AN EXPLORATION OF THE VASCULAR FLORA OF PINE CITY NATURAL AREA, MONROE COUNTY, ARKANSAS, U.S.A., IN COMPARISON TO THE MISSISSIPPI ALLUVIAL PLAIN IN EASTERN ARKANSAS (U.S.A.)

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ABSTRACT

The Mississippi Alluvial Plain (MAP) ecoregion in eastern Arkansas has had >90% of its land area converted to agriculture and has historically been under-collected floristically, including the ecologically unique site, Pine City Natural Area (PCNA). Actively managed by the Arkansas Natural Heritage Commission, PCNA contains diverse loblolly pine-post oak flatwoods and some of the last known saline barrens in the MAP. Our inventory of the vascular flora in and around PCNA resulted in the documentation of 113 families, 308 genera, and 576 taxa (including infraspecific taxa); 482 (83.7%) are native, 9 (1.6%) are of state conservation concern, and 184 (31.9%) represent county records. The total taxa known for Monroe County, Arkansas, increased from 583 to 767. The most taxa-rich families included Poaceae (92 taxa), Asteraceae (65), Cyperaceae (48), and Fabaceae (42). In the surrounding ten-county region, 27 taxa (4.7%) documented at PCNA had not been vouchered, and 196 taxa (34.0%) are known from half or fewer surrounding MAP counties. We examined families in need of additional exploration in the MAP to better understand county-level floristic richness. The richest graminoid families, the Poaceae, Cyperaceae, and Juncaceae, are apparently the most understudied in the MAP, based on low relative numbers of herbarium specimens. The richness in the PCNA flora, in comparison to the broader MAP, demonstrates the need for continued floristic inventory in eastern Arkansas to locate areas of high conservation value in need of protection.

RESUMEN

La ecorregión 'Mississippi Alluvial Plain' (MAP) en el este de Arkansas ha tenido más del 90% de su superficie terrestre convertida para la agricultura e históricamente no se ha recolectado lo suficiente desde el punto de vista florístico, incluido el Área Natural de Pine City (PCNA) un sitio ecológicamente único. PCNA es administrado activamente por la Comisión del Patrimonio Natural de Arkansas, contiene diversos bosques llanos de pino y roble y algunos de las últimas tierras yermas salinas conocidas en el MAP. Nuestro inventario de la flora vascular en PCNA y sus alrededores resultó en la documentación de 113 familias, 308 géneros y un total de 576 taxones (incluyendo taxones infraespecíficos); 482 (83,7%) son nativos, 9 (1,6%) son de interés para la conservación en Arkansas y 184 (31,9%) representan nuevas citas para el condado. El total de taxones conocidos para el condado de Monroe, Arkansas, aumentó de 583 a 767. Las familias más ricas en taxones incluyeron Poaceae (92 taxones), Asteraceae (65), Cyperaceae (48) y Fabaceae (42). En la región de los diez condados que rodea el condado de Monroe, 27 taxones (4,7%) documentados en PCNA no han sido registrados en la región, y 196 taxones (34,0%) se conocen en la mitad o menos de los condados MAP circundantes. Examinamos familias que necesitan exploración adicional en el MAP para comprender mejor la riqueza florística a nivel de condado. Las familias graminoides más ricas, Poaceae, Cyperaceae, y Juncaceae, son aparentemente las menos estudiadas en el MAP, en base al bajo número de exsicatas. La riqueza de la flora de PCNA, en comparación con el MAP más amplio, demuestra la necesidad de más investigación en el este de Arkansas para encontrar áreas de alto valor de conservación que necesitan protección.

Key Words: Floristic inventory, collection bias, collection practices, oak savanna, pine flatwoods, oak flatwoods, southeastern grasslands, natural area, rare species, Red-cockaded Woodpecker

INTRODUCTION

Major losses of biodiversity influence ecosystems from local to global scales (Cardinale et al. 2012; Hooper et al. 2012), so it is imperative to document current community composition for the conservation and preservation of ecosystems. Developing a flora, a list of vascular plant species present in a defined unit area (Palmer 2018), is a first step for defining plant communities. Floras provide a snapshot of the species present in an area at a specific time, which allows observations to be made regarding changing patterns in plant communities (Pascal et al. 2008), the invasion of exotic species (Lucardi et al. 2020a), and alterations to species' distributions over time (Morueta-Holme et al. 2015).

J. Bot. Res. Inst. Texas 16(1): 165–194. 2022
https://doi.org/10.17348/jbrit.v16.i1.1226

The collection of floristic data has varied through space and time, and it has been long recognized that southeastern floras, especially in Arkansas, have lagged behind other states in terms of the number of collections per county, land area, and the number of species collected (Duncan 1953). Within Arkansas, counties in the West Gulf Coastal Plain and Interior Highlands have had more comprehensive floristic documentation than counties in the Mississippi Alluvial Plain (MAP) Ecoregion (Fig. 1, Gentry et al. 2013). The *Atlas of the Vascular Plants of Arkansas* documents fewer than 800 taxa for most counties, and few have had systematic surveys. Even well-collected counties with relatively intact ecosystems benefit from floristic work (Marsico 2005). Marsico's (2005) survey of Montgomery County (in the Ouachita Mountains) increased the documented number of taxa from 762 to 1111; Witsell's (2007) survey in Saline County (in the Ouachita Mountains and West Gulf Coastal Plain) increased the documented number of taxa from 767 to 1519; and Baker's (2007) surveys in Scott and Yell Counties (both including the Ouachita Mountains and Arkansas Valley Ecoregions) increased the documented number of taxa from 478 to 857 and 643 to 1132, respectively. These systematic surveys were all conducted in the western portion of Arkansas (Fig. 1); whereas the only published systematic survey of an area exclusively in the MAP, Wilcox (1973) for Crittenden County, was not included in the *Atlas of the Vascular Plants of Arkansas* because most of the specimens had been lost (Gentry et al. 2013). A few unpublished master's theses from the region represent incomplete, preliminary surveys that are not widely accessible, including: Lawrence (McNalty 1970), Lee (Davis 1974), Lonoke (Hardcastle 1993), Mississippi (Wyatt 1972), and Poinsett Counties (Johnson 1969), of which only the Mississippi County flora is in a MAP-only region. Two publications include the MAP and Crowley's Ridge: St. Francis County (Deneke & Browne 1987) and St. Francis National Forest in Lee and Phillips Counties (Ison 1996).

The MAP is a level-III ecoregion that extends along the eastern one-third of Arkansas, west of the Mississippi River (U.S. EPA 2013). Over 90% of the Arkansas MAP natural vegetation has been converted by clearing for row-crop agriculture (Holder 1970). While the ecoregion is predominantly flat, temperature and precipitation gradients exist from north to south, with the south being warmer and wetter (from north to south: average annual temperature = 15–17°C [59–63°F] and average annual precipitation = 122–137 cm [48–54 in]). The geology, consisting entirely of unconsolidated sediments, ranges in age from the formation of the Grand Prairie in the Sangamonian Stage (75–125,000 years BP, before the formation of the Mississippi River Alluvial Plain) to the Wisconsinan Stage (present–75,000 years BP, Saucier 1994). Nearly 50 distinct soil series have formed in the MAP (Brye et al. 2013).

Within the MAP, little information has been published about Pine City Natural Area (PCNA), aside from four citations about the federally endangered Red-cockaded Woodpecker (*Dryobates borealis*, Montague et al. 1993; Montague 1995; Holimon & Montague 2003; Rudolph et al. 2004) and one note about the pre-settlement conditions of the tree community in Monroe County (Bragg 2005). This site is home to the only known Red-cockaded Woodpecker population in the MAP Ecoregion and one of two areas of naturally occurring loblolly pine (*Pinus taeda*) known from the MAP, the other occurring on Macon Ridge in northeastern Louisiana and south-central Chicot County, Arkansas (Bragg, personal communication). Aside from the native loblolly pines, little is known about the current plant communities, one being saline barrens on a rare soil series, Lafe. This sodic soil series, having a high concentration of sodium near the soil surface (Horn et al. 1964), only occurs in 0.004% of the MAP. The soil conditions edaphically maintain some of the last known saline barrens in Arkansas outside the West Gulf Coastal Plain and Arkansas Valley ecoregions (ANHC 2018). With so much of the region's landscape under cultivation, remaining natural communities need to be surveyed for plant taxa present. Prior to this study, Monroe County had 583 vouchered taxa, making it the sixth least rich county in Arkansas in terms of documented vascular plant taxa (70 of 75; Gentry et al. 2013). Documenting the flora of PCNA contributes to baseline knowledge for understanding the diversity of plants in the MAP, describes the plant communities present at PCNA, and informs conservation management strategies. Here, we provide a vascular plant inventory of PCNA and the surrounding area; categorize the flora by major taxonomic group, duration, and growth habit; examine the uniqueness of PCNA within the known flora of the broader region of the MAP in east-central Arkansas; and catalog underexplored plant families needing additional exploration in the MAP to better understand county-level distribution of taxa.

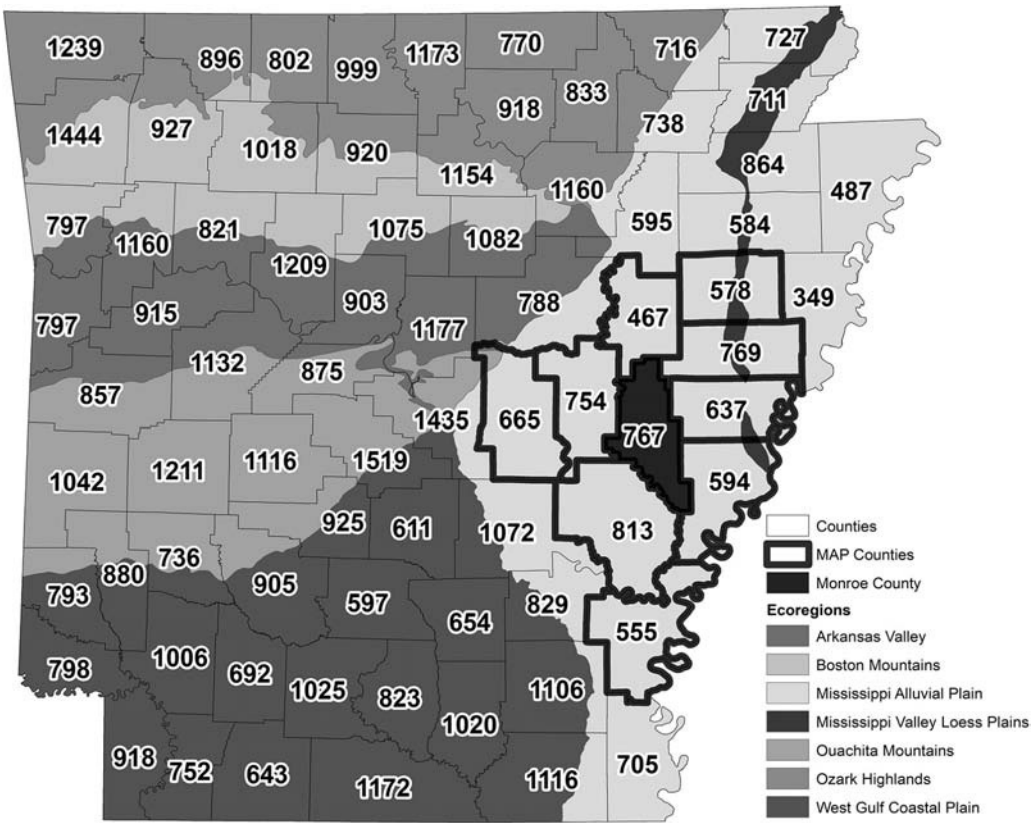

Fig. 1. Map of Arkansas ecoregions and taxonomic richness by county (Gentry et al. 2013). Counties with bold borders included in analysis of greater Mississippi Alluvial Plain.

MATERIALS AND METHODS

Study site.—The study site consists primarily of Pine City Natural Area (PCNA) in Monroe County, Arkansas, U.S.A, and a neighboring 32.38-hectare (80-acre) private property (the McClinton property, surveyed with owner permission). Ditches and roadsides within 3 km (1.9 mi) surrounding PCNA were sampled opportunistically, and all but four specimens were collected within 250 m (820 ft) of the PCNA and McClinton properties (Fig. 2). PCNA is owned by the Arkansas Natural Heritage Commission (ANHC), which has a fee title to the property (ANHC 2018). Parcels of PCNA were acquired in 1988, 1989, 2001, 2003, 2007, 2008, 2009, and 2011. The total size now owned by the ANHC is 422.2 hectares (1043.2 acres). The land is located in Township 1 South, Range 1 West, with 163.9 hectares (405.1 acres) in Section 17, 16.2 hectares (40 acres) in the NE ¼ of Section 19, 15.7 hectares (38.7 acres) in the NE ¼ of Section 20, 16.2 hectares (40 acres) in the NW ¼ of Section 22, and 100.5 hectares (248.4 acres) in Section 27 (Fig. 2). The latitude and longitude, as listed by the ANHC, are 34.604930°N, 91.135650°W. The topography of the site is relatively flat, with a total relief of 2.35 m (7.71 ft), and elevations ranging from 52.58 m to 54.93 m (172.5 ft to 180.2 ft, Arkansas GIS Office 2018); however, narrow ranges in elevation are important for future comparative analyses with this flora (Palmer & Richardson 2012).

Climate.—PCNA climate is broadly described as humid sub-tropical (Cfa) according to the Köppen-Geiger climate classification (Beck et al. 2018), with hot, droughty summer (June to September) and cool, wet winters (December to March). Thirty-year average monthly maximum temperatures in the summer range

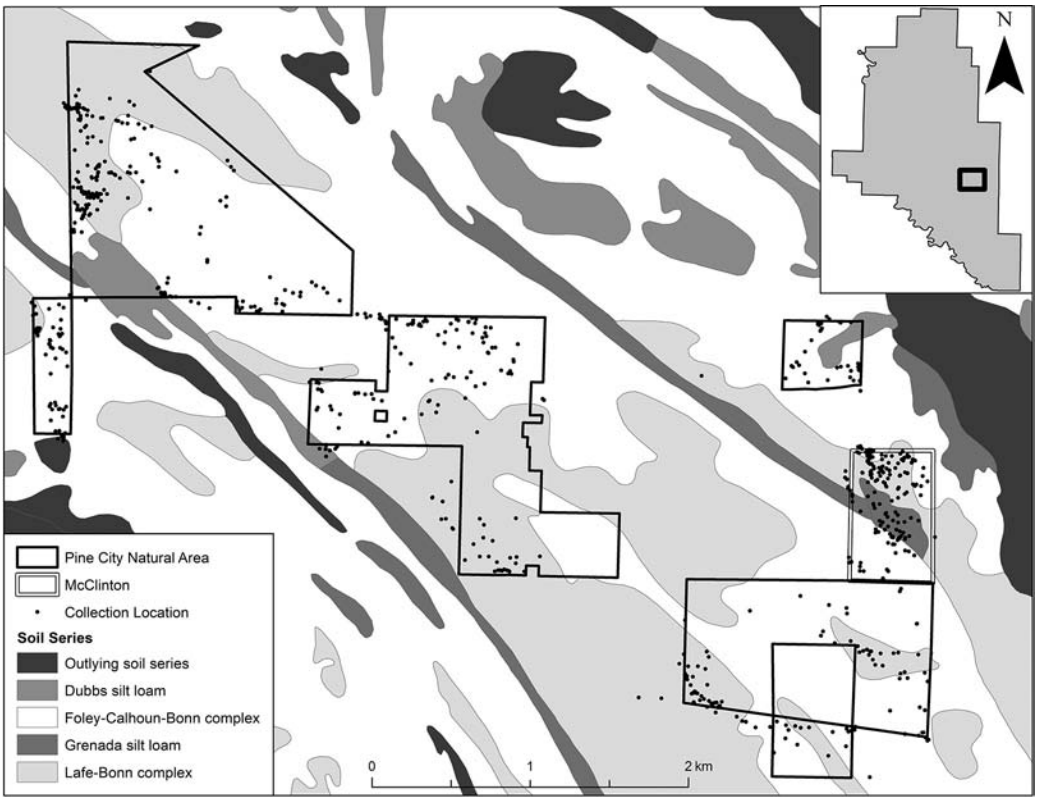

Fig. 2. Map of the surveyed area (Pine City Natural Area, the McClinton property, and surrounding ditches and roadsides) with specimen locations and soil series. Inset map shows survey area in relation to Monroe County.

from 30.1°C to 32.9°C (86.2°F to 91.2°F) and average monthly minimum temperatures in the summer range from 18.0°C to 23.0°C (64.4°F to 73.4°F, NOAA 2021). Thirty-year average monthly maximum temperatures in the winter range from 10.2°C to 17.2°C (50.4°F to 63.0°F), and average monthly minimum temperatures in the winter range from 0.7°C to 6.0°C (33.3°F to 42.8°F, NOAA 2021). The 30-year annual average precipitation is 128.6 cm (50.6 in) per year with more rain in the winter (44.8 cm, 17.6 in) compared to the summer (32.8 cm, 12.9 in) and the highest monthly rainfall in the months of March (13.2 cm, 5.2 in) and April (15.1 cm, 5.9 in; NOAA 2021).

