



Plant Community Composition and Structure Monitoring at Agate Fossil Beds National Monument

2017 Data Summary Report

Natural Resource Data Series NPS/NGPN/NRDS—2018/1163



ON THE COVER

Landscape view of Agate Fossil Beds National Monument.
Photograph courtesy of the National Park Service.

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Natural Resource Data Series NPS/NGPN/NRDS—2018/1163

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Abstract

This report presents the results of vegetation monitoring efforts in 2017 at Agate Fossil Beds National Monument (AGFO) by the Northern Great Plains Inventory and Monitoring Network (NGPN) and the Northern Great Plains Fire Effects Program (NGPFire). This was the seventh year of field work conducted by NGPN at AGFO.

In 2017, crew members from NGPN visited six long-term plant community monitoring (PCM) plots and NGPFire visited eight additional PCM and fire plant community monitoring (FPCM) plots to collect data on the plant communities at AGFO. This collaborative effort is part of a long-term monitoring program established to better understand the condition of the mixed-grass prairie, riparian, and upland regions in AGFO. NGPN staff collected species richness, herb-layer height, native and exotic (non-native) species abundance, ground cover, and site disturbance data at each of the six plots. The NGPFire crew collected herb-layer height, native and exotic species abundance, and ground cover data at each of their eight PCM/FPCM plots. An additional eleven riparian community monitoring (RCM) plots were also evaluated for species richness and cover of native and exotic species.

Monitoring crews identified 124 unique plant species from a total of 25 monitoring plots. Of those species, 23 were exotic species and one, Canada thistle (*Cirsium arvense*), is a noxious species in Nebraska. Pale yellow iris (*Iris pseudacorus*), which is monitored as an exotic species of concern, was found in four of the eleven RCM plots. Five rare plant species plus two species potentially new to the park were also observed in 2017. Overall, both upland and riparian monitoring plots were more native than exotic in absolute cover. The most common disturbance was small mammal use, recorded in all six upland monitoring plots visited by NGPN.

Acknowledgments

We thank 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 AGFO for providing logistical support and safety checks. Also thanks to Dyar Frank from Scotts Bluff National Monument for assisting with data collection. The 2017 NGPN vegetation field crew of L. LaFleur, S. Rockwood, I. Ashton, C. Davis and R. Manuel, with the assistance of the NGPFire crew of D. Swanson, M. Whitman, I. Muirhead, and T. Schaffner collected all the data included in this report.

Introduction

Agate Fossil Beds National Monument was established in 1965 to protect and preserve a large concentration of ancient mammal fossils. The monument contains 2,270 acres of mixed-grass prairie intersected by riparian vegetation along the Niobrara River. Vegetation monitoring began in AGFO in 1998 by the Heartland Inventory & Monitoring Program (James 2010a) and the Northern Great Plains Fire Ecology Program (FireEP; Wienk et al. 2011). In 2010, AGFO was incorporated into the Northern Great Plains Inventory & Monitoring Network (NGPN). At this time, vegetation monitoring protocols and plot locations were revised to better represent the entire monument and to coordinate efforts with the FireEP (Symstad et al. 2012b), and sampling efforts began in 2011 (Ashton et al. 2011). In 2012, the NGPN began monitoring additional plots within the riparian corridor of the Niobrara River system to assess riparian condition.

This report provides summaries of the data collected in 2017 from fourteen upland plots and eleven riparian plots. For a more in-depth data report on long-term trends of vegetation at AGFO, refer to the 2011-2015 summary report (Ashton and Davis, 2016).

