National Park Service
U.S. Department of the Interior

Plant Community Monitoring Project History

Version 1.4, 2026

Heartland Inventory & Monitoring Network

Wilson's Creek National Battlefield
6424 West Farm Road 182
Republic, MO 65738

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Contents

Page

Figures....iii
Tables....iv
Introduction....1
Protocol (and Prototype) Versions....1
Sample Design and History by Park....2
Parks Addressed....2
Park: Effigy Mounds National Monument (EFMO)....3
Monitoring Establishment Date....3
Design....3
Deviations....3
Monitoring History....4
Site Details....9
EFMO Goat Prairie....9
FMO Forest Sites....16
EFMO Prairie Sites....16
Park: George Washington Carver National Monument (GWCA)....17
Monitoring Establishment Date....17
Deviations....17
Monitoring History....17
Park: Herbert Hoover National Historic Site (HEHO)....19
Monitoring Establishment Date....19
Deviations....19
Monitoring History....19
Park: Homestead National Historical Park (HOME)....20
Monitoring Establishment Date....20
Deviations....20

Monitoring History 20
Park: Lincoln Boyhood National Memorial (LIBO) 22
Monitoring Establishment Date 22
Deviations 22
Monitoring History 22
Park: Hot Springs National Park (HOSP) 23
Monitoring Establishment Date 23
Deviations 23
Monitoring History 23
Park: Pea Ridge National Military Park (PERI) 25
Monitoring Establishment Date 25
Deviations 25
Monitoring History 25
Park: Pipestone National Monument (PIPE) 27
Monitoring Establishment Date 27
Deviations 27
Monitoring History 27
Park: Tallgrass Prairie National Preserve (TAPR) 30
Monitoring Establishment date 30
Deviations 30
Monitoring History 30
Park: Wilson's Creek National Battlefield (WICR) 36
Monitoring Establishment date 36
Deviations 36
Monitoring History 36
Literature Cited 42

Figures

Page

Figure 1. EFMO goat prairie site 1 layout 10
Figure 2. EFMO goat prairie site 6 layout 11
Figure 3. EFMO goat prairie site 13 layout 12
Figure 4. EFMO goat prairie site 14 layout 13
Figure 5. EFMO goat prairie site 16 layout 14

Tables

Page

Table 1. Plan for monitoring forest vegetation at EFMO....3
Table 2. Effigy Mounds National Monument vegetation monitoring community site history....5
Table 3. EFMO Plant Community Monitoring History. X indicates the site was sampled....8
Table 4. EFMO goat prairie sites sampled for overstory based on the VegMon database....15
Table 5. EFMO goat prairie sites sampled for understory based on the VegMon database....15
Table 6. EFMO goat prairie sites sampled for canopy cover based on the VegMon database....15
Table 7. George Washington Carver National Monument site history....17
Table 8. George Washington Carver National Monument monitoring history....18
Table 9. Herbert Hoover National Historic Site vegetation monitoring community site history....19
Table 10. Herbert Hoover National Historic Site monitoring history....19
Table 11. Homestead National Historical Park vegetation monitoring community site history....20
Table 12. Homestead National Historical Park monitoring history....21
Table 13. Lincoln Boyhood National Memorial vegetation monitoring community site history....22
Table 14. Lincoln Boyhood National Memorial monitoring history....22
Table 15. Hot Springs National Park vegetation monitoring community site history....23
Table 16. Hot Springs National Park monitoring history....24
Table 17. Pea Ridge National Battlefield vegetation monitoring community site history....25
Table 18. Pea Ridge National Battlefield monitoring history....26
Table 19. Pipestone National Monument vegetation monitoring community site history....27
Table 20. Pipestone National Monument monitoring history....29
Table 21. Tallgrass Prairie National Preserve vegetation monitoring community site history....30
Table 22. Tallgrass Prairie National Preserve monitoring history....33
Table 23. Wilson's Creek National Battlefield vegetation monitoring community site history....37
Table 24. Wilson's Creek National Battlefield monitoring history....39
Table 25. Manley Woods monitoring history (1997–2017) by standard operating procedure....41

Introduction

The plant community monitoring protocol was one of the first projects initiated when the Prairie Cluster Prototype began. The narrative of the vegetation monitoring protocol (Leis et al. 2022) and Middlemis-Brown (2016) provide historical background into the administrative development of the project. There have been five published versions of the protocol through the development of the project. Each version marks development in the project that was reflected in the reports of that era and provides insights into how sampling changed over time. This document is intended to complement the historical project narratives by compiling a detailed sampling history of parks and the monitoring sites therein. This documentation is intended to functionally support project implementation, such as field sampling and analysis.

Protocol Versions

Prototype

Willson, G.D., L. Thomas M. DeBacker, W.M. Rizzo, and C. Buck. 2000. Draft plant community monitoring protocol for six prairie parks. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Missouri Field Station, 302 Gentry Hall, University of Missouri Columbia, Missouri.

Protocols

Version 1.0

Willson, G.D., L. Thomas, M. DeBacker, W.M. Rizzo, and C. Buck. 2002. Plant community monitoring protocol for six prairie parks. U.S. Department of the Interior, U.S. Geological Survey, Northern Prairie Wildlife Research Center Inventory and Monitoring Protocol.

Version 2.0

DeBacker, M.D., A.N. Sasseen, C. Becker, G.A. Rowell, L.P. Thomas, J.R. Boetsch, and G.D. Willson. 2004. Vegetation community monitoring protocol for the Heartland I&M Network and Prairie Cluster Prototype Monitoring Program, version 2.0. National Park Service, Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program, Wilson's Creek National Battlefield, Republic, Missouri. 40 p. plus appendices.

Version 3.0

James, K.M., M.D. DeBacker, G.A. Rowell, J.L. Haack, and L.W. Morrison. 2009. Vegetation community monitoring protocol for the Heartland Inventory and Monitoring Network. Natural Resource Report NPS/HTLN/NRR — 2009/141. National Park Service, Fort Collins, Colorado.

Version 4.0

Leis, S.A., M.D. DeBacker L.W. Morrison, G.A. Rowell, and J.L. Haack. 2022. Vegetation community monitoring protocol for the Heartland Inventory and Monitoring Network: Narrative, version 4.0. Natural Resource Report NPS/HTLN/NRR—2022/2477. National Park Service, Fort Collins, Colorado. https://doi.org/10.36967/2294948

The most significant protocol change that altered sampling designs was written by James et.al. (2009). This revision changed the revisit design from a rotating panel design twice annually for two years in a row and three years off to one visit every fourth year without a rotating panel. Analysis of data produced from the two-visit design was done by choosing the maximum value of all species recorded across the two visits. The combined dataset replaced the raw two-sample data in the database. Hence, the VegMon database includes only a single value for each species recorded in plots for a given monitoring year. The sampling event assignment (PeriodID) was retained with the maximum value, but a year field was added to the database to solve query needs arising from multiple PeriodIDs in a year. The change in revisit design affected all the parks *except* Hot Springs National Park, Lincoln Boyhood National Memorial, and Pea Ridge National Military Park. The forest sites at Effigy Mounds National Monument were also not affected by this change. James et.al. (2009) also altered the sampling design for the Tallgrass Prairie National Preserve. The changes to the TAPR sampling design will be discussed in that section of this document. Quality assessment methods to assess species pseudoturnover and observer error were initiated in 2018.

In the Heartland Inventory and Monitoring Network (HTLN) prototype stage, park prairies were the primary plant community being monitored. Woodland and forested communities were added as HTLN grew. We distinguish different types of tree dominant communities in the process of collecting and summarizing data. For example, woodlands and forests have distinct characteristics and gradients within each. However, for the purposes of this history, we will refer to all communities dominated by trees as forested. This should provide some consistency for understanding the monitoring history of HTLN parks. We acknowledge some inconsistency in our database fields regarding categorizing tree-dominated communities, evidenced in the tables below that describe "park vegetation monitoring community site history."

Sample Design and History by Park

Documentation of the sample design and history at each park can be critical for continued consistent field operations. These same elements are key for implementing and interpreting analyses. Below we describe the sampling design and history for each of the HTLN parks that currently fall under the plant community monitoring project.

Parks Addressed

(Jump to the park by clicking on the hyperlinked name.)

Effigy Mounds National Monument (EFMO)
George Washington Carver National Monument (GWCA)
Herbert Hoover National Historic Site (HEHO)
Homestead National Historical Park (HOME)
Lincoln Boyhood National Memorial (LIBO)
Hot Springs National Park (HOSP)
Pea Ridge National Military Park (PERI)
Pipestone National Monument (PIPE)
Tallgrass Prairie National Preserve (TAPR)
Wilson's Creek National Battlefield (WICR)

Park: Effigy Mounds National Monument (EFMO)

Monitoring Establishment Date

EFMO is one of the prototype parks. Goat prairie and restored prairie sites were installed in 1997 and 2001. Forest sites (fire effects sites) were installed from 2003 to 2005.

Design

Goat prairie sites were monitored at a similar frequency as other HTLN sites in other parks. Each goat prairie site is somewhat unique, so we detailed the sample design and history of each site below. Prairie sites were installed in restored prairie occurring in two different management units. These three sites were installed as typical HTLN prairie sites.

The forest sites were monitored in a similar design to the NPS fire effects monitoring program. The revisit design for these sites was determined by the prescribed fire schedule (Table 1). Pre-burn sampling occurred once within five years prior to a burn (to represent pre-burn conditions), and post-burn sampling occurred during the first and third growing seasons post-burn (Draft monitoring plan is located at HTLN\Files\HTLNc\Projects\Fire\Documents\Reference\Fire monitoring plans). Reporting was scheduled for after the completion of one fire in each management unit. Unit N3 has not been burned yet, so reporting on forest monitoring at this site has not taken place.

Table 1. Plan for monitoring forest vegetation at EFMO. Taken from *EFMO Fire_Monitoring_09.V.2.docx* draft plan. X = scheduled for sampling, f = fuels, os = overstory, v/gc = vegetation/ground cover. Table is presented in its original form.

