



Plant Community Composition and Structure Monitoring at Knife River Indian Villages National Historic Site

2018 Data Report

Natural Resource Data Series NPS/NGPN/NRDS—2019/1199



**ON THIS PAGE**

A view of the riparian forests at Knife River Indian Villages National Historic Site. This view is of long-term plant community monitoring plot PCM_006, visited in July 2018.

Photograph courtesy of the National Park Service.

ON THE COVER

Image from long-term plant community monitoring plot PCM_001 at Knife River Indian Villages National Historic Site, visited in July 2018.

Photograph courtesy of the National Park Service.

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Molly B. Davis

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

January 2019

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. 2019. Plant community composition and structure monitoring at Knife River Indian Villages National Historic Site: 2018 data report. Natural Resource Data Series NPS/NGPN/NRDS—2019/1199. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	iv
Tables	v
Abstract	vi
Acknowledgments.....	vii
Introduction.....	1
Methods.....	3
Sample Design.....	3
Plot Layout and Sampling	4
Data Management and Analysis	7
Results.....	9
Further Analysis	17
Literature Cited	18

Figures

	Page
Figure 1. Map of Knife River Indian Villages National Historic Site (KNRI) long-term monitoring plots visited in 2018.	2
Figure 2. Long-term monitoring plot layout used for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.....	5
Figure 3. The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept quadrats to document plant diversity and abundance.....	5
Figure 4. Plot PCM_011 at Knife River Indian Villages National Historic Site, July 2018.....	16

Tables

	Page
Table 1. Field journal for Northern Great Plains Network (NGPN) plant community monitoring (PCM) at Knife River Indian Villages National Historic Site (KNRI) in 2018.	3
Table 2. Field journal for Northern Great Plains Fire Ecology Program (NGPFire) visits to plant community monitoring (PCM) plots at Knife River Indian Villages National Historic Site (KNRI) in 2018.	4
Table 3. Exotic species included in the Northern Great Plains Network’s early detection and rapid response program.	6
Table 4. List of all plant species identified in Knife River Indian Villages National Historic Site (KNRI) long-term plant community monitoring plots in 2018.....	9
Table 5. Total number of plant species identified in plots monitored at Knife River Indian Villages National Historic Site in 2018.	13
Table 6. Absolute percent cover of native and exotic plant species in plots monitored at Knife River Indian Villages National Historic Site in 2018.	13
Table 7. Woody species data from 3 long-term monitoring plots visited at Knife River Indian Villages National Historic Site in 2018.	14
Table 8. Surface fuels summary for 3 plots visited in 2018 at Knife River Indian Villages National Historic Site by the Northern Great Plains Network.....	15
Table 9. Disturbance type and area observed in 8 plots visited at Knife River Indian Villages National Historic Site by the Northern Great Plains Network in 2018.	15

Abstract

This report presents the results of vegetation monitoring in 2018 at Knife River Indian Villages National Historic Site (KNRI) by the Northern Great Plains Inventory and Monitoring Network (NGPN) and the Northern Great Plains Fire Ecology Program (NGPFire). This was the eighth year of field work conducted by NGPN at KNRI.

In 2018, 14 long-term plant community monitoring (PCM) plots were visited to collect data on the plant communities at KNRI. Crew members from NGPN visited eight PCM plots and the NGPFire crew visited six PCM plots. 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. Data was not collected at one plot visited by NGPN, PCM_009, because of concerns for crew safety. At each of the remaining 13 plots, crews measured species richness, herb-layer height, native and non-native species abundance, and ground cover. In plots where woody species were present, tree regeneration, tall shrub density, tree density, and woody fuel loads were also measured. At the plots visited by NGPN, early detection exotic species and disturbances were assessed as well.

In 2018, monitoring crews identified 79 unique plant species, 13 of which were exotic species. No rare plants or early detection exotic plants were observed. Plot PCM_017, located in the North Prairie burn unit, had the highest total of unique species: 28 native, plus 4 exotic species. At one plot, PCM_008, only exotic species were observed. Tree regeneration and fuel load data were collected in 3 of the 14 plots. A total of eight different tree and shrub species were present. The most commonly observed disturbances were soil disturbance and windstorm.

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 KNRI for providing logistical support and performing safety checks. The NGPN crew of C. Davis, R. Manuel, and R. Oltjenbruns, and the NGPFire crew of D. Swanson, I. Muirhead, J. Roy, and K. Ronsoni collected all the data included in this report. Special thanks to volunteer C. Dixon for assisting the NGPFire crew with data collection. Thanks to D. Swanson for commenting on an earlier draft of this report.

Introduction

Knife River Indian Villages National Historic Site (KNRI) was established in 1974 with a mission to commemorate the culture and history of the Northern Great Plains Indian peoples and to preserve, study, and interpret the historic and archeological resources of the site. KNRI sits on 1,758 acres of upland mixed-grass prairie and riparian forests, much of which has a long history of human use. As a result of its agricultural legacy and a loss of natural disturbance regimes, exotic species play a major role in the makeup of the park's current vegetation (DeKeyser and Krabbenhoft 2006). In 1997 the Northern Great Plains Fire Ecology Program began monitoring vegetation in KNRI (NGPFire; Wienk et al. 2010), and in 2010 KNRI monitoring was incorporated into the Northern Great Plains Inventory & Monitoring Network (NGPN). At that time, vegetation monitoring protocols and plot locations were modified to better represent the entire park and to better coordinate efforts with NGPFire (Symstad et al. 2012b). A total of 37 plots were established in KNRI by NGPFire and NGPN, and combined sampling efforts began in 2011 (Ashton et al. 2012).