Plant communities and soils.—The plant communities at PCNA and the surrounding area are broadly classified as: loblolly pine-post oak flatwoods, calcareous/sodic oak savanna, wet oak flatwoods, mesic floodplain forest, hardwood depression, marsh/shrub swamp (including beaver impacted communities), saline barrens, old field, ditch, and disturbed areas (such as roadsides, parking areas, old home sites; Table 1, Figs. 6–19). Most of the plant communities present at PCNA experience a harsh annual, hydroxeric cycle with xeric, drought conditions in the summer and saturation and inundation for the fall, winter, and spring (ANHC 2018). Most of PCNA has saline soils developed in loess and silt-mantled backwater or lacustrine alluvial deposits on late Pleistocene terraces of the Mississippi River (Horn et al. 1964). The soils have nearly level slopes and occupy broad shallow basins, creating poorly to somewhat poorly drained conditions. PCNA soils are classified as sodic soils, containing high levels of salts, with a high electrical conductivity and high percentages of exchangeable sodium and magnesium (Horn et al. 1964). The depth of this concentrated salt layer differentiates the two dominant sodic, silt-loam soil complexes at PCNA. The Lafe-Bonn complex, covering

Table 1. General characteristics of plant communities present in the surveyed area.

Plant community	Soils	Flooding	Canopy dominants	Understory dominants
Loblolly pine-post oak flatwoods	Moderately to poorly drained	Occasional low spots with winter/spring saturation; summer drought	*Pinus taeda*, *Quercus stellata*; occasional *Q. nigra*, *Q. phellos*	*Dichanthelium* spp., *Carex* spp., *Eleocharis verrucosa*, *Liatris pycnostachya*, *Eupatorium semiserratum*, *Solidago ulmifolia* var. *ulmifolia*, *Phlox glaberrima*, *Ranunculus fascicularis*, *Eragrostis spectabilis*
Calcareous/Sodic oak savanna	High salt and calcium content; moderately to poorly drained	Winter/spring saturation; summer drought	Sparse, spaced *Quercus stellata*	*Ulmus alata*, *Vaccinium arboreum*, *Carex complanata*, *Danthonia spicata*, *Dichanthelium* spp., *Liatris hirsuta*
Wet oak flatwoods	Low terrace flats, poorly drained; clay subsoil	Winter/spring saturation; summer drought	*Quercus phellos* and *Carya ovata* dominant in shallower/shorter duration flooded areas and *Q. lyrata* in deeper/longer duration flooded areas; occasional *Celtis laevigata*, *Ulmus rubra*, *Fraxinus pennsylvanica*	**Short-flooded:** *Ilex decidua*, *Pluchea camphorata*, *Vernonia missurica*, *Lackeya multiflora*, *Ludwigia palustris*, *Commelina virginica*, *Carex reniformis*, *Leersia virginica*, *Chasmanthium laxum* **Long-flooded:** *Styrax americanus* var. *pulverulentus*, *Carex hyalinolepis*, *Carex joorii*, *Asclepias perennis*, *Clematis crispa*, *Saururus cernuus*
Mesic floodplain forest	Stream flood banks; moderately to poorly drained	Frequent but no prolonged saturation or droughts	*Quercus pagoda*, *Q. palustris*, *Q. michauxii*, *Carya ovata*	*Carex typhina*, *Lobelia cardinalis*, *Justicia lanceolata*
Hardwood depression	Shallow swales and depressions; poorly drained	Prolonged flooding	*Acer rubrum* var. *drummondii*, *Fraxinus profunda*, *Ulmus americana*, *Quercus lyrata*	*Swida foemina*, *Lycopus rubellus*, *Saururus cernuus*, *Bidens discoidea*, *Carex intumescens* var. *intumescens*
Marsh/shrub swamp	Poorly drained	Nearly permanently inundated	If woody vegetation present, *Cephalanthus occidentalis*	*Carex* spp., *Coleataenia rigidula* ssp. *rigidula*, *Leersia oryzoides*, *Juncus effusus* ssp. *solutus*, *Bidens laevis*
Saline barrens	High salt content; moderately to poorly drained	Winter/spring saturation; summer drought	Little to no woody vegetation, occasional short *Quercus stellata* and *Ulmus alata*	*Packera tomentosa*, *Erigeron tenuis*, *Mononeuria muscorum*, *Croton willdenowii*, *Hypericum drummondii*, *Plantago virginica*, *Cyperus echinatus*, *Juncus dichotomus*
Old field	Previously tilled; moderately to poorly drained	Variable	Little to no woody vegetation	*Andropogon hirsutior*, *Baccharis halimifolia*, *Dichanthelium scoparium*, *Steinchisma hians*, *Tridens strictus*, *Rubus* spp.
Ditch	Manmade; poorly drained	Wet in winter and spring and variable in summer	Little to no woody vegetation	*Ludwigia peploides* var. *glabrescens*, *Lemna* spp., *Callitriche heterophylla* var. *heterophylla*, *Sagittaria platyphylla*, *Typha latifolia*
Disturbed areas (roadsides, parking areas, old home sites)	Variable	Variable	Little to no woody vegetation	Variable

29.6% of PCNA and the McClinton property, has a sodic horizon at a depth less than 25 cm; the predominant plant communities on this soil are saline barrens and loblolly pine-post oak flatwoods (Fig. 2). The Foley-Calhoun-Bonn complex, covering 65.4% of PCNA and the McClinton property, has a sodic horizon about 60 cm below the surface with acidic upper horizons; the predominant plant communities on this soil include loblolly pine-post oak flatwoods, wet oak flatwoods, and hardwood depression (Fig. 2).

Plant collection and survey.—The field site was visited nearly once a week in 2018 and once every two weeks, on average, in 2019 by Diana Soteropoulos and/or Joseph Ledvina from March to November for a total of 43 site visits to collect specimens. Two short, opportunistic surveys occurred in 2020. Vouchers were collected through the duration of the growing season – spring, summer, and fall – for two years to capture the vascular plant richness at the site level. Field site visits occurred biweekly during the summer when many plants senesce due to xeric conditions.

Because the entire site could not be searched on each visit, we divided the property into units that maximized the habitat types sampled on a given day. This sequential sampling of diverse community types increased the opportunity to encounter plants growing in different environmental conditions while minimizing distance traveled (Palmer et al. 2002). In each site visit, the primary habitat types – loblolly pine-post oak flatwoods, wet oak flatwoods, and saline barrens – were searched. We haphazardly wandered the entire property approximately once a month and collected plants not previously encountered. We primarily collected plants in reproductive condition, though we occasionally collected woody taxa that can be identified in sterile condition. We assigned each plant an annual, sequential collection number in the field. We entered this unique collection number in a Garmin Dakota 20 GPS unit to export latitude and longitude coordinates for each plant, minimizing transcription error from the GPS unit to paper and from paper to the collection database. We placed each plant in a uniquely numbered field collection bag associated with the collection number on a standardized field collection datasheet to track the field identification, number of pictures, habitat description, and associated species. We stored plants in a cooler until they were pressed and dried using standard herbarium techniques (Bridson & Forman 1998).

The necessity of careful field notes about growth habit (erect, decumbent, etc.), flower and fruit color, bark color and features, rhizomes, stolons, and other features that are more easily described with fresh plant material or in the field has long been noted for inclusion with specimen labels (Fogg 1940). We implemented this approach using recent tools to supplement field notes by uploading many digital images taken in the field to be associated with a specimen record through the online community-science platform iNaturalist (iNaturalist.org; Heberling & Isaac 2018). Noting important features from field images saves time in the field, reduces the risk of transcription error from a field notebook to a specimen database, and allows other scientists to assess the features from photos. Herbarium specimen records and iNaturalist observations have been linked by having the URL on the specimen label associated with the observation and in online herbarium databases in the occurrence remarks field (Heberling & Isaac 2018).

Priority species list development for second field season.—Prior to the second field season, we created a priority species list for taxa not collected during the first season. To create this list, we organized a spreadsheet of the *Atlas of the Vascular Plants of Arkansas* (Gentry et al. 2013) with a row for each taxon known from the state and columns for each county. We indicated the known presence of a taxon within a county as a "1." We tallied the presence of taxa in the six counties bordering Monroe County (Arkansas, Lee, Phillips, Prairie, St. Francis, and Woodruff) and also tallied the presence of taxa within the broader context of the Mississippi Alluvial Plain around Monroe County to increase the total number of counties to 10, including Monroe County itself to capture taxa known from the county but not yet collected (additional counties: Cross, Desha, Lonoke). We sorted the spreadsheet to list all taxa known from Monroe followed by number of bordering counties and number of MAP counties in descending order. We matched all taxa collected in 2018 and noted them as "collected" in our priority field. Then we assigned a priority of which taxa we expected to find using habitat description and wetland indicator status for the MAP and West Gulf Coastal Plain ecoregions of Arkansas. High priority taxa received additional notes about flowering time, expected locations at PCNA to

search, and brief notes to distinguish taxa from congeners. We sorted this list by flowering time to prepare for each collection day.

Taxonomic list.—Plants were identified with the Flora of North America Editorial Committee (1993+), Smith (1994), Steyermark's *Flora of Missouri* (Yatskievych 1999, 2006, 2013), and *Flora of the Southeastern United States: Arkansas* (Weakley 2020). Voucher specimens were deposited at STAR and ANHC, with additional specimens (when more than two specimens were pressed) shared with APSC, HXC, MICH, UAM, and UARK. Specimens collected from PCNA in the ANHC and UARK herbaria were used to help complete the species list.

We compiled a taxonomic list of all species and subspecific (variety or subspecies) taxa identified in accordance with established guidelines for published floras in Palmer & Richardson (2012), organized with species alphabetically within families, which are presented in alphabetical order by major group. Authorities match those in Weakley (2020), which will be used to update the *Atlas of the Vascular Plants of Arkansas* (Gentry et al. 2013). The new *Flora of Arkansas* follows the synonymy used in the greater context of the *Flora of the Southeastern United States* (Weakley 2020), which is a dynamic document with frequent updates of taxonomy to reflect new understanding of taxa. Using a reference with updated taxonomy and a history of nomenclatural changes allows for the flora of PCNA to be easily updated in the future, as nomenclature undergoes further revision (Peet et al. 2018). The designation of invasive and nonnative species for Arkansas follows criteria established in Gentry et al. (2013). Taxa tracked by the ANHC as species of conservation concern are noted (ANHC 2022).

To explore the importance of the PCNA flora within the MAP, we created two summary tables, one summarizing the flora documented at PCNA (Table 2, Appendix 1), and a second displaying the number of taxa found at PCNA compared to the ten surrounding counties (Table 3). To investigate groups potentially requiring additional collection in the MAP for a more complete understanding of county-level distributions, we created three bar charts comparing the PCNA flora to the known Monroe County flora: the number of taxa for the 21 richest families (Fig. 3); the proportion of taxa that were county records within categories of duration (n=3), major group (n=4), and growth habit (n=7, Fig. 4); and the numbers of collected taxa that were county records, collected taxa known from Monroe County, and uncollected taxa known from the county, within categories of duration, major group, and growth habit (Fig. 5). The Arkansas Vascular Flora Committee assigned categories for each taxon for major group (dicot, gymnosperm, monocot, pteridophyte; Gentry et al. 2013); categories for duration are perennial, short-lived (annual or biennial), variable (can be both perennial or short-lived; USDA, NRCS 2022), and growth habit categories are fern, forb, graminoid, herbaceous vine, shrub, tree, woody vine (Baker & Witsell, pers. comm.).

RESULTS

The vascular flora documented at PCNA and surrounding areas consists of 576 species; there are 88 subspecific taxa recognized among these species but never more than one per species (Table 2, Appendix 1). These taxa represent 308 genera and 113 families (Table 2). The most taxa-rich families include Poaceae (92 taxa), Asteraceae (65), Cyperaceae (48), and Fabaceae (42). Fifty-one families are represented by a single taxon, 20 represented by two taxa, and 10 represented by three taxa. The most taxa-rich genera include *Carex* (28), *Dichanthelium* (16), *Juncus* (10), *Cyperus* (9), and *Ranunculus* (9). Taxa of conservation concern at the state level totaled 9 (1.6%), including within Poaceae (3), Cyperaceae (2), Orchidaceae (2), Asteraceae (1), and Salviniaceae (1). A total of 94 non-native taxa are documented (16.3%), with 15 taxa (2.6%) considered invasive and 79 taxa (13.7%) considered introduced (Table 2). Families with the most non-native taxa include Fabaceae (11), Poaceae (9), and Asteraceae (3).

Of the 576 taxa documented, 183 (31.8%) represent county records, increasing the total taxa known for Monroe County, Arkansas, from 583 to 767 and elevating its taxonomic richness ranking from 70th to 52nd out of 75 counties (Fig. 1). Families with the most county records include Poaceae (44, 47.8%), Cyperaceae (19,

Table 2. Summary of vascular plant families, genera, taxa (with count of infraspecific taxa in parentheses) and taxonomic status according to Gentry et al. (2013) with updated conservation rankings from ANHC (2022).

Major Group	Families	Genera	Taxa	Native	Conservation Concern	Introduced	Invasive
Pteridophyte	6	8	10(1)	9	1	0	0
Gymnosperm	2	2	2(0)	2	0	0	0
Angiosperms:							
Dicots	86	216	369(58)	311	1	48	9
Monocots	19	82	195(29)	151	7	31	6
TOTAL	113	308	576	473	9	79	15

Table 3. Counts of the number of taxa and cumulative percentage of taxa found in Pine City Natural Area compared to the number of records in the ten counties (Arkansas, Cross, Desha, Lee, Lonoke, Monroe, Phillips, Prairie, St. Francis, and Woodruff) surrounding it.

MAP Counties	Taxa	Cumulative %
0	27*	4.69
1	13	6.94
2	31	12.33
3	35	18.4
4	50	27.08
5	40	34.03
6	62	44.79
7	65	56.08
8	83	70.49
9	84	85.07
10	86	100

*Includes seven *Dichanthelium* spp. that may prove more widespread in Arkansas (Thomas, in prep.).

39.6%), Asteraceae (16, 24.6%), and Fabaceae (14, 33.3%). For additional families representing ≥1% of the flora, 60% of Juncaceae (10), 46.7% of Rosaceae (7), 42.9% of Plantaginaceae (6), and 45.5% of Ranunculaceae (5) represent county records (Fig. 3). Many taxa represent county records at the family level, including Dennstaedtiaceae (1), Aristolochiaceae (1), Berberidaceae (1), Hydrocharitaceae (1), Lentibulariaceae (1), Linaceae (1), Phrymaceae (1), Tetrachondraceae (1), Agavaceae (2), and Iridaceae (2). Considering the flora at PCNA compared to the 10 counties surrounding it, 27 taxa (4.7%)—including seven *Dichanthelium* spp. which may prove more widespread—have not been vouchered in the region (Table 3), and 196 taxa (34.0%) are known from five or fewer counties in the surrounding MAP (Table 3).

In terms of life-span categories (Fig. 4 Duration) for taxa found at PCNA, short-lived (annual or biennial) taxa had a higher proportion of county records (62, 38.1%) compared to perennial (109, 30.1%) and variable (12, 25.5%) taxa. When partitioned into major groups (Fig. 4 Major Group), monocots had the highest proportion of county records (90, 46.2%) compared to pteridophytes (3, 30%) and dicots (90, 24.7%). When partitioned into growth habits (Fig. 4 Growth Habit), graminoids had the highest proportion of county records (69, 46.3%) compared to forbs (92, 30.7%), ferns (3, 30%), shrubs (5, 21.7%), trees (8, 16.3%), woody vines (3, 15.8%), and herbaceous vines (3, 13%).

In terms of life-span categories (Fig. 5 Duration) for all taxa now known from Monroe County, about one quarter of the taxa in each category represented county records (perennial = 109 taxa, short-lived = 62 taxa, and variable = 12 taxa), and about one quarter of the taxa in each category were not documented (perennial = 123 taxa, short-lived = 50 taxa, and variable = 18 taxa). In terms of major groups (Fig. 5 Major Group), only three gymnosperms are known from the county, and one (*Taxodium distichum*) was not found at PCNA; fewer dicots were county records (17%, 90 taxa) compared to known taxa from the county (28%, 147 taxa) that were not collected; whereas more monocots were county records (39%, 90 taxa) compared to Monroe County monocots not found at PCNA (16%, 36 taxa). In terms of growth habits (Fig. 5 Growth Habit), many taxa are relatively well-known for some growth habit classes, which have a smaller percentage of county records than the percentage of known taxa not found, e.g., trees had 8 county records (11%) compared to 25 taxa not found (34%). In contrast, graminoids had 69 county records (40%) compared to 25 taxa not found (14%).

