



Plant Community Composition and Structure Monitoring for Fort Laramie National Historic Site

2017 Data Report

Natural Resource Data Series NPS/NGPN/NRDS—2017/1140



ON THE COVER

Photograph of long-term monitoring plot FOLA_PCM_002 at Fort Laramie National Historic Site, 2017

Photograph courtesy of the National Park Service

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December 2017

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

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Please cite this publication as:

Davis, M. B. 2017. Plant community composition and structure monitoring for Fort Laramie National Historic Site: 2017 data report. Natural Resource Data Series NPS/NGPN/NRDS—2017/1140. National Park Service, Fort Collins, Colorado.

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Abstract

This report presents the results of vegetation monitoring in 2017 at Fort Laramie National Historic Site (FOLA) by the Northern Great Plains Inventory and Monitoring Network (NGPN). This was the seventh year of field work conducted by NGPN at FOLA.

Crew members from NGPN visited six long-term monitoring plots to collect data on the plant communities at FOLA. This work is part of a long-term monitoring effort designed to provide a better understanding of the condition of the vegetation community at FOLA 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.

Our 2017 findings can be summarized as follows: The NGPN monitoring crew identified 87 plant species in six monitoring plots, 26 of which were exotic species. Generally, the two riparian plots had more native species and were more diverse than the four upland plots. Seedlings and trees were present in the two riparian plots. The majority of tree regeneration observed was for eastern cottonwood (*Populus deltoides*). The most commonly observed ground disturbances were the result of flooding in the riparian zone and animal use, which includes grazing.

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 FOLA, particularly M. Evans, for help in the field. The 2017 NGPN vegetation field crew of C. Davis, R. Manuel, and W. Vogel collected all the data included in this report.

Introduction

Fort Laramie National Historic Site (FOLA) was established in 1938 to protect and preserve the well-known military post that occupies 833 acres on the boundary of the northern mixed-grass and short-grass prairie region (Lauenroth et al. 1999). The park is a mosaic of disturbed old-fields, riparian forests, and native prairie (Heidel 2004). The Northern Great Plains Inventory & Monitoring Program (NGPN) began vegetation monitoring at FOLA in 2011 (Ashton et al. 2012) and has revisited the park every year between 2011 and 2017. A total of 30 permanent vegetation monitoring plots were established at FOLA between 2011 and 2014. Of these 30 plots, 10 plots were randomly distributed throughout the park to better study herbaceous plant communities, 15 plots were established in the riparian forest to assess forest condition, and 5 plots were used to study both riparian forest condition and herbaceous plant communities (Ashton and Davis 2016). In this report, we provide summaries of the data collected from four upland plots and two riparian plots in 2017 (Figure 1).

