VASCULAR FLORA OF E. C. HAFER PARK, EDMOND, OKLAHOMA

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ABSTRACT

E. C. Hafer Park is located on the western edge of the Cross Timbers ecoregion, in central Oklahoma within the City of Edmond. The park contains post oak-blackjack oak forest, tallgrass prairie, riparian forest, and areas developed for recreational activities. A vascular plant inventory conducted during 2013, 2015, 2016, and 2017 yielded 270 species in 190 genera and 65 families. The largest families were the Asteraceae (46 species), Poaceae (42), and Fabaceae (27). There were 96 annuals, four biennials, and 170 perennials. Sixty species (22.2%) were not native to the United States. No rare species currently being tracked by the Oklahoma Natural Heritage Inventory were present. Compared to floristic inventories for other sites of similar size in Oklahoma, Hafer Park has a relatively high number of species. However, it also has a relatively high percentage of exotic species from other continents, some of which are invasive and are threatening the native forest, grassland, and riparian plant communities.

INTRODUCTION

Efforts to protect biodiversity often focus on large natural habitats outside of highly urbanized locations, but efforts should also be made to preserve and promote biodiversity in urban forests and other urban green spaces that have maintained relatively high levels of biodiversity including species of conservation concern (Alvey 2006). In a literature review of species richness in urban parks on five continents, Nielsen et al. (2013) found that those with a diversity of habitats and microhabitats can be biodiversity hotspots with large components of native species of all plant and animal groups. For vascular plants, however, urban parks often have a large percentage of exotic species, sometimes over 50% (Nielsen et al. 2013).

Palmer et al. (1995) summarized the importance of floristic inventories in providing data for research on biodiversity, environmental impact assessment, and management decisions. The Floras of North America project (Palmer 2017) promotes the compilation of floras, emphasizing their importance as "baselines for understanding patterns of, and threats to, modern biodiversity".

We conducted a floristic inventory of E. C. Hafer Park, an urban park in central Oklahoma, from 2013 to 2017. Our

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objectives were to 1) document the vascular plant richness of a central Oklahoma urban park; 2) contribute to our knowledge of plant distributions in Oklahoma; 3) assess the threat that exotic species, i.e., from other continents, pose to the biodiversity of this urban park; and 4) provide a resource that can be used by the City of Edmond to conserve the biodiversity of Hafer Park and to educate the public.

STUDY AREA

E. C. Hafer Park is located in the City of Edmond, Oklahoma County, Oklahoma (T14N, R2W, SW1/4 of Sec 31). Latitudinal extent is from 35° 38'17" N to 35° 38' 44" N, and longitudinal extent is from 97° 27' 6" W to 97° 27' 37" W. The park consists of approximately 49 hectares (=121 acres). Spring Creek flows west to east along the southern edge of the park. Elevation ranges from approximately 326 m to 345 m. Soils are Stephenville-Darnell-Niotaze shallow, sandy and loamy soils that are moderately acidic and humus-poor, and occur on steep slopes up to 18% (Carter and Gregory 2008).

The climate is continental. According to climate data for the past 15 years (2002–2016) from Mesonet stations in Oklahoma County (Oklahoma Climatological Survey 2017b), average annual precipitation was 89.8 cm. The mean annual temperature for 2002–2016 was 16.1°C, with daily average temperatures ranging from 3.9°C in January to 27.8° C in July. Temperatures ranged from an average low temperature of -1.7°C in January to an average daytime high of 33.3°C in July. Average wind speed was 8 mph.

The climate averages for the past 15 years differ somewhat from longer-term historical trends. For example, from 2002–2016 spring and summer had the highest average precipitation, but historically fall and spring have been the wettest seasons (Oklahoma Climatological Survey 2017a). Annual precipitation for Oklahoma County varied considerably for the four years during which this vascular plant survey was conducted, ranging from 75.4 cm to 131.3 cm.

E. C. Hafer Park is in the Central Red-Bed Plains physiographic province, in which "Permian red shales and sandstone form gently rolling hills and broad, flat plains" (Curtis et al. 2008). It is on the western edge of the Cross Timbers ecoregion (Oklahoma Forestry Services 2017) and is in the Northern Cross Timbers Level III Ecoregion (Environmental Protection Agency 2017). The dominant potential vegetation is post oak-blackjack oak woodland (Duck and Fletcher 1943).

King and Cheek (2015) documented the land-use history of the site. From the early 1900s to the 1940s, historical documents indicate that it was privately owned and farmed. From 1952 to 1972, a portion of the site housed a sewage treatment facility operated by the City of Edmond. Following decommissioning of the facility in 1972 and the acquisition of additional small tracts of land, the site was commissioned as E. C. Hafer Park in 1979. Paved trails, playgrounds, picnic areas, and pavilions have been constructed, but the eastern half of the park is primarily post oak-blackjack oak forest with tallgrass prairie in the northeast corner.

