

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

## TOS SITE CHARACTERIZATION REPORT: DOMAIN 09

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## CHANGE RECORD

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## TABLE OF CONTENTS

<b>1</b>	<b>DESCRIPTION</b>	<b>1</b>
1.1	Purpose . . . . .	1
1.2	Scope . . . . .	1
<b>2</b>	<b>RELATED DOCUMENTS AND ACRONYMS</b>	<b>1</b>
2.1	Applicable Documents . . . . .	1
2.2	Reference Documents . . . . .	1
2.3	Acronyms . . . . .	2
<b>3</b>	<b>DOMAIN 09 OVERVIEW: NORTHERN PLAINS DOMAIN</b>	<b>3</b>
<b>4</b>	<b>CORE SITE- WOODWORTH (WOOD)</b>	<b>5</b>
4.1	TOS Spatial Sampling Design . . . . .	5
4.2	Belowground Biomass . . . . .	9
4.2.1	Site-Specific Methods . . . . .	9
4.2.2	Results . . . . .	10
4.3	Plant Characterization and Phenology Species Selection . . . . .	12
4.3.1	Site-Specific Methods . . . . .	12
4.3.2	Results . . . . .	12
4.4	Beetles . . . . .	16
4.4.1	Site-Specific Methods . . . . .	16
4.4.2	Results . . . . .	16
4.5	Mosquitoes . . . . .	17
4.5.1	Site-Specific Methods . . . . .	17
4.6	Ticks . . . . .	17
4.6.1	Site-Specific Methods . . . . .	17
4.7	Species Reference Lists . . . . .	17

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

<b>5</b>	<b>RELOCATABLE SITE 1- DAKOTA COTEAU FIELD SCHOOL (DCFS)</b>	<b>19</b>
5.1	TOS Spatial Sampling Design . . . . .	19
5.2	Belowground Biomass . . . . .	23
5.2.1	Site-Specific Methods . . . . .	23
5.2.2	Results . . . . .	23
5.3	Plant Characterization and Phenology Species Selection . . . . .	25
5.3.1	Site-Specific Methods . . . . .	25
5.3.2	Results . . . . .	26
5.4	Beetles . . . . .	34
5.4.1	Site-Specific Methods . . . . .	34
5.4.2	Results . . . . .	34
5.5	Mosquitoes . . . . .	36
5.5.1	Site-Specific Methods . . . . .	36
5.6	Ticks . . . . .	36
5.6.1	Site-Specific Methods . . . . .	36
5.7	Species Reference Lists . . . . .	36
<b>6</b>	<b>RELOCATABLE SITE 2- NORTHERN GREAT PLAINS RESEARCH LABORATORY (NOGP)</b>	<b>37</b>
6.1	TOS Spatial Sampling Design . . . . .	37
6.2	Belowground Biomass . . . . .	41
6.2.1	Site-Specific Methods . . . . .	41
6.2.2	Results . . . . .	41
6.3	Plant Characterization and Phenology Species Selection . . . . .	43
6.3.1	Site-Specific Methods . . . . .	43
6.3.2	Results . . . . .	44
6.4	Beetles . . . . .	50
6.4.1	Site-Specific Methods . . . . .	50
6.4.2	Results . . . . .	50
6.5	Mosquitoes . . . . .	50
6.5.1	Site-Specific Methods . . . . .	50
6.5.2	Results . . . . .	50
6.6	Ticks . . . . .	51

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

6.6.1	Site-Specific Methods . . . . .	51
6.6.2	Results . . . . .	51
6.7	Species Reference Lists . . . . .	51
<b>7</b>	<b>REFERENCES</b>	<b>52</b>
<b>8</b>	<b>APPENDIX A: DATA PRODUCT NUMBERS</b>	<b>52</b>

## LIST OF TABLES AND FIGURES

Table 1	NLCD land cover classes and area within the TOS site boundary at WOOD. . . . .	7
Table 2	NLCD land cover classes and TOS plot numbers at WOOD. . . . .	8
Table 3	Number of Distributed Base Plots per NLCD land cover class per protocol at WOOD. . . . .	8
Table 4	Number of Tower Plots per protocol at WOOD. . . . .	9
Table 5	Fine root mass per depth increment (cm) at WOOD. . . . .	10
Table 6	Cumulative fine root mass as a function of depth (cm) at WOOD. . . . .	10
Table 7	Fine root biomass sampling summary data at WOOD. . . . .	12
Table 8	Site plant characterization and phenology species summary at WOOD. . . . .	12
Table 9	Per plot breakdown of species richness, diversity, and herbaceous cover at WOOD. . . . .	15
Table 10	Beetle identification results at WOOD. . . . .	16
Table 11	NLCD land cover classes and area within the TOS site boundary at DCFS. . . . .	21
Table 12	NLCD land cover classes and TOS plot numbers at DCFS. . . . .	22
Table 13	Number of Distributed Base plots per NLCD land cover class per protocol at DCFS. . . . .	22
Table 14	Number of Tower Plots per protocol at DCFS. . . . .	22
Table 15	Fine root mass per depth increment (cm) at DCFS. . . . .	23
Table 16	Cumulative fine root mass as a function of depth (cm) at DCFS. . . . .	24
Table 17	Fine root biomass sampling summary data at DCFS. . . . .	25
Table 18	Site plant characterization and phenology species summary at DCFS. . . . .	26
Table 19	Per plot breakdown of species richness, diversity, and herbaceous cover at DCFS. . . . .	33
Table 20	Beetle identification results at DCFS. . . . .	35
Table 21	NLCD land cover classes and area within the TOS site boundary at NOGP. . . . .	39
Table 22	NLCD land cover classes and TOS plot numbers at NOGP. . . . .	40

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

Table 23	Number of Distributed Base plots per NLCD land cover class per protocol at NOGP. . . . .	40
Table 24	Number of Tower Plots per protocol at NOGP. . . . .	40
Table 25	Fine root mass per depth increment (cm) at NOGP. . . . .	41
Table 26	Cumulative fine root mass as a function of depth (cm) at NOGP. . . . .	42
Table 27	Fine root biomass sampling summary data at NOGP. . . . .	43
Table 28	Site plant characterization and phenology species summary at NOGP. . . . .	44
Table 29	Per plot breakdown of species richness, diversity, and herbaceous cover at NOGP. . . . .	49
Table 30	Beetle identification results at NOGP. . . . .	50
Table 31	Mosquito identification results at NOGP. . . . .	50
Table 32	Tick identification results at NOGP. . . . .	51
Table 33	NEON data product names and descriptions. . . . .	52
Figure 1	NEON project map with Domain 09 highlighted in red. . . . .	3
Figure 2	Site boundaries within Domain 09. . . . .	3
Figure 3	Map of TOS plot centroids within the NEON TOS sampling boundary at WOOD. . . . .	6
Figure 4	Map of the tower airshed and TOS plot centroids at WOOD. . . . .	7
Figure 5	Cumulative root mass by pit depth at WOOD. . . . .	11
Figure 6	Map of TOS plot centroids within the NEON TOS sampling boundary at DCFS. . . . .	20
Figure 7	Map of the tower airshed and TOS plot centroids at DCFS. . . . .	21
Figure 8	Cumulative root mass by pit depth at DCFS. . . . .	25
Figure 9	Map of TOS plot centroids within the NEON TOS sampling boundary at NOGP. . . . .	38
Figure 10	Map of the tower airshed and TOS plot centroids at NOGP. . . . .	39
Figure 11	Cumulative root mass by pit depth at NOGP. . . . .	43

# 1 DESCRIPTION

## 1.1 Purpose

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

## 1.2 Scope

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

# 2 RELATED DOCUMENTS AND ACRONYMS

## 2.1 Applicable Documents

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

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

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<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.000913	TOS Science Design for Spatial Sampling
RD[04]	NEON.DOC.011056	TIS Site Characterization Report
RD[05]	NEON.DOC.001670	AIS Site Characterization Report
RD[06]	NEON.DOC.003885	TOS Site Characterization Methods
RD[07]	NEON.DOC.000481	TOS Protocol and Procedure: Small Mammal Sampling
RD[08]	NEON.DOC.014041	TOS Protocol and Procedure: Breeding Landbird Abundance and Diversity
RD[09]	NEON.DOC.014042	TOS Protocol and Procedure: Plant Diversity Sampling
RD[10]	NEON.DOC.000987	TOS Protocol and Procedure: Measurement of Vegetation Structure
RD[11]	NEON.DOC.014040	TOS Protocol and Procedure: Plant Phenology

### 2.3 Acronyms

<b>Acronym</b>	<b>Definition</b>
BOLD	Barcode of Life Datasystems
NLCD	National Land Cover Database



### 3 DOMAIN 09 OVERVIEW: NORTHERN PLAINS DOMAIN

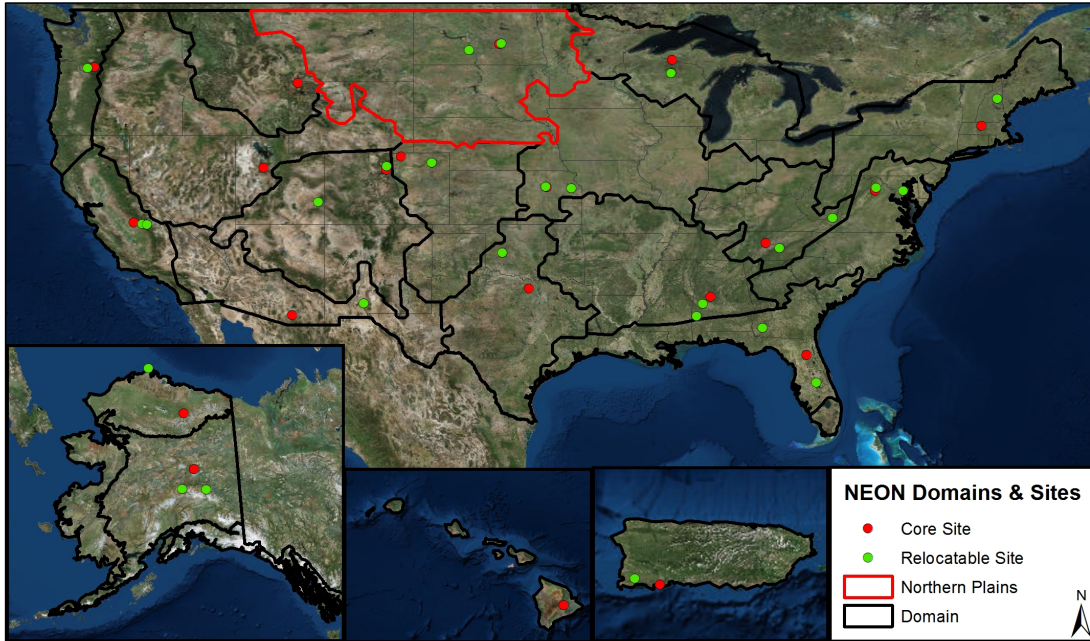


Figure 1: NEON project map with Domain 09 highlighted in red.