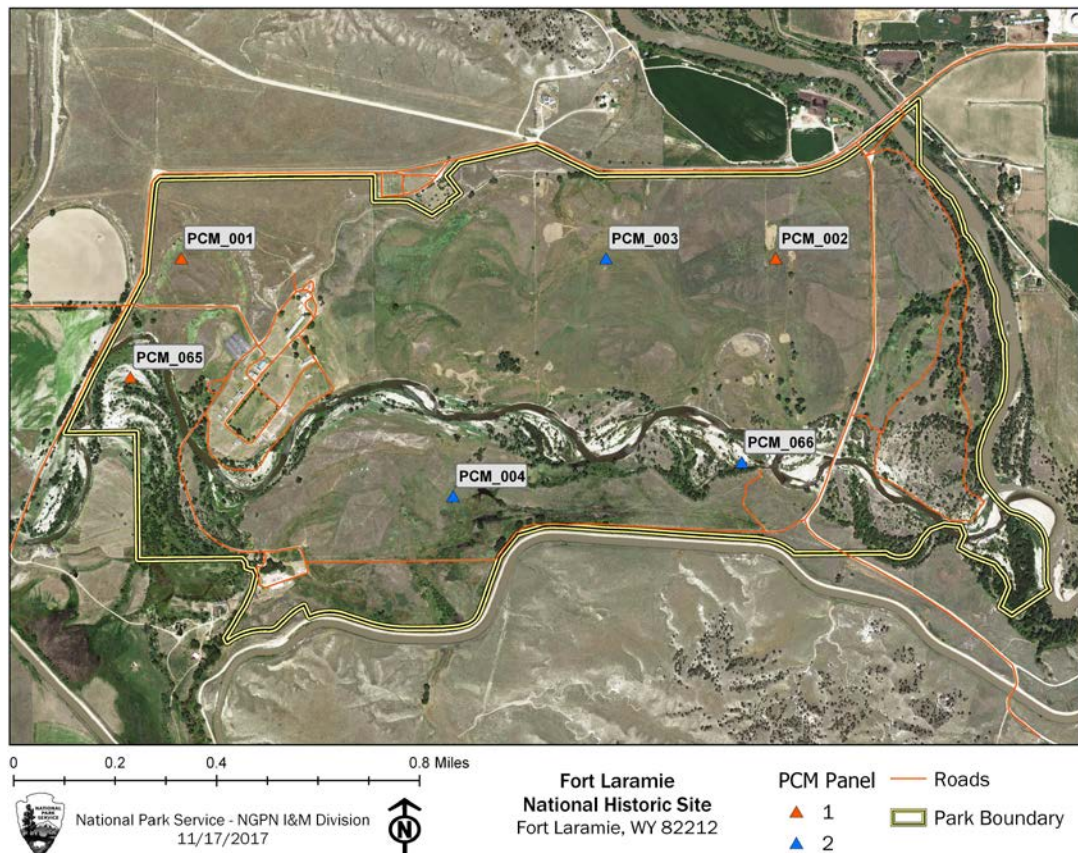


Figure 1. Map of Fort Laramie National Historic Site (FOLA) plant community monitoring plots visited in 2017. Long-term vegetation monitoring plots were established by the Northern Great Plains Inventory and Monitoring Program (NGPN) between 2011 and 2014. Three Panel 1 plots (in red), and three Panel 2 plots (in blue) were monitored in 2017.

Methods

The NGPN Plant Community Composition and Structure Monitoring Protocol (Symstad et al. 2012b, a) was used to monitor long-term vegetation plots at FOLA. Below, we briefly describe the general approach, but for those interested in 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 implemented a survey in 2011 to monitor plant community structure and composition using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using the GRTS design, 15 randomly located sites within FOLA were selected. These 15 sites were split into five panels with three sites each. The NGPN crew visits two panels (six sites) every year. In 2017, the NGPN crew visited sites in panel 1 and panel 2 (Figure 1). Data from these randomly selected sites can be used to estimate condition of vegetation communities for the whole park, and over time can be used to discern trends in condition. In 2017, sampling at Fort Laramie National Historic Site was completed by a three-person crew in approximately 91.25 crew hours, including travel time (see Table 1 for a detailed list of activities for each day).

Table 1. Field journal for Northern Great Plains Network plant community monitoring at Fort Laramie National Historic Site in 2017.

Date	Travel Time (Hrs)	Housing	Plot Read	Notes
Tuesday, May 30, 2017	4.5	Holiday Inn Express, Torrington, WY	PCM 002	2 hrs to read plot, crew of 3
			PCM 003	2 hrs to read plot, crew of 3
Wednesday, May 31, 2017	1.0	Holiday Inn Express, Torrington, WY	PCM 004	2.25 hrs to read plot, crew of 3
			PCM 066	5.25 hrs to read plot, crew of 3, total of 1.5 hrs spent on plot setup due to past floods and buried rebar
Thursday, June 1, 2017	4.5	N/A	PCM 001	crew of 3 + M. Evans, 1.25 hrs to read plot
			PCM 065	crew of 3, 3.25 hrs to read plot

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 m² quadrats located systematically along each transect (Figure 2). When NGPN staff identified a plant species that was not included on the verified park species list, voucher plant specimens were collected when possible and submitted to a botanist for independent verification.

