

A Vascular Flora of Lynch's Woods Park, Newberry County, South Carolina

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ABSTRACT Lynch's Woods Park (Newberry County, South Carolina) was floristically surveyed between 2002 and 2005. The Park features north-facing slopes, granite outcrops, and several small streams within the Piedmont physiographic province. A total of 528 vascular plant species were documented within the 101.2 ha, including 91 (17%) nonnatives. Three species, *Anemone berlandieri*, *Eurybia mirabilis*, and *Rhododendron eastmanii* were rare species. Analysis of community structure revealed that most of the area was a mixed mesophytic forest, with the upland sites developing toward an oak-hickory forest.

INTRODUCTION Lynch's Woods Park is located in Newberry County, South Carolina. The 101.2-hectare (250 acres) Park is administered by Newberry County and is actively used by hikers, joggers, bikers, picnickers, and horseback riders. Recently, the Palmetto Trail, a coast-to-mountain hiking trail within South Carolina in the process of construction, was opened within the park (more information on the Palmetto Trail may be obtained at www.palmettoconservation.org).

The Park was originally part of a 283 ha (700 acre) tract of farmland owned by Reverend Elijah Lynch (Boswell 2001). The property was deeded to Job Johnstone in 1849. During the Depression, the land was deeded to Newberry City and County. Subsequently, the property was subdivided to produce Lynch's Woods Park and the county fairgrounds, the two being bisected by a highway (US Highway 76). In 1936, the Civilian Conservation Corps constructed a 6.9 km (4.3 mi) dirt road through the park (Figure 1). The construction included a camp. Yet, over the next 50 yr the park had limited use. In 1991, the Newberry Soil and Water Conservation District obtained a grant to improve the park. Included in the improvements were the addition of a parking area, restroom facilities, a picnic pavilion and well-marked trails throughout the Park.

Lynch's Woods Park is within the Piedmont physiographic province (Barry 1980) with an elevation variation from 130 m (420 ft) at the

eastern end of the Park (Figure 1) to just over 170 m (550 ft) at the western end (elevations above sea level are from the Newberry East Quadrangle, USGS topographic map). Included in the topographical variation are several steep north-facing slopes along Rocky Branch Creek, a tributary of Cannons Creek, which flows eastward into the Broad River. Geologically, Lynch's Woods area has a combination of several underlying rock types, including mylonitic biotite gneiss, granitoid, and amphibolite (Niewendorp and Clendenin 1995). The granitoid portions commonly outcrop within the park producing areas of shallow soil or exposed rock, especially along slopes and ravines.

Two powerline cuts are on park property (Figure 1). One runs in a north-south direction and passes through the western end of the park. The second cut forms the southern boundary along the western half of the park, then bisects the eastern portion of the park. From personal observation over the last twenty years, the powerline cuts have been maintained through a combination of mowing and herbicide spraying accomplished in the fall.

Included within the park are a number of large individual specimens of American beech (*Fagus grandifolia* Ehrh.), loblolly pine (*Pinus taeda* L.) and white oak (*Quercus alba* L.). Yet, natural disasters have damaged portions of Lynch's Woods Park over the last quarter century. In March 1984, a series of severe storms, including high winds and tornados damaged downtown Newberry

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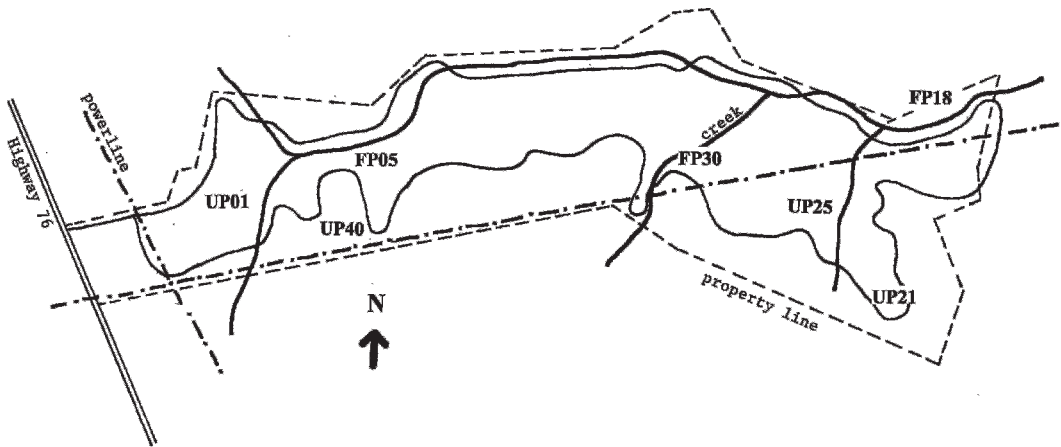


Figure 1. Map of Lynch's Woods showing streams, roads, powerline cuts and location of community plots.

