Vascular Flora of Love Valley Wildlife Management Area, Love County, Oklahoma

Bruce W. Hoagland
Oklahoma Biological Survey and Department of Geography, University of Oklahoma, Norman, OK 73019

Forrest Johnson (deceased)
Oklahoma Biological Survey, and Department of Botany and Microbiology, University of Oklahoma, Norman, OK 73019

This article reports the results of an inventory of the vascular plants from the Love Valley Wildlife Management Area in south-central Oklahoma. Three hundred sixty-eight species of vascular plants in 258 genera and 86 families were collected. The most species were collected from the families Asteraceae (54), Poaceae (47), and Fabaceae (35). One hundred six species were annuals, and 241 were perennials. Sixty-nine species of woody plants were present. Thirty-one exotic species were collected representing 8.6% of the flora. One species tracked by the Oklahoma Natural Heritage Inventory was found. This study reports 162 species previously not documented in Love County. ***© 2004 Oklahoma Academy of Science***

INTRODUCTION

Biotic inventories are the foundation of conservation biology and biogeographic research. This study had two objectives, the first of which was to fill a gap in floristic data for south-central Oklahoma. Prior to 1997, the year collecting began for this study, 345 species were reported from Love County (Hoagland 2004). Botanical study of Love County began on 15 April 1913, when G. W. Stevens collected 54 specimens. In addition to 1913, peak years for plant collecting in Love County were 1938 (51 specimens) and 1953 (42 specimens; Hoagland 2004).

The second objective of this study was to provide a comprehensive floristic inventory and species for resource managers at Love Valley Wildlife Management Area (LVWMA). Such inventories aid resource managers in locating populations of sensitive species and documenting the occurrence of exotic and nuisance species (Barkley 2000). Ignorance of the presence of exotic species can be detrimental to sensitive species and / or exert adverse economic impacts (Ertter 2000).

STUDY AREA

The LVWMA encompasses 3,134 ha in Love County (Fig. 1; Wyatt 2004). It is located along the North Bank of the Red River immediately upstream from Lake Texoma. The LVWMA was established in 1969 and is one of 64 wildlife management areas maintained by the Oklahoma Department of Wildlife Conservation. Latitudinal extent ranges from 33.72°N to 33.82°N and longitudinal extent from 97.02°W to 94.14°W.

The LVWMA is located within the subtropical humid (Cf) climate zone (Trewartha 1968). Summers are warm (mean July temperature = 27.7°C) and humid, whereas winters are relatively short and mild (mean January temperature = 1.9°C). Mean annual precipitation is 105.6 cm, with periodic severe droughts (Oklahoma Climatological Survey 2003). Physiographically, the study area is located within the Osage Plains section of the Central Lowlands province (Hunt 1974) and the Dissected Coastal Plain province of Oklahoma (Curtis and Ham 1979). The surface geology is primarily Quaternary silt, sand, and clay, but an outcropping of

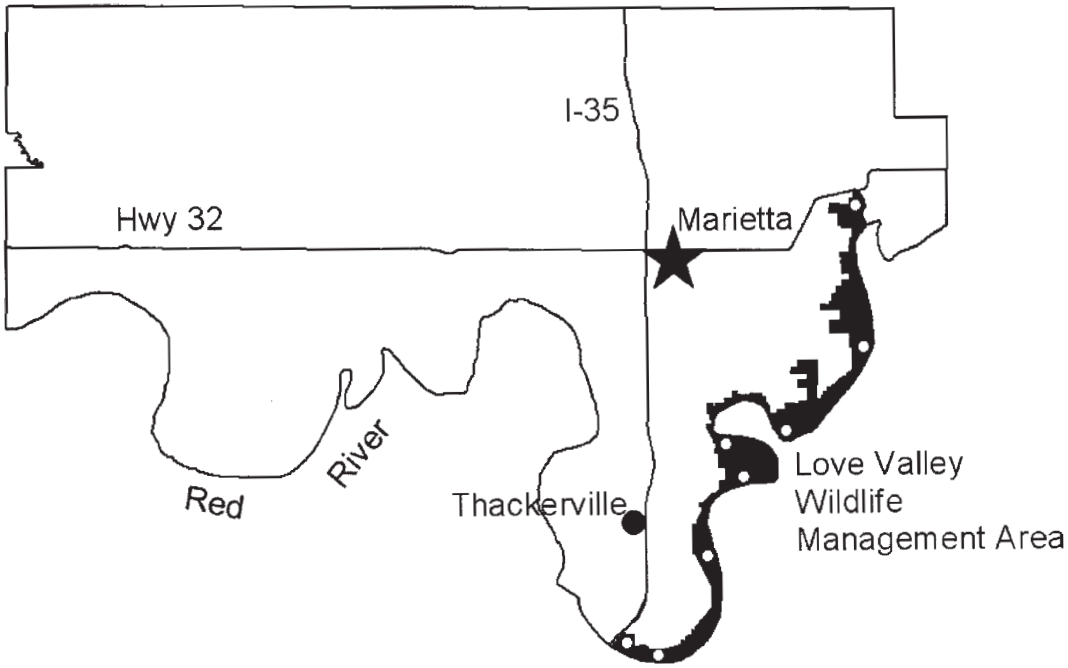

Figure 1: Location of Love Valley Wildlife Management Area and floristic collection sites. Collection sites are denoted as white circles.

