THE VASCULAR FLORA OF ESTILL COUNTY, KENTUCKY, U.S.A.

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"No botanical endeavor has more uses than a well-documented catalogue of a local flora"—*D.C. Peattie* (1946)

ABSTRACT

The vascular flora of Estill County, Kentucky was investigated during four growing seasons in 1987, 1988, 1989, and 2022. This study documented a total of 963 vascular plant species (773 herbaceous, 190 woody), representing 479 genera and 134 families. Numbers of taxa by major plant groups were fern and fern allies (42), gymnosperms (6), basal angiosperms (1), magnoliidae (10), monocots (244), and eudicots (660). This Estill County flora represents 33.2% of the known vascular plants of Kentucky. Families with the largest numbers of taxa were Asteraceae (126), Poaceae (109), Cyperaceae (61), Fabaceae (49), Lamiaceae (36), Rosaceae (35), and Apiaceae (20). These seven families represent 45.2% of the total flora. The largest genus was *Carex* (40), followed by *Solidago* (17), *Dichanthelium* (15), *Quercus* (14), *Symphyotrichum* (13), and *Viola* (12). *Quercus* (14) was the largest woody genus. Non-native species (153) comprised 15.9% of the flora. Eighty-two are listed by the Kentucky Invasive Plant Council, with 27 categorized as a "Severe Threat." Twenty-three plants are listed as Endangered (7), Threatened (6), Special Concern (10), or Commercially Exploited (1). Two state records and a third county record were documented. Ten significant locations are described on the basis of field observations and plant sampling. Habitats included mesophytic ravines, limestone outcrops, cliffs, and ridgetops, ruderal/disturbed areas, marshy areas, swamps, oak-hickory forests, shorelines of ponds, creeks, streams and rivers, roadsides, xeric ridgetops, pine forests, railroad tracks, sandstone ridgetops and cliffs, and dry shaly areas. The species richness of Estill County averages 1.5 species per ha. It has the third highest number of documented taxa for a single Kentucky county.

RESUMEN

La flora vascular del condado de Estill, Kentucky, se investigó durante cuatro temporadas de crecimiento en 1987, 1988, 1989 y 2022. Este estudio documentó un total de 963 especies de plantas vasculares (773 herbáceas y 190 leñosas), que representan 479 géneros y 134 familias. El número de taxones por grupos principales de plantas fue el siguiente: helechos y plantas afines (42), gimnospermas (6), angiospermas basales (1), magnoliidae (10), monocotiledóneas (244) y eudicotiledóneas (660). La flora del condado de Estill representa el 33,2% de las plantas vasculares conocidas de Kentucky. Las familias con mayor número de taxones fueron las asteráceas (126), las poáceas (109), las ciperáceas (61), las fabáceas (49), las lamiáceas (36), las rosáceas (35) y las apiáceas (20). Estas siete familias representan el 45,2% de la flora total. El género más numeroso fue *Carex* (40), seguido de *Solidago* (17), *Dichanthelium* (15), *Quercus* (14), *Symphyotrichum* (13) y *Viola* (12). *Quercus* (14) fue el género leñoso más numeroso. Las especies no autóctonas (153) constituyeron el 15,9% de la flora. Ochenta y dos están incluidas en la lista del Consejo de Plantas Invasoras de Kentucky, y 27 están clasificadas como «amenaza grave». Veintitrés plantas están clasificadas como en peligro de extinción (7), amenazadas (6), de especial preocupación (10) o explotadas comercialmente (1). Se documentaron dos registros estatales y un tercer registro del condado. Se describen diez lugares significativos basándose en observaciones de campo y muestreos de plantas. Los hábitats incluyen barrancos mesofíticos, afloramientos de piedra caliza, acantilados y cimas de colinas, áreas ruderales/perturbadas, zonas pantanosas, bosques de robles y nogales, orillas de estanques, arroyos, riachuelos y ríos, bordes de carreteras, cimas de colinas xéricas, bosques de pinos, vías férreas, cimas de colinas y acantilados de arenisca, y áreas secas y arcillosas. La riqueza de especies del condado de Estill es de una media de 1,5 especies por hectárea. Es el tercer condado de Kentucky con mayor número de taxones documentados.

INTRODUCTION

The Commonwealth of Kentucky is in the southeast United States and includes about 104,700 sq km (40,400 sq mi or 26 million acres) that extend from the Mississippi River to the West Virginia/Virginia border. Kentucky's boundaries range north to south from latitude 39°9′N to 36°30′N and east to west from longitude

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81°58′W to 89°34′W. The floristic richness of Kentucky may be attributed to its geology, topography, physiography and soils (Taylor 1995; Jones 2005; Dourson & Dourson 2019). In the early 1940s, the number of vascular plants listed for Kentucky was less than 2000 (Taylor 1995). Six works have attempted to catalog the vascular plants of Kentucky: McFarland (1942) listed 1,583 species, Braun (1943) 2,803 species, Browne and Athey (1992) 3,142 species, Medley (1993) 3,254 taxa, Jones (2005) 2,600 species, and Campbell and Medley (2018) 3,131 taxa. The lists of Browne and Athey (1992), Medley (1993), and Campbell and Medley (2018) included species from literature reports (lacking documented specimens) as well as hybrids and intraspecific taxonomic groups.

Several other books have been published on various aspects of the flora of Kentucky: woody plants—259 species (Garman 1913); wildflowers and ferns—662 species (Wharton & Barbour 1971); trees and shrubs—282 species (Wharton & Barbour 1973); fern and fern allies—82 species (Cranfill 1980); aquatic and wetland plants—421 species (Beal & Thieret 1986); weeds—160 species (Haragan 1991); flora of the Inner Bluegrass—1,200 species (Wharton & Barbour 1991); wildflowers and ferns—634 species (Barnes & Francis 2004); rare wildflowers—75 species (Barnes et al. 2008); and woody plants of Kentucky and Tennessee—457 species (Jones & Wofford 2013). In addition, Clark and Weckman (2008) published an *Annotated Catalog and Atlas of Kentucky Woody Plants* compiling 417 species, and Dourson and Dourson (2019) published *Wildflowers and Ferns of Red River Gorge and the Greater Red River Basin,* detailing 450 species, but listing 1,573 species. The Office of Kentucky Nature Preserves states the flora of the state is close to 2,900 plant species (KEEC 2024). Floristic and ecological studies conducted in Kentucky have been well-documented by Davies (1953), Browne (1965), Fuller (1979), Fuller et al. (1989), and Jones et al. (2007).

Although there has been a substantial amount of botanical work conducted in the state, few studies have addressed county floras. County floras have been conducted in only 38 (32%) of the 120 counties in Kentucky, with 12 completed in the 1800s and only 26 since 1900. Most county floras published prior to the turn of the 20th century were timberland surveys by the Kentucky Geological Survey (Jones 1986). A brief synopsis of these early floras is given by Davies (1953).

Since 1950, nineteen counties in Kentucky have been the subject of county floras (Fig. 1). Guetig (1993) provides information on county floras up through 1991. In 1993, two floristic investigations for Masters' theses involving counties in the Kentucky Cumberland Plateau Region were completed: Estill County (Guetig 1993) and Jackson County (Abner 1993). These were the first county floras conducted in the Cumberland Plateau since Rogers (1941) flora of McCreary County. Since 2000, only three county floras have been completed: Clinton County (Gorton 2000), Garrard County (Overbeck 2014), and Boyle County (Braunreiter 2015).

Estill County represents an area in eastern Kentucky which has received few botanical studies and encompasses parts of three physiographic regions: Outer Bluegrass, Knobs, and Cumberland Plateau. Davies (1953) attributes the neglect of the eastern portion of the state to the mountainous terrain that occurs in the region. Estill County is estimated to be 75% forested, with 1,804 ha (4,458 acres) included within the Daniel Boone National Forest (DBNF; Lee 1981; Estill Development Alliance 2022).

The objectives of this floristic inventory are: 1) document the vascular flora of the county from field collections and pre-existing herbaria specimens; 2) compile an annotated list of vascular plant species; 3) document the presence of rare and significant species; 4) describe special areas and habitats; and 5) determine the species richness per hectare of the county. The broader purpose behind these objectives is to contribute to the knowledge of the flora of Kentucky.

DESCRIPTION OF STUDY AREA

Location and General Description

Estill County is in the east-central portion of the State (Fig. 2), situated between the Bluegrass Region and the highlands of eastern Kentucky. Its location has been referred to as where the "Bluegrass kisses the Mountains (Estill Development Alliance 2022)". Latitude coordinates are from 37°51′10″N to 37°32′35″N; Longitude coordinates are from 84°7′15″W to 83°43′30″W on the USGS 7.5′ quadrangle maps of Palmer and Leighton,

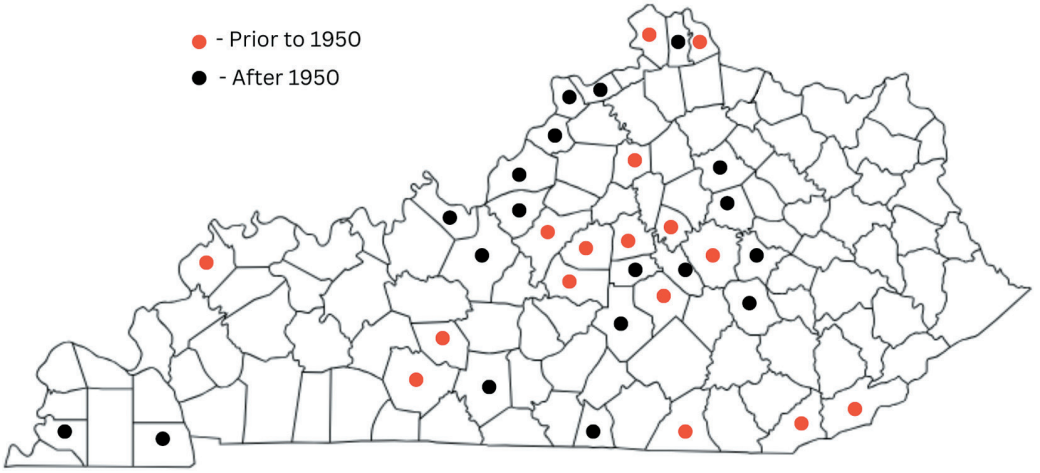

Fig. 1. Counties in Kentucky with published or Master's theses floras.

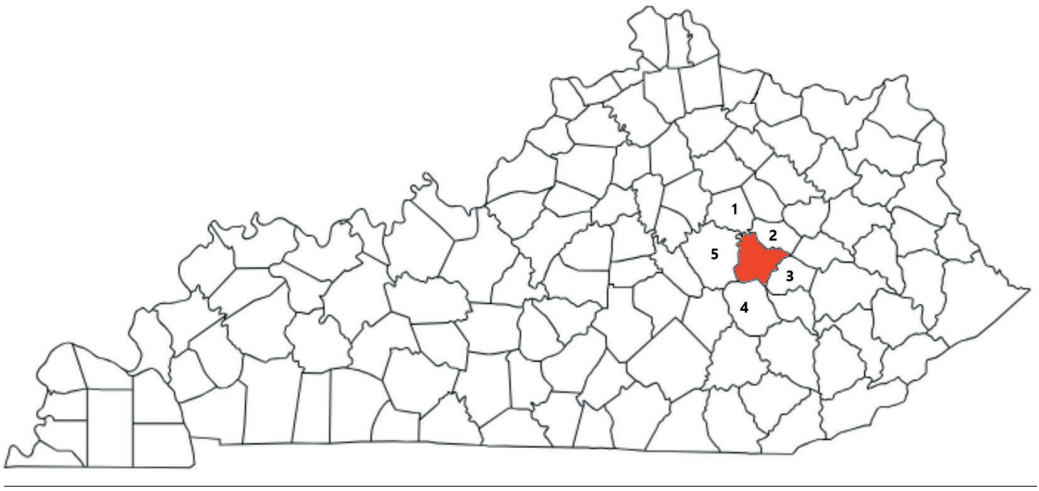

Fig. 2. Location of Estill County, Kentucky with surrounding counties; **1.** Clark; **2.** Powell; **3.** Lee; **4.** Jackson; and **5.** Madison.

Kentucky. Elevations range from 173 m at the mouth of Red River to 461 m along the ridges of Zion Mountain (McGrain & Currens 1978). The county embraces an area of ca. 66,304 ha (163,841 acres), of which ca. 49,728 ha (122,881 acres) are forested (Newton et al. 1974; McIntosh 2007: U.S. Census Bureau 2022). Kentucky contiguous counties are Madison to the west, Clark to the northwest, Powell to the northeast, Lee to the east, and Jackson to the south (Fig. 2).

Estill County, the 50th county established in Kentucky, was formed in 1808 from parts of Clark and Madison counties (Elbon 2022). It was named in honor of Captain James Estill, a Kentucky Militia officer killed in 1782 at the Battle of Little Mountain, also referred to as "Estill's Defeat (Rennick 1987; Barnes 2007)." As of 2022, Estill County had a population of 14,138 (U.S. Census Bureau 2022). The two largest communities are Irvine and Ravenna, with the former as the county seat. Ravenna was a hub for the Louisville and Nashville Railroads, which were consolidated into CSX Transportation (LJAC Digital Access 2024). The railroad is no longer operational. Principal crops are tobacco, corn, and hay, with cattle, hogs, pigs, and sheep as the principal livestock (McIntosh 2007).

Physiography, Geology, and Soils

Estill County lies within two physiographic provinces according to Fenneman (1938): the Lexington Plain of the Interior Low Plateaus (IP) Province and the Cumberland Plateau Section of the Appalachian Plateaus (AP) Province. Quarterman and Powell (1978) describe five subsections of the Lexington Plain (or Bluegrass), with the outer two subsections, the Outer Bluegrass and the Knobstone Escarpment and Knobs, present in Estill County. Woods et al. (2002) name the ecoregions present in Estill County as Outer Bluegrass of the Interior Plateau, and Knobs-Lower Scioto Dissected Plateau and Northern Forested Plateau Escarpment of the Western Allegheny Plateau. The county is dissected by the Kentucky River and its major tributaries from southeast to northeast (McGrain & Currens 1978) and Red River (with its tributary, Plum Creek), which forms the northern border with Clark and Powell counties. Both rivers provided access to transportation of materials for early industries (LJAC Digital Access 2024). Principal tributary streams include Station Camp, Red Lick, Crooked, Clear, Miller and Drowning creeks (Newton et al. 1974; McIntosh 2007).

Jillson (1928) described the topography of Estill County as a "maturely dissected plateau with no flat lands except in the western part between Drowning Creek and the Kentucky River (Fig. 3)." Perennial streams cut through rock layers that display different weathering characteristics. As a result, shales and siltstones are the first to erode, while dolomites, limestones, and sandstones form rock outcrops (McIntosh 2007). The geology and soils of the three major physiographic sections of the county are described below. Information follows Newton et al. 1974, McDowell 1986, and McIntosh 2007, unless noted otherwise.

1) The Outer Bluegrass (OB) comprises the northwestern edge of Estill County along the Kentucky and Red rivers near Clark and Madison counties (Fig. 4). This is the smallest physiographic region in the county, occupying 5,304 ha (13,107 acres). The relief of this region is "low to moderate" with soils thick over limestone and thin over shales. This region is underlain by lower Silurian and Ordovician limestone and shaly limestone of the Richmond and Maysville Formations (Bladen 1984). These formations are generally softer and less resistant to erosion (McGrain 1983). The shales and limestones (Silurian and Devonian Ages) of the Richmond Formation underlie the OB to the east and south, and north and west respectively. The Silurian strata are generally thicker and contain more shale in the eastern portion of this region (Quarterman & Powell 1978). Alluvial deposits along the Kentucky and Red Rivers in the eastern part of this region are underlain by the Ordovician Age Drakes Formation (Simmons 1967; Greene 1968). The composition of this formation is dolomite, limestone, mudstone, and shale. It generally ranges in thickness from 610-4,572 cm.

The soils of the Outer Bluegrass in Estill County are composed of the Fairmont-Shrouts-Allegheny and the Colyer-Shrouts-Allegheny Associations. The Fairmont-Shrouts-Allegheny Association occupies about five percent of the study area. This soil association is found in the hilly region along the Kentucky River on the northwestern edge of the county. Only half of this association is forested. These soils are characterized as steep, shallow and deep, well-drained soils of v-shaped valleys and long, narrow ridgetops. The Colyer-Shrouts-Allegheny Association occupies 15% of the survey area. These soils are characterized as steep, shallow and deep, or well-drained on tops of narrow ridges.

2) The Knobs region is an area of narrow ridgetops and hillsides comprising 29,837 ha (73,728 acres) in the central portion of Estill County (Fig. 4; Taylor 1995). Quarterman and Powell (1978) refer to this area as the Knobstone Escarpment. They characterize the topography as "steep slopes gullied by small streams with steep gradients trending down the face of the escarpment." Fenneman (1938) described this region as "a maturely dissected erosion product consisting of hills known as Knobs." The knobs near Irvine are composed of rocks of the Silurian, Devonian and Mississippian systems, these composed of shale with most of them capped with limestone (Anderson & Anderson 1927). Limestone outcrops were formed throughout the Knobs region due to the erosion of the Cincinnati Arch (Burroughs 1926), a regional uplift that extends from Ohio through central Kentucky to the Nashville Dome in central Tennessee. The Knobs consist of shales, siltstones, and sandstones of the Borden and Bedford Formations. This area of narrow ridgetops and steep slopes between deep v-shaped valleys is predominantly composed of New Albany

Shale of the Middle and Lower Devonian and Mississippian (Quarterman & Powell 1978: Simmons 1967). This shale is an organic-rich black shale that consists of thin beds of greenish-gray shale. This formation is extensive throughout the knobs of Estill County and is also found in parts of the Cumberland Plateau region. Campbell et al. (1989) mentioned that this "black shale" is often found at lower elevations along the western edge of the Stanton Ranger District (western portion of Estill County).

Overlying the New Albany Shale is Mississippian limestone, siltstone, and shales of the Borden Formation. The most extensive member of this formation in the county is the Nancy Member. It is composed of clay shale and silty shale.

Above the Borden Formation and below the Breathitt and Lee Formations is the limestone, minor sandstone, and shale region referred to as "Newman Limestone." Exposures of the St. Louis, St. Genevieve, and Upper Limestone Members are found on the knobs in the northeastern, central, and southern portions of Estill County (Simmons 1967; Greene 1968; Rice 1972; Black 1977, 1978; Haney & Rice 1978). The St. Genevieve Limestone Member overlies the St. Louis Limestone Member and consists of oolitic and skeletal limestone that commonly outcrops as cliffs (Rice 1972). The narrow ridges (and upper slopes) of the Grassy Knob Ridge System, as well as those in the watersheds of Red Lick and White Oak creeks, are often composed of well-developed limestone cliffs. These cliffs often attain much greater heights than the sandstone cliffs of these areas and are some of the highest limestone cliffs in Kentucky, with some extending significantly above the tree crowns of the maturing secondary forest below. This degree of exposure has fostered the development of barren/prairie-like vegetation, particularly when the clifftop aspects are south to southwest. The lichen biota and vascular flora of these clifftops are home to a number of mid-western species including the lichens *Calogaya saxicola* (Hoffm.) Vondrák, *Leproplaca cirrochroa* (Ach.) Arup, Frödén & Søchting, and *Protoparmeliopsis muralis* (Schreb.) M. Choisy, and the vascular plant species *Bouteloua curtipendula*, *Muhlenbergia cuspidata*, *Symphoricarpos albus*, and *Silphium terebinthinaceum* (Allen Risk, pers. comm.; Campbell et al. 1989 & 1991). Campbell et al. (1989) describes the limestone cliffs in the Stanton Ranger District as "generally smaller than the sandstone cliffs" and "prominent along some narrow ridge systems at the western edge of the district."

Soils of the Knobs in Estill County are comprised primarily of the Huntington-Newark-Morehead and Shelocta-Brookside-Latham Associations. The Huntington-Newark-Morehead Association is characterized by deep, well-drained soils of floodplains and stream terraces of the Kentucky River and its larger tributaries. Most of this association is utilized for agricultural purposes. The soils of the Shelocta-Brookside-Latham Association are strongly acidic and derived from shale, siltstone, and sandstone. This association occupies mountain-sides, long, narrow ridgetops, and floodplains.

3) The Cumberland Plateau (CP), also referred to as the Eastern Coalfields (Browne & Athey 1992), is a "maturely dissected, uplifted plain" that covers an area of 31,163 ha (77,006 acres) in the southeastern portion of Estill County (Fig. 4; Miller 1919; Jillson 1927). It (along with the Cumberland Mountains) encompasses 35 counties (Taylor 1995) and constitutes over 25% of the total area in Kentucky (Martin 1987). The region is characterized by narrow floodplains, long, steep mountainsides, and narrow ridgetops or upper slopes.

The Pottsville Escarpment forms the western border of the Cumberland Plateau. It is composed primarily of the Corbin Sandstone Member of the Lee Formation. This member is the most widespread sandstone unit that "crops out" in eastern Kentucky (Rice, 1984). The Breathitt Formation overlies the Lee Formation on the eastern side of the basin and underlies all of eastern Kentucky. It consists of gray siltstone and shale, subgraywacke, and minor amounts of ironstone and limestone (Rice 1984). Campbell et al. (1989) mention that this formation contains less sandstone and more coal than the Lee Formation.

The major soil associations of the Cumberland Plateau in Estill County are Shelocta-Latham-Jefferson and Latham-Shelocta-Gilpin. The Shelocta-Latham-Jefferson Association is characterized by deep, well-drained soils of mountains and narrow ridgetops. The soils of the Latham-Shelocta-Gilpin Association are strongly acidic and derived from acid siltstone, shale, and clay. They are moderately well-drained soils of ridgetops and colluvial areas.

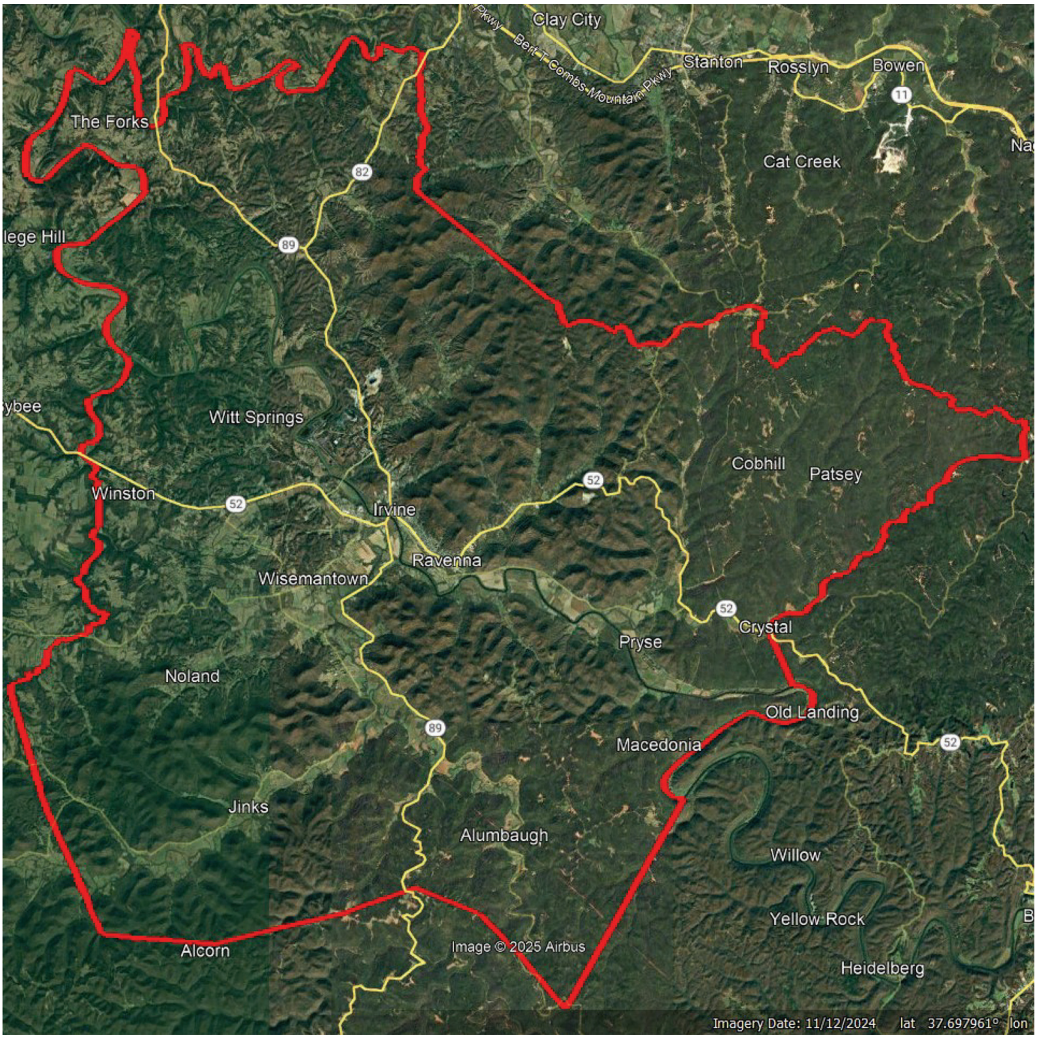

Fig. 3. Topography of Estill County, Kentucky. Outline of county in red. Google Earth V 7.3.6.10201 (April 9, 2025). Estill County, Kentucky, USA. 37.693512, –83.976706 [Eye Alt. 41.75 mi (June 8, 2025)]. Adapted from Google Earth by Ethan Guetig.

Previous Accounts of the Vegetation

The study area lies within Küchler's (1964) Oak-Hickory Forest Region and Bailey's (1980) Oak-Hickory Division of the Eastern Deciduous Forest. Dominants noted by Küchler, such as *Quercus alba, Q. rubra, Q. velutina, Carya cordiformis,* and *C. ovata*, are found throughout the county occupying dry upland forests. Braun (1950) characterizes the vegetation of Estill County as part of her Western Mesophytic Forest Region (Outer Bluegrass) and Mixed Mesophytic Forest Region (Knobs and Cumberland Plateau). Dyer (2006) places both of these forest regions into one region, the Mesophytic Forest Region, and describes it as "the most diverse forest region compositionally, with a large number of canopy dominants." The vegetation of the three major physiographic regions in the county are described below. Descriptions are based on Braun (1950) and Wharton (1945), except as indicated.