Unit	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
N1	f, os	f, v/gc [1]	–	–	f, os, v/gc	–	–	–	X [2]	–	–
N2	–	–	f, os, v/gc	–	f, os, v/gc[1]	–	–	X	–	–	X
N3	–	–	f, os, v/gc	–	–	–	X [2]	–	–	X	–
S1	–	–	f, os, v/gc	f, os, v/gc [1]	–	–	X	–	–	–	X [2]
S2	–	– [1]	f, os, v/gc	–	–	–	X [1]	–	–	X	–

[1] Years with prescribed fire.

[2] Years for which prescribed fires are planned.

Deviations

See site details section below. Some one-line sites were installed in the goat prairie to limit sites to one community type. Goat prairie sites were assessed for safety in 2017. Endpoints at sites 1 and 6 were adjusted to increase safety while monitoring. The tree tag on Site 6 AS witness tree (juniper) was also removed by request of the park. See trip reports for March 2017 and July 2017 for further details.

Monitoring of the restored prairie sites was discontinued in 2017. Monumenting of sites 7 and 8 had been removed prior to the 2013 monitoring event and it is unclear how precisely the sites were located for the monitoring that year. Sites 7 and 8 will not be reinstalled because of sensitivity to

previously unrecognized mounds in the proximity. The remaining prairie site, 9, was not statistically viable by itself, so we also suspended monitoring of that site.

The prescribed fire program has been suspended since 2009, and all forest sites were either in a pre-burn status or five or more years past the last burn. We suspended monitoring of these forest sites in 2015.

Monitoring History

Table 2 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the VegMon database.

Table 3 provides a historical perspective on which sites were sampled during each monitoring event.

Table 2. Effigy Mounds National Monument vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Comments	Discontinued
forest	1	Goat prairie	Unit S-1	split type	05-Jun-1997	–	–
forest	2	Goat prairie	Unit H-1-A	out of park on veg map	06-Jun-2001	A line only	–
forest	4	Goat prairie	Unit H-1-A	White Oak - Red Oak Forest (white oak - chinquapin oak phase)	06-Jun-2001	A line only	–
forest	5	Goat prairie	Unit H-1-A	White Oak - Red Oak Forest (white oak - chinquapin oak phase)	06-Jun-2001	A line only Split between red cedar phase and white oak - chinquapin oak phase.	–
forest	6	Goat prairie	Unit S-1	split type	03-Jun-1997	–	–
forest	13	Goat prairie	Unit N-2	split type	11-Jun-1997	–	–
forest	14	Goat prairie	Unit S-1	White Oak - Red Oak Forest (oak - hickory phase)	07-Jun-1997	–	–
forest	16	Goat prairie	Unit N-1	White Oak - Red Oak Forest (white oak - chinquapin oak phase)	08-Jun-1997	–	–
prairie	7	Restored	North unit resto-ration (N-2)	Central Mesic Tallgrass Prairie	10-Jun-1997	Monumenting removed	Jul-2017
prairie	8	Restored	North unit resto-ration (N-2)	Central Mesic Tallgrass Prairie	10-Jun-1997	Monumenting removed	Jul-2017
prairie	9	Restored	South unit resto-ration (S-2)	Central Mesic Tallgrass Prairie	11-Jun-1997	–	Jul-2017
forest	3	Woodland	Unit N-1	White Oak - Red Oak Forest (white oak - chinquapin oak phase)	29-Jun-2002	–	–
forest	10	Woodland	Unit N-1	White Oak - Red Oak Forest (oak - hickory phase)	08-Jul-2003	–	–

Resource	Site Number	Description	Park Unit	Community	Installed	Comments	Discontinued
forest	11	Woodland	Unit N-1	White Oak - Red Oak Forest (oak - hickory phase)	08-Jul-2003	–	–
forest	12	Woodland	Unit N-1	White Oak - Red Oak Forest (oak - hickory phase)	08-Jul-2003	AS in Maple - Basswood Forest (disturbed oak phase)	–
forest	21	Woodland	Unit N-1	White Oak - Red Oak Forest (oak - hickory phase)	08-Jul-2003	–	–
forest	22	Woodland	Unit S1	White Oak - Red Oak Forest (oak - hickory phase)	05-Apr-2005	–	–
forest	23	Woodland	Unit S2	split type	05-Apr-2005	–	–
forest	24	Woodland	Unit S2	White Oak - Red Oak Forest (oak - hickory phase)	05-Apr-2005	–	–
forest	25	Woodland	Unit S2	White Oak - Red Oak Forest (oak - hickory phase)	05-Apr-2005	–	–
forest	26	Woodland	Unit S1	White Oak - Red Oak Forest (oak - hickory phase)	05-Apr-2005	–	–
forest	27	Woodland	Unit S1	Maple - Basswood Forest (disturbed oak phase)	05-Apr-2005	–	–
forest	28	Woodland	Unit S1	Maple - Basswood Forest (disturbed hardwoods phase)	05-Apr-2005	–	–
forest	29	Woodland	Unit N3	White Oak - Red Oak Forest (oak - hickory phase)	05-Apr-2005	–	–
forest	30	Woodland	Unit N3	–	05-Apr-2005	road put in through site, replaced with site 35	16-Jul-2007
forest	31	Woodland	Unit N2	Maple - Basswood Forest (disturbed hardwoods phase)	06-Apr-2005	–	–

Resource	Site Number	Description	Park Unit	Community	Installed	Comments	Discontinued
forest	32	Woodland	Unit N2	split type	06-Apr-2005	–	–
forest	33	Woodland	Unit N2	Maple - Basswood Forest (disturbed oak phase)	06-Apr-2005	AS in White Oak - Red Oak Forest (bigtooth aspen phase)	–
forest	34	Woodland	Unit N2	Maple - Basswood Forest (disturbed oak phase)	06-Apr-2005	split between MB (disturbed oak phase) & bigtooth aspen phase	–
forest	35	Woodland	Unit N3	White Oak - Red Oak Forest (oak - hickory phase)	16-Jul-2007	Used B-line from site 30 and created new A line. AF and BS in different MAP_DESC type	–

Table 3. EFMO Plant Community Monitoring History. X indicates the site was sampled. The sites were sorted within community types by the number of times sampled.

Sampling Date	Goat Prairie Sites								Prairie Sites			Forest Sites																			Number of Sites Visited
	16	1	13	14	2	4	5	6	7	8	9	3	10	11	12	21	22	26	27	28	23	24	25	31	32	33	34	29	35	30	
1998Jun21	X	X	X	X	–	–	–	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
1998Sep09	X	X	X	X	–	–	–	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
2001Jun04	X	X	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11
2001Sep09	X	X	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11
2002Jun28	X	–	–	–	X	X	X	–	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
2002Sep16	X	–	–	–	X	X	X	–	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
2003Jul8	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
2004Jul19	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
2005Jul7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	–	X	13
2005Jun20	X	X	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11
2005Sep12	X	X	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11
2006Jul12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	–	–	–	–	–	–	–	–	4
2007Jul15	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	X	X	X	X	–	X	–	10
2009Jul23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	–	–	–	–	–	–	–	7
2009Jun22	X	X	X	X	X	X	–	–	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
2010Jul14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	–	6
2012Jul24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	–	–	–	–	–	–	–	3
2013Jul22	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
2013Jun26	X	X	X	X	X	X	–	–	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
2014Jul14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	–	–	–	–	–	–	–	–	4
2017Jul11	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
2022July7	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Times Sampled	12	10	10	10	10	10	8	8	8	8	8	6	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	2	2	1	n/a