When woody species (trees or tall shrubs) were present within 38 m of plot center, woody species data were collected. Trees with diameter at breast height (DBH) > 15 cm, located within the entire 0.1 ha plot (Figure 2), were mapped and tagged. For each tree, the species, DBH, status (live or dead), and condition (e.g., leaf-discoloration, insect-damaged, etc.) were recorded. For all poles ($2.54 \leq \text{DBH} \leq 15$ cm) located within a 10 m radius subplot centered in the larger 50 m x 20 m plot (Figure 2), only DBH and status were recorded. Tree and tall shrub species with DBH < 2.54 cm (seedlings) were tallied by species within the 10 m radius subplot (Figure 2). 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 when 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 four plots: PCM_002, PCM_004, PCM_065, and PCM_066, but not observed within the plot area of PCM_002 and PCM_004. Also, no woody fuels intersected the fuel lines in PCM_002 and PCM_004. Therefore, no woody species or fuels data were collected in these two plots.

Common disturbances, including impacts from grazing, rodent burrowing, animal trails, and flooding, were assessed and documented at each plot. The type and area of the disturbances were recorded in square meters and ranged from 0 m² (not present) to 1000 m² (the whole plot area) for each type of disturbance.

Plots were also assessed for the presence of target exotic species (Table 2). These target exotic species were chosen in collaboration with the Midwest Invasive Plant Network, the Northern Great Plains Exotic Plant Management Team, park managers, and local weed experts based on these species' potential to spread into the park and cause significant ecological impacts. Each target species identified at a site was assigned an abundance class based on an ocular estimate of cover for that species. Abundance classes ranged from 1-5, where class 1 = one individual, class 2 = few individuals, class 3 = cover of 1-5%, class 4 = cover of 5-25%, and class 5 = cover $> 25\%$ of the plot. The data gathered from this procedure are critical for early detection and rapid response to new exotic species threats.

