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Natural Resource Stewardship and Science

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

2019 Data Report

Natural Resource Data Series NPS/FOUS/NRDS—2019/1245

ON THIS PAGE
The fort at Fort Union Trading Post National Historic Site as seen from a Plant Community Monitoring plot.
Photograph courtesy of the National Park Service.

ON THE COVER
Northern Great Plains Inventory & Monitoring crew members identifying plants at a plot at Fort Union Trading Post National Historic Site.
Photograph courtesy of the National Park Service.

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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.

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Abstract

This report presents the results of vegetation monitoring efforts in 2019 at Fort Union Trading Post National Historic Site (FOUS) by the Northern Great Plains Inventory and Monitoring Network (NGPN). This was the ninth year that NGPN conducted field work at FOUS.

Crew members from NGPN visited nine long-term monitoring plots to collect data on the plant communities at FOUS. Six plots were part of the regularly scheduled monitoring interval. Three additional plots were read in the Bodmer Overlook Unit to evaluate the effects of cattle grazing in the unit. 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 nine plots. In three plots where woody species were present, tree regeneration, tall shrub density, tree density, and woody fuel loads were also measured.

In 2019, the NGPN monitoring crew identified 94 unique plant species in nine monitoring plots. Of those species, 15 were exotic species. The five plots located in the Bodmer Overlook Unit were more diverse and had more native species than the four plots located in the Upland Terrace Unit near the fort. No trees or woody fuels were present in the nine plots, but the crew did identify one green ash (*Fraxinus pennsylvanica*) seedling. One rare plant, alyssumleaf phlox (*Phlox alyssifolia*, ranked G5/S1 in North Dakota), was observed during our surveys. The entire Bodmer Overlook Unit (approximately 30 acres) was grazed by cattle in early May, but our field crew noticed very little grazed vegetation when they visited in late July. The most commonly observed disturbance was small mammal activity.

Acknowledgments

Thank you to the staff at FOUS for providing logistical support. The 2019 NGPN vegetation field crew—S. Rockwood, E. Duda, and T. Schaffner—collected all the data included in this report.

Introduction

Fort Union Trading Post National Historic Site (FOUS) was established in 1966 to recognize and 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. Plot locations were shifted 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 2019 from four Upland Terrace plots and five plots in the Bodmer Unit (Figure 1).