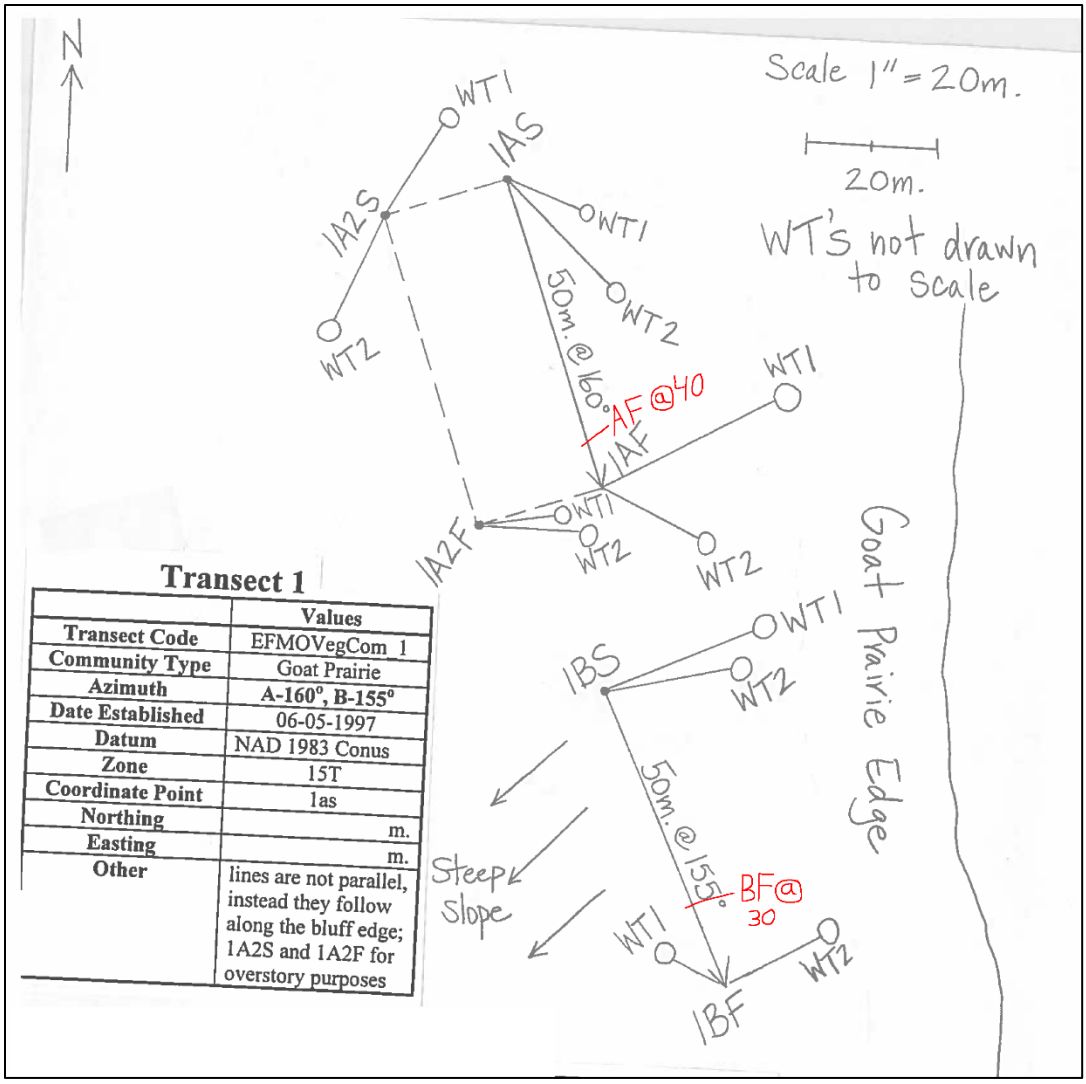
Site Details

EFMO Goat Prairie

Note: N is used for counts of numbers of sites while n is used for counts of number of plots. Site diagrams are included below, but can also be found here HTLN\Files\HTLNc\Projects\PlantCommunities\3 Documents\Protocol\Implementation\EFMO goat site diagrams.pdf

Site 1

Overstory is collected on the A transect. The overstory site in this case is bounded by the A transect on the east and 20 m to the west there is a second set of rebar to form the 20 x 50 m area for overstory collection (Figure 1). **Densiometer** readings have varied through time (all plots or only A line plots). In the future, read all plots for canopy cover (four at each plot). **Understory** (n = 8): the two transects are adjacent from a N-S perspective. Transect A now has four plots 10A, 20A, 30A, 40A. Plot 50A is in a precarious position and should no longer be sampled (2017). Transect B has four plots 0B, 10B, 20B, 30B (B transect was truncated to 30 m in 2017 for safety).



Transect 1

	Values
Transect Code	EFMOVegCom_1
Community Type	Goat Prairie
Azimuth	A-160°, B-155°
Date Established	06-05-1997
Datum	NAD 1983 Conus
Zone	15T
Coordinate Point	1as
Northing	m.
Easting	m.
Other	lines are not parallel, instead they follow along the bluff edge; 1A2S and 1A2F for overstory purposes

Figure 1. EFMO goat prairie site 1 layout. This site was modified to improve safety in 2017. See red notes added to the original diagram.

Site 2

Overstory = 20 x 50 m plot centered on the transect line. **Understory** = single 50 m transect with five plots beginning at 10A. **Densiometer**: n = 5, four readings at each of five plots.

Site 4

Overstory = plot is centered on the transect line with 5 m on either side (10 x 50 m = 500 m^2). The ridge previously accommodated a full site centered on that transect (20 x 50 m) = 10,000 m^2, but it no longer does. **Understory** = single 50 m transect with five plots beginning at 10A

Site 5

Understory = single transect with five plots beginning at 0A. Transect is 40 m long. 0A, 30A no longer safe to sample plants. Densiometer and litter depth still possible. **No overstory. Densiometer:** n = 5, four per veg plot.

Site 6

Overstory is collected using the exterior transects A and B lines. Transect A is 40 m long. The outer transect B was originally 40 m long but is now 30 m long. It now begins at what originally was the 10 m mark (the 0B was eroded and unsafe in 2017). **Overstory:** The overstory area bounded by the A line and exterior B line was originally 800 m^2 but was reduced to 700 m^2 in 2017. In 2022, The A-line was placed roughly in place based on the GNSS data so that overstory could be sampled. **Understory** was sampled at 4 plots on the A-line, (0A, 10A, 30A, 40A; plot 20A was no longer safe to measure as of 2017), and an additional three understory plots are located on an inner 20 meter transect, located in the center of the overstory plot (20B, 30B, 40B; Figure 2). In 2022, the A-line could not be relocated because of missing monumenting at the start, and rebar laying loose on the soil at the finish. The A-line was also severely eroded in the middle of the line. **Densiometer**: currently n = 3 (B line), four observations per veg plot (previously 8 plots were measured for canopy cover, but in 2022 only the 3 B-line plots were observed).

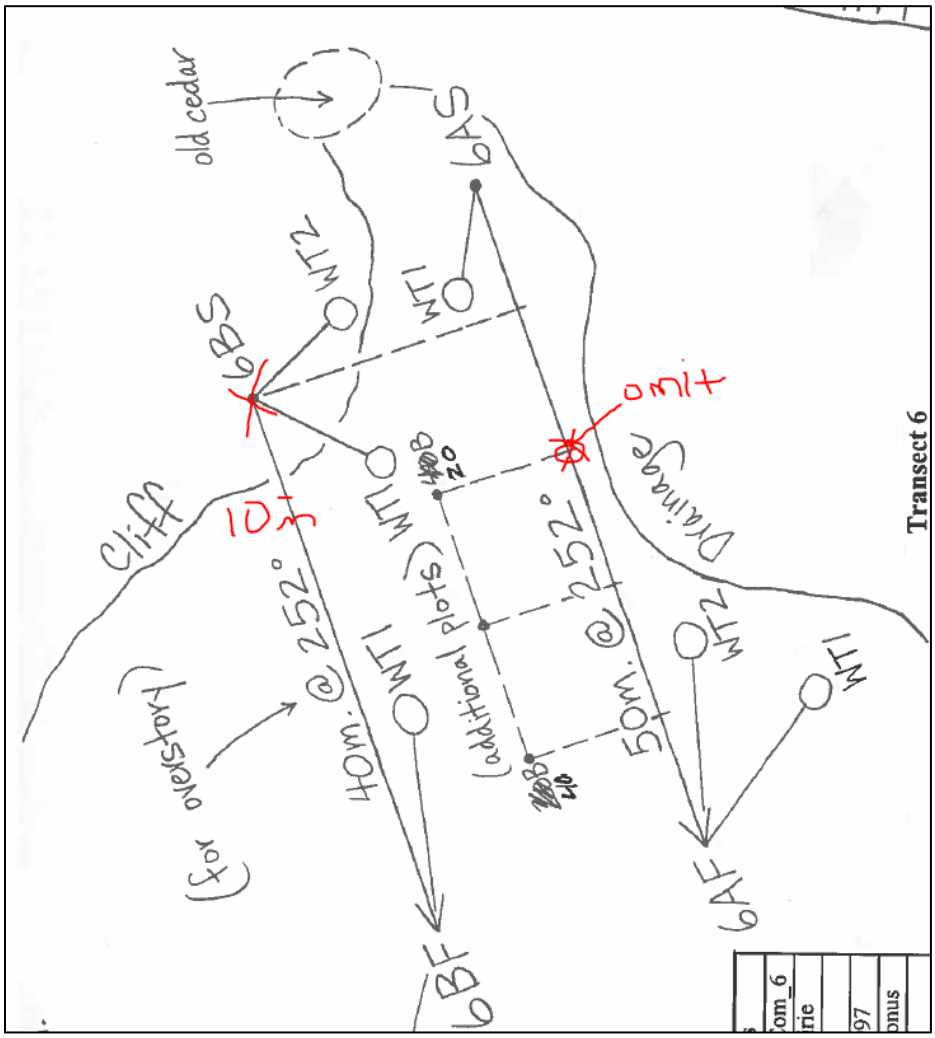
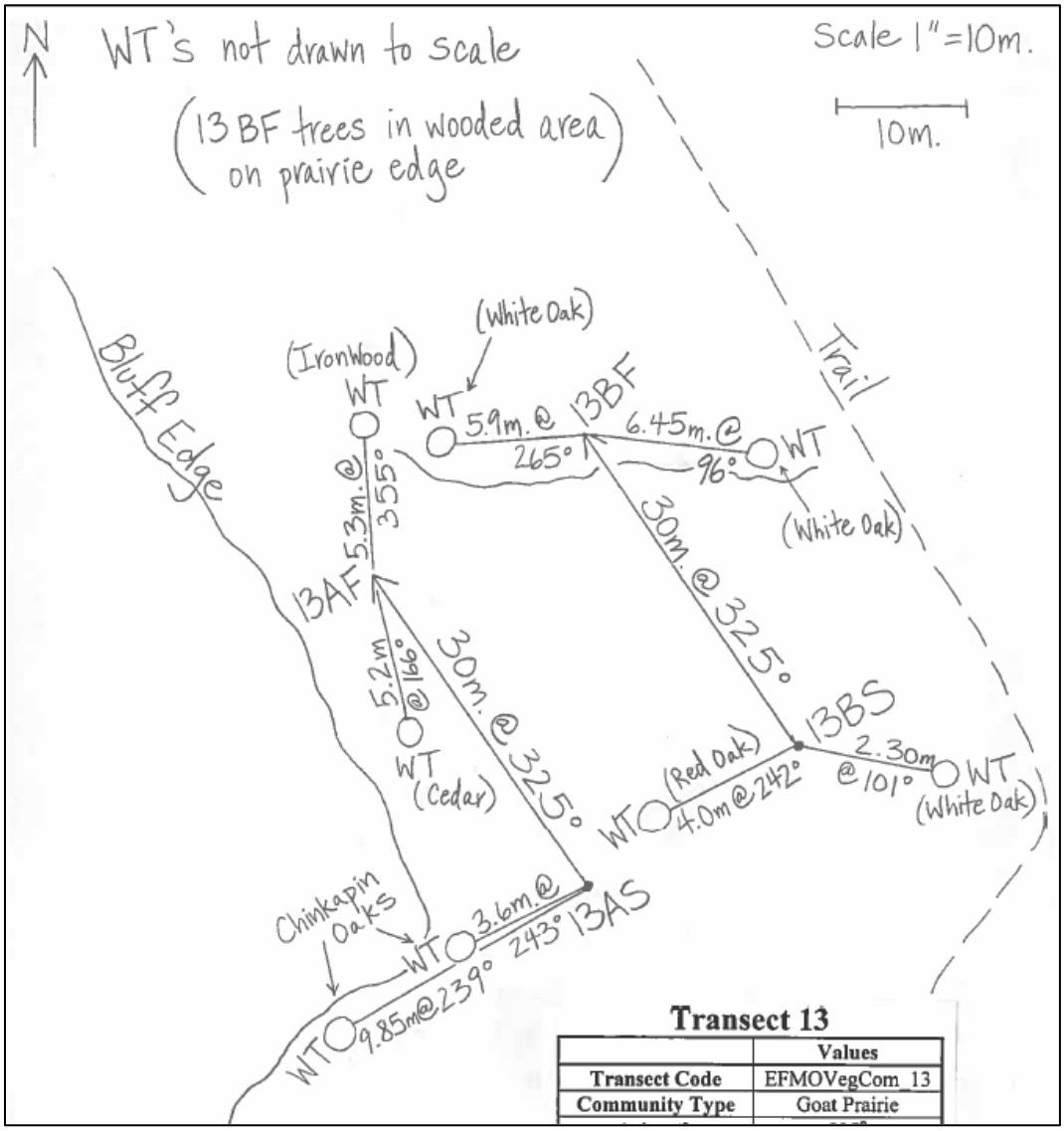


