



# Plant Community Composition and Structure Monitoring at Fort Union Trading Post National Historic Site

## *2017 Data Summary Report*

Natural Resource Data Series NPS/NGPN/NRDS—2018/1145



**ON THE COVER**

View of the fort at Fort Union Trading Post National Historic Site.  
Photograph courtesy of the National Park Service.

---

# **Plant Community Composition and Structure Monitoring at Fort Union Trading Post National Historic Site**

## ***2017 Data Summary Report***

Natural Resource Data Series NPS/NGPN/NRDS—2018/1145

Stephanie L. Rockwood

National Park Service  
Northern Great Plains Inventory & Monitoring Network  
231 E. St. Joseph St.  
Rapid City, SD 57701

January 2018

U.S. Department of the Interior  
National Park Service  
Natural Resource Stewardship and Science  
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of those protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the [Northern Great Plains Inventory & Monitoring website](#), and the [Natural Resource Publications Management website](#). To receive this report in an accessible format optimized for use with screen readers for the visually or cognitively impaired, please email [irma@nps.gov](mailto:irma@nps.gov).

Please cite this publication as:

Rockwood, S. L. 2018. Plant community composition and structure monitoring at Fort Union Trading Post National Historic Site: 2017 data summary report. Natural Resource Data Series NPS/NGPN/NRDS—2018/1145. National Park Service, Fort Collins, Colorado.

# Contents

	Page
Figures.....	iv
Tables.....	iv
Abstract.....	v
Acknowledgments.....	vi
Introduction.....	1
Methods.....	3
Sample Design.....	3
Plot Layout and Sampling.....	3
Data Management and Analysis.....	6
Results.....	8
Further Analysis.....	14
Literature Cited.....	15

# Figures

	Page
<b>Figure 1.</b> Map of Fort Union Trading Post National Historic Site (FOUS) plant community monitoring plots visited in 2017. ....	2
<b>Figure 2.</b> Long-term monitoring plot layout for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.....	4
<b>Figure 3.</b> The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and quadrats (right panel) to document plant diversity and abundance.....	5
<b>Figure 4.</b> A 2017 view of long-term monitoring plot FOUS_PCM_130, which is located in the Bodmer Unit at Fort Union Trading Post National Historic Site.....	12
<b>Figure 5.</b> Photograph of long-term monitoring plot FOUS_PCM_001 at Fort Union Trading Post National Historic Site in 2017, showing extreme drought conditions in the mowed area of the Upland Terrace Unit.....	13

# Tables

	Page
<b>Table 1.</b> Field Journal for NGPN plant community monitoring at Fort Union Trading Post National Historic Site (FOUS). ....	3
<b>Table 2.</b> Exotic species included in the Northern Great Plains Network’s early detection and rapid response program.....	5
<b>Table 3.</b> A list of all plant species identified in Fort Union Trading Post National Historic Site’s long-term plant community monitoring plots in 2017.....	8
<b>Table 4.</b> Total number of plant species identified in each of the six plots monitored at FOUS in 2017. ....	11
<b>Table 5.</b> Absolute percent cover of native and exotic plant species in plots monitored at FOUS in 2017. ....	12
<b>Table 6.</b> Disturbance type and area observed in five plots visited at FOUS in 2017.....	13

## Abstract

This report presents the results of the Northern Great Plains Inventory and Monitoring Network's vegetation monitoring at Fort Union Trading Post National Historic Site (FOUS) in 2017. This was the seventh year that the Northern Great Plains Inventory and Monitoring Network (NGPN) conducted field work at FOUS.

Crew members from NGPN visited six long-term monitoring plots to collect data on the plant communities at FOUS. This work is part of a long-term monitoring effort designed to provide a better understanding of the condition of the vegetation community and how it changes over time. NGPN staff measured species richness, herb-layer height, native and non-native species abundance, ground cover, and site disturbance at each of the six plots. In plots where woody species were present, tree regeneration, tall shrub density, tree density, and woody fuel loads were also measured.

In 2017, the NGPN monitoring crew identified 71 unique plant species in six monitoring plots. Of those species, 16 were exotic. The two plots located in the Bodmer Overlook Unit were more diverse and had more native species than the four plots located in the Upland Terrace area near the fort. No trees or woody fuels were present in the six plots, but the crew did identify a single green ash (*Fraxinus pennsylvanica*) seedling. The most commonly observed ground disturbances resulted from mowing by the park in the Upland Terrace, severe drought, and animal use.

## **Acknowledgments**

We thank all the authors of the NGPN Plant Community Monitoring Protocol, particularly A. Symstad, for outstanding guidance on data collection and reporting. Thank you to the staff at FOUS for providing logistical support and to F. MacVaugh for providing comments on an earlier draft. The 2017 NGPN vegetation field crew—C. Davis, R. Manuel, R. Oltjenbruns, and L. LaFleur—collected all the data included in this report.