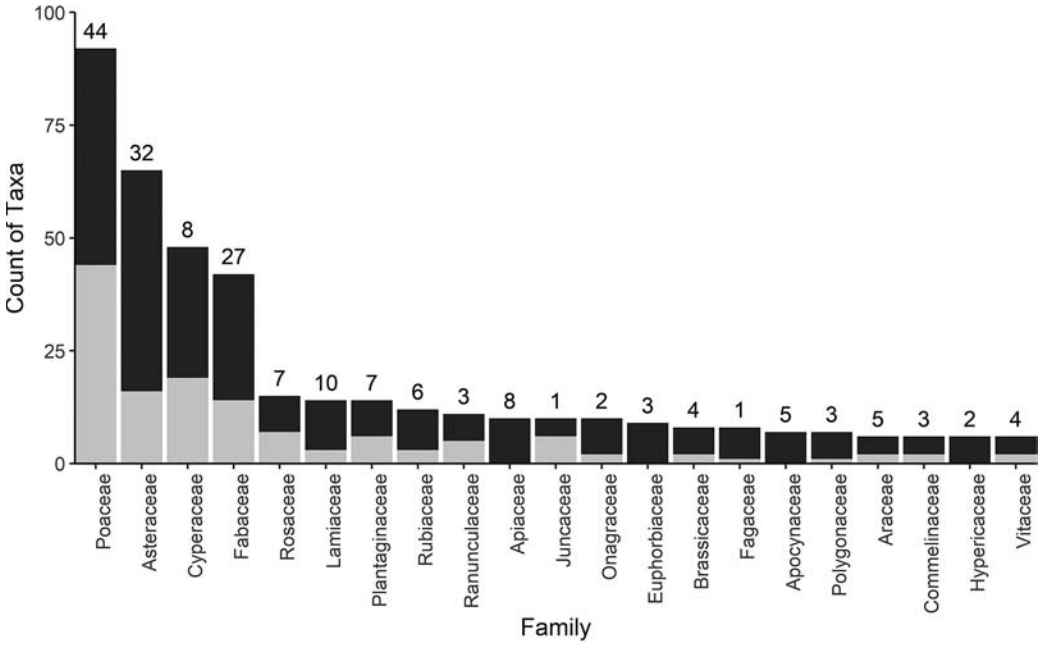

Fig. 3. Families representing ≥1% of the flora (six taxa per family). Light gray indicates county records and black indicates known taxa. The number of genera per family are listed above each column.

DISCUSSION

Pine City Natural Area (PCNA) is a diverse, unique site in the Mississippi Alluvial Plain (MAP) of east-central Arkansas. Although PCNA accounts for only 0.26% of Monroe County's land area, almost as many taxa previously known from the county (583) were documented at PCNA (576, Table 2), and more taxa were documented at PCNA than had been documented in four counties in the MAP (Fig. 1, Gentry et al. 2013): Desha (555), Mississippi (487), Woodruff (467), and Crittenden (349). In terms of documented taxonomic richness with the addition of 183 county records, the vouchered Monroe County flora increased to 767 taxa, making it the second richest county located entirely within the bounds of the MAP behind Arkansas County (813). The elevation of the county's known taxonomic richness rank to 52 out of 75 counties puts it ahead of counties from more diverse or mixed ecoregions, including the West Gulf Coastal Plain counties of Lafayette (752), Nevada (692), Cleveland (654), Columbia (643), Grant (611), and Dallas (597); MAP counties that include portions of the Mississippi Valley Loess Plains Ecoregion (Crowley's Ridge), Clay (727), Greene (711), Lee (637), Phillips (594), Poinsett (584), and Cross (578); MAP counties that include portions of the Ozark Highlands, Lawrence (738) and Randolph (716); and three additional counties with mixed ecoregions (Fig. 1). For taxonomic richness, eastern Arkansas has the eight lowest counties and 14 of the 19 counties in the lowest quartile, highlighting the need for additional systematic inventory in this underexplored region of the state.

The uniqueness of PCNA emphasizes the families in need of additional exploration in east-central Arkansas, particularly the MAP. Over one third of the taxa found at PCNA have been documented at five or fewer of the ten counties surrounding it in the MAP (Table 3), and 27 taxa (4.7%) had not been documented in any of the surrounding counties (Appendix 1). Two previously undocumented taxa, *Lagerstroemia indica* and *Narcissus ×odorus*, are introduced and likely more widespread, escaping cultivation or persisting as waifs. Six of these taxa are considered taxa of conservation concern in Arkansas: *Azolla caroliniana*, *Spiranthes lacera* var. *lacera*, *Dichanthelium arenicoloides*, *D. chrysopsidifolium*, *D. roanokense*, and a *Solidago* currently under

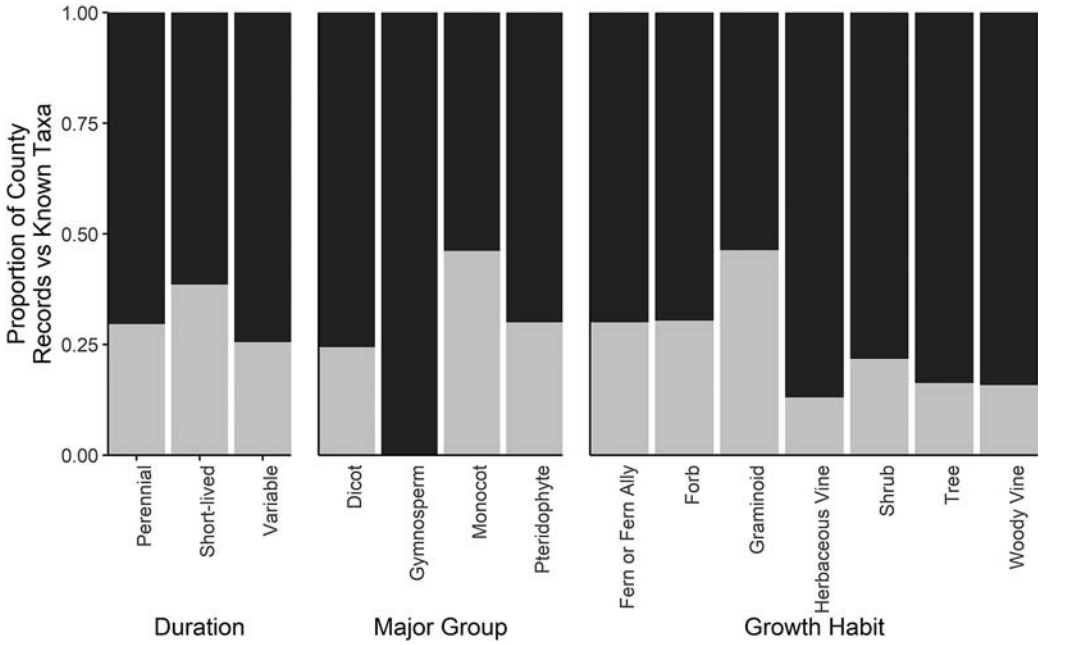

Fig. 4. Proportion of vascular plant county records (light gray) compared to known taxa (black) collected at Pine City Natural Area for duration, major group, and growth habit.

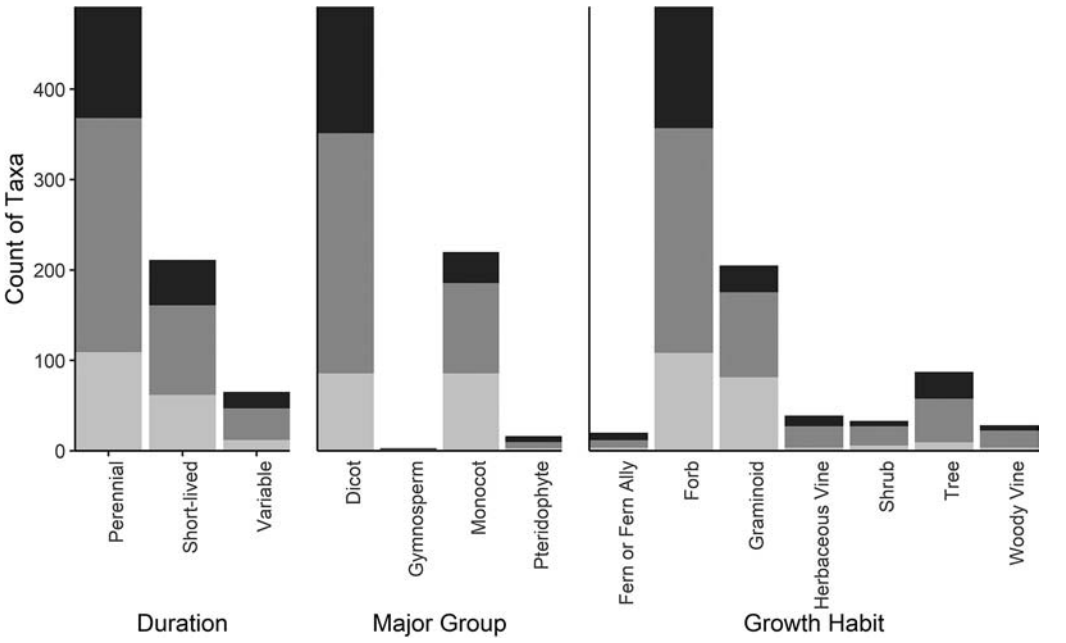

Fig. 5. Count of vascular plant county records collected (light gray), known taxa collected (medium gray), and known taxa not collected (black) at Pine City Natural Area for duration, major group, and growth habit.

study in sect. *Solidago* subsect. *Maritimae* (Torrey & A. Gray) G. L. Nesom, a subsection not previously reported from Arkansas (Witsell, in prep). Ten taxa are Poaceae; with an additional three graminoid taxa (2 Cyperaceae and 1 Typhaceae), almost half of the taxa not documented in any of the surrounding counties are graminoids. Of taxa found in less than half of the surrounding MAP counties (Table 3, Appendix 1), 33.7% are graminoids (39 Poaceae, 19 Cyperaceae, 7 Juncaceae, 1 Typhaceae), despite graminoids comprising only 20.2% of all taxa known from the ten counties (Gentry et al. 2013). Under-reported, non-graminoid families follow those documented at PCNA (Fig. 3): 19 Asteraceae, 17 Fabaceae, 7 Rosaceae, and 6 Plantaginaceae, but with the addition of Lamiaceae (7). Most of these families are species-rich, contain cryptic diversity, and their under collection might represent collection bias due to the difficulty of identifying specimens.

Non-showy flowering plants (such as graminoids – sedges, grasses, and rushes) tend to be under-collected and under-reported in North America despite the high diversity of species within this group. In examining sampling bias in Australia, New England (U.S.A.), and South Africa from ~5 million digitized herbarium records, Daru et al. (2018) found that graminoid specimens in Australia and South Africa were overrepresented compared to New England, which overrepresented herbs and trees. In examining co-associated taxa compared to specimen data for the Robert K. Godfrey Herbarium (FSU), Pearson (2018) found that fewer graminoids were included as associated taxa records (20.9%) compared to specimen records (26.8%), showing that graminoids are underrepresented as co-associated taxa. In comparison to arctic herbarium collection bias in Nunavut, Canada, eastern Arkansas also exhibits under-collection of Asteraceae, Fabaceae, and Ranunculaceae (Panchen et al. 2019). However, Poaceae is the most over-collected Nunavut family, and graminoids are over-represented in contrast to being the most under-collected family and growth habit in eastern Arkansas (Fig. 3, 4, 5; Panchen et al. 2019). As another demonstration of under-collection of graminoids in the PCNA flora, of three families that had 10 taxa each (Apiaceae, Juncaceae, and Onagraceae), six Juncaeae were county records compared to two Onagraceae and zero Apiaceae (Fig. 3).

Taxa-rich genera at PCNA accentuate the collection bias within the MAP, particularly for graminoids. Of the ten genera representing ≥1% of the flora (those with six or more taxa per genus), 50% are graminoid genera, and 65.7% of the taxa (69) are graminoids (Fig. 3, Appendix 1), including *Carex* (28, 32.1% county records [cr]), *Dichanthelium* (16, 56.3% cr), *Juncus* (10, 60% cr), *Cyperus* (9, 44.4% cr), and *Eragrostis* (6, 50% cr). Non-graminoid, taxa-rich genera include *Ranunculus* (9, 44.4% cr), *Quercus* (8, 12.5% cr), *Ludwigia* (7, 28.6% cr), *Helianthus* (6, 16.7% cr), and *Trifolium* (6, 50% cr). The two most taxa-rich genera at PCNA show contrasting patterns with regard to species of conservation concern, which may be under-represented because they are rare (Daru et al. 2018) but are also subject to targeted search efforts (Groves et al. 1995). *Carex* is the largest temperate genus globally with >2100 species (Waterway et al. 2015), though the study area lies south of the richest North American latitudes (Martín-Bravo et al. 2019) and in the "neglected area" of plant collection in eastern Arkansas (Hyatt 1998). However, only one of the 28 taxa documented (*Carex lupuliformis*) is of conservation concern, with populations previously documented at PCNA (ANHC 2022). Conversely, three of 16 *Dichanthelium* are of conservation concern (*D. arenicoloides*, *D. chrysopsidifolium*, *D. roanokense*), and all three are county records (Appendix 1, Gentry et al. 2013). Additionally, seven *Dichanthelium* had not been reported from the surrounding MAP area, though many of these species may be vouchered in the region and identified through redetermination in the ongoing taxonomic revision by the *Dichanthelium of Arkansas* project (Thomas, in prep). *Dichanthelium* may be the most under-collected genus in the MAP, with cryptic diversity and identification challenges; it is actively under study and revision across the state (Thomas, in prep).

In addition to documenting the need for further floristic inventory in east-central Arkansas, the flora of PCNA exemplifies the efficacy of conservation efforts at the natural area, as demonstrated by the total number of taxa, the low percentage of nonnative taxa, and the number and distribution of conservative and rare taxa. As previously noted, this flora documents more taxa than are reported for some entire counties in Arkansas. The PCNA flora had a small percentage (16.3%) of non-native taxa compared to floras of the southeastern U.S.A. (Lucardi et al. 2020b), and an incredibly small number of nonnative taxa per hectare (0.20), less than the average number of nonnative taxa per hectare (1.41) for 27 regional floras in Georgia and South Carolina

(Lucardi et al. 2020b). Anecdotally, most nonnative taxa at PCNA were found along roadside rights-of-way, parking areas, and old homesites. The low percentage of nonnative taxa and location of nonnative taxa in disturbed habitats demonstrates the conservation value of the habitat management at PCNA, which consists of prescribed burns for some portion of the natural area every three years, removal of hardwood encroachment, thinning dense midstory, and targeted invasive species management through mechanical removal and herbicide (ANHC 2018). During an opportunistic survey in 2020 after the primary collection for this flora in 2018-9, a population of a newly documented invasive species, *Murdannia keisak*, was brought to the attention of the ANHC's stewardship staff, who began intensive eradication efforts within weeks of the population's discovery. In addition to having a low number of nonnative taxa in the natural area, conservative taxa were documented throughout the property and surveyed area. In total, 17 unique element occurrence records, which document the occurrence of a taxon of state conservation concern, for eight taxa were submitted to the Heritage Program Database (ANHC 2022).

Furthermore, the flora of PCNA illustrates the need for additional conservation in the MAP and eastern Arkansas. The adjacent private property (McClinton, Fig. 2) included many taxa not found on the protected natural area, including two taxa of conservation concern (*Azolla caroliniana* and *Spiranthes lacera* var. *lacera*). The property also contained the largest population of *Spiranthes praecox* monitored and a fourth taxon of conservation concern, *Eleocharis wolfii*. While not of conservation concern, a putative *Liatris hirsuta* was documented here for the first time in eastern Arkansas since 1955 and represents a range extension east of the White River. While the specimen closely resembles *L. hirsuta*, it is also similar to a potentially undescribed entity known from the blackland prairies in southwestern Arkansas (Witsell, personal communication). Whether a rediscovered species believed to be locally extirpated or an undescribed species, the discovery offers much excitement from an equally uncommon habitat type: a calcareous/sodic post oak savanna. This habitat type is not found on the adjacent natural area, and the occurrence on the McClinton tract may represent the only remaining example in the MAP. The post oak savanna exists in a matrix with saline barrens; both habitats have been edaphically maintained since the site has not undergone extensive habitat restoration and management like the natural area. The property also has loblolly pine-post oak flatwoods with mature pine trees which can support cavities for the federally endangered Red-cockaded Woodpecker; after thinning the midstory to promote an herbaceous understory, this tract could help establish a fifth Red-cockaded Woodpecker colony in the MAP, part of a population which has grown from a single breeding group in 2003 to four in 2017 with a long-term goal of supporting ten breeding groups (ANHC 2018; Holimon, personal communication). Given the number of rare taxa and unique, high-quality habitats, the McClinton property is a land acquisition priority for the ANHC.

The effort to undertake a comprehensive floristic inventory has been criticized as unnecessary in the 21st century (West 1998; Heywood 2001) concurrent with a decline in funding for creating, maintaining, and digitizing natural history collections (Suarez & Tsutsui 2004; Paknia et al. 2015). Yet, the impact of our findings validates the importance of the time and effort invested in a systematic survey. With so few areas of natural vegetation remaining in the MAP, the importance of documenting current species richness and composition is paramount. While most of the MAP has been converted to agricultural use, pockets of species-rich remnants exist, and these areas need to be searched, documented, protected, and managed to preserve the remaining diversity in this ecoregion. In addition to natural area inventory, privately owned sites can have higher average species richness than protected areas and maintain species of conservation concern not found on nearby protected areas (McCune et al. 2017) and also need to be surveyed to protect remaining intact habitats. The flora documented here will be invaluable to: 1) describe the plant communities present in this ecologically unique site, 2) document occurrences of taxa of conservation concern tracked by the ANHC, 3) allow for comparisons of these communities with others in the state, including the communities at the McClinton property, for identifying conservation priorities, and 4) provide a baseline for measuring habitat management efficacy, including evaluating whether diversity is increasing or decreasing under specific management practices.

