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Natural Resource Stewardship and Science

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

2013 Annual Report

Natural Resource Data Series NPS/NGPN/NRDS—2014/610

ON THE COVER
Fort Union Trading Post National Historic Site, 2013
Photograph by: J. Ladd, NPS

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

2013 Annual Report

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Acknowledgments

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Introduction

During the last century, much of the prairie within the Northern Great Plains has been plowed for cropland, planted with non-natives to maximize livestock production, or otherwise developed, making it one of the most threatened ecosystems in the United States. Within North Dakota, greater than 71% of the area of native mixed-grass prairie has been lost since European settlement (Samson and Knopf 1994). The National Park Service (NPS) plays an important role in preserving and restoring some of the last pieces of intact prairies within the Northern Great Plains. The stewardship goal of the NPS is to "preserve ecological integrity and cultural and historical authenticity" (NPS 2012); however, resource managers struggle with the reality that there have been fundamental changes to the disturbance regimes, such as climate, fire, and large ungulate grazing, that have historically maintained prairies, and there is the continual pressure of exotic invasive species. Long-term monitoring is essential to sound management of prairie landscapes, because it can provide information on environmental quality and condition, benchmarks concerning ecological integrity, and early warning signs for declines in ecosystem health.

Fort Union Trading Post National Historic Site (FOUS) was established in 1966 with a mission to commemorate the significant role played by Fort Union as a fur trading post on the Upper Missouri River. The trading post sits on 444 acres of upland mixed-grass prairie and riparian forests. The Northern Great Plains Inventory & Monitoring Program (NGPN) began vegetation monitoring at FOUS in 2011(Ashton et al. 2012), and surveys using similar methods were done in 2010 for the vegetation management plan (Symstad 2011). Two distinct areas of grassland in FOUS are monitored: the upland terrace surrounding the fort and the Bodmer Overlook Unit. The upland terrace surrounding the fort has an extensive history of agriculture and more recently has been planted with native plant species (Symstad 2011). The Bodmer Overlook Unit is a 30-acre parcel of rolling hills above the fort that is relatively intact native prairie (Symstad 2011). Vegetation monitoring protocols were established and plot locations were chosen that represent the park and to coordinate efforts with the Northern Great Plains Fire Ecology Program (FireEP). The long-term objectives of the NGPN plant community monitoring effort (Symstad et al. 2012b) in FOUS are to:

1. Determine park-wide status and long-term trends in vegetation species composition (e.g., exotic vs. native) and structure (e.g., cover, height) of herbaceous and shrub species.

2. Improve our understanding of the effects of external drivers and management actions on plant community species composition and structure by correlating changes in vegetation composition and structure with changes in climate, landscape patterns, atmospheric chemical composition, fire, and invasive plant control.

This report is intended to provide a timely release of basic data sets and data summaries from our sampling efforts at FOUS in 2013. This was NGPN's third year of sampling, and we visited 6 plots (Figure 1). Not all plots are visited every year, and we expect it will take 2 more years to visit every plot in the park twice. We expect to produce reports with more in-depth data analysis and interpretation when we complete 5 years of sampling. In the interim, reports, spatial data, and data summaries can be provided for park management and interpretation upon request.

