

SURVEY FOR SPECIAL PLANT SPECIES OF CONCERN
IN DEVILS TOWER NATIONAL MONUMENT



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ABSTRACT

Botanical surveys were conducted at Devils Tower National Monument for six special plant species of concern. Data were collected on four of the target species, a fifth additional species of concern was documented, and a status correction was made. Two of the target species were not relocated and possible explanations for failure to relocate the two species are discussed. Among the documented species, Devils Tower NM variously represents the only extant population, the largest populations, or one of few populations in Wyoming. In all cases, the species are at or near their western distribution limits. Incidental to this work, 12 additions to the Devils Tower National Monument flora were found, bringing the tally to 461 species and pointing to the robustness of earlier floristic inventory at the Monument. The rich flora and its biogeographic diversity reflect the significance of this monumental Black Hills landmark as a biological and cultural meeting ground. The Monument provides protection for biogeographically-significant plants that are rare in Wyoming.

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Cover photos: The cover represents the Devils Tower landscape and three of five target species documented in this study: upper right – *Glandularia bipinnatifida*, upper left – Devils Tower, lower left – *Carex emoryi* habitat on the Belle Fourche River, and lower right – *Elymus villosus*.

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INTRODUCTION

Surveys for Wyoming special plant species of concern were conducted at Devils Tower National Monument (NM) to update and expand information on these target species¹ by Wyoming Natural Diversity Database (WYNDD). Even though the identities of special plant species of concern in Devils Tower NM were well-established, information on precise locations, extent, populations and habitat requirements were incomplete.

The target species were first documented at Devils Tower NM as part of a general plant inventory (Marriott 1982), and later recognized as species of conservation concern in Wyoming based on compilation of existing available records across the state over time. . A program was later developed by Marriott for monitoring rare and noxious plant species that included the target species and noxious weed species (Marriott 1989). An updated summary of known target records was provided by Walter Fertig (2000). This was followed by a separate report on the potential vascular plants at the Monument developed by Fertig based on distribution data from the rest of Crook County (Fertig 2001). Over this time period, there were also changes to the target list for Devils Tower NM reflecting changes in the content of the Wyoming plant species of concern list prepared by the Wyoming Natural Diversity Database (WYNDD). Target species were removed from tracking when found to be more widespread in Wyoming than previously known, and target species additions were made in the course of compiling statewide information.

At the start of this project in 2007, at least six target species were known from Devils Tower NM (*Asclepias verticillata*, Whorled milkweed; *Carex emoryi*, Emory's sedge; *Elymus villosus*, Hairy wild-rye; *Glandularia bipinnatifida*, Dakota vervain; *Helianthemum bicknellii*, Plains frostweed, and *Viola pedatifida*, Prairie violet) following the target list in Heidel (2007). Five of the six had been documented in recent decades, and the sixth was based on a historic collection made in 1897 (*Elymus villosus*). All six of the target species are near the western limits of their rangewide distribution rather than species that are imperiled or vulnerable throughout their distribution. A couple species in the Monument that were once considered rare are no longer tracked as Wyoming plant species of concern.

The flora of Devils Tower NM was documented in detail by Marriott (1982). As such, it was one of 245 robust floristic datasets recently used to evaluate floristic biogeography across North America (McLaughlin 2007). Fertig (2001) made nomenclatural updates and compiled additional location data, mainly from vegetation mapping studies (The Nature Conservancy 1996). In the 2001 report Fertig identified 101 plant species as having high or moderate probability of occurring within Monument boundaries, in addition to the 449 already documented. His predictions were based on a model that compared the known flora in Crook County with general habitats in Devils Tower NM. In 2004, Hollis Marriott provided review and certification of plant data for the Monument. This was a first step in the Inventorying and Monitoring program that lead to the current posting of the Monument flora as part of the NPSpecies database (<http://science.nature.nps.gov/im/apps/npspp/>). The species "predicted" by

¹ WYNDD uses a standardized ranking system originally developed by the Nature Conservancy and its network of national heritage programs (now called NatureServe) to assess the global and statewide abundance and probability of extinction of each species and infraspecific taxon. Global ranks and state ranks are used to determine which of Wyoming's native plant species area tracked in the state. The list of target species includes all local endemics and most regionally endemic and disjunct plant species, as well as many peripheral species that are potentially vulnerable in the state.