Figure 2. EFMO goat prairie site 6 layout. The A line now begins with the 10 m plot and the 20 m plot is eliminated. On the B overstory line, the transect begins at 10 m and ends at 40 m. Note the text in red added into the original diagram.

Site 13

Understory transects A & B were installed as only 30 m long with plots located at both 0 and 30 m (8 plots), but observers appear to have extended the transects to include 40A and 40B in some years (n = 10; Figure 3). The A-line was not sampled in 2022 due to erosion of most of the plots. Analysis should consider maintaining the original installation configuration. **Densiometer:** four measurements in 8 plots (n = 8). **Overstory** area 30 x 20 m = 600 m^2.



Transect 13

	Values
Transect Code	EFMOVegCom_13
Community Type	Goat Prairie

Figure 3. EFMO goat prairie site 13 layout. Note, transects are 30 m long.

Site 14

This site was installed as a traditional HTLN rectangular monitoring site (Figure 4). **Overstory** and **understory** data are collected as prescribed in the plant community monitoring protocol. **Densiometer** readings were also taken per the protocol except the number of plots sampled for canopy cover has varied over time. In 2022, we did not sample plot 20A because of a hanging dead limb over the plot.

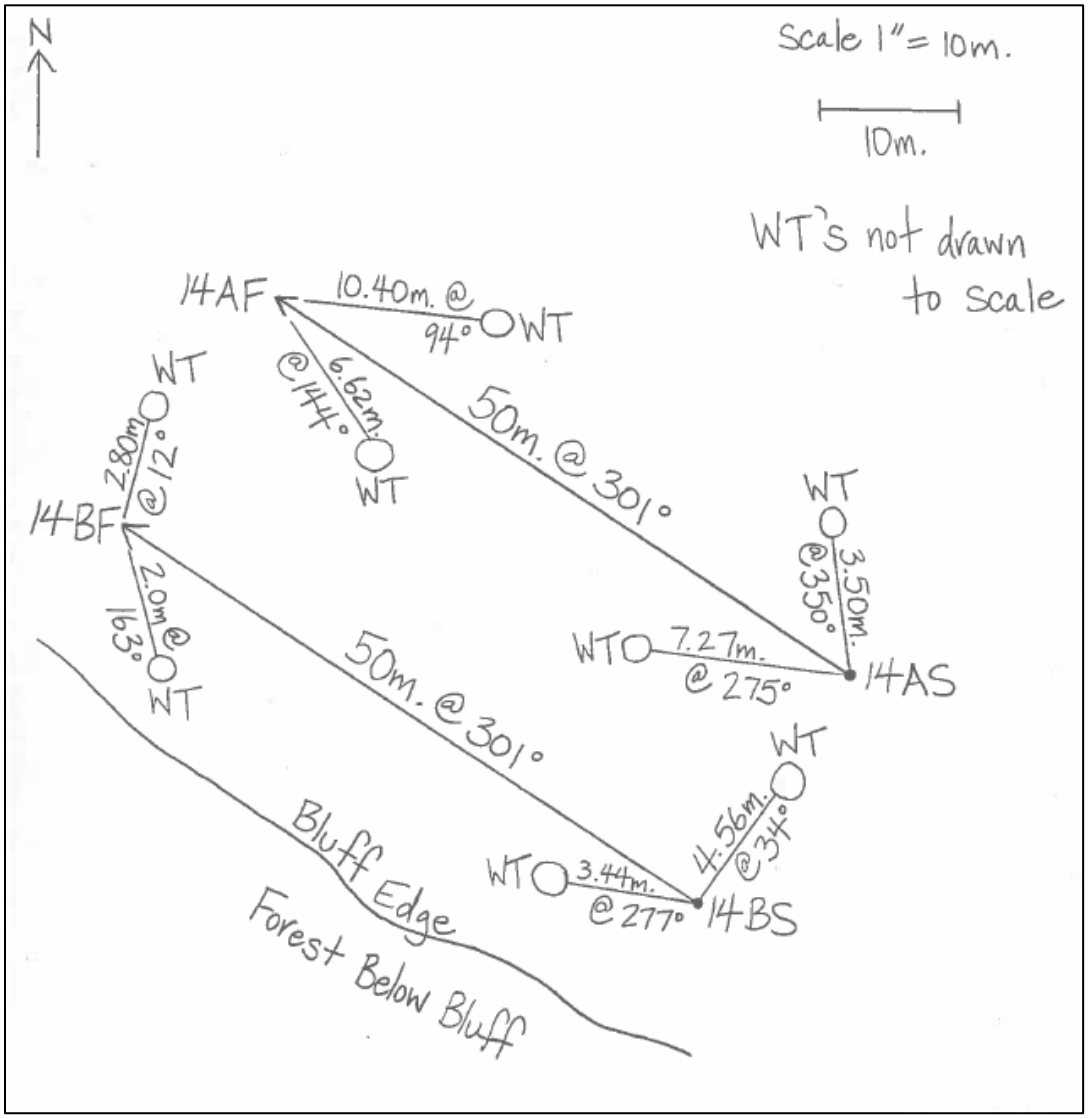


Figure 4. EFMO goat prairie site 14 layout. This site had no major deviations from the standard sites described in the protocol.

Site 16

This site was installed as traditional HTLN rectangular monitoring site (Figure 5). **Overstory** and **understory** data are collected as prescribed in the plant community monitoring protocol except Plot 10A and 50A are no longer safe to sample as of 2022 (n = 8). Plot 40A was sampled from inside the plot for safety reasons. **Densiometer** readings were also taken per the protocol except the number of plots sampled for canopy cover has varied over time.

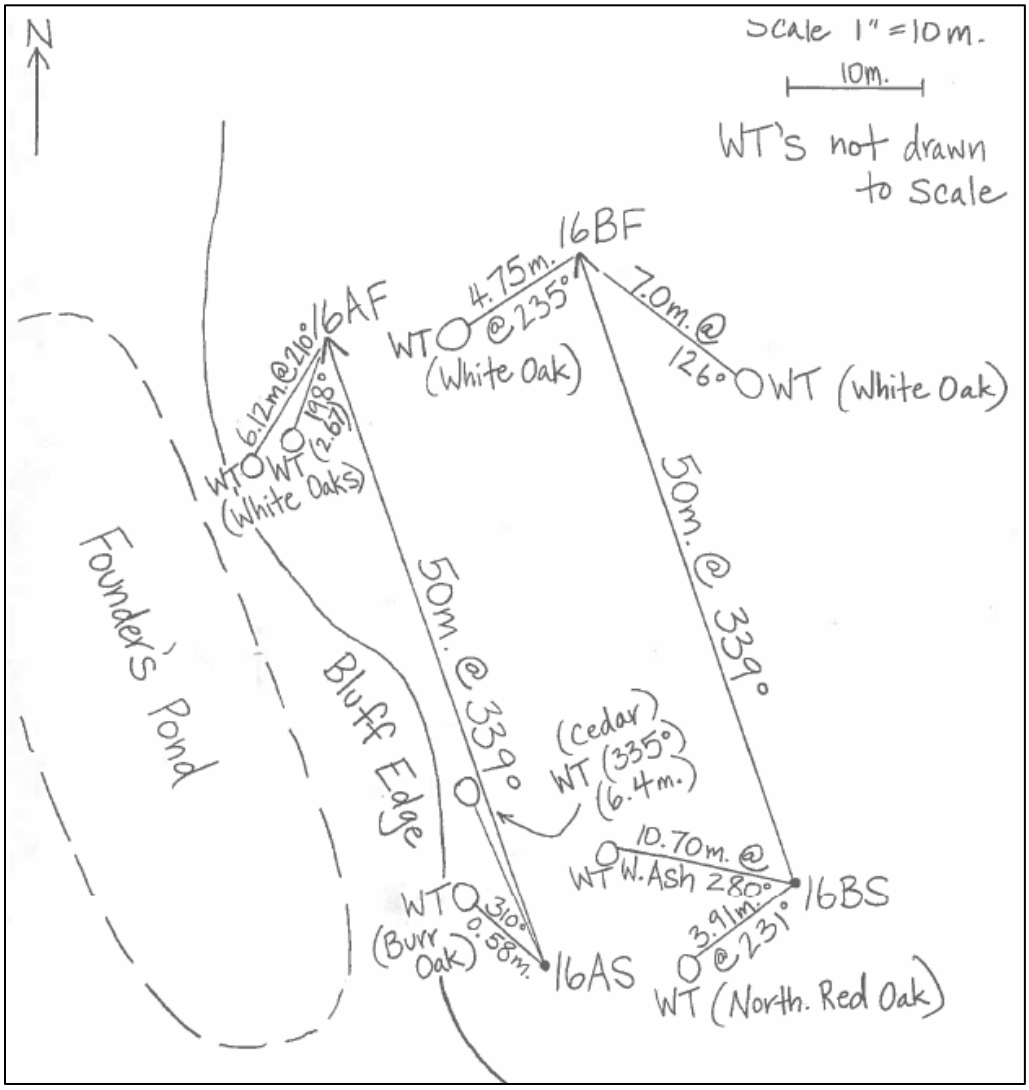


Figure 5. EFMO goat prairie site 16 layout. The only deviation from the standard sites described in the protocol was the omission of plot 10A for safety reasons in 2017.