Cretaceous sandstone is also preset (Branson and Johnson 1979). Elevation ranges from 197 m to 243 m. The primary soil association at LVWMA is the Miller-Yahola, which is composed of deep, clayeyand loamey soils in bottomlands. The Dougherty-Eufaula association occurs on deep sandy soils in uplands (Maxwell and Reasoner 1966). The predominant potential vegetation types are *Quercus stellata-Q. marilandica* forest and woodlands, bottomland forests, and tallgrass prairies (Duck and Fletcher 1943). These vegetation types are restricted in distribution. The majority of bottomland forests are tilled and planted in crops. Oldfields are also a common land cover type at LVWMA.

METHODS

Eight collection sites were established at LVWMA for intensive floristic sampling. Sites were selected following a review of US Geological Survey 1:24,000 topographic maps and field reconnaissance. The predominant vegetation association at these sites was classified according to Hoagland (2000). Collections also were made randomly throughout the LVWMA from March through October 1997. Vouchers for species exotic to North America 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 Waterfall (1969), Great Plains Flora Association (1986), and Diggs et al (1999). Origin, either native or introduced, was determined by using Taylor and Taylor (1991) and US Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS 2004). Nomenclature follows the (USDA-NRCS 2004). Voucher specimens were deposited at OKL.

RESULTS AND DISCUSSION

A total of 368 species of vascular plants in 86 families and 258 genera were collected at LVWMA (Table 1). Among the angiosperms, 78 were monocots, and 276 were dicots. In addition, there were five species

Table 1: Summary of floristic collections made at Love Valley Wildlife Management Area, Love County, Oklahoma.*

Taxonomic group	Species	Native spp.	Introduced spp.
Equisetophyta	1	1	0
Pteridophyta	5	5	0
Coniferophyta	1	1	0
Magnoliophyta			
Magnoliopsida	277	259	18
Liliopsida	84	72	12
Total	368	338	30

* Table format follows Palmer et al (1995).

of ferns, one fern ally, and one gymnosperm. The Asteraceae (54), Poaceae (47), and Fabaceae (35) had the greatest number of species. The genera *Carex* (8), *Quercus* (6), and *Symphyotrichum* (6) included the greatest number of species. One hundred six species of annuals, 12 biennials, and 241 perennials were in the LVWMA flora. Sixty-nine species of woody plants were collected: 27 trees, 26 shrubs, and 16 woody vines.

Thirty-one species (8.6%) from 12 families were introduced to North America. The families with the greatest number of introduced species were Poaceae (12) and Fabaceae (9). Eighteen of the introduced species were annuals, one was biennial, and 12 were perennials. The percentage of exotic species was low in comparison to recently published floristic inventories. At Keystone Wildlife Management Area, 15% of the flora was composed of exotic species, 12% at the Chickasaw National Recreation Area, (Hoagland and Johnson 2001), 9% at the Oologah Wildlife Management Area (Hoagland and Wallick 2003) and Hugo Wildlife Management Area (Hoagland and Buthod, forthcoming), and 11% for an inventory of Tillman County (Hoagland et al, forthcoming). However, both Red Slough and Grassy Slough had a much lower percentage of exotics, 6.6% (Hoagland and Johnson, forthcoming). No federally listed threatened or endangered species were encountered at LVWMA. *Marsilea vestita* (G5S1) was the only species tracked by the Oklahoma Natural Heritage Inventory (ONHI; 2004) encountered. (Species are ranked by the ONHI according to level of imperilment at the global [G] and state [S] level on a scale of 1-5; with 1 representing a species that is imperiled and 5 a species that is secure [Groves et al 1995]).

As a result of this study, 523 species are now known to occur in Love County. A comparison with the Atlas of the Flora of Oklahoma database (AFO; Hoagland 2004) revealed that of the 361 species reported in this study, 162 had been previously collected in Love County. However, 164 species reported in the AFO database were not collected in this study.

The eight collection sites occurred within four vegetation associations. These associations are described in Hoagland (2000). A brief description of each follows.

***Quercus stellata-Q. marilandica-Carya texana* forest association**

This association occurred on uplands with deep sandy soils and was of limited extent. Associated species include *Aesculus glabra, Cercis canadensis, Helianthus hirsutus, Juglans nigra, Monarda punctata, Prunus mexicana, Schizachyrium scoparium, Symphoricarpos orbiculatus* and *Viburnum rufidulum*.

***Fraxinus pennsylvanica - Ulmus americana* forest association**

Most common in seasonally flooded bottomlands along the Red River. Common associates include *Acer negundo, Ampelopsis cordata, Boehmeria cylindrica, Celtis laevigata, Gleditsia triacanthos,* and *Morus rubra.*

***Schizachyrium scoparium-Bouteloua curtipendula* herbaceous association**

This association occurred on upland slopes underlain by Cretaceous sandstone. Common associated species include *Andropogon gerardii, Artemisia psilostachya,*

Helianthus hirsutus, Krameria lanceolata, Pediomelum cuspidatum, Rhus aromatica, Symphyotrichum ericoides, and *Tridens flavuus.*

Wetland and aquatic vegetation

Wetlands were limited to human-made ponds, a spring, and some seeps. As a result, it was decided not to classify wetlands into specific vegetation associations. Therefore, all wetland habitats have been assigned this designation. At the seeps and springs, the most common species were *Hydrocotyle verticillata, Lemna minor, Marsilea vestita, Rorippa nasturtium-aquaticum,* and *Spirodela polyrhiza.*

The vegetation in human-made ponds was in the *Typha* (*angustifolia, domingensis*) herbaceous association. Associated species included *Amorpha fruticosa, Andropogon glomeratus, Carex crus-crovi, Cephalanthus occidentalis, Ludwigia peploides, Pluchea odorata, Polygonum lapathifolium,* and *Salix nigra.*

Disturbed areas and old-field vegetation

This includes areas in crop cultivation, wildlife food plots, roadsides, and other areas exhibiting signs of physical disruption. It was by far the most common land cover type. Associated species include *Bothriochloa ischaemum, Daucus pusillus, Digitaria sanguinalis, Lespedeza cuneata, Melilotus alba, Rhus glabra,* and *Trifolium dubium.* Old-fields were characterized by *Amaranthus rudis, Ambrosia trifida, Aristida oligantha, Cirsium horridulum,* and *Conyza canadensis. Sorghum halepense* covers extensive areas of retired crop land, roadsides, and drainage ditches.