Fertig (2001) did not represent collections and verifications and were not posted. They did raise questions whether there could be such a significant expansion to the park's flora. For this reason, a secondary objective was added to the study plan to document any additions to the known flora.

STUDY AREA

Devils Tower National Monument protects Devils Tower and provides access to it, a prominent columnar monolith of igneous rock that rises near the banks of the Belle Fourche River in Crook County, Wyoming. It was the first national monument designated in the United States, by President Theodore Roosevelt on September 24, 1906. It is the only unit of the National Park Service (NPS) in northeastern Wyoming, and provides the highest level of protection for biological diversity in this area of the state.

The Monument encompasses an area of 1347 acres (545 ha) that spans 3840-5112 ft (1,272 ft; 388 m) elevation (Figure 1). The singular Devils Tower landform is geologically mapped as an area of Eocene extrusive igneous bedrock (Love and Christianson 1985), surrounded by two older sedimentary formations, the Spearfish Formation and Sundance Formation (of the Triassic-Permian; and of the Upper-Middle Jurassic, respectively). There are two younger Quaternary deposits superimposed, Quaternary alluvium in the Belle Fourche River valley and Quaternary landslide at the base of Devils Tower. The geological map units correspond in part with the soils map units (USDA Soil Conservation Service 1983).

There are extensive baseline studies of Devils Tower NM flora and vegetation. The flora was documented by Marriott (1982), with almost 450 species. The vegetation is comprised of 16 primary vegetation types (The Nature Conservancy 1996). Vegetation mapping work (The Nature Conservancy 1996; Salas and Pucherelli 1998) was used in developing best management practices (BMPs) in the Devils Tower NM Fire Management Plan (www.nps.gov/deto/fmp/index.htm) and the Northern Great Plains Exotic Plant Management Plan (www.northerngreatplains-nps.com). Additional regional baseline studies, local management planning studies, management response research and literature review that provide context for Devils Tower NM natural resources management are presented in Marriott 1989, Marriott and Jones 1989, Marriott 1990, cited in this report, or cited in the current Devils Tower General Management Plan (USDI NPS 2002). This project is intended to help minimize impacts to resources and advance biological diversity conservation in keeping with management practices.

The climate of Devils Tower is a continental climate regime augmented by a montane influence that increases summer precipitation levels. The average monthly temperature is 6.9° C (44.4° F), ranging from monthly averages of 1.3° C (34.3° F) in January to 30.7° C (87.3° F) in July (USDI NOAA 2008 based on data from 1959-2006). The average annual precipitation is 43.46 cm (17.11 in), ranging from 1.52 cm (0.60 in) in January to 7.87 cm (3.10 in) in June. It may be significant that this study followed a drought period. From 2000-2006 there was only one year slightly above average annual precipitation, and two years with extreme low annual precipitation values of little more than 13 cm (about 5 in). By contrast, there had never been annual precipitation values less than 26 cm (about 10 in) since the start of annual climate data record-keeping at Devils Tower that started in 1959. The climate conditions of 2007 and 2008

were mild and well-suited to botanical survey compared to prior years, and to the 1987-1988 period when Marriott (1989) conducted studies. Exceptional spring rainfalls in 2007 provided 12.42 cm (4.89 in) in May alone, which on top of winter precipitation marked the end of prolonged drought (USDI NPS 2007).

METHODS

Survey targets for this project were vascular plant species known from Devils Tower NM that are on the current Wyoming state species of concern list (Heidel 2007). Surveys were done when the phenological conditions of the six target plant species were most conspicuous and their diagnostic characteristics discernible. Field surveys were conducted in early summer for half of the species (June 2007) and later in summer for the rest (July 2008). Field help was provided for one day by Jessica Daniels (NPS) and Jill Larson (WYNDD). Survey of each of the target species began in the vicinity of the original collection locale, and expanded outward in similar habitats identified using black and white aerial photographs and vegetation maps (The Nature Conservancy 1996; Salas and Pucherelli 1998). Background information on the framework for developing and maintaining lists and assigning state ranks to special plant species of concern in Wyoming is presented in Appendix E.

At each site where target species were documented, a sensitive species survey form was filled out (Appendix A), Geographic Positioning Satellite (GPS) points were recorded, and a photograph was taken. Specimen vouchers were collected for target species if the documentation signified new information, and to verify the determinations in difficult groups (sedges and grasses). They are deposited at Mount Rushmore NM with a duplicate on loan to the Rocky Mountain Herbarium at the University of Wyoming in Laramie.

