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THE VASCULAR FLORA OF THE RED RIVER GORGE IN POWELL, MENIFEE,
AND WOLFE COUNTIES KENTUCKY

BY

THOMAS STEELE MCFADDEN

THESIS APPROVED:


Chair, Advisory Committee


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Member, Advisory Committee


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THE VASCULAR FLORA OF THE RED RIVER GORGE IN POWELL, MENIFEE,
AND WOLFE COUNTIES KENTUCKY

BY

THOMAS STEELE MCFADDEN

Submitted to the Faculty of the Graduate School of
Eastern Kentucky University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

2018

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DEDICATION

I dedicate this work to my loving parents Dan and Lori McFadden. Without their encouragement and support to follow my passions this would have never been possible.

ACKNOWLEDGEMENTS

This project would have been impossible without the help of a number of people and organizations. First, I would like to thank my advisor Dr. Brad Ruhfel, as well as my committee members Drs. Jennifer Koslow and Luke Dodd, for their advice and mentorship. A special thanks to Dr. Ross C. Clark, and the Stanton Ranger District office for donating collections, over 1,800 specimens, to help complete the project. Thank you to the herbaria and their curators who allowed me to visit and work in those collections, specifically Drs. Alan Risk (MDKY), Jessica Budke (TENN), Ralph Thompson (BEREA), and Robert Paratley (KY). Thank you to Dr. Robert Naczi for helping to identify the *Carex* and *Dichantheium* vouchers, as well as Drs. Ronald Jones and Ross C. Clark for help with a number of difficult identifications. A big thanks to Dan Dourson, David Taylor, and Tara Littlefield for advice on places in the Red River Gorge to visit and localities of hard to find species, as well as the Kentucky State Nature Preserves Commission and Ian Horn for providing known rare species locality information. Additional thanks to David Taylor for help with permitting. Last, but not least, thank you to the Ronald L. Jones Herbarium (EKY) staff that helped with a number of curatorial duties that saved me days of work, specifically Bailey King, Calvin Andries, Levi Mauk, Nick Koenig, and Robert Pace. Funding for this project was provided in part by Battelle, Eastern Kentucky University Department of Biological Sciences, Kentucky Native Plant Society, Kentucky Society of Natural History, and Society of Herbarium Curators.

ABSTRACT

The Red River Gorge (RRG) is a 26,283 ha natural area within Menifee, Powell, and Wolfe counties of Kentucky. This area is in the Cumberland Plateau Physiographic Section which is a southern subsection of the Appalachian Plateau Physiographic Province. It is a mecca of outdoor recreation, hosting thousands of visitors each year, while also being home to a unique flora worthy of continued protection. A vascular flora was conducted between the fall of 2016 and the summer of 2018. Additional vouchers donated by Dr. Ross C. Clark and the Stanton Ranger District office, as well as vouchers deposited at regional herbaria were used to complete this flora. This project utilized 3021 vouchers from 1940–2018, and documented 1023 taxa, including 1004 species, 455 genera, and 139 families. The most taxon-rich families include Asteraceae (137), Poaceae (99), Cyperaceae (74), Fabaceae (50), and Rosaceae (49). There were 145 exotic species found, including 74 that are considered invasive in some way by the Kentucky Invasive Plant Council. A total of 23 taxa found are state-listed, including *Solidago albopilosa* a RRG endemic. Additionally, 40 taxa found are new county records and 40 taxa are new to the RRG. There were 10 ecological systems found in the RRG with 33 unique associations within them. Of these, 11 associations are listed as vulnerable (G3) and three are listed as imperiled (G2) by NatureServe. A species-area curve was updated for the Cumberland Plateau Physiographic Section resulting in an improved r^2 value of 0.86.

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I. Introduction

The Red River Gorge (RRG) is a 26,283 ha natural area located within Menifee, Powell, and Wolfe counties of Kentucky (Figs. 1 & 2). Most of the RRG is situated in the Cumberland Plateau Physiographic Section (CP; Fig. 1), which stretches from east central Kentucky, south through central Tennessee and into northern Alabama and Georgia (Fenneman 1946).

The RRG is an impressive geologic system described by Weir and Richards (1974) as being an important non-consumptive resource due to the “spectacular scenery of the winding valleys and canyons of the Red River and its tributaries and of the surrounding rugged uplands...”. The RRG is floristically distinctive because it is geologically diverse. A unique flora has developed due to the variety of habitats provided by the vast sandstone cliff faces and a multitude of rockhouses and rock arches embedded in the mixed mesophytic forest region. In fact, the RRG is home to the white-haired goldenrod (*Solidago albopilosa* E.L. Braun); a species previously listed as federally threatened that is endemic to rock-houses in the RRG (U.S. Fish and Wildlife Service 2016). Recreational activities include biking, camping, canoeing/kayaking, hiking, horseback riding, hunting, rock climbing, wildflower walks, and wildlife viewing. The phrase “loved to death” is often used when RRG recreation is discussed (Members of the Bluegrass Group Sierra Club 2000).

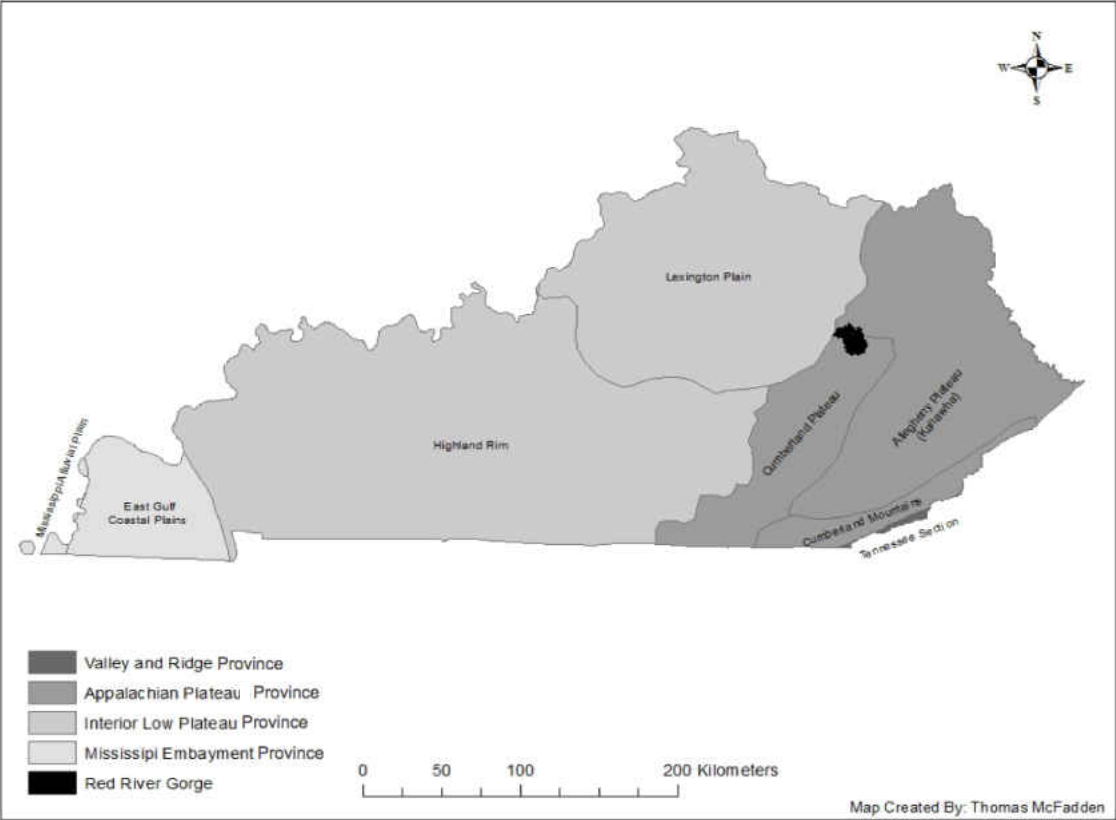


Figure 1. The Physiographic Provinces and Physiographic Sections of Kentucky and location of the Red River Gorge.

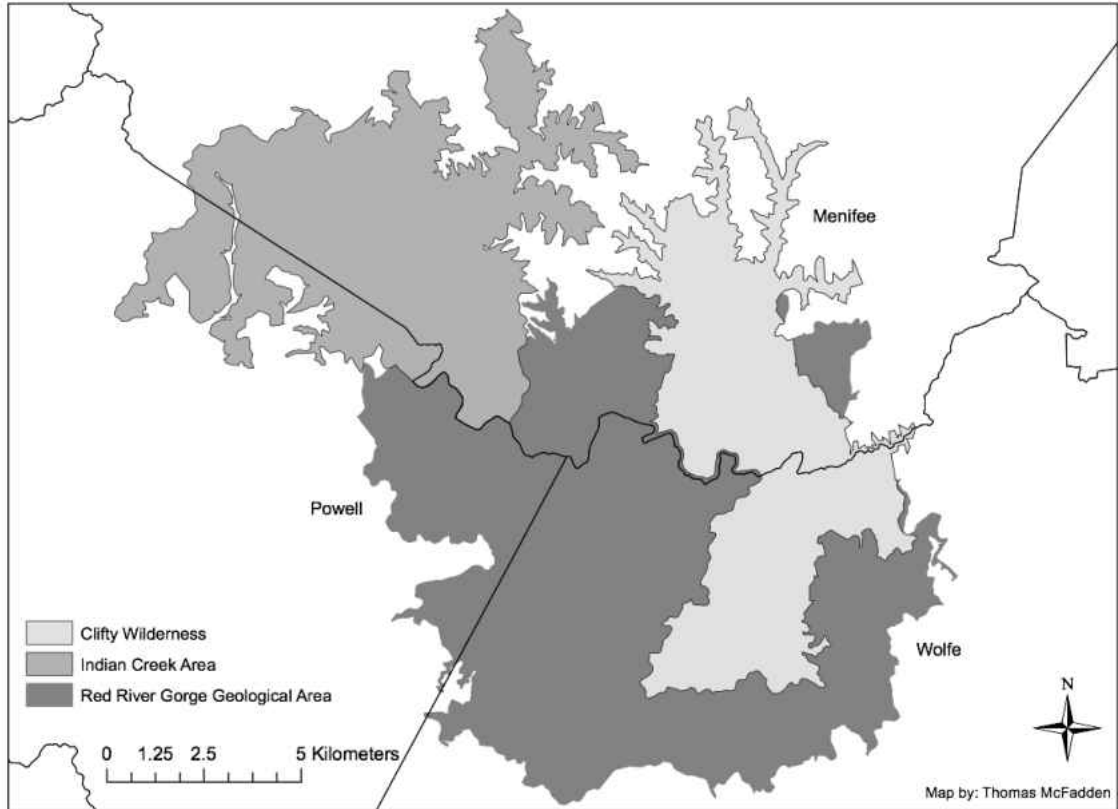


Figure 2. The Red River Gorge (Clifty Wilderness, Indian Creek Area, and Red River Gorge Geological Area) of Kentucky shown with Powell, Menifee, and Wolfe County boundaries.

The CP has been the focus of a number of floristic works and Prater III (2015) developed a species-area curve for the region, which was updated from Huskins and Shaw (2010). Researchers have conducted 16 floras in the CP (Table 1) with most from Tennessee, and only two from Kentucky. This represents a gap in the floristic knowledge of the northern CP, and more broadly, the state of Kentucky.

Table 1. Summary of vascular floras from the Cumberland Plateau physiographic section across Alabama, Georgia, Kentucky, and Tennessee. Floras are listed from largest to smallest in terms of area covered. A dash indicates that the information was not given in the publication.

Source	State	Area (ha)	Total Taxa	Native Taxa	% Native	Rare Taxa	% Rare	Exotic Taxa	% Exotic
Beck and Van Horn 2007	TN	10,300	1,072	896	83.6%	21	2.0%	176	16.4%
Fleming and Wofford 2004	TN	8,900	879	776	88.3%	16	1.8%	103	11.7%
Allawos 1994	TN	5,407	522	481	92.1%	8	1.5%	41	7.9%
Blyveis 2011	TN	4,970	692	600	86.7%	10	1.4%	92	13.3%
Wofford <i>et al.</i> 1979	TN	4,047	675	633	93.8%	17	2.5%	42	6.2%
Dickson 1992	AL	4,047	623	572	91.8%	-	-	51	8.2%
Schmalzer <i>et al.</i> 1985	TN	4,000	725	665	91.7%	19	2.6%	60	8.3%
Clark 1966	TN	3,626	597	560	93.8%	9	1.5%	37	6.2%
Huskins and Shaw 2010	TN	2,862	604	530	87.7%	11	1.8%	74	12.3%
Spaulding 1995	AL	2,528	1,072	883	82.4%	-	-	189	17.6%
Goodson 2000	TN	1,896	585	541	92.5%	13	2.2%	44	7.5%
Prater III 2015	GA	1,780	672	581	86.5%	28	4.2%	91	13.5%
Clements and Wofford 1991	TN	1,000	574	546	95.1%	10	1.7%	28	4.9%
Weckman <i>et al.</i> 2003	KY	262	502	447	89.0%	5	1.0%	55	11.0%
Bailey Jr and Coe 2001	TN	330	398	367	92.2%	8	2.0%	31	7.8%
Thompson <i>et al.</i> 2000	KY	77	350	337	96%	4	1.1%	13	3.7%

In general, the flora of Kentucky is relatively less well documented than the flora of other states in the Southeast. There are far fewer vouchers collected in Kentucky and stored in herbaria, with Kentucky having ca. 178,677 total vouchers compared with Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia each having ca. 36,000 to 336,000 more vouchers (SERNEC

Data Portal 2017; accessed June 23, 2018). What is known about the flora of Kentucky has been determined largely from projects like this one, and the resulting vouchers stored in herbaria. There is still much work to be done, with species new to Kentucky regularly being documented (Campbell and Medley 1989; Abbott *et al.* 2001; Naczi *et al.* 2002; Poindexter and Thompson 2008; Chapel and Vincent 2013).

Previous work and project rationale

Floras are an important resource that serve as the foundation of biological knowledge for any area and they are becoming increasingly important in research (Palmer *et al.* 1995; Palmer and Richardson 2012). In addition to allowing species determination to be verified, vouchers and associated metadata collected while conducting a flora create records that have many scientific and applied uses [*e.g.*, determining climate change impacts, monitoring rare or invasive plant species, monitoring restoration and human land use effects, economic evaluation, a source of genomic information, and more (Palmer *et al.* 1995; Lavoie 2013)]. Vouchers and metadata are even more useful to the community if they are available on publicly accessible databases that include multiple herbarium collections, such as the Southeast Regional Network of Expertise and Collections (SERNEC) Data Portal (2017).

Research of the RRG flora prior to the start of this study (Higgins 1970; U.S. Forest Service *et al.* 1989; Francis 1998; Studlar and Fuselier 2018) provides a baseline for our knowledge of the vascular and non-vascular plants of the area. Dourson and Dourson (2018) report on the flora of the broader Red River watershed and utilized preliminary data from this study. Additionally, there have been three biological

inventories (Jones 2000a; b; Weckman 2005), which included some floristic information, conducted on the Natural Bridge State Resort Park, which is directly adjacent to the RRG, located on its southwest border.

There are three pertinent reasons a current flora and associated vouchers are needed. First, the species-area curve (SAC) for the CP (Prater III 2015) estimates that 1017 species should be present in the RRG, meaning the only flora specifically of the RRG (Higgins 1970), which reported 555 species, is vastly incomplete. Additionally, the Higgins (1970) flora lacked an explicitly defined survey area for the RRG and provided very little description of habitats present. Second, there are very few RRG vouchers stored in herbaria. There were only 145 vouchers listed in the SERNEC database prior to the start of this study, which would only represent 14.2% of the expected richness of the area (SERNEC Data Portal 2017). The vouchers collected by Higgins were stored at the Davies Herbarium of the University of Louisville (DHL; Higgins 1970). This herbarium was officially closed in 2008 and the Higgins vouchers were moved to the Murray State University Herbarium (MUR), and then moved again to the Austin Peay State University Herbarium (APSC), with many vouchers likely lost or destroyed by pests (Ross C. Clark, pers. comm.). The larger Stanton Ranger District inventory (U.S. Forest Service *et al.* 1989) collected only vouchers of species that were state listed, and the majority of species were identified only by field identification. Field identification can significantly increase the number of false positive records for species reported in an area, which can then be very difficult to refute (Groom and Whild, 2017). False positive identifications can be particularly detrimental to species of conservation concern; making them appear more common than they truly are. Only vouchered

specimens can have their identities verified and be used effectively in future research applications. Finally, the RRG is a substantial teaching and research resource within the region (*e.g.*, KSNPC/USFS 1989; Francis 1998; White and Drozda 2006; Carr 2007), and a vouchered flora with updated taxonomy and habitat descriptions will serve as a baseline of information for future works.

This flora will increase the knowledge of the CP flora (particularly the northern portion which has received little attention), the flora of Kentucky, and the floras of the three counties in which the RRG is located. The objectives of this project are to: (1) create a vouchered collection of vascular plant species found in the RRG to be stored in the Eastern Kentucky University (EKU) herbarium, (2) develop a publicly accessible annotated list of vascular plants that occur in the RRG, (3) locate and document populations of any state or federally-listed species, (4) describe the plant communities present, (5) compare the species richness and species composition to other sites in the CP and Kentucky, and (6) update the SAC developed for the CP.

Site description

Geography.

The RRG is located within the Daniel Boone National Forest (DBNF) and is under the jurisdiction of the United States Forest Service (USFS). The RRG is situated near the northwestern edge of the CP of Kentucky (Fig. 1) in the Frenchburg, Pomeroyton, Scranton, and Slade USGS 15-minute topographic quadrangles. The RRG covers portions of Menifee, Powell, and Wolfe Counties (Fig. 2), and is located entirely within the Red River watershed, which covers a larger geographic area. The RRG

(26,283 ha; Fig. 2) as defined by this study, includes the Red River Gorge Geological Area (RRGGA; 15,057 ha), the Clifty Wilderness (CW; 5,078 ha), and the Indian Creek Area (ICA; 6,148 ha), as well as the private land in-holdings present within those areas. It is approximately 3.5 km east of Slade, Kentucky, and the maximum extent of the area is from latitudes 37.7611 and 37.9269 and longitudes -83.71 and -83.5069 , with a centroid at latitude 37.859 and longitude -83.629 . The area is bordered by private land on all sides except for the Natural Bridge State Resort Park bordering it to the southwest. State and Forest Service roads intersect with the RRG (Fig. 3), with a network of hiking trails throughout the area (U.S. Forest Service 2012). The Red River flows through the center of the RRG from east to west and has four tributaries within the study site that are a stream order of three or higher (Fig. 4; Kentucky Division of Water 2011). The highest elevation is ca. 366 m and the lowest elevation is ca. 200 m.

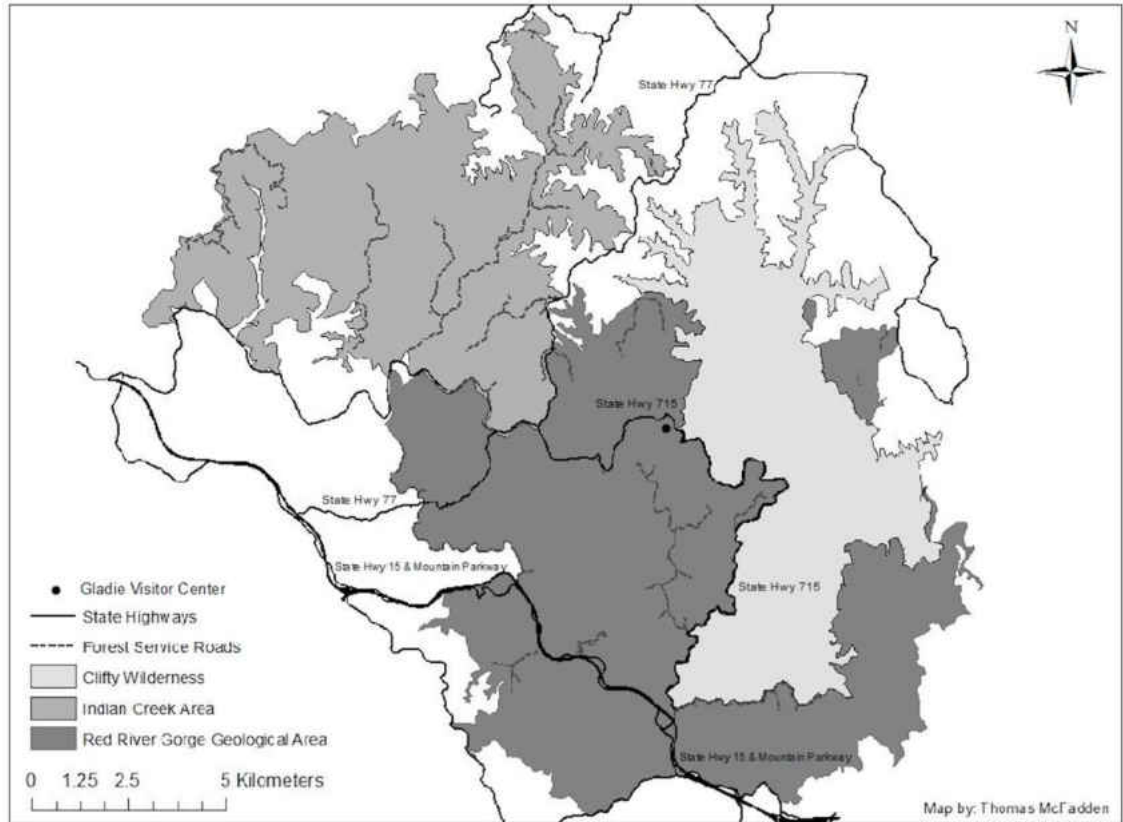


Figure 3. Major roads that intersect with the Red River Gorge, KY.

al. 2002). Following the Environmental Protection Agency's (EPA) ecoregion classification system (Woods *et al.* 2002), the RRG is located in is the Western Allegheny Plateau (EPA level III ecoregion 70), which is land that has steep elevation relief and is still primarily forested by mixed mesophytic forest (Woods *et al.* 2002). The western portion of the RRG is located in the Northern Forested Plateau Escarpment (EPA level IV ecoregion 70g), which is described as being rugged with highly dissected cliffs with narrow ravines (Woods *et al.* 2002). This region was previously described as the Pottsville Escarpment (Smalley 1986; Francis 1998). The eastern portion of the RRG is located in the Ohio/Kentucky Carboniferous Plateau (EPA level IV ecoregion 70f) which is less rugged and dissected than the western portion of the RRG.

Physiography, geology, and soils.

The RRG is famous for the many natural rock arches found throughout the area. The sandstone ridges located here are perfect for the formation of arches, which often develop when differential weathering forms a depression in a narrow ridge (McGrain 1983). Over time this depression continues to erode more quickly than the remaining cliff until an opening is formed through the cliff, thus, leaving an arch (McGrain 1983).

Sandstone rockhouses are an important geological feature common in the RRG. Rockhouses are depressions in cliff faces that extend inward under the overhang of the cliff line above. Francis (1998) described them as cave-like recesses of sufficient size to allow for human occupation. Rockhouses were historically utilized by Native Americans and early settlers and harbor a unique flora within the RRG (Francis 1998).

The rocks of the RRG originated ca. 359–299 million years ago in the Mississippian and Pennsylvanian periods during the late Paleozoic era. There are four

exposed rock formations that can be seen in the RRG (Weir 1974; Weir and Richards 1974; Francis 1998). Through geologic time water erosion formed the steep valleys seen today. This erosion has exposed the older Mississippian rock in the stream bottoms and on the lower sides of valleys. The formations will be explained from oldest to youngest in the following text and are subsequently found from lowest to highest elevations. All formation ages are reported using the geologic time scale put forth by Walker *et al.* (2012).

There are two rock formations exposed in the RRG that originated in the Mississippian Period. The oldest rocks are found in the Borden Formation, which is a series of marine shale and siltstone up to 27.4 m thick that formed in the early Mississippian (Weir 1974; Francis 1998). The Borden Formation is exposed in the lower reaches of the Red River on the west side of the RRG (Weir 1974; Francis 1998). The second oldest formation has been most recently described as the Slade Formation, and is a layer of gray limestone up to 27 m thick (Weir 1974; Francis 1998). It can be found at the lower elevations near the Red River and some of its tributaries.

There are also two Pennsylvanian-aged rock formations exposed in the RRG. The first is known as the Lee Formation (Weir 1974; Weir and Richards 1974). It is comprised of two separate layers, which together can be up to 110 m thick. The older layer is mostly shale and siltstone with some minor coal seams and is known as the Tongue of the Breathitt Formation, which is up to 30.5 m thick (Weir 1974; Weir and Richards 1974). The younger layer is the Corbin Sandstone Member of the Lee Formation. It is a layer of sandstone and sandstone conglomerate as much as 79.5 m thick (Weir 1974; Weir and Richards 1974). This layer has formed resistant sandstone

ridge caps along the Pottsville Escarpment resulting in vertical cliffs that can reach nearly 30.5 m in height (Weir 1974). The second rock formation of Pennsylvanian age, the Breathitt Formation, is the youngest rock found in the RRG. Where this formation is present in the RRG it is made up of shale and siltstone. (Weir 1974; Weir and Richards 1974). There are also several coal seams found within this formation (Weir 1974; Weir and Richards 1974). It can reach 85.3 m thick in the RRG and is the rock formation that comprises the highest ridge tops at ca. 366 m in elevation (Weir 1974; Weir and Richards 1974).

Erosion of exposed rocks resulted in deposition of alluvial soils throughout the drainage during the Quaternary period (2.6 mya – present). Most of the soil in the RRG belongs to the Ultisol Order, which are highly weathered soils (Weir 1974; Weir and Richards 1974). The majority of the soils in the RRG are silty or sandy loams, highly acidic, excessively drained, and have poor nutrient levels (Weir 1974; Weir and Richards 1974). The soil tends to be rocky and thin on the slopes and ridgetops but can be up to 12.2 m thick along some of the lower reaches of the Red River (Weir 1974).

Climate.

Climate data were gathered from the nearest National Oceanic and Atmospheric Administration weather station in Stanton, Kentucky, ca. 21 km east of RRG (latitude 37.860 and longitude -83.897) at 220 m in elevation (National Oceanic & Atmospheric Administration 2017). This station collected temperature and precipitation data between 1981 and 2010. The climate of the area is generally moderate with cool winters and warm summers. The average daily temperature is 12.3°C. The average hottest month is

July, with the mean daily maximum being 29.3°C. The coldest average month is January, with the mean daily minimum being -5.1°C. The average yearly precipitation is 122.3 cm. The wettest average month is May (13.5 cm), and the driest average month is October (8.2 cm).

Land use history.

Radiocarbon dating of Native American artifacts from the Cloudsplitter rock shelter within the RRG indicates that humans have been utilizing the area for at least 10,950 years (Delcourt *et al.* 1998). However, native populations in the area remained low until around 3,000 years ago, when an increase in wildfire activity produced an increase in chestnut and oaks; resulting in an increase in human land use (Delcourt *et al.* 1998). Nut shells indicate that chestnuts, acorns, walnuts, and hickory nuts were important food resources for humans in the fall. At the same time, increased charcoal deposits around rock shelters indicate that fire was used by Native Americans to establish garden plots and maintain a mast producing forest (Delcourt *et al.* 1998). Pollen, seeds, and rind found within rock shelters suggest that squash (*Cucurbita pepo* L.), bottle gourd (*Lagenaria siceraria* (Molina) Standley), and sunflower (*Helianthus annuus* L.) were cultivated on the slopes around inhabited rock shelters (Delcourt *et al.* 1998). Between 1,000 and 250 years ago there was a decrease in the Native American use of eastern Kentucky forests, which coincides with cultural changes and an increased reliance on higher crop yields; resulting in a shift to aggregated communities on more fertile lands (Delcourt *et al.* 1998).

In the late 18th century, Europeans began to settle Kentucky. Settlers were also attracted to the rockhouses of the RRG, which provided a natural shelter. After the

removal of Native American communities, settlers used rockhouses as lumber barns, family dwellings, and campsites (Walck. *et al.* 1996).

Post-settlement (19th – 20th centuries) changes were the most dramatic within the RRG. At the time of settlement, the RRG was part of an extensive forest, with 95% of Kentucky being forested (Jones 2005). Around the 1830's trees were being extensively harvested within the state to fuel iron ore industry furnaces (Jones 2005). The timber industry continued to grow into the 20th century, and between 1880 and 1914, 45 billion board feet of lumber was extracted from Kentucky (Jones 2005). By the 1920's, almost all of the forests in the state had been clear-cut (Jones 2005). The RRG was not spared from clear-cut logging. However, there are some small areas with very harsh topography that may not have been cut including Tight Hollow in Powell County (Scheff 2012).

The RRG was originally purchased in 1937 as a part of the creation of the Cumberland National Forest; later renamed the Daniel Boone National Forest in 1966 (Collins 1975). After a dam was proposed to be built on the Red River near Indian Creek in 1962, action was taken by non-governmental organizations (NGO's) to "Save the Gorge" by stopping all efforts that might damage its scenic and environmental value (Collins 1975). The dam project was abandoned in 1969 (Collins 1975). Later in 1969, a timber sale took place in the RRG and ignited another public controversy (Collins 1975). As a result, NGO's sought to give the RRG special classification that would restrict any logging (Collins 1975). Subsequently, in 1976 much of the Red River drainage was designated as the Red River Gorge Geological Area, which is a National

Natural Landmark, National Archaeological District, and is on the National Register of Historic Places. In 1985, Congress designated a portion of the RRGGA as the CW.

The area in the RRG that receives the most protection is the CW. Logging, drilling/mining for fossil fuels or minerals (with the exception of privately owned minerals), and all industrious or commercial activities are prohibited on wilderness lands such as the CW. No permanent structures can be built on the landscape including roads, and no motorized vehicles can be used in the area except in cases of emergencies (Beach et al. 2004). Few official trails are established and maintained in the CW to help ensure wilderness values are honored. However, wilderness areas do allow for horseback riding on designated trails and with permits.

The RRGGA is also well protected as a National Natural Landmark. Logging is generally not conducted unless needed for habitat management (U.S. Forest Service 2004). Other resource extraction can be conducted either by the USFS (only if it does not disturb the surface) or in certain circumstances if privately owned (U.S. Forest Service 2004) Horseback riding is allowed on designated trails or with permits. This area also contains roads (Fig. 3), many established trails, and other permanent structures, which allow for easier access and thus more recreational use of the area.

The ICA receives the least amount of protection being national forest federal land. National forest lands are managed by the USFS for multiple use and therefore can allow logging and other resource extraction. However, the forest service does take into consideration biological and recreational value of an area before doing anything that may disrupt it and must allow for public input into such matters. Horseback riding is

allowed on designated trails and with permits. This area also contains roads and established trails for easier access and more recreational use.

Vegetation and flora.

The RRG occurs in an area classically described as the mixed mesophytic forest region by Braun (1950) and similarly by Kuchler (1964). It is characterized by a species-rich tree canopy dominated by a mixture of deciduous and evergreen species with no single species dominant across the area. This region also has a spectacularly rich ground layer. It is considered one of the most biologically rich forests of any region in the United States and is best developed in southeastern KY and northeastern TN (Jones 2005; Weakley 2015). In KY the mixed mesophytic forest region corresponds with the Appalachian Highlands Physiographic Province (Braun 1950; Jones 2005). This area was more recently described by Dyer (2006) as the mesophytic forest region, which largely corresponds with the combination of Braun's (1950) western mesophytic and mixed mesophytic forest regions. The tree species with highest importance values in this region are *Acer rubrum* L. and *Quercus alba* L. (Dyer 2006).

