VASCULAR FLORA OF THE FOUR CANYONS PRESERVE, ELLIS COUNTY, OKLAHOMA

Bruce W. Hoagland

Oklahoma Biological Survey and Department of Geography University of Oklahoma Norman, Oklahoma 73019, U.S.A.
bhoagland@ou.edu

Amy K. Buthod

Oklahoma Biological Survey University of Oklahoma Norman, Oklahoma 73019, U.S.A.
amybuthod@ou.edu

ABSTRACT

This paper reports the results of an inventory of the vascular plants from The Nature Conservancy's Four Canyons Preserve in Ellis County, Oklahoma. A total of 371 taxa of vascular plants in 244 genera and 77 families were collected, with the most species occurring in the families Asteraceae (69), Poaceae (64), and Fabaceae (38). One hundred-twelve species were annuals, four biennials, and 255 perennials. Fifty-one species of woody plants were present. Twenty-nine exotic species were collected representing 7.8% of the flora. Six tracked by the Oklahoma Natural Heritage Inventory were found.

RESUMEN

En este artículo se presentan los resultados de un inventario de plantas vasculares de The Nature Conservancy's Four Canyons Preserve en Ellis County, Oklahoma. Se colectaron un total de 371 taxa de plantas vasculares de 244 géneros y 77 familias, siendo la mayoría de las especies pertenecientes a las familias Asteraceae (69), Poaceae (64), y Fabaceae (38). Ciento doce especies fueron anuales, cuatro bienales, y 255 perennes. Están presentes cincuenta y una especies de plantas leñosas. Se colectaron veintinueve especies exóticas que representan el 7.8% de la flora. Se encontraron seis especies a las que hace un seguimiento el Oklahoma Natural Heritage Inventory.

INTRODUCTION

There are currently 501 taxa of vascular plants known to occur in Ellis County, Oklahoma (Hoagland et al. 2006). The first collections in the county were made in 1913 by G.W. Stevens, who deposited 69 species. In the following year, 63 collections were deposited at the University of Oklahoma Herbarium (OKL) by R.L. Clifton. No collections from Ellis County were deposited in state herbaria between 1915 and 1927. After that time, there was steady collection in the county. The 1970s were an active decade for botanical study of Ellis County, culminating in the deposit of 101 specimens at (OKL) collected by Barber, K. Pearce, and R. Thompson in 1976. From 1985 to 1986, F.B. Erteeb deposited 405 specimens from Ellis County at the Oklahoma State University (OKLA) herbarium as part of a floristic study of Northwest Oklahoma. In 1998, N. McCarty and B. Hoagland deposited 226 specimens at OKL in conjunction with a study of wetland and woody plants. Since that time there has been little collection effort in Ellis County. The objective of this study was to provide a floristic inventory to aid Nature Conservancy personnel in management of the Four Canyons Preserve (FCP) and remedy a gap in our knowledge of the flora of western Oklahoma.

STUDY AREA

The FCP (Fig. 1) was established by The Nature Conservancy in 2004 and protects 1,376 hectares. It is within the Subtropical Humid (Cf) climate zone (Trewartha 1968). Summers are warm (mean July temperature = 26.6° C) and humid, and winters are relatively short and mild (mean January temperature = 0.3° C). Mean annual precipitation is 60.4 cm (Oklahoma Climatological Survey 2006).

Physiographically, the study area is located in the Western Redbed Plains (Curtis & Ham 1979) of Osage Plains Physiographic Province (Hunt 1974). The topography consists of gently rolling hills with deeply eroded canyons. The surface geology is comprised of Permian age sandstones and shale in the uplands and quaternary alluvial deposits on the Canadian River floodplain (Branson & Johnson 1979). The Quinlan-Woodward soil association, a reddish loamy upland soil predominates at the site. The Lincoln-Spur Associa-

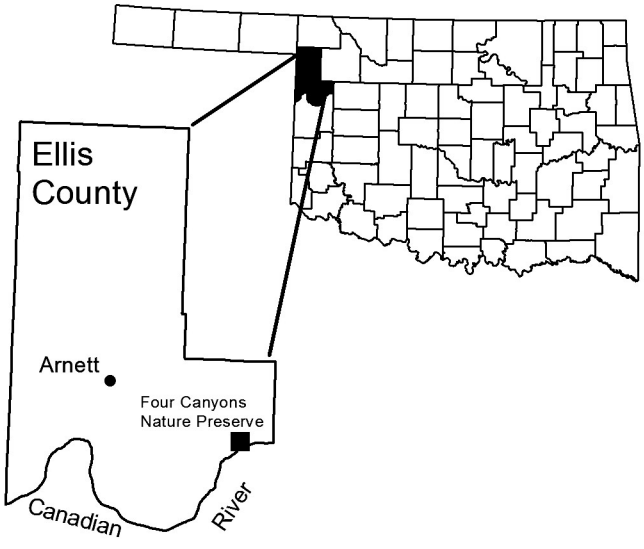

Fig. 1. Location of The Nature Conservancy Four Canyons Preserve in Ellis County, Oklahoma.

tion, consisting of sandy to laomy soils, predominates on the Canadian River floodplain (Cole 1961). Duck and Fletcher (1943) classified the study area as part of the mixedgrass eroded plains, defined as having a "...mixed grass composition and a definite ravine relief which is generally wooded. It is part of an extensive area of similar vegetational conditions extending as an overlapping of tall grass species from the east, with short grass species from the west northward across the United States." Vegetation along the Canadian River was classified as bottomland, a category that was not clearly defined, but would include cottonwoods and riparian shrubs and herbaceous species in the study area.

