ABSTRACT

Alabaster Caverns State Park is located in the Cimarron Gypsum Hills of northwestern Oklahoma, a semi-arid region of the state. The majority of the park is dominated by mixed-grass prairie and gypsum outcrops, with some riparian habitat and wooded north-facing slopes. A vascular plant inventory conducted from 2004 through 2007 yielded 274 species in 199 genera and 66 families. The largest families were the Poaceae (52 species), Asteraceae (47), and Fabaceae (23). There were 100 annuals, 6 biennials, and 163 perennials, as well as 5 species that have more than one life history form. Forty-two species (15.3%) were not native to North America. Three taxa currently being tracked by the Oklahoma Natural Heritage Inventory (2012) were present: Echinocereus reichenbachii (S3G5), Haploesthes greggii (S1G4?), and Marsilea vestita (S1G5). Compared to floristic inventories of sites in the Cimarron Gypsum Hills that are less impacted by public visitation, but more intensively grazed, Alabaster Caverns State Park has a higher number of species as well as a higher proportion of introduced species.

INTRODUCTION

Palmer et al. (1995) summarized the importance of floristic inventories in providing data for research on biodiversity, environmental impact assessment, and management decisions. The need for further studies of the vascular flora of the Gypsum Hills Physiographic Province was noted by Hoagland (2000). Since that time, two publications have provided floristic inventories of areas within the Cimarron Gypsum Hills of northwestern Oklahoma. Buckallew and Caddell (2003, 2004) summarized the vascular flora of the Selman Living Laboratory, located approximately 6 miles west of Alabaster Caverns State Park in Woodward County. It supports primarily mixed-grass prairie and gypsum outcrop communities and was part of the Selman Ranch until 1998. Hoagland and Buthod (2005) surveyed a gypsum-dominated, currently-grazed ranch located approximately 24 miles southeast of Alabaster Caverns in Major County. Alabaster Caverns was established as a state park in the 1950s and therefore has a different land-use history. It is heavily visited by the public and is a site on the Western Oklahoma Wildlife Trail. The objectives of this inventory were to contribute to our knowledge of plant distributions in Oklahoma and in the Cimarron Gypsum Hills; to compare the vascular flora of Alabaster Caverns State Park to that of previously-described, more intensively-grazed but less heavily-visited sites in the Cimarron Gypsum Hills; and to provide a resource that
can be used by state park personnel for education and conservation purposes.

**STUDY AREA**

Alabaster Caverns State Park is located in Woodward County, Oklahoma (36°42'00"N, -99°08'47"W; T26N R18W SW1/4 of Sec. 28 and NW1/4 of NW1/4 of Sec. 33). The land for the park was purchased by the State of Oklahoma in 1953. It became a state park in 1956 (Allen 2007) and is managed by the Oklahoma Tourism and Recreation Department. The park consists of approximately 81 hectares (=200 acres). Cedar Creek, a tributary of Long Creek, flows west to east through Cedar Canyon and roughly bisects the park. Elevation ranges from about 488 m to 532 m.

The climate is semi-arid. According to climate data for Woodward County (Oklahoma Climatological Survey 2012), average annual precipitation is about 61 cm. The growing season lasts approximately 186 days, from mid-April to mid-October. The mean annual temperature is 15.6º C, with daily average temperatures ranging from 2.0º C in January to 27.8º C in July. Temperatures range from an average low of -5.6º C in January to an average daytime high of 35º C in July. Winds average 11 miles per hour and most often are from the south or southwest.

Alabaster Caverns lies in the Cimarron Gypsum Hills Province of Oklahoma (Curtis et al. 1979). Most of the park is underlain by the Blaine Formation, consisting of alternating layers of gypsum and shale formed during the Permian Period. The gypsum outcrops on the site belong to this formation. The Flowerpot Shale, which underlies the Blaine Formation, is exposed in Cedar Canyon (Meyers et al. 1969). Soils belong to the Vernon-Cottonwood Association and are excessively-drained loams and clay loams that have formed from gypsum and gypsiferous shales (Nance et al. 1963). The potential vegetation type is mixed grass (Duck and Fletcher 1943).

**METHODS**

We intensively surveyed the site throughout the growing seasons of 2004 and 2005. During those years, we visited the site 19 times, from May through October of 2004, and from April to October of 2005. We also surveyed the site in March and May of 2006. During most visits, we walked the areas both north and south of the canyon, and attempted to visit all major habitats within the park. We recorded all vascular plant species we encountered, noted whether they were in flower or fruit, and collected voucher specimens. We collected exotic species only from naturalized populations, excluding cultivated species from around the visitor center and campgrounds. A few species were identified by sight and documented only by photographs, generally because of their rarity at the site or their rarity status in Oklahoma. We added a few species to our vascular plant species list during plot sampling in 2006 and 2007 for a study of the vascular plant communities across the Cimarron Gypsum Hills (Rice 2008). References used for specimen identification included Hitchcock (1971), Great Plains Flora Association (1986), Diggs et al. (1999), Tyrl et al. (2005, 2010), and Barkworth et al. (2007). The organization of taxa in our species list is based on Angiosperm Phylogeny Group (APG III) recommendations (Stevens 2012), and nomenclature follows the PLANTS Database compiled by the United States Department of Agriculture, Natural Resources Conservation Service (USDA, NRCS 2012). The PLANTS Database was also used to determine whether each species was native to North America or introduced, and whether it was an annual, biennial, or perennial. In cases where species have more than one life form across their range, we noted the life form(s) encountered at Alabaster Caverns State Park. Voucher specimens were deposited in the University of Central Oklahoma (CSU) Herbarium.
RESULTS AND DISCUSSION

