J. Ky. Acad. Sci. 63(1):53–64. 2002.

Vascular Flora of the Henderson Fork Road Surface-mined Area, Bell County, Kentucky

Barbara L. Rafaill and Ralph L. Thompson

Department of Biological Sciences, Georgetown College, Georgetown, Kentucky 40324 and Department of Biology, Berea College, Berea, Kentucky 40404

ABSTRACT

From 1986–2001, we conducted a descriptive study of the vascular flora on the 38-year-old Henderson Fork Road Surface-mined Area in Bell County, Kentucky. This 3.4 ha area had been contour mined for coal between 1962 and 1963 and then hand-planted with *Robinia pseudoacacia* and seeded with a mixture of *Festuca elatior* and *Lespedeza cuneata*. We delineated seven habitats from the original highwall, bench, and outslope topographic positions created during mining. Our annotated list of vascular plants comprises 312 species in 201 genera from 82 families. Forty-one species (13%) are non-native. Taxa consist of Equisetophyta (1), Lycopodophyta (1), Polypodiophyta (10), Pinophyta (2), and Magnoliophyta (298). The most important families in species richness are Asteraceae (55), Poaceae (36), Cyperaceae (16), Fabaceae (15), and Rosaceae (13). Sørensen's Index of Similarity is a coefficient of 0.747 between the flora of Henderson Fork Road Surface-mined Area and a nearby larger prelaw coal-mined area. Species richness of the surface-mined area is comparable to that expected on unmined areas of the same size in the Mixed Mesophytic Forest Region.

INTRODUCTION

The Surface Mine Control and Reclamation Act of 1977 (SMCRA), or Public Law 95-87, was enacted to ensure that land surface-mined for coal was reclaimed to their original contours and planted with a 90% herbaceous vegetation cover to control erosion and stimulate productivity. Prior to that time in Kentucky, some efforts were made to reclaim coal surface mines. During the 1980s and 1990s, studies were conducted on the flora and vegetation of five pre-SMCRA mines that had been reclaimed between 1963 and 1975 in the Appalachian Plateaus Physiographic Province of Kentucky. The vascular flora of four of these surface-mined areas has been described: Lily in Laurel County (Thompson et al. 1984); Trace Branch in Rockcastle County (Thompson and Wade 1991); Log Mountain in Bell County (Thompson et al. 1996); and Fonde in Bell County (Wade and Thompson 1999). These four areas developed vegetation characterized by diverse plant communities with high species richness. Furthermore, these prelaw mine sites provided new habitats not found in the contiguous unmined areas or postlaw surface-mined areas.

This paper documents the flora and plant associations of the fifth reclaimed pre-SMCRA site, the Henderson Fork Road Surface-mined Area, a 38-year-old contour coal mine in Bell County, Kentucky. The objectives of our study are to: 1) document the vascular flora with representative herbarium vouchers; 2) describe the habitats, plant associations, and successional trends; and 3) compile an annotated list with origin of taxon, habitats, and relative abundance.

THE STUDY AREA

The Henderson Fork Road Surface-mined Area (HFR) is located on a W-SW mountain slope 20 km northwest of Middlesboro, Kentucky, in southwestern Bell County, at latitude 36° 38′ 21″ N and longitude 83° 51′ 34″ W near the junction of Kentucky Highways 74 and 3485 (Henderson Fork Road).

HFR is a 3.4 ha contour coal-mined site located within the Log Mountains of the Cumberland Mountain Section of the Appalachian Plateaus Province of Fenneman (1938). It is situated on a mid-slope position at ca. 686 m in elevation. HFR occurs on the Hignite Coal Bed at the base of the Hignite Formation in contact with the underlying Catron Formation of the Pennsylvanian System. The Hignite Formation is a sequence of interbedded siltstone, sandstone, claystone, and coal (Rice and Maughan 1978).

