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Plant Community Composition and Structure Monitoring at Jewel Cave National Monument

2018 Data Report

Natural Resource Data Series NPS/NGPN/NRDS—2019/1196

ON THE COVER

Northern Great Plains Inventory & Monitoring crew members monitoring a vegetation plot at Jewel Cave National Monument. Photograph courtesy of the National Park Service.

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2018 Data Report

Natural Resource Data Series NPS/NGPN/NRDS—2019/1196

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Abstract

This report presents the results of the Northern Great Plains Inventory and Monitoring Network's vegetation monitoring at Jewel Cave National Monument (JECA) in 2018. This was the eighth year that the Northern Great Plains Inventory and Monitoring Network (NGPN) conducted field work at JECA.

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

In 2018, the NGPN monitoring crews identified 132 unique plant species in six monitoring plots. Of those species, 16 were exotic species. On average, the absolute cover of native species was much greater than the absolute cover of exotic species. No rare species were observed in any of the six plots. NGPN crews collected tree regeneration and fuel load data in all six plots. Three different tree and shrub species were present, however ponderosa pine was the dominant species. Ground disturbances, observed in three of the six plots, included animal use, a road, storm damage, and soil disturbance.

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 JECA for providing logistical support and safety checks, especially M. Wiles. We thank the seasonal staff and SCA volunteers at JECA—M. Fareedi, A. Kanwar, B. Reddem, N. Tate, and H. Klein—for their help with field work. We also thank M. Bynum for assistance in the field. The 2018 NGPN vegetation field crew—C. Davis, I. Ashton, R. Manuel, T. Schaffner, M. Davis and S. Rockwood—collected the data included in this report.

Introduction

Jewel Cave National Monument (JECA) is located in the southwestern Black Hills of South Dakota. It was established in 1908 with the mission to preserve Jewel Cave through management of the surface and subsurface ecosystem, while providing opportunities for the pursuit of scientific interests and public enjoyment. While covering a relatively small area (516 ha, 1274 ac), JECA contains diverse native ponderosa forest and grassland communities (Marriot and Hartman 1986, Ashton et al. 2012a). In 2000, the Jasper Fire greatly impacted the park, moderately to severely burning seventy-five percent of the landscape and resulting in more than 50% of the trees in the park dying due to fire-injury (Lentile et al. 2005). Ninety-five percent of the monument was affected by this forest fire (NPS 2004), resulting in a patchwork of intact and entirely consumed ponderosa pine stands.

The Northern Great Plains Inventory & Monitoring Program (NGPN) began annual vegetation monitoring efforts in JECA in 2011 (Ashton et al. 2012a). Vegetation monitoring protocols and plot locations were chosen to represent the entire park and to coordinate efforts with the Northern Great Plains Fire Ecology Program (NGPFire; Figure 1). In this report, we provide summaries of the vegetation data collected in 2018 from six monitoring plots. For a more in-depth data report on long-term trends at JECA, refer to the 2011-2017 summary report (Ashton et al. 2018).

