorado, which is a shifting agricultural site in Domain 10.

Key Characteristics:

- Site Host: Private land owner
- Logan County, Colorado
- Area: 3.23 km²
- Elevation: 1,350-1,370m
- Site Vegetation: 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. Cropping systems under no-till management were initiated in 1985. These systems included:
 - Winter wheat (*Triticum aestivum* L.)-fallow
 - Winter wheat-maize (*Zea mays* L.)-fallow
 - Winter wheat-maize-proso millet (*Panicum miliaceum* L.)-fallow
 - Continuous cropping (crops grown over the years included maize, sorghum, winter wheat, forage millet, and sunflower)
 - Perennial grass
 - Grass stands were established in the spring of 1986 and contain a mixture of perennial species including warm and cool season grasses.
- 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 in the catena.

<i>Title:</i> TOS Site Characterization Report: D10		<i>Date:</i> 09/29/2016
<i>NEON Doc. #:</i> NEON.DOC.003883	<i>Author:</i> R. Krauss	<i>Revision:</i> A

- 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 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 plots that are distributed throughout the site according to the spatial design are hereafter referred to as ‘Distributed Plots’. TOS plots that are randomly allocated within the airshed of the NEON Terrestrial Instrument System (TIS) tower to collect complementary data are not stratified by NLCD class; these plots are hereafter referred to as ‘Tower Plots’. 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.