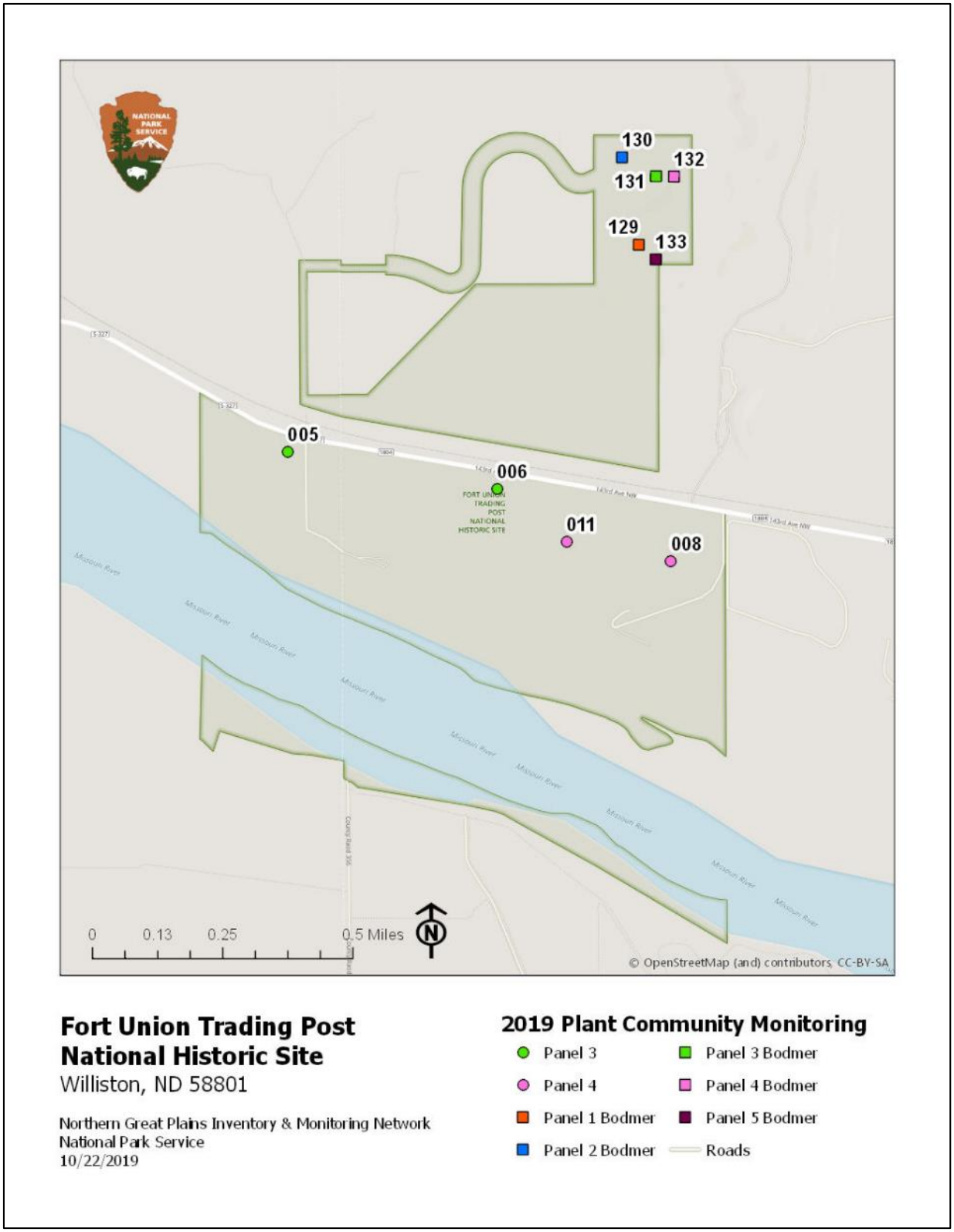

Figure 1. Map of Fort Union Trading Post National Historic Site plant community monitoring plots visited in 2019 by the Northern Great Plains Network Inventory & Monitoring Program.

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 https://www.nps.gov/im/ngpn/plant-communities.htm.

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 be established as Plant Community Monitoring plots (PCM plots). These sites were split into five panels, with three sites in each panel. An NGPN crew visits three plots from two panels (six PCM plots total) during late July every year, using a rotating sampling schedule that consists of half the plots visited the previous year, and the remaining plots having been visited five years prior. 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 2019, the NGPN crew visited sites in panels 3 and 4, plus three additional sites in the Bodmer Unit (Figure 1). Sampling was completed by a three-person crew over two and a half days (Table 1). This total does not include the drive time between Rapid City and FOUS. The crew lodged for three nights in Williston, ND.

In May of 2019, FOUS park management and the Northern Great Plains Exotic Plant Management Team (EPMT) released cattle onto the Bodmer Unit, in an effort to control exotic species and increase the growth of native species. Fifty-five cow-calf pairs were released on May 1, 2019 and taken out late on May 13, 2019 or early on May 14, 2019 (F. MacVaugh, personal communication, October 23, 2019). This was the second year that cattle were allowed to graze on the Bodmer Unit. For details about last year's grazing program, refer to the 2018 data summary report (Schaffner 2019).

Table 1. Field journal for monitoring plot visits at Fort Union Trading Post National Historic Site in 2019.

Date Visited	Plot Name	Park Unit	Field Notes
7/26/2019	PCM_008	Upland Terrace	–
7/26/2019	PCM_011	Upland Terrace	–
7/27/2019	PCM_005	Upland Terrace	–
7/27/2019	PCM_006	Upland Terrace	–
7/27/2019	PCM_129	Bodmer Unit	Grazed
7/27/2019	PCM_133	Bodmer Unit	Grazed
7/28/2019	PCM_130	Bodmer Unit	Grazed
7/28/2019	PCM_131	Bodmer Unit	Grazed
7/28/2019	PCM_132	Bodmer Unit	Grazed

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 (≤ 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^2 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.