(Freeland 1984). Damage was also realized within the park and, as a result about four hectares (10 acres) of land was clearcut that summer. In July 2000 a thunderstorm created severe damage to several areas of the park (pers. obs.). The winds associated with this storm knocked down over 100 mature trees, including individuals of loblolly pine, tulip poplar (*Liriodendron tulipifera* L.) and white oak. As a result of both of these natural disasters, openings were generated within the woodland that quickly allowed for growth of seedlings (mostly loblolly pine) and saplings.

In 2000, I discovered that Lynch's Woods Park, along with other locations in the Piedmont of South Carolina, contained May-white azalea (*Rhododendron eastmanii* Kron & Creel), a recently described species of azalea (Kron and Creel 1999). As part of a project to determine the size of the *R. eastmanii* populations and determine the associated species (Horn 2005), I realized a high diversity of species was present within the park. The object of this study was to document vascular plant species located within the park and to characterize woodland communities, as seen in 2002 through 2005.

MATERIALS AND METHODS From May 2002 through September 2003, monthly botanical surveys of the park were completed to document the vascular flora of the park. Subsequent visits to Lynch's Woods Park through August 2005 resulted in further findings. During each visit surveys were conducted by walking along the road, power line cuts, and tracing several transects

through the woodlands. The woodland transects were designed specifically to investigate stream bottoms, ridge tops and slopes. A cumulative species list was generated and voucher specimens of almost all encountered vascular plant species were collected. Voucher specimens were deposited in the Newberry College Herbarium (NBYC). In the case of several trees, vegetative vouchers were collected as flowering or fruiting material was never seen. In an attempt to determine the level of disturbance, the number of introduced species was determined with reference to Weakley (2005).

In addition to the species list, the woodland community types were delineated. Locations selected for analysis were chosen to represent the diversity of community types based on elevation (floodplain vs. upland) and visual dominants (pine vs. hardwood). Three floodplain sites were selected, one was at the lowest elevation within the park (abbreviated as FP18), one with a visual dominance of loblolly pine (*Pinus taeda*) within its canopy (FP30), and the third had a mixture of hardwood species (FP05). Four upland sites were sampled. Two of the upland sites (UP01 and UP25) were of a mixed pine-hardwood composition. The woodland plot at the highest elevation (UP21) was selected as it was visually dominated by hickory (*Carya* sp.). The other upland site (UP40) was dominated by winged elm (*Ulmus alata* Michx.).

At each of the seven sites the most important species was determined using the quantitative methods outlined by Pederson et al. (1997). This involved the random selection of

six 0.053 ha circular plots (13 m radius) within each community. For each of the seven plots, all woody plants over 2.5 cm diameter at breast height (DBH, 1.3 m above ground) were measured for DBH and identified to species. Relative density (RD) and relative basal area (RBA) were calculated for each community type. The importance value (IV) for saplings and trees was calculated as the sum of RD and RBA, with a total IV for each site being 200. The most important tree species at each site were then compared against the community types of South Carolina, as described by Nelson (1986).

RESULTS

Species composition

A total of 528 vascular plant taxa were documented and identified from Lynch's Woods Park, including 13 ferns and fern allies, 3 gymnosperms, and 512 angiosperms (Appendix). The largest families represented include the Poaceae (78 species), Asteraceae (66 species), Fabaceae (36 species), and the Cyperaceae (24 species). Of the species discovered, 91 (17.2%) are considered nonnative.

Two species are on the South Carolina Heritage Trust list of rare plants: *Rhododendron eastmanii* and *Anemone berlandieri* Pritzel. The former is very common along north-facing slopes above the streams while the latter is only found within an oak-hickory forest. A third species, *Eurybia mirabilis* (Torr. & A. Gray) G. L. Nesom is not listed by the Heritage Trust, but Weakley (2005, p. 138) states it is an endemic of North Carolina and South Carolina and is a "US species of concern." This species is occasional along slopes next to the streams.