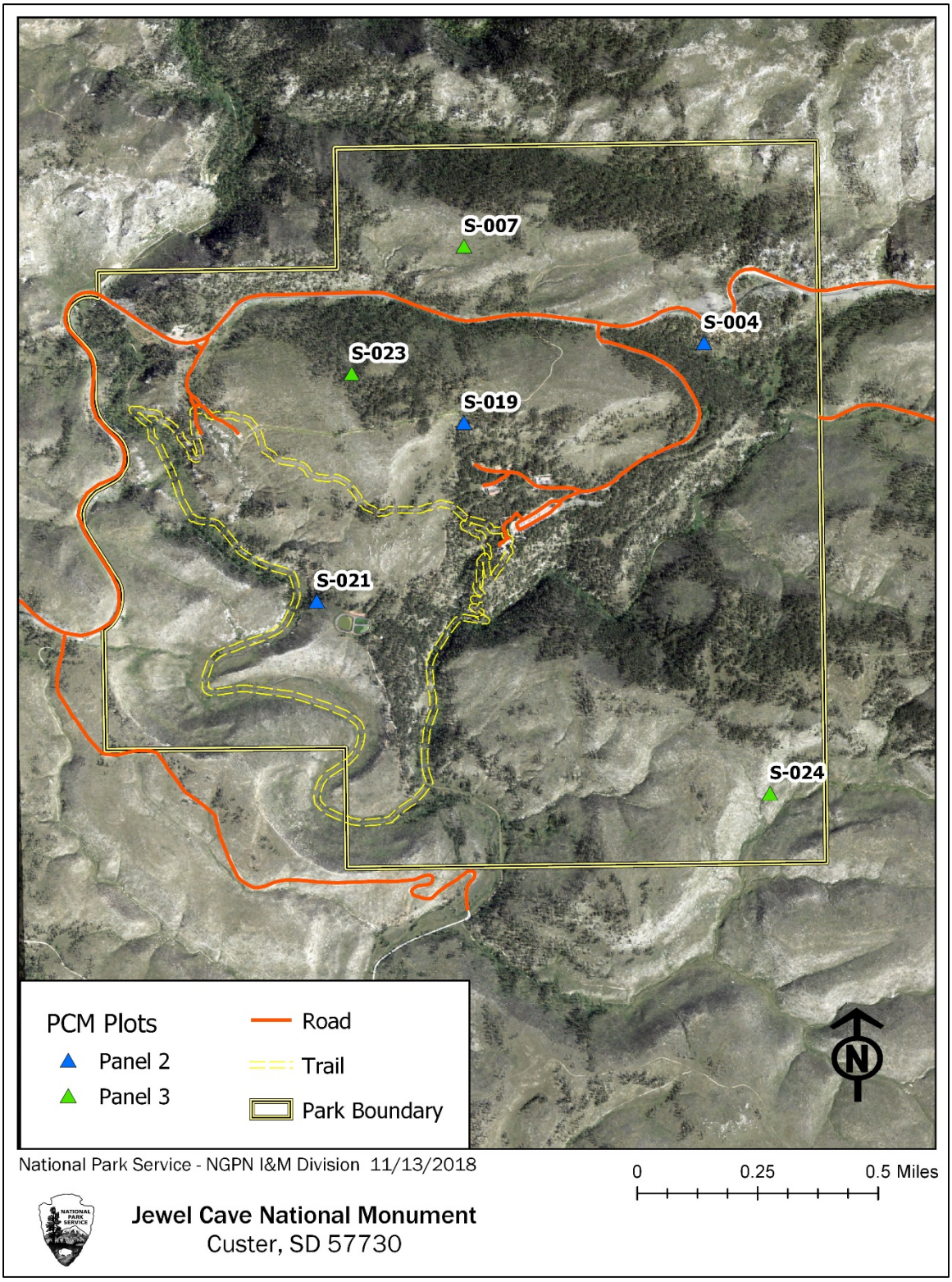

Figure 1. Map of Jewel Cave National Monument (JECA) plant community monitoring (PCM) plots visited in 2018 by the Northern Great Plains Network Inventory & Monitoring Program (NGPN). Three panel 2 plots (in blue) and three panel 3 plots (in green) were monitored.

Methods

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

Sample Design

The NGPN team implemented a survey to monitor plant community structure and composition at JECA using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, 15 randomly located sites were selected within JECA to be established as Plant Community Monitoring plots (PCM plots). These sites were split into five panels containing three sites each. An NGPN crew visits two panels (six PCM plots) during early July every year, using a rotating sampling scheme that consists of three plots visited the previous year and three plots that have not been visited for four years. Data from these randomly selected sites can be used to estimate the condition of vegetation communities for the whole park and to discern trends in condition over time. In 2018, the NGPN crew visited sites in panel 2 and panel 3 (Figure 1). Sampling was completed by two NGPN crews, with help from JECA staff and volunteers, in approximately 140 crew hours (Table 1).

Table 1. Field journal for plant community monitoring plot visits at Jewel Cave National Monument in 2018. A total of 6 plots were visited by the Northern Great Plains Network Inventory & Monitoring monitoring crews.

Date Visited	Plot Name	Field Notes
July 2, 2018	PCM_021	6 person crew; plot difficult to locate, and terrain steep and rugged
July 2, 2018	PCM_023	5 person crew; lots of seedlings and grass species
July 3, 2018	PCM_004	4 person crew; moderate plant diversity and easy access to plot
July 3, 2018	PCM_019	4 person crew; open grassland with moderate diversity; poison ivy
July 5, 2018	PCM_007	6 person crew; many downed snags
July 5, 2018	PCM_024	5 person crew; accessed via Lithograph Canyon road

Plot Layout and Sampling

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

When woody species were present within 38 m of plot center, tree regeneration and tall shrub density data were collected within a 10 m radius subplot centered in the larger 50 m x 20 m (0.1 ha) plot. Trees within the entire 0.1 ha plot with a diameter at breast height (DBH) of > 15 cm were mapped and tagged. For each tree, the species, DBH, status (live or dead), and condition (e.g., leaf-discoloration, insect-damaged) were recorded. For all poles (2.54 ≤ DBH ≤ 15 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. In 2018, NGPN changed the way these species counts were made. Previously, once the count for a species had reached 100, seedlings of that species were not counted in the following quarters and a calculated estimate was made when the data was analyzed. Now, all seedling species present are always counted or estimated in all four quarters of the 10 m radius subplot while in the field. 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.