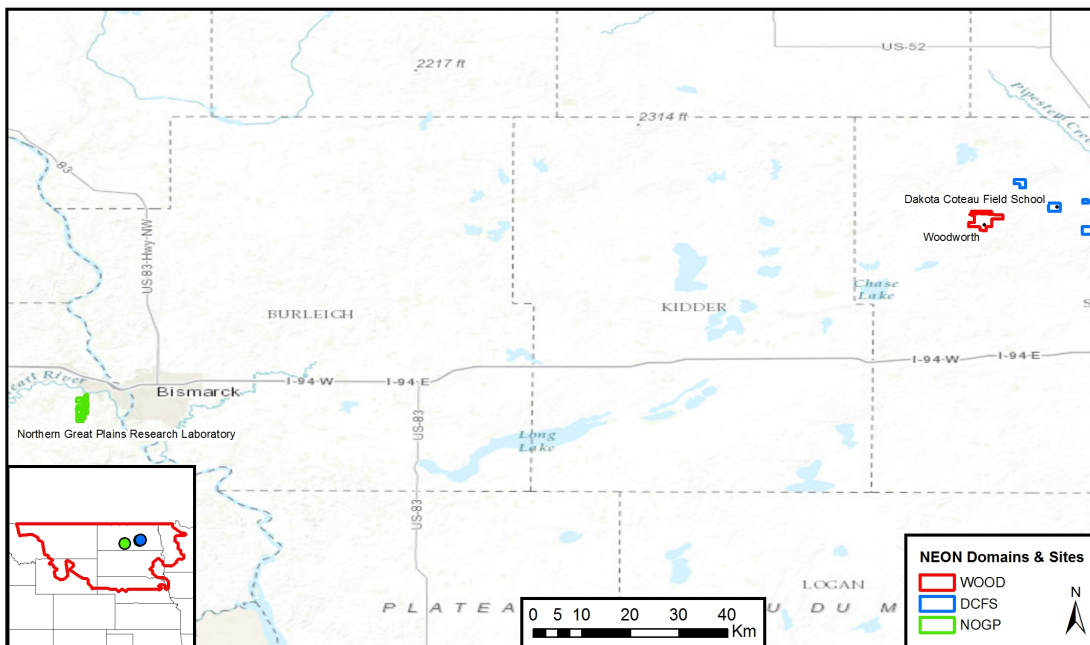


Figure 2: Site boundaries within Domain 09.

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

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

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

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

## 4 CORE SITE- WOODWORTH (WOOD)

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

Key Characteristics:

- Site host: U.S. Geological Survey and U.S. Fish and Wildlife Service. The site is part of the larger Chase Lake National Wildlife Refuge.
- Located in: Stutsman County, ND
- Area: 11 km<sup>2</sup>
- Elevation: 570-610m
- Dominant vegetation type: The prairie contains a combination of short and mid-grasses dominated by blue grama (*Bouteloua gracilis*) and green needle grass (*Nassella viridula*). Tame grasses, legumes, and many species of wildflower are also present (Chase Lake National Wildlife Refuge, 2015).
- General management: The Chase Lake National Wildlife Refuge was established in 1908 as a reserve and breeding ground for native birds and is the fifteenth oldest refuge in the country (Chase Lake National Wildlife Refuge, 2015). While the site has historically been tilled, cultivated, and grazed, current management is focused on re-seeding with native plant species. Light cattle grazing and prescribed burns also occur throughout the site to promote the growth of native species.
- The Prairie Pothole aquatic site is located within the WOOD TOS Sampling Boundary. See the AIS site characterization report for more details (RD[05]).
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research.

### 4.1 TOS Spatial Sampling Design

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

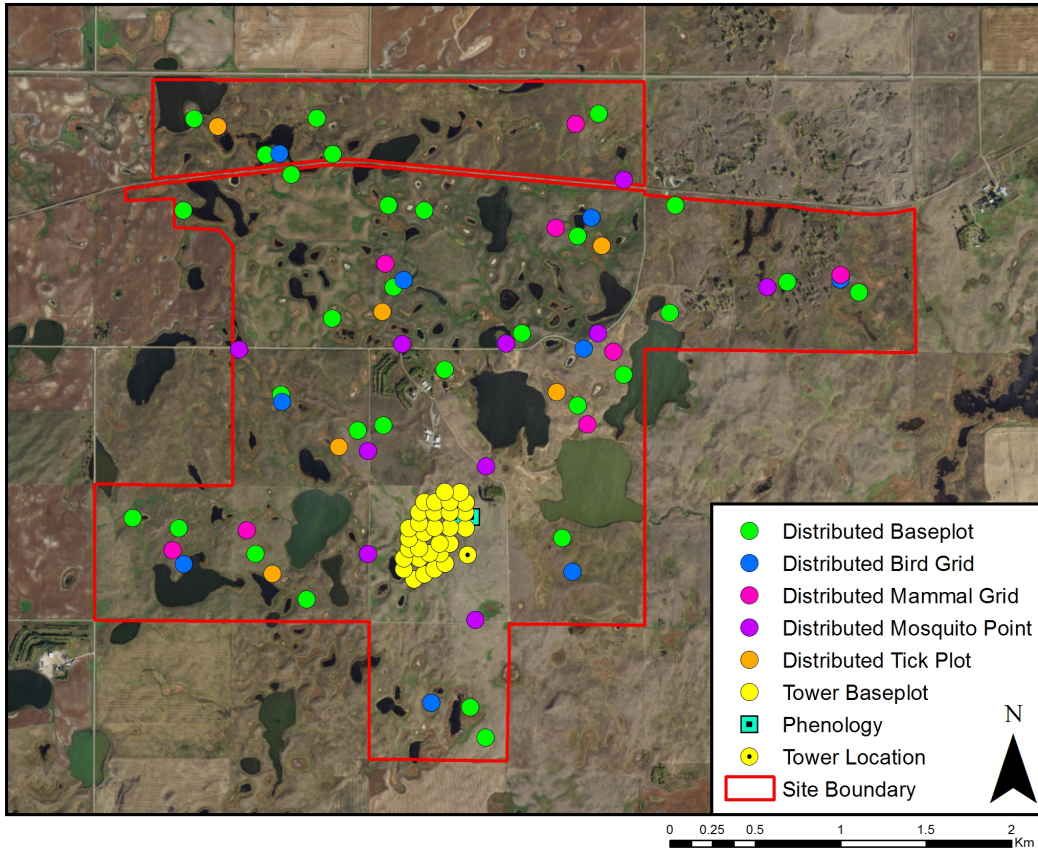


Figure 3: Map of TOS plot centroids within the NEON TOS sampling boundary at WOOD.

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

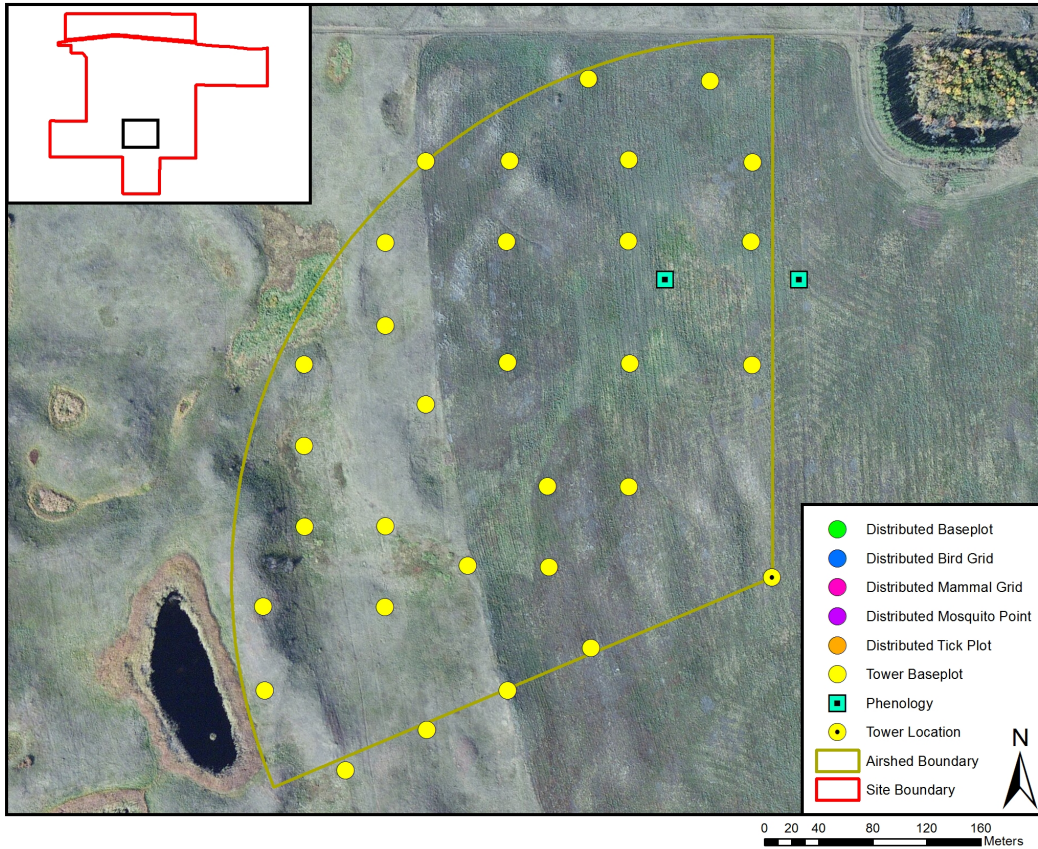


Figure 4: Map of the tower airshed and TOS plot centroids at WOOD.

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

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

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

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

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

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Emergent Herbaceous Wetlands	10
Distributed	Base Plot	Grassland Herbaceous	20
Distributed	Bird Grid	Emergent Herbaceous Wetlands	2
Distributed	Bird Grid	Grassland Herbaceous	7
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Emergent Herbaceous Wetlands	1
Distributed	Tick Plot	Grassland Herbaceous	5
Tower	Base Plot	NA	30
Tower	phenology	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover type within the airshed is grassland herbaceous.

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

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Emergent Herbaceous Wetlands	Beetles	3
Distributed	Base Plot	Grassland Herbaceous	Beetles	7
Distributed	Base Plot	Emergent Herbaceous Wetlands	Canopy Foliage Chemistry	6
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	10
Distributed	Base Plot	Emergent Herbaceous Wetlands	Coarse Downed Wood	7
Distributed	Base Plot	Grassland Herbaceous	Coarse Downed Wood	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Digital Hemispherical Photos for Leaf Area Index	7
Distributed	Base Plot	Grassland Herbaceous	Digital Hemispherical Photos for Leaf Area Index	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Herbaceous Biomass	7
Distributed	Base Plot	Grassland Herbaceous	Herbaceous Biomass	13
Distributed	Base Plot	Emergent Herbaceous Wetlands	Plant Diversity	10
Distributed	Base Plot	Grassland Herbaceous	Plant Diversity	20
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Biogeochemistry	2

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Soil Biogeochemistry	4
Distributed	Base Plot	Emergent Herbaceous Wetlands	Soil Microbes	2
Distributed	Base Plot	Grassland Herbaceous	Soil Microbes	4
Distributed	Base Plot	Emergent Herbaceous Wetlands	Vegetation Structure	7
Distributed	Base Plot	Grassland Herbaceous	Vegetation Structure	13

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

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

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	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	30
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	2

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

## 4.2 Belowground Biomass

### 4.2.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 150 cm by NEON staff in September 2012. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30 cm, the belowground biomass site characterization data are critical for scaling belowground biomass measurements to greater depths; see the TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index (AD[7]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Roots were sorted to two diameter size categories ( $\leq 2$  mm and 2-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to

30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

#### 4.2.2 Results

Table 5: Fine root mass per depth increment (cm) at WOOD.

Upper Depth	Lower Depth	Mean (mg per cm <sup>3</sup> )	Std Dev
0	10	7.5	7.22
10	20	0.77	0.24
20	30	0.51	0.01
30	40	0.2	0.09
40	50	0.72	0.69
50	60	0.21	0.11
60	70	0.08	0.05
70	80	0.06	0.06
80	90	0.15	0.21
90	100	0.08	0.05
100	110	0.01	0.01
110	130	0.03	0.02
130	150	0	0.01

Table 6: Cumulative fine root mass as a function of depth (cm) at WOOD.