Preliminary research (unpubl. data) suggests that one taxon found is of hybrid origin, and is here designated as *Asimina parviflora* (Michx.) Dunal \times *Asimina triloba* (L.) Dunal.

Communities

A total of 45 woody species were measured as part of the community structure study (Table 1). The richest woody species density was measured at FP05 (32) while the lowest density was at UP05 (18). Four species were found within all seven analyzed communities, *Pinus taeda*, *Quercus alba*, *Fraxinus americana* L., and *Liquidambar styraciflua* L. *Pinus taeda* was the most important species at two of the seven sites, as measured by IV values.

The floodplain sites were quite different in terms of species composition with only one species, *Carpinus caroliniana* Walter consistently of high importance at each site (Table 1). At FP05 the most important species (importance values over 20) were *Carpinus caroliniana* (an importance value of 30.8), *Liquidambar styraciflua* (26.3), and *Quercus alba* (20.8). Other important trees included *Liriodendron tulipifera* L. (19.6), *Acer leucoderme* Small (15.2), and *Cornus florida* L. (13.4). FP18 was dominated by *Liquidambar styraciflua* (56.7), *Liriodendron tulipifera* (41.0), *Ulmus americana* L. (30.6), and *Carpinus caroliniana* (22.1). The most important species at FP30 were *Pinus taeda* (74.2) and *Carpinus caroliniana* (29.0). Other important trees included *Acer rubrum* L. (17.0) and *Liquidambar styraciflua* (14.8).

Like the floodplain, the upland sites were dominated by a diversity of species (Table 1). The only species consistently of importance was *Pinus taeda*. At UP01, the most important species were *Quercus alba* (41.4), *Liriodendron tulipifera* (31.1), *Pinus taeda* (25.1), *Liquidambar styraciflua* (24.8), and *Quercus rubra* L. (20.5). UP21 contained *Carya glabra* (Mill.) Sweet (41.1), *Fraxinus americana* (33.0), *Quercus alba* (24.3), *Carya ovata* (Mill.) K. Koch (24.2), *Juniperus virginiana* L. (22.2), *Quercus velutina* Lam. (20.2), and *Pinus taeda* (15.0). The most important species at UP25 was *Pinus taeda* (70.3). Also of importance were *Cornus florida* (26.4), *Quercus alba* (21.3), and *Acer rubrum* (15.8). At the fourth site, UP40, the most important species were *Ulmus alata* (63.5), *Pinus taeda* (43.0), *Liquidambar styraciflua* (20.8), and *Juniperus virginiana* (16.6).

DISCUSSION

Species composition

Use of a species-area curve generated by Wade and Thompson (1991) for the mixed mesophytic forest region predicts that Lynch's Woods should have about 458 species. Hence, the presence of 528 species within the Park is 70 (15.2%) above that calculated by the equation. The greater diversity is most likely related to the numerous habitats associated with the Park's topographical variation (including steep slopes), the maintained power-line cuts, and variation in soil depth due to granitic outcrops.

Most of the nonnative species present were not considered a serious threat to the native

Table 1. Importance values (IV) of woody species at seven sites within Lynch's Woods Park. Sites where a species was present, but not part of the statistical sample, are indicated by a plus (+)