We identified 274 species in 199 genera and 66 families (Table 1, Appendix). These included 4 monilophyes (1 species of horsetail and 3 ferns), 1 gymnosperm, 210 eudicots, and 59 monocots. There was one additional subspecific taxon. Species in the Poaceae (52), Asteraceae (47), and Fabaceae (23) far outnumbered those in other families. Only 7 other families were represented by more than 5 species: Euphorbiaceae (11), Brassicaceae (8), Caryophyllaceae (7), Plantaginaceae (7), Solanaceae (7), Apocynaceae (6), and Onagraceae (6). The largest genera were Astragalus (6 species), Oenothera (6), Chamaesyce (5), and Asclepias (5). One hundred species were annuals, 6 were biennials, and 163 were perennials. Five species had more than one life form. Thirty-six species were trees (18 species), shrubs (12), or woody vines (6). Cylindropuntia imbricata is included on the species list because it apparently has escaped from cultivation within the park.

Three taxa tracked by the Oklahoma Natural Heritage Inventory (2012) were present: Marsilea vestita (S1G5), Haploesthes gregii (S1G4?), and Echinocereus reichenbachii (S3G5). Rarity ranks, in parentheses, range from 1 (critically imperiled) to 5 (demonstrably secure) at the state (S) and global (G) levels.

The park includes primarily mixed-grass prairie and gypsum outcrop plant communities. The major plant association (Hoagland 2000) is the Schizachyrium scoparium-Castilleja purpurea var. citrina-Lesquerella gordonii herbaceous association. The north-facing slopes are wooded, and the ravines of Cedar Canyon are dominated by Juniperus virginiana. The areas adjacent to the visitor center and within and adjacent to the park’s two campgrounds are disturbed. Although the area south of the canyon has not been grazed since the 1950s, the area north of Cedar Canyon was leased for grazing until 1997 (Caywood 2006), and contains some old-field vegetation. Wetland and riparian vegetation is found along Cedar Creek and on the edges of a pond near the western boundary of the park.

Forty-two species (15.3 %) in 16 families were not native to North America. Four of these species (Bothriochloa ischaemum, Bromus tectorum, Sorghum halepense, and Tamarix ramosissima) are listed as Oklahoma problem species, 4 (Ailanthus altissima, Erodium cicutarium, Melilotus officinalis, and Ulmus pumila) are on the Oklahoma Watch List, and 14 are problems in border states (Oklahoma Invasive Plants Council 2012). Seventeen species of Poaceae were introduced.

Compared with the recently-grazed Selman Living Lab (Buckallew and Caddell 2003, 2004) and the currently-grazed Major County ranch (Hoagland and Buthod 2005), Alabaster Caverns State Park had a higher number of plant species, although it is smaller (81 ha) than the Selman Living Lab (129.5 ha) and approximately the same size as the Major County ranch (80+ ha). The higher number of species is in part due to the higher number and proportion of introduced species at Alabaster Caverns. Of the 229 species at the Selman Living Lab, 21 (9%) were introduced. Of the 233 species at the Major County ranch, 22 (10.6%) were introduced. The higher number of introduced species at Alabaster Caverns can be attributed to disturbance associated with the high number of visitors to the park, especially around the visitor center and campgrounds. Of the 274 species at Alabaster Caverns State Park, 175 also occur at the Selman Living Lab. Of the 99 species that occur at Alabaster Caverns but not at the Selman Living Lab, 33 are introduced species. Other differences in species composition are due to differences in land-use history and habitats between the two sites; the Selman Living Lab had been recently grazed when it was inventoried, and it includes sandsage grassland as well as a much larger floodplain than Alabaster Caverns State Park. Although the northern part of Alabaster Caverns State Park was grazed recently, the southern part has not been grazed since the 1950s. Because the Selman Living Lab is located only 6 miles...
to the west of Alabaster Caverns State Park, annual temperature and precipitation are the same, and therefore do not contribute to differences in species composition. Alabaster Caverns State Park shares 163 species with the Major County ranch. Differences in species composition between those 2 sites can be attributed in part to their different grazing histories as well as to some differences in habitats. The Major County Ranch is grazed currently, and contains a large pond, disturbed areas associated with oil well pads, and more roads than Alabaster Caverns State Park.

Environmental factors also differ between the sites. Although average temperature differs by only 1° C, average annual precipitation is approximately 61 cm for Alabaster Caverns State Park and approximately 70 cm for the Major County ranch.