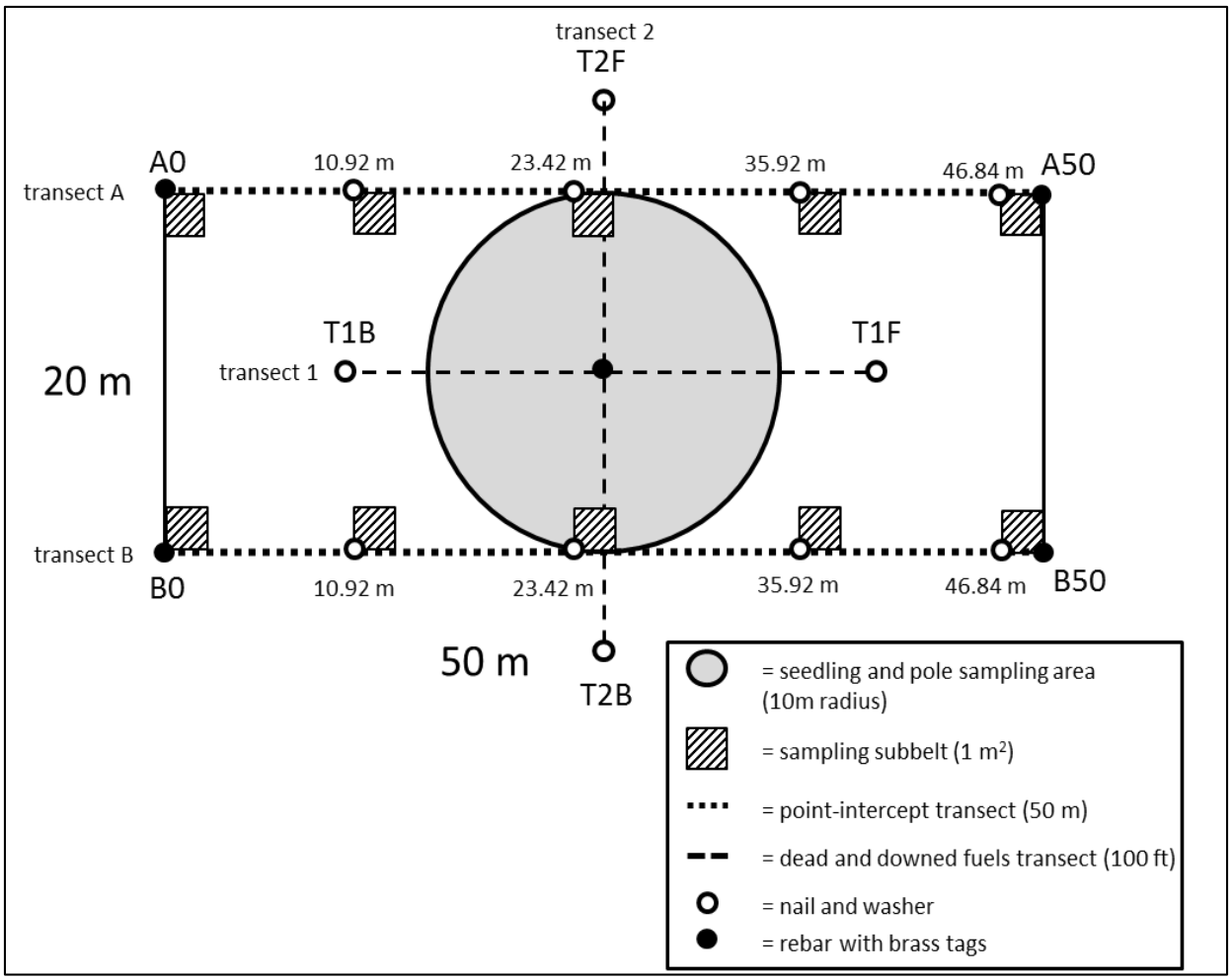

Figure 2. Long-term monitoring plot layout used by NGPN for sampling vegetation.