ACKNOWLEDGMENTS

We thank Debbie Benesh, Steve Gray, Newell McCarty, and Patty Smith for field assistance. Constructive and useful comments were provided by two anonymous reviewers. This project was funded by a grant from the Oklahoma Department of Wildlife Conservation.

REFERENCES

Barkley TM. 2000. Floristic studies in contemporary botany. Madroño 47:253-258.

Branson CC, Johnson KS. 1979. Generalized geologic map of Oklahoma. In: Johnson KS, Branson CC, Curtis NM, Ham WE, Harrison WE, Marcher MV, and Roberts JF, editors. Geology and earth resources of Oklahoma. Norman (OK): Oklahoma Geological Survey. p 4.

Curtis NM, Ham WE. 1979. Geomorphic provinces of Oklahoma. In: Johnson KS, Branson CC, Curtis NM, Ham WE, Harrison WE, Marcher MV, and Roberts JF, editors. Geology and earth resources of Oklahoma. Norman (OK): Oklahoma Geological Survey. p 5.

Diggs GM, Lipscomb BL, O'Kennon, RJ. 1999. Shinners and Mahler's illustrated flora of North Central Texas. Fort Worth (TX): Botanical Research Institute of Texas and Austin College. 1626 p.

Duck LG, Fletcher JB. 1943. A game type map of Oklahoma. A survey of the game and furbearing animals of Oklahoma. Oklahoma City (OK): Oklahoma Department of Wildlife Conservation.

Ertter B. 2000. Floristic surprises in North America north of Mexico. Ann Miss Bot Gard 87:81-109.

Great Plains Flora Association. 1986. Flora of the Great Plains. Lawrence (KS): University Press of Kansas. 1392 p.

Groves CR, Klein ML, Breden TF. 1995. Natural Heritage Programs: public-private partnerships for biodiversity conservation. Wildlife Soc Bull 23:784-790.

Hoagland BW. 2000. The vegetation of Oklahoma: a classification of landscape mapping and conservation planning. Southw Nat 45:385-420.

Hoagland BW. 2004. Atlas of the flora of Oklahoma [online]. Available from: http://www.biosurvey.ou.edu. (Accessed on 1 March 2004).

Hoagland BW, Buthod A. 2003. Vascular flora of the Keystone Wildlife Management Area, Creek, Pawnee, and Osage Counties, Oklahoma. Okla Nat Plant Rec 3:23-37.

Hoagland BW, Buthod A. 2004. Vascular flora of Hugo Lake Wildlife Management Area, Choctaw County, Oklahoma. Southeast Nat (forthcoming).

Hoagland BW, Crawford-Callahan P, Crawford P, Johnson FL. 2004. Vascular flora of Hackberry Flat, Fredrick Lake, and Suttle Creek, Tillman County, Oklahoma. Sida 21:429-445.

Hoagland BW, FL Johnson. 2001. Vascular flora of the Chickasaw National Recreation Area, Murray County, Oklahoma. Castanea 66:383-400.

Hoagland BW, Johnson FL. 2004. Vascular flora of Red Slough and Grassy Slough Wildlife Management Areas, Gulf Coastal Plain, McCurtain County, Oklahoma. Castanea 69 (forthcoming)

Hoagland BW, Wallick K. 2003. Vascular flora of Oologah Wildlife Management Area, Nowata County, Oklahoma. Proc Okla Acad Sci 83:47-62.

Hunt CB. 1974. Natural regions of the United States and Canada. San Francisco (CA): WH Freeman. 725 p.

Maxwell AJ, Reasoner R. 1966. Soil survey of Love County, Oklahoma. Washington, D.C.: United States Department of Agriculture. 94 p.

Oklahoma Climatological Survey. 2004. Oklahoma Climatological Data [online]. Available from http://www.ocs.ou.edu/. (Accessed on 1 March 2004).

Oklahoma Natural Heritage Inventory. 2003. ONHI working list of rare Oklahoma plants [online]. Available from http://www.biosurvey.ou.edu/publicat.html. (Accessed on 1 March 2004).

Palmer MW, Wade GL, Neal P. 1995. Standards for the writing of floras. Bioscience 45:339-345.

Taylor RJ, Taylor CS. 1991. An annotated list of the ferns, fern allies, gymnosperms, and flowering plants of Oklahoma. Durant (OK): Southeastern Oklahoma State University. 133 p.

Trewartha, GT. 1968. An introduction to climate. New York: McGraw-Hill. 399 p.

USDA-NRCS 2003. The PLANTS database [online]. Available from: National Plant Data Center, Baton Rouge, LA, at http://plants.usda.gov/plants. (Accessed on 1 March 2004).

Waterfall UT 1969. Keys to the flora of Oklahoma, 4th ed. Stillwater (OK): Published by the author. 246 p.

Wyatt T. 2004. Love Valley Wildlife Management Area [online]. Available from: www.wildlifedepartment.com. (Accessed on 1 March 2004).