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



Upper Depth	Lower Depth	Mean Cumulative (g per m <sup>2</sup> )	Cumulative Std Dev
110	130	1035.58	725.18
130	150	1036.51	726.65

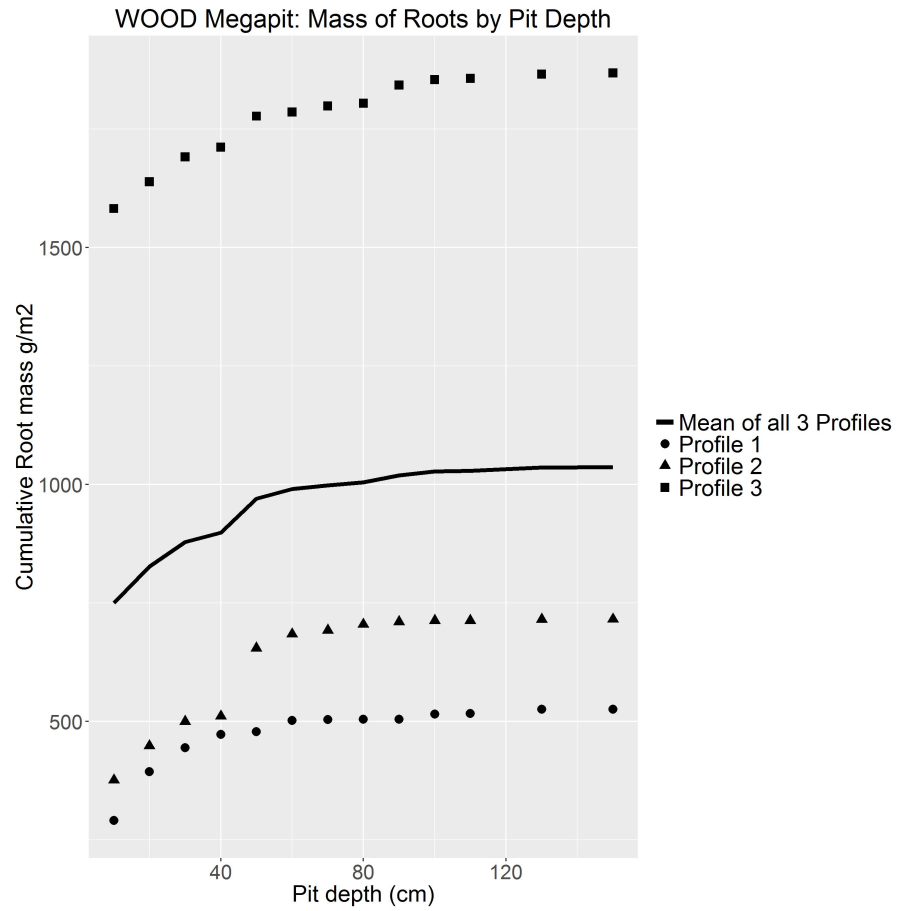


Figure 5: Cumulative root mass by pit depth at WOOD.

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

Table 7: Fine root biomass sampling summary data at WOOD.

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

### 4.3 Plant Characterization and Phenology Species Selection

#### 4.3.1 Site-Specific Methods

Plant characterization data were collected by an external contractor during July of 2013. Plant characterization data informs sampling procedure 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; 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.

#### 4.3.2 Results

Table 8: Site plant characterization and phenology species summary at WOOD.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
POPR	<i>Poa pratensis</i> L.	1	52	NA	NA
ELRE4	<i>Elymus repens</i> (L.) Gould	2	8	NA	NA
BRIN2	<i>Bromus inermis</i> Leyss.	3	6	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
ARAB3	<i>Artemisia absinthium</i> L.	4	5	NA	NA
ANGE	<i>Andropogon gerardii</i> Vitman	5	4	NA	NA
NAVI4	<i>Nassella viridula</i> (Trin.) Barkworth	6	3	NA	NA
MESA	<i>Medicago sativa</i> L.	7	3	NA	NA
DECE	<i>Deschampsia cespitosa</i> (L.) P. Beauv.	8	2	NA	NA
SCSC	<i>Schizachyrium scoparium</i> (Michx.) Nash	9	2	NA	NA
SOMI2	<i>Solidago missouriensis</i> Nutt.	10	2	NA	NA
POAM8	<i>Polygonum amphibium</i> L.	11	1	NA	NA
HECO26	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth	12	1	NA	NA
PASM	<i>Pascopyrum smithii</i> (Rydb.) Á. Löve	13	1	NA	NA
BOGR2	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths	14	1	NA	NA
ELCO	<i>Elaeagnus commutata</i> Bernh. ex Rydb.	15	1	NA	NA
BOCU	<i>Bouteloua curtipendula</i> (Michx.) Torr.	16	1	NA	NA
PHAR3	<i>Phalaris arundinacea</i> L.	17	<1	NA	NA
GLLE3	<i>Glycyrrhiza lepidota</i> Pursh	18	<1	NA	NA
HOJU	<i>Hordeum jubatum</i> L.	19	<1	NA	NA
SYOC	<i>Symphoricarpos</i> <i>occidentalis</i> Hook.	20	<1	NA	NA
MEOF	<i>Melilotus officinalis</i> (L.) Lam.	21	<1	NA	NA
GABO2	<i>Galium boreale</i> L.	22	<1	NA	NA
CAREX	<i>Carex</i> sp.	23	<1	NA	NA
VICIA	<i>Vicia</i> sp.	24	<1	NA	NA
SOCA6	<i>Solidago canadensis</i> L.	25	<1	NA	NA
ACMI2	<i>Achillea millefolium</i> L.	26	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
HEVI4	<i>Heterotheca villosa</i> (Pursh) Shinnery	26	<1	NA	NA
CIAR4	<i>Cirsium arvense</i> (L.) Scop.	28	<1	NA	NA
PEAR6	<i>Pedimelum argophyllum</i> (Pursh) J. Grimes	28	<1	NA	NA
LATAP	<i>Lactuca tatarica</i> (L.) C.A. Mey. var. <i>pulchella</i> (Pursh) Breitung	30	<1	NA	NA
ARLU	<i>Artemisia ludoviciana</i> Nutt.	31	<1	NA	NA
CACA4	<i>Calamagrostis canadensis</i> (Michx.) P. Beauv.	32	<1	NA	NA
HEMA2	<i>Helianthus maximiliani</i> Schrad.	33	<1	NA	NA
ASOV	<i>Asclepias ovalifolia</i> Decne.	34	<1	NA	NA
ARFR4	<i>Artemisia frigida</i> Willd.	35	<1	NA	NA
DAPU5	<i>Dalea purpurea</i> Vent.	35	<1	NA	NA
RACO3	<i>Ratibida columnifera</i> (Nutt.) Woot. & Standl.	35	<1	NA	NA
VIAM	<i>Vicia americana</i> Muhl. ex Willd.	35	<1	NA	NA
SOAR2	<i>Sonchus arvensis</i> L.	39	<1	NA	NA
ASSY	<i>Asclepias syriaca</i> L.	40	<1	NA	NA
ROAR3	<i>Rosa arkansana</i> Porter	40	<1	NA	NA
COAR4	<i>Convolvulus arvensis</i> L.	42	<1	NA	NA
AMPS	<i>Ambrosia psilostachya</i> DC.	43	<1	NA	NA
ARCA12	<i>Artemisia campestris</i> L.	44	<1	NA	NA
ASTER	<i>Aster</i> sp.	44	<1	NA	NA
GAAR	<i>Gaillardia aristata</i> Pursh	44	<1	NA	NA
GETR	<i>Geum triflorum</i> Pursh	44	<1	NA	NA
PONO3	<i>Potentilla norvegica</i> L.	44	<1	NA	NA
SPHE	<i>Sporobolus heterolepis</i> (A. Gray) A. Gray	44	<1	NA	NA
CEAR4	<i>Cerastium arvense</i> L.	50	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
GRSQ	<i>Grindelia squarrosa</i> (Pursh) Dunal	50	<1	NA	NA
HEPA19	<i>Helianthus pauciflorus</i> Nutt.	50	<1	NA	NA
ANCA8	<i>Anemone canadensis</i> L.	53	<1	NA	NA
ANMU	<i>Anemone multifida</i> Poir.	53	<1	NA	NA
ECAN2	<i>Echinacea angustifolia</i> DC.	53	<1	NA	NA
HELIA3	<i>Helianthus</i> sp.	53	<1	NA	NA
LILE3	<i>Linum lewisii</i> Pursh	53	<1	NA	NA
LIPU	<i>Liatris punctata</i> Hook.	53	<1	NA	NA
RUAQF	<i>Rumex aquaticus</i> L. var. <i>fenestratus</i> (Greene) Dorn	53	<1	NA	NA
THAR5	<i>Thlaspi arvense</i> L.	53	<1	NA	NA
TRDU	<i>Tragopogon dubius</i> Scop.	53	<1	NA	NA
CRCH	<i>Crataegus chrysoarpa</i> Ashe	62	<1	NA	NA

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

Table 9: Per plot breakdown of species richness, diversity, and herbaceous cover at WOOD.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
10539	18	1.89	234
12587	18	2.31	242
13867	12	1.46	140
23863	21	1.72	174
2603	7	1.28	124
555	17	1.79	146
55863	9	1.56	128
5675	15	1.7	141
57899	15	1.49	114
59947	14	1.53	128
7723	20	1.95	158
8491	18	2.23	168
WOOD_042	11	1.84	124

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

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

#### 4.4 Beetles

##### 4.4.1 Site-Specific Methods

Beetle site characterization was conducted in September 2012 by NEON staff following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Beetle site characterization data was collected to start site level teaching collections. All beetle specimens from the site were pooled before identification. For DNA sequence data generated as a result of these efforts, visit the Barcode of Life Datasystems (BOLD) at <http://www.boldsystems.org>. For more information on this protocol and data product numbers see Appendix A.

##### 4.4.2 Results

Table 10: Beetle identification results at WOOD.

Sample ID	Scientific Name
NEONTcarabid5994	<i>Harpalus herbivagus</i>
NEONTcarabid5996	<i>Harpalus herbivagus</i>
NEONTcarabid5995	<i>Harpalus herbivagus</i>
NEONcarabid5997	Carabidae spp.
NEONTcarabid8006	<i>Agonum cupreum</i>
NEONTcarabid8003	<i>Agonum cupreum</i>
NEONTcarabid8005	<i>Agonum cupreum</i>
NEONTcarabid8008	<i>Agonum cupreum</i>
NEONcarabid8014	<i>Syntomus americanus</i>

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

Sample ID	Scientific Name
NEONcarabid8017	<i>Syntomus americanus</i>
NEONcarabid8016	<i>Syntomus americanus</i>
NEONcarabid8019	<i>Syntomus americanus</i>
NEONcarabid8021	<i>Syntomus americanus</i>
NEONcarabid8018	<i>Syntomus americanus</i>
NEONcarabid8010	<i>Syntomus americanus</i>
NEONcarabid8024	<i>Syntomus americanus</i>
NEONcarabid8009	<i>Syntomus americanus</i>
NEONcarabid8015	<i>Syntomus americanus</i>
NEONcarabid8020	<i>Syntomus americanus</i>
NEONcarabid8011	<i>Syntomus americanus</i>
NEONcarabid8022	<i>Syntomus americanus</i>
NEONTcarabid5989	<i>Amara latior</i>
NEONcarabid8023	<i>Microlestes linearis</i>

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

## 4.5 Mosquitoes

### 4.5.1 Site-Specific Methods

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

## 4.6 Ticks

### 4.6.1 Site-Specific Methods

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

## 4.7 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., 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]).

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

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- Hanson, B.A., and G.A. Swanson. 1989. Coleoptera species inhabiting prairie wetlands of the Cottonwood Lake area, Stustmans county, North Dakota. The Prairie Naturalist. 21, 49-57.
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- Meyer, Mavis I. 1985. Classification of native vegetation at the Woodworth Station, North Dakota. The Prairie Naturalist, 17:3, 165-167.
- Williams, S.H., and J.E. Austin. 2014, Legacy data for a northern prairie grassland-Woodworth Study Area, North Dakota, 1963-89: U.S. Geological Survey Open-File Report 2014-1188, 85 p., <http://dx.doi.org/10.3133/Ofr20141188>.



Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

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

The Dakota Coteau Field School site is located ~100 miles northeast of Bismarck, ND and ~ 10 miles east of the Woodworth site. DCFS is a managed prairie in an undulating matrix of small lakes, ponds, and ephemeral prairie potholes.