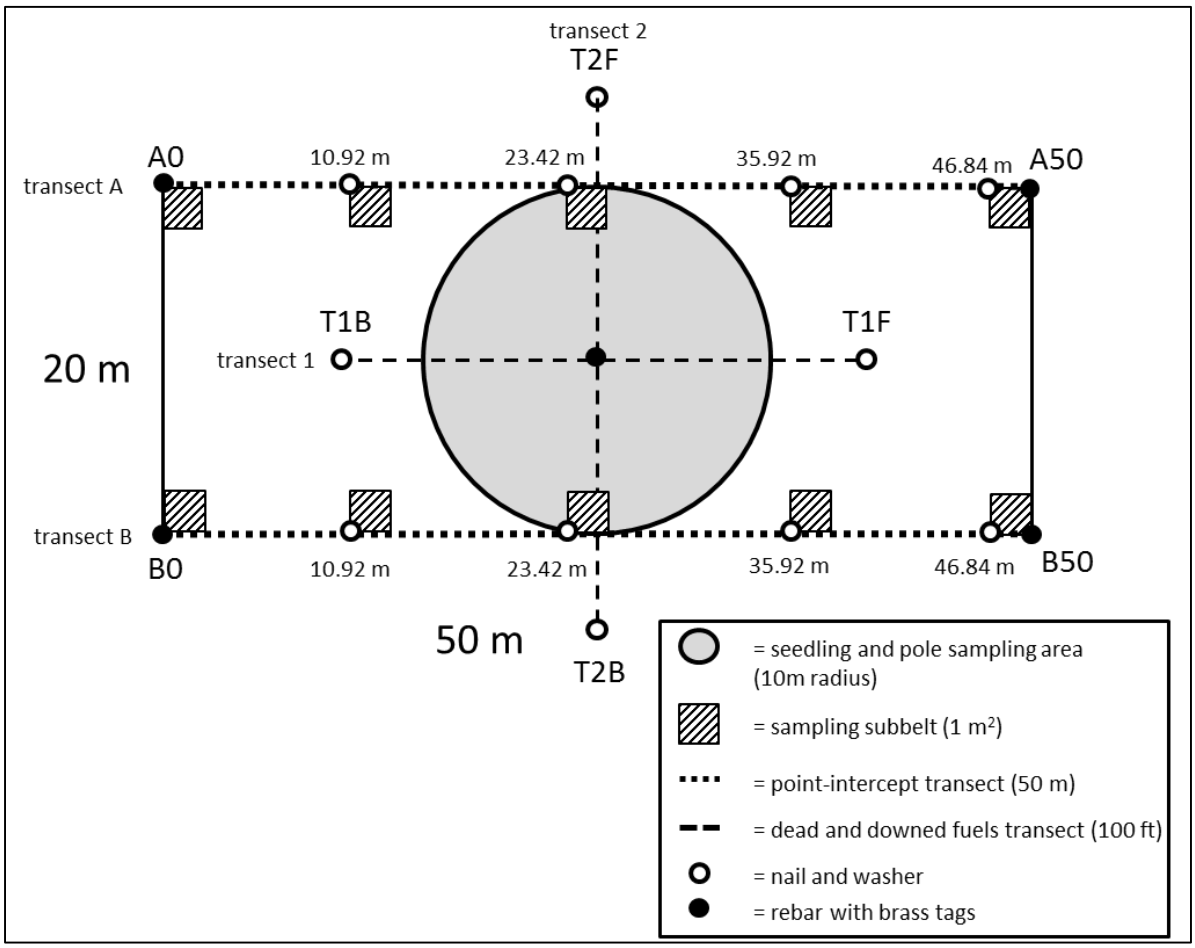

Figure 2. Long-term monitoring plot layout used for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.