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

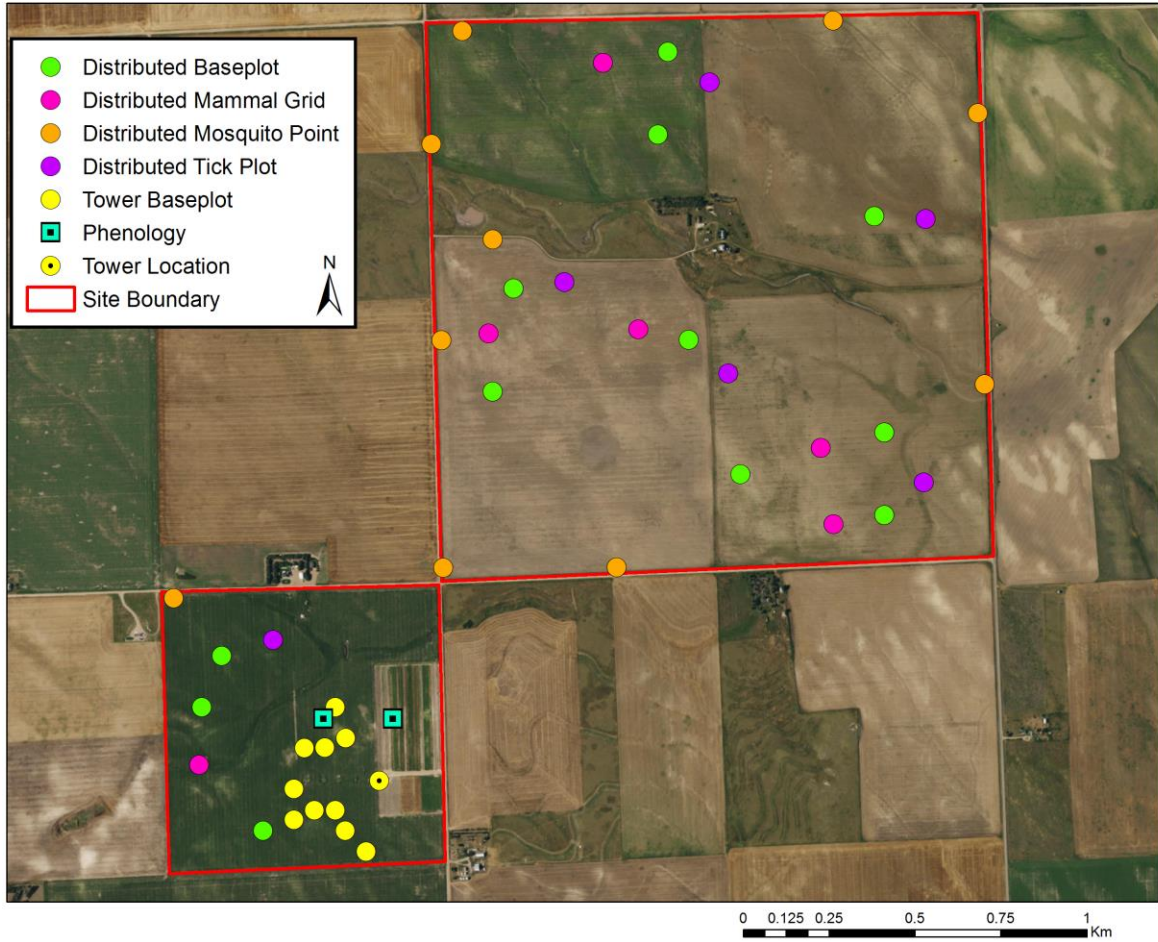


Figure 6. Map of TOS plot locations within the NEON TOS sampling boundary at STER.