Fig. 6. Loblolly pine-post oak flatwoods with *Phlox pilosa* ssp. *pilosa* at Pine City Natural Area (34.61130, -91.13675) on April 26, 2019.

Fig. 7. Loblolly pine-post oak flatwoods with *Phlox glaberrima* at Pine City Natural Area (34.59833, -91.12056) on June 1, 2018.

Fig. 8. Loblolly pine-post oak flatwoods with open saline barrens dominated by *Liatris pycnostachya* at Pine City Natural Area (34.602, -91.118) on August 9, 2019.

Fig. 9. Calcareous/sodic post oak savanna with *Packera tomentosa* and *Andropogon hirsutior* in saline barrens in foreground at McClinton property (34.59527, -91.09511) on April 8, 2018.

Fig. 10. Short-flooded wet oak flatwoods with abundant, dense colonies of *Carex hyalinolepis* and *Ulmus rubra*, *Acer rubrum* var. *drummondii*, *Fraxinus pennsylvanica*, *Quercus michauxii*, and *Liquidambar styraciflua* at Pine City Natural Area (34.60055, -91.12292) on April 20, 2018.

Fig. 11. Short-flooded wet oak flatwoods with *Chasmanthium laxum* on elevated, mossy hummocks and *Quercus phellos*, *Pinus taeda*, *Carya ovata*, *and Quercus lyrata* in canopy at Pine City Natural Area (34.60879, -91.12976) on September 28, 2018.

Fig. 12. Long-flooded wet oak flatwoods at with *Quercus lyrata*, *Quercus phellos*, *Acer rubrum* var. *drummondii*, *Carya ovata*, and *Ulmus rubra* at Pine City Natural Area (34.59889, -91.11861) on April 20, 2018.

Fig. 13. Beaver-impacted hardwood depression with floating *Azolla microphylla* and *Limnobium spongia* and canopy dominants including *Acer rubrum* var. *drummondii*, *Fraxinus profunda*, *Quercus lyrata*, and *Diospyros virginiana* at McClinton property (34.58861, -91.09389) on August 11, 2018.

Fig. 14. Hardwood depression with *Swida foemina, Hymenocallis occidentalis* var. *occidentalis, Packera glabella, Boehmeria cylindrica, Gratiola virginica,* and *Saururus cernuus* at McClinton property (34.59401, -91.09683) on May 3, 2019.

Figs. 15 & 16. Marsh with *Carex lupulina*, *C. triangularis*, and *Gylceria septentrionalis* at McClinton property (34.59104, -91.09400 & 34.59156, -91.09400) on May 4, 2018.

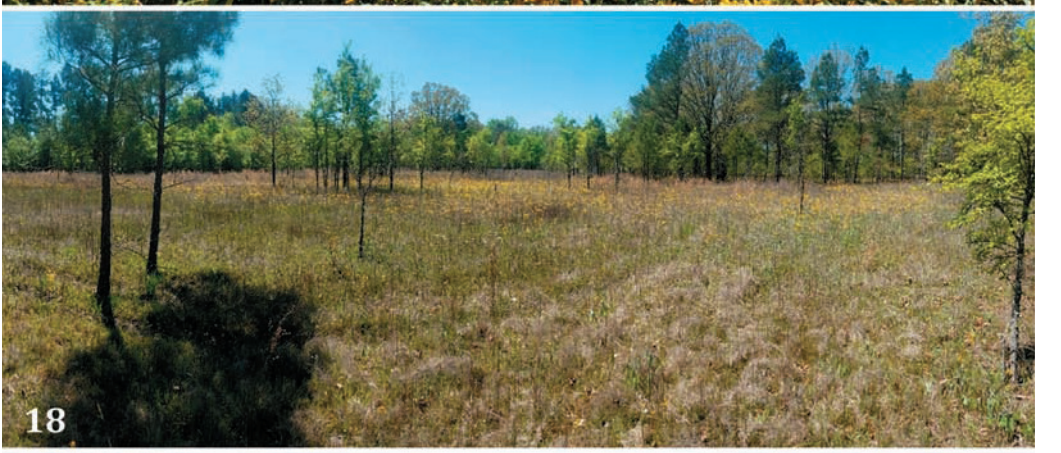

Fig. 17. Marsh dominated by *Bidens laevis* at McClinton property (34.59154, -91.09373) on October 10, 2019.
Fig. 18. Saline barrens with *Packera tomentosa* at Pine City Natural Area (34.61056, -91.13972) on April 20, 2018.
Fig. 19. Saline barrens with *Erigeron tenuis* at Pine City Natural Area (34.58389, -91.09500) on June 8, 2018.

APPENDIX 1
Checklist of Taxa

Taxa (species, subspecies, and varieties) documented at Pine City Natural Area (PCNA) and the surrounding area in the present study. Taxonomy follows the *Flora of the Southeastern United States: Arkansas* (Weakley 2020) except for *Dichanthelium*, which follows Thomas (in prep). County record taxa are denoted with a plus sign (+) before the name and non-native taxa have an asterisk (*) before the name. Taxonomic status abbreviations follow the en dash (—): conservation concern (C, scientific names also bolded), introduced (I), invasive (V); taxa without a status abbreviation are native. The number in parentheses indicates the number of counties (up to 10: Arkansas, Cross, Desha, Lee, Lonoke, Monroe, Phillips, Prairie, St. Francis, and Woodruff) surrounding PCNA where the taxon is found; taxa not documented in any of the surrounding counties have a **(0)**. The abbreviations denote plant communities where taxa were collected or included as a co-associate (Table 1). Plant community abbreviations are:

LPF: Loblolly pine-post oak flatwoods
COS: Calcareous/Sodic oak savanna
WOF: Wet oak flatwoods
MFF: Mesic floodplain forest
HD: Hardwood depression
MSS: Marsh/shrub swamp
SB: Saline barrens
OF: Old field
D: Ditch
DA: Disturbed areas (Roadsides, parking areas, old home sites)

Voucher specimens follow Diana L. Soteropoulos's collector numbers, except 18-0442 to 18-0502 which were collected by Joseph A. Ledvina; five taxa vouchered at PCNA by other collectors include the collector's last name and collector number. Note: canopy dominants *Quercus nigra* and *Ulmus americana* were not vouchered in this study.

PTERIDOPHYTES

Aspleniaceae
Asplenium platyneuron (L.) Britton, Sterns, & Poggenb.—(8); DA; 18-0969

Dennstaedtiaceae
+*Pteridium pseudocaudatum* (Clute) Christenhusz—(3); LPF; 18-0310

Isoetaceae
Isoetes melanopoda Gay & Durieu ex Durieu ssp. *melanopoda*—(4); COS, LPF, SB, WOF; 18-0888, 18-0065, 18-0098, 18-0171, 18-0235, 18-0245

Ophioglossaceae
Botrypus virginianus (L.) Michx.—(10); LPF; 19-0078
+*Ophioglossum pycnostichum* (Fernald) Á. Löve & D. Löve—(5); WOF; 18-0122
Sceptridium biternatum (Savigny) Lyon—(9); LPF, WOF; 18-0829, 18-0876, 18-0951
Sceptridium dissectum (Spreng.) Lyon.—(10); HD; 19-0193

Polypodiaceae
Pleopeltis michauxiana (Weath.) Hickey & Sprunt—(10); COS, LPF, WOF; 18-0067, 18-0798

Salviniaceae
+***Azolla caroliniana* Willd.**—C; **(0)**; MSS; 18-0202, 18-0210, 18-0582
Azolla microphylla Kaulf.—(8); D, MSS; 19-0186

GYMNOSPERMS

Cupressaceae
Juniperus virginiana L.—(10); DA, LPF; 18-0606

Pinaceae
Pinus taeda L.—(9); LPF, SB, WOF; 18-0021

DICOTS

Acanthaceae
Justicia lanceolata (Chapm.) Small—(10); LPF, MSS, WOF, MFF; 18-0362, 18-0514, 18-0567
Ruellia humilis Nutt.—(9); LPF, SB; 18-0481, 18-0666

Aceraceae
Acer rubrum L. var. *drummondii* (Hook. & Arn. ex Nutt.) Sarg.—(5); HD, MSS, WOF; 18-0545

Altingiaceae
Liquidambar styraciflua L.—(10); HD, MFF, MSS, WOF; 18-0901

Amaranthaceae
Amaranthus hybridus L. ssp. *hybridus*—(7); DA; 18-0622, 18-0690
**Amaranthus palmeri* S. Watson—I; (7); DA; 18-0805
+**Amaranthus spinosus* L.—I; (7); DA; 19-0097

Anacardiaceae
Rhus copallinum L. var. *latifolia* Engl.—(8); DA, LPF, OF; 18-0600
Rhus glabra L.—(10); DA; 18-0593
Toxicodendron radicans (L.) Kuntze var. *radicans*—(9); LPF, WOF, DA; 18-0515

Apiaceae
Chaerophyllum tainturieri Hook.—(9); DA; 18-0093, 18-0120, 19-0034
Cicuta maculata L. var. *maculata*—(9); D, HD, LPF, MSS, WOF; 18-0378
Cynosciadium digitatum DC.—(8); WOF; 18-0377, 18-0497
Eryngium prostratum Nutt. ex DC.—(6); DA, LPF, WOF; 18-0527
Eryngium yuccifolium Michx. var. *yuccifolium*—(7); LPF; 18-0562
Limnosciadium pinnatum (DC.) Mathias & Constance—(3); SB; 18-0449
Ptilimnium capillaceum (Michx.) Raf.—(9); DA, LPF; 19-0157
Ptilimnium nuttallii (DC.) Britton—(8); DA, LPF, SB; 18-0382, 18-0466, 18-0596, 18-0430, 18-0482, 19-0081
Sanicula canadensis L. var. *canadensis*—(10); DA, LPF; 18-0355, 18-0486
**Torilis arvensis* (Huds.) Link—I; (8); DA; 18-0489

Apocynaceae
Amsonia tabernaemontana Walter—(9); MFF; 18-0099
Apocynum cannabinum L.—(8); DA, OF; 18-0492
Asclepias perennis Walter—(8); D, HD, WOF; 18-0360, 18-0464, 18-0783
Asclepias purpurascens L.—(3); LPF; 18-0886, 19-0076
Asclepias viridis Walter—(6); SB; 18-0258
Gonolobus suberosus (L.) R. Br. in W. Aiton & W.T. Aiton var. *granulatus* (Scheele) Krings & Q.Y. Xiang—(7); DA; 19-0160
Thyrsanthella difformis (Walter) Pichon—(9); LPF, WOF; 18-0319

Aquifoliaceae
Ilex decidua Walter—(10); HD, LPF, WOF; 18-0526, 18-0983
+*Ilex vomitoria* Aiton—**(0)**; LPF; 18-0520

Araliaceae
Aralia spinosa L.—(8); LPF; 18-0718
Hydrocotyle ranunculoides L. f.—(5); HD, MSS; 18-0644, 19-0106

Aristolochiaceae
+*Endodeca serpentaria* (L.) Raf.—(2); LPF; 19-0109

Asteraceae

Acmella repens (Walter) Rich. in Pers.—(8); HD, MSS; 18-0686, 18-0687

+*Ambrosia artemisiifolia* L.—(9); DA, HD, LPF, SB; 18-0737, 19-0200

+*Ambrosia bidentata* Michx.—(5); DA, OF, SB, WOF; 18-0636, 18-0787

Ambrosia trifida L. var. *trifida*—(8); D, DA; 18-0734

Baccharis halimifolia L.—(10); DA, MSS, OF, SB; 18-0924

Bidens aristosa (Michx.) Britton—(9); D, LPF, MSS, SB, WOF; 18-0801, 18-0822, 18-0835

+*Bidens bipinnata* L.—(2); DA; 18-0946

Bidens discoidea (Torr. & A. Gray) Britton—(3); HD, MSS; 18-0850, 18-0879, 19-0207

Bidens laevis (L.) Britton, Sterns & Poggenb.—(4); HD, MSS; 18-0847, 19-0204, 19-0205

Boltonia asteroides (L.) L'Hér. var. *recognita* (Fernald & Griscom) Cronquist—(3); LPF; 18-0757

Boltonia diffusa Elliott var. *diffusa*—(6); DA, LPF, OF, SB; 18-0632

Conoclinium coelestinum (L.) DC. in DC. & A. DC.—(10); LPF, WOF; 18-0766

Coreopsis lanceolata L.—(5); DA, LPF, SB; 18-0243

Coreopsis tinctoria Nutt. var. *tinctoria*—(10); DA, LPF, OF, SB; 18-0475

Eclipta prostrata (L.) L.—(9); DA, MSS, WOF; 18-0661, 18-0698

Elephantopus carolinianus Raeusch.—(8); LPF; 19-0156

+*Erechtites hieraciifolius* (L.) Raf. ex DC. in DC. & A. DC.—(4); DA, LPF, WOF; 18-0785

Erigeron annuus (L.) Pers.—(9); DA, OF, LPF; 18-0370, 18-0504, 18-0580

Erigeron canadensis L.—(10); DA, OF; 18-0577

Erigeron philadelphicus L. var. *philadelphicus*—(10); DA, OF; 18-0290, 18-0277, 18-0287, 18-0289

Erigeron strigosus Muhl. ex Willd. var. *strigosus*—(9); DA, SB; 19-0080

Erigeron tenuis Torr. & A. Gray—(8); LPF, SB; 18-0385, 19-0093, 18-0080, 18-0261, 18-0262, 18-0439

+*Eupatorium capillifolium* (Lam.) Small—(2); DA; 18-0906

Eupatorium perfoliatum L.—(5); LPF, WOF; 18-0759

+*Eupatorium scabridum* Elliott—(2); LPF; 18-0754

Eupatorium semiserratum DC. in DC. & A. DC.—(4); LPF, WOF; 18-0563, 18-0619, 18-0670

Eupatorium serotinum Michx.—(10); DA, LPF; 18-0767, 18-0773

Euthamia leptocephala (Torr. & A. Gray) Greene ex Porter & Britton—(8); LPF, SB, WOF; 18-0540, 19-0217, 18-0828, 18-0834, 18-0836, 18-0866, 18-0890, 18-0904, 18-0929

+*Gamochaeta antillana* (Urban) Anderb.—**(0)**; DA; 19-0082

+*Gamochaeta purpurea* (L.) Cabrera—(4); DA, LPF, SB; 18-0609, 18-0679, 18-0788, 18-0308, 18-0350, 18-0363

Helenium amarum (Raf.) H. Rock var. *amarum*—(10); DA, LPF; 18-0476

Helenium flexuosum Raf.—(9); LPF, MSS, SB, WOF; 18-0479

Helianthus angustifolius L.—(8); LFP; 19-0214

+*Helianthus divaricatus* L.—(5); LFP; 18-0770

Helianthus hirsutus Raf.—(6); LFP; 18-0692, 18-0752

Helianthus mollis Lam. in Lam. et al.—(4); LFP; 19-0163

Helianthus strumosus L.—(6); LFP; 18-0715, 18-0772

Helianthus tuberosus L.—(6); DA; 18-0903

Iva annua L.—(10); DA, OF, SB, WOF; 18-0789

Krigia cespitosa (Raf.) K.L. Chambers—(10); DA, SB; 18-0116, 18-0156, 18-0271

Krigia dandelion (L.) Nutt.—(9); LPF, SB; 18-0068, 18-0112

Lactuca canadensis L.—(8); LPF; 18-0534, 18-0605, 18-0693

**Lactuca serriola* L.—I; (9); DA; 18-0627

+*Liatris hirsuta* Rydb.—(2); COS; 18-0550, 18-0831

Liatris pycnostachya Michx.—(6); LFP, SB; 18-0553, 18-0597

**Matricaria chamomilla* L.—I; (8); DA; 18-0087

Mikania scandens (L.) Willd.—(9); HD, MSS, WOF; 18-0603

Packera glabella (Poir.) C. Jeffrey—(10); D, HD, MFF, WOF; 18-0050, 18-0118

Packera tomentosa (Michx.) C. Jeffrey—(8); LPF, SB; 18-0010, 18-0020, 18-0055

Pluchea camphorata (L.) DC. in DC. & A. DC.—(8); D, HD, MSS, WOF; 18-0738, 18-0769

+*Pseudognaphalium obtusifolium* (L.) Hilliard & B.L. Burtt—(6); DA, LPF; 18-0980

Pyrrhopappus carolinianus (Walter) DC. in DC. & A. DC.—(10); DA; 18-0614

Solidago altissima L. var. *pluricephala* M.C. Johnst.—(10); DA, OF; 18-0816, 18-0837, 18-0862

Solidago nemoralis Aiton ssp. *nemoralis*—(7); LPF, OF; 18-0915

+***Solidago* sect. *Solidago* subsect. *Maritimae* (Torrey & A. Gray) G.L. Nesom**—C; **(0)**; LPF; 19-0089, 19-0132, 18-0900, 18-0931, 18-0933