METHODS

We surveyed the park during the growing seasons (March through October) of 2013, 2015, 2016, and 2017. During those years, we visited the site 23 times, with 6 collecting dates in the spring, 10 in the summer, and 7 in the fall. We recorded the vascular plant species encountered and collected voucher specimens. We collected non-native and exotic species only from naturalized populations, excluding cultivated species in flower beds, picnic areas, playgrounds, etc. A few species were

identified by sight and documented only by photographs because of their rarity at the site or because the steep slope of Spring Creek made a collection impossible. References used for specimen identification included Great Plains Flora Association (1986), Diggs et al. (1999), Yatskievyich (1999), Barkworth et al. (2007), and Tyrl et al. (2015). In addition to our collections, we searched the University of Central Oklahoma Herbarium (CSU) database and added a few previously collected species from the park. Specimens were identified only to the species level.

The organization of taxa in our species list is based on Angiosperm Phylogeny Group (APG III) recommendations (Stevens 2017). Nomenclature follows the Integrated Taxonomic Information System (2017). The PLANTS Database (USDA NRCS 2017) was used for common names and to determine whether each species was native to the United States, its duration (annual, biennial, or perennial), and its growth form (forb, graminoid, shrub, tree, or woody vine). If duration varied or if more than one growth form was listed in the PLANTS Database, the duration and growth form listed for Oklahoma by Taylor and Taylor (1994) was used. Voucher specimens were deposited in the University of Central Oklahoma (CSU) Herbarium. Our reporting of site location and geography, taxonomy, voucher specimens, botanical effort, exotic species, taxonomic list, and summary table follows recommendations by Palmer and Richardson (2012) for published floras. An "invasive species", as defined by Executive Order 13112, is one that is "1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (USDA National Agricultural Library 2017).

Table 1 Summary of floristic collections from E. C. Hafer Park in Edmond, Oklahoma*

Taxonomic Group	Families	Genera	Species	Native spp.	Non-native spp.
Monilophyta	1	1	1	1	0
Pinophyta	1	1	1	1	0
Magnoliophyta					
Eudicots	55	146	206	162	44
Monocots	8	42	62	46	16

* Table format follows Palmer (1995)

RESULTS AND DISCUSSION

We identified 270 species in 190 genera and 65 families (Table 1; Appendix). These included one monilophyte, one gymnosperm, 206 eudicots, and 62 monocots. Species in the Asteraceae (46), Poaceae (42), and Fabaceae (27) far outnumbered those in other families. Only six other families were represented by more than five species: Euphorbiaceae (9), Cyperaceae (8), Rosaceae (8), Rubiaceae (7), Plantaginaceae (6), and Polygonaceae (6). The largest genera, each with five species, were *Quercus*, *Solidago*, and *Bromus*. Ninety-six species (35.5%) were annuals, four (1.5%) were biennials, and 170 (63%) were perennials. Thirty-eight species were trees, 12 were shrubs, and 10 were woody vines. There were 157 forbs and 53 graminoids.

No rare species tracked by the Oklahoma Natural Heritage Inventory (2017) were present. Sixty species (22.2%) in 26 families were not native to the United States. These included 13 species of Poaceae, 10 species of Fabaceae, and 5 species of Asteraceae. All but one non-native species (*Torilis arvensis*) were exotic to North America. Eight exotic species (*Albizia julibrissin*, *Bromus japonicus*, *Bromus tectorum*, *Lespedeza cuneata*, *Ligustrum sinense*, *Lonicera japonica*, *Rosa multiflora*, *Sorghum halepense*) are listed as Oklahoma Problem Species by the Oklahoma Invasive Plants Council (2017). Five of these species (*B. tectorum*, *L. cuneata*, *L. sinense*, *L. japonica*, *S. halepense*) and one native species (*Juniperus virginiana*) are on the OKIPC's "Dirty Dozen" list of the worst invasive species in the state. Four species (*Erodium cicutarium, Lonicera maackii*, *Melilotus officinalis*, *Pyrus calleryana*) are on the Oklahoma Watch List, and an additional 19 species are listed as problem species in states bordering Oklahoma (Oklahoma Invasive Plants Council 2017). Other species may become problems in the future. For example, *Koelreuteria paniculata*, *Nandina domestica*, and *Pistacia chinensis* were found in the forest, and these cultivated species are considered invasive in Texas and other southeastern states (Texas Invasives 2017).

The major plant communities at Hafer Park and brief descriptions of common species are as follows:

1. ***Quercus stellata-Quercus marilandica/Schizachyrium scoparium* woodland association** (Hoagland 2000)

Post oak/blackjack oak woodland is the predominant vegetation association in the park. Common species included *Celtis* spp., *Cornus drummondii, Juniperus virginiana, Morus rubra*, *Quercus muehlenbergii*, *Sideroxylon lanuginosum*, *Symphoricarpos orbiculatus,* and *Ulmus* spp. *Fraxinus pennsylvanica*, *Prunus mexicana, Quercus shumardii, and Viburnum rufidulum* were occasionally encountered. Exotic woody plants found in this community included *Ligustrum sinense*, *Lonicera maackii*, *Pyrus calleryana*, and *Rosa multiflora*.