SPECIES	FP05	FP18	FP30	UP01	UP21	UP25	UP40
<i>Acer floridanum</i>					7.6	8.2	1.9
<i>Acer leucoderme</i>	15.2	0.4	5.1				
<i>Acer negundo</i>	2.1						
<i>Acer rubrum</i>	7.9		17.0	9.2		15.8	3.8
<i>Aralia spinosa</i>			2.8				
<i>Carpinus caroliniana</i>	30.8	22.1	29.0	4.2			
<i>Carya alba</i>		+	4.9	17.4		9.9	
<i>Carya glabra</i>	9.7				41.1		7.0
<i>Carya ovata</i>					24.2		
<i>Celtis georgiana</i>	+				0.3	+	+
<i>Celtis laevigata</i>	+	19.7		0.6			0.2
<i>Cercis canadensis</i>		2.4	6.1	0.6	2.2	3.6	
<i>Cornus florida</i>	13.4	0.4	4.4	11.7		26.4	1.1
<i>Diospyros virginiana</i>	0.4				+		
<i>Fagus grandifolia</i>	7.8	0.9	10.9	4.7		1.3	1.7
<i>Frangula caroliniana</i>	0.4	+					
<i>Fraxinus americana</i>	8.0	1.5	10.4	5.5	33.0	1.9	6.6
<i>Halesia carolina</i>	0.9	1.4					
<i>Ilex decidua</i>					0.3	+	
<i>Ilex opaca</i>		+				1.0	+
<i>Juglans nigra</i>	0.9	+					
<i>Juniperus virginiana</i>	0.9	1.0	+		22.2	0.7	16.6
<i>Ligustrum sinense</i>	+	0.3	+	+			
<i>Lindera benzoin</i>	0.4	+					
<i>Liquidambar styraciflua</i>	26.3	56.7	14.8	24.8	+	2.9	20.8
<i>Liriodendron tulipifera</i>	19.6	41.0	8.4	31.1		6.9	+
<i>Magnolia acuminata</i>	0.5		+				
<i>Morus rubra</i>	0.6	1.7	+		2.0		+
<i>Nyssa sylvatica</i>	0.4		0.9			6.8	0.7
<i>Oxydendrum arboreum</i>			1.6	1.3		1.9	
<i>Pinus echinata</i>					2.4		2.0
<i>Pinus taeda</i>	14.1	15.4	74.2	25.1	15.0	70.3	43.0
<i>Platanus occidentalis</i>		0.5	+				
<i>Prunus caroliniana</i>	0.9	0.4					
<i>Prunus serotina</i>	+	+	+	1.2	+	1.7	0.9
<i>Quercus alba</i>	20.8	3.3	1.6	41.4	24.3	21.3	10.8
<i>Quercus falcata</i>					+	1.6	0.2
<i>Quercus nigra</i>	0.4	+	+		+		6.4
<i>Quercus phellos</i>		+		+	+	+	0.9
<i>Quercus rubra</i>	8.6		4.4	20.5			10.4
<i>Quercus velutina</i>	4.4	+			20.2	6.0	1.1
<i>Ulmus alata</i>	+				4.8	+	63.5
<i>Ulmus americana</i>	4.4	30.6	2.9	0.6	0.2	11.2	
<i>Vaccinium arboreum</i>							0.4
<i>Viburnum prunifolium</i>						0.7	
<i>Vitis rotundifolia</i>	+	0.4	0.5				
IV TOTAL FOR SITE	199.8	200.1	199.9	199.9	199.8	200.1	200.0
TOTAL NUMBER SPECIES RECORDED	32	28	25	18	21	24	25

species within the Park. Several species, including *Hedera helix* L., *Ilex crenata* Thunb., *Ligustrum japonicum* Thunb., *Liriope muscari* (Decne.) Bailey, and *Nandina domestica* Thunb. are rare within the park and are probably introductions from an adjacent residential subdivision. They are all represented within the park by fewer than ten individuals each. Two species appear to have

been planted in a former picnic area, *Pachysandra terminalis* Siebold & Zucc. and *Hemerocallis fulva* (L.) L.; these two have not spread outside a small area near some concrete picnic tables.

Several nonnative species are clearly common and have a potential for additional spread. *Elaeagnus umbellata* Thunb. has produced a thicket in one area of the Park and

the related *Elaeagnus pungens* Thunb. is represented by scattered individuals. *Murdannia keisak* (Hassk.) Hand.-Mazz. is common along the streambeds in several areas. *Microstegium vimineum* (Trin.) A. Camus is common along roadsides and on floodplains in several areas. Three of these four species (all except *Murdannia keisak*) have been documented as weedy to the point of potentially excluding native species in other areas within the Piedmont of South Carolina (Miller 2003). The spread and domination of these species may reduce the diversity of other plant species within a community.

Communities

Most of the woodland at Lynch's Woods can be classified as a Mesic Mixed Hardwood forest and probably accounts for about 75% of the entire woodland area of the Park (Figure 1). Four of the seven communities sampled (FP05, FP30, UP01, and UP25) clearly fit into this forest type, as delineated by Nelson (1986). This community is described as containing a wide variety of hardwood canopy and subcanopy species along slopes, including *Fagus grandifolia*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, and *Quercus* spp. The presence of *Carya* spp. and a circumneutral soil pH (pers. obs.) suggests that this area could also be considered a Basic Forest. These two community types are relatively hard to distinguish based on canopy species composition (Nelson 1986). In most of the woodland, *Pinus taeda* is a remnant of the succession process, especially at FP30, UP25, and UP01. In addition, *Pinus taeda* will continue to be an important species as a result of the effect of storms, as seen in 1984 and 2000.