METHODS

Five collection sites were regularly visited for intensive floristic sampling. Additional collections were also made randomly throughout the site. Collecting began on March through October 1999. Sites were selected following a review of U. S. Geological Survey 1:24,000 topographic maps and field reconnaissance. The predominant vegetation association at these sites was classified according to Hoagland (2000). Vouchers for exotic species were made from naturalized populations only, thus excluding cultivated and ornamental plants. Specimens were processed at the Robert Bebb Herbarium of the University of Oklahoma (OKL) following standard procedures. Manuals used for specimen identification included Correll and Johnston (1970), Great Plains Flora Association (1986), and Waterfall (1973). Origin, either native or introduced, was determined using Taylor and Taylor (1991) and USDA-NRCS (2006). Nomenclature follows the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS 2006). Voucher specimens were deposited at the Robert Bebb Herbarium (OKL) at the University of Oklahoma.

RESULTS AND DISCUSSION

A total of 371 taxa of vascular plants in 77 families and 244 genera were collected (Appendix 1). Among the angiosperms, 86 were monocots and 283 were dicots. In addition, there were two ferns and allies and one gymnosperm. The Asteraceae (69), Poaceae (64), and Fabaceae (38) had the greatest number of species. The genus *Asclepias* had the greatest number of species (10). One hundred-twelve species were annuals, four

biennials, and 255 perennials. Fifty-one species of woody plants were collected. One hundred and eleven species previously unreported from Ellis County were collected in this study.

Thirty taxa (8.1% of the flora) from 14 families were exotic. The families with the greatest number of introduced species were Poaceae with twelve, Asteraceae with four, and Fabaceae with two. Genera with the most exotic species were *Bromus* with three and *Vulpia* with two. The percentage of exotic species in this flora is comparable with reports from other floras in Oklahoma (7–15% exotic) (Hoagland & Johnson 2001, 2004a, 2004b; Hoagland & Buthod 2003, 2004; Hoagland & Wallick 2003; Hoagland et al. 2004; Hoagland et al. 2004; Hoagland & Buthod 2005a; Hoagland & Buthod 2005b; Hoagland & Johnson 2005), with the exception of two sites in McCurtain County, where 6.6% of the flora consisted of exotic species (Hoagland & Johnson 2004c). See Table 1 for a floristic summary of FCP.

No federally listed threatened or endangered species were encountered. However, five species tracked by the ONHI (2005) were present: *Argythamnia mercurialina* (G5,S2S3), *Echinocereus reichenbachii* (G5, S2), *Escobaria vivipara* (G5, S2S3), *Muhlenbergia bushii* (G5, S1S2), *Vitis rupestris* (G3, S?) and *Zinnia grandiflora* (G4G5, S?). Species are ranked according to level of imperilment at the state (S) and global (G) levels on a scale of 1–5; 1 representing a species that is imperiled and 5 one that it is secure. A "?" indicates a species with rank influx (Groves et al. 1995).

The five collection sites at Four Canyons occurred within six vegetation associations. A brief description of each follows:

1. Disturbed areas and old-fields were locations exhibiting signs of physical disruption, such as roadsides and home sites. This includes a portion of the Canadian River floodplain that was converted to *C. dactylon* in years prior to acquisition by The Nature Conservancy. Common plants in disturbed areas included *Aegilops cylindrica*, *Bothriochloa laguroides*, *Bromus catharticus*, *Cucurbita foetidissima*, *Eragrostis cilianensis, Geranium carolinianum*, *Hordeum pusillum, Mollugo verticillata*, *Oxalis stricta*, *Phytolacca americana*, *Polygonum aviculare*, *Portulaca halimoides*, *Quincula lobata*, *Rhus glabra, and Tribulus terrestris*.

2. *Quercus muehlenbergii-Juniperus virginiana* woodland association occupied deep sandstone canyons at the FCP. This vegetation type does not appear in Hoagland (2000). Although *Q. muehlenbergii* has been reported from counties immediately south of Ellis, it does not occur as a dominant species. The co-occurrence of *J. virginiana* is likely the result of fire suppression, but additional research is necessary to character species composition and stand history. Associated species included *Acalypha ostryifolia, Celastrus scandens*, *Cornus drummondii, Elymus canadensis, Galium aparine, Juglans microcarpa, Parietaria penslvanica, Pellaea atropurpurea*, *Ribes aureum*, *Sideroxylon lanuginosum, Smilax tamnoides, Symphoricarpos orbiculatus*, *Toxicodendron radicans, Tridens flavus*, and *Ulmus rubra*. *Muhlenbergia bushii*, a species tracked by ONHI, occurred in this habitat.

3. *Quercus havardii-Sporobolus cryptandrus-Schizachyrium scoparium* shrubland association was limited to a deposit of sandy soils on the western edge of the preserve. Extensive occurrences of this vegetation association are west of the FCP on deep sandy soils. Associated species included *Artemisia filifolia, Bouteloua gracilis, Indigofera miniata*, *Mentzelia multiflora, Oenothera grandis*, *Prunus gracilis*, and *Yucca glauca.*

4. *Schizachyrium scoparium-Bouteloua curtipendula-Bouteloua gracilis* herbaceous association occurred on the well-drained soils and rocky slopes. It was the most abundant vegetation type at FCP. Plant cover was sparse on sandstone outcrops Associated forb species included *Amorpha canescens, Argemone polyanthemos, Astragalus gracilis, Calylophus hartwegii, Ceanothus herbaceous, Comandra umbellata, Croton texensis, Dalea aurea, Desmodium sessilifolium, Hedeoma drummondii, Hedyotis nigricans*, *Ipomoea leptophylla, Ipomopsis longiflora, Lesquerella ovalifolia*, *Krameria lanceolata, Monarda clinopodioides, Pediomelum cuspidatum*, *Ptelea trifoliata, Sorghastrum nutans*, *Sphaeralcea coccinea, Stillingia sylvatica*, *Streptanthus hyacinthoides*, and *Symphyotrichum ericoides*. Species tracked by the ONHI that occurred in this association were *Argythamnia mercurialina*, *Escobaria vivipara* and *Zinnia grandiflora*.