Specific forest types in the RRG change depending on aspect, slope, soil acidity and soil moisture levels (NatureServe 2017). The mesic forest types in the RRG are described by Jones (2005) as Mixed Deciduous Forests and Mixed Oak Forests. The xeric forest types are described as Xeric Oak Forests and Pine Forests by Jones (2005).

Previous works on the flora of the RRG (Higgins 1970; U.S. Forest Service *et al.* 1989; Francis 1998; Dourson and Dourson 2018; Studlar and Fuselier 2018) provide a baseline for our knowledge of the vascular and non-vascular plants that occur there. However, few vascular plant vouchers available for review. There are 21 state-listed

species reported by the Kentucky State Nature Preserves Commission (KSNPC) as occurring in the RRG (Table 2). Ten of these species do not have vouchers available to verify species determinations and the most recent sightings for some species is prior to 1980, which is considered historical by the KSNPC (Kentucky State Nature Preserves Commission 2014).

Table 2. Kentucky state-listed species reported as occurring in the Red River Gorge, KY, per the Kentucky State Nature Preserves Commission (KSNPC) in December 2016. Last Reported is the last date the species was reported seen by the KSNPC. Pops. Reported is the number of populations reported by KSNPC. Pops. Searched For is the number of populations searched for between 2016–2018. Pops. Located is the number of populations found in the field between 2016–2018. Vouchers Located is the number of vouchers found in herbaria between 2016–2018.

Scientific Name	Last Reported	Pops. Reported	Pops. Searched For	Pops. located	Vouchers Located
<i>Acer spicatum</i> Lam.	1980	2	1	0	0
<i>Aconitum uncinatum</i> L.	1980	1	1	0	0
<i>Ageratina luciae-brauniae</i> (Fernald) King & Rob.	1995	2	2	2	2
<i>Bartonia virginica</i> (L.) B.S.P.	1992	1	1	0	0
<i>Calopogon tuberosus</i> (L.) B.S.P.	1970	2	2	0	0
<i>Carex rugosperma</i> Mack.	1938	1	1	2	0
<i>Circaea alpina</i> L.	1989	14	3	0	6
<i>Cornus stolonifera</i> Michx.	2004	1	1	0	1
<i>Cypripedium parviflorum</i> Salisb.	1988	1	1	1	1
<i>Lilium philadelphicum</i> L.	1987	6	3	0	1
<i>Liparis loeselii</i> (L.) L.C. Richard	1996	1	1	1	0
<i>Maianthemum canadense</i> Desf.	1989	9	2	1	4
<i>Melampyrum lineare</i> Desr. var. <i>pectinatum</i> (Pennel) Fernald	1988	1	1	0	6
<i>Monotropsis odorata</i> Schwein. ex Elliott	2010	4	1	2	1
<i>Platanthera psychodes</i> (L.) Lindley	1970	2	1	0	1
<i>Podostemum ceratophyllum</i> Michx.	1988	10	3	0	2
<i>Pseudognaphalium micradenium</i> (Weatherby) G.L. Nesom	1938	1	1	0	0
<i>Sambucus racemosa</i> L. var. <i>pubens</i> (Michx.) House	1978	1	1	0	0
<i>Scutellaria arguta</i> Buckley	1988	1	1	0	0
<i>Solidago albopilosa</i> E. L. Braun	2013	84	2	2	7
<i>Taxus canadensis</i> Marshall	1992	11	2	0	4

II. Methods

The data reported here include all minimum community standards for floras set forth by Palmer *et al.* (1995) and Palmer and Richardson (2012), as well as additional work outlined below. Authorities for all vascular plant species names mentioned henceforth can be found in Appendix A.

Species-area curve.

A SAC is a mathematical representation of the relationship of area and the number of species present for a region, and can be used to compare the floristic richness of multiple sites (Arrhenius 1921; Gleason 1922). Number of species is plotted on the Y-axis, total area is plotted on the X-axis, and a power regression is fitted to the data points using the equation

$$S = cA^z$$

where S is the number of species, c is a constant, A is the area, and z is the slope of the line.

To obtain the expected number of species present in RRG, a SAC was constructed using Microsoft Excel (Microsoft 2018), with the known floras of the CP (Table 1). Two floras from Table 1 are excluded from the SAC because they do not meet criteria set forth by Wade and Thompson (1991); these were also excluded by Prater III (2015). Allawos's (1994) flora was excluded due to an unusually low number of taxa reported for the size of the area surveyed. Spaulding's (1995) flora was excluded because it had an extraordinarily large proportion of exotic species. There was one additional flora (Thompson *et al.* 2000) included in the SAC presented here that was not present in Prater III (2015). Additionally, there were two KY floras listed by Prater III

(2015) as occurring in the CP that do not occur in the CP as described by Fenneman (1946) and were thus not included. A new SAC including the results of this flora is provided.

Collection and curation.

A collection permit was obtained from the USFS in the fall of 2016 and renewed in the fall of 2017 to allow for the legal collection of plants in the RRG. Localities of previously reported state-listed species were provided from the KSNPC in the fall of 2016. State-listed species localities, consultations with relevant individuals [*e.g.*, Tara Littlefield (KSNPC Botanist), David Taylor (DBNF Botanist), Ross C. Clark (EKU professor emeritus), and Ronald Jones (EKU professor emeritus)], and initial scouting trips were used to determine localities in the RRG that should be targeted for collection.

There were 10 main collection areas repeatedly visited throughout the study (Table 3, Fig. 5). Additionally, expeditions were made to state-listed species localities provided by the KSNPC. Additional areas were surveyed while traveling to and from major collection sites and state-listed species localities. All ecological systems and associations listed in the Results were visited.

Table 3. Main collection areas visited between 2016–2018. Coordinates are the centroid of the collection area.

Site	General Locality	Coordinates
1	Hatton Ridge near Powdermill Trail	37.879789, -83.702201
2	Indian Creek near Railroad Hollow	37.854424, -83.681591
3	Smallwood Branch	37.881948, -83.677699
4	Head of Mariba Fork	37.905274, -83.577339
5	Booth Pond on Fletcher Ridge	37.902507, -83.580910
6	Gladie Visitor Center	37.834227, -83.609758
7	Gladie Creek near Sargent Branch	37.840363, -83.607624
8	Slopes around Red River at Suspension Bridge	37.828908, -83.624058
9	Tarr Ridge near Frenchburg Job Corps	37.861951, -83.649653
10	Wolfpen Creek	37.831121, -83.629491

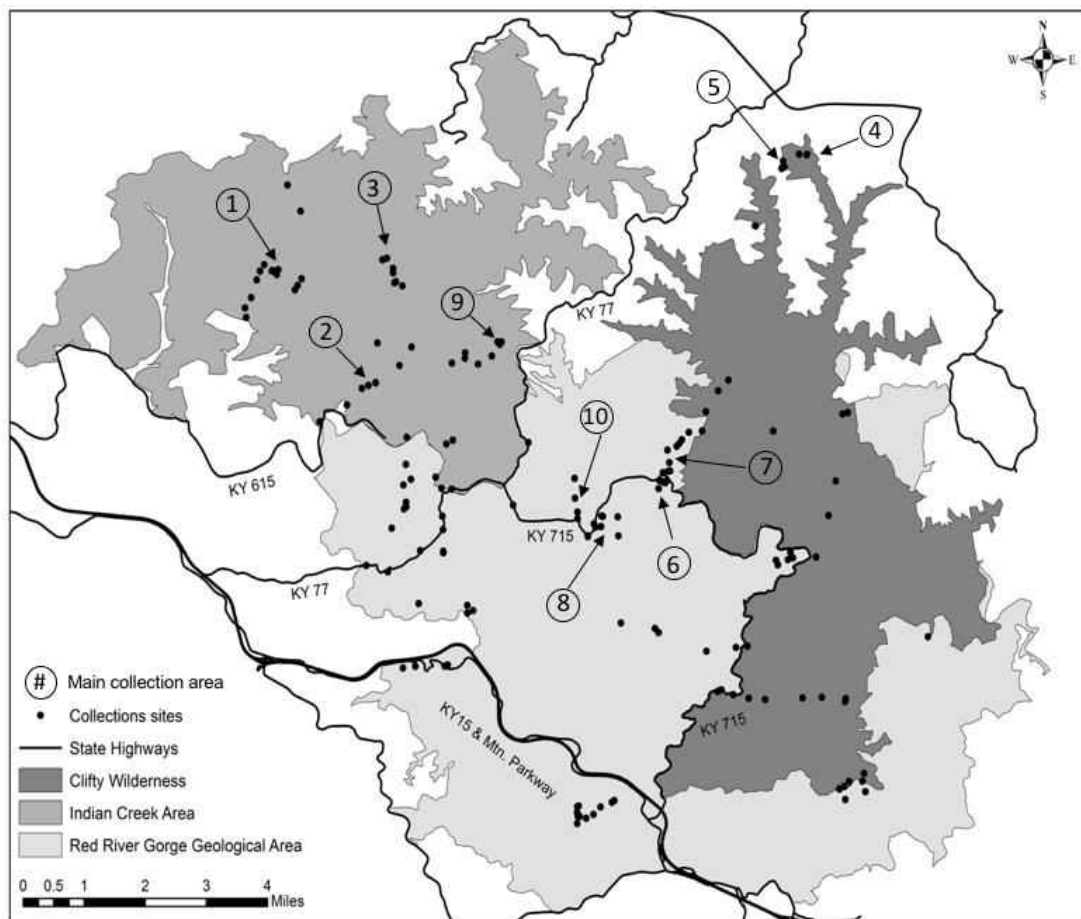


Figure 5. Vascular plant collection sites in the Red River Gorge, KY, between 2016 and 2018. Numbers for each main collection area refer to localities listed in Table 3.

Weekly to bi-weekly trips were made during the growing seasons (February-November) for voucher collection of vascular plants. Plant identification, taxonomy, and native/exotic status follows Weakley (2015). Plants were collected with appropriate material for species identification [*i.e.* with reproductive structures (*e.g.*, fruits, flowers, cones, and spores), or specific vegetative structures (*e.g.* roots and tendrils) if needed]. Information such as date, reproductive features, vegetative features (*e.g.* leaf and stem characteristics), general locality, GPS coordinates, and notes on habitat (*e.g.* soil type and surrounding community type) were recorded with voucher collections. Species with small populations (<20 individuals) or that are state or federally listed were not collected but photographed to ensure proper identification, with photographs attached to the SERNEC Symbiota digital voucher. Photos were taken in accordance with proposed community standards (Baskauf and Kirchoff 2008). Vouchers were collected in duplicate and deposited in the Ronald L. Jones Herbarium (EKY) at ECU and Austin Peay State University (APSU).

Trips to several other herbaria including the Ralph L. Thompson Herbarium at Berea College (BEREA, now permanently housed at ECU), the Murray State University Herbarium (MDKY), the University of Kentucky Herbarium (KY), and the University of Tennessee Herbarium (UT) were made to examine vouchers from the RRG. Austin Peay State University was not visited as all vouchers from Higgins (1970) flora were in preparation for a move to a new facility. Additionally, ca. 600 RRG vouchers were donated to the ECU herbarium from the USFS Stanton Ranger District Office, and ca. 1500 unprocessed RRG collections made by Dr. Ross C. Clark (ECU) and his students were made available to the author to assist in the completion of this

project. All vouchers were annotated in person to ensure proper identification and taxonomy, *i.e.* images of vouchers on the SERNEC Data Portal were not used. The species list, including all vouchers examined for each species, was managed using the Species Checklist feature on the SERNEC Data Portal (2017).

There were three major collectors and collection periods included in this project. The first is Johnny B. Varner who collected 182 specimens from 1971–1973; second is Ross C. Clark who collected 1,504 specimens from 1985–1998; finally, Thomas S. McFadden collected 501 specimens from 2016–2018. Paul D. Higgins also collected vouchers from the RRG in the late 1960s (Higgins 1970). However, these specimens were temporarily unavailable, and the status of these vouchers remains unknown.

Estimation of abundance.

Abundance of each species encountered in the field during the study was estimated using a scale modified from Palmer *et al.* (1995; Table 4; Appendix A). This scale is compatible to most commonly used measures of abundance and is intentionally broad to make it difficult to place a species in the wrong category. An increase or decrease of two categories for a species may indicate that there is a significant change in abundance (Palmer *et al.* 1995). Species known only from herbarium vouchers (*i.e.* they were not seen in the field during this study) were not assigned abundance values.

Table 4. Abundance estimation scale for vascular plants modified from Palmer *et al.* (1995).

Density	Score	Description
Abundant	5	Dominant or codominant in one or more common habitats
Frequent	4	Easily seen or found in one or more common habitats but not dominant
Occasional	3	Widely scattered but not difficult to find
Infrequent	2	Difficult to find with few individuals or colonies but found in several locations
Rare	1	Very difficult to find and limited to one or very few locations or uncommon habitats

Source: Palmer, M.W., G.L. Wade, and P. Neal. 1995. Standards for the writing of floras. *BioScience* 45: 339–345.

Species of conservation concern

Species of conservation concern documented during this project are discussed in detail in Appendix B. Species were included in Appendix B if they met one of three criteria. One, they are listed by the KSNPC as endangered, threatened, or of special concern (Kentucky State Nature Preserves Commission 2018). Two, they are considered sensitive by the Daniel Boone National Forest (U.S. Forest Service 2018). Three, they are considered rare to the area by Weakley (2015) or Jones (2005). All species reported as present in the RRG by the KSNPC are discussed even if they were not found.

New species records

All exotic species and species of conservation concern were checked to see if they were new county records. Species were determined to be county records if they

were not listed as present in that county by a variety of sources (Cranfill 1980; Beal and Thieret 1986; Clark and Weckman 2008; SERNEC Data Portal 2017; Campbell 2018; Kentucky State Nature Preserves Commission 2018).

Additionally, all species were checked to see if they were new records for the RRG. A species was considered new to the RRG if it was not found by U.S. Forest Service *et al.* (1989) and Dourson and Dourson (2018).

Ecological systems and associations

The habitats of the RRG were classified using NatureServe's (2017) International Vegetation Classification system which is a hierarchical system of categorizing community types as they exist on the landscape. An ecological system is a group of plant community types (i.e., associations) that tend to occur together within a landscape, and have similar ecological processes, substrates, and/or environmental gradients (NatureServe 2017). Associations are the lowest level of the hierarchy and describe specific plant communities that exist on the landscape, including listing dominant diagnostic species, growth form, substrates, hydrology, and disturbance regimes (NatureServe 2017). Associations are assigned global conservation status ranks (G-ranks) by NatureServe (2017), which are then used by state and federal entities to make policy and management decisions (NatureServe 2017). G-ranks are assigned G1 through G5 and are defined in Table 5.

Table 5. NatureServe global conservation status rank (G-rank) explanations.

G-rank	Explanation
G1	Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure—Common; widespread and abundant.

III. Results

Species-area curve

The SAC developed by Prater III (2015) was modified to exclude two KY floras that do not occur in the CP (Sole *et al.* 1983; McEwan *et al.* 2005) and one KY flora that was not included (Thompson *et al.* 2000). It resulted in the equation:

$$S = 152.05A^{0.1867}$$

With an r^2 value of 0.82. This curve will henceforth be referred to as the Modified Prater III (2015) species-area curve and estimated that 1016 species should be present in the RRG. There were 1004 species found, which was 98.8% of the expected richness of the RRG.

When the results of this study were added to the curve it resulted the equation:

$$S = 156.65A^{0.1818}$$

With an r^2 value of 0.86 (Fig. 6). This curve will henceforth be referred to as the Updated CP species-area curve.

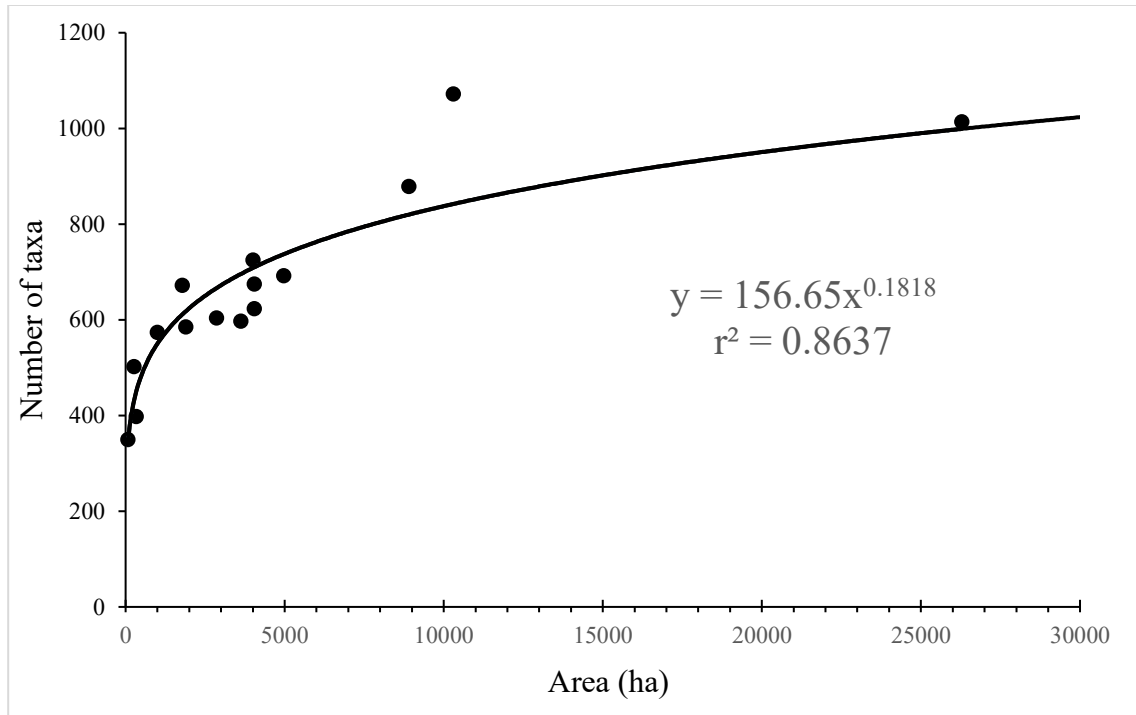


Figure 6. Updated species-area curve of the Cumberland Plateau Physiographic Section in the USA.

Floristic summary

In total, 1023 taxa (species plus infraspecific taxa) of vascular plants were identified using 3021 vouchers, including 1004 species from 455 genera in 139 families. Of that total, 145 (14.2%) taxa are exotic, and 23 (2.3%) are state listed (Table 6). The composition of taxa was as follows: seven Lycophytes (Clubmosses), 45 Monilophytes (Ferns), seven Gymnosperms, and 964 Angiosperms (15 Magnoliids and early diverging Angiosperms; 257 Monocots; and 692 Eudicots; Table 6). The most taxon-rich families include Asteraceae (137), Poaceae (99), Cyperaceae (74), Fabaceae (50), and Rosaceae (49). The species list and estimations of abundance can be found in Appendix A and online (<http://sernecportal.org/portal/checklists/checklist.php?cl=4833&proj=&dynclid=0>).

Notably there were 23 species documented by Higgins (1970) that were not found during this study (Table 7)

Table 6. Taxonomic distribution of vascular plants of the Red River Gorge, KY.

	Families	Genera	Species	Total Taxa	Exotic	Native	State listed
Lycophytes	3	4	7	7	0	7	0
Monilophytes	16	26	44	45	0	45	1
Gymnosperms	3	4	7	7	0	7	1
Angiosperms	117	421	946	964	145	819	21
Early Angiosperms & Magnoliids	7	11	15	15	0	15	0
Monocots	22	87	250	257	35	222	7
Eudicots	88	323	681	692	110	582	14
Total	139	455	1004	1023	145	878	23

Source: Higgins, P.D. 1970. A preliminary survey of the vascular flora of the Red River Gorge of Kentucky. M.S. Thesis. University of Louisville, Louisville, Kentucky.

Table 7. Twenty-three species reported in the Red River Gorge, KY by Higgins (1970), with taxonomy updated to Weakley (2015), that were not documented in the field or by a voucher during this study.

Species
<i>Aesculus glabra</i> Willd.
<i>Agalinis fasciculata</i> (Elliott) Raf.
<i>Angelica atropurpurea</i> L.
<i>Carex nigromarginata</i> Schw.
<i>Cyperus erythrorhizos</i> Muhl.
<i>Galium parisiense</i> L.
<i>Hordeum pusillum</i> Nutt.
<i>Houstonia longifolia</i> Gaertn.
<i>Houstonia tenuifolia</i> Nutt.
<i>Hypochaeris radicata</i> L.
<i>Lobelia georgiana</i> McVaugh
<i>Paspalum dissectum</i> (L.) L.
<i>Physostegia virginiana</i> (L.) Bentham
<i>Poa languida</i> Hitchc.
<i>Poa palustris</i> L.
<i>Quercus marilandica</i> Muenchh.
<i>Rhododendron periclymenoides</i> (Michx.) Shinnars
<i>Rosa virginiana</i> Mill.
<i>Setaria viridis</i> (L.) Beauv.
<i>Sphenopholis nitida</i> (Biehler) Scribn.
<i>Spiranthes cernua</i> (L.) Richard
<i>Trillium aureum</i> Pollich
<i>Ulmus alata</i> Michx.

Sources: Higgins, P.D. 1970. A preliminary survey of the vascular flora of the Red River Gorge of Kentucky. M.S. Thesis. University of Louisville, Louisville, Kentucky.; Weakley, A.S. 2015. Flora of the Southern and Mid-Atlantic States. [Working Draft, 21 May 2015]. University of North Carolina, Chapel Hill, North Carolina.

Invasive species

There were 74 species found that the Kentucky Invasive Plant Council (KY-IPC) have listed as invasive in some manner (Table 8). Of these, 23 species are listed as

a severe threat, meaning that they invade native plant communities, displace native plants, and are widespread in the state (KY-IPC 2018). There are 22 species listed as a significant threat, meaning they have invasive characteristics but pose less of a threat to native plant communities and typically only invade natural communities through disturbance corridors (KY-IPC 2018). There are 22 species that are listed as a moderate threat, meaning that they typically only persist in heavily disturbed areas or agricultural fields (KY-IPC 2018). Finally, seven species are on the KY-IPC watch list, which means that they are not yet well documented in the state but are known to be invasive in neighboring states.

Table 8. Exotic invasive species found in the Red River Gorge, KY. The table is organized by threat level from most severe to least severe. Threat levels are assigned by the Kentucky Invasive Plant Council. Four species marked with an asterisk (*) were noted to be particularly prevalent in the Red River Gorge.

Species	Threat level
<i>Achyranthes japonica</i> (Miquel) Nakai var. <i>hachijoensis</i> Honda	Severe
<i>Alliaria petiolata</i> (Bieberstein) Cavara & Grande	Severe
<i>Cirsium arvense</i> (L.) Scopoli	Severe
<i>Dioscorea polystachya</i> Turcz.	Severe
<i>Elaeagnus umbellata</i> Thunb.	Severe
<i>Euonymus fortunei</i> (Turcz.) Handel-Mazzetti,	Severe
<i>Ficaria verna</i> Hudson subsp. <i>calthifolia</i> (Rchb.) Nyman	Severe
<i>Glechoma hederacea</i> L.	Severe
<i>Lespedeza cuneata</i> G. Don	Severe
<i>Lolium arundinaceum</i> (Schreb.) S.J. Darbyshire	Severe
<i>Lonicera japonica</i> Thunb.	Severe
<i>Lonicera maackii</i> (Rupr.) Herder	Severe
<i>Lysimachia nummularia</i> L.	Severe

Table 8 (Continued)

Species	Threat level
<i>Melilotus alba</i> Medikus	Severe
<i>Melilotus officinalis</i> (L.) Lam.	Severe
* <i>Microstegium vimineum</i> (Trin.) A. Camus	Severe
* <i>Miscanthus sinensis</i> Andersson	Severe
<i>Pueraria montana</i> (Lour.) Merr. var. <i>lobata</i> (Willd.) Maesen	Severe
<i>Reynoutria japonica</i> Houtt.	Severe
* <i>Rosa multiflora</i> Thunb. ex Murr.	Severe
<i>Securigera varia</i> (L.) Lassen	Severe
<i>Sorghum halepense</i> (L.) Pers.	Severe
* <i>Stellaria media</i> (L.) Vill.	Severe
<i>Agrostis stolonifera</i> L.	Significant
<i>Albizia julibrissin</i> Durazz.	Significant
<i>Berberis thunbergii</i> DC.	Significant
<i>Bromus inermis</i> Leyss.	Significant
<i>Cirsium vulgare</i> (Savi) Ten.	Significant
<i>Daucus carota</i> L.	Significant
<i>Echinochloa crus-galli</i> (L.) P. Beauv. var. <i>crus-galli</i>	Significant
<i>Hemerocallis fulva</i> L.	Significant
<i>Lespedeza bicolor</i> Turcz.	Significant
<i>Lolium pratense</i> (Huds.) S.J. Darbyshire	Significant
<i>Medicago lupulina</i> L.	Significant
<i>Morus alba</i> L.	Significant
<i>Ornithogalum umbellatum</i> L.	Significant
<i>Perilla frutescens</i> (L.) Britton	Significant
<i>Persicaria longiseta</i> (Bruijn) Kitag.	Significant
<i>Persicaria maculosa</i> Gray	Significant
<i>Poa compressa</i> L.	Significant

Table 8 (Continued)

Species	Threat level
<i>Poa pratensis</i> L.	Significant
<i>Rubus phoenicolasius</i> Maxim.	Significant
<i>Spiraea japonica</i> L. f.	Significant
<i>Tussilago farfara</i> L.	Significant
<i>Verbascum thapsus</i> L.	Significant
<i>Allium vineale</i> L.	Moderate
<i>Arctium minus</i> Bernh.	Moderate
<i>Barbarea vulgaris</i> W. T. Aiton	Moderate
<i>Buddleja davidii</i> Franch.	Moderate
<i>Chenopodium album</i> L.	Moderate
<i>Cichorium intybus</i> L.	Moderate
<i>Commelina communis</i> L.	Moderate
<i>Deutzia scabra</i> Thunb.	Moderate
<i>Elaeagnus angustifolia</i> L.	Moderate
<i>Hypericum perforatum</i> L.	Moderate
<i>Ipomoea hederacea</i> Jacq.	Moderate
<i>Ipomoea purpurea</i> (L.) Roth	Moderate
<i>Lamium amplexicaule</i> L.	Moderate
<i>Lamium purpureum</i> L.	Moderate
<i>Lotus corniculatus</i> L.	Moderate
<i>Nepeta cataria</i> L.	Moderate
<i>Oxalis stricta</i> L.	Moderate
<i>Poa annua</i> L.	Moderate
<i>Potentilla indica</i> (Jacks.) Th. Wolf	Moderate
<i>Potentilla recta</i> L.	Moderate
<i>Rumex acetosella</i> L.	Moderate
<i>Torilis japonica</i> (Houtt.) DC.	Moderate

Table 8 (Continued)

Species	Threat level
<i>Lamium maculatum</i> L.	Watch List
<i>Sonchus asper</i> (L.) Hill	Watch List
<i>Trifolium campestre</i> Schreb.	Watch List
<i>Trifolium pratense</i> L.	Watch List
<i>Trifolium repens</i> L.	Watch List
<i>Vicia sativa</i> L.	Watch List
<i>Vicia villosa</i> Roth	Watch List

State-listed species

There were 21 state-listed species reported as present in the RRG by the KSNPC (Table 2). Attempts were made to find at least one population of each species. A total of 12 populations representing seven of these species were located during the project. Vouchers were located for 12 species (Table 2). There were seven species reported that were neither located nor represented by vouchers (Table 2). Further, 10 additional state-listed species not reported by KSNPC, although possibly reported by Dourson and Dourson (2018), are documented here (Appendix A, B).

New species records

There were 40 county records of exotic or species of conservation concern discovered for either Menifee, Powell, or Wolfe County (Table 9). Forty species were discovered that were not known to occur in the RRG (Table 9). In all, seven new records were found that are exotic species and three new records found that are state-listed (Table 9).

Table 9. New species records: county records and new records to the Red River Gorge, KY. Species marked with an exclamation point (!) are state listed. Species marked with an asterisk (*) are exotic.

Taxon	Collector(s)	Menifee	Powell	Wolfe	RRG
<i>Agrostis scabra</i>	R. Clark				X
<i>Amelanchier laevis</i>	T. McFadden		X		X
<i>Amelanchier spicata</i>	R. Clark		X		
<i>Antennaria howellii</i> subsp. <i>neodioica</i>	R. Clark		X		X
<i>Asarum acuminatum</i>	R. Clark		X		X
* <i>Bromus commutatus</i>	R. Clark				X
<i>Calystegia sepium</i>	R. Clark	X	X	X	X
<i>Carex laxiculmis</i> var. <i>copulata</i>	R. Clark; T. McFadden	X	X		
<i>Carex styloflexa</i>	R. Clark	X			
<i>Carex tonsa</i>	R. Clark; T. McFadden				X
<i>Celtis tenuifolia</i>	R. Paratley		X		
* <i>Convallaria majalis</i>	R. Paratley			X	X
<i>Cornus stolonifera</i>	R. Clark			X	X
<i>Desmodium nuttallii</i>	R. Clark				X
<i>Diarrhena obovata</i>	R. Clark	X			X
<i>Dicentra canadensis</i>	R. Clark	X			
<i>Digitaria ciliaris</i>	R. Clark			X	X
* <i>Elaeagnus angustifolia</i>	T. McFadden			X	X
<i>Equisetum</i> × <i>ferrissii</i>	S. Weber; C. Brown	X	X		X
<i>Erythronium umbilicatum</i>	T. McFadden	X			X
! <i>Euphorbia mercurialina</i>	R. Clark		X		X
* <i>Ficaria verna</i> subsp. <i>calthifolia</i>	T. McFadden		X		X
<i>Gentiana andrewsii</i>	R. Clark		X		X
<i>Hypericum virgatum</i>	T. McFadden				X
* <i>Kerria japonica</i>	R. Clark		X		X
* <i>Lamium maculatum</i>	T. McFadden		X		X
* <i>Lotus corniculatus</i>	C. Hanley	X			X
<i>Lysimachia quadriflora</i>	T. McFadden	X			X
<i>Monarda russeliana</i>	R. Clark				X
<i>Mononeuria patula</i>	C. Hanley				X
<i>Oenothera parviflora</i>	T. McFadden	X			X
<i>Penstemon pallidus</i>	B. Stacy		X		X
* <i>Plantago major</i>	T. McFadden			X	X

Table 9 (Continued)

Taxon	Collector(s)	Menifee	Powell	Wolfe	RRG
* <i>Rosa luciae</i>	R. Clark		X		X
<i>Salvia azurea</i> var. <i>grandiflora</i>	R. Clark	x			X
<i>Senecio suaveolens</i>	R. Clark	X			X
<i>Senna hebecarpa</i>	R. Clark	X			X
! <i>Solidago curtisii</i>	T. McFadden		X	X	X
<i>Stachys nuttallii</i>	D. Sasser		X		X
! <i>Stellaria longifolia</i>	R. Clark				X
<i>Thaspium chapmannii</i>	R. Paratley	X			X
<i>Tradescantia ohiensis</i>	D. Sasser		X		X
<i>Viola incognita</i>	T. McFadden				X
* <i>Yucca flaccida</i>	R. Clark; T. McFadden				X
<i>Zizia trifoliata</i>	R. Clark			X	X

Ecological systems and associations

There are nine NatureServe tracked ecological systems found in the RRG with 33 unique associations within the systems (Table 10). One system listed, Anthropogenically Disturbed Areas, is not currently tracked on NatureServe (2017) due to conservation priorities (Table 10). There are 11 vulnerable (G3) associations and three imperiled (G2) associations in the RRG. These systems and associations were observed in the field during the study and are the best approximation of the habitat types present in the RRG.