In the interest of checking floristic completeness, surveys were also directed across the full range of habitats present in the study area, with emphasis on wetland and riparian habitats. Emphasis was also given to taxonomic groups that are more difficult to identify, including grasses and sedges. The primary taxonomic key used in the field was Dorn (2001). The Great Plains Flora Association (1986) was consulted for more detailed information. The regional reference by Larson and Johnson (1999) and references for particular plant groups (e.g. sedges; Johnston 2001) were also employed.

The GPS data were used to create points and polygons in the WYNDD database for all documented populations and subpopulations of the target species. Habitat data, population numbers and documentation data were used to update and assign attributes to each population and its parts. These element occurrence records and source feature records are part of the WYNDD statewide database systems used by land managing agencies, researchers and consultants.

RESULTS

Four of the six target species were relocated and surveyed in Devils Tower NM, and an additional species of concern was documented for the first time. A map of all target species currently known from Devils Tower NM is presented in Figure 1, and a summary table of all current and previously reported target species is presented in Table 1.

Figure 1. Map of special plant species of concern at Devils Tower National Monument²

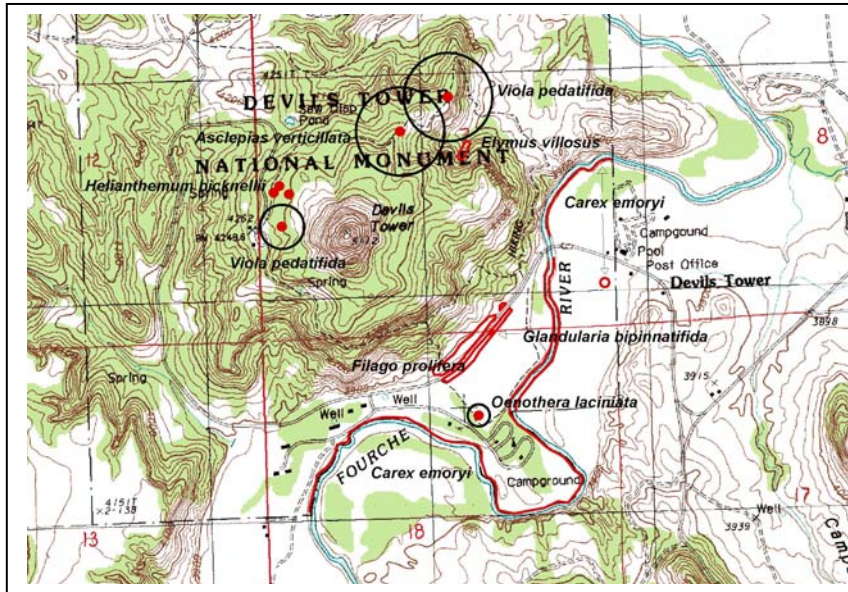


Table 1. Special plant species of concern at Devils Tower National Monument
[Includes current and previously reported target species]

Scientific Name	Common Name	Track ? ³	Re- located?	Heritage Rank	Fed. Status	County	Managed Area
<i>Asclepias verticillata</i>	Whorled milkweed	Yes	No	G5/S1	None	Crook	Devils Tower NM
<i>Carex emoryi</i>	Emory's sedge	Yes	Yes	G5/S1	None	Crook, Goshen Platte?	Devils Tower NM Fort Laramie NM Rawhide WMA
<i>Dichanthelium wilcoxianum</i>	Wilcox's panic grass	No	na	G5/S2	None	Crook Weston	Black Hills NF Devils Tower NM Newcastle BLM
<i>Elymus villosus</i>	Hairy wild-rye	Yes	Yes	G5/S1	None	Crook	Black Hills NF Devils Tower NM Newcastle BLM
<i>Filago prolifera</i>	Rabbit tobacco	Yes	Yes - New	G5/S1	None	Crook Natrona Platte	Devils Tower NM
<i>Glandularia bipinnatifida</i>	Dakota vervain	Yes	Yes	G5/S1	None	Crook Fremont	Devils Tower NM
<i>Helianthemum bicknellii</i>	Plains frostweed	Yes	Yes	G5/S1	None	Crook	Black Hills NF Devils Tower NM Newcastle BLM
<i>Oenothera laciniata</i>	Cut-leaved evening-primrose	Yes	Yes	G5/S1	None	Campbell Crook	Black Hills NF Devils Tower NM
<i>Verbesina encelioides</i>	Cowpen crownbeard	No	na	G5/S2	None	Albany Campbell Converse Crook Goshen Platte Sweetwater	
<i>Viola pedatifida</i>	Prairie violet	Yes	No	G5/S1	None	Crook	Black Hills NF Devils Tower NM Newcastle BLM?