5. *Schizachyrium scoparium—Castilleja purpurea* var. *citrina—Lesquerella gordonii* herbaceous association occurred on shallow soils over gypsum. The extent of vegetation cover varies with the degree of gypsum exposure. Associates include *Bouteloua hirsuta, Erioneuron pilosum, Chaetopappa ericoides, Liatris punctata*, *Phacelia integrifolia*, *Psilostrophe tagetina*, and *Tetraneuris scaposa*. *Echinocereus reichenbachii,* which is tracked by the Oklahoma Natural Heritage Inventory, occurred in this habitat type.

6. Wetland and Riparian vegetation included the margins of small ponds at FCP and wet areas along the floodplain of the Canadian River. Although multiple wetland vegetation associations are present at the FCP, they are limited in aerial extent and readily intergrade. Classifying Canadian River floodplain vegetation is further confounded by land use/land conversion practices of the landowner prior to The Nature Conservancy. Possible wetland vegetation types present include *Polygonum pensylvanicum-Polygonum lapathifolium* herbaceous association, *Schoenoplectus americanus—Eleocharis montevidensis* herbaceous association, and the *Tamarix chinensis* shrubland association.

APPENDIX 1

Annotated species list for The Nature Conservancy's Four Canyon Preserve. The first entry indicates habitat (**DAOF** = disturbed areas and old fields, **QHSC** = *Quercus havardii-Sporobolus cryptandrus-Schizachyrium*

Table 1. Summary of floristic collections from the Four Canyons Preserve, Ellis County, Oklahoma.*

Taxonomic Group	Species	Native	Exotic
Pteridophyta	2	2	0
Coniferophyta	1	1	0
Magnoliophyta	364	337	27
Magnoliopsdia	277	261	16
Liliopsida	87	76	11

Table follows the format of Palmer et al. 1995.

scoparium shrubland association, **QMJV** = *Quercus muehlenbergii-Juniperus virginiana* woodland association, **SSBC** = *Schizachyrium scoparium-Bouteloua curtipendula-Bouteloua gracilis* herbaceous association, **SSCP** = *Schizachyrium scoparium-Castilleja purpurea* var. *citrina-Lesquerella gordonii* herbaceous association, **WETL** = wetland and riparian) followed by life history is designated as **A**=annual, **B**=biennial, or **P**=perennial, and collection number. Introduced species are noted with an asterisk.

PTERIDOPHYTA

Equisetaceae

Equisetum laevigatum A. Braun—DAFL, WETL; P; 4C-103

Pteridaceae

Pellaea atropurpurea (L.) Link—QMJV; P; 4C-030

CONIFEROPHYTA

Cupressaceae

Juniperus virginiana L.—GMJV, DAUP, SSBC; P; 4C-019

MAGNOLIOPHYTA—MAGNOLIOPSIDA

Acanthaceae

Ruellia humilis Nutt.—SSBC; P; 4C-330

Amaranthaceae

Amaranthus albus L.—DAUP; A; 4C-329

Anacardiaceae

Rhus aromatica Aiton—QHSC, SSBC; P; 4C-027
Rhus glabra L.—SSBC; P; 4C-214
Toxicodendron radicans (L.) Kuntze—QMJV; P; 4C-307

Apiaceae

Ammoselinum popei Torr. & A. Gray—SSBC; A; 4C-075
Cymopterus acaulis (Pursh) Raf.—SSBC; P; 4C-015
Eurytaenia texana Torr. & A. Gray—SSBC; A; 4C-288
Spermolepis echinata (Nutt. ex DC.) A.Heller—DAUP, SSBC; A; 4C-121

Apocynaceae

Apocynum cannabinum L.—DAFL, DAUP, SSBC; P; 4C-187

Asclepiadaceae

Asclepias arenaria Torr.—SSBC; P; 4C-280
Asclepias asperula (Dcne.) Woods.—SSBC; P; 4C-078
Asclepias engelmanniana Woods.—SSBC; P; 4C-266
Asclepias latifolia (Torr.) Raf.—SSBC; P; 4C-434
Asclepias pumila (A. Gray) Vail—QHSC; P; 4C-378
Asclepias stenophylla A. Gray—SSBC; P; 4C-239
Asclepias syriaca L.—DAFL; P; 4C-432
Asclepias tuberosa L.—SSBC; P; 4C-164
Asclepias verticillata L.—SSBC; P; 4C-336
Asclepias viridiflora Raf.—SSBC; P; 4C-345

Asteraceae

Ambrosia psilostachya DC.—DAFL, DAUP, QMJV, SSBC; P; 4C-346
Amphiachyris dracunculoides (DC.) Nutt.—DAUP, SSBC; A; 4C-291
Aphanostephus skirrhobasis (DC.) Trel.—QHSC, SSBC; a; 4C-217
Artemisia dracunculus L.—SSBC; P; 4C-293
Artemisia filifolia Torr.—QHSC, SSBC; P; 4C-292
Artemisia ludoviciana Nutt.—DAUP, SSBC; P; 4C-037
Baccharis salicina Torr. & A. Gray—DAFL; P; 4C-340
Brickellia eupatorioides (L.) Shinners—SSBC; P; 4C-398
Centaurea americana Nutt.—DAUP, SSBC; A; 4C-290
Chaetopappa ericoides (Torr.) G.L. Nesom—SSCP; P; 4C-013
Chloracantha spinosa (Benth.) G.L. Nesom—DAFL; P; 4C-232
Cirsium ochrocentrum A. Gray—DAUP, SSBC; P; 4C-180
Cirsium undulatum (Nutt.) Spreng.—DAUP, SSBC; P; 4C-274
Conyza canadensis (L.) Cronquist—DAUP, QMJV, SSCP; A; 4C-305
Croptilon hookerianum (Torr. & A. Gray) House—SSBC; A; 4C-326
Echinacea angustifolia DC.—SSBC; P; 4C-264
Engelmannia peristenia (Raf.) Goodman & C.A.Lawson—SSBC; P; 4C-056
Erigeron bellidiastrum Nutt.—QHSC; A; 4C-112
Erigeron divergens Torr. & A. Gray—SSBC; P; 4C-419
Erigeron strigosus Muhl. ex Willd.—SSBC; A; 4C-165
Euthamia gymnospermoides Greene—SSBC; P; 4C-384
Evax prolifera Nutt. ex DC.—DAUP, SSBC; A; 4C-110
Flaveria campestris J.R.Johnst.—DAFL, DAUP; A; 4C-377
Gaillardia aestivalis (Walter) H.Rock—QHSC, SSBC; P; 4C-385
Gaillardia pulchella Foug.—QHSC, SSBP; A; 4C-052
Gaillardia suavis (AGray & Engelm.) Britt & Rusby—SSCP; P; 4C-060
Grindelia lanceolata Nutt. SSBC; P; 4C-366