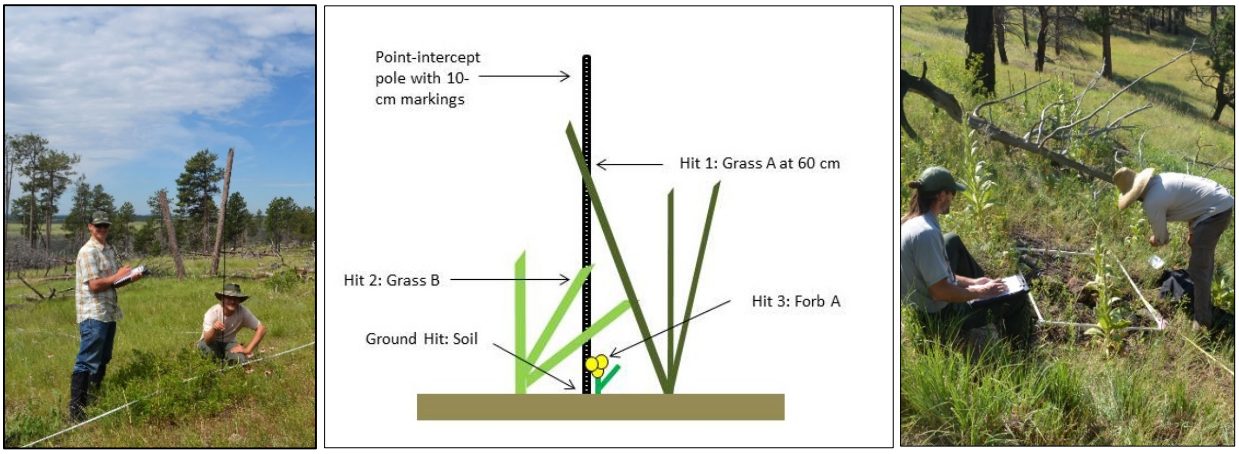

Figure 3. The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and quadrats (right panel) to document plant diversity and abundance.

Common disturbances were assessed and documented at each plot. The type, which included animal trails and fire, was recorded. In 2018 a new category called soil disturbance was added, which is defined as loose, exposed soil from all sources. Plots were also assessed for the presence and abundance of target exotic species (Table 2), which is critical for early detection and rapid response to exotic species threats. These species were chosen in collaboration with the Midwest Invasive Plant Network, Northern Great Plains Exotic Plant Management Team, park managers, and local weed experts. Each target species was assigned an abundance class from 1–5, based on an ocular estimate of cover, where 1 = one individual, 2 = few individuals, 3 = cover of 1–5%, 4 = cover of 5–25%, and 5 = cover > 25% of the plot.

Table 2. Exotic species included in the Northern Great Plains Network's early detection and rapid response program.

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

Table 2 (continued). Exotic species included in the Northern Great Plains Network's early detection and rapid response program.

Habitat	Scientific Name	Common Name
Upland	*Taeniatherum caput-medusae*	medusahead
Upland	*Chondrilla juncea*	rush skeletonweed
Upland	*Gypsophila paniculata*	baby's breath
Upland	*Centaurea virgata; C.diffusa*	knapweeds
Upland	*Linaria dalmatica; L. vulgaris*	toadflax
Upland	*Euphorbia myrsinites & E. cyparissias*	myrtle spurge
Upland	*Dipsacus fullonum & D. laciniatus*	common teasel
Upland	*Salvia aethiopis*	Mediterranean sage
Upland	*Ventenata dubia*	African wiregrass

Data Management and Analysis

FFI (FEAT/FIREMON Integrated; http://frames.gov/ffi/) was the primary software environment used for managing our sampling data. FFI is used by a variety of agencies (e.g., NPS, USDA Forest Service, U.S. Fish and Wildlife Service), has a national-level support system, and generally conforms to the Natural Resource Database Template standards established by the Inventory and Monitoring Program. Species scientific names, codes, common names, and native status are from the USDA Plants Database (USDA-NRCS 2018). However, nomenclature follows the Integrated Taxonomic Information System (ITIS). In the few cases where ITIS recognized a new name that was not in the USDA PLANTS database, the new name was used, and a unique plant code was assigned.

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

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

The conservation status rank of plant species observed at JECA in 2018 was determined by cross-referencing with the NatureServe conservation status list, as well as the South Dakota rare plant species lists. For the purpose of this report, a species is considered rare or of conservation concern if its global (G) or state (S) conservation status rank is classified as critically imperiled (G1/S1), imperiled (G2/S2), or vulnerable (G3/S3). The 2018 species list was also cross-referenced with the list of noxious weeds maintained by the South Dakota Department of Agriculture.

Results

There are 460 vascular plant species on the JECA species list, and NGPN monitoring crews identified a total of 132 species from six monitoring plots in 2018 (Table 3). Of these species, 16 are exotic species for the park. The 2018 species list was cross-referenced with state-wide rare and noxious exotic species lists for South Dakota. Two species matched the South Dakota exotic species list: Canada thistle (*Cirsium arvense*) and leafy spurge (*Euphorbia esula*). No rare plant species were identified by either crew. Plant species identified in 2018 were also cross-referenced with the NPSpecies list for JECA, which resulted in one potential new species for the park: rough false pennyroyal (*Hedeoma hispida*). Samples of this species will be collected during a future field season for verification. Another species observed, needleleaf sedge (*Carex duriuscula*), is not on the NPSpecies list but was vouchered and verified in 2016.