² Collection records that were not relocated in 2007-08 surveys are represented by a point with a buffer of location uncertainty.

³ Plant species that are currently tracked as species of concern (Heidel 2007) are indicated by "Yes" in the Track? Column. All species ranked S1 are known from 5 or fewer extant, well-documented occurrences and are potentially vulnerable in the state.

Survey results for the five relocated target species are presented below. This information is included in the records for each of the Devils Tower NM target species populations (Appendix C; from WYNDD 2008), and accompanying photos are presented (Appendix D). Target species information from Devils Tower NM has been used to prepare or update each state species abstracts (Appendix E). Species abstracts represent the status of rare species in Wyoming, and include lists of supporting references.

At Devils Tower NM, *Carex emoryi* (Emory's sedge) is dominant in almost continuous bands along most of the riverbanks of the Belle Fourche River. It is absent or interrupted where the river cuts into steep upland slopes north of the entrance station, where the river channel was altered immediate south of the entrance stations, as well as at a spot where cutbanks are starting to form. It is present in a small area of abandoned oxbow south of the entrance station, where it was originally documented during vegetation mapping (The Nature Conservancy 1996; Salas and Pucherelli 1998). Its Devils Tower population represents the largest of five known extant populations in Wyoming. The continuity of clumps made it impossible to estimate numbers during this survey, but by their extent, population numbers are inferred to be at least in the 10,000's. *Carex emoryi* is also present on the North Platte River at Fort Laramie National Historic Site, where there is more fluctuation of river levels, an incised channel in places, and more extensive, competing non-native species on the river bank compared to Devils Tower NM. This species cannot be identified without fruit. It produces fruit in late May and early June that readily shatter, and it is possible that it does not produce fruit in unfavorable years. There are non-native species associated with *Carex emoryi* (*Alopecurus arundinaceus*, *Cirsium arvense*, *Euphorbia esula*, *Phalaris arundinacea*, *Phleum pratense*) and there has been major noxious weed control of *Euphorbia esula* in the vicinity. Only *Phalaris arundinacea* appeared to become locally abundant and possibly outcompetes with *Carex emoryi*. The latter is more commonly associated with the native *Spartina pectinata* (Prairie cordgrass) and *Elymus canadensis* (Nodding wild-rye; see cover). Its habitat is affected by water flow regime as regulated by the Keyhole Reservoir dam upstream. *Carex emoryi* forms dense clumps that can approach 1.5 ft (0.5 m) high, and may provide habitat for the Black Hills jumping meadow mouse which has a directly-overlapping distribution in Devils Tower NM.

Elymus villosus (Hairy wild-rye) was collected at Devils Tower in 1897 by D. Griffith. The original collection site was described as "lowland opening." The site documented during this survey is located above and easily accessible from such an opening, but the immediate surroundings would be more precisely described as a deciduous hardwood ravine dominated by *Quercus macrocarpa* (Bur oak) and *Fraxinus pensylvanica* (Green ash), with *Prunus virginiana* (Chokecherry) and *Carex sprengelii* (Sprengel's sedge). The Devils Tower population of hairy wild-rye is one of nine known extant populations in Wyoming. Roughly 500 stems were observed but because the plant grows in clumps, the total number of individuals was much lower. One other native species of wild-rye is common in the same locale (*Elymus virginicus*), and in deciduous woodland ravines elsewhere in the Monument. The hairy wildrye site is particularly sheltered because it is at the base of a north-facing slope on an alluvial fan. The setting has dense grass cover over most of the area and some shrub cover, though less than the nearest deer exclosure study site (Merrill et al. 2003). Some level of browse was observed, in addition to signs of wildlife bedding. There were noxious weeds present, more at the lower

margins than the interior of the stand, including *Euphorbia esula* (Leafy spurge), *Carduus nutans* (Musk thistle) and *Cynoglossum officinale* (Hound's tongue).