Grindelia nuda Wood var. *nuda*—DAUP; P; 4C-349
*Grindelia squarrosa (*Pursh) Dunal—DAUP; A; 4C-372
Gutierrezia sarothrae (Pursh) Britt & Rusby—SSBC; P; 4C-294
Haloesthes greggii A. Gray—SSCP; P; 4C-289
Helenium amarum (Raf.) H.Rock—DAUP, SSBC; A; 4C-043
Helianthus annuus L.—DAFL, DAUP, WETL; A; 4C-312
Helianthus petiolaris Nutt.—DAFL; A; 4C-352
Heterotheca stenophylla (A. Gray) Shinners var. *stenophylla*—SSBC; P; 4C-286
Heterotheca subaxillaris (Lam.) Britt & Rusby—SSBC; A; 4C-296
Hymneopappus flavescens A. Gray—SSBC; B; 4C-170
Hymneopappus tenuifolius Pursh—QHSC, SSBC; P; 4C-237
Iva annua L.—DAFL; A; 4C-354
Lactuca serriola L.*—DAUP; A; 4C-343
Liatris mucronata DC.—SSBC; P; 4C-416
Liatris punctata Hook.—SSBC, SSCP; P; 4C-371
Liatris squarrosa (L.) Michx.—SSBC; P; 4C-331
Lygodesmia juncea (Pursh) D.Don ex Hook.—SSBC; P; 4C-271
Machaeranthera pinnatifida (Hook.) Shinners—SSBC; P; 4C-285
Packera plattensis (Nutt.) W.A.Weber & Á. Löve—SSBC; B; 4C-018
Pluchea odorata (L.) Cass.—DAFL, WETL, QMJV; A; 4C-361
Psilostrophe tagetina (Nutt.) Greene var. *cerifera* (A.Nels.) B.L. Turner—SSCP; B; 4C-031
Pyrrhopappus grandiflorus (Nutt.) Nutt.—DAUP, SSBC; P; 4C-094
Ratibida columnifera (Nutt.) Wooten & Standl.—SSBC; P; 4C-303
Senecio riddellii Torr. & A. Gray—DAFL; P; 4C-040
Solidago altissima L.—SSBC; P; 4C-415
Solidago canadensis L. var. *canadensis*—QMJV, SSBC; P; 4C-428
Solidago gigantea Aiton—WETL, SSBC; P; 4C-419
Solidago petiolaris Aiton—SSBC; P; 4C-411
Sonchus asper (L.) Hill*—DAUP, QMJV; A; 4C-186
Symphyotrichum ericoides (L.) G.L. Nesom var. *ericoides*—SSBC; P; 4C-394
Symphyotrichum fendleri (A. Gray) G.L. Nesom—SSBC; P; 4C-414
Symphyotrichum oblongifolium (Nutt.) G.L. Nesom—SSBC; P; 4C-298
Symphyotrichum subulatum (Michx.) G.L. Nesom—DAFL, WETL; A; 4C-035
Taraxacum officinale G.Weber ex AWigg.*—DAUP; P; 4C-029
Tetraneuris linearifolia (Hook.) Greene—SSBC; A; 4C-010
Tetraneuris scaposa (DC.) Greene—SSCP; P; 4C-011
Thelesperma megapotamicum (Spreng.) Kuntze—SSBC; P; 4C-038
Townsendia exscapa (H.Richards.) Porter—SSBC; P; 4C-003
Tragopogon dubius Scop.*—DAUP; A; 4C-105
Vernonia baldwinii Torr.—DAUP, QMJV; P; 4C-319
Xanthium strumarium L.—DAFL, WETL; A; 4C-356
Zinnia grandiflora Nutt.—SSCP; P; 4C-316

Boraginaceae
Cryptantha minima Rydb.—SSBC; A; 4C-084
Lappula occidentalis (S.Watson) Greene var. occidentalis—DAUP; A; 4C-141
Lithospermum caroliniense (Walter ex J.F.Gmel.) MacMil..—SSBC; P; 4C-144
Lithospermum incisum Lehm.—SSCP, SSBC; P; 4C-016

Brassicaceae
Camelina microcarpa DC.*—DAUP; A; 4C-072
Descurainia pinnata (Walter) Britt—DAUP; A; 4C-020
Draba cuneifolia Nutt. ex Torr. & A. Gray—DAUP, SSBC; A; 4C-022
Lepidium densiflorum Schrad.—DAUP, SSBC; A; 4C-093
Lepidium oblongum Small—DAUP, SSBC; A; 4C-017
Lesquerella gordonii (A. Gray) S.Watson—SSCP; A; 4C-024
Lesquerella ovalifolia Rydb.ex Britt—SSBC; P; 4C-118
Streptanthus hyacinthoides Hook.—SSBC; A; 4C-258