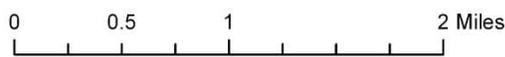
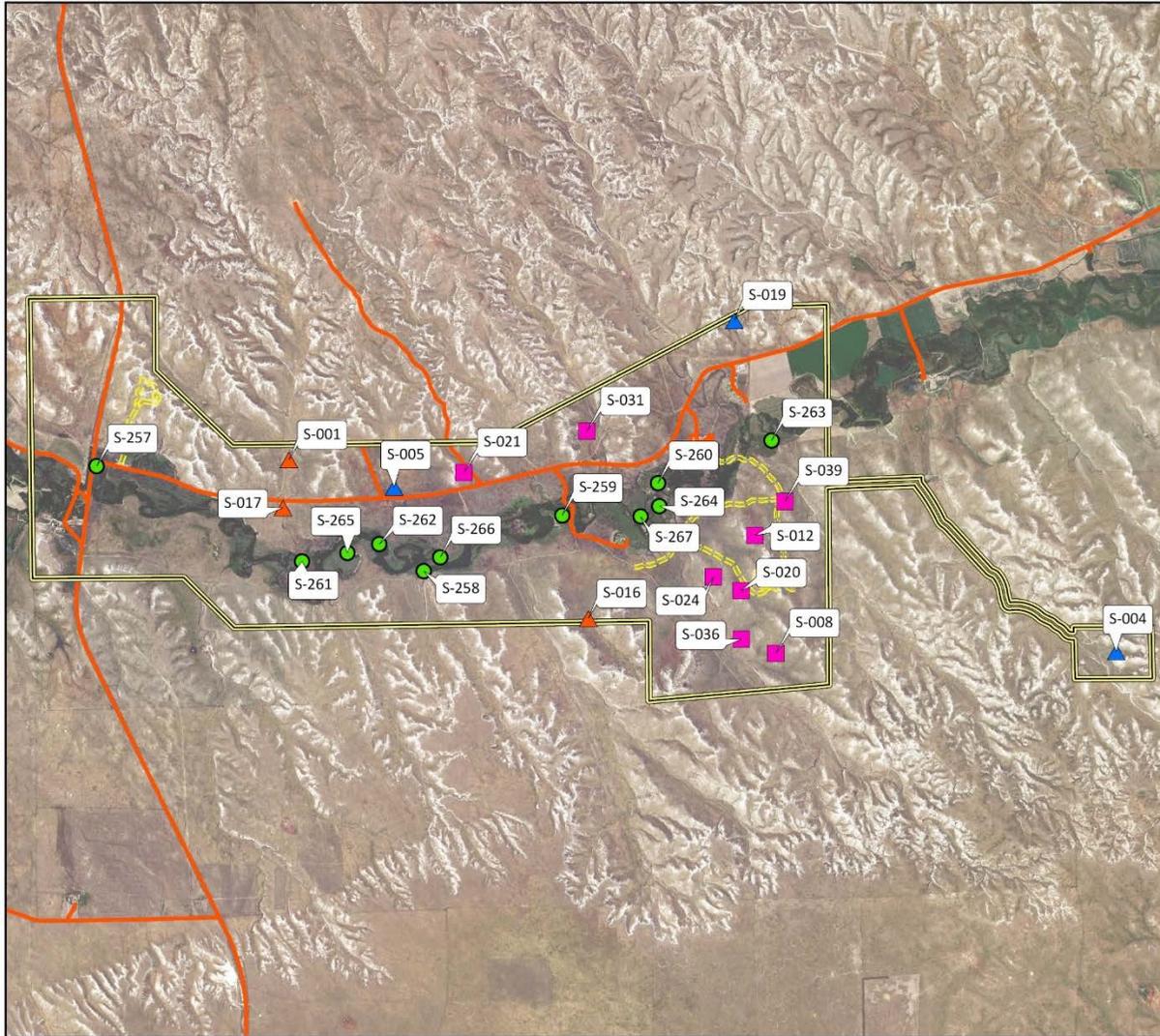
Methods

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 and NGPFire implemented a survey to monitor plant community structure and composition in AGFO using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, NGPN selected 16 randomly located sites within the upland grasslands of AGFO to become Plant Community Monitoring plots (PCM plots). An NGPN crew visits two panels (six PCM plots) in late May and early June every year, using a rotating sampling scheme that consists of three sites visited the previous year and three 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. A similar GRTS design was used to select 17 additional plots that fell within the riparian zone along the Niobrara River, called riparian community monitoring (RCM) plots.

In 2017, the NGPN crew visited PCM six plots in panel 1 and panel 2 in late May and early June, and eleven RCM plots in late August (Figure 1). Sampling of PCM plots was completed by a three-person crew in approximately 49 crew hours, and sampling of RCM plots was completed by two 2-person crews in approximately 25 crew hours (Table 1). These totals do not include the drive time between Rapid City and AGFO. Monitoring crews lodged at AGFO in park housing.



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- ▲ NGPN Panel 1
- ▲ NGPN Panel 2
- NGPFire
- Riparian
- ▭ Park Boundary
- Road
- - - Trail

**Agate Fossil Beds National Monument
 Sioux County, Nebraska 69346**

Figure 1. Map of Agate Fossil Beds National Monument (AGFO) long-term monitoring plots visited in 2017. Northern Great Plains Inventory & Monitoring (NGPN) monitoring crew visited six plant community monitoring (PCM) plots, three in Panel 1 and three in Panel 2. The Northern Great Plains Fire Effects Program (NGPFire) monitoring crew visited an additional eight plots. NGPN also visited eleven plots along the riparian corridor to assess vegetation composition along the Niobrara River.

Table 1. Field journal for NGPN plant community monitoring at Agate Fossil Beds National Monument (AGFO) in 2017. Two separate visits took place, one for upland vegetation monitoring and one for riparian vegetation monitoring.