Filago prolifera (Rabbit tobacco) was collected for the first time in Devils Tower NM in 2007, an addition to the target species and the flora. It is present in higher parts of the prairie dog town where there is a well-drained 1-5% slope, however slight, rather than on the flats. It is an annual species. The moist growing season conditions of 2007 may have favored a flush of seed germination, or perhaps made it more "robust" and noticeable than this diminutive plant is during most years. Its Devils Tower population represents the largest of four known extant populations in Wyoming. During survey repeated estimates were made of the number of *Filago prolifera* plants per square meter, and were the basis for estimating that total population size is at least in the 10,000's. It is found at gaps in *Buchloe dactyloides* (Buffalo grass) sod; not in the sod nor on the road right-of-way where the sod ends. It occurs with two non-native annual species, *Alyssum desertorum* (Desert alyssum) and *Bromus tectorum* (Cheatgrass) that may possibly compete. The habitat is dissected by the roadway, so any expansion of the right-of-way or visitor pull-offs on either side of the road would directly impact the species. It matures and dries up by late June and does not appear to be affected by foot travel. Its distribution overlaps and encompasses that of *Glandularia bipinnatifida*.

Glandularia bipinnatifida (Dakota vervain) was first collected at Devils Tower NM in 1982 and the population was mapped in detail in 1988 (Marriott 1989). Its Devils Tower population represents the only known extant population in Wyoming. In the original baseline monitoring, the extent of the population was delimited by metal tags attached to the base of the adjoining roadway posts. While the tags are no longer present, the location description and original measurement of the population extent as spanning 13 roadway posts starting at the east end of the second pull-off, was found to be the same in 2007. The population extent was described as app. 5 m x 10 m in 1988, but the population extent was 50 m long as determined with a tape measure in 2007. The numbers in 2007 were estimated at 276 plants, compared to the census of 113 plants in 1988, which may have been affected by drought conditions at the time. This species showed no signs of being browsed despite proximity to active prairie dog mounds, and is generally unpalatable (Larson and Johnson 1999). A more detailed replication of the 1988 baseline might be considered. There are no immediate threats to the existing population barring changes to the road, the pull-off, the management of the road right-of-way, or to the interpretive features at the pull-off.

Helianthemum bicknellii (Plains frostweed) was first collected from the Monument in 1982 from Ponderosa pine forest. Its Devils Tower population represents one of six known populations documented in Wyoming in recent years (1970-2008). Though it is a small population of about 50 plants, the plants were healthy and many had more than one stem. The original locations were described as near the Devils Tower Visitors Center parking lot and at the west base of the tower. The species was found in low numbers in two areas that match these descriptions. In both areas, the species is in places with sparse vegetation, where there is upland moss cover (*Polytrichum* spp.) and relatively low duff. These areas had no fire or low fire intensity (cite) and plants did not occur directly among noxious weeds, though there were patches of *Euphorbia esula* nearby. Rangewide, *Helianthemum bicknellii* is known from "dry sandy soil of open woods and plains (Great Plains Flora Association 1986). In the Black Hills

National Forest, *Helianthemum bicknellii* is known from prescribed burn treatments (Burkhart personal comm. 2008) though its response to fire might be expected to vary with duff depth, fuel load and intensity in general. The two Devils Tower locations are situated between two major trails; some *Helianthemum bicknellii* plants are directly along the lower trail, and there is some off-trail use where the species occurs nearest the upper trail. However, there were no signs of damage to the plants for their proximity to trails, and elsewhere in Wyoming, other populations are found in trail settings, roadsides and abandoned roadbeds.

In addition to target species initially identified, *Oenothera laciniata* (Cut-leaved evening primrose) also was found at the Monument. It belongs on the list of Wyoming plant species of concern as a native species known from five or fewer locations in Wyoming, and possibly affected by management action. It was not on the original list for the project due to an error in the master list (Heidel 2007) from which targets were derived. The original specimen label location was described as in prairie dog town near the amphitheater on disturbed alluvial soil. It was observed in bud in 2007 but there were no survey notes taken. It is one of three target species in the Monument that occupy prairie dog habitat.

The inventory also expanded the known Devils Tower NM flora, with addition of 12 vouchered species (Table 2), for an updated total of 461 species (Appendix F). These additions represent about half of the total collections made during the project (including vouchered target species); all collections are listed in Appendix G. Only four of the 12 additions had been identified on the list of “potential vascular plant flora of Devils Tower National Monument” (Fertig 2001). Almost all of the species added are native species (Table 2). The majority of the species added occupied wetland habitat or settings that are at least seasonally wet (Table 2).