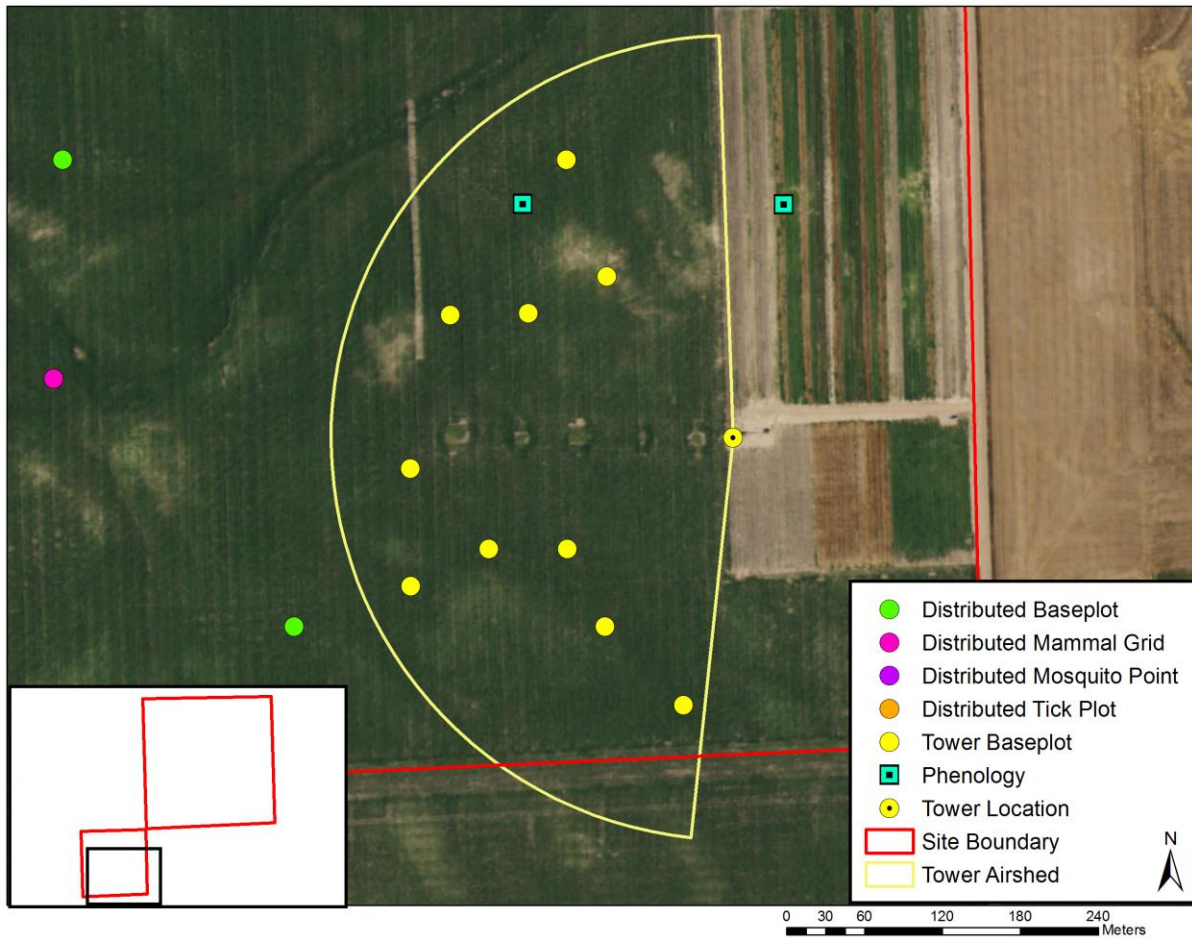


Figure 7. Map of the airshed area at STER. More information about the tower airshed can be found in the FIU site characterization reports (RD[04])

Table 12. NLCD Land Cover Classes and Area within the TOS site boundary at STER.

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

NLCD Class	Site Area (km ²)	Percent
Cultivated Crops	2.77	85.53
Grassland/ Herbaceous	.287	8.86
Developed, Open Space	.173	5.33

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

NLCD Class	Site Area (km ²)	Percent
Developed, Low Intensity	.002	.06
Deciduous Forest	.007	.22

Table 13. NLCD Land Cover Classes and TOS plot numbers at STER.

Note: NLCD land cover classes as not used to stratify tower plots

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Cultivated Crops	12
Distributed	Bird Points	Cultivated Crops	12
Distributed	Mammal Grid	Cultivated Crops	6
Distributed	Mosquito Point	Cultivated Crops	10
Distributed	Tick Plot	Cultivated Crops	6
Tower	Base Plot	N/A	10
Tower	Phenology	N/A	2

Table 14. Number of distributed base plots per NLCD Land Cover Class per protocol at STER.

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

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

Table 15. Number of tower base plots per protocol at STER.

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

Plot Type	Plot Subtype	Protocol	Number of Plots
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Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Tower	Base Plot	Below Ground Biomass Coring	10
Tower	Base Plot	Biogeochemistry	4
Tower	Base Plot	Coarse Downed Debris	10
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	10
Tower	Base Plot	Plant Diversity	3
Tower	Base Plot	Herbaceous Productivity	10
Tower	Base Plot	Litterfall and Fine Woody Debris	10
Tower	Base Plot	Mat-Forming Bryophyte Production	10
Tower	Base Plot	Soil Microbes	4
Tower	Base Plot	Vegetation Structure	10

5.2 Belowground Biomass

5.2.1 Site-Specific Methods

Belowground biomass characterization data was collected down to 160 cm by NEON staff in August 2013. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30cm, 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 (RD[8]) for more information. The tables below summarize the belowground biomass site characterization work and more data and information can be found by searching the data product numbers in Appendix A. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]) except a 5.08cm diameter bulk density soil corer and soil knife was used to extract soil to test out protocols methods. The tables below summarize the belowground biomass site characterization work and more data and information can be found by searching the data product numbers in Appendix A.

5.2.2 Results

Table 16. Domain 10 STER fine root mass per depth increment (mg/cm³)

Upper Depth	Lower Depth	Average Mass per Increment mg/cm ³	Standard Deviation
0	10	0.097	0.048
10	20	0.059	0.041
20	30	0.064	0.022
30	40	0.046	0.023
40	50	0.011	0.002
50	60	0.02	0.006
60	70	0.04	0.041

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Upper Depth	Lower Depth	Average Mass per Increment mg/cm ³	Standard Deviation
70	80	0.03	0.020
80	90	0.03	0.035
90	100	0.01	0.009
100	120	<0.01	0.005
120	140	<0.01	0.0003
140	160	<0.01	0.0005