Date Visited	Field Time	Plot Name	Field Notes
5/30/2017	2.25 hr	PCM_016	3-person crew
	2 hr	PCM_005	3-person crew
5/31/2017	3 hr	PCM_017	Plot taken back out of dormant status; 3-person crew, with T. Schaffner from NGPFire
	3 hr	PCM_004	Park escort needed; travel to site ~30 min; 4-person crew, including Dyar Frank from SCBL
	1.75 hr	PCM_019	Plot started on 5/31 and completed 6/1; 3-person crew
6/1/2017	2.25 hr	PCM_001	3-person crew
8/23/2017	Approx. 1 hour per plot	RCM_257	25 m transect; 4-person crew, assisted by Dyar Frank from SCBL
		RCM_258	2-person crew
		RCM_259	2-person crew
		RCM_261	3-person crew, assisted by Dyar Frank from SCBL
8/24/2017	Approx. 1 hour per plot	RCM_264	2-person crew; Only 10 points of data collected
		RCM_260	2-person crew
		RCM_262	2-person crew
		RCM_263	2-person crew
		RCM_265	2-person crew
		RCM_266	2-person crew
		RCM_267	2-person crew

When a PCM plot fell within an active burn unit, NGPFire visits additional sites based on a 1, 2, 5, and 10 year sampling schedule. NGPFire also established and monitored a number of new sites focused in active burn units (Fire FPCM plots) using the same GRTS sampling schema. The NGPFire crew visited eight plots including both PCM and FPCM plots in late May and early June. Sampling was completed by a four-person crew in approximately 16 crew hours (Table 2).

Table 2. Field journal for NGPFire plant community monitoring at Agate Fossil Beds National Monument (AGFO) in 2017.

Date Visited	Field Time	Plot Name	Burn Unit	Field Notes
5/30/2018	Approx. 2 hrs per plot	PCM_021 FPCM_031	River North	4-person crew
5/31/2018	Approx. 2 hrs per plot	PCM_012 PCM_020 PCM_024 FPCM_039	Carnegie	4-person crew
6/1/2018	Approx. 2 hrs per plot	PCM_008 FPCM_036	Carnegie	4-person crew

Plot Layout and Sampling

At each PCM 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). 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. NGPFire also collected species richness and cover data using the point-intercept method, but did not use the quadrat method for collection of species presence data.

NGPN monitored riparian plant communities in AGFO in riparian plant community monitoring (RCM) plots. At RCM plots, vegetation was measured using the point-intercept method as described above, along a single 50 m transect that ran perpendicular to the river channel. These plots are not permanently marked and are relocated using GPS coordinates.

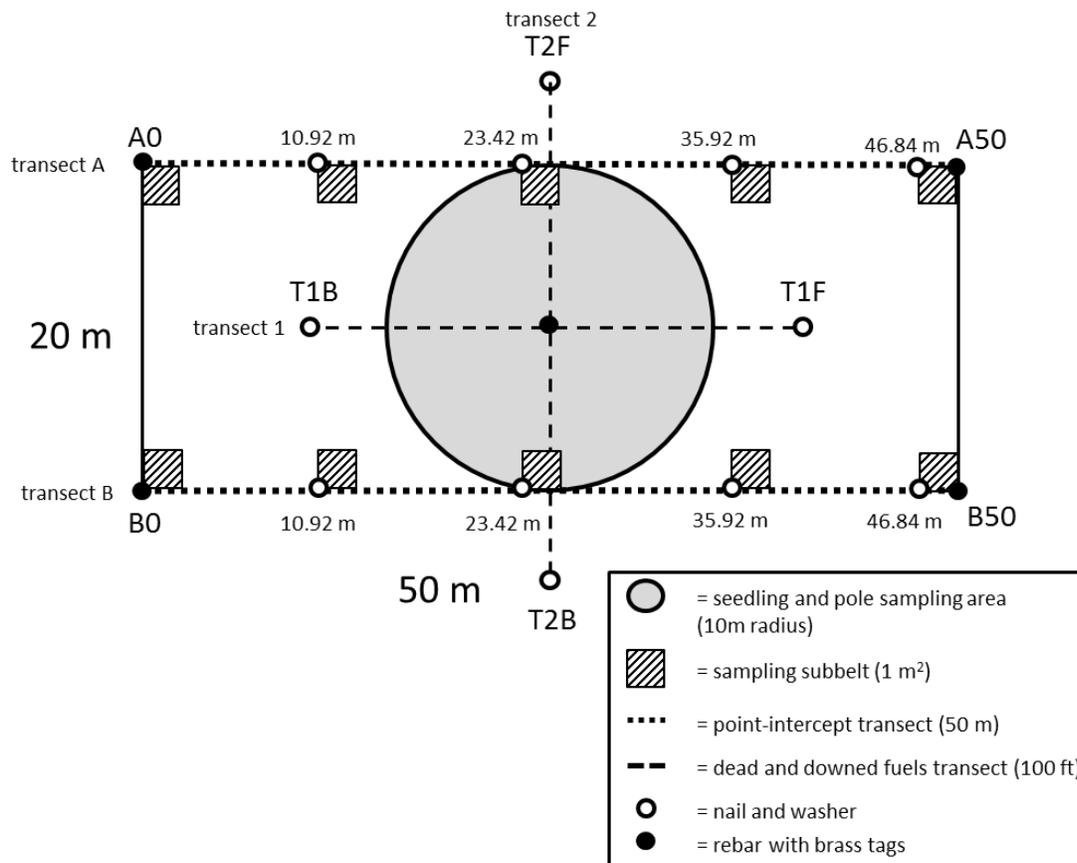


Figure 2. Long-term monitoring plot layout used for sampling vegetation used by the Northern Great Plains Inventory and Monitoring vegetation crew.