2. ***Schizachyrium scoparium-Sorghastrum nutans* herbaceous association** (Hoagland 2000)

This tallgrass prairie community was found in the northeast corner of the park. Commonly encountered species included *Acacia angustissima*, *Ambrosia psilostachya*, *Asclepias verticillata*, *Asclepias viridis*, *Bouteloua* spp., *Chamaecrista fasciculata*, *Coreopsis tinctoria*, *Dichanthelium* spp., *Eragrostis* spp., *Gaillardia aestivalis*, *Lespedeza* spp., *Liatris punctata*, *Panicum virgatum*, *Psoralidium tenuiflorum*, *Sabatia campestris*, *Solidago* spp., *Symphyotrichum ericoides*, and *Xanthisma texanum*. *Rhus glabra* has spread into much of this area. The invasive native *Juniperus virginiana* and the invasive exotic *Lespedeza cuneata* are threatening this community.

3. **Riparian forest**

Riparian forest was found on the steep banks of Spring Creek. Common woody species included *Catalpa speciosa*, *Celtis* spp.,

Cercis canadensis, *Cornus drummondii*, *Juglans nigra*, *Juniperus virginiana*, *Morus rubra*, *Populus deltoides*, *Salix nigra*, *Sapindus saponaria*, *Ulmus americana*, and *Ulmus rubra*. *Quercus macrocarpa*, *Q. muehlenbergii*, *Acer negundo*, *Gymnocladus dioicus*, and *Equisetum laevigatum* were occasionally encountered. Common vines included *Cocculus carolinus*, *Parthenocissus quinquefolia*, *Smilax* spp., and *Toxicodendron radicans*. Exotic woody plants found in this community included *Albizia julibrissin* and *Ulmus parvifolia*.

4. **Disturbed areas**

This type of vegetation was found predominately in mowed lawns around picnic areas and playgrounds and along paved trails. Common species included *Ambrosia trifida*, *Arenaria serpyllifolia*, *Bromus* spp., *Cerastium pumilum*, *Cruciata pedemontana*, *Cynodon dactylon*, *Erodium cicutarium*, *Geranium pusillum*, *Lamium amplexicaule*, *Lonicera japonica*, *Medicago lupulina*, *Scleranthus annuus*, *Stellaria media*, *Sherardia arvensis*, *Sorghum halepense*, *Trifolium repens*, and *Veronica* spp. Disturbed areas of Spring Creek have been invaded by exotic species such as *Phragmites australis*, *Parthenium hysterophorus*, and *Clematis terniflora*.

A comparison with the species-area relationship for 59 Oklahoma floras published by Palmer (2007) indicates the flora of Hafer Park is among the richest for areas of a similar size. However, of all the floras listed, only one (Vance Air Force Base) had a higher proportion of non-native species (46.8%) than Hafer Park (22.2%). The next highest is for a checklist of plants in Cleveland County, at 17.5%. The percentage of non-native taxa from grassland-dominated sites (Buthod and Hoagland 2016) in Oklahoma ranged from 8.8% to 15%. The percentage of non-native taxa for Alabaster Caverns State Park, a heavily-visited park in the Cimarron Gypsum Hills of Woodward County, Oklahoma, was 15.3% (Caddell and Rice 2012). Inventories of natural areas in Oklahoma generally exclude cultivated plants that have not become naturalized, and those plants have been excluded in the inventory reported here. However, the proportion of non-native species for Hafer Park would be much higher if those plants were included.

This inventory indicates that Hafer Park has a rich vascular plant community, in spite of the development of large portions for recreational use. It has a variety of habitats that support high plant diversity within the rapidly developing City of Edmond. However, the native plant communities at Hafer Park are threatened by an increase in exotic, invasive plants that are already reported as invasive within the state, as well as perhaps by others that are considered invasive in adjacent states. The diversity of the understory of the post oak-blackjack oak forest is being threatened particularly by the invasion of Chinese privet (*Ligustrum sinense*), and the tallgrass prairie in the northeast corner of the park is being threatened particularly by encroachment of the native invader eastern red cedar (*Juniperus virginiana*) and by the exotic invasive *Lespedeza cuneata*.

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APPENDIX

Vascular Plant Species from E. C. Hafer Park, Edmond, Oklahoma

Annotated species list with organization based on Angiosperm Phylogeny Group (APG III) recommendations (Stevens 2017). Nomenclature is based on ITIS (2017), and common names are from the USDA PLANTS Database (USDA NRCS 2017). Duration (A=annual, B=biennial, P=perennial), growth form (F=forb, G=graminoid, S=shrub, T=tree, V=woody vine), and collection numbers follow species name. Duration, nativity, and growth form are from the USDA PLANTS Database (USDA NRCS 2017). If duration varied or if more than one growth form was listed in the PLANTS Database, the duration and growth form listed for Oklahoma by Taylor and Taylor (1994) was used. Non-native species to the United States are indicated with an asterisk (*). Collectors are AK= Aaron Kidd, AP= Alonna Price Smith, CC= Carmen Cowo Esqueda, GC=Gloria Caddell, HU=Hitomi Ushio, KC= Katie Christoffel, RC= Rachel Cotts, SD= Shahang Derakhshan, TW=T. Williams, and YS=Yukiko Shimoda. Voucher specimens were deposited in the University of Central Oklahoma Herbarium (CSU).