Site Histories by Standard Operating Procedures

We further detailed the sampling history at the EFMO goat prairies by standard operating procedure because of inconsistencies that may make ferreting out the history otherwise challenging (Tables 4–6).

Table 4. EFMO goat prairie sites sampled for overstory based on the VegMon database. X indicates the site was sampled.

Year	Site 1	Site 2	Site 4	Site 5	Site 6	Site 13	Site 14	Site 16	Number of Sites Sampled
1997	X	–	–	NA	X	X	X	X	5
2001(02)	–	X	X	NA	X	X	X (02)	X	6
2005	X	X	X	NA	X	X	X	X	7
2009	–	–	–	NA	–	X	X	X	3
2013	–	–	–	NA	–	X	X	X	3
2017	X	X	X	NA	X	X	X	X	7
2022	X	X	X	NA	X	X	X	X	7

Table 5. EFMO goat prairie sites sampled for understory based on the VegMon database. X indicates the site was sampled.

Year	Site 1 (n=10)	Site 2 (n=5)	Site 4 (n=5)	Site 5 (n=5)	Site 6 (n=8)	Site 13 (n=10)	Site 14 (n=10)	Site 16 (n=10)	Number of Sites Sampled
1997	X	–	–	–	X	X	–	–	3
1998	X	–	–	–	X	X	X	X	5
2001	X	X	X	X	X	X	X	X	8
2002		X	X	X	–	–	–	X	4
2005	X	X	X	X	X	X	X	X	8
2009	X	X	X	–	–	X (n=8)	X	X	6
2013	X	X	X	–	–	X (n=8)	X	X (B only)	6
2017	X (n=9)	X	X	X	X (n=7)	X	X	X (n=9)	8
2022	X (n=9)	X	X	X (n=3)	X (n=3)	X (n=4)	X (n =9)	X (n=8)	8

Table 6. EFMO goat prairie sites sampled for canopy cover based on the VegMon database. n = number of plots observed (4 observations/plot). X indicates the site was sampled.

Year	Site 1 (n=5)	Site 2 (n=5)	Site 4 (n=5)	Site 5 (n=5)	Site 6 (n=8)	Site 13 (n=8)	Site 14 (n=10)	Site 16 (n=10)	Number of Sites Sampled
1997	–	–	–	–	–	–	–	–	0
1998	–	–	–	–	–	–	–	–	0
2001	X (n=10) [1]	X	X	X	X	X	X	X	8
2002	–	X	X	X	–	–	–	X	4
2005	X	X	X	X	X	X	X	X	8
2009	X (n=10) [1]	–	–	–	–	X	X	X	4
2013	–	–	–	–	–	X	X	X (n=5)	3

Year	Site 1 (n=5)	Site 2 (n=5)	Site 4 (n=5)	Site 5 (n=5)	Site 6 (n=8)	Site 13 (n=8)	Site 14 (n=10)	Site 16 (n=10)	Number of Sites Sampled
2017	X (n=6)	X	X	X	X (n=7)	X	X	X	8
2022	X (n=4)	X	X	X	X (n=3)	X (n=4)	X	X	8

[1] Use A line data only (n = 5)

FMO Forest Sites

Monitoring at the forest sites included the complement of woodland/forest SOPs as well as fuel load monitoring described in the fire ecology protocol (Leis et al. 2011). Only one major deviation occurred in the forest sites. A trail was constructed through site 30 after installation. The site was flipped to retain the B transect and a new A line was installed on the opposite side of the original site. The site was renamed EFMO_35.

EFMO Prairie Sites

Prairie sites (7, 8, 9) were sampled according to standard prairie protocols with the following exceptions: Overstory was recorded only in the first three monitoring years (1997, 2001, 2005) and regeneration was observed in 1998, 2005, and 2013.

Park: George Washington Carver National Monument (GWCA)

Monitoring Establishment Date

In May 2004, seven sites were installed and remain to this day. The seven sites are standard HTLN prairie sites. Management actions have varied from mowing/haying and burning through time.

Deviations

None.

Monitoring History

Table 7 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database. Table 8 provides a historical perspective on which sites were sampled during each monitoring event. Double sampling for quality assessment was first conducted in the park in 2020.

Table 7. George Washington Carver National Monument site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	1	Restored	Unit 5	Nonnative ruderal grassland	5/25/2004	–
prairie	2	Restored	Unit 5	Nonnative ruderal grassland	5/25/2004	–
prairie	3	Restored	Unit 4	Nonnative ruderal grassland	5/25/2004	–
prairie	4	Restored	Unit 3	Nonnative ruderal grassland	5/27/2004	–
prairie	5	Restored	Unit 7	Nonnative ruderal grassland	5/27/2004	–
prairie	6	Restored	Unit 7	Nonnative ruderal grassland	5/27/2004	–
prairie	7	Restored	Unit 7	Nonnative ruderal grassland	5/28/2004	–

Table 8. George Washington Carver National Monument monitoring history. X indicates the site was sampled.

Sampling Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Number of Sites Visited
5/25/2004	X	X	X	X	X	X	X	7
8/30/2004	X	X	X	X	X	X	X	7
5/31/2005	X	X	X	X	X	X	X	7
9/6/2005	X	X	X	X	X	X	X	7
6/16/2008	X	X	X	X	X	X	X	7
6/25/2012	X	X	X	X	X	X	X	7
7/1/2016	X	X	X	X	X	X	X	7
6/16/2020	X	X	X	X	X	X	X	7
6/23/2025	X	X	X	X	X	X	X	7
Times Sampled	9	9	9	9	9	9	9	n/a

Park: Herbert Hoover National Historic Site (HEHO)

Monitoring Establishment Date

Four sites were installed in May 2004 at HEHO with two more sites added in 2005. A new site (15) was installed in 2022.

Deviations

Sites were established to coordinate with Dr. Christiansen's long-term monitoring at the park (see Williams et al. 2007). Sites (2, 8) were destroyed, the result of construction projects in the park in 2021. Those sites were necessarily retired. Site 15 was installed as a replacement.

Monitoring History

Table 9 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database. Park Units were updated in the 2022 version of the prairie management plan. Table 9 was updated to reflect the change. Table 10 provides a historical perspective on which sites were sampled during each monitoring event. Double sampling for quality assessment was first conducted in the park in 2022.

Table 9. Herbert Hoover National Historic Site vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	1	Restored	PMU 4	Restored Tallgrass Prairie	8/10/2004	–
prairie	7	Restored	PMU 2	Restored Tallgrass Prairie	8/10/2004	–
prairie	2	Restored	PMU 3	Restored Tallgrass Prairie	8/11/2004	01/01/2022
prairie	8	Restored	PMU 1	Restored Tallgrass Prairie	8/11/2004	01/01/2022
prairie	4	Restored	PMU 2	Restored Tallgrass Prairie	6/24/2005	–
prairie	10	Restored	PMU 5	Restored Tallgrass Prairie	6/24/2005	–
prairie	15	Restored	PMU 3	Restored Tallgrass Prairie	7/12/2022	–

Table 10. Herbert Hoover National Historic Site monitoring history. X indicates the site was sampled.

Sampling Date	Site 1	Site 10	Site 2	Site 4	Site 7	Site 8	Site 15	Number of Sites Visited
6/9/2004	X	–	X	–	X	X	–	4
6/23/2005	X	X	X	X	X	X	–	6
9/15/2005	X	X	X	X	X	X	–	6
6/22/2009	X	X	X	X	X	X	–	6
6/24/2013	X	X	X	X	X	X	–	6
7/13/2017	X	X	X	X	X	X	–	6
7/10/2022	X	X	–	X	X	–	X	5
7/6/2026	X	X	–	X	X	–	X	5
Times Sampled	8	7	6	7	8	6	2	n/a

Park: Homestead National Historical Park (HOME)

Monitoring Establishment Date

One of the original prototype parks, monitoring was initiated at HOME in 1998 with five prairie sites. Three forest sites were added between 2000 and 2005, and the final two prairie sites were installed in 2009.

Deviations

In 2002, sites 1 and 3 were not collected in June because they had been recently burned (May 31). Site 3 was not collected in August either. Site 8 was not monitored in 2017 because of safety issues resulting from a recent windstorm event. We were unable to complete quality assessment double sampling procedures in the woodland sites in 2026 because of time constraints.

Monitoring History

Table 11 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database. Table 12 provides a historical perspective on which sites were sampled during each monitoring event. Double sampling for quality assessment was first conducted in the park in 2022. Woodland trees were number tagged in December of 2021 in preparation for the summer 2022 sampling event. Park units were updated in the 2020 version of the fire management plan but have not been updated here.

Table 11. Homestead National Historical Park vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	1	Restored	3	Restored Prairie	6/17/1998	–
prairie	2	Restored	2	Restored Prairie	6/17/1998	–
prairie	3	Restored	3	Restored Prairie	6/17/1998	–
prairie	4	Restored	2	Restored Prairie	6/17/1998	–
prairie	5	Restored	2	Restored Prairie	6/17/1998	–
prairie	10	Restored	5	Restored Prairie	6/8/2009	–
prairie	9	Restored	1	Restored Prairie	6/8/2009	–
forest	6	Successional	–	Successional Forest	6/21/2000	–
forest	7	Successional	–	Successional Forest	4/30/2002	–
forest	8	Bur Oak	–	Bur Oak Woodland	6/7/2005	–

Table 12. Homestead National Historical Park monitoring history. X indicates the site was sampled.