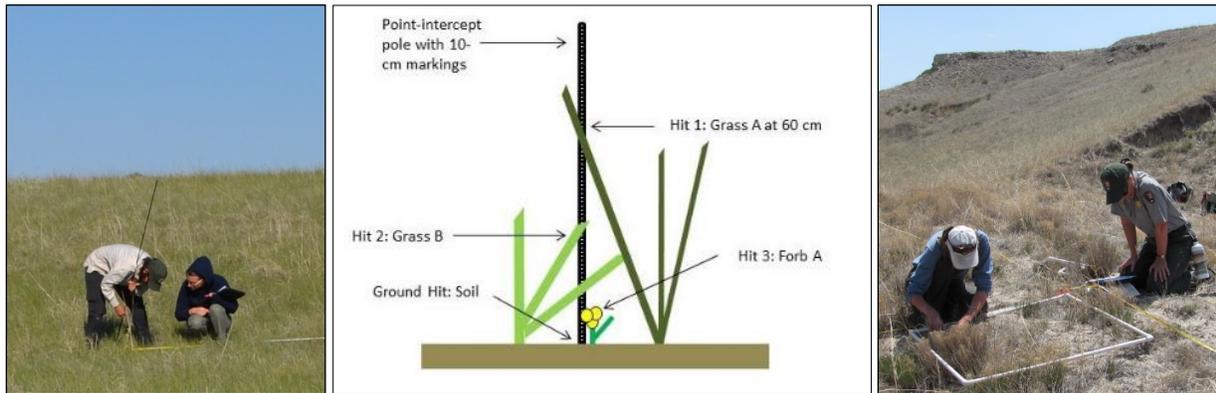


Figure 3. The Northern Great Plains Inventory & Monitoring vegetation crew used point-intercept (left and center panel) and quadrats (right panel) to document plant diversity and abundance.

The NGPN crew assessed and documented common disturbances at each plot. The type, which included animal use and fire, and the approximate area (m²) of each disturbance was 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. The State Noxious Species column indicates species included on the Nebraska state list of noxious weeds.

Habitat	Scientific Name	Common Name	State Noxious Species
Riparian	<i>Alliaria petiolata</i>	garlic mustard	–
	<i>Polygonum cuspidatum</i> ; <i>P. sachalinense</i> ; <i>P. x bohemicum</i>	knotweeds	X
	<i>Pueraria montana</i> var. <i>lobata</i>	kudzu	–
	<i>Iris pseudacorus</i>	yellow iris	–
	<i>Ailanthus altissima</i>	tree of heaven	–
	<i>Lepidium latifolium</i>	perennial pepperweed	–
	<i>Arundo donax</i>	giant reed	–
	<i>Rhamnus cathartica</i>	common buckthorn	–
	<i>Heracleum mantegazzianum</i>	giant hogweed	–

Table 3 (continued). Exotic species included in the Northern Great Plains Network’s early detection and rapid response program. The State Noxious Species column indicates species included on the Nebraska state list of noxious weeds.

Upland	<i>Centaurea solstitialis</i>	yellow star thistle	–
	<i>Hieracium aurantiacum</i> ; <i>H. caespitosum</i>	orange and meadow hawkweed	–
	<i>Isatis tinctoria</i>	Dyer's woad	–
	<i>Taeniatherum caput-medusae</i>	medusahead	–
	<i>Chondrilla juncea</i>	rush skeletonweed	–
	<i>Gypsophila paniculata</i>	baby's breath	–
	<i>Centaurea virgata</i> ; <i>C. diffusa</i>	knapweeds	X
	<i>Linaria dalmatica</i> ; <i>L. vulgaris</i>	toadflax	–
	<i>Euphorbia myrsinites</i> & <i>E. cyparissias</i>	myrtle spurge	–
	<i>Dipsacus fullonum</i> & <i>D. laciniatus</i>	common teasel	–
	<i>Salvia aethiopsis</i>	Mediterranean sage	–
	<i>Ventenata dubia</i>	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 2017). 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, 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 AGFO in 2017 was determined by cross-referencing with the NatureServe conservation status list, as well as the Nebraska 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 (S2/G2), or vulnerable (S3/G3). More information on conservation ranks can be found at the [NatureServe](#) website. The 2017 species list was also cross-referenced with the list of noxious weeds maintained by the [Nebraska Department of Agriculture](#).



Overview photo of long-term monitoring plot AGFO_PCM_004, located at the *Stenomylus* fossil site in the southeast part of Agate Fossil Beds National Monument. Photograph courtesy of the National Park Service.