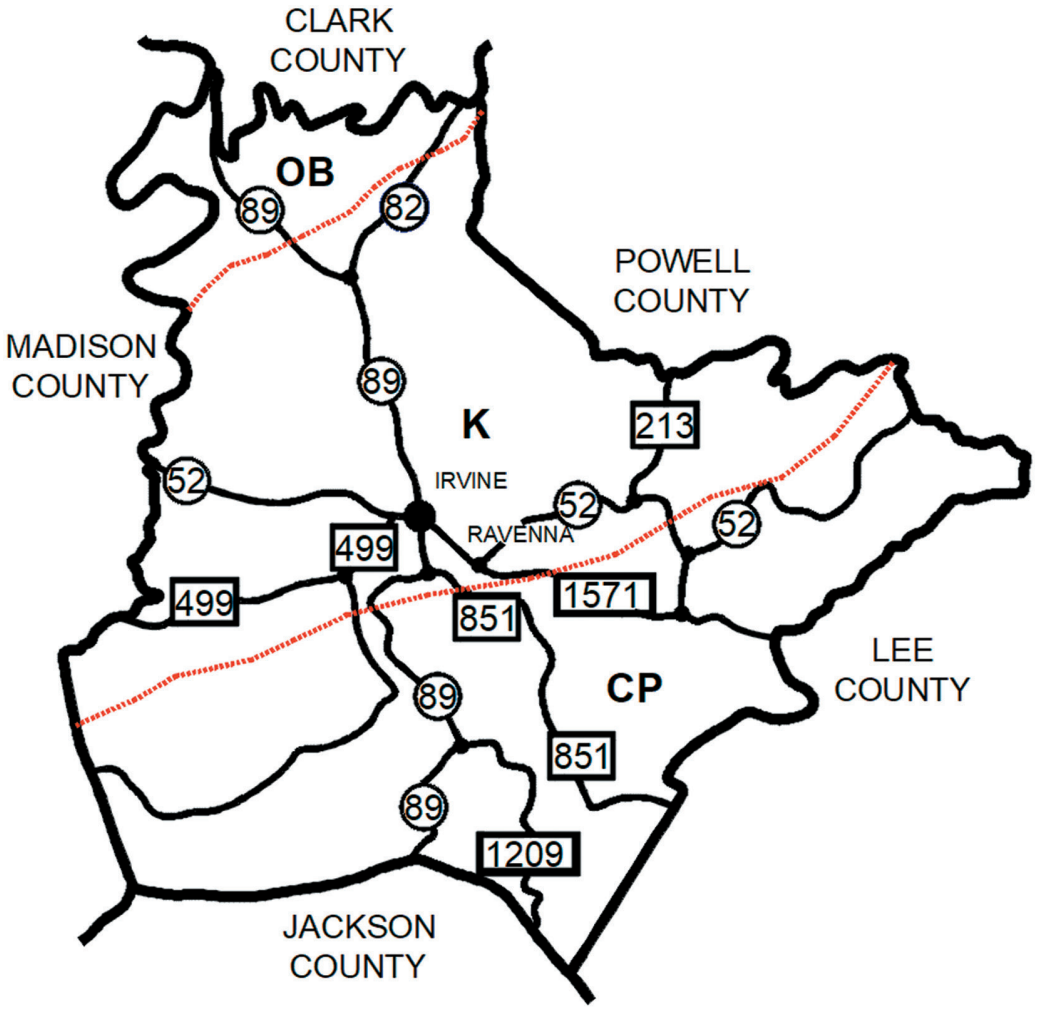

Fig. 4. Physiographic regions of Estill County, Kentucky. **OB**=Outer Bluegrass, **K**=Knobs, and **CP**=Cumberland Plateau.

1) The vegetation of the Outer Bluegrass in Estill County is characteristic of Braun's (1950) Western Mesophytic Forest Region and Bryant et al. (1993) Oak-Hickory Forest. Quarterman and Powell (1978) state that this forest region "lies between the Mixed Mesophytic Forest Region to the east and south, Beech-Maple to the north, and Oak-Hickory to the northwest, west and south." The transition from mixed mesophytic to oak-hickory forests can be recognized by the loss of *Tilia americana* var. *heterophylla* and *Aesculus flava*. This area is a "transition from extensive mixed mesophytic communities in the east to extensive oak and oak-hickory communities in the west." Mixed hardwoods are dominant throughout the region and often in combination with *Quercus alba*, *Q. muehlenbergii*, *Acer saccharum*, *Fagus grandiflora*, *Carya* sp., and *Fraxinus* sp. The major upland associations are mixed mesophytic, oak-ash-maple, beech-maple, and mixed hardwoods (Bryant 1987).

2) The forests of the Knobs were classified by Braun (1950) as comprising part of her Mixed Mesophytic Forest Region, with some sections more related to the Western Mesophytic Forest Region. She described the vegetation of the Knobs as mixed mesophytic with oak, oak-hickory and oak-chestnut communities

occupying the drier slopes and uplands. Pine, red cedar, and prairie relics are often found on the driest barren sites of these slopes and uplands (Quarterman & Powell 1978). Mesophytic uplands support a chestnut-beech-tulip tree community with oak-tulip tree forests occupying areas of low relief (Quarterman & Powell 1978).

The upland forests of the Knobs region have been logged at least once and are characterized as secondary oak forests (Bryant 1987; Bryant et al. 1993). Muller and McComb (1986) recognize five forest types for the Knobs: 1) white oak; 2) chestnut oak; 3) scarlet oak; 4) mesophytic hardwoods; and 5) transitional forests. Hickories are present throughout the region but of only minor importance (Bryant et al. 1993). Wharton (1945) described five upland forest types: pine, oak-pine, chestnut oak-scarlet oak, white oak, and mixed mesophytic forest. Forests on hilltops, ridges and south-facing hillsides include pine, oak-pine, and chestnut oak-scarlet oak. The pine and oak-pine forests are dominated by *Pinus virginiana*, with *Quercus montana* as co-dominant or second in importance. Common associates include *Quercus alba*, *Q. coccinea*, *Q. falcata*, *Q. stellata*, and *Q. velutina*. *Carya glabra* and *Nyssa sylvatica* are important secondary species in both forest types. The chestnut oak-scarlet oak forest is a phase of the oak-hickory association that is dominated by *Quercus montana*, *Q. coccinea*, and *Q. velutina*. Other associates include *Acer rubrum*, *Carya glabra*, *C. ovata*, *C. tomentosa*, *Nyssa sylvatica*, *Quercus alba*, *Q. falcata*, *Q. imbricaria*, *Q. marilandica*, *Q. rubra*, and *Q. stellata*. The understory is predominantly composed of *Amelanchier arborea*, *Cercis canadensis*, *Benthamidia florida*, *Crataegus crus-galli*, and *Oxydendrum arboreum*.

Forests situated on less exposed hillsides and in coves include white oak and mixed mesophytic taxa. White oak forests prevail on north, northwest, and east slopes. Dominant species include *Quercus alba*, *Q. coccinea*, and *Q. velutina*. Common associates include *Acer rubrum*, *Carya glabra*, *C. ovata*, *C. tomentosa*, *Morus rubra*, and *Quercus rubra*. Understory species include *Benthamidia florida*, *Carpinus caroliniana*, *Cercis canadensis*, and *Magnolia tripetala*.

Throughout the Knobs, mixed mesophytic forest is restricted to coves, north slopes, and steep slopes above streams. These forests are characterized by high biodiversity at the community level (Hinkle et al. 1993). Four association segregates are found within the mixed mesophytic forest. They are: 1) basswood-tulip tree-white oak-beech; 2) beech; 3) beech-white oak-sugar maple; and 4) tulip tree-red maple-white oak. Common canopy species include *Acer rubrum*, *Aesculus flava*, *Carya laciniosa*, *Celtis occidentalis*, *Fagus grandiflora*, *Liriodendron tulipifera*, *Quercus rubra*, *Tsuga canadensis*, and *Ulmus americana*. Understory species include *Amelanchier arborea*, *Carpinus caroliniana*, and *Magnolia tripetala*.

3) The Cumberland Plateau (CP) was characterized as mixed mesophytic forest on mesic sites with oak-pine forests on dry ridges and hilltops before extensive logging (Braun 1950). Mixed mesophytic communities are now restricted to cool valley slopes (Smalley 1979 & 1982). The CP portion of Estill County is considered to be part of Braun's "Cliff Section," which forms the western edge of the Cumberland Plateau and Alleghany Plateau in Kentucky. Martin (1987) summarizes Braun's major plant communities as "swamps on flat, dissected plateaus, to widespread white oak-beech, hemlock, and oak-hickory communities at elevations below 600 m. High elevations are characterized by a maple-basswood-buckeye segregate on mesic sites and various oak communities on drier sites."

The Cumberland Plateau is composed of Pottsville sandstone and conglomerate that support mixed mesophytic forests like those in the Cumberland Mountains. Ridgetops composed of Mississippian limestone are characterized by chestnut oak and oak-hickory communities. The latter community type commonly contains prairie plants.

Climate

Based on the Köppen Climate Classification (Rosenberg 2018), the climate of Estill County is humid, subtropical (Cfa), with warm and humid summers and moderately cold winters (Newton et al. 1974). Thornthwaite (1948) classified this area as humid mesothermal, $B_3{}^1B_3{}^1rb_3$, with precipitation distributed evenly throughout all seasons. Average annual precipitation is 122 cm (47.23 in), with most falling during the growing season (175 days). The average annual temperature is 55.9°F (13.3°C) with an average winter temperature of 36.2°F

(2.2°C) and summer temperature of 73.5°F (23°C) (McIntosh 2007), with average lows of 23°F (-5°C) in the winter to average highs of 86°F (30°C) in the summer months.

History and Land Use

Unless noted otherwise, information on the history and land use of Estill County follows Estill Development Alliance (2022), Johnstone (1974), and Newton et al. (1974). The first people known to inhabit the state of Kentucky were called "Mound Builders (Burroughs 1926)." It is not known if these ancient people were ancestors of the American Indian or a group that moved southwest to Mexico. Indian folklore describes these prehistoric people as white men that possessed the skill to make and use metal tools and war utensils. They also produced well-cultivated fields.

As mound builders began to disappear, Indian tribes inhabited the region. The first Indians known to occur in Estill County were the Shawnee. They had a trading post and camping ground at Estill Springs along Station Camp Creek. The Shawnee mined the lead in the area. They referred to this area as "Ah-wah-nee—a deep grassy place." It was described as a place of "lush meadows, plentiful game in the forests, fish in sparkling streams, and fruit, berries, and nuts abounded (Kleber 1992)."

Indians made numerous trails throughout the Knobs region that later became the primary roadways for early European settlers (Burroughs 1926). Johnstone (1974) claims that KY 89, which runs north to south through Estill County, was one of the major trails in pioneer days. One of the best known trails was "Warrior's Path" or the Cumberland Gap Trail. This trail extended "from Red River across the Kentucky at the mouth of Cow Run (near Irvine, Estill County), up Station Creek, across the Cumberland-Kentucky watershed to the Cumberland River at Buffalo Creek and Flat Lick, and thence up the river and its branches to Cumberland Gap."

Native American communities influenced forest composition and structure (Russell 1983), especially because of their extensive use of fire. Native people and European settlers used fire to reduce understory and promote browse for game (Oak 2002). Martin (1989) states "If there were Indians in a region, there was fire." Cronon (1983), mentioned that the early settlers observed Indians burning forests. This was practiced in the spring and fall in order to keep the forest floor clear of undergrowth (Cronon 1983; Taylor 1995).

The first settlers of European descent thought to have entered Estill County were Dr. Thomas Walker and his party of explorers. Dr. Walker and his party followed the Cumberland Gap into the county and are said to have crossed the Kentucky River near Irvine. Famous frontiersmen such as John Finley and Daniel Boone led expeditions into Estill County in 1767 and 1769 respectively (Johnstone 1974; McIntosh 2007). While on a trading and hunting expedition, John Finley visited Station Camp Creek, where he traded with the Shawnees. After setting up a permanent camp on Red River, Daniel Boone and John Stewart visited "Estill Springs." In the summer of 1769, Squire Boone met up with his brother and Stewart. They were attacked by Indians near a cane-brake, which left Stewart mortally wounded. The Boone's fled for their lives and established a camp on Station Camp in Estill County.

One of the earliest industries established in Estill County was the production of iron (Kleber 1992). This began in 1810 and reached its peak in the 1840s and 1850s (Collins 1975). In order to smelt the iron ore, furnaces (fueled by charcoal) were constructed throughout the Knobs region. In Estill County, three primary furnaces were established: Red River Iron Works (Fitchburg Furnace) 1869-1874; Estill Steam Furnace 1830-1874; and Cottage Furnace 1856-1873. The remains of these furnaces are still standing (Lee 1981).

The most noteworthy furnace was the Fitchburg Furnace (Fig. 5). It is located about 12 miles from Irvine on Furnace Fork of Miller's Creek in DBNF. It was 81 feet high and 115 feet long and regarded as the largest charcoal-burning furnace in the state (Collins 1975; Fitchburg Interactive Site 2022). This furnace required wood from 320 ha (791 acres) of land a year to supply charcoal for the smelting of the iron (Miller 1919; Burroughs 1926; Collins 1985; Martin 1989). Burroughs (1926) states that "this caused the forests to be cut away very rapidly." During the 1860s and early 1870s, the iron was primarily used for the railroads (LJAC Digital Access 2024).

The iron ore industry declined after 1865 due to the depletion of iron deposits and timber (Kleber 1992). Martin (1989) believes the Cumberland forests were used extensively to fuel the furnaces and keep them "in

Fig. 5. Fitchburg Furnace, Estill County, Kentucky. Courtesy of the University of Kentucky Special Collections & Archives.

blast" 24 hours a day. Between 1808 and 1875, the Red River Iron District caused sections of Powell and Estill Counties to be "completely deforested (Burroughs 1926)."

Muller (1987) concluded the upland forests were all logged at least once. No old growth forests were discovered during the present study. The forests were extensively cleared during the period from 1808–1875 in support of lumber and charcoal production (Burroughs 1926), as well as for fuelwood and urban expansion (Whitney 1990). Most of the woodlands consist of small second or third growth pine, gum, oak, and chestnut (Jillson 1927). Very little of the original forests remains intact today (Harker et al. 1981). Linney (1882) attributed this to poor land use, erosion, and fire.

The economy of Estill County is centered on petroleum, forest products, and farming. Approximately 75% of the county is wooded with 60–79% in commercial forest (Karan & Mather 1977). Logging, forest products, and operation of sawmills are the major sources of income (Newton et al. 1974). Although Estill County is located near the border of the Eastern Coalfields, it does not contain the coal reserves as do many of the other counties in the Coalfield region. The county has produced a total of slightly over 300,000 tons of coal (LJAC Digital Access 2024).

The most productive agricultural areas in the county are the fertile bottomlands (Kleber 1992). Farmland accounts for 45–65% of the county, cropland 3.5–9.5%, and pasture 18–24% (Karan & Mather 1977). The primary crops are burley tobacco, corn, and alfalfa (hay), with beef cattle, hogs and a small number of sheep dominating the livestock production. Farming in Estill County has declined. Land cleared on steep hillsides for pasture and crops have reverted back to woodland.

After World War II, the county became the greatest oil producer in Kentucky (McIntosh 2007). The Ross Creek Oil Pool in the county was the most active in the state during the early 1900s (Fig. 6; Nuttall 1998). In 1981, Estill County ranked 14th among Kentucky's oil producing counties (Lee 1981).

Botanical History

Several floristic studies and plant atlases cite plants from Estill County (Garman 1913; Anderson 1924, 1947; McCoy 1938; Harvill 1941; Braun 1943; Reed 1958, 1962, 1981; Ettman & McAdoo 1979; Harker et al. 1979, 1981; Cranfill, 1980; United States Forest Service *n.d.*; Kentucky Division of Forestry 1985; Beal & Thieret 1986; Clark & Weckman 2008; and Campbell & Medley 2018). These studies were not comprehensive studies with respect to documentation of the flora and vegetation of Estill County.

Early botanizing in Kentucky was based on the travels of such eminent workers as F.A. Michaux, C.S. Rafinesque, C.W. Short, R. Peter, and H.A. Griswald. In 1819, Rafinesque documented the first vascular plants from Estill County when he reported on the occurrence of *Betula rupestris* Raf. (= *Betula lenta* L.). He stated, "I have discovered this shrub in the cliffs and on the sandstone rocks of the Kentucky River in Estill County." He also described *Cornus obliqua* Raf. [*Cornus amomum* P. Mill var. *obliqua* (Raf.) J.S. Wilson] as growing with *Betula rupestris* in the same locality. One year later, Rafinesque (1820) listed *Melothria nigra* Raf. (= *Melothria pendula* L.) as growing near Estill County in the valley of the Kentucky River. Rafinesque (1836) visited Irvine and Estill Springs on the Kentucky River which he described as "eastern knobs."

The first study specifically targeting vascular plants in Estill County was by Anderson and Anderson (1927). They studied the fern flora of a knob near Irvine, Kentucky. Their study represented collections over a five–year period which yielded only 22 species and one variety. While on vacation in Irvine, Anderson (1929) added four fern species to his previous list, raising the number to 27 taxa.

The most noteworthy floristic and vegetation study conducted in Estill County, prior to 1950 was by Mary. E. Wharton. She studied the vascular plants of the Devonian-Mississippian Black Shale Region of Kentucky (commonly known as the "Knobs"). Wharton (1945) reported 311 species and varieties from Estill County and included habitat descriptions, distributional status, and relative abundance for each taxon. Fifteen species listed by Wharton (1945) as occurring in the county were not collected during the present study.

Campbell et al. (1989) surveyed the vascular plants of the DBNF, which included portions of Estill County. They documented federally and state-listed plant and animal species from the Stanton Ranger District. A total of 617 species of vascular plants were reported as occurring in Estill County. Sixteen listed "rare" species were documented in various habitats along the Grassy Knob Ridge System and Ravenna Knob (just north of the city of Ravenna). This list was based upon voucher specimens, literature reports, and onsite identification (Campbell et al. 1989).

Campbell et al. (1991) conducted a similar inventory of the Berea Ranger District of the DBNF, which included the southern part of Estill County. They surveyed sites in the Station Camp Creek Corridors, Long Branch Knobs, and Zion Mountain Ridge System. A total of 41 listed "rare" species were documented in the district, eight of which were reported from Estill County. The large wood lettuce (*Prenanthes crepidinea* Michx.) was reported northeast of Reeves Mountain (Campbell et al. 1991), but no voucher specimens could be located.

The most comprehensive floristic study conducted in Estill County documenting the vascular flora and plant communities was by Guetig (1993), who provided habitat descriptions and relative abundance for 853 species, varieties, and hybrids. Sixteen species listed as "rare" by Warren et al. (1986) were documented. He also reported on six rare and noteworthy species of grasses and provided habitat descriptions and state distributional status (Guetig 1994).

SERNEC Data Portal (2022) lists 2,255 voucher specimens (in 40 herbaria) from Estill County. Other than those collected by R. Guetig, specimens were also collected by W. Anderson, J. Campbell, W. Martin, M. Medley, R. Thompson, and M. Wharton. Campbell and Medley (2018) mapped 739 species for Estill County, whereas the *Tennessee-Kentucky Plant Atlas* (Shaw et al. 2022) lists 694 vascular plant species for the county.

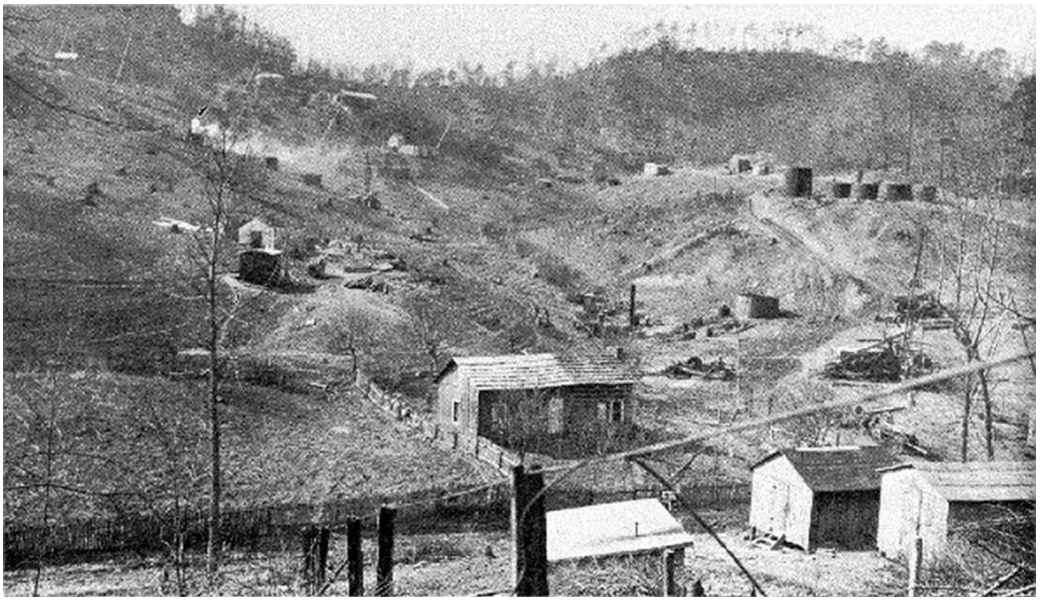

Fig. 6. Ross Creek Oil Pool, Estill County, Kentucky. Photograph taken in 1919 by Willard Rouse Jillson, Courtesy of the University of Kentucky, Kentucky Geological Survey.

Cranfill (1980) mapped 12 pteridophyte species, Beal and Thieret (1986) mapped 43 aquatic plants, and Clark and Weckman (2008) mapped 149 woody plants.

MATERIALS AND METHODS

Floristic Survey

The systematic collection of vascular plants from Estill County was originally conducted by the first author over the three growing seasons of 1987, 1988, and 1989. A total of 65 locations were visited over 32 field days, and more than 1,700 specimens were collected. Field and herbarium work resumed in 2022, and a total of 33 locations were visited over 32 field days, during which an additional 450 specimens were collected. This latest field work focused on aquatic habitats, dry wooded hillsides, and waste areas such as railroads, vacant lots, ditches, and ruderal fields, targeting in particular aquatic plants and non-native species. Voucher specimens collected over these time periods were prepared by standard herbarium techniques and deposited in the herbarium at Eastern Kentucky University (EKY).

References used over these time periods to assist in the identification of the specimens included Gleason and Cronquist (1991), Steyermark (1963), Radford et al. (1968), Strausbaugh and Core (1978), Godfrey and Wooten (1979, 1981), Cranfill (1980), Beal and Thieret (1986), Jones (2005), Tennessee Flora Committee (2014), and Weakley (2024). Rogers et al. (2022) and KY-IPC (2013) were used for the listings of state-listed and invasive species, respectively. Nomenclature for families, genera, and species has been updated to follow Weakley (2024). Species in the checklist are divided into fern and fern allies, gymnosperms, and angiosperms, with classification for the latter following APG IV (2016).

In the initial stages of this study the following herbaria were searched for pre-existing specimens from Estill County (acronyms following Thiers 2024): Berea College (BEREA); Eastern Kentucky University (EKY); Gray Herbarium (GH); Morehead State University (MDKY); Northern Kentucky University (KNK); University of Kentucky (KY); University of Louisville (DHL); and University of Michigan (MICH). More recent records were obtained by revisiting EKY and KY, and by visiting the following websites: SERNEC Data Portal (2022),

Tennessee-Kentucky Atlas (Shaw et al. 2022), and *Atlas of Vascular Plants in Kentucky* (Campbell and Medley 2018) websites. In addition, documented photographs of Estill County plants were searched at iNaturalist (2023).

Collecting stations, representing a variety of habitats, were established throughout the study area using topographic, geologic, and soil maps as well as random visits. Habitats included limestone outcrops, xeric ridgetops, rock houses, marshy areas, river floodplains, mesic lowland woods, and dry upland forests. These stations were visited regularly during each growing season. Additional sites, including roadsides, railroad tracks, drainage ditches, pastures, ponds, creek beds, and ruderal areas were inventoried to provide the greatest diversity possible.

Species Richness

Thompson and Thompson (2016) define species richness as "a measure of completeness for a floristic study of different-sized areas or regions having been adequately surveyed." The species richness per ha of Estill County was determined by dividing the total number of species documented by the total area of the county. Estill County's species richness was compared to 10 floras within the same physiographic regions in Kentucky.

RESULTS AND DISCUSSION

Floristic Analysis

The known vascular flora of Estill County is comprised of 963 species and infra-specific taxa, representing 134 families and 479 genera (Table 1). This included 19 varieties, six subspecies, five hybrids, and one form. The total taxa (963) accounts for 33.2% of the 2,900 estimated vascular plants by KEEC (2024). Taxonomic distribution (Table 1) includes 42 fern and fern allies (4.4%), six gymnosperms (0.6%), one basal angiosperms (0.1%), ten magnoliidae (1.0%), 244 monocots (25.4%), and 660 eudicots (68.5%). A total of 773 (80.3%) were herbaceous and 190 (19.7%) woody.

The largest families and genera are listed below, with numbers indicative of species or taxa. Asteraceae (126) and Poaceae (109) were the largest families, followed by Cyperaceae (61), Fabaceae (49), Lamiaceae (36), Rosaceae (35), and Apiaceae (20). The ten largest families in terms of taxa account for 493 (51.2%) of 963 taxa (Table 2). The largest genera were *Carex* (40 species), *Solidago* (17), *Dichanthelium* (15), and *Symphyotrichum* (13). Other large genera included *Quercus* (14 taxa), *Viola* (12), *Juncus* (10) *Asclepias* (9), and *Asplenium* (9). One hundred sixty species documented during this study represent range extensions and county records (Appendix I). One hundred fifty-three species are non-native, representing 15.9% of the total taxa (Table 1). The largest non-native families were Poaceae (34 taxa), Fabaceae (18), Asteraceae (15), and Brassicaceae (11). In his study of 26 floras, Pysek (1998) lists these families as having the highest percentage of non-native species. Eighty-two of the 153 exotics were listed as invasive by KY-IPC (2013). They are categorized as severe threat (27 species), significant threat (26), moderate threat (21), and watch list (8).

Woody taxa included 107 trees, 65 shrubs, and 18 vines. *Quercus* was the largest woody genus, with 14 species. Major genera of shrubs and vines were *Hypericum* (7 species) and *Smilax* (6).

Three hundred twenty-nine taxa, representing 34.2% of the listed flora, were not collected during this study, but were verified from pre-existing specimens at local, state and regional herbaria (24). Of the 329 species, 121 were housed in EKY, 78 in KY, 33 in APSC, 31 in MICH, 16 in GH, 12 in BEREA, seven in MDKY, six in MO, four in TENN, four in NCU, three in KNK, two in DHL, two in NY, and one in each KE, MEM, MU, NCSC, NY, SAT, USAM, UWSP, VBD, WS, and WIS.