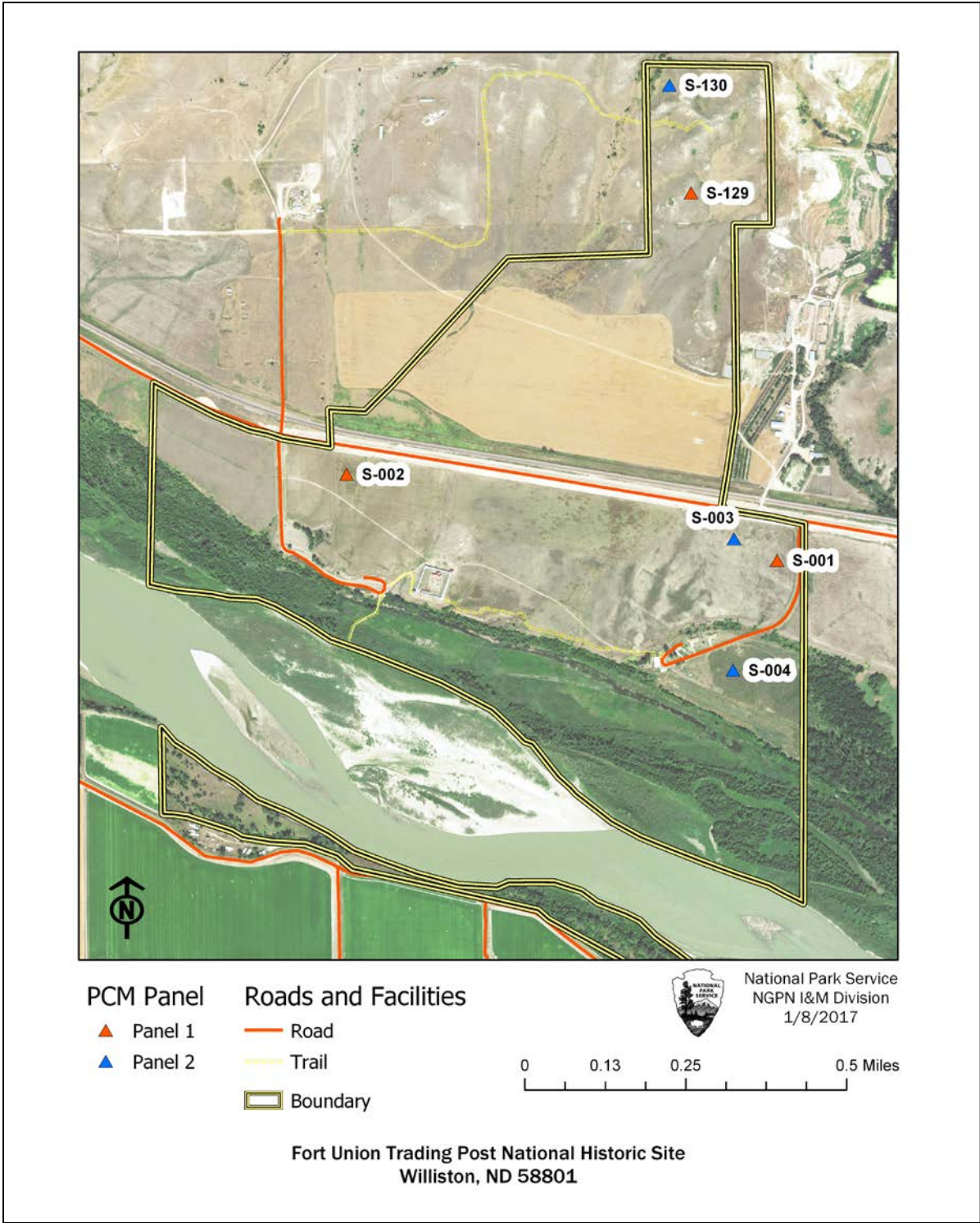


## Introduction

Fort Union Trading Post National Historic Site (FOUS) was established in 1966 “to commemorate the significant role played by Fort Union as a fur trading post on the Upper Missouri River.” (NPS 2013). The trading post sits on 444 acres of upland mixed-grass prairie and riparian forests. Vegetation monitoring at FOUS was initiated by the Northern Great Plains Fire Ecology Program in 1997 (NGPFire; Wienk et al. 2010). In 2011, the Northern Great Plains Inventory & Monitoring Network (NGPN) and NGPFire combined their efforts to establish a single, coordinated vegetation monitoring protocol, shift plot locations to better represent the entire park (Symstad et al. 2011), and meet the goals of the FOUS vegetation management plan (Symstad 2012). Combined sampling efforts began in 2011 (Ashton et al. 2012).

Two distinct areas of grassland at FOUS are monitored: the Upland Terrace and the Bodmer Overlook Unit (hereafter, the Bodmer Unit). The Upland Terrace, which surrounds the reconstructed fort, has an extensive history of agricultural use that predates the creation of the park. More recently, it was planted with native species (Symstad 2012). The Bodmer Unit, a 30-acre parcel of rolling hills north of the fort and terrace, is comprised of relatively intact native prairie (Symstad 2012).

In this report, we provide summaries of the vegetation data collected in 2017 from four Upland Terrace plots and two plots in the Bodmer Unit (Figure 1). For a more in-depth data report on long-term trends at FOUS, refer to the 2010–2016 summary report (Ashton and Davis 2017).