The floodplain at FP18, which is at the lowest elevation within the park, can be considered a developing Bottomland Hardwood Forest. In addition to the relatively flat topography, several floodplain canopy species are abundant, including *Celtis occidentalis* L., *Liquidambar styraciflua*, and *Ulmus americana*. A typical wetland subcanopy tree, *Carpinus caroliniana*, is also abundant. Interestingly, Nelson (1986) also includes Small Stream Forest to describe the seasonally flooded lowlands bordering small streams. In the case of Lynch's Woods Park, the absence of some typical floodplain species (*Quercus lyrata* Walter and *Quercus michauxii* Nutt.), as seen in other areas of Newberry County (pers. obs.),

suggests that this area of Lynch's Woods Park is not developed into an ideal example of a Bottomland Hardwood forest.

An upland Oak-Hickory forest community occurs at UP21. The dominance of multiple species of hickories and oaks accounts for over half of the canopy species present. The relatively dry nature of this site is partially seen in several granitic rock outcrops. In addition, a state-listed rare species, *Anemone berlandieri* Pritzel, has been found within the community. UP40 is an unusual community, being dominated by *Ulmus alata* and *Pinus taeda*. The presence of hickories and some oak species suggest this may be a younger site that UP21, but developing toward a similar climax of an oak-hickory forest.

It is clear from the combined data of the diversity of species found, the presence of rare species, and the healthy examples of Mixed Mesophytic and Oak-Hickory Forests that Lynch's Woods Park is an unusual tract of land. Every effort should be made to preserve the Park as an example of communities within the Piedmont of South Carolina.

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APPENDIX List of species collected at Lynch's Woods Park, 2002–2005. An asterisk (*) in front of an entry indicates a nonnative species. An exclamation point (!) in front of an entry indicates a taxon for which a voucher was not collected. All voucher collection numbers are those of Charles N. Horn. Taxonomy follows Weakley (2005).

FERNS AND FERN ALLIES

ASPLENIACEAE

Asplenium platyneuron (L.) Britton, Stearns & Poggenb. – 13932

BLECHNACEAE

Woodwardia areolata (L.) T. Moore – 13749

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn – 13946

DRYOPTERACEAE

Athyrium asplenioides (Michx.) Eaton – 14915

Onoclea sensibilis L. – 15941

Polystichum acrostichoides (Michx.) Schott – 13741

OPHIOGLOSSACEAE

Botrypus virginianus (L.) Holub – 13776

Sceptridium dissectum (Spreng.) Lyon – 14228

OSMUNDACEAE

Osmunda cinnamomea L. – 14587

Osmunda regalis L. – 14588

POLYPODIACEAE

Pleopeltis polypodioides (L.) E. G. Andrews & Windham – 14429

PTERIDIACEAE

Adiantum pedatum L. – 13826

THELYPTERIDACEAE

**Macrothelypteris torresiana* (Gaudich.) Ching – 14838

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. – 13937

PINACEAE

Pinus echinata Mill. – 14365

Pinus taeda L. – 13906

ANGIOSPERMS

ACANTHACEAE

Ruellia caroliniensis (J. F. Geml.) Steud. – 13921

ADOXACEAE

Sambucus canadensis L. – 14596

Viburnum acerifolium L. – 14354

Viburnum prunifolium L. – 13960

AGAVACEAE

Yucca filamentosa L. – 15255

ALISMACEAE

Alisma subcordatum Raf. – 14814

ALLIACEAE

Allium canadense L. – 13752, 14593

**Allium vineale* L. – 14592

ALTINGIACEAE

Liquidambar styraciflua L. – 14196

ANACARDIACEAE

Rhus copallinum L. – 13972

Rhus glabra L. – 14580

Toxicodendron radicans (L.) Kuntze – 13818

ANNONACEAE

Asimina parviflora (Michx.) Dunal – 14450

Asimina triloba (L.) Dunal – 14384

Asimina parviflora (Michx.) Dunal × *Asimina triloba* (L.) Dunal – 16179

APIACEAE

- Angelica venenosa* (Greenway) Fernald – 13979
Chaerophyllum tainturieri Hook. – 13822
 **Daucus carota* L. – 14519
Daucus pusillus Michx. – 14581
Ligusticum canadense (L.) Britton – 15071, 15914
Sanicula canadensis L. – 13748
Sanicula marilandica L. – 13910
Sanicula smallii E. P. Bicknell – 14151
Zizia aptera (A. Gray) Fernald – 14261