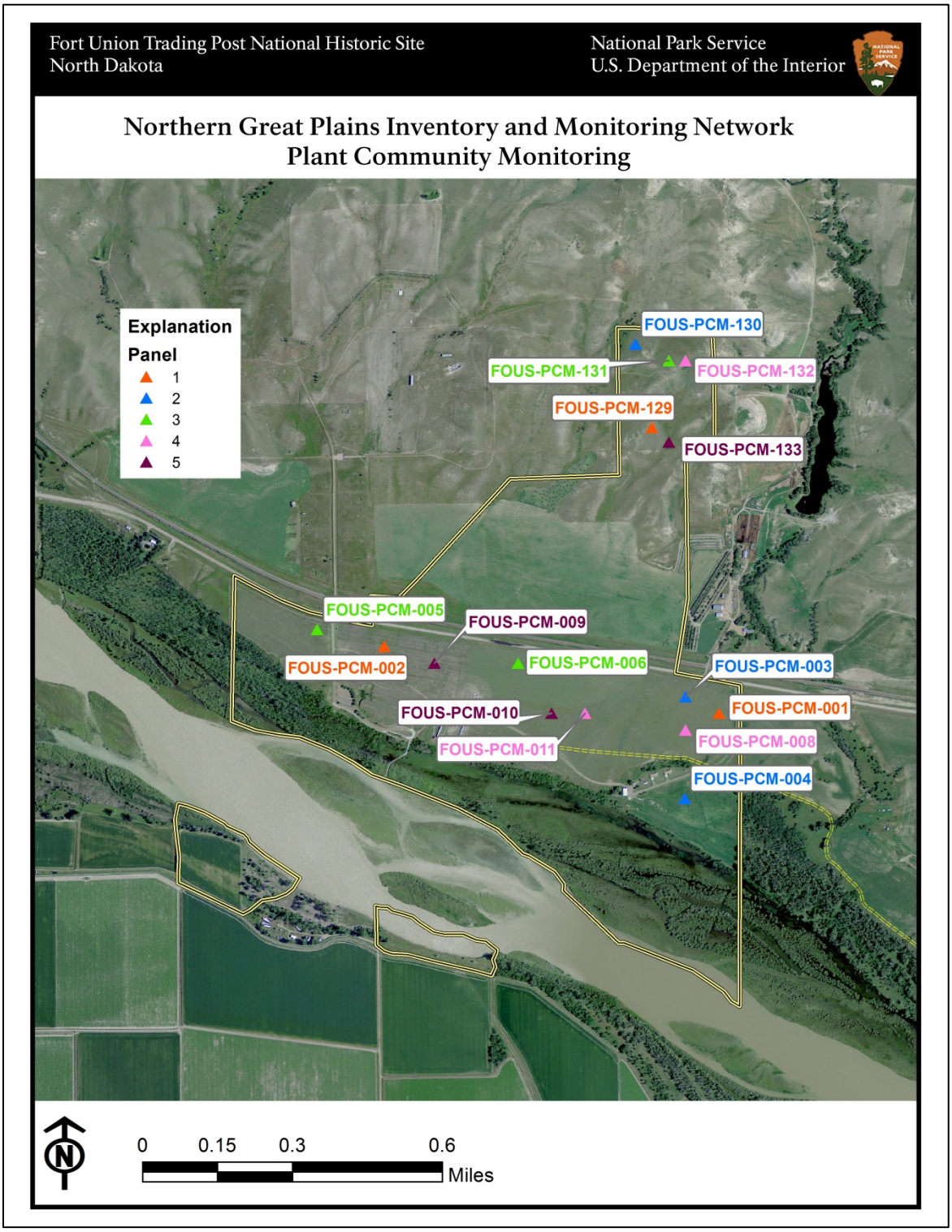


Figure 1. Map of plant community monitoring plots at Fort Union Trading Post National Historic Site (FOUS). Plant community monitoring plots in Panel 2 (blue) and Panel 3 (green) were surveyed in 2013.

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. Below, we briefly describe the general approach. For those interested in more detail, please see Symstad et al. 2012, available at http://science.nature.nps.gov/im/units/ngpn/monitor/plants.cfm.

Sample Design

We implemented a survey to monitor plant community structure and composition in FOUS using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, we selected 15 randomly located sites within FOUS (Figure 1). We split these 15 sites into 5 panels with 3 sites each. We visit 2 panels (6 sites) every year, and after 5 years (2015) we will have visited all 15 sites twice. In 2011, we visited sites in panel 1 and panel 5, and in 2012 we visited sites in panel 1 and panel 2 (Figure 1). In 2013, we visited sites in panel 2 and panel 3 during the last week of July. Data from these randomly selected sites can be used to estimate condition of vegetation communities for the whole park and over time to discern trends in condition over time.

Plot Layout and Sampling

At each of the sites we visited, we 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. Species richness data from the point-intercept method were supplemented with species presence data collected in 5 sets of nested square quadrats (0.01 m^2, 0.1 m^2, 1 m^2, and 10 m^2) located systematically along each transect (Figure 2). In 2013, sampling at FOUS took a 4-person crew 3.5 days with travel time (see Appendix A for a detail of activities each day).