Table 10. Ecological systems and associations as defined by NatureServe (2017) present in the Red River Gorge, KY.

Ecological system	Association	Association I.D. #	Status
Allegheny-Cumberland Dry Oak Forest and Woodland	Appalachian Low-Elevation Mixed Pine / Blue Ridge Blueberry Forest	CEGL007119	G3
	Ridge and Valley Dry-Mesic White Oak - Hickory Forest	CEGL007240	G4
	Interior Southern Red Oak - White Oak Forest	CEGL007244	G4
	Southeastern Interior Southern Red Oak - Post Oak Forest	CEGL007247	G4
	Low-Elevation Mixed Oak / Heath Forest	CEGL008521	G5
	Subxeric Ridgetop Chestnut Oak Forest	CEGL008431	G4
Anthropogenically Disturbed Areas (not tracked by NatureServe)	NA	NA	NA
Central Interior Highlands and Appalachians Sinkhole and Depression Pond	Upland Sweetgum - Red Maple Pond	CEGL007388	G2
	Eastern Watershield Pond	CEGL004527	G4
Cumberland Acidic Cliff and Rockhouse	Cumberland Plateau Clifftop Sandstone Barrens	CEGL004061	G3
	Cumberland Plateau Rockhouse	CEGL004301	G2
	Cumberland Plateau Sandstone Cliff (Dry Type)	CEGL004392	G3
	Appalachian Low-Elevation Mixed Pine / Blue Ridge Blueberry Forest	CEGL007119	G3
	Cumberland Plateau Wet Sandstone Cliff	CEGL008432	G3

Table 10 (Continued)

Ecological system	Association	Association I.D. #	Status
Cumberland Riverscour	Rocky Bar and Shore (Alder - Yellowroot Type)	CEGL003895	G3
	Rocky Bar and Shore (Twisted Sedge Type)	CEGL004103	G3
	Water-willow Rocky Bar and Shore	CEGL004286	G4
	Rocky Bar and Shore (Riverweed Type)	CEGL004331	G4
	River Birch Levee Forest	CEGL007312	G4
Cumberland Sandstone Glade and Barrens	Cumberland Plateau Clifftop Sandstone Barrens	CEGL004061	G3
	Appalachian Low-Elevation Mixed Pine / Blue Ridge Blueberry Forest	CEGL007119	G3
	Cumberland Bedrock Heath Shrubland	CEGL008470	G3
Cumberland Seepage Forest	Appalachian Forested Acidic Seep	CEGL007443	G3
	Swamp Forest - Bog (Typic Type)	CEGL007565	G2
South-Central Interior Mesophytic Forest	Unglaciated Beech - Maple Forest	CEGL002411	G4
	East-Central Hemlock - Hardwood Forest	CEGL005043	G3
	Northern Mixed Mesophytic Forest	CEGL005222	G4
	Ridge and Valley Calcareous Forest	CEGL006201	G4
	Central Appalachian Rich Cove Forest	CEGL006237	G4
	Ruderal Tuliptree Forest (Rich Type)	CEGL007220	GNA
South-Central Interior Small Stream and Riparian	River Birch - Sycamore Small River Floodplain Forest	CEGL002086	G5
	Floodplain Canebrake	CEGL003836	G2
	Rocky Bar and Shore (Alder - Yellowroot Type)	CEGL003895	G3

Table 10 (Continued)

Ecological system	Association	Association I.D. #	Status
	Rocky Bar and Shore (Twisted Sedge Type)	CEGL004103	G3
	Water-willow Rocky Bar and Shore	CEGL004286	G4
	Rocky Bar and Shore (Riverweed Type)	CEGL004331	G4
	Southern Interior Box-elder Floodplain Forest	CEGL004690	G4
	River Birch Levee Forest	CEGL007312	G4
	Appalachian Forested Acidic Seep	CEGL007443	G3
	Swamp Forest - Bog (Typic Type)	CEGL007565	G2
Southern Appalachian Low-Elevation Pine Forest	Ruderal Virginia Pine Forest	CEGL002591	GNA
	Appalachian Low-Elevation Mixed Pine / Blue Ridge Blueberry Forest	CEGL007119	G3

Source: NatureServe. 2017. NatureServe Explorer. Available at: <http://explorer.natureserve.org/servlet/NatureServe?init=Ecol> [Accessed May 17, 2018].

IV. Discussion

This work has greatly improved the understanding of the flora of the CP, KY, and the RRG. The species-area curve developed by Prater III (2015) for the CP has been updated to include three additional floras and improved the fit of the curve. There were 40 new species records discovered for the area. Further, there is now a complete set of vouchers available for review in local herbaria, with the majority stored at the Ronald L. Jones Herbarium (EKY). Abundance values have been determined for 518 of the taxa present in the RRG (Appendix A). A complete list of exotic species has been developed with invasive species noted and discussed (Table 8). There were 23 state-listed species found, with seven species being found in the field and given updated locality information (Table 2; Appendix A, B). There were an additional 44 species of conservation concern found. A complete description of RRG habitats has been provided with all ecological systems and associations described in detail.

Species-area curve

The updated species-area curve presented here will be a useful estimate of species richness of sites across the CP. The inclusion of two new KY floras provided better representation of the northern CP and a slightly better fit to the curve raising the r^2 value from 0.81 to 0.86. However, floras are most often conducted on areas of known botanical and conservation importance (Wade and Thompson 1991). The overall high proportion of native taxa for the CP floras indicate that they were conducted at high-quality natural areas. Therefore, as Wade and Thompson (1991) discuss, species-area curves like this will be most accurate when estimating species richness of similar high-quality areas.

Comparison to other floras

The RRG contained 1023 taxa, which is 35.73% of the total KY flora (Weakley 2015). The RRG flora was 85.82% native, which is higher than the state overall at 68.5% (Weakley 2015). This is an indication that the RRG is an area with a high-quality flora which deserves continued protection.

This work is one of 17 floras conducted in the CP and the largest area surveyed for vascular plants in the CP to date (Table 1). The mean proportion of native taxa for other CP floras is 90.25% and the mean proportion of rare taxa is 2.07%. Overall the flora of the RRG is very similar to the other CP floras in its species per area, proportion of native taxa, and proportion of state-listed taxa. The RRG has a slightly lower proportion of native taxa at 85.82% than the other CP floras. There are likely two reasons for this. First, the RRG flora covers the largest area of the CP floras with 15,983 more hectares surveyed than the second largest flora (Table 1). It is likely that as you survey a larger area you encompass more disturbed areas, and thus include more exotic species. Another possible reason is that the RRG is a heavily used recreation area and this is known to introduce exotic species (Wells and Lauenroth 2007; Olive and Marion 2009; Adams and Zaniwski 2012). The RRG has a very similar proportion of state-listed species at 2.30% and contained 98.9% of the expected richness based on the modified Prater III (2015) CP species-area curve.

Exotic species

Exotic species are those that establish wild populations outside of their original range (KY-IPC 2018). In total 14.1% of the flora in the RRG is exotic. The majority of

these exotic species are found in ruderal sites like roadsides, fields/lawns, dumping sites, and other heavily disturbed areas. However, there are 74 exotic species in the RRG (Table 8) that are considered invasive, which means that they establish populations in natural communities, thus displacing native species in the same area (KY-IPC 2018).

Exotic and also invasive species are likely becoming more prevalent in the RRG. There were 11 exotic species that are new species records for the RRG (Table 9). Three of those species, *Elaeagnus angustifolia*, *Ficaria verna*, and *Lamium maculatum*, are listed as invasive threats to KY (Table 8). All of these species have been found since 2011. Further, Ross C. Clark (pers. comm.) noted that *Alliaria petiolata*, a species listed as a severe threat (Table 8), was not present in the RRG during his time spent collecting there.

Four species, all listed as a severe threat by the KY-IPC, were noted during this study to be highly invasive in the RRG (Table 8). The grass *Microstegium vimineum* is found along most roadways, trails, and stream corridors. It is also readily observed in undisturbed communities. *M. vimineum* was noted to be directly competing with some rare species including *Ageratina luciae-brauniae* and *Liparis loeseli*. Another grass, *Miscanthus sinensis*, is commonly seen along roadways but was noted to be particularly prevalent on ridgetops in oak pine forests and near the edges of rock outcrops. *Rosa multiflora*, a shrub, is prolific along streams and trails. It was noted to develop near monoculture stands and is also found in high-quality undisturbed areas like Tight Hollow. Lastly the herb *Stellaria media* is most often found in the riparian habitats of

the RRG. It is prolific along the floodplain of the Red River and in some areas was one of only a few ground layer species.

Species of conservation concern

The RRG hosts 67 species that were noted to be of some level of conservation concern, another indication that the RRG is a high quality natural area. In total, 23 state-listed species are documented as in the RRG, with three being new species records for the area. There are an additional 44 species documented in the RRG that are considered rare by Weakley (2015), and or Jones (2005). Of these, 6 species are considered sensitive by the USFS. Detailed accounts for all species of conservation concern species can be found in Appendix B.

There were several state-listed species reported by the KSNPC as present in the RRG that were not able to be relocated. There were 13 populations of state-listed species searched for that could not be found in the field during this study (Table 2). This is an indication that these species are becoming rarer across the RRG, and likely throughout their limited range in KY. However, this project was time-limited and not every reported population could be searched for. Additionally, localities for these populations are often obscure, making relocation challenging. There are eight state-listed species reported by the KSNPC that could not be located in the field and for which no voucher could be found (Table 2). It is hard to determine with certainty if these species were ever a part of the RRG flora. Vouchering specimens is the standard for floristic work and should always be done, especially when reporting new or rare

species to an area (Palmer *et al.* 1995). For species too rare to collect, photo vouchers are also a viable option, especially with the advent of the SERNEC Data Portal (2017).

New species records

The new species records found during this project (Table 10) are of valuable importance to better understanding the flora of the CP and KY. The KY flora is understudied relative to other states and field-work based studies like this one are increasingly rare (Jones 2005; Ríos-Saldaña *et al.* 2018). This study demonstrates there is still much to learn about the KY flora, which is a requisite tool to conserve species and understand what effects we are having on the landscape.

Ecological systems

There are nine NatureServe tracked ecological systems and one system, Anthropogenically Disturbed Areas, that is not tracked by NatureServe (NatureServe 2017). These ecological systems are discussed below in alphabetical order.

Allegheny-Cumberland Dry Oak Forest and Woodland

This ecological system makes up much of the upland habitat found in the RRG. It is dry hardwood forest habitat growing over acidic soils. It is described by Jones (2005) as mixed oak and xeric oak woods. This system occurs mostly on the middle-to-upper slopes of ridges. It can also be found on the ridge tops that are less exposed and have a soil substrate. As you move to more exposed and drier sites this system gradually transitions into Southern Appalachian Low-Elevation Pine Forest. However, it is common in the RRG for this system to suddenly transition into thin bands of

Cumberland Sandstone Glade and Barrens when ridges and slopes with soil abruptly end at cliff edges that have little to no soil. As you move to more mesic sites this system gradually transitions into South-Central Interior Mesophytic Forests. This typically happens as you move downslope towards valley bottoms.

This system is dominated by a mixture of oaks and hickories, particularly *Carya tomentosa* and *Quercus montana*, usually with a mixture of other upland oaks and hickories. Other canopy dominants include *Acer rubrum* and *Nyssa sylvatica*. There is typically the addition of *Pinus rigida* and *P. virginiana* in drier sites. The understory is dominated by early recruits of the canopy species as well as *Cercis canadensis*, *Cornus florida*, *Oxydendrum arboreum*, and *Sassafras albidum*. The shrub layer is typically made up of a combination of *Kalmia latifolia*, *Rubus flagellaris*, *Smilax rotundifolia*, *Vaccinium pallidum*, and *V. stamineum*. The herbaceous layer is sparse but typically includes *Chimaphila maculata*, *Danthonia spicata*, *Polystichum acrostichoides*, and *Schizachyrium scoparium*. Rare species found in this system include *Carex rugosperma*, *Castanea dentata*, and *Lilium philidelphicum*.

Six component associations were identified as being present in this system in the RRG (Table 11). Five are listed as secure (G5) or apparently secure (G4), and one, Appalachian Low-Elevation Mixed Pine / Blue Ridge Blueberry Forest, is listed as vulnerable (G3; Table 11). This association occurs on the gradient towards Cumberland Sandstone Glade and Barrens, and Southern Appalachian Low-Elevation Pine Forest systems. Although this association is not considered rare, it is listed as vulnerable (G3) due to threats posed by southern pine beetle (*Dendroctonus frontalis* Zimmerman) infestations, which are exacerbated by climate change (Jones 2005; NatureServe 2017).

Additionally, this association is subject to its vegetation becoming more mesic over time due to a combination of fire suppression and pine stand deaths (NatureServe 2017).

Anthropogenically Disturbed Areas

This system is common in the RRG. It is made up of habitats that include roadsides, ditches, mowed fields/lawns, old home sites, and an abandoned limestone quarry. There is generally a high proportion of ruderal native and exotic species at these sites including *Digitaria ischaemum*, *Lolium arundinaceum*, *Lonicera japonica*, *Phalaris arundinacea*, *Plantago virginica*, *Schizachyrium scoparium*, *Trifolium pratense*, and *T. repens*. Typically, these ruderal species do not occur outside of areas that have been heavily disturbed. One rare species, *Liparis loeselii*, occurs in this system at an abandoned quarry.

Central Interior Highlands and Appalachians Sinkhole and Depression Pond

This system is a small and isolated component of the RRG and can be natural or manmade. It was found in only four locations in the RRG during this study. Booth Pond on Fletcher ridge is a natural ridgetop forested depression wetland. The other three locations where this system was observed were manmade wildlife impoundments located on Tarr Ridge, Tunnel Ridge, and Rush Ridge. Due to the isolated nature of this system, it generally transitions abruptly into the system that surrounds it. In the RRG these systems were found on ridgetops that were predominantly Allegheny-Cumberland Dry Oak Forest and Woodland.

The vegetation of this system varies widely based on association. Booth Pond is forested and dominated by an over story of *Acer rubrum*, *Liquidambar styraciflua*, and *Nyssa sylvatica*. The understory and shrub layer consisted of *Cephalanthus occidentalis*, *Pinus virginiana*, and *Quercus alba*. The herbaceous layer included *Utricularia gibba* as a floating aquatic as well as *Carex crinita*, *C. lupulina*, *C. grayii*, *Dichanthelium microcarpon*, *Eleocharis tenuis*, *Ludwigia palustris*, *Sagittaria latifolia*, and *Scirpus cyperinus* as emergent aquatics. One rare plant (*Eleocharis tenuis*) is found at Booth Pond. The manmade wildlife impoundments were open water habitats with no woody component. They typically had *Brasenia schreberi* as a floating aquatic and *Carex lupulina*, *Lycopus virginicus*, and *Onoclea sensibilis* surrounding the edges as emergent aquatics.

There were only two associations noted as being present in this system in the RRG (Table 11). One is listed as an imperiled (G2) association and that is the Upland Sweetgum - Red Maple Pond (Table 11). This association is poorly understood and is designed to accommodate a variety of isolated upland depression wetlands in the Appalachians (NatureServe 2017). It is listed as imperiled (G2) because the full extent of its range is unknown, and the exact nature of the vegetation is poorly understood (NatureServe 2017).

Cumberland Acidic Cliff and Rockhouse

This system is common in the RRG and found around the many cliff-bound ridges as well as at the heads of many streams. Rockhouses are abundant in the RRG and are a diagnostic characteristic of this system (Francis 1998; NatureServe 2017).

This system is found only on the walls of cliffs and within the area of the rockhouses. Thus, it very abruptly transitions into South-Central Interior Mesophytic Forest, or Allegheny-Cumberland Dry Oak Forest and Woodland depending on aspect and position.

The vegetation in this system is often sparse due to the general lack of soils. Frequent species include *Asplenium montanum*, *A. rhizophyllum*, *Heuchera parviflora*, *Osmundastrum cinnamomeum*, *Rhododendron maximum*, *Solidago albopilosa*, *Thalictrum mirabile*, and *Vandenboschia boschiana*. Drier sites are often much less rich and may contain only a few species. Rare species found in this system include *Ageratina luciae-brauniae*, *Circaea alpina*, *Primula frenchii*, and *Solidago albopilosa*.

There are five associations in this system present in the RRG. Four of these associations are listed as vulnerable (G3), due to their limited range, and the sites where they occur have a limited extent (NatureServe 2017). One association, Cumberland Plateau Rockhouse, is listed as imperiled (G2). This is because this association has a small range, located only in the CP, and is subject to heavy recreational use and looting of archeological resources (NatureServe 2017). In the RRG rock climbing is noted as having a deleterious impact on these communities (White and Drozda 2006).

Cumberland Riverscour

This system is found in and along the Red River as well as its tributaries. It is a common system in the RRG but is confined to the streams and immediate edges. This system transitions into a South-Central Interior Small Stream and Riparian system as you move away from the actual stream bed.

Species that can be found in the scour of the stream bed are *Bidens frondosa*, *Justicia americana*, *Persicaria hydropiperoides*, *P. longiseta*, *P. punctata*, and *Poa trivialis*. Larger areas of scour like that found on the Red River and near the mouth of Gladie Creek support a shrub component of *Platanus occidentalis*, that is kept stunted, and *Salix sericea*. There is generally a canopy that overhangs from the banks and is dominated by *Acer negundo*, *Betula nigra*, and *Platanus occidentalis*. On the immediate banks of the streams are often *Alisma subcordatum*, *Alnus serrulata*, *Carex gracilescens*, *C. lupulina*, *C. lurida*, and *Xanthorhiza simplicissima*. Rare species found in this system include *Carex torta*, and *Podostemum ceratophyllum*.

There are five associations in this system in the RRG (Table 11). Three of the associations are listed as apparently secure (G4), and two of them, Rocky Bar and Shore (Alder - Yellowroot Type), and Rocky Bar and Shore (Twisted Sedge Type), are listed as vulnerable (G3). The latter are listed as vulnerable (G3) because they are restricted by geography and habitat and are thus susceptible to elimination through disturbances that alter flow regimes such as damming (NatureServe 2017).

Cumberland Sandstone Glade and Barrens

This system is common in the RRG. The most prominent examples of it are found at Sky Bridge and Chimney Top Rock. This system is described in Jones (2005) as rock outcrop communities, and gradually transitions into Southern Appalachian Low-Elevation Pine Forest. However, it may suddenly transition into an Allegheny-Cumberland Dry Oak Forest and Woodland system when a ridge or slope abruptly ends in a cliff ledge.

The shrub layer is the most prominent in this system with common species being *Amelanchier arborea*, *Gaylussacia baccata*, *Hamamelis virginiana*, *Kalmia latifolia*, *Vaccinium corymbosum*, *V. pallidum*, and *V. stamineum*. There are some stunted trees that occur providing a short open canopy, which primarily consists of *Pinus virginiana* and *P. echinata*. Common herbaceous layer species are *Carex tosa*, *Dichanthelium columbianum*, and *Pteridium latiusculum*. Rare species found in this system include *Carex tosa*, *Dichanthelium columbianum*, *Melampyrum lineare* var. *pectinatum*, and *Rhododendron prinophyllum*.

There are three associations that occur within this system in the RRG (Table 11). They are all listed as vulnerable (G3) due primarily to the threat of southern pine beetle. They are also naturally limited in size and threatened by development, off road vehicles, and recreation (NatureServe 2017). Sky Bridge and Chimney Top Rock, two of the best examples of this community type in the RRG, are also some of the most popular tourist destinations in the area, which makes recreation a threat to this system. It is common to find undesignated trails leading to rock outcrops that are not mapped accompanied with graffiti and rock carvings.

Cumberland Seepage Forest

This system is rare in the RRG, with the only true example of it occurring near the head of Fish Trap Branch. Downstream this community gradually transitions into a South-Central Interior Mesophytic Forest system as the gradient of Fish Trap Branch increases and the soil becomes less saturated.

This system has an open canopy made up of *Acer rubrum*, *Nyssa sylvatica*, *Liriodendron tulipifera* and *Tsuga canadensis*. The shrub layer and understory are also sparse and consists of *Amelanchier laevis*, *Rhododendron maximum*, and *Rubus argutus*. The herbaceous layer is dense and is almost completely dominated by very large *Osmunda spectabilis*, *Osmundastrum cinnamomeum*, and dense *Sphagnum* sp. Other herbaceous species include *Phlox maculata*, *Platanthera clavellata*, and *Scirpus polyphyllus*. No rare species are known to occur in this system.

There are two associations assigned to this single site because they are highly related associations and the site contains elements of both (Table 11). The associations are listed as vulnerable (G3) and imperiled (G2). They are listed this way because almost all examples of these associations are less than 5 acres, and the flat terrain they inhabit make them susceptible to development (NatureServe 2017).

South-Central Interior Mesophytic Forest

This system is the most abundant in the RRG and can be found on mid and lower slopes, where there is deeper soil and less exposure, as well as in the bottoms. This system is described as mixed deciduous forest by Jones (2005) and is consistent with the mixed mesophytic forest described by Braun (1950; NatureServe 2017). This community gradually transitions into a South-Central Interior Small Stream and Riparian system as you move closer to major streams, and gradually transitions into an Allegheny-Cumberland Dry Oak Forest and Woodland system as you move further upslope where the soil is thinner and there is more exposure.

The canopy is generally dense and can be dominated by different species depending on the association present. Common dominants include *Acer saccharum*, *Aesculus flava*, *Betula lenta*, *Fagus grandifolia*, *Fraxinus americana*, *Liriodendron tulipifera*, *Pinus strobus*, *Quercus rubra*, *Tilia americana* var. *heterophylla*, and *Tsuga canadensis*. Common species of the understory include *Asimina triloba*, *Cercis canadensis*, *Cornus alternifolia*, *Lindera benzoin*, *Magnolia macrophylla*, *M. tripetala*, *Rhododendron maximum*, *Sambucus canadensis*, and *Staphylea trifolia*. The herbaceous layer of this system is often extremely rich, with some of the most conspicuous species being *Actaea podocarpa*, *Anemone acutiloba*, *Asclepias exaltata*, *Cardamine angustata*, *C. diphylla*, *Maianthemum racemosum*, *Phlox divaricata*, *Trillium erectum*, *T. grandiflorum*, *Valeriana pauciflora*, *Viola blanda*, and *V. rostrata*. Rare plants found in this system include *Cypripedium parviflorum* var. *parviflorum*, *Juglans cinerea*, *Maianthemum canadense*, *Scutellaria saxatilis*, *Solidago curtisii*, *Stellaria longifolia*, and *Taxus canadensis*.

There are six associations in this system in the RRG. Five of them are listed as apparently secure (G4; Table 11). One of them, East-Central Hemlock - Hardwood Forest, is listed as vulnerable (G3) because of threats to *Tsuga canadensis* populations from the hemlock wooly adelgid (*Adleges tsugae* Annand).

South-Central Interior Small Stream and Riparian

This system is found in the small floodplains around major streams in the RRG like, Gladie Creek, Indian Creek, the Red River, and Swift Camp Creek (Fig. 4). This is common system in the RRG and transitions into South-Central Interior Mesophytic

Forest as you move away from the stream, and transitions into Cumberland Riverscour as you enter the stream bed.

The canopy of this system is dense and often dominated by *Acer negundo*, *Acer rubrum*, *Aesculus flava*, *Betula nigra*, and *Platanus occidentalis*. Common species of the shrub layer include *Alnus serrulata*, *Cercis canadensis*, *Cornus amomum*, *Dirca palustris*, *Hydrangea arborescens*, and *Viburnum rufidulum*. The herbaceous layer is rich, with the most common species being, *Arundinaria gigantea*, *Boehmeria cylindrica*, *Carex plantaginea*, *C. prasina*, *Impatiens capensis*, *Pilea pumila*, *Phryma leptostachya*, *Poa sylvestris*, and *Viola eriocarpa*. Rare species that occur in this system are *Cypripedium parviflorum* var. *parviflorum*, *Juglans cinerea*, *Maianthemum canadense*, *Platanthera psycodes*, and *Taxus canadensis*.

There are 10 associations present in this system in the RRG. Five are listed as secure (G5) or apparently secure (G4), two are listed as vulnerable (G3), and two are listed as imperiled (G2; Table 11). The Floodplain Canebrake association is listed as G2 because much of this association has been lost and is under threat of development, as it occupies flat areas with rich soils that are often converted to farmland. The other two C3 vulnerable and one C2 imperiled associations have been discussed in other systems, they are the Rocky Bar and Shore (Alder - Yellowroot Type), Rocky Bar and Shore (Twisted Sedge Type), and Upland Sweetgum - Red Maple Pond associations respectively.

Southern Appalachian Low-Elevation Pine Forest

This system was described by Jones (2005) as Pine Forests and can be found along more exposed ridgetops where the soil is thinner. This system is relatively common in the RRG although larger tracts of this system are infrequent. One of the best examples found was on Hatton Ridge Rd ca. 2km south of the Hatton Ridge Rd. Cemetery. As you move towards rock outcrops and cliff edges this system gradually transitions into a Cumberland Sandstone Glade and Barren system, and as you move towards less exposed slopes with more developed soil this system transitions into an Allegheny-Cumberland Dry Oak Forest and Woodland system.

The canopy in this system can be open or closed with dominant species being a combination of *Pinus echinata*, *P. rigida*, and *P. virginiana*, with other canopy trees being *Oxydendrum arboreum*, *Quercus coccinea*, and *Q. montana*. The shrub layer is generally sparse, although it becomes more prominent as you begin to transition into a Cumberland Sandstone Glade and Barrens system. Common shrubs include *Hamamelis virginiana*, stunted *Juniperus virginiana*, *Vaccinium corymbosum*, *V. pallidum*, and *V. stamineum*. The herbaceous layer is also sparse, with common species being *Chimaphila maculata*, *Epigaea repens*, and *Goodyera pubescens*. A rare species found in this system is *Monotropsis odorata*.

Threats

Although the RRG flora was saved from annihilation by efforts that halted the construction of a dam on the Red River (Collins 1975), there are still a number of threats to the area. Many are broad scale problems that threaten the entire KY flora, and thus must be addressed by actions at a more regional or even a world-wide scale in the

case of climate change. However, some threats, especially recreation, are issues that influence the RRG at the local level.

Rock climbing is a recreational sport that has boomed over the past few decades in the RRG. It is estimated that 7,500 climbers visit the RRG every year (Maples *et al.* in press). Research indicates that rock climbing has serious negative effects on species richness, species composition, and species diversity for bryophytes, lichens, and vascular plants (McMillan and Larson 2002). The proportion of exotic species has also been shown to significantly increase on cliffs that are regularly climbed, and it is thought that climbers bring exotic seeds in on their clothes and gear (McMillan and Larson 2002). Sandstone cliffs, like those present at the RRG, often have loose substrate that is removed by rock climbers, which in turn removes the species that rely on it (Adams and Zaniewski 2012). Several rare vascular plant species are known to occur on or near cliffs (*e.g. Ageratina luciae-brauniae*, *Asplenium* hybrids, *Solidago albopilosa*, *Thalictrum mirabile*, and *Vandenboschia boschiana*). Recreation by rock climbers has been established as a threat to *Solidago albopilosa* (Shea 1993) and is also likely a threat to the other cliff species mentioned.

Other recreational activities such as hiking, camping, and horseback riding are also common in the RRG. Contemporary visitors to the RRG are attracted to rockhouses just as Native Americans were. Because rockhouses tend to be popular hiking destinations, recreation is a severe threat to the Cumberland Plateau Rockhouse association present within them, which is listed by NatureServe (2017) as imperiled (G2; Francis 1988). As a result of trampling, many rockhouses in the RRG that would typically have a dense ground layer of vegetation, are nearly denuded (Francis 1998).

Damage tends to occur very rapidly even with light usage, with recovery taking much longer (Cole 2004). The CW allows for horseback riding, and this can cause heavy disturbance on slopes and in floodplains (Olive and Marion 2009). Horses have been documented to bring exotic seeds into areas through their dung, providing a mechanism by which exotic species can be introduced into areas that they would have otherwise not been able to reach (Campbell and Gibson 2001; Wells and Lauenroth 2007).

A number of insect pests also pose threats to the RRG, including Asian longhorn beetle (*Anoplophora glabripennis* Motschulsky), emerald ash borer (*Agrilus planipennis* Fairmaire), hemlock woolly adelgid, and southern pine beetle. The Asian longhorn beetle is an exotic boring insect that infests a wide variety of tree species including *Acer negundo*, *Betula* spp., *Platanus occidentalis*, and *Fraxinus* spp. (Lensing 2017). It has not been found in KY yet, but was located in southeastern Ohio in 2011 (Lensing 2017). Given recreational traffic flow from urban areas associated with outbreaks, the Asian longhorn beetle should be monitored for in the RRG. Emerald ash borer is an exotic pest that infests all *Fraxinus* spp. in KY. It was discovered in Michigan in 2002 and has since killed more than 15 million trees (Lensing 2017). Emerald ash borer kills trees within 1–3 years of infestations. It was discovered in KY in 2009 and has since been discovered in the RRG (Lensing 2017). The transportation of infested firewood is a major cause of dispersal for this insect and likely how it was introduced to the RRG. The loss of the majority of *Fraxinus* spp. populations in the RRG is likely. Hemlock woolly adelgid is an exotic pest that infests *Tsuga canadensis* and kills trees within 3–6 years of infestations (Lensing 2017). Where this species has been present for 10 years or more, as many as 80% of the hemlocks have died (Lensing

2017). Hemlock woolly adelgid was discovered in KY in 2006 and was confirmed in the RRG by 2015 (Lensing 2017). The loss of *Tsuga canadensis*, an important canopy species, is likely. Southern pine beetle is a native pest that infests *Pinus echinata*, *P. rigida* and *P. virginiana* in Kentucky. Outbreaks of this species can last three to four years and typically occur at 25–30 year intervals in KY (Palli 2017). However, outbreaks could increase in frequency with climate change (NatureServe 2017). Southern pine beetle typically only kills stressed trees (Palli 2017), however as trees die, pine dominated associations can be transformed by the establishment of more mesic species (Jones 2005; NatureServe 2017).

Lastly, climate change is threat to the flora of the RRG and more broadly the flora of KY as a whole. It has been shown to cause extinction and drastic range changes for species (Thomas *et al.* 2004). The RRG sits at the northern edge of the CP and a number of species in the RRG reach their southern range limit in this area (*e.g.* *Allium burdickii*, *Carex hitchcockiana*, *Taxus canadensis*; Weakley 2015). Species like these will likely be extirpated from the RRG but maintain populations in the more northern parts of their range, as the climate of KY becomes warmer (Jones 2005). Other species that are endemic to the region (*e.g.* *Ageratina luciae-brauniae*, *Clethra acuminata*, *Solidago albopilosa*; Weakley 2015) will likely not be able to adapt quickly enough to deal with changing conditions and become extinct entirely (Jones 2005).

V. Conclusions and future directions

This is the largest flora to date in the CP. The updated species-area curve for CP and flora of the RRG presented here provide a greatly improved understanding of this botanically important region and natural area. Rare, exotic, and invasive species information, as well as complete habitat descriptions have all been compiled into a single place, providing a solid baseline of information for future research and management decisions. In the future there are two main areas of research that should be focused on to build upon this work.