MONILOPHYTA
Equisetaceae
Equisetum laevigatum A. Braun (smooth horsetail) – P; F; GC1315

GYMNOSPERMS/PINOPHYTA
Cupressaceae
Juniperus virginiana L. (eastern redcedar) – P; T; AP105, CC50

ANGIOSPERMS/MAGNOLIOPHYTA
EUDICOTS
Acanthaceae
Dicliptera brachiata (Pursh) Spreng. (branched foldwing) – A; F; GC1316
Ruellia humilis Nutt. (fringeleaf wild petunia) – P; F; AP127, KC88

Adoxaceae
Viburnum rufidulum Raf. (rusty blackhaw) – P; T, S; KC91

Amaranthaceae
Amaranthus arenicola I.M. Johnst. (sandhill amaranth) – A; F; KC115, KC116
Froelichia floridana (Nutt.) Moq. (plains snakecotton) – A; F; AP107

Anacardiaceae
**Pistacia chinensis* Bunge (Chinese pistache) – P; T; KC123
Rhus copallinum L. (winged sumac) – P; S; AP96, CC67
Rhus glabra L. (smooth sumac) – P; S; AP124, SD67
Toxicodendron radicans (L.) Kuntze (eastern poison ivy) – P; V; KC69

Apiaceae
Chaerophyllum tainturieri Hook. (hairyfruit chervil) – A; F; GC 1306
Sanicula canadensis L. (Canadian blacksnakeroot) – B; F; AP75
**Torilis arvensis* (Huds.) Link (spreading hedgeparsley) – A; F; AP93, KC68

Apocynaceae
Apocynum cannabinum L. (Indianhemp) – P; F; AP122
Asclepias verticillata L. (whorled milkweed) – P; F; AP109
Asclepias viridis Walter (green antelopehorn) – P; F; RC74

Asteraceae
Achillea millefolium L. (common yarrow) – P; F; AP67
Ambrosia psilostachya DC. (Cuman ragweed) – P; F; CC49
Ambrosia trifida L. (great ragweed) – A; F; KC87
Amphiachyris dracunculoides (DC.) Nutt. (prairie broomweed) – A; F; SD69
Antennaria parlinii Fernald (Parlin's pussytoes) – P; F; KC139
Artemisia ludoviciana Nutt. (white sagebrush) – P; F; GC1300
Bidens bipinnata L. (Spanish needles) – A; F; KC89
Bradburia pilosa (Nutt.) Semple (soft goldenaster) – A; F; AP92, CC52, CC53
Cirsium altissimum (L.) Hill (tall thistle) – B; F; KC39
Cirsium undulatum (Nutt.) Spreng. (wavyleaf thistle) – P; F; AP120
Conyza canadensis (L.) Cronquist (Canadian horseweed) – A; F; AK1
Coreopsis tinctoria Nutt. (golden tickseed) – A; F; AP94
**Cosmos sulphureus* Cav. (sulphur cosmos) – A; F; KC80
Diaperia prolifera (Nutt. ex DC.) Nutt. (bighead pygmycudweed) – A; F; RC59
Diaperia verna (Raf.) Morefield (spring pygmycudweed) – A; F; GC1301
Eclipta prostrata (L.) L. (false daisy) – A; F; KC150
Elephantopus carolinianus Raeusch (Carolina elephantsfoot) – P; F; KC58
Erigeron strigosus Muhl. ex Willd. (prairie fleabane) – A; F; AP90
Gaillardia aestivalis (Walter) H. Rock (lanceleaf blanketflower) – P; F; AP99
Gamochaeta argyrinea G. L. Nesom (silvery everlasting) – A; F; AP53
Gamochaeta purpurea (L.) Cabrera (spoonleaf purple everlasting) – P; F; GC1302
Grindelia ciliata (Nutt.) Spreng. (Spanish gold) – A; F; KC95
Helianthus annuus L. (common sunflower) – A; F; KC42, KC94
Helianthus mollis Lam. (ashy sunflower) – P; F; KC40
Heterotheca subaxillaris (Lam.) Britton & Rusby (camphorweed) – A; F; SD60, KC149
Lactuca ludoviciana (Nutt.) Riddell (biannual lettuce) – B; F; AK3
**Lactuca serriola* L. (prickly lettuce) – A; F; AP113
Liatris punctata Hook. (dotted blazing star) – P; F; SD72, GC1317
**Parthenium hysterophorus* L. (Santa Maria feverfew) – A; F; KC148
Pluchea camphorata (L.) DC. (camphor pluchea) – P; F; KC76
Pseudognaphalium obtusifolium (L.) Hilliard & B.L. Burtt (rabbit-tobacco) – A; F; KC112
Pyrrhopappus grandiflorus (Nutt.) Nutt. (tuberous desert-chicory) – P; F; RC57
Solidago canadensis L. (Canada goldenrod) – P; F; KC102
Solidago missouriensis Nutt. (Missouri goldenrod) – P; F; KC77
Solidago nemoralis Aiton (gray goldenrod) – P; F; CC48
Solidago rigida L. (stiff goldenrod) – P; F; CC42
Solidago speciosa Nutt. (showy goldenrod) – P; F; CC41
Symphyotrichum drummondii (Lindl.) G.L. Nesom (Drummond's aster) – P; F; CC70, KC78, KC85
Symphyotrichum ericoides (L.) G.L. Nesom (white heath aster) – P; F; CC44
Symphyotrichum subulatum (Michx.) G.L. Nesom (eastern annual saltmarsh aster) – A; F; KC99, KC147, SD79