APPENDIX 1

Annotated species list for Love Valley Wildlife Management Area. The first entry is the life history (Ann = Annual, Bie = Biennial, Per = Perennial), followed by species not native to North America (designated with an asterisk), abundance (1 - least abundant, 5 = dominant [see Palmer et al 1995]), habit (Upl = *Quercus stellata-Q. marilandica-Carya texana* forest association, Blf = *Fraxinus pennsylvanica - Ulmus americana* forest association, Grl = *Schizachyrium scoparium - Bouteloua curtipendula* herbaceous association, Wetl = Wetland and aquatic vegetation, Daof = Disturbed areas and old-field vegetation). Voucher specimens were deposited at the Robert Bebb Herbarium at the University of Oklahoma (OKL).

EQUISETOPHYTA
Equisetaceae
Equisetum hyemale L. - Per; 4 ; Daof

PTERIDOPHYTA
Aspleniaceae
Asplenium platyneuron (L.) B. S. P. - Per; 2 ; Upl

Dryopteridaceae
Woodsia obtusa (Spreng.) Torr. - Per; 2; Upl
Marsiliaceae
Marsilea vestita Hook. &Grev. - Per; 4; Wetl

Ophioglossaceae
Ophioglossum engelmannii Prandtl - Per; 2; Upl

Pteridaceae
Pellaea atropurpurea (L.) Link. - Per; 2; Upl

CONIFEROPHYTA
Cupressaceae
Juniperus virginiana L. - Per; 4; Grl

MAGNOLIOPHYTA
MAGNNOLIOPSIDA
Acanthaceae
Ruellia strepens L. - Per; 4; Blf

Aceraceae
Acer negundo L. - Per; 4; Blf

Amaranthaceae
Amaranthus rudis Sauer - Ann; 2; Blf
Froelichia floridana (Nutt.) Moq - Ann; 4; Upl
F. gracilis (Hook.) Moq - Ann; 2; Daof

Anacardiaceae
Rhus aromatic Ait - Per; 4; Grl
R. copallinum L. - Per; 2; Grl
R. glabra L. - Per; 4; Daof
Toxicodendron radicans (L.) Kuntze - Per; 4; Upl

Apiaceae
Chaerophyllum tainturieri Hook. - Ann; 4; Daof
Daucus pusillus Michx. - Ann; 4; Daof
Hydrocotyle verticillata Thunb. - Per; 2; Wetl
Polytaenia nuttallii DC. - Per; 2; Grl
Sanicula canadensis L. - Bie; 2; Upl
Spermolepis inermis (Nutt ex DC.) Mathias & Constance - Ann; 2; Daof

Apocynaceae
Apocynum cannabinum L. - Per; 3; Daof

Aquifoliaceae
Ilex decidua Walt. - Per; 2; Blf, Upl

Aristolochiaceae
Aristolochia tomentosa Sims - Per; 4; Daof

Asclepiadaceae
Asclepias asperula (Dcne.) Woods - Per; 2; Grl
A. verticillata L. - Per; 2; Daof
A. viridiflora Raf. - Per; 2; Grl
A. virdis Walt. - Per; 2; Daof
Cynanchum laeve (Michx.) Pers. - Per; 4; Daof
Matelea gonocarpus (Walt.) Shinners - Per; 2; Upl
M. cynanchoides (Englem.) Woods. - Per; 4; Daof

Asteraceae
Achillea millefolium L. - Per; 3; Daof
Ambrosia psilostachya DC. - Per; 4; Grl
A. trifida L. - Ann; 5; Daof
Amphiachyris dracunculoides (DC.) Nutt. - Ann; 2; Grl, Upl
Aphanostephus skirrhobasis (DC.) Trel. - Ann; 2; Daof, Upl
Arnoglossum plantagineum Raf. - Per; 2; GRl
Baccharis salicina Torr. & Gray - Per; 2; Daof
Bidens bipinnata L. - Ann; 4; Upl
B. frondosa L. - Ann; 2; Daof
Centaurea americana Nutt. - Ann; 2; Grl
Chrysopsis pilosa Nutt. - Ann; 2; Daof
Cirsium altissimum (L.) Hill - Bie; 2; Grl
C. horridulum Michx. - Bie; 2; Daof
Conoclinium coelestinum (L.) DC. - Per; 2; Daof
Conyza canadensis (L.) Cronq. - Ann; 3; Daof
Croptilon divaricatum (Nutt) Raf. - Ann; 2; Upl
Dracopis amplexicaulis (Vahl.) Cass. - Ann;2;Blf
Echinacea angustifolia DC. - Per; 2; Grl
*Eclipta prostrat*a (L.) L. - Ann; 4; Blf
Engelmannia peristenia (Raf.) Goodman & Lawson - Per; 2; Grl
Erigeron strigosus Muhl. Ex Willd. - Bie; 2; Daof
Eupatorium serotinum Michx. - Per; 2; Blf, Daof
Evax prolifera Nutt. ex DC. - Ann; 2; Daof
Gaillardia aestivalis (Walt.) H. Rock - Per; 4; Grl
Gamochaeta purpurea (L.) Cabrera - Bie; 2; Daof,Grl
Grindelia lanceolata Nutt. - Ann; 4; Grl
Helenium amarum (Raf.) H. Rock. - Ann; 4; Daof
Helianthus annuus L. - Ann; 5; Daof