**Figure 1.** Map of Fort Union Trading Post National Historic Site (FOUS) plant community monitoring plots visited in 2017. Three Panel 1 plots (in red) and three Panel 2 plots (in blue) were monitored in 2017.

## Methods

The NGPN Plant Community Composition and Structure Monitoring Protocol (Symstad et al. 2012b, a) describes in detail the methods used for sampling long-term plots. The general approach is briefly described below. For more detail, please see Symstad et al. 2012a, available at <http://science.nature.nps.gov/im/units/ngpn/monitor/plants.cfm>.

### Sample Design

The NGPN team implemented a survey to monitor plant community structure and composition at FOUS using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, 15 randomly located sites were selected within FOUS to become Plant Community Monitoring plots (PCM plots). These sites were split into five panels containing three sites each. An NGPN crew visits two panels (six PCM plots) during late July every year, using a rotating sampling scheme that consists of three sites visited the previous year and three sites that have not been visited for five years. Data from these randomly selected sites can be used to estimate the condition of vegetation communities for the whole park and to discern trends in condition over time. In 2017, the NGPN crew visited sites in panel 1 and panel 2 (Figure 1). Sampling was completed by a four-person crew in approximately 72 crew hours (Table 1). This total does not include the drive time between Rapid City and FOUS. The crew lodged for two nights in Williston, ND.

**Table 1.** Field Journal for NGPN plant community monitoring at Fort Union Trading Post National Historic Site (FOUS). Travel time listed does not include the approximately 6 hours of drive time between FOUS and the NGPN office in Rapid City, SD.

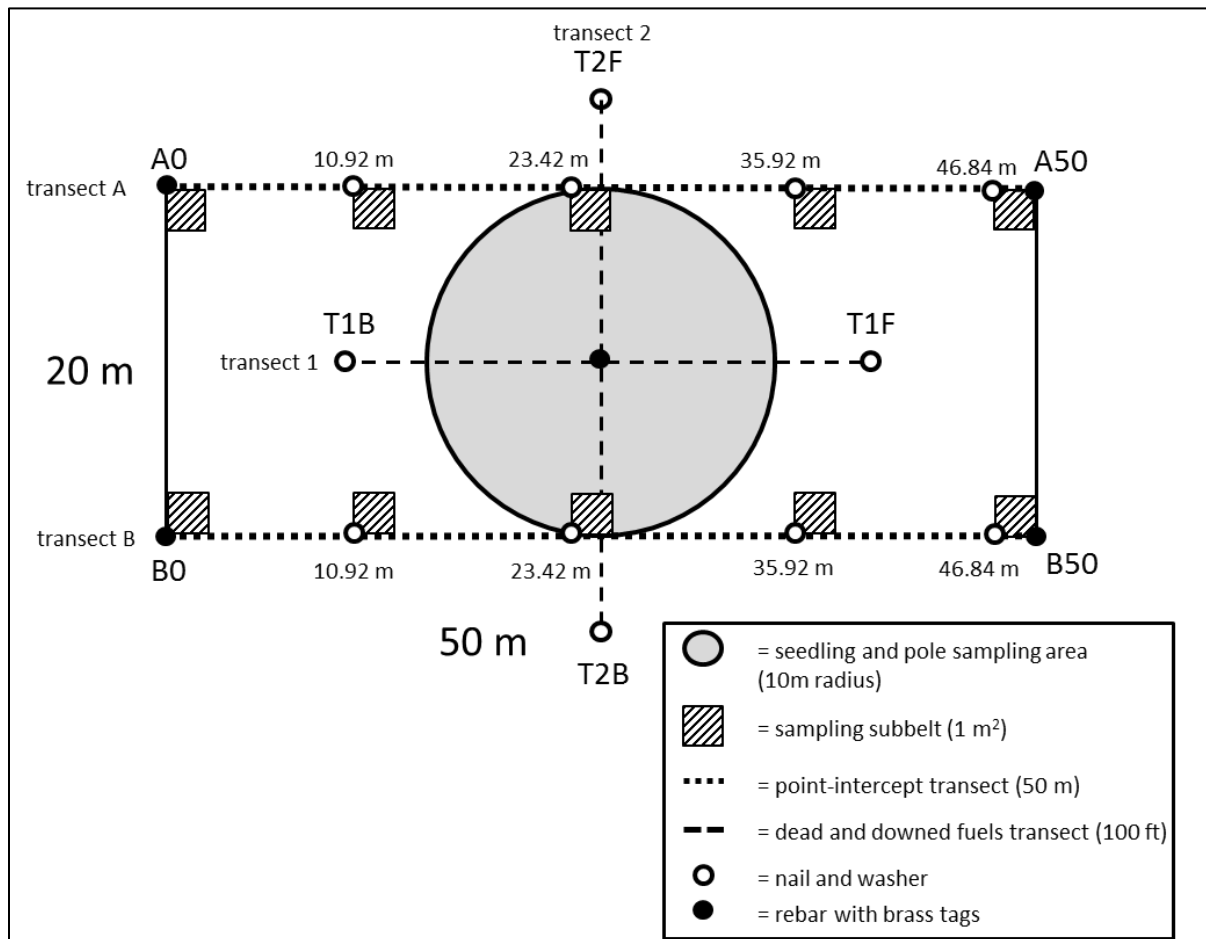
Date Visited	Travel Time	Field Time	Plot Name	Field Notes
7/29/2017	40 min each way	3.25 hrs	PCM_129	Tree transects were installed
		2 hrs	PCM_130	One seedling
		1 hr	PCM_002	Plot mowed and very dry
7/30/2017	40 min each way	2 hrs	PCM_001	Plot mowed and very dry
		2 hrs	PCM_003	Plot mowed and very dry
		2 hrs	PCM_004	Vegetation very dry