Twenty-three taxa from Estill County were listed by Rodgers et al. (2022) as Endangered (7), Threatened (6), Special Concern (10), or Commercially Exploited (1). Rare species accounted for 2.5% of the total flora and represent five percent of the 474 rare plant species in Kentucky (Table 3). Endangered species are *Amelanchier spicata* (State record), *Calamagrostis insperata* (State record), *Castanea dentata*, *Paxistima canbyi*, *Symphoricarpos albus*, and *Trichostema setaceum*. Threatened species include *Clematis catesbyana*, *C. glaucophylla*, *Elymus svensonii*, *Gratiola viscidula*, *Juglans cinerea*, and *Muhlenbergia cuspidata*. Species of Special Concern are *Asclepias purpurascens*, *Aureolaria patula*, *Bouteloua curtipendula*, *Carex corrugata*, *C. rugosperma*, *Dryopteris carthusiana*, *Juncus articulatus*, *Lathyrus venosus*, *Patis racemosa*, and *Phlox subulata*. One taxon, *Panax*

Table 1. Taxonomic distribution of vascular plants in Estill County, Kentucky.

Division	Family	Genera	Species Number	Native	Exotic	Species Composition (%)
Fern & Fern Allies	15	26	42	0	0	4.4
Gymnosperms	2	3	6	0	0	.6
Basal Angiosperms	1	1	1	0	0	.1
Magnoliidae	5	9	10	0	0	1.0
Monocots	23	95	244	198	46	25.4
Eudicots	88	345	660	553	107	68.5
Total	**134**	**479**	**963**	**751**	**153**	**100**

Table 2. Generic and species richness in the ten largest plant families in Estill County, Kentucky.

Family	Genera	Species	Native	Exotic	Species Composition (%)
Apiaceae	13	20	17	3	2.1
Asteraceae	57	126	111	15	13.1
Brassicaceae	15	20	9	11	2.1
Cyperaceae	6	61	60	1	6.3
Fabaceae	30	49	31	18	5.1
Lamiaceae	20	36	30	6	3.7
Plantaginaceae	9	19	13	6	2.0
Poaceae	50	109	77	34	11.3
Rosaceae	14	35	31	4	3.6
Rubiaceae	5	18	16	2	1.9
Total	**219**	**493**	**395**	**100**	**51.2**

Table 3. State-listed plant taxa and conservation rankings in Estill County, Kentucky by Rodgers et al. (2022).*

Taxa	State Protection	S Rank	G Rank
Amelanchier spicata (Lam.) K. Koch	E	S1	G5
Asclepias purpurascens L.	SC	S3	G5?
Aureolaria patula (Chapman) Pennell	SC	S3	G3
Bouteloua curtipendula (Michx.) Torr.	SC	S3?	G5T5
Calamogrostis insperata Swallen	E	S1S2	G4T3
Carex corrugata Fernald	SC	S3?	G5?
Carex rugosperma Mackenzie	SC	S3?	G5T5
Castanea dentata (Marsh.) Borkh.	E	S1	G3
Clematis catesbyana Pursh.	T	S2	G4T5
Clematis glaucophylla Small.	T	S2	G4?
Dryopteris carthusiana (Vill.) H.P. Fuchs	SC	S3	G5
Elymus svensonii Church	T	S2S3	G3
Gratiola viscidula Pennell	T	S2	G4G5
Juglans cinerea L.	T	S2S3	G3
Juncus articulatus L.	SC	S2S3	G5
Lathyrus venosus Muhl. ex Willd.	SC	S2S3	G5
Muhlenbergia cuspidata (Torr. ex Hook) Rydb.	T	S2	G5
Panax quinquefolius L.	CE	S3	G3G4
Patis racemosa (Sm.) Romasch., P.M. Peterson, & Soreng.	SC	S3?	G5
Paxistima canbyi A. Gray	E	S1	G2?
Phlox subulata L.	SC	S3	G5
Symphoricarpos albus (L.) S.F. Blake	E	S1	G5T5
Trichostema setaceum Houtt.	E	S1	G3G4

*Source of S and G ranks

quinquefolius, is considered Commercially Exploited. *Calamogrostis insperata* was documented by J. Campbell growing along the Grassy Knob Ridge System in dry woods on narrow ridges above limestone cliffs. *Amelanchier spicata* was collected in 1988 by L. McKinney near a small grassy opening on Ravenna Knob, found in dry forests above limestone cliffs with *Paxistima canbyi*.

One state-listed species, *Cypripedium kentuckiense*, has been reported by Reed (1981) and the United States Forest Service (*n.d.*) as occurring in Estill County, but this taxon was not documented in the present study. One hundred sixty taxa collected by the first author represent new county records. Not including state-listed species, 35 taxa are designated as "noteworthy" (Table 4). They are found in 10 or fewer counties within the state (Campbell & Medley 2018; Shaw et al. 2022) or listed in SERNEC Data Portal (2022) as "detailed locality information protected." iNaturalist (2023) provides documented photographs of plants from Estill County. It gives the location, date and photographer name for each species listed. Ten plant species listed for the county on iNaturalist (2023), but not collected during the present study, and not included in the annotated species list, are; *Arnoglossum atriplicifolium*, *Brassica rapa*, *Cleome hassleriana*, *Iodanthus pinnatifidus*, *Magnolia macrophylla*, *Muscari botryoides*, *Perilla frutescens*, *Populus deltoides*, *Sagittaria calycina*, and *Spiranthes vernalis*.

Species Richness

County flora comparisons were made regarding physiographic region, size of county (ha), and species richness (number of taxa). Estill County's rich flora of 963 exceeds the 954 predicted for the county (Wade and Thompson 1991) and that of other floras of similar size and from the same physiographic region (Table 5). Comparative examples include 713 taxa from Clark County (Outer Bluegrass, Knobs), 961 from Garrard County (Outer Bluegrass, Knobs), 877 from Clinton County (Cumberland Plateau), 671 from Jackson County (Cumberland Plateau), and 805 from Bullitt County (Outer Bluegrass, Knobs). County floras showing lower numbers of taxa than Estill County (Table 5), but covering larger areas, may be attributed to different habitat types, elevation, geology, land use history, lack of field collecting, and herbarium searches (Henry—575, Bullitt—805, Casey—252, and Jackson—671). Estill County has the highest number of total taxa among the ten counties listed in Table 5. Statewide, Estill County has the third highest number of species for a single county flora behind Calloway County (Woods & Fuller 1988) with 1,018 species and Hardin County (Cranfill 1991) with 1,126 species. Of the four county floras in the Cumberland Plateau, Estill County has the highest number of documented taxa (963), compared to Clinton County (877), Jackson County (671), and McCreary (692).

The species richness (number of species per hectare) of Estill County (1.5) compares favorably with other county floras from the Outer Bluegrass, Knobs, and Cumberland Plateau (Table 5). Four counties rank higher than Estill County. They include Boyle (1.52), Garrard (1.59), Clinton (1.65), and Oldham (1.67). It should be noted that Estill County is larger in size than the preceding four counties.

Accurate comparisons are affected by several factors, such as size of study area, physical factors (climate, geology, topography, soil composition etc.), difference between physiographic regions, different land use histories, collecting frequency and thoroughness, methods and manuals utilized to identify taxa, nomenclatural changes, and inclusion of taxa (varieties, subspecies, and hybrids). Wharton and Barbour (1991) state "No floristic account of a region is ever complete because every square meter of ground cannot be covered at all seasons."

Rare Species

Of the 474 species listed by Rodgers et al. (2022) for Kentucky, twenty-three are here documented for Estill County. Two woody species, *Castanea dentata* and *Juglans cinerea*, are being threatened by chestnut blight and butternut canker, respectively (Thompson & Fleming 2004). Each taxon is given below, with a brief description of range, listed status, general locality, habitat, Kentucky county distribution and common associates. Sources for the county distribution include SERNEC Data Portal (2022), Shaw et al. (2022), and Campbell and Medley (2018).

In addition to these twenty-three taxa, seven species documented represent formerly state-listed taxa by Warren et al. (1986), KSNPC (1996, 1997, 1999, 2000, 2001, 2010, 2012, & 2015), and OKNP (2019a). They include *Cystopteris tenuis*, *Dichanthelium boreale*, *Malus angustifolia*, *Monarda bradburiana*, *Nabalus albus*,

Table 4. Noteworthy plant species of Estill County, Kentucky, documented in less than10 counties in state.*

Aplectrum hyemale (Muhl. ex Willd.) Torr.	*Mosla dianthera* (Buch.-Ham.) Maxim.
Asplenium ruta-muraria L. var. *cryptolepis* (Fernald) Wherry	*Muhlenbergia capillaris* (Lam.) Trin.
Carex muhlenbergii Schkuhr ex Willd.	*Nabalus albus* (L.) Hook.
Chenopodium standleyanum Aellen	*Platanthera flava* (L.) Lindl. var. *herbiola* (R. Br.) Luer
Coreopsis grandiflora Hogg	*Platanthera flava* (L.) Lindl.
Cypripedium acaule Aiton	*Ricinus communis* L.
Dichanthelium bicknelli (Nash) LeBlond	*Salix alba* L.
Erianthus giganteus (Walter) P. Beauv.	*Scirpus pungens* (Vahl) Palla.
Eurybia schreberi (Nees) Nees	*Smilax ecirrhata* (Engelm. ex Kunth.) S. Watson
Galactia volubilis (L.) Britton	*Solidago harrisii* Steele
Galium divaricatum Pourr. ex Lam.	*Sorghum bicolor* (L.) Moench
Hydrastis canadensis L.	*Spiranthes cernua* (L.) G. Don
Hypopitys lanuginosa (Michx.) Small	*Sporobolus compositus* (Poir.) Merr. var. *drummondii* (Trin.)
Ipomoea cordatotriloba Dennst.	Kartez & Gandhi (Poir.) Merr.
Juncus articulatus L.	*Sporobolus indicus* (L.) R.Br.
Juncus scirpoides Lam.	*Swida racemosa* (Lam.) Moldenke
Lagerstroemia indica L.	*Tipularia discolor* (Pursh) Nutt.
Leucothoe fontanesiana (Steud.) Sleumer	*Vernonia noveboracensis* (L.) Michx.

*Future monitoring should be conducted.

Table 5. Species richness of Estill County compared to other floras in the Outer Bluegrass (OB), Knobs (K), & Cumberland Plateau (CP).

County (Study)	Physiographic Region	Size(ha)	Species Richness	Species/ha Value
McCreary County (Rogers 1941)	CP	117,44	692	0.59
Clark County (Beckett, 1956)	OB,K	66,200	713	1.08
Oldham County (Matthews 1967)	OB	50,764	846	1.67
Henry County (Gentry 1963)	OB,K	75,369	575	0.76
Bullitt County (Gunn 1968)	OB,K	76,949	805	1.05
Casey County (Murphy 1970)	K	115,513	252	0.22
Estill County	OB,K,CP	66,304	963	1.50
Jackson County (Abner 1993)	CP	89,873	671	0.75
Clinton County (Gorton 2000)	CP	53,095	877	1.65
Garrard County (Overbeck 2014)	OB,K	60,606	961	1.59
Boyle County (Braunreiter 2015)	OB,K	47,397	722	1.5

Silphium terebinthanaceum, and *Synandra hispidula*. Six herbaceous species considered rare or infrequent by the first author include *Elymus macgregorii* var. *hirsutispiculus*, *Hypopitys lanuginosa*, *Juncus scirpoides*, *Platanthera flava* var. *flava*, *P. flava* var. *herbiola*, *P. lacera*, and *Spiranthes cernua*. State rarity status of *Elymus macgregorii* var. *hirsutispiculus* for Kentucky is currently unknown. Haines (2020) states "this new variety is likely rare in most states it is encountered in."

Four species not documented by this study have been listed as rare in Estill County and are currently being monitored by OKNP (2018). They include *Castanea pumila* (Threatened), *Solidago puberula* (Special Concern), *Spiranthes lucida* (Threatened), and *Thaspium pinnatifidum* (Threatened).

The 23 rare, state-listed species monitored by Rodgers et al. (2022) follow alphabetically:

1) ***Amelanchier spicata*** (Lam.) K. Koch (Running Serviceberry) Endangered (E)
Running serviceberry is a deciduous shrub occurring in the upland forests of the AP (Jones 2005). Medley (1993) recorded it as rare in dry woodlands on a limestone ridge in Estill County in the Cliff Section of the Cumberland Plateau. In 1988, *Amelanchier spicata* was discovered near a small grassy opening above limestone cliffs on the western end of Ravenna Knob [*McKinney 94* (EKY)]. This collection represents the first and only record for *A. spicata* in Kentucky. This serviceberry is known from 29 states in the central and eastern United States (USDA, NRCS 2022). In Kentucky, this shrub has only been reported from Estill County (Campbell & Medley 2018; SERNEC Data Portal 2022; USDA, NRCS 2022).

2) ***Asclepias purpurascens*** L. (Purple Milkweed) Special Concern (SC)
Purple milkweed is a native perennial occurring in 29 states throughout the eastern and central United States (USDA, NRCS 2022). It was first documented in Kentucky from Jefferson County in 1800 [*Mueller n.d.* (MIN)]. This milkweed is distributed throughout the state except for the mountainous, eastern portion. Medley (1993) lists purple milkweed as uncommon in prairies, woodland edges and openings, and on roadsides in eastern Kentucky (Carter County); in the Bluegrass (Campbell and Fleming counties); in the Knobs (Bath, Boyle, Bullitt, Estill, Lincoln, Montgomery, Powell, and Rockcastle counties); on the Highland Rim (Breckinridge, Grayson, Hardin, Lincoln, Lyon, Meade, Pulaski, and Trigg counties); in the Shawnee Hills (McLean and Ohio counties); and on the Coastal Plain (Ballard and McCracken counties). Three counties (Fleming, Ohio, and Rockcastle) listed by Medley (1993) do not have documented specimens in the SERNEC Data Portal (2022). The SERNEC Data Portal (2022) lists Adair, Anderson, Barren, Caldwell, Christian, Crittenden, Garrard, Jefferson, Knox, Lewis, Livingston, Marshall, Owsley, Robertson, Union, Washington, and Webster counties. Campbell and Medley (2018) added Cumberland County. USDA NRCS (2022) also lists Edmonson County. *A. purpurascens* plant was documented along a roadside in Estill County [*Medley and Thieret 10761-84* (APSC)].

3) ***Aureolaria patula*** (Chapman) Pennell (Spreading False Foxglove) Special Concern (SC)
Spreading false foxglove is a hemi-parasitic perennial native to the upper southeastern United States (Chafin 2007) and occurs in the IP and AP (Jones 2005). *Aureolaria patula* occupies limestone slopes of canopy openings in mixed hardwood forests (KSNPC 2015). The first known documentation of this plant in Kentucky was in 1923 from Nelson County [*McFarland 365* (IND)]. *A. patula* is only known from Alabama, Georgia, Kentucky, and Tennessee (USDA, NRCS 2022). Medley (1993) reports it as rare on woodland limestone bluffs in the Shawnee Hills (Edmonson County); on the Highland Rim (Hart); and on the Big South Fork of the eastern Highland Rim (McCreary and Pulaski counties). In Kentucky, spreading false foxglove occurs in the south-central part of the state. It is listed in SERNEC Data Portal (2022) as occurring in seven counties (Barren, Edmonson, Estill, Hart, McCreary, Nelson, and Pulaski) and mapped by Campbell and Medley (2018) in eight counties (Adair, Butler, Clinton, Cumberland, Green, Taylor, Warren, and Wayne). USDA, NRCS (2022) added two counties (Logan and Russell). Specimens [*Guetig 771* (EKY)] were documented on dry, open ridgetops along Mississippian limestone cliffs near the Upper White Oak School. Woody associates include *Celtis pumila*, *Fraxinus quadrangulata*, *Quercus marilandica*, *Rhus aromatica*, *Symphoricarpos albus*, *Vaccinium stamineum*, and *Viburnum rufidulum*.

4) ***Bouteloua curtipendula*** (Michx.) Torr. (Side-Oats Grama) Special Concern (SC)
Side-oats grama, a perennial warm season grass, occurs in hill prairies (in Illinois), dry upland prairies, glades, and thinly wooded bluffs and barrens (OKNP 2015, 2018; Hilty 2019). In Kentucky, it is known from the IP, occurring in barrens and grassy slopes (Jones 2005). Medley (1993) reports *Bouteloua curtipendula* as rare in prairies, cedar glades, and on limestone cliff edges. The first documentation of side-oats grama in Kentucky was from Lincoln County in 1835 [*Short n.d.* (USCH)]. Campbell and Medley (2018) mapped it from Estill, Jefferson, Lewis, Lincoln, Logan, Madison, Robertson, Rowan, and Warren counties. In addition to these counties, SERNEC Data Portal (2022) documents side-oats grama from Garrard County. USDA, NRCS (2022) also reports it from Boone, Clark, Edmonson, Hardin, and Oldham counties. Several individuals were discovered growing on an outcrop of Grassy Knob, a xeric limestone prairie located in Camp Burnamwood [*Guetig 959* (EKY)]. *B. curtipendula* and *Muhlenbergia cuspidata* are considered "local dominants" in grassy openings on limestone outcrops (Campbell et al. 1989). Common grassy associates include *Agrostis perennans*, *Andropogon gerardii*, *Dichanthelium boscii*, *D. laxiflorum*, *Schizachyrium scoparium*, *Sorghastrum nutans*, and *Sporobolus neglectus*. Invasive plant species are a threat to *B. curtipendula*.

5) ***Calamagrostis insperata*** Swallen (Porter's Reed Grass) Endangered (E)
Porter's reed grass occurs in the AP (Jones 2005) on north-west and north-east facing dry mesic forests (KSNPC 2015; OKNP 2018). Medley (1993) describes this plant as rare in dry mesic woodlands on limestone, siltstone, and sandstone ridge tops and slopes in Estill County in the Cliff Section of the Cumberland

Plateau. *Calamagrostis insperata* is reported from Arkansas, Georgia, Illinois, Indiana, Kentucky, Mississippi, Ohio, and Tennessee (USDA, NRCS 2022). Campbell and Medley (2018) and USDA, NRCS (2022) mapped Porter's reed grass for only Estill County. SERNEC Data Portal (2022) does not list any record of *C. insperata* in Kentucky. This plant was first discovered in 1988 along the White Oak Cliff section in Estill County [*Campbell n.n.* (KY)]. Patches of *C. insperata* were found growing in dry woods on narrow ridges above limestone cliffs. Common associates on limestone outcrops include *Paxistima canbyi*, *Quercus montana*, and *Q. muehlenbergii*. The largest patch of this plant was found with *Rhus aromatica* in transitional forest of oak-ash and sugar maple (Campbell et. al. 1989).

6) ***Carex corrugata*** Fernald Prune-fruit Sedge. Special Concern (SC)
Prune-fruit sedge is found in the Mississippi Embayment and IP of Kentucky (Jones 2005), occurring sporadically throughout these regions. Kentucky is the northern limit for *Carex corrugata* and is usually found in wet-mesic deciduous forests, calcium-rich alluvial clay, and silts on floodplains (Naczi 1992; Naczi et al. 2002). It was not listed for Kentucky by Medley (1993), although it was first documented in Kentucky for Hardin County in 1977 [*Cranfill 239a* (MICH)]. Campbell and Medley (2018) and USDA NRCS (2022) mapped *C. corrugata* for six counties in Kentucky (Butler, Campbell, Fulton, Hardin, McCracken, and Union). USDA, NRCS (2022) reports this sedge from 17 states. SERNEC Data Portal (2022) documents specimens from two additional counties (Estill and Jackson). In 1999, the prune-fruit sedge was collected in Estill County at the edge of an open, pastured, mesic forest upslope from Knob Lick Branch [*Naczi 7801* (MICH)].

7) ***Carex rugosperma*** Mackenzie Parachute Sedge. Special Concern (SC)
Parachute sedge, a perennial herb, occurs in dry to mesic woodlands and prairies (Jones 2005; KSNPC 2015; OKNP 2018). In Kentucky, it is known from the IP and AP (Jones 2005). Medley (1993) describes *Carex rugosperma* as rare on rock outcrops in Lewis County; on a dry ridge in Lawrence County; and in dry woodlands on ridgetops in Powell and Wolfe counties. In 1981, *C. rugosperma* was first documented in Fleming County [*Hannan and Phillippe 6770* (EKY)]. This sedge has been reported from 14 counties in Kentucky. Campbell and Medley (2018) mapped the parachute sedge from Carter, Harlan, Jackson, Knott, Lawrence, Leslie, Lewis, Martin, and McCreary counties. SERNEC Data Portal (2022) also documents *C. rugosperma* from Estill and Fleming counties. USDA, NRCS (2022) reports this sedge from 20 states and 24 counties in Kentucky, including the following counties not previously listed; Boyd, Bullitt, Casey, Crittenden, Elliott, Floyd, Greenup, Hardin, Jefferson, Livingston, Menifee, Powell, and Rowan. Several plants were documented on a limestone outcrop on Grassy Knob [*Guetig 955* (EKY)]. Woody associates include *Smilax rotundifolia*, and *Vitis aestivalis*.

8) ***Castanea dentata*** (Marsh.) Borkh. American Chestnut. Endangered (E)
The American chestnut constituted one of every four trees in the AP in Kentucky and reached its greatest density in the Cumberland Mountains (Rhodes & Park 2001). The chestnut blight (*Cryophonectria parasitica*) has decimated the American chestnut throughout its range (Wang et al. 2013; Buland et al. 2020). The blight spread across the southern Appalachians and Kentucky during the 1920s and 1930s (Cochran 1990). It is estimated that by 1940, the chestnut blight had killed 50-99% of American chestnuts throughout its range (Oak 2002). *Castanea dentata* occurs across Kentucky (IP and AP) in dry to mesic forests and acidic woodlands (Jones 2005). Medley (1993) reports *C. dentata* was formerly abundant in dry to mesic forests in the Cumberland Mountains, Appalachian Plateau, Knobs, eastern Highland Rim and the eastern and southern margins of the Shawnee Hills. In Kentucky, American chestnut was first documented from Harlan County in 1893 [*Kearney 110* (NCU)]. In 1979, this plant was collected in Estill County growing on the west side of Hill Road [*Evans July 4, 1979* (EKY)].

Castanea dentata has been reported from 88 counties in Kentucky. SERNEC Data Portal (2022) mapped this tree for 58 counties. Campbell & Medley (2018) added Knott, Magoffin, and Ohio counties. USDA NRCS (2022) also added Anderson, Ballard, Boone, Caldwell, Campbell, Carrol, Christian, Crittenden, Davies, Fayette, Franklin, Fulton, Grant, Grayson, Hopkins, Henry, Hickman, Jessamine, Kenton, Livingston, Lyon, McCracken, McLean, Morgan, Oldham, Roberston, and Spencer counties.

9) ***Clematis catesbyana*** Pursh Satin Curls. Threatened (T)
Satin curls is native to north central and eastern United States (POWO 2022). It is restricted to several disjunctive regions in the SEUS (Essig 1990). Medley (1993) listed *Clematis catesbyana* as rare along roadsides and ditches in Warren County on the Highland Rim. The first documented specimen of satin curls in Kentucky was in 1970 [*Nicely and Gough 3069* (NCU)]. They found this climbing vine along roadsides and ditches in Warren County. *C. catesbyana* is known from only five counties in Kentucky; Clinton, Estill, Harlan, Jackson, and Warren (SERNEC Data Portal 2022). Campbell and Medley (2018) and USDA NRCS (2022) mapped *C. catesbyana* for only Warren County in Kentucky. In Estill County, satin curls was documented in 2009 from Preacher Estes Mountain [*Estes et al. 10692* (APSC)]. It was found on an upper south-facing slope above a narrow dirt road.

10) ***Clematis glaucophylla*** Small Whiteleaf Leather-Flower. Threatened (T)
Clematis glaucophylla has a native range from Oklahoma to the southeastern United States (POWO 2022). It occurs in the IP and AP of Kentucky, usually in mesic woods and thickets (Jones 2005). Medley (1993) listed whiteleaf leather-flower as rare on a prairie edge in Rowan County on the Allegheny Plateau and on sandstone boulder-cobble bars on the banks of the Cumberland River in McCreary and Whitley counties. The first herbarium account of *C. glaucophylla* in Kentucky was in 1963 [*Browne and Browne 6802* (MEM)]. It was documented from Hart County. Whiteleaf leather-flower is known from 22 counties in Kentucky, primarily in the eastern portion of the state. SERNEC Data Portal (2022) documents it from Barren, Clay, Clinton, Cumberland, Edmonson, Estill, Hart, Laurel, Letcher, McCreary, and Pulaski counties. Campbell and Medley (2018) mapped an additional seven counties, including Bell, Carter, Lewis, Menifee, Powell, Rowan, and Rockcastle. USDA, NRCS (2022) also mapped Carlisle, Fleming, Owsley, and Warren counties. In Estill County, *C. glaucophylla* was found growing in a wet ditch at the base of a mesic wooded slope along the floodplain of the Kentucky River [*Guetig 277* (EKY)]. Woody associates were *Carya cordiformis*, *C. glabra*, *Juglans nigra*, *Platanus occidentalis*, *Rhus glabra*, *Smilax bona-nox*, and *Ulmus alata*.

11) ***Dryopteris carthusiana*** (Vill.) H.P. Fuchs Spinulose Woodfern. Special Concern (SC)
Dryopteris carthusiana occurs in the IP and AP and is found in mesic to wet woods (Jones 2005) and acidic, organic-rich bogs (KSNPC 2015). Medley (1993) describes it as rare in mesophytic woodlands on the Coastal Plain (Hickman County); in the Shawnee Hills (Muhlenberg County); in the Bluegrass (Jefferson, Kenton, Oldham, and Shelby counties); and on the eastern Highland Rim (Rockcastle County). In Kentucky, the spinulose woodfern was first recorded from Wolfe County in 1859 [*Wilson 1004* (MU)]. In 1982, this plant was collected in Estill County in a pine forest on Happy Top Mountain [*Pounds s.n.* (EKY)]. *D. carthusiana* is known from 28 counties in Kentucky. Campbell and Medley (2018) mapped the spinulose woodfern for Bell, Bourbon, Carlisle, Carter, Estill, Harlan, Harrison, Jackson, Kenton, Laurel, Lewis, Madison, Muhlenberg, Powell, Rockcastle, Rowan, and Wolfe counties. SERNEC Data Portal (2022) documents this plant for Caldwell, Elliott, Fleming, Greenup, Larue, and Menifee counties. USDA, NRCS (2022) added Henry and Oldham counties.