Forest soils of ridges and 2–70% slopes in the Log Mountains that have been surface mined for coal are classified as the Fairpoint and Bethesda soil series. These mixed soils are

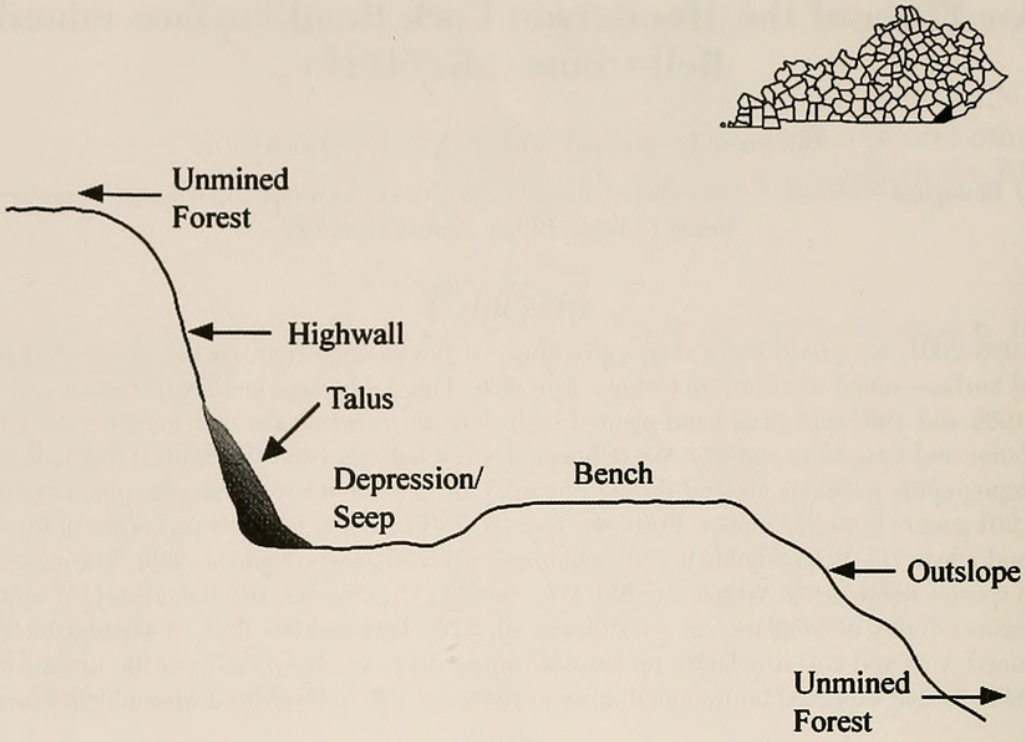

Figure 1. Configuration of the Henderson Fork Road Surface-mined Area ca. 38 years post-mining, Bell County, Kentucky.

typically acid to non-acid loamy-skeletal, very deep, well-drained, and moderately permeable Typic Udorthents (Childress 1992). A study of the outslope soils at HFR after the first 20 years showed a pH range of 4.6–4.9 in the top 30 cm, organic matter between 1.29 and 1.68%, and the beginning of soil profile development (Rafaill 1988).

The climate in the vicinity of the study site is classified as temperate humid continental with warm summers, cool winters, and abundant or adequate precipitation in all seasons (Trewartha 1968). However, periodic droughts do occur and often contribute to problems with fire. At the Middlesboro Weather Station during the 1961–1990 period, the mean annual precipitation was 130 cm including a mean snowfall of 37 cm. Mean annual temperature was 13.3°C with a mean summer maximum of 23°C and a mean winter minimum of −4°C. The mean growing season was 170 days based on 0°C (University of Kentucky Agricultural Weather Center 1995).

The forests of upper slopes and ridgecrests in the Log Mountains are described as the All Deciduous Mixed Mesophytic Community Type of the Mixed Mesophytic Forest Region by Braun (1950). This complex vegetation type is characterized by several important canopy species sharing dominance. Küchler (1964) mapped this region within the Mixed Mesophytic *(Acer-Aesculus-Fagus-Liriodendron-Quercus-Tilia)* Forest.

During 1962–1963, the study site area was contour mined for coal, which created the highwall, bench, and outslope topographic positions typical of prelaw mining (Figure 1). To facilitate revegetation for erosion control and nitrogen-fixation, the entire mine was seeded with a mixture of *Festuca elatior* and *Lespedeza cuneata* and hand-planted with *Robinia pseudoacacia* seedlings. This grass and legume combination was the standard reclamation mix used in the early-to-mid 1960s in the eastern United States (Vogel 1981). Although the mine received no postmining fertilizer or lime treatment, a well-established herbaceous cover of grass and legumes developed with good survival of *Robinia pseudoacacia.* By 1983, the HFR outslope supported saplings typical of the Mixed Mesophytic Forest Region, e.g., *Acer rubrum, Liriodendron tulipifera, Quercus rubra, Oxydendrum arboreum,* and *Robinia pseudoacacia* (Rafaill 1988).