+*Solidago ulmifolia* Muhl. ex Willd. var. *ulmifolia*—(7); LPF; 19-0110, 19-0121, 18-0756, 18-0761, 18-0763, 18-0898

**Sonchus asper* (L.) Hill—I; (9); DA; 18-0387

+*Symphyotrichum divaricatum* (Nutt.) G.L. Nesom—**(0)**; DA; 19-0213

Symphyotrichum dumosum (L.) G.L. Nesom—(7); LPF, SB, WOF; 19-0146, 18-0844, 18-0865, 18-0872

+*Symphyotrichum lateriflorum* (L.) Á. Löve & D. Löve—(7); WOF; 18-0963

Symphyotrichum pilosum (Willd.) G.L. Nesom var. *pilosum*—(10); DA, LPF, OF, SB; 18-0930, 18-0937

Symphyotrichum racemosum (Elliott) G.L. Nesom—(7); DA, LPF, WOF; 18-0920, 18-0978, 19-0218

+**Taraxacum erythrospermum* Andrzejowski ex Besser—I; (1); DA; 19-0043

Vernonia missurica Raf.—(9); LPF, WOF; 18-0205, 18-0437, 18-0640, 18-0669, 18-0685

Xanthium orientale L.—(9); MSS, WOF; 18-0881, 19-0210

Berberidaceae

+*Podophyllum peltatum* L.—(9); LPF; 19-0027

Bignoniaceae

Bignonia capreolata L.—(10); HD, LPF, WOF; 18-0181

Campsis radicans (L.) Seem. ex Bureau—(10); LPF, MSS, WOF; 18-0502

Boraginaceae

Myosotis macrosperma Engelm.—(6); COS, DA, LPF; 18-0071, 18-0147, 19-0038

Brassicaceae

+**Cardamine hirsuta* L.—I; (8); DA, COS, SB; 18-0766, 18-0006, 18-0072, 19-0003

+*Cardamine parviflora* L. var. *arenicola* (Britton) O.E. Schulz—(4); SB; 19-0022

Cardamine pensylvanica Muhl. ex Willd.—(7); DA, LPF, MSS, SB; 18-0095, 18-0104, 19-0012

**Lepidium didymum* L.—I; (4); DA; 19-0021

Lepidium virginicum L. var. *virginicum*—(10); DA; 18-0167, 18-0242, 19-0033

Planodes virginicum (L.) Greene—(8); DA; 19-0013, 19-0018

Rorippa palustris (L.) Besser ssp. *palustris*—(8); D, DA, MSS, OF; 18-0117, 19-0046, 19-0197

Rorippa sessiliflora (Nutt. ex Torr. & A. Gray) Hitchc.—(6); DA, OF; 19-0035

Campanulaceae

Lobelia appendiculata A. DC.—(5); LPF, SB, WOF; 18-0349, 18-0902, 19-0153

Lobelia cardinalis L.—(9); MFF, MSS, WOF; 18-0819

+*Triodanis biflora* (Ruiz & Pav.) Greene—(7); DA; 18-0283

Cannabaceae
Celtis laevigata Willd.—(9); DA, WOF; 18-0168, 18-0940

Caprifoliaceae
**Lonicera japonica* Thunb. ex Murray—V; (9); DA, LPF, SB; 18-0263

Caryophyllaceae
+**Cerastium fontanum* Baumg. ssp. *vulgare* (Hartm.) Greuter & Burdet—I; (3); DA, SB; 18-0069
**Cerastium glomeratum* Thuill.—I; (10); DA, LPF, OF, SB; 18-0607, 18-0736, 18-0964, 18-0131, 18-0345, 19-0048
Mononeuria muscorum (Fassett) Dillenb. & Kadereit—(5); DA, LPF, SB; 18-0966, 19-0159, 18-0097, 18-0225, 18-0394, 18-0458, 19-0029
+*Sagina decumbens* (Elliott) Torr. & A. Gray—(7); DA, LPF, SB; 18-0090, 19-0009, 19-0023
**Stellaria media* (L.) Vill.—I; (9); DA; 18-0115, 19-0005

Ceratophyllaceae
Ceratophyllum demersum L.—(6); HD, MSS; 18-0201, 19-0185

Chenopodiaceae
**Chenopodium album* L.—I; (8); DA, OF; 18-0802, 18-0945

Cistaceae
Lechea tenuifolia Michx.—(6); LPF, SB; 18-0383, 18-0510

Convolvulaceae
Cuscuta campestris Yunck.—(5); HD, MSS; 18-0846, 18-0982, 19-0190
Cuscuta gronovii Willd. ex Roem. & Schult.—(4); DA, WOF; 18-0895, 19-0198
**Ipomoea hederacea* Jacq.—I; (10); DA; 18-0741
Ipomoea lacunosa L.—(9); DA, MSS; 18-0743, 18-0859

Cornaceae
Swida foemina (Mill.) Rydb.—(8); HD, WOF; 18-0531, 19-0192

Cucurbitaceae
Melothria pendula L.—(8); DA; 18-0574

Ebenaceae
Diospyros virginiana L.—(10); DA, HD, LFP, MSS, WOF; 18-0450, 18-0780

Ericaceae
Vaccinium arboreum Marshall—(7); SB, LPF; 18-0552

Euphorbiaceae
Acalypha gracilens A. Gray—(7); DA, LPF; 18-0663
Acalypha rhomboidea Raf.—(7); LPF; 18-0523
Acalypha virginica L.—(9); DA, WOF; 18-0578
Croton capitatus Michx.—(10); DA, LPF, SB, WOF; 18-0609, 18-0679, 18-0788
Croton glandulosus L. var. *septentrionalis* Müll. Arg.—(5); LPF, OF, SB; 19-0158
Croton willdenowii G.L. Webster—(4); LPF, SB; 18-0201, 19-0185, 18-0549, 18-0630, 18-0677, 18-0729
Euphorbia maculata L.—(8); DA; 18-0554
Euphorbia nutans Lag.—(10); DA; 18-0612, 18-0891
Euphorbia spathulata Lam.—(6); SB; 18-0165, 18-0284

Fabaceae
**Aeschynomene indica* L.—I; (5); D; 18-0976
**Albizia julibrissin* Durazz.—V; (9); DA; 18-0525
Amorpha fruticosa L.—(10); HD, MSS; 18-0381
Amphicarpaea bracteata (L.) Fernald var. *bracteata*—(4); LPF; 18-0760b, 20-0002
Apios americana Medik.—(7); LPF, MSS; 19-0134, 19-0164
Baptisia lactea (Raf.) Thieret—(5); LPF; 18-0452, 19-0066
Cercis canadensis L.—(10); DA; 19-0020
Chamaecrista fasciculata (Michx.) Greene var. *fasciculata*—(10); LPF, MSS; 18-0620, 18-0716
+*Chamaecrista nictitans* (L.) Moench var. *nictitans*—(7); LPF; 18-0975
Clitoria mariana L. var. *mariana*—(9); LPF; 18-0966, 19-0159
Desmodium canescens (L.) DC.—(4); DA; 18-0936
+*Desmodium glabellum* (Michx.) DC.—**(0)**; LPF, WOF; 18-0168, 18-0940, 18-0749, 18-0864, 18-0885
Desmodium paniculatum (L.) DC. var. *paniculatum*—(5); DA, LPF, WOF; 18-0671, 18-0702, 18-0811
+*Galactia regularis* (L.) Britton, Sterns & Poggenb.—(4); LPF; 19-0155
Gleditsia aquatica Marshall—(9); MSS; 18-0180
Gleditsia triacanthos L.—(10); LPF, OF, SB; 18-0264
+**Glycine max* (L.) Merr.—I, waif; (3); DA; Baker 14-0130
**Kummerowia striata* (Thunb.) Schindl.—I; (8); DA, SB; 18-0706, 19-0152
Lackeya multiflora (Torr. & A. Gray) Fortunato, L.P. Queiroz & G.P. Lewis—(7); LPF, WOF; 18-0740, 18-0760a
**Lathyrus hirsutus* L.—I; (9); DA; 18-0335, 19-0060
**Lespedeza cuneata* (Dum. Cours.) G.Don—V; (9); DA, OF, SB; 18-0662
Lespedeza hirta (L.) Hornem. var. *hirta*—(4); LPF; 18-0764
+*Lespedeza procumbens* Michx.—(4); LPF; 18-0762
+*Lespedeza repens* (L.) W.P.C. Barton—(7); LPF; 18-0724
Lespedeza virginica (L.) Britton—(8); LPF; 18-0668
+**Medicago arabica* (L.) Huds.—I; (4); DA; 18-0140
+*Neptunia lutea* (Leavenw.) Benth.—**(0)**; SB; 18-0496, 18-0676
+*Orbexilum pedunculatum* (Mill.) Rydb.—(5); LPF, WOF; 19-0079
+*Robinia pseudoacacia* L.—(9); LPF; 18-0717
**Senna obtusifolia* (L.) H.S. Irwin & Barneby—I; (9); DA; 18-0628
Sesbania herbacea (Mill.) McVaugh—(10); DA, MSS, OF, SB; 18-0637
+*Strophostyles leiosperma* (Torr. & A. Gray) Piper—(5); DA, LPF; 18-0674, 18-0883, 19-0149
Strophostyles umbellata (Muhl. ex Willd.) Britton in Britton & A. Br.—(4); LPF, SB; 18-0705
Stylosanthes biflora (L.) Britton, Sterns & Poggenb.—(6); LPF; 18-0338, 18-0751
**Trifolium arvense* L.—I; (6); DA; 19-0142
+**Trifolium dubium* Sibth.—I; (7); DA; 18-0141, 18-0332
**Trifolium incarnatum* L.—I; (7); DA; 19-0044
+*Trifolium reflexum* L.—(4); LPF; 18-0329
**Trifolium repens* L.—I; (9); DA, OF; 18-0288
+**Trifolium resupinatum* L.—I; (2); DA; 19-0068
**Vicia sativa* L. ssp. *nigra* (L.) Ehrh.—I; (9); DA, SB; 18-0101, 18-0136, 18-0592, 18-0128, 18-0337, 19-0031
**Vicia villosa* Roth. ssp. *varia* (Host) Corb.—I; (8); D, DA; 18-0371

Fagaceae
Quercus alba L.—(10); LPF; 19-0052
Quercus lyrata Walter—(9); HD, MFF, MSS, WOF; 18-0214, 18-0604
Quercus michauxii Nutt.—(9); MFF, WOF; 18-0085, 18-0294
Quercus pagoda Raf.—(8); DA, MFF, WOF; 18-0182, 19-0119, 18-0771, 18-0927, 18-0948
Quercus palustris Münchh.—(8); HD, WOF; 18-0779, 18-0952, 19-0166
Quercus phellos L.—(10); HD, LPF, WOF; 18-0103, 18-0164, 18-0799
+*Quercus shumardii* Buckley—(6); WOF; 18-0529, 18-0923
Quercus stellata Wangenh.—(8); COS, LPF, SB, WOF; 18-0113, 18-0791, 18-0955

Geraniaceae
Geranium carolinianum L.—(8); DA, SB; 18-0149, 18-0222, 18-0286
+**Geranium dissectum* L.—I; (4); DA; 19-0030

Haloragaceae
Myriophyllum pinnatum (Walter) Britton, Sterns & Poggenb.—(2); D, MSS; 18-0895, 19-0198, 19-0055, 19-0130, 19-0131
+*Proserpinaca palustris* L.—(3); D, MSS; 18-0174, 18-0501, 19-0151

Heliotropiaceae
**Heliotropium indicum* L.—I; (9); DA; 18-0528, 18-0660

Hippocastanaceae
Aesculus pavia L. var. *pavia*—(10); LPF; 18-0108, 18-0721

Hydroleaceae
Hydrolea ovata Nutt. ex Choisy—(7); MSS; 19-0194
Hydrolea uniflora Raf.—(6); D, MSS; 18-0565, 18-0613

Hypericaceae
Hypericum drummondii (Grev. & Hook.) Torr. & A. Gray—(7); SB; 18-0631, 18-0635
Hypericum hypericoides (L.) Crantz—(9); LPF; 18-0357
Hypericum lobocarpum Gatt.—(7); COS, LPF; 18-0624, 18-0748, 18-0551, 18-0599, 18-0601
Hypericum mutilum L. var. *mutilum*—(7); MSS; 18-0654
Hypericum punctatum Lam.—(9); OF; 18-0537
Triadenum walteri (J.F. Gmel.) Gleason—(2); MSS; 18-0714

Juglandaceae
Carya cordiformis (Wangenh.) K. Koch—(7); HD; 19-0168
+*Carya glabra* (Mill.) Sweet—(6); LPF; 18-0219
Carya illinoinensis (Wangenh.) K. Koch—(10); DA; 18-0290
Carya laciniosa (F. Michx.) Loudon—(4); HD, MFF; 18-0588
Carya ovata (Mill.) K. Koch—(8); HD, WOF; 18-0846, 18-0982, 19-0190, 18-0229, 18-0591, 18-0722

Lamiaceae
Callicarpa americana L.—(9); LPF, WOF; 18-0575, 18-0719
**Glechoma hederacea* L.—V; (3); DA; 19-0117
+*Hedeoma hispida* Pursh—(2); SB; 18-0268, 18-0403
Hedeoma pulegioides (L.) Pers.—(4); DA, LPF; 18-0909
**Lamium amplexicaule* L. var. *amplexicaule*—I; (10); DA; 18-0241
**Lamium purpureum* L.—I; (4); DA; 19-0007
Lycopus rubellus Moench—(4); HD, MSS; 18-0709, 18-0855, 19-0203
Lycopus virginicus L.—(4); WOF; 18-0794, 18-0797
+**Perilla frutescens* (L.) Britton—V; (6); DA; 18-0935
Prunella vulgaris L. var. *lanceolata* (W.P.C. Barton) Fernald—(8); DA; 18-0503
Pycnanthemum muticum (Michx.) Pers. var. *muticum*—(9); WOF; 18-0491
Pycnanthemum tenuifolium Schrad.—(7); LPF, WOF; 18-0478
+*Scutellaria australis* (Fassett) Epling—(4); LPF, SB; 18-0049, 18-0079
Teucrium canadense L. var. *canadense*—(8); MSS; 18-0648, 18-0649

Lauraceae
Sassafras albidum (Nutt.) Nees—(9); DA; 19-0026

Lentibulariaceae
+*Utricularia gibba* L.—**(0)**; HD, MSS; 19-0065, 19-0107, 19-0182

Linaceae
+*Linum curtissii* Small—(4); SB; 18-0470

Linderniaceae
Lindernia anagallidea (Michx.) Pennell—(8); MSS; 18-0652

Lythraceae
Ammannia coccinea Rottb.—(10); D, MSS; 18-0917
+**Lagerstroemia indica* L.—I, waif; **(0)**; DA; 19-0169
Lythrum lanceolatum Elliott—(6); LPF; 19-0171

Malvaceae
Hibiscus lasiocarpos Cav.—(10); D, MSS; 18-0585
**Sida spinosa* L.—I; (10); DA, MSS, OF; 18-0572, 18-0744, 18-0858

Melastomataceae
Rhexia mariana L. var. *mariana*—(6); LPF, SB; 18-0934, 19-0170

Meliaceae
**Melia azedarach* L.—V; (8); DA; 18-0944

Menispermaceae
Cocculus carolinus (L.) DC.—(8); DA, LPF; 18-0949, 18-0968

Molluginaceae
**Mollugo verticillata* L.—I; (9); DA; 18-0623

Montiaceae
Claytonia virginica L. var. *virginica*—(10); LPF; 18-0001, 18-0008

Moraceae
**Broussonetia papyrifera* (L.) L'Hér. ex Vent.—V; (8); DA; 18-0052, 18-0608
Morus rubra L.—(10); DA, LPF; 18-0720

Nelumbonaceae
Nelumbo lutea Willd.—(10); MSS; 19-0180

Nyssaceae
Nyssa sylvatica Marshall—(8); LPF; 18-0878

Oleaceae
Fraxinus americana L.—(10); HD; 19-0108
Fraxinus pennsylvanica Marshall—(9); LPF, MSS, WOF; 18-0170, 18-0211, 18-0586
Fraxinus profunda (Bush) Bush ex Britt.—(3); HD, MSS; 18-0203, 18-0658, 19-0184
**Ligustrum sinense* Lour.—V; (9); DA, SB; 18-0938, 18-0970

Onagraceae
Ludwigia alternifolia L.—(8); HD, MSS, OF, SB, WOF; 18-0590
Ludwigia decurrens Walter—(7); D, MSS; 18-0856, 18-0863
Ludwigia glandulosa Walter—(7); WOF; 19-0167
+*Ludwigia leptocarpa* (Nutt.) H. Hara—(3); MSS; 18-0848, 18-0857, 18-0880
+*Ludwigia linearis* Walter var. *puberula* Engelm. & A. Gray—(2); LPF, OF, SB; 18-0548, 18-0633, 18-0926
Ludwigia palustris (L.) Elliott—(8); D, WOF; 18-0389, 18-0921, 19-0150
Ludwigia peploides (Kunth) P.H. Raven var. *glabrescens* (Kuntze) Shinners—(10); D, MSS; 18-0581, 18-0731
Oenothera biennis L.—(10); DA; 18-0810, 18-0977
Oenothera laciniata Hill—(10); DA, OF; 19-0041
Oenothera linifolia Nutt.—(5); SB; 18-0198