Key Characteristics:

- Site host: State of North Dakota Land Trust
- Located in: Stutsman County, ND
- Area: 7.78 km<sup>2</sup>
- Elevation: 490-595m
- Dominant vegetation type: DCFS is characterized by rolling hills, rocky soils, and prairie potholes. Kentucky blue grass (*Poa pretensis* (L.)), silver buffaloberry (*Shepherdia argentea*), and fireberry hawthorn (*Crataegus chrysocarpa*) are dominant species.
- General management: DCFS has no record of historical tilling and is moderately grazed throughout the year.
- The Prairie Lake aquatic site is located within the DCFS TOS Sampling Boundary. See the AIS site characterization report for more details (RD[05]).
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research.

### 5.1 TOS Spatial Sampling Design

TOS Distributed Plots were allocated at DCFS according to a spatially balanced and stratified-random design (RD[3]). The 2011 National Land Cover Database (NLCD) was selected for stratification because of the consistent and comparable data availability across the United States. TOS Tower Plots were allocated according to a spatially balanced design in and around the NEON tower airshed (RD[03]). The maps below depict the plot locations for the first year of NEON sampling. Some plot locations may change over time due to logistics, safety, and science requirements. Please visit the NEON website (<http://www.neonscience.org>) for updated plot locations at each site.

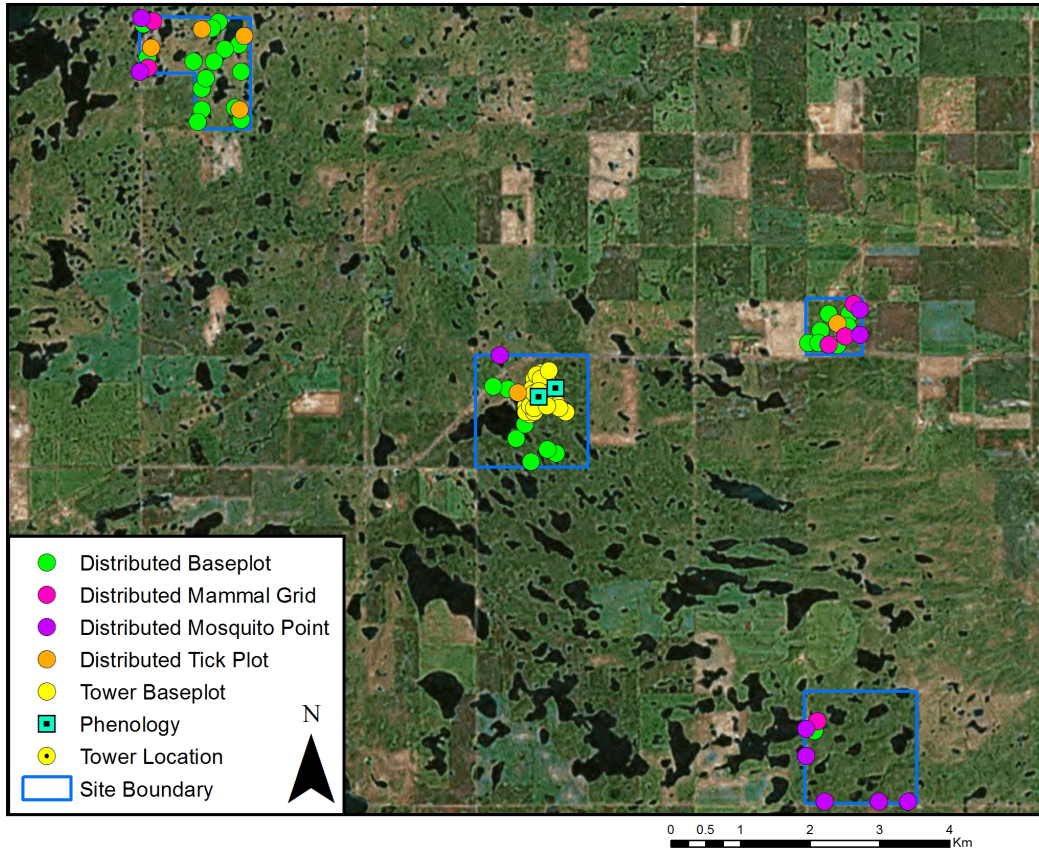


Figure 6: Map of TOS plot centroids within the NEON TOS sampling boundary at DCFS.

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

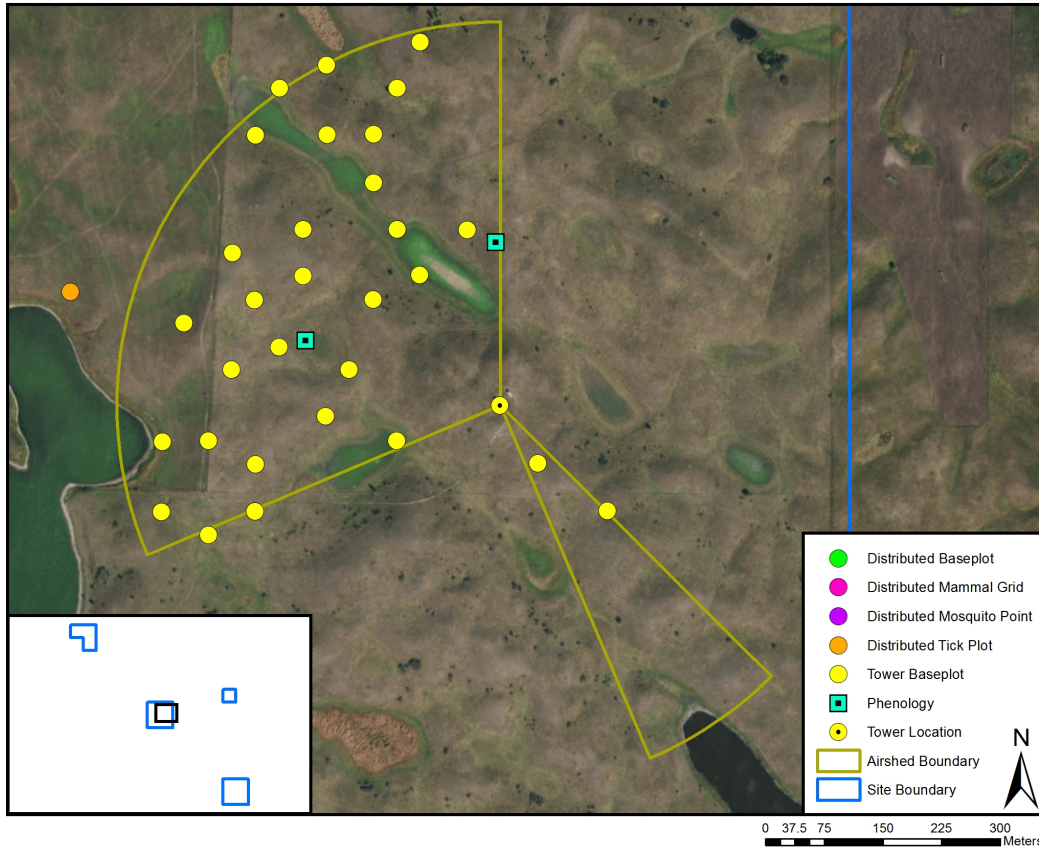


Figure 7: Map of the tower airshed and TOS plot centroids at DCFS.

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

Table 11: NLCD land cover classes and area within the TOS site boundary at DCFS.

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

<i>Title:</i> TOS Site Characterization Report: Domain 09		<i>Date:</i> 04/14/2017
<i>NEON Doc. #:</i> NEON.DOC.003893	<i>Author:</i> R.Krauss	<i>Revision:</i> A

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

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland Herbaceous	30
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Grassland Herbaceous	6
Tower	Base Plot	NA	30
Tower	phenology	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover types within the airshed include: grassland herbaceous, emergent herbaceous wetlands, and shrub scrub.

Table 13: Number of Distributed Base plots per NLCD land cover class per protocol at DCFS.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Beetles	10
Distributed	Base Plot	Grassland Herbaceous	Birds	20
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	6
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 14: Number of Tower Plots per protocol at DCFS.

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

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Canopy Foliage Chemistry	4
Tower	Base Plot	Coarse Downed Wood	30
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	30
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	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 Belowground Biomass

### 5.2.1 Site-Specific Methods

Belowground biomass characterization data were collected down to a depth of 140 cm by NEON staff in September 2012. Since the NEON protocol for long-term, operational sampling of belowground biomass only collects data to a depth of 30 cm, the belowground biomass site characterization data are critical for scaling belowground biomass measurements to greater depths; see the TOS Science Design for Plant Biomass, Productivity, and Leaf Area Index (AD[7]) for more information. Samples were collected following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Roots were sorted to two diameter size categories ( $\leq 2$  mm and 2-30 mm) and by root status (live or dead). The tables below summarize all the belowground biomass less than or equal to 30 mm diameter; size class data and more information can be found by searching the NEON data portal for the data product numbers in Appendix A.

### 5.2.2 Results

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

Upper Depth	Lower Depth	Mean (mg per cm <sup>3</sup> )	Std Dev
0	10	4.24	0.85
10	20	0.6	0.19
20	30	0.48	0.14
30	40	0.42	0.26

<b>Upper Depth</b>	<b>Lower Depth</b>	<b>Mean (mg per cm<sup>3</sup>)</b>	<b>Std Dev</b>
40	50	0.33	0.27
50	60	0.21	0.14
60	70	0.2	0.18
70	80	0.12	0.08
80	90	0.09	0.07
90	100	0.09	0.03
100	120	0.03	0.01
120	140	0	0

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

<b>Upper Depth</b>	<b>Lower Depth</b>	<b>Mean Cumulative (g per m<sup>2</sup>)</b>	<b>Cumulative Std Dev</b>
0	10	423.72	84.71
10	20	484.18	82.5
20	30	532.62	85.23
30	40	574.74	77.97
40	50	607.36	87.21
50	60	628.26	84.83
60	70	648.12	100.79
70	80	659.64	108.19
80	90	668.31	115.12
90	100	677.03	117.57
100	120	682.76	118.6
120	140	683.28	119.06

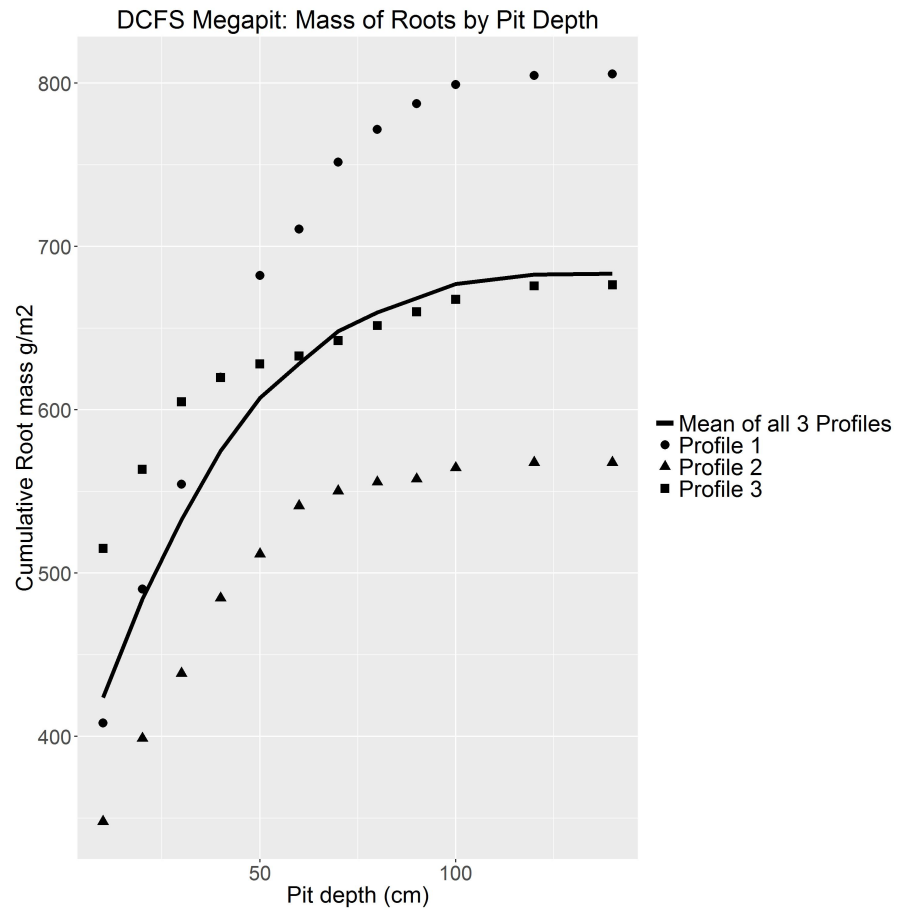


Figure 8: Cumulative root mass by pit depth at DCFS.