### Plot Layout and Sampling

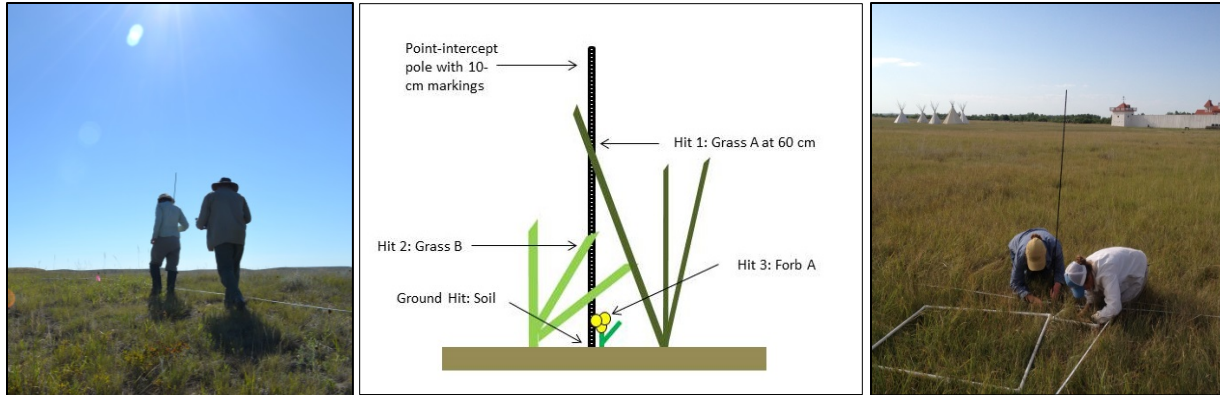
At each site visited, the NGPN crew recorded plant species cover and frequency in a rectangular, 50 m x 20 m (0.1 ha), permanent plot (Figure 2). Data on ground cover, herb-layer height ( $\leq 2$  m), and plant cover were collected on two 50 m transects (the long sides of the plot) using a point-intercept method (Figure 3). Species richness data from the point-intercept method were supplemented with species presence data collected in five 1 m<sup>2</sup> quadrats located systematically along each transect (Figure 2). If a plant species was identified in the plot but was not included on the verified park species list, a voucher plant specimen was collected when possible and submitted to a botanist for independent verification.

When woody species were present within 38 m of plot center, tree regeneration and tall shrub density data were collected within a 10 m radius subplot centered in the larger 50 m x 20 m (0.1 ha) plot. Trees within the 0.1 ha plot with a diameter at breast height (DBH) of > 15 cm were mapped and tagged. For each tree, the species, DBH, status (live or dead), and condition (e.g., leaf-discoloration, insect-damaged) were recorded. For all poles ( $2.54 \leq \text{DBH} \leq 15 \text{ cm}$ ) located within the 10 m radius subplot, only DBH and status were recorded. Tree and tall shrub species with  $\text{DBH} < 2.54 \text{ cm}$  (seedlings) were tallied by species within the 10 m radius subplot. Dead and downed woody fuel load data were collected along two perpendicular, 100 ft (30.49 m) transects (fuel lines) with midpoints at the center of the plot (Figure 2), following Brown's Line methods (Brown 1974, Brown et al. 1982). Fuel load data were only collected if at least one piece of woody litter or fuel intersected a fuel line.

In 2017, woody species were present within 38 m of plot center of two plots: PCM\_129 and PCM\_130. Data was collected in PCM\_130, but no woody species were observed within the plot area of PCM\_129. No woody fuels intersected the fuel lines in either of these plots, therefore no fuels data were collected.



**Figure 2.** Long-term monitoring plot layout for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.



**Figure 3.** The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and quadrats (right panel) to document plant diversity and abundance.

Common disturbances were assessed and documented at each plot. The type, which included rodent mounds, mowing, animal trails, and fire, was recorded. Plots were also assessed for the presence and abundance of target exotic species (Table 2), which is critical for early detection and rapid response to exotic species threats. These species were chosen in collaboration with the Midwest Invasive Plant Network, Northern Great Plains Exotic Plant Management Team, park managers, and local weed experts. Each target species was assigned an abundance class from 1–5, based on an ocular estimate of cover, where 1 = one individual, 2 = few individuals, 3 = cover of 1–5%, 4 = cover of 5–25%, and 5 = cover > 25% of the plot.

**Table 2.** Exotic species included in the Northern Great Plains Network’s early detection and rapid response program. The State Noxious Species column indicates species included on the Montana (MT) or North Dakota (ND) state list of noxious weeds. ND-M indicates species considered noxious only in McKenzie County, ND.