Cactaceae
Echinocereus reichenbachii (Terscheck ex Walp.) Haage f.—SSBC, SSCP; P; 4C-136
Escobaria vivipara (Nutt.) Buxb.—SSBC; P; 4C-174
Opuntia macrorhiza Engelm.—DAUP, SSBC; P; 4C-424

Campanulaceae
Triodanis holzingeri McVaugh—DAUP, SSBC; A; 4C-246
Triodanis perfoliata (L.) Nieuwl.—DAUP, SSBC; A; 4C-273

Capparaceae
Polanisia dodecandra (L.) DC.—QHSC, SSBC; A; 4C-379

Caprifoliaceae
Symphoricarpos orbiculatus Moench—QMJV; P; 4C-147

Caryophyllaceae
Dianthus armeria L.*—SSBC; A; 4C-088
Paronychia jamesii Torr. & A. Gray—SSCP; P; 4C-247

Celastraceae
Celastrus scandens L.—QMJV; P; 4C-039

Chenopodiaceae
Atriplex canescens (Pursh) Nutt.—SSBC; P; 4C-104
Chenopodium leptophyllum (Moq.) Nutt. ex S.Watson—DAUP; A; 4C-268
Chenopodium simplex (Torr.) Raf.—QMJV; A; 4C-376
Monolepis nuttalliana (Schult.) Greene—WETL; A; 4C-143
Salsola tragus L.*—DAFL, DAUP; A; 4C-341

Convolvulaceae
Convolvulus arvensis L.*—DAUP; P; 4C-210
Evolvulus nuttallianus Schult.—SSCP; P; 4C-051
Ipomoea leptophylla Torr.—SSBC; P; 4C-218

Cornaceae
Cornus drummondii C.A.Mey.—QMJV; P; 4C-203

Cucurbitaceae
Cucurbita foetidissima Kunth—DAUP; P; 4C-178

Elaeagnaceae
Elaeagnus angustifolia L.*—DAFL; P; 4C-374

Euphorbiaceae
Acalypha ostryifolia Riddell—DAUP, QMJV; A; 4C-185
Argythamnia mercurialina (Nutt.) Müll.Arg.—SSBC; P; 4C-197

Chamaesyce fendleri (Torr. & A. Gray) Small—DAUP, QHSC; P; 4C-099
Chamaesyce glyptosperma (Engelm.) Small—DAUP, SSBC; A; 4C-334
Chamaesyce missurica (Raf.) Shinners—SSBC; A; 4C-359
Chamaesyce serpens (Kunth) Small—SSBC; A; 4C-335
Croton texensis (Klotzsch) Müll.Arg.—QHSC; A; 4C-227
Euphorbia marginata Pursh—DAUP, SSBC; A; 4C-304
Euphorbia spathulata Lam.—SSCP; A; 4C-085
Stillingia sylvatica Garden ex L.—SSBC; P; 4C-163
Tragia ramosa Torr.—SSCP; P; 4C-355

Fabaceae
Amorpha canescens Pursh—SSBC; P; 4C-150
Amorpha fruticosa L.—DAFL; P; 4C-160
Astragalus gracilis Nutt.—SSBC; P; 4C-132
Astragalus lotiflorus Hook.—SSBC; P; 4C-007
Astragalus missouriensis Nutt.—SSBC; P; 4C-008
Astragalus mollissimus Torr.—SSBC; P; 4C-445
Astragalus plattensis Nutt.—SSBC; P; 4C-133
Baptisia australis (L.) R.Br. ex Aiton—SSBC; P; 4C-044
Baptisia bracteata Muhl. ex Elliot—SSBC; P; 4C-106
Caesalpinia jamesii (Torr. & A. Gray) Fisher—SSBC; P; 4C-323
Dalea aurea Nutt. ex Pursh—SSBC; P; 4C-212
Dalea candida Michx. ex Willd.—SSBC; P; 4C-265
Dalea enneandra Nutt.—SSBC; P; 4C-220
Dalea lanata Spreng—DAFL; P; 4C-284
Dalea purpurea Vent.—SSBC; P; 4C-213
Dalea villosa (Nutt.) Spreng.—DAFL; P; 4C-283
Desmanthus illinoensis (Michx.) MacMil.. ex B. L. Rob. & Fernald—DAFL; P; 4C-313
Desmodium sessilifolium (Torr.) Torr. & A. Gray—SSBC; P; 4C-369
Glycyrrhiza lepidota Pursh—DAFL; P; 4C-184
Gymnocladus dioicus (L.) K. Koch—QMJV; P; 4C-406
Indigofera miniata Ortega—QHSC; P; 4C-444
Lespedeza capitata Michx.—SSBC; P; 4C-440
Lespedeza stuevei Nutt.—SSBC; P; 4C-381
Melilotus officinalis (L.) Lam.*—DAFL, DAUP; A; 4C-309
Mimosa borealis A. Gray—SSBC; P; 4C-161
Mimosa nuttallii (DC.) B.L. Turner—SSBC; P; 4C-062
Oxytropis lambertii Pursh var. *artciulata* (Greene) Barneby—SSBC; P; 4C-426
Oxytropis lambertii Pursh var. *lambertii*—SSBC; P; 4C-134
Pediomelum cuspidatum (Pursh) Rydb.—SSBC; P; 4C-156
Pediomelum digitatum (Nutt. ex Torr. & A. Gray) Isely—SSBC; P; 4C-238
Pediomelum linearifolium (Torr. & A. Gray) J. W. Grimes—SSBC; P; 4C-250
Psoralidium tenuiflorum (Pursh) Rydb.—SSBC; P; 4C-263
Robinia pseudoacacia L.—QMJV; P; 4C-504
Senna marilandica (L.) Link—QMJV; P; 4C-342
Sophora nuttalliana B.L. Turner—SSBC; P; 4C-425
Strophostyles leiosperma (Torr. & A. Gray) Piper—SSBC; A; 4C-321
Vicia americana Muhl. ex Willd.—SSBC; P; 4C-096
Vicia ludoviciana Nutt.—SSBC; A; 4C-113