Continued floristic work

One of the most important projects to come will be georeferencing the 2,573 vouchers used in this study that lack GPS coordinate data. This will allow for unexplored areas, possibly the upper reaches of the Red River and western portions of Indian Creek, to be determined and targeted for future floristic work which may reveal new species and rare plant populations.

More work should focus on locating populations of species of conservation concern, especially state-listed species' populations that were not able to be located during this study. This project was time-limited, and more species and populations would likely be found with more exploration. Additionally, there are possible undescribed species in the RRG that are likely of conservation concern (Dourson and Dourson 2018). However, care should be taken to voucher any new species or population discovered. Reports that are not supported by vouchers are difficult to verify.

The flora of cliff lines in KY is poorly understood (Jones 2005) and the Cumberland Acidic Cliff and Rockhouse ecological system is common in the RRG. Because of this, the RRG is one of the top rock climbing destinations in the country, yet quantitative data on the effects rock climbing in the southeast, the CP, and KY is non-existent. In-depth studies on the flora of KY cliffs and of the effects of rock climbing on the RRG flora must be conducted in order to understand the impacts of this recreational activity in the region.

The online species list developed during this project is easily updatable. As more herbaria are added to the SERNEC Data Portal (2017) it should be monitored for new RRG vouchers and unreported species. These and vouchers from future floristic works in the RRG should be added to the online list. Additionally, the Austin Peay State University Herbarium was not visited during this project. It is home to the Higgins (1970) vouchers, as well as a set of Max Medley collections that are important historical vouchers for the RRG. Subsequent efforts should be made to assess their status and include them in this flora.

Monitoring threats to the flora

Recreation will be an ongoing threat to the flora of the RRG. It can be devastating to rare species that already have limited ranges (*e.g. Solidago albopilosa*). Areas with species noted in this work as being of conservation concern should be discouraged from any recreational use. As the effects of rock climbing on the RRG remains unknown, rock climbing should be limited to areas that are already heavily used, with pristine cliff faces protected.

Insect pests will be a perpetual threat to the flora of the RRG. Eastern pine beetle, emerald ash borer, and hemlock woolly adelgid all pose contemporary threats to associations present in the RRG (NatureServe 2017). It will be important to monitor and understand how the flora changes as *Fraxinus* spp., *Pinus* spp., *Tsuga canadensis*, and the associations they are dominant in are lost in the RRG.

Finally, the flora of the RRG is likely to change as the planet's climate changes. Future projects should focus on monitoring species at the southern limit of their range to see if they are becoming less common, as well as monitoring for southern species expanding their range into the northern CP. Additionally, careful attention should be given to species that are endemic to the region to see if climate change is having a negative effect on them.

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APPENDICES

Appendix A: Vascular species list for the Red River Gorge in Menifee, Powell, and
Wolfe Counties Kentucky

Appendix A: Vascular species list for the Red River Gorge in Menifee, Powell, and Wolfe Counties Kentucky

Annotated species list of vascular plants and vouchers for the Red River Gorge in Menifee, Powell, and Wolfe Counties Kentucky. The list is organized first by major group [Lycopodiophyta, Monilophyta, Acrogymnosperma, Magnoliids and early diverging angiosperms, Monocotyledonae, and Dicotyledonae] and then alphabetically by family, genus, and species. Species preceded by an asterisk (*) are exotic; two asterisks (**) indicate the species is on the invasive species list developed by the Kentucky Invasive Plant Council. An exclamation point (!) indicates the species is listed by the Kentucky State Nature Preserves Commission as Endangered, Threatened or of Special Concern. Species that were observed in the field during this project are followed by a number (*e.g.* *Acer rubrum* L. [5]) which indicates abundance (Table 4). Vouchers are deposited at the Ronald L. Jones Herbarium (EKY) at Eastern Kentucky University unless otherwise noted. All T. McFadden duplicates are deposited at Austin Peay State University Herbarium (APSU). Vouchers with no collection numbers (*i.e.*, listed as *s.n.*) are followed by the date they were collected (yyyy-mm-dd). Further all vouchers linked to the species list can be reviewed online at:

<http://sernecportal.org/portal/checklists/checklist.php?cl=4833&proj=&dynclid=0>

LYCOPODIOPHYTA (CLUBMOSSES)

HUPERZIACEAE

Huperzia lucidula (Michx.) Trvisan: [3]

J. Getch 82, N. Coons 77, J. Fitzpatrick 62, R. Clark 22161, T. McFadden 302

Huperzia porophila (Lloyd & Underw.) Holub

R. Clark 21746, R. Clark 21118a, R. Clark 21015

LYCOPODIACEAE

Dendrolycopodium hickeyi (W.H. Wagner, Beitel & R.C. Moran) A. Haines: [1]

T. McCoy *s.n.* (1959-12-05), T. McFadden 459, T. McFadden 547

Dendrolycopodium obscurum (L.) A. Haines

K. Johnson 54

Diphasiastrum digitatum (Dill. *ex* A. Braun) Holub [4]

T. McCoy *s.n.* (1961-08-25), R. Clark 21291, R. Clark 22198, T. McFadden 387

Diphasiastrum tristachyum (Pursh) Holub

R. Clark 21022, R. Clark 94, P. Froelich 166, R. Clark 22200, R. Clark 22443

SELAGINELLACEAE

Lycopodioides apoda (L.) Kuntze [3]

R. Clark 21750, R. Clark 21574, T. McFadden 439, T. McFadden 550

MONILOPHYTA (FERNS)

ASPLENIACEAE

Asplenium bradleyi D.C. Eaton

J. Fitzpatrick 67, N. Coons 36, R. Clark 24094

Asplenium montanum Willd. [3]

E. Browne 9535, R. Clark 21006, R. Clark 21739, R. Clark 21595

Asplenium pinnatifidum Nutt. [3]

R. Clark 21007, R. Clark 22211, R. Clark 21957, R. Clark 22640, T. McFadden 536

Asplenium platyneuron (L.) B.S.P. [4]

E. Browne 9522, R. Clark 21432, K. Johnson 49, P. Froelich 151, T. McFadden 834

Asplenium resiliens Kunze [2]

T. McFadden 645

Asplenium rhizophyllum L. [4]

J. Lassetter 2392, M. Beckett 1262, D. Taylor 69, S. Weber 114, C. Brown 120, A. Rentas 124, N. Coons 53, T. McFadden 332

Asplenium ruta-muraria L. var. *cryptolepis* (Fernald) Wherry [3]

K. Knauss 42, T. McFadden 729

Asplenium trichomanes L. subsp. *trichomanes*

E. Browne 2625, R. Clark 21740

Asplenium × *trudellii* Wherry (pro sp.) [*montanum* × *pinnatifidum*] [3]

T. McFadden 469, T. McFadden 699

ATHYRIACEAE

Athyrium asplenoides (Michx.) A.A. Eaton [4]

R. Clark 21001, E. Browne 9497, R. Clark 21769, R. Clark 21702, R. Clark 22251, R. Clark 21617, J. Buskin 1443, J. Varner 7681, R. Clark 21624

Deparia acrostichoides (Sw.) M. Kato

E. Browne 9552, R. Clark 21603, R. Clark 21000

CYSTOPTERIDACEAE

Cystopteris bulbifera (L.) Bernh. [4]
R. Clark 21970, R. Clark 22515, R. Clark 22201

Cystopteris protrusa (Weath.) Blasdell [3]
R. Clark 22196, R. Clark 21013b, R. Clark 22697

Cystopteris tenuis (Michx.) Desv.
J. Campbell *s.n.* (1988-08-01) , J. Campbell *s.n.* (1988-08-24)

DENNSTAEDTIACEAE

Dennstaedtia punctilobula (Michx.) T. Moore [4]
R. Clark 21667, R. Clark 21030, J. Buskin *s.n.* (1972-07-14), J. Varner 7771, R. Clark 21667

Pteridium latiusculum (Desv.) Hieronymus *ex* Fries var. *latiusculum* [4]
J. Varner 7683, T. McFadden 615

Pteridium latiusculum (Desv.) Hieronymus *ex* Fries var. *pseudocaudatum* (Clute)
Maxon
E. Browne 9542, C. Brown 62, J. Varner 7772

DIPLAZIOPSISIDACEAE

Homalosorus pycnocarpus (Spreng.) Pic.Serm.
R. Clark 21705, R. Clark 21010, R. Clark 21705

DRYOPTERIDACEAE

Dryopteris carthusiana (Vill.) H.P.Fuchs
R. Clark 21281

Dryopteris goldiana (Hook. *ex* Goldie) A. Gray
R. Clark 21897, R. Clark 21896

Dryopteris intermedia (Muhl. *ex* Willd.) A. Gray [3]
E. Browne 9525, M. Wharton 9618, R. Clark 22117, R. Clark 21352, R. Clark 21002,
T. McFadden 393, T. McFadden 701

Dryopteris marginalis (L.) A. Gray [4]
R. Clark 21277, R. Clark 21435, R. Clark 21481, R. Clark 21018, R. Clark 22689

Polystichum acrostichoides (Michx.) Schott [4]
T. Antonio 7421, E. Browne 9515, E. Browne 2622, P. Froelich 175, S. Weber 142, K.
Knauss 38, C. Brown 102, J. Varner 7214, J. Varner 7732, J. Varner 7427, J. Varner
7757, T. McFadden 477

EQUISETACEAE

Equisetum arvense L. [4]
R. Clark 21300, R. Clark 22170

Equisetum hyemale L. subsp. *affine* (Engelm.) Calder & Taylor [4]
R. Clark 22305, R. Clark 21269, K. Johnson 12, T. McFadden 315

Equisetum × *ferrissii* Clute (pro sp.) [*hyemale* × *laevigatum*]
C. Brown 130, S. Weber 103

HYMENOPHYLLACEAE

Vandenboschia boschiana (J.W. Sturm ex Bosch) Ebihara & K. Iwats. [2]
M. Medley 463-78, R. Clark 21768, E. Browne... 2633

LYGODIACEAE

Lygodium palmatum (Bernh.) Sw. [3]
J. Lassetter 2393, R. Hyerczyk 170, Donald Pelly *s.n.* (1976-07-16), E. Browne 2630, J.
Fitzpatrick-Cooper 68, K. Knauss 45, J. Buskin *s.n.* (1972-10-08), T. McFadden 289

ONOCLEACEAE

Onoclea sensibilis L. var. *sensibilis* [4]
R. Clark 21753, T. McFadden 606

OPHIOGLOSSACEAE

Botrypus virginianus (L.) Michx. [4]
R. Clark 21332, S. Weber 139

Ophioglossum vulgatum L. [3]
R. Clark 22203

Sceptridium biternatum (Savigny) Lyon [2]
T. McFadden 600

Sceptridium dissectum (Spreng.) Lyon [4]
R. Clark 22171, R. Clark 22204, R. Clark 22128, R. Clark 21859, R. Clark 21981, R.
Clark 22594, T. McFadden 452, T. McFadden 480

OSMUNDACEAE

Osmunda claytoniana L. var. *claytoniana* [3]
T. Antonio 7443, R. Clark 21757, R. Clark 21757, T. McFadden 700

Osmunda spectabilis Willd. [3]
K. Johnson 6, J. Varner 7734, T. McFadden 637

Osmundastrum cinnamomeum (L.) C. Presl [4]
E. Browne 9513, R. Clark 21317, R. Clark 21003, T. McFadden 454A

POLYPODIACEAE

Polypodium appalachianum Haufler & Windham [3]
E. Browne 9536 [MDKY]

Polypodium virginianum L. [3]
R. Clark 21004, R. Clark 21616, J. Varner 7904, J. Buskin 1344, T. McFadden 692

PTERIDACEAE

Adiantum pedatum L. [4]
T. Antonio 7419, R. Hyerczyk 163, J. Norton 145, R. Clark 21020, K. Johnson 11, C.
Brown 103, D. Taylor 66, J. Getch 77, R. Clark 21020, J. Varner 8033, J. Varner 7892

Pellaea atropurpurea (L.) Link [2]
J. Lassetter 2391, R. Clark 21998, T. McFadden 642

Vittaria appalachiana Farrar & Mickel [2]
T. McFadden 533, T. McFadden 548

THELYPTERIDACEAE

Parathelypteris noveboracensis (L.) Ching [4]
E. Browne 9504, R. Clark 21008, J. Varner 7737

Phegopteris hexagonoptera (Michx.) Fee [3]
E. Browne 9503, R. Clark 21696, R. Clark 21011

Thelypteris palustris Schott var. *pubescens* (G. Lawson) Fernald [1]
T. McFadden 644

WOODSIACEAE

Woodsia obtusa (Spreng.) Torr. subsp. *obtusa*
R. Clark 21134

ACROGYMNOSPERMAE (GYMNOSPERMS)

CUPRESSACEAE

Juniperus virginiana L. [4]

R. Clark 21027, R. Clark 21358, K. Johnson 81, T. McFadden 859

PINACEAE

Pinus echinata Mill. [3]

K. Johnson 44, R. Clark 22679

Pinus rigida Hook. & Arn. [4]

E. Browne 9541, R. Clark 21895, A. Rentas 52, J. Varner 7686, J. Varner 7438, T. McFadden 389

Pinus strobus L. [5]

E. Browne 9514, R. Clark 21446, R. Clark 21026, J. Varner 7739, J. Varner 7430, J. Varner 7227, T. McFadden 321

Pinus virginiana Mill. [5]

T. Antonio 7396, C. Way 181, D. Murphy 68, N. Coons 076, R. Murray 125, S. Weber 97, R. Clark 21021, 31234100461316 63, J. Varner 7685, J. Varner 7447, J. Varner 7707, T. McFadden 568, T. McFadden 847

Tsuga canadensis (L.) Carriere [5]

T. M. Antonio 7386, K. Knauss 57, N. Coons 050, K. Johnson 69, R. Clark 21025, J. Varner 7730, J. Varner 7900, J. Varner 7718, T. McFadden 818

TAXACEAE

Taxus canadensis Marsh. [2]

J. Campbell *s.n.* (1988-08-14), K. Huie-Netting 50, B. Fields 881, K. Johnson 37; R. Pace SOTINKY37; R. Pace SOTINKY26; R. Pace SOTINKY28; R. Pace SOTINKY29

MAGNOLIIDS AND EARLY DIVERGING ANGIOSPERMS

ANNONACEAE

Asimina triloba (L.) Dunal [4]

R. Clark 21414, A. Rentas 122, K. Johnson 76, D. Murphy 100, R. Clark 21074, J. Buskin 1455, J. Varner 7213, J. Varner 7744

ARISTOLOCHIACEAE

Asarum acuminatum (Ashe) E.P. Bicknell

R. Clark 21304

Asarum canadense L. [4]

M. Beckett 1255, H. Helm *s.n.* (1973-05-00), R. Clark 22147, T. McFadden 803, T. McFadden 871

Endodeca serpentaria Raf. [4]

R. Clark 21760, R. Clark 21870, C. Clark 22517, T. McFadden 640

Isotrema macrophyllum (Lam.) C.f. Reed

R. Clark 24476

CABOMBACEAE

Brasenia schreberi J.F. Gmel. [2]

T. McFadden 581

LAURACEAE

Lindera benzoin (L.) Blume [4]

E. Browne 9511, J. Norton 121, P. Froelich 163, R. Clark 21068, J. Varner 7745, J. Varner 7216, R. Clark *s.n.* (1985-07-13), T. McFadden 338

Sassafras albidum (Nutt.) Nees [4]

E. Browne 9531, A. Rentas 118, P. Froelich 158, K. Knauss 53, R. Clark *s.n.* (1985-07-13), R. Murray 122, C. Brown 91, J. Varner 7735, T. McFadden 884, T. McFadden 885

MAGNOLIACEAE

Liriodendron tulipifera L. [5]

D. Murphy 81, R. Clark 20951, J. Varner 7719, J. Varner 7445

Magnolia acuminata (L.) L. [4]

R. Clark 20986, R. Clark 21091, T. McFadden 576

Magnolia macrophylla Michx. [4]

E. Browne 9493, k. Johnson 36, R. Clark 21062, J. Getch 61, C. Brown 81, R. Clark 22285, P. Froelich 161, R. Clark 22506, R. Clark 22506, T. McFadden 801

Magnolia tripetala (L.) L. [4]

T. Antonio 7426, R. Clark 21072, R. Clark 22284, K. Johnson 64, J. Norton 109, R. Clark 22747

NYMPHAEACEAE

Nuphar advena (Aiton) W.T. Aiton

R. Clark 22104

SAURURACEAE

Saururus cernuus L.

R. Hannan 2941, R. Clark 22093

MONOCOTYLEDONAE (MONOCOTS)

ACORACEAE

**Acorus calamus* L.
D. Sasser 293

AGAVACEAE

**Yucca flaccida* Haw. [1]
R. Clark 22179, T. McFadden 832

ALISMATACEAE

Alisma subcordatum Raf. [3]
R. Clark 22314, R. Clark 21575, R. Clark 22045, T. McFadden 572

Sagittaria australis (J.G. Sm.) Small
K. Feeman 155, R. Clark 21577

Sagittaria latifolia Willd. [2]
T. McFadden 684

ALLIACEAE

Allium burdickii (Hanes) A.G. Jones [1]
T. McFadden 588

**Allium oleraceum* L.
D. Sasser 142

Allium tricoccum Aiton [4]
R. Clark 21451, R. Clark 22202, T. McFadden 844

***Allium vineale* L. [4]
R. Clark 21393, T. McFadden 808

AMARYLLIDACEAE

**Narcissus pseudonarcissus* L. [3]
R. Clark 22178, T. McFadden 335

ARACEAE

Arisaema dracontium (L.) Schott [1]
T. McFadden 890

Arisaema triphyllum (L.) Schott [4]
B. Stacy 4, R. Clark 21328, R. Murray 116, R. Clark 21707, R. Clark 22191

CHIONOGRAPHIDACEAE

Chamaelirium luteum (L.) A. Gray
S. Denham *s.n.* (1964-05-23), A. Rentas 67

COLCHICACEAE

Uvularia grandiflora Sm. [4]
T. Zimmerman *s.n.* (1981-04-18), R. Hyerczyk 166, R. Clark 21703, R. Clark 22174, D. Murphy 118, R. Clark 21042, T. McFadden 359, T. McFadden 590

Uvularia perfoliata L. [4]
C. Peters 2, R. Clark 21357, R. Clark 21297, R. Clark 21264, A. Rentas *s.n.* (1987-06-20), R. Murray 96, K. Johnson 21, R. Clark 22716

Uvularia sessilifolia L. [3]
R. Clark 21629

COMMELINACEAE

***Commelina communis* L.
R. Clark 21607

**Commelina diffusa* Burm. f.
R. Clark 22027

Commelina virginica L.
R. Clark 22099

Tradescantia ohiensis Raf.
D. Sasser 193

CYPERACEAE

Bulbostylis capillaris (L.) Kunth ex C.B. Clarke
R. Clark 21140

Carex albursina Torrey
R. Parately *s.n.* (2006-07-26) [KY]

Carex austrolucorum (Rettig) D.B. Poind. & Naczi [3]
R. Clark 21312, T. McFadden 445

Carex baileyi Britton [3]
R. Clark 21036, T. McFadden 623, T. McFadden 635, T. McFadden 676, T. McFadden 689

Carex blanda Dewey
R. Clark 22734, R. Clark 21187

Carex bromoides Schkuhr ex Willd.
R. Clark 21467

Carex careyana Torr. ex Dewey [3]
R. Clark 22140, R. Clark 22140, R. Clark 21470, R. Clark 21468, T. McFadden 330

Carex cephalophora Muhl. ex Willd.
R. Clark 21766

Carex communis L.H. Bailey
R. Clark 21346, R. Clark 21755

Carex complanata Torr. & Hook.
W. Meijer *s.n.* (1979-06-26), R. Clark 21056

Carex crinita Lam. [2]
K. Freeman 157, R. Hannan 2933

Carex cristatella Britton
M. Hines *s.n.* (1996-07-14) [KY]

Carex cumberlandensis Naczi, Kral & Bryson
R. Clark 21330

Carex debilis Michx. [4]

R. Clark 22518, T. McFadden 456A, T. McFadden 457A, T. McFadden 490

Carex digitalis Willd.

R. Clark 21491, R. Clark 21502

Carex emmonsii Dewey ex Torr.

R. Clark 22184

Carex festucacea Willd. [3]

T. McFadden 489

Carex flexuosa Muhl. ex Willd. [3]

R. Clark 21935, T. McFadden 731

Carex frankii Kunth [2]

C. Brown 77, T. McFadden 554

Carex glaucodea Tuck. ex Olney [3]

R. Clark 22255, T. McFadden 465

Carex gracilescens Steud. [4]

R. Clark 21426, R. Clark 21268, R. Clark 21449, R. Clark 22175, R. Clark 21412, R. Clark 21292, R. Clark 21444, R. Clark 21450, R. Clark 21416, R. Clark 21276, R. Clark 21289, R. Clark 21296, R. Clark 21289, R. Clark 21290, R. Clark 21267, T. McFadden 864

Carex gracillima Schwein.

R. Clark 21413, R. Clark 21425

Carex granularis Muhl. ex Willd.

Landon E. McKinney 5044

Carex gynandra Schwein. [3]

T. McFadden 634

Carex hirsutella Mack. [3]

A. Rentas 39, A. Rental 76, R. Clark 22456, R. Clark 22444, T. McFadden 610

Carex hitchcockiana Dewey

R. Clark 21149

Carex intumescens Rudge var. *fernaldii* L.H. Bailey [1]

T. McFadden 486

Carex intumescens Rudge var. *intumescens* [3]

R. Clark 21547, R. Clark 22520, T. McFadden 579, T. McFadden 627, T. McFadden 661

Carex laxiculmis Schwein. var. *copulata* (L.H. Bailey) Fernald [3]

R. Clark *s.n.* (1988-05-02), R. Clark 21179, R. Clark 21179, T. McFadden 650

Carex laxiculmis Schwein. var. *laxiculmis*

R. Athey 2694 [TENN]

Carex laxiflora Lam. [4]

R. Clark 21185, R. Clark 21424, R. Clark 21325, R. Clark 1988-05-01, R. Clark 21283, R. Clark 21327, R. Clark 22160, R. Clark 22146, R. Clark 21420, R. Clark *s.n.* (1988-05-01), R. Clark 21137, R. Clark 21185, R. Clark 21369, R. Clark 21410, T. McFadden 862

Carex lupulina Muhl. ex Willd. [4]

T. McFadden 502, T. McFadden 663

Carex lurida Wahlenb. [4]

R. Clark *s.n.* (1988-07-29), T. McFadden 501, T. McFadden 520

Carex muehlenbergii Schkuhr ex Willd.

R. Clark 22470

Carex normalis Mack. [2]

T. McFadden 482

Carex oligocarpa Schkuhr ex Willd. [2]

T. McFadden 461

Carex pedunculata Muhl. ex Willd. [2]

J. Campbell *s.n.* (1988-04-22), T. McFadden 839

Carex pensylvanica Lam.

R. Clark 21190

Carex planispicata Naczi

R. Athey 2699 [TENN]

Carex plantaginea Lam. [4]

R. Clark 21326, R. Murray 133, R. Clark 21742, T. McFadden 320

Carex platyphylla Carey

D. Smith *s.n.* (1959-04-11) [KY]

Carex prasina Wahlenb. [4]
R. Clark 21323, T. McFadden 434, T. McFadden 481

Carex purpurifera Mack. [3]
R. Clark *s.n.* (1988-05-01), T. McFadden 863

Carex radiata (Wahlenb.) Small [4]
T. McFadden 636, T. McFadden 639

Carex rosea Schkuhr *ex* Willd. [4]
C. Brown 95, R. Clark 22490, R. Clark 22463

!*Carex rugosperma* Mack. [2]
T. McFadden 878, T. McFadden 880, T. McFadden 886

Carex scabrata Schwein.
R. Clark *s.n.*, R. Clark 21744

Carex scoparia Schkuhr *ex* Willd. [3]
T. McFadden 523

Carex squarrosa L. [3]
T. McFadden 527

Carex stipata Muhl. *ex* Willd.
W. Meijer *s.n.* (1988-04-30), R. Clark 22192, R. Clark 22167, R. Clark 21442

Carex striatula Michx.
J. Campbell *s.n.* (1988-05-19) [KY], J. Campbell *s.n.* (1988-05-19) [KY]

Carex styloflexa Buckley
R. Clark 21433

Carex swanii (Fernald) Mack.
R. Clark 21762, R. Clark 21055

Carex tonsa (Fernald) E.P. Bicknell [3]
R. Clark 23163, T. McFadden 805, T. McFadden 888

Carex torta Boott *ex* Tuck. [2]
T. McFadden 855

Carex tribuloides Wahlenb.
Setser *s.n.* (1973-07-03) [MDKY], Setser *s.n.* (1973-07-03) [MDKY], L. Meade *s.n.* (1974-06-09) [MDKY]

Carex virescens Muhl. ex Willd. [4]
R. Clark s.n. (1989-07-15), R. Clark 22453, T. McFadden 609

Carex vulpinoidea Michx. [3]
R. Clark s.n. (1988-09-17), T. McFadden 557, R. Clark 21031

Carex willdenowii Schkuhr ex Willd. [3]
Landon E. McKinney 11145, T. McFadden 879

Carex woodii Dewey [1]
T. McFadden 545

Cyperus flavescens Willd. ex Kunth
R. Clark s.n. (1988-09-18), R. Clark 22627

Cyperus hortensis Dorr
R. Clark s.n. (1988-09-18)

Cyperus strigosus L.
R. Clark 21901, R. Clark 21509, R. Clark 22605

Eleocharis obtusa (Willd.) J.A. Schultes
R. Clark 21900

Eleocharis ovata (Roth) Roemer & J.A. Schultes
R. Clark 21899, R. Clark 22313

Eleocharis tenuis (Willd.) Schult. [1]
Kin Freeman 164, T. McFadden 483

Fimbristylis autumnalis Roem. & Schult.
R. Clark s.n. (1988-09-18)

Schoenoplectus tabernaemontani (K.C. Gmel.) Palla
C. Hanley 19

Scirpus cyperinus (L.) Kunth [2]
K. Feeman 160, R. Clark 21832, R. Clark 21554, T. McFadden 659, R. Clark 22597

Scirpus georgianus Harper [3]
T. McFadden 508, T. McFadden 571

Scirpus polyphyllus Vahl [3]
R. Clark 22021, R. Clark 22714, T. McFadden 633, R. Clark 21651, R. Clark 21751

Scleria oligantha Michx. [3]

R. Hyerczyk 169, R. Clark 21726, T. McFadden 460, T. McFadden 564, R. Clark 22473, R. Clark 22598

Scleria pauciflora Muhl. var. *caroliniana* (Willd.) Alph. Wood

R. Clark 21048

Scleria triglomerata Michx.

C. Way 200, A. Rentas 90

DIOSCOREACEAE

***Dioscorea polystachya* Turcz. [3]

R. Clark 21132

Dioscorea villosa L. [4]

R. Clark 21863, A. Rentas 68, J. Varner 7426, R. Clark 21783, T. McFadden 403

HEMEROCALLIDACEAE

***Hemerocallis fulva* L. [2]

A. Rentas 104

HYACINTHACEAE

***Ornithogalum umbellatum* L. [3]

B. Stacy 21

HYPOXIDACEAE

Hypoxis hirsuta (L.) Coville [4]

J. Fitzpatrick-Cooper 90, J. Buskin 1251, T. McFadden 395, T. McFadden 453A

IRIDACEAE

Iris cristata Aiton [4]

C. Peters 3, B. Stacy 3, C. Way 127, R. Clark 21306, R. Clark 21049

**Iris germanica* L.

R. Clark 22182

Iris verna L. [4]

Paul H. Simms 26, K. Johnson 90, J. Buskin 1255, R. Clark 22718, T. McFadden 378

Iris virginica L. var. *shrevei* (Small) E.S. Anderson

R. Clark 22038, J. Lassetter 3506

Sisyrinchium angustifolium Phil. [3]

G. Winburn *s.n.* (1970-05-24) [MDKY], D. Sasser 83

JUNCACEAE

Juncus acuminatus Michx.

R. Clark 21552, R. Clark 21582, R. Clark 21655, R. Clark 22711

Juncus anthelatus (Wiegand) R.E. Brooks

R. Clark 21599

Juncus biflorus Elliot

T. McFadden 559

Juncus debilis A. Gray

R. Clark 21182, R. Clark 21182

Juncus diffusissimus Buckley

R. Clark 21976

Juncus effusus L. [4]

K. Feeman 165, R. Clark 21652, R. Clark 22741, T. McFadden 487, T. McFadden 507,
T. McFadden 535, T. McFadden 628

Juncus tenuis Willd. [4]

R. Clark 21032, R. Clark 22256, R. Clark 22265, R. Clark 21183, R. Clark 21672X, R.
Clark 22256, T. McFadden 555

Luzula acuminata Raf. var. *carolinae* (S. Watson) Fernald [4]

J. Lassetter 2384, R. Clark 21285, J. Buskin *s.n.* (1972-07-05), T. McFadden 336, T.
McFadden 443

Luzula bulbosa (Alph. Wood) Smyth & Smyth [3]

T. McFadden 845

Luzula echinata (Small) F.J. Herm. [4]

R. Clark 21370, T. McFadden 830

Luzula multiflora (Ehrhart) Legeune var. *multiflora* [4]
T. McFadden 374, T. McFadden 840

LILIACEAE

Clintonia umbellulata (Michx.) Morong [4]
R. Clark *s.n.* (1985-07-14), A. Rentas 57, R. Clark 21279, R. Clark 22215, J. Buskin
1365, T. McFadden 472

Erythronium americanum Ker Gawl. [4]
M. Cooper 25, R. Clark 22135, T. McFadden 826

Erythronium umbilicatum Parks & Hardin subsp. *umbilicatum* [3]
T. McFadden 350, T. McFadden 809

Lilium canadense L. [3]
J. Fitzpatrick-Cooper 91, J. Norton 147, R. Clark 22266, T. McFadden 583

!*Lilium philadelphicum* L.
T. McFarland 44 [MDKY]

Medeola virginiana L. [4]
J. Norton 136, J. Getch 83, R. Clark 21316, D. Murphy 111, T. McFadden 444

Prosartes lanuginosa (Michx.) D. Don [4]
T. Antonio 7451, E. Browne 9502, R. Clark 21339, T. McFadden 447

!*Prosartes maculata* (Buckley) A. Gray
K. Huie-Netting 10, R. Clark 21480

NARTHECIACEAE

Aletris farinosa L.
E. Browne 9492, A. Rentas 21

ORCHIDACEAE

Aplectrum hyemale (Muhl. ex Willd.) Torr.
R. Clark 21363

Cleistosiopsis bifaria (Fernald) Pansarn & F. Barros
D. Sasser 397, Julian Campbell *s.n.* (1988-07-08) [KY]

Corallorhiza odontorhiza Nutt. [3]

R. Clark 22961, T. McFadden 294, T. McFadden 669

Corallorhiza wisteriana Conrad

R. Clark 21367

Cypripedium acaule Aiton [4]

R. Clark 21684, D. Murphy, R. Clark 93, R. Clark 22685, J. Varner 7220, R. Clark 21046, T. McFadden 473

!*Cypripedium parviflorum* Salisb. var. *parviflorum* [1]

T. McFadden 446, D. Sasser 92

Cypripedium parviflorum Salisb. var. *pubescens* (Willd.) Knight [3]

K. Huie-Netting 1, R. Clark 21334, R. Clark 21043, R. Clark 22743, T. McFadden 450

Galearis spectabilis (L.) Raf. [4]

K. Huie-Netting 22, M. Beckett 1217, C. Peters 10, B. Stacy 5, R. Clark 21338, R. Clark 21305, R. Clark 21050, T. McFadden 584

Goodyera pubescens (Willd.) R. Br. [4]

J. Getch 59, R. Clark 21115, C. Brown *s.n.* (1987-06-20), R. Murray 132, R. Clark 21713, J. Buskin 1515, T. McFadden 587

Isotria verticillata Raf.