METHODS

We conducted an intensive floristic survey of the entire Henderson Fork Road Surface-

Table 1. Classification of vascular plants at Henderson Fork Road Surface-mined Area.

Division	Family	Genera	Species	Native	Exotic	Species composition percent
Lycopodiophyta	1	1	1	1	0	0.3
Equisetophyta	1	1	1	1	0	0.3
Polypodiophyta	4	8	10	10	0	3.2
Pinophyta	2	2	2	2	0	0.6
Magnoliophyta	74	189	298	257	41	95.6
Magnoliopsida	63	148	224	194	30	71.8
Liliopsida	11	41	74	63	11	23.7
Total:	82	201	312	271	41	100.0

mined Area during the growing seasons of 1988 and 1989. Collecting trips were also made in 1986, 1987, 1993, 1996, and 2001. Voucher specimens were processed and deposited in the Berea College Herbarium (BEREA). References used for identification were Gleason and Cronquist (1991) and Strausbaugh and Core (1978). Classification and nomenclature follow Gleason and Cronquist (1991).

An annotated species list was compiled from field collections and includes origin of taxon (native or exotic), codes for habitats and relative abundance, and a representative voucher specimen number.

Species similarity between the 38-year-old HFR site and a comparable 25-year-old coal surface mine in Bell County, the Log Mountain Surface-mined Demonstration Area, was determined using Sørensen's Index of Similarity after Mueller-Dombois and Ellenberg (1974).

Species richness was determined from the species-area curve, $S = 272A^{0.113}$ where S is the number of species and A is the area in hectares (Wade and Thompson 1991). This compares the number of species expected in unmined areas of the same size within the Mixed and Western Mesophytic Forest Regions to those actually found at HFR.

Plant associations are plant communities with uniform habitat conditions, a characteristic physiognomy, and a definite floristic composition. Through plant collections and field survey work, we defined associations at HFR based on the existing surface-mined habitats, forest physiognomy, and the relative abundance of the characteristic trees, shrubs, woody vines, and herbs. Taxa are given in order of relative abundance in the section on Habitats and Associations.

RESULTS AND DISCUSSION

Floristic Analysis

We documented 312 species representing 201 genera in 82 families at HFR (Table 1). These taxa are comprised of 298 Magnoliophyta (74 Liliopsida, 224 Magnoliopsida), 2 Pinophyta, 10 Polypodiophyta, 1 Equisetophyta, and 1 Lycopodiophyta. Of these taxa, 271 (87%) were native and 41 (13%) were exotic (Table 1). The most important families in terms of species richness were Asteraceae (55), Poaceae (36), Cyperaceae (16), Fabaceae (15), and Rosaceae (13). These five families correspond to the five largest families for Kentucky as reported by Browne and Athey (1992). The most common genera represented were *Carex* (10) followed by *Aster*, *Solidago*, and *Panicum* (8 each). A special concern species in Kentucky, *Gentiana decora* (KSNPC 2000), was documented on the bench habitat.

Floristic Similarity

Sørensen's Index of Similarity was calculated for a comparison of the flora between HFR and a 25-year-old pre-SMCRA coal-mined area, the Log Mountain Surface-mined Demonstration Area (LMDA), a 14.2 ha contour mine at ca. 900 m located 1.2 km away. The Sørensen's Index of Similarity is 0.747 with 251 species common to the two sites. This significant coefficient would have been even higher if certain features between the two sites were more comparable, e.g., the younger LMDA had 24% greater surface area, 24 surviving planted reclamation species, 74 exotic

Table 2. Species-area relationships on five pre-SMCRA coal surface-mined areas in Kentucky.[1]

Surface-mined area	Area (ha)	Number known species	Number predicted species[2]	Percent deviation
Henderson Fork Road	3.4	312	312	−0.0
Log Mountain	14.2	360	367	−1.9
Lily	14.0	350	367	−4.6
Trace Branch	2.5	272	302	−9.9
Fonde	7.3	298	340	−12.6

[1] Modified from Wade and Thompson (1993).
[2] Based on a species-area prediction equation for the combined Mixed and Western Mesophytic Forest Regions (Wade and Thompson 1991).

species, and a total of 360 species overall (Thompson et al. 1996).