Habitat	Scientific Name	Common Name	State Noxious Species
Riparian	<i>Alliaria petiolata</i>	garlic mustard	–
	<i>Polygonum cuspidatum</i> ; <i>P. sachalinense</i> ; <i>P. x bohemicum</i>	knotweeds	MT
	<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	–
	<i>Iris pseudacorus</i>	yellow iris	MT
	<i>Ailanthus altissima</i>	tree of heaven	–
	<i>Lepidium latifolium</i>	perennial pepperweed	MT
	<i>Arundo donax</i>	giant reed	–
	<i>Rhamnus cathartica</i>	common buckthorn	–
	<i>Heracleum mantegazzianum</i>	giant hogweed	–
Upland	<i>Centaurea solstitialis</i>	yellow star thistle	MT
	<i>Hieracium aurantiacum</i> ; <i>H. caespitosum</i>	orange and meadow hawkweed	MT
	<i>Isatis tinctoria</i>	Dyer's woad	MT

**Table 2 (continued).** Exotic species included in the Northern Great Plains Network’s early detection and rapid response program. The State Noxious Species column indicates species included on the Montana (MT) or North Dakota (ND) state list of noxious weeds. ND-M indicates species considered noxious only in McKenzie County, ND.

Habitat	Scientific Name	Common Name	State Noxious Species
Upland (cont.)	<i>Taeniatherum caput-medusae</i>	medusahead	–
	<i>Chondrilla juncea</i>	rush skeletonweed	MT
	<i>Gypsophila paniculata</i>	baby's breath	ND-M
	<i>Centaurea virgata</i> ; <i>C. diffusa</i>	knapweeds	MT,ND
	<i>Linaria dalmatica</i> ; <i>L. vulgaris</i>	toadflax	MT,ND
	<i>Euphorbia myrsinites</i> & <i>E. cyparissias</i>	myrtle spurge	–
	<i>Dipsacus fullonum</i> & <i>D. laciniatus</i>	common teasel	–
	<i>Salvia aethiopsis</i>	Mediterranean sage	–
	<i>Ventenata dubia</i>	African wiregrass	–

### Data Management and Analysis

FFI (FEAT/FIREMON Integrated; <http://frames.gov/ffi/>) was the primary software environment used for managing our sampling data. FFI is used by a variety of agencies (e.g., NPS, USDA Forest Service, U.S. Fish and Wildlife Service), has a national-level support system, and generally conforms to the [Natural Resource Database Template](#) standards established by the Inventory and Monitoring Program. Species scientific names, codes, common names, and native status are from the USDA Plants Database (USDA-NRCS 2017). However, nomenclature follows the [Integrated Taxonomic Information System](#) (ITIS). In the few cases where ITIS recognized a new name that was not in the USDA PLANTS database, the new name was used, and a unique plant code was assigned.

After data were entered in the database, 100% of records were verified with the original data sheets to minimize transcription errors, followed by a 10% review of records to confirm accuracy. After all data were entered and verified, automated queries were used to check for any remaining errors in the data. When errors were identified by the crew or the automated queries, corrections were made to the original datasheets and the FFI database.

Data summaries were produced using the FFI reporting and query tools. The number of species encountered in each plot was calculated using data from point-intercept, quadrat, woody species, and target species protocols. Absolute cover was calculated using point-intercept data and is the total number of vegetation intercepts. This is often greater than 100% because more than one species can be intercepted per point due to overlapping vegetation.

The conservation status rank of plant species observed at FOUS in 2017 was determined by cross-referencing with the NatureServe conservation status list, as well as the Montana and North Dakota rare plant species lists. For the purpose of this report, a species is considered rare or of conservation concern if its global (G) or state (S) conservation status rank is classified as critically imperiled (G1/S1), imperiled (G2/S2), or vulnerable (G3/S3). More information on conservation ranks can be found at the [NatureServe](#) website. The 2017 species list was also cross-referenced with the list of noxious weeds maintained by the [North Dakota Department of Agriculture](#) and the [Montana Department of Agriculture](#). North Dakota also has county-level lists of noxious species. Fort Union is located in both Billings and Williams Counties, but only Billings County has county-specific noxious weeds listed.

## Results

There are 386 vascular plant species on the [FOUS species list](#), and the NGPN monitoring crew identified a total of 71 species from six monitoring plots visited in 2017 (Table 3). Of these, 16 are exotic species for the park. The 2017 species list was cross-referenced with rare and noxious exotic species lists for North Dakota and Montana. One species, large beardtongue (*Penstemon grandiflorus*), is considered rare in Montana because its presence has been verified only in Custer County, in the southeast portion of the state. Although identified in PCM\_003, that plot is located on the North Dakota side of the park. No other species matched the state-wide lists for rare plants. Regarding exotic species, two matched state-wide lists: field bindweed (*Convolvulus arvensis*) and leafy spurge (*Euphorbia esula*). Both exotic species are abundant and widespread in Montana, and management priorities are designated at the local weed district level. Occasionally, a monitoring crew comes across a plant not on the park species list. In 2017, the crew identified Carolina draba (*Draba reptans*).