H. hirsutus Raf. - Per; 4; Daof
H. petiolaris Nutt. - Ann; 2; Blf
Hymenopappus scabiosaeus L'Her. - Bie; 4; Daof
Iva annua L. - Ann; 3 ;Daof
Lactuca canadensis L. - Ann; 2; Upl
Liatris punctata Hook. - Per; 4; Grl
Lindheimera texana Gray & Engelm. - Ann; 2; Grl
Packera plattensis (Nutt.) W.A.Weber & A Löve - Per; 2; Grl
Pluchea odorata (L.) Cass. - Per; 2; Daof
Pyrrhopappus carolinianus (Walt.) DC. - Per; 2; Daof
P. grandiflorus (Nutt.) Nutt. - Per; 4; Daof
Rayjacksonia annua (Rydb.) R.L. Hartman & M.A. Lane - Ann; 4; Upl
Rudbeckia hirta L. - Per; 2; Daof,Daof
Solidago canadensis L. - Per; 4; Daof
S. ulmifolia Muhl. ex Willd. - Per; 4; Grl
Sonchus asper (L.) Hill* - Ann; 3; Blf
Symphyotrichum drummondii (Lindl.) Nesom - Per; 4; Daof
S. ericoides (L.) Nesom - Per; 4; Daof; Upl
S. lateriflorum (L.) A.& D. Löve - Per; 4; Daof
S. oblongifloium (Nutt.) Nesom - Per; 2; Grl
S. ontarione (Wieg.) Nesom - Per; 4; Daof
S. subulatum (Michx.) Nesom - Ann; 2; Daof
Thelesperma filifolium (Hook.) Gray - Per; 4; Daof
Verbesina encelioides (Cav.) Benth. & Hook f. ex Gray - Ann; 2; Blf
Vernonia baldwinii Torr. - Per; 2; Daof
Xanthium strumarium L. - Ann; 3; Daof

Bignoniaceae
Campsis radicans (L.) Seem. ex Bureau - Per; 2; Daof

Boraginaceae
Heliotropium convolvulaceum (Nutt.) Gray - Ann; 2; Blf
Myosotis verna Nutt. - Bie; 4; Daof

Brassicaceae
Draba reptans (Lam.) Fern. - Ann; 2; Daof
Lepidium virginicum L. - Ann; 4; Daof
Rorippa nasturtium-Wetlum (L.) Hayek. - Per; 4; Wetl
Sibara virginica (L.) Rollins - Ann; 2; Daof

Cactaceae
Opuntia macrorhiza Engelm. - Per; 2; Upl

Campanulaceae
Triodanis perfoliat (L.) Niew. var *biflora* (Ruiz & Pavon) Bradley - Ann; 2; Daof

Caprifoliaceae
Lonicera flava Sims - Per; 3; Grl
Symphoricarpos orbiculatus Moench. - Per; 2; Upl
Viburnum rufidulum Raf. - Per; 2; Grl

Caryophyllaceae
Arenaria serpyllifolia L.* - Ann; 2; Daof
Paronychia jamesii Torr. & Gray - Per; 4; Daof

Chenopodiaceae
Chenopodium album L. - Ann; 2; Daof
C. leptophyllum (Moq.) Nutt. ex S. Wats. - Ann; 4; Daof
C. standleyanum Aellen - Ann; 2; Daof
Salsola tragus L.* - Ann; 2; Blf

Cistaceae
Helianthemum georgianum Chapman - Per; 2; Upl, Daof
Lechea mucronata Raf. - Per; 2; Daof

Convolvulaceae
Ipomoea coccinea L.* - Ann; 2; Daof
I. pandurata (L.) G.F.W. Mey. - Per; 2; Daof

Cornaceae
Cornus drummondii C.A. Mey. - Per; 2; Daof

Cucurbitaceae
Cucurbita foetidissima Kunth - Per; 2; Daof
Melothria pendula L. - Per; 2; Daof

Ebenaceae
Diospyros virginianna L. - Per; 4; Upl

Euphorbiaceae
Acalypha ostryifolia Riddell - Ann; 4; Daof
Chamaesyce missurica (Raf.) Shinners - Ann; 4; Grl,Daof
C. nutans (Lag.) Small - Ann; 4; Daof
C. serpyllifolia (Pers.) Small - Ann; 4; Daof
Cnidoscolus texanus (Muell.-Arg.) Small - Per; 2; Daof
Croton capitatus Michx. - Ann; 2; Upl
C. glandulosus L. var. *septentrionalis* Muell. Arg. - Ann; 4; Daof
C. monanthogynus Michx. - Ann; 4; Daof
C. texensis (Klotzsch) Muell.-Arg. - Ann; 4; Daof
Tragia betonicifolia Nutt. - Per; 2; Daof

Fabaceae
Acacia angustissima (P.Mill.) Kuntze var. *hirta* (Nutt.) B.L.Robins. - Per; 4; Grl
Albizia julibrissin Durazz.* - Per; 2; Daof
Amorpha fruticosa L. - Per; 2; Blf, Wetl
Amphicarpaea bracteata (L.) Fern. - Per; 2; Daof
Astragalus crassicarpus Nutt. - Per.; 4; Grl
A. nuttallianus DC. - Per; 4; Grl
Cercis canadensis L. - Per; 4; Upl
Chamaecrista fasciculata (Michx.) Greene - Ann; 4; Daof
Dalea aurea Nutt. ex Pursh - Per; 2; Grl
D. enneandra Nutt. - Per; 2; Grl
D. multiflora (Nutt.) Shinners - Per; 4; Daof
D. purpurea Vent. - Per; 2; Grl
Desmodium paniculatum (L.) DC. - Per; 4; Daof,Blf
D. sessilifolium (Torr.) Torr. & Gray - Per; 2; Grl
Gleditsia triacanthos L. - Per; 2; Daof
Indigofera miniata Ortega var. *leptosepala* (Nutt.) B. L. Turner - Per; 2; Daof
Lathyrus hirsutus L.* - Ann; 2; Daof
Lespedeza cuneata (Dum. Cours.) G. Don* - Per; 4; Daof
Medicago minima (L.) L.* - Ann; 3; Daof