Table 17. Domain 10 STER cumulative fine root mass as a function of depth (g/m²)

Upper Depth	Lower Depth	Average Mass per Increment g/ m ²	Standard Deviation
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	17.23
80	90	39.60	20.45
90	100	40.77	21.23
100	120	42.14	22.26
120	140	42.36	22.19
140	160	42.52	22.12

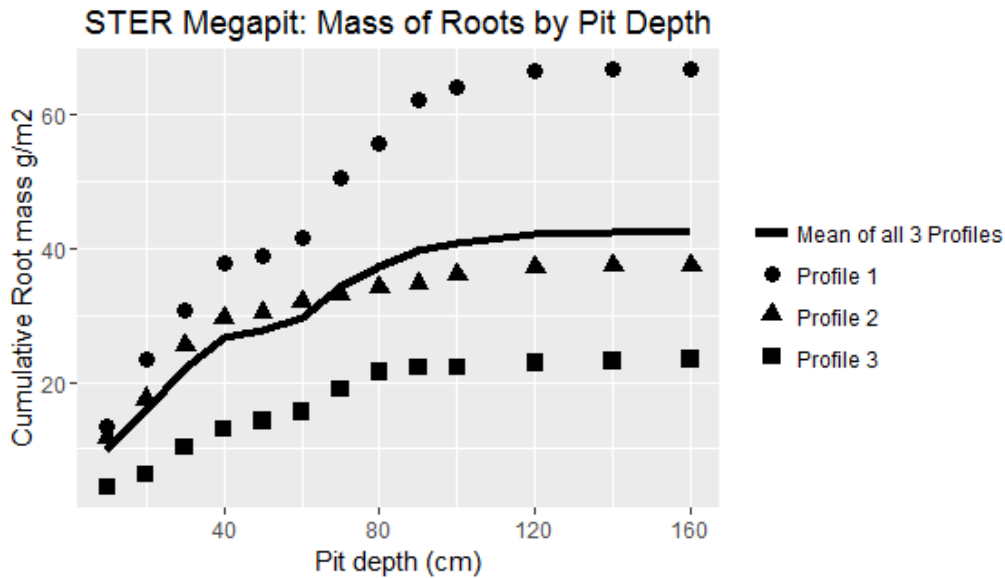


Figure 8. STER Cumulative Root Mass by Pit Depth

Table 18. Domain 10 STER fine root biomass sampling summary data

Total Pit Depth	160 cm
Total Cumulative Mass at 30cm (g/m ²)	22.125
Total Cumulative Mass at 100cm (g/m ²)	40.77
Total Cumulative Mass (g/m ²)	42.52

5.3 Plant Characterization and Phenology Species Selection

5.3.1 Site-Specific Methods

Since STER is an agriculture site, plant characterization data were not collected. Plant diversity data were collected in July 2013 by NEON technicians. 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.

5.3.2 Results

Table 19. Per Plot Breakdown of species richness, Diversity, and Herbaceous Cover at STER

Plot ID	Species Richness	Shannon Diversity Index	% Total Herbaceous Cover
STER_001	17	2.67	10
STER_003	17	2.00	19

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

Plot ID	Species Richness	Shannon Diversity Index	% Total Herbaceous Cover
STER_004	16	2.48	12
STER_005	24	3.04	13
STER_006	13	2.32	9

5.4 Beetles

5.4.1 Site-Specific Methods

Beetle site characterization was done at STER in August of 2009 following standard methods referenced in TOS Site Characterization Methods (RD[6]). Beetle site characterization data was collected to start site level teaching collections. Specimens were pooled before being sent to a taxonomist. For sequencing information visit BOLD (<http://www.boldsystems.org/>). For more information on this protocol and data product numbers see Appendix A.