Table 2. Additions to the known vascular plant flora at Devils Tower National Monument

Scientific name	Common Name	Predicted? ⁴	Native?	Terrestrial/ Wetland
<i>Alopecurus arundinaceus</i>	Creeping meadowfoxtail	No	No	Wetland
<i>Carex vulpinoidea</i>	Common fox sedge	No	Yes	Wetland
<i>Carex xerantica</i>	Dryland sedge	No	Yes	~Wetland
<i>Catabrosa aquatica</i>	Brook grass	No	Yes	Wetland
<i>Conium maculatum</i>	Poison hemlock	Yes	No	~Wetland
<i>Eleocharis acicularis</i>	Needle spikerush	Yes	Yes	Wetland
<i>Filago prolifera</i>	Rabbit tobacco	No	Yes	Terrestrial
<i>Glyceria grandis</i>	American mannagrass	Yes	Yes	Wetland
<i>Gnaphalium exilifolium</i>	Slender cudweed	No	Yes	Terrestrial
<i>Juncus torreyi</i>	Torrey's rush	Yes	Yes	Wetland
<i>Physalis heterophylla</i>	Clammy groundcherry	Yes	Yes	Terrestrial
<i>Poa glaucifolia</i>	Pale-leaf bluegrass	No	Yes	~Wetland

⁴ Based on Fertig (2001); Table 2

DISCUSSION

The eight target species of Devils Tower NM reflect its biogeographic significance and the potentially vulnerable components of its flora. These plants represent a spectrum of four different habitats on Devils Tower NM. Three species occupy the black-tailed prairie dog town (*Filago prolifera*, *Glandularia bipinnatifida*, and *Oenothera laciniata*), a natural disturbance regime favoring species adapted to it. The paucity of records statewide for all three species may point to the scarcity of information on the flora of black-tailed prairie dog towns in Wyoming. The *Filago prolifera* population encompasses the *Glandularia bipinnatifida* population and is much more extensive. The presence of *Oenothera laciniata* was noted in surveys for the other two species, but the species had not been targeted for survey and no habitat data were collected. There are also three target species that had been reported from Ponderosa pine forest, but only one of the three (*Helianthemum bicknellii*) could be relocated. The remaining two target species were found on riverbanks (*Carex emoryi*) and in an isolated hardwood ravine (*Elymus villosus*.)

Of the eight target species known or previously documented on Devils Tower NM, only *Carex emoryi* is found on another National Park Service unit in Wyoming. None of the others are known from NPS units or permanently protected sites in the state. Two of the five target species that were relocated during this project are widespread in Devils Tower NM and their local populations represent the largest known in Wyoming (*Carex emoryi*, *Filago prolifera*). One represents the only known extant population in Wyoming (*Glandularia bipinnatifida*). Two of the five target species occur in low numbers or limited areas of Devils Tower NM (*Elymus villosus*, *Helianthemum bicknellii*), though it is noteworthy that the former had not been collected in the area since 1897.

The failure to relocate two species is also significant. *Viola pedatifida* was previously, known from two separate locales on opposite sides of Devils Tower; the more recent one in open woodland near the Visitors Center and the other in grassland. There are several factors and possible explanations for failure to relocate it. Its linear leaflets are inconspicuous among graminoid vegetation, leaf litter and pine needle duff. It produces underground flowers as well as above-ground flowers, and is more easily overlooked in year when above-ground flowers are not produced. One of the two locales is directly above the Devils Tower Visitors Center parking lot, and though last viewed in 1999, was only known to have two plants. There were no estimates of numbers at the other locale. It is possible that the species no longer persists at one or both areas in Devils Tower NM, the suitability of its habitats have changed, e.g., with encroachment of *Euphorbia esula* in the area, with natural succession, or management practices like spot treatment of *Euphorbia esula* in the area impacted the species. In any case, the timing of surveys (including first week of June 2007) and the repeat check for vegetative plants as part of *Helianthemum* surveys (last week of July 2008) mark careful scrutiny with more than one possible explanation for negative results. It is recommended that any weed treatment work in the two locales be preceded by repeated early summer surveys.