The major vegetation associations at Alabaster Caverns and brief descriptions of common species are as follows:

1. Schizachyrium scoparium-Castilleja purpurea var. cirtina-Lesquerella gordonii herbaceous association

   This was the predominant vegetation association in the park, on the gypsum outcrops and shallow soils on gypsum (Figures 1-3). Common associated species included Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Chamaesyce glyptosperma, Croton monanthogynous, Dalea enneandra, Echinocereus reichenbachii, Heterotheca stenophylla, Lithospermum incisum, Mentzelia nuda, Mentzelia oligosperma, Nama stevensii, Oenothera hartwegii, Oenothera serrulata, Opuntia phaeacantha, Paronychia jamesii, Phacelia integrifolia, Polanisia dodecandra, Polysgala alba, Portulaca pilosa, Psilotrophe tagetina, Sporobulus cryptandrus, Thelesperma magapotamicum, Tridens nuticus var. elongatus, and Yucca glauca. Two of these species, Phacelia integrifolia (Figure 4) and Nama stevensii (Figure 5), as well as the less-commonly encountered Haploesthes greggii (Figure 6), are found only on gypsum substrates in Oklahoma and are considered obligate gypsumophiles. Two of the species in this habitat, Echinocereus reichenbachii (Figure 7) and Haploesthes greggii, are being tracked by the Oklahoma Natural Heritage Inventory. Woody species occurred mainly on the steep north-facing slopes and ravines of Cedar Canyon, and included Celtis laevigata var. reticulata, Cornus drummondii, Gleditsia triacanthos, Juniperus virginiana, Morus rubra, Rhus glabra, Rhus aromatica, Ribes aureum, Sapindus saponaria, Sideroxylon lanuginosum, Symphoricarpus orbiculatus, Ulmus americana, Ulmus rubra, and Vitis acerifolia.

2. Wetland and riparian vegetation

   This vegetation was found along the banks of Cedar Creek as well as the margins of the pond. Associated species included Amorpha fruticosa, Baccharis salicina, Carex gravenia, Eleocharis montevidensis, Equisetum spp., Nasturtium officinale, Phluea odorata, Populus deltoides, Rannunculus seleratus, Salix nigra, and Vitis riparia. A wet depression in the grassland on the north side of the canyon supported Marsilea vestita, a species tracked by the Oklahoma Natural Heritage Inventory.

3. Disturbed areas and old-field vegetation

   This type of vegetation was found in disturbed areas along roadsides and trails near the visitor center, in campgrounds, and in areas with deeper soils north of the canyon that were grazed until 1997. Common species in disturbed areas along roadsides, trails, and campgrounds were Arenaria serpyllifolia, Bothriochloa ischaemum, Bromus spp., Chamaesarcabula conoides, Digitaria ciliaris, Erodium cicutarium, Equisetum var. orbiculatus, Glandularia pulvina, Holostenum umbellatum, Lamium amplexicaule, Melilotus officinalis, Quinclus lobata, Veronica spp., and Tribulus terrestris. Common species in old fields included Ambrosia psilostachya, Amphiachyris dracunculoides, Aristida oligantha, Artemisia ludoviciana, Bothriochloa lagunoides, Bromus spp., Chamaesycce spp., and Gutierrezia sarothrae. Many of these species increase with grazing. Thickets of Prunus angustifolia were also present.
ACKNOWLEDGMENTS

We thank Tom Creider of the Oklahoma Department of Tourism and Recreation, as well as Dean Taylor and Mike Caywood of Alabaster Caverns State Park, for permission to conduct this study. Funding for the 2005 season was provided by a mini-grant from the University of Central Oklahoma Joe Jackson College of Graduate Studies and Research. We also thank William Caire for his assistance with collections, and anonymous reviewers for constructive suggestions.

Table 1  Summary of floristic collections from Alabaster Caverns State Park in the Cimarron Gypsum Hills, Woodward County, Oklahoma*

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<th>Taxonomic Group</th>
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<th>Species</th>
<th>Native spp.</th>
<th>Exotic spp.</th>
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<td>274</td>
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*Table format follows Palmer et al. (1995)
LITERATURE CITED


Available from: http://www.mobot.org/MOBOT/research/APweb/


APPENDIX

Annotated species list for Alabaster Caverns State Park, Woodward County, Oklahoma. Nomenclature and common names are based on USDA, NRCS (2012). Organization of taxa is based on Angiosperm Phylogeny Group (APG III) recommendations (Stevens 2012). Life history (A=annual, B=biennial, P=perennial) and collection numbers follow the species names. Taxa introduced to North America are indicated with an asterisk (*) and those on the Oklahoma Natural Heritage Inventory Plant Tracking List are indicated with a symbol (+). Voucher specimens were deposited in the University of Central Oklahoma Herbarium (CSU).

MONOXYLPHYTA
Equisetaceae
*Equisetum L sp. (horsetail) – P; GMC1215

Marsileaceae
+Marsilea vestita Hook & Grev. (hairy waterclover) – P; GMC1145

Pteridaceae
Cheilanthes feei T. Moore (slender lipfern) – P; GMC800
Pellaea atropurpurea (L.) Link (purple cliffbreak) – P; GMC815

GYMNOSPERMS/PINOPHYTA
Cupressaceae
Juniperus virginiana L. var. virginiana (eastern redcedar) – P; GMC816

ANGIOSPERMS/MAGNOLIOPHYTA
EUDICOTS
Amaranthaceae
Amaranthus tuberculatus (Moq.) Sauer (roughfruit amaranth) – A; GMC1245
*Chenopodium album L. var. album (lambsquarters) – A; KR930
Chenopodium berlandieri Moq. (pitseed goosefoot) – A; GMC1217

Anacardiaceae
Rhus aromatica Aiton – P; GMC811
Rhus copallinum L. (winged sumac) – P; GMC1177
Rhus glabra L. (smooth sumac) – P; GMC849
Toxicodendron radicans (L.) Kuntze (eastern poison ivy) – P; GMC1267