M. sativa L* - Per; 4; Daof
Melilotus alba Medikus* - Ann; 2; Daof
Mimosa nuttallii (DC.) B.L. Turner - Per; 4; Grl
Neptunia lutea (Leavenworth) Benth. - Per; 2; Grl
Pediomelum cuspidatum (Pursh) Rydb. - Per; 4; Grl
P. linearifolium (Torr. & Gray) J. Grimes - Per; 2; Grl
Prosopis glandulosa Torr. - Per; 2; Grl
Robinia pseudoacacia L. - Per; 5; Daof
Sesbania herbacea (P.Mill.) McVaugh - Ann; 2; Blf
Strophostyles helvula (L.) Ell. - Ann; 4; Daof
S. leiosperma (Torr. & Gray) Piper - Ann; 4; Daof
Stylosanthes biflora (L.) B.S.P. - Per; 2; Daof
Tephrosia virginiana (L.) Pers. - Per; 2; Daof
Trifolium campestre Schreb.* - Ann; 3; Daof
T. dubium Sibthorp* - Ann; 4; Daof
Vicia sativa L.ssp. *nigra* (L.) Ehrh.* - Ann; 2; Daof

Fagaceae
Quercus buckleyi Nixon & Dorr - Per; 4; Grl
Q. macrocarpa Michx. - Per; 2; Blf
Q. marilandica Muenchh. - Per; 3; Upl
Q. muehlenbergii Engelm. - Per; 2; Upl
Q. shumardii Buckl. - Per; 4; Bfl
Q. stellata Wangenh. - Per; 5; Upl

Gentianaceae
Sabatia campestris Nutt. - Ann; 2; Daof

Geraniaceae
Geranium carolinianum L. - Ann; 4; Daof

Haloragaceae
Myriophyllum spicatum L.* - Per; 4; Wetl

Hippocastanaceae
Aesculus glabra Willd. var. *arguta* (Buckl.) B.L. Robins. - Per; 2; Daof

Hydrophyllaceae
Nama hispidum Gray - Ann; 2; Daof

Juglandaceae
Carya illinoinensis (Wangenh.) K. Koch - Per; 4; Daof
C. texana Buckl. - Per; 4; Upl
Juglans nigra L. - Per; 3; Upl

Krameriaceae
Krameria lanceolata Torr. - Per; 4; Grl

Lamiaceae
Hedeoma hispida Pursh - Ann; 2; Daof
Monarda citriodora Cerv. ex Lag. - Per; 3; Daof
M. punctata L. - Per; 4; Upl
Salvia azurea Michx. ex Lam. - Per; 4; Grl
Scutellaria parvula Michx. var. *missouriensis* (Torr.) Goodman & Lawson - Per; 2; Grl
Teucrium canadense L. - Per; 4; Daof

Linaceae
Linum sulcatum Riddell - Ann; 2; Daof

Loganiaceae
Polypremum procumbens L. - Ann; 4; Daof

Lythraceae
Ammannia coccinea Rottb. - Ann; 2; Blf
Rotala ramosior (L.) Koehne - Ann; 2; Blf

Malvaceae
Callirhoe involucrata (Torr. & Gray) Gray - Per; 2; Daof
Hibiscus laevis All. - Per; 4; Blf
Sida spinosa L. - Ann; 4; Daof

Menispermaceae
Cocculus carolinus (L.) DC. - Per; 4; Daof, Blf

Moraceae
Maclura pomifera (Raf.) Schneid. - Per; 2; Daof, Blf
Morus rubra L. - Per; 4; Blf

Nyctaginaceae
Mirabilis nyctaginea (Michx.) MacM. - Per; 2; Daof

Oleaceae
Forestiera pubescens Nutt. - Per; 4; Daof, Grl
Fraxinus pennsylvanica Marsh. - Per; 2; Blf
F. texensis (Gray.) Sarg. - Per; 2; Grl
Ligustrum sinense Lour.* - Per; 2; Blf

Onagraceae
Calylophus serrulatus (Nutt.) Raven - Per; 2; Daof
Gaura sinuata Nutt. ex Ser. - Per; 2; Grl
Ludwigia peploides (Kunth.) Raven ssp. *glabrescens* (Kuntze) Raven - Per; 2; Blf
Oenothera laciniata Hill var. *lancinata* - Ann; 2; Daof
O. rhombipetala Nutt. ex Torr. & Gray - Ann; 3; Daof
O. speciosa Nutt. - Per; 2; Daof
Stenosiphon linifolius (Nutt. ex James) Heynh. - Per; 2; Grl

Oxalidaceae
Oxalis stricta L. - Per; 4; Daof
O. violaceae L. - Per; 2; Daof

Papaveraceae
Argemone polyanthemos (Fedde) G.B. Ownbey - Bie; 2; Daof

Passifloraceae
Passiflora incarnata L. - Per; 2; Daof
P. lutea L. - Per; 2; Upl

Pedaliaceae
Proboscidea louisianica (Miller) Thellung - Ann; 2; Daof

Phytolaccaceae
Phytolacca americana L. - Per; 2; Daof
Rivina humilis L. - Per; 2; Blf