12) ***Elymus svensonii*** G.L. Church Svenson's Wildrye. Threatened (T)
Elymus svensonii is endemic to the IP of Kentucky and Tennessee (NatureServe 2022). Svenson's wildrye occurs on limestone bluffs with shallow soils, especially on rocky slopes and ledges (KSNPC 2015; OKNP 2018). In Kentucky, it inhabits xeric woodlands (Jones 2005). This plant has only been documented from five states; Arkansas, Kentucky, Mississippi, Oklahoma, and Tennessee (USDA, NRCS 2022). Medley (1993) reports Svenson's wildrye as rare on dry-mesic wooded bluffs along the Dix and Kentucky Rivers in the Bluegrass (Anderson, Franklin, Garrard, Henry, Jessamine, Mercer, Owen, and Woodford counties); and on a limestone ridge in the Cliff Section of the Cumberland Plateau (Estill County). Campbell and Medley (2018) mapped *E. svensonii* for Adair, Anderson, Franklin, Garrard, Jessamine, Mercer, Owen, and Woodford counties. USDA NRCS (2022) lists Anderson, Estill, and Fayette counties. SERNEC Data Portal (2022) added Henry County and BONAP (2022) Shelby County. The first documentation of *E.*

svensonii in Kentucky was from Anderson County in 1956 [*Wharton 10079b* (EKY)]. Svenson's wildrye was collected on a limestone ridgetop near Preacher Estes Mountain (PEM) in Estill County [*Campbell s.n.* (KY)]. About 20 plants were found in an open oak-ash-cedar woodland (Campbell et al. 1989).

13) ***Gratiola viscidula*** Pennell. Short's Hedge Hyssop. Threatened (T)

Gratiola viscidula is native to North America. It occurs in open wetlands, alluvial forests, and wet streambanks in the IP and AP (Jones 2005; KSNPC 2015). Medley (1993) describes Short's hedge hyssop as rare on wet stream banks and meadows on the Appalachian Plateau (Estill, Greenup, Knox, Laurel, Rowan, and Whitley counties); on floating mats in the eastern Knobs (Bath County); and on floating mats or in sinkhole ponds on the Highland Rim (Hart and Wayne counties). In Kentucky, the first herbarium record for *G. viscidula* was in 1978 from Knox County [*Stamper 30* (EKY)]. It was rooted in mud along a creek bank. Campbell and Medley (2018) mapped Short's hedge hyssop from Bath, Estill, Greenup, Hart, Knox, Laurel, Rowan, and Wayne counties. SERNEC Data Portal (2022) added Carter County. USDA, NRCS (2022) also listed Jackson and Whitley counties. In 1978, *G. viscidula* was documented in Estill County [*Lassetter s.n.* (EKY)]. It was discovered in a marshy area along a floodplain of the Kentucky River at the east end of Ravenna. Common associates were *Saurus cernuus*, *Carex* spp., and *Scirpus* spp.

14) ***Juglans cinerea*** L. Butternut. Threatened (T)

Juglans cinerea is native to central and eastern United States and southeastern Canada (Schultz 2003). It occurs across Kentucky in bottomlands, ravines and moist slopes (Jones 2005; KSNPC 2015). Medley (1993) lists *J. cinerea* as formerly frequent in mesic wooded ravines and along streams throughout the state, but considered it rare on the Coastal Plain. Butternut is listed for 85 counties in Kentucky. USDA, NRCS (2022) mapped 83 counties with SERNEC Data Portal (2022) adding Garrard and Larue. Populations have been drastically affected by the butternut canker (*Sirococcus clavigigneti-juglandacearum*) (Nature Serve 2022). The first documentation of *J. cinerea* in Kentucky was in 1909 from Logan County [*Eggleston 5436* (NY)]. In Estill County, butternut was found growing on a mesic slope near a rock house along the Iron Furnace Trail in the DBNF [*Guetig 855* (EKY)]. Woody associates included *Acer saccharum*, *Asimina triloba*, *Carpinus caroliniana*, *Carya ovata*, *Fraxinus americana*, *Liriodendron tulipifera*, *Morus alba,* and *Ulmus rubra*.

15) ***Juncus articulatus*** L. Jointed Rush. Special Concern (SC)

Juncus articulatus is native to Eurasia, Canada, and the United States. In Kentucky, this perennial rush occurs in wet meadows, bogs, and shores (Jones 2005; KSNPC 2015; OKNP 2018). Medley (1993) lists jointed rush as rare in low wet ground and along stream margins in the Cliff Section of the Cumberland Plateau (Carter, Elliott, Estill, Lee, Rowan, and Wolfe counties). In Kentucky, this plant was first discovered in Carter County in 1965 [*Browne and Browne 11035* (MDKY)]. *J. articulatus* is known from 11 counties in Kentucky, primarily in the eastern portion. Campbell and Medley (2018) mapped this rush for Carter, Elliott, Estill, Lee, Madison, Perry, Rowan, and Wolfe counties. SERNEC Data Portal (2022) also documents Greenup, Kenton, and Pendleton counties. USDA, NRCS (2022) lists the same counties. Jointed rush was discovered in Estill County on limestone ledges near streams and in open forests, usually mixed with grasses (Campbell et al. 1989). A specimen from Estill County is located at the University of Kentucky Herbarium [*Campbell n.d.* (KY)].

16) ***Lathyrus venosus*** Muhl. ex Willd. Smooth Veiny Peavine. Special Concern (SC)

Lathyrus venosus, a perennial herb, occurs in dry to mesic woods, especially in base-rich soils (KSNPC 2015), and along streams in the Cumberland Mountains of the AP (Jones 2005). Medley (1993) describes smooth veiny peavine as rare on ridgetops and upper slopes in the Cumberland Mountains (Bell County) and on the Cumberland Plateau (Estill, Floyd, Leslie, Perry, and Whitley counties). This plant was first discovered in Kentucky in 1983 from Bell County [*Medley 8047-83* (APSC)]. Campbell and Medley (2018) mapped *L. venosus* for Bell, Estill, Floyd, Owsley, and Whitley counties. SERNEC Data Portal (2022) documents McCreary County with USDA, NRCS (2022) adding Harlan and Leslie counties. Two sites were discovered in the Grassy Knob Ridge System below limestone cliffs in dry woods and thickets with

small openings (Campbell et al. 1989). In 1988, smooth veiny peavine was documented in Estill County along a steep, south-facing slope at the west end of a cliff above White Oak Creek [*Campbell n.d.* (EKY)]. Common woody associates include *Carya glabra*, *Ceanothus americanus*, *Cercis canadensis*, *Fraxinus americana*, *Juniperus virginiana*, *Pinus virginiana*, and *Quercus* spp.

17) ***Muhlenbergia cuspidata*** (Torr) Rydb. Plains Muhly. Threatened (T)

Muhlenbergia cuspidata is native to central Canada and the United States (Fryer 2009) and occurs in barrens and hillsides of the IP (Jones 2005; KSNPC 2015). Medley (1993) lists plains muhly as rare on limestone cliff edges in the Inner Bluegrass (Garrard County); on the eastern Highland Rim (Pulaski County); and in the Cliff Section of the Cumberland Plateau (Estill County). The first documented specimen of *M. cuspidata* in Kentucky was from Pulaski County in 1939 [*Braun 2631* (NY)]. SERNEC Data Portal (2022) mapped plains muhly for Estill, Garrard, and Pulaski counties. Campbell and Medley (2018) also listed Logan and Wayne counties. USDA, NRCS (2022) added Anderson and Russell counties. Several plants of *M. cuspidata* were discovered growing on a southwest-facing outcrop of Grassy Knob, a xeric limestone prairie located in Camp Burnamwood [*Guetig 957a* (EKY)]. It occurs in scattered clumps at most exposed edges of the outcrop where soil is shallow (less than or equal to 5cm). Common woody associates are the same as *Bouteloua curtipendula*. Campbell et al. (1989) reported *M. cuspidata* at four sites along the Grassy Knob Ridge System. All sites were southwest-facing limestone cliffs. In Kentucky, it may serve as an indicator of long established grasslands, especially for other xeric limestone prairies.

18) ***Panax quinquefolius*** L. Ginseng. Commercially Exploited (CE)

Panax quinquefolius is native to hardwood forests in eastern North America (MDNR 2022). In Kentucky, ginseng occurs in mesic forests throughout the state, but its frequency has declined because of historical and current harvesting for its medicinal qualities (McGraw et al. 2003; Jones 2005; Case et al. 2007). Medley (1993) reports *P. quinquefolius* as rare in mesic woodlands, possibly in every county. The first known documented specimen for this perennial in Kentucky was in 1842 [*Short s.n.* (NY)]. No county distribution data was provided. The first county record in the state was recorded for Lyon County in 1909. [*Eggleston 4739* (NY)].

Panax quinquefolius has been reported from 74 counties in Kentucky. SERNEC Data Portal (2022) lists ginseng for 62 counties. USDA NRCS (2022) added Boone, Clark, Fayette, Hickman, Owen, and Woodford counties. Two plants of ginseng were found growing in a steep northeast-facing mesic ravine near a rock house in the Cottage Furnace area of the DBNF [*Guetig 394* (EKY)]. Common woody associates include *Acer saccharum*, *Asimina triloba*, *Benthamidia florida*, *Fagus grandifolia*, *Lindera benzoin*, and *Liriodendron tulipifera*.

19) ***Patis racemosa*** (Sm.) Romasch., P.M. Peterson, & Soreng Black–Seeded Rice Grass. Special Concern (SC)

Patis racemosa is found throughout North America, usually occurring in dry to mesic, often rocky forests of the IP and AP (Jones 2005). Medley (1993) reports black-seeded rice grass as rare on mesic to dry-mesic limestone bluffs, edges of limestone boulders and above or near streams in the Bluegrass (Anderson, Clark, Garrard, Jessamine, and Trimble counties); and in the Cliff Section of the Cumberland Plateau (Estill, Jackson, Menifee, and Rowan counties). In Kentucky, the first herbarium record for *P. racemosa* was from Rowan County [*Braun 4820* (MO)]. SERNEC Data Portal (2022) documents this grass from Carter, Estill, Jackson, Rowan, and Trimble counties. Campbell and Medley (2018) added Clark, Jessamine, and Powell counties. USDA, NRCS (2022) also listed Garrard and Menifee counties. In Estill County, black–seeded rice grass was documented in 1988 [*Campbell n.d.* (KY)].

Patis racemosa was found in the Grassy Knob and Preacher Estes Mountain Ridge System on dry north or north-facing limestone clifftop ledges. Common woody associates include *Benthamidia floida*, *Fraxinus quadrangulata*, *Juniperus virginiana*, *Quercus muehlenbergii*, *Q. rubra*, and *Symphoricarpos albus* (Campbell et al. 1989, 1991).

20) ***Paxistima canbyi*** A. Gray Canby's Mountain Lover. Endangered (E)

Paxistima canbyi is a dwarf, broadleaf evergreen shrub that is native to the eastern United States. In

Kentucky, it occurs on calcareous rocks and slopes and in dry woodland ridges and limestone cliff lines in the IP and AP (Jones 2005). Medley (1993) lists Canby's mountain lover as rare on dry, narrow, wooded limestone ridges and cliff edges on the Allegheny Plateau (Carter County); on knobs and ridges on the Cumberland Plateau (Estill, Jackson, and Powell counties); above the Big South Fork on the eastern Highland Rim (McCreary, Pulaski, and Wayne counties); and along Jessamine Creek in the Inner Bluegrass (Jessamine County). The first documentation of *P. canbyi* in Kentucky was from Carter County in 1936 [*Braun 1176* (GH)]. SERNEC Data Portal (2022) documents this shrub from Campbell, Carter, Estill, Jackson, Jessamine, McCreary, Pulaski, and Wayne counties. Campbell and Medley (2018) added Powell County. USDA, NRCS (2022) added Russell County. In Estill County, Canby's mountain lover was documented growing on the eastside of White Oak Creek along Chamberlain Branch in the DBNF [*Campbell n.s.* (KY)]. *P. canbyi* was also recorded from limestone cliffs projecting from Preacher Estes Mountain (Campbell et al. 1991). Common woody associates include *Fraxinus quadrangulata*, *Juniperus virginiana*, *Ostrya virginiana*, *Quercus muehlenbergii*, *Q. rubra*, *Rhus aromatica*, and *Rosa carolina* (Campbell et al. 1989).

21) ***Phlox subulata*** L. Moss-Pink. Special Concern (SC)

Phlox subulata is native to the eastern and central United States (MOBOT 2022). In Kentucky, it occurs in the IP and AP in sandy or rocky woods and cliff lines (Jones 2005). Medley (1993) reports moss-pink as rare on limestone cliff edges and sandstone ridge crests on the Allegheny Plateau (Carter, Menifee, Morgan, and Rowan counties); in the Knobs (Bath, Estill, Jefferson, Powell, and Rowan counties); in the Bluegrass (Fayette and Shelby counties); on the Highland Rim (Adair County); and on the Coastal Plain (Calloway County). The first documentation of *P. subulata* in Kentucky was in 1837 [*Short s.n.* (NCU)]. However, no county data was provided. In 1927, *P. subulata* was documented growing in Estill County [*Anderson 425* (GH)]. Campbell and Medley (2018) mapped moss-pink for Bath, Carter, Estill, Jackson, Madison, Powell, and Rowan counties. SERNEC Data Portal (2022) documents an additional nine counties (Adair, Breathitt, Calloway, Elliott, Floyd, Greenup, Kenton, Lawrence, and Perry). USDA, NRCS (2022) added Fayette, Garrard, Jessamine, Morgan, and Rockcastle counties. Several populations of *P. subulata* were found along narrow limestone ridgetops of the Upper White Oak Creek area of the Grassy Knob Ridge System (*Guetig 754* (EKY)]. Large patches were found in small grassy opening on the clifftops. Common woody associates include *Celtis pumila*, *Fraxinus quadrangulata*, *Juniperus virginiana*, and *Quercus marilandica*.

22) ***Symphoricarpos albus*** (L.) S.F. Blake Common Snowberry. Endangered (E)

Symphoricarpos albus is a small shrub native to North America, usually occurring in open, rocky, limestone woods and on calcareous ledges and woodlands in the IP (Jones 2005; McWilliams 2000; KSNPC 2015). Medley (1993) lists common snowberry as rare on narrow limestone ridges and cliff edges in the Knobs (Estill, Jackson, and Madison counties); and in the Cliff Section of the Cumberland Plateau. The first documented specimen of this plant in Kentucky was in 1903 from Fayette County [*Didlake s.n.* (KNK)]. Campbell and Medley (2018) and USDA, NRCS (2022) mapped *S. albus* for Estill, Jackson, and Madison counties. SERNEC Data Portal (2022) reported Fayette County. Common snowberry was found in Estill County in open forests on xeric limestone ridgetops of the Upper White Oak Creek along the Grassy Knob Ridge System [*Guetig 728* (EKY)]. Common woody associates include *Fraxinus americana*, *F. quadrangulata*, and *Quercus muehlenbergii*. Campbell et al. (1991) reported two sites (open oak-ash-cedar forests and thickets) in the Preacher Estes Mountain area.

23) ***Trichostema setaceum*** Houtt. Narrow-Leaved Blue Curls. Endangered (E)

Trichostema setaceum is an herbaceous annual native to the eastern United States. It occurs across Kentucky in dry to mesic, open woods and fields (Jones 2005) and around rock outcrops of the Coastal Plain (KSNPC 2015). Medley (1993) lists it as rare or frequent in dry to moist meadows, fields, disturbed areas, and open oak-hickory woodlands on the Coastal Plain (Calloway and Fulton counties); in the Appalachian Plateau (Johnson and Knox counties); and in the Knobs (Bullitt, Clark, Estill, and Lincoln

counties). Narrow-leaved blue curls was first documented in Kentucky in 1939 [*Wharton 422* (NCU)]. She discovered it in Estill County one mile southeast of Hargett in dry oak-hickory woods. Campbell and Medley (2018) mapped *T. setaceum* for Calloway, Estill, Johnson, Knox, and Meade counties. USDA, NRCS (2022) added Bullitt, Clark, Edmonson, Fulton, Lincoln, Madison, McCreary, and Whitley counties. SERNEC Data Portal (2022) also lists Pulaski County.

Possible State Records and a Notable Collection

During this study, three regionally uncommon species were documented for Estill County. A discussion of two possible state records and a third Kentucky county distribution record follows alphabetically;

1) ***Ipomoea cordatotriloba*** Dennst. Tie-vine (Convolvulaceae)—Voucher specimen: Estill Co.: 1 Sept 2022, *R. Guetig 1271-22* (EKY). *Ipomoea cordatotriloba* is restricted to the United States and Mexico (Wood et al. 2020), occurring from southern North Carolina, to south Florida, and west to east Texas and Arkansas (Weakley 2024), and occasionally occurring as a waif further north. The present collection is the first clear documentation of this taxon in Kentucky, as it is not mapped by Campbell and Medley (2018) or USDA, NRCS (2022) for the state. The only possible previous record for tie-vine in Kentucky is a 1934 collection, identified as *I. trichocarpa* from a dry field in Nelson County [*R. Greenwell 1655* (DOV)], but the identity of the specimen is questionable. This Estill County specimen was collected at a single site growing on a dry, rocky roadside along KY 89. The only nearby collection is from Knox County, Tennessee [*B. Wofford s.n.* (APSC)].
2) ***Lagerstroemia indica*** L. Crepe-myrtle (Lythraceae)—Voucher specimen: Estill Co.: 16 Aug 2022, *R. Guetig 1204-22* (EKY). Crepe-myrtle is native from the Himalayas through south China, southeast Asia and Japan (MOBOT 2024a). Weakley (2024) states that it can spread to disturbed sites and natural areas from plantings across southern U.S. but Graham in FNA 10 (2021) states that it does not naturalize. Campbell and Medley (2018) and USDA, NRCS (2022) do not map this taxon for the state. SERNEC Data Portal (2022) lists 14 specimens all of which are cultivated. This voucher specimen apparently represents the first record of this species as an escape from plantings in Kentucky. A single shrub of *L. indica* was found in Estill County growing alongside a large drainage ditch next to a wooded area along a state road.
3) ***Leucothoe frontanesiana*** (Steud.) Sleumer. Doghobble (Ericaceae)—Voucher specimen: Estill Co.: 28 Apr 2024, *R. Guetig 993-22* (EKY). Doghobble is a southern Appalachian endemic ranging from southwest Virginia to western North Carolina and eastern Tennessee to northwest Georgia (Weakley 2024). It occurs in forested areas, dense thickets, stream banks, and moist ravines (MOBOT 2024b; Weakley 2024). This species has been previously documented from mixed hardwood-hemlock ravines in Madison and Harlan counties, and these counties are mapped by Campbell and Medley (2018) and USDA, NRCS (2022). A detailed discussion of these collections by D. Taylor, R. Thompson, K. Thompson, and associates is provided by Abbott et al. (2001). This voucher specimen represents the third county in Kentucky documented for *L. fontanesiana*. The Estill County specimen was discovered in a thicket near a pond at the base of a southwest-facing ravine.

Non-Native and Invasive Species

A total of 153 non-native and naturalized species account for 15.9% of the taxa in Estill County and 26.8% of the 570 exotic listed by Jones (2005). Species from Poaceae (34), Fabaceae (18), and Asteraceae (15) were most prevalent among non-natives. Of the 153 non-native species, monocots (45) accounted for 29.4% and eudicots (107) for 70%. In 2013, the Kentucky Invasive Plant Council (KY-IPC) categorized 180 non-native species as Severe Threat, Significant Threat, Moderate Threat, and Watch List. Invasive species (82) accounted for 8.5% of the total flora. Of the 82 species, 27 (32.9%) are listed as Severe Threat, 26 (31.7%) as Significant Threat, 19 (23.1%) as Moderate Threat, and 8 (10%) as Watch List. Table 6 lists the 27 species categorized as a "Severe Threat" to the natural flora of Estill County. The Poaceae (15), Fabaceae (14), Asteraceae (8), and Brassicaceae (5) accounted for 51.2% of Estill County's invasive plants.

Based on field observations, the twelve most invasive plant species impacting the flora are *Festuca arundinacea* (Severe Threat), *Glechoma hederacea* (Severe Threat), *Lespedeza cuneata* (Severe Threat), *Melilotus*

Table 6. Non-native species designated as "Severe Threat" in Estill County, Kentucky, by KY-EPPC (2013).

Species	Common Name	Family
Alliaria petiolata (M. Bieb.) Cavara & Grande	Garlic Mustard	Brassicaceae
Arthraxon hispidus (Thunb.) Makino	Hairy Joint Grass	Poaceae
Carduus nutans L.	Musk Thistle	Asteraceae
Conium maculatum L.	Poison Hemlock	Apiaceae
Elaeagnus umbellata Thunb.	Autumn Olive	Eleagnaceae
Euonymus fortunei (Turcz.) Hand.-Mazz.	Winter Creeper	Celastraceae
Festuca arundinacea Schreb.	Kentucky 31 Fescue	Poaceae
Glechoma hederacea L.	Ground Ivy	Lamiaceae
Lespedeza cuneata (Dum-Cours.) G. Don	Sericea Lespedeza	Fabaceae
Ligustrum sinense Lour.	Privet	Oleaceae
Lonicera japonica Thunb.	Japanese Honeysuckle	Caprifoliaceae
Lonicera maackii (Rupr.) Maxim.	Bush Honeysuckle	Caprifoliaceae
Lysimachia nummularia L.	Moneywort	Primulaceae
Lythrum salicaria L.	Purple Loosestrife	Lythraceae
Melilotus alba Medik.	White Sweet Clover	Fabaceae
Melilotus officinalis (L.) Pall.	Yellow Sweet Clover	Fabaceae
Microstegium vimineum (Trin.) A. Camus	Japanese Stilt Grass	Poaceae
Miscanthus sinensis Andersson	Chinese Silver Grass	Poaceae
Paulownia tomentosa (Thunb.) Steud.	Princess Tree	Bignoniaceae
Phragmites australis (Cav.) Trin. ex Steud.	Common Reed	Poaceae
Pueraria montana (Lour.) Merr. var. *lobata* (Willd.) Maesen & S.M. Almeida	Kudzu	Fabaceae
Pyrus calleryana Decne.	Callery Pear	Rosaceae
Reynoutria japonica Houtt.	Japanese Knottweed	Polygonaceae
Rosa multiflora Thunb.	Multiflora Rose	Rosaceae
Securigera varia (L.) Lassen	Crwon Vetch	Fabaceae
Sorghum halepense (L.) Pers.	Johnson Grass	Poaceae
Stellaria media (L.) Vill.	Chickweed	Caryophyllaceae

officinalis (Severe Threat), *Microstegium vimineum* (Severe Threat), *Pueraria montana* var. *lobata* (Severe Threat), *Rosa multiflora* (Severe Threat), *Sorghum halepense* (Severe Threat), *Daucus carota* (Significant Threat), *Setaria faberi* (Significant Threat), *Barbarea vulgaris* (Moderate Threat), and *Trifolium repens* (Watch List).

Non-native species were commonly found in anthropogenically disturbed areas such as drainage ditches, fence rows, sidewalks, roadsides, pastures, and railroad tracks. The presence of these exotics indicate past and current disturbances in the county. Non-native species are commonly introduced into ecosystems by the dropping and tracking of seeds when animals and humans transverse an area (Andries & Ruhfel 2020). Climate change, global transport, and habitat modification are likely to accelerate their expansion (Maskell et al. 2006).

Vegetation

The forests of Estill County are similar to those described earlier by Wharton (1945), Braun (1950), Küchler (1964), and Campbell et al. (1989 & 1991). Oak-Hickory forests are dominated by upland oaks and hickories with common associates of *Fraxinus americana*, *Juglans nigra*, *Juniperus virginiana*, and *Prunus serotina*. Typical shrubs and vines include *Rhus aromatica*, *R. copallina*, *Smilax rotundifolia*, *Viburnum acerifolium*, and *V. rufidulum*. Mixed mesophytic forests are dominated by *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, and *Tilia americana* var. *heterophylla*. Smaller trees and shrubs include *Carpinus caroliniana*, *Euonymous atropurpureus*, *Hamamelis virginiana*, *Ostrya virginiana*, *Lindera benzoin*, and *Oxydendron arboreum*.

Drier steep slopes, cliff ledges, and outcrops of limestone substrates are characterized by woody species such as *Celtis pumila*, *Cercis canadensis*, *Fraxinus quadrangulata*, *Juniperus virginiana*, *Malus coronaria*, *Ptelea trifoliata*, *Quercus marilandica*, *Q. muehlenbergii*, *Q. stellata*, *Symphoricarpos orbiculatus*, *Ulmus alata*, and *U. thomasii*. Dominant grasses include *Andropogon gerardii*, *Bouteloua curtipendula, Danthonia spicata*,

Muhlenbergia cuspidata, *Schizachyrium scoparium*, *Setaria faberi*, *Sorghastrum nutans, Sporobolus vaginiflorus*, and *Tridens flavus*.

Floodplains, streams, and river banks are characterized by *Acer negundo*, *A. nigrum*, *A. saccharinum*, *Alnus serrulata*, *Asimina triloba*, *Fraxinus pensylvanicus*, *Platanus occidentalis*, *Rubus allegheniensis, R. occidentalis*, *Salix caroliniana*, *S. exigua*, *S. sericea*, *Sambucus canadensis*, and *Swida alternifolia*.

Significant Areas

Ten areas are considered to be "significant," based on the number of rare and noteworthy species present and their populations. All of these areas are found within the DBNF. They are found within two major areas: Knobs region – Grassy Knob Ridge System and Cumberland Plateau - Zion Mountain Ridge System.

I. KNOBS

1) Grassy Knob Ridge System

The Grassy Knob Ridge System (GKRS) extends from Irvine, Estill County to Clay City, Powell County and encompasses an area of about 1,113 ha (4.2973 sq. mi.). In Estill County, approximately 417 ha (1.61 sq. mi.) of the GKRS lies within the Stanton District of the DBNF. The central section of the GKRS can reached by traveling 1.6 km north of Irvine on KY 89, east on KY 1705 (road to Upper White Oak School) and then following the dirt road along the main fork of White Oak Creek. The GKRS has been described as "a system of narrow limestone ridges and sandstone-capped knobs." It is largely forested with small grassy areas, thickets, with dry, open woods scattered throughout the area. These habitats are situated along south or west-facing slopes of xeric limestone cliffs (Campbell et al. 1989).

Significant areas along this ridge system include: A) Grassy Knob; B) White Oak Creek Area (including the northern ridge); C) Cottage Furnace Ridge, and D) Camp Burnamwood. In Estill County, a total of ten state-listed species were documented from the Grassy Knob Ridge System. Listed plants included *Bouteloua curtipendula*, *Calamagrostis insperata*, *Juglans cinerea*, *Lathyrus venosus*, *Muhlenbergia cuspidata*, *Panax quinquefolius*, *Patis racemosa*, *Paxistima canbyi*, *Phlox subulata*, and *Symphoricarpos albus*. Other plants of particular interest include *Carex gravida*, *Muhlenbergia capillaris*, *Phaseolus polystachios*, *Solidago harrisii*, and *Ulmus thomasii* (Campbell et al. 1989).