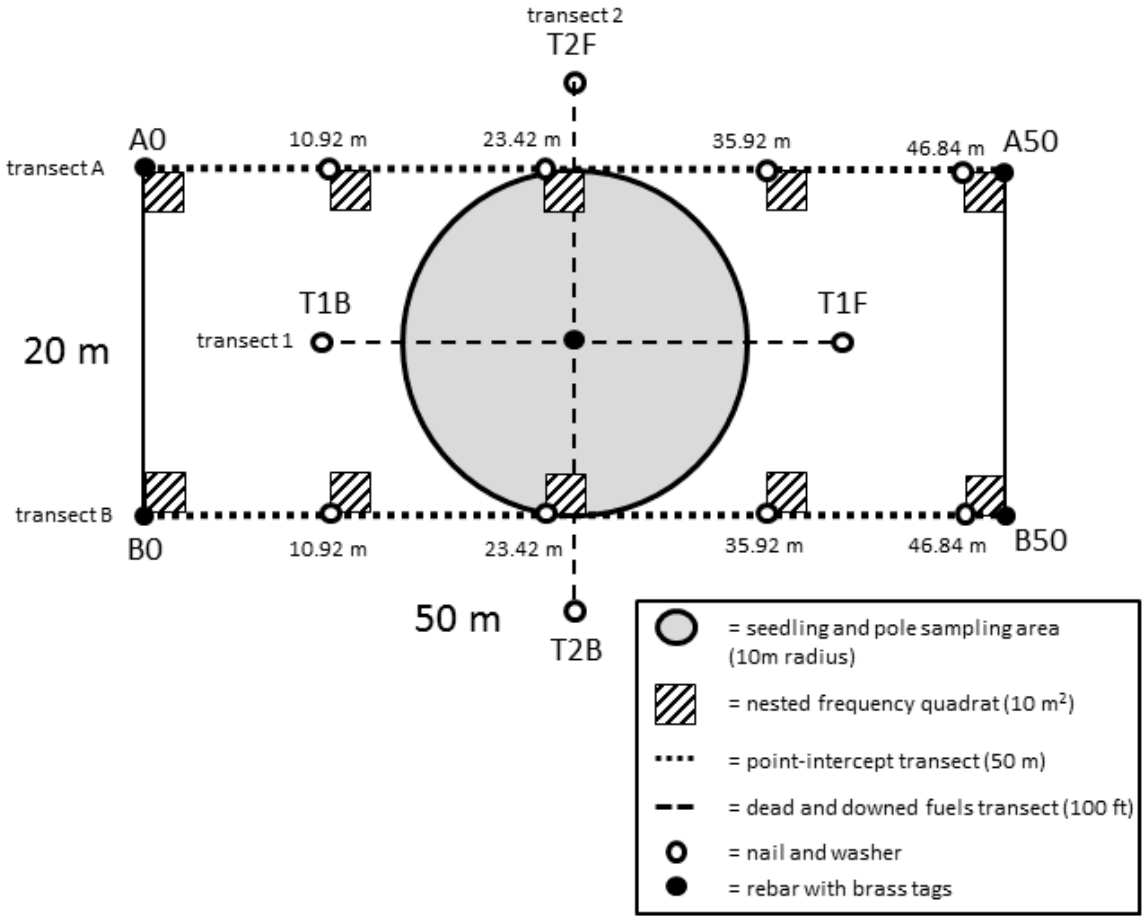


Figure 2. Long-term monitoring plot used for sampling vegetation in Fort Union Trading Post National Historic Site.

When woody species were present, tree regeneration and tall shrub density data were collected within a 10 m radius subplot centered in the larger 50 m x 20 m plot (Figure 2). Trees with diameter at breast height (DBH) > 15 cm, located within the entire 0.1 ha plot, are mapped and tagged. For each tree, the species, DBH, status, and condition (e.g., leaf-discoloration, insect-damaged, etc.) are recorded. In 2013, we found a green ash (*Fraxinus pennsylvanica*) seedling in PCM_130; this was the same seedling seen in 2012 (Ashton et al. 2013). We did not find trees or tall shrub species in any other sites.

At all plots, we also surveyed the area for common disturbances and target species of interest to the park (Table 1). Common disturbances included such things as roads, rodent mounds, animal trails, and fire. For all plots, the type and severity of the disturbances were recorded. We also surveyed the area for exotic species that have the potential to spread into the park and cause significant ecological impacts (Table 1). For each target species that was present at a site, an abundance class was given on a scale from 1-5, where 1 = one individual, 2 = few individuals, 3 = cover of 1-5%, 4 = cover of 5-25%, and 5 = cover > 25% of the plot. The information gathered from this procedure is critical for

early detection and rapid response to such threats. In addition, if they were present, we noted plant species that are considered rare or vulnerable to loss in North Dakota (Table 2).

Table 1. Exotic species surveyed for at Fort Union Trading Post National Historic Site as part of the early detection and rapid response program within the Northern Great Plains Network.

Scientific Name	Common Name	Habitat
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	Riparian
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	Upland

Table 2. Rare species that were surveyed for during the 2013 field season at Fort Union Trading Post National Historic Site.

Scientific Name	Common Name
Oxytropis sericea	white locoweed

Data Management and Analysis

We used FFI (FEAT/FIREMON Integrated; http://frames.gov/ffi/) as the primary software environment 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 (National Park Service 2007).

Species scientific names, codes, and common names are from the USDA Plants Database (USDA-NRCS 2012; http://plants.usda.gov/). However, nomenclature follows the Integrated Taxonomic Information System (ITIS) (http://www.itis.gov). In the few cases where ITIS recognizes 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 for the sites were entered, 100% of records were verified against the original data sheet to minimize transcription errors. Next, 10% of the records were reviewed a second time to confirm accuracy. After all data were entered and verified, automated queries were developed to check for

errors in the data (e.g. typos, duplicated species). When errors were caught by the crew or the automated queries, changes were made to the original datasheets and the FFI database as needed.

Plant life forms (e.g., shrub, forb) were based on definitions from the USDA Plants Database (USDA-NRCS 2012). Warm-season grasses were identified primarily using a guide by Skinner (2010). Summaries were produced using the FFI reporting and query tools, and statistical summaries and graphics were generated using R software (version 2.15.1).

We measured diversity at the plots in 3 ways: species richness, the Shannon Index, and Pielou's Index of Evenness. Species richness is simply a count of the species recorded in an area. The Shannon Index, H', is a measure of the number of species in an area and how even abundances are across the community. It typically ranges between 0 (low richness and evenness) to 3.5 (high species richness and evenness). Pielou's Index of Evenness, J', measures how even abundances are across taxa. It ranges between 0 and 1; values near 0 indicate dominance by a single species, and values near 1 indicate nearly equal abundance of all species present.