Species Richness

A predicted species richness for an unmined contiguous area was 312 species using the species-area curve (Wade and Thompson 1991). Actual species richness at HFR was 312 taxa, and thus, relative species richness (the actual number of species divided by the expected number of species) was 100% or precisely what was predicted by the species-area curve. Therefore, HFR is the most floristically rich of the five inventoried pre-SMCRA surface-mined areas in eastern Kentucky and is comparable to contiguous unmined land (Table 2).

Rare Species

The discovery of *Gentiana decora* at HFR is important because it is classified as a "special concern species" in Kentucky by the KSNPC (2000). One or more species currently on the 2000 Kentucky list of endangered, threatened, or special concern species have been found at each of the four previously studied pre-SMCRA surface-mined areas (Thompson et al. 1984; Thompson and MacGregor 1986; Thompson and Wade 1991; Thompson et al. 1996; Wade and Thompson 1993). None of these rare species were found in adjacent unmined areas during initial or subsequent floristic reconnaissances. Pre-SMCRA surface-mined areas have provided unique disturbed habitats as "refugia" where rare species have become established (Thompson and Wade 1991; Thompson et al. 1996).

Habitats and Associations

The highwall, bench, and outslope were the three initial topographic positions created by surface mining at HFR. Each of the positions has developed varying habitats which now support distinctive plant associations (plant communities) of trees, shrubs, woody vines, and herbs.

Highwall. A 5–8 m contour highwall is contiguous to the bench and parallel to the outslope for the entire length of the mined area (Figure 1). The highwall ranges from a 90° slope to less than 45° as a result of erosion and subsequent talus accumulation. Two highwall habitats were identified, xeric eroded highwall and mesic eroded highwall.

The xeric eroded highwall is an open area characterized by severe soil erosion and exposed sandstone strata. This habitat supports the *Acer-Oxydendrum-Danthonia* Association. Diagnostic trees are *Acer rubrum, Liriodendron tulipifera, Oxydendrum arboreum,* and *Nyssa sylvatica. Rubus allegheniensis, Rhus copallinum, Vaccinium corymbosum, Smilax rotundifolia,* and *Toxicodendron radicians* are found in the shrub and woody vine layer. Indicator herbs are *Danthonia compressa, Andropogon virginicus, Panicum lanuginosum, Aristida dichotoma, Aster paternus, Coreopsis major, Solidago arguta, Lysimachia quadrifolia, Campanula divaricata,* and *Lespedeza intermedia.*

The mesic eroded highwall constitutes the majority of the overall highwall. The more shaded, moist conditions of this habitat have promoted establishment of characteristic perennial species of the Mixed Mesophytic Forest. The *Acer-Liriodendron-Hydrangea-Microstegium* Association is characteristic of this habitat. Diagnostic canopy trees are *Acer rubrum, Liriodendron tulipifera, Acer saccharum, Nyssa sylvatica, Fraxinus americana, Quercus rubra,* and *Q. prinus.* Indicator shrubs and woody vines are *Hydrangea arborescens, Clematis virginiana, Sambucus canadensis, Toxi-*

codendron radicans, and *Parthenocissus quinquefolia*. The naturalized *Microstegium vimineum* is the predominant herb of the mesic highwall. Other characteristic herbs include *Impatiens pallida, Eupatorium rugosum, Laportea canadensis, Cryptotaenia canadensis, Sanicula canadensis, Viola* spp., *Solidago caesia*, and *Carex* spp. More fern species are found on the mesic highwall than in any other habitat. Ferns include *Polystichum acrostichoides, Thelypteris hexagonoptera, T. noveboracensis*, and *Botrychium virginianum*.

Bench. A bench was formed when minesoils dredged from the steep mountain to expose the coal were pushed onto the mixed mesophytic forest below (Figure 1). The existing partially-leveled bench varies from 10 m to over 30 m at the widest point. It possesses the greatest species richness at HFR. All bench areas are well covered by vegetation except for ruts created from recent 4-wheel traffic along the old coal haul road. The bench currently supports a mixture of mostly native and some exotic species. The seeded *Festuca elatior* and *Lespedeza cuneata* have clearly declined over time through plant succession. The four bench habitats are xeric open, mesic shaded, standing water depressions, and seasonally wet seeps.