Apocynaceae
Ammoselinum popei Torr. & A. Gray (plains sandparsley) – A; KR753
Sanicula canadensis L. (Canadian blacksnakeroot) – B; GMC1170
Spermolepis inermis (Nutt. ex DC.) Mathias & Constance (Red River scaleseed) – A; GMC1165

Apocynaceae
Apocynum cannabinum L. (Indianhemp) – P; GMC 1137
Asclepias asperula (Decne.) Woodson ssp. capricornu (Woodson) Woodson (antelopehorns) – P; GMC1096

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Asclepias engelmanniana Woodson (Engelmann’s milkweed) – P; GMC1186  
Asclepias latifolia (Torr.) Raf. (broadleaf milkweed) – P; GMC1189  
Asclepias viridiflora Raf. (green comet milkweed) – P; GMC870  
Asclepias viridis Walter (green antelopehorn) – P; GMC1136  

*Asteraceae*  
*Achillea millefolium* L. (common yarrow) – P; GMC1107  
*Ambrosia psilostachya* DC. (Cuman ragweed) – P; GMC897  
*Ambrosia trifida* L. (great ragweed) – A; GMC914  
*Amphiachyris dracunculoides* (DC.) Nutt. (prairie broomweed) – A; GMC922  
*Artemisia dracunculus* L. (tarragon) – P; GMC921  
*Artemisia filifolia* Torr. (sand sagebrush) – P; GMC895  
*Artemisia ludoviciana* Nutt. ssp. *ludoviciana* (white sagebrush) – P; GMC941  
*Baccharis salicina* Torrey & A. Gray (willow baccharis) – P; GMC901  
*Brickellia eupatorioides* (L.) Shinners var. *corymbulosa* (Torr. & A. Gray) Shinners  
(false boneset) – P; GMC1242  
*Chaetopappa ericoides* (Torr.) G. L. Nesom (rose heath) – P; GMC1063  
*Cirsium undulatum* (Nutt.) Spreng. (wavy leaf thistle) – P; GMC1161  
*Conyza canadensis* (L.) Cronquist (Canadian horseweed) – A; KR929  
*Conyza ramosissima* Cronquist (dwarf horseweed) – A; GMC1256  
*Echinacea angustifolia* DC. (blacksamson echinacea) – P; GMC1136  
*Erigeron cf. divergens* Torr. & A. Gray (spreading fleabane) – B; GMC973  
*Erigeron strigosus* Muhl. ex Willd. (prairie fleabane) – A; GMC1097  
*Evax prolifera* Nutt. ex DC. (bighead pygmycudweed) – A; GMC1030  
*Gaillardia pulchella* Foug. (Indian blanket) – A; GMC828  
*Gaillardia suavis* (A. Gray & Engelm.) Britton & Rusby (perfumeballs) – P; GMC1133  
*Grindelia papposa* G. L. Nesom and Suh (Spanish gold) – A; GMC1203  
*Grindelia squarrosa* (Pursh) Dunal (curlycup gumweed) – B; GMC935  
*Gutierrezia sarothrae* (Pursh) Britton & Rusby (broom snakeroot) – P; GMC907  
+*Haploesthes greggii* A. Gray (false broomweed) – P; GMC1147  
*Helianthus annuus* L. (common sunflower) – A; GMC854  
*Helianthus petiolaris* Nutt. (prairie sunflower) – A; GMC1244  
*Heterotheca stenophylla* (A. Gray) Shinners (stiffleaf false goldenaster) – P; GMC891  
*Hymenopappus tenuifolius* Pursh (Chalk Hill hymenopappus) – B; GMC1128  
*Iva annua* L. (annual marshelder) – A; GMC1257  
*Lactuca ludoviciana* (Nutt.) Riddell (biannual lettuce) – B; GMC814  
*Liatris punctata* Hook. (dotted blazing star) – P; GMC926  
*Machaeranthera pinnatifida* (Hook.) Shinners (tansyaster) – P; GMC1160  
*Packera platensis* (Nutt.) W.A. Weber & Á. Löve (prairie groundsel) – B, P; GMC1104  
*Pluchea odorata* (L.) Cass. (sweetscent) – A; GMC1251  
*Psilostrophe tagetina* (Nutt.) Greene var. *cerifera* (A. Nelson) B. L. Turner (woolly paperflower) – P; GMC843  
*Pyrrhopappus grandiflorus* (Nutt.) Nutt. (tuberous desert-chicory) – P; GMC1005  
*Ratibida columnifera* (Nutt.) Woot. & Standl. (upright prairie coneflower) – P; GMC1113  
*Senecio riddellii* Torr. & A. Gray (Riddell’s ragweed) – P  
*Solidago missouriensis* Nutt. var. *fasciculata* Holz (Missouri goldenrod) – P; GMC1220  
*Solidago petiolaris* Aiton (downy ragged goldenrod) – P; GMC908
*Sonchus asper* (L.) Hill (spiny sowthistle) – A; GMC1142  
*Sympotrichum ericoides* (L.) G. L. Nesom (white heath aster) – P; GMC944  
*Taraxacum officinale* F. H. Wigg (common dandelion) – P; GMC822  
*Tetranerus scaposa* (DC.) Greene (stemmy four-nerve daisy) – P; GMC1053  
*Thelesperma megapotamicum* (Spreng.) Kuntze (Hopi tea greenthread) – P; GMC803  
*Tragopogon dubius* Scop. (yellow salsify) – B; GMC1143  
*Vernonia baldwinii* Torr. (Baldwin’s ironweed) – P; GMC900, GMC864  
*Xanthium strumarium* L. var. *canadense* (Mill.) Torr. & Gray (Canada cocklebur) – A; GMC1253