**Taraxacum officinale* F.H. Wigg. (common dandelion) – P; F; AP64
Thelesperma filifolium (Hook.) A. Gray (stiff greenthread) – P; F; AP108
**Tragopogon dubius* Scop. (yellow salsify) – A; F; AP104
Verbesina virginica L. (white crownbeard) – P; F; SD71
Vernonia baldwinii Torr. (Baldwin's ironweed) – P; F; KC41
Xanthisma texanum DC. (Texas sleepydaisy) – A; F; SD77

Berberidaceae
**Nandina domestica* Thunb. (sacred bamboo) – P; S; GC1320, KC83, SD75

Bignoniaceae
Campsis radicans (L.) Seem. ex Bureau (trumpet creeper) – P; V; GC 1322
Catalpa speciosa (Warder) Warder ex Engelm. (northern catalpa) – P; T; RC38, KC101, KC163

Boraginaceae
Myosotis verna Nutt. (spring forget-me-not) – A; F; GC1291

Brassicaceae
**Capsella bursa-pastoris* (L.) Medik. (shepherd's purse) – A; F; KC127
Lepidium virginicum L. (Virginia pepperweed) – A; F; AP71, RC48, GC1294

Cactaceae
Opuntia humifusa (Raf.) Raf. (devil's-tongue) – P; S; GC1319

Campanulaceae
Triodanis perfoliata (L.) Nieuwl. (clasping Venus' looking glass) – A; F; RC42

Cannabaceae
Celtis laevigata Willd. (sugarberry) – P; T; RC77
Celtis occidentalis L. (common hackberry) – P; T; KC59
Celtis reticulata Torr. (netleaf hackberry) – P; T; AP65, KC37, KC84

Caprifoliaceae
**Lonicera japonica* Thunb. (Japanese honeysuckle) – P; V; SD66, KC162
**Lonicera maackii* (Rupr.) Herder (Amur honeysuckle) – P; S; GC1285
Lonicera sempervirens L. (trumpet honeysuckle) – P; V; YS31
Symphoricarpos orbiculatus Moench (coralberry) – P; S; SD63

Caryophyllaceae
**Arenaria serpyllifolia* L. (thymeleaf sandwort) – A; F; AP74, RC82
**Cerastium pumilum* W. Curtis (European chickweed) – A; F; RC41, GC1292
**Scleranthus annuus* L. (German knotgrass) – A; F; GC1304
**Stellaria media* (L.) Vill. (common chickweed) – A; F; RC45

Celastraceae
**Euonymus europaeus* L. (European spindletree) – P; S; KC57

Cistaceae
Lechea tenuifolia Michx. (narrowleaf pinweed) – P; F; AP103, GC1278, KC61

Cornaceae
Cornus drummondii C.A. Mey. (roughleaf dogwood) – P; T; AP58, CC64, RC56

Cucurbitaceae
Melothria pendula L. (Guadeloupe cucumber) – P; F; KC109

Ebenaceae
Diospyros virginiana L. (common persimmon) – P; T; KC50

Euphorbiaceae
Acalypha gracilens A. Gray (slender threeseed mercury) – A; F; KC46, SD58
Acalypha ostryifolia Riddell (pineland threeseed mercury) – A; F; KC117
Croton glandulosus L. (vente conmigo) – A; F; KC48, KC75
Croton lindheimerianus Scheele (threeseed croton) – A; F; AP110
Croton monanthogynus Michx. (prairie tea) – A; F; SD78
Euphorbia corollata L. (flowering spurge) – P; F; CC62
Euphorbia dentata Michx. (toothed spurge) – A; F; KC47
Euphorbia maculata L. (spotted sandmat) – A; F; SD64, KC49
Euphorbia nutans Lag. (eyebane) – A; F; KC97