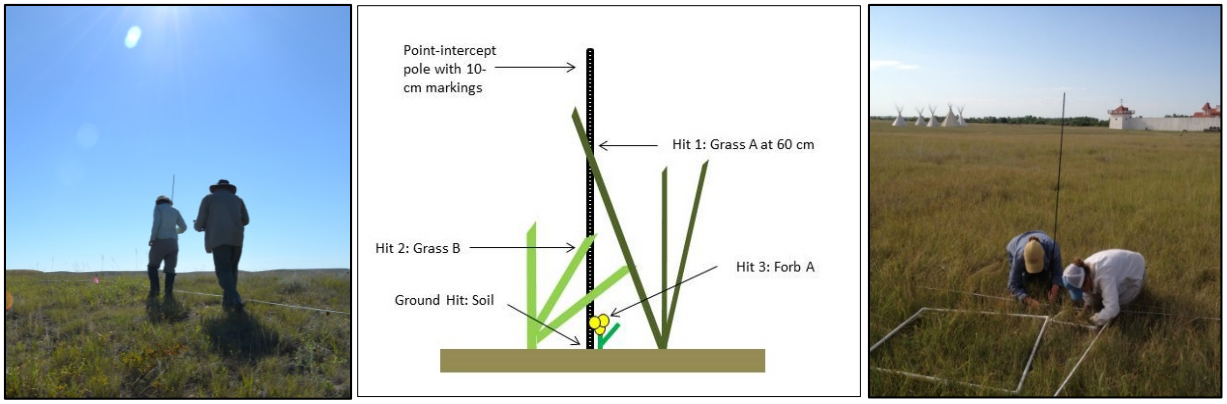

Figure 3. The NGPN vegetation crew uses point-intercept (left and center panel above) and quadrat (right panel above) sampling methods to record plant diversity and abundance.

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. For each tree (DBH>15 cm), the species, diameter at breast height (DBH), live or dead status, and condition (e.g., leaf-discoloration, insect-damaged) were recorded. For all poles ($2.54 \leq DBH \leq 15$ cm) located within the 10 m radius subplot, only DBH and status were recorded. Seedlings (DBH < 2.54 cm) were tallied by species within the 10 m radius subplot. In 2019, NGPN changed the way these seedling counts were made. Previously, stump sprouts (stems originating between ground level and 137 cm on the bole of trees that have died or been cut) were tallied individually, often resulting in a high number of stump sprouts. Now, we only count one sprout per stump. 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.

Common disturbances were assessed and documented at each plot. The type of disturbance, such as grazing, fire, erosion, and herbicide treatment was recorded, and the area of the disturbance was estimated in m^2. For some large-scale disturbances like fire, the disturbance was recorded as either present or absent. 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.

Habitat	Scientific Name	Common Name
Riparian	*Alliaria petiolata*	garlic mustard
Riparian	*Polygonum cuspidatum; P. sachalinense; P. x bohemicum*	Knotweeds
Riparian	*Pueraria montana var. lobata*	Kudzu
Riparian	*Iris pseudacorus*	yellow iris
Riparian	*Ailanthus altissima*	tree of heaven
Riparian	*Lepidium latifolium*	perennial pepperweed
Riparian	*Arundo donax*	giant reed
Riparian	*Rhamnus cathartica*	common buckthorn
Riparian	*Heracleum mantegazzianum*	giant hogweed
Upland	*Centaurea solstitialis*	yellow star thistle
Upland	*Hieracium aurantiacum; H. caespitosum*	orange and meadow hawkweed
Upland	*Isatis tinctoria*	Dyer's woad
Upland	*Taeniatherum caput-medusae*	medusahead
Upland	*Chondrilla juncea*	rush skeletonweed
Upland	*Gypsophila paniculata*	baby's breath
Upland	*Centaurea virgata; C.diffusa*	Knapweeds
Upland	*Linaria dalmatica; L. vulgaris*	Toadflax
Upland	*Euphorbia myrsinites & E. cyparissias*	myrtle spurge
Upland	*Dipsacus fullonum & D. laciniatus*	common teasel
Upland	*Salvia aethiopis*	Mediterranean sage
Upland	*Ventenata dubia*	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 2018). 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 and R software (R version 3.6.1). 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 2019 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). The 2019 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.

Results

There are 353 vascular plant species on the FOUS species list, and the NGPN monitoring crew identified a total of 94 species from nine monitoring plots in 2019 (Table 3). Of these species, 15 are exotic species for the park. Because FOUS is located in both North Dakota and Montana, the 2019 species list was cross-referenced with the rare and noxious exotic species lists for both states. Two plants—*Penstemon grandiflorus* and *Physaria ludoviciana*—were observed that are considered rare in Montana; however, they were observed in the North Dakota part of the park. A third plant—*Phlox alyssifolia*—was observed in North Dakota and is actually rare for the state. *Phlox alyssifolia* (alyssumleaf phlox) is ranked G5/S1 by NatureServe, meaning it is uncommon within North Dakota, but is globally secure.