The failure to relocate *Asclepias verticillata* is particularly vexing because Devils Tower NM is the only place where this species has been reported in Wyoming. The collection by Marriott (#889) was originally determined as *A. pumila* but later annotated by R. Dorn to *A. verticillata*. In Devils Tower NM, *A. pumila* is widespread in open and semi-open habitats. In

surveying habitat where the controversial specimen was collected, i.e., “Ponderosa pine forest with grass understory on rocky-sandy soil about 600-900 feet northeast of the tower” and similar sites, *A. pumila* and *A. viridiflora* were the only milkweed species that were found.

There are three possible explanations for his failure to relocate *A. verticillata*. First it is possible that the species was simply missed, though it is the species that is more conspicuous than *A. pumila* and the timing was identical with the original collection period. Another possibility is that it no longer persists. However, established perennials are not apt to disappear in the absence of cause, and there would have had to have been a highly localized cause if *A. pumila* still persists in the area. The third possibility is that the original specimen represents an aberrant *A. pumila* individual. One specimen of *A. pumila* was collected during this project, but this hypothesis was not evaluated in the field. A comparison of the original specimen against the key in Dorn (2001) and the species descriptions in the Great Plains Flora Association (1986) is presented in Table 3. Robert Dorn, the author of the Wyoming flora (2001), indicates that in general the “appearance of the two is usually strikingly different, the one short and compact [*A. pumila*], the other tall and loose [*A. verticillata*]” (Dorn personal communication 2008). The specimen in question (*Marriott #889*) has leaves that are loosely-arranged on the stem, though not particularly tall. These characteristics need to be evaluated further in the field by documenting the full range of variability, i.e. all permutations of height, leaf density and orientation, and flower dimensions, in the area of the original collection and along surrounding environmental gradients. With the information currently at hand, *A. verticillata* remains on the tracking list of WYNDD and the Devils Tower record is kept in the database with note that survey efforts in 2008 failed to find it.

Table 3. Evaluation of the *Asclepias verticillata* specimen collected at Devils Tower National Monument against primary taxonomic references

[Comparison of *Marriott #889* against the Dorn (2001) key and the Great Plains Flora Association (1986) description]

Characteristics	DEVILS TOWER SPECIMEN	<i>Asclepias verticillata</i>		<i>Asclepias pumila</i>	
		Great Plains Flora Association (1986)	Dorn (2001)	Great Plains Flora Association (1986)	Dorn (2001)
Underground structure	Rhizomatous(?)	Sparingly branched rootcrown		Taproot or slender rhizome	
Stem height	2-2.4 dm	3.5-9 dm	Mostly grter than 2 dm	0.5-4 dm	Mostly less than 2 dm
Position of leaves	Almost all on the lower 2/3 of the plant have 3 leaves per node	Verticillate to subverticillate, mostly 3-6 per node	Leaves mostly whorled	Alternate in a tight spiral, or whorled near base	Spirally arranged, very crowded
Leaf shape	4.4-4.8 cm max.	Filiform; 1.5-8 cm long, 0.5-1.5 mm wide	Mostly 4 cm or less long	Filiform, 1.5-6 cm long, 0.5-1 mm wide	Sometimes over 4 cm long
Pedicels	11 mm	Filiform, 5-11 mm		Filiform, 4-12 mm	
Flowers		5.5-7.5 mm tall		5-8 mm tall	
Calyx lobes		Green to purple, 1.2-2.5		Green to purple, 1.5-2.6	
Corolla lobes	3.5 mm	White to greenish-white or purple tinged, reflexed, 3.5-4.5		White or tinged with rose or yellow-green, reflexed, 2-8-4.2	
Gynostegium		Greenish white, stipitate, glabrous		Greenish white, stipitate, glabrous,	
Column	1.3 mm	Subcylindric, 0.7-1.1mm, horns acicular, arching over the anther		subcylindric, 1.6-1.9 mm, horns acicular, arching over the anther	

This study points to the need for further consideration of the flora of black-tailed prairie dog towns in Wyoming, using Devils Tower NM records as a springboard. The management of rare plant species in prairie dog towns is linked to the health of the prairie dog colony. The only other requisite measure is ensuring that dryland noxious weeds do not enter the colony and become established. Invasion by species like *Hyoscyamus niger* (henbane) are possible. The treatment of target species in such disturbed settings poses a special challenge to botanists using rule-based criteria for defining rarity, not wanting to dismiss disturbance-adapted native species with a place in the state flora as unimportant. Prairie dog towns at the margins of a species' range may have a conservation biology role, even for species such as *Oenothera laciniata*, though referred to by the Great Plains Flora Association (1986) as "a common weed of fields, pastures, stream valleys, open woodlands, prairie ravines, roadsides, and waste places." It is also possible that the prairie dog town flora, like other disturbed floras, has dynamic species composition. It might be "natural" for species to become established and also to become locally extirpated. Devils Tower NM provides a unique opportunity to evaluate the possible dynamics.