5.4.2 Results

Table 20. STER Beetle (Family Carabidae) Identification Results

BOLD Sample ID	Subfamily name	Species name	Collection date
NEONTcarabid673	Scaritinae	<i>Pasimachus elongatus</i>	8/24/2009
NEONTcarabid672	Trechinae	<i>Elaphropus anceps</i>	8/17/2009
NEONTcarabid864	Harpalinae	<i>Poecilus scitulus</i>	8/17/2009
NEONTcarabid110	Harpalinae	<i>Cyclotrachelus torvus</i>	8/31/2009
NEONTcarabid863	Harpalinae	<i>Poecilus scitulus</i>	8/17/2009
NEONTcarabid683	Harpalinae	<i>Cratacanthus dubius</i>	8/17/2009
NEONTcarabid50	Harpalinae	<i>Harpalus amputatus</i>	8/31/2009
NEONTcarabid678	Harpalinae	<i>Anisodactylus rusticus</i>	8/17/2009
NEONTcarabid693	Harpalinae	<i>Agonum placidum</i>	8/24/2009
NEONTcarabid34	Harpalinae	<i>Cyclotrachelus torvus</i>	8/31/2009
NEONTcarabid145	Harpalinae	<i>Poecilus scitulus</i>	8/31/2009
NEONTcarabid524	Harpalinae	<i>Cratacanthus dubius</i>	8/24/2009
NEONTcarabid698	Harpalinae	<i>Cymindis interior</i>	8/24/2009
NEONTcarabid330	Harpalinae	<i>Harpalus opacipennis</i>	8/31/2009
NEONTcarabid677	Harpalinae	<i>Anisodactylus rusticus</i>	8/17/2009
NEONTcarabid73	Harpalinae	<i>Harpalus reversus</i>	8/31/2009
NEONTcarabid125	Harpalinae	<i>Harpalus reversus</i>	8/31/2009
NEONTcarabid675	Scaritinae	<i>Pasimachus elongatus</i>	8/24/2009

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

BOLD Sample ID	Subfamily name	Species name	Collection date
NEONTcarabid144	Harpalinae	<i>Harpalus pensylvanicus</i>	8/31/2009
NEONTcarabid340	Harpalinae	<i>Amara latior</i>	8/31/2009
NEONTcarabid688	Harpalinae	<i>Harpalus pensylvanicus</i>	8/17/2009
NEONTcarabid119	Harpalinae	<i>Anisodactylus carbonarius</i>	8/31/2009
NEONTcarabid680	Harpalinae	<i>Cratacanthus dubius</i>	8/17/2009
NEONTcarabid342	Harpalinae	<i>Amara latior</i>	8/31/2009
NEONTcarabid866	Harpalinae	<i>Poecilus scitulus</i>	8/17/2009
NEONTcarabid684	Harpalinae	<i>Cratacanthus dubius</i>	8/17/2009
NEONTcarabid875	Harpalinae	<i>Amara carinata</i>	8/24/2009
NEONTcarabid676	Scaritinae	<i>Pasimachus elongatus</i>	8/17/2009
NEONTcarabid860	Harpalinae	<i>Cyclotrachelus constrictus</i>	8/24/2009
NEONTcarabid533	Scaritinae	<i>Pasimachus elongatus</i>	8/24/2009
NEONTcarabid689	Harpalinae	<i>Harpalus pensylvanicus</i>	8/17/2009
NEONTcarabid344	Harpalinae	<i>Amara latior</i>	8/31/2009
NEONTcarabid35	Harpalinae	<i>Harpalus amputatus</i>	8/31/2009
NEONTcarabid106	Harpalinae	<i>Cyclotrachelus torvus</i>	8/31/2009
NEONTcarabid446	Harpalinae	<i>Agonum placidum</i>	8/24/2009
NEONTcarabid538	Cicindelinae	<i>Cicindela punctulata</i>	8/24/2009
NEONTcarabid77	Scaritinae	<i>Pasimachus elongatus</i>	8/31/2009
NEONTcarabid111	Harpalinae	<i>Cyclotrachelus torvus</i>	8/31/2009
NEONTcarabid679	Harpalinae	<i>Anisodactylus sp. 1</i>	8/17/2009
NEONTcarabid118	Harpalinae	<i>Poecilus scitulus</i>	8/31/2009
NEONTcarabid155	Harpalinae	<i>Poecilus scitulus</i>	8/31/2009
NEONTcarabid173	Harpalinae	<i>Cyclotrachelus torvus</i>	8/31/2009
NEONTcarabid674	Scaritinae	<i>Pasimachus elongatus</i>	8/17/2009
NEONTcarabid395	Cicindelinae	<i>Cicindela punctulata</i>	8/24/2009
NEONTcarabid512	Cicindelinae	<i>Cicindela punctulata</i>	8/24/2009
NEONTcarabid121	Harpalinae	<i>Harpalus amputatus</i>	8/31/2009
NEONTcarabid879	Harpalinae	<i>Amara sp. 1</i>	8/17/2009
NEONTcarabid59	Harpalinae	<i>Amara carinata</i>	8/31/2009
NEONTcarabid149	Harpalinae	<i>Harpalus amputatus</i>	8/31/2009
NEONTcarabid177	Harpalinae	<i>Poecilus scitulus</i>	8/31/2009
NEONTcarabid135	Harpalinae	<i>Amara carinata</i>	8/31/2009
NEONTcarabid861	Harpalinae	<i>Poecilus lucublandus</i>	8/24/2009
NEONTcarabid28	Harpalinae	<i>Amara carinata</i>	8/31/2009
NEONTcarabid17	Trechinae	<i>Bembidion rapidum</i>	8/31/2009
NEONTcarabid410	Harpalinae	<i>Cratacanthus dubius</i>	8/24/2009