A) Grassy Knob

Grassy Knob (GK) is located 10 km north of Irvine on KY 89 and 2 km northeast of KY 794. It forms the western end of the Grassy Knob Ridge System (Fig. 7). It is situated within Camp Burnamwood and is underlain by limestone outcrops (Newman Formation) with residual soils and south-facing slopes. Baskin and Baskin (2000) and Lawless et al. (2006) describe Xeric Limestone Prairies's (XLP) as occurring on "moderate to steep slopes with south to west aspects, and shallow rocky soils derived from calcareous substrates." The calcareous substrate include limestones, dolomite, and shale (Baskin et al. 1994). Based on their descriptions, Grassy Knob is considered a XLP. The KSNPC (2015) and OKNP (2019a) designate this plant community as "Limestone/dolomite prairie" and is considered "endangered." Yahn (2023) describes it as an "extremely rare" community in Kentucky, where soils are thin with bedrock of limestone or dolomite. This community is dominated by *Schizachyrium scoparium*. A total of four state-listed plant species were documented from Grassy Knob: *Bouteloua curtipendula*, *Lathyrus venosus*, *Muhlenbergia cuspidata*, and *Phlox subulata*. Large populations of *B. curtipendula* and *M. cuspidata* occur on the exposed south-facing limestone outcrop (Fig. 8 A & B). Other noteworthy species include *Andropogon gerardii*, *Brickellia eupatorioides*, *Ceanothus americanus*, *Liatris aspera*, *L. spicata*, *Lithospermum canescens*, *Muhlenbergia capillaris*, *Rubus flagellaris*, *Schizachyrium scoparium*, *Sorghastrum nutans*, *Sporobolus vaginiflorus*, and *Symphyotrichum oolentangiense*.

The western outcrop of Grassy Knob is dominated with little blue stem (*Schizachyrium scoparium*). This species is reported as the characteristic dominant of XLP's in Kentucky and the eastern United States (Lawless 2005). It is also dominant in barren and glade communities (Quarterman et al. 1993). Important associates of *S. scoparium* include, *Andropogon gerardii, Bouteloua curtipendula,* and

Fig. 7. Grassy Knob (Xeric Limestone Prairie), Estill County, Kentucky. Photograph taken in 1988 by Richard G. Guetig. Re-imaged by Steve Grider.

Sorghastrum nutans. Lawless (2005) lists these species as dominant taxa of XLP's in the eastern United States. He also reports that limestone outcrops similar to Grassy Knob are present in limited numbers and are the most extreme rock outcrops of XLP's in Kentucky.

The surrounding forest vegetation is all second growth. Dominant woody species include *Carya glabra*, *Pinus virginiana*, *Quercus alba*, *Q. coccinea*, and *Q. montana*. Frequent woody species include *Carya ovata*, *Fraxinus quadrangulata*, *Juniperus virginiana*, and *Liriodendron tulipifera*. Scattered throughout the south-facing aspects and upper cliff ledges of Grassy Knob are open grassy areas. Conspicuous species include *Andropogon gerardii*, *Bouteloua curtipendula*, *Danthonia spicata*, *Muhlenbergia cuspidata*, *Schizachyrium scoparium*, *Sorghastrum nutans*, *Sporobolus compositus*, *S. vaginiflorus*, and *Tridens flavus*.

B) White Oak Creek Area

The following description of the White Oak Creek Area (WOCA) is based on Campbell et al. (1989). The head of White Oak Creek can be reached by taking the dirt road near the west (main) fork of the creek off KY 1705. The WOCA consists of creeks and lower slopes of Devonian shale, cliffs of Mississippian shales and siltstones, Mississippian limestone cliffs, xeric ridgetops, grassy openings, thickets, open forests, and open exposed clifftops. These habitats are situated along south- and west-facing slopes. Populations of six state-listed plant species were located within the WOCA. They were *Bouteloua curtipendula*, *Calamagrostis insperata*, *Lathyrus venosus*, *Paxistima canbyi*, *Phlox subulata*, and *Symphoricarpos albus*. Along the northern ridge, thirty plants of *L. venosus* were found on steep slopes of the western end of the Grassy Knob cliff section. Below the cliffs of Mississippian shales and siltstones, *Silphium terebinthinaceum* occupied open places. A patch of *Paxistima canbyi* was found along the west-facing cliffs of Mississippian limestone. *C. insperata* was found in dry woods above limestone cliffs, often 3–20 meters from the actual clifftop. *B. curtipendula* was dominant on the open exposed clifftops of this region. *Symphoricarpos albus* was found in open woods and thickets along the narrow saddle of Mississippian limestone. *Monarda bradburiana* was associated with *Paxistima canbyi* under patches of *Juniperus virginiana*. Other plants of interest included *Andropogon gerardii*,

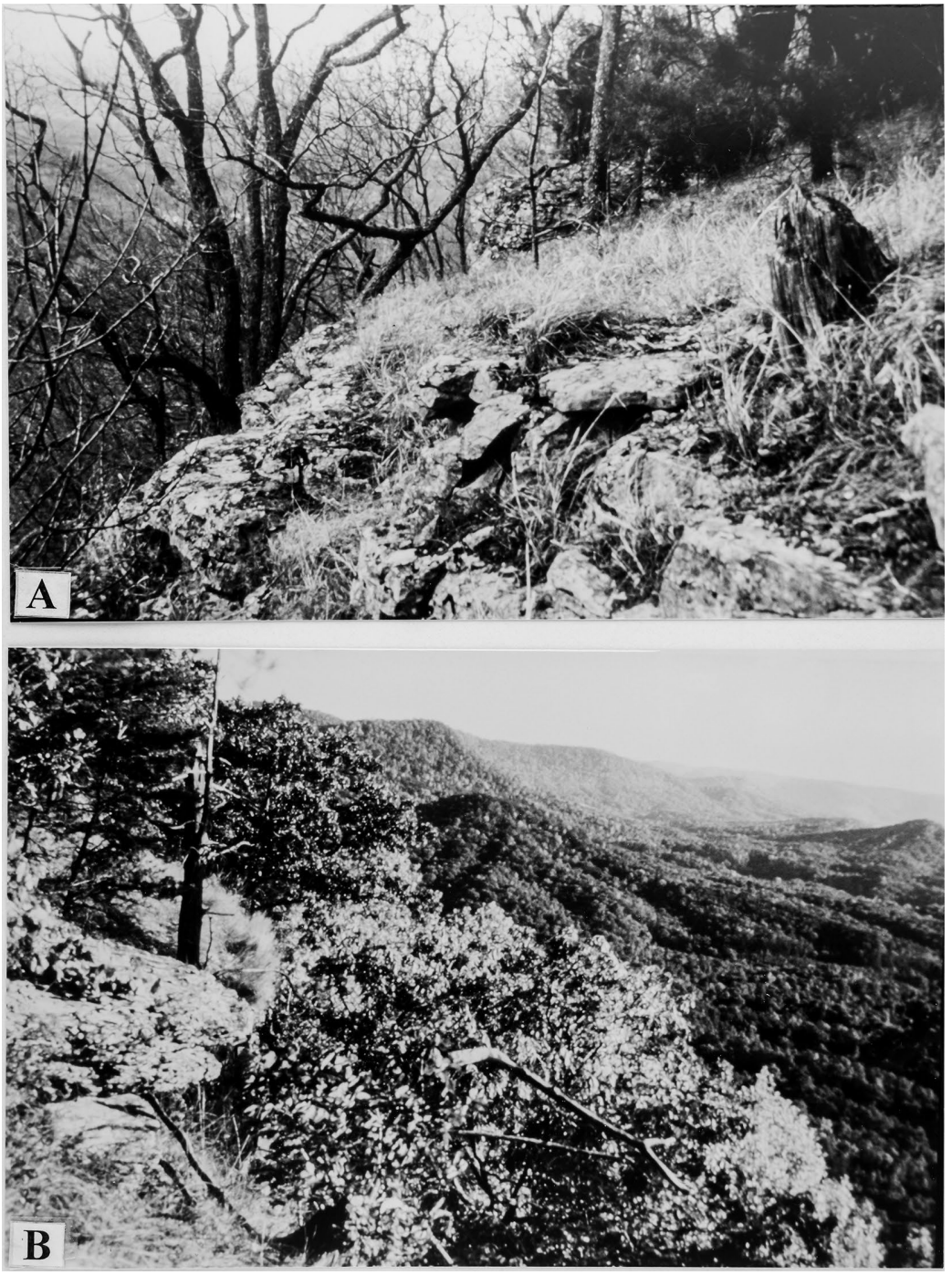

Fig. 8. Grassy Knob outcrop. A) Western Edge B) Eastern Edge. Photographs taken in 1988 by Richard G. Guetig. Re-imaged by Steve Grider.

Carex pensylvanica, *Fraxinus quadrangulata*, *Muhlenbergia capillaris*, *Phaseolus polystachios*, *Schizachyrium scoparium*, and *Sorghastrum nutans*.

Dominant woody species in the area were *Carya glabra* and *Quercus montana*. The distinctive woody elements found include *Ceanothus americanus*, *Celtis pumila*, and *Quercus stellata*. Characteristic herbs of woods and thickets include *Borodinia laevigata*, *Chimaphila maculata*, *Desmodium* sp., *Euphorbia corollata*, *Heuchera villosa*, and *Lobelia spicata*.

Open exposed clifftops and xeric ridgetops of this area support small grassy areas and thickets with south- and west-facing aspects. The vegetation of these clifftops is similar to Grassy Knob. The distinctive elements include the state-listed species of this area along with *Carex pensylvanica*, *Danthonia spicata*, *Galactia regularis*, *Helianthus divaricatus*, *Liatris squarrulosa*, *Schizachyrium scoparium*, *Sorghastrum nutans*, and *Sporobolus compositus*.

The northern ridge of the Upper White Oak Area (WOCA) consists of limestone cliffs, young woods and thickets, open clifftops, sandy ridgetops, and open forests. The vegetation of this area is virtually identical to Grassy Knob and WOCA. Conspicuous species found at this site include *Carex hirsutella*, *Phlox subulata*, *Quercus marilandica*, *Robinia pseudoacacia*, and *Ulmus rubra*.

Limestone cliffs and ridgetops contain small grassy areas similar in composition to the adjacent knobs. *Silphium terebinthinaceum* was found in open areas along the trail below the limestone cliffs. Several large plants of *Symphoricarpos albus* were found on the saddle above the limestone cliffs. *Tilia americana* var. *heterophylla* is a major component of the open ridgetop forest. Frequent trees of the sandy ridgetops include *Carya tomentosa*, *Nyssa sylvatica*, and *Oxydendrum arboreum*. Distinctive herbaceous species include *Carex digitalis*, *Diarrhena americana*, *Symphyotrichum shortii*, and *Triosteum angustifolium*.

C) Cottage Furnace Ridge

The eastern ridge of the Grassy Knob Ridge System consists of a broad limestone ridge near Cottage Furnace. This area is referred as Cottage Furnace Ridge. It tends to be more moist than the western end (Grassy Knob) of the ridge system. Open forests, sandstone peaks, xeric cliffs, and small grassy areas characterize this ridge. Three state-listed plants, *Juglans cinerea*, *Muhlenbergia cuspidata*, and *Panax quinquefolius* were found occupying the ground layer of forests and grassy areas of narrow ridges and clifftops. *M. cuspidata* occurs in bare flat clifftop areas at the end of this long ridge. Healthy trees of *J. cinerea* occur on the lower slopes of moist ravines along Iron Furnace Trail (eastern end of the ridge).

Forests are dominated by *Acer saccharum*, *Carya ovata*, *Fraxinus americana*, *F. quadrangulata*, *Quercus muehlenbergii*, *Q. rubra*, and *Ulmus rubra*. Conspicuous herbs of small open areas along ridges and clifftops are *Asclepias viridiflora, Carex eburnea, Croton monanthogynus, Lespedeza violacea, Minuartia patula, Penstemon hirsutus,* and *Symphyotrichum oblongifolium* (Campbell et al. 1989).

D) Camp Burnamwood

Camp Burnamwood (CB) is located 8 km north of Irvine on KY 89 and east on KY 794. Habitats include dry upland forests, low mesic woodlands, creek beds, clear-cut areas, old fields, ponds, and transitional regions between old fields and oak-hickory forests. Plants of particular interest include *Carex cephalophora*, *C. laxiflora*, *C. rosea*, *C. umbellata*, *Hypopitys lanuginosa, Leucothoe fontanesiana, Monotropa uniflora*, *Platanthera lacera*, and *Sparganium americanum*. The documentation of *L. fontanesiana* in Estill County represents the third county record for Kentucky. Grassy Knob is part of CB and forms the western end of the Grassy Knob Ridge System. Refer to Grassy Knob discussion for habitat description and "listed" plants.

The forests of Camp Burnamwood are all second growth vegetation. Forest trees include *Acer saccharum, Benthamidia florida, Carya glabra, C. ovata, Cercis canadensis, Fraxinus americana, Juniperus virginiana, Liriodendron tulipifera, Quercus muehlenbergii, Q. rubra, Q. stellata,* and *Viburnum rufidulum*. Dry upland forests leading to Grassy Knob are composed of *Carya glabra, C. ovata, Prunus serotina, Quercus muehlenbergii, Q. rubra,* and *Viburnum rufidulum*.

Low mesic woodlands are scattered throughout Camp Burnamwood. They are often located near streams and clear-cut areas. Frequent woody species include *Acer saccharum*, *Benthamidia florida, Cercis canadensis, Fraxinus americana*, *Liriodendron tulipifera*, and *Sambucus canadensis*. Woody species found in woodlands near streams and clear-cut areas include *Aesculus flava*, *Hamamelis virginiana*, *Salix nigra*, and *Sassafras albida*.

Woody species found growing in transitional regions between old fields and oak-hickory forests include *Celastrus scandens, Frangula caroliniana, Juniperus virginiana, Liquidambar styraciflua, Pinus virginiana, Quercus stellata, Rhus copallinum,* and *Wisteria frutescens*.

2) Ravenna Knob

Information on Ravenna Knob (RK) follows Campbell et al. (1989). RK encompasses an area of about 49 ha (121 acres) and is located just 0.8 km northeast of Ravenna. It can be reached by traveling west from KY 52. The knob consists of limestone-capped hills with residual sandstone in small places. The ridgetops are extremely narrow and the cliffs are well-developed. The area is characterized by south- and west-facing slopes that are mostly forested. Along some of the narrower ridges and clifftops, thickets and grassy openings are found. This site is similar to the Grassy Knob Ridge System except that it is much smaller and has fewer rare plants. A total of four state-listed plant species were documented from RK. They include *Amelanchier spicata*, *Patis racemosa*, *Paxistima canbyi*, and *Symphoricarpos albus*.

Woodlands situated on limestone talus (below cliffs) and hilltops tend to be small and open. Dominant woody species include *Acer saccharum*, *Benthamidia florida, Celtis tenuifolia*, *Cercis canadensis*, *Frangula caroliniana, Fraxinus quadrangulata*, *Juniperus virginiana*, *Ptelea trifoliata*, *Quercus montana*, and *Q. rubra*. Thickets and nearby open ledges occupy the narrower parts of the knob. A large population of *Symphoricarpos albus* (locally co-dominant) was found in thickets dominated with *Rhus aromatica*, *Smilax bona-nox*, and *Vitis aestivalis*.

Small grassy openings and open forest vegetation characterize the small knob to the northwest of the hill. Two patches of *Paxistima canbyi* were found on the southwest side of the northern extreme of the hilltop. Common grasses were *Andropogon gerardii*, *Schizachyrium scoparium*, and *Sporobolus compositus*. Open forest canopy species included *Acer saccharum*, *Fraxinus quadrangulata*, *Juniperus americana*, and *Quercus montana*. The forest edge adjacent to the small grassy opening along the northern extreme of the knob contained a small population *of Amelanchier spicata*. This represents the first report of this species in Kentucky.

A small population of *Patis racemosa* was found at the cliff base of the northwestern knob. Common associates include *Carex platyphylla*, *Hepatica acutiloba*, and *Solidago harrissii*. Found below the limestone outcrop along the ridge trail farther north was a small patch of *Silphium terebinthinaceum* (Campbell et al. 1989).

3) Iron Furnace Trail

Iron Furnace Trail is located 6.8 km east of Irvine on KY 52 and 7.9 km northeast on Hwy 213 from KY 52. It is found in the DBNF (Stanton District) near Cottage Furnace. The area is heavily forested, with one main gravel road traversing its boundaries. Habitats include dry and mesic woods, clear-cut areas near logging roads, roadsides, rock houses, and steep, moist ravines. State-listed plants include *Juglans cinerea* and *Panax quinquefolius*. Other plants of interest include *Aquilegia canadensis*, *Erythronium americanum*, *Galearis spectabilis*, *Gymnocladus dioicus*, and *Trillium sessile*.

The overstory vegetation of the area is characterized as Oak-Hickory Forest. The dry, upland forests are composed of *Carya glabra*, *C. ovata*, *Quercus montana*, and *Q. velutina*. *Paulownia tomentosa* is frequent along gravel roads.

Dominant canopy trees of steep, moist ravines near rock houses include *Gymnocladus dioicus*, *Juglans cinerea*, and *Liriodendron tulipifera*. The understory vegetation is very dense and composed primarily of *Acer saccharum*, *Asimina triloba*, and *Staphylea trifolia*.

II. CUMBERLAND PLATEAU

Zion Mountain Ridge System

The following descriptions of the Zion Mountain Ridge System (ZMRS) and listed areas are based on Campbell et al. (1991). The ZMRS extends from Big Hill, Madison County to South Irvine, Estill County and encompasses an area of about 1,036 ha (2,560 acres). The north-side and south-side of the ridge system can be reached from KY 499 and KY 594 respectively. Campbell et al. (1991) described the ZMRS as being composed of "narrow, limestone-capped ridges instead of round knobs." The area is predominantly forested with scattered old fields occupying the broader ridgetops and farmlands situated along stream valleys. Compared to the Grassy Knob Ridge System, it has less open clifftop vegetation and fewer rare grasses. Significant areas along the Zion Mountain Ridge System (ZMRS) include: A) Turner Hollow and its surrounding ridges; B) Preacher Estes Mountain; C) Rice Hollow; and D) Station Camp Creek Corridor. A total of six state-listed plant species in this region were documented for Estill County. They were *Elymus svensonii*, *Muhlenbergia cuspidata*, *Patis racemosa*, *Paxistima canbyi*, *Phlox subulata*, and *Symphoricarpos albus*.

A) Turner Hollow

Turner Hollow is 1.0 km north of the Berea District near Red Lick Creek. This hollow and its surrounding ridges is west of Spruce Pine Branch. Two state-listed plants were found on exposed limestone outcrops. They were *Muhlenbergia cuspidata* and *Symphoricarpos albus*. Other noteworthy species include *Melica nitens* and *Ulmus thomasii*.

B) Preacher Estes Mountain

Preacher Estes Mountain (PEM) is located 1-2 km north of the Berea District. This mountain is characterized by narrow limestone ridges that support open oak-ash-cedar forest and thickets. State-listed plants include *Muhlenbergia cuspidata*, *Paxistima canbyi*, *Phlox subulata*, and *Symphoricarpos albus*. On a limestone ridge near PEM, a "disjunct" population (about 20 plants) of *Elymus svensonii* was found. Populations of *Paxistima canbyi* and *Symphoricarpos albus* were found along the ridges to the north and south. Also found were small patches of *Muhlenbergia cuspidata*. Along dry clifftop ledges and cliff-bases, larger populations of *Patis racemosa* were found. Another plant of interest was *Solidago harrissii*.

C) Rice Hollow

Rice Hollow is located southwest of Rice Cemetery and includes the most mature forests of the Zion Mountain Ridge System (ZMRS). Dominant woody species below the cliffs include *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, and *Tilia americana* var. *heterophylla*. Throughout the ZMRS, southwest-facing clifftops are similar in composition to the clifftops of the Grassy Knob Ridge System. Conspicuous woody species include *Celtis pumila*, *Chionanthus virginicus*, and *Zanthoxylum americanum*.

D) Station Camp Creek Corridor

The Station Camp Creek Corridor (SCCC) encompasses an area of 4,047 ha (10,000 acres) that covers portions of Jackson and Estill Counties. The SCCC system of ridges is composed of Pennsylvanian bedrock and slopes of Mississippian bedrock. Limestone cliffs are also prevalent along most of the corridor. The majority of the corridor is situated in Jackson County with only a small portion extending into Estill County. Four state-listed plants are found in the SCCC. They are *Patis racemosa*, *Spiranthes lucida*, *Synandra hispidula*, and *Taxus canadensis*. *Taxus canadensis* has been documented from Jackson County, but has not been discovered in Estill County. A few plants of *Spiranthes lucida* have been reported from the Middle Fork of Station Camp Creek in Estill County, but no vouchers were located. Populations of *Patis racemosa* (10 to 20 clumps) were found at two sites southeast of PEM. They were found at the base of limestone cliffs. Healthy populations of *Synandra hispidula* were found occupying lower slopes of southwest-facing moist ravines.

A mesophytic woodland along Station Camp Creek is located 5.2 km southeast of Irvine on KY

1209 from KY 89. Both south-and southwest-facing slopes are found. This relatively small knob lies within the SCCC and consists of moist south- to southwest-facing slopes with gullies dissecting the hillside. At the base of this mixed mesophytic woodland is a creek bed, old field, and drainage ditch, all of which are near a gravel road.

The canopy of this site is mixed mesophytic and predominantly composed of *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Magnolia tripetala, Quercus muehlenbergii, Q. montana,* and *Tilia americana* var. *heterophylla*. Other conspicuous woody species include *Carpinus caroliniana, Euonymus atropurpureus, Gleditsia triacanthos, Hamamelis virginiana, Juniperus virginiana,* and *Sambucus canadensis*.

The creek bed and drainage ditch is located at the base of the southwest-facing moist ravine. Neither the creek bed nor the drainage ditch experienced drought at any time during this study. Common sedges included *Carex baileyi*, *C. frankii, C. granularis*, *C. lurida*, *C. platyphylla*, *C. purpurifera*, and *C. vulpinoidea*.

Conservation Implications

In 1995, 11% of Kentucky's known vascular plants were state-listed. Eight plants were federally-listed with five plants reported as "extirpated (Taylor 1995)." Rodger's et al. (2022) reported 474 state-listed plant species comprising 18% of the known vascular plants reported by Jones (2005). OKNP (2019b) listed 18 extirpated plant species. This increase in state-listed and extirpated species may be attributed to natural and especially human-caused disturbances. Since 1985, the Kentucky Nature Preserves (KNP) in partnership with the United States Fish and Wildlife monitor and manages federally-listed and at-risk plants. The KNP oversees the Rare Plant Conservation Section, which is the only plant conservation in the State (KEEC 2024).

Several factors threaten the native flora of Estill County. Natural disturbances include windstorms, tornadoes, fires, floods, landslides, and insect eruptions (Taylor 1995). Anthropogenic practices such as urban development, road construction, farming (crops), livestock grazing, herbicides, insecticides, fertilizers, erosion control, coal mining, and logging have directly affected habitat loss and accelerated the invasion of non-native taxa (Jones 2005). Managed timber harvesting also affects habitat loss (Taylor 1995). Non-native species out-compete native species for natural resources, transform habitats (Pimm et al. 1995), and disrupt the balance of ecosystems (e.g., kudzu). Although introduced species may increase the overall species diversity, their long term presence may lead to the endangerment and/or extinction of native species (Taylor 1995). On-going climate change is predicted to have major impacts on the flora of the region. Climate change, especially temperature changes, is already affecting species phenology (changes in flowering events, longer growing seasons, etc.) including earlier bud-bursts, flowering, fruit ripening, and pollinator effect (Auffret 2021: Parmesan & Hanley 2015). It is also driving shifts in native species ranges and habitats and accelerating the introduction of invasive exotic species into new geographic regions (Parmesan & Hanley 2015). Herbarium specimens are currently being used in phenological studies to predict how sensitive a species is and how it will respond to climate changes (Willis et al. 2017).

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APPENDIX I

Annotated vascular plant list for Estill County, Kentucky

Nomenclature follows Weakley (2024). The list is arranged alphabetically by family, genus, and species within fern and fern allies, gymnosperms, and angiosperms (basal angiosperms, magnoliidae, monocots, and eudicots). Species preceded by an asterisk (*) are nonnative, two asterisks (**) indicate the species is on the invasive species list developed by the KY-IPC (2013). Herbaceous and woody county records are based on Campbell and Medley (2018), SERNEC Data Portal (2022), and Shaw et al. (2022). County records are preceded by a bold print dagger (**†**). State records are preceded by a bold print diesis (**‡**).

Rare plants are preceded with a bold print exclamation point (**!**). State status of plants listed by Rodgers et al. (2022) as Endangered (E), Threatened (T), Special Concern (SC), and Commercially Exploited (CE) are in bold print after the scientific name. State and global rank follow the state status in bold print.

Collections made by the first author are designated by a collection number in italics at the end of the entry. Species abundance value (abundant, common, infrequent, and rare) is subjectively assigned to each species according to individual density and population frequency within the county. Habitat type abbreviations (MR, L, R/D, etc.) are given after the abundance values and are defined in Table 7. Voucher specimens are deposited at the Ronald L. Jones Herbarium at Eastern Kentucky University (EKY). Those specimens deposited in other herbaria are listed with the collector's last name, collector's number or date collected, and the herbarium acronym in parentheses. All herbaria acronyms follow Thiers (2024). Specimens without a collection number are indicated as *sine numero* (*s.n.*) and those without a date (*n.d.*).