Fabaceae
Acacia angustissima (Mill.) Kuntze (prairie acacia) – P; F; CC45
Acmispon americanus (Nutt.) Rydb. (American bird's-foot trefoil) – A; F; RC73
**Albizia julibrissin* Durazz. (silktree) – P; T; KC51, KC105
Cercis canadensis L. (eastern redbud) – P; T; AP66, SD57, KC137
Chamaecrista fasciculata (Michx.) Greene (partridge pea) – A; F; AP102, CC43
Desmanthus illinoensis (Michx.) MacMill. ex B.L. Rob. & Fernald (Illinois bundleflower) – P; F; AP97
Desmodium paniculatum (L.) DC. (panicledleaf ticktrefoil) – P; F; KC153
Desmodium sessilifolium (Torr.) Torr. & A. Gray (sessileleaf ticktrefoil) – P; F; CC59
Desmodium viridiflorum (L.) DC. (velvetleaf ticktrefoil) – P; F; KC141
Galactia regularis (L.) Britton, Sterns & Poggenb. (eastern milkpea) – P; F; KC66, AP131
Gleditsia tricanthos L. (honeylocust) – P; T; GC 1321
Gymnocladus dioicus (L.) K. Koch (Kentucky coffeetree) – P; T; GC1283
**Kummerowia stipulacea* (Maxim.) Makino (Korean clover) – A; F; KC152
Lespedeza capitata Michx. (roundhead lespedeza) – P; F; CC55
**Lespedeza cuneata* (Dum. Cours.) G. Don (sericea lespedeza) – P; F; SD74
Lespedeza stuevei Nutt. (tall lespedeza) – P; F; KC55
Lespedeza virginica (L.) Britton (slender lespedeza) – P; F; CC46
**Medicago lupulina* L. (black medick) – A; F; RC47
**Medicago minima* (L.) L. ex Bartal. (little bur-clover) – A; F; RC46
**Melilotus albus* Medik. (white sweet clover) – A; F
**Melilotus officinalis* (L.) Lam. (yellow sweet clover) – A; F; GC1280
Psoralidium tenuiflorum (Pursh) Rydb. (slimflower scurf pea) – P; F; AP100
Robinia pseudoacacia L. (black locust) – P; T; KC98

Strophostyles helvola (L.) Elliott (amberique-bean) – A; F; AK7
**Trifolium dubium* Sibth. (suckling clover) – A; F; AP56
**Trifolium repens* L. (white clover) – P; F; RC53, KC157
**Vicia sativa* L. (garden vetch) – A; F; GC1295

Fagaceae
Quercus macrocarpa Michx. (bur oak) – P; T; KC70
Quercus marilandica Munchh. (blackjack oak) – P; T; CC66
Quercus muehlenbergii Engelm. (chinquapin oak) – P; T; SD56
Quercus shumardii Buckley (Shumard's oak) – P; T; KC90
Quercus stellata Wangenh. (post oak) – P; T; CC68

Gentianaceae
Sabatia campestris Nutt. (Texas star) – A; F; AP128

Geraniaceae
**Erodium cicutarium* (L.) L'Hér ex Aiton (redstem stork's bill) – A; F; AP63
**Geranium pusillum* L. (small geranium) – A; F; RC40, GC1297
Geranium texanum (Trel.) A. Heller (Texas geranium) – A; F; GC1307

Juglandaceae
Carya illinoinensis (Wangenh.) K. Koch (pecan) – P; T; KC93
Juglans nigra L. (black walnut) – P; T; RC78

Lamiaceae
**Lamium amplexicaule* L. (henbit deadnettle) – A; F; KC126
Monarda citriodora Cerv. ex Lag. (lemon beebalm) – A; F; AP98
Scutellaria parvula Michx. (small skullcap) – P; F; GC1298
Teucrium canadense L. (Canada germander) – P; F; AP129

Malvaceae
Callirhoe involucrata (Torr. & A. Gray) A. Gray (purple poppymallow) – P; F; KC154
**Hibiscus trionum* L. (flower of an hour) – A; F

Menispermaceae
Cocculus carolinus (L.) DC. (Carolina coralbead) – P; F; AP119, KC82

Molluginaceae
Mollugo verticillata L. (green carpetweed) – A; F; KC110

Montiaceae
Phemeranthus parviflorus (Nutt.) Kiger (sunbright) – P; F; GC1279

Moraceae
**Morus alba* L. (white mulberry) – P; T; KC124
Morus rubra L. (red mulberry) – P; T; SD65

Nyctaginaceae
Mirabilis albida (Walter) Heimerl (white four o'clock) – P; F; AP130
**Mirabilis jalapa* L. (marvel of Peru) – P; F; KC114
Mirabilis nyctaginea (Michx.) MacMill. (heartleaf four o'clock) – P; F; GC1296

Oleaceae
Fraxinus pennsylvanica Marsh. (green ash) – P; T; KC65, KC106
**Ligustrum sinense* Lour. (Chinese privet) – P; S; AP91, SD59, GC1299

Onagraceae
Ludwigia alternifolia L. (seedbox) – P; F; AP126
Oenothera biennis L. (common evening primrose) – B; F; KC108
Oenothera curtiflora W.L. Wagner & Hoch (velvetweed) – A; F
Oenothera laciniata Hill (cutleaf evening primrose) – P; F; AP69

Oxalidaceae
Oxalis dillenii Jacq. (slender yellow woodsorrel) – P; F; AP54, RC36
Oxalis violacea L. (violet woodsorrel) – P; F