In this report, we provide summaries of the vegetation data collected in 2018 from a total of 13 plots (Figure 1). For a more in-depth data report on long-term trends at KNRI, refer to the 1998-2016 summary report (Davis and Ashton, 2017).

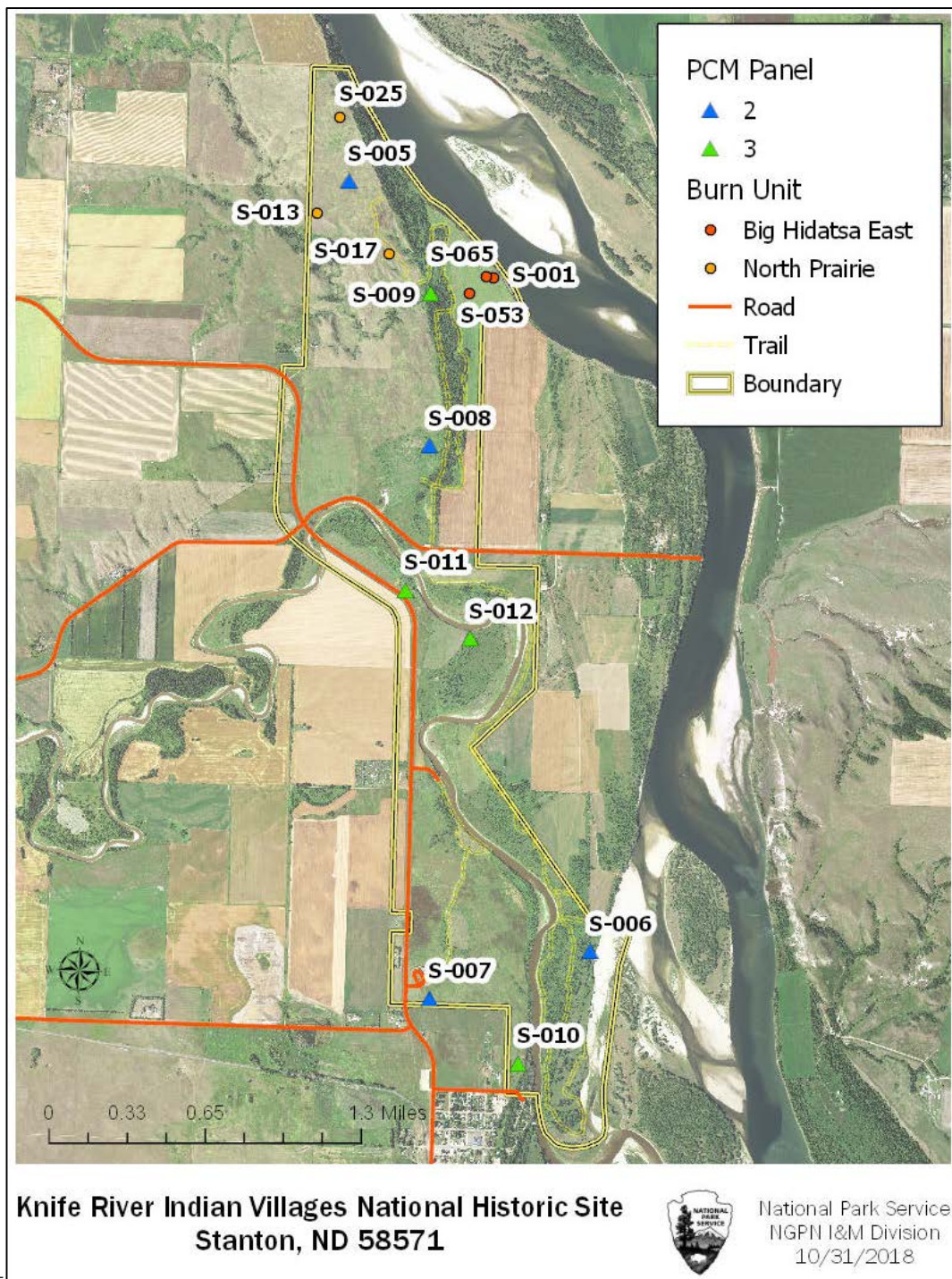


Figure 1. Map of Knife River Indian Villages National Historic Site (KNRI) long-term monitoring plots visited in 2018. Four Panel 2 and four Panel 3 Plant Community Monitoring (PCM) plots were visited by the Northern Great Plains Inventory & Monitoring (NGPN), and six plots were visited by the Northern Great Plains Fire Ecology Program (NGPFire). Burn unit designations are based on the KNRI fire management plan for prescribed fire use in the park.