The 2019 species list was also cross-referenced with the state exotic species lists for both North Dakota and Montana. We found two species that are considered noxious weeds by at least one of the states: leafy spurge *(Euphorbia esula*) and field bindweed *(Convolvulus arvensis)*. Leafy spurge, a noxious weed in both Montana and North Dakota, was observed at PCM_132 in the Bodmer Unit in North Dakota. Field bindweed, a noxious weed in Montana, was observed at PCM_132 and PCM_133 in the Bodmer Unit in North Dakota.

Table 3. List of all plant species identified in Fort Union Trading Post National Historic Site plant community monitoring plots in 2019. In the Notes column, “Exotic” indicates that a species is not native to the park or, in the case where only the genus was identified, there are some species within that genus that are exotic. State or county noxious weed species are designated in the Notes column. Rare species are designated in the Notes column as Rare, along with their conservation rank. Species that are not on the NPS species list are indicated in the Notes column as new.

Family	Symbol	Scientific Name	Common Name	Notes
Anacardiaceae	TORY	*Toxicodendron rydbergii*	western poison ivy	–
Asteraceae	ANMI3	*Antennaria microphylla*	littleleaf pussytoes	–
Asteraceae	ANPA4	*Antennaria parvifolia*	small-leaf pussytoes	–
Asteraceae	ARCA12	*Artemisia campestris*	field sagewort	–
Asteraceae	ARFR4	*Artemisia frigida*	fringed sagewort	–
Asteraceae	ARLU	*Artemisia ludoviciana*	white sagebrush	–
Asteraceae	COCA5	*Conyza canadensis*	horseweed	–
Asteraceae	CRRU3	*Crepis runcinata*	fiddleleaf hawksbeard	–
Asteraceae	ECAN2	*Echinacea angustifolia*	blacksamson echinacea	–
Asteraceae	GUSA2	*Gutierrezia sarothrae*	broom snakeweed	–
Asteraceae	HEVI4	*Heterotheca villosa*	hairy false goldenaster	–
Asteraceae	LIPU	*Liatris punctata*	dotted blazing star	–
Asteraceae	LOAR5	*Logfia arvensis*	field cottonrose	Exotic
Asteraceae	LYJU	*Lygodesmia juncea*	rush skeletonplant	–
Asteraceae	PACA15	*Packera cana*	woolly groundsel	–

Table 3 (continued). List of all plant species identified in Fort Union Trading Post National Historic Site plant community monitoring plots in 2019. In the Notes column, “Exotic” indicates that a species is not native to the park or, in the case where only the genus was identified, there are some species within that genus that are exotic. State or county noxious weed species are designated in the Notes column. Rare species are designated in the Notes column as Rare, along with their conservation rank. Species that are not on the NPS species list are indicated in the Notes column as new.

Family	Symbol	Scientific Name	Common Name	Notes
Asteraceae	RACO3	*Ratibida columnifera*	upright prairie coneflower	–
Asteraceae	SOMI2	*Solidago missouriensis*	Missouri goldenrod	–
Asteraceae	SYER	*Symphyotrichum ericoides*	white heath aster	–
Asteraceae	SYOB	*Symphyotrichum oblongifolium*	aromatic aster	–
Asteraceae	TAOF	*Taraxacum officinale*	common dandelion	Exotic
Asteraceae	TEAC	*Tetraneuris acaulis*	stemless four-nerve daisy	–
Asteraceae	TRDU	*Tragopogon dubius*	yellow salsify	Exotic
Asteraceae	XASP99	*Xanthisma spinulosum*	lacy tansyaster	–
Brassicaceae	ALDE	*Alyssum desertorum*	desert madwort	Exotic
Brassicaceae	BOHO99	*Boechera holboellii*	Holboell's rockcress	–
Brassicaceae	DEPI	*Descurainia pinnata*	western tansymustard	–
Brassicaceae	DESO2	*Descurainia sophia*	herb sophia	Exotic
Brassicaceae	LEDE	*Lepidium densiflorum*	common pepperweed	–
Brassicaceae	PHLU99	*Physaria ludoviciana*	foothill bladderpod	Rare (Ranked G5/S2S3 in MT; observed in ND)
Cactaceae	ESVI2	*Escobaria vivipara*	spinystar	–
Cactaceae	OPFR	*Opuntia fragilis*	brittle pricklypear	–
Cactaceae	OPPO	*Opuntia polyacantha*	plains pricklypear	–
Caprifoliaceae	SYOC	*Symphoricarpos occidentalis*	western snowberry	–
Chenopodiaceae	KRLA2	*Krascheninnikovia lanata*	winterfat	–
Chenopodiaceae	SAKA	*Salsola kali*	Russian thistle	Exotic
Convolvulaceae	COAR4	*Convolvulus arvensis*	field bindweed	Exotic; Noxious in MT (observed in ND)
Cyperaceae	CADU6	*Carex duriuscula*	needleleaf sedge	–
Cyperaceae	CAFI	*Carex filifolia*	threadleaf sedge	–
Cyperaceae	CAIN9	*Carex inops*	sun sedge	–
Euphorbiaceae	EUES	*Euphorbia esula*	leafy spurge	Exotic; Noxious in MT and ND (observed in ND)
Euphorbiaceae	EUGL3	*Euphorbia glyptosperma*	ribseed sandmat	–
Fabaceae	ASGI5	*Astragalus gilviflorus*	plains milkvetch	–
Fabaceae	ASLO4	*Astragalus lotiflorus*	lotus milkvetch	–