Passifloraceae
Passiflora lutea L. (yellow passionflower) – P; F; KC38

Phytolaccaceae
Phytolacca americana L. (American pokeweed) – P; F; AP123

Plantaginaceae
Plantago aristata Michx. (largebracted plantain) – A; F; AP76
Plantago patagonica Jacq. (woolly plantain) – A; F; RC64, KC161
Plantago virginica L. (Virginia plantain) – A; F; RC39, AP57, GC1290
**Veronica arvensis* L. (corn speedwell) – A; F; GC1293, KC155
**Veronica hederifolia* L. (ivyleaf speedwell) – A; F; KC138
**Veronica polita* Fr. (gray field speedwell) – A; F; KC132

Polygonaceae
Fallopia scandens (L.) Holub (climbing false buckwheat) – P; F; GC1313
Persicaria bicornis (Raf.) Nieuwl (Pennsylvania smartweed) – A; F; KC100
Persicaria lapathifolia (L.) Gray (curlytop knotweed) – A; F; KC118
Persicaria virginiana (L.) Gaertn. (jumpseed) – P; F; KC119
**Polygonum aviculare* L. (prostrate knotweed) – A; F; KC92
Rumex hastatulus Baldwin (heartwing sorrel) – P; F; AP62, RC63

Portulacaceae
Portulaca pilosa L. (kiss me quick) – A; F; GC1286

Ranunculaceae
**Clematis terniflora* DC. (sweet autumn virginsbower) – P; V; KC107
Ranunculus abortivus L. (littleleaf buttercup) – P; F

Rosaceae
Geum canadense Jacq. (white avens) – P; F; GC1282, KC142
Prunus angustifolia Marshall (Chickasaw plum) – P; S; KC140
Prunus gracilis Engelm. & A. Gray (Oklahoma plum) – P; S; RC75, AP121
Prunus mexicana S. Watson (Mexican plum) – P; T; KC134
Prunus virginiana L. (chokecherry) – P; T; YS30
**Pyrus calleryana* Decne. (Callery pear) – P; T; KC72
**Rosa multiflora* Thunb. (multiflora rose) – P; V; KC71
Rubus aboriginum Rydb. (garden dewberry) – P; S; HU32, YS32

Rubiaceae
**Cruciata pedemontana* (Bellardi) Ehrend. (piedmont bedstraw) – A; F; RC43, RC44
Diodella teres (Walter) Small (poorjoe) – A; F; CC54
Galium aparine L. (stickywilly) – A; F; GC1288
Galium circaezans Michx. (licorice bedstraw) – P; F; AP95, RC80
Galium pilosum Aiton (hairy bedstraw) – P; F; AP68
Houstonia pusilla Schoepf (tiny bluet) – A; F; KC131, GC1289
**Sherardia arvensis* L. (blue fieldmadder) – A; F; AP73

Rutaceae
Zanthoxylum americanum Mill. (common pricklyash) – P; T; AP125, KC56, KC135

Salicaceae
Populus deltoides W. Bartram ex Marshall (eastern cottonwood) – P; T; KC52, KC96
Salix nigra Marshall (black willow) – P; T; RC58

Santalaceae
Phoradendron serotinum (Raf.) M.C. Johnst. (oak mistletoe) – P; S; KC125

Sapindaceae
Acer negundo L. (boxelder) – P; T
Acer saccharinum L. (silver maple) – P; T; KC122
**Koelreuteria paniculata* Laxm. (goldenrain tree) – P; T; RC81
Sapindus saponaria L. (western soapberry) – P; T; KC44, KC62, KC79

Sapotaceae
Sideroxylon lanuginosum Michx. (gum bully) – P; T; SD53

Solanaceae
Solanum dimidiatum Raf. (western horsenettle) – P; F; TW46
Solanum elaeagnifolium Cav. (silverleaf nightshade) – P; F; KC103
Solanum ptycanthum Dunal (West Indian nightshade) – A; F; KC113, KC120

Ulmaceae
Ulmus americana L. (American elm) – P; T; RC35, SD54, SD55, KC128
**Ulmus parvifolia* Jacq. (Chinese elm) – P; T; GC1314
Ulmus rubra Muhl. (slippery elm) – P; T; CC63

Urticaceae
Parietaria pensylvanica Muhl. ex Willd. (Pennsylvania pellitory) – A; F; RC55

Violaceae
Viola bicolor Pursh (field pansy) – A; F; KC130
Viola sororia Willd. (common blue violet) – P; F; KC136

Vitaceae
Parthenocissus quinquefolia (L.) Planch. (Virginia creeper) – P; V; AP112
Vitis vulpina L. (frost grape) – P; V; RC68, RC79

MONOCOTS
Amaryllidaceae
**Allium vineale* L. (wild garlic) – P; F; KC158
Nothoscordum bivalve (L.) Britton (crowpoison) – P; F; KC133

Asparagaceae
**Muscari botryoides* (L.) Mill. (common grape hyacinth) – P; F; KC129

Commelinaceae
**Commelina communis* L. (Asiatic dayflower) – A; F; KC81
Commelina erecta L. (whitemouth dayflower) – P; F; AK2, AP101, RC72
Tradescantia ohiensis Raf. (bluejacket) – P; F; RC70, AP111