Sampling Date	Site1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Number of Sites Visited
1998Aug24	X	X	X	X	X	–	–	–	–	–	5
1998Jun16	X	X	X	X	X	–	–	–	–	–	5
1999Aug30	X	X	X	X	X	–	–	–	–	–	5
1999Jun24	X	X	X	X	X	–	–	–	–	–	5
2000Jun19	X	X	X	X	X	X	–	–	–	–	6
2000Sep12	X	X	X	X	X	X	–	–	–	–	6
2002Aug20	–	X	–	X	X	X	X	–	–	–	5
2002Jun10	–	X	–	X	X	X	X	–	–	–	5
2005Aug22	X	X	X	X	X	–	–	–	–	–	5
2005Jun6	X	X	X	X	X	X	X	X	–	–	8
2006Jun22	X	X	X	X	X	X	X	X	–	–	8
2006Sep14	X	X	X	X	X	–	–	–	–	–	5
2009Jun8	X	X	X	X	X	X	X	X	X	X	10
2013Jun10	X	X	X	X	X	X	X	X	X	X	10
2017June19	X	X	X	X	X	X	X	–	X	X	9
2022June21	X	X	X	X	X	X	X	X	X	X	10
2026June15	X	X	X	X	X	X	X	X	X	X	10
Times Sampled	15	17	15	17	17	11	9	6	5	5	n/a

Park: Lincoln Boyhood National Memorial (LIBO)

Monitoring Establishment Date

Four forest sites were established at LIBO in 2011.

Deviations

Analysis indicates that there may be some confusion on identification of maple species between the first and second monitoring events. Sampling in 2024 indicated a large number of tree falls, especially in site 1. Despite having tagged the trees in 2019, it was difficult to tell where the lines should be laid. Many of the trees in all sites also lost their tags resulting in a large effort to retag and measure trees.

Monitoring History

Table 13 provides detailed information on the history of each site. Table 14 provides a historical perspective on which sites were sampled during each monitoring event. Quality assessment double sampling procedures were first conducted at the park in 2019.

In 2024, the project leader could not attend the field sampling. Monitors from the INDU fire effects team assisted with sampling efforts.

Table 13. Lincoln Boyhood National Memorial vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
forest	1	Forest	Cemetery Hill	Restored Deciduous Forest	6/27/2011	–
forest	2	Forest	Cemetery Hill	Restored Deciduous Forest	6/27/2011	–
forest	3	Forest	–	Ruderal Forest	6/27/2011	–
forest	4	Forest	Cemetery Hill	Restored Deciduous Forest	6/27/2011	–

Table 14. Lincoln Boyhood National Memorial monitoring history. X indicates the site was sampled.

Sampling Date	Site 1	Site 2	Site 3	Site 4	Number of Sites Sampled
6/27/2011	X	X	X	X	4
7/20/2015	X	X	X	X	4
7/15/2019	X	X	X	X	4
6/24/2024	X	X	X	X	4
Times Sampled	4	4	4	4	n/a

Park: Hot Springs National Park (HOSP)

Monitoring Establishment Date

Seven forest sites were established at HOSP in 2007. Forest SOPs were developed to build on the original prairie SOPs.

Deviations

The intervals between the first three monitoring events were longer than the prescribed 4 years. During monitoring in 2024, it was discovered that the identification tags on the transects were mislabeled. The A and B designations were transposed. Witness tree tags were correctly placed and research from trip reports and labels in the spatial data were consulted. As a result, the transect tags were switched between the A and B lines. The B line finish was previously placed at 40 m, likely because of proximity to a trail. The B line was extended to 50 m for the overstory sampling. It is unclear whether past monitoring events included the whole 0.1 ha or if the B line was truncated.

Monitoring History

Table 15 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database. Table 16 provides a historical perspective on which sites were sampled during each monitoring event. Trees in the monitoring sites were tagged in fall 2023 in preparation for the 2024 monitoring event.

Fuels lines were sampled by the fire ecology team from the Ozark Scenic riverways in conjunction with the monitoring in 2024. It is unclear if they made the appropriate adjustments to the slope and azimuth for each transect based on the changes to the transect lines labeling. Double sampling for quality assessment was first implemented in 2024.

Table 15. Hot Springs National Park vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps. See Leis 2017 for more information.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
forest	1	Woodland	lower slope	Ozark-Ouachita Dry-Mesic White Oak - Black Oak - Hickory Forest Ouachita-Ozark Small Stream Hardwood Forest Shortleaf Pine - Oak Dry-Mesic Woodland	3/5/2007	–
forest	2	Woodland	lower slope (Crabtree)	Ouachita-Ozark Small Stream Hardwood Forest Shortleaf Pine - Oak Dry-Mesic Woodland	3/5/2007	–
forest	3	Woodland	middle slope	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	3/5/2007	–

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
forest	4	Woodland	upper slope	Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland Ozark-Ouachita Dry-Mesic White Oak - Black Oak - Hickory Forest	3/5/2007	–
forest	5	Woodland	middle slope	Ouachita-Ozark Small Stream Hardwood Forest	3/5/2007	–
forest	6	Woodland	upper slope	Ozark-Ouachita Dry-Mesic White Oak - Black Oak - Hickory Forest	3/5/2007	–
forest	7	Woodland	upper slope (Old Growth North)	Shortleaf Pine - Oak Dry-Mesic Woodland	3/5/2007	–

Table 16. Hot Springs National Park monitoring history. X indicates the site was sampled.

Sampling Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Number of Sites Sampled
6/25/2007	X	X	X	X	X	X	X	7
7/7/2014	X	X	X	X	X	X	X	7
7/8/2024	X	X	X	X	X	X	X	7
Times Sampled	3	3	3	3	3	3	3	n/a

Park: Pea Ridge National Military Park (PERI)

Monitoring Establishment Date

Forest sites were established at PERI in 2007. Forest SOPs were developed to build on the original prairie SOPs in the protocol.

Deviations

The first two monitoring events were five years apart rather than the prescribed four years. Overstory trees were tagged in 2020 in all the monitoring sites. Tags were uniquely numbered with the aim of maintaining a more consistent record of species identification over time.

Sampling was attempted in 2020 but was not completed because of COVID-19 safety needs. Those data were not entered into the database. Regular sampling resumed for all sites in 2021.

Monitoring History

Table 17 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database. Table 18 provides a historical perspective on which sites were sampled during each monitoring event. Double sampling for quality assessment was first conducted in the park in 2021.

Table 17. Pea Ridge National Battlefield vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
forest	8	OAH	Natural area	Ozark oak-hickory woodland/forest	4/2/2007	–
forest	9	OAH	Natural area	Ozark oak-hickory woodland/forest	4/2/2007	–
forest	10	OAH	Natural area	Ozark oak-hickory woodland/forest	4/2/2007	–
forest	11	QUMA	Natural area	post oak-blackjack oak savanna/ woodland forest type	4/2/2007	–
forest	12	QUMA	Natural area	post oak-blackjack oak savanna/ woodland forest type	4/2/2007	–
forest	13	OAH	Natural area	Ozark oak-hickory woodland/forest	4/2/2007	–
forest	15	OAH	Natural area	Ozark oak-hickory woodland/forest	4/2/2007	–

Table 18. Pea Ridge National Battlefield monitoring history. X indicates the site was sampled.

Sampling Date	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 15	Sites Sampled
7/30/2007	X	X	X	X	X	X	X	7
7/16/2012	X	X	X	X	X	X	X	7
7/7/2016	X	X	X	X	X	X	X	7
7/13/2020	X	–	–	X	X	–	–	3
7/12/2021	X	X	X	X	X	X	X	7
7/14/2025	X	X	X	X	X	X	X	7
Times Sampled	6	5	5	6	6	5	5	n/a

Park: Pipestone National Monument (PIPE)

Monitoring Establishment Date

Four initial sites were installed at PIPE by the Prairie Cluster Prototype in 1996. Additional sites were installed in 1997 (5), 1998 (5), and 2009 (2). Sites were distributed between three prairie types (remnant tallgrass, restored tallgrass, Sioux Quartzite prairie) at the park. The dataset is considered stable beginning in 1997.

Deviations

Four sites were retired in 2010 to avoid adverse effects on a rare plant. Sites were originally monitored annually with the omission of 2000. After 2002, a three-year return interval continued until 2009. The final two monitoring events had four-year return intervals. One-transect sites (sites 5 and 6; N = 5 plots each) were installed to limit those sites to the rocky Sioux Quartzite community type spatially.

Monitoring History

Table 19 provides the history of each site (largely from the Locations table in the *VegMon* database. Table 20 provides a historical perspective on which sites were sampled at each monitoring event. Double sampling for quality assessment was first conducted in the park in 2022.

Table 19. Pipestone National Monument vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discon-tinued	Comments
prairie	1	Native	1	–	7/24/1996	1/1/2010	–
prairie	2	Native	1	–	7/24/1996	1/1/2010	–
prairie	3	Native	1	–	7/24/1996	1/1/2010	–
prairie	4	Native	1	–	7/24/1996	1/1/2010	–
prairie	5	Sioux Quartzite	1	Bur Oak Woodland	6/23/1997	–	B line only, 40 m long
prairie	6	Sioux Quartzite	1	Rock Outcrop	6/23/1997	–	B line only, 40 m long
prairie	10	Sioux Quartzite	1	Northern Tallgrass Quartzite Outcrop	6/17/1998	–	–
prairie	7	Restored	3	Restored Tallgrass Prairie	6/24/1997	–	–
prairie	8	Restored	3	Restored Tallgrass Prairie	6/25/1997	–	–
prairie	9	Restored	3	Central Mesic Tallgrass Prairie	6/26/1997	–	–
prairie	11	Native	1	Central Mesic Tallgrass Prairie	6/18/1998	–	–
prairie	12	Native	1	Central Mesic Tallgrass Prairie	6/18/1998	–	–
prairie	13	Native	1	Central Mesic Tallgrass Prairie	6/19/1998	–	–
prairie	14	Native	1	Central Mesic Tallgrass Prairie	6/20/1998	–	–
prairie	15	Restored	3	Central Mesic Tallgrass Prairie	6/8/2009	–	–

Resource	Site Number	Description	Park Unit	Community	Installed	Discon-tinued	Comments
prairie	16	Restored	3	Restored Tallgrass Prairie	6/8/2009	–	–
prairie	17	Restored	3	Restored Tallgrass Prairie	6/8/2009	–	–

Table 20. Pipestone National Monument monitoring history. X indicates the site was sampled. Sites 1–4 were retired and are not included in this table.