R. Clark 21447

Liparis liliifolia (L.) Rich. ex Ker Gawl. [4]

R. Clark 22484, T. McFadden 595

!*Liparis loeselii* (L.) Rich. [1]

T. McFadden 649

Malaxis unifolia Michx. [3]

J. Norton 100, T. McFadden 668

Platanthera ciliaris (L.) Lindl. [2]

T. McFadden 666

Platanthera clavellata (Michx.) Luer [3]

M. Wharton 9611

Platanthera flava (L.) Lindl.

J. Lassetter 3507

Platanthera psychodes (L.) Lindl.
J. Norton 101

Tipularia discolor (Pursh) Nutt. [3]
R. Clark 21362, T. McFadden 603

Triphora trianthophora (Sw.) Rydb. var. *trianthophora* [2]
T. McFadden 641

POACEAE

Agrostis hyemalis (Walter) B.S.P.
R. Clark 21948, R. Clark 21519, R. Clark 21630

Agrostis perennans (Walter) Tuck.
R. Clark 22454, R. Clark 24468, R. Clark 22333, R. Clark 21831, R. Clark 21778, R.
Clark 21777, R. Clark 22615

Agrostis scabra Willd.
R. Clark 22035, R. Clark 21930

***Agrostis stolonifera* L.
R. Clark 21877, R. Clark 22596

Andropogon gerardii Vitman
R. Clark 22677

Andropogon gyrans Ashe
R. Clark 23873

Andropogon virginicus L. var. *virginicus*
R. Clark 22290, R. Clark 21821

**Anthoxanthum odoratum* L. [3]
T. McFadden 512

Aristida dichotoma Michx.
R. Clark 22292, R. Clark 22046, R. Clark 22639

Arundinaria gigantea (Walter) Muhl. [4]
E. Browne 9549, R. Clark 21382, R. Clark *s.n.* (1987-06-21), K. Knauss 60

Brachyelytrum erectum P. Beauv. [4]
J. Norton 135, J. Buskin 1447, R. Clark 22695, R. Clark 21695, T. McFadden 679, R.
Clark 21773, R. Clark 21039, R. Clark 21155

**Bromus commutatus* Schrad.

R. Clark 22225

***Bromus inermis* Leyss.

R. Clark 22438, R. Clark 21909, R. Clark 22220, R. Clark 22224

**Bromus japonicus* Thunb. ex Murr.

A. Rentas 23, R. Clark 22437

Bromus nottowanus Fernald

R. Clark 21712, R. Clark 21059

Bromus pubescens Muhl. ex Willd. [4]

R. Clark 22693, T. McFadden 517, T. McFadden 542, T. McFadden 621, R. Clark 21156

Chasmanthium latifolium (Michx.) Yates

R. Clark 21146, R. Clark 21682

Cinna arundinacea L. [3]

T. McFadden 656

Coleataenia anceps (Michx.) Soreng subsp. *anceps* [4]

T. McFadden 611, R. Clark 21833

Coleataenia rigidula (Bosc ex Nees) Lebl. subsp. *rigidula*

R. Clark 22047

**Dactylis glomerata* L.

R. Clark 21034, R. Clark 22229, A. Rentas 89, R. Clark 22221

Danthonia compressa Austin [1]

T. McFadden 534

Danthonia sericea Nutt.

R. Clark 124, J. Buskin 1342, R. Clark 22495

Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes [4]

K. Johnson 88, J. Fitzpatrick 93, N. Coons 82, R. Clark 21719, D. Taylor 80, R. Clark 22448, R. Clark 24464, R. Clark 24465, R. Clark 24471, R. Clark 22489, R. Clark 22497, R. Clark 22507, R. Clark 22519, T. McFadden 464, T. McFadden 567, R. Clark 22631, R. Clark 22226, R. Clark 22227, R. Clark 22228

Diarrhena americana P. Beauv. [3]

R. Clark 24093, R. Clark 21699, T. McFadden 510, T. McFadden 647, R. Clark 21150

Diarrhena obovata (Gleason) Brandenburg
R. Clark 21152

Dichantheium aciculare (Desv. ex Poir.) Gould & Clark
R. Clark 21950

Dichantheium acuminatum (Desv. ex Poir.) Gould & Clark var. *acuminatum*
R. Clark 21718, R. Clark 21724

Dichantheium acuminatum (Desv. ex Poir.) Gould & Clark var. *fasciculatum* (Torr.)
Freckmann
A. Rentas 45, R. Clark 21052

Dichantheium acuminatum (Desv. ex Poir.) Gould & Clark var. *lindheimeri* (Nash)
Gould & Clark
R. Clark 21716, R. Clark 21856

Dichantheium boscii (Poir.) Gould & Clark [3]
D. Taylor 81, R. Clark 22502, R. Clark 21928

Dichantheium clandestinum (L.) Gould [3]
R. Clark 21571, R. Clark 21880, R. Clark 21946

Dichantheium columbianum (Scribn.) Freckman [2]
J. Campbell *s.n.* (1988-06-30), T. McFadden 616, J. Campbell *s.n.* (1988-06-27), J.
Campbell *s.n.* (1988-06-30)

Dichantheium commutatum (J.A. Schultes) Gould var. *ashei* (Pearson ex Ashe)
Mohlenbr.
D. Taylor 79, J. Buskin 1348, R. Clark 24462, R. Clark 21869

Dichantheium commutatum (J.A. Schultes) Gould var. *commutatum*
R. Clark 22450, R. Clark 21524, R. Clark 24087

Dichantheium depauperatum (Muhl.) Gould
R. Clark 22494

Dichantheium dichotomum (L.) Gould var. *dichotomum*
R. Clark 21534, R. Clark 21837, R. Clark 21701, K. Feeman 148, A. Rentas 12

Dichantheium laxiflorum (Lam.) Gould
R. Clark 22063, R. Clark 21955

Dichantheium linearifolium (Scribn. ex Nash) Gould
A. Rentas 73

Dichantheium meridionale (Ashe) Freckmann
R. Clark 22684, R. Clark 22493, R. Clark 21836, R. Clark 21951, R. Clark 22219

Dichantheium microcarpon (Muhl. ex Willd.) Mohlenbr. [2]
T. McFadden 658

Dichantheium oligosanthos (J.A. Schultes) Gould
T. Antonio 7392

Dichantheium polyanthes (Schult.) Mohlenbr.
J. Varner 7688, A. Rentas 38, J. Norton 134, R. Clark 21717, J. Fitzpatrick-Cooper 84,
J. Buskin 1452, R. Clark 21556, R. Clark 21835, R. Clark 21053

Dichantheium sabulorum (Lam.) Gould & Clark
J. Campbell *s.n.* (1988-06-17)

Dichantheium sphaerocarpon (Elliott) Gould
R. Clark 21536

Dichantheium villosissimum (Nash) Freckmann
J. Campbell *s.n.* (1988-06-30)

Dichantheium yadkinense (Ashe) Mohlenbr.
J. Campbell *s.n.* (1988-07-27), J. Campbell *s.n.* (1988-07-21)

Digitaria ciliaris (Retz.) Koel.
R. Clark 21961

**Digitaria ischaemum* (Schreb.) Schreb. ex Muhl. [4]
R. Clark 22317, R. Clark 22334, R. Clark 24091, R. Clark 21805, R. Clark 22634, R.
Clark 22607

***Echinochloa crus-galli* (L.) P. Beauv. var. *crus-galli*
R. Clark 22316, R. Clark 21815

Echinochloa muricata (P. Beauv.) Fernald var. *muricata*
R. Clark 21614

**Eleusine indica* (L.) Gaertn.
R. Clark 21560

Elymus hystrix L. var. *hystrix* [4]
R. Clark 21566, T. McFadden 493, T. McFadden 541, T. McFadden 619

Elymus macgregorii R. Brooks & J.J.N. Campbell [3]
T. McFadden 513

Elymus riparius Wiegand
R. Clark 21886

Elymus virginicus L. var. *virginicus* [4]
R. Clark 21143, R. Clark 21565

Eragrostis frankii C.A. Mey. ex Steud.
R. Clark 21908

Eragrostis hypnoides (Lam.) B.S.P.
R. Clark 22107

**Eragrostis minor* Host
L. Meade s.n. (1970-06-25) [MDKY]

Eragrostis pectinacea (Michx.) Nees ex Steud.
R. Clark 22061

Eragrostis spectabilis (Pursh) Steud.
R. Clark 22092

Erianthus alopecuroides (L.) Elliot
R. Clark 22303

Festuca subverticillata (Pers.) Alexeev
R. Clark 24461, R. Clark 22500, R. Clark 21572, R. Clark 21058, R. Clark 21131, R.
Clark 21121B

Glyceria melicaria (Michx.) F.T. Hubbard [3]
T. McFadden 629, R. Clark 22232

Glyceria striata (Lam.) A.S. Hitchc.
R. Clark 21573, R. Clark 21581, R. Clark 21862, R. Clark 21057, R. Clark
21159, R. Clark 21181

Leersia oryzoides (L.) Sw. [3]
T. McFadden 624, R. Clark 22042

Leersia virginica Willd. [3]
R. Clark 21531, R. Clark 21578, R. Clark 22330

***Lolium arundinaceum* (Schreb.) S.J. Darbyshire [4]
T. McFadden 498, R. Clark 21154

***Lolium pratense* (Huds.) S.J. Darbyshire [4]
R. Clark 22440

***Microstegium vimineum* (Trin.) A. Camus [5]
R. Clark 21124, T. McFadden 686, T. McFadden 690, T. McFadden 697, R. Clark
22588

***Miscanthus sinensis* Andersson [4]
Gary W. Libby *s.n.* (1978-09-30), R. Clark 21249, R. Clark 22626, T. McFadden 806

Muhlenbergia frondosa (Poir.) Fernald [3]
T. McFadden 414, R. Clark 22020

Muhlenbergia schreberi J.F. Gmel.
R. Clark 21927

Muhlenbergia sobolifera (Muhl. ex Willd.) Trin.
R. Clark 21756

Muhlenbergia sylvatica Torr. ex A Gray
R. Clark 22337, R. Clark 21846, R. Clark 21879, R. Clark 21983

Muhlenbergia tenuiflora (Willd.) B.S.P. [4]
R. Clark 22698, R. Clark 21700, T. McFadden 677, T. McFadden 727, R. Clark 21044

Panicum dichotomiflorum Michx. var. *dichotomiflorum*
R. Clark 22318, R. Clark 21834, R. Clark 22017, R. Clark 21024

Panicum flexile (Gattinger) Scribn.
R. Clark 21969, R. Clark 21931

Panicum philadelphicum Bernh. ex Trin. subsp. *gattingeri* (Nash) Freckman & Lelong
R. Clark 22018

Panicum philadelphicum Bernh. ex Trin. subsp. *philadelphicum*
R. Clark 21754, R. Clark 21806

Paspalum laeve Michx. var. *laeve*
R. Clark 21787

Paspalum setaceum Michx. var. *muhlenbergii* (Nash) Fernald
R. Clark 22031, R. Clark 22067, R. Clark 21811

**Phalaris arundinacea* L. [4]
R. Clark 21587, T. McFadden 505

**Phleum pratense* L. subsp. *pratense*
R. Clark 22223, R. Clark 21666

Poa alsodes A. Gray [4]

J. Buskin 1447, R. Clark 21422, R. Clark 21417, T. McFadden 333, T. McFadden 440, R. Clark 21501, R. Clark 21497, R. Clark 21295, R. Clark 21492, R. Clark 21465, R. Clark 21428, R. Clark 21434, R. Clark 21437

***Poa annua* L. [3]

R. Clark 22199, R. Clark 23164, T. McFadden 497

Poa autumnalis Scribn. [3]

T. McFadden 433, R. Clark 21471

Poa chapmaniana Scribn.

R. Clark 21561

***Poa compressa* L.

R. Clark 21548

***Poa pratensis* L.

R. Clark 22439

Poa sylvestris A. Gray [4]

R. Clark 22742, R. Clark 22162, R. Clark 22163, R. Clark 22164, R. Clark 22194, R. Clark 22141, R. Clark 22159, T. McFadden 348, R. Clark 21489, R. Clark 21474, R. Clark 21360, R. Clark 21345, T. McFadden 856

**Poa trivialis* L. subsp. *trivialis* [3]

R. Clark 21319, T. McFadden 857

Schizachyrium scoparium (Michx.) Nash var. *scoparium* [4]

R. Clark 21911, R. Clark 22637, R. Clark 22636

Setaria parviflora (Poir.) Kerguelen [3]

T. McFadden 618, R. Clark 21810

**Setaria pumila* (Poir.) Roemer & Shultes subsp. *pumila* [4]

R. Clark 22708, R. Clark 21790, R. Clark 22638, R. Clark 22611, R. Clark 22575

Sorghastrum nutans (L.) Nash [3]

R. Clark 23023, T. McFadden 748, R. Clark 21912

***Sorghum halepense* (L.) Pers. [4]

J. Fitzpatrick 94, R. Clark 22011

Tridens flavus (L.) A.S. Hitchc. [4]

R. Clark 22709, R. Clark 21631, R. Clark 21914, R. Clark 22625, R. Clark 22613, R. Clark 22610

RUSCACEAE

**Convallaria majalis* L.

R. Paratley *s.n.* (2005-05-18) [KY]

!*Maianthemum canadense* Desf. [2]

J. Campbell 37069, Raymond Athey 2378, R. Clark 21176, R. Clark 21176, R. Clark 22621, T. McFadden 471

Maianthemum racemosum (L.) Link subsp. *racemosum* [4]

T. Antonio 7411, J. Varner 7881, T. McFadden 424

Polygonatum biflorum (Walter) Elliott var. *biflorum* [4]

J. Varner 7882, T. McFadden 425

Polygonatum pubescens (Willd.) Pursh [3]

C. Peters 4, A. Rentas 115, R. Clark 22193

SMILACACEAE

Smilax ecirrata (Engelm. ex Kunth) S. Watson

R. Paratley *s.n.* (2010-05-07) [KY]

Smilax glauca Walter [4]

E. Browne 9546.5, A. Rentas 27, J. Varner 7434

Smilax hispida Muhl. ex Torr.

E. Browne 9532, R. Clark 21129, R. Clark 21371, A. Rentas 120, R. Clark 21092

Smilax hugeri (Small) J.B.S. Norton ex Pennell

D. Taylor 96, Ross. C. Clark 21343, R. Clark 21706

Smilax rotundifolia L. [4]

S. Weber 135, D. Taylor 37, K. Johnson 105, J. Varner 7218, J. Varner 7432, T. McFadden 488

TRILLIACEAE

Trillium erectum L. [4]

R. Hines 42, R. Clark 21272b, T. McFadden 358A

Trillium flexipes Raf.

R. Clark 21171

Trillium grandiflorum (Michx.) Salisb. [4]
R. Clark 21273, R. Clark 21430, T. McFadden 360

Trillium sessile L. [1]
K. Huie-Netting 7, R. Clark 21459, T. McFadden 833

Trillium sulcatum Patrick [4]
M. Beckett 1258, H. Helm *s.n.* (1973-05-01), R. Clark 21047, R. Clark *s.n.* (1987-06-21), R. Clark 21272, R. Clark 21280, J. Buskin 1201, T. McFadden 358B

TYPHACEAE

**Typha angustifolia* L.
R. Clark 23962

Typha latifolia L.
R. Clark 22181

EUDICOTYLEDONAE (EUDICOTS)

ACANTHACEAE

Justicia americana Vahl
A. Rentas 113, R. Clark 21164

Ruellia caroliniensis (J.F. Gmel.) Steud. [3]
R. Clark 21996, R. Clark 22249, R. Clark 21820, R. Clark 22249

Ruellia strepens L. [2]
T. McFadden 735

ADOXACEAE

Sambucus canadensis L. [4]
R. Clark 21148, R. Clark 22687, J. Varner 7755, J. Varner 7919, T. McFadden 539

Viburnum acerifolium L. [4]
R. Clark 20974, A. Rentas 46, J. Varner 7905, J. Varner 7886, J. Buskin 1355, T. McFadden 307

Viburnum alabamense (McAtee) Sorrie
R. Clark 21605

Viburnum cassinoides L.
R. Clark 22521, K. Johnson 2, J. Varner 7989

Viburnum dentatum L. [3]
R. Clark 22197

Viburnum prunifolium L.
R. Clark 22144, R. Clark 22144

Viburnum rufidulum Raf. [3]
R. Clark 21882, R. Clark 22275, R. Clark 22209, R. Clark 21882, R. Clark 22209, T. McFadden 872

ALTINGIACEAE

Liquidambar styraciflua L. [4]
K. Feeman 152, R. Clark 21479, K. Johnson 15, A. Rentas 127, T. McFadden 484

AMARANTHACEAE

***Achyranthes japonica* (Miquel) Nakai var. *hachijoensis* Honda
W. Overbeck s.n. (2010-09-09) [BEREA]

Amaranthus hybridus L.
R. Clark 21657, R. Clark 22060

**Amaranthus spinosus* L.
R. Clark 22026

***Chenopodium album* L.
R. Clark 21910

**Dysphania ambrosioides* (L.) Mosyakin & Clemants
R. Clark 21677

ANACARDIACEAE

Rhus copallinum L. var. *latifolia* Engl. [4]
R. Clark 20949, R. Clark 21512, R. Clark 22279, A. Rentas 66, J. Varner 7692, J.
Varner 7761, T. McFadden 881

Rhus glabra L. [4]
R. Clark 21255, R. Clark 21511, J. Varner 7993, T. McFadden 853

Rhus typhina L. [1]
R. Clark 22077, T. McFadden 851, D. Sasser 28

Toxicodendron radicans (L.) Kuntze [4]
S. Weber 137, J. Norton 111, R. Clark 21714, J. Varner 7428, J. Varner 7741

APIACEAE

Angelica venenosa (Greenway) Fernald [3]
Floyd Swink 5764, R. Clark 21894, T. McFadden 678, R. Clark 22600

Chaerophyllum procumbens L. Crantz var. *procumbens*
R. Clark 22732A, R. Clark 21353x

Chaerophyllum tainturieri Hook [4]
R. Clark 21388, R. Clark 21376, T. McFadden 842

Cicuta maculata L.

R. Clark 21849, R. Clark 21585, R. Clark 21615

Cryptotaenia canadensis DC. [4]

R. Clark 21604, R. Clark 21127, R. Clark 21865, R. Clark 21095, R. Clark 21650, R. Clark 22339, R. Clark 22336, R. Clark 22250, T. McFadden 529

***Daucus carota* L. [4]

R. Clark 21936, J. Varner 7699, T. McFadden 574, R. Clark 22629

Erigenia bulbosa (Michx.) Nutt. [4]

R. Clark 21407, R. Clark 22134, T. McFadden 331

Osmorhiza claytonii (Michx.) C.B. Clarke

K. Huie-Netting 33, C. Brown 87, R. Clark 21158, R. Clark 22445

Osmorhiza longistylis (Torr.) DC. [3]

J. Varner 7877, T. McFadden 398

Oxypolis rigidior (L.) Raf. [2]

T. McFadden 670

Sanicula canadensis L. var. *canadensis* [4]

T. McFadden 709, D. Taylor 15633, D. Murphy 76, R. Clark 21096

Sanicula odorata (Raf.) K.M. Pryer & L.R. Phillippe

R. Clark 22501, R. Clark 21709

Sanicula smallii E.P. Bicknell

R. Clark 21774, R. Clark 21953, A. Rentas 41, J. Buskin *s.n.* (1972-07-14)

Sanicula trifoliata E.P. Bicknell

R. Clark 21087, R. Clark 22706

Taenidia integerrima (L.) Drude

R. Clark 24455

Thaspium barbinode (Michx.) Nutt. [3]

R. Clark 22960, R. Clark 22512, R. Clark 21660

Thaspium chapmanii (J.M. Coult. & Rose) Small

R. Paratley *s.n.* (2015-06-04) [KY]

Thaspium trifoliatum (L.) A. Gray [3]

K. Huie-Netting 9, D. Taylor 98, T. McFadden 456

***Torilis japonica* (Houtt.)
C. Hanley 43

Zizia aptera (A. Gray) Fernald [3]
R. Clark 21487, R. Clark 22503, T. McFadden 865

Zizia trifoliata (Michx.) Fernald
R. Clark 22692

APOCYNACEAE

Apocynum cannabinum L. [4]
R. Clark 22006, K. Johnson 56, R. Clark 21513, J. Varner 7420, J. Varner 7696

Asclepias exaltata L. [3]
T. McFadden 543

Asclepias incarnata L. [4]
R. Clark 22089

Asclepias quadrifolia Jacq.
R. Clark 22504, R. Clark 22485

Asclepias syriaca L. [3]
R. Clark 21510, R. Clark 21793

Asclepias tuberosa L.
C. Hanley 90, C. Hanley 258

Asclepias variegata L.
R. Clark 22488, J. Buskin 1405

AQUIFOLIACEAE

Ilex montana Torr. & A. Gray ex A. Gray [3]
J. Campbell *s.n.* (1988-06-27), R. Clark 21610, R. Clark 22212, R. Clark 21687, R. Clark 21111

Ilex opaca Aiton [4]
T. Antonio 7406, E. Browne 9527, C. Brown 118, A. Rentas 74, J. Getch 64, R. Clark 21598, R. Clark 20989

Ilex verticillata A. Gray
R. Clark 21736, N. Coons 49, F. Fitzpatrick-Cooper 69, R. Clark 21736

ARALIACEAE

Aralia racemosa L. [3]

K. Huie-Netting 49, R. Clark 21959, J. Varner 7750, T. McFadden 594

Aralia spinosa L. [4]

C. Brown 72, R. Clark 21301, R. Clark 22276, J. Varner 7219, J. Varner 7767, J. Varner 8026, T. McFadden 299

Panax quinquefolius L. [2]

S. Weber 138, R. Clark 22119, R. Clark 21857

Panax trifolius L. [3]

M. Cooper 28, J. Lassetter 2388, R. Clark 21463, T. McFadden 431

ASTERACEAE

Achillea borealis Bong. [3]

R. Clark 21643

Ageratina altissima (L.) R.M. King & H. Rob. var. *altissima*

J. Buskin *s.n.* (1972-09-09), R. Clark 21825, T. McFadden 693

Ageratina luciae-brauniae (Fernald) King & H. Rob [1]

J. Campbell *s.n.* (1988-08-08), J. Campbell *s.n.* (1988-08-08), T. McFadden 726

Ambrosia artemisiifolia L. [4]

A. Rentas 93, J. Varner 7708, J. Varner 7964, J. Varner 7796

Ambrosia trifida L. [3]

R. Clark 21120

Antennaria howellii Greene subsp. *neodioica* (Greene) R.J. Bayer

K. Johnson 96

Antennaria parlinii Fernald subsp. *fallax* (Greene) Bayer & Stebbins

R. Clark 22003

Antennaria parlinii Fernald subsp. *parlinii*

R. Clark 21484

Antennaria plantaginifolia (L.) Richardson var. *plantaginifolia*

R. Clark 21765

Antennaria solitaria Rydb.
M. Gumbert 1, R. Clark 22720

***Arctium minus* Bernh. [2]
T. McFadden 876

Arnoglossum atriplicifolium (L.) H. Rob. [3]
R. Clark 22235, R. Clark 21679, R. Clark 21986

Arnoglossum reniforme (Hook.) H. Rob. [3]
T. McFadden 598

Bidens bipinnata L. [3]
R. Clark 21813, J. Varner 7765, T. McFadden 293

Bidens cernua L.
R. Clark 22039

Bidens connata Muhl. ex Willd. [3]
T. McFadden 682

Bidens frondosa L. [3]
R. Clark 21803, R. Clark 22328, R. Clark 21809, T. McFadden 707

Bidens polylepis S.F. Blake
R. Clark 22321, R. Clark 21888

**Bidens tripartita* L.
R. Clark 21785, R. Clark 21785

Centaurea stoebe L. subsp. *micranthos* (S.G. Gmel. ex Gugler) Hayek
R. Clark 21668

Chrysopsis mariana (L.) Elliot
R. Clark 21829, J. Varner 7794, R. Clark 24097, R. Clark 21960, R. Clark 22630

***Cichorium intybus* L. [4]
A. Rentas 88, R. Clark 21517

***Cirsium arvense* (L.) Scop. [3]
R. Clark 21508, J. Varner 7210, R. Clark 21508

Cirsium carolinianum (Walter) Fernald & B.G. Schub.
R. Clark 22486

Cirsium discolor (Muhl. ex Willd.) Spreng. [3]
J. Faulkner 228, R. Paratley *s.n.* (2002-09-14) [KY]

Cirsium muticum Michx.
R. Clark 21903, R. Clark 22308, R. Clark 22964

***Cirsium vulgare* (Savi) Ten.
R. Clark 22057

Conoclinium coelestinum DC. [3]
J. Varner 7715, R. Clark 22304, R. Clark 21784, R. Clark 22606

Conyza canadensis Cronquist var. *canadensis*
R. Clark 22041, R. Clark 21916

Coreopsis lanceolata L.
R. Clark 22261, R. Clark 22261

Coreopsis major Walter [4]
D. Taylor 36, C. Brown 68, R. Clark *s.n.* (1989-07-16) , J. Buskin 1438, T. McFadden 526

Coreopsis tripteris L.
J. Varner 7724, R. Clark 21944

Doellingeria infirma (Michx.) Greene [3]
T. M. Antonia 7429, J. Varner 7687, J. Varner 7703, R. Clark 21943, T. McFadden 680

Echinacea purpurea (L.) Moench [3]
N. Coons 44, J. Getch 56, R. Clark 22262, R. Clark 22262, T. McFadden 537

Eclipta prostrata (L.) L.
R. Clark 22033

Elephantopus carolinianus Raeusch. [4]
R. Clark 21733, R. Clark 21816, J. Buskin 1516, J. Varner 7762, J. Varner 7896, R. Clark 21733, R. Clark 22595, T. McFadden 298

Erechtites hieraciifolius (L.) Raf. ex DC.
R. Clark 22329

Erigeron annuus (L.) Pers. [3]
R. Clark 2156, A. Rentas 29

Erigeron philadelphicus L. var. *philadelphicus* [4]
R. Clark 21261, T. McFadden 418

Erigeron pulchellus Michx. var. *brauniae* Fernald
J. Campbell *s.n.* (1988-05-17)

Erigeron pulchellus Michx. var. *pulchellus* [4]
K. Huie-Netting 25, R. Clark 21486, T. McFadden 384, T. McFadden 453

Erigeron strigosus Muhl. ex Willd. var. *strigosus* [4]
R. Clark 21540, R. Clark 21818, T. McFadden 500

Eupatorium album L.
R. Clark 21725

Eupatorium altissimum L.
C. Hanley 243

Eupatorium perfoliatum L. [3]
J. Faulkner 8

Eupatorium rotundifolium L.
T. Antonio 7430, R. Clark 21642, R. Clark 21675, R. Clark 21786

Eupatorium serotinum Michx.
R. Clark 21839, R. Clark 24096

Eupatorium sessilifolium L.
J. Faulkner 313

Eurybia divaricata (L.) G.L. Nesom [4]
R. Clark 21647, R. Clark 21771, R. Clark 21611, R. Clark 22635, T. McFadden 295, T. McFadden 316, T. McFadden 688, T. McFadden 724

Eurybia macrophylla Cass. [3]
T. McFadden 694

Eurybia surculosa (Michx.) G.L. Nesom
E. Browne 9538, R. Clark 21942

Euthamia graminifolia (L.) Nutt. var. *nuttallii* (Greene) W. Stone
R. Clark *s.n.* (1988-09-18)

Eutrochium fistulosum (Barratt) E.E. Lamont [4]
R. Clark 21569, R. Clark 21635, R. Clark 21918, R. Clark 21967, T. McFadden 651, T. McFadden 721

Eutrochium purpureum (L.) E.E. Lamont var. *purpureum*
R. Clark 21105

**Galinsoga quadriradiata* Ruiz & Pav.
R. Clark 21561Y

Gamochaeta purpurea (L.) Cabrera [3]
R. Clark *s.n.* (1985-07-14), T. McFadden 467

Helenium autumnale L.
R. Clark 22050

Helenium flexuosum Raf.
R. Clark 21661, R. Clark 21626

Helianthus decapetalus L.
R. Clark 22991, R. Clark 22079

Helianthus divaricatus L.
T. Antonio 7403B, T. Antonio 7415

Helianthus hirsutus Raf.
C. Hanley 7, C. Hanley 18, C. Hanley 52, J. Varner 7723

Helianthus microcephalus Torr. & A. Gray [3]
R. Clark 21801, R. Clark 21526, R. Clark 22326, R. Clark 21939, J. Varner 7421, J. Varner *s.n.* (1973-08-20), J. Varner 7429, R. Clark 22331, T. McFadden 696

Helianthus strumosus L.
R. Clark 22958, R. Clark 21104

**Helianthus tuberosus* L.
R. Clark 22309

Heliopsis helianthoides (L.) Sweet
R. Clark 22070, R. Clark 21940

Hieracium gronovii L.
R. Clark 24469, R. Clark 21923, R. Clark 22297, R. Clark 22614, R. Clark 22053

Hieracium paniculatum L.
R. Clark 21776, J. Buskin *s.n.* (1972-09-09), R. Clark 22620

Hieracium scabrum Michx.
J. Faulkner 256

Hieracium venosum L. [4]
R. Clark 24458, R. Clark 86, J. Buskin 1345

Ionactis linariifolia (L.) Greene
J. Buskin 1603, R. Clark 22683, R. Clark 23024

Iva annua L.
D. Taylor 17240

Krigia biflora (Walter) S.F. Blake var. *biflora* [4]
R. Clark 21456, T. McFadden 429, T. McFadden 475

Lactuca biennis (Moench) Fern. [3]
R. Clark 22007, T. McFadden 719

Lactuca canadensis L.
R. Clark 21516

Lactuca floridana Gaertn.
R. Clark 22300

**Lactuca serriola* L.
R. Clark 21952

**Leucanthemum vulgare* Lam. [4]
R. Clark 21402, T. McFadden 499

Liatris spicata (L.) Willd. var. *spicata* [1]
R. Clark 22258, T. McFadden 561

Nabalus altissimus Hook.
R. Clark 22009

Nabalus serpentarius (Pursh) Hook.
R. Clark 21925

Packera anonyma (Alph. Wood) W.A. Weber & A. Love
R. Clark 22449, R. Clark 21190, A. Rentas 147, R. Clark 21190, T. McFadden 468

Packera aurea (L.) A. Love & D. Love [4]
K. Huie-Netting 24, M. Cooper 17, B. Stacy 12, R. Clark 21275, J. Buskin 1252, T. McFadden 319, T. McFadden 351, T. McFadden 383, T. McFadden 411

Packera glabella (Poir) C. Jeffrey
R. Clark 22132

Packera obovata (Muhl. ex Willd.) W.A. Weber & A. Love [4]
K. Huie-Netting 21, R. Clark 21485, R. Clark 21282, T. McFadden 530