**Boraginaceae**  
*Lappula occidentalis* (S. Watson) Greene (flatspine stickseed) – A; KR752  
*Lithospermum incisum* Lehm. (narrowleaf stoneseed) – P; GMC968

**Brassicaceae**  
*Camelina rumelica* Velen. (graceful false flax) – A; GMC1089  
*Capsella bursa-pastoris* (L.) Medik. (shepherd’s purse) – A; GMC979  
*Descurainia pinnata* (Walter) Britton (western tansymustard) – A; GMC1031  
*Draba reptans* (Lam.) Fernald (Carolina draba) – A; GMC965  
*Lepidium densiforum* Schrad. (common pepperweed) – A; GMC1086  
*Lepidium oblongum* Small (veiny pepperweed) – A, B; GMC1081, GMC963  
*Lesquerella gordonii* (A. Gray) S. Watson (Gordon’s bladderpod) – A; GMC966, GMC1057  
*Nasturtium officinale* W.T. Aiton (watercress) – P; GMC1179

**Cactaceae**  
*Cylindropuntia imbricata* (Haw.) F.M.Knuth (tree cholla) – P  
*Echinocereus reichenbachii* (Terscheck ex Walp.) hort ex Haage (lace hedgehog cactus) – P  
*Escobaria missouriensis* (Sweet) D.R. Hunt (Missouri foxtail cactus) – P; GMC1195  
*Escobaria vivipara* (Nutt.) Buxbaum var. *vivipara* (spinystar) – P; GMC1164  
*Opuntia phaeacantha* Engelm. (tulip pricklypear) – P; GMC1144

**Campanulaceae**  
*Triodanis perfoliata* (L.) Nieuwl. (clasping Venus’ looking-glass) – A; GMC1122

**Cannabaceae**  
*Celtis laevigata* Willd. var. *laevigata* (sugarberry) – P; GMC1071  
*Celtis laevigata* Willd. var. *reticulata* (Torr.) L.D. Benson (netleaf hackberry) – P; GMC917  
*Celtis occidentalis* L. (common hackberry) – P; GMC804

**Caprifoliaceae**  
*Symphoricarpos orbiculatus* Moench (coralberry) – P; GMC915

**Caryophyllaceae**  
*Arenaria serpyllifolia* L. (thymeleaf sandwort) – A; GMC821  
*Cerastium nutans* Raf. (nodding chickweed) – A; GMC1064  
*Cerastium pumilum* W. Curtis (European chickweed) – A; GMC1039  
*Holosteum umbellatum* L. (jagged chickweed) – A; GMC976  
*Paronychia jamesii* Torr. & A. Gray (James’ nailwort) – P; GMC883

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Silene antirrhina L. (sleepy silene) – A; GMC1123
*Stellaria media (L.) Vill. ssp. pallida (Dumort) Asch. & Graebon. (common chickweed) – A; GMC1014

**Celastraceae**
Celastrus scandens L. (American bittersweet) – P; GMC1002

**Cleomaceae**
Polanisia dodecandra (L.) DC. (redwhisker clammyweed) – A; GMC868

**Clusiaceae**
*Hypericum perforatum* L. (common St. Johnswort) – P; GMC1166

**Convolvulaceae**
Evolvulus nuttallianus Schult. (shaggy dwarf morning-glory) – P; GMC1088
Ipomoea leptophylla Torr (bush morning-glory) – P; GMC1146

**Cornaceae**
Cornus drummondii C.A. Mey. (roughleaf dogwood) – P; GMC799

**Cucurbitaceae**
Cucurbita foetidissima Kunth (Missouri gourd) – P; GMC1172

**Euphorbiaceae**
Acalypha ostryifolia Riddell (pineland threeseed mercury) – A; GMC927
Chamaesyce stictospora (Engelm.) Small (slimseed sandmat) – A; GMC892
Chamaesyce glyptosperma (Engelm.) Small (ribseed sandmat) – A; GMC1219
Chamaesyce maculata (L.) Small (spotted sandmat) – A; GMC1241
Chamaesyce missurica (Raf.) Shinners (prairie sandmat) – A; GMC869
Chamaesyce serpens (Kunth) Small (matted sandmat) – A; GMC1259
Croton monanthogynus Michx. (prairie tea) – A; GMC930
Croton texensis (Klotzsch) Mull. Arg. (Texas croton) – A; GMC886, GMC862, GMC902
Euphorbia dentata Michx. (toothed spurge) – A; GMC953
Euphorbia marginata Pursh (snow on the mountain) – A; GMC937
Euphorbia spathulata Lam. (warty spurge) – A; GMC1060