Table 3. List of all plant species identified in Jewel Cave National Monument (JECA) 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 South Dakota in the Notes column. Species that are not on the NPS species list for JECA are indicated with “New” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Anacardiaceae	RHTR	*Rhus trilobata*	skunkbush sumac	–
Anacardiaceae	TORY	*Toxicodendron rydbergii*	western poison ivy	–
Apiaceae	MUTE3	*Musineon tenuifolium*	slender wildparsley	–
Apocynaceae	APAN2	*Apocynum androsaemifolium*	spreading dogbane	–
Asclepiadaceae	ASOV	*Asclepias ovalifolia*	oval-leaf milkweed	–
Asteraceae	ACMI2	*Achillea millefolium*	common yarrow	–
Asteraceae	ANNE	*Antennaria neglecta*	field pussytoes	–
Asteraceae	ANPA4	*Antennaria parvifolia*	small-leaf pussytoes	–
Asteraceae	ARFR4	*Artemisia frigida*	prairie sagewort	–
Asteraceae	ARLU	*Artemisia ludoviciana*	white sagebrush	–
Asteraceae	BREU	*Brickellia eupatorioides*	false boneset	–
Asteraceae	CIAR4	*Cirsium arvense*	Canada thistle	Exotic, Noxious
Asteraceae	CIUN	*Cirsium undulatum*	wavyleaf thistle	–
Asteraceae	ECAN2	*Echinacea angustifolia*	blacksamson echinacea	–
Asteraceae	ERIGE2	*Erigeron sp*	fleabane	–
Asteraceae	EUME17	*Eurybia merita*	subalpine aster	–
Asteraceae	GAAR	*Gaillardia aristata*	blanketflower	–
Asteraceae	GRSQ	*Grindelia squarrosa*	curlycup gumweed	–
Asteraceae	GUSA2	*Gutierrezia sarothrae*	broom snakeweed	–
Asteraceae	HEPA19	*Helianthus pauciflorus*	stiff sunflower	–
Asteraceae	LASE	*Lactuca serriola*	prickly lettuce	Exotic
Asteraceae	LIPU	*Liatris punctata*	dotted blazing star	–

Table 3 (continued). List of all plant species identified in Jewel Cave National Monument (JECA) 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 South Dakota in the Notes column. Species that are not on the NPS species list for JECA are indicated with “New” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Asteraceae	LYJU	*Lygodesmia juncea*	rush skeletonplant	–
Asteraceae	MUOB99	*Mulgedium oblongifolium*	blue lettuce	–
Asteraceae	PACA15	*Packera cana*	woolly groundsel	–
Asteraceae	PAPA20	*Packera paupercula*	balsam groundsel	–
Asteraceae	SOMI2	*Solidago missouriensis*	Missouri goldenrod	–
Asteraceae	SOMO	*Solidago mollis*	velvety goldenrod	–
Asteraceae	SONE	*Solidago nemoralis*	gray goldenrod	–
Asteraceae	SOPT4	*Solidago ptarmicoides*	prairie goldenrod	–
Asteraceae	SORI2	*Solidago rigida*	stiff goldenrod	–
Asteraceae	SYLA3	*Symphyotrichum laeve*	smooth blue aster	–
Asteraceae	SYMPH4	*Symphyotrichum sp*	aster	–
Asteraceae	SYOB	*Symphyotrichum oblongifolium*	aromatic aster	–
Asteraceae	TAOF	*Taraxacum officinale*	common dandelion	Exotic
Asteraceae	TEAC	*Tetraneuris acaulis*	stemless four-nerve daisy	–
Asteraceae	TRDU	*Tragopogon dubius*	yellow salsify	Exotic
Boraginaceae	CYOF	*Cynoglossum officinale*	gypsyflower	Exotic
Boraginaceae	LIIN2	*Lithospermum incisum*	narrowleaf stoneseed	–
Brassicaceae	ARPY4	*Arabis pycnocarpa*	creamflower rockcress	–
Brassicaceae	DRRE2	*Draba reptans*	Carolina draba	–
Brassicaceae	PHAR99	*Physaria arenosa*	Great Plains bladderpod	–
Brassicaceae	PHLU99	*Physaria ludoviciana*	foothills bladderpod	–
Campanulaceae	CARO2	*Campanula rotundifolia*	bluebell bellflower	–
Caprifoliaceae	SYAL	*Symphoricarpos albus*	common snowberry	–
Caprifoliaceae	SYOC	*Symphoricarpos occidentalis*	western snowberry	–
Caryophyllaceae	SILEN	*Silene sp*	catchfly	Exotic
Cyperaceae	CADU6	*Carex duriuscula*	needleleaf sedge	New
Cyperaceae	CAIN9	*Carex inops*	long-stolon sedge	–
Cyperaceae	CAREX	*Carex sp*	sedge	–
Cyperaceae	CARO5	*Carex rossii*	Ross' sedge	–
Elaeagnaceae	SHCA	*Shepherdia canadensis*	russet buffaloberry	–
Euphorbiaceae	EUES	*Euphorbia esula*	leafy spurge	Exotic, Noxious
Fabaceae	ASFL2	*Astragalus flexuosus*	flexile milkvetch	–
Fabaceae	ASLA27	*Astragalus laxmannii*	Laxmann's milkvetch	–
Fabaceae	ASMI10	*Astragalus missouriensis*	Missouri milkvetch	–