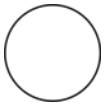
Disturbances were recorded in square meters and ranged from 0 (not present) to 2290 m^2 (the whole plot area) for each type of disturbance. We report the sum of all individual disturbances, so the value can be greater than 2290 m^2.

Reporting on Natural Resource Condition

Results were summarized in a Natural Resource Condition Table based on the templates from the State of the Park report series (http://www.nps.gov/stateoftheparks/). The goal is to improve park priority setting and to synthesize and communicate complex park condition information to the public in a clear and simple way. By focusing on specific indicators, such as exotic species cover, park condition can be evaluated in a consistent way in subsequent years. The status and trend of each indicator is scored and assigned a corresponding symbol based on the key found in Table 3.

We chose a set of indicators and specific measures that can describe the condition of vegetation in the Northern Great Plains and the status of exotic plant invasions. The measures include absolute herb-layer canopy cover, native species richness, evenness, relative cover of exotic species, and annual brome cover. Reference values were based on descriptions of historic condition and variation, past studies, and/or management targets. The current park condition was compared to a reference value, and its status was scored as one of the following: good condition, warrants moderate caution, or warrants significant concern based on this comparison (Table 3). Good condition was applied to values that fell within the range of the reference value, and significant concern was applied to conditions that fell outside the bounds of the reference value. In some case, reference conditions can be determined only after we have accumulated more years of data. When this is the case, we refer to these as "To be determined" and estimate condition based on our professional judgment.

Table 3. Key to the symbols used in the Natural Resource Condition Table. The background color represents the current status, the arrow summarizes the trend, and the thickness of the outside line represents the degree of confidence in the assessment. A symbol that does not contain an arrow indicates that there is insufficient information to assess a trend. Based on the State of the Park reports (http://www.nps.gov/stateoftheparks/).

Condition Status		Trend in Condition		Confidence in Assessment	
	Warrants Significant Concern		Condition is Improving		High
	Warrants Moderate Concern		Condition is Unchanging		Medium
	Resource is in Good Condition		Condition is Deteriorating		Low

Results and Discussion

While much of the the southern part of the Northern Great Plains suffered from drought in 2013, Fort Union Trading Post NHS experienced normal conditions. Drought conditions were not present when we visited in July (Figure 3). Average canopy cover was 138% (Table 4) in 2013, which was very similar to the previous year (Ashton et al. 2013). There was a large amount of standing litter on the ground, with ground cover at the sites averaging 95% plant litter.

We found 82 plant species at FOUS in 2013 (Appendix B). Graminoids, which includes grasses, sedges, and rushes, accounted for most of the vegetative cover at FOUS. Forbs and shrubs were present, but in much lower abundance (Figure 4). We found 21 exotic species at the park. Native graminoids accounted for most of the plant cover. Western wheatgrass (*Pascopyrum smithii*) and blue grama (*Bouteloua gracilis*) were particularly abundant (Figure 5). We did not find any rare or exotic target exotic species (Table 1).

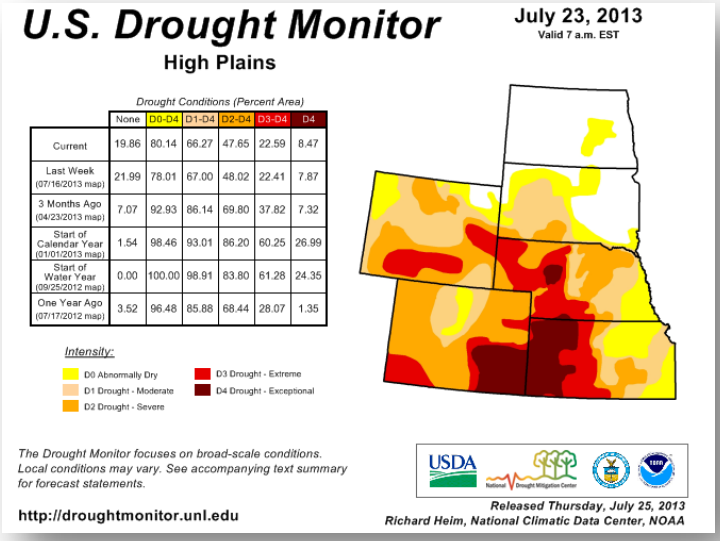


Figure 3. Drought conditions in late July 2013 in the Northern Great Plains. Fort Union Trading Post NHS experienced normal conditions.