Fagaceae
Quercus havardii Rydb.—QHSC; P, 4C-046
Quercus muehlenbergii Engelm. -QMJV; P; 4C-034
Quercus stellata Wangenh.—QHSC; P; 4C-446

Fumariaceae
Corydalis micrantha (Engelm. ex A. Gray) A. Gray—SSBC; A; 4C-004

Gentianaceae
Eustoma exaltatum (L.) Salisb. ex G.Don—DAFL; P; 4C-297

Geraniaceae
Geranium carolinianum L.—DAUP; A; 4C-087

Grossulariaceae
Ribes aureum Pursh var. *villosum* DC.—QMJV; P; 4C-014

Hydrophyllaceae
Nama stevensii C.L. Hitchc.—SSCP; A; 4C-142
Phacelia integrifolia Torr.—SSCP; A; 4C-125

Juglandaceae
Juglans microcarpa Berl.—QMJV; P; 4C-205

Krameriaceae
Krameria lanceolata Torr.—SSBC; P; 4C-148

Lamiaceae
Hedeoma drummondii Benth.—SSBC; P; 4C-222
Hedeoma hispida Pursh—DAUP, SSCP; A; 4C-090
Monarda clinopodioides A. Gray—SSCP; A; 4C-272
Monarda punctata L. var. *occidentalis* (Epling) Palmer & Steyerm.—SSBC; A; 4C-254
Salvia azurea Michx. ex Lam.—SSBC; P; 4C-272
Scutellaria drummondii Benth.—SSBC; P; 4C-100
Scutellaria resinosa Torr.—SSBC; P; 4C-102
Teucrium canadense L.—QMJV, WETL; P; 4C-182

Linaceae
Linum lewisii Pursh var. *lewisii*—SSBC; A; 4C-006
Linum rigidum Pursh—SSBC; A; 4C-120

Loasaceae
Mentzelia decapetala (Pursh ex Sims) Urb. & Gilg ex Gilg—SSBC; P; 4C-370
Mentzelia multiflora (Nutt.) A. Gray—QHSC; A; 4C-370
Mentzelia nuda (Pursh) Torr. & A. Gray—SSBC; P; 4C-324
Mentzelia oligosperma Nutt. ex Sims—SSCP; P; 4C-193

Malvaceae
Callirhoe involucrata (Torr. & A. Gray) A. Gray—SSBC; P; 4C-054
Sphaeralcea coccinea (Nutt.) Rydb.—SSBC; P; 4C-079

Molluginaceae
Mollugo verticillata L.—DAUP, WETL; A; 4C-308

Moraceae
Maclura pomifera (Raf.) Schneid.—QMJV; P; 4C-196
Morus alba L.*—QMJV; P; 4C-259
Morus rubra L.—QMJV; P; 4C-422

Nyctaginaceae
Mirabilis linearis (Pursh) Heimerl—SSBC; P; 4C-257
Mirabilis nyctaginea (Michx.) MacMil..—QMJV; P; 4C-179

Onagraceae
Calylophus berlandieri Spach—SSBC; P; 4C-041
Calylophus hartwegii (Benth.) P.H.Raven—SSBC; P; 4C-071
Calylophus serrulatus (Nutt.) P.H.Raven—SSBC; P; 4C-097
Gaura coccinea Nutt. ex Pursh—SSBC; P; 4C-126
Gaura longiflora Spach—DAUP; A; 4C-241
Gaura villosa Torr.—QHSC; P; 4C-410
Oenothera grandis (Britt) Smyth—DAUP, QHSC; P; 4C-089
Oenothera jamesii Torr. & A. Gray—WETL; B; 4C-387
Oenothera laciniata Hill—DAUP, SSBC; A; 4C-059
Oenothera macrocarpa Nutt.—SSBC; P; 4C-050
Oenothera rhombipetala Nutt. ex Torr. & A. Gray—QHSC; A; 4C-400
Stenosiphon linifolius (Nutt. ex James) Heynh.—SSBC; P; 4C-208

Oxalidaceae
Oxalis stricta L.—DAUP, SSBC; P; 4C-067
Oxalis violacea L.—SSBC; P; 4C-058

Papaveraceae
Argemone polyanthemos (Fedde) G.B. Ownbey—SSBC; A; 4C-061

Phytolaccaceae
Phytolacca americana L.—QMJV; P; 4C-198

Plantaginaceae
Plantago patagonica Jacq.—DAUP, SSBC; A; 4C-111
Plantago rhodosperma Dcne.—DAUP, SSBC; A; 4C-114

Polemoniaceae
Ipomopsis longiflora (Torr.) V.E.Grant—QHSC, SSBC; A; 4C-395

Polygalaceae
Polygala alba Nutt.—SSBC, SSCP; P; 4C-055

Polygonaceae
Erigonum annuum Nutt.—SSBC; A; 4C-306
Erigonum longifolium Nutt.—SSBC; P; 4C-032
Polygonum amphibium L.—WETL; P; 4C-262
Polygonum aviculare L.*—DAUP; A; 4C-328
Polygonum lapathifolium L.—WETL; A; 4C-209
Polygonum pensylvancium L.—WETL; A; 4C-360
Polygonum ramosissimum Michx.—DAUP, WETL; A; 4C-322

Portulacaceae
Portulaca halimoides L.—DAUP; A; 4C-436
Portulaca oleracea L.—DAUP; A; 4C-358

Primulaceae
Androsace occidentalis Pursh—DAUP, SSBC; A; 4C-021
Samolus ebracteatus Kunth—DAFL; P; 4C-318