The xeric open bench is similar to the xeric, eroded highwall habitat. In the small sites where it occurs, it interrupts the more extensive mesic shaded bench habitat. Perennial herbs are dominant and a closed canopy has not yet developed. The *Panicum-Solidago-Lespedeza* Association characterizes this habitat. Volunteer trees include *Acer rubrum, Liriodendron tulipifera, Nyssa sylvatica*, and *Oxydendrum arboreum. Rubus allegheniensis* is the preeminent shrub and *Toxicodendron radicans* and *Smilax glauca* are representative woody vines. During spring and summer, perennial herbs are *Danthonia compressa, Festuca elatior, Dactylis glomerata, Panicum lanuginosum, Potentilla simplex*, and *Fragaria virginiana*. Late summer and fall flora are dominated by the Asteraceae, Poaceae, and Fabaceae. Indicator species include *Solidago nemoralis, S. rugosa, S. bicolor, Andropogon virginicus, Agrostis perennans, Lespedeza cuneata, L. intermedia*, and *Desmodium paniculatum. Lycopodium digitatum* and *Asplenium platyneuron* are present at the junction of the bench and outslope.

The mesic shaded bench occupies most of the length of the bench, and where it occurs, is continuous from the mesic highwall to the mesic outslope. The *Acer-Liriodendron-Microstegium* Association is dominant here. Important trees are *Acer rubrum, Liriodendron tulipifera, Acer saccharum, Cornus florida*, and *Robinia pseudoacacia*. Other invading trees include *Aesculus flava, Fraxinus americana, Cercis canadensis*, and *Prunus serotina*. A characteristic woody vine, *Clematis virginiana*, is interspersed with *Toxicodendron radicans, Parthenocissus quinquefolia*, and *Vitis aestivalis*. Indicator herbs include *Microstegium vimineum, Elymus hystrix, Ambrosia trifida, Impatiens pallida, Aster divaricatus, A. cordifolius, Eupatorium rugosum, Solidago flexicaulis*, and *Laportea canadensis*. A single colony of *Aplectrum hyemale* was found in one small area.

The standing water depressions occur on low bench areas of open pits and low depressions created from mining (Figure 1). Many wetland species are present in these seasonal to permanent wetland areas which support the *Salix-Typha-Carex* Association. *Salix nigra* and *S. sericea* found along narrow woody borders in these locations are dying out from progression of secondary succession. *Sambucus canadensis, Hydrangea arborescens, Clematis virginiana*, and *Toxicodendron radicans* are typical shrubs and woody vines present. Important species are *Typha latifolia, Carex prasina, Scirpus cyperinus*, and *Juncus effusus*. Other characteristic wetland species include *Leersia orzyoides, Microstegium vimineum, Rumex obtusifolius, Ludwigia alternifolia, Epilobium coloratum, Eupatorium fistulosum, Prunella vulgaris*, and *Polygonum* spp. In 1988 this habitat was quite dense with plants but, by 1996, spacing between plants was evident from shading effects.

The seasonally wet seeps is the most extensive of the two wetland types. These areas are the result of seepage from the highwall which flows onto the bench. This seepage either creates seasonally wet seep meadows or simply drains as narrow channels onto the outslope. Wetland seeps support the herbaceous *Impatiens-Equisetum-Leersia* Association. In the spring, *Equisetum arvense* forms almost solid

stands and is interspersed with *Impatiens pallida, I. capensis, Carex prasina, Glyceria striata,* and *Leersia orzyoides.* Other characteristic species are *Carex lurida, Scirpus polyphyllus, Juncus effusus, Panicum clandestinum,* and *Microstegium vimineum.* In the summer and fall, *Ludwigia alternifolia, Eupatorium fistulosum, E. perfoliatum, Mimulus ringens, Polygonum sagittatum,* and *Lobelia siphilitica* are representative species. *Sambucus canadensis, Hydrangea arborescens,* and *Clematis virginiana* are interspersed among the wetland herbs. *Gentiana decora* accompanied by *Spiranthes cernua, Habernaria clavellata, Chelone glabra,* and *Woodwardia areolata* were only found at the border of one seep.