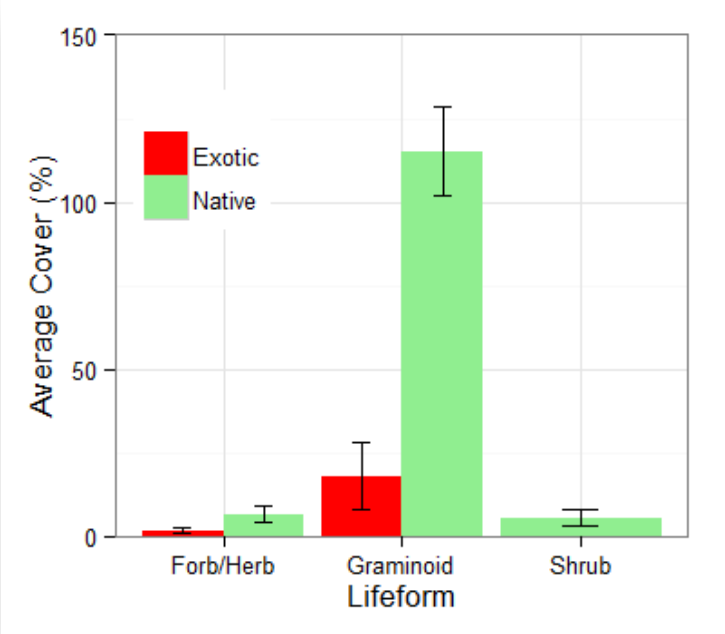


Figure 4. Average cover by lifeform and nativity in 8 plant community monitoring plots in Fort Union Trading Post National Historic Site in 2013. Native (green) and exotic (red) graminoids were the most abundant lifeform across the plots. Bars represent means ± standard errors.

Table 4. Natural resource condition summary table for upland plant communities in Fort Union Trading Post National Historic Site (FOUS).

Indicator of Condition	Specific Measures	2013 Value (mean ± SE)	Reference Condition and Data Source	Condition Status/Trend	Rationale for Resource Condition
Upland Plant Community Structure and Composition	Absolute herb-layer canopy cover	138 ± 16.2 %	TBD [1]		FOUS protects and manages small remnants of native mixed-grass prairie. The park is characterized by lower native species richness around the fort, which falls well below the natural range of variability for northern mixed-grass prairie. Plots in the Bodmer Overlook Unit contain more native species and are generally in good condition. The condition assessment for canopy cover and evenness is based on professional judgment, but as we collect more data and understand the natural range of variability our confidence in these assessments will increase.
	Native species richness (based on average of 10 1m^2 quadrats per plot)	5 ± 1.3 species	8-18 species [2]		
	Evenness (based on point-intercept of 2-50m transects per plot)	0.68 ± 0.06	TBD [1]		
Exotic Plant Early Detection and Management	Relative cover of exotic species	13 ± 6 %	≤ 10 % cover [3]		FOUS has determined that the desired condition for vegetation in upland areas comprises ≤ 10% total cover of exotic species. On average, the plots visited in 2013 had exotic cover slightly above this value. However, there was a great deal of variation across the park. Four of 6 sites met the desired condition, including both of the sites in the Bodmer Overlook Unit. Two other sites had very high exotic cover. To maintain the park as a whole at the desired condition, the best strategy will be to target management and restoration efforts in these areas of high exotic cover.

References and Data Sources:
1. To be determined when more data are available. 2. Symstad, A. J. and J. L. Jonas*. in press*. Using natural range of variation to set decision thresholds: a case study for Great Plains grasslands.in G. R. Gutenspergen, editor. Application of threshold concepts in natural resource decision making. Springer Verlag. 3. Symstad, A. J. 2011. A vegetation management plan for Fort Union Trading Post National Historic Site: Final report for interagency agreement number F154910005 (April 2012). Natural Resource Technical Report NPS/FOUS/NRR—2012/502. National Park Service, Fort Collins, Colorado.