Results

There are a total of 453 plant species on the AGFO species list, and the NGPN and NGPFire monitoring crews identified a total of 124 species from fourteen upland monitoring plots and eleven riparian monitoring plots visited in 2017 (Table 4). The 2017 species list was cross-referenced with state-wide rare and noxious species lists for Nebraska. There were 23 exotic species for the park, of which one, Canada thistle (*Cirsium arvense*), was a noxious weed species for Nebraska. Five plant species observed in 2017 are classified as rare in Nebraska. Three of these species are considered potentially vulnerable (S3S5) at the state level: winterfat (*Krascheninnikovia lanata*), western tansymustard (*Descurainia pinnata*), and witchgrass (*Panicum virgatum*). One species, spotted fritillary (*Fritillaria atropurpurea*; Figure 4), is considered imperiled (S2) in Nebraska. Another species NGPN observed, hairy false goldenaster (*Heterotheca villosa*; Figure 4), is considered critically imperiled (S1). However, the classifications for hairy false goldenaster and western tansymustard are based on an infraspecific (subspecies or variety) level of species identification. While these taxon (*H. villosa* variety *minor*, and *D. pinnata* subspecies *intermedia*) have the potential to be found in western Nebraska, NGPN crews do not identify plant species to that taxonomic level due to difficulty and time restraints in the field.

Plant species identified by monitoring crews were also cross-referenced with the NPSpecies list for AGFO, which resulted in two potential new species for the park: pondweed (*Potamogeton spp.*), and reed canarygrass (*Phalaris arundinacea*). Both of these were observed in plots along the riparian corridor. Samples of these species will need to be collected during a future field season for verification.



Figure 4. Two plant species observed at AGFO in 2017, the spotted fritillary (*Fritillaria atropurpurea*, left) and the hairy false goldenaster (*Heterotheca villosa*, right), classified as rare in the state of Nebraska. Photographs courtesy of the National Park Service.

Table 4. List of all plant species identified in Agate Fossil Beds National Monument long-term plant community monitoring plots in 2017. In the Notes column, “U” indicates that a species was identified during upland vegetation monitoring and “R” indicates riparian monitoring. Species found during both visits will have both “U” and “R”. “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 Nebraska in the Notes column. Species considered to be rare are marked with the appropriate global or state conservation ranks, and species not on the NPS species list for AGFO are indicated with “New” in the Notes column.

Family	Scientific Name	Common Name	Notes
Agavaceae	<i>Yucca glauca</i>	soapweed yucca	U
Asclepiadaceae	<i>Asclepias incarnata</i>	swamp milkweed	R
	<i>Asclepias speciosa</i>	showy milkweed	R
Asteraceae	<i>Ambrosia psilostachya</i>	Cuman ragweed	U, R
	<i>Artemisia dracunculus</i>	tarragon	U
	<i>Artemisia frigida</i>	prairie sagewort	U, R
	<i>Bidens frondosa</i>	devil's beggartick	R
	<i>Cirsium arvense</i>	Canada thistle	R, Exotic, Noxious
	<i>Cirsium canescens</i>	prairie thistle	U
	<i>Cirsium flodmanii</i>	Flodman's thistle	R
	<i>Conyza canadensis</i>	Canadian horseweed	U, R
	<i>Cyclachaena xanthifolia</i>	giant sumpweed	U, R
	<i>Erigeron spp.</i>	fleabane	U
	<i>Gutierrezia sarothrae</i>	broom snakeweed	U
	<i>Helianthus spp.</i>	sunflower	U, Exotic
	<i>Heterotheca villosa</i>	hairy false goldenaster	U, G5/S1*
	<i>Lactuca serriola</i>	prickly lettuce	U, R, Exotic
	<i>Lygodesmia juncea</i>	rush skeletonplant	U
	<i>Mulgedium oblongifolium</i>	blue lettuce	U, R
	<i>Packera cana</i>	woolly groundsel	R
	<i>Solidago canadensis</i>	Canada goldenrod	R
	<i>Solidago gigantea</i>	giant goldenrod	R
	<i>Sonchus arvensis</i>	field sowthistle	R, Exotic
<i>Symphyotrichum spp.</i>	heath aster	U	
<i>Symphyotrichum lanceolatum</i>	white panicle aster	R	
<i>Taraxacum officinale</i>	common dandelion	U, Exotic	
<i>Tragopogon dubius</i>	yellow salsify	U, R, Exotic	
Boraginaceae	<i>Cryptantha spp.</i>	cryptantha	U
	<i>Lappula occidentalis</i>	flatspine stickseed	U
	<i>Lithospermum incisum</i>	narrowleaf stoneseed	U

*Conservation rank based on infraspecific (variety or subspecies) level of classification.

Table 4 (continued). List of all plant species identified in Agate Fossil Beds National Monument long-term plant community monitoring plots in 2017. In the Notes column, “U” indicates that a species was identified during upland vegetation monitoring and “R” indicates riparian monitoring. Species found during both visits will have both “U” and “R”. “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 Nebraska in the Notes column. Species considered to be rare are marked with the appropriate global or state conservation ranks, and species not on the NPS species list for AGFO are indicated with “New” in the Notes column.