Cyperaceae
Carex muehlenbergii Schkuhr ex Willd. (Muhlenberg's sedge) – P; G; AP87, RC60
Carex retroflexa Muhl. ex Willd. (reflexed sedge) – P; G; GC1305
Cyperus echinatus (L.) Alph. Wood (globe flatsedge) – P; G; KC144
Cyperus lupulinus (Spreng.) Marcks (Great Plains flatsedge) – P; G; AP78, RC51
Cyperus reflexus Vahl (bentawn flat sedge) – P; G; AP59, AP117
Cyperus squarrosus L. (bearded flat sedge) – A; G; AP61
Lipocarpha drummondii (Nees) G.C. Tucker (Drummond's halfchaff sedge) – A; G; AP118
Scleria ciliata Michx. (fringed nutrush) – P; G; GC1277

Iridaceae
Sisyrinchium angustifolium Mill. (narrowleaf blue-eyed grass) – P; F; KC159

Juncaceae
Juncus coriaceus Mack. (leathery rush) – P; G; AP79
Juncus interior Wiegand (inland rush) – P; G; GC1303
Juncus marginatus Rostk. (grassleaf rush) – P; G; AK6, RC61, AP60

Poaceae
Andropogon gerardii Vitman (big bluestem) – P; G; CC60
Andropogon ternarius Michx. (splitbeard bluestem) – P; G; GC1287, GC1318
Aristida oligantha Michx. (prairie threeawn) – A; G; CC57
Bothriochloa laguroides (DC.) Herter (silver beardgrass) – P; G; KC143, GC1276

Bouteloua curtipendula (Michx.) Torr. (sideoats gramma) – P; G; KC64
Bouteloua dactyloides (Nutt.) Columbus (buffalograss) – P; G; AP83
Bouteloua hirsuta Lag. (hairy grama) – P; G; KC63
**Bromus catharticus* Vahl (rescuegrass) – A; G; GC1310, RC50
**Bromus commutatus* Schrad. (meadow brome) – A; G; RC62
**Bromus japonicus* Thunb. ex Murray (Japanese brome) – A; G; AP77
Bromus pubescens Muhl. ex Willd. (hairy woodland brome) – P; G; RC54
**Bromus tectorum* L. (cheatgrass) – A; G; GC1309
Cenchrus incertus M.A. Curtis (field sandbur) – P; G; KC121, AP116
Chasmanthium latifolium (Michx.) H.O. Yates (Indian woodoats) – P; G; AP114
Chloris verticillata Nutt. (tumble windmill grass) – P; G; SD68
Coelorachis cylindrica (Michx.) Nash (cylinder jointtail grass) – P; G; AP81
Coleataenia anceps (Michx.) Soreng (beaked panicgrass) – P; G; KC36
**Cynodon dactylon* (L.) Pers. (Bermudagrass) – P; G; RC49, KC160
**Dactylis glomerata* L. (orchardgrass) – P; G; AP82
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark (tapered rosette grass) – P; G; KC74, AP115, AP52
Dichanthelium oligosanthes (Schult.) Gould (Heller's rosette grass) – P; G; GC1311, KC60
Dichanthelium scoparium (Lam.) Gould (velvet panicum) – P; G; SD70
Digitaria ciliaris (Retz.) Koeler (southern crabgrass) – A; G; KC111
Echinochloa muricata (P. Beauv.) Fernald (rough barnyardgrass) – A; G; KC104
**Eleusine indica* (L.) Gaertn. (Indian goosegrass) – A; G; KC146
Elymus virginicus L. (Virginia wildrye) – P; G; AK4, AP72
Eragrostis capillaris (L.) Nees (lace grass) – A; G; KC73
Eragrostis secundiflora J. Presl (red lovegrass) – P; G; KC53
Eragrostis spectabilis (Pursh) Steud. (purple lovegrass) – P; G; CC56
Hordeum pusillum Nutt. (little barley) – A; G; AP70, RC52
Panicum virgatum L. (switchgrass) – P; G; CC61, KC145
Paspalum setaceum Michx. (thin paspalum) – P; G; AP80, KC45
**Phragmites australis* (Cav.) Trin. ex Steud. (common reed) – P; G; KC151
**Poa annua* L. (annual bluegrass) – A; G; AP55, RC37
**Schedonorus arundinaceus* (Shreb.) Dumort. (tall fescue) – P; G; KC156, RC65
Schizachyrium scoparium (Michx.) Nash (little bluestem) – P; G; CC47
**Setaria faberi* R.A.W. Herrm. (Japanese bristlegrass) – A; G; AK5, SD61
Sorghastrum nutans (L.) Nash (Indiangrass) – P; G; CC58
**Sorghum halepense* (L.) Pers. (Johnsongrass) – P; G; RC71, KC54, AP86
Tridens flavus (L.) Hitchc. (purpletop tridens) – P; G; SD76
**Vulpia myuros* (L.) C.C. Gmel. (annual fescue) – A; G; AP85
Vulpia octoflora (Walter) Rydb. (sixweeks fescue) – A; G; GC1312

Smilacaceae
Smilax bona-nox L. (saw greenbrier) – P; V; AP106
Smilax tamnoides L. (bristly greenbrier) – P; V; RC69