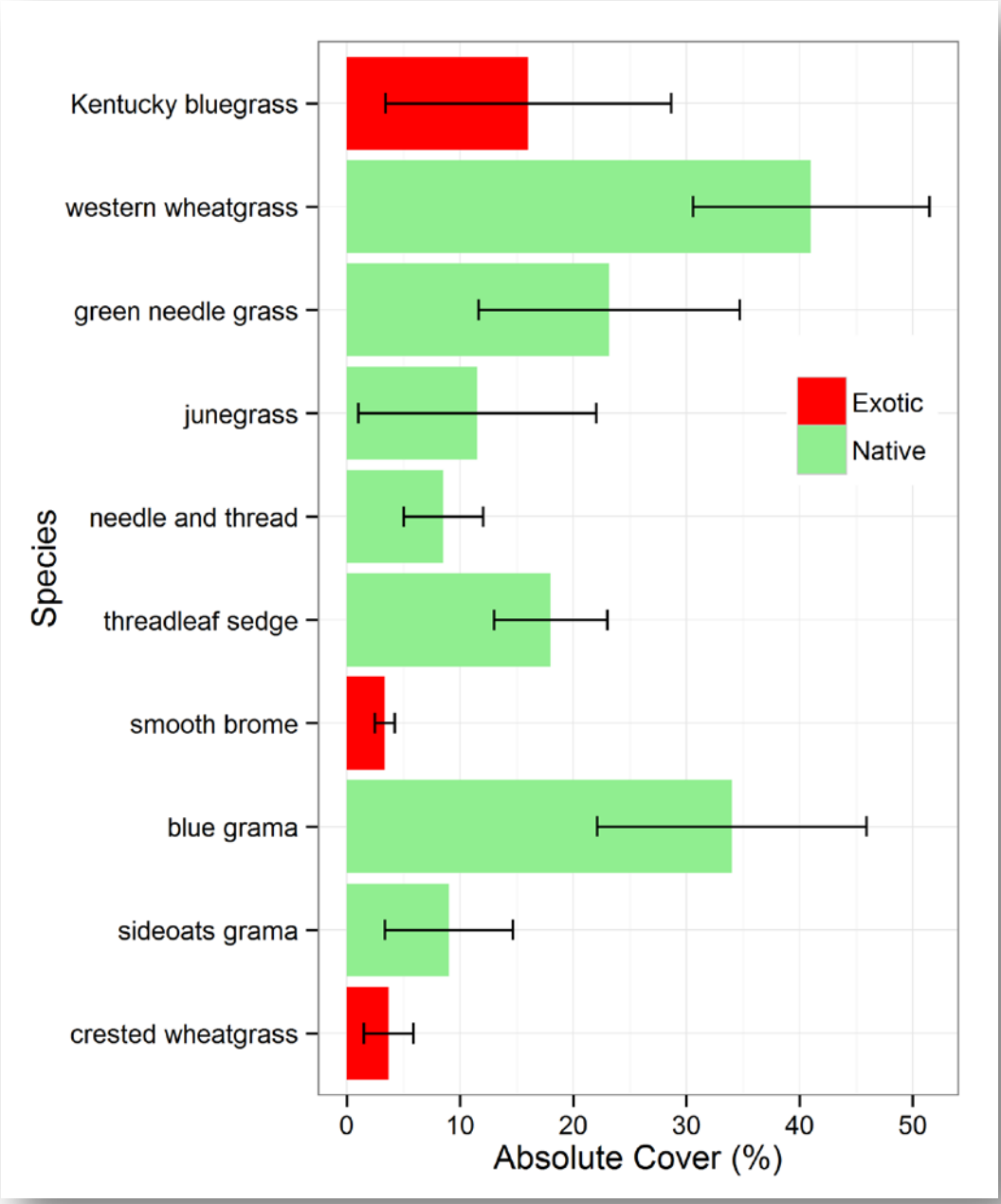


Figure 5. The average absolute cover of the 10 most common native (green) and exotic (red) plants recorded at Fort Union Trading Post National Historic Site in 2013. Bars represent means ± standard errors.

Average species richness at each of the 6 plots was measured by point-intercept and in 1 m^2 and 10 m^2 quadrats (Table 5). On average, there are about 2 exotic species within the 1 m^2 quadrat (Table 5). From the point-intercept data, we found average plot diversity, H', to be 1.6 ± 0.21. Evenness, J', averaged 0.68 ± 0.06 across the plots (Table 4). When including only native species, average diversity and evenness were 1.3 ± 0.2 and 0.72 ± 0.06, respectively.

Table 5. Average plant species richness in 6 plots at Fort Union Trading Post National Historic Site in 2013. Values represent means ± standard errors, n=6.

	Point-intercept	**1 m^2 quadrats**	**10 m^2 quadrats**
Species richness	10 ± 1.9	6 ± 1.2	10 ± 1.8
Native species richness	8 ± 2.0	5 ± 1.3	8 ± 2.1
Exotic species richness	3 ± 0.6	2 ± 0.2	3 ± 0.5
Graminoid species richness	8 ± 0.9	4 ± 0.5	6 ± 0.5
Forb species richness	2 ± 0.7	2 ± 0.6	4 ± 1.1

There was a great deal of variation in species richness across sites, and the plots found in the Bodmer Overlook Unit had more native species than the areas surrounding the fort (Table 6). Species richness in the mixed-grass prairie is determined by numerous factors including fire regime, large ungulate grazing, and weather fluctuations (Symstad and Jonas 2011). While it is difficult to define a reference condition for species richness that can vary so much spatially and temporally, the natural range of variation over long-time periods may be a good starting point (Symstad and Jonas *in press*). Long-term records of species diversity in mixed-grass prairie in a moderately grazed site in Montana ranged between 8 and 18 species per square meter (10-90th percentile range) between 1933-1945 (Symstad and Jonas *in press*). Species richness in the upland areas surrounding the fort fall below the natural range, but the plots in the Bodmer Overlook Unit fall within it (Table 6). The Bodmer Overlook should be managed to maintain this native prairie.

The average relative cover of exotic species at sites in FOUS was moderate (13 ± 6%; Table 4). In 4 of the 6 sites, exotic cover was below the management target of 10% cover (Symstad 2011), but it was much higher in two sites (PCM_004 and PCM_005; Table 6). Crested wheatgrass (*Agropyron cristatum*) was the most abundant exotic species at site PCM_005, and Kentucky bluegrass (*Poa pratensis*) was the most abundant at PCM_004. A troublesome exotic, Japanese brome (*Bromus japonicus*) was present in the park but in very low abundance (we found it as 1.3 % cover at site PCM_005). The presence of annual bromes in mixed-grass prairie is associated with decreased productivity and altered nutrient cycling compared to native grasslands (Ogle et al. 2003), and there is strong evidence from regions farther west that cheatgrass alters fire regimes and the persistence of native species (D'Antonio and Vitousek 2003). The presence of bromes in FOUS should be monitored, and where possible, management actions should be taken to keep it in low abundance. Unfortunately, the control of annual bromes has presented a major challenge to Northern Great Plains parks, and the best strategy for management remains unclear.