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

BOLD Sample ID	Subfamily name	Species name	Collection date
NEONTcarabid692	Harpalinae	<i>Agonum placidum</i>	8/24/2009
NEONTcarabid409	Harpalinae	<i>Cratacanthus dubius</i>	8/24/2009
NEONTcarabid682	Harpalinae	<i>Cratacanthus dubius</i>	8/24/2009
NEONTcarabid30	Harpalinae	<i>Anisodactylus carbonarius</i>	8/31/2009
NEONTcarabid72	Harpalinae	<i>Harpalus amputatus</i>	8/31/2009
NEONTcarabid100	Harpalinae	<i>Harpalus reversus</i>	8/31/2009
NEONTcarabid146	Harpalinae	<i>Harpalus pensylvanicus</i>	8/31/2009
NEONTcarabid92	Harpalinae	<i>Amara carinata</i>	8/31/2009
NEONTcarabid27	Harpalinae	<i>Amara carinata</i>	8/31/2009
NEONTcarabid690	Harpalinae	<i>Harpalus reversus</i>	8/17/2009
NEONTcarabid542	Harpalinae	<i>Poecilus lucublandus</i>	8/24/2009
NEONTcarabid876	Harpalinae	<i>Amara latior</i>	8/17/2009
NEONTcarabid874	Harpalinae	<i>Amara carinata</i>	8/17/2009
NEONTcarabid58	Harpalinae	<i>Harpalus pensylvanicus</i>	8/31/2009
NEONTcarabid685	Harpalinae	<i>Harpalus caliginosus</i>	8/17/2009
NEONTcarabid1	Harpalinae	<i>Agonoleptus conjunctus</i>	8/31/2009
NEONTcarabid126	Harpalinae	<i>Amara latior</i>	8/31/2009
NEONTcarabid78	Scaritinae	<i>Pasimachus elongatus</i>	8/31/2009
NEONTcarabid416	Harpalinae	<i>Harpalus caliginosus</i>	8/24/2009
NEONTcarabid539	Harpalinae	<i>Poecilus lucublandus</i>	8/24/2009
NEONTcarabid862	Harpalinae	<i>Poecilus scitulus</i>	8/17/2009
NEONTcarabid64	Harpalinae	<i>Poecilus scitulus</i>	8/31/2009
NEONTcarabid1496	Harpalinae	<i>Galerita janus</i>	8/17/2009
NEONTcarabid1495	Harpalinae	<i>Harpalus sp. 2</i>	8/17/2009
NEONTcarabid88	Harpalinae	<i>Harpalus reversus</i>	8/31/2009
NEONTcarabid691	Harpalinae	<i>Agonum placidum</i>	8/17/2009