Table 3 (continued). List of all plant species identified in Jewel Cave National Monument (JECA) 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 South Dakota in the Notes column. Species that are not on the NPS species list for JECA are indicated with “New” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Fabaceae	DACA7	*Dalea candida*	white prairie clover	–
Fabaceae	DAPU5	*Dalea purpurea*	purple prairie clover	–
Fabaceae	GLLE3	*Glycyrrhiza lepidota*	American licorice	–
Fabaceae	MELU	*Medicago lupulina*	black medick	Exotic
Fabaceae	MEOF	*Melilotus officinalis*	yellow sweetclover	Exotic
Fabaceae	PEAR6	*Pediomelum argophyllum*	silverleaf Indian breadroot	–
Fabaceae	PEES	*Pediomelum esculentum*	large Indian breadroot	–
Fabaceae	PSTE5	*Psoralidium tenuiflorum*	slimflower scurfpea	–
Fabaceae	VIAM	*Vicia americana*	American vetch	–
Gentianaceae	FRSP	*Frasera speciosa*	elkweed	–
Grossulariaceae	RICE	*Ribes cereum*	wax currant	–
Grossulariaceae	RIOX	*Ribes oxyacanthoides*	Canadian gooseberry	–
Iridaceae	IRMI	*Iris missouriensis*	Rocky Mountain iris	–
Iridaceae	SIMO2	*Sisyrinchium montanum*	strict blue-eyed grass	–
Lamiaceae	HEHI	*Hedeoma hispida*	rough false pennyroyal	New
Lamiaceae	MOFI	*Monarda fistulosa*	wild bergamot	–
Liliaceae	ALCE2	*Allium cernuum*	nodding onion	–
Liliaceae	ALTE	*Allium textile*	textile onion	–
Liliaceae	ANEL5	*Anticlea elegans*	mountain deathcamas	–
Liliaceae	CALOC	*Calochortus sp*	mariposa lily	–
Liliaceae	CANU3	*Calochortus nuttallii*	sego lily	–
Liliaceae	LEMO4	*Leucocrinum montanum*	common starlily	–
Liliaceae	MAST4	*Maianthemum stellatum*	starry false lily of the valley	–
Liliaceae	TOVE2	*Toxicoscordion venenosum*	meadow deathcamas	–
Linaceae	LILE3	*Linum lewisii*	Lewis flax	–
Onagraceae	OESU99	*Oenothera suffrutescens*	scarlet beeblossom	–
Pinaceae	PIPO	*Pinus ponderosa*	ponderosa pine	–
Plantaginaceae	SYWY99	*Synthyris wyomingensis*	Wyoming kittentails	–
Poaceae	ACHY	*Achnatherum hymenoides*	Indian ricegrass	–
Poaceae	ACRI8	*Achnatherum richardsonii*	Richardson's needlegrass	–
Poaceae	ANGE	*Andropogon gerardii*	big bluestem	–
Poaceae	BOCU	*Bouteloua curtipendula*	sideoats grama	–
Poaceae	BOGR2	*Bouteloua gracilis*	blue grama	–
Poaceae	BRAN	*Bromus anomalus*	nodding brome	–
Poaceae	BRIN2	*Bromus inermis*	smooth brome	Exotic