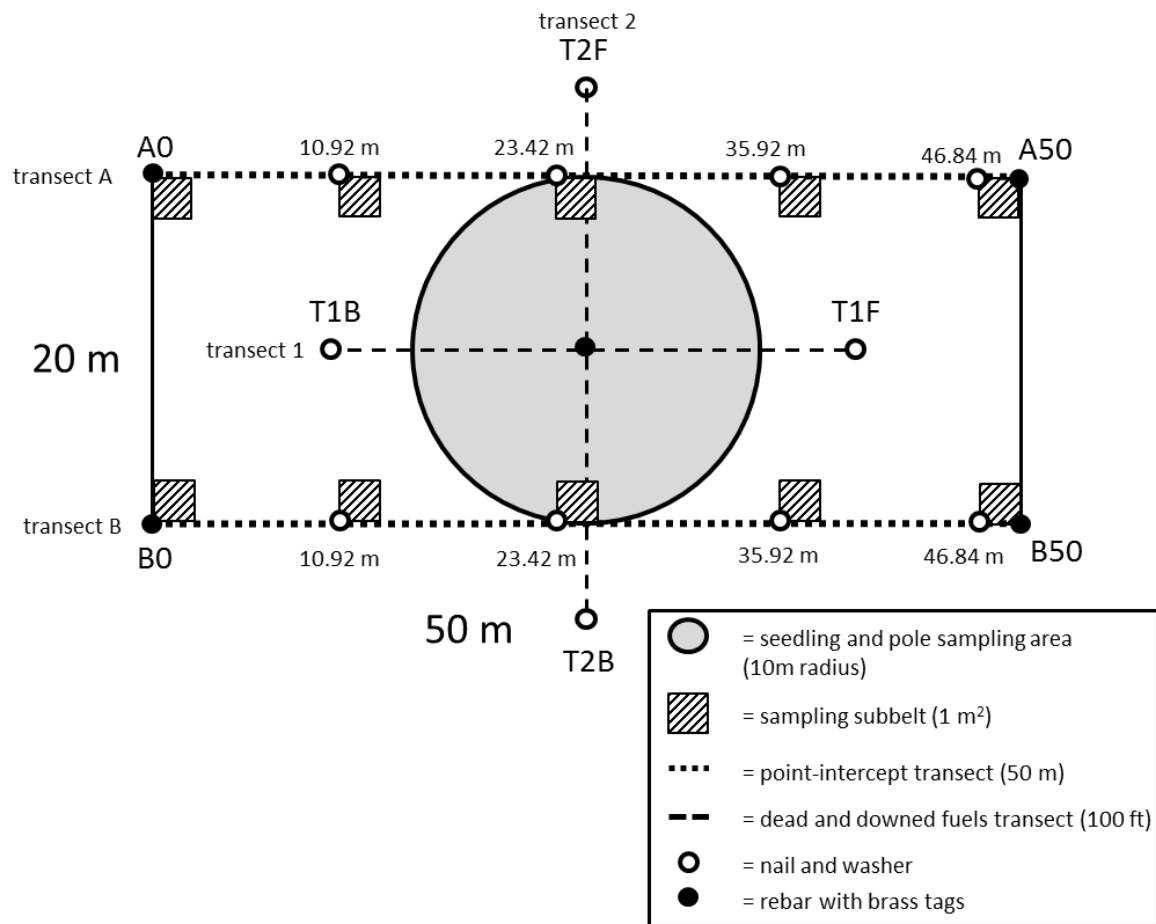


Figure 2. Long-term monitoring plot layout used for sampling vegetation at Fort Laramie National Historic Site.

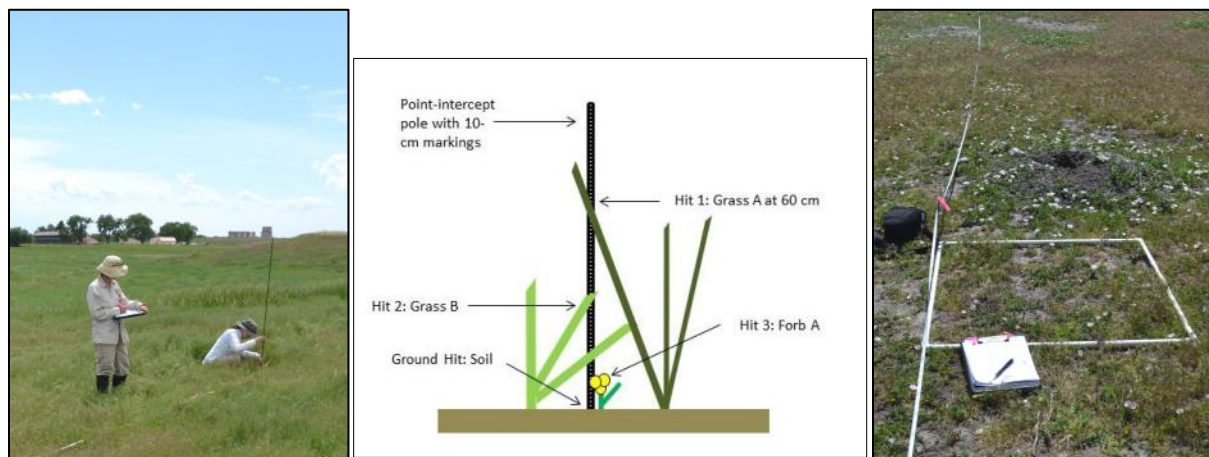


Figure 3. The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and 1m² quadrats (right panel) to document plant diversity and abundance.

Table 2. Exotic species surveyed at Fort Laramie National Historic Site as part of the early detection and rapid response program within the Northern Great Plains Network.

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

Data Management and Analysis

FFI (FEAT/FIREMON Integrated; <http://frames.gov/ffi/>) was used 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.

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) (<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 monitoring data were entered in the database, 100% of records were verified with the original data sheets to minimize transcription errors and a further 10% of records were reviewed a second time. 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, changes were made to the original datasheets and the FFI database as needed.

Data summaries were produced using the FFI reporting and query tools. The number of species per plot is a count of all unique species encountered in the plot, 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 along the transects. This is often greater than 100% because more than one species can be intercepted per point due to overlapping vegetation. Tree density is derived from a count of individual trees within the 0.1 ha plot. Pole and seedling densities are derived from counts of poles and seedlings within the smaller circular 0.314 ha subplot. Tree, pole, and seedling densities are all expressed as the number of individuals per hectare.

The list of species observed at FOLA in 2017 was cross-referenced with the Wyoming rare plant species list maintained by the Wyoming Natural Diversity Database (WYNDD). For the purpose of this report, a species was considered rare or of conservation concern if it had a conservation status rank of S1, S2, or S3. More information on conservation ranks can be found at the NatureServe website (<http://www.natureserve.org/conservation-tools/conservation-status-assessment>.) The species list was also cross-referenced with the list of Wyoming Designated Noxious Weeds (<https://www.wyoweed.org/weeds/state-designated-weeds>).