Ranunculaceae
Anemone caroliniana Walter—SSBC; P; 4C-025
Delphinium carolinianum Walter—SSBC; P; 4C-155
Ranunculus sceleratus L.—WETL; A; 4C-091

Rhamnaceae
Ceanothus herbaceous Raf.—SSBC; P; 4C-076

Rosaceae
Prunus angustifolia Marsh—QHSC, SSBC; P; 4C-005
Prunus gracilis Engelm. & A. Gray—QHSC; P; 4C-443
Pyrus communis L.*—QMJV; P; 4C-437

Rubiaceae
Cephalanthus occidentalis L.—WETL; P; 4C-183
Galium aparine L.—DAUP, QMJV; A; 4C-190
Hedyotis nigricans (Lam.) Fosberg—SSBC, SSCP; P; 4C-216

Rutaceae
Ptelea trifoliata L.—SSBC; P; 4C-047

Salicaceae
Populus deltoides Bartram ex Marsh—DAFL, WETL; P; 4C-066
Salix exigua Nutt.—DAFL, WETL; P; 4C-108
Salix nigra Marsh—DAFL, WETL; P; 4C-107

Santalaceae
Comandra umbellata (L.) Nutt.—SSBC; P; 4C-109

Sapindaceae
Sapindus saponaria L. var. *drummondii* (Hook. & Arn.) L.D. Benson—QMJV; P; 4C-317

Sapotaceae
Sideroxylon lanuginosum Michx.—QMJV; P; 4C-200

Scrophulariaceae
Agalinis aspera (Douglas ex Benth.) Britt—SSBC; A; 4C-386
Castilleja purpurea (Nutt.) G.Don var. *citrina* (Pennell) Shinners—SSCP; P; 4C-081
Castilleja sessiliflora Pursh—SSBC; P; 4C-023
Nuttallanthus texanus (Scheele) D.A.Sutton—SSBC; A; 4C-095
Penstemon albidus Nutt.—SSCP; P; 4C-083
Penstemon buckleyi Pennell—SSBC; P; 4C-115
Penstemon cobaea Nutt.—SSBC; P; 4C-049
Veronica arvensis L.*—DAUP; A; 4C-080
Veronica peregrina L.—SSBC; A; 4C-116

Solanaceae
Chamaesaracha conioides (Moric. ex Dunal) Britt—DAUP, SSBC; P; 4C-009
Datura stramonium L.—QMJV; A; 4C-423
Physalis longifolia Nutt.—DAUP; P; 4C-234
Physalis mollis Nutt. var. *mollis*—DAUP; P; 4C-117
Quincula lobata (Torr.) Raf..—DAUP, SSBC; P; 4C-234
Solanum elaeagnifolium Cav.—DAUP, QMJV, SSBC; P; 4C-045
Solanum dimidiatum Raf..—DAUP, SSBC; P; 4C-269
Solanum rostratum Dunal—DAUP; A; 4C-206

Tamaricaceae
Tamarix chinensis Lour.*—DAFL; P; 4C-048

Ulmaceae
Celtis laevigata Willd.—QMJV; P; 4C-215
Ulmus americana L.—QMJV; P; 4C-042
Ulmus pumila L.*—QMJV; P; 4C-442
Ulmus rubra Muhl.—QMJV; P; 4C-396
Urticaceae
Parietaria penslvanica Muhl. ex Willd.—QMJV; A; 4C-202

Verbenaceae
Glandularia pumila (Rydb.) Umber—DAUP, SSBC; A; 4C-086

Phyla nodiflora (L.) Greene—DAFL, WETL; P; 4C-221
Verbena bracteata Lag. & Rodr.—DAUP; A; 4C-140
Verbena stricta Vent.—DAUP; P; 4C-235

Vitaceae
Cissus trifoliata (L.) L.—QMJV; P; 4C-065
Parthenocissus quinquefolia (L.) Planch.—QMJV; P; 4C-057
Vitis acerifolia Raf.—QMJV; P; 4C-074
Vitis rupestris Scheele—QMJV; P; 4C-074

Zygophyllaceae
Tribulus terrestris L.*—DAUP, QHSC; A; 4C-367

MAGNOLIOPHYTA—LILIOPSIDA

Agavaceae
Yucca glauca Nutt.—DAUP, QHSC, SSBC; P; 4C-146

Commelinaceae
Commelina erecta L.—DAUP, SSBC; P; 4C-226
Tradescantia occidentalis (Britt) Smyth—SSBC; P; 4C-137
Tradescantia ohiensis Raf.—SSBC; P; 4C-162

Cyperaceae
Carex gravida Bailey—WETL; P; 4C-231
Carex festucacea Schkuhr ex Willd.—WETL; P; 4C-287
Cyperus schweinitzii Torr.—SSBC; P; 4C-204
Eleocharis erythropoda Steud.—DAFL, WETL; P; 4C-168
Eleocharis montevidensis Kunth—DAFL, WETL; P; 4C-167
Eleocharis obtusa (Willd.) Schult.—DAFL, WETL; A; 4C-223
Eleocharis tenuis (Willd.) Schult. var. *verrucosa* (Svenss.) Svenss.—DAFL, WETL; P; 4C-168
Schoenoplectus pungens (Vahl) Palla—DAFL, WETL; P; 4C-101

Iridaceae
Sisyrinchium angustifolium P.L.Mill—SSBC; P; 4C-082

Juncaceae
Juncus brachyphyllus Wiegmann—DAFL, WETL; P; 4C-224
Juncus interior Wiegmann—DAFL, WETL; P; 4C-169
Juncus torreyi Coville—DAFL, WETL; P; 4C-344

Liliaceae
Allium drummondii Regel—SSBC; P; 4C-012
Allium perdulce S.V.Fraser—SSBC; P; 4C-077
Androstephium caeruleum (Scheele) Greene—SSBC; P; 4C-002