Among the twelve additions to the Monument flora, seven of the species are native wetland species, three are native terrestrial species, and two are exotic wetland species. The wetland additions to the flora were collected in an ephemeral wetland (one), a seep (one), on the river (two), and at one of the three spring-fed streams in the Monument (five). One of the new exotic species, *Conium maculatum* (Poison hemlock), was a discovery made by Taryn Flesjer of the National Park Service. It was subsequently collected and confirmed as part of this study. It appears to be a recent introduction based on single location, young age of plants, and proximity to one of the most heavily-visited places in the Monument near the Visitors Center. The plant was sprayed by herbicide in 2007 but the species reappeared in 2008. Poison hemlock is recognized as noxious in Idaho, Oregon and Washington. It points to the ongoing possibility of noxious weed introductions to the flora, and it highlights the benefits of vigilance.

Of the twelve species added to the flora, only four had been identified as likely to be found on Fertig's list of potential species (2001). The survey results point to the rigor of the original work (Marriott 1982) and the low likelihood of very many additional species being found. During the first field visit, most of the potentially new species that were observed in vegetative condition later proved to be species that are already documented. There was at least one species, *Munroa squarrosa*, that remained on the working list of potentially new species which was never confirmed or refuted.

This study did not aim to relocate previously documented members of the flora or to advance monitoring. The persistence/viability of woodland flora may warrant further consideration in the future in light of noxious weed invasion, intensive and extensive weed control work, and management initiatives to restore natural fire regimes.

Ongoing restoration of 50 acres of meadow located west of Administrative offices, previously plowed, will ideally include native species adapted to the area. For both management and natural resource baselines, a list and records of each species included in the mix and its original seed source will ideally be maintained and cross-referenced in the master flora and in GIS natural resource databases.

The Devils Tower NM has an exceptionally rich flora that complements its recognition as a national monument. There are currently 1023 species known from Crook County, WY as reported in Dorn (2001), of which 59.6% are present in Devils Tower NM. The floras of Devils Tower NM as currently known and Fort Laramie National Historic Site (376 species; Heidel 2004) complement one another with combined floras of 661 species (less than 50% overlap between the two). Fort Laramie National Historic Site has a relatively larger component of southern Great Plains species, while the Devils Tower flora has a much larger component of Rocky Mountain and eastern deciduous forest species. In both units, the wetland flora contributes significantly over 10% to total numbers (at least 55 species at Devils Tower=11.9% and at least 53 species at Fort Laramie=14.1%), reflecting on the persistence of the wetland flora despite alterations and uses, and on their respective wetland habitat diversity that includes springs and extensive riparian zones.

The flora of Devils Tower NM is posted as part of NPSpecies for reference (<http://science.nature.nps.gov/im/apps/npspp/>) and the 12 species are appropriate to add to it. There is a Devils Tower wildflower checklist (Marriott 1995) and a Devils Tower tree checklist (San Miguel and Marriott 1996) that are excellent introductions for the general public, and also posted at the Devils Tower NM homepage. In addition, interpretive programs might be advanced by presenting information on the most conspicuous plants of the landscape and on important cultural plants as windows into the history of the Monument. Culturally significant plants are cited in the USDA Plants Database (<http://plants.usda.gov/>) and in ethnobotany books that address the floras and cultures of the area. Beyond this, it might be of interest to develop a complete checklist publication, organized by both common and scientific names, for people interested in exploring the flora on their own.

While this survey has added site-specific information for five target species, the status information for three target species in Devils Tower NM is incomplete. Additional surveys are warranted for *Asclepias verticillata* in late July with key taxonomic characteristics in mind, for *Oenothera laciniata* in July, and for *Viola pedatifida* in early June. The Devils Tower photos provided in Appendix C and the state plant species abstracts in Appendix D can be used by NPS staff for surveys for these purposes, with minimum standards for documentation. The maps of target species distribution as presented in Appendix B are also being provided as GIS layers that can be incorporated as natural resource GIS themes for management and planning.

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