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

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

### 5.3 Plant Characterization and Phenology Species Selection

#### 5.3.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during August of 2015. Plant characterization data informs sampling procedure 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; see the TOS Protocol and Procedure: Plant Diversity Sampling (RD[09]) for more information.
2. Mean canopy area values were calculated based on all species specific shrub canopy diameter measurements within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.
3. Mean ABH (area at breast height) measurements were calculated based on diameter at breast height measurements for all woody vegetation with a diameter greater than 1cm at 130cm height within the entire plot or subplot; see the TOS Protocol and Procedure: Measurement of Vegetation Structure (RD[10]) for more information.

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

### 5.3.2 Results

Table 18: Site plant characterization and phenology species summary at DCFS.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
SHAR	<i>Shepherdia argentea</i> (Pursh) Nutt.	1	<1	<1	NA
POPR	<i>Poa pratensis</i> L.	2	12	NA	NA
CRCH	<i>Crataegus chrysoarpa</i> Ashe	3	<1	<1	NA
SYOC	<i>Symphoricarpos occidentalis</i> Hook.	4	4	NA	NA
BRIN2	<i>Bromus inermis</i> Leyss.	5	3	NA	NA
ELAC	<i>Eleocharis acicularis</i> (L.) Roem. & Schult.	6	3	NA	NA
GLGR	<i>Glyceria grandis</i> S. Watson	7	2	NA	NA
GLLE3	<i>Glycyrrhiza lepidota</i> Pursh	8	1	NA	NA
GABO2	<i>Galium boreale</i> L.	9	1	NA	NA
ANCA8	<i>Anemone canadensis</i> L.	10	<1	NA	NA



Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
DIOLS	<i>Dichanthelium oligosanthes</i> (Schult.) Gould var. <i>scribnerianum</i> (Nash) Gould	11	<1	NA	NA
ELRE4	<i>Elymus repens</i> (L.) Gould	12	<1	NA	NA
SOCA6	<i>Solidago canadensis</i> L.	13	<1	NA	NA
OLRI	<i>Oligoneuron rigidum</i> (L.) Small	14	<1	NA	NA
SPPE	<i>Spartina pectinata</i> Bosc ex Link	15	<1	NA	NA
CIFL	<i>Cirsium flodmanii</i> (Rydb.) Arthur	16	<1	NA	NA
COUM	<i>Comandra umbellata</i> (L.) Nutt.	17	<1	NA	NA
LATAP	<i>Lactuca tatarica</i> (L.) C.A. Mey. var. <i>pulchella</i> (Pursh) Breitung	17	<1	NA	NA
ARLU	<i>Artemisia ludoviciana</i> Nutt.	19	<1	NA	NA
RUCR	<i>Rumex crispus</i> L.	20	<1	NA	NA
PRVI	<i>Prunus virginiana</i> L.	21	<1	NA	NA
ACMI2	<i>Achillea millefolium</i> L.	22	<1	NA	NA
RAMA2	<i>Ranunculus macounii</i> Britton	23	<1	NA	NA
AMCA6	<i>Amorpha canescens</i> Pursh	24	<1	NA	NA
BESY	<i>Beckmannia syzigachne</i> (Steud.) Fernald	25	<1	NA	NA
SCSC	<i>Schizachyrium scoparium</i> (Michx.) Nash	26	<1	NA	NA
MELU	<i>Medicago lupulina</i> L.	27	<1	NA	NA
PEAR6	<i>Pediomelum argophyllum</i> (Pursh) J. Grimes	27	<1	NA	NA
ANCY	<i>Anemone cylindrica</i> A. Gray	29	<1	NA	NA
ARAB3	<i>Artemisia absinthium</i> L.	29	<1	NA	NA
ROAR3	<i>Rosa arkansana</i> Porter	31	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
NAVI4	<i>Nassella viridula</i> (Trin.) Barkworth	32	<1	NA	NA
TORA2	<i>Toxicodendron radicans</i> (L.) Kuntze	32	<1	NA	NA
ONBEO	<i>Onosmodium bejariense</i> DC. ex A. DC. var. <i>occidentale</i> (Mack.) B.L. Turner	34	<1	NA	NA
SOAR2	<i>Sonchus arvensis</i> L.	35	<1	NA	NA
CAAT2	<i>Carex atherodes</i> Spreng.	36	<1	NA	NA
TYLA	<i>Typha latifolia</i> L.	37	<1	NA	NA
2PLANT	Unknown plant	38	<1	NA	NA
CIAR4	<i>Cirsium arvense</i> (L.) Scop.	39	<1	NA	NA
HEVIV	<i>Heterotheca villosa</i> (Pursh) Shinnars var. <i>villosa</i>	40	<1	NA	NA
HEPA19	<i>Helianthus pauciflorus</i> Nutt.	41	<1	NA	NA
VIPE2	<i>Viola pedatifida</i> G. Don	42	<1	NA	NA
ARAN7	<i>Argentina anserina</i> (L.) Rydb.	43	<1	NA	NA
EUES	<i>Euphorbia esula</i> L.	44	<1	NA	NA
MEAR4	<i>Mentha arvensis</i> L.	45	<1	NA	NA
SECO2	<i>Senecio congestus</i> (R. Br.) DC.	45	<1	NA	NA
SOMI2	<i>Solidago missouriensis</i> Nutt.	45	<1	NA	NA
SYLA6	<i>Symphyotrichum lanceolatum</i> (Willd.) G.L. Nesom	48	<1	NA	NA
BOGR2	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths	49	<1	NA	NA
HOJU	<i>Hordeum jubatum</i> L.	50	<1	NA	NA
PASM	<i>Pascopyrum smithii</i> (Rydb.) Á. Löve	51	<1	NA	NA
SYER	<i>Symphyotrichum ericoides</i> (L.) G.L. Nesom	51	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
GETR	<i>Geum triflorum</i> Pursh	53	<1	NA	NA
ASSY	<i>Asclepias syriaca</i> L.	54	<1	NA	NA
ANNE	<i>Antennaria neglecta</i> Greene	55	<1	NA	NA
ASAG2	<i>Astragalus agrestis</i> Douglas ex G. Don	56	<1	NA	NA
LYAS	<i>Lycopus asper</i> Greene	57	<1	NA	NA
PHHE5	<i>Physalis heterophylla</i> Nees	57	<1	NA	NA
AMAR2	<i>Ambrosia artemisiifolia</i> L.	59	<1	NA	NA
SCPU10	<i>Schoenoplectus pungens</i> (Vahl) Palla	59	<1	NA	NA
STPI6	<i>Stachys pilosa</i> Nutt.	59	<1	NA	NA
ASSP	<i>Asclepias speciosa</i> Torr.	62	<1	NA	NA
PONO3	<i>Potentilla norvegica</i> L.	62	<1	NA	NA
JUARL	<i>Juncus arcticus</i> Willd. ssp. <i>littoralis</i> (Engelm.) Hultén	64	<1	NA	NA
LIAS	<i>Liatris aspera</i> Michx.	65	<1	NA	NA
TAOF	<i>Taraxacum officinale</i> F.H. Wigg.	66	<1	NA	NA
ECAN2	<i>Echinacea angustifolia</i> DC.	67	<1	NA	NA
LIIN2	<i>Lithospermum incisum</i> Lehm.	68	<1	NA	NA
POPA2	<i>Poa palustris</i> L.	68	<1	NA	NA
RUMA4	<i>Rumex maritimus</i> L.	68	<1	NA	NA
POAME	<i>Polygonum amphibium</i> L. var. <i>emersum</i> Michx.	71	<1	NA	NA
CYOF	<i>Cynoglossum officinale</i> L.	72	<1	NA	NA
MEOF	<i>Melilotus officinalis</i> (L.) Lam.	73	<1	NA	NA
PLMA2	<i>Plantago major</i> L.	73	<1	NA	NA
TRDU	<i>Tragopogon dubius</i> Scop.	75	<1	NA	NA
CARO2	<i>Campanula rotundifolia</i> L.	76	<1	NA	NA
RACO3	<i>Ratibida columnifera</i> (Nutt.) Woot. & Standl.	77	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
RUHI2	<i>Rudbeckia hirta</i> L.	77	<1	NA	NA
ZIAU	<i>Zizia aurea</i> (L.) W.D.J. Koch	77	<1	NA	NA
ARCA12	<i>Artemisia campestris</i> L.	80	<1	NA	NA
BODA2	<i>Bouteloua dactyloides</i> (Nutt.) J.T. Columbus	80	<1	NA	NA
PEES	<i>Pediomelum esculentum</i> (Pursh) Rydb.	80	<1	NA	NA
ALST	<i>Allium stellatum</i> Fraser ex Ker Gawl.	83	<1	NA	NA
ANGE	<i>Andropogon gerardii</i> Vitman	83	<1	NA	NA
CHAL7	<i>Chenopodium album</i> L.	83	<1	NA	NA
ELTRS	<i>Elymus trachycaulus</i> (Link) Gould ex Shinnery ssp. <i>subsecundus</i> (Link) Á. Löve & D. Löve	83	<1	NA	NA
CAPE42	<i>Carex pellita</i> Muhl. ex Willd.	87	<1	NA	NA
DAPU5	<i>Dalea purpurea</i> Vent.	87	<1	NA	NA
RANUNCSPP	Ranunculaceae sp.	87	<1	NA	NA
RAOR3	<i>Ranunculus orthorhynchus</i> Hook.	87	<1	NA	NA
SYLAG	<i>Symphyotrichum laeve</i> (L.) Á. Löve & D. Löve var. <i>geyeri</i> (A. Gray) G.L. Nesom	87	<1	NA	NA
VIAM	<i>Vicia americana</i> Muhl. ex Willd.	87	<1	NA	NA
POAR7	<i>Potentilla arguta</i> Pursh	93	<1	NA	NA
ALAR	<i>Alopecurus arundinaceus</i> Poir.	94	<1	NA	NA
ANROR	<i>Antennaria rosea</i> Greene ssp. <i>rosea</i>	94	<1	NA	NA
CAREXSPP	<i>Carex</i> sp.	94	<1	NA	NA
ELCA	<i>Elatine californica</i> A. Gray	94	<1	NA	NA
RORIPSPP	<i>Rorippa</i> sp.	94	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
CAINH2	<i>needleleaf sedge</i> <i>needleleaf sedge</i>	99	<1	NA	NA
ERAGRSP	<i>Eragrostis</i> sp.	99	<1	NA	NA
KOMA	<i>Koeleria macrantha</i> (Ledeb.) Schult.	99	<1	NA	NA
VEST	<i>Verbena stricta</i> Vent.	99	<1	NA	NA
ORLI	<i>Orogenia linearifolia</i> S. Watson	103	<1	NA	NA
HECO26	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth	104	<1	NA	NA
MUCU3	<i>Muhlenbergia cuspidata</i> (Torr. ex Hook.) Rydb.	105	<1	NA	NA
SOCAL	<i>Solidago canadensis</i> L. var. <i>lepida</i> (DC.) Cronquist	105	<1	NA	NA
ARFR4	<i>Artemisia frigida</i> Willd.	107	<1	NA	NA
CAVU2	<i>Carex vulpinoidea</i> Michx.	107	<1	NA	NA
ERST3	<i>Erigeron strigosus</i> Muhl. ex Willd.	107	<1	NA	NA
LICA12	<i>Lithospermum canescens</i> (Michx.) Lehm.	107	<1	NA	NA
PUPAM	<i>Pulsatilla patens</i> (L.) Mill. ssp. <i>multifida</i> (Pritz.) Zamels	107	<1	NA	NA
SPCOC2	<i>Sporobolus compositus</i> (Poir.) Merr. var. <i>compositus</i>	107	<1	NA	NA
ATSU2	<i>Atriplex subspicata</i> (Nutt.) Rydb.	113	<1	NA	NA
OLAL2	<i>Oligoneuron album</i> (Nutt.) G.L. Nesom	113	<1	NA	NA
PRRAM2	<i>Prenanthes racemosa</i> Michx. var. <i>multiflora</i> (Cronquist) Dorn	113	<1	NA	NA
RUMEXSP	<i>Rumex</i> sp.	113	<1	NA	NA
SUCA2	<i>Suaeda calceoliformis</i> (Hook.) Moq.	113	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
ASTRASPP	<i>Astragalus</i> sp.	118	<1	NA	NA
SIMO2	<i>Sisyrinchium montanum</i> Greene	118	<1	NA	NA
ASCR2	<i>Astragalus crassicaarpus</i> Nutt.	120	<1	NA	NA
ASFL2	<i>Astragalus flexuosus</i> Douglas ex G. Don	120	<1	NA	NA
ASMI10	<i>Astragalus missouriensis</i> Nutt.	120	<1	NA	NA
BOCU	<i>Bouteloua curtipendula</i> (Michx.) Torr.	120	<1	NA	NA
CIUN	<i>Cirsium undulatum</i> (Nutt.) Spreng.	120	<1	NA	NA
EQUISSPP	<i>Equisetum</i> sp.	120	<1	NA	NA
GRSQ	<i>Grindelia squarrosa</i> (Pursh) Dunal	120	<1	NA	NA
LAMIACSPP	Lamiaceae sp.	120	<1	NA	NA
LOSP	<i>Lobelia spicata</i> Lam.	120	<1	NA	NA
PEAL2	<i>Penstemon albidus</i> Nutt.	120	<1	NA	NA
RAMI2	<i>Ranunculus micranthus</i> Nutt.	120	<1	NA	NA
VIOLACSPP	Violaceae sp.	120	<1	NA	NA
AGCR	<i>Agropyron cristatum</i> (L.) Gaertn.	132	<1	NA	NA
ANOC2	<i>Androsace occidentalis</i> Pursh	132	<1	NA	NA
ARDR4	<i>Artemisia dracuncululus</i> L.	132	<1	NA	NA
ASVE	<i>Asclepias verticillata</i> L.	132	<1	NA	NA
BUAR3	<i>Buglossoides arvensis</i> (L.) I.M. Johnst.	132	<1	NA	NA
ELAM3	<i>Elatine americana</i> (Pursh) Arn.	132	<1	NA	NA
EQAR	<i>Equisetum arvense</i> L.	132	<1	NA	NA
LIPU	<i>Liatriis punctata</i> Hook.	132	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
LOUNU	<i>Lotus unifoliolatus</i> (Hook.) Benth. var. <i>unifoliolatus</i>	132	<1	NA	NA
LYJU	<i>Lygodesmia juncea</i> (Pursh) D. Don ex Hook.	132	<1	NA	NA
OXCO	<i>Oxalis corniculata</i> L.	132	<1	NA	NA
OXLA3	<i>Oxytropis lambertii</i> Pursh	132	<1	NA	NA
PEPR7	<i>Pedicularis procera</i> A. Gray	132	<1	NA	NA
POPE8	<i>Potentilla pensylvanica</i> L.	132	<1	NA	NA
PORI3	<i>Potentilla rivalis</i> Nutt.	132	<1	NA	NA
SCIRPSPP	<i>Scirpus</i> sp.	132	<1	NA	NA
SEIN2	<i>Senecio integerrimus</i> Nutt.	132	<1	NA	NA
STPI	<i>Stanleya pinnata</i> (Pursh) Britton	132	<1	NA	NA
VEHA2	<i>Verbena hastata</i> L.	132	<1	NA	NA
VIPE	<i>Viola pedata</i> L.	132	<1	NA	NA
VISO	<i>Viola sororia</i> Willd.	132	<1	NA	NA
ZIEL2	<i>Zigadenus elegans</i> Pursh	132	<1	NA	NA