Family	Scientific Name	Common Name	Notes
Brassicaceae	<i>Alyssum desertorum</i>	desert madwort	U, Exotic
	<i>Descurainia pinnata</i>	western tansymustard	U, G5/S3S5*
	<i>Draba reptans</i>	Carolina draba	U
	<i>Lepidium densiflorum</i>	common pepperweed	U
	<i>Physaria ludoviciana</i>	foothill bladderpod	U
	<i>Sisymbrium altissimum</i>	tall tumbledustard	U, R, Exotic
Cactaceae	<i>Opuntia fragilis</i>	brittle pricklypear	U
Chenopodiaceae	<i>Atriplex micrantha</i>	twoscale saltbush	R, Exotic
	<i>Chenopodium</i>	goosefoot	U, Exotic
	<i>Kochia scoparia</i>	burningbush, kochia	U, Exotic
	<i>Krascheninnikovia lanata</i>	winterfat	U, G5/S3S5
	<i>Salsola</i> spp.	Russian thistle	U, Exotic
	<i>Salsola tragus</i>	prickly Russian thistle	U, Exotic
Commelinaceae	<i>Tradescantia occidentalis</i>	prairie spiderwort	U
Cyperaceae	<i>Carex</i> spp.	sedge	R
	<i>Carex duriuscula</i>	needleleaf sedge	U
	<i>Carex filifolia</i>	threadleaf sedge	U
	<i>Carex pellita</i>	woolly sedge	R
	<i>Carex praegracilis</i>	clustered field sedge	R
	<i>Schoenoplectus pungens</i>	common threesquare	R
	<i>Schoenoplectus tabernaemontani</i>	softstem bulrush	R
Equisetaceae	<i>Equisetum laevigatum</i>	smooth horsetail	R
Euphorbiaceae	<i>Croton texensis</i>	Texas croton	U
	<i>Euphorbia</i> spp.	spurge	U, Exotic
Fabaceae	<i>Astragalus gracilis</i>	slender milkvetch	U
	<i>Glycyrrhiza lepidota</i>	American licorice	R
	<i>Lathyrus polymorphus</i>	manystem pea	U
	<i>Lupinus plattensis</i>	Nebraska lupine	U
	<i>Lupinus pusillus</i>	rusty lupine	U
	<i>Medicago sativa</i>	alfalfa	U, Exotic
	<i>Psoraleidum lanceolatum</i>	lemon scurfpea	U
	<i>Psoraleidum tenuiflorum</i>	slimflower scurfpea	U

*Conservation rank based on infraspecific (variety or subspecies) level of classification.

Table 4 (continued). List of all plant species identified in Agate Fossil Beds National Monument long-term plant community monitoring plots in 2017. In the Notes column, “U” indicates that a species was identified during upland vegetation monitoring and “R” indicates riparian monitoring. Species found during both visits will have both “U” and “R”. “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 Nebraska in the Notes column. Species considered to be rare are marked with the appropriate global or state conservation ranks, and species not on the NPS species list for AGFO are indicated with “New” in the Notes column.

Family	Scientific Name	Common Name	Notes
Hydrophyllaceae	<i>Ellisia nyctelea</i>	Aunt Lucy	U
Iridaceae	<i>Iris pseudacorus</i>	paleyellow iris	R, Exotic
Juncaceae	<i>Juncus balticus</i>	Baltic rush	R
Lamiaceae	<i>Hedeoma hispida</i>	rough false pennyroyal	U
	<i>Lycopus americanus</i>	American water horehound	R
	<i>Lycopus asper</i>	rough bugleweed	R
	<i>Mentha arvensis</i>	wild mint	R
	<i>Scutellaria lateriflora</i>	blue skullcap	R
Lemnaceae	<i>Lemna minor</i>	common duckweed	R, G5/S3S5
Liliaceae	<i>Fritillaria atropurpurea</i>	spotted fritillary	U, G5/S2
Loasaceae	<i>Mentzelia decapetala</i>	tenpetal blazingstar	U
Malvaceae	<i>Sphaeralcea coccinea</i>	scarlet globemallow	U
Melanthiaceae	<i>Toxicoscordion venenosum</i>	meadow deathcamas	U
Nyctaginaceae	<i>Mirabilis hirsuta</i>	hairy four o'clock	U
Onagraceae	<i>Epilobium ciliatum</i>	fringed willowherb	R
	<i>Epilobium leptophyllum</i>	bog willowherb	R
	<i>Oenothera curtiflora</i>	velvetweed	U
	<i>Oenothera suffrutescens</i>	scarlet beeblossom	U
Orobanchaceae	<i>Orobanche fasciculata</i>	clustered broomrape	U
Papaveraceae	<i>Argemone polyanthemus</i>	crested pricklypoppy	U
Plantaginaceae	<i>Plantago patagonica</i>	woolly plantain	U
Poaceae	<i>Achnatherum hymenoides</i>	Indian ricegrass	U
	<i>Agropyron cristatum</i>	crested wheatgrass	U, Exotic
	<i>Agrostis gigantea</i>	redtop	R, Exotic
	<i>Alopecurus arundinaceus</i>	creeping meadow foxtail	R, Exotic
	<i>Bouteloua gracilis</i>	blue grama	U
	<i>Bromus tectorum</i>	cheatgrass	U, Exotic
	<i>Calamovilfa longifolia</i>	prairie sandreed	U
	<i>Distichlis spicata</i>	saltgrass	R
	<i>Elymus spp.</i>	wildrye	R, Exotic
	<i>Elymus lanceolatus</i>	thickspike wheatgrass	U
	<i>Elymus repens</i>	quackgrass	R, Exotic