APOCYNACEAE

- Amsonia tabernaemontana* Walter – 14432
Apocynum cannabinum L. – 13794, 14432
Asclepias amplexicaulis Sm. – 13802
Asclepias tuberosa L. – 14600
Gonolobus suberosus (L.) R. Br. – 13961
Matelea decipiens (Alexander) Woodson – 13489
Trachelospermum diffusum (Walter) A. Gray – 13817

AQUIFOLIACEAE

- **Ilex crenata* Thunb. – 15713
Ilex decidua Walter – 13919, 14355
Ilex opaca Aiton – 13991

ARACEAE

- Arisaema triphyllum* (L.) Schott – 14925

ARALIACEAE

- Aralia spinosa* L. – 13452
 **Hedera helix* L. – 14376
Hydrocotyle verticillata Thunb. – 14182

ARISTOLOCHIACEAE

- Aristolochia serpentaria* L. – 13727
Hexastylis arifolia (Michx.) Small – 13743

ASTERACEAE

- Ageratina aromatica* (L.) Spach – 14251
Ambrosia artemisiifolia L. – 13450
Antennaria plantaginifolia (L.) Richardson – 14472
Baccharis halimifolia L. – 14361
Bidens bipinnata L. – 14168
Bidens vulgata Greene – 14226
Brickellia eupatorioides (L.) Shinnars – 16103
 **Centaurea cyanus* L. – 13811
Chrysogonum virginianum L. var. *australe* (Alexander ex Small) Ahles – 14471
Chrysopsis mariana (L.) Elliott – 14244
Cirsium horridulum Michx. – 13855
 **Cirsium vulgare* (Savi) Ten. – 13904
Conoclinium coelestinum (L.) DC. – 14223
Conyza canadensis (L.) Cronquist – 14218
 **Crepis pulchra* L. – 13782
Eclipta prostrata (L.) L. – 14206
Elephantopus carolinianus Raeusch. – 14133, 15075
Elephantopus tomentosus L. – 15076
Erechtites hieracifolia (L.) Raf. ex DC. – 14224
Erigeron annuus (L.) Pers. – 14520
Erigeron strigosus Muhl. ex Willd. – 14589
Eupatorium capillifolium (Lam.) Small – 14246
Eupatorium hyssopifolium L. – 14154
Eupatorium leucolepis (DC.) Torr. & A. Gray – 14256
Eupatorium rotundifolium L. – 15506
Eupatorium serotinum Michx. – 14204

- Eurybia mirabilis* (Torr. & A. Gray) G. L. Nesom – 14352, 15940, 16036
Euthamia tenuifolia (Pursh) Nutt. – 14356
Eutrochium purpureum (L.) E. E. Lamont – 13907
 **Facelis retusa* (Lam.) Sch. Bip. – 13801, 14470
Gamochaeta purpurea (L.) Cabrera – 13747
 **Helenium amarum* (Raf.) H. Rock – 13938
Helianthus atrorubens L. – 14172
Heterotheca subaxillaris (Lam.) Britton & Rusby – 14000
Hieracium gronovii L. – 14155
Hieracium venosum L. – 15833
 **Hypochaeris brasiliensis* (Less.) Griseb. – 14506
 **Hypochaeris radicata* L. – 13770
Krigia cespitosa (Raf.) K. L. Chambers – 14464
Krigia dandelion (L.) Nutt. – 14400, 14427
Krigia virginica (L.) Willd. – 14400, 14455
Lactuca canadensis L. – 14141, 15943
Lactuca floridana (L.) Gaertn. – 15069
 **Leucanthemum vulgare* Lam. – 13804
Mikania scandens (L.) Willd. – 14126
Packera anonyma (Wood) W. A. Weber & A. Love – 14469
Packera glabella (Poiret) C. Jeffrey – 14461
Pluchea camphorata (L.) DC. – 14231
Prenanthes serpentaria Pursh – 14241
Pseudognaphalium helleri (Britton) Anderb. – 14264
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