FERN AND FERN ALLIES

ASPLENIACEAE

Asplenium bradleyi D.C. Eaton—*J. Williamson August 10, 1878* (MO)
Asplenium ebenoides R. R. Scott—*A. Cusick 32897* (MU)
Asplenium montanum Willd.—*J. Campbell October 6, 1988* (KY)
Asplenium pinnatifidum Nutt.—*R. Hannan & L. Phillippe 6901* (EKY)
Asplenium platyneuron (L.) B.S.P.—Abundant. MR. *295*
Asplenium resiliens Kunze—*M. Medley 08152-83* (APSC)
Asplenium rhizophyllum L.—Common. MR. *310*
Asplenium ruta-muraria L. var. *cryptolepis* (Fernald) Wherry—Common. X. *897*
Asplenium × *trudelli* Wherry—*J. Campbell November 10, 1990* (KY)

ATHYRIACEAE

Athyrium asplenioides (Michx.) D.C. Eaton—*M. Wharton 5181A* (NY)
Deparia acrostichoides (Sw.) M. Kato—Common. MR. *321*

CYSTOPTERIDACEAE

Cystopteris bulbifera (L.) Bernh.—Common. MR. *312*
Cystopteris protrusa (Weath.) Blasdell ex Desv.—Infrequent. MR. *186*
†*Cystopteris tenuis* (Michx.) Desv.—Common. RT. *267*

DENNSTAEDTIACEAE

Pteridium latiusculum (Desv.) Hieron.—Common. O-H *773*
Sitobolium punctilobulum (Michx.) Desv.—*M. Wharton 2988* (MICH)

DIPLAZIOPSIDACEAE

Diplaziopsis pycnocarpa (Spreng.) M.G. Price—*R. Jones 4112* (EKY)

DRYOPTERIDACEAE

!*Dryopteris carthusiana* (Vill.) H.P. Fuchs. **SC, S3G5.** —*L. Pounds September 1, 1982* (EKY)
Dryopteris goldiana (Hook.) A. Gray—Common. MR. *311*
Dryopteris marginalis (L.) A. Gray—*R. Hannan & L. Phillippe 6894* (EKY)
Polystichum acrostichoides (Michx.) Schott—Abundant. MR. *79*
†*Polystichum acrostichoides* (Michx.) Schott f. *incisum* (A. Gray) Gilb.—Infrequent. L. *877*
Woodsia obtusa (Spreng.) Torr.—Common. L. *757*

EQUISETACEAE

Equisetum arvense L.—Common. MR. *123*
†*Equisetum praealtum* Raf.—Infrequent. SA. *1151-22*

LYCOPODIACEAE

Diphasiastrum digitatum (Dill.) Holub—Common. MR. *122*
Huperzia lucidula (Michx.) Trevis.—Common. MR. *158*

LYGODIACEAE

†*Lygodium palmatum* (Bernh.) Sw.—Infrequent. MR. *968-22*

ONOCLEACEAE

Onoclea sensibilis L.—Common. SA. *246*

OPHIOGLOSSACEAE

†*Botrypus virginianum* (L.) Michx.—Abundant. O-H. *185*
Ophioglossum vulgatum L.—*L. Pounds July 1, 1982* (EKY)
Sceptridium biternatum (Savigny) Lyon—*J. Campbell October 14, 1988* (KY)
†*Scepteridium dissectum* (Spreng.) Lyon—Common. X. *892*

OSMUNDACEAE

Osmunda spectabilis Willd.—*W. Anderson 511* (WS)

POLYPODIACEAE

Pleopeltis michauxiana (Weath.) Hickey & Sprunt.—*M. Medley 19117* (APSC)

Table 7. Codes for relative abundance and habitat type in annotated species list (Appendix I).

Relative Abundance:	
Abundant	Occurring in large numbers throughout the county in a variety of habitats.
Common	Plentiful throughout the county in certain habitats.
Infrequent	Scattered or occasional in certain habitats throughout the county.
Rare	Usually occurring at only one or two sites throughout the county.
Habitat Types:	
MR =	Mesophytic Ravine
L =	Limestone outcrops, cliffs, & ridgetops
R/D =	Ruderal/Disturbed areas
MKyRF =	Marshy areas of Kentucky River Floodplain
SA =	Swampy Areas
O-H =	Oak-Hickory forest
S =	Shorelines of ponds, creeks, steams, & rivers
R =	Roadsides
X =	Xeric ridgetops
RML =	Ridgetops along Mississippian limestone cliffs
PF =	Pine Forest
RT =	Railroad Track

Polypodium virginianum L.—*R. Hannan & L. Phillippe 6899* (EKY)

PTERIDACEAE

Adiantum pedatum L.—Abundant. MR. *327*
Myriopteris lanosa (Michx.) Grusz & Windham—Infrequent. X. *913*
Pellaea atropurpurea (L.) Link—Abundant. RML. *898*
Pellaea glab ella M ett. e x K uhn—*D. Est es, R. T hompson, & P . Threadgill 10699* (APSC)

THELYPTERIDACEAE

Amauropelta noveboracensis (L) S.E. Fawc. & A.R. Smith—Common. MR. *166*
Phegopteris hexagonoptera (Michx.) Fée—Common. MR. *125*

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L.—Abundant. O-H. *440*

PINACEAE

Pinus echinata Mill.—*D. Pittillo 2858* (KY)
Pinus rigida Mill.—*J. Thieret 53177* (KNK)
Pinus strobus L.—Common. X. *506*
Pinus virginiana Mill.—Abundant. O-H. *437*
Tsuga canadensis (L.) Carriere—Common. O-H. *710*

ANGIOSPERMS

BASAL ANGIOSPERMS

CABOMBACEAE

†*Brasenia schreberi* J.F. Gmel—Rare. SA. *1184-22*

MAGNOLIIDAE

ANNONACEAE

Asimina triloba (L.) Dunal—Abundant. MR. *476*

ARISTOLOCHIACEAE

†*Asarum canadense* L.—Common. MR. *17*
†*Endodeca serpentaria* (L.) Raf.—Common. L. *741*
Isotrema macrophylla (Lam.) C.F. Reed—*R. Jones 4159* (EKY)

LAURACEAE

Lindera benzoin (L.) Blume—Common. MR. *213*
Sassafras albidum (Nutt.) Nees—Common. O-H. *650*

MAGNOLIACEAE

Liriodendron tulipifera L.—Abundant. MR. *859*
Magnolia acuminata (L.) L.—*R. Jones 4151* (EKY)
Magnolia tripetala (L.) L.—Common. MR. *317*

SAURURACEAE

Saururus cernuus L.—*M. Camacho 21* (EKY)

MONOCOTS

ACORACEAE

**Acorus calamus* L.—*M. Camacho 23* (EKY)

ALISMATACEAE

Alisma subcordatum Raf.—Common. SA. *818*
†*Sagittaria latifolia* Willd.—Common. SA. *694*
†*Sagittaria brevirostra* Mack. & Bush.—Rare. MKyRF. *1270-22*

ALLIACEAE

Allium canadense L.—Common. MR. *110*
Allium cernuum Roth—Common. MKyRF. *240*
***Allium sativum* L.—*M. Wharton 3130* (MICH)
***Allium vineale* L.—Common. R/D. *145*

AMARYLLIDACEAE
*†*Narcissus pseudo-narcissus* L.—Infrequent. R. *969-22*

ARACEAE
Arisaema dracontium (L.) Schott—Common. SA. *706*
Arisaema pusillum (Peck) Nash—*M. Wharton 3915* (MICH)
Arisaema triphyllum (L.) Schott—Abundant. MR. *13*

COLCHICACEAE
Uvularia grandiflora Sm.—Common. MR. *159*
Uvularia perfoliata L.—Common. MR. *21*

COMMELINACEAE
**Commelina communis* L.—Abundant. R. *1105-22*
Commelina erecta L.—*J. Lassetter 3055* (EKY)
Commelina virginica L.—Infrequent. R. *1128-22*
Tradescantia virginiana L.—*R. Hannan & L. Phillippe 6892* (EKY)

CYPERACEAE
Carex albicans Willd. ex Spreng.—*M. Medley 18762* (APSC)
Carex amphibola Steud.—Infrequent. MR. *638A*
Carex arctata Boott—*J. Campbell 14 Apr 1988* (KY)
Carex baileyi Britton—Common. MR. *232*
Carex blanda Dewey—Common. MR. *638B*
Carex bromoides Willd.—*J. Campbell September 23, 1988* (KY)
Carex cephalophora Muhl. ex Willd.—Infrequent. R/D. *297*
Carex communis L.H. Bailey—*J. Campbell April 14, 1988* (KY)
Carex complanata Torr. & Hook.—Common. MR. *793*
Carex conjuncta Boott—Infrequent. SA. *142*
!*Carex corrugata* Fernald **SC, S3?G5?**—*R. Naczi 7801* (MICH)
Carex cristatella Britton—Infrequent R/D. *698*
Carex digitalis Willd.—*R. Naczi 7778* (SAT)
Carex frankii Kunth—Abundant. MR. *132*
Carex glaucodea Tuck.—*M. Medley 8163* (APSC)
Carex granularis Muhl. ex Willd.—Common. SA. *129*
Carex hirsutella Mack.—Common. MR. *637*
Carex laevivaginata (Kük.) Mack.—*W. Anderson 466* (MO)
Carex laxiflora Lam.—Infrequent. SA. *642*
Carex lupulina Muhl. ex Willd.—Common. SA. *1018-22*
Carex lurida Wahlenb.—Abundant. SA. *719*
Carex mesochorea Mack.—*M. Wharton 2269* (MICH)
Carex muhlenbergii Schkuhr ex Willd.—Infrequent. X. *729*
Carex normalis Mack.—*D. Walker 276* (EKY)
Carex oligocarpa Schkuhr ex Willd.—*R. Naczi 7789* (MICH)
Carex pensylvanica Lam.—*R. Naczi 7820* (MICH)
Carex planispicata Naczi—*R. Naczi 7801* (MICH)
Carex platyphylla Carey—Infrequent. MR. *593*
Carex projecta Mack.—*J. Campbell October 6, 1988* (KY)
Carex purpurifera Mack.—Infrequent. MR. *609*
Carex rosea Schkuhr ex Willd.—Infrequent. SA. *640*
!†*Carex rugosperma* Mack. **SC, S3?G5T5**—Rare. L. *955*
Carex siccata Dewey—*F. Bowers & A. Bogdansky 477* (UWSP)
Carex sparganioides Willd.—*J. Campbell August 1, 1988* (KY)
Carex squarrosa L.—Common. MKyRF. *284*
Carex tribuloides Wahlenb.—Common. MKyRF. *698*
Carex typhina Michx.—*J. Campbell October 6, 1988* (KY)
Carex vir escens M uhl. ex Willd.—*R. Hannan & L. P hillippe 6993* (EKY)
Carex vulpinoidea Michx.—Common. MR. *131*
Carex willdenowii Schkuhr ex Willd.—*R. Naczi 7777* (MICH)
Cyperus bipartitus Torr.—*R. Mears 432* (EKY)
**Cyperus br evifolioides* Thieret & D elahouss.—Infrequent. SA. *1216-22*
Cyperus erythrorhizos Muhl.—Common. SA. *406*
Cyperus esculentus L.—*R. Mears 371* (EKY)
Cyperus flavescens L.—Common. SA. *1239-22*
Cyperus lancastriensis Porter—*G. Libby & S. Walker 458* (EKY)
Cyperus odoratus L.—*R. Mears 433* (EKY)
Cyperus strigosus L.—Abundant. SA. *721*
†*Eleocharis erythropoda* Steud.—Infrequent. SA. *1238B-22*
Eleocharis obtusa (Willd.) Schult.—*M. Wharton 4397* (MICH)
Eleocharis ovata (Roth) Roem. & Schult.—Common. SA. *675*
Eleocharis tenuis (Willd.) Schult.—Common. MKyRF. *662*
Schoenoplectus pungens (Vahl) Palla—Common. SA. *264*
Schoenoplectus tab ernaemontani (C.C. Gmel .) P alla.—*D. W alker 281* (EKY)
Scirpus atrovirens Willd.—Common. R/D. *103*
Scirpus cyperinus (L.) Kunth—Common. SA. *829*
Scirpus georgianus R.M. Harper—*M. Wharton 4399* (MICH)
Scirpus pendulus Muhl.—Common. MKyRF. *114*
Scirpus polyphyllus Vahl—Infrequent. SA. *677*
Scleria oligantha Michx.—*R. Hannan & L. Phillippe 6880* (EKY)
Scleria triglomerata Michx.—Infrequent. L. *920*

DIOSCOREACEAE
†*Dioscorea villosa* L.—Common. RT. *59*

HEMEROCALLIDACEAE
***Hemerocallis fulva* (L.) L.—Common. R. *661*

HYACINTHACEAE
**Ornithogalum umbellatum* L.—Infrequent. MKyRF. *54B*
**Hyacinthoides non-scripta* (L.) Chourd—Infrequent. R. *560*

HYDROCHARITACEAE
Najas guadalupensis (Spreng.) Magnus—Infrequent. SA. *717*

HYPOXIDACEAE
Hypoxis hirsuta (L.) Coville—*B. McInteer 2152* (KY)

IRIDACEAE
**Iris domestica* (L.) Goldblatt & Mabb.—*E. Browne & E. Browne 7082* (EKY)
Iris cristata Aiton—Common. MR. *576*
**Iris germanica* L.—Common. R. *622*
Iris verna L.—*M. Medley 18776* (DHL)
Sisyrinchium albidum Raf.—*W. Martin May 3,1978* (EKY)
Sisyrinchium angustifolium Mill.—Common. R/D. *61*

JUNCACEAE
Juncus acuminatus Michx.—Common. SA. *693*
Juncus anthelatus (Wiegand) R.E. Brooks—*M. Medley 8173* (APSC)
!*Juncus articulatus* L. **SC, S2S3G5**—*J. Campbell August 2, 1988* (KY)
†*Juncus canadensis* J. Gay ex Laharpe—Infrequent. SA. *697B*
Juncus diffusissimus Buckley—Common. SA. *686*
Juncus effusus L. subsp. *solutus* (Fernald &Wiegand) Hämet-Ahti—Common. SA. *648*
Juncus marginatus Rostk.—Common. MR. *792*
†*Juncus scirpoides* Lam.—Infrequent. SA. *1137-22*
Juncus tenuis Willd.—Abundant. MR. *204*
Juncus torreyi Coville—Infrequent. MKyRF. *821*
Luzula echinata (Small) F.J. Herm.—*M. Wharton 1700* (NCU)

LILIACEAE
Erythronium americanum Ker. Gawl.—Common. MR. *543*
†*Lilium canadense* L.—Infrequent. R. *1150-22*
**Lilium lancifolium* Thunb.—Infrequent. R. *833*
Medeola virginica L.—*M. Wharton 2314* (KY)
Prosartes lanuginosa (Michx.) D.Don.—Common. MR. *14*

ORCHIDACEAE
Aplectrum hyemale (Muhl. ex Willd.) Torr.—Infrequent. L. *775*
Cypripedium acaule Aiton—*S. Hanscom 16* (EKY)
Galearis spectabilis (L.) Raf.—Infrequent. MR. *44*
Goodyera pubescens (Willd.) R.Br.—Common. MR. *343*

Liparis liliifolia (L.) Rich ex Lindl.—*W. Anderson 526* (GH)
Platanthera flava (L.) Lindl. var. *flava*—*G. Libby 416* (EKY)
Platanthera flava (L.) Lindl. var. *herbiola* (R. Br.) Luer—Rare. SA. *1067-22*
Platanthera lacera (Michx.) G. Don.—Rare. R/D. *702*
Spiranthes cernua (L.) Rich.—*A. Risk 718* (MDKY)
Tipularia discolor (Pursh) Nutt.—Common. MR. *861*

POACEAE

**Agrostis gigantea* Roth—Common. O-H. *293*
Agrostis hyemalis (Walter) B.S.P.—Common. MR. *247*
Agrostis perennans (Walter) Tuck.—Common. O-H. *952*
***Agrostis stolonifera* L.—*D. Walker 513* (EKY)
Andropogon gerardii Vitman—Infrequent. L. *948*
Andropogon virginicus L.—Common. R/D. *368*
**Anthoxanthum odoratum* L.—*R. Thompson 07-58* (BEREA)
Aristida dichotoma Michx.—*J. Campbell October 14, 1988* (KY)
***†Arthraxon hispidus* (Thunb.) Makino—Common. S. *1306-22*
Arundinaria gigantea (Walter) Muhl.—Common. MKyRF. *400*
**†Avena sativa* L.—Common. R/D. *139*
!Bouteloua curtipendula* (Michx.) Torr. **SC, S3?G5T5**—Rare. L. *959*
Brachyelytrum erectum (Schreb.) P. Beauv.—*R. Hannan & L. Phillippe 6962* (EKY)
**†Bromus commutatus* Schrad.—Abundant. R/D. *645*
***Bromus inermis* Leyss.—Common. R. *618*
***Bromus japonicus* Thunb.—Abundant. R/D. *636*
Bromus nottowaynus Fernald—Common. MR. *208*
Bromus pubescens Muhl.—Abundant. R/D. *646*
***Bromus racemosus* L.—*N. Hill 1 May 1968* (EKY)
**Bromus secalinus* L.—*J. Thieret 55215* (KNK)
***Bromus tectorum* L.—Infrequent. R. *616*
!Calamogrostis insperata* Swallen **E, S1S2G4T3**—*J. Campbell July 14, 1988* (KY)
Cenchrus longispinus (Hack) Fernald—*G. Libby & D. Walker 454* (KNK)
Chasmanthium latifolium (Michx.) H.O. Yates—Common. MR. *322*
Cinna arundinacea L.—*A. Risk 706* (MDKY)
Coleataenia anceps (Michx.) Soreng subsp. *anceps*—*A. Risk 714* (MDKY)
Coleataenia rigidula (Bosc ex Nees) LeBlond—*D. Walker 513* (EKY)
**Cynodon dactylon* (L.) Pers.—Common. RT. *265*
Danthonia spicata (L.) P. Beauv.—Common. R/D. *654*
Diarrhena americana P. Beauv.—Common. MR. *398*
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark—Common. MR. *194*
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *lindheimeri* (Nash) Gould & C.A. Clark—*J. Campbell July 14, 1988* (KY)
Dichanthelium acuminatum Sw. var. *themale* (Bol.) W ipff.—*W. Anderson 501* (MO)
Dichanthelium bicknellii (Nash) LaBlond—*J. Campbell July 12, 1988* (KY)
Dichanthelium boreale (Nash) Freckman.—*J. Campbell July 12, 1988* (KY)
Dichanthelium boscii (Poir.) Gould & C.A. Clark—Abundant. R. *97*
Dichanthelium clandestinum (L.) Gould—Common. O-H. *643*
Dichanthelium commutatum (Schult.) Gould. var. *commutatum*—*J. Campbell 1 Jul 1988* (KY)
Dichanthelium dichotomum (L.) Gould—Common. L. *953*
Dichanthelium laxiflorum (Lam.) Gould—Common. O-H. *950*
Dichanthelium linearifolium (Scribn.) Gould—Common. L. *744*
Dichanthelium microcarpon (Muhl. ex Elliott) Mohlenbr.—*J. Campbell August 2, 1988* (KY)
Dichanthelium polyanthes (Schult.) Mohlenbr.—Common. L. *787*
Dichanthelium scribnerianum (Nash) J.R. Thomas—*M. Medley 19103* (APSC)
**Digitaria ischaemum* (Schreb.) Schreb.—*J. Campbell October 14, 1988* (KY)
**†Digitaria sanguinalis* (L.) Scop. Abundant. R/D. *1231-22*
**Echinochloa crus-galli* (L.) P. Beauv.—Abundant. RT. *309*
Echinochloa muricata (P. Beauv.) Fernald—*J. Varner 8372* (TENN)
**Eleusine indica* (L.) Gaertn.—Abundant. R/D. *515*
Elymus glabriflorus (Vasey) Scribn. & C.R. Ball—Infrequent. L. *755*
Elymus hystrix L.—Common. S. *703*
Elymus macgregoriorum R.E. Brooks & J.J.N. Campbell var. *hirsutispiculus* A. Haines—Common. RT. *254*
Elymus riparius Wiegand—*J. Campbell August 2, 1988* (KY)
!Elymus svensonii* G.L. Church **T, S2S3G3 J**. *Campbell April 8, 1990* (KY)
Elymus villosa Muhl.—Abundant. L. *680*
Elymus virginicus L.—Common. R/D. *691*
Eragrostis capillaris (L.) Nees—Infrequent. RT. *261*
Erianthus alopecuroides (L.) Elliott—Infrequent. R. *534*
**†Erianthus giganteus* (Walter) P. Beauv.—Infrequent. S. *527*
Festuca octoflora Walter—*A. Risk 4448* (MDKY)
**Festuca rubra* L.—*N. Hill May 1, 1968* (EKY)
Festuca subverticillata (Pers.) E.B. Alexeev—Infrequent. R/D. *207*
Glyceria striata (Lam.) Hitchc.—Common. S. *130*
Hordeum pusillum Nutt.—Common. R. *617*
Kellochloa verrucosa (Muhl. ex Lizarazu—*J. Fedders September 21, 1980* (EKY)
Leersia oryzoides (L.) Sw.—Common. MKyRF. *690*
Leersia virginica Willd.—*A. Risk 720* (MDKY)
***Lolium arundinaceum* (Schreb.) Darbysh.—Common. S. *133*
**Lolium perenne* L.—Common. RT. *256*
Melica nitens (Scribn.) Nutt.—*J. Campbell May 31, 1990* (KY)
***Microstegium vimineum* (Trin.) A. Camus—Infrequent. R/D. *539*
****†Miscanthus sinensis* Andersson—Infrequent. R. *1275- 22*
Muhlenbergia capillaris (Lam.) Trin.—*J. Campbell October 6, 1988* (KY)
!Muhlenbergia cuspidata* (Torr.) Rydb. **T, S2G5**—Rare. L. *957*
Muhlenbergia frondosa (Poir.) Fernald—*Y. Thompson 15* (EKY)
Muhlenbergia sobolifera (Muhl.) Trin.—Infrequent. L. *906*
Muhlenbergia tenuiflora (Kunth) Trin.—*J. Campbell August 24, 1988* (KY)
Panicum capillare L.—Infrequent. RT. *502*
Panicum dichotomiflorum Michx.—Common. MR. *484*
Panicum flexile (Gatt.) Scribn.—*D. Shankland 16* (EKY)
Panicum philadelphicum Bernh. ex Trin. subsp. *gattingeri* (Nash) Freckmann & Lelong—Infrequent. R/D. *537*
****†Paspalum dilatatum* Poir.—Infrequent. R/D. *1205-22*
Paspalum pubiflorum Rupr.—*J. Campbell August 24, 1988* (KY)
!Patis racemosa* (Sm.) Romasch., P.M. Peterson & Soreng. **SC, S3?G5**—*J. Campbell October 6, 1988* (EKY)
**Phleum pratense* L.—Common. MKyRF. *232*
****†Phragmites australis* (Cav.) Trin. ex Steud.—Common. R. *1202-22*
Poa autumnalis Muhl. ex Elliott—*J. Campbell April 19, 1988* (KY)
***Poa compressa* L.—*R. Hannan & L. Phillippe 6992* (EKY)
Poa cuspidata Nutt.—*M. Wharton 1702* (KY)
***Poa pratensis* L.—Common. RT. *260*
Poa sylvestris A. Gray—Infrequent. R. *205*
Schizachyrium scoparium (Michx.) Nash—Infrequent. L. *951*
**Secale cereale* L.—Common. R. *620*
***Setaria faberi* R.A.W. Herrm.—Abundant. R. *954*
**Setaria pumila* (Poir.) Roem & Schult.—Common. X. *509*
**Setaria viridis* (L.) P. Beauv.—*W. Martin July 4, 1978* (EKY)

Sorghastrum nutans (L.) Nash—Infrequent. O-H. *949*
**Sorghum bicolor* (L.) Moench—*D. Walker 516* (EKY)
***Sorghum halepense* (L.) Pers.—Common. RT. *245*
Sphenopholis intermedia (Rydb.) Rydb.—*N. Hill May 1, 1968* (EKY)
Sphenopholis nitida (Biehler) Scribn.—*M. Wharton 3898* (KY)
Sphenopholis obtusata (Michx.) Scribn.—*W. Anderson 225* (MO)
Sporobolus compositus (Poir.) Merr. var. *drummondii* (Trin.) Kartesz & Gandhi—Common. L. *958*
**Sporobolus indicus* (L.) R. Br.—*K. Sirimongkhon 10* (EKY)
Sporobolus neglectus Nash—*J. Campbell October 14, 1988* (KY)
Sporobolus vaginiflorus (Torr. ex A. Gray) Alph. Wood—*M. Medley 15115* (APSC)
Tridens flavus (L.) Hitchc.—*D. Walker 514* (EKY)
**Triticum aestivum* L.—*N. Hill May 1, 1968* (EKY)

POTAMOGETONACEAE
†*Potamogeton diversifolius* Raf.—Infrequent. S. 1169-22
Potamogeton nodosus Poir.—Common. SA. *716*

RUSCACEAE
Convallaria majalis L.—*J. Campbell June 5, 2020* (APSC)
Maianthemum racemosum (L.) Link—Abundant. *586*
Polygonatum biflorum (Walter) Elliott—Common. *184*
Polygonatum pubescens (Willd.) Pursh—Infrequent. *58*

SMILACACEAE
Smilax bona-nox L.—Common. L. *530*
Smilax ecirrhata (Engelm. ex Kunth.) S. Watson var. *hugeri* (Small) H.E. Ahles—Infrequent. MR. *86*
Smilax glauca Walter—Common. R/D. *851*
Smilax herbacea L.—Common. O-H. *93*
Smilax hispida Raf.—*T. Weckman 10292* (EKY)
Smilax rotundifolia L.—Common. L. *961*

TRILLIACEAE
Trillium erectum L.—Common. O-H. *316*
Trillium grandiflorum (Michx.) Salisb.—Common. MR. *578*
Trillium sessile L.—Common. MR. *44*

TYPHACEAE
†*Sparganium americanum* Nutt.—Rare. S. *1069-22*
Typha angustifolia L.—Infrequent. SA. *800*
Typha latifolia L.—Abundant. S. *353*

EUDICOTS

ACANTHACEAE
†*Justicia americana* (L.) Vahl—Abundant. S. *683*
†*Ruellia caroliniensis* (J.F. Gmel.) Steud.—Common. X. *271*
†*Ruellia strepens* L.—Common. S. *223*

ALTINGIACEAE
Liquidambar styraciflua L.—Abundant. O-H. *447*

ANACARDIACEAE
Rhus aromatica Aiton—Common. O-H. *156*
Rhus copallinum L.—Abundant. O-H. *301*
Rhus glabra L.—Common. RT. *276*
Toxicodendron radicans (L.) Kuntze—*T. Weckman 10291* (EKY)

APIACEAE
Angelica venenosa (Greenway) Fernald—*M. Wharton 3145* (KY)
Chaerophyllum tainturieri Hook.—Common. RT. *561*
Cicuta maculata L.—*J. Skidmore 35* (EKY)
***Conium maculatum* L.—Common. S. *140*
Cryptotaenia canadensis (L.) DC.—Abundant. S. *91*
******†****Daucus carota* L.—Abundant. R. *175*
Erigenia bulbosa (Michx.) Nutt.—Infrequent. MR. *11*
Osmorhiza claytonia (Michx.) C.B. Clarke—Common. O-H. *37*
Osmorhiza longistylis (Torr.) DC.—Common. MR. *170*
***Pastinaca sativa* L.—*R. Thompson 07-123* (BEREA)
Sanicula canadensis L.—Abundant. L. *190*
Sanicula odorata (Raf.) Pryer & Phillippe—Common. MR. *324*
†*Sanicula smallii* E.P. Bicknell—Infrequent. X. *782*
Sanicula trifoliata E.P. Bicknell—*R. Hannan & L. Phillippe 256B* (EKY)
Taenidia integerrima (L.) Drude—*R. Hannan & L. Phillippe 2575* (EKY)
Thaspium barbinode (Michx.) Nutt.—Common. O-H. *658*
Thaspium chapmanii (Coult. & Rose) Small—*D. Estes, R. Thompson, & P. Threadgill 10683* (APSC)
Thaspium trifoliatum (L.) A. Gr ay v ar. *aureum* (L.) Br itton—*J. Campbell April 19, 1988* (KY)
†*Thaspium trifoliatum* (L.) A. Gray—Infrequent. MR. *612*
Zizia aptera (A. Gray) Fernald—Common. L. *724*