**Table 3.** A list of all plant species identified in Fort Union Trading Post National Historic Site’s long-term plant community monitoring plots in 2017. An “X” in the “Exotic” column means the species is not native to the park or, in cases where only the genus was identified, some species in that genus are exotic. State-wide noxious weed species are designated as MT for Montana or ND for North Dakota in the Exotic column. ND-M indicates species considered noxious only in McKenzie County, ND. Species considered to be rare are marked with the appropriate global or state conservation ranks. Species in bold are not on the NPS species list for FOUS.

Family	Symbol	Scientific Name	CommonName	Exotic	Rare
Asclepiadaceae	ASPU	<i>Asclepias pumila</i>	plains milkweed	–	–
Asteraceae	ARFR4	<i>Artemisia frigida</i>	prairie sagewort	–	–
	COCA5	<i>Conyza canadensis</i>	Canadian horseweed	–	–
	ECAN2	<i>Echinacea angustifolia</i>	blacksamson echinacea	–	–
	GUSA2	<i>Gutierrezia sarothrae</i>	broom snakeweed	–	–
	HEVI4	<i>Heterotheca villosa</i>	hairy false goldenaster	–	–
	LIPU	<i>Liatris punctata</i>	dotted blazing star	–	–
	LYJU	<i>Lygodesmia juncea</i>	rush skeletonplant	–	–
	SOMI2	<i>Solidago missouriensis</i>	Missouri goldenrod	–	–
	SYER	<i>Symphyotrichum ericoides</i>	white heath aster	–	–
	SYOB	<i>Symphyotrichum oblongifolium</i>	aromatic aster	–	–
	TAOF	<i>Taraxacum officinale</i>	common dandelion	X	–
	TEAC	<i>Tetraneuris acaulis</i>	stemless four-nerve daisy	–	–
TRDU	<i>Tragopogon dubius</i>	yellow salsify	X	–	



**Table 3 (continued).** A list of all plant species identified in Fort Union Trading Post National Historic Site's long-term plant community monitoring plots in 2017. An "X" in the "Exotic" column means the species is not native to the park or, in cases where only the genus was identified, some species in that genus are exotic. State-wide noxious weed species are designated as MT for Montana or ND for North Dakota in the Exotic column. ND-M indicates species considered noxious only in McKenzie County, ND. Species considered to be rare are marked with the appropriate global or state conservation ranks. Species in bold are not on the NPS species list for FOUS.

Family	Symbol	Scientific Name	CommonName	Exotic	Rare
Brassicaceae	ALDE	<i>Alyssum desertorum</i>	desert madwort	X	–
	DRRE2	<b><i>Draba reptans</i></b>	<b>Carolina draba</b>	–	–
	ERCA14	<i>Erysimum capitatum</i>	sanddune wallflower	–	–
	LEDE	<i>Lepidium densiflorum</i>	common pepperweed	–	–
	THAR5	<i>Thlaspi arvense</i>	field pennycress	X	–
Cactaceae	OPPO	<i>Opuntia polyacantha</i>	plains pricklypear	–	–
Caprifoliaceae	SYOC	<i>Symphoricarpos occidentalis</i>	western snowberry	–	–
Chenopodiaceae	KOSC	<i>Kochia scoparia</i>	burningbush, kochia	X	–
	KRLA2	<i>Krascheninnikovia lanata</i>	winterfat	–	–
	SAKA	<i>Salsola kali</i>	Russian thistle	X	–
Convolvulaceae	COAR4	<i>Convolvulus arvensis</i>	field bindweed	X, MT	–
Cyperaceae	CADU6	<i>Carex duriuscula</i>	needleleaf sedge	–	–
	CAFI	<i>Carex filifolia</i>	threadleaf sedge	–	–
	CAIN9	<i>Carex inops</i>	long-stolon sedge	–	–
	CAREX	<i>Carex</i>	sedge	–	–
Euphorbiaceae	EUSE5	<i>Euphorbia serpyllifolia</i>	thyme-leaf spurge	–	–
	EUES	<i>Euphorbia esula</i>	leafy spurge	X, MT	–
Fabaceae	ASGI5	<i>Astragalus gilviflorus</i>	plains milkvetch	–	–
	DAPU5	<i>Dalea purpurea</i>	purple prairie clover	–	–
	MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	X	–
Liliaceae	ALTE	<i>Allium textile</i>	textile onion	–	–
Linaceae	LIRI	<i>Linum rigidum</i>	stiffstem flax	–	–
Malvaceae	SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	–	–
Oleaceae	FRPE	<i>Fraxinus pennsylvanica</i>	green ash	–	–
Onagraceae	OESU99	<i>Oenothera suffrutescens</i>	scarlet beeblossom	–	–

**Table 3 (continued).** A list of all plant species identified in Fort Union Trading Post National Historic Site's long-term plant community monitoring plots in 2017. An "X" in the "Exotic" column means the species is not native to the park or, in cases where only the genus was identified, some species in that genus are exotic. State-wide noxious weed species are designated as MT for Montana or ND for North Dakota in the Exotic column. ND-M indicates species considered noxious only in McKenzie County, ND. Species considered to be rare are marked with the appropriate global or state conservation ranks. Species in bold are not on the NPS species list for FOUS.