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 and NGPFire implemented a survey to monitor plant community structure and composition at KNRI using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, 20 randomly located sites were selected within KNRI to become Plant Community Monitoring (PCM) plots. These sites were split into five panels of four sites each. An NGPN crew visits two panels (eight PCM plots) during late July every year, using a rotating sampling scheme that consists of four sites visited the previous year and four sites that have not been visited for four years. 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. In 2018, the NGPN crew visited sites in panel 2 and panel 3 (Figure 1). Sampling was completed by a three-person crew in approximately 75 crew hours (Table 1). This total does not include weather delays or drive time between Rapid City and KNRI. The crew lodged for three nights at the AmericInn in Beulah, ND.

Table 1. Field journal for Northern Great Plains Network (NGPN) plant community monitoring (PCM) at Knife River Indian Villages National Historic Site (KNRI) in 2018. An NGPN crew of three people completed 8 PCM plots.

Date Visited	Plot Name	Field Notes
7/24/2018	PCM_005	–
7/25/2018	PCM_006	–
7/23/2018	PCM_007	–
7/24/2018	PCM_008	Very weedy fast plot
7/24/2018	PCM_009	Dormant in 2018. We decided it was not safe to work in this plot in 2018 due to numerous broken tree branches suspended in the canopy.
7/26/2018	PCM_010	Quad A1 was mowed. A5 and B3 nails are missing; need to be replaced
7/25/2018	PCM_011	–
7/25/2018	PCM_012	–

NGPFire established new sites focused in active burn units [Fire Plant Community Monitoring (FPCM) plots] using the same GRTS sampling schema. When a PCM or FPCM plot fell within an active burn unit, NGPFire visited those plots based on a 1, 2, 5, and 10 year post-fire sampling schedule. In 2018, the NGPFire crew visited a total of six sites in two active burn units (Figure 1). Burn unit sampling was completed by a four-person crew plus one volunteer in approximately 100

crew hours (Table 2). This total does not include weather delays or drive time between Wind Cave National Park and KNRI. The crew also lodged for three nights at the AmericInn in Beulah, ND.

Table 2. Field journal for Northern Great Plains Fire Ecology Program (NGPFire) visits to plant community monitoring (PCM) plots at Knife River Indian Villages National Historic Site (KNRI) in 2018. An NGPFire crew of four people plus one volunteer completed six PCM plots.

Date Visited	Burn Unit	Plot Name	Field Notes
7/17/2018	Big Hidatsa East	FPCM_053	–
7/18/2018	Big Hidatsa East	FPCM_065	–
7/18/2018	Big Hidatsa East	PCM_001	–
7/17/2018	North Prairie	FPCM_025	–
7/17/2018	North Prairie	PCM_013	Bring origin rebar on next visit
7/17/2018	North Prairie	PCM_017	–

Plot Layout and Sampling

At each site visited, the NGPN and NGPFire crews 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). The NGPFire crew measured species presence at five quadrats per plot (three along the A-transect and two along the B-transect), and the NGPN crew measured species presence at ten quadrats per plot. 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.