Table 3 (continued). List of all plant species identified in Fort Union Trading Post National Historic Site plant community monitoring plots in 2019. In the Notes column, “Exotic” indicates that a species is not native to the park or, in the case where only the genus was identified, there are some species within that genus that are exotic. State or county noxious weed species are designated in the Notes column. Rare species are designated in the Notes column as Rare, along with their conservation rank. Species that are not on the NPS species list are indicated in the Notes column as new.

Family	Symbol	Scientific Name	Common Name	Notes
Fabaceae	DACA7	*Dalea candida*	white prairie clover	–
Fabaceae	DAPU5	*Dalea purpurea*	purple prairie clover	–
Fabaceae	MEOF	*Melilotus officinalis*	yellow sweetclover	Exotic
Fabaceae	MESA	*Medicago sativa*	alfalfa	Exotic
Fabaceae	VIAM	*Vicia americana*	American vetch	–
Lamiaceae	HEHI	*Hedeoma hispida*	rough false pennyroyal	–
Liliaceae	ALST	*Allium stellatum*	autumn onion	–
Liliaceae	ALTE	*Allium textile*	textile onion	–
Linaceae	LILE3	*Linum lewisii*	Lewis flax	–
Linaceae	LIRI	*Linum rigidum*	stiffstem flax	–
Malvaceae	SPCO	*Sphaeralcea coccinea*	scarlet globemallow	–
Oleaceae	FRPE	*Fraxinus pennsylvanica*	green ash	–
Onagraceae	OESE3	*Oenothera serrulata*	yellow sundrops	–
Onagraceae	OESU99	*Oenothera suffrutescens*	scarlet beeblossom	–
Plantaginaceae	PLPA2	*Plantago patagonica*	woolly plantain	–
Poaceae	AGCR	*Agropyron cristatum*	crested wheatgrass	Exotic
Poaceae	ANGE	*Andropogon gerardii*	big bluestem	–
Poaceae	ARPU9	*Aristida purpurea*	purple threeawn	–
Poaceae	BOCU	*Bouteloua curtipendula*	sideoats grama	–
Poaceae	BODA2	*Bouteloua dactyloides*	buffalograss	–
Poaceae	BOGR2	*Bouteloua gracilis*	blue grama	–
Poaceae	BRIN2	*Bromus inermis*	smooth brome	Exotic
Poaceae	CALO	*Calamovilfa longifolia*	prairie sandreed	–
Poaceae	DISP	*Distichlis spicata*	saltgrass	–
Poaceae	ELLA3	*Elymus lanceolatus*	thickspike wheatgrass	–
Poaceae	ELTR7	*Elymus trachycaulus*	slender wheatgrass	–
Poaceae	HECO26	*Hesperostipa comata*	needle and thread	–
Poaceae	HESP11	*Hesperostipa spartea*	porcupinegrass	–
Poaceae	KOMA	*Koeleria macrantha*	prairie Junegrass	–
Poaceae	MUCU3	*Muhlenbergia cuspidata*	plains muhly	–
Poaceae	MUPA99	*Muhlenbergia paniculata*	tumblegrass	–
Poaceae	NAVI4	*Nassella viridula*	green needlegrass	–