Najadaceae
Naja guadalupensis (Spreng.) Magnus—WETL; A; 4C-350

Poaceae
Aegilops cylindrica Host*—DAUP; A; 4C-053
Agrostis hyemalis (Walter) B.S.P.—WETL; P; 4C-348
Andropogon glomeratus (Walter) B.S P.—DAFL; P; 4C-300
Andropogon hallii Hack.—SSBC; G, P; 4C-311
Aristida adscensionis L.—DAUP, QHSC; A; 4C-389
Aristida oligantha Michx.—DAUP, QHSC, SSBC; A; 4C-382
Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey—DAUP, SSBC; P; 4C-252
Aristida purpurea Nutt. var. *purpurea*—DAUP, SSBC; P; 4C-277
Bothriochloa laguroides (DC.) Herter—DAUP, SSBC; P; 4C-278
Bothriochloa saccharoides (Sw.) Rydb.—DAUP, SSBC; P; 4C-413
Bouteloua curtipendula (Michx.) Torr. SSBC; P; 4C-195
Bouteloua gracilis (Willd. ex Kunth) Lag. ex Griffiths—DAUP, QHSC, SSBC; P; 4C-333
Bouteloua hirsuta Lag.—SSCP; P; 4C-195
Bromus catharticus Vahl*—DAUL; A; 4C-068
Bromus japonicus Thunb. ex Murr*—DAUL; A; 4C-261
Bromus tectorum L. *—DAUL, SSBC; A; 4C-064
Buchloe dactyloides (Nutt.) Engelm.—SSBC; P; 4C-070
Calamovilfa gigantea (Nutt.) Scribn. & Merr—DALF; P; 4C-302
Cenchrus spinifex Cav.—DAUP, QHSC; P; 4C-255
Chloris verticillata Nutt.—DAUP; P; 4C-207
Cynodon dactylon (L.) Pers.*—DAUP, DAFL; P; 4C-194
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *fasiculatum* (Torr.) Freckmann—SSBC; P; 4C-233
Dichanthelium clandestinum (L.) Gould—QHSC, SSBC; P; 4C-122
Dichanthelium villosissimum (Nash) Freckmann var. *praecocius* (A.S. Hitchc. & Chase) Freckmann—SSBC; P; 4C-332
Distichlis spicata (L.) Greene—DAFL; P; 4C-151
Echinochloa muricata (P.Beauv.) Fernald—WETL; A; 4C-253
Elymus canadensis L.—DAUP, QMJV, SSBC; P; 4C-230
Elymus virginicus L.—DAUP, QMJV, SSBC; P; 4C-405
Eragrostis cilianensis (All.) Vignet ex Janch.*—DAUP; A; 4C-390
Eragrostis secundiflora J.Presl—DAUP, SSBC; P; 4C-236
Eragrostis spectabilis (Pursh) Steud.—DAUP, SSBC; P; 4C-337
Eragrostis trichodes (Nutt.) Wood—DAUP, QHSC; P; 4C-383
Erioneuron pilosum (Buckl.) Nash—QHSC, SSBC; P; 4C-191
Hordeum jubatum L.—DAFL, DAUP; P; 4C-175
Hordeum pusillum Nutt.—DAUP; A; 4C-069
Leptochloa fusca (L.) Kunth—WETL; A; 4C-431
Lolium arundianceum (Schreb.) Darbysh.*—DAUP; P; 4C-427
Monroa squarrosa (Nutt.) Torr.—QHSC, SSBC; P; 4C-211
Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi—DAFL; P; 4C-408
Muhlenbergia bushii Pohl—QMJV; P; 4C-202
Muhlenbergia racemosa (Michx.) B.S.P.—QMJV; P; 4C-420
Panicum capillare L.—DAUP, SSBC; A; 4C-314
Panicum hallii Vasey—SSBC; P; 4C-392
Panicum obtusum Kunth—DAFL, SSBC; P; 4C-199
Panicum virgatum L.—DAFL, SSBC; P; 4C-325
Pascopyrum smithii (Rydb.) Á. Löve—DAUP; P; 4C-171
Paspalum setaceum Michx.—QHSC, SSBC; P; 4C-225
Phalaris caroliniana Walter—-WETL; A; 4C-138
Phragmites australis (Cav.) Trin. ex Steud.—DAFL; P; 4C-438
Poa arachnifera Torr.—DAUP, SSBC; P; 4C-135
Polypogon monspeliensis (L.) Desf.*—DAFL, WETL; G, A; 4C-139
Saccharum ravennae (L.) L.* DAFL, WETL; G, P; 4C-301
Schizachyrium scoparium (Michx.) Nash—QHSC, SSBC; P; 4C-363
Setaria parviflora (Poir.) Kerguélen—DAFL, DAUP; P; 4C-338
Sorghastrum nutans (L.) Nash—SSBC; P; 4C-357
Sorghum halepense (L.) Pers.*—DAUP; P; 4C-177
Spartina pectinata Bosc ex Link—DAFL; P; 4C-315

Sphenopholis obtusata (Michx.) Scribn.—WETL; A; 4C-153
Sporobolus cryptandrus (Torr.) A. Gray—QHSC, SSBC; P; 4C-391
Sporobolus neglectus Nash—DAUP, QHSC; A; 4C-399
Tridens albescens (Vasey) Wooten & Standl.—SSBC, QHSC; P; 4C-380
Tridens flavus (L.) A.S. Hitchc.—QMJV, SSBC; P; 4C-310
Vulpia octoflora (Walter) Rydb.—DAUP; A; 4C-130
Vulpia sciurea (Nutt.) Henry—DAUP; G, A; 4C-131

Smilacaceae
Smilax tamnoides L.—QMJV; P; 4C-201

Typhaceae
Typha domingensis Pers.—DAFL, WETL; P; 4C-249

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