Pityopsis graminifolia (Michx.) Nutt. var. *latifolia* (Fernald) Semple & F.D. Bowers
J. Varner 7977, J. Buskin *s.n.* (1972-09-09), R. Clark 22632, R. Clark 21956

Polymnia canadensis L. [2]
T. McFadden 622

Pseudognaphalium obtusifolium (L.) Hillard & B.L. Burt [3]
J. Varner 8025, J. Varner 7690, J. Varner 7965, R. Clark 21963, R. Clark 22287, R.
Clark 21641

Pyrrhopappus carolinianus DC.
R. Clark 22071

Rudbeckia fulgida Aiton var. *fulgida* [3]
D. Taylor 99

Rudbeckia fulgida Aiton var. *umbrosa* (C.L. Boynton & Beadle) Cronquist
R. Clark 21881

Rudbeckia hirta L. var. *hirta* [3]
T. McFadden 522, K. Knauss 65, R. Clark 22072, R. Clark 21802

Rudbeckia hirta L. var. *pulcherrima* Farw.
R. Clark 22257, R. Clark 21670, R. Clark 22257, R. Clark 21103

Rudbeckia laciniata L. var. *laciniata* [3]
R. Clark 21941, R. Clark 21989

Sericocarpus asteroides B.S.P.
S. Weber 127, J. Buskin *s.n.* (1972-07-14), J. Varner 7443, R. Clark *s.n.* (1985-07-14),
R. Clark 21954

Sericocarpus linifolius (L.) B.S.P.
R. Clark 22686

Silphium asteriscus L. var. *asteriscus*
R. Clark 22259, R. Clark 21710, R. Clark 21979, R. Clark 21101

Smallanthus uvedalius (L.) Mackenzie ex Small
J. Fitzpatrick-Cooper 92, C. Hanley 10

!*Solidago albopilosa* E.L. Braun [3]
J. Campbell *s.n.* (1988-09-19), M. Medley 2863–80, R. Clark 21770, J. Campbell *s.n.*
(1988-09-08), M. Medley 330-78, R. Clark 21770, D. Taylor 65, T. McFadden 544

Solidago altissima L. var. *altissima*
R. Clark 21800

Solidago arguta Torr. & Gray
M. Wharton 9621, R. Clark 21990, R. Clark 21789, R. Clark 21789

Solidago bicolor L.
R. Clark 24095

Solidago caesia L. var. *caesia* [4]
T. McFadden 698B, R. Clark 24086, J. Varner 7983, T. McFadden 312, R. Clark *s.n.*
(1988-09-17)

Solidago canadensis L.
J. Faulkner 246

!*Solidago curtisii* Torr. & A. Gray [1]
T. McFadden 304, T. McFadden 306, T. McFadden 698A

Solidago erecta Pursh
T. Antonio 7455, R. Clark 22599, R. Clark 22599, R. Clark 21949, R. Clark 21843X, J.
Buskin 1556, J. Varner 8027

Solidago flexicaulis L. [3]
E. Browne 9555, E. Browne 9520, J. Varner 7897, R. Clark 22963, T. McFadden 310,
T. McFadden 314

Solidago gigantea Ait.
R. Clark 21851, R. Clark 22306

Solidago hispida Muhl. ex Willd. var. *hispida*
R. Clark 21913

Solidago nemoralis Ait.
R. Clark 21676, R. Clark 22295, R. Clark 21915, J. Buskin 1553

Solidago odora Aiton [3]
R. Clark 22612, J. Buskin 1552, D. Murphy 122, R. Clark 22633

Solidago rigidiuscula (Torr. & A. Gray) Porter [2]
R. Clark 21633, T. McFadden 291

Solidago rugosa P. Miller var. *aspera* Fernald [2]
T. McFadden 683

Solidago rugosa P. Miller var. *rugosa* [3]
R. Clark 21850, R. Clark 22586, T. McFadden 290

Solidago sphacelata Raf.
D. Sasser 311

Solidago ulmifolia Muhl. ex Willd.
R. Clark 21988

***Sonchus asper* (L.) Hill [3]
T. McFadden 515

Symphotrichum cordifolium (L.) G.L. Nesom
J. Buskin s.n. (1972-10-08), R. Clark 22263

Symphotrichum dumosum (L.) G.L. Nesom [3]
T. McFadden 301, R. Clark 21980

Symphotrichum lanceolatum (Willd.) G.L. Nesom
T. McFadden 695

Symphotrichum lateriflorum (L.) A. Love & D. Love
J. Buskin s.n. (1972-10-08)

Symphotrichum lowrieianum (Porter) G.L. Nesom
R. Clark 21609

Symphotrichum novae-angliae (L.) G.L. Nesom
C. Hanley 276

Symphotrichum ontarionis (Wiegand) G.L. Nesom var. *ontarionis*
R. Clark 22106

Symphotrichum patens (Aiton) G.L. Nesom var. *patens*
R. Clark 21987

Symphotrichum phlogifolium (Muhl. ex Willd.)
R. Jones s.n. (1977-09-29), R. Jones 2038

Symphotrichum pilosum (Willd.) G.L. Nesom
R. Clark 21814

Symphyotrichum prenanthoides (Muhl. ex Willd.) G.L. Nesom [3]
J. Varner 8032, R. Clark 21852, R. Clark 21887, R. Clark 21844

Symphyotrichum puniceum (L.) A. Love & D. Love
J. Buskin s.n. (1972-09-09), R. Clark 21965

Symphyotrichum racemosum (Elliott) G.L. Nesom var. *racemosum*
R. Clark 22100

Symphyotrichum undulatum (L.) G.L. Nesom
R. Clark 21817, R. Clark 22603

**Taraxacum officinale* G.H. Weber ex Wiggers [4]
R. Clark 21457, T. McFadden 368

**Tragopogon pratensis* L.
D. Sasser 294

***Tussilago farfara* L. [4]
R. Thompson 93-111, R. Clark 21841, T. McFadden 352, T. McFadden 874

Verbesina alternifolia (L.) Britton ex Kearney
R. Clark 21938, R. Clark 21819, J. Varner 7722, R. Clark 21938, R. Clark 22591

Vernonia gigantea Trel., Branner & Coville [4]
R. Clark 21847, R. Clark 21638

Xanthium strumarium L. [3]
R. Clark 21788, R. Clark 21648, R. Clark 22014

BALSAMINACEAE

Impatiens capensis Meerb. [4]
R. Clark 21558, J. Norton 144, J. Buskin 1520, J. Varner 7773, J. Varner 8065

Impatiens pallida Nutt. [3]
R. Clark 21600

BERBERIDACEAE

***Berberis thunbergii* DC.
R. Clark 22109

Caulophyllum thalictroides (L.) Michx. [3]
R. Clark 22121

Jeffersonia diphylla (L.) Pers. [2]
T. McFadden 870

Podophyllum peltatum L. [4]
B. Stacy 13, D. Murphy 114, A. Rentas 80, R. Clark 21076, R. Clark 21359, J. Buskin
1449, J. Varner 7863

BETULACEAE

Alnus serrulata (Aiton) Willd. [4]
R. Clark 21503, R. Clark 21262, R. Clark 21503, R. Clark 21184, J. Varner 8066

Betula alleghaniensis Britton [2]
K. Johnson 16, R. Clark 21172

Betula lenta L. [5]
R. Clark *s.n.* (1985-07-14), E. Browne 9523, R. Clark 21108, K. Knauss 68, R. Clark
21071, P. Froelich 177, R. Clark 20981, J. Varner 7713, R. Clark 22255, T. McFadden
311, T. McFadden 613

Betula nigra L. [4]
R. Clark 21399, J. Varner 8064

Carpinus caroliniana Walter. var. *virginiana* (Marsh.) Fernald [4]
T. McFadden 532, T. Weckman 1691, R. Clark 22282, K. Johnson 70, R. Clark 22185,
J. Norton 116, J. Varner 7980

Corylus americana Walter [4]
R. Clark 21892, R. Clark 21293, R. Clark 21063, T. McFadden 325

Ostrya virginiana (Mill.) K. Koch [4]
R. Clark 22283, R. Clark *s.n.* (1985-07-14), R. Clark 21125, T. McFadden 376, T.
McFadden 386

BIGNONIACEAE

Bignonia capreolata L. [4]
C. Brown 133, R. Clark 21135, J. Varner 7918

Campsis radicans (L.) Seem. *ex* Bureau [3]
D. Murphy 115, R. Clark 21147, J. Getch 73, R. Clark 21086, J. Varner 7995

**Catalpa speciosa* (Warder) Warder ex Engelm.
R. Clark 23026

BORAGINACEAE

Cynoglossum virginianum [3]
S. Weber 105

Mertensia virginica [4]
M. Cooper 27, R. Clark 21452, R. Clark 22130, R. Clark 22130, T. McFadden 343

BRASSICACEAE

***Alliaria petiolata* (M. Bieb.) Cavara & Grande [4]
T. McFadden 458

***Barbarea vulgaris* W.T. Aiton [4]
R. Clark 21904, R. Clark 22165, T. McFadden 422, T. McFadden 843

Boechera laevigata (Muhl. ex Willd.) Al-Shehbaz [3]
A. Rentas 119, R. Clark 21860, T. McFadden 837

**Brassica napus* L.
R. Clark 21396, R. Clark 21396

Cardamine angustata O.E. Schulz [4]
John R. Omer 1, J. Lassetter 2383, M. Riehemann s.n. (1980-04-19), R. Clark 21333, R. Clark 22176, T. McFadden 346

Cardamine bulbosa (Schreb. ex Muhl.) B.S.P. [3]
R. Clark 21406, T. McFadden 326, T. McFadden 327

Cardamine concatenata (Michx.) O. Schwarz [3]
M. Cooper 12, T. McFadden 340

Cardamine diphylla (Michx.) Alph. Wood [4]
K. Huie-Netting 30, R. Clark 21441, R. Clark 21374, R. Clark 22189, R. Clark 21405, T. McFadden 426, R. Clark 22131, T. McFadden 810

Cardamine douglassii Britton
John R. Omer 1, J. Faulkner 322

**Cardamine hirsuta* L. [3]
R. Clark 22725, T. McFadden 318, R. Clark 21378

Cardamine parviflora L. var. *arenicola* (Britt.) O.E. Schulz
R. Clark 21391

Cardamine pensylvanica Muh. ex Willd. [2]
T. McFadden 867

Cardamine rotundifolia Michx.
R. Clark 22737

**Draba verna* L. [3]
T. McFadden 811

**Lepidium campestre* (L.) Ait. f.
R. Clark 21383

**Lepidium virginicum* L.
R. Clark 22034

**Nasturtium officinale* R. Br.
J. Faulkner 357

Planodes virginicum (L.) Greene
R. Clark 22169

Rorippa palustris (L.) Besser subsp. *palustris*
R. Clark 21690

CAMPANULACEAE

Campanulastrum americanum (L.) Small
R. Clark 21646, R. Clark 22238

Lobelia cardinalis L. [3]
R. Clark 21876, R. Clark 21644, J. Varner 8039, R. Clark 21644, T. McFadden 685

Lobelia inflata L. [4]
R. Clark 21932, R. Clark 21530, R. Clark 21723, R. Clark 22579, T. McFadden 601, T.
McFadden 713

Lobelia puberula Michx. [3]
J. Varner 7693, J. Buskin *s.n.* (1972-08-13), T. McFadden 309

Lobelia siphilitica L. [3]
R. Clark 21780, J. Varner 8034

Lobelia spicata Lam. [4]
D. Sasser 297, R. Paratley *s.n.* (2015-05-04) [KY]

Triodanis perfoliata (L.) Nieuwl.
R. Clark 21168, A. Rentas 60

CANNABACEAE

Celtis occidentalis L. [4]
R. Clark 21974, R. Clark 22111, R. Clark 22491, A. Rentas 110

Celtis tenuifolia Nutt.
R. Paratley *s.n.* (2010-05-07) [KY]

CAPRIFOLIACEAE

***Lonicera japonica* Thunb. [4]
R. Clark 21248, R. Clark 21121, T. McFadden 479, T. McFadden 861

***Lonicera maackii* (Rupr.) Herder [3]
R. Clark 22142, R. Clark 22142

Symphoricarpos orbiculatus Moench [3]
R. Clark 21475, J. Fitzpatrick-Cooper 82, R. Clark 22724

Triosteum angustifolium L. var. *angustifolium*
R. Clark 21711, R. Clark 22739

Valeriana pauciflora Michx. [3]
R. Clark 21462, J. Varner 7879, T. McFadden 417

Valerianella radiata Dufr. [4]
R. Clark 21390, R. Clark 22731, T. McFadden 421

CARYOPHYLLACEAE

**Cerastium glomeratum* Thuill. [3]
R. Clark 21401, R. Clark 22186, R. Clark 22730

Cerastium nutans Raf.
R. Clark 21389

**Cerastium semidicandrum* L.

J. Buskin 1346

**Dianthus armeria* L.

R. Clark 21763

Mononeuria patula (Michx.) Dillenb & Kadereit

C. Hanley 369

**Saponaria officinalis* L.

D. Sasser 30

Silene rotundifolia Nutt.

R. Hannan 768, N. Coons 35, R. Clark 22210, D. Taylor 54, C. Brown 101, K. Johnson 63, J. Fitzpatrick-Cooper 102

Silene stellata (L.) Aiton

R. Clark 21079, J. Fitzpatrick-Cooper 100, R. Clark 21694

Silene virginica L.

R. Clark 22483

!*Stellaria longifolia* Muhl. ex Willd.

R. Clark 22722

***Stellaria media* (L.) Vill. [5]

R. Clark 21169, R. Clark 22151, R. Clark 21387, R. Clark 21169, R. Clark 22736, R. Clark 22133, T. McFadden 341, T. McFadden 361, T. McFadden 829

**Stellaria pallida* (Dumort.) F. Crepin [3]

T. McFadden 427

Stellaria pubera Michx. [4]

M. Riehemann 41, K. Huie-Netting 6, T. Zimmerman *s.n.* (1981-04-18), M. Cooper 11, C. Peters 20, B. Stacy 7, R. Clark 22150, R. Clark 21322, J. Varner 7862, J. Buskin 1199, T. McFadden 339, T. McFadden 819

CELASTRACEAE

Celastrus scandens L.

R. Clark 21065, R. Clark 21472, J. Varner 7997

Euonymus americanus L. [4]

E. Browne 9526, K. Johnson 26, R. Clark 20994, J. Fitzpatrick-Cooper 99, J. Varner 7758, J. Varner 7978, J. Varner 7872, T. McFadden 452A, T. McFadden 841

Euonymus atropurpureus Jacq. [3]
R. Clark 22136, R. Clark 21431

Euonymus fortunei (Turcz.) Hand.-Mazz.
C. Andries 73

CISTACEAE

Lechea minor L.
R. Clark 22492

CLETHRACEAE

Clethra acuminata Michx. [3]
K. Huie-Netting 32, E. Browne 9499, C. Way 146, N. Coons 41, S. Weber 119, J. Getch
54, C. Brown 112, A. Rentas 71, K. Johnson 62, J. Varner 7921, J. Varner 7215, T.
McFadden 492, T. McFadden 704

CONVOLVULACEAE

Calystegia sepium (L.) R. Br.
R. Clark 22030, R. Clark 21542

Cuscuta compacta Juss. ex Choisy
R. Clark 21885, R. Clark 22069, R. Clark 22098

Cuscuta gronovii Willd. ex J.A. Schultes
R. Clark 22324

Cuscuta pentagona Engelm.
R. Clark 22016

***Ipomoea hederacea* Jacq.
R. Clark 22015, R. Clark 22076

Ipomoea lacunosa L.
R. Clark 22008

Ipomoea pandurata (L.) G. Mey.
R. Clark 21975, J. Norton 137

***Ipomoea purpurea* (L.) Roth
J. Faulkner 414

CORNACEAE

Cornus alternifolia L.f. [4]
J. Fitzpatrick-Cooper 104, R. Clark 21070, A. Rentas 62, J. Varner 7717

Cornus amomum Mill. [3]
R. Hannan 2930, R. Clark 21130, T. McFadden 509

Cornus florida L. [4]
E. Browne 9501, C. Way 125, J. Getch 62, K. Johnson 43, R. Clark 20975, J. Varner 7229, J. Varner 7865, J. Varner 7425, T. McFadden 317

Cornus obliqua Raf. [3]
A. Rentas 99, R. Clark 21294, R. Clark 22029, J. Varner 7871

Cornus racemosa Lam.
J. Campbell *s.n.* (1988-07-01)

Cornus stolonifera Michx.
R. Clark 25569

Cornus stricta Lam.
E. Browne 9544

CRASSULACEAE

Sedum ternatum Michx. [4]
K. Huie-Netting 4, B. Stacy 1, C. Way 149, S. Weber 153, K. Johnson 67, R. Clark 21320, K. Knauss 59, T. McFadden 402

CUCURBITACEAE

Sicyos angulatus L.
R. Clark 22068

EBENACEAE

Diospyros virginiana L.
R. Clark 20958, J. Varner 7696, J. Varner 7423

ELAEAGNACEAE

***Elaeagnus angustifolia* L. [2]

T. McFadden 380

***Elaeagnus umbellata* Thunb. [4]

K. Huie-Netting 15, D. Murphy 78, R. Clark 21454, J. Varner 7845, J. Varner 7845, R. Clark 22735, R. Clark 20984

ERICACEAE

Chimaphila maculata (L.) Pursh [4]

C. Peters 14, J. Buskin 1453, T. McFadden 519

Epigaea repens L. [4]

John R. Omer 35, J. Lassetter 2380, J. Lassetter 2390, E. Browne 9540, R. Clark 21308, R. Clark 20959, D. Murphy 80, C. Brown 111, J. Buskin 1195, J. Varner 7223, T. McFadden 391

Gaultheria procumbens L. [4]

J. Lassetter 40, C. Way 174, E. Browne 9507, D. Murphy 88, J. Getch 55, P. Froelich 144, K. Johnson 72, C. Brown 82, J. Varner 7682, J. Varner 7224, J. Varner 7442, J. Buskin 1448, J. Buskin 1198, T. McFadden 563

Gaylussacia baccata (Wangenh.) K. Koch [4]

K. Johnson 83, D. Taylor 32, J. Fitzpatrick-Cooper 109, R. Clark 20976, N. Coons 70, R. Clark 20956, J. Varner 8400

Hypopitys monotropa Crantz

J. Lassetter 41, R. Clark 22715

Kalmia latifolia L. [5]

T. Antonio 7385, Joe Evans 1979-07-05, E. Browne 9510, R. Clark 20961, D. Murphy 83, P. Froelich 149, A. Rentas 53, K. Johnson 101, R. Clark 21023, K. Knauss 36, J. Varner 7212, J. Varner 7729, J. Varner 7440, T. McFadden 451A

Monotropa uniflora L. [4]

R. Hyerczyk 171, C. Way 152, C. Brown 117, S. Weber 154, J. Norton 115, T. McFadden 593, T. McFadden 716

!*Monotropis odorata* Schwein. ex Elliot [2]

K. Feeman *s.n.* (1995-05-26), T. McFadden 382, T. McFadden 747

Oxydendrum arboreum (L.) DC. [5]

K. Johnson 92, P. Froelich 143, J. Getch 67, J. Varner 7441, J. Varner 7225, J. Varner 7769, T. McFadden 614, T. McFadden 631, T. McFadden 632

Rhododendron calendulaceum (Michx.) Torr.

R. Clark 22487

Rhododendron maximum L. [5]

T. Antonio 7383, Joe Evans 1979-07-05, T. Antonio 7384, C. Way 143, E. Browne 9543, E. Browne... 9517, P. Froelich 157, J. Norton 107, P. Froelich 190, K. Johnson 95, C. Brown 64, J. Varner 7756, J. Buskin 1439, T. McFadden 646

Rhododendron prinophyllum (Small) Millais

J. Faulkner 379

Vaccinium corymbosum L. [4]

K. Johnson 57, R. Clark 20992, T. McFadden 745, R. Clark 22616

Vaccinium pallidum Aiton [4]

R. Clark 20971, R. Clark 22508, A. Rentas 34, D. Murphy 66, K. Knauss 35, J. Buskin s.n. (1972-06-24), J. Buskin s.n. (1972-05-07), T. McFadden 565, K. Johnson 93, J. Fitzpatrick 47, J. Getch 75

Vaccinium stamineum L. [4]

R. Clark 20957, K. Johnson 52, J. Fitzpatrick 56, D. Taylor 47, J. Buskin s.n. (1972-06-24), J. Buskin s.n. (1972-05-31), T. McFadden 566

EUPHORBIACEAE

Acalypha rhomboidea Raf.

R. Clark 22096, R. Clark 22066, R. Clark 21807, R. Clark 21797, R. Clark 22576

Acalypha virginica L.

R. Clark 21663

Euphorbia corollata L. [3]

R. Clark 21533, R. Clark 21720, J. Varner 7694, J. Varner 7726

Euphorbia maculata L.

R. Clark 22075, R. Clark 21795, R. Clark 22577

!*Euphorbia mercurialina* Michx.

R. Clark 21375

Euphorbia nutans Lag.
R. Clark 22286, R. Clark 22323

**Euphorbia prostrata* Ait.
R. Clark 22240

FABACEAE

***Albizia julibrissin* Durazz. [2]
T. McFadden 582

Amorpha fruticosa L.
R. Clark 21538

Amphicarpaea bracteata (L.) Fernald [3]
R. Clark 22019, R. Clark 21144, T. McFadden 671

Apios americana Medik. [3]
C. Way 206, R. Clark 21163, R. Clark 22301, T. McFadden 657

Cassia hebecarpa Fernald
J. Faulkner 281

Cercis canadensis L. [4]
J. Getch 72, K. Johnson 27, A. Rentas 65, R. Clark 21106, R. Clark 21258, J. Varner
8029, T. McFadden 375, T. McFadden 873

Chamaecrista nictitans (L.) Moench var. *nictitans*
R. Clark 24098, R. Clark 24098, J. Varner 7766, J. Buskin 1518

Clitoria mariana L.
R. Clark 21527

Desmodium canescens (L.) DC.
R. Clark 21962

Desmodium ciliare (Muhl. ex Willd.) DC.
R. Paratley *s.n.* (2002-09-14) [KY]

Desmodium cuspidatum (Muhl. ex Willd.) DC. ex D. Don
R. Clark 22010

Desmodium marilandicum (L.) DC.
R. Clark 21830, R. Clark 21921

Desmodium nuttallii (Schindl.) B.G. Schub.
R. Clark 21933

Desmodium paniculatum DC.
R. Clark 21934, R. Clark 21919, J. Buskin 1569

Desmodium perplexum B.G. Schub.
R. Clark 21812, R. Clark 22095

Desmodium rotundifolium DC. [3]
R. Clark 21543, R. Clark 21871, J. Varner 7702

Desmodium viridiflorum (L.) DC.
C. Hanley 222, J. Buskin 1568

Gleditsia triacanthos L. [3]
R. Clark 22056

Hylodesmum glutinosum (Muhl. ex Willd.) H. Ohashi & R.R. Mill [3]
R. Clark 22115, R. Clark 21848, R. Clark 22340

Hylodesmum nudiflorum (L.) H. Ohashi & R.R. Mill [4]
T. Antonio 7395, C. Brown 132, J. Varner 7684, J. Buskin 1519, T. McFadden 602, W.
Haag *s.n.* (1985-08-18)

Hylodesmum pauciflorum (Nutt.) H. Ohashi & R.R. Mill
R. Clark 22120

**Kummerowia stipulacea* (Maxim.) Makino
R. Clark 22307

**Kummerowia striata* (Thunb.) Schindl.
R. Clark 21958, R. Clark 22320, R. Clark 21971

***Lespedeza bicolor* Turcz.
R. Clark 21117

***Lespedeza cuneata* G. Don [4]
R. Clark 21649, R. Clark 22299

Lespedeza hirta Hornem.
R. Clark 22288, R. Clark 21920, R. Clark 21727, J. Buskin *s.n.* (1972-09-09), R. Clark
24088, R. Clark 24088

Lespedeza procumbens Michx. [3]
R. Clark 22296, R. Clark 21926, R. Clark 22082

Lespedeza repens (L.) W. Bartram
D. Murphy 70, R. Clark 21722, J. Buskin 1528

Lespedeza violacea (L.) Pers. [4]
R. Clark 21799, R. Clark 21922, R. Clark 21826, J. Buskin 1566, R. Clark 24089

***Lotus corniculatus* L.
C. Hanley 106

***Medicago lupulina* L. [3]
R. Clark 21518, T. McFadden 531

**Medicago sativa* L.
J. Varner 7994

***Melilotus alba* Medikus
A. Rentas 30

***Melilotus officinalis* (L.) Lam.
A. Rentas 44

Orbexilum pedunculatum (Mill.) Rydb.
D. Sasser 398

Phaseolus polystachios (L.) B.S.P.
J. Faulkner 310

**Pueraria montana* (Loureiro) Merrill var. *lobata* (Willd.) van der Maessen & S.
Almeida
R. Clark 21984

**Robinia hispida* L. var. *hispida*
R. Clark 21507

Robinia pseudoacacia L. [4]
R. Clark 21109, K. Johnson 40, R. Clark 21094, J. Varner 7990

***Securigera varia* (L.) Lassen [3]
R. Clark 21259, R. Clark 22248

Senna hebecarpa (Fernald) Irwin & Barneby
R. Clark 22237

Senna marilandica (L.) Link
C. Hanley 200

Tephrosia virginiana Pers.

A. Rentas 49, R. Clark 21116b, C. Brown 83, J. Buskin 1463, R. Clark 24090

***Trifolium campestre* Schreb.

D. Sasser 81

**Trifolium hybridum* L.

C. Hanley 61

***Trifolium pratense* L. [4]

D. Murphy 74, R. Clark 21730, K. Knauss 66, J. Buskin 1395

***Trifolium repens* L. [4]

A. Rentas 28, R. Clark 21392

Vicia caroliniana Walter [4]

K. Huie-Netting 26, R. Hines 46, C. Peters 17, B. Stacy 10, M. Cooper 15, R. Clark 21251, J. Varner 7888, T. McFadden 369, T. McFadden 815

***Vicia sativa* L.

C. Hanley *s.n.* (1989-05-20)

***Vicia villosa* Roth

D. Sasser 77

FAGACEAE

!*Castanea dentata* (Marsh.) Borkh. [3]

T. Antonio 7397, E. Browne 9523.5, E. Browne 9498, Judith Rozeman 79, P. Froelich 153, J. Getch 66, R. Clark 20979, R. Clark 20995, T. McFadden 705

Fagus grandifolia Ehrh. [5]

E. Browne 9506, K. Johnson 60, R. Clark 20978, R. Clark 20983, J. Varner 7728, T. McFadden 827

Quercus alba L. [5]

R. Clark 20999, R. Clark 21732

Quercus bicolor Willd.

R. Clark 22081, R. Clark 21731, R. Clark 21731

Quercus coccinea Munchh. [5]

J. Getch 68, K. Johnson 102, J. Norton 118, R. Clark 20985, R. Clark 20963

Quercus falcata Michx. [3]
K. Johnson 42, R. Clark 22084

Quercus imbricaria Michx.
R. Parately *s.n.* (2005-05-24) [KY]

Quercus marilandica Munchh.
K. Johnson 65, R. Clark 20987

Quercus montana Willd. [5]
E. Browne 9516, R. Clark 20969, R. Clark 21522, J. Varner 7704, T. McFadden 381

Quercus muhlenbergii Engelm.
R. Clark 21482, R. Clark 21500

Quercus rubra L. [5]
R. Clark 22116, R. Clark 21067, R. Clark 22113

Quercus shumardii Buckley [2]
R. Clark 22122, T. McFadden 734

Quercus stellata Wangenh. [3]
R. Clark 21189, R. Clark 21189

Quercus velutina Lam. [4]
R. Clark 20991, K. Johnson 58, R. Clark 20960

GENTIANACEAE

Gentiana andrewsii Griseb.
R. Clark 22074

Gentiana saponaria L.
William M. Meijer *s.n.* (1971-10-09)

Gentiana villosa L.
D. Sasser 255

Obolaria virginica L. [3]
K. Huie-Netting 29, John R. Omer 44, R. Clark 21287, Ross. C. Clark 21253, T. McFadden 887

Sabatia angularis (L.) Pursh
R. Clark 21639, R. Clark 21539, J. Varner 7437

GERANIACEAE

Geranium carolinianum L.

R. Clark 21400, J. Buskin 1347

Geranium maculatum L. [4]

K. Huie-Netting 28, H. Helm *s.n.* (1973-05-01), M. Riehemann 27, C. Peters 5, B. Stacy 9, M. Cooper 13, M. Horvath *s.n.* (1980-08-28), R. Clark 21307, J. Buskin 1258, T. McFadden 365, T. McFadden 405

GROSSULARIACEAE

Ribes cynosbati L.

R. Clark 22723

HAMAMELIDACEAE

Hamamelis virginiana L. [4]

E. Browne 9526.5, R. Clark 20955, K. Johnson 91, Doris Taylor 38, C. Brown 85, J. Getch 69, K. Knauss 55, T. McFadden 744

HYDRANGEACEAE

***Deutzia scabra* Thunb. [1]

T. McFadden 653

Hydrangea arborescens L. [4]

T. Antonio 7408, K. Johnson 66, C. Brown 97, R. Clark 21061, J. Varner 7746, R. Clark *s.n.* (1985-07-14), T. McFadden 503

HYDROPHYLLACEAE

Hydrophyllum appendiculatum Michx.

D. Sasser 100

Hydrophyllum canadense L. [3]

T. McFadden 589

HYPERICACEAE

Hypericum gentianoides (L.) B.S.P.

R. Clark 22291

Hypericum mutilum L. [3]

R. Clark 21601, R. Clark 21545, R. Clark 22315, R. Clark 22048, J. Varner 7893

***Hypericum perforatum* L.

C. Hanley 94

Hypericum punctatum Lam. [4]

J. Fitzpatrick-Cooper 106, R. Clark 22264, R. Clark 21562, R. Clark 21653, R. Clark 22740, R. Clark 22749, R. Clark 22965, R. Clark 21645, T. McFadden 570

Hypericum stragulum P. Adams & N. Robson

J. Lassetter 43, R. Clark 22442, R. Clark 20952, R. Clark 22280, C. Brown 89

Hypericum tubulosum Walter

R. Clark 22080

Hypericum virgatum Lam. [3]

T. McFadden 540

JUGLANDACEAE

Carya cordiformis (Wangenh.) K. Koch [4]

A. Rentas 117, R. Clark 21985

Carya glabra (Mill.) Sweet [4]

R. Clark 20998, A. Rentas 58, J. Varner 7226, R. Clark 23025

Carya laciniosa (Michx. f.) G. Don

R. Clark 21445, R. Clark 22955, R. Clark 22322

Carya ovata (Mill.) K. Koch. [3]

A. Rentas 140

Carya pallida (Ashe) Engl. & Graebn. [4]

R. Clark 22094, R. Clark 22678

Carya tomentosa (Poir.) Nutt. [4]

R. Clark 21085, R. Clark 22278, R. Clark 20990, R. Clark 20973, R. Clark 22959, R. Clark *s.n.* (1985-07-14)

!*Juglans cinerea* L. [2]

R. Clark 21504, T. McFadden 441, J. Faulkner 371

Juglans nigra L. [4]

R. Clark *s.n.* (1985-07-14), R. Clark 21342, R. Clark 21354

LAMIACEAE

Collinsonia canadensis L.