Results

There are 380 vascular plant species on the FOLA plant species list (<https://irma.nps.gov/NPSpecies/Search/SpeciesList/FOLA>), and the NGPN monitoring crew identified 87 of these species in six monitoring plots visited in 2017 (Table 3). Of these plant species, 26 are exotic species at FOLA. We observed two species that are not on the park species list, Carolina draba (*Draba reptans*) and prairie groundsel (*Packera plattensis*). No rare species were observed in any of the six plots visited in 2017. Based on all species data collected in 2017, plot PCM_066 which is located in riparian habitat, had the greatest number of native species present (Table 4). Plot PCM_003, an upland prairie plot, had the fewest native species present, and the highest absolute cover of exotic species (Table 5) which was primarily composed of cheatgrass (*Bromus tectorum*) and smooth brome (*Bromus inermis*). No target early detection exotic species were observed in any of the six plots visited in 2017.

Table 3. List of all plant species identified in FOLA long-term plant community monitoring plots in 2017. Species are grouped by plant family. An “X” in the “Exotic” column means that 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. Species designated as noxious weeds by the state of Wyoming are marked with “WY” in the Exotic column. Species designated as declared weeds by Goshen County are marked with “G” in the Exotic column. Species considered to be rare in Wyoming are marked in the “Rare” column and the state conservation ranks provided (no rare species were observed in 2017).

Family	Symbol	Scientific Name	Common Name	Exotic	Rare
Aceraceae	ACNE2	<i>Acer negundo</i>	boxelder	–	–
Anacardiaceae	TORY	<i>Toxicodendron rydbergii</i>	western poison ivy	–	–
Apiaceae	MUTE3	<i>Musineon tenuifolium</i>	slender wildparsley	–	–
Asclepiadaceae	ASVI	<i>Asclepias viridiflora</i>	green comet milkweed	–	–
Asteraceae	AMPS	<i>Ambrosia psilostachya</i>	Cuman ragweed	–	–
	AMTO3	<i>Ambrosia tomentosa</i>	skeletonleaf burr ragweed	WY	–
	ARBI2	<i>Artemisia biennis</i>	biennial wormwood	X	–
	ARCA12	<i>Artemisia campestris</i>	field sagewort	–	–
	ARFR4	<i>Artemisia frigida</i>	prairie sagewort	–	–
	ARLU	<i>Artemisia ludoviciana</i>	white sagebrush	–	–
	CIAR4	<i>Cirsium arvense</i>	Canada thistle	WY	–
	CIFL	<i>Cirsium flodmanii</i>	Flodman's thistle	–	–
	COCA5	<i>Conyza canadensis</i>	Canadian horseweed	–	–
	EUOC4	<i>Euthamia occidentalis</i>	western goldentop	–	–
	GRSQ	<i>Grindelia squarrosa</i>	curlycup gumweed	–	–
	HELIA3	<i>Helianthus</i>	sunflower	–	–
	HEAN3	<i>Helianthus annuus</i>	common sunflower	–	–
	LASE	<i>Lactuca serriola</i>	prickly lettuce	X	–

* Species are not on the NPS species list for Fort Laramie National Historic Site (also in bold font).

Table 3 (continued). List of all plant species identified in FOLA long-term plant community monitoring plots in 2017. Species are grouped by plant family. An “X” in the “Exotic” column means that 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. Species designated as noxious weeds by the state of Wyoming are marked with “WY” in the Exotic column. Species designated as declared weeds by Goshen County are marked with “G” in the Exotic column. Species considered to be rare in Wyoming are marked in the “Rare” column and the state conservation ranks provided (no rare species were observed in 2017).