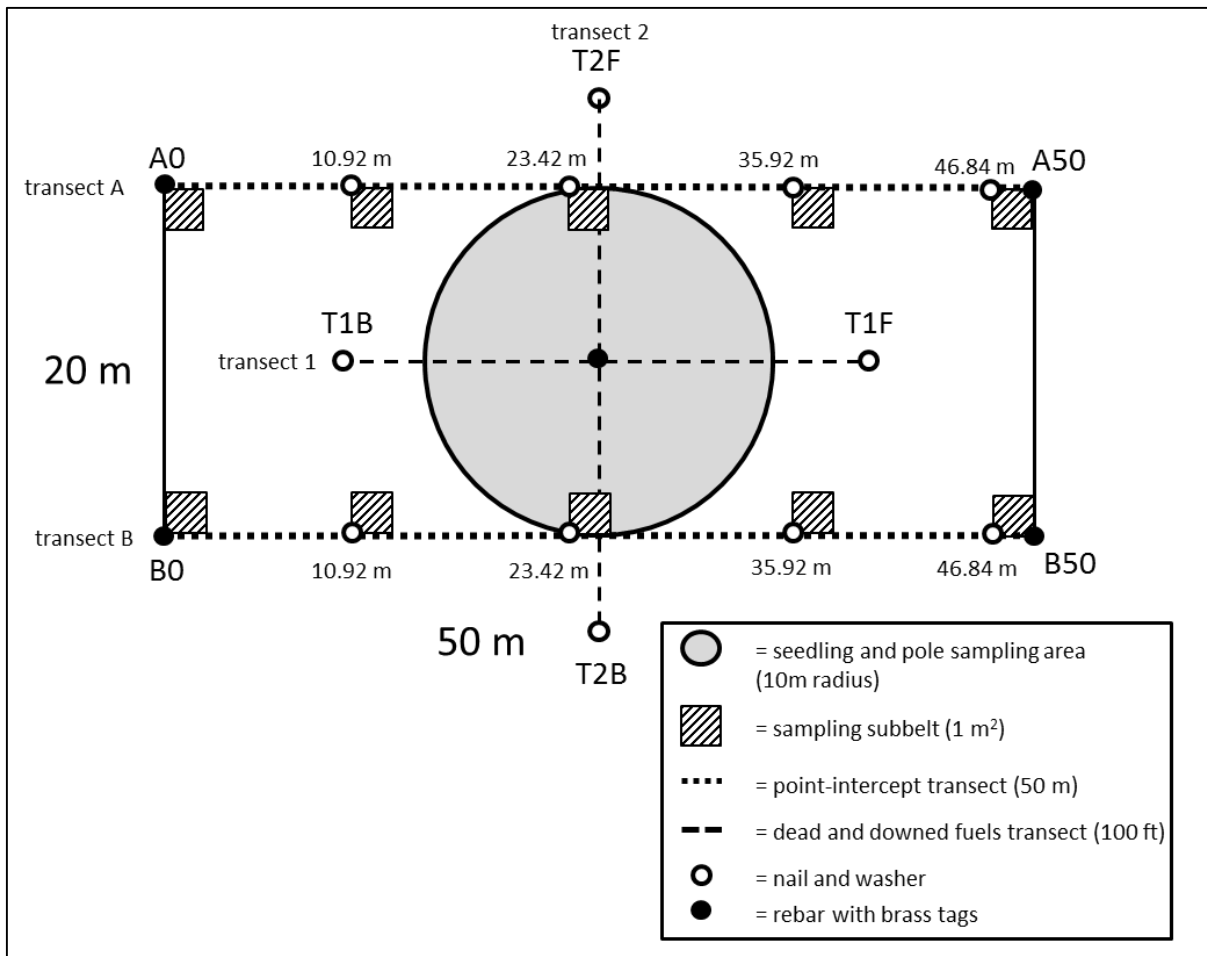


Figure 2. Long-term monitoring plot layout used for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.

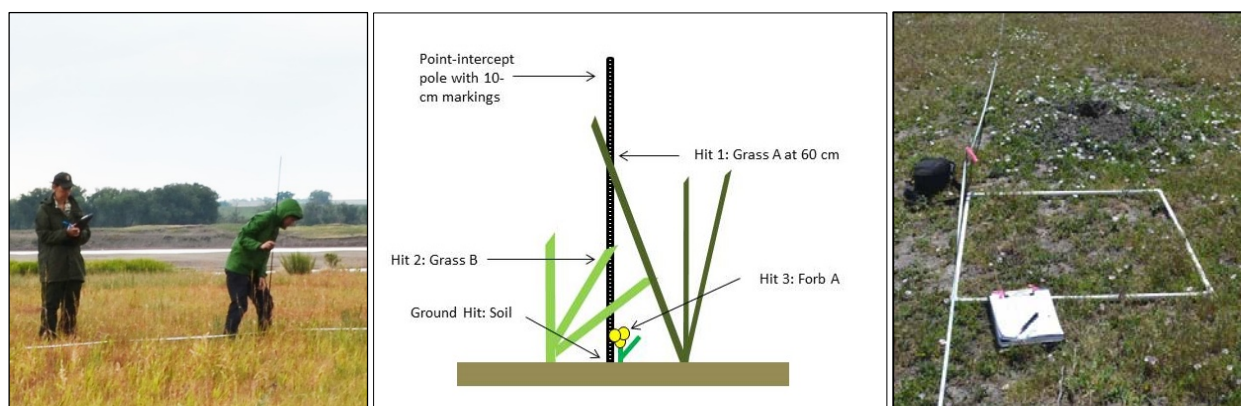


Figure 3. The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and quadrats (right panel) to document plant diversity and abundance.

When woody species were present within 38 m of plot center, monitoring crews collected tree regeneration and tall shrub density data within a 10 m radius subplot centered in the larger 50 m x 20

m (0.1 ha) plot. Trees with diameter at breast height (DBH) > 15 cm, present within the 0.1 ha plot 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 ($2.54 \text{ cm} \leq \text{DBH} \leq 15 \text{ cm}$) located within the 10 m radius subplot, only DBH and status were recorded. Tree and tall shrub species with DBH < 2.54 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.

The NGPN crew assessed and documented common disturbances at each plot. The type, which included rodent mounds, animal trails, and fire, and the approximate area (m^2) of each disturbance were recorded. Plots were also assessed for the presence and abundance of target exotic species (Table 3), 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 3. Exotic species included in the Northern Great Plains Network's early detection and rapid response program. ND Status indicates if the species is on North Dakota's list of noxious weeds.

Habitat	Scientific Name	Common Name	ND Status
Riparian	<i>Alliaria petiolata</i>	garlic mustard	—
Riparian	<i>Polygonum cuspidatum</i> ; <i>P. sachalinense</i> ; <i>P. x bohemicum</i>	knotweeds	—
Riparian	<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	—
Riparian	<i>Iris pseudacorus</i>	yellow iris	—
Riparian	<i>Ailanthus altissima</i>	tree of heaven	—
Riparian	<i>Lepidium latifolium</i>	perennial pepperweed	—
Riparian	<i>Arundo donax</i>	giant reed	—
Riparian	<i>Rhamnus cathartica</i>	common buckthorn	—
Riparian	<i>Heracleum mantegazzianum</i>	giant hogweed	—
Upland	<i>Centaurea solstitialis</i>	yellow star thistle	—
Upland	<i>Hieracium aurantiacum</i> ; <i>H. caespitosum</i>	orange and meadow hawkweed	—
Upland	<i>Isatis tinctoria</i>	Dyer's woad	—
Upland	<i>Taeniatherum caput-medusae</i>	medusahead	—
Upland	<i>Chondrilla juncea</i>	rush skeletonweed	—
Upland	<i>Gypsophila paniculata</i>	baby's breath	—
Upland	<i>Centaurea virgata</i> ; <i>C. diffusa</i>	knapweeds	Noxious

Table 3 (continued). Exotic species included in the Northern Great Plains Network’s early detection and rapid response program. ND Status indicates if the species is on North Dakota’s list of noxious weeds.