**Fabaceae**
Amorpha canescens Pursh (leadplant) – P; GMC825
Amorpha fruticosa L. (false indigo bush) – P; GMC840
Astragalus gracilis Nutt. (slender milkvetch) – P; GMC993
Astragalus lotiflorus Hook. (lotus milkvetch) – P; GMC967, GMC992
Astragalus missouriensis Nutt. (Missouri milkvetch) – P; GMC1092, GMC1269, GMC969
Astragalus mollissimus Torr. (woolly locoweed) – P; GMC1093
Astragalus nuttallianus DC. var. austrinus (Small) Barneby (smallflowered milkvetch) – A; GMC1049
Astragalus platensis Nutt. (Platte River milkvetch) – P; GMC1046, GMC1047, GMC1099
Dalea aurea Nutt. ex Pursh (golden prairie clover) – P; GMC863
Dalea candida Michx. ex Willd. var. candida (white prairie clover) – P; GMC866
Dalea enneandra Nutt. (nineanther prairie clover) – P; GMC1154
Dalea purpurea Vent. (purple prairie clover) – P; GMC1153
Desmanthus illinoensis (Michx.) MacMill. ex B.L Rob. & Fernald (Illinois bundleflower) – P; GMC924
Gleditsia triacanthos L (honeylocust) – P; GMC986
*Medicago minima (L.) L. (little bur-clover) – A; GMC1043
*Melilotus officinalis (L.) Lam. (sweetclover) – A,B; GMC827, GMC850
Mimosa quadrivalvis L. (fourvalve mimosa) – P; GMC1090
Pediomelum cuspidatum (Pursh) Rydb. (largebract Indian breadroot) – P; GMC1091, GMC 1135
Prosopis glandulosa Torr. (honey mesquite) – P; GMC932
Psoralidium tenuiflorum (Pursh) Rydb. (slimflower scurfpea) – P; GMC1169
Robinia pseudoacacia L. (black locust) – P; GMC1070
Vicia americana Muhl. ex Willd. (American vetch) – P; GMC1000
Vicia ludoviciana Nutt. (Louisiana vetch) – A; GMC1094

Fagaceae
Quercus muehlenbergii Engelm. (chinkapin oak) – P

Geraniaceae
*Erodium cicutarium (L.) L’Her. ex Aiton (redstem stork’s bill) – A; GMC 836
*Geranium pusillum L. (small geranium) – A; 1020

Grossulariaceae
Ribes aureum Pursh var. villosum DC. (golden currant) – P; GMC971

Hydrophyllaceae
Nama stevensii C.L. Hitchc. (Steven’s fiddleleaf) – A; GMC1041
Phacelia integrifolia Torr. (gyp phacelia) – A,B; GMC1187

Lamiaceae
Hedeoma hispida Pursh (rough false pennyroyal) – A; GMC795
*Lamium amplexicaule L. (henbit deadnettle) – A; GMC981
Monarda clinopodioides A. Gray (basil beebalm) – A; GMC1159
Teucrium laciniatum Torr. (lacy germander) – P; GMC1134

Linaceae
Linum pratense (Norton) Small (meadow flax) – A; GMC1066
Linum rigidum Pursh (stiffstem flax) – A; GMC1067

Loasaceae
Mentzelia nuda (Pursh) Torr. & A. Gray var. stricta (Osterh.) Harrington (bractless blazingstar) – B,P; GMC1188
Mentzelia oligosperma Nutt. ex Sims (chickenthief) – P; GMC802

Malvaceae
Callirhoe involucrata (Torr. & A. Gray) A. Gray (purple poppymallow) – P; GMC1006
Sphaeralcea coccinea (Nutt.) Rydb. (scarlet globemallow) – P; GMC1051
Molluginaceae
*Mollugo verticillata* L. (green carpetweed) – A; GMC1229

Moraceae
*Morus rubra* L (red mulberry) – P: GMC1138

Nyctaginaceae
*Mirabilis linearis* (Pursh) Heimerl (narrowleaf four o’clock) – P; GMC1180
*Mirabilis nyctaginea* (Michx.) MacMill. (heartleaf four o’clock) – P; GMC1139

Oleaceae
*Forestiera pubescens* Nutt. (stretchberry) – P; GMC1249

Onagraceae
*Oenothera cinerea* (Wooton & Standl.) W.L. Wagner & Hoch (woolly beeblossom) – P; GMC809
*Oenothera curtiflora* W.L. Wagner & Hoch (velvetweed) – A; GMC1148
*Oenothera glaucifolia* W.L. Wagner & Hoch (false gaura) – P; GMC807
*Oenothera hartwegii* Benth. (Hartweg’s sundrops) – P; GMC1127
*Oenothera serrulata* Nuttall (yellow sundrops) – P; GMC1110
*Oenothera suffrutescens* (Ser.) W.L. Wagner & Hoch (scarlet beeblossom) – P; GMC1052, GMC1126

Orobanchaceae
*Agalinis aspera* (Douglas ex Benth.) Britton (tall false foxglove) – A; GMC1228
*Castilleja purpurea* (Nutt.) G. Don var. *citrina* (Pennell) Shinners (prairie Indian paintbrush) – P; GMC991
*Orobanche ludoviciana* Nutt. ssp. *multiflora* (Nutt.) T.S. Collins ex H.L. White & W.C. Holmes (manyflower broomrape) – A; GMC1196

Oxalidaceae
*Oxalis corniculata* L. (creeping woodsorrel) – A; GMC983
*Oxalis dillenii* Jacq. (slender yellow woodsorrel) – P; GMC1019

Papaveraceae
*Argemone polyanthemos* (Fedde) G.B. Ownbey (crested pricklypoppy) – A
*Corydalis micrantha* (Engelm. ex A. Gray) A. Gray (smallflower fumewort) – A; GMC1271