Table 3 (continued). List of all plant species identified in Jewel Cave National Monument (JECA) 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 South Dakota in the Notes column. Species that are not on the NPS species list for JECA are indicated with “New” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Poaceae	BRJA	*Bromus japonicus*	Japanese brome	Exotic
Poaceae	DASP2	*Danthonia spicata*	poverty oatgrass	–
Poaceae	ELCA4	*Elymus canadensis*	Canada wildrye	–
Poaceae	ELLA3	*Elymus lanceolatus*	thickspike wheatgrass	–
Poaceae	ELRE4	*Elymus repens*	quackgrass	Exotic
Poaceae	ELTR7	*Elymus trachycaulus*	slender wheatgrass	–
Poaceae	HECO26	*Hesperostipa comata*	needle and thread	–
Poaceae	HESP11	*Hesperostipa spartea*	porcupinegrass	–
Poaceae	KOMA	*Koeleria macrantha*	prairie Junegrass	–
Poaceae	MUCU3	*Muhlenbergia cuspidata*	plains muhly	–
Poaceae	MUPA99	*Muhlenbergia paniculata*	tumblegrass	–
Poaceae	NAVI4	*Nassella viridula*	green needlegrass	–
Poaceae	PASM	*Pascopyrum smithii*	western wheatgrass	–
Poaceae	PAVI2	*Panicum virgatum*	switchgrass	–
Poaceae	PIMI7	*Piptatherum micranthum*	littleseed ricegrass	–
Poaceae	POIN	*Poa interior*	inland bluegrass	–
Poaceae	POPR	*Poa pratensis*	Kentucky bluegrass	Exotic
Poaceae	SCSC	*Schizachyrium scoparium*	little bluestem	–
Poaceae	SPHE	*Sporobolus heterolepis*	prairie dropseed	–
Polemoniaceae	PHAL3	*Phlox alyssifolia*	alyssumleaf phlox	–
Polemoniaceae	PHHO	*Phlox hoodii*	spiny phlox	–
Polygalaceae	POAL4	*Polygala alba*	white milkwort	–
Ranunculaceae	ANCY	*Anemone cylindrica*	candle anemone	–
Ranunculaceae	ANMU	*Anemone multifida*	Pacific anemone	–
Ranunculaceae	ANPA19	*Anemone patens*	eastern pasqueflower	–
Rosaceae	AMAL2	*Amelanchier alnifolia*	Saskatoon serviceberry	–
Rosaceae	FRVI	*Fragaria virginiana*	Virginia strawberry	–
Rosaceae	GETR	*Geum triflorum*	old man's whiskers	–
Rosaceae	PHMO4	*Physocarpus monogynus*	mountain ninebark	–
Rosaceae	POCO13	*Potentilla concinna*	elegant cinquefoil	–
Rosaceae	PRVI	*Prunus virginiana*	chokecherry	–
Rosaceae	ROAC	*Rosa acicularis*	prickly rose	–
Rosaceae	ROAR3	*Rosa arkansana*	prairie rose	–
Rubiaceae	GABO2	*Galium boreale*	northern bedstraw	–
Santalaceae	COUM	*Comandra umbellata*	bastard toadflax	–

Table 3 (continued). List of all plant species identified in Jewel Cave National Monument (JECA) 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 South Dakota in the Notes column. Species that are not on the NPS species list for JECA are indicated with “New” in the notes column.

Family	Symbol	Scientific Name	Common Name	Notes
Scrophulariaceae	VETH	Verbascum thapsus	common mullein	Exotic
Solanaceae	PHLO4	Physalis longifolia	longleaf groundcherry	–
Unknown	UNKFORB	Unknown forb	unknown forb	Exotic
Violaceae	VIAD	Viola adunca	hookedspur violet	–
Violaceae	VINU2	Viola nuttallii	Nuttall's violet	–
Violaceae	VIOLA	Viola sp	violet	Exotic

Based on the total count of unique species observed in all plots in 2018, PCM_004 had the highest number with 71 total species (Table 4). This plot also had the highest number of native species, with 65 species. Absolute cover calculations (Table 5) reflected a greater percent of native species cover compared to exotic species cover in all six PCM plots. PCM_024 had the highest absolute native species cover, and PCM_007 had the highest absolute exotic species cover.

Table 4. Total number of plant species identified in each of the six plots monitored at Jewel Cave National Monument (JECA) in 2018. This is a count of all unique species identified in the plot using species data from point-intercept, quadrat, woody species, and target species protocols.

Plot	Native Species	Exotic Species	Total Species
PCM_004	65	6	71
PCM_007	42	7	49
PCM_019	48	11	59
PCM_021	53	5	58
PCM_023	36	7	43
PCM_024	56	7	63

Table 5. Absolute percent cover of native and exotic plant species in plots monitored at Jewel Cave National Monument (JECA) 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	Absolute % Native Cover	Absolute % Exotic Cover
PCM_004	96	4
PCM_007	146	48
PCM_019	130	39
PCM_021	67	2
PCM_023	101	20
PCM_024	161	15

The NGPN monitoring crew collected woody species data in all six plots visited in 2018 (Table 6). Three unique species were observed in the plots, and all were dominated by ponderosa pine (*Pinus ponderosa*). PCM_007 had no live trees or poles within the plot, nor did it have any seedlings. PCM_024 (Figure 4) did not have any trees or poles, but crews did observe seedling regeneration for both ponderosa pine and Saskatoon serviceberry (*Amelanchier alnifolia*). Saskatoon serviceberry was abundant in the understory of five of the six monitoring plots.