Upland	<i>Linaria dalmatica</i> ; <i>L. vulgaris</i>	toadflax	Noxious
Upland	<i>Euphorbia myrsinites</i> & <i>E. cyparissias</i>	myrtle spurge	–
Upland	<i>Dipsacus fullonum</i> & <i>D. laciniatus</i>	common teasel	–
Upland	<i>Salvia aethiopis</i>	Mediterranean sage	–
Upland	<i>Ventenata dubia</i>	African wiregrass	–

Starting in 2018, several changes were made to the protocol to avoid inconsistent density calculations: first, seedlings (i.e. trees and tall shrubs with DBH < 2.54 cm) were always counted or estimated in all four quarters of the 10 m radius subplot. Previously, once the count for a species had reached 100, seedlings were not counted in the following quarters. Also in 2018, a new category of disturbance, Soil Disturbance, was added. Soil Disturbance is defined as loose, exposed soil from all sources.

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 recognizes a new name that was not in the USDA PLANTS database, the new name was used, and a unique plant code was assigned. In the case where there is not enough evidence for genus and species identification, a special code for the unknown species was created. These are then designated as an exotic species in the total count, but omitted from the species list.

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 early detection exotic 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 KNRI in 2018 was determined by cross-referencing with the NatureServe conservation status list, as well as the North Dakota rare plant

species list. For the purpose of this report, a species was considered rare or of conservation concern if its state or global conservation status rank was critically imperiled (S1/G1), imperiled (S1/G2), or vulnerable (S3/G3). More information on conservation ranks can be found at the [NatureServe](#) website. The 2018 species list was also cross-referenced with the list of noxious weeds maintained by the [North Dakota Department of Agriculture](#).

Results

Of the 14 plots we visited, one plot, PCM_009, was left dormant in 2018 due to concerns for crew safety. A recent windstorm that left branches suspended in the canopy made it unsafe for crews to be in the plot. Because it is part of Panel 3, it will be revisited next year when Panel 3 and Panel 4 plots are visited.

There are 285 plant species on the KNRI species list, and the NGPN and NGPFire monitoring crews identified a total of 79 unique species from 13 monitoring plots visited in 2018 (Table 4). Of these species, 13 are exotic species for the park. In some cases, we were not able to identify the plant, or were only able to identify it to genus level: these individuals are shown in Table 4, but are not included in the count of unique species listed above. The 2018 species list was cross-referenced with state-wide rare and noxious exotic species lists for North Dakota. Two noxious exotic species matched the North Dakota list: Canada thistle (*Cirsium arvense*) and leafy spurge (*Euphorbia esula*). These exotic species are abundant and widespread in North Dakota. No rare plant species were identified by either crew. We also cross-referenced the 2018 species list with the NPSpecies list for KNRI, and found six species that monitoring crews identified that were not on the NPSpecies list. Of the six, two have recently been confirmed and vouchered for the park: Indiangrass (*Sorghastrum nutans*) and green bristlegrass (*Setaria viridis*). The remaining four species, smooth oxeye (*Heliopsis helianthoides*), needleleaf sedge (*Carex duriuscula*), leadplant (*Amorpha canescens*), and littleseed ricegrass (*Piptatherum micranthum*), are either mis-identifications or new additions to the park species list, and should be collected during a future field season for verification.

Table 4. List of all plant species identified in Knife River Indian Villages National Historic Site (KNRI) long-term plant community monitoring plots in 2018. 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-wide noxious weed species designated as “Noxious” for North Dakota in the Notes column. Four species that are not verified to occur at KNRI are indicated with “Unverified” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Aceraceae	ACNE2	<i>Acer negundo</i>	boxelder	–
Asclepiadaceae	ASPU	<i>Asclepias pumila</i>	plains milkweed	–
Asclepiadaceae	ASSY	<i>Asclepias syriaca</i>	common milkweed	–
Asteraceae	ACMI2	<i>Achillea millefolium</i>	common yarrow	–
Asteraceae	ANTEN	<i>Antennaria</i>	pussytoes	–
Asteraceae	ANPA4	<i>Antennaria parvifolia</i>	small-leaf pussytoes	–
Asteraceae	ARDR4	<i>Artemisia dracunculus</i>	tarragon	–
Asteraceae	ARFR4	<i>Artemisia frigida</i>	prairie sagewort	–
Asteraceae	ARLU	<i>Artemisia ludoviciana</i>	white sagebrush	–
Asteraceae	CIAR4	<i>Cirsium arvense</i>	Canada thistle	Exotic, Noxious