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

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

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
DCFS_061	34	2.32	195
DCFS_062	37	3.05	78
DCFS_063	35	2.89	106
DCFS_064	29	2.79	70
DCFS_065	37	3.12	76
DCFS_066	19	2.2	69
DCFS_067	47	3.53	81
DCFS_068	23	2.79	47
DCFS_069	31	2.52	62
DCFS_070	35	2.87	74
DCFS_071	51	2.73	151

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
DCFS_072	42	3.48	93
DCFS_073	29	2.83	35
DCFS_074	23	2.66	54
DCFS_075	42	3	135
DCFS_076	28	2.89	51
DCFS_077	24	2.82	61
DCFS_078	34	2.77	120
DCFS_079	17	2.34	61
DCFS_080	32	2.91	60
DCFS_081	40	3	78
DCFS_082	42	3.21	63
DCFS_083	28	2.49	90
DCFS_084	26	2.7	38
DCFS_085	37	2.85	124
DCFS_086	38	3.21	93
DCFS_087	45	3.03	127
DCFS_088	32	2.84	73
DCFS_089	48	3.4	106
DCFS_090	33	2.71	103

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

## 5.4 Beetles

### 5.4.1 Site-Specific Methods

Beetle site characterization was conducted in 2012 by NEON staff following the standard methods outlined in TOS Site Characterization Methods (RD[6]). Beetle site characterization data was collected to start site level teaching collections. All beetle specimens from the site were pooled before identification. For more information on this protocol and data product numbers see Appendix A.

### 5.4.2 Results



Table 20: Beetle identification results at DCF5.

Sample ID	Scientific Name
NEON8001	<i>Brachinus cyanochroaticus</i>
NEON8002	<i>Brachinus cyanochroaticus</i>
NEON5995	<i>Harpalus herbivagus</i>
NEON5996	<i>Harpalus herbivagus</i>
NEON5994	<i>Harpalus herbivagus</i>
NEON8003	<i>Agonum cupreum</i>
NEON8004	<i>Agonum cupreum</i>
NEON8005	<i>Agonum cupreum</i>
NEON8006	<i>Agonum cupreum</i>
NEON8008	<i>Agonum cupreum</i>
NEON5979	<i>Pterostichus pensylvanicus</i>
NEON8007	<i>Pterostichus femoralis</i>
NEON8117	<i>Poecilus lucublandus</i>
NEON5987	<i>Poecilus lucublandus</i>
NEON5980	<i>Poecilus lucublandus</i>
NEON5990	<i>Poecilus lucublandus</i>
NEON5991	<i>Poecilus lucublandus</i>
NEON5992	<i>Poecilus lucublandus</i>
NEON5981	<i>Poecilus lucublandus</i>
NEON5988	<i>Poecilus lucublandus</i>
NEON5978	<i>Poecilus lucublandus</i>
NEON5993	<i>Poecilus lucublandus</i>
NEON5983	<i>Poecilus lucublandus</i>
NEON5984	<i>Poecilus lucublandus</i>
NEON5985	<i>Poecilus lucublandus</i>
NEON5986	<i>Poecilus lucublandus</i>
NEON5998	<i>Amara angustata</i>
NEON5999	<i>Amara angustata</i>
NEON5989	<i>Amara latior</i>
NEON8000	<i>Amara cupreolata</i>

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

## 5.5 Mosquitoes

### 5.5.1 Site-Specific Methods

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

## 5.6 Ticks

### 5.6.1 Site-Specific Methods

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

## 5.7 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., reptiles, amphibians, small mammals), these lists were often required to secure permits. Key references identified in this effort are listed below. Species lists and associated references for small mammals and breeding landbirds can be found in the appendices of the respective protocols (RD[07], RD[08]). See the WOOD species reference list section for statewide resources.

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

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

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

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

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

Key Characteristics:

- Site host: U.S. Department of Agriculture, Agricultural Research Service
- Located in: Morton, ND
- Area: 5.86 km<sup>2</sup>
- Elevation: 515-595m
- Dominant vegetation type: NOGP contains a mix of native grasslands, tame grasses, legumes, and many species of wildflowers. Around the NEON tower smooth brome (*Bromus inermis* L) and Kentucky bluegrass (*Poa pretensis* (L.)) are common. Depending on the type of research, various crop species are planted as well.
- General management: The Northern Great Plains Research Laboratory’s mission is to “develop adaptive and integrative practices for sustainable crop, livestock, and rangeland systems” (National Resource Management Research, 2016).
- Plot Selection: NEON TOS Plots were allocated across the site following NEON standard criteria and avoiding existing research.

### 6.1 TOS Spatial Sampling Design

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

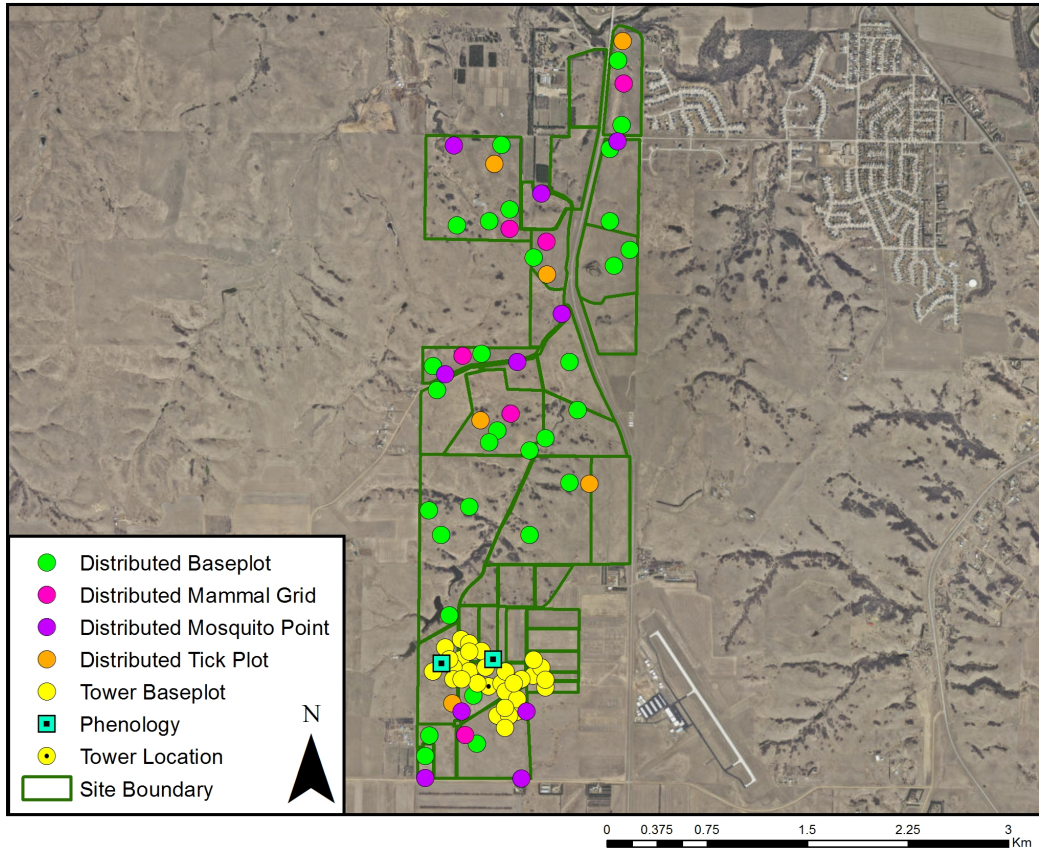


Figure 9: Map of TOS plot centroids within the NEON TOS sampling boundary at NOGP.