Date Sampled	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Number of Sites Sampled
1997Aug27	X	X	X	X	X	–	–	–	–	–	–	–	–	5
1997Jun23	X	X	X	X	X	–	–	–	–	–	–	–	–	5
1998Jun16	X	X	X	X	X	X	X	X	X	X	–	–	–	10
1998Sep14	X	X	X	X	X	X	X	X	X	X	–	–	–	10
1999Jun25	X	X	X	X	X	X	X	X	X	X	–	–	–	10
1999Oct03	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2001Jun13	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2001Sep05	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2002Jun18	–	–	–	–	–	–	X	X	–	X	–	–	–	3
2002Sep14	–	–	–	–	–	–	X	X	–	X	–	–	–	3
2005Aug24	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2005Jun8	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2006Jun20	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2006Sep11	X	X	X	X	X	X	X	X	X	X	–	–	–	10
2009Jun8	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2013Jun17	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2017June13	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2022June7	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2026June24	X	X	X	X	X	X	X	X	X	X	X	X	X	13
Times Sampled	17	17	17	17	17	15	17	17	15	17	5	5	5	n/a

Park: Tallgrass Prairie National Preserve (TAPR)

Monitoring Establishment date

One of the prototype parks, 39 sites were installed at TAPR from 1997 to 2000, 22 sites in 2002, and 10 in 2006. The sampling design initially included a suite of core sites supplemented by rotating panel sites. Sampling occurred twice annually through 2010. In 2014, the design switched to 30 core sites sampled on a four-year return interval. The change proposal is included in the Appendix and in the 2009 version of the protocol (James et al. 2009).

Deviations

The sample design changed in 2010. The panel design was retired, and 30 sites were designated as core sites to be visited every fourth year. In 2010, the 30 core sites were sampled in two seasons, then in 2014 only one sample event occurred.

Monitoring History

Table 21 provides detailed information on the history of each site. This table is largely pulled from the Locations table in the *VegMon* database.

Table 22 provides a historical perspective on which sites were sampled during each monitoring event. Double sampling for quality assessment was first conducted in the park in 2018.

Table 21. Tallgrass Prairie National Preserve vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps. Sites with completed fields are the core 30 sites currently being monitored.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	1	–	–	–	6/30/1997	1/1/2010
prairie	2	–	–	–	7/1/1997	1/1/2010
prairie	4	–	–	–	7/1/1997	1/1/2010
prairie	7	–	–	–	7/3/1997	1/1/2010
prairie	8	–	–	–	7/3/1997	1/1/2010
forest	11	–	–	–	9/1/1997	1/1/2010
forest	12	–	–	–	9/1/1997	1/1/2010
forest	13	–	–	–	9/1/1997	1/1/2010
forest	14	–	–	–	9/1/1997	1/1/2010
forest	15	–	–	–	9/1/1997	1/1/2010
forest	16	–	–	–	9/1/1997	1/1/2010
forest	17	–	–	–	9/1/1997	1/1/2010
forest	18	–	–	–	9/1/1997	1/1/2010
forest	19	–	–	–	9/1/1997	1/1/2010
forest	20	–	–	–	9/1/1997	1/1/2010
prairie	22	–	–	–	5/17/2000	1/1/2010

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	21	–	–	–	5/18/2000	1/1/2010
prairie	27	–	–	–	5/18/2000	1/1/2010
prairie	26	–	–	–	5/20/2000	1/1/2010
prairie	28	–	–	–	5/21/2000	1/1/2010
prairie	33	–	–	–	9/5/2000	1/1/2010
prairie	32	–	–	–	9/18/2000	1/1/2010
prairie	31	–	–	–	9/19/2000	1/1/2010
prairie	37	–	–	–	9/19/2000	1/1/2010
prairie	38	–	–	–	9/20/2000	1/1/2010
prairie	39	–	–	–	10/6/2000	1/1/2010
prairie	40	–	–	–	10/6/2000	1/1/2010
prairie	41	–	–	–	4/29/2002	1/1/2010
prairie	47	–	–	–	4/30/2002	1/1/2010
prairie	49	–	–	–	4/30/2002	1/1/2010
prairie	51	–	–	–	5/1/2002	1/1/2010
prairie	56	–	–	–	5/1/2002	1/1/2010
prairie	57	–	–	–	5/1/2002	1/1/2010
prairie	58	–	–	–	5/1/2002	1/1/2010
prairie	45	–	–	–	5/20/2002	1/1/2010
prairie	60	–	–	–	5/21/2002	1/1/2010
prairie	62	–	–	–	5/21/2002	1/1/2010
prairie	63	–	–	–	4/12/2006	1/1/2010
prairie	69	–	–	–	4/13/2006	1/1/2010
prairie	72	–	–	–	4/14/2006	1/1/2010
prairie	6	–	–	–	7/2/1997	5/1/2002
prairie	5	–	–	–	7/2/1997	5/1/2000
prairie	3	Upland pasture	Big	Tallgrass Prairie	7/1/1997	–
prairie	9	Upland pasture	Big	Tallgrass Prairie	7/4/1997	–
prairie	10	Upland pasture	Windmill	Tallgrass Prairie	7/4/1997	–
prairie	23	Upland pasture	Big	Tallgrass Prairie	5/17/2000	–
prairie	29	Upland pasture	Big	Split types	5/19/2000	–
prairie	24	Upland pasture	Big	split types	5/20/2000	–
prairie	25	Upland pasture	Windmill	Tallgrass Prairie	5/20/2000	–
prairie	30	Upland pasture	Red House	Tallgrass Prairie	8/28/2000	–
prairie	34	Upland pasture	Red House	Split types	9/5/2000	–
prairie	36	Upland pasture	Red House	Tallgrass Prairie	9/7/2000	–
prairie	35	Upland pasture	Red House	Tallgrass Prairie	9/14/2000	–

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued
prairie	42	Upland pasture	Crusher Hill	Tallgrass Prairie	4/29/2002	–
prairie	43	Upland pasture	Crusher Hill	Tallgrass Prairie	4/29/2002	–
prairie	44	Upland pasture	Crusher Hill	Tallgrass Prairie	4/29/2002	–
prairie	46	Upland pasture	Crusher Hill	Tallgrass Prairie	4/30/2002	–
prairie	48	Upland pasture	Crusher Hill	Split types	4/30/2002	–
prairie	54	Upland pasture	Big	Tallgrass Prairie	5/1/2002	–
prairie	59	Upland pasture	Big	Tallgrass Prairie	5/1/2002	–
prairie	52	Upland pasture	Windmill	Tallgrass Prairie	5/1/2002	–
prairie	53	Upland pasture	Windmill	Rocky Mixed Prairie	5/1/2002	–
prairie	55	Upland pasture	Big	Tallgrass Prairie	5/21/2002	–
prairie	61	Upland pasture	Big	Tallgrass Prairie	5/21/2002	–
prairie	50	Upland pasture	Red House	Tallgrass Prairie	5/21/2002	–
prairie	64	Upland pasture	Big	Tallgrass Prairie	4/12/2006	–
prairie	65	Upland pasture	Big	Tallgrass Prairie	4/13/2006	–
prairie	66	Upland pasture	Big	Rocky Mixed Prairie	4/13/2006	–
prairie	67	Upland pasture	Big	Tallgrass Prairie	4/13/2006	–
prairie	68	Upland pasture	Big	Tallgrass Prairie	4/13/2006	–
prairie	70	Upland pasture	Big	Tallgrass Prairie	4/13/2006	–
prairie	71	Upland pasture	Big	Tallgrass Prairie	4/14/2006	–

Table 22. Tallgrass Prairie National Preserve monitoring history. X indicates the site was sampled.

Sites	2001 Jun26	2001 May14	2001 Oct15	2002 May13	2002 Sep30	2003 May12	2003 Oct2	2004 May10	2004 Oct7	2005 May16	2005 Oct3	2006 May15	2006 Oct01	2007 May18	2007 Oct01	2008 May5	2008 Oct06	2010 Jun01	2010 Oct04	2014 Jun11	2018 Jun06	2023 June	Times Sampled
24	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
25	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
29	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
30	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
34	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
35	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
36	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
9	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
42	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
43	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
46	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
48	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	x	19
52	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
53	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
54	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
55	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
59	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
61	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19
66	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	11
68	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	11
70	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	11
71	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	11
65	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	X	X	X	X	X	X	10
10	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	X	X	X	9
23	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	X	X	X	X	X	9

Sites	2001 Jun26	2001 May14	2001 Oct15	2002 May13	2002 Sep30	2003 May12	2003 Oct2	2004 May10	2004 Oct7	2005 May16	2005 Oct3	2006 May15	2006 Oct01	2007 May18	2007 Oct01	2008 May5	2008 Oct06	2010 Jun01	2010 Oct04	2014 Jun11	2018 Jun06	2023 June	Times Sampled
3	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	X	X	X	X	X	9
44	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–	–	X	X	X	X	X	9
50	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	X	X	X	X	X	7
64	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	X	X	X	X	X	7
67	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	X	X	X	X	X	7
1	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	4
2	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	4
21	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	4
22	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	4
26	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	4
27	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	4
28	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	4
31	–	X	X	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
32	–	X	X	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
33	–	X	X	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
37	–	X	X	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
38	–	X	X	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
4	–	X	X	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	4
41	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	4
45	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	4
47	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	4
49	–	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	4
7	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	4
8	–	X	X	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	4
40	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
51	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	2

Sites	2001 Jun26	2001 May14	2001 Oct15	2002 May13	2002 Sep30	2003 May12	2003 Oct2	2004 May10	2004 Oct7	2005 May16	2005 Oct3	2006 May15	2006 Oct01	2007 May18	2007 Oct01	2008 May5	2008 Oct06	2010 Jun01	2010 Oct04	2014 Jun11	2018 Jun06	2023 June	Times Sampled
56	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	2
57	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	2
58	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	2
6	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
60	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	2
62	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	2
63	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	2
69	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	2
72	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	2
39	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Number of Sites Sampled	1	27	29	23	23	24	24	26	26	29	29	28	28	28	28	22	23	30	30	30	30	30	n/a

Park: Wilson's Creek National Battlefield (WICR)

Monitoring Establishment date

One of the original prairie cluster parks, monitoring was initiated at WICR in 1997. However, data is considered stable as of 1998.