Outslope. The outslope was formed when minesoil overburden from the bench was pushed onto the steep forested terrain below. The current outslope ranges from 30 to 60 m from the edge of the bench down to the bottom (Figure 1). Several tree species survived partial burial by mine overburden, but most of the existing vegetation developed from seed rain and the seed bank intermixed within the original minesoils.

The mesic outslope occupies the greatest surface area at HFR, and the *Acer-Liriodendron-Microstegium-Aster* Association is the most extensive plant association. *Robinia pseudoacacia* originally planted on the outslope is being shaded out by the canopy. Important volunteer trees are *Acer rubrum, Liriodendron tulipifera, Fraxinus americana, Acer saccharum, Oxydendrum arboreum, Nyssa sylvatica, Cornus florida, Magnolia acuminata,* and *Aesculus flava.* Characteristic shrubs and woody vines include *Clematis virginiana, Toxicodendron radicans, Parthenocissus quinquefolia, Vitis aestivalis, Smilax rotundifolia,* and *Rubus allegheniensis.* Surface fire burned parts of the outslope and bench between 1987 and 1988. Woody plants were scorched and stem die-back occurred, while herbaceous species were burned back to ground level. Currently, forest vegetation shows little evidence of negative effects from fire.

Herbaceous species on the outslope are floristically rich in the spring and fall. Spring indicator herbs include *Anemonella thalictroides, Viola palmata, V. canadensis, Carex* spp., *Sedum ternatum, Geranium maculatum, Erythronium americanum, Trillium erectum, T. grandiflorum,* and *Polygonatum biflorum.* Important summer and fall herbs are *Microstegium vimineum, Aster divaricatus, A. undulatus, A. cordifolius, Prenanthes altissima, Solidago caesia, S. flexicaulis, Panicum boscii, Verbesina occidentalis,* and *Polygonum scandens.* Ferns are *Polystichum acrostichoides, Dryopteris marginalis, Thelypteris noveboracensis,* and *T. hexagonoptera.*

Vegetation and Plant Succession

A mixed mesophytic forest is developing on HFR through a mosaic of primary and secondary succession. Seed rain from the conterminous unmined area and the intermixed remnant seed bank have enabled plant colonization and succession to occur throughout the three major topographic positions: highwall, bench, and outslope. Vegetation is characteristic of mid-successional stages and invading or volunteering woody and herbaceous species are mostly native. The original plantings of *Robinia pseudoacacia* and seeded exotic *Festuca elatior* and *Lespedeza cuneata* are actively being replaced. Invading tree species, at present, are dominated by those with easily dispersed propagules carried by wind, e.g., *Acer rubrum* and *Liriodendron tulipifera.* The seral stages of progressive succession at HFR are similar in development to the four other pre-SMCRA surface-mined areas that have been studied (Thompson et al. 1984; Thompson et al. 1986; Thompson and Wade 1991; Thompson et al. 1996; Wade and Thompson 1999).

ANNOTATED LIST OF VASCULAR PLANTS

The annotated plant list is arranged alphabetically by family and species. An asterisk (*) precedes an exotic taxon. Scientific names are followed by habitats, relative abundance, and collector's number.

Habitats created by surface coal mining are designated with a numbered code: 1 = highwall, 2 = bench, 3 = outslope, and 4 = wetland areas. Relative abundance categories (frequency of occurrence) are modified from Thompson and Jones (2001): Abundant (A)—dominant or codominant (thousands of individuals or colonies); Frequent (F)—easily or generally encountered but not dominant (hun-

dreds of individuals or colonies); Occasional (O)—widely scattered but not difficult to locate (31 to 100 individuals or colonies); Infrequent (I)—found in several locations but difficult to locate (6 to 30 individuals or colonies); and Rare (R)—difficult to find and limited to one or two localities (1 to 5 individuals or colonies). Relative abundance for each HFR taxon was determined through field observations of each species and refers to the overall distribution among all habitats.

Herbarium voucher specimens are those of Barbara L. Rafaill (R), Ralph L. Thompson (T), and Thompson and Rafaill (T & R).