Table 6. Characteristics of the plant community at 6 plots in Fort Union Trading Post National Historic Site in 2013 including species richness, average cover of smooth brome, exotic plant cover, and area of disturbance.

Management Unit	Plot	Native species richness in 1 m^2	Exotic cover (%)	Number of native forbs in 1 m^2	Smooth brome cover (%)	Disturbance within site (m^2)
Upland Terrace	FOUS_PCM_003	2	5	1	4	0
	FOUS_PCM_004	3	38	0	1	20
	FOUS_PCM_005	4	25	1	0	2290
	FOUS_PCM_006	3	3	1	3	2291
	Site Average	3 ± *0.3*	*18 ± 8.3*	1 ± *0.3*	2 ± *0.9*	-
Bodmer Overlook	FOUS_PCM_130	8	2	3	0	5
	FOUS_PCM_131	10	8	5	0	3
	Site Average	*9 ± 1.0*	*5 ± 3*	*3 ± 1*	*0*	-

Disturbance from grazing, fire, and humans affects plant community structure and composition in mixed-grass prairie. For this reason, we measured the approximate area affected by natural and human disturbances at each site we visited. In 2013, the most common disturbance was from mowing/planting and small mammal burrowing both of which were evident in 2 of the 6 sites. Native forb cover was very low at the sites that had been mowed (Table 6), averaging 0 to 1 species per meter squared. Recent mowing had removed the tops of some native forbs and likely prevented them from reaching maturity and setting seed. Many of these natives, such as *Penstemon grandiflorus*, were seeded during the restoration effort in 2006 and 2010 (Symstad 2011). On the other hand, the mowing treatment is likely contributing to reduced exotic cover in these areas and to meeting the goals of maintaining a low vegetation stature (Symstad 2011). Low vegetation stature maintains a landscape appearance similar to the likely appearance and structure around FOUS during the most active period of the fort (Symstad 2011).

Summary

In conclusion, FOUS protects a remnant of native northern mixed-grass prairie in the Bodmer Overlook Unit and more disturbed areas in the upland fields surrounding the fort. A few sites in the park have a high cover of exotic species. To retain ecological integrity, it is important to continue efforts to reduce the cover of invasive plants. Allowing for natural disturbances such as fire and for active management such as mowing may be critical to maintaining plant diversity at FOUS, but it should be balanced with the need to protect intact native communities and prevent further invasions of exotic species. Continued monitoring efforts will be critical to track changes in the condition of the vegetation communities in FOUS.

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Appendix A: Field journal for plant community monitoring in FOUS for the 2013 season

Plant community composition monitoring in Fort Union National Historic Site was completed using a crew of 4 people working 3, 10-hour days. We spent approximately 144 crew hours.

Date	Day of week	Approximate Travel Time (hrs)	Housing	Sites Visited/Notes
July 28, 2013	Friday	2.5	Marquis Inn and Suites	Travel from Theodore Roosevelt NP
July 27, 2013	Saturday	1.25	Marquis Inn and Suites	PCM-130 PCM-131 PCM-005
July 28, 2013	Sunday	1.25	Marquis Inn and Suites	PCM-005 PCM-004 PCM-003 PCM-006
July 29, 2013	Monday	7.5	N/A	Travel to Rapid City, SD