Plantaginaceae
Plantago aristata Michx. - Ann; 2; Daof
P. patagonica Jacq. - Ann; 2; Daof
P. virginica L. - Ann; 2; Grl

Polemoniaceae
Phlox pilosa L. -Per; 2; Daof

Polygalaceae
Polygala incarnata L. - Ann; 2; Grl

Polygonaceae
Eriogonum annuum Nutt. - Ann; 4; Grl, Upl
Polygonum hydropiperoides Michx. - Per; 3; Blf
P. lapathifolium L. - Ann; 2; Blf
P. pensylvanicum L. - Ann; 2; Blf
P. punctatum Ell. - Ann; 2; Blf
P. scandens L. - Per; 2; Daof
Rumex crispus L.* - Per; 4; Daof
R. hastatulus Baldw. - Per; 2; Daof

Primulaceae
Samolus ebracteatus Kunth. - Per; 2; Blf

Ranunculaceae
Anemone berlandieri Pritz. - Per; 4; Daof
Delphinium carolinianum Walt. ssp. *virescens* (Nutt.) Brooks - Per; 2; Daof
Ranunculus abortivus L. - Bie; 2; Blf

Rhamnaceae
Berchemia scandens (Hill) K. Koch - Per; 4; Blf
Ceanothus americanus L. - Per; 2; Daof
C. herbaceus Raf. - Per; 4; Grl
Frangula caroliniana (Walt.) Gray - Per; 2; Upl

Rosaceae
Crataegus pruinosa (Wendl. f.) K. Koch - Per; 2; Blf
Geum canadense Jacq. var. *camporum* (Rydb.) Fern. & Weatherb. - Per; 2; Blf
Prunus angustifolia Marsh. - Per; 4; Daof
P. mexicana S. Wats. - Per; 2; Blf
Rosa multiflora Thunb. ex Murr.* - Per; 2; Daof
Rubus flagellaris Willd. - Per; 4; Daof
R. trivialis Michx. - Per; 2; Blf

Rubiaceae
Cephalanthus occidentalis L. - Per; 4; Blf
Diodia teres Walt. - Ann; 4; Daof
Galium aparine L. - Ann; 4; Daof
G. circaezans Michx. - Per; 2; Upl
Hedyotis nigricans (Lam.) Fosberg - Per; 2; Grl

Rutaceae
Ptelea trifoliata L. - Per; 2; Upl
Zanthoxylum clava-herculis L. - Per; 4; Upl
Z. hirsutum Buckl. - Per; 4; Upl,Daof

Salicaceae
Populus deltoides Marsh. - Per; 5; Blf
Salix exigua Nutt. - Per; 2; Blf
S. nigra Marsh. - Per; 4; Blf

Sapindaceae
Cardiospermum halicacabum L. - Per; 4; Daof
Sapindus saponaria L. var. *drummondii* (Hook & Arn.) L. Benson - Per; 2; Upl

Scrophulariaceae
Castilleja indivisa Engelm. - Ann; 4; Daof
Nuttallanthus texanus (Scheele) D. A. Sutton - Bie; 4; Daof
Penstemon cobaea Nutt. - Per; 4; Grl
P. laxiflorus Pennell -Per; 2; Daof
Verbascum blattaria L.* - Bie; 2; Daof
Veronica anagallis -Wetla L. - Bie; 2; Blf, Wetl
V. peregrina L. - Ann; 2; Daof

Smilacaceae
Smilax bona-nox L. - Per; 2; Daof
S. rotundifolia L. - Per; 4; Blf
S. tamnoides L. - Per; 4; Blf

Solanaceae
Physalis angulata L. - Ann; 2; Daof
P. mollis Nutt. - Per; 2; Daof
Solanum dimidiatum Raf. - Per; 2 ;Daof
S. rostratum Dunal - Ann; 2; Daof

Tamaricaceae
Tamarix chinensis Lour.* - Per; 2; Blf

Ulmaceae
Celtis laevigata Willd. - Per; 2; Blf
C. laevigata Willd. var. *reticulata* (Torr.) L. Benson - Per; 4; Upl
Ulmus alata Michx. - Per; 2; Grl
U. americana L. - Per; 2; Blf
U. crassifolia Nutt. - Per; 4; Grl,Upl

Urticaceae
Boehmeria cylindrica (L.) Sw. - Per; 2; Blf
Parietaria pensylvanica Muhl. ex Willd. - Ann; 2; Daof

Valerianaceae
Valerianella radiata Dufr. - Ann; 4; Daof

Verbenaceae
Callicarpa americana L. - Per; 2; Upl
Glandularia bipinnatifida (Nutt.) Nutt. - Per; 4; Daof
Phyla nodiflora (L.) Greene - Per; 4; Blf
Verbena halei Small - Per; 4; Daof
V. urticifolia L. - Per; 2; Daof

Viscaceae
Phoradendron tomentosum (DC.) Engelm. ex Gray - Per; 2; Upl

Vitaceae
Ampelopsis arborea (L.) Koehne - Per; 4; Daof
A. cordata Michx. - Per; 4; Upl
Cissus incisa (L.)l. - Per; 2; Daof, Blf
Parthenocissus quinquefolia (L.) Planch. - Per; 4; Blf
Vitis aestivalis Michx. - Per; 4; Daof
V. mustangensis Buckl. - Per; 3; Daof, Bfl, Daof

Zygophyllaceae
Tribulus terrestris L.* - Ann; 4; Daof

LILIOPSIDA
Alismataceae
Echinodorus berteroi (Spreng.) Fassett - Per; 3; Blf
E. cordifolius (L.) Griesb. - Per; 3; Blf
Sagittaria graminea Michx. - Per; 3; Blf