Table 4 (continued). List of all plant species identified in Knife River Indian Villages National Historic Site (KNRI) long-term plant community monitoring plots in 2018. 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-wide noxious weed species designated as “Noxious” for North Dakota in the Notes column. Four species that are not verified to occur at KNRI are indicated with “Unverified” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Asteraceae	CIFL	<i>Cirsium flodmanii</i>	Flodman's thistle	–
Asteraceae	ECAN2	<i>Echinacea angustifolia</i>	Blacksamson Echinacea	–
Asteraceae	HEHE5	<i>Heliopsis helianthoides</i>	smooth oxeye	Unverified
Asteraceae	HEVI4	<i>Heterotheca villosa</i>	hairy false goldenaster	–
Asteraceae	LIPU	<i>Liatris punctata</i>	dotted blazing star	–
Asteraceae	LYJU	<i>Lygodesmia juncea</i>	rush skeletonplant	–
Asteraceae	MUOB99	<i>Mulgedium oblongifolium</i>	blue lettuce	–
Asteraceae	RACO3	<i>Ratibida columnifera</i>	upright prairie coneflower	–
Asteraceae	SOMI2	<i>Solidago missouriensis</i>	Missouri goldenrod	–
Asteraceae	SYMPH4	<i>Symphyotrichum</i>	aster	Exotic
Asteraceae	SYER	<i>Symphyotrichum ericoides</i>	white heath aster	–
Asteraceae	TAOF	<i>Taraxacum officinale</i>	common dandelion	Exotic
Asteraceae	TRDU	<i>Tragopogon dubius</i>	yellow salsify	Exotic
Boraginaceae	LIIN2	<i>Lithospermum incisum</i>	narrowleaf stone seed	–
Brassicaceae	LEDE	<i>Lepidium densiflorum</i>	common pepperweed	–
Caprifoliaceae	SYOC	<i>Symphoricarpos occidentalis</i>	western snowberry	–
Chenopodiaceae	CHENO	<i>Chenopodium</i>	goosefoot	Exotic
Chenopodiaceae	SATR12	<i>Salsola tragus</i>	prickly Russian thistle	Exotic
Commelinaceae	TROC	<i>Tradescantia occidentalis</i>	prairie spiderwort	–
Convolvulaceae	COAR4	<i>Convolvulus arvensis</i>	field bindweed	Exotic
Cyperaceae	CAREX	<i>Carex</i>	sedge	–
Cyperaceae	CABR10	<i>Carex brevior</i>	shortbeak sedge	–
Cyperaceae	CADU6	<i>Carex duriuscula</i>	needleleaf sedge	Unverified
Cyperaceae	CAFI	<i>Carex filifolia</i>	threadleaf sedge	–
Cyperaceae	CAIN9	<i>Carex inops</i>	long-stolon sedge	–
Euphorbiaceae	EUPHO	<i>Euphorbia</i>	spurge	Exotic
Euphorbiaceae	EUES	<i>Euphorbia esula</i>	leafy spurge	Exotic, Noxious
Fabaceae	AMCA6	<i>Amorpha canescens</i>	leadplant	Unverified
Fabaceae	ASBI2	<i>Astragalus bisulcatus</i>	twogrooved milkvetch	–
Fabaceae	DACA7	<i>Dalea candida</i>	white prairie clover	–

Table 4 (continued). List of all plant species identified in Knife River Indian Villages National Historic Site (KNRI) long-term plant community monitoring plots in 2018. 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-wide noxious weed species designated as “Noxious” for North Dakota in the Notes column. Four species that are not verified to occur at KNRI are indicated with “Unverified” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Fabaceae	DAPU5	<i>Dalea purpurea</i>	purple prairie clover	–
Fabaceae	GLLE3	<i>Glycyrrhiza lepidota</i>	American licorice	–
Fabaceae	MESA	<i>Medicago sativa</i>	alfalfa	Exotic
Fabaceae	PEAR6	<i>Pedimelum argophyllum</i>	silverleaf Indian breadroot	–
Fabaceae	VIAM	<i>Vicia Americana</i>	American vetch	–
Lamiaceae	STPI6	<i>Stachys pilosa</i>	hairy hedgenettle	–
Malvaceae	SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	–
Oleaceae	FRPE	<i>Fraxinus pennsylvanica</i>	green ash	–
Onagraceae	OESU99	<i>Oenothera suffrutescens</i>	scarlet beeblossom	–
Poaceae	ANGE	<i>Andropogon gerardii</i>	big bluestem	–
Poaceae	ARPU9	<i>Aristida purpurea</i>	purple threeawn	–
Poaceae	BOCU	<i>Bouteloua curtipendula</i>	sideoats grama	–
Poaceae	BOGR2	<i>Bouteloua gracilis</i>	blue grama	–
Poaceae	BRIN2	<i>Bromus inermis</i>	smooth brome	Exotic
Poaceae	CALO	<i>Calamovilfa longifolia</i>	prairie sandreed	–
Poaceae	DIWI5	<i>Dichanthelium wilcoxianum</i>	fall rosette grass	–
Poaceae	ELRE4	<i>Elymus repens</i>	quackgrass	Exotic
Poaceae	ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	–
Poaceae	HECO26	<i>Hesperostipa comata</i>	needle and thread	–
Poaceae	KOMA	<i>Koeleria macrantha</i>	prairie Junegrass	–
Poaceae	MUCU3	<i>Muhlenbergia cuspidata</i>	plains muhly	–
Poaceae	NAVI4	<i>Nassella viridula</i>	green needlegrass	–
Poaceae	PACA6	<i>Panicum capillare</i>	witchgrass	–
Poaceae	PAVI2	<i>Panicum virgatum</i>	switchgrass	–
Poaceae	PASM	<i>Pascopyrum smithii</i>	western wheatgrass	–
Poaceae	PIMI7	<i>Piptatherum micranthum</i>	littleseed ricegrass	Unverified
Poaceae	POPR	<i>Poa pratensis</i>	Kentucky bluegrass	Exotic
Poaceae	SCSC	<i>Schizachyrium scoparium</i>	little bluestem	–
Poaceae	SEVI4	<i>Setaria viridis</i>	green bristlegass	Exotic
Poaceae	SONU2	<i>Sorghastrum nutans</i>	Indiangrass	–