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

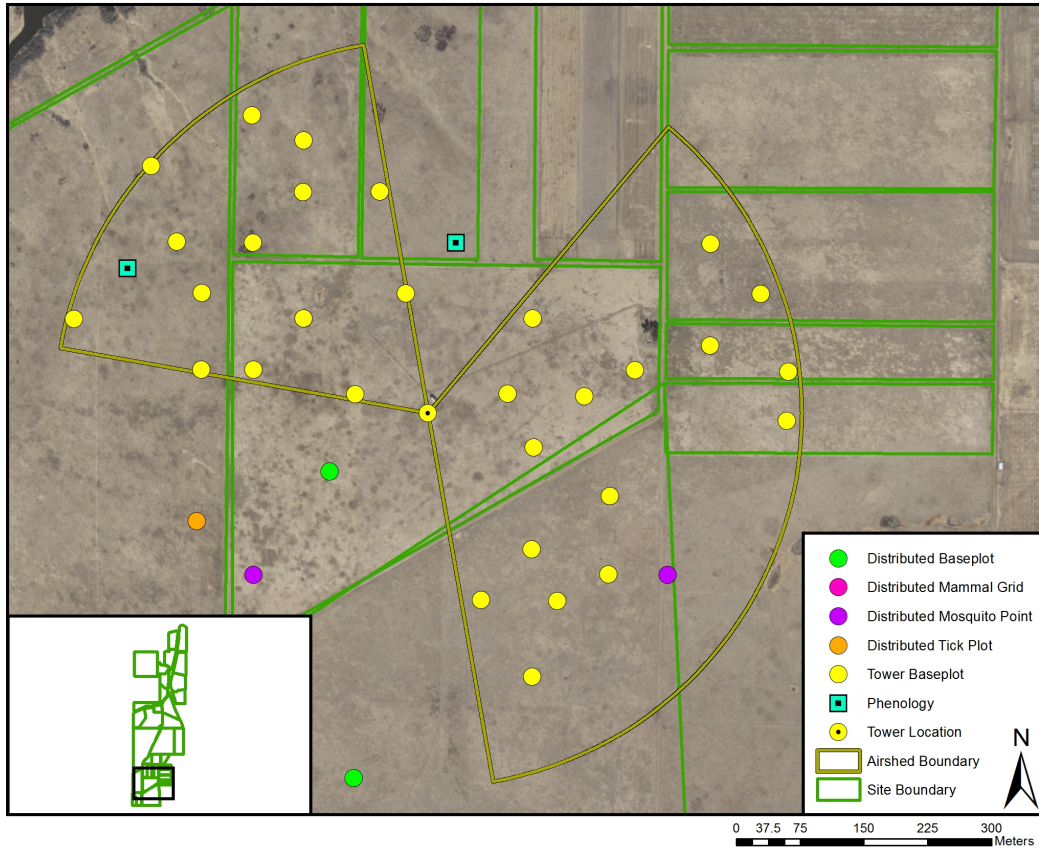


Figure 10: Map of the tower airshed and TOS plot centroids at NOGP.

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

Table 21: NLCD land cover classes and area within the TOS site boundary at NOGP.

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

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

Water, Developed, or Barren Land NLCD classes.

Table 22: NLCD land cover classes and TOS plot numbers at NOGP.

Plot Type	Plot Subtype	NLCD Class	Number of Plots Established
Distributed	Base Plot	Grassland Herbaceous	30
Distributed	Mammal Grid	Grassland Herbaceous	6
Distributed	Mosquito Point	Grassland Herbaceous	10
Distributed	Tick Plot	Grassland Herbaceous	6
Tower	Base Plot	NA	30
Tower	phenology	NA	2

Note: NLCD land cover classes are not used to stratify Tower Plots which are located in and around the NEON tower airshed. The dominant NLCD land cover types within the airshed include: grassland herbaceous and shrub scrub.

Table 23: Number of Distributed Base plots per NLCD land cover class per protocol at NOGP.

Plot Type	Plot Subtype	NLCD Class	Protocols	Number of Plots
Distributed	Base Plot	Grassland Herbaceous	Beetles	10
Distributed	Base Plot	Grassland Herbaceous	Birds	20
Distributed	Base Plot	Grassland Herbaceous	Canopy Foliage Chemistry	6
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 24: Number of Tower Plots per protocol at NOGP.

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Below Ground Biomass Coring	30
Tower	Base Plot	Canopy Foliage Chemistry	4

Plot Type	Plot Subtype	Protocols	Number of Plots
Tower	Base Plot	Coarse Downed Wood	30
Tower	Base Plot	Digital Hemispherical Photos for Leaf Area Index	30
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	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 Belowground Biomass

### 6.2.1 Site-Specific Methods

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

### 6.2.2 Results

Table 25: Fine root mass per depth increment (cm) at NOGP.

Upper Depth	Lower Depth	Mean (mg per cm <sup>3</sup> )	Std Dev
0	10	10.02	2.01
10	20	2.03	1.3
20	30	1.53	1.14
30	40	0.9	0.21
40	50	0.41	0.23

Upper Depth	Lower Depth	Mean (mg per cm <sup>3</sup> )	Std Dev
50	60	0.38	0.21
60	70	0.32	0.16
70	80	0.21	0.05
80	90	0.12	0.05
90	100	0.07	0.05
100	120	0.05	0
120	140	0.04	0.01
140	160	0.04	0.02
160	180	0.02	0.01
180	200	0.02	0.01

Table 26: Cumulative fine root mass as a function of depth (cm) at NOGP.

Upper Depth	Lower Depth	Mean Cumulative (g per m <sup>2</sup> )	Cumulative Std Dev
0	10	1001.93	200.7
10	20	1204.5	329.84
20	30	1357.05	443.65
30	40	1447.5	461.78
40	50	1488.79	484.23
50	60	1526.31	501.37
60	70	1558.27	508.51
70	80	1578.83	510.9
80	90	1590.54	512.28
90	100	1597.91	511.57
100	120	1608.31	510.98
120	140	1617.24	508.13
140	160	1625.35	510.98
160	180	1629.41	509.8
180	200	1633.21	510.87



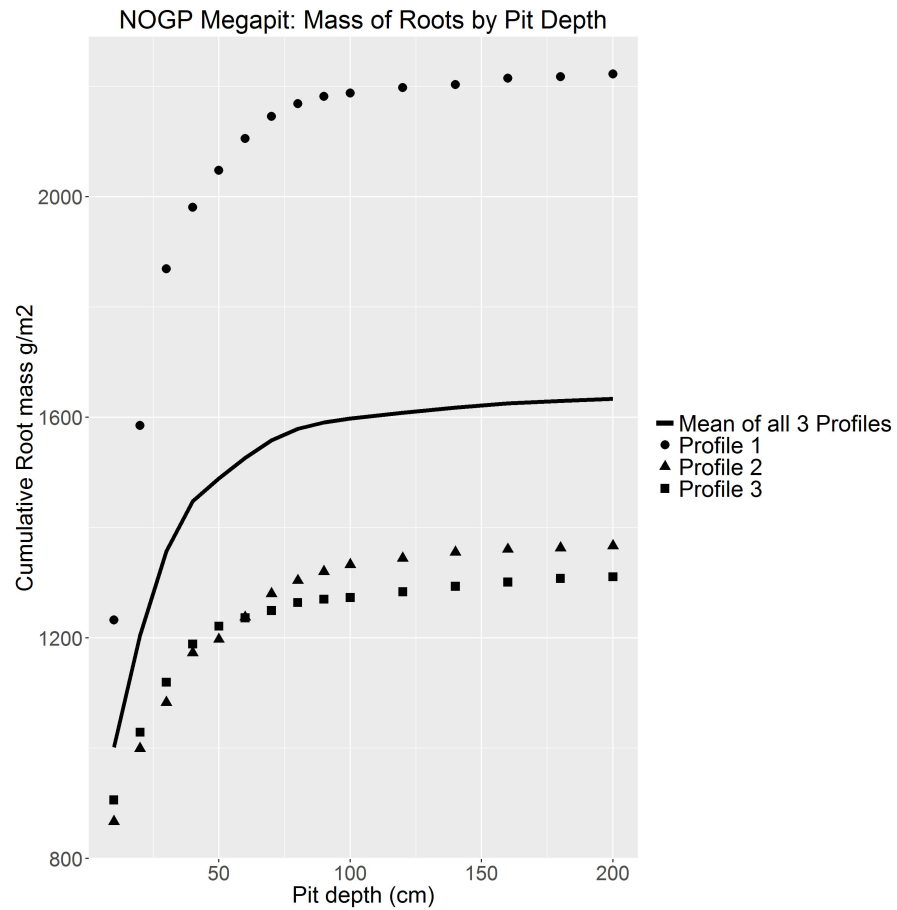


Figure 11: Cumulative root mass by pit depth at NOGP.

Table 27: Fine root biomass sampling summary data at NOGP.

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

### 6.3 Plant Characterization and Phenology Species Selection

#### 6.3.1 Site-Specific Methods

Plant characterization data were collected by NEON staff during July of 2015. Plant characterization data informs sampling procedure 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; 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.

### 6.3.2 Results

Table 28: Site plant characterization and phenology species summary at NOGP.