Appendix B: List of plant species found in 2013 at FOUS

Family	Code	*Scientific Name*	Common Name	Exotic
Asteraceae	ANMI3	*Antennaria microphylla*	littleleaf pussytoes	
	ARFR4	*Artemisia frigida*	prairie sagewort	
	COCA5	*Conyza canadensis*	Canadian horseweed	
	ECAN2	*Echinacea angustifolia*	blacksamson echinacea	
	ERPU2	*Erigeron pumilus*	shaggy fleabane	
	GUSA2	*Gutierrezia sarothrae*	broom snakeweed	
	HEPA19	*Helianthus pauciflorus*	stiff sunflower	
	HEVI4	*Heterotheca villosa*	hairy false goldenaster	
	LASE	*Lactuca serriola*	prickly lettuce	*
	LIPU	*Liatris punctata*	dotted blazing star	
	MUOB99	*Mulgedium oblongifolium*	blue lettuce	
	PACA15	*Packera cana*	woolly groundsel	
	RACO3	*Ratibida columnifera*	upright prairie coneflower	
	SYER	*Symphyotrichum ericoides*	white heath aster	
	SYOB	*Symphyotrichum oblongifolium*	aromatic aster	
	TAOF	*Taraxacum officinale*	common dandelion	*
	TEAC	*Tetraneuris acaulis*	stemless four-nerve daisy	
	TRDU	*Tragopogon dubius*	yellow salsify	*
Boraginaceae	LIIN2	*Lithospermum incisum*	narrowleaf stoneseed	
Brassicaceae	ALDE	*Alyssum desertorum*	desert madwort	*
	CAMI2	*Camelina microcarpa*	littlepod false flax	*
	LEDE	*Lepidium densiflorum*	common pepperweed	
	SIAL2	*Sisymbrium altissimum*	tall tumblemustard	*
	THAR5	*Thlaspi arvense*	field pennycress	*
Campanulaceae	CARO2	*Campanula rotundifolia*	bluebell bellflower	
Caprifoliaceae	SYOC	*Symphoricarpos occidentalis*	western snowberry	
Chenopodiaceae	CHENO	*Chenopodium* species	goosefoot	*
	KOSC	*Kochia scoparia*	burningbush	*
	KRLA2	*Krascheninnikovia lanata*	winterfat	
Cyperaceae	CAFI	*Carex filifolia*	threadleaf sedge	
Euphorbiaceae	EUGL3	*Euphorbia glyptosperma*	ribseed sandmat	
Fabaceae	ASTRA	*Astragalus* species	milkvetch	
	ASGI5	*Astragalus gilviflorus*	plains milkvetch	
	ASPE5	*Astragalus pectinatus*	narrowleaf milkvetch	
	DACA7	*Dalea candida*	white prairie clover	
	DAPU5	*Dalea purpurea*	purple prairie clover	
	LAPO2	*Lathyrus polymorphus*	manystem pea	
	MESA	*Medicago sativa*	alfalfa	*
	MEOF	*Melilotus officinalis*	yellow sweetclover	*
	PSLA3	*Psoralidium lanceolatum*	lemon scurfpea	
	VIAM	*Vicia americana*	American vetch	
Lamiaceae	HEHI	*Hedeoma hispida*	rough false pennyroyal	
Liliaceae	ALTE	*Allium textile*	textile onion	
Linaceae	LILE3	*Linum lewisii*	Lewis flax	

Family	Code	*Scientific Name*	Common Name	Exotic
Linaceae	LIRI	*Linum rigidum*	stiffstem flax	
Malvaceae	SPCO	*Sphaeralcea coccinea*	scarlet globemallow	
Oleaceae	FRPE	*Fraxinus pennsylvanica*	green ash	
Onagraceae	OESE3	*Oenothera serrulata*	yellow sundrops	
	OESU99	*Oenothera suffrutescens*	scarlet beeblossom	
Poaceae	AGCR	*Agropyron cristatum*	crested wheatgrass	*
	ANGE	*Andropogon gerardii*	big bluestem	
	BOCU	*Bouteloua curtipendula*	sideoats grama	
	BOGR2	*Bouteloua gracilis*	blue grama	
	BRIN2	*Bromus inermis*	smooth brome	*
	BRJA	*Bromus japonicus*	Japanese brome	*
	CALO	*Calamovilfa longifolia*	prairie sandreed	
	ELCA4	*Elymus canadensis*	Canada wildrye	
	ELEL5	*Elymus elymoides*	squirreltail	
	ELTR7	*Elymus trachycaulus*	slender wheatgrass	
	HECO26	*Hesperostipa comata*	needle and thread	
	HOJU	*Hordeum jubatum*	foxtail barley	
	KOMA	*Koeleria macrantha*	prairie Junegrass	
	MUCU3	*Muhlenbergia cuspidata*	plains muhly	
	MUSQ3	*Munroa squarrosa*	false buffalograss	
	NAVI4	*Nassella viridula*	green needlegrass	
	PAVI2	*Panicum virgatum*	switchgrass	
	PASM	*Pascopyrum smithii*	western wheatgrass	
	PHPR3	*Phleum pratense*	timothy	*
	POPR	*Poa pratensis*	Kentucky bluegrass	*
	SCSC	*Schizachyrium scoparium*	little bluestem	
	SEVI4	*Setaria viridis*	green bristlegrass	*
	SPCR	*Sporobolus cryptandrus*	sand dropseed	
Polemoniaceae	PHHO	*Phlox hoodii*	spiny phlox	
Polygalaceae	POAL4	*Polygala alba*	white milkwort	
Polygonaceae	ERPA9	*Eriogonum pauciflorum*	fewflower buckwheat	
	FACO	*Fallopia convolvulus*	black bindweed	*
Primulaceae	ANOC2	*Androsace occidentalis*	western rockjasmine	
Ranunculaceae	ANPA19	*Anemone patens*	eastern pasqueflower	
Rosaceae	POTEN	*Potentilla* species	cinquefoil	*
	ROWO	*Rosa woodsii*	Woods' rose	
Santalaceae	COUM	*Comandra umbellata*	bastard toadflax	
Scrophulariaceae	PEAL2	*Penstemon albidus*	white penstemon	
	PEGR7	*Penstemon grandiflorus*	large beardtongue	
Unknown Family	UNKFORB	*Unknown forb*	Unknown forb	*
	UNKGRAM	*Unknown graminoid*	Unknown graminoid	*