Plantaginaceae
*Nuttallanthus canadensis* (L.) D.A. Sutton (Canada toadflax) – A; KR441
*Penstemon cobaea* Nutt. (cobaea beardtongue) – P; GMC1056
*Plantago patagonica* Jacq. (woolly plantain) – A; GMC1087
*Plantago rhodosperma* Decne. (redseed plantain) – A; GMC1062
*Veronica arvensis* L. (corn speedwell) – A; GMC1045
*Veronica peregrina* L. ssp. *xalapensis* (Kunth) Pennell (hairy purslane speedwell) – A; GMC964
*Veronica polita* Fr. (gray field speedwell) – A; GMC 984

Polygalaceae
*Polygala alba* Nutt. (white milkwort) – P; GMC865

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**Polygonaceae**

*Polygonum persicaria* L. (spotted ladysthumb) – A; GMC1190
*Polygonum ramosissimum* Michx. (bushy knotweed) – A; GMC1191
*Rumex altissimus* Alph. Wood (pale dock) – P; GMC1209

**Portulacaceae**

*Portulaca oleracea* L. (little hogweed) – A; GMC1232
*Portulaca pilosa* L. (kiss me quick) – A; GMC925

**Primulaceae**

*Androsace occidentalis* Pursh (western rockjasmine) – A; GMC1272

**Ranunculaceae**

*Delphinium carolinianum* Walter ssp. *virescens* (Nutt.) R.E. Brooks (Carolina larkspur) – P
*Ranunculus sceleratus* L. (cursed buttercup) – A

**Rhamnaceae**

*Ceanothus herbaceus* Raf. (Jersey tea) – P; GMC1106

**Rosaceae**

*Prunus angustifolia* Marsh. (Chickasaw plum) – P; GMC844, GMC972

**Rubiaceae**

*Galium aparine* L. (stickywilly) – A; GMC1003
*Galium circaezans* Michx. (licorice bedstraw) – P; GMC1193
*Stenaria nigricans* (Lam.) Terrell var. *nigricans* (prairie bluet) – P; GMC1167

**Salicaceae**

*Populus deltoides* Bartram ex Marsh. (eastern cottonwood) – P
*Salix nigra* Marsh. (black willow) – P; GMC997

**Sapindaceae**

*Sapindus saponaria* L. var. *drummondii* (Hook. and Arn.) L.D. Benson (western soapberry) – P; GMC1206

**Sapotaceae**

*Sideroxylon lanuginosum* Michx. (gum bully) – P; GMC835, GMC1207

**Simaroubaceae**

*Ailanthus altissima* (Mill.) Swingle (tree of heaven) – P

**Solanaceae**

*Chamaesaracha conoides* (Moric. ex Dunal) Britton (gray five eyes) – P; GMC1044
*Physalis cf. hederifolia* A. Gray (ivyleaf groundcherry) – P; GMC857
*Physalis longifolia* Nutt. (longleaf groundcherry) – P; GMC1205
*Physalis mollis* Nutt. (field groundcherry) – P; GMC1216
*Quincula lobata* (Torr.) Raf. (Chinese lantern) – P; GMC1085

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Solanum elaeagnifolium Cav. (silverleaf nightshade) – P; GMC896
Solanum rostratum Dunal (buffalobur nightshade) – A; GMC936

Tamaricaceae
*Tamarix ramosissima Ledeb. (saltcedar) – P; GMC1192

Ulmaceae
Ulmus americana L. (American elm) – P; GMC970
*Ulmus pumila L. (Siberian elm) – P; GMC978
Ulmus rubra Muhl. (slippery elm) – P

Urticaceae
Parietaria pensylvanica Muhl. ex Willd. (Pennsylvania pellitory) – A

Verbenaceae
Glandularia bipinnatifida (Nutt.) Nutt. (Dakota mock vervain) – P; GMC1050
Glandularia pumila (Rydb.) Umber (pink mock vervain) – A; GMC830

Violaceae
Viola bicolor Pursh (field pansy) – A; GMC962

Vitaceae
Cissus trifoliata (L.) L. (sorrelvine) – P; GMC845
Parthenocissus quinquefolia (L.) Planch. (Virginia creeper) – P; GMC823
Vitis acerifolia Raf. (mapleleaf grape) – P; GMC1175
Vitis riparia Michx. (riverbank grape) – P; GMC826, GMC1208

Zygophyllaceae
*Tribulus terrestris L. (puncturevine) – A; GMC1198

MONOCOTS
Amaryllidaceae
Allium drummondii Regel (Drummond's onion) – P; GMC987

Asparagaceae
Androstephium coeruleum (Scheele) Greene (blue funnel lily) – P; GMC974
Yucca glauca Nutt. var. glauca (soapweed yucca) – P; GMC1061

Commelinaceae
Tradescantia occidentalis (Britton) Smyth (prairie spiderwort) – P; GMC1095