5.5 Mosquitoes

5.5.1 Site-Specific Methods

Mosquito site characterization work was done at Sterling in August 2009 following standard methods outlined in the TOS Site Characterization Methods (RD[6]) to test protocol methods and start site level species lists. No pathogen testing was conducted. For sequencing information visit <http://www.boldsystems.org/>. For more information on this protocol and data product numbers see Appendix A.

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

5.5.2 Results

Table 21. STER Mosquito Trap Locations

Trap Location	lat	long
1	40.462	-103.029
2	40.464	-103.028
3	40.462	-103.027

Table 22. STER Mosquito (Family Culicidae, sub family Culicinae) Identification Results

Sample ID	Species name	Collection date	Trap Location
NEONTculicid855	<i>Psorophora signipennis</i>	8/14/2009	1
NEONTculicid854	<i>Psorophora signipennis</i>	8/14/2009	1
NEONTculicid852	<i>Aedes dorsalis</i>	8/14/2009	1
NEONTculicid856	<i>Aedes vexans</i>	8/14/2009	1
NEONTculicid853	<i>Aedes trivittatus</i>	8/14/2009	1
NEONTculicid857	<i>Aedes vexans</i>	8/14/2009	2
NEONTculicid766	<i>Psorophora signipennis</i>	8/14/2009	2
NEONTculicid763	<i>Aedes trivittatus</i>	8/14/2009	2
NEONTculicid765	<i>Psorophora signipennis</i>	8/14/2009	2
NEONTculicid764	<i>Aedes trivittatus</i>	8/14/2009	2
NEONTculicid858	<i>Aedes dorsalis</i>	8/14/2009	2
NEONTculicid850	<i>Aedes trivittatus</i>	8/14/2009	3
NEONTculicid848	<i>Culex tarsalis</i>	8/14/2009	3
NEONTculicid845	<i>Aedes nigromaculis</i>	8/14/2009	3
NEONTculicid846	<i>Aedes nigromaculis</i>	8/14/2009	3
NEONTculicid847	<i>Culex tarsalis</i>	8/14/2009	3
NEONTculicid767	<i>Aedes dorsalis</i>	8/14/2009	3
NEONTculicid840	<i>Aedes dorsalis</i>	8/14/2009	3
NEONTculicid841	<i>Aedes dorsalis</i>	8/14/2009	3
NEONTculicid844	<i>Aedes nigromaculis</i>	8/14/2009	3
NEONTculicid839	<i>Aedes vexans</i>	8/14/2009	3
NEONTculicid849	<i>Culex tarsalis</i>	8/14/2009	3
NEONTculicid842	<i>Aedes nigromaculis</i>	8/14/2009	3
NEONTculicid768	<i>Aedes trivittatus</i>	8/14/2009	3
NEONTculicid851	<i>Psorophora signipennis</i>	8/14/2009	3
NEONTculicid843	<i>Aedes nigromaculis</i>	8/14/2009	3

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

5.6 Ticks

5.6.1 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.

5.7 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., herptiles, 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.

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).

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

6 REFERENCES

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

“Front Range”. *America 2050*. Regional Plan Association. (http://www.america2050.org/front_range.html, 28 July 2016).

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

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

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 23. Data Product Numbers

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-m ² and plant species presence at 10-m ² , 100-m ² and 400-m ²	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

Title: TOS Site Characterization Report: D10		Date: 09/29/2016
NEON Doc. #: NEON.DOC.003883	Author: R. Krauss	Revision: A

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