Table 6. Woody species data from five long-term monitoring plots visited at Jewel Cave National Monument (JECA) in 2018. DBH categories are tree (DBH>15 cm), pole (2.54 cm<DBH>15 cm), and seedling (DBH<2.54 cm).

Plot	Species	DBH	Count	Status	Density/Hectare
PCM_004	Saskatoon serviceberry	Seedling	165	Live	5251
PCM_004	ponderosa pine	Pole	6	Live	191
PCM_004	ponderosa pine	Tree	17	Live	170
PCM_007	ponderosa pine	Pole	1	Dead	10
PCM_007	ponderosa pine	Tree	8	Dead	80
PCM_019	Saskatoon serviceberry	Seedling	538	Live	17123
PCM_019	chokecherry	Seedling	2	Live	64
PCM_019	ponderosa pine	Seedling	42	Live	1337
PCM_019	ponderosa pine	Pole	1	Dead	32
PCM_019	ponderosa pine	Pole	1	Live	31.85
PCM_019	ponderosa pine	Tree	2	Dead	20
PCM_019	ponderosa pine	Tree	9	Live	90
PCM_021	Saskatoon serviceberry	Seedling	153	Live	4869.51
PCM_021	chokecherry	Seedling	169	Live	5378.74
PCM_021	ponderosa pine	Pole	4	Dead	127.39
PCM_021	ponderosa pine	Pole	17	Live	541.4
PCM_021	ponderosa pine	Tree	2	Dead	20
PCM_021	ponderosa pine	Tree	21	Live	210
PCM_023	Saskatoon serviceberry	Seedling	462	Live	14704.01
PCM_023	ponderosa pine	Seedling	135	Live	4296.63
PCM_023	ponderosa pine	Tree	1	Dead	10
PCM_023	ponderosa pine	Tree	36	Live	360
PCM_024	Saskatoon serviceberry	Seedling	135	Live	4296.63
PCM_024	ponderosa pine	Seedling	3	Live	95.48

Figure 4. Photograph of long-term monitoring plot PCM_024 at Jewel Cave National Monument in 2018. Photograph courtesy of the National Park Service.

Surface fuels and dead and downed wood provide foraging habitat and refugia for small wildlife species, as well as substrate for mosses and fungi. Downed wood can also provide “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. NGPFire has developed a management target for surface fuels with a goal to maintain fuel loads between 2 and 10 tons per acre within the Black Hills parks. NGPN surveyed and measured surface fuels in 6 plots visited in JECA (Table 7).

Table 7. Surface fuels summary for six plots at Jewel Cave National Monument (JECA) in 2018.

	Average Tons per Acre										Avg. Depth (in.)		
Macroplot	**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_004	0.10	0.68	0.00	0.78	0.00	1.16	1.94	2.38	2.48	6.79	0.1	0.6	0.8
PCM_007	0.06	0.81	1.46	2.33	3.11	27.23	32.67	4.67	1.14	38.47	0.3	0.3	0.6
PCM_019	0.00	0.14	2.20	2.34	1.68	0.78	4.79	0.53	1.26	6.58	0.0	0.3	0.3
PCM_021	0.04	0.62	0.82	1.48	0.00	2.41	3.90	17.69	2.52	24.11	1.0	0.6	1.6
PCM_023	0.02	0.41	1.45	1.88	8.33	8.84	19.04	1.50	1.74	22.28	0.1	0.4	0.5
PCM_024	0.10	1.77	8.04	9.91	1.99	17.57	29.47	1.50	1.04	32.01	0.1	0.3	0.3

Disturbances occurred three of the six plots at JECA visited by NGPN in 2018 (Table 8). There was a variety of disturbances observed, including grazing, animal trails, a road, and erosion. This year, NGPN began assessing the total area of exposed soil disturbance. This was observed in two plots, PCM_004 and PCM_021, as a result of a road and from erosion, respectively.

Table 8. Disturbance types and occurrence in six plant community monitoring plots visited in 2018 at Jewel Cave National Monument (JECA).

Plot	Disturbance Type	Area (m^2)
PCM_004	Grazing	3
PCM_004	Road	36
PCM_004	Soil Disturbance	36
PCM_007	Storm (Wind)	1000
PCM_021	Animal Trail	10
PCM_021	Erosion	15
PCM_021	Soil Disturbance	15

Further Analysis

This 2018 Data Report is intended to provide a basic review of the data collected during the NGPN vegetation monitoring team's 2018 visit to Jewel Cave National Monument. All data included in this report is available upon request from the Northern Great Plains Inventory and Monitoring Network, as well as in the archives found in the IRMA Data Store.

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