Family	Symbol	Scientific Name	CommonName	Exotic	Rare
Poaceae	AGCR	<i>Agropyron cristatum</i>	crested wheatgrass	X	–
	ANGE	<i>Andropogon gerardii</i>	big bluestem	–	–
	ARPU9	<i>Aristida purpurea</i>	purple threeawn	–	–
	BOCU	<i>Bouteloua curtipendula</i>	sideoats grama	–	–
	BOGR2	<i>Bouteloua gracilis</i>	blue grama	–	–
	BRIN2	<i>Bromus inermis</i>	smooth brome	X	–
	BRJA	<i>Bromus japonicus</i>	Japanese brome	X	–
	CALO	<i>Calamovilfa longifolia</i>	prairie sandreed	–	–
	ELCA4	<i>Elymus canadensis</i>	Canada wildrye	–	–
	ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	–	–
	ELVI3	<i>Elymus virginicus</i>	Virginia wildrye	–	–
	HECO26	<i>Hesperostipa comata</i>	needle and thread	–	–
	KOMA	<i>Koeleria macrantha</i>	prairie Junegrass	–	–
	MUCU3	<i>Muhlenbergia cuspidata</i>	plains muhly	–	–
	MUSQ3	<i>Munroa squarrosa</i>	false buffalograss	–	–
	NAVI4	<i>Nassella viridula</i>	green needlegrass	–	–
	PASM	<i>Pascopyrum smithii</i>	western wheatgrass	–	–
	PAVI2	<i>Panicum virgatum</i>	switchgrass	–	–
	POPR	<i>Poa pratensis</i>	Kentucky bluegrass	X	–
	SCSC	<i>Schizachyrium scoparium</i>	little bluestem	–	–
SEVI4	<i>Setaria viridis</i>	green bristlegrass	X	–	
Polemoniaceae	PHHO	<i>Phlox hoodii</i>	spiny phlox	–	–
Polygalaceae	POAL4	<i>Polygala alba</i>	white milkwort	–	–
Polygonaceae	ERPA9	<i>Eriogonum pauciflorum</i>	fewflower buckwheat	–	–
Primulaceae	ANOC2	<i>Androsace occidentalis</i>	western rockjasmine	–	–
Ranunculaceae	ANEMO	<i>Anemone</i>	anemone	X	–
	ANPA19	<i>Anemone patens</i>	eastern pasqueflower	–	–

**Table 3 (continued).** A list of all plant species identified in Fort Union Trading Post National Historic Site's long-term plant community monitoring plots in 2017. An "X" in the "Exotic" column means the species is not native to the park or, in cases where only the genus was identified, some species in that genus are exotic. State-wide noxious weed species are designated as MT for Montana or ND for North Dakota in the Exotic column. ND-M indicates species considered noxious only in McKenzie County, ND. Species considered to be rare are marked with the appropriate global or state conservation ranks. Species in bold are not on the NPS species list for FOUS.

Family	Symbol	Scientific Name	CommonName	Exotic	Rare
Rosaceae	ROWO	<i>Rosa woodsii</i>	Woods' rose	–	–
Santalaceae	COUM	<i>Comandra umbellata</i>	bastard toadflax	–	–
Scrophulariaceae	PEAL2	<i>Penstemon albidus</i>	white penstemon	–	–
	PEGR7	<i>Penstemon grandiflorus</i>	large beardtongue	–	S1 (MT)
Unknown Family	UNKGRAM	<i>Unknown graminoid</i>	unknown graminoid	X	–

Based on the total count of unique species observed in all plots in 2017, the two plots located in the Bodmer Unit (Figure 4) had more species per plot (Table 4). These plots also had more native species, both in total plant species count and absolute cover (Table 5). PCM\_129 had the most native species, with 43 out of 46 species identified in the plot and 145% absolute cover. Exotic species occurrence and absolute cover were higher overall in the four plots located within the Upland Terrace Unit. The most commonly intercepted exotic plant species were crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*).

**Table 4.** Total number of plant species identified in each of the six plots monitored at FOUS in 2017. This is a count of all unique species identified in the plot using species data from point-intercept, quadrat, woody species, and target species protocols.

Plot	Park Unit	Native species	Exotic species	Total species
FOUS_PCM_001	Upland Terrace	5	3	8
FOUS_PCM_002	Upland Terrace	8	7	15
FOUS_PCM_003	Upland Terrace	9	9	18
FOUS_PCM_004	Upland Terrace	9	4	13
FOUS_PCM_129	Bodmer	43	3	46
FOUS_PCM_130	Bodmer	25	4	29



**Figure 4.** A 2017 view of long-term monitoring plot FOUS\_PCM\_130, which is located in the Bodmer Unit at Fort Union Trading Post National Historic Site. Photograph courtesy of the National Park Service.

**Table 5.** Absolute percent cover of native and exotic plant species in plots monitored at FOUS in 2017. Absolute percent cover is calculated using the point-intercept data. This includes overlapping species canopies, which can result in values greater than 100%.