Family	Symbol	Scientific Name	Common Name	Exotic	Rare
Asteraceae (continued)	ONAC	<i>Onopordum acanthium</i>	Scotch cottonthistle	WY	–
	PAPL12*	<i>Packera plattensis*</i>	prairie groundsel*	–	–
	SYER	<i>Symphyotrichum ericoides</i>	white heath aster	–	–
	TAOF	<i>Taraxacum officinale</i>	common dandelion	X	–
	TRDU	<i>Tragopogon dubius</i>	yellow salsify	X	–
	XAST	<i>Xanthium strumarium</i>	rough cocklebur	–	–
Boraginaceae	CYOF	<i>Cynoglossum officinale</i>	gypsyflower	WY	–
	LAOC3	<i>Lappula occidentalis</i>	flatspine stickseed	–	–
Brassicaceae	ALDE	<i>Alyssum desertorum</i>	desert madwort	X	–
	CAMI2	<i>Camelina microcarpa</i>	littlepod false flax	X	–
	DEPI	<i>Descurainia pinnata</i>	western tansymustard	–	–
	DRRE2*	<i>Draba reptans*</i>	Carolina draba*	–	–
	LEDE	<i>Lepidium densiflorum</i>	common pepperweed	–	–
	SIAL2	<i>Sisymbrium altissimum</i>	tall tumbledmustard	X	–
	THAR5	<i>Thlaspi arvense</i>	field pennycress	X	–
Cactaceae	OPMA2	<i>Opuntia macrorhiza</i>	twistspine pricklypear	–	–
Caprifoliaceae	SYOC	<i>Symphoricarpos occidentalis</i>	western snowberry	–	–
Chenopodiaceae	CHENO	<i>Chenopodium</i>	goosefoot	X	–
Chenopodiaceae (continued)	KOSC	<i>Kochia scoparia</i>	burningbush, kochia	X	–
	SATR12	<i>Salsola tragus</i>	prickly Russian thistle	X	–
Convolvulaceae	COAR4	<i>Convolvulus arvensis</i>	field bindweed	WY	–
Cyperaceae	CAREX	<i>Carex</i>	sedge	–	–
	CADO2	<i>Carex douglasii</i>	Douglas' sedge	–	–
	CADU6	<i>Carex duriuscula</i>	needleleaf sedge	–	–
	CAFI	<i>Carex filifolia</i>	threadleaf sedge	–	–
	CAHY4	<i>Carex hystericina</i>	bottlebrush sedge	–	–
	CAPR5	<i>Carex praeegracilis</i>	clustered field sedge	–	–
Elaeagnaceae	SHAR	<i>Shepherdia argentea</i>	silver buffaloberry	–	–
Equisetaceae	EQLA	<i>Equisetum laevigatum</i>	smooth horsetail	–	–
Euphorbiaceae	EUGL3	<i>Euphorbia glyptosperma</i>	small ribseed sandmat	–	–
Fabaceae	GLLE3	<i>Glycyrrhiza lepidota</i>	American licorice	G	–
	MELU	<i>Medicago lupulina</i>	black medick	X	–

* Species are not on the NPS species list for Fort Laramie National Historic Site (also in bold font).

Table 3 (continued). List of all plant species identified in FOLA long-term plant community monitoring plots in 2017. Species are grouped by plant family. An “X” in the “Exotic” column means that 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. Species designated as noxious weeds by the state of Wyoming are marked with “WY” in the Exotic column. Species designated as declared weeds by Goshen County are marked with “G” in the Exotic column. Species considered to be rare in Wyoming are marked in the “Rare” column and the state conservation ranks provided (no rare species were observed in 2017).