APOCYNACEAE
†*Apocynum cannabinum* L.—Common. R/D. *136*
Asclepias incarnata L.—Common. S. *695*
Asclepias quadrifolia Jacq.—Common. X. *730*
!*Asclepias purpur ascens* L. **SC, S3G5?** *—M. Medley & J. T hieret 10761* (APSC)
Asclepias syriaca L.—Common. MR. *220*
Asclepias tuberosa L.—Common. MR. *282*
Asclepias variegata L.—*J. Campbell April 4, 1988* (KY)
Asclepias verticillata L.—Infrequent. X. *723*
Asclepias viridiflora Raf.—Abundant. X. *731*
Asclepias viridis Walter—Infrequent. SR. *595*
Cynanchum leave (Michx.)Pers.—Infrequent. MKyRF. *339*
******†****Vinca minor* L.—Common. R/D. *1274-22*

AQUIFOLIACEAE
†*Ilex opaca* Aiton—Infrequent. O-H. *966-22*
Ilex verticillata (L.) A. Gr ay—*R. Clark, J. Campbell, & G. Snowden 23,918* (EKY)

ARALIACEAE
Aralia racemosa L.—Infrequent. L. *780*
*****†****Hedera helix* L.—Infrequent. R/D. *970-22*
!*Panax quinquefolius* L. **CE, S3G3G4**—Rare. MR. *394*

ASTERACEAE
Achillea millefolium L.—Abundant. R/D. *70*
Ageratina altissima (L.) R.M. King & H. Rob.—Abundant. O-H. *430*
†*Ambrosia artemisiifolia* L.—Abundant. R/D. *374*
†*Ambrosia trifida* L.—Common. R/D. *375*
Antennaria parlinii Fernald subsp. *parlinii*—*S. Baker 45* (EKY)
Antennaria plantaginifolia (L.) Hook.—Abundant. MR. *582*
†*Antennaria solitaria* Rydb.—Infrequent. R. *101*
*****†****Anthemis cotula* L.—Infrequent. RT. *263*
******†****Arctium minus* (Hill) Bernh.—Common. R. *340*
†*Arnoglossum reniforme* (Hook.) H. Rob.—Infrequent. MR. *1096-22*
******†****Artemisia vulgaris* L.—Common. R/D. *378*
Astranthium integrifolium (Michx.) Nutt.—Common. X. *596*
Bidens bipinnata L.—*J. Campbell October 14, 1988* (KY)
Bidens frondosa L.—*H. Gleason & C. Griffith 429* (MICH)
Bidens polylepis S.F. Blake—Common. MKyRF. *380*
Bidens vulgata Greene—*H. Gleason 429* (NY)
Brickellia eupatorioides (L.) Shinners—*W. Martin September 10, 1978* (EKY)
******†****Carduus nutans* L.—Common. R. *176*

*†*Centaurea stoebe* L. subsp. *micranthos* (S.G. Gmel. ex Gugler) Hayek.—Infrequent. RT. *1092-22*
**Chrysanthemum vulgare* Lam.—Common. MR. *460*
**†*Cichorium intybus* L.—Common. R. *148*
†*Cirsium discolor* (Muhl. ex Willd.) Spreng.—Abundant. R. *357*
†*Cirsium muticum* Michx.—Infrequent. RT. *1133-22*
**†*Cirsium vulgare* (Savi) Ten.—Common. R/D. *342*
Conoclinium coelestinum (L.) DC.—Common. R/D. *365*
Coreopsis auriculata L.—*S. Hanscom 49* (EKY)
**Coreopsis grandiflora* Hogg—*J. Lassetter 30600* (EKY)
Coreopsis major Walter—Abundant. O-H. *177*
*†*Crepis pulchra* L.—Common. MKyRF. *275*
Doellingeria infirma (Michx.) Greene—Common. L. *732*
Echinacea purpurea (L.) Moench—Common. O-H. *1156-22*
Elephantopus carolinianus Raeusch—Infrequent. L. *891*
Erechtites hieraciifolius (L.) Raf.—*D. Walker 583* (EKY)
Erigeron annuus (L.) Pers.—Abundant. MR. *795*
Erigeron canadensis L.—Abundant. MKyRF. *334B*
Erigeron philadelphicus L.—Abundant. R. *38*
Erigeron strigosus Muhl. ex Willd.—Common. MR. *461*
Eupatorium album L.—Infrequent. MKyRF. *369*
†*Eupatorium altissimum* L.—Common. O-H. *435*
Eupatorium perfoliatum L.—Common. S. *846*
Eupatorium serotinum Michx.—Common. R/D. *369B*
†*Eupatorium sessilifolium* L.—Common. X. *908*
Eurybia divaricata (L.) G.L. Nesom—Common. MR. *392*
Eurybia macrophylla (L.) Cass.—Infrequent. L. *943*
†*Eurybia schreberi* (Nees) Nees—Infrequent. MR. *346*
†*Euthamia graminifolia* (L.) Nutt.—Infrequent. O-H. *441*
Eutrochium fistulosum (Barratt) E.E. Lamont—*W. Anderson 356* (GH)
†*Eutrochium purpureum* (L.) E.E. Lamont—Common. L. *785*
**†Galinsoga quadriradiata* Ruiz & Pav. Common. M/R. *1106-22*
†*Gamochaeta purpurea* (L.) Cabrera—Common. MR. *78*
†*Gillenia trifoliata* (L.) Moench—Infrequent. R/D. *1080-22*
Helenium autumnale L.—*D. Walker 502* (EKY)
†*Helenium flexuosum* Raf.—Common. R/D. *823*
Helianthus divaricatus L.—Common. X. *917*
†*Helianthus giganteus* L.—Infrequent. MR. *1297-22*
†*Helianthus hirsutus* Raf.—Common. MR. *462*
Helianthus microcephalus Torr. & A. Gray—Common. X. *919*
Helianthus strumosus L.—Common. X. *875*
Heliopsis helianthoides (L.) Sweet—Common. MR. *349*
Hieracium gronovii L.—Infrequent. L. *871*
Hieracium venosum L.—Common. R. *627*
Ionactis linariifolia (L.) Greene—*J. Campbell October 14, 1988* (KY)
†*Iva annua* L.—Abundant. R/D. *371*
Krigia biflora (Walter) S.F. Blake—Common. R. *583*
†*Krigia dandelion* (L.) Nutt.—Common. R. *67*
Lactuca biennis (Moench) Fernald—*H. Gleason & C. Griffith 415* (MICH)
†*Lactuca canadensis* L.—Common. S. *835*
Lactuca floridana (L.) Gaertn.—Common. O-H. *889*
Liatris aspera Michx.—Infrequent. L. *941*
Liatris spicata (L.) Willd.—*W. Martin April 16, 1978* (EKY)
Liatris squarrosa (L.) Michx.—*W. Martin July 30, 1978* (EKY)
Nabalus albus (L.) Hook.—Rare. MKyRF. *528*
Nabalus altissimus (L.) Hook.—*J. Campbell October 6, 1988* (KY)
Nabalus serpentaria (Pursh) Hook.—*J. Campbell October 6, 1988* (KY)
Packera anonyma (Alph. Wood) W.A. Weber & Á. Löve—Common. MR. *127*
Packera aurea (L.) Á. Löve & D. Löve—Common. R. *33*
†*Packera glabella* (Poir.) C. Jeffrey—Infrequent. R/D. *51*
Packera obovata (Muehl. ex Willd.) W.A. Weber & Á. Löve—Common. MR. *611*
†*Polymnia canadensis* L.—Common. L. *895*
Pseudognaphalium obtusifolium (L.) Hilliard & B.L. Burtt.—Common. MKyRF. *531*
Pyrrhopappus carolinianus (Walter) DC.—*J. Lassetter & D. Walker 3502* (EKY)
Rudbeckia fulgida Aiton—Common. R/D. *1229-22*
†*Rudbeckia hirta* L.—Common. S. *832*
Rudbeckia triloba L.—Common. S. *844*
Rudbeckia umbrosa C.L. Boynton & Beadle—*J. Campbell October 6, 1988* (KY)
Sericocarpus asteroides (L.) B.S.P.—Common. L. *768*
†*Silphium astericus* L. var. *trifoliatum* (L.) J.A. Clevinger—Infrequent. L. *872B*
Silphium terebinthinaceum Jacq. var. *lucy-brauniae* Steyermark—Rare. L. *927*
Solidago altissima L.—*M. Wharton 1508* (MICH)
Solidago arguta Aiton var. *arguta*—*M. Medley 18775* (APSC)
Solidago bicolor L.—Infrequent. O-H. *422*
Solidago caesia L.—Abundant. L. *940*
†*Solidago canadensis* L.—Common. MR. *449*
Solidago erecta Banks ex Pursh—*M. Wharton 1506* (MICH)
Solidago flexicaulis L.—Common. O-H. *431*
†*Solidago gigantea* Aiton—Common. MR. *330*
Solidago harrisii Steele—*M. Medley 19119* (APSC)
†*Solidago hispida* Muhl. ex Willd.—Common. L. *918*
Solidago juncea Aiton—*J. Campbell September 20, 1988* (KY)
Solidago nemoralis Aiton—Common. L. *939*
Solidago rigida L.—*W. Martin July 16, 1978* (EKY)
†*Solidago rugosa* Mill.—Common. X. *909*
Solidago speciosa Nutt.—*J. Campbell October 14, 1988* (KY)
Solidago sphacelata Raf.—Infrequent. MKyRF. *524*
Solidago ulmifolia Muhl.—Common. MR. *387*
**Sonchus asper* (L.) Hill—Abundant. R. *99*
Symphytrichum cordifolium (L.) G.L. Nesom—Common. MR. *489*
Symphyotrichum laeve (L.) Á. Löve & D. Löve—*M. Medley 15108* (APSC)
Symphyotrichum lateriflorum (L.) Á. Löve & D. Löve—*J. Campbell October 6, 1988* (KY)
Symphyotrichum novae-angliae (L.) G.L. Nesom— Common. O-H. *423*
Symphyotrichum oblongifolium (Nutt.) G.L. Nesom—Infrequent. L. *963*
Symphyotrichum ontarionis (Wiegand) G.L. Nesom— Common. MR. *473*
Symphyotrichum patens (Aiton) G.L. Nesom var. *patens*—*W. Martin October 10, 1978* (EKY)
Symphyotrichum phlogifolium (Muhl. ex Willd.) G.L. Nesom—Common. MR. *382*
Symphyotrichum pilosum (Willd.) G.L. Nesom—Common. MKyRF. *370*
†*Symphyotrichum racemosum* (Elliott) G.L. Nesom—Infrequent. SA. *1313-22*
Symphyotrichum shortii (Lindl.) G.L. Nesom—Infrequent. MR. *485*
Symphyotrichum undulatum (L.) G.L. Nesom—Common. O-H. *451*
Symphyotrichum urophyllum (Lindl. ex DC.) G.L. Nesom—*W. Martin October 26, 1978* (EKY)
**†Taraxacum officinale* F.H. Wigg.—Abundant. R/D. *985-22*
**Tragopogon dubius* Scop.—*J. Campbell May 20, 1988* (KY)
***Tussilago farfara* L.—*R. Thompson 13-659* (BEREA)
Verbesina alternifolia (L.) Britton—Common. MKyRF. *418*
Vernonia gigantea (Walter) Trel. ex Branner & Coville—Common. R. *337*

Vernonia noveboracensis (L.) Michx.—*D. Walker 503* (EKY)
†*Xanthium strumarium* L. var. *glabratum* (DC.) Cronquist—Common. MR. *465*

BALSAMINACEAE
Impatiens capensis Meerb.—Common. MR. *219*
Impatiens pallida Nutt.—Abundant. RT. *259*

BERBERIDACEAE
Caulophylum thalictroides (L.) Michx.—Common. MR. *16*
Jeffersonia diphylla (L.) Pers.—Common. MR. *19*
Podophyllum peltatum L.—Abundant. MR. *116*

BETULACEAE
Alnus serrulata (Aiton) Willd.—Common. S. *410*
Betula lenta L.—*T. Weckman 10328* (EKY)
Betula nigra L.—*M. Wharton 3013* (KY)
Carpinus caroliniana Walter—Common. O-H. *469*
Corylus americana Walter—*D. Pittillo 2639* (KY)
Ostrya virginiana (Mill.) K. Koch—Common. MR. *320*

BIGNONIACEAE
Bignonia capreolata L.—*E. Browne & E. Browne 7821* (EKY)
†*Campsis radicans* (L.) Seem. ex Bureau—Abundant. R. *215*
Catalpa speciosa (Warder) Warder ex Engelm.—Common. RT. *501*

BORAGINACEAE
Andersonglossum virginianum (L.) J.I. Cohen—Common. O-H. *602*
Hackelia virginiana (L.) I.M. Johnst.—*M. Wharton 3152* (KY)
Lithospermum canescens (Michx.) Lehm.—*R. Hannan & L. Phillippe 7001* (EKY)
Lithospermum latifolium Michx.—*J. Campbell July 14, 1988* (KY)

BRASSICACEAE
Abdra brachycarpa (Nutt. ex Torr. & A. Gray) Greene—*M. Medley 18759* (DHL)
******Alliaria petiolata* (M. Bieb.) Cavara & Grande—Abundant. R. *974-22*
Borodinia canadensis (L.) P. J. Alexander & Windham—*R. Hannan & L. Phillippe 6996* (EKY)
Borodinia burkii (Porter) P.J. Alexander & Windham—*M. Medley 18773* (APSC)
Borodinia laevigata (Muhl. ex Willd.) P.J. Alexander & Windham—Common. MR. *212*
******Barbarea vulgaris* Aiton—Abundant. MR. *24*
*****Capsella bursa-pastoris* (L.) Medik.—Abundant. R. *64*
Cardamine angustata O.E. Schulz.—Common. MR. *57*
Cardamine concatenata (Michx.) Schwartz—Abundant. S. *112*
*****Cardamine hirsuta* L.—Common. MR. *29*
Descurainia pinnata (Walter) Britton—*J. Campbell May 4, 1991* (KY)
*****Draba verna* L.—Common. R/D. *557*
*****Erysimum repandum* L.—*J. Campbell May 31, 1990* (KY)
******Hesperis matronalis* L.—Infrequent. R/D. *628*
***†**Lepidium campestre* (L.) R.Br.—Common. R. *975-22*
Lepidium virginicum L.—Common. R. *56*
******Mummenhoffia alliacea* (L.) Esmaibegi & Al-Shehbaz—*A. Cusick 32,898* (EKY)
****†**Noccaea perfoliata* (L.) Al-Shehbaz—Abundant. RT. *563*
Rorippa palustris (L.) Besser—Infrequent. S. *692*
*****Sisymbrium officinale* (L.) Scop.—Common. S. *146*

CACTACEAE
Opuntia cespitosa Raf.—*M. Medley 19109-88* (APSC)

CAMPANULACEAE
Campanulastrum americanum (L.) Small—Common. S. *834*
Lobelia cardinalis L.—Infrequent. SA. *1258-22*
Lobelia inflata L.—Abundant. MR. *356*
Lobelia siphilitica L.—Infrequent. MR. *385*
Lobelia spicata Lam.—Infrequent. O-H. *1068-22*
Triodanis perfoliata (L.) Nieuwl.—Common. MR. *76*

CANNABACEAE
Celtis occidentalis L.—Common. MR. *1255-22*
Celtis pumila Pursh—Infrequent. RML. *742*

CAPPARACEAE
Polanisia dodecandra (L.) DC.—*G. Snyder 79* (KE)

CAPRIFOLIACEAE
******Lonicera japonica* Thunb.—Abundant. R/D. *75*
****†**Lonicera maackii* (Rupr.) Herder—Infrequent. R/D. *1053-22*
!*Symphoricarpos albus* (L.) S.F. Blake **E, S1G5T5**—Rare. X. *750*
†*Symphoricarpos orbiculatus* Moench—Rare. X. *882*
Triosteum angustifolium L.—Infrequent. X. *863*
Triosteum aurantiacum E.P. Bicknell—*R. Hannan & L. Phillippe 2534* (EKY)

CARYOPHYLLACEAE
Cerastium nutans Raf.—*B. McInteer 2145* (KY)
***†**Dianthus armeria* L.—Infrequent. RT. *1090-22*
Paronychia canadensis (L.) Alph. Wood—*R. Hannan & L. Phillippe 6897* (EKY)
Paronychia fastigiata (Raf.) Fernald—*M. Wharton 2992A* (MICH)
Sabulina patula (Michx.) Small—*W. Martin May 27, 1978* (EKY)
Sabulina muscorum (Fassett) E.S. Schilling—*M. Medley 19101* (APSC)
Silene caroliniana Walter subsp. *wherryi* (Small) Fernald—*M. Wharton 1655B* (MICH)
Silene rotundifolia Nutt.—*R. Hannan & L. Phillippe 6969* (EKY)
Silene stellata (L.) Aiton—*H. Bryant 113* (APSC)
Silene virginica L.—Common. R. *66*
****†**Stellaria media* (L.) Vill.—Abundant. R/D. *976B-22*
Stellaria pubera Michx.—Common. S. *565*

CELASTRACEAE
Celastrus scandens L.—*R. Hannan & L. Phillippe 2567* (EKY)
Euonymus atropurpureus Jacq.—Common. O-H. *535*
******Euonymus fortunei* (Turcz.) Hand.-Mazz.—Common. MK yRF. *1116-22*
!*Paxistima canbyi* A. Gray **E, S1G2?**—Rare. SR. *738*

CHENOPODIACEAE
Chenopodiastrum simplex (Torr.) S. Fuentes, Uotila & Borsch—*D. Estes, R. Thompson, & P. Threadgill 10698* (APSC)
******Chenopodium album* L.—*M. Medley 19122-88* (APSC)
Chenopodium standleyanum Aellen—*M. Medley 15112* (APSC)

CONVOLVULACEAE
Convolvulus americanus (Sims) Greene—*J. Campbell October 6, 1988* (KY)
Convolvulus sepium L.—*D. Walker 368* (EKY)
Convolvulus spithamaeus L.—*J. Sole June 6, 1979* (EKY)
Cuscuta pentagona Engelm.—*D. Pittillo 2848* (KY)
*****Ipomoea coccinea* L.—Common. R/D. *364*
‡*Ipomoea cordatotriloba* Dennst.—Rare. R. *1271-22*
****†**Ipomoea hederacea* Jacq.—Common. R. *1273-22*
*****Ipomoea lacunosa* L.—*D. Walker 628* (EKY)
†*Ipomoea pandurata* (L.) G.F.W. Meyer—Infrequent. R. *1157-22*
****†**Ipomoea purpurea* (L.) Roth—Common. R. *1304-22*

CORNACEAE
Benthamidia florida (L.) Spach—Abundant. MR. *22*
Swida alternifolia (L.) Small—*T. Weckman 10297* (EKY)
Swida racemosa (Lam.) Moldenke—*J. Campbell October 6, 1988* (KY)

CRASSULACEAE
Sedum ternatum Michx.—*W. Anderson 280* (GH)

CUCURBITACEAE
**Citrullus lanatus* (Thunb.) Matsum. & Nakai.—*G. Libby & D. Walker 455* (BEREA)

DIPSACACEAE
**Dipsacus fullonum* L.—Abundant. R. *336*

EBENACEAE
†*Diospyros virginiana* L.—Common. O-H. *428*

ELAEAGNACEAE
***Elaeagnus umbellata* Thunb.—Common. R/D. *1005-22*

ERICACEAE
Chimaphila maculata (L.) Pursh—Common. MR. *285*
Epigaea repens L.—*M. Wharton 1699* (KY)
Gaultheria procumbens L.—*T. Weckman 10321* (EKY)
Gaylussacia bac cata (Wangenh.) K . Koch— *T. W eckman 10324* (EKY)
†*Hypopitys lanuginosa* (Michx.) Small—Rare. MR. *1163-22*
Kalmia latifolia L.—Common. PF. *134*
†*Leucothoe fontanesiana* (Steud.) Sleumer—Rare. MR. *993-22*
Monotropa uniflora L.—Infrequent. MR. *1030-22*
Oxydendrum arboreum (L.) DC.—Abundant. O-H. *541*
†*Rhododendron calendulaceum* (Michx.) Torr.—Rare. O-H. *984-22*
†*Rhododendron maximum* L.—Rare. MR. *967-22*
Vaccinium corymbosum L.—*M. Wharton 6062* (KY)
Vaccinium pallidum Aiton—Common. RML. *743*
Vaccinium stamineum L.—Common. RML. *767*

EUPHORBIACEAE
Acalypha rhomboidea Raf.—Common. O-H. *438*
Acalypha virginica L.—Common. RML. *733A*
Euphorbia c ommutata Engelm.— *D. Est es, R. T hompson, & P . Threadgill 10697* (APSC)
Euphorbia corollata L.—Abundant. L. *756*
Euphorbia dentata Michx.—*J. Conrad 565* (KY)
†*Euphorbia nutans* Lag.—Common. MKyRF. *376*
Euphorbia spathulata Lam.—*B. McInteer 1042* (WIS)
**Ricinus communis* L.—*R. Thompson 85-1657* (BEREA)

FABACEAE
***Albizia julibrissin* Durazz.—*T. Weckman 10339* (EKY)
Amphicarpaea bracteata (L.) Fernald—*W. Anderson 153* (GH)
Apios americana Medik.—Common. O-H. *1260-22*
Chamaecrista fasciculata (Michx.) Greene—Common. R. *328B*
†*Cercis canadensis* L.—Abundant. MR. *23*
Clitoria mariana L.—*M. Wharton 3102* (KY)
**Desmanthus illinoensis* (Michx.) MacMill. ex B.L. Rob. & Fernald—Infrequent. R/D. *801*
Desmodium canescens (L.) DC.—Abundant. R. 329
Desmodium cuspidatum (M uhl. ex Willd.) DC.— *W. A nderson 599* (GH)
Desmodium paniculatum (L.) DC.—Infrequent. X. *883*
†*Desmodium rotundifolium* DC.—Frequent. O-H. *1218-22*
Galactia regularis (L.) Britton—*W. Martin October 10, 1978* (EKY)
Gleditsia triacanthos L.—Common. R/D. *1032-22*
Gymnocladus dioicus (L.) K. Koch—Infrequent. MR. *1318-22*
Hylodesmum glutinosum (Muhl. ex Willd.) H.Ohashi & R.R.Mill.—*R. Hannan & L. Phillippe 2547* (EKY)
†*Hylodesmum nudiflorum* (L.) H. Ohashi & R.R. M ill.—Common. MR. *351*
Hylodesmum pauciflorum (Nuttall) H. Ohashi & R.R. M ill.—*M. Wharton 3138* (MICH)
***Kummerowia striata* (Thunb.) Schindl.—Common. O-H. *1280-22*
**Lathyrus latifolius* L.—Common. R/D. *180*
!*Lathyrus v enosus* M uhl. e x Willd. **SC, S2S3G5**—*J. L assetter 3499* (EKY)
***Lespedeza cuneata* (Dum. Cours.) G. Don.—Abundant. X. *869*
Lespedeza frutescens (L.) Hornem.—Abundant. L. *964*
Lespedeza hirta (L.) Hornem.—*W. Anderson 1934* (GH)
Lespedeza r epens (L.) Bar ton—*W. A nderson S eptember 12, 1934* (GH)
Lespedeza violacea (L.) Pers.—Abundant. L. *383*
Lespedeza virginica (L.) Britton—Common. L. *965*
**†*Lotus corniculatus* L.—Infrequent. R/D. *1136-22*
***Medicago lupulina* L.—Common. R. *149*
**Medicago sativa* L.—Abundant. R. *328A*
***Melilotus alba* Medik.—Abundant. R. *179*
***Melilotus officinalis* (L.) Pall.—Common. RT. 151
Orbexilum p edunculatum (Mill.) Rydb.—*R. Hannan & L. P hillippe 6889* (EKY)
Phaseolus polystachios (L.) BSP—Infrequent. RML. 772
***Pueraria montana* (Lour.) Merr. var. *lobata* (Willd.) Maesen & S.M. Almeida—Common. R. *384*
†*Robinia hispida* L.—Infrequent. O-H. *61*
Robinia pseudoacacia L.—Abundant. R/D. *69*
**†*Securigera varia* (L.) Lassen.—Common. R. *77*
Senna marilandica (L.) Link—Common. SA. *1268-22*
Strophostyles helvola (L.) Elliott—Common. MKyRF. *403*
Strophostyles umbellata (Muhl. ex Willd.) Britton—*M. Wharton 3108* (KY)
Stylosanthes biflora (L.) B.S.P.—*W. Anderson July 28, 1928* (GH)
Tephrosia virginiana (L.) Pers.—*R. Hannan & L. Phillippe 7000* (EKY)
***Trifolium campestre* Schreb.—Common. R. *46*
**Trifolium hybridum* L.—Infrequent. X. *876*
***Trifolium pratense* L.—Common. R/D. *63*
***Trifolium repens* L.—Abundant. R. *41*
Vicia caroliniana Walter—*W. McGuffey 39* (EKY)
**†*Vicia villosa* Roth.—Common. R. *1035-22*
**†*Wisteria frutescens* (L.) Poir.—Infrequent. O-H. *1221-22*

FAGACEAE
!*Castanea dentata* (M arshall) B orkh. E , S1G3— *M. W harton 2294* (MICH)
**Castanea mollissima* Blume—Escaped. R/D. *1305-22*
Fagus grandiflora Ehrh.—Abundant. O-H. *169*
Quercus alba L.—Abundant. O-H. *425*
Quercus bushii-× (*Q. marilandica* × *Q. velutina*) Sarg.—*R. Hannan & L. Phillippe 6989* (EKY)
Quercus beadle-×(*Q. alba* × *Q. michauxii*) Trel.—Infrequent. O-H. *893*
Quercus coccinea Münchh.—*M. Wharton 1501* (KY)
Quercus falcata Michx.—Common. O-H. *852*
†*Quercus imbricaria* Michx.—Infrequent. O-H. *1141-22*
Quercus marilandica Münchh.—Common. RML. *766*
Quercus montana Willd.—Abundant. MR. *427*
Quercus muehlenbergii Engelm.—Infrequent. X. *452*
Quercus rubra L.—*R. Hannan & L. Phillippe 6984* (EKY)
Quercus saulii-× (*Q. alba* × *Q. montana*) Schneid.—Infrequent. O-H. *779*
Quercus shumardii Buckley—*T. Weckman 10327* (EKY)
Quercus stellata Wangenh.—Abundant. O-H. *424*
Quercus velutina Lam.—Common. O-H. *426*

FUMARIACEAE
Corydalis flavula (Raf.) DC.—*A. Clevenger 2* (EKY)
Dicentra cucullaria (L.) Bernh.—Common. MR. *15*