E. Browne 9500, A. Black *s.n.* (2013-09-19), R. Clark 21195, R. Clark 21875, J. Varner 8035, J. Varner 7751, J. Buskin *s.n.* (1972-09-09)

Cunila origanoides (L.) Britton [3]

C. Way 166, D. Taylor 102, R. Clark 21827, R. Clark 21664, T. McFadden 681

***Glechoma hederacea* L. [3]

R. Clark 21380, R. Clark 22190

Hedeoma pulegioides Pers.

R. Clark 21792

***Lamium amplexicaule* L. [4]

T. McFadden 807

***Lamium maculatum* L. [1]

T. McFadden 804

***Lamium purpureum* L. [4]

R. Clark 21384, T. McFadden 344

Lycopus virginicus L. [4]

R. Clark 21586, R. Clark 21654, R. Clark 21878, R. Clark 22097, R. Clark 21752, J. Varner 7895, R. Clark 21858, R. Clark 22585, T. McFadden 604, T. McFadden 626, R. Clark 21683

Meehania cordata (Nutt.) Britton [3]

J. Fitzpatrick-Cooper 74, R. Clark 21336, R. Clark 21145, R. Clark 22516, T. McFadden 491

Monarda bradburiana Beck

R. Clark 24466

Monarda clinopodia L. [4]

R. Murray 135, D. Taylor 92, R. Clark 22234, R. Clark 21708, T. McFadden 504

Monarda fistulosa L. var. *fistulosa* [2]

T. McFadden 599

Monarda fistulosa L. var. *mollis* (L.) Benth.

J. Norton 133, R. Clark 21090b

Monarda russeliana Nutt. ex Sims
R. Clark 22013

***Nepeta cataria* L.
C. Hanley 105

***Perilla frutescens* (L.) Britton
R. Clark 21992

Prunella vulgaris L. var. *lanceolata* (W. Bart.) Fern [3]
T. McFadden 717

Prunella vulgaris L. var. *vulgaris* [4]
T. Antonio 7402, P. Froelich 183, R. Clark 21845, R. Clark 21521

Pycnanthemum incanum Michx. [3]
C. Way 135, S. Weber 128, R. Clark 21528, R. Clark 21796, T. McFadden 573

Pycnanthemum pycnanthemoides (Leavenworth) Fernald
J. Buskin s.n. (1972-08-13), J. Varner 7764

Pycnanthemum tenuifolium Schrad.
R. Clark 21659, R. Clark 21608, R. Clark 22090

Salvia azurea Michx. Lam. var. *grandiflora* Benth.
R. Clark 22302

Salvia lyrata L. [4]
K. Johnson 31, R. Clark 21490, A. Rentas 36, R. Clark 21009, J. Varner 7875, T. McFadden 454

Scutellaria elliptica Muhl. ex Willd. var. *elliptica* [4]
J. Buskin s.n. (1972-06-24), T. McFadden 578, T. McFadden 580

Scutellaria elliptica Muhl. ex Willd. var. *hirsuta* (Short & Peter) Fernald [3]
K. Johnson 46, T. McFadden 518

Scutellaria incana Biehler
R. Clark 21637, R. Clark 21704, S. Weber 106, R. Clark 21889, R. Clark 22239

Scutellaria lateriflora L.
R. Clark 22085

!*Scutellaria saxatilis* Riddell [1]
J. Campbell s.n. (1988-09-02), T. McFadden 551

Stachys nuttallii Shuttlw. ex Benth.
D. Sasser 102

Stachys tenuifolia Willd.
R. Clark 22086

Synandra hispidula (Michx.) Britton [2]
William Meijer 1974-05-04, T. McFadden 449

Teucrium canadense L.
R. Hannan 2931, R. Clark 22055

LENTIBULARIACEAE

Utricularia gibba Le Conte [1]
T. McFadden 667

LINACEAE

Linum medium (Planchon) Britton var. *texanum* (Planch.) Fernald
R. Clark 22298

Linum striatum Walter
R. Clark 21665

Linum virginianum L.
D. Murphy 65, C. Brown 67, J. Varner 7695, R. Clark 24100

LINDERNIACEAE

Lindernia dubia (L.) Pennell
R. Clark 21680, R. Clark 21618, R. Clark 22312

LYTHRACEAE

Cuphea viscosissima St. Hill [3]
R. Clark 22058

MALVACEAE

**Abutilon theophrastii* Medik.

R. Clark 21628

Hibiscus moscheutos L.

R. Clark 22088

Hibiscus syriacus L.

C. Hanley 113

**Malva moschata* L.

J. Faulkner 386

**Sida spinosa* L.

R. Clark 22043, R. Clark 22319

Tilia americana L. var. *heterophylla* (Vent.) Louden [4]

R. Clark 21173, A. Rentas 97, C. Brown 138, R. Clark 21069

MELASTOMATACEAE

Rhexia virginica L.

B. Johnson *s.n.* (1956-06-30) [KY]

MENISPERMACEAE

Menispermum canadense Pall. [3]

R. Clark 21423, R. Clark 22514

MOLLUGINACEAE

**Mollugo verticillata* L.

R. Clark 22064

MONTIACEAE

Claytonia caroliniana Michx. [4]

M. Cooper 14, R. Clark 21288, R. Clark 21341, T. McFadden 334

Claytonia virginica L. [4]

R. Clark 22153, R. Clark 22153, J. Buskin 1200, T. McFadden 324

MORACEAE

**Maclura pomifera* (Raf.) Schneid.

J. Varner 7878

***Morus alba* L.

R. Clark 22719

Morus rubra L. [3]

R. Clark 21119, R. Clark 21107, J. Varner 7899, J. Varner 8000

NYSSACEAE

Nyssa sylvatica Marsh. [5]

D. Taylor 45, J. Getch 65, R. Clark 20950, J. Varner 7436, J. Varner 7221, J. Varner 7733, T. McFadden 577

OLEACEAE

Fraxinus americana L. [4]

R. Clark 21822

Fraxinus biltmoreana Beadle [4]

A. Rentas 105, R. Clark 21084, J. Varner 8062, R. Clark 22704

Fraxinus pennsylvanica Marsh. [4]

R. Clark 21973

Fraxinus quadrangulata Michx.

R. Clark 22123

ONAGRACEAE

!*Circaea alpina* L.

J. Campbell *s.n.* (1988-06-27), J. Campbell *s.n.* (1988-08-01), J. Campbell *s.n.* (1988-07-22), J. Campbell *s.n.* (1988-08-08), R. Clark 21738, D. Sasser 262

Circaea canadensis (L.) Hill [4]

A. Rentas 100, R. Clark 21193, R. Clark 22700, J. Buskin *s.n.* (1972-07-14)

Ludwigia alternifolia Walter [4]

R. Clark 21612, R. Clark 22102, R. Clark 21824, R. Clark 22242, J. Varner 7710, R. Clark 22712, R. Clark 21671

Ludwigia decurrens Walter

R. Clark 22040

Ludwigia palustris (L.) Ell. [3]

R. Clark 22049, R. Clark 22311, T. McFadden 665

Oenothera biennis L.

R. Clark 21377

Oenothera laciniata Hill

J. Faulkner 218

Oenothera parviflora L. [3]

T. McFadden 521

Oenothera tetragona Roth var. *fraseri* (Pursh) Munz

D. Sasser 113

OROBANCHACEAE

Agalinis purpurea (L.) Pennell

R. Clark 22024

Agalinis tenuifolia (Vahl.) Raf.

R. Clark 21995

Aphyllon uniflorum (L.) Torr. & A. Gray

R. Clark 23162, T. McFadden 396

Aureolaria flava (L.) Farw.

R. Clark 22000

Aureolaria laevigata (Raf.) Raf.

R. Clark 21917, J. Buskin *s.n.* (1972-08-13), J. Varner 7701

Aureolaria virginica (L.) Pennell

R. Clark 22243, R. Clark 21698, R. Clark 22243

Conopholis americana Wallr. [4]

R. Clark 21078, R. Murray 134, R. Clark 21344, K. Johnson 4, C. Brown *s.n.* (1987-06-21), T. McFadden 450A

Epifagus virginiana (L.) W. Bartram [4]
R. Clark 21964, T. McFadden 313

!*Melampyrum lineare* Desr. var. *pectinatum* (Pennell) Fernald
J. Campbell *s.n.* (1988-06-28), M. Medley 39, K. Johnson 30, N. Coons 72, R. Clark
21110, K. Knauss 69

Pedicularis canadensis L. [4]
K. Huie-Netting 12, M. Horvath *s.n.* (1980-04-20), M. Cooper 16, R. Clark 21266, R.
Clark 21102, T. McFadden 448

OXALIDACEAE

Oxalis dillenii Jacq.
R. Clark 21557, R. Clark 21397

Oxalis grandis Small
D. Sasser 44

Oxalis montana Raf. [3]
J. Campbell *s.n.* (1988-09-08), A. Rentas 125, R. Clark 21167

***Oxalis stricta* L. [4]
T. Antonio 7442, R. Clark 21613, R. Clark 21536x, R. Clark 21782, R. Clark 21192, R.
Clark 21557, R. Clark 21734, R. Clark 21791

Oxalis violacea L. [3]
R. Clark 21355, T. McFadden 451

PAPAVERACEAE

Corydalis flavula (Raf.) DC. [3]
T. McFadden 814

Dicentra canadensis (Goldie) Walp. [3]
R. Clark 21408, T. McFadden 850

Dicentra cucullaria (L.) Bernh. [4]
R. Clark 21494, T. McFadden 362, T. McFadden 824

Sanguinaria canadensis L. [4]
M. Cooper 7, R. Clark 21364, T. McFadden 342, T. McFadden 822

Stylophorum diphyllum (Michx.) Nutt. [4]
M. Cooper 20, R. Clark 21409, R. Clark 21409, T. McFadden 432, T. McFadden 849

PASSIFLORACEAE

Passiflora lutea L.
J. Fitzpatrick-Cooper *s.n.* (1989-07-15), J. Getch 58, R. Clark 22110, R. Clark 21978

PENTHORACEAE

Penthorum sedoides L.
R. Clark 22108x, R. Clark 21584

PHRYMACEAE

Mimulus alatus Aiton
R. Clark 21589, R. Clark 22087, R. Clark 21579

Mimulus ringens L. [2]
R. Clark 21968, T. McFadden 648

Phryma leptostachya L. [4]
R. Clark 22247, D. Murphy 113, T. McFadden 597

PHYTOLACCACEAE

Phytolacca americana L. [4]
R. Clark 21081, J. Varner 7727

PLANTAGINACEAE

Chelone glabra L.
R. Hannan 2934, A. Black *s.n.* (2013-09-19), R. Clark 21864, J. Varner 7982

Penstemon digitalis Nutt. *ex* Sims
D. Sasser 106, J. Faulkner 17

Penstemon pallidus Small
B. Stacy 17, J. Varner 7868

**Plantago lanceolata* L. [4]
K. Johnson 33

**Plantago major* L. [1]
T. McFadden 703

**Plantago rugelii* Decne. [4]
A. Rentas 47, D. Murphy 102, R. Clark 21840

Plantago virginica L. [4]
R. Clark 21403, T. McFadden 511

**Veronica arvensis* L. [4]
R. Clark 21548, R. Clark 21385, A. Rentas 95, J. Buskin 1250, R. Clark
22729

**Veronica officinalis* L.
S. Denham *s.n.* (1964-05-23), R. Clark 21759

**Veronica peregrina* L.
R. Clark 21398

**Veronica serpyllifolia* L.
R. Clark 21749

Veronicastrum virginicum (L.) Farw.
D. Sasser 88

PLATANACEAE

Platanus occidentalis L. [4]
T. McFadden 347

PODOSTEMACEAE

!*Podostemum ceratophyllum* Michx.
R. Clark 21758, M. Medley 740-79

POLEMONIACEAE

Phlox divaricata L. [4]

M. Cooper 21, R. Clark 21440, R. Clark 21368, R. Clark 21499, R. Clark 21368, T. McFadden 354, T. McFadden 373

Phlox glaberrima L. [3]

D. Taylor 101, R. Clark 24472, S. Weber 111, T. McFadden 455

Phlox maculata L. var. *pyramidalis* (Sm.) Wherry [3]

J. Norton 132, R. Clark 21567, T. McFadden 638, T. McFadden 675

Phlox paniculata L.

R. Clark 21972

Polemonium reptans L. var. *reptans* [4]

A. Rentas 107, R. Clark 22511, R. Clark 21379

Polemonium reptans L. var. *villosum* E.L. Braun [4]

T. McFadden 328, T. McFadden 858

POLYGALACEAE

Polygala curtissii A. Gray [2]

R. Clark 21715, D. Taylor 39, J. Buskin 1526, T. McFadden 569

Polygala sanguinea L.

R. Clark 21674

Polygala senega L.

R. Clark 22505, R. Clark 21098

POLYGONACEAE

Fallopia cristata (Engelm ex A. Gray) Holub

R. Clark 22956

Fallopia scandens (L.) Holub

R. Clark 21594

Persicaria hydropiper (L.) Spach

R. Clark 22037

Persicaria hydropiperoides (Michx.) Small [3]
R. Clark 21622, R. Clark 22101, R. Clark 21883, T. McFadden 660

***Persicaria longiseta* (Bruijn) Kitag. [4]
T. McFadden 296, T. McFadden 687, T. McFadden 702, T. McFadden 708, T.
McFadden 710

***Persicaria maculosa* Gray
R. Clark 21808

Persicaria pennsylvanica (L.) G. Maza
R. Clark 21884

Persicaria punctata (Elliot) Small [4]
R. Clark 21854, T. McFadden 652, T. McFadden 720

Persicaria sagittata (L.) Gross.
R. Clark 21853, R. Clark 21627, R. Clark 22957

Persicaria setacea (Baldw.) Small [3]
R. Clark 22073, T. McFadden 730

Persicaria virginiana (L.) Gaertn. [4]
R. Clark 21741, R. Clark 22702

**Polygonum aviculare* L.
R. Clark 22025, R. Clark 22332

Polygonum erectum L.
R. Clark 22028, R. Clark 22327

***Reynoutria japonica* Houtt.
R. Clark 22587

***Rumex acetosella* L.
R. Clark 22065

**Rumex crispus* L. [3]
R. Clark 21907

**Rumex obtusifolius* L.
R. Clark 21138

PRIMULACEAE

!*Lysimachia borealis* (Raf.) U. Manns & Anderb.
J. Campbell *s.n.* (1988-05-24), J. Campbell 626

Lysimachia ciliata L.
R. Clark 21590, R. Clark 21583

Lysimachia lanceolata Walter
R. Clark 21591, R. Clark 21686, R. Clark 148, D. Murphy 109

***Lysimachia nummularia* L.
R. Clark 21250

Lysimachia quadriflora Sims [1]
R. Clark 22254, T. McFadden 674

Lysimachia quadrifolia L. [4]
S. Weber 155, J. Buskin 1400, D. Murphy 104

!*Primula frenchii* (Vasey) A.R. Mast & Reveal [1]
J. Campbell *s.n.* (1991-05-01)

RANUNCULACEAE

Actaea pachypoda Elliot [3]
C. Peters 18, R. Clark 21309, T. McFadden 528

Actaea podocarpa DC. [3]
J. Campbell *s.n.* (1988-09-21), J. Campbell *s.n.* (1988-10-06), R. Clark 22688, T. McFadden 596

Actaea racemosa L.
D. Taylor 97, J. Fitzpatrick 41

Anemone acutiloba (DC.) G. Lawson [4]
J. Lassetter 2382

Anemone americana (DC.) H. Hara [4]
J. Kendall 30, M. Cooper 8, R. Clark 21448, S. Weber 152, T. McFadden 322

Anemone quinquefolia L.
R. Clark 21464

Anemone virginiana L. [4]
T. Antonio 7409, D. Taylor 63, R. Clark 21640, R. Clark 22694, T. McFadden 612

Aquilegia canadensis L. [4]
J. R. Smith *s.n.* (1975-04-20), M. Horvath *s.n.* (1980-04-25), K. Johnson 7, T. McFadden 643

Clematis viorna L. [3]
J. Norton 144, J. Getch 76, R. Clark 22143, F. Fitzpatrick-Cooper 86, T. McFadden 538

Clematis virginiana L.
R. Clark 21298, R. Clark 21197, J. Varner 8043

Delphinium tricorne Michx. [4]
R. Clark 21455, J. Varner 7861, T. McFadden 404

***Ficaria verna* Hudson subsp. *calthifolia* (Rchb.) Nyman [1]
T. McFadden 345

Hydrastis canadensis L.
R. Clark 21890, R. Clark 22208, R. Clark 22139

Ranunculus abortivus L. [4]
M. Cooper 9, R. Clark 22154, R. Clark 22733, T. McFadden 407, T. McFadden 438, T. McFadden 836, T. McFadden 866, T. McFadden 868, T. McFadden 875

Ranunculus hispidus Michx. [4]
M. Cooper 24, R. Clark 21254, R. Clark 22155, R. Clark 22727, T. McFadden 428, T. McFadden 838

Ranunculus recurvatus Poir. [4]
C. Peters 22, B. Stacy 8, R. Clark 22216, J. Buskin 1337, R. Clark 21196, T. McFadden 367, T. McFadden 399, T. McFadden 835

Thalictrum clavatum DC.
T. Antonio 7418, D. Taylor 73, A. Rentas 92, K. Knauss 50

Thalictrum dioicum L.
R. Parately *s.n.* (2010-05-07) [KY]

Thalictrum mirabile Small [3]
Landon E. McKinney 24

Thalictrum pubescens Pursh
E. Browne 9556, C. Hanley 72, R. Clark 22118, R. Clark 21568, R. Clark 21905

Thalictrum thalictroides (L.) Eames & B. Boivin [4]
M. Cooper 6, C. Peters 13, R. Clark 21324, J. Buskin 1205, T. McFadden 355, T.
McFadden 371, T. McFadden 823, T. McFadden 825, R. Paratley *s.n.* (2015-06-04)

Xanthorhiza simplicissima Marsh. [3]
J. Lassetter 2385, C. Brown 144, K. Johnson 13, J. Buskin *s.n.* (1972-04-21), T.
McFadden 474

RHAMNACEAE

Ceanothus americanus L. [3]
E. Browne 9524, J. Buskin *s.n.* (1972-06-24), R. Clark 22602, T. McFadden 524

Frangula caroliniana (Walter) A. Gray
D. Sasser 71

ROSACEAE

Agrimonia parviflora Aiton [4]
R. Clark 21874, T. McFadden 300, R. Clark 22590

Agrimonia pubescens Wallr. [3]
R. Clark 22703, R. Clark 21966, T. McFadden 654

Agrimonia rostellata Wallr.
T. Antonio 7416, E. Browne 9077, R. Clark 22618, R. Clark 21891

Amelanchier arborea (Michx. f.) Fernald [4]
K. Johnson 28, R. Clark 22496, D. Taylor 46, J. Varner 7230, J. Varner 7742, R. Clark
21868, T. McFadden 746, T. McFadden 749

Amelanchier laevis Wiegand [1]
T. McFadden 630

Amelanchier spicata (Lam.) K. Koch
R. Clark 22451

Aronia melanocarpa (Michx.) Elliot
R. Clark 21606

Aruncus dioicus (Walter) Fernald
K. Johnson 78

**Chaenomeles speciosa* Nakai
R. Clark *s.n.* (1989-04-24), R. Clark 21263

Crataegus crus-galli L.
R. Clark 22052

Crataegus disperma Ashe [1]
T. McFadden 516

Crataegus iracunda Beadle
R. Clark 22054, R. Clark 22137, R. Clark 21669

Crataegus mollis Scheele
D. Sasser 158

Crataegus pruinosa (Wendl. f.) K. Koch
R. Clark 22726, R. Clark 22738

Crataegus uniflora Munchh.
R. Clark 22745, R. Clark 21505, R. Clark 21488

Fragaria virginiana Duchesne
R. Clark 21496, T. McFadden 882

Geum canadense Jacq. [3]
J. Buskin *s.n.* (1972-07-14), R. Clark 22701, T. McFadden 575

Geum fragarioides (Michx.) Smedmark
R. Clark 22728

Geum vernum (Raf.) Torr. & A. Gray [4]
R. Clark 21495, R. Clark 21461, T. McFadden 506

Geum virginianum L.
R. Clark 21122

Gillenia stipulata (Muhl. ex Willd.) Baill. [3]
R. Clark 22012, T. McFadden 525

**Kerria japonica* (L.) DC.
R. Clark 21498

Malus coronaria (L.) Mill.
R. Clark 21632, R. Clark 22277

**Malus pumila* P. Mill.

R. Clark 21924, R. Clark 22744, R. Clark 22748

Potentilla canadensis L. [3]

R. Clark 21356, J. Buskin 1263, T. McFadden 390, T. McFadden 466

***Potentilla indica* (Jacks.) Th. Wolf [4]

T. McFadden 370, T. McFadden 831

***Potentilla recta* L. [3]

D. Sasser 32

Potentilla simplex Michx. [3]

R. Clark 21256, K. Johnson 68

Prunus americana Marsh. [3]

Jeffrey A. Hawkins *s.n.* (1992-04-25), R. Clark 22059, J. Varner 7880, R. Clark 21728, T. McFadden 816

Prunus angustifolia Marsh.

R. Clark 21515

**Prunus cerasus* L. [2]

R. Clark 22183, T. McFadden 846

Prunus mexicana S. Watson [2]

R. Clark 21728, R. Clark 22188, T. McFadden 877

Prunus munsoniana W. Wight & Hedrick [2]

P. Higgins 2084, T. McFadden 817, T. McFadden 848

**Prunus persica* (L.) Batsch [2]

R. Clark 22267, T. McFadden 800

Prunus serotina Ehrh. [4]

R. Clark 21514, T. McFadden 883

Rosa carolina L. [3]

R. Clark 21162, R. Clark 22002, R. Clark 21080, R. Clark 21842, T. McFadden 617, T. McFadden 854

**Rosa luciae* Franch. & Rochebr.

R. Clark 24480

***Rosa multiflora* Thunb. *ex* Murr. [5]

R. Clark 21576, R. Clark 22005, R. Clark 21303, R. Clark 21473, R. Clark 22138, T. McFadden 476, T. McFadden 852

Rosa palustris Marsh.
R. Clark 22044

Rosa setigera Michx.
J. Faulkner 447

Rubus allegheniensis Porter [3]
R. Clark 21113, C. Brown 74

Rubus argutus Link.
R. Clark 21634, R. Clark 21945, R. Clark 21893

Rubus flagellaris Willd. [4]
R. Clark 21302, R. Clark 22062, A. Rentas 37, R. Murray 137, R. Clark 22710, T. McFadden 552

Rubus hispidus L. [1]
T. McFadden 558

Rubus occidentalis L.
R. Clark 21060

Rubus pensilvanicus Poir. [3]
R. Clark 22236

***Rubus phoenicolasius* Maxim. [2]
T. McFadden 802

***Spiraea japonica* L. f.
R. Clark 21681

Spiraea tomentosa L.
R. Clark 22001

RUBIACEAE

Cephalanthus occidentalis L. [2]
K. Feeman 154, R. Hannan 2942, R. Clark 21580, J. Varner 8061, T. McFadden 662

Diodella teres (Walt.) Small
R. Clark 22047

Diodia virginiana L.
R. Clark 21674, R. Clark 22022

Galium aparine L. [3]

A. Rentas 78, R. Clark 21386, J. Buskin 1336, R. Clark 22145, T. McFadden 412

Galium asprellum Michx.

R. Clark 22091

Galium circaezans Michx.

R. Clark 22245, J. Fitzpatrick-Cooper 49, R. Clark 21947, S. Weber 110, J. Norton 130

Galium lanceolatum Torr.

R. Clark 22114

Galium pilosum Aiton

J. Buskin 1441

Galium tinctorium (L.) Scop.

D. Sasser 34

Galium triflorum Michx. [4]

T. Antonio 7405, R. Clark 21775, R. Murray 93, D. Taylor 71, N. Coons 055, R. Clark 22690, R. Clark 22245, T. McFadden 592, T. McFadden 711

Houstonia caerulea L. [4]

M. Riehemann 25, S. Riehemann *s.n.* (1980-04-19), M. Cooper 23, R. Clark 21745, S. Weber 133, R. Clark 21311, R. Clark 21112, J. Buskin 1204, R. Clark 22717, T. McFadden 385, T. McFadden 562, T. McFadden 607

Houstonia canadensis Willd. *ex* Roem. & Schult. [3]

T. McFadden 459A, T. McFadden 733

Houstonia purpurea L. [4]

T. Antonio 7446, R. Clark 21157, R. Clark 21019, R. Clark 21099, J. Buskin 1349, J. Buskin *s.n.* (1972-06-24), D. Murphy 103, N. Coons 039

Mitchella repens L. [4]

A. Rentas 143, R. Clark 20968, K. Johnson 86, N. Coons 045, J. Varner 7700, J. Buskin 1335, T. McFadden 288

SALICACEAE

**Populus balsamifera* L.

R. Clark 22207

Populus grandidentata Michx.

R. Clark 21066, R. Clark 21636

**Populus × jackii* Sarg. [*balsamifera* × *deltoides*]
R. Clark 22338

**Salix alba* L. [1]
T. McFadden 496

Salix caroliniana Michx.
J. Varner 7712

Salix humilis Marsh.
R. Clark 21257, R. Clark 21247, R. Clark 21532

Salix nigra Marsh. [4]
R. Clark 21161, J. Varner 7706

Salix sericea Marsh. [4]
R. Clark 22168, R. Clark 22129, T. McFadden 655, T. McFadden 860

SANTALACEAE

Phoradendron leucarpum (Raf.) Reveal & M.C. Johnston *ssp. leucarpum*
R. Thompson 88-3198 [BEREA], R. Thompson 88-3199 [BEREA]

Pyrularia pubera Michx. [3]
C. Way 136, E. Browne 9529.5, P. Froelich 154, R. Clark 20980, J. Buskin 1394, T. McFadden 470

SAPINDACEAE

Acer negundo L. [5]
R. Clark 21873, R. Clark 22032, J. Norton 105, J. Varner 7874

Acer nigrum Michx. f. [3]
R. Clark 22112, R. Clark 21906, K. Knauss 64

Acer rubrum L. [5]
K. Freeman 153, R. Clark 21691, R. Clark 21123, R. Clark 20964, J. Norton 91, R. Clark 21321, J. Varner 7433, J. Varner 7220, J. Varner 7761

Acer saccharinum L.
K. Johnson 104

Acer saccharum Marsh. [5]

K. Johnson 71, R. Clark *s.n.* (1985-07-14), R. Clark 21898, R. Clark 21623, R. Clark 21411, R. Clark 22023, R. Clark 21867, R. Clark 21353, R. Clark 21685, J. Varner 7906

Aesculus flava Aiton [5]

R. Clark 22281, K. Johnson 74, R. Clark 21093, R. Clark *s.n.* (1985-07-14)

SAXIFRAGACEAE

Heuchera americana L. [4]

R. Clark 21260, A. Rentas 70, K. Johnson 80, T. McFadden 308, T. McFadden 410

Heuchera longiflora Rydb.

J. Buskin *s.n.* (1972-07-14)

Heuchera macrorhiza Small

J. Varner 7891

Heuchera parviflora Bartl.

C. Brown 121, R. Clark 21747, J. Buskin 1511

Heuchera villosa Michx. [3]

K. Johnson 8, R. Clark 22696

Mitella diphylla L. [4]

K. Huie-Netting 20, M. Cooper 1, C. Peters 11, J. Lassetter 2389, R. Clark 21133, T. McFadden 353

Tiarella cordifolia L. [4]

B. Stacy 19, M. Cooper 26, K. Huie-Netting 3, H. Helm *s.n.* (1973-05-01), M. Beckett 1261, B. Stacy 2, C. Peters 12, R. Clark 21165, R. Clark 21313, R. Clark 21194, J. Buskin 1259, T. McFadden 36

SCROPHULARIACEAE

**Buddleja davidii* Franch.

D. Taylor 18772 [BEREA]

Scrophularia marilandica L.

R. Clark 21997, J. Varner 8040

**Verbascum blattaria* L.
C. Hanley 23, D. Sasser 31

***Verbascum thapsus* L. [3]
R. Clark 21151

SOLANACEAE

**Datura stramonium* L.
R. Clark 21658

**Nicandra physalodes* Scop.
J. Faulkner 239

Physalis longifolia Nutt. var. *subglabrata* (Mack. & Bush) Cronquist
J. Faulkner 240

Solanum carolinense L. [3]
C. Brown 90, R. Clark 21529, T. McFadden 514

**Solanum nigrum* L.
R. Clark 21688

Solanum ptychanthum Dunal
R. Clark 21688

STAPHYLEACEAE

Staphylea trifolia L. [4]
R. Clark 21418, A. Rentas 109, R. Clark 21100, J. Varner 7956, R. Clark 22148, T.
McFadden 406

THYMELAEACEAE

Dirca palustris L. [3]
R. Clark 21438, R. Clark 22691, T. McFadden 828

ULMACEAE

Ulmus americana L. [4]
R. Clark 21394, A. Rentas 102, J. Varner 7916, R. Clark 22641

Ulmus rubra Muhl. [4]

R. Clark *s.n.* (1985-07-14), R. Clark 22187, R. Clark 21252, A. Rentas 42, J. Varner 7753

URTICACEAE

Boehmeria cylindrica (L.) Sw. [5]

R. Clark 21551, R. Clark 21872, R. Clark 21128, J. Norton 138, T. McFadden 297

Laportea canadensis (L.) Weddell [5]

R. Clark 21772, J. Varner 7749, T. McFadden 714

Parietaria floridana Nutt. [1]

D. Taylor *s.n.* (1990-07-02) [BEREA]

Parietaria pensylvanica Muhl. *ex* Willd. [3]

C. Brown 123, A. Rentas 81

Pilea pumila (L.) A. Gray [3]

R. Clark 21153, R. Clark 22699, T. McFadden 605

VERBENACEAE

Verbena hastata L.

R. Hannan 2929, J. Faulkner 287

Verbena urticifolia L.

R. Clark 21570, J. Buskin *s.n.* (1972-07-14), R. Clark 22707

VIOLACEAE

Cubelium concolor (T.F. Forst.) Raf. [3]

D. Murphy 109, R. Clark *s.n.* (1985-07-14), A. Rentas 111, T. McFadden 413, T. McFadden 585

Viola affinis LeConte [3]

R. Clark 21265, R. Clark 21335, T. McFadden 821

Viola bicolor Pursh [3]

T. McFadden 813

Viola blanda Willd. [4]

R. Clark *s.n.* (1989-04-24) , B. Stacy 6, C. Peters 15, J. Kendall 21, K. Huie-Netting 17, S. Riehemann *s.n.* (1980-04-19), R. Clark 22195, M. Riehemann 38, J. Buskin 1211

Viola canadensis L. var. *canadensis* [4]

S. Weber 109, R. Clark 21089, R. Clark 21310, C. Brown 114, T. McFadden 364, T. McFadden 401

Viola cucullata Aiton [3]

J. Faulkner 18, D. Sasser 136, R. Paratley *s.n.* (2005-05-25)

Viola eriocarpa Schwein. [4]

M. Cooper 2, R. Clark 21315, T. McFadden 357, T. McFadden 416, T. McFadden 820

Viola hastata Michx. [3]

J. Kendall 27, M. Riehemann 26, R. Clark 21170, J. Buskin 1208

Viola hirsutula Brainerd

R. Clark 21373

Viola incognita Brainerd [1]

T. McFadden 394

Viola labradorica Schrank

M. Cooper 18, M. Cooper 19, R. Paratley *s.n.* (2005-05-18)

Viola pallens (Banks *ex* Ging.) Brainerd

R. Clark 21178, D. Murphy 91, R. Clark 21286

Viola palmata L

Fred Kirchoff 31, M. Wharton 5424, J. Buskin 1352, R. Clark 21697, R. Clark 21372

Viola pedata L.