Table 3 (continued). List of all plant species identified in Fort Union Trading Post National Historic Site plant community monitoring plots in 2019. In the Notes column, “Exotic” indicates that a species is not native to the park or, in the case where only the genus was identified, there are some species within that genus that are exotic. State or county noxious weed species are designated in the Notes column. Rare species are designated in the Notes column as Rare, along with their conservation rank. Species that are not on the NPS species list are indicated in the Notes column as new.

Family	Symbol	Scientific Name	Common Name	Notes
Poaceae	PASM	*Pascopyrum smithii*	western wheatgrass	–
Poaceae	POPR	*Poa pratensis*	Kentucky bluegrass	Exotic
Poaceae	SCSC	*Schizachyrium scoparium*	little bluestem	–
Poaceae	SEVI4	*Setaria viridis*	green bristlegrass	Exotic
Poaceae	SPCR	*Sporobolus cryptandrus*	sand dropseed	
Polemoniaceae	PHAL3	*Phlox alyssifolia*	alyssumleaf phlox	Rare (Ranked G5/S1 in ND; observed in ND)
Polemoniaceae	PHHO	*Phlox hoodii*	spiny phlox	–
Polygalaceae	POAL4	*Polygala alba*	white milkwort	–
Polygonaceae	ERPA9	*Eriogonum pauciflorum*	fewflower buckwheat	–
Polygonaceae	FACO	*Fallopia convolvulus*	black bindweed	Exotic
Primulaceae	ANOC2	*Androsace occidentalis*	western rockjasmine	–
Ranunculaceae	ANCY	*Anemone cylindrica*	candle anemone	–
Ranunculaceae	ANPA19	*Anemone patens*	eastern pasqueflower	–
Rosaceae	ROAR3	*Rosa arkansana*	prairie rose	–
Santalaceae	COUM	*Comandra umbellata*	bastard toadflax	–
Scrophulariaceae	ORLU2	*Orthocarpus luteus*	yellow owl's-clover	–
Scrophulariaceae	PEGR5	*Penstemon gracilis*	lilac penstemon	–
Scrophulariaceae	PEGR7	*Penstemon grandiflorus*	large beardtongue	Rare (Ranked G5/S1 in MT; observed in ND)
Scrophulariaceae	PENST	*Penstemon*	beardtongue	–
Unknown Family	UNKFORB	Unknown forb	unknown forb	Exotic
Violaceae	VINU2	*Viola nuttallii*	Nuttall's violet; yellow prairie violet	–

Based on the total count of unique species observed in all plots in 2019, the five plots located in the Bodmer Unit had more total species per plot, and more native species per plot, than the plots located in the Upland Terrace Unit (Table 4). Plots PCM_129 and PCM_131 both had the most native cover (Table 5), and of the two, PCM_129 (Figure 4) had the highest number of unique native species (Table 4). Only one plot, PCM_133 in the Bodmer Unit, had more exotic cover than native cover (Table 5). This plot was dominated by crested wheatgrass (*Agropyron cristatum)* (Figure 5).

Table 4. Total number of plant species identified in each of the nine plots monitored at Fort Union Trading Post National Historic Site (FOUS) in 2019. 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	Exotic species	Native species	Total species
FOUS_PCM_005	Upland Terrace	11	21	32
FOUS_PCM_006	Upland Terrace	6	11	17
FOUS_PCM_008	Upland Terrace	6	19	25
FOUS_PCM_011	Upland Terrace	10	15	25
FOUS_PCM_129	Bodmer Unit	4	61	65
FOUS_PCM_130	Bodmer Unit	8	42	50
FOUS_PCM_131	Bodmer Unit	6	48	54
FOUS_PCM_132	Bodmer Unit	8	61	69
FOUS_PCM_133	Bodmer Unit	11	28	39

Table 5. Absolute percent cover of native and exotic plant species in plots monitored at Fort Union Trading Post National Historic Site (FOUS) in 2019. 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 % Exotic Cover	Absolute % Native Cover
FOUS_PCM_005	Upland Terrace	35	76
FOUS_PCM_006	Upland Terrace	15	115
FOUS_PCM_008	Upland Terrace	1	78
FOUS_PCM_011	Upland Terrace	12	125
FOUS_PCM_129	Bodmer Unit	4	159
FOUS_PCM_130	Bodmer Unit	16	143
FOUS_PCM_131	Bodmer Unit	23	159
FOUS_PCM_132	Bodmer Unit	24	145
FOUS_PCM_133	Bodmer Unit	76	54

Figure 4. Plot PCM_129 was one of the plots with the most native species diversity at Fort Union Trading Post National Historic Site in 2019. Photograph courtesy of the National Park Service.