GENTIANACEAE
†*Frasera caroliniensis* Walter—Infrequent. R. *105*
Gentiana villosa L.—*J. Campbell November 30, 1990* (KY)
Obolaria virginica L.—Common. O-H. *45*
Sabatia angularis (L.) Pursh—Common. MR. *345*

GERANIACEAE
Geranium carolinianum L. var. *carolinianum*—Common. MR. *117*
Geranium maculatum L.—Common. MR. *27*

GROSSULARIACEAE
Ribes cynosbati L.—*J. Campbell April 8, 1990* (KY)

HAMAMELIDACEAE
Hamamelis virginiana L.—Common. MR. *224*

HYDRANGEACEAE
Hydrangea arborescens L.—Abundant. MR. *214*

HYDRASTIDACEAE
Hydrastis canadensis L.—Rare. MR. *18*

HYDROPHYLLACEAE
Hydrophyllum canadense L.—Abundant. MR. *82*
Hydrophyllum macrophyllum Nutt.—*W. Anderson 474* (GH)
Phacelia bipinnatifida Michx.—*S. Hanscon 15* (EKY)

HYPERICACEAE
†*Hypericum drummondii* (Grev. & Hook.) Torr. & A. Gray—Infrequent. SA. *1171-22*
Hypericum gentianoides (L.) B.S.P.—*M. Wharton 3129* (MICH)
Hypericum mutilum L.—Infrequent. S. *808*
**†*Hypericum perforatum* L. Common. RT. *1108-22*
Hypericum prolificum L.—Infrequent. S. *803*
Hypericum punctatum Lam.—Abundant. MR. *239*
Hypericum stragulum W.P. Adams & N. Robson.—*T. Weckman 10319* (EKY)

JUGLANDACEAE
Carya cordiformis (Wangenh.) K. Koch—Common. MR. *523*
Carya glabra (Mill.) Sweet—Abundant. O-H. *850*
Carya ovata (Mill.) K. Koch—Abundant. O-H. *421*
Carya pallida (Ashe) Engl. & Graebn.—*D. Pittillo 2859* (KY)
Carya tomentosa (Lam.) Nutt.—*J. Evans June 17, 1979* (EKY)
!*Juglans cinerea* L. **T, S2S3G3**—Rare. MR. *855*
Juglans nigra L.—Common. MKyRF. *272*

LAMIACEAE
Collinisia canadensis L.—Common. X. *880*
Cunila origanoides (L.) Britton—Common. L. *956*
**Glechoma hederacea* L.—Common. R. *40*
Hedeoma pulegioides (L.) Pers.—Common. RML. *752*
**Lamium amplexicaule* L.—*B. Smith 5* (EKY)
**Lamium purpureum* L.—Common. R/D. *50*
Lycopus americanus Muhl.—Common. S. *827*
Lycopus virginicus L.—*W. Anderson September 2, 1941* (GH)
Meehania cordata (Nutt.) Britton—Infrequent. MR. *284*
**Mentha* × *piperita* L.—*D. Walker 506* (EKY)
Monarda bradburiana Beck.—*W. Martin June 17, 1978* (EKY)
†*Monarda brevis* (Fosberg & Artz) Floden.—*D. Estes, R. Thompson, & P. Threadgill 10687* (APSC)
Monarda clinopodia L. —Rare. RML. *789*
Monarda fistulosa L. var. *fistulosa*—Infrequent. R. *848*
Monarda fistulosa L. var. *mollis* (L.) Benth.—*M. Wharton 3127* (MICH)
**Mosla dianthera* (Buch.-Ham.) Maxim.—Common. R. *466*
**Nepeta cataria* L.—Infrequent. RML. *737*
Physostegia virginiana (L.) Benth.—Common. R. *847*
†*Prunella vulgaris* L. var. *lanceolata* (Barton) Fernald—Abundant. R/D. *288*
†*Pycnanthemum incanum* (L.) Michx.—Infrequent. O-H. *864*
Pycnanthemum loomsii Nutt.—*D. Estes, R. Thompson, & P. Threadgill 10691* (APSC)
Pycnanthemum pycnanthemoides (Leavenw.) Fernald—Common. R. *510*
Pycnanthemum tenuifolium Schrad.—Common. S. *814*
Salvia lyrata L.—*M. Wharton 3893* (TENN)
†*Scutellaria elliptica* Muhl.—Abundant. MR. *790*
Scutellaria inc ana Biehler v ar. *punctata* (Chapm.) C. M ohr—*M. Wharton 3097* (TENN)
Scutellaria lateriflora L.—*A. Risk 713* (MDKY)
Scutellaria nervosa Pursh—*M. Wharton 2285* (MICH)
Scutellaria ovata Hill—Infrequent. X. *932*
Scutellaria parvula Michx.—*E. Browne & E. Browne 7076* (MEM)
†*Stachys cordata* Riddell—Common. MR. *173*
Synandra hispidula (Michx.) Britton—Rare. MR. *160*
Teucrium canadense L.—Abundant. MR. *798*
Trichostema coeruleum (Michx.) K.S.McClell. & Weakley—*W. Martin September 10, 1978* (EKY)
Trichostema dichotomum L.—*H. Gleason & C. Griffith 422* (APSC)
!*Trichostema setaceum* Houtt. **E, S1G5**—*M. Wharton 422* (NCU)

LINACEAE
Linum curtissii Small—Infrequent. S. *707*
Linum striatum Walter—Infrequent. S. *819*
Linum virginianum L.—*D. Estes, R. Thompson, & P. Threadgill 10688* (APSC)

LYTHRACEAE
Cuphea visc ossima Jac q.—*D. Est es, R. T hompson, & P . T hreadgill 10686* (APSC)
‡*Lagerstroemia indica* L.—Rare. R/D. *1204-22*
**†Lythrum salicaria* L.—Infrequent. SA. *1266-22*

MALVACEAE
**Abutilon theophrasti* Medik.—Infrequent. MR. *512*
Hibiscus moscheutos L.—Infrequent. SA. *1144-22*
**†Hibiscus syriacus* L.—Infrequent. R. *1228-22*
**Sida spinosa* L.—Infrequent. S. *416*
Tilia americana L. var. *americana*—*T. Weckman 10310* (EKY)
Tilia americana L. var. *heterophylla* (Vent.) Loudon—*R. Hannan & L. Phillippe 6934* (EKY)

MELASTOMATACEAE
Rhexia virginica L.—*D. Walker 366* (EKY)

MENISPERMACEAE
Menispermum canadense L.—Infrequent. O-H. *1159-22*

MONTIACEAE
Claytonia virginica L.—Common. MR. *592*

MORACEAE
**Broussonetia papyrifera* (L.) L´Hér.—*R. Thompson 85-1638* (BEREA)
**Fatoua villosa* (Thunb.) Nakai.—*R. Thompson 15-1235* (BEREA)
**Maclura pomifera* (Raf.) C.K. Scheid.—Common. R/D. *52*
**Morus alba* L.—*T. Weckman 10338* (EKY)
Morus rubra L.—Abundant. R. *471*

NYSSACEAE
Nyssa sylvatica Marshall—Common. O-H. *481*

OLEACEAE
Chionanthus virginicus L.—*J. Campbell June 12, 1990* (KY)
†*Fraxinus americana* L.—Abundant. O-H. *479*
Fraxinus pennsylvanica Marshall—Common. S. *141*
Fraxinus quadrangulata Michx.—Common. RML. *761*
**Ligustrum obtusifolium* Siebold & Zucc.—*T. Weckman 10334* (EKY)
**†Ligustrum sinense* Lour.—Infrequent. R/D. *1057-22*

ONAGRACEAE
Circaea canadensis (L.) Hill—Abundant. L. *325*
Epilobium coloratum Biehler—*D. Walker 493* (EKY)
Ludwigia alternifolia L.—Common. S. *868*
Ludwigia decurrens Walter—Infrequent. S. *409*
Ludwigia palustris (L.) Elliott—Infrequent. MKyRF. *688*
†*Ludwigia peploides* (Kunth) P.H. Raven var. *glabresens* (Kuntze) Shinners—Infrequent. SA. *1168-22*
†*Oenothera biennis* L.—Abundant. S. *413*
Oenothera fruticosa L.—*R. Peter June 1, 1834* (MICH)
Oenothera laciniata Hill—*D. Demaree 55,876* (VDB)

OROBANCHACEAE
Agalinis fasciculata (Elliott) Raf.—*J. Campbell September 20, 1988* (KY)
Agalinis gattingeri (Small) Small ex Britton —*W. Martin September 10, 1978* (EKY)
†*Agalinis purpurea* (L.) Pennell—Infrequent. SA. *1285-22*
Agalinis tenuifolia (Vahl) Raf.—*W. Anderson September 12, 1934* (GH)
Aphyllon uniflorum (L.) Torr. & A. Gray—*N. Hill May 1, 1968* (EKY)
Aureolaria flava (L.) Farw.—*J. Campbell April 8, 1990* (KY)
Aureolaria laevigata (Raf.) Raf.—*H. Gleason & C. Griffith 437* (MICH)
!†*Aureolaria patula* (Chapm.) Pennell **SC, S3G3**—Rare. RML. *771*
Aureolaria virginica (L.) Pennell—*D. Estes, R. Thompson, & P. Threadgill 10684* (APSC)
†*Conopholis americana* (L.) Wallr.—Common. MR. *283*
†*Epifagus virginiana* (L.) Barton—Common. MR. *464*
†*Pedicularis canadensis* L.—Common. MR. *568*

OXALIDACEAE
Oxalis dillenii Jacq.—Common. MR. *326*
Oxalis stricta L.—Common. MKyRF. *331*
Oxalis violacea L.—Common. MR. *598*

PAPAVERACEAE
Sanguinaria canadensis L.—Common. MR. *608*
Stylophorum diphyllum (Michx.) Nutt.—Common. MR. *20*

PASSIFLORACEAE
†*Passiflora incarnata* L.—Infrequent. R/D. *1243-22*
Passiflora lutea L.—Infrequent. RML. *740*

PAULOWNIACEAE
**† *Paulownia tomentosa* (Thunb.) Siebold & Zuccarini ex Steud.—Infrequent. R. *475*

PENTHORACEAE
Penthorum sedoides L.—*A. Risk 709* (MDKY)

PHRYMACEAE
Mimulus ringens L.—Common. S. *825*
†*Phryma leptostachya* L.—Common. *879*

PHYTOLACCACEAE
Phytolacca americana L.—Abundant. R/D. *183*

PLANTAGINACEAE
**Chaenorhinum minus* (L.) Lange—*R. Thompson 14-299* (BEREA)
†*Chelone glabra* L.—Infrequent. S. *411*
Gratiola neglecta Torr.—Infrequent. S. *696*
!*Gratiola viscidula* Pennell **T, S2G4G5**—*J. Lassetter 3054* (EKY)
Kickxia elatine (L.) Dumort.—*W. Anderson August 28, 1941* (GH)
Leucospora multifida (Michx.) Nutt.—*R. Thompson 19-345* (BEREA)
Penstemon canescens (Britton) Britton—Infrequent. R/D. *54*
†*Penstemon digitalis* Nutt. ex Sims—Infrequent. S. *670*
Penstemon hirsutus (L.) Willd.—*W. Martin June 17, 1978* (EKY)
†*Penstemon laevigatus* Aiton—Common. RT. *278*
Penstemon pallidus Small—*R. Hannan & L. Phillippe 2582* (EKY)
Plantago aristata Michx.—Common. R/D. *704*
**Plantago lanceolata* L.—Abundant. R. *68*
†*Plantago rugelii* Decne.—Infrequent. R. *1103-22*
Plantago virginica L.—Abundant. R/D. *72*
**Veronica arvensis* L.—*M. Wharton 2266* (KY)
**†Veronica officinalis* L.—Common. O-H. *100*
**†Veronica serpyllifolia* L.—R/D. *1002-22*
Veronicastrum virginicum (L.) Farw.—*J. Campbell October 14, 1988* (KY)

PLANTANACEAE
Platanus occidentalis L.—Abundant. S. *1022-22*

POLEMONIACEAE
Phlox divaricata L.—Abundant. MR. *1*
Phlox glaberrima L.—*R. Hannan & L. Phillippe 6959* (EKY)
Phlox maculata L.—*M. Wharton 3120* (MICH)
Phlox paniculata L.—Abundant. S. *836*
!*Phlox subulata* L. **SC, S3G5**—Rare. *754*
Polemonium reptans L.—Abundant. MR. *7*

POLYGALACEAE
Polygala ambigua (Nutt.) Pástore & Abbot—*W. Anderson July 28, 1928* (GH)
†*Polygala officinallis* Spach—Common. L. *778*
Polygala sanguinea (L.) Pástore & Abbot—Common. S. *705*

POLYGONACEAE
†*Fallopia scandens* (L.) Holub—Infrequent. X. *904B*
†*Persicaria lapathifolia* (L.) Delarbre—Infrequent. S. *866*
**†*Persicaria longiseta* (Bruijn) Kitag.—Common. S. *379*
***Persicaria maculosa* S.F. Gray—*D. Walker 270* (EKY)
†*Persicaria pensylvanica* (L.) M.Gomez—Infrequent. S. *811*
†*Persicaria punctata* (Elliott) Small—Common. O-H. *448*
Persicaria sagittata (L.) H. Gross ex Nakai.—Common. SA. *1284-22*
Persicaria virginiana (L.) Gaertn.—*M. Wharton 5187A* (MICH)
**†*Reynoutria japonica* Houtt.—Infrequent. MKyRF. *520*
***Rumex acetosella* (L.) Mill.—Common. S. *292*
**Rumex crispus* L.—Abundant. MR. *118*
**Rumex obtusifolius* L.—*M. Wharton 2984* (KY)

PRIMULACEAE
Anagallis arvensis L.—*D.Estes, R. Thompson, & P. Threadgill 09-393* (BEREA)
***Lysimachia nummularia* L.—Common. S. *143*
Lysimachia quadrifolia L.—Common. R/D. *653*
Primula meadia (L.) A.R. Mast & Reveal—*R. Thompson n.d.* (BEREA)
Samolus parviflorus Raf.—Common. S. *826*
Steironema ciliatum (L.) Baudo.—Abundant. MR. *225*

RANUNCULACEAE
Actaea pachypoda Elliott—Abundant. RT. *276B*
Actaea racemosa L.—Common. MR. *279*
Anemone virginiana L.—Infrequent. RT. *273*
†*Aquilegia canadensis* L.—Infrequent. MR. *548*
!*Clematis catesbyana* Pursh **T, S2G4G5**—*D. Estes, R. Thompson, & P. Threadgill 10692* (APSC)
!†*Clematis glaucophylla* Small **T, S2G4?**—Rare. MR. *277*
Clematis viorna L.—*W. Anderson 92* (GH)
Clematis virginiana L.—Abundant. R/D. *404*
Delphinium tricorne Michx.—Common. MR. *8*
Hepatica acutiloba DC.—*B. Smith 7* (EKY)
Ranunculus abortivus L.—Common. MR. *31*
***Ranunculus bulbosus* L.—*N. Hill May 1, 1968* (EKY)
Ranunculus hispidus Michx.—Common. MR. *25*
Thalictrum thalictroides (L.) Eames & Boivin—Abundant. X. *551*
Thalictrum dioicum L.—*M. Wharton 1696* (KY)
Thalictrum pubescens Pursh—Common. MR. *354*

RHAMNACEAE
Ceanothus americanus L.—Infrequent. L. *916*
Frangula caroliniana (Walter) A. Gray—Common. O-H. *433*

ROSACEAE
Agrimonia parviflora Aiton—*J. Campbell May 20, 1988* (KY)
Agrimonia rostellata Wallr.—Abundant. X. *915*
Amelanchier arborea (F. Michx.) Fernald—*M. Wharton 1663B* (KY)
!*Amelanchier spicata* (Lam.) K. Koch **E, S1G5**—*L.McKinney 94* (EKY)
Aruncus dioicus (Walter) Fernald—Common. MR. *108*
Crataegus calpodendron (Ehrh.) Medik.—*M. Medley 8168* (APSC)
Crataegus coccinea L.—*T. Weckman 10301* (EKY)
Crataegus crus-galli L.—*M. Wharton 3087* (GH)
Crataegus pruinosa (H.L. Wendl.) K. Koch—Rare. L. *933*
Fragaria virginiana Mill.—Common. R. *36*
†*Geum canadense* Jacq.—Abundant. R/D. *243*
Geum vernum (Raf.) Torr. ex A.Gray—*M. Wharton 3894* (APSC)
Geum virginianum L.—Infrequent. MR. *1129-22*
Gillenia stipulata (Muhl. ex Willd.) Nutt.—*R. Hannan & L. P hillippe 6926* (EKY)
†*Malus coronaria* (L.) Mill.—Infrequent. X. *938*
Physocarpus opulifolius (L.) Maxim.—Infrequent. RML. *760*
Potentilla canadensis L.—*B. Billings 16* (EKY)
Potentilla norvegica L.—Common. R/D. *236*
***Potentilla recta* L.—Common. R/D. *1033-22*
†*Potentilla reptans* L.—Infrequent. O-H. *1085-22*
Potentilla simplex Michx.—Common. R. *601*
Prunus americana Marshall—*T. Weckman 10302* (EKY)
Prunus angustifolia Marshall—*J. Campbell July 14, 1988* (KY)
Prunus mexicana S. Watson—Infrequent. L. *934*
**Prunus persica* (L.) Batsch—Infrequent. X. *888*
Prunus serotina Ehrh.—Abundant. O-H. *439*
***Pyrus calleryana* Decne—Common. R/D. *1307-22*
Rosa carolina L.—Common. R. *96*
***Rosa multiflora* Thunb.—Common. R/D. *711*
Rosa palustris Marshall—*J. Lassetter 3059* (EKY)
Rosa setigera Michx.—Common. R/D. *699*
†*Rubus allegheniensis* Porter—Common. MKyRF. *49*
Rubus flagellaris Willd.—Common. R/D. *603*
Rubus occidentalis L.—Common. MKyRF. *48*
Rubus pensylvanicus Poir.—*M. Wharton 3912A* (KY)

RUBIACEAE
Cephalanthus occidentalis L.—Common. S. *813*
Diodia virginiana L.—Common. S. *809*
†*Galium aparine* L.—Common. MR. *10*
Galium circaezans Michx.—Common. X. *191*
Galium divaricatum Pourr. ex Lam.—*M. Wharton 3177* (NCU)
Galium lanceolatum Torr.—*J. Campbell April 14, 1988* (KY)
**Galium parisiense* L.—*M. Wharton 3117* (MICH)
†Galium pedemontanum* (Bellardi) All.—Infrequent. SA. *1195-22*
Galium tinctorium L.—Common. S. *820*
Galium triflorum Michx.—*J. Campbell October 6, 1988* (KY)
Hexasepalum teres (Walter) J.H.Kirkbr.—Common. R/D. *1276-22*
Houstonia caerulea L.—Common. MR. *581*
Houstonia canadensis Willd. ex Roem. & Schult.—Common. S. *656*
Houstonia ciliata Torr.—*M. Wharton 3908* (NCSC)
Houstonia longifolia Gaertn.—*M. Wharton 2978* (NCU)
Houstonia nigricans (Lam.) Fernald—Common. L. *784*
Houstonia tenuifolia Nutt.—*M. Wharton 4386* (TENN)
†*Houstonia purpurea* L.—Abundant. S. *634*

RUTACEAE
†*Ptelea trifoliata* L.—Infrequent. RML. *759*
Zanthoxylum americanum Mill.—*M. Wharton 6061* (MICH)

SALICACEAE
***Populus alba* L.—Common. R/D. *540*
†*Populus grandidentata* Michx.—Infrequent. L. *781*
**Salix alba* L.—Infrequent. S. *718*
†*Salix caroliniana* Michx.—Common. S. *672*
Salix interior Rowlee.—Common. S. *671*
Salix humilus Marshall—*M. Wharton 3113* (MICH)
Salix nigra Marshall—Abundant. MKyRF. *53*
Salix sericea Marshall—*T. Weckman 10333* (EKY)

SANTALACEAE
Comandra umbellata (L.) Nutt.—*J. Campbell August 24, 1988* (KY)

SAPINDACEAE
Acer negundo L.—Abundant. S. *52*
**Acer nigrum* F. Michx.—*M. Wharton 3125* (MICH)
Acer rubrum L.—Abundant. MR. *478*
†*Acer rubrum* L. var. *trilobum* Torr. & A. Gray ex K. Koch—Infrequent. MR. *1281-22*
Acer saccharinum L.—Abundant. S. *503*
Acer saccharum Marshall—Abundant. MR. *480*
Aesculus flava Solander—Common. O-H. *652*

SAXIFRAGACEAE
Heuchera americana L.—*R. Jones & L. Pounds 4046* (EKY)
Heuchera longiflora Rydb.—*No collector data 1374* (APSC)
Heuchera villosa Michx.—Common. MR. *313*
Tiarella cordifolia L.—Common. MR. *567*

SCROPHULARIACEAE
†Verbascum blattaria* L.—Common. MKyRF. *251*
****†***Verbascum thaspus* L.—Abundant. R. *299*

SOLANACEAE
**Datura stramonium* L.—Common. R. *366*
†*Physalis longifolia* Nutt.—Infrequent. S. *837*
Physalis virginiana Mill.—*M. Medley 08143* (APSC)
Solanum carolinense L.—Abundant. R/D. *443*

STAPHYLEACEAE
Staphylea trifolia L.—Common. MR. *81*

ULMACEAE
Ulmus alata Michx.—Infrequent. MKyRF. *529*
Ulmus americana L.—Common. S. *514*
Ulmus rubra Muhl.—Common. O-H. *477*
Ulmus thomasii Sarg.—*J. Campbell May 20, 1988* (EKY)

URTICACEAE
Boehmeria cylindrica (L.) Sw.—Abundant. S. *867*
Parietaria p ensylvanica Muhl. ex Willd.—*R. Hannan & L. P hillippe 6970* (EKY)
Pilea pumila (L.) A. Gray—*H. Gleason & C. Griffith 445* (MICH)

VALERIANACEAE
†*Valeriana pauciflora* Michx.—Common. MR. *588*
Valerianella radiata (L.) Dufr.—Common. MR. *982-22*
Valerianella umblicata (Sull.) Alph. Wood—*J. Lassetter 3500* (USAM)

VERBENACEAE
†*Phyla lanceolata* (Michx.) Greene—Common. S. *817*
†*Verbena hastata* L.—Common. S. *842A*
Verbena simplex Lehm.—Common. R. *621*
Verbena urticifolia L.—Abundant. *842B*

VIBURNACEAE
Sambucus canadensis L.—Common. O-H. *290*
Viburnum acerifolium L.—Abundant. O-H. *604*
Viburnum prunifolium L.—*T. Weckman 3802* (EKY)

Viburnum rafinesqueanum Schult.—*R. Hannan & L. P hillippe 6933* (EKY)
Viburnum rufidulum Raf.—Common. L. *762*

VIOLACEAE

Cubelium concolor (T.F. Forst.) Raf. ex Britton & A. Br.—*R. Hannan & L. Phillippe 2562* (EKY)
†*Viola blanda* Willd.—Infrequent. MR. *996-22*
Viola canadensis L.—Abundant. MR. *4*
Viola cucullata Aiton—*M. Wharton 3905* (KY)
Viola hirsutula Brainerd—Infrequent. X. *573*
Viola palmata L.—Infrequent. *W. Anderson 436* (GH)
Viola pedata L.—Infrequent. X. *577*
Viola pubescens Aiton—Abundant. MR. *5*
Viola rafinesquei Greene—*M. Wharton 1657* (KY)
†*Viola rostrata* Pursh.—Common. MR. *566*
†*Viola sagittata* Aiton—Infrequent. MR. *1000-22*
Viola sororia Willd.—Abundant. MR. *9*
Viola striata Aiton—Infrequent. MR. *84*

VISCACEAE

Phoradendron leucarpum (Raf.) Reveal & M.C. Johnst.—*R. Thompson 3186* (BEREA)

VITACEAE

Ampelopsis cordata Michx.—Infrequent. S. *804*
†*Parthenocissus quinquefolia* (L.) Planch.—Abundant. MKyRF. *270*
Vitis aestivalis Michx.—Common. O-H. *960*
Vitis vulpina L.—*M. Wharton 4389* (MO)

SUMMARY AND CONCLUSIONS

This floristic inventory represents a comprehensive survey of vascular plants for a single county that lies within the Outer Bluegrass (8%), Knobs (45%), and Cumberland Plateau (47%) physiographic regions in Kentucky. Estill County encompasses 66,304 ha (163,841 acres), with about 1804 ha (4,458 acres), or 3% of the county, within the Daniel Boone National Forest. The county includes mesophytic ravines, limestone outcrops, cliffs and ridgetops, ruderal/disturbed areas of fields and roadsides and railroad tracks, marshy areas and ponds, swamps and floodplains, and smaller streams, and rivers. Both oak-hickory forests and mixed mesophytic forests occur in the county, and ten significant locations were reported, including Grassy Knob, an endangered xeric limestone prairie. No old growth forest sites were identified within the county.

The vascular plant list documents 963 taxa (773 herbaceous and 190 woody) in 479 genera from 134 families. One hundred fifty-three species, representing 15.9%, were non-native or exotic. Eighty-two invasive species were documented, with 27 categorized as "Severe Threat." The list also includes 23 state-listed taxa, two state record naturalized species (*Ipomoea cordatotriloba* and *Lagerstroemia indica*), and 160 county distributional records (including only the third county record for the native *Leucothoe fontanesiana*). Thirty-five additional species are listed as "noteworthy" based on their distribution in ten counties or less in the state. The species richness of Estill County is the third highest number of taxa documented for a single Kentucky county with a species per hectare value of 1.5.

Estill County remains heavily forested and sparsely populated, with about 75% of the county covered by forests and a human population of about 14,200, or 21 people per sq km (55 per sq mi), but serious threats are impending. These threats include continued development of urban and rural areas, logging, invasive species, and climate change. The emission of greenhouse gases and rise in temperatures will undoubtedly result in an increasing threat to those species already endangered, and cause more species to fall into this category. Warming temperatures will have multiple effects, including changes in the habitats and geography of where particular species can exist, affect flowering and fruiting periods and interactions with pollinators, and will accelerate the invasion of exotic species.

This study has increased our knowledge of Kentucky's flora. It is believed that specimens from the present study will provide valuable information for species phenology, distribution, abundance, taxonomic affinity, comparative biodiversity studies, and genetic diversity within and between populations. It is also hoped that this floristic information will facilitate the monitoring of Estill County plant populations as they are affected by many ongoing threats, such as determining phenological changes in species, implementing land-use management plans, conservation strategies for rare species and diverse habitats, predicting changes in species interactions, restoration practices, and providing educational tools. This account of the Estill County flora will provide baseline data for all these efforts, and hopefully help to offset and alleviate the many problems faced by our native flora and fauna in the upcoming decades.

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