Table 4 (continued). List of all plant species identified in Knife River Indian Villages National Historic Site (KNRI) long-term plant community monitoring plots in 2018. 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-wide noxious weed species designated as “Noxious” for North Dakota in the Notes column. Four species that are not verified to occur at KNRI are indicated with “Unverified” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Poaceae	SPCR	<i>Sporobolus cryptandrus</i>	sand dropseed	–
Poaceae	THIN6	<i>Thinopyrum intermedium</i>	intermediate wheatgrass	Exotic
Polemoniaceae	PHHO	<i>Phlox hoodii</i>	spiny phlox	–
Polygalaceae	POAL4	<i>Polygala alba</i>	white milkwort	–
Ranunculaceae	THDA	<i>Thalictrum dasycarpum</i>	purple meadow-rue	–
Rosaceae	AMAL2	<i>Amelanchier alnifolia</i>	Saskatoon serviceberry	–
Rosaceae	PRVI	<i>Prunus virginiana</i>	chokecherry	–
Rosaceae	ROAR3	<i>Rosa arkansana</i>	prairie rose	–
Salicaceae	PODE3	<i>Populus deltoides</i>	plains cottonwood	–
Salicaceae	SAAM2	<i>Salix amygdaloides</i>	peachleaf willow	–
Scrophulariaceae	PEAL2	<i>Penstemon albidus</i>	white penstemon	–
Ulmaceae	ULAM	<i>Ulmus americana</i>	American elm	–
Ulmaceae	ULPU	<i>Ulmus pumila</i>	Siberian elm	Exotic
Unknown family	UNKFORB	Unknown forb	unknown forb	Exotic
Unknown family	UNKGRAM	Unknown graminoid	unknown graminoid	Exotic
Vitaceae	PAVI5	<i>Parthenocissus vitacea</i>	woodbine	–

Based on the total count of unique species observed in all plots in 2018, PCM_017 had the highest number with 32 total species, followed by PCM_013 with 28 species (Table 5). These two plots also had the most native species, with 28 and 26 respectively. Absolute cover calculations (Table 6) showed that plots visited by NGPN were on average more exotic than native, while plots visited by NGPFire were on average more native. Two plots, PCM_008 and PCM_011, had no native species recorded using the point-intercept method, and very few species in the plot overall. Plot PCM_007 had the highest absolute cover of exotic species, and FPCM_065 had the highest absolute cover of native species.

Table 5. Total number of plant species identified in plots monitored at Knife River Indian Villages National Historic Site in 2018. This is a count of all unique species identified in the plot using species data from point-intercept, quadrat, woody species, and early detection exotic species protocols.

Plot	Burn Unit*	Native Species	Exotic Species	Total Species
KNRI_PCM_005	–	25	2	27
KNRI_PCM_006	–	12	6	18
KNRI_PCM_007	–	6	5	11
KNRI_PCM_008	–	0	3	3
KNRI_PCM_010	–	18	6	24
KNRI_PCM_011	–	1	6	7
KNRI_PCM_012	–	5	4	9
KNRI_PCM_001	Big Hidatsa East	17	4	21
KNRI_FPCM_053	Big Hidatsa East	14	5	19
KNRI_FPCM_065	Big Hidatsa East	17	4	21
KNRI_PCM_013	North Prairie	26	2	28
KNRI_PCM_017	North Prairie	28	4	32
KNRI_FPCM_025	North Prairie	19	3	22

*Plot is visited by Northern Great Plains Fire Ecology Program (NGPFire); associated burn unit is listed.

Table 6. Absolute percent cover of native and exotic plant species in plots monitored at Knife River Indian Villages National Historic Site in 2018. Absolute percent cover is calculated using the point-intercept data. This includes overlapping species canopies, which can result in values greater than 100%.

Plot	Burn Unit*	Absolute Cover %	
		Exotic	Native
KNRI_PCM_005	–	111	38
KNRI_PCM_006	–	125	17
KNRI_PCM_007	–	138	44
KNRI_PCM_008	–	116	0
KNRI_PCM_010	–	77	26
KNRI_PCM_011	–	20	0
KNRI_PCM_012	–	98	2
KNRI_PCM_001	Big Hidatsa East	18	145
KNRI_FPCM_053	Big Hidatsa East	38	129
KNRI_FPCM_065	Big Hidatsa East	31	148
KNRI_PCM_013	North Prairie	60	114
KNRI_PCM_017	North Prairie	53	136
KNRI_FPCM_025	North Prairie	78	97

*Plot is visited by Northern Great Plains Fire Ecology Program (NGPFire); associated burn unit is listed.