Family	Symbol	Scientific Name	Common Name	Exotic	Rare
Fabaceae (continued)	MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	X	–
Grossulariaceae	RIBES	<i>Ribes</i>	currant	–	–
Lemnaceae	LETU2	<i>Lemna turionifera</i>	turion duckweed	–	–
Malvaceae	SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	–	–
Oleaceae	FRPE	<i>Fraxinus pennsylvanica</i>	green ash	–	–
Plantaginaceae	PLMA2	<i>Plantago major</i>	common plantain	–	–
	PLPA2	<i>Plantago patagonica</i>	woolly plantain	–	–
Poaceae	BOGR2	<i>Bouteloua gracilis</i>	blue grama	–	–
	BRIN2	<i>Bromus inermis</i>	smooth brome	X	–
	BRJA	<i>Bromus japonicus</i>	Japanese brome	X	–
Poaceae (continued)	BRTE	<i>Bromus tectorum</i>	cheatgrass	X	–
	CALO	<i>Calamovilfa longifolia</i>	prairie sandreed	–	–
	ELRE4	<i>Elymus repens</i>	quackgrass	X	–
	ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	–	–
	HECO26	<i>Hesperostipa comata</i>	needle and thread	–	–
	HOPU	<i>Hordeum pusillum</i>	little barley	–	–
	NAVI4	<i>Nassella viridula</i>	green needlegrass	–	–
	PAVI2	<i>Panicum virgatum</i>	switchgrass	–	–
	PASM	<i>Pascopyrum smithii</i>	western wheatgrass	–	–
	POPR	<i>Poa pratensis</i>	Kentucky bluegrass	X	–
	SPPE	<i>Spartina pectinata</i>	prairie cordgrass	–	–
	SPCR	<i>Sporobolus cryptandrus</i>	sand dropseed	–	–
Rosaceae	POSU25	<i>Potentilla supina</i>	Paradox cinquefoil	–	–
Rubiaceae	GATR3	<i>Galium triflorum</i>	fragrant bedstraw	–	–
Salicaceae	POAC5	<i>Populus ~~A~~—acuminata</i>	lanceleaf cottonwood	–	–
	POAN3	<i>Populus angustifolia</i>	narrowleaf cottonwood	–	–
	PODE3	<i>Populus deltoides</i>	eastern cottonwood	–	–
	SAAM2	<i>Salix amygdaloides</i>	peachleaf willow	–	–
	SAEX	<i>Salix exigua</i>	narrowleaf willow	–	–
	SAFR	<i>Salix fragilis</i>	crack willow	X	–
Solanaceae	PHLO4	<i>Physalis longifolia</i>	longleaf groundcherry	–	–

* Species are not on the NPS species list for Fort Laramie National Historic Site (also in bold font).

Table 3 (continued). List of all plant species identified in FOLA long-term plant community monitoring plots in 2017. Species are grouped by plant family. An “X” in the “Exotic” column means that 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. Species designated as noxious weeds by the state of Wyoming are marked with “WY” in the Exotic column. Species designated as declared weeds by Goshen County are marked with “G” in the Exotic column. Species considered to be rare in Wyoming are marked in the “Rare” column and the state conservation ranks provided (no rare species were observed in 2017).

Family	Symbol	Scientific Name	Common Name	Exotic	Rare
Typhaceae	TYAN	<i>Typha angustifolia</i>	narrowleaf cattail	X	–
Unknown Family	UNKFORB	Unknown forb	unknown forb	X	–
	UNKGRAM	Unknown graminoid	unknown graminoid	X	–
Verbenaceae	PHCU3	<i>Phyla cuneifolia</i>	wedgeleaf	–	–
	VEBR	<i>Verbena bracteata</i>	bigbract verbena	–	–
	VEHA2	<i>Verbena hastata</i>	swamp verbena	–	–

* Species are not on the NPS species list for Fort Laramie National Historic Site (also in bold font).

Table 4. Total number of plant species identified in each of the six plots monitored at Fort Laramie National Historic Site in 2017. The number of species per plot 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	Habitat	Native species	Exotic species	Total species
PCM_001	Upland	9	6	15
PCM_002	Upland	13	12	25
PCM_003	Upland	7	9	16
PCM_004	Upland	14	9	23
PCM_065	Riparian	22	16	38
PCM_066	Riparian	24	8	32

Table 5. Absolute percent cover of native and exotic plant species in plots monitored at Fort Laramie National Historic Site in 2017. Absolute percent cover is measured using the point-intercept method which includes overlapping species canopies, resulting in some cover values greater than 100%.

Plot	Habitat	Absolute Cover (%)	
		Native	Exotic
PCM_001	Upland	77	40
PCM_002	Upland	74	44
PCM_003	Upland	52	83
PCM_004	Upland	101	59
PCM_065	Riparian	26	31
PCM_066	Riparian	33	10

Woody species were surveyed in four plots in 2017 (PCM_002, PCM_004, PCM_065, and PCM_066). Trees, seedlings, and surface fuels were only observed in the two riparian plots, PCM_065 and PCM_066 (Tables 6 – 8). Data from the remaining two plots (zeroes) were not included in Tables 6 – 8. Tree regeneration was greatest in PCM_066, where both poles and seedlings were observed (Table 6 & 7). The majority of tree regeneration observed was for eastern cottonwood (*Populus deltoides*).