D. Taylor 41, R. Clark 22682

Viola rostrata Pursh [4]

C. Peters 21, H. Helm *s.n.* (1973-05-01), K. Huie-Netting 27, M. Riehemann 37, M. Cooper 5, S. Riehemann *s.n.* (1980-04-19), T. Zimmerman *s.n.*, R. Clark 21177, R. Clark 21329, R. Clark 22172, R. Clark 21178, J. Buskin 1212, T. McFadden 356

Viola rotundifolia Michx. [3]

R. Clark 22214, J. Buskin 1208

Viola sagittata Aiton

R. Clark 21761

Viola sororia Willd. [4]

C. Peters 19, M. Wharton 5427, K. Huie-Netting 5, R. Clark 22721, R. Clark 22173, R. Clark 22156, T. McFadden 379, T. McFadden 437

Viola striata Aiton

R. Clark 21404, J. Buskin 1254

VITACEAE

Parthenocissus quinquefolia (L.) Planch. [4]

R. Clark *s.n.* (1985-07-14), R. Clark 21520, J. Varner 7866, J. Buskin 1461, J. Varner 7748, J. Varner 7431

Vitis aestivalis Michx. var. *aestivalis* [3]

R. Clark 21596, J. Varner 7720, R. Clark 22705

Vitis aestivalis Michx. var. *bicolor* Deam [3]

K. Johnson 100, R. Clark 20953, J. Varner 7424

Vitis cinerea (Engelm. in A. Gray) Engelm. *ex* Mill. var. *baileyana* (Munson) Comeaux

R. Clark 21729

Vitis riparia Michx.

R. Clark 21838, R. Clark 21678

Vitis vulpina L.

R. Clark 21118b

Appendix B: Species of conservation concern accounts

Appendix B: Species of conservation concern accounts

For each species the following information is provided: Scientific name, common name, status, the habitat it is found in throughout KY, general localities it can be found in the RRG (if it was not found, areas that should be searched are given), and any additional notes. A species is included in this appendix if it is state-listed or it is considered rare by Jones (2005) or Weakley (2015), with any discrepancies between them discussed. Locality information is not given for state-listed species but are available on the herbarium labels for each voucher. All vouchers mentioned in this list can be found in Appendix A. The abbreviation AP stands for Appalachian Physiographic Province, IP stands for Interior Low Plateau, and ME stands for Mississippi Embayment.

Acer spicatum Lam. (Sapindaceae). Mountain maple. Endangered.

Mountain maple is a shrub or small tree that can be found in mixed mesophytic forests in the IP and AP regions of KY (Jones 2005; Weakley 2015). Two populations of this species were reported as present by the KSNPC, however there were no vouchers located, and it was not observed during the study. It was last seen in 1980. It should be searched for in high-quality sheltered cove forests. Most likely to be found in cold air drainage zones along streams emerging from cave mouths (Ross C. Clark, pers. comm.).

Aconitum uncinatum L. (Ranunculaceae). Appalachian blue monkshood. Threatened.

Appalachian blue monkshood is a fall flowering perennial herb that occurs in mesic forests and cove forests of the IP and AP regions of KY (Jones 2005; Weakley 2015). One population of this species was reported as present by the KSNPC, however there were no vouchers located, and it was not observed during the study. It was last seen in 1980 and according to KSNPC reports, the population was extirpated in September 1988 by the building of a canoe launch site. It should be searched for in alluvial woods along the banks of the Red River.

Actaea podocarpa DC. (Ranunculaceae). Mountain black-cohosh. Rare.

Mountain black-cohosh is a perennial herb that can be found in rich cove forest in the AP region of KY (Jones 2005; Weakley 2015). This species was collected during this project along Spaas Creek. It is also known from two vouchers. One was collected by Ross C. Clark along Chimney Top Creek in 1992. One was collected by Julian Campbell along the Red River in 1988.

Ageratina luciae-brauniae (Fernald) King & H. Robinson (Asteraceae). Rockhouse white snakeroot. Special Concern.

Rockhouse white snakeroot is a fall flowering perennial herb that is found in sandstone rock houses or overhanging sandstone cliffs in the AP region of KY (Jones 2005; Weakley 2015). The KSNPC reported 2 populations of this species. Both populations were found and a voucher was collected as a part of this study. It is also known from a number of vouchers deposited at EKY from the same locations. This

species is endemic to cliffbases and rockhouses in the CP of TN and KY (Weakley 2015).

Allium burdickii (Hanes) A.G. Jones (Alliaceae). White Ramps. Rare.

White ramps are summer flowering herbs that are found in rich cove forests in the IP and AP regions of KY (Jones 2005). This species was collected in the floodplain of Spaas Creek in early June. Weakley (2015) notes that this species flowers ca. one month earlier than *Allium tricoccum* Aiton, and that pattern was observed with this population.

Amelanchier spicata (Lam.) K. Koch (Rosaceae). Dwarf serviceberry. Rare

Dwarf serviceberry is a spring flowering shrub that can be found on dry, acidic, and sandy sites in the AP region of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Ross C. Clark in an upland woods along Spaas Creek in 1991. It was not otherwise observed during this study. Dwarf serviceberry is circumscribed by Jones (2005) as *Amelanchier stolonifera* Wiegand and was not clearly documented in KY at that time.

Anemone quinquefolia L. (Ranunculaceae). Wood anemone. Rare.

Wood anemone is a perennial herb that can be found in rich moist forest in the AP region of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Dr. Ross C. Clark along Gladie Creek in 1988. It was not otherwise observed during this study.

Antennaria howelii Greene subsp. *neodiocia* (Greene) Bayer (Asteraceae). Smaller pussytoes. Rare.

Smaller pussytoes is a spring flowering herb that can be found in dry fields and open woodlands in the AP region of KY (Jones 2005; Weakley 2015). It is known from a single voucher made by K. Johnson in 1987 in an oak-pine-heath woods along Chimney Top Road. It was not otherwise observed during this study.

Arisaema dracontium (L.) Schott (Araceae). Green dragon. Rare.

Green dragon is a spring flowering herb that is found in floodplains and bottoms across KY (Jones 2005; Weakley 2015). It was collected during this project in the floodplain of the Red River. This species is common in more western parts of the state but rare throughout the Appalachian Highlands (Weakley 2015) and rare in the Red River Gorge.

Bartonia virginica (L.) BSP. (Gentianaceae). Virginia bartonia. Threatened.

Virginia bartonia is a fall flowering annual herb that can be found in wet woods, swamps, and bogs in the ME, IP and AP regions of KY (Jones 2005; Weakley 2015). One population of this species was reported by the KSNPC. However, there are no existing vouchers, and it was not observed during the study. It was last seen in 1992.

Betula alleghaniensis Britton (Betulaceae). Yellow birch. Rare.

Yellow birch is a spring flowering tree that can be found mid to high elevation mixed mesophytic forests in the AP and IP regions of KY (Jones 2005; Weakley 2015).

It is known from two vouchers, one collected by K. Johnson along Clifty Creek in 1987, and one collected by Ross C. Clark along Clifty Creek in 1987. This species was also observed during this study along Mariba Fork near a rockhouse.

Bulbostylis capillaris (L.) Kunth ex Clarke (Cyperaceae). Densetuft hairsedge. Rare.

Densetuft hairsedge is a fall flowering herb found in rocky or sandy woods across KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Ross C. Clark on limestone outcrops along the Red River in 1987. It was not otherwise observed during this study.

Calopogon tuberosus (L.) BSP. (Orchidaceae). Common grass-pink. Endangered.

Common grass-pink is a summer flowering herb that is found in wet to dry habitats in the AP region of KY, such as powerline cuts, wet meadows, and bogs (Jones 2005; Weakley 2015). Two populations of this species were reported by the KSNPC, however there are no existing vouchers, and it was not observed during the study. It was last seen in 1970.

Carex austrolucorum (Rettig) D.B. Poind. & Naczi (Cyperaceae). Appalachian woodland sedge. Rare.

Appalachian woodland sedge is a perennial spring flowering herb that can be found on xeric to mesic wooded slopes in oak forests in the AP and IP regions of KY (Weakley 2015). This species was collected during this project in Tight Hollow on the upper slopes of the ravine near the cliff line. It is also known from a voucher collected

by Ross C. Clark near Nada Tunnel in 1988. This taxon is circumscribed by Jones (2005) as *Carex lucorum* Willd. and was only recognized at the varietal level at that time. This species is a southern Appalachian endemic.

Carex baileyi Britton (Cyperaceae). Bailey's sedge. Rare.

Bailey's sedge is a perennial spring flowering herb that can be found in bog and seeps in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species was collected during this study along Fish Trap Branch, along Mariba Fork, and along Copperas Creek. It is also known from a voucher collected by Ross C. Clark along King Branch in 1985.

Carex bromoides (Cyperaceae). Common brome sedge. Rare.

Common brome sedge is a perennial spring flowering herb that can be found in forested bogs and seeps across KY (Jones 2005; Weakley 2015). It is known from a single voucher collected by Ross C. Clark in 1988 along Gladie Creek. It was not otherwise observed during this study.

Carex cristatella Britton (Cyperaceae). Crested sedge. Rare.

Crested sedge is a perennial spring flowering herb that can be found in wet meadows and along river shores in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by M. Hines along the Red River. It was not otherwise observed during this study.

Carex laxiculmis Schwein. var. *copulata* (L.H. Bailey) Fernald (Cyperaceae). Spreading sedge. Rare.

Spreading sedge is a perennial spring flowering herb that can be found in rich mesic forests flood plains in the AP and IP regions of KY (Jones 2005; Weakley 2015). It was collected during this study in a boggy abandoned limestone quarry. It is also known from two vouchers collected by Ross C. Clark, one along Fish Trap Branch in 1988, and one along Gladie Creek in 1988.

Carex pedunculata Muhl. ex Willd. (Cyperaceae). Longstalk sedge. Rare.

Longstalk sedge is a spring flowering perennial herb that is found in nutrient rich mesic forests in the AP region of KY (Jones 2005; Weakley 2015). This species was collected during this project on the slopes around Fish Trap Branch. It is also known from a voucher collected by Julian Campbell along KY 715.

Carex rugosperma Mack. (Cyperaceae). Parachute sedge. Threatened.

Parachute sedge is a perennial graminoid that can be found in the shallow soils of rock outcrops and exposed forest edges in the AP region of KY (Jones 2005; Weakley 2015). One population of this species was reported by the KSNPC as occurring on the exposed rock outcrops of Sky Bridge in Wolfe County. However, after reviewing previously collected vouchers and collecting vouchers in the same area this population was determined to be *C. tonsa* (Fernald) E.P.Bicknell. This species differs in having glabrous perigynia. This identification was likely caused by the fact that many authors circumscribe this species differently (Weakley 2015). A previously unknown

population of parachute sedge was located during this project. Parachute sedge seemed to be more abundant on less exposed north and east facing forested cliff edges and ridges, whereas *C. tonsa* seemed to be more abundant on more exposed south and west facing rock outcrops and un-forested cliff edges.

Carex scabrata Schwein. (Cyperaceae). Eastern rough sedge. Rare.

Eastern rough sedge is a spring flowering perennial herb that can be found in seepages on slopes as well as on the margins of small forested streams in the AP and IP regions in KY (Jones 2005; Weakley 2015). It is known from two vouchers collected by Ross C. Clark, one was collected along Grays Branch in 1988 and one was collected along Sarges Branch in 1988. It was not otherwise observed during this study.

Carex styloflexa Buckley (Cyperaceae). Bent sedge. Rare.

Bent sedge is a spring flowering perennial herb that can be found in wooded bogs and wet forests in the AP and IP regions of KY. This species is known from a single voucher collected by Ross C. Clark along Fish Trap Branch in 1988. It was not otherwise observed during this study.

Carex tonsa (Fernald) E.P.Bicknell (Cyperaceae). Shaved Sedge. Rare.

Shaved sedge is a perennial graminoid that can be found in the shallow soils of rock outcrops and exposed forest edges in the AP region of KY and is reported by Weakley (2015) to be rare in this area. This species was found during this study on very

dry exposed rock outcrops on Sky Bridge in Wolfe County as well as a west facing cliff and rock outcrop on Hatton Ridge ca. 1 km south of the cemetery on Hatton Ridge Rd.

Carex woodii Dewey (Cyperaceae). Wood's sedge. Rare.

Wood's sedge is a spring flowering perennial herb that can be found on the moist slopes of cove forests in the AP region of KY (Jones 2005; Weakley 2015). It was collected during this project on the slopes below Sky Bridge.

Circaea alpina L. (Onagraceae). Alpine enchanter's-nightshade. Special Concern.

Alpine enchanter's-nightshade is a species of spring flowering perennial herb that can be found in on wet mossy ledges and in the spray behind waterfalls in the IP and AP regions of KY (Jones 2005; Weakley 2015). This species is known from six vouchers, with the most recent being from June 1988. It was not otherwise observed during this study.

Cleistesiopsis bifaria (Fernald) Pansarin & Barros (Orchidaceae). Small spreading pogonia. Rare.

Small spreading pogonia is a perennial spring flowering herb that can be found on dry ridgetops in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species is known from two vouchers, one collected by Dell Sasser along trail 223 in 1980, and one collected by Julian Campbell along Chimney Top Rock Ridge. It was not otherwise observed during this study.

Commelina virginica L. (Commelinaceae). Virginia dayflower. Rare.

Virginia dayflower is a spring flowering herb that can be found in wet woods and swamps across KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Dr. Ross C. Clark along the Red River in 1988. It was not otherwise observed during this study.

Cornus stolonifera Michx. (Cornaceae). Red osier dogwood. Rare.

Red osier dogwood is a spring/summer flowering shrub that is typically found in wet woods and swamps (Weakley 2015). This species is known from the RRG by one voucher collected in October 2004 by Dr. Ross C. Clark and was found in a xeric oak-pine-heath woods over sandstone along the trail from the Sky Bridge parking area to Sky Bridge. This an unusual habitat for this species according to the description Weakley (2015) gives, however this species is commonly known from sand dunes in it's northern range (Ross C. Clark, pers. comm.). It was not otherwise observed during this study.

Cypripedium parviflorum Salisb. var. *parviflorum* (Orchidaceae). Small yellow lady's-slipper. Threatened.

Small yellow lady's-slipper is a spring flowering perennial herb that grows in mesic lowland forests in the AP region of KY (Jones 2005; Weakley 2015). This taxon was collected as a part of this study. There was also one voucher found that was collected by Dell Sasser in 1979 along Greasy Branch. The more common variety *C.*

parviflorum var. *pubescens* (Willd.) Knight is found infrequently in the RRG in mesic forests.

Cystopteris tenuis (Michx.) Desv. (Cystopteridaceae). Mackay's bladder fern. Rare.

Mackay's bladder fern is a perennial fern that can be found on moist cliffs and rock outcrops across KY (Jones 2005; Weakley 2015). This species is known from two vouchers collected by Julian Campbell, one collected on Mariba Fork in 1988, and one collected on Sarges Branch in 1988. It was not otherwise observed during this study.

Dendrolycopodium hickeyi (W.H. Wagner, Beitel & R.C. Moran) A. Haines (Lycopodiaceae). Hickey's tree-clubmoss. Rare.

Hickey's tree-clubmoss is a perennial herb that can be found sandy hardwood forests in the AP region of KY. This species was collected during this project on a cliff edge in the vicinity of Angel Windows and on a cliff edge on a ridge south of Dark Hollow. It is also known from a voucher collected by Thomas McCoy on Pine Ridge in 1959.

Diarrhena obovata (Gleason) Brandenburg (Poaceae). Western beakgrain. Rare.

Western beakgrain is a perennial graminoid that can be found in rich alluvial forests across KY (Jones 2005; Weakley 2015). It is known from a single voucher collected by Ross C. Clark along the Red River in 1988. It was not otherwise observed during this study.

Dichanthelium columbianum (scribner) Freckman (Poaceae). American witchgrass.
Rare.

American witchgrass is a perennial graminoid that can be found over sandy thin soil in open areas across KY (Jones 2005; Weakley 2015). This species was collected during this project on a sandstone outcrop along Hatton Ridge. It is also known from three vouchers collected by Julian Campbell, one collected on Auxier Ridge in 1988, one collected along Rock Bridge Trail in 1988, and one collected on a ridge west of Nada Tunnel in 1988.

Erythronium umbilicatum Parks & Hardin spp. *umbilicatum* (Liliaceae). Dimpled trout lily. Rare.

Dimpled trout lily is a perennial spring flowering herb that occurs in rich mesic forests in the AP region of KY (Jones 2005; Weakley 2015). This species was collected twice during this project along Indian Creek and along the in the bottoms adjacent to the Gladie Visitor Center. This species differs from the more common *E. americanum* by the lack of auricles at the base of the petals. Although this species was previously reported for the state, all records had recently been dismissed as misidentifications (Ronald Jones, pers. comm.) The two vouchers reported here are possible state records for this species, with the exception of one older voucher deposited at the Marshall University Herbarium (MUHW) that should be checked.

Erigeron pulchellus Michx. var. *brauniae* Fernald (Asteraceae). Robin's-plantain. Rare.

This variety of robin's-plantain is a spring flowering herb that is found in the AP region of KY (Jones 2005; Weakley 2015). It is known from a single voucher collected by J. Campbell in May 1988 along the Red River. It was not otherwise observed during this study. This variety has glabrous hairs as compared to *Erigeron pulchellus* Michx. var. *pulchellus* which is more common throughout the state.

Hieracium scabrum Michx. (Asteraceae). Sticky hawkweed. Rare.

Sticky hawkweed is a summer flowering herb that can be found in open woods and fields across KY (Jones 2005; Weakley 2015). It is known from a single voucher collected by Johnny Faulkner in October 1979 near Chimney Top Rd. It was not otherwise observed during this study. This species is considered rare by Jones (2005), however Weakley (2015) considers it to be infrequent in our area.

Juglans cinerea L. (Juglandaceae). White walnut. Special Concern

White walnut is a deciduous tree that can be found in nutrient-rich mesic forests across KY (Jones 2005; Weakley 2015). This species was collected during this project. It is also known from two previously collected vouchers collected by Johnny Faulkner and Ross C. Clark. This species is threatened by a fungus (butternut canker; Jones 2005).

Lilium philadelphicum L. (Liliaceae) Wood lily. Threatened.

Wood lily is a summer flowering perennial herb that can be found in open woodlands especially over thin soils in the AP region of KY (Jones 2005; Weakley

2015). There was one voucher at MDKY collected by Frank McFarland in June 1940. This species was not observed otherwise during this study. It was last seen in 1987. It should be searched for on dry oak forest ridgetops in the vicinity of Sky Bridge, as well as ridgetops that have recently been burned.

Liparis loeselii (L.) Rich. (Orchidaceae). Loesel's twayblade. Threatened.

Loesel's twayblade is a perennial spring flowering herb that occurs in wet woods, seeps and bogs in the AP region of KY. This species was collected during this study. This orchid was noted to be threatened with extirpation by exotic invasive species. A dense population of *Microstegium vimineum* was observed growing over much of the *L. loeselii* population, with other exotic invasive species found at the same site including *Duetzia scabra*, *Lonicera japonica*, *Persicaria longiseta*, and *Rosa multiflora*.

Lycopodioides apoda (L.) Kuntze (Selaginelliaceae). Meadow spikemoss. Rare.

Meadow spikemoss is a lycophyte that can be found in wet meadows and streambanks across KY (Jones 2005; Weakley 2015). This species was collected during this project in Tight Hollow and along Parched Corn Creek. It is also known from two vouchers collected by Ross C. Clark, one along Stillwater Creek in 1988, and one along Sarges Branch in 1988.

Lysimachia borealis (Raf.) Manns & Anderberg (Primulaceae). Maystar. Endangered.

Maystar is a spring flowering perennial herb that occurs in rich mixed mesophytic forests in the AP region of KY (Jones 2005; Weakley 2015). It is known from two vouchers collected in 1988 by Julian Campbell. It was not otherwise observed during this study. The last report of this species is from 1988.

Lysimachia quadriflora Sims (Primulaceae). Smooth loosestrife. Rare.

Smooth loosestrife is a summer flowering herb that can be found in wet open woods in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species was collected in a seep along Osborn Bend Trail. It is also known from a voucher collected by Ross C. Clark along trail 214 in 1989.

Maianthemum canadense Desf. (Ruscaceae). Canada mayflower. Threatened.

Canada mayflower is a perennial spring flowering herb that is found in mixed mesophytic forests of the AP region in KY (Jones 2005; Weakley 2015). It was collected as a part of this study. There are also five vouchers that document this species being present in numerous locations around the RRG.

Melampyrum lineare Desr. var. *pectinatum* (Pennell) Fernald (Orobanchaceae). Pine-barren cow-wheat. Endangered.

Pine-barren cow-wheat is an annual, hemiparasitic, fall flowering, herb that can be found in dry sandy habitats of the AP region of KY (Jones 2005; Weakley 2015). It

is known from six vouchers, and last seen in 1988. It was not otherwise observed during this study. This is the only known location for this taxon in KY.

Monarda russeliana Nutt. ex Sims (Lamiaceae). White beebalm. Rare.

White beebalm is a perennial spring flowering herb that can be found in dry woods and thickets in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Ross C. Clark in a xeric oak-pine woods near the mouth of Spaas Creek in 1988.

Monotropsis odorata Schwein. ex Elliott (Ericaceae). Sweet pinesap. Threatened.

Sweet pinesap is a perennial, heteromycotrophic, spring flowering, herb that can be found in upland oak-pine forests, especially those with abundant heaths, in the AP region of KY (Jones 2005; Weakley 2015). This species was collected during this study. There is also one voucher collected in May 1995 by Kim Feeman.

Parietaria floridana Nutt. (Urticaceae). Florida pellitory. Rare.

Florida pellitory is an annual herb that is found in sandy soils in AP region of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by David Taylor in a rockhouse along Indian Creek in 1990. It was not otherwise observed during this study. This voucher is the only known voucher of this species in KY and was not a species reported by Jones (2005).

Phaseolus polystachios (L.) B.S.P. (Fabaceae). Wild bean. Rare.

Wild bean is a perennial herbaceous vine that can be found in thickets and woodlands across KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Johnny Faulkner near Hwy 715. It was not otherwise observed during this study. This species is considered rare by Jones (2005). However, Weakley (2015) considers this species infrequent.

Platanthera psycodes (L.) Lindl. (Orchidaceae). Purple fringed orchid. Endangered.

Purple fringed orchid is a summer flowering perennial herb that grows in moist forests, seeps, bogs and stream banks in the AP region of KY (Jones 2005; Weakley 2015). It is known from a single voucher collected by Joyce Norton in 1989. It was not otherwise observed during this study.

Podostemum ceratophyllum Michx. (Podostemaceae). Riverweed. Special Concern.

Riverweed is an aquatic perennial herb that grows attached to rocks in shallow streams in the IP and AP regions of KY (Jones 2005; Weakley 2015). It is known in the RRG from a voucher collected by Ross C. Clark in 1988 and a voucher collected by Max Medley in 1979. It was not otherwise observed during this study.

Primula frenchii (Vasey) Mast & Reveal (Primulaceae). French's shooting-star. Special Concern.

French's shooting-star is a spring flowering perennial herb that can be found in sandstone rock houses in the AP region of KY (Jones 2005; Weakley 2015). It is known

from a single voucher collected by Julian Campbell. It was not otherwise observed during this study.

Prosartes maculata (Buckley) A. Gray (Liliaceae). Spotted mandarin. Special Concern.

Spotted mandarin is a spring flowering perennial herb that can be found in rich mesophytic forests, especially cove forests in the AP and IP regions of KY (Jones 2005; Weakley 2015). It is known from two vouchers, one collected by K. Huie-Netting in 1996 and one collected by Ross C. Clark in 1988. It was not otherwise observed during this study. The population found by Ross C. Clark was noted to be extirpated by a tornado in 1989 (Ross C. Clark, pers. comm.).

Prunus mexicana S. Watson (Rosaceae). Mexican plum. Rare.

Mexican plum is a spring flowering tree that can be found along stream, fencerows, and in upland forests across KY (Jones 2005; Weakley 2015). This species was collected during this project along KY 613. It is also known a voucher collected by Ross C. Clark along Sarges Branch in 1988. This species is rare in the Appalachian Highlands of KY but is more common in western parts of the state.

Pseudognaphalium micradenium (Weatherby) Nesom (Asteraceae). Small rabbit tobacco. Historical.

Small rabbit tobacco is a fall flowering annual herb that was once known to occur in dry sandy woods in the AP region of KY (Jones 2005; Weakley 2015). One population of this species was reported by the KSNPC, however there were no existing

vouchers that could be found, and it was not observed during the study. The last sighting of small rabbit tobacco in the RRG was in 1938, and the species is now likely extirpated from the region. It should be searched for on dry open ridgetops.

Rhododendron prinophyllum (Small) Millais (Ericaceae). Early azalea. Rare.

Early azalea is a spring flowering shrub that can be found in upland oak forests in the AP region of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Johnny Faulkner along Chimney Top Rd. in 1980. It was not otherwise observed during this study.

Rhus typhina L. (Anacardiaceae). Staghorn sumac. Rare.

Staghorn sumac is a spring flowering shrub that can be found along roadsides, in old pastures, thickets, and clearings across KY (Jones 2005; Weakley 2015). It was collected during this study in a thicket that borders Spaas Creek. It is also known from a voucher collected by Dell Sasser in 1979 along Grays Branch.

Salvia azurea Michx. ex Lam. var. *grandiflora* Bentham (Lamiaceae). Blue sage. Rare.

Blue sage is a perennial fall flowering that is known from sandy rock open woods in the IP and ME regions of KY (Jones 2005; Weakley 2015). This species has not yet been documented in the Appalachian Highlands of KY by Jones (2005) or Weakley (2015). It is known from a single voucher collected by Ross C. Clark on the slopes around Indian Creek in 1989. It was not otherwise observed during this study.

David Taylor (pers. comm.) reports that the area this was found in was on a slide repair site and had been seeded with a wildflower mix.

Sambucus racemosa L. var. *pubens* (Michx.) Traut. & Meyer (Adoxaceae). Red Elderberry. Endangered.

Red Elderberry is a spring flowering shrub that can be found in northern hardwood forests mostly at higher elevations in the AP region of KY (Jones 2005; Weakley 2015). One population of this taxon was reported by the KSNPC, however there were no existing vouchers that could be found, and it was not observed during this study. The last sighting was in 1978. It should be searched for along streambanks in rich woods.

Saururus cernuus L. (Saururaceae). Lizard's tail. Rare.

Lizard's tail is a perennial herb that is found in wetlands and along streambanks across KY (Jones 2005; Weakley 2015). This species is known from two vouchers, one collected by Ross C. Clark along the Red River in 1988, and one collected along the Red River in 1972. It was not otherwise observed during this study. This species is more common in the IP and ME regions of KY (Weakley 2015).

Scleria pauciflora Muhl. ex Willd. var. *caroliniana* A. Wood (Cyperaceae). Carolina nutrush. Rare.

Carolina nutrush is a summer flowering herb that can be found in dry forests and glades in the AP and IP region of KY (Jones 2005; Weakley 2015). This species is

known from a single voucher collected by Ross C. Clark along Rough Trail in 1988. It was not otherwise observed during this study.

Scutellaria saxatilis Riddell (Lamiaceae). Rock Skullcap. Threatened.

Rock skullcap is a summer flowering perennial herb that grows in mesic rocky forests in the IP and AP regions of KY (Jones 2005; Weakley 2015). It was collected during this project. It is also known from a voucher collected by Julian Campbell.

Solidago albopilosa E.L.Braun (Asteraceae). White-haired goldenrod. Threatened.

White-haired goldenrod is a fall flowering perennial herb that grows in sandstone rockhouses and under overhanging cliffs in the AP region of KY (Jones 2005; Weakley 2015). It is endemic to the RRG in Powell, Menifee, and Wolfe Counties. It was collected during this project and is known from six vouchers.

Solidago curtisii Torr. & A. Gray (Asteraceae). Curtis's goldenrod. Threatened.

Curtis's goldenrod is a fall flowering perennial herb that can be found on mesic forested slopes in the AP region of KY (Jones 2005; Weakley 2015). This species was collected during this study.

Stellaria longifolia Muhl. ex Willd. (Caryophyllaceae). Longleaf stitchwort. Special Concern.

Longleaf stitchwort is a spring flowering perennial herb that can be found in wet meadows and woods across KY (Jones 2005; Weakley 2015). This species is known

from a single voucher collected by Ross C. Clark. It was not otherwise observed during this study.

Symphotrichum puniceum (L.) A. Love & D. Love (Asteraceae). Purple-stem aster.

Rare.

Purple-stem aster is a fall flowering perennial herb that can be found in mesic to wet open woods and ditches in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species is known from two vouchers, one collected by Ross C. Clark along highway 715 in 1988, and one collected by Jerry Buskin along Rock Bridge Nature Trail in 1972. It was not otherwise observed during this study.

Taxus canadensis Marshall (Taxaceae). Canada yew. Threatened.

Canada yew is a shrub that can be found in mixed mesophytic forests in the AP region of KY (Jones 2005; Weakley 2015). It has been noted that deer can have a devastating effect on this species (Weakley 2015). It is known from eight vouchers the most recent of which was collected in 2014 by Robert Pace. It was not otherwise observed during this study.

Thalictrum mirabile DC. (Ranunculaceae). Rockhouse meadowrue. Rare.

Rockhouse meadowrue can be found along wet sandstone cliffs in the AP region of KY (Jones 2005; Weakley 2015). This species is known from a single voucher collected by Landon McKinney below cliffs in Menifee County in 1988. It was also observed during this study below cliffs in Tight Hollow. Rockhouse meadowrue is a southern Appalachian endemic and is most common in the Cumberland Plateau.

Triphora trianthophora (Swartz) Rydberg var. *trianthophora* (Orchidaceae). Three birds orchid. Rare.

Three birds orchid is a perennial spring flowering herb that can be found in mixed mesic forests across KY (Jones 2005; Weakley 2015). It was collected during this project along a tributary to the Red River. This species is of small stature and has a very short flowering period and is often not seen as a result.

Vandenboschia boschiana (Sturm) Ebihara & K. Iwatsuki (Hymenophyllaceae). Appalachian filmy fern. Rare.

Appalachian filmy fern is a perennial fern that can be found growing on the moist walls of overhanging cliffs and rockhouses in the AP and IP regions of KY (Jones 2005; Weakley 2015). This species is known from three vouchers, one collected by Max Medley in 1978, one collected by Ross C. Clark in the vicinity of Nada Tunnel in 1988, and one collected by Elizabeth Browne in the vicinity of Nada Tunnel in 1960. It was also observed during this project at the Nada Tunnel location.

Viola incognita Brainerd (Violaceae). No common name. Rare.

V. incognita is a perennial spring flowering herb that can be found in rich mesic forests in the AP and IP regions of KY (Weakley 2015). This species was collected during this project at the mouth of a rockhouse on a tributary of Clear Branch. *V. incognita* is circumscribed as a synonym of the more common *V. blanda* Willd. by Jones (2005). However, Weakley (2015) considers *V. incognita* distinct and rare across its range in the southern Appalachians.