The NGPN monitoring crew collected woody species data in 3 plots in 2018: PCM_006, PCM_010, and PCM_012. Eight unique species of trees and shrubs were observed in these plots, and forests were dominated by boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and plains cottonwood (*Populus deltoides*). No plains cottonwood seedlings were observed, however green ash seedlings were common in the understory of the cottonwoods in PCM_006.

Table 7. Woody species data from 3 long-term monitoring plots visited at Knife River Indian Villages National Historic Site in 2018. DBH categories are tree (DBH > 15 cm), pole (2.54 cm ≤ DBH ≤ 15 cm), and seedling (DBH < 2.54 cm).

Plot Name	Common Name	DBH	Status	Density/ha.
PCM_006	American elm	Seedling	Live	64
PCM_006	green ash	Seedling	Live	7989
PCM_006	peachleaf willow	Tree	Live	10
PCM_006	plains cottonwood	Tree	Dead	20
PCM_006	plains cottonwood	Tree	Live	180
PCM_010	boxelder	Pole	Dead	30
PCM_010	boxelder	Pole	Live	170
PCM_010	boxelder	Seedling	Live	191
PCM_010	chokecherry	Seedling	Live	64
PCM_010	green ash	Seedling	Live	350
PCM_010	plains cottonwood	Tree	Live	20
PCM_010	Saskatoon serviceberry	Seedling	Live	414
PCM_010	Siberian elm	Seedling	Live	127
PCM_012	boxelder	Pole	Live	40
PCM_012	boxelder	Seedling	Live	32
PCM_012	green ash	Tree	Dead	10
PCM_012	green ash	Tree	Live	90
PCM_012	green ash	Seedling	Live	64

Dead and downed wood and surface fuels provide foraging habitat and refugia for small wildlife species, as well as substrate for mosses and fungi. Downed wood sometimes also provides “nursery” logs for vascular plant establishment. However, when surface fuels are too abundant in a forest they can increase the risk of high intensity fires. NGPN measured surface fuels in 3 plots (Table 8).

Table 8. Surface fuels summary for 3 plots visited in 2018 at Knife River Indian Villages National Historic Site by the Northern Great Plains Network.

Macroplot	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	Litt	Total	Duff	Litt	Total
PCM_006	0.20	0.12	1.90	2.22	0.00	0.45	2.67	4.19	2.02	8.88	0.4	1.2	1.6
PCM_010	0.00	0.00	0.00	0.00	0.00	0.99	0.99	0.00	0.81	1.80	0.0	0.5	0.5
PCM_012	0.30	1.11	1.52	2.93	0.55	2.08	5.56	0.98	2.11	8.65	0.1	1.3	1.4

Disturbances were observed in 6 of the 8 plots visited by NGPN in 2018 (Table 9). The most common disturbances were soil disturbance and windstorm. Herbicide treatment and re-seeding were observed at plot PCM_011 (Figure 4). The plot was sprayed on May 15, 2018 with Razor Pro, and drill-seeded on May 28, 2018 with the following species list: big bluestem, Indiangrass, switchgrass, little bluestem, sideoats grama, blue grama, prairie sandreed, green needlegrass, Canada wildrye, and western wheatgrass (personal communication J. Schiferl, December 16, 2018). All eight plots were also assessed for the presence of early detection exotic species, but none were found in 2018. Disturbance and early detection exotic species data were not collected in plots visited by NGPFire.

Table 9. Disturbance type and area observed in 8 plots visited at Knife River Indian Villages National Historic Site by the Northern Great Plains Network in 2018. The disturbance area was approximated out of a total area of 1000 m².

Plot	Disturbance Type	Area (m ²)
PCM_005	Small Mammal	2
PCM_005	Soil Disturbance	2
PCM_006	Windstorm	1000
PCM_010	Off-Road	40
PCM_010	Animal Trail	10
PCM_010	Flood	100
PCM_010	Erosion	10
PCM_010	Soil Disturbance	110
PCM_011	Soil Disturbance	800
PCM_011	Herbicide	1000
PCM_012	Grazing	2
PCM_012	Windstorm	1000



Figure 4. Plot PCM_011 at Knife River Indian Villages National Historic Site, July 2018. The entire plot was treated with herbicide and re-seeded using machinery. Photograph courtesy of the National Park Service.

Further Analysis

This 2018 Data Report is intended to provide a basic review of the data collected during the NGPN team's 2018 visit to Knife River Indian Villages National Historic Site. All data included in this report is available upon request from the Northern Great Plains Inventory and Monitoring Network, and 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. Knife River Indian Villages National Historic Site plant community composition and structure monitoring: 2011 annual report. Natural Resource Technical Report NPS/NGPN/NRTR—2012/529. 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.
- Davis, C. J., and I. W. Ashton. 2017. Plant community composition and structure monitoring for Knife River Indian Villages National Historic Site: 2011-2016 summary report. Natural Resource Report NPS/NGPN/NRR—2017/1391. National Park Service, Fort Collins, Colorado.
- DeKeyser, E. and K. Krabbenhoft. 2006. Prairie management plan for the Knife River Indian Villages National Historic Site. North Dakota State University, Fargo, ND.
- 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. 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 1.0. Natural Resource Report NPS/NGPN/ NRR-2012/489.
- USDA-NRCS. 2018. The PLANTS Database (<http://plants.usda.gov>, 1 November 2018). 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

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NPS 468/150225, January 2019

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Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525