*Conservation rank based on infraspecific (variety or subspecies) level of classification.

Table 4 (continued). List of all plant species identified in Agate Fossil Beds National Monument long-term plant community monitoring plots in 2017. In the Notes column, “U” indicates that a species was identified during upland vegetation monitoring and “R” indicates riparian monitoring. Species found during both visits will have both “U” and “R”. “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 Nebraska in the Notes column. Species considered to be rare are marked with the appropriate global or state conservation ranks, and species not on the NPS species list for AGFO are indicated with “New” in the Notes column.

Poaceae, continued	<i>Elymus trachycaulus</i>	slender wheatgrass	U, R
	<i>Hesperostipa comata</i>	needle and thread	U
	<i>Hordeum jubatum</i>	foxtail barley	R
	<i>Koeleria macrantha</i>	prairie Junegrass	U
	<i>Leersia oryzoides</i>	rice cutgrass	R
	<i>Muhlenbergia asperifolia</i>	scratchgrass	R
	<i>Panicum capillare</i>	witchgrass	R, G5/S3S5
	<i>Panicum virgatum</i>	switchgrass	R
	<i>Pascopyrum smithii</i>	western wheatgrass	U, R
	<i>Phalaris arundinacea</i>	reed canarygrass	R, New
	<i>Poa pratensis</i>	Kentucky bluegrass	U, R, Exotic
	<i>Schizachyrium scoparium</i>	little bluestem	U
	<i>Spartina gracilis</i>	alkali cordgrass	R
	<i>Sphenopholis obtusata</i>	prairie wedgescale	R
	<i>Sporobolus cryptandrus</i>	sand dropseed	U
<i>Vulpia octoflora</i>	sixweeks fescue	U	
Polemoniaceae	<i>Phlox andicola</i>	prairie phlox	U
	<i>Phlox hoodii</i>	spiny phlox	U
Polygonaceae	<i>Eriogonum annuum</i>	annual buckwheat	U
	<i>Rumex venosus</i>	veiny dock	U
Potamogetonaceae	<i>Potamogeton spp.</i>	pondweed	R, New
Salicaceae	<i>Salix interior</i>	sandbar willow	R
Santalaceae	<i>Comandra umbellata</i>	bastard toadflax	U
Scrophulariaceae	<i>Penstemon angustifolius</i>	broadbeard beardtongue	U
Solanaceae	<i>Physalis virginiana</i>	Virginia groundcherry	U
Typhaceae	<i>Typha angustifolia</i>	narrowleaf cattail	R
	<i>Typha latifolia</i>	broadleaf cattail	R
Violaceae	<i>Urtica dioica</i>	stinging nettle	R

*Conservation rank based on infraspecific (variety or subspecies) level of classification.

Upland Monitoring

NGPN and NGPFire monitoring crews identified a total of 79 unique plant species in fourteen upland plant community monitoring (PCM) plots visited in 2017 (Table 4). Based on this total, PCM_004 had the highest count with 45 total species (Table 5). This was followed closely by PCM_001 and PCM_017, with 40 and 38 species respectively. These three plots also had the most native species. Absolute cover calculations (Table 6) indicated that the plant communities in plots visited in 2017 had much greater native species cover than exotic species cover. There was only one exception to this in PCM_005, where absolute cover of native and exotic species was almost the same.

NGPN observed disturbances in each of the six plots visited in 2017 (Table 7). The most common disturbances were small mammal activity and prescribed fire. The monitoring crew also assessed the six plots for the presence of early detection exotic species, but none were found in 2017.

Table 5. Total number of plant species identified in each of the 14 upland plots monitored at AGFO in 2017 by NGPN and NGPFire. This is a count of all unique species identified in the plot using species data from point-intercept, quadrat, and target species protocols.

Plot	Burn Unit*	Exotic Species	Native Species	Total Species
AGFO_FPCM_031	River North	2	7	9
AGFO_FPCM_036	Carnegie	1	11	12
AGFO_FPCM_039	Carnegie	0	11	11
AGFO_PCM_001	–	8	32	40
AGFO_PCM_004	–	4	41	45
AGFO_PCM_005	–	10	14	24
AGFO_PCM_008	Carnegie	2	11	13
AGFO_PCM_012	Carnegie	4	15	19
AGFO_PCM_016	–	6	21	27
AGFO_PCM_017	–	9	29	38
AGFO_PCM_019	–	9	13	22
AGFO_PCM_020	Carnegie	1	9	10
AGFO_PCM_021	River North	4	13	17
AGFO_PCM_024	Carnegie	1	10	11

*If plot is visited by Northern Great Plains Fire Effects Program (NGPFire), associated burn unit is listed.