Orobanchaceae
+*Agalinis fasciculata* (Elliott) Raf.—(8); OF, SB; 18-0774, 18-0817
+*Agalinis heterophylla* (Nutt.) Small ex Britton—(3); OF; 18-0812
Agalinis tenuifolia (Vahl) Raf.—(6); SB, WOF; 18-0786, 18-0827
+*Agalinis viridis* (Small) Pennell—(2); OF, SB; 18-0778, 18-0823

Oxalidaceae
Oxalis dillenii Jacq.—(10); SB; 18-0270
+*Oxalis texana* (Small) Fedde—**(0)**; LPF; 18-0076, 18-0123
Oxalis violacea L.—(8); COS; 18-0070, 18-0840

Passifloraceae
Passiflora incarnata L.—(10); DA; 18-0583
Passiflora lutea L.—(10); LPF; 18-0943

Penthoraceae
Penthorum sedoides L.—(9); MSS, WOF; 18-0647, 18-0735

Phrymaceae
+*Mimulus alatus* Aiton—(8); MSS; 18-0646

Phyllanthaceae
Phyllanthus caroliniensis Walter—(7); DA, LPF; 18-0701

Phytolaccaceae
Phytolacca americana L.—(10); DA, WOF; 18-0374

Plantaginaceae
+*Callitriche heterophylla* Pursh var. *heterophylla*—(2); D, LPF, MSS, WOF; 18-0053, 18-0082, 19-0051
Gratiola neglecta Torr.—(9); DA, LPF; 18-0036, 18-0159, 18-0188, 18-0218, 19-0140
+*Gratiola virginiana* L.—(4); D; 18-0092
Linaria texana Scheele—(9); DA; 18-0187
Mecardonia acuminata (Walter) Small var. *acuminata*—(3); LPF; 18-0667
Penstemon digitalis Nutt. ex Sims—(7); LPF; 18-0297
Plantago aristata Michx.—(9); SB; 18-0422, 18-0532
+*Plantago heterophylla* Nutt.—(4); SB; 19-0024
+*Plantago pusilla* Nutt.—(2); SB; 18-0160
Plantago rugelii Decne.—(8); DA; 18-0543, 19-0135
Plantago virginica L.—(10); SB; 18-0025, 18-0150, 18-0434
**Veronica arvensis* L.—I; (8); DA; 18-0094, 18-0151
+**Veronica hederifolia* L.—I; (1); DA; 18-0142, 19-0004
+*Veronica peregrina* L. var. *peregrina*—(9); DA; 19-0017, 19-0028

Platanaceae
Platanus occidentalis L.—(9); DA, WOF; 18-0617, 19-0211

Polemoniaceae
Phlox glaberrima L.—(6); LPF; 18-0455, 18-0507, 18-0307, 18-0513, 18-0538, 18-0539
+*Phlox pilosa* L. ssp. *pilosa*—(9); LPF, WOF; 18-0074, 18-0106, 18-0247

Polygalaceae
Polygala sanguinea L.—(6); SB; 18-0440

Polygonaceae
Brunnichia ovata (Walter) Shinners—(9); HD, LPF, WOF; 18-0573, 18-0664
+*Persicaria bicornis* (Raf.) Nieuwl.—(7); DA, MSS; 18-0851, 18-0908
Persicaria densiflora (Meisn.) Moldenke—(6); D, MSS; 18-0854, 18-0907
Persicaria hydropiperoides (Michx.) Small—(9); HD, LFP, MSS, OF, WOF; 18-0588, 18-0433, 18-0468, 18-0519, 18-0560, 18-0979, 19-0183
Persicaria lapathifolia (L.) Gray—(10); D, DA; 18-0615, 18-0981
**Rumex crispus* L. ssp. *crispus*—I; (8); DA; 18-0248
Rumex verticillatus L.—(7); D; 18-0183

Portulacaceae
**Portulaca oleracea* L.—I; (3); DA; 18-0804, 18-0972

Primulaceae
+*Centunculus minimus* L.—(1); DA, SB; 18-0385, 19-0093
+*Hottonia inflata* Elliott—(1); MSS; 19-0001, 19-0002, 19-0050
Steironema lanceolatum (Walter) A. Gray—(4); LPF; Simon s.n.
Steironema radicans (Hook.) A. Gray—(7); WOF; 19-0172

Ranunculaceae
Clematis crispa L.—(9); WOF; 18-0185, 18-0380, 19-0047
+*Myosurus minimus* L.—(5); DA; 19-0010
Ranunculus abortivus L.—(10); DA, LPF; 18-0172
**Ranunculus bulbosus* L.—I; (10); DA; 19-0040
Ranunculus fascicularis Muhl. ex J.M. Bigelow—(8); LPF, SB; 18-0109, 18-0311, 18-0317, 18-0028, 18-0031, 19-0025
Ranunculus laxicaulis Darby—(6); D, MSS, WOF; 18-0062, 18-0075, 18-0105
+*Ranunculus micranthus* Nutt. in Torr. & A. Gray—**(0)**; LPF; 19-0019
+**Ranunculus parviflorus* L.—I; (6); DA; 19-0039
+*Ranunculus pusillus* Poir. in Lam. et al.—(6); MSS, OF, SB; 18-0126, 18-0206
**Ranunculus sardous* Crantz—I; (9); DA, SB; 18-0404, 18-0127, 18-0246, 18-0293, 19-0032
+*Ranunculus sceleratus* L. var. *sceleratus*—(5); HD, MSS; 18-0200, 19-0064

Rhamnaceae
Berchemia scandens (Hill) K. Koch—(9); HD, WOF; 18-0295

Rosaceae
+*Crataegus berberifolia* Torr. & A. Gray—(4); HD, LPF, WOF; 18-0984
+*Crataegus crus-galli* L.—(4); LPF; 19-0178
Crataegus marshallii Eggl. in N.L. Britton & J.A. Shafer—(7); COS, LPF; 18-0036
Crataegus viridis L.—(8); HD, WOF; 18-0986
Geum canadense Jacq.—(8); DA, LPF; 18-0490
Potentilla simplex Michx.—(8); LPF; 18-0916, 19-0036
+*Prunus angustifolia* Marshall—(5); LPF, SB; 18-0485, 19-0011
+*Prunus mexicana* S. Watson—(8); WOF; 18-0169, 19-0014
Prunus serotina Ehrh. var. *serotina*—(10); DA, LPF; 18-0178
+**Pyrus calleryana* Decne.—V; (4); OF, SB; 18-0003
Rosa carolina L. ssp. *subserrulata* (Rydb.) W.H. Lewis—(8); LPF, WOF; 19-0175
+**Rosa lucieae* Franch. & Rochebr. ex Crép.—I; (2); D; 19-0067
+*Rubus flagellaris* Willd.—**(0)**; LPF; 19-0053, 20-0003
Rubus pensilvanicus Poir.—(5); LPF, OF, WOF; 18-0086, 19-0054
Rubus trivialis Michx.—(8); DA, OF; 19-0045

Rubiaceae
Cephalanthus occidentalis L.—(10); HD, MSS; 18-0498
Diodia virginiana L.—(9); DA, LPF, OF; 18-0524
Galium aparine L.—(10); DA, LPF; 18-0077, 18-0145
Galium circaezans Michx.—(6); LPF; 20-0004
Galium obtusum Bigelow var. *obtusum*—(6); HD, LPF, SB, WOF; 18-0986, 18-0083, 18-0162, 18-0352, 18-0598
**Galium sherardia* E.H.L. Krause—I; (8); DA; 18-0138
+*Galium tinctorium* L. var. *floridanum* Wiegand—(7); DA, SB; 18-0224, 18-0398, 19-0061
Hexasepalum teres (Walter) J.H. Kirkbr.—(7); DA, SB; 18-0546
+*Houstonia micrantha* (Shinners) Terrell—(4); SB; 18-0014, 18-0038
Houstonia pusilla Schoepf—(7); SB; 18-0019
+*Houstonia tenuifolia* Nutt.—(5); LFP; 18-0521, 19-0077
Oldenlandia boscii (DC.) Chapm.—(3); WOF; 18-0894

Salicaceae
+**Populus ×canescens* (Aiton) Sm.—I; (4); DA; 18-0139
Populus deltoides Bartram ex Marshall ssp. *deltoides*—(9); LPF; 18-0768
Populus heterophylla L.—(7); WOF; 18-0300
Salix humilis Marshall—probably extirpated due to habitat change; (4); LPF; Shepherd 230
Salix nigra Marshall—(9); MSS; 18-0051, 18-0208

Sapindaceae
**Cardiospermum halicacabum* L.—I; (8); DA; Nutt 179

Saururaceae
Saururus cernuus L.—(10); HD, MSS, WOF; 18-0467

Scrophulariaceae
+**Verbascum blattaria* L.—I; (4); DA; 18-0487
**Verbascum thapsus* L. ssp. *thapsus*—I; (10); DA; 19-0148

Solanaceae
Physalis angulata L.—(9); DA, MSS, OF, WOF; 18-0626, 18-0659, 18-0893
+*Physalis pubescens* L.—(3); DA, LPF; 18-0939, 19-0216

Solanum carolinense L. var. *carolinense*—(10); DA, OF; 18-0375
Solanum emulans Raf.—(8); DA, HD, WOF; 18-0922, 19-0199

Styracaceae
Styrax americanus Lam. in Lam. et al. var. *pulverulentus*—(10); HD, WOF; 18-0033, 18-0368, 19-0090, 18-0453, 18-0500, 18-0877

Tetrachondraceae
+*Polypremum procumbens* L.—(4); DA; 18-0558, 18-0672

Ulmaceae
Planera aquatica J.F. Gmel.—(6); MSS; 18-0711
Ulmus alata Michx.—(10); COS, DA, LPF, MSS, SB, WOF; 18-0022, 18-0568
Ulmus rubra Muhl.—(9); HD, WOF; 18-0124

Urticaceae
Boehmeria cylindrica (L.) Sw.—(10); HD, MSS, WOF; 18-0569
Parietaria pensylvanica Muhl. ex Willd.—(6); DA; 19-0136

Valerianaceae
Valerianella radiata (L.) Dufr.—(10); DA, OF, SB; 18-0088

Verbenaceae
+**Verbena brasiliensis* Vell.—I; (6); DA; 18-0493
Verbena urticifolia L.—(8); DA, LPF; 18-0947

Viburnaceae
Sambucus canadensis L.—(10); DA, MFF; 18-0471

Violaceae
+*Viola bicolor* Pursh—(8); DA; 19-0008
Viola missouiriensis Greene—(10); LPF; 18-0030
+*Viola sagittata* Aiton—(5); LPF, SB; 18-0011, 18-0078, 18-0889

Vitaceae
+*Muscadinia rotundifolia* (Michx.) Small var. *rotundifolia*—(9); LPF, WOF; 18-0516
Nekemias arborea (L.) J. Wen & Boggan—(9); DA, LPF, MSS; 18-0665
Parthenocissus quinquefolia (L.) Planch.—(10); COS, LPF, WOF; 18-0899
Vitis cinerea (Engelm. in A. Gray) Engelm. ex Millardet—(8); DA, WOF; 18-0445
Vitis palmata Vahl—(6); HD, WOF; 18-0469, 19-0176, 19-0195
+*Vitis vulpina* L.—(6); DA; 18-0941

MONOCOTS

Agavaceae
+*Agave virginica* L.—(7); LPF, SB; 18-0579
+**Yucca*—I; (3); DA; 18-0985

Alismataceae
Echinodorus cordifolius (L.) Griseb.—(8); D, MSS; 18-0566, 18-0882
Sagittaria calycina Engelm.—(5); D, MSS; 18-0959, 19-0196
+*Sagittaria platyphylla* (Engelm.) J.G. Sm.—(5); D, MSS; 18-0695, 18-0384, 18-0448, 18-0616, 18-0732, 18-0861, 18-0918

Alliaceae
+**Allium ampeloprasum* L.—I; (5); DA; 18-0472
+*Allium canadense* L.—(5); DA; 18-0281
**Allium vineale* L.—I; (8); DA; 18-0441, 18-0443
+*Nothoscordum bivalve* (L.) Britton in Britton & A. Br.—(5); SB; 18-0015

Amaryllidaceae
Hymenocallis occidentalis (Leconte) Kunth var. *occidentalis*—(8); LPF, WOF; 18-0639
+**Narcissus* ×*medioluteus* Mill.—I; (2); DA; 18-0129
+**Narcissus* ×*odorus* L.—I; **(0)**; DA; 19-0006
+**Narcissus jonquilla* L.—I, waif; (2); DA; 19-0015
+**Narcissus pseudonarcissus* L.—I; (2); DA; 19-0016

Araceae
Arisaema dracontium (L.) Schott in Schott & Endl.—(10); HD, WOF; 18-0587, 19-0062
+**Arum italicum* Mill. ssp. *italicum*—I; (1); DA; 19-0059
Lemna minuta Kunth in Humb. et al.—(4); D, MSS; 18-0073, 18-0312
Lemna obscura (Austin) Daubs—(3); D, MSS; 18-0712
Spirodela polyrhiza (L.) Schleid.—(5); D, MSS; 18-0100, 18-0280
+*Wolffia columbiana* H. Karst.—(2); MSS; 18-0713

Commelinaceae
**Commelina communis* L.—I; (10); DA, LPF, MSS; 18-0488, 18-0688, 18-0974
Commelina virginica L.—(10); HD, WOF; 18-0589, 18-0602
+**Murdannia keisak* (Hassk.) Hand.-Mazz.—V; (2); DA, MFF, WOF; 20-0121
+*Tradescantia hirsutiflora* Bush—(4); LPF; 18-0096
Tradescantia occidentalis (Britton) Smyth var. *occidentalis*—(6); DA, HD, LPF; 18-0251, 18-0400, 18-0784
Tradescantia ohiensis Raf.—(7); SB; 18-0114

Cyperaceae
+*Carex amphibola* Steud.—(5); DA, LPF; 19-0114, 19-0123
Carex aureolensis Steud.—(10); D, HD, MSS, WOF; 18-0185, 18-0380, 19-0047, 18-0390, 19-0091, 19-0111, 19-0133
+*Carex blanda* Dewey—(6); DA; 18-1003, 18-0177, 19-0113
Carex bushii Mack.—(3); LPF, OF, SB; 18-0157
Carex caroliniana Schwein.—(8); COS, D, DA, LPF, MSS, WOF; 18-0536, 18-0274, 18-0326, 18-0413, 18-0463, 18-0517, 19-0086, 19-0138
+*Carex complanata* Torr. & Hook.—(5); COS, LPF, SB; 18-0093, 18-0120, 19-0034, 18-0231, 18-0232, 18-0244, 18-0259, 18-0323, 18-0414, 18-0456, 18-0950
Carex crus-corvi Shuttlew. ex Kunze—(6); D, MSS; 18-0276
+*Carex digitalis* Willd. var. *floridana* (L.H. Bailey) Naczi & Bryson—**(0)**; DA; 19-0116
Carex festucacea Schkuhr ex Willd.—(6); LPF; 18-0109, 18-0311, 18-0317
Carex flaccosperma Dewey—(10); HD, MSS, WOF; 18-0671, 18-0702, 18-0811, 18-0155, 18-0163, 18-0215, 18-0376
Carex glaucodea Tuck. ex Olney—(6); COS, LPF, SB; 18-0069, 18-0256, 18-0275, 18-0298, 18-0321, 18-0343, 18-0411, 18-0435, 18-0460, 19-0105, 19-0141, 19-0145
Carex hirsutella Mack.—(7); SB; 18-0404
Carex hyalinolepis Steud.—(9); LPF, MSS, WOF; 18-0309, 18-0461, 18-0107, 18-0133, 18-0134, 18-0175, 18-0216
Carex intumescens Rudge var. *intumescens*—(8); HD, WOF; 18-0101, 18-0136, 18-0592
Carex joorii L.H. Bailey—(6); HD, WOF; 18-0695
Carex leavenworthii Dewey—(10); DA; 19-0168, 18-0144, 18-0334, 19-0058, 19-0115, 19-0118
Carex louisianica L.H. Bailey—(4); MSS; 18-0209
+***Carex lupuliformis* Sartwell ex Dewey**—C; (3); LPF, WOF; 18-0382, 18-0466, 18-0596
Carex lupulina Muhl. ex Willd.—(10); D, HD, LPF, MSS; 18-0936, 18-0359, 18-0700, 19-0202
+*Carex oklahomensis* Mack.—(4); LPF, OF; 18-0033, 18-0368, 19-0090
+*Carex oxylepis* Torr. & Hook.—(8); WOF; 19-0057
Carex ozarkana P.E. Rothr. & Reznicek—(3); MSS, SB; 18-0205, 18-0437