Figure 5. Crested wheatgrass (*Agropyron cristatum)*, seen growing in the foreground, contributed to the high exotic plant cover observed at plot PCM_133 at Fort Union Trading Post National Historic Site in 2019. Photograph courtesy of the National Park Service.

NGPN surveyed for woody species in three plots (PCM_129, PCM_130, and PCM_131) that met the parameters for the woody species protocols. No trees were found in any of the plots. One green ash (*Fraxinus pennsylvanica*) seedling was found in PCM_130. We did not measure surface fuels at plots PCM_129, PCM_130, and PCM_131 because no woody debris crossed the tree transects.

All plots were surveyed for early detection exotic species and disturbances. No target exotic species were found, however disturbances were observed in each of the nine plots visited (Table 6). The most commonly observed disturbance was small mammal activity. The entire Bodmer Unit (approximately 30 acres) was grazed by cattle in early May, but our field crew noticed very little grazed vegetation when they visited in late July.

Table 6. Disturbance types and occurrence in plant community monitoring plots visited in 2019 at Fort Union Trading Post National Historic Site. Area is recorded as 0 in several Bodmer Unit plots in order to document that there was grazing in the Bodmer Unit this year, even though crew members did not observe evidence of recently grazed vegetation when they visited.

Plot	Park Unit	Disturbance Type	Comments	Area (m^2) or Present/Absent
FOUS_PCM_005	Upland Terrace	Prairie Dog	–	2
FOUS_PCM_005	Upland Terrace	Other	mowing; not recent	1000
FOUS_PCM_006	Upland Terrace	Other	recent mowing	1000
FOUS_PCM_008	Upland Terrace	Prairie Dog	–	1
FOUS_PCM_008	Upland Terrace	Soil Disturbance	–	1
FOUS_PCM_008	Upland Terrace	Other	mowing	1000
FOUS_PCM_011	Upland Terrace	Small Mammal	several small animal burrows	1
FOUS_PCM_011	Upland Terrace	Other	recent tracks from mower	5
FOUS_PCM_129	Bodmer Unit	Graz	Bodmer Unit cattle grazing	0
FOUS_PCM_129	Bodmer Unit	Small Mammal	–	1
FOUS_PCM_129	Bodmer Unit	Soil Disturbance	–	1
FOUS_PCM_130	Bodmer Unit	Animal Trail	–	2
FOUS_PCM_130	Bodmer Unit	Small Mammal	–	4
FOUS_PCM_130	Bodmer Unit	Graz	Bodmer Unit cattle grazing	0
FOUS_PCM_131	Bodmer Unit	Graz	Bodmer Unit cattle grazing	0
FOUS_PCM_131	Bodmer Unit	Small Mammal	–	1
FOUS_PCM_131	Bodmer Unit	Soil Disturbance	–	1
FOUS_PCM_132	Bodmer Unit	Animal Trail	–	3
FOUS_PCM_132	Bodmer Unit	Small Mammal	–	2
FOUS_PCM_132	Bodmer Unit	Soil Disturbance	–	5
FOUS_PCM_132	Bodmer Unit	Graz	Bodmer Unit cattle grazing	0
FOUS_PCM_133	Bodmer Unit	Animal Trail	cattle trails	20
FOUS_PCM_133	Bodmer Unit	Graz	Bodmer Unit cattle grazing	10
FOUS_PCM_133	Bodmer Unit	Small Mammal	several animal holes	2

Further Analysis

This Data Report is intended to provide a basic review of the data collected during the NGPN monitoring team's 2019 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, as well as in the archives found in the IRMA Data Store. For an in-depth data analysis on long-term trends at FOUS, refer to the 2010–2016 summary report (Ashton and Davis 2017).

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