Commelinaceae
Commelina erecta L. var. *deamiana* Fer. - Per; 2; Daof
Tradescantia ohiensis Raf. - Per; 2; Daof

Cyperaceae
Carex amphibola Steud. - Per; 4; Upl
C. blanda Dewey - Per; 4; Blf
C. tetrastachya Scheele - Per; 4; Daof, Blf
C. crus-corvi Shuttlew ex. Kunze - Per; 2; Wetl
C. flaccosperma Dewey - Per; 2; Upl
C. gravida Bailey - Per; 4; Daof, Upl
C. hystericina Muhl Ex Willd. -Per; 2; Daof
C. planostachys Kuntze - Per; 2; Grl
Cyperus esculentus L. - Per; 4; Blf
Eleocharis montevidensis Kunth. - Per; 2; Wetl
E. parvula (Roemer & J. A. Schultes) Link ex Bluff, Nees, & Schauer - Per; 4; Blf
Fimbristylis vahlii (Lam.) Link. - Ann; 4; Blf
Schoenoplectus americanus (Pers.) Volk. ex Schinz & R. Keller - Per; 4; Blf
S. tabernaemontani (K.C. Gmel.) Palla - Per; 2; Blf
Scleria ciliata Michx. - Per; 2; Grl

Iridaceae
Sisyrinchium angustifolium P. Miller - Per; 2; Daof

Lemnaceae
Lemna minor L. - Per; 4; Wetl
L. perpusilla Torr. - Per; 4; Wetl
Spirodela polyrhiza (L.) Schleiden. - Per; 4; Wetl

Liliaceae
Allium canadense L. - Per; 3; Daof
Yucca glauca Nutt. - Per; 4; Grl

Poaceae
Aegilops cylindrica Host. * - Ann; 2; Daof
Andropogon gerardii Vitman - Per; 4; Grl
A. glomeratus (Walt.) B.S.P. - Per; 4; Blf
Aristida oligantha Michx. - Ann; 4; Grl
Bothriochloa ischaemum (L.) Keng var. *songarica* (Rupr. ex Fisch. & C.A. Mey.) Celarier & Harlan* - Per; 4; Grl
B. saccharoides (Sw.) Rydb. var. torreyanus (Steud.) Gould - Per; 3; Daof
Bouteloua curtipendula (Michx.) Torr. - Per; 4; Grl
B. hirsuta Lag. - Per; 4; Grl
B. rigidiseta (Steud.) A.S. Hitchc. - Per; 4; Grl
Bromus catharticus Vahl.* - Ann; 2; Daof
B. japonicus Thunb. ex Murr.* - Ann; 2; Daof
B. tectorum L. * - Ann; 4; Daof,Daof
Buchloe dactyloides (Nutt.) Engelm - Per; 2; Daof
Cenchrus spinifex Cav. - Ann; 2; Daof
Chloris cucullata Bisch. - Per; 2; Daof
Chloris verticillata Nutt. - Per; 4; Daof
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark - Per; 2; Upl
D. oligosanthes (Schult.) Gould var. *scribnerianum* (Nash.) Gould - Per: 2; Daof, Upl, Grl
Digitaria sanguinalis (L.) Scop. - Ann; 4; Daof
Echinochloa crus-galli (L.) Beauv.* - Ann; 4; Daof
Eleusine indica (L.) Gaertn.* - Ann; 4; Daof
Elymus virginicus L. - Per; 2; Upl, Daof
Eragrostis cilianensis (All.) Vign. ex Janchen* - Ann; 4; Daof
E. secundiflora J. Presl. ssp. oxylepis (Torr.) S. D. Koch - Per; 4; Upl
Hordeum pusillum Nutt. - Ann; 4; Daof
Leersia oryzoides (L.) Sw. - Per; 4; Blf
Leptochloa fusca (L.) Kunth ssp. *fascicularis* (Lam.) N. Snow - Ann; 2; Blf
L. panicea (Retz.) Ohwi ssp. *mucronata* (Michx.) Nowack - Ann; 4; Daof
Lolium perenne L. ssp. *multiflorum* (Lam.) Husnot - Ann; 4; Daof
Nassella leucotricha (Trin. & Rupr.) Pohl - Per; 4; Daof
Panicum capillare L. - Ann; 4; Daof
P. dichotomiflorum Michx. - Ann; 4; Daof
P. obtusum Kunth. - Per; 2; Daof
P. virgatum L. - Per; 4; Blf
Paspalum dilatatum Poir.* - Per; 4; Blf
P. distichum L. - Per; 2; Blf
P. laeve Michx. - Per; 3; Daof
P. setaceum Michx. - Per; 2; Upl
Pennisetum glaucum (L.) R. Br.* - Per; 4; Upl
Poa bigelovii Vasey & Scribn. - Ann; 2; Upl
Saccharum ravennae (L.) L.* - Per; 2; Blf
Schizachyrium scoparium (Michx.) Nash - Per; 5; Grl
Sorghum halepense (L.) Pers.* - Per; 3; Daof
Tridens flavus (L.) A.S. Hitchc. - Per; 4; Upl, Daof
T. muticus (Torr.) Nash - Per; 2; Blf
Urochloa ciliatissima (Buckl.) R. Webster - Per; 4; Daof
Vulpia octoflora (Walt.) Rydb. - Ann; 2; Upl

Typhaceae
Typha angustifolia L. - Per; 4; Blf; Wetl
T. domingensis Pers. - Per; 4; Wetl

Received: March 8, 2004; Accepted August 12, 2004