Carex reniformis (L.H. Bailey) Small—(6); HD, LPF, SB, WOF; 18-0001, 18-0008, 18-0161, 18-0184, 18-0273, 18-0316, 18-0320, 18-0348, 18-0522
Carex sangamonensis (Clokey) Mohlenbr.—(10); LPF, WOF; 19-0110, 19-0121
+*Carex texensis* (Torr. ex L.H. Bailey) L.H. Bailey—(5); DA; 18-0182, 19-0119
Carex triangularis Boeck.—(7); D, DA, LPF, MSS, SB; 18-0620, 18-0716, 18-0207, 18-0253, 18-0291, 18-0324, 18-0406, 18-0436, 18-0442, 18-0454, 19-0092
Carex typhina Michx.—(6); MFF; 19-0146
+*Carex vulpinoidea* Michx.—(9); D, MSS; 19-0089, 19-0132
+*Cyperus acuminatus* Torr. & Hook.—(2); DA, SB; 18-0557, 18-0746, 19-0103
Cyperus echinatus (L.) A.W. Wood—(9); COS, DA, OF, SB; 18-0386, 18-0474, 18-0457, 18-0505, 18-0541, 18-0707, 18-0777, 18-0818, 18-0843, 18-0869, 18-0870, 18-0871
Cyperus erythrorhizos Muhl.—(7); MSS; 18-0656, 18-0849
+*Cyperus esculentus* L. var. *leptostachyus* Boeck.—(8); DA, MSS; 18-0971
**Cyperus iria* L.—I; (9); DA; 18-0624, 18-0748
+*Cyperus odoratus* L. var. *odoratus*—(3); HD; 19-0206
Cyperus pseudovegetus Steud.—(9); D, DA, MSS, SB, WOF; 20-0005, 18-0432, 18-0634, 18-0638, 18-0795, 18-0800, 18-0928, 19-0101
+*Cyperus refractus* Engelm. ex Boeck.—(1); WOF; 18-0540, 19-0217
Cyperus strigosus L.—(8); DA, MSS; 18-0559, 18-0742, 18-0905
+*Eleocharis engelmannii* Steud.—(3); SB; 18-0401
+*Eleocharis lanceolata* Fernald—(3); SB; 18-0424
Eleocharis obtusa (Willd.) Schult.—(9); DA, HD, LPF, MSS; 18-0594, 18-0792, 18-0747, 19-0187, 19-0189
+*Eleocharis verrucosa* (Svenson) L.J. Harms—(2); DA, LPF, SB; 18-0378, 18-0228, 18-0272, 18-0304, 18-0353
***Eleocharis wolfii* (A. Gray) A. Gray ex Britton in Patt.**—C; (4); COS, LPF, WOF; 19-0158, 18-0084, 18-0130, 18-0340
+**Fimbristylis littoralis* Gaudich.—I; (2); D; 18-0733
Isolepis carinata Hook. & Arn. ex Torr.—(7); DA, SB; 18-0158, 18-0197, 18-0260, 19-0049
+*Isolepis pseudosetacea* (Daveau) Gand.—**(0)**; SB; 18-0039, 18-0056
Rhynchospora corniculata (Lam.) A. Gray—(9); D, MSS; 18-0447, 18-0511, 18-0564
+*Scirpus cyperinus* (L.) Kunth—(6); MSS, WOF; 18-0710
Scleria oligantha Michx.—(3); LPF; 18-0356, 19-0112

Hemerocallidaceae
**Hemerocallis fulva* (L.) L.—I; (7); DA; 18-0388

Hyacinthaceae
**Muscari neglectum* Guss. ex Ten.—I, waif; (1); DA; 19-0037
+**Ornithogalum umbellatum* L.—I, waif; (3); DA; 18-0146

Hydrocharitaceae
+*Limnobium spongia* (Bosc) Rich. ex Steud.—(6); HD, MSS; 18-0645, 19-0181

Hypoxidaceae
Hypoxis hirsuta (L.) Coville—(5); LPF, SB; 18-0018

Iridaceae
+*Iris fulva* Ker Gawl.—(6); D, HD, MSS; 18-0213
+*Sisyrinchium angustifolium* Mill.—(9); DA; 18-0179

Juncaceae
+*Juncus acuminatus* Michx.—(3); HD, SB; 18-0391, 18-0427
+*Juncus biflorus* Elliott—(3); SB, LPF; 18-0392, 19-0137
Juncus brachycarpus Engelm. in A. Gray—(5); COS, DA, HD, LPF, OF, SB; 18-0475, 18-0236, 18-0339, 18-0393, 18-0426, 19-0102
Juncus dichotomus Elliott—(3); COS, DA, LPF, SB; 18-0975, 18-0196, 18-0255, 18-0302, 18-0322, 18-0758, 19-0104, 19-0147, 19-0161
+*Juncus diffusissimus* Buckley—(7); DA, SB; 19-0099
Juncus effusus L. ssp. *solutus* (Fernald & Wiegand) Hämet-Ahti—(10); D, MSS; 18-0199, 18-0446
+*Juncus marginatus* Rostk.—(3); SB; 18-0193, 18-0428
+*Juncus nodatus* Coville in Britton & A. Br.—(1); MSS; 19-0129
Juncus tenuis Willd.—(7); DA; 19-0083
+*Juncus validus* Coville—(2); D, DA; 19-0084

Marantaceae
Thalia dealbata Fraser ex Roscoe—(5); D; 18-0473

Orchidaceae
+***Spiranthes lacera* (Raf.) Raf. var. *lacera***—C; **(0)**; LPF; 18-0641
Spiranthes niklasii M.C. Pace—(6); WOF; 18-0910, 18-0954
***Spiranthes praecox* (Walter) S. Watson in A. Gray et al.**—C; (2); HD, LPF; 18-0347, 18-0399
Spiranthes vernalis Engelm. & A. Gray—(4); COS; 18-0438

Poaceae
+*Agrostis elliottiana* Schult.—(2); SB; 18-0221, 18-0266
Agrostis hyemalis (Walter) Britton, Sterns & Poggenb.—(7); COS, LPF, OF, SB; 19-0020, 18-0252, 18-0285, 18-0301, 18-0327, 18-0416, 18-0418, 18-0451
+*Agrostis perennans* (Walter) Tuck.—(6); LPF, WOF; 18-0911, 18-0965, 19-0179
+**Aira elegans* Roem. & Schult.—I; (1); DA, SB; 18-0267, 19-0069
Alopecurus carolinianus Walter—(10); DA, SB; 18-0132, 18-0195
+*Andropogon hirsutior* (Hack.) Weakley & LeBlond—(7); DA, LPF, OF, SB; 18-0838
+*Andropogon tenuispatheus* (Nash) Nash—(7); OF; 18-0958
+*Andropogon ternarius* Michx.—(2); SB; 18-0956
+*Aristida dichotoma* Michx—(2); SB; 18-0824, 18-0830, 18-0990
+*Aristida longespica* Poir.—(4); SB; 18-0708, 18-0815
Aristida oligantha Michx.—(9); SB; 18-0683, 18-0814, 18-0989
Arundinaria gigantea (Walter) Muhl.—(10); LPF, WOF; 18-0961
+**Arundo donax* L.—V, waif; (2); DA; 19-0212
+**Briza minor* L.—I; (2); SB; 18-0265
+**Bromus commutatus* Schrad.—I; (6); DA, SB; 18-0237, 18-0328, 18-0223, 18-0240, 18-0269, 18-0372, 18-0395, 18-0444, 19-0120, 20-0116
Chasmanthium latifolium (Michx.) H.O. Yates—(9); LPF, WOF; 18-0536
Chasmanthium laxum (L.) H.O. Yates—(7); LPF, WOF; 18-0643
Chasmanthium sessiliflorum (Poir.) H.O. Yates var. *sessiliflorum*—(7); LPF; 18-0888
+*Cinna arundinacea* L.—(4); LPF, WOF; 18-0377, 18-0497, 18-0790, 18-0912, 18-0962
Coleataenia anceps (Michx.) Soreng ssp. *anceps*—(10); LPF, WOF; 18-0594, 18-0792
Coleataenia rigidula (Bosc ex Nees) LeBlond ssp. *rigidula*—(8); D, WOF; 18-0607, 18-0736, 18-0964
**Cynodon dactylon* (L.) Pers.—V; (10); DA; 18-0386, 18-0474
Danthonia spicata (L.) P. Beauv. ex Roem. & Schult.—(6); COS, LPF; 18-0237, 18-0328
Dichanthelium aciculare (Desv. ex Poir.) Gould & C.A. Clark—(3); COS, SB; 18-0488, 18-0688, 18-0974, 18-0415, 18-0417, 18-0832, 18-0867
+***Dichanthelium arenicoloides* (Ashe) LeBlond**—C; **(0)**; LPF; Witsell 12-0033
+*Dichanthelium boscii* (Poir.) Gould & C.A. Clark—(5); LPF; 20-0005

+***Dichanthelium chrysopsidifolium* (Nash) J.R. Thomas & Wipff**—C; **(0)**; SB; 18-0455, 18-0507
Dichanthelium depauperatum (Muhl.) Gould—(5); COS, LPF; 18-0949, 18-0968, 18-0330, 18-0412, 19-0075
+*Dichanthelium dichotomum* (L.) Gould—(5); LPF; 18-0309, 18-0461
+*Dichanthelium inflatum* (Scribn. & J.G. Sm.) J.R. Thomas—**(0)**; SB; 18-0408, 18-0506, 18-0868
+*Dichanthelium lanuginosum* (Elliott) Gould—**(0)**; COS, LPF, SB; 18-0557, 18-0746, 19-0103, 18-0420, 18-0518, 18-0842, 19-0074, 19-0173, 20-0120, 20-0122
Dichanthelium laxiflorum (Lam.) Gould—(6); LPF; 18-0643, 18-0315, 18-0462, 20-0119
Dichanthelium longiligulatum (Nash) Freckmann—(7); LPF; 20-0117
+*Dichanthelium microcarpon* (Muhl. ex Elliott) Mohlenbr.—**(0)**; LPF, WOF; 18-0984, 18-0465, 19-0071, 19-0165
+*Dichanthelium neuranthum* (Griseb.) LeBlond—**(0)**; SB; 18-0421
+*Dichanthelium polyanthes* (Schult.) Mohlenbr.—(4); LPF; 19-0073, 19-0177
+***Dichanthelium roanokense* (Ashe) LeBlond**—C; **(0)**; LPF, WOF; 18-0219, 18-0313, 18-0776, 20-0115
Dichanthelium scoparium (Lam.) Gould—(7); DA, LPF, SB; 18-0342, 18-0409, 18-0495
Dichanthelium sphaerocarpon (Elliott) Gould—(6); LPF, SB; 18-0971, 18-0331, 18-0419, 19-0162, 19-0174
**Digitaria ciliaris* (Retz.) Koeler—I; (8); DA; 18-0498, 18-0621, 18-0803, 18-0808, 18-0892
Dinebra panicea (Retz.) P.M. Peterson & N. Snow ssp. *brachiata* (Steud.) P.M. Peterson & N. Snow—(7); DA; 18-0806
Dinebra panicoides (J. Presl) P.M. Peterson & N. Snow—(9); D, MSS; 18-0243, 18-0653, 18-0960, 19-0209
+**Echinochloa colonum* (L.) Link—I; (4); DA; 19-0096
**Echinochloa crusgalli* (L.) P. Beauv. var. *crusgalli*—V; (8); DA, LPF; 18-0484, 18-0555
Echinochloa muricata (P. Beauv.) Fernald var. *muricata*—(10); DA; 18-0699
**Eleusine indica* (L.) Gaertn.—I; (8); DA; 18-0571
+*Elymus glabriflorus* (Vasey ex L.H. Dewey) Scribn. & C.R. Ball var. *glabriflorus*—(7); DA, LPF; 18-0544, 19-0144, 19-0154
Elymus virginicus L.—(9); SB, WOF; 18-0508, 18-0512, 18-0642
+**Eragrostis cilianensis* (All.) Vignolo ex Janch.—I; (5); DA; 19-0094
Eragrostis hypnoides (Lam.) Britton, Sterns & Poggenb.—(7); MSS; 18-0657
+*Eragrostis intermedia* Hitchc.—(1); OF, SB; 18-0681, 18-0781, 18-0807
Eragrostis pectinacea (Michx.) Nees var. *pectinacea*—(9); DA; 18-0809
+**Eragrostis pilosa* (L.) P. Beauv. var. *pilosa*—I; (1); DA; 19-0088, 19-0095
Eragrostis spectabilis (Pursh) Steud.—(7); COS, LPF, SB; 18-0802, 18-0945, 18-0704, 18-0727, 18-0750, 18-0833, 18-0841, 19-0215
Erianthus giganteus (Walter) P. Beauv.—(6); DA, LPF, OF; 18-0887, 18-0925, 19-0208
+**Festuca myuros* L.—I; (3); D, DA; 18-0333, 18-0373
+*Festuca octoflora* Walter var. *octoflora*—(2); LPF, OF, SB; 18-0656, 18-0849, 18-0364, 18-0459, 20-0118
+*Festuca paradoxa* Desv.—**(0)**; LPF; 18-0535, 19-0143
Glyceria septentrionalis Hitchc.—(4); MSS, OF; 18-0204, 18-0366, 18-0369
+*Hordeum pusillum* Nutt.—(6); DA, LPF, SB; 19-0178, 18-0190, 18-0249, 18-0397
Leersia lenticularis Michx.—(5); WOF; 18-0796
Leersia oryzoides (L.) Sw.—(7); D, MSS; 18-0845, 18-0860
Leersia virginica Willd.—(8); WOF; 18-0723, 18-0793
**Lolium arundinaceum* (Schreb.) Darbysh.—V; (6); DA, OF; 18-0282
**Lolium perenne* L. var. *aristatum* Willd.—I; (8); DA, LPF, SB; 18-0559, 18-0742, 18-0905, 18-0153, 18-0344, 18-0346, 18-0396, 18-0431, 19-0042
+*Muhlenbergia schreberi* J.F. Gmel.—(2); DA; 18-0942
+**Oryza sativa* L.—I, waif; (3); MSS; 18-0852
Panicum dichotomiflorum Michx. var. *dichotomiflorum*—(9); MSS; 18-0853
Panicum virgatum L. var. *virgatum*—(6); LPF; 18-0673, 18-0775
+**Paspalum dilatatum* Poir. ssp. *dilatatum*—I; (7); DA; 18-0533, 18-0611
Paspalum floridanum Michx.—(8); DA, LPF; 18-0675
Paspalum laeve Michx. var. *circulare* (Nash) W. Stone—(6); LPF, SB; 18-0561, 18-0726, 18-0874
Paspalum setaceum Michx. var. *muhlenbergii* (Nash) D.J. Banks—(6); SB; 18-0509, 18-0678, 18-0873
+*Phalaris caroliniana* Walter—(8); DA, LPF, OF, SB; 18-0589, 18-0602, 18-0367, 18-0405, 19-0070
Phanopyrum gymnocarpon (Elliott) Nash—(1); HD, MSS; 18-0820, 19-0201
**Poa annua* L.—I; (7); COS, DA, SB; 18-0004, 18-0063, 18-0423
+**Poa pratensis* L. ssp. *pratensis*—I; (6); DA; 18-0166, 18-0361, 19-0056
+*Poa sylvestris* A. Gray—**(0)**; WOF; 18-0379
+*Schizachyrium scoparium* (Michx.) Nash var. *divergens* (Hack.) Gould—(3); LPF, SB; 18-0839
+**Setaria faberi* R.A.W. Herrm.—I; (4); DA; 18-0625
Setaria parviflora (Poir.) Kerguélen—(8); DA, LPF, SB; 18-0610, 18-0755
+*Sorghastrum nutans* (L.) Nash—(4); LPF, OF; 18-0953
**Sorghum halepense* (L.) Pers.—V; (9); 18-0483, 18-0494
+*Sphenopholis intermedia* (Rydb.) Rydb.—**(0)**; LPF; 19-0072
+*Sphenopholis obtusata* (Michx.) Scribn.—(6); LPF, OF; 18-0292, 18-0351
Sporobolus vaginiflorus (Torr. ex A. Gray) A.W. Wood—(3); SB; 18-0988
Steinchisma hians (Elliott) Nash—(6); D, LPF, OF, SB, WOF; 18-0209, 18-0425, 18-0480, 18-0584, 18-0682, 18-0728, 18-0745
+*Tridens flavus* (L.) Hitchc.—(7); LPF; 18-0739
Tridens strictus (Nutt.) Nash—(9); LPF, MSS, OF, SB; 18-0595, 18-0680
Tripsacum dactyloides (L.) L. var. *dactyloides*—(7); D, MSS; 18-0689
**Urochloa platyphylla* (Munro ex C. Wright) R.D. Webster—I; (10); DA, MSS, OF, SB; 19-0057, 18-0629, 18-0655, 18-0696, 18-0813, 19-0087
+**Urochloa ramosa* (L.) T.Q. Nguyen—I; (1); DA; 19-0191

Pontederiaceae

Heteranthera limosa (Sw.) Willd.—(8); MSS; 18-0651
+*Heteranthera missouriensis* C.N. Horn—(6); D; 18-0782, 19-0188

Smilacaceae

Smilax bona-nox L. var. *bona-nox*—(8); LPF, WOF; 18-0230
Smilax glauca Walter—(8); LPF, WOF; 18-0226
Smilax rotundifolia L.—(9); LPF, SB, WOF; 18-0227, 18-0296, 18-0576

Typhaceae

+*Sparganium americanum* Nutt.—**(0)**; MSS; 18-0499
Typha latifolia L.—(8); D, MSS; 18-0542, 18-0691

APPENDIX 2
Recommendations for Student Floras

In light of our success in documenting a diverse flora, we suggest these practices from lessons learned.