Table 6. Density and number of trees and poles observed at two plots visited at Fort Laramie National Historic Site in 2017. Size class categories are tree (DBH > 15 cm) and pole (2.54 cm ≤ DBH ≤ 15 cm).

Plot	Common name	Scientific name	Live/Dead	Size Class	Total # of Individuals	Density (stems/hectare)
PCM_065	crack willow	<i>Salix fragilis</i>	L	Tree	1	10
PCM_065	eastern cottonwood	<i>Populus deltoides</i>	L	Tree	1	10
PCM_066	eastern cottonwood	<i>Populus deltoides</i>	L	Pole	10	319
PCM_066	eastern cottonwood	<i>Populus deltoides</i>	L	Tree	11	110
PCM_066	silver buffaloberry	<i>Shepherdia argentea</i>	L	Pole	1	32

Table 7. Seedling density from two plots visited at Fort Laramie National Historic Site in 2017. Seedlings have a DBH < 2.54 cm.

Plot	Common name	Scientific name	Density (seedlings/hectare)
PCM_065	crack willow	<i>Salix fragilis</i>	127
PCM_065	green ash	<i>Fraxinus pennsylvanica</i>	64
PCM_066	eastern cottonwood	<i>Populus deltoides</i>	15786
PCM_066	green ash	<i>Fraxinus pennsylvanica</i>	64
PCM_066	lanceleaf cottonwood	<i>Populus Æ—acuminata</i>	64
PCM_066	narrowleaf cottonwood	<i>Populus angustifolia</i>	32
PCM_066	narrowleaf willow	<i>Salix exigua</i>	13431
PCM_066	peachleaf willow	<i>Salix amygdaloides</i>	223

Table 8. Surface fuels summary for two plots visited in 2017 at Fort Laramie National Historic Site.

Plot	Average Tons per Acre										Avg. Depth (in.)		
	1-hr	10-hr	100-hr	1-100-hr	1000-hr sound	1000-hr rotten	1-1000-hr	Duff	Litter	Total	Duff	Litt	Total
PCM_065	0.00	0.00	1.28	1.27	0.00	0.00	1.27	0.00	0.180	1.45	0.00	0.11	0.11
PCM_066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.12	0.12

Disturbances were observed in five of the six plots visited in 2017 (Table 9). The most common disturbances were flooding in the riparian zone and animal use. There was substantial sand deposition and debris from flooding at plot PCM_066 (Figure 4). Evidence of grazing, including grazed vegetation and horse droppings, was observed throughout plots PCM_002, PCM_003, and PCM_004.

Table 9. Disturbance type and area observed in five plots visited at Fort Laramie National Historic Site in 2017. The disturbance area was approximated out of a total area of 1000 m².

Plot	Disturbance Type	Size (m ²)
FOLA_PCM_002	Grazing	1000
FOLA_PCM_002	Small Mammal	5
FOLA_PCM_003	Grazing	1000
FOLA_PCM_003	Small Mammal	10
FOLA_PCM_004	Grazing	1000
FOLA_PCM_004	Small Mammal	15
FOLA_PCM_004	Ephemeral Stream	300
FOLA_PCM_065	Flood	500
FOLA_PCM_066	Flood	1000



Figure 4. Photograph of long-term monitoring plot FOLA_PCM_066 at Fort Laramie National Historic Site, 2017, showing substantial sand deposition and debris from flooding. Of the plots monitored in 2017, FOLA_PCM_066 had the greatest number of native species and the greatest seedling regeneration. Photograph courtesy of the National Park Service.

Further Analysis

This 2017 Data Report is intended to provide a basic review of the data collected during our visit to Fort Laramie National Historic Site in 2017. All the data included in this report is available from the Northern Great Plains Inventory and Monitoring Network upon request and is archived at <https://irma.nps.gov/DataStore>.

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NPS 375/141458, December 2017

National Park Service
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