Table 6. Absolute percent cover of native and exotic plant species in plots monitored at AGFO in 2017 by NGPN and NGPFire. 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*	Exotic Species Absolute Cover (%)	Native Species Absolute Cover (%)
AGFO_FPCM_031	River North	6	118
AGFO_FPCM_036	Carnegie	1	93
AGFO_FPCM_039	Carnegie	0	104
AGFO_PCM_001	–	14	149
AGFO_PCM_004	–	0	93
AGFO_PCM_005	–	66	81
AGFO_PCM_008	Carnegie	4	91
AGFO_PCM_012	Carnegie	9	119
AGFO_PCM_016	–	28	126
AGFO_PCM_017	–	25	109
AGFO_PCM_019	–	14	141
AGFO_PCM_020	Carnegie	1	96
AGFO_PCM_021	River North	7	105
AGFO_PCM_024	Carnegie	1	115

*If plot is visited by Northern Great Plains Fire Effects Program (NGPFire), associated burn unit is listed.

Table 7. Disturbance type and area observed in six plots visited at AGFO by NGPN in 2017. The disturbance area was approximated out of a total area of 1000 m².

Plot Name	Disturbance Type	Area (m ²)
AGFO_PCM_001	Small Mammal	15
AGFO_PCM_004	Small Mammal	50
AGFO_PCM_005	Small Mammal	75
	Rx Fire	1000
AGFO_PCM_016	Small Mammal	35
	Rx Fire	1000
AGFO_PCM_017	Animal Trail	10
	Small Mammal	30
	Trash	2
AGFO_PCM_019	Small Mammal	30



Long-term monitoring plot AGFO_PCM_016, located in the south-central part of Agate Fossil Beds National Monument. Photograph courtesy of the National Park Service.

Riparian Monitoring

From the eleven RCM plots visited in 2017, NGPN monitoring crews identified a total of 56 unique plant species (Table 4). Overall, the plots in the riparian corridor have fewer species and have a higher absolute cover of exotic species when compared to the upland plots. Plot RCM_267 had the highest total number of species and the highest number of native species, with 25 and 20 species respectively (Table 8). RCM_261 had the highest absolute cover of native species with 198%, and RCM_260 had the highest absolute cover of exotic species with 112% (Table 9).

One species observed along the riparian corridor, the pale yellow iris (*Iris pseudacorus*), is on the target list for early detection of exotic species. This species was recorded in four of the eleven RCM plots visited by NGPN in 2017: RCM_258, RCM_259, RCM_262, and RCM_267. For a more in-depth discussion on the abundance and cover of pale yellow iris, refer to the 2011-2015 Summary Report for AGFO (Ashton and Davis, 2016).

Table 8. Total number of plant species identified in each of the 11 riparian plots monitored at AGFO in 2017 by NGPN. This is a count of all unique species identified in the plot using species data from the point-intercept protocol.

Plot	Exotic Species	Native Species	Total Species
AGFO_RCM_257	1	7	8
AGFO_RCM_258	4	14	18
AGFO_RCM_259	3	7	10
AGFO_RCM_260	4	13	17
AGFO_RCM_261	3	19	22
AGFO_RCM_262	1	6	7
AGFO_RCM_263	5	12	17
AGFO_RCM_264	4	4	8
AGFO_RCM_265	5	6	11
AGFO_RCM_266	4	9	13
AGFO_RCM_267	5	20	25

Table 9. Absolute percent cover of native and exotic plant species in riparian plots monitored at AGFO in 2017 by NGPN. Absolute percent cover is calculated using the point-intercept data. This includes overlapping species canopies, which can result in values greater than 100%.

Plot	Exotic Species Absolute Cover %	Native Species Absolute Cover %
AGFO_RCM_257	2	130
AGFO_RCM_258	44	100
AGFO_RCM_259	70	102
AGFO_RCM_260	112	168
AGFO_RCM_261	32	198
AGFO_RCM_262	20	150
AGFO_RCM_263	72	122
AGFO_RCM_264	22	12
AGFO_RCM_265	106	108
AGFO_RCM_266	62	94
AGFO_RCM_267	54	148



Photo of NGPN crew monitoring a riparian plant community (RCM) plot at Agate Fossil Beds National Monument in 2017. Photograph courtesy of the National Park Service.

Further Analysis

This 2017 Data Summary Report is intended to provide a basic review of the data collected during the NGPN team's 2017 visit to Agate Fossil Beds National Monument. All data included in this report is available upon request from the Northern Great Plains Inventory and Monitoring Network, plus it is archived at <https://irma.nps.gov/DataStore>.

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