Floristic inventory planning:

- Talk to ecologists and floristic experts about their knowledge of the habitats and flora of the area.
- Study materials available about the area, including management plans for natural areas, scientific literature about named places (such as the city, county, or ecoregion).
- Review historic aerial imagery of the area to see how the plant communities have changed and target additional areas that might warrant surveys nearby (Google Earth v. 7.3 2018).
- Contact private landowners to receive permission to survey properties of interest.
- Write the study site section of the methods first and consider how the abiotic factors (climate, elevation, soils) might impact the plants encountered.
- Plan field days to capture diversity of species among habitat types.

Priority species list development (see Materials and Methods for additional detail):

- Develop a priority list of taxa to increase the ability to document as many taxa as possible.
- Study local plant atlases or digitized specimen data to understand what has been documented near the area of interest.
- Review floras and keys to determine habitats and flowering windows of expected species.
- Study herbarium material and note distinguishing characteristics to find and voucher cryptic taxa.

Plant collection:

- Embrace difficult taxonomic groups, such as aquatic plants, grasses, rushes, and sedges.
- For diverse and difficult groups (e.g., *Carex* sect. Ovales, *Dichanthelium*):
  - Plan targeted collection days for groups with a short season.
  - Look at potential morphological differences to collect as many taxa as possible.
- Take field photos and submit iNaturalist observations (Heberling & Isaac 2018).
- Streamline label preparation with born-digital collections software, collNotes and collBook (Powell et al. 2019):
  - We wish this software were available in 2018 during the first season for use. This software provides tools to link co-associated taxa through specimen data, minimize retyping of habitat types, and associate vouchers with GPS coordinates, removing the possibility of transcription errors from a field notebook.
- Place each collected specimen in a uniquely numbered bag to:
  - Link the correct voucher to loose fruits/flowers that may fall off the specimen.
  - Associate voucher with correct record data.
- Store collected specimens with a little bit of water or damp paper towel and place them in a cooler to prevent wilting.
- Press plants within 24 hours of collection.
- Place lemnoids directly in a fragment packet with top and bottom surfaces visible.
- Use waxed paper to dry delicate material, such as aquatic plants and deliquescent petals.
- Longitudinally dissect funnelform flowers and press open.

Plant identification:

- Post iNaturalist observations early to examine names suggested by the community; if the initial identification is wrong it represents a learning opportunity.
- Visit well-curated herbaria to have correctly identified reference material.
- Consult with taxonomic experts in a data- or specimen-based exchange.
- Key difficult taxa with experienced botanists and learn from their approaches.

Communicate findings:

- Provide data for species of conservation concern to the local Natural Heritage Program or Conservation Data Center.
- Report interesting findings and share photographs of plants with private landowners.
- Publish floristic inventory in a journal that promotes this type of research.
- Share publication citation with Floras of North America project (Palmer 2018).

Additional resources for plant collection practices (and sources within):

- Liesner 1995
- University of Florida Herbarium 2019

ACKNOWLEDGMENTS

We thank the Students United in Preserving, Exploring, and Researching Biodiversity (SUPERB) scholarship program for funding mileage reimbursement to support this research (NSF 1564954) and providing the opportunity to explore biodiversity in this underexplored area in the Mid-South. We thank the Arkansas Center of Biodiversity Collections grant (NSF 1561743), Arkansas State University Environmental Science Program, and Arkansas Native Plant Society for additional student and project support.

The McClinton property was instrumental in finding unknown diversity in the Pine City area, and we thank Glen Davenport on behalf of the Marion McClinton Estate for permission to survey the property.

This work would not have been possible without the helpful field assistance of J. Richard Abbott and Dylan P. DeRouen. Molly Robinson, Karen Seale, and Linda Pneuman, assisted with mounting specimens for the ANHC and STAR collections.

This flora benefited greatly from group keying of difficult taxa, including a *Symphyotrichum* section *Dumosi* day with J. Richard Abbott, and expert specimen identification confirmation by Brent Baker, Theo Witsell, Tony Reznicek (*Carex*), Justin Thomas (*Dichanthelium*), Dwayne Estes (*Solidago*), Marisa Szubryt (*Euthamia*), and Edward Schilling (genetic material testing of hybrids). To support specimen identification, we referenced the physical collections at ANHC, MICH, and STAR.

This manuscript was improved by comments from J. Richard Abbott, Brent Baker, Dwayne Estes, Steven Greene, Mohamed Milad, John Nowlin, Chris Reid, Marisa Szubryt, Theo Witsell, and an anonymous reviewer.

REFERENCES

Arkansas Natural Heritage Commission. 2018. Pine City Natural Area management plan. Internal agency document. Pine City, Arkansas, U.S.A.

Arkansas Natural Heritage Commission. 2022. Database of elements of special conservation concern. Little Rock, AR, U.S.A.

Arkansas GIS Office. 2018. 3D elevation program 1-meter resolution digital elevation model. Available at https://gis.arkansas.gov/product/dem-1m-2018/. Accessed September 2018.

Baker, B.T. 2007. The vascular flora of Scott County and Yell County, Arkansas. M.S. Thesis, University of Central Arkansas, U.S.A.

Beck, H.E., N.E. Zimmermann, T.R. McVicar, N. Vergopolan, A. Berg, & E.F. Wood. 2018. Present and future Köppen-Geiger climate classification maps at 1-km resolution. Sci. Data 5(1):1–12.

Bragg, D.C. 2005. Presettlement *Pinus taeda* in the Mississippi Valley Alluvial Plain of the Monroe County, Arkansas area. J. Ark. Acad. Sci. 59:187–95.

Bridson, D. & L. Forman. 1998. The herbarium handbook. 3rd ed. Richmond, Surrey, Royal Botanic Gardens, Kew, UK.

Brye, K.R., E.P. Mersiovsky, L.A. Hernandez, & L.B. Ward. 2013. Soils of Arkansas. Arkansas Agricultural Experiment Station, University of Arkansas System Division of Agriculture, Fayetteville, U.S.A.

Cardinale, B.J., J.E. Duffy, & A. Gonzalez. 2012. Biodiversity loss and its impact on humanity. Nature 486(7401):59–67.

Daru, B.H. (& 10 others). 2018. Widespread sampling biases in herbaria revealed from large-scale digitization. New Phytol. 217(2):939–55.

Davis, J.R. 1974. Vascular plants of Lee County, Arkansas. M.S. Thesis, Arkansas State University, U.S.A.

Deneke, C.F. & E.F. Brown. 1987. The vascular flora of St. Francis County, Arkansas. Sida 2:1–13.

Duncan, W.H. 1953. Taxonomic collections of vascular plants in the southeastern states — their abundance and relation to production of floras. Rhodora 55(660):353–58.

Flora of North America Editorial Committee, eds. 1993. Flora of North America North of Mexico. 20+ Vols. New York, U.S.A. and Oxford, UK.

Fogg, J.M. 1940. Suggestions for collectors. Rhodora 42(497):145–57.

Gentry, J.L., G.P. Johnson, B.T. Baker, C.T. Witsell, & J.D. Ogle, eds. 2013. Atlas of the vascular plants of Arkansas. Fayetteville, AR: University of Arkansas Herbarium, U.S.A.

Google Earth v. 7.3. 2018. Arkansas and Louisiana. Available at http://www.earth.google.com. Accessed January 2018.

Groves, C.R., M.L. Klein, & T.F. Breden. 1995. Natural Heritage Programs: public-private partnerships for biodiversity conservation. Wildl. Soc. Bull. 23(4):784–90.

Hardcastle, E. 1993. A natural area ecoinventory of Lonoke County and ecological survey of Indian Lake Barrens. M.S. Thesis, University of Arkansas, U.S.A.

Heberling, J.M. & B.L. Isaac. 2018. iNaturalist as a tool to expand the research value of museum specimens. Appl. Pl. Sci. 6(11):1–8.

Heywood, V. 2001. Floristics and monography – an uncertain future? Taxon 50:361–80.

Holder, T.H. 1970. Disappearing wetlands in eastern Arkansas. Arkansas Plan. Comm., U.S.A.

Holimon, W.C. & W.G. Montague. 2003. Reciprocal translocation reestablishes breeding status of Mississippi Alluvial Plain population of Red-cockaded Woodpeckers in Arkansas. J. Ark. Acad. Sci. 57:197–98.

Hooper, D.U., E.C. Adair, B.J. Cardinale, J.E.K. Byrnes, B.A. Hungate, K.L. Matulich, A. Gonzalez, J.E. Duffy, L. Gamfeldt, & M.I. O'Connor. 2012. A global synthesis reveals biodiversity loss as a major driver of ecosystem change. Nature 486(7401):105–8.

Horn, M.E., E.M. Rutledge, H.C. Dean, & M. Lawson. 1964. Classification and genesis of some solonetz (sodic) soils in eastern Arkansas. Soil Sci. Soc. Amer. J. 28:688–92.

Hyatt, P.E. 1998. Arkansas *Carex* (Cyperaceae): a briefly annotated list. Sida 18(2):535–54.

Ison, C.F. 1996. Vascular flora of St. Francis National Forest in Arkansas. Castanea 61:49–61.

Johnson, M.I. 1969. A survey of the vascular flora of Poinsett County, Arkansas. M.S. Thesis, Memphis State University, TN, U.S.A.

Liesner, R. 1995. Field techniques used by Missouri Botanical Garden. Available at mobot.org/MOBOT/molib/fieldtechbook/welcome.shtml. Accessed January 2022.

Lucardi, R.D., E.S. Bellis, C.E. Cunard, J.K. Gravesande, S.C. Hughes, L.E. Whitehurst, S.J. Worthy, K.S. Burgess, & T.D. Marsico. 2020a. Seeds attached to refrigerated shipping containers represent a substantial risk of nonnative plant species introduction and establishment. Sci. Rep. 2020 101 10(1):1–10.

Lucardi, R.D., C.E. Cunard, S.C. Hughes, K.S. Burgess, J.N. Reed, L.E. Whitehurst, S.J. Worthy, & T.D. Marsico. 2020b. An initial industrial flora: a framework for botanical research in cooperation with industry for biodiversity conservation. PloS One 15(4):1–24.

Marsico, T.D. 2005. The vascular flora of Montgomery County, Arkansas. Sida 21(4):2389–2423.

Martín-Bravo, S., P. Jiménez-Mejías, T. Villaverde, M. Escudero, M. Hahn, D. Spalink, E.H. Roalson, A.L. Hipp, & the Global Carex Group. 2019. A tale of worldwide success: behind the scenes of *Carex* (Cyperaceae) biogeography and diversification. J. Syst. Evol. 57(6):695–718.

McCune, J.L., A. Van Natto, & A.S. MacDougall. 2017. The efficacy of protected areas and private land for plant conservation in a fragmented landscape. Landscape Ecol. 32(4):871–82.

McNalty, R. 1970. Vascular plants of Lawrence County, Arkansas. M.S. Thesis, Arkansas State University, U.S.A.

Montague, W.G. 1995. Cavity protection techniques for Red-cockaded Woodpeckers. J. Ark. Acad. Sci. 49:115–20.

Montague, W.G., C.F. Bailey, J.C. Neal, & D.A. James. 1993. Unhatched eggs in nests of Red-cockaded Woodpeckers. J. Ark. Acad. Sci. 47:77–81.

Morueta-Holme, N., K. Engemann, P. Sandoval-Acuña, J.D. Jonas, R.M. Segnitz, & J.C. Svenning. 2015. Strong upslope shifts in Chimborazo's vegetation over two centuries since Humboldt. Proc. Natl. Acad. Sci. U. S. A. 112(41):12741–45.

NOAA National Centers for Environmental Information. 2021. U.S. climate normals, Stuttgart 9 ESE. Available at https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-monthly&timeframe=30&location=AR&station=USC00036920. Accessed January 2022.

Paknia, O., H. Rajaei Sh, & A. Koch. 2015. Lack of well-maintained natural history collections and taxonomists in megadiverse developing countries hampers global biodiversity exploration. Org. Divers. Evol. 15(3):619–29.

Palmer, M.W. 2018. Floras of North America Project. Available at http://plantbio.okstate.edu/floras/. Accessed June 26, 2018.

Palmer, M.W., P.G. Earls, B.W. Hoagland, P.S. White, & T. Wohlgemuth. 2002. Quantitative tools for perfecting species lists. Environmetrics 13(2):121–37.

Palmer, M.W. & J.C. Richardson. 2012. Biodiversity data in the information age: do 21st century floras make the grade? Castanea 77(1):46–59.

Panchen, Z.A., J. Doubt, H.M. Kharouba, & M.O. Johnston. 2019. Patterns and biases in an Arctic herbarium specimen collection: implications for phenological research. Appl. Pl. Sci. 7(3):1-12.

Pascal, V., B. Jeanne, U. Stefan, A. Burga Conradin, & W. Gian-Reto. 2008. One century of vegetation change on Isla Persa, a Nunatak in the Bernina Massif in the Swiss Alps. J. Veg. Sci. 19(5):671–80.

Pearson, K.D. 2018. Rapid enhancement of biodiversity occurrence records using unconventional specimen data. Biodivers. Conserv. 27(11):3007-3018.

Peet, R.K., K.A. Palmquist, T.R. Wentworth, M.P. Schafale, A.S. Weakley, & M.T. Lee. 2018. Carolina Vegetation Survey: an initiative to improve regional implementation of the U.S. National Vegetation Classification. Phytocoenologia 48(2):171–79.

Powell, C., J. Motley, H. Qin, & J. Shaw. 2019. A born-digital field-to-database solution for collections-based research using collNotes and collBook. Appl. Pl. Sci. 7(8):3–7.

Rudolph, D.C., R.N. Conner, R.R. Schaefer, D. Saenz, D.K. Carrie, N.R. Carrie, R.W. Maxey, W.G. Montague, J. Neal, K. Moore, & J. Skeen. 2004. Red-cockaded Woodpecker status and management: West Gulf Coastal Plain and Interior Highlands. In: Red-cockaded Woodpecker road to recovery. Costa, R. & S.J. Daniels, eds. Hancock House Publ. Blaine, WA, U.S.A. Pp: 283–291.

Saucier, R.T. 1994. Geomorphology and Quaternary geologic history of the Lower Mississippi Valley Volume 1. Vol. I. Vicksburg, MS, U.S.A.

Smith, E.B. 1994. Keys to the flora of Arkansas. The University of Arkansas Press. Fayetteville, AR, U.S.A.

Suarez, A.V. & N.D. Tsutsui. 2004. The value of museum collections for research and society. Bioscience 54(1):393–402.

Thomas, J.T. In prep. *Dichanthelium* of Arkansas.

University of Florida Herbarium. 2019. Plant specimen collecting and pressing bibliography. Available at www.florida museum.ufl.edu/herbarium/methods/hmcollectingbib.htm. Accessed January 2022.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022. The PLANTS Database. Available at http://plants.usda.gov. Accessed October 2020.

U.S. Environmental Protection Agency (EPA). 2013. Level III Ecoregions of the Continental United States. Map Scale 1:7,500,000. Corvallis, OR, U.S.A.

Waterway, M.J. & the Global *Carex* Group. 2015. Making *Carex* Monophyletic (Cyperaceae, Tribe Cariceae): A new broader circumscription. Bot. J. Linn. Soc. 179(1):1–42. Doi:10.1111/boj.12298.

Weakley, A.S. 2020. Flora of the southeastern United States: Arkansas. Chapel Hill, NC, U.S.A. Available at https://ncbg.unc.edu/research/unc-herbarium/floras/. Accessed October 2020.

West, J.G. 1998. Floristics and biodiversity research in Australia: the 21st century. Aust. Syst. Bot. 11:161–74.

Wilcox, W.H. 1973. A survey of the vascular flora of Crittenden County, Arkansas. Castanea 38(3):286–97.

Witsell, C.T. 2007. The vascular flora of Saline County, Arkansas. M.S. Thesis, University of Arkansas at Little Rock.

Witsell, C.T. In Prep. Would the real *Solidago austrina* please stand up? Investigations into *Solidago* sect. *Solidago* subsect. *Maritimae* in the Mississippi Alluvial Plain of Arkansas.

Wyatt, T.W. 1972. Vascular plants of Mississippi County, Arkansas. M.S. Thesis, Arkansas State University, U.S.A.

Yatskievych, G.A. 1999. Steyermark's flora of Missouri. Volume 1. Rev. ed. Missouri Dept. of Conservation in assoc. with Missouri Botanical Garden, St. Louis, U.S.A.

Yatskievych, G.A. 2006. Steyermark's flora of Missouri. Volume 2. Rev. ed. Missouri Botanical Garden Press, St. Louis, U.S.A.

Yatskievych, G.A. 2013. Steyermark's flora of Missouri. Volume 3. Rev. ed. Missouri Botanical Garden Press, St. Louis, U.S.A.