Cyperaceae
Carex gravida L.H. Bailey (heavy sedge) – P; GMC838
Cyperus lupulinus (Spreng.) Marcks (Great Plains flatsedge) – P; GMC929
Eleocharis montevidensis Kunth (sand spikerush) – P; GMC1273
Poaceae
*Aegilops cylindrica* Host (jointed goatgrass) – A; GMC1108
*Andropogon hallii* Hack. (sand bluestem) – P; GMC950
*Aristida oligantha* Michx. (prairie threeawn) – A; GMC1221, GMC1262
*Aristida purpurea* Nutt. (purple threeawn) – P; GMC861
*Bothriochloa ischaemum* (L.) Keng (yellow bluestem) – P; GMC955
*Bothriochloa laguroides* (DC.) Herter ssp. *torreyana* (Steed.) Allred & Gould (silver beardgrass) – P; GMC1162
*Bouteloua curtipendula* (Michx.) Torr. (sideoats grama) – P; GMC846
*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths (blue grama) – P; GMC872
*Bouteloua hirsuta* Lag. (hairy grama) – P; GMC884
*Bromus catharticus* Vahl (rescuegrass) – A; GMC989
*Bromus arvensis* L. (field brome) – A; GMC1119
*Bromus tectorum* L. (cheatgrass) – A; GMC1124, GMC988
*Buchloe dactyloides* (Nutt.) J.T. Columbus (buffalograss) – P; GMC1116, GMC1027, GMC960
*Cenchrus spinifex* Cav. (coastal sandbur) – A; GMC834
*Chloris verticillata* Nutt. (tumble windmill grass) – P; GMC1231
*Dactylis glomerata* L. (orchardgrass) – P; GMC1140
*Dichanthelium oligosanthes* (Schult.) Gould var. *scribnerianum* (Nash) Gould (Scribner’s rosette grass) – P; GMC1101, GMC1152
*Digitaria ciliaris* (Retz.) Koeler (southern crabgrass) – A; GMC1230, GMC1255
*Echinochloa muricata* (P. Beauv.) Fernald (rough barnyardgrass) – A; GMC1264
*Eleusine indica* (L.) Gaertn. (Indian goosegrass) – A; GMC1254
*Elymus canadensis* L. (Canada wildrye) – P; GMC1155
*Elymus virginicus* L. (Virginia wildrye) – P; GMC1210
*Eragrostis ciliaris* (All.) Vign. ex Janchen (stinkgrass) – A; GMC1222
*Eragrostis secundiflora* J. Presl ssp. *oxylepis* (Torr.) S.D. Koch (red lovegrass) – P; GMC920
*Eragrostis spectabilis* (Pushr) Steud. (purple lovegrass) – P; GMC943
*Erioneuron pilosum* (Buckley) Nash (hairy woollygrass) – P; KR404
*Hordeum pusillum* Nutt. (little barley) – A; GMC1102, GMC791
*Lolium perenne* L. (perennial ryegrass) – P; GMC788
*Muhlenbergia racemosa* (Michx.) Britton, Sterns & Poggenb. (marsh muhly) – P; GMC904
*Panicum capillare* L. (witchgrass) – A; GMC1218, GMC856
*Panicum obtusum* Kunth (vine mesquite) – P; GMC1248, GMC946
*Panicum virgatum* L. (switchgrass) – P; GMC874
*Pascopyrum smithii* (Rydb.) Á. Lóe (western wheatgrass) – P; GMC1129
*Phalaris caroliniana* Walter (Carolina canarygrass) – A; GMC1083
*Poa annua* L. (annual bluegrass) – A; GMC980
*Poa arida* Vasey (plains bluegrass) – P; GMC1018
*Poa pratensis* L. (Kentucky bluegrass) – P; GMC990, GMC1007, GMC790, GMC1022
*Schedonorus phoenix* (Scop.) Holub (tall fescue) – P; GMC1021
*Sclerochloa dura* (L.) P. Baeuv. (common hardgrass) – A; GMC977
*Schizachyrium scoparium* (Michx.) Nash (little bluestem) – P; GMC940
*Secale cereale* L. (cereal rye) – A; GMC1011
*Setaria pumila* (Poir.) Roem. & Schult. (yellow foxtail) – A; GMC1240
*Setaria viridis* (L.) P. Beauv. (green bristlegrass) – A; GMC911, GMC1199
*Sorghastrum nutans* (L.) Nash (Indiangrass) – P; GMC898

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*Sorghum halepense* (L.) Pers. (Johnsongrass) – P; GMC824, GMC912
*Sporobolus compositus* (Poir.) Merr. var. *compositus* (composite dropseed) – P; GMC931, GMC1223
*Sporobolus cryptandrus* (Torr.) A. Gray (sand dropseed) – P; GMC876, GMC1225, GMC1234
*Thinopyrum ponticum* (Podp.) Z.-W. Liu & R.-C. Wang (tall wheatgrass) – P; GMC1265
*Tridens flavus* (L.) Hitchc. (purpletop tridens) – P; GMC1213
*Tridens muticus* (Torr.) Nash var. *elongatus* (Buckley) Shinners (slim tridens) – P; GMC 1224, GMC1233
*Tripsacum dactyloides* (L.) L. (eastern gamagrass) – P; GMC847, GMC1184
*Vulpia octoflora* (Walter) Rydb. (sixweeks fescue) – A; GMC1033, GMC994
Figure 2  *Castilleja purpurea* var. *citrina* on gypsum outcrop at Alabaster Caverns State Park. Photo by G. Caddell.

Figure 3  *Lesquerella gordoni* with basal rosette of *Phacelia integrifolia* on gypsum outcrop at Alabaster Caverns State Park. Photo by G. Caddell.
Figure 4 *Phacelia integrifolia*, an obligate gypsophile, at Alabaster Caverns State Park. Photo by G. Caddell.

Figure 5 *Nama stevensii*, an obligate gypsophile, at Alabaster Caverns State Park. Photo by G. Caddell.
Figure 6  *Haploesthes greggii*, an obligate gypsophile, at Alabaster Caverns State Park. Photo by G. Caddell.

Figure 7  *Echinocereus reichenbachii* at Alabaster Caverns State Park. Photo by G. Caddell.