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
ELAN	<i>Elaeagnus angustifolia</i> L.	1	<1	NA	0.01
POPR	<i>Poa pratensis</i> L.	2	14	NA	NA
SYOC	<i>Symphoricarpos occidentalis</i> Hook.	3	3	NA	NA
BRIN2	<i>Bromus inermis</i> Leyss.	4	1	NA	NA
MEOF	<i>Melilotus officinalis</i> (L.) Lam.	5	<1	NA	NA
ARLU	<i>Artemisia ludoviciana</i> Nutt.	6	<1	NA	NA
PEAR6	<i>Pediomelum argophyllum</i> (Pursh) J. Grimes	7	<1	NA	NA
ROAR3	<i>Rosa arkansana</i> Porter	8	<1	NA	NA
NAVI4	<i>Nassella viridula</i> (Trin.) Barkworth	9	<1	NA	NA
OLRI	<i>Oligoneuron rigidum</i> (L.) Small	10	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
LATAP	<i>Lactuca tatarica</i> (L.) C.A. Mey. var. <i>pulchella</i> (Pursh) Breitung	11	<1	NA	NA
PASM	<i>Pascopyrum smithii</i> (Rydb.) Á. Löve	12	<1	NA	NA
CIFL	<i>Cirsium flodmanii</i> (Rydb.) Arthur	13	<1	NA	NA
ANGE	<i>Andropogon gerardii</i> Vitman	14	<1	NA	NA
ANCY	<i>Anemone cylindrica</i> A. Gray	15	<1	NA	NA
AGCR	<i>Agropyron cristatum</i> (L.) Gaertn.	16	<1	NA	NA
LOUNU	<i>Lotus unifoliolatus</i> (Hook.) Benth. var. <i>unifoliolatus</i>	17	<1	NA	NA
SYER	<i>Symphyotrichum ericoides</i> (L.) G.L. Nesom	18	<1	NA	NA
GACO5	<i>Gaura coccinea</i> Nutt. ex Pursh	19	<1	NA	NA
CIAR4	<i>Cirsium arvense</i> (L.) Scop.	20	<1	NA	NA
TAOF	<i>Taraxacum officinale</i> F.H. Wigg.	21	<1	NA	NA
HEPA19	<i>Helianthus pauciflorus</i> Nutt.	22	<1	NA	NA
PUPAM	<i>Pulsatilla patens</i> (L.) Mill. ssp. <i>multifida</i> (Pritz.) Zamels	22	<1	NA	NA
ECAN2	<i>Echinacea angustifolia</i> DC.	24	<1	NA	NA
PRVI	<i>Prunus virginiana</i> L.	25	<1	NA	NA
BOGR2	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths	26	<1	NA	NA
SCSC	<i>Schizachyrium scoparium</i> (Michx.) Nash	26	<1	NA	NA
DAPU5	<i>Dalea purpurea</i> Vent.	28	<1	NA	NA
CAINH2	<i>Carex inops</i> L.H. Bailey ssp. <i>heliophila</i> (Mack.) Crins	29	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
AMCA6	<i>Amorpha canescens</i> Pursh	30	<1	NA	NA
SOMI2	<i>Solidago missouriensis</i> Nutt.	30	<1	NA	NA
VIPE2	<i>Viola pedatifida</i> G. Don	32	<1	NA	NA
ANMI3	<i>Antennaria microphylla</i> Rydb.	33	<1	NA	NA
VIAM	<i>Vicia americana</i> Muhl. ex Willd.	34	<1	NA	NA
SOCA6	<i>Solidago canadensis</i> L.	35	<1	NA	NA
HESP11	<i>Hesperostipa spartea</i> (Trin.) Barkworth	36	<1	NA	NA
DIOLS	<i>Dichanthelium oligosanthes</i> (Schult.) Gould var. <i>scribnerianum</i> (Nash) Gould	37	<1	NA	NA
RACO3	<i>Ratibida columnifera</i> (Nutt.) Woot. & Standl.	37	<1	NA	NA
LIPU	<i>Liatris punctata</i> Hook.	39	<1	NA	NA
ARFR4	<i>Artemisia frigida</i> Willd.	40	<1	NA	NA
SOAR2	<i>Sonchus arvensis</i> L.	40	<1	NA	NA
HECO26	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth	42	<1	NA	NA
LICA12	<i>Lithospermum canescens</i> (Michx.) Lehm.	42	<1	NA	NA
ACMI2	<i>Achillea millefolium</i> L.	44	<1	NA	NA
COUM	<i>Comandra umbellata</i> (L.) Nutt.	45	<1	NA	NA
ASCR2	<i>Astragalus crassicaarpus</i> Nutt.	46	<1	NA	NA
2PLANT	Unknown plant	47	<1	NA	NA
GRSQ	<i>Grindelia squarrosa</i> (Pursh) Dunal	48	<1	NA	NA
TRDU	<i>Tragopogon dubius</i> Scop.	48	<1	NA	NA
POAR7	<i>Potentilla arguta</i> Pursh	50	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
KOMA	<i>Koeleria macrantha</i> (Ledeb.) Schult.	51	<1	NA	NA
COCA5	<i>Conyza canadensis</i> (L.) Cronquist	52	<1	NA	NA
ELTRS	<i>Elymus trachycaulus</i> (Link) Gould ex Shinnars ssp. <i>subsecundus</i> (Link) Á. Löve & D. Löve	52	<1	NA	NA
DACA7	<i>Dalea candida</i> Michx. ex Willd.	54	<1	NA	NA
HECUO2	<i>Heliotropium curassavicum</i> L. var. <i>obovatum</i> DC.	54	<1	NA	NA
LYJU	<i>Lygodesmia juncea</i> (Pursh) D. Don ex Hook.	54	<1	NA	NA
ARM12	<i>Arctium minus</i> Bernh.	57	<1	NA	NA
OXCO	<i>Oxalis corniculata</i> L.	57	<1	NA	NA
PEFRP	<i>Petasites frigidus</i> (L.) Fr. var. <i>palmatus</i> (Aiton) Cronquist	57	<1	NA	NA
ARAB3	<i>Artemisia absinthium</i> L.	60	<1	NA	NA
CAFI	<i>Carex filifolia</i> Nutt.	61	<1	NA	NA
CYOF	<i>Cynoglossum officinale</i> L.	61	<1	NA	NA
EUES	<i>Euphorbia esula</i> L.	61	<1	NA	NA
MELU	<i>Medicago lupulina</i> L.	61	<1	NA	NA
PEES	<i>Pediomelum esculentum</i> (Pursh) Rydb.	61	<1	NA	NA
POAL4	<i>Polygala alba</i> Nutt.	61	<1	NA	NA
POPUP5	<i>Potamogeton pusillus</i> L. ssp. <i>pusillus</i>	61	<1	NA	NA
ASAG2	<i>Astragalus agrestis</i> Douglas ex G. Don	68	<1	NA	NA
ASVE	<i>Asclepias verticillata</i> L.	68	<1	NA	NA
PHHE5	<i>Physalis heterophylla</i> Nees	68	<1	NA	NA
BOCU	<i>Bouteloua curtipendula</i> (Michx.) Torr.	71	<1	NA	NA

Taxon ID	Scientific Name	Rank	Mean Percent Cover	Mean Canopy Area (m <sup>2</sup> per m <sup>2</sup> )	Mean ABH (cm <sup>2</sup> per m <sup>2</sup> )
HEHI	<i>Hedeoma hispida</i> Pursh	71	<1	NA	NA
LIIN2	<i>Lithospermum incisum</i> Lehm.	71	<1	NA	NA
POAR3	<i>Poa arida</i> Vasey	71	<1	NA	NA
THAR5	<i>Thlaspi arvense</i> L.	71	<1	NA	NA
BODA2	<i>Bouteloua dactyloides</i> (Nutt.) J.T. Columbus	76	<1	NA	NA
HOJU	<i>Hordeum jubatum</i> L.	76	<1	NA	NA
SPCOC2	<i>Sporobolus compositus</i> (Poir.) Merr. var. <i>compositus</i>	76	<1	NA	NA
PEGR5	<i>Penstemon gracilis</i> Nutt.	79	<1	NA	NA
VEBR	<i>Verbena bracteata</i> Cav. ex Lag. & Rodr.	79	<1	NA	NA
ARPU9	<i>Aristida purpurea</i> Nutt.	81	<1	NA	NA
CALO	<i>Calamovilfa longifolia</i> (Hook.) Scribn.	81	<1	NA	NA
CIUN	<i>Cirsium undulatum</i> (Nutt.) Spreng.	81	<1	NA	NA
ELRE4	<i>Elymus repens</i> (L.) Gould	81	<1	NA	NA
HERI	<i>Heuchera richardsonii</i> R. Br.	81	<1	NA	NA
LACA	<i>Lactuca canadensis</i> L.	81	<1	NA	NA
LICA2	<i>Ligusticum canbyi</i> (J.M. Coult. & Rose) J.M. Coult. & Rose	81	<1	NA	NA
OENU	<i>Oenothera nuttallii</i> Sweet	81	<1	NA	NA
SIAL2	<i>Sisymbrium altissimum</i> L.	81	<1	NA	NA
VINE	<i>Viola nephrophylla</i> Greene	81	<1	NA	NA

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

Table 29: Per plot breakdown of species richness, diversity, and herbaceous cover at NOGP.

Plot ID	Species Richness	Shannon Diversity Index	Percent Total Herbaceous Cover
NOGP_061	10	1.69	21
NOGP_062	28	2.61	65
NOGP_063	18	1.8	48
NOGP_064	24	2.4	51
NOGP_065	23	2.25	38
NOGP_066	20	2.31	23
NOGP_067	25	2.42	63
NOGP_068	23	2.41	45
NOGP_069	37	3.29	50
NOGP_070	23	1.64	59
NOGP_071	14	1.85	20
NOGP_072	29	2.61	38
NOGP_073	25	1.81	57
NOGP_074	13	1.13	43
NOGP_075	24	2.86	28
NOGP_076	26	2.58	40
NOGP_077	21	1.98	54
NOGP_078	28	2.46	58
NOGP_079	12	1.8	13
NOGP_080	35	3.03	65
NOGP_081	26	2.85	62
NOGP_082	27	2.33	72
NOGP_083	30	2.88	55
NOGP_084	35	2.98	76
NOGP_085	20	1.98	39
NOGP_086	27	2.68	65
NOGP_087	24	2.66	36
NOGP_088	10	1.5	19
NOGP_089	23	2.49	49
NOGP_090	15	2.24	19

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

## 6.4 Beetles

### 6.4.1 Site-Specific Methods

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

### 6.4.2 Results

Table 30: Beetle identification results at NOGP.

Sample ID	Scientific Name
NEONTcarabid8117	<i>Poecilus lucublandus</i>
NEONcarabid8110	<i>Syntomus americanus</i>
NEONcarabid8114	<i>Syntomus americanus</i>
NEONcarabid8116	<i>Syntomus americanus</i>
NEONcarabid8112	<i>Syntomus americanus</i>
NEONcarabid8115	<i>Syntomus americanus</i>
NEONcarabid8113	<i>Syntomus americanus</i>
NEONcarabid8111	<i>Syntomus americanus</i>

## 6.5 Mosquitoes

### 6.5.1 Site-Specific Methods

Mosquito site characterization was conducted in July 2013 by NEON staff following the standard methods outlined in TOS Site Characterization Methods (RD[6]) to test protocol methods and start site level species lists. No pathogen testing was performed and all samples were pooled before identification. For more information on this protocol and data product numbers see Appendix A. See the WOOD species reference list section for statewide resources.

### 6.5.2 Results

Table 31: Mosquito identification results at NOGP.

Sample ID	Scientific Name	Count
NOGP.July2013.SC.1	<i>Aedes dorsalis</i>	153



Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

Sample ID	Scientific Name	Count
NOGP.July2013.SC.1	<i>Aedes flavescens</i>	20
NOGP.July2013.SC.1	<i>Aedes nigromaculis</i>	2
NOGP.July2013.SC.1	<i>Aedes vexans</i>	41
NOGP.July2013.SC.1	<i>Aedes</i> spp.	31
NOGP.July2013.SC.1	<i>Culex tarsalis</i>	154
NOGP.July2013.SC.1	<i>Culex</i> spp.	2
NOGP.July2013.SC.1	<i>Culiseta inornata</i>	21
NOGP.July2013.SC.1	Culicidae spp.	71

## 6.6 Ticks

### 6.6.1 Site-Specific Methods

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

### 6.6.2 Results

Table 32: Tick identification results at NOGP.

Sample ID	Scientific Name	Number of Adult Males	Number of Adult Females
NOGP.000.20130712.SC.1	<i>Dermacentor variabilis</i>	4	2

## 6.7 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., reptiles, amphibians, small mammals), these lists were often required to secure permits. Key references identified in this effort are listed below. Species lists and associated references for small mammals and breeding landbirds can be found in the appendices of the respective protocols (RD[07], RD[08]). See the WOOD species reference list section for statewide resources.

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

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

Title: TOS Site Characterization Report: Domain 09		Date: 04/14/2017
NEON Doc. #: NEON.DOC.003893	Author: R.Krauss	Revision: A

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

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

## 7 REFERENCES

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

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

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

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

## 8 APPENDIX A: DATA PRODUCT NUMBERS

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

Table 33: 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

Name	Description	Identification Code
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 <sup>2</sup> and plant species presence at 10-m <sup>2</sup> , 100-m <sup>2</sup> and 400-m <sup>2</sup>	NEON.DOM.SITE.DP1.10058
Plant phenology observations	Phenophase status and intensity of tagged plants	NEON.DOM.SITE.DP1.10055
Plant foliar stable isotopes	Field collection metadata describing the sampling of sun-lit canopy foliar tissues for stable isotope compositions. Also includes raw data returned from the laboratory.	NEON.DOM.SITE.DP1.10053
Plant foliar physical and chemical properties	Plant sun-lit canopy foliar physical (e.g., leaf mass per area) and chemical properties reported at the level of the individual.	NEON.DOM.SITE.DP1.10026
Non-herbaceous perennial vegetation structure	Field measurements of individual non-herbaceous perennial plants (e.g. cacti, ferns)	NEON.DOM.SITE.DP1.10045.
Ground beetles sampled from pitfall traps	Taxonomically identified ground beetles and the plots and times from which they were collected.	NEON.DOM.SITE.DP1.10022
Ground beetle sequences DNA barcode	CO1 DNA sequences from select ground beetles	NEON.DOM.SITE.DP1.10020
Mosquitoes sampled from CO2traps	Taxonomically identified mosquitoes and the plots and times from which they were collected	NEON.DOM.SITE.DP1.10043
Mosquito-borne pathogen status	Presence/absence of a pathogen in a single mosquito sample (pool)	NEON.DOM.SITE.DP1.10041
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