Plot	Park Unit	Absolute Cover (%)	
		Native	Exotic
FOUS_PCM_001	Upland Terrace	66	5
FOUS_PCM_002	Upland Terrace	81	39
FOUS_PCM_003	Upland Terrace	85	16
FOUS_PCM_004	Upland Terrace	52	96
FOUS_PCM_129	Bodmer	145	2
FOUS_PCM_130	Bodmer	130	18

Woody species were surveyed for in two plots in 2017, PCM\_129 and PCM\_130. A single green ash (*Fraxinus pennsylvanica*) seedling was identified within the 10 m radius subplot boundary of PCM\_130. No trees or surface fuels were found in either plot in 2017.

Disturbances were observed in each of the six plots visited in 2017 (Table 6). The most common were mowing and small mammal activity. Mowing occurred throughout PCM\_001 (Figure 5), PCM\_002 and PCM\_003, all located in the Upland Terrace unit. All six plots were also surveyed for early detection exotic species, but none were found in 2017.

**Table 6.** Disturbance type and area observed in five plots visited at FOUS in 2017. The disturbance area was approximated out of a total area of 1000 m<sup>2</sup>.

Plot	Disturbance Type	Area (m <sup>2</sup> )
FOUS_PCM_001	Mowed	1000
FOUS_PCM_001	Extreme Drought	1000
FOUS_PCM_002	Mowed	1000
FOUS_PCM_003	Mowed	1000
FOUS_PCM_004	Small Mammal	2
FOUS_PCM_129	Grazing	10
FOUS_PCM_130	Small Mammal	10



**Figure 5.** Photograph of long-term monitoring plot FOUS\_PCM\_001 at Fort Union Trading Post National Historic Site in 2017, showing extreme drought conditions in the mowed area of the Upland Terrace Unit. Photograph courtesy of the National Park Service.

## **Further Analysis**

This 2017 Data Summary Report is intended to provide a basic review of the data collected during the NGPN team's 2017 visit to Fort Union Trading Post National Historic Site. All data included in this report is available upon request from the Northern Great Plains Inventory and Monitoring Network, plus it is archived at <https://irma.nps.gov/DataStore>.

## Literature Cited

- Ashton, I., M. Prowatzke, M. Bynum, T. Shepherd, S. K. Wilson, and K. Paintner-Green. 2012. Fort Union Trading Post National Historic Site plant community composition and structure monitoring: 2011 annual report. Natural Resource Technical Report NPS/NGPN/NRTR—2012/528. National Park Service, Fort Collins, Colorado.
- Ashton, I. W. and C. J. Davis. 2017. Plant community composition and structure monitoring for Fort Union Trading Post National Historic Site: 2010 – 2016 summary report. Natural Resource Report NPS/NGPN/NRR—2017/1406. National Park Service, Fort Collins, Colorado.
- Brown, J. K. 1974. Handbook for inventorying downed material. General Technical Report INT-16. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.
- Brown, J. K., R. D. Oberhue, and C. M. Johnston. 1982. Inventorying surface fuels and biomass in the Interior West. General Technical Report INT-129. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.
- [NPS] National Park Service. 2013. Foundation document: Fort Union Trading Post National Historic Site, North Dakota. NPS. 436/120807. National Park Service, Midwest Regional Office, Omaha, Nebraska.
- Stevens, D. L. and A. R. Olsen. 2003. Variance estimation for spatially balanced samples of environmental resources. *Environmetrics* 14:593-610.
- Stevens, D. L. and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association* 99:262-278.
- Symstad, A. J., R.A. Gitzen, C. L. Wienk, M. R. Bynum, D. J. Swanson, A. D. Thorstenson, and K. J. Paintner. 2011. Plant community composition and structure monitoring protocol for the Northern Great Plains I&M Network: version 1.00. Natural Resource Report NPS/NGPN/ NRR-2011/291.
- Symstad AJ. 2012. A vegetation management plan for Fort Union Trading Post National Historic Site: Final report for interagency agreement number F154910005 (April 2012). Natural Resource Report. NPS/FOUS/NRR—2012/502. National Park Service, Natural Resource Stewardship and Science. Fort Collins, Colorado.
- Symstad, A. J., R.A. Gitzen, C. L. Wienk, M. R. Bynum, D. J. Swanson, A. D. Thorstenson, and K. J. Paintner. 2012a. Plant community composition and structure monitoring protocol for the Northern Great Plains I&M Network-Standard Operating Procedures: version 1.01. Natural Resource Report NPS/NGPN/ NRR-2012/489.1.
- Symstad, A. J., R.A. Gitzen, C. L. Wienk, M. R. Bynum, D. J. Swanson, A. D. Thorstenson, and K. J. Paintner. 2012b. Plant community composition and structure monitoring protocol for the

Northern Great Plains I&M Network: version 1.01. Natural Resource Report NPS/NGPN/ NRR-2012/489.

USDA-NRCS. 2015. The PLANTS Database (<http://plants.usda.gov>, 06 December 2017). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Wienk, C., A. Thorstenson, J. Freeman, and D. Swanson. 2010. Northern Great Plains Fire Ecology Program review: 1997-2007. Natural Resource Report NPS/NRDS/NRDS—2010/112. National Park Service, Fort Collins, Colorado.



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 436/141777, January 2018

National Park Service  
U.S. Department of the Interior



---

[Natural Resource Stewardship and Science](#)

1201 Oakridge Drive, Suite 150  
Fort Collins, CO 80525