Deviations

Monitoring sites at WICR have been in fluctuation over time. Sites 1–3 were retired to avoid adverse effects on a rare species. Sites 8 and 9 have been suspended because the transition to a tangled forest has made the current SOPs impossible to deploy. Sites 10, 11, 12, 13 were installed as one-line sites to monitor management by goats. After that project ended, Sites 10 and 11 were retired and sites 12 and 13 were expanded to full sites 18 and 19. Monitoring initially occurred twice a season and annually. Although the forest sites may have been sampled separately from the prairie sites in some years. The forest sites were not fully sampled between 2008 and 2017 because of safety and access constraints.

The four sites in Manley Woods have been valuable for learning about changes in management and recovery from tornado damage over time. See the Manley Woods report (Leis and James 2008) for details. There was a break in monitoring of that unit between 2007 and 2017. An attempt to monitor the woods in 2012 yielded data for site 7, but the field crew was unable to reach the other three sites.

In 2020, overstory trees were tagged in all of the monitoring sites where they occurred. Tags were uniquely numbered with the aim of maintaining a more consistent record of species identification over time.

Monitoring History

Table 23 provides detailed information on the history of each site. This table was pulled from the Locations table in the *VegMon* database. Double sampling for quality assessment was first conducted in the prairies in 2020, but we were unable to complete the double sampling in Manley Woods that year due to time and weather constraints. Quality assessment was completed for both reference frames in 2025. In 2025, the OZAR fire effects unit sampled collaboratively with HTLN and collected the Brown's line fuel data in Manely Woods during plant community sampling.

Table 24 provides a historical perspective on which sites were sampled during each monitoring event.

The Manley Woods unit at WICR has a unique monitoring history. As monitoring was being developed, a tornado occurred in the forest. Pre-burn standard operating procedures were supplemented with additional monitoring for fuels after this event. Table 25 details the implementation of standard operating procedures in this unit. The SOPs available to be included in long-term analysis vary by monitoring year (Table 25; Leis and James 2008).

Table 23. Wilson's Creek National Battlefield vegetation monitoring community site history. Community refers to communities delineated in the park vegetation community maps.

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued	Comments
prairie	9	Restored	–	Split: Upland Deciduous Woodland and Forest, Mixed Warm and Cool-season Grassland and Ruderal Shrubland	5/28/1998	3/1/2016	formerly WICR Restoration 1N Site transitioned to woodland and impossible to sample as of 2016
prairie	8	Restored	–	Split: Mixed Warm and Cool-season Grassland and Ruderal Shrubland, Upland Deciduous Woodland and Forest	5/28/1998	3/1/2016	formerly WICR Restoration 1N Site transitioned to dense wood-land and impossible to sample as of 2016
prairie	10	–	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	7/31/2001	1/1/2010	A line only.
prairie	11	–	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	7/31/2001	1/1/2010	A line only
prairie	12	–	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	7/31/2001	4/29/2008	B line added to become WICR_VegMon_18
prairie	13	–	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	7/31/2001	4/29/2008	B line added to become WICR_VegMon_19
prairie	19	Restored	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	4/29/2008	–	formerly WICR prairie - goat site 13
prairie	14	Restored	–	Mixed Warm and Cool-Season Grassland and Ruderal Shrubland	4/29/2008	–	–
prairie	15	Restored	–	Mixed Warm and Cool-Season Grassland and Ruderal Shrubland	4/29/2008	–	–
prairie	16	Restored	–	Mixed Warm and Cool-Season Grassland and Ruderal Shrubland	4/29/2008	–	–
prairie	18	Restored	–	Mixed Warm and Cool-season Grassland and Ruderal Shrubland	4/29/2008	–	formerly WICR prairie - goat site 12
prairie	17	Restored	–	Mixed Warm and Cool-Season Grassland and Ruderal Shrubland	4/29/2008	–	–
forest	1	–	–	Glade	4/29/1997	1/1/2010	–

Resource	Site Number	Description	Park Unit	Community	Installed	Discontinued	Comments
forest	2	–	–	Glade	5/1/1997	1/1/2010	–
forest	3	–	–	Glade	5/5/1997	1/1/2010	–
forest	7	Upland Oak woodland	Manley Woods	Upland deciduous Woodland and Forest	5/8/1997	–	–
forest	6	Upland Oak woodland	Manley Woods	Manley Shrubland and Woodland	5/9/1997	–	–
forest	4	Upland Oak woodland	Manley Woods	Manley Shrubland and Woodland	5/9/1997	–	–
forest	5	Upland Oak woodland	Manley Woods	Manley Shrubland and Woodland	5/26/1998	–	–
Woodland	60	Woodland	SW-2	Upland Deciduous Woodland and Forest	–	–	Used briefly by MSU class only.

Table 24. Wilson's Creek National Battlefield monitoring history. X indicates the site was sampled. Sites were sorted by times visited within their community types. Sites 1, 2, and 3 were retired and are not included in this dataset.

	Forest Sites (Manley Woods unit)				Restored Prairie Sites															
Dates Sampled	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**14**	**15**	**16**	**17**	**10**	**11**	**12**	**13**	**18**	**19**	**Number of Sites Visited**
1998May15	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	9
1998Sep25	X	X	X	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	9
1999Jun01	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	6
1999Sep21	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	6
2000May30	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	6
2000Sep18	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	6
2001Jul31	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	4
2001Jun26	–	–	–	–	–	–	X	X	X	–	–	–	–	–	–	–	–	–	–	3
2001Sep25	–	–	–	–	–	–	X	X	X	–	–	–	–	–	–	–	–	–	–	3
2002Aug06	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	4
2003Jul29	–	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	4
2003Jun16	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
2003May21	X	X	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	7
2003Sep8	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	5
2004Jul26	X	X	X	X	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	8
2004Jun01	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	5
2004Sep1	–	–	–	–	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	5
2006Sep20	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
2007Jun13	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
2008May27	–	–	–	–	X	X	–	–	–	X	X	X	X	–	–	–	–	X	X	8
2008Sep08	–	–	–	–	X	X	–	–	–	X	X	X	X	–	–	–	–	X	X	8
2009May26	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	–	–	–	–	4

Dates Sampled	Forest Sites (Manley Woods unit)				Restored Prairie Sites															Number of Sites Visited
	4	5	6	7	8	9	1	2	3	14	15	16	17	10	11	12	13	18	19	
2011May31	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	–	–	–	–	4
2012Jun18	–	–	–	X	–	–	–	–	–	X	X	X	X	–	–	–	–	X	X	7
2016Jun28	–	–	–	–	–	–	–	–	–	X	X	X	X	–	–	–	–	X	X	6
2017Jul18	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
2020Jun20	X	X	X	X	–	–	–	–	–	X	X	X	X	–	–	–	–	X	X	10
2025Jun16	X	X	X	X	–	–	–	–	–	X	X	X	X	–	–	–	–	X	X	10
Times Sampled	13	13	13	14	12	12	8	8	8	8	8	8	8	4	4	4	4	6	6	n/a

Table 25. Manley Woods monitoring history (1997–2017) by standard operating procedure. X indicates sampling occurred; P = partial.

Element	Site	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2020	2025
Understory	4	–	–	–	–	–	–	X	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Regeneration	4	–	–	–	–	–	–	–	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Overstory	4	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–	X	X	X
fuels-pre	4	–	–	–	–	–	–	X	X	X	–	–	–	X	–	–	X	–	–	–	–	X		X
Fuels-post	4	–	–	–	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–
fire history	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
understory	5	–	–	–	–	–	–	X	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Regeneration	5	–	–	–	–	–	–	–	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Overstory	5	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–	X	X	X
fuels-pre	5	–	–	–	–	–	–	X	X	X	–	–	–	–	–	–	–	–	–	–	–	X		X
fuels-post	5	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–		–
fire history	5	X	X	X	X	X	X	X	X	X	X	X	X	–	X	X	X	X	X	X	X	X	X	X
Understory	6	X	X	X	X	–	–	X	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Regeneration	6	–	–	–	–	–	–	X	X	–	X	X	–	–	–	–	–	–	–	–	–	X	X	X
Overstory	6	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–	X	X	X
fuels-pre	6	–	–	–	–	–	–	X	X	X	–	–	–	X	–	–	X	–	–	–	–	X		X
fuels-post	6	–	–	–	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–		–
fire history	6	–	–	–	–	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Understory	7	–	–	–	–	–	–	X	X	–	X	X	–	–	–	–	X	–	–	–	–	X	X	X
Regeneration	7	–	–	–	–	–	–	X	X	–	X	X	–	–	–	–	X	–	–	–	–	X	X	X
Overstory	7	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	X	–	–	–	–	X	X	X
fuels-pre	7	–	–	–	–	–	–	X	X	X	–	–	–	X	–	–	X	–	–	–	–	X		X
fuels-post	7	–	–	–	–	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–		–
fire history	7	X	X	X	X	X	X	X	X	X	X	X	X	P	X	X	X	X	X	X	X	X	X	X

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