EQUISETOPHYTA

Equisetaceae

Equisetum arvense L. 4; F. *T 01-20*

LYCOPODIOPHYTA

Lycopodiaceae

Lycopodium digitatum Dill. ex A. Braun 2; R. *T 01-681*

POLYPODIOPHYTA

Aspleniaceae

Asplenium platyneuron (L.) Oakes 1, 2; I. *T 87-820*

Athyrium thelypteroides (Michx.) Desv. 1; I. *T 96-442*

Dryopteris marginalis (L.) A. Gray 3; I. *T & R 88-472*

Polystichum acrostichoides (Michx.) Schott 2, 3; O. *T 87-834*

Thelypteris hexagonoptera (Michx.) Weath. 3; I. *T & R 88-2429*

T. noveboracensis (L.) Nieuwl. 3; O. *T & R 88-467*

Blechnaceae

Woodwardia areolata (L.) Moore 4; R. *T 89-1347*

Dennstaedtiaceae

Pteridium aquilinum (L.) Kuhn. 1; I. *T & R 88-433*

Ophioglossaceae

Botrychium dissectum Spreng. 2; R. *T 89-500*

B. virginianum (L.) Sw. 3; I. *T & R 88-463*

PINOPHYTA

Cupressaceae

Juniperus virginiana L. 2; R. *T & R 93-173*

Pinaceae

Pinus virginiana P. Mill. 1; R. *T & R 88-459*

MAGNOLIOPHYTA—MAGNOLIOPSIDA

Aceraceae

Acer rubrum L. 1, 2, 3; F. *R 596*

A. saccharum Marsh. 1, 2, 3; O. *T & R 88-445*

Anacardiaceae

Rhus copallinum L. 1, 2; O. *T & R 93-169*

R. glabra L. 1, 3; I. *R 591*

Toxicodendron radicans (L.) Kuntze 1, 2, 3; F. *T 89-1646*

Apiaceae

Cicuta maculata L. 4; I. *T 96-434*

Cryptotaenia canadensis (L.) DC. 1, 2, 3; I. *R 896*

**Daucus carota* L. 1, 2; I. *R 919*

Osmorhiza claytonii (Michx.) C.B. Clarke 3; O. *T & R 88-475*

Sanicula canadensis L. 1, 2; O. *R 878*

S. gregaria E. Bickn. 1; I. *T & R 93-178*

S. trifoliata E. Bickn. 1; R. *T & R 93-179*

Thaspium barbinode (Michx.) Nutt. 2, 3; I. *T & R 93-160*

Apocynaceae

Apocynum cannabinum L. 2, 4; O. *R 903*

Araliaceae

Aralia racemosa L. 1; R. *T 88-2162*

Aristolochiaceae

Asarum canadense L. 2; I. *T 01-27*

Asclepiadaceae

Asclepias exaltata L. 1; R. *T & R 93-176*

A. syriaca L. 4; R. *T 96-437*

Asteraceae

**Achillea millefolium* L. 1, 2; O. *T 87-829*

Ambrosia artemisiifolia L. 1, 2; O. *T 88-2136*

A. trifida L. 2. 4; F. *R 541*

**Arctium minus* Schk. 2; R. *R 972*

Aster cordifolius L. 1, 2, 3; F. *T 88-2721*

A. divaricatus L. 1, 2, 3; F. *T & R 88-2454*

A. dumosus L. 1, 2; I. *T & R 88-2448*

A. lateriflorus (L.) Britt. 1, 3; O. *T 88-2716*

A. paternus Cronq. 1, 2; I. *R 971*

A. phlogifolius (Muhl.) Nees 1; R. *T 88-2706*

A. pilosus Willd. 2; O. *T 88-2735*

A. undulatus L. 1, 3; O. *T 88-2715*

Bidens comosa (A. Gray) Wieg. 4; I. *T 96-436*

B. frondosa L. 4; F. *T & R 88-2414*

B. polylepis S.F. Blake 4; O. *T & R 88-2472*

Cacalia atriplicifolia L. 2, 3; I. *R 952*
**Chrysanthemum leucanthemum* L. 1, 2; O. *T 87-830*
Conyza canadensis (L.) Cronq. 2; R. *T & R 88-2438*
Coreopsis major Walt. 1; O. *R 909*
Erechtites hieracifolia (L.) Raf. 2; I. *R 739*
Erigeron annuus (L.) Pers. 2; I. *R 886*
E. philadelphicus L. 2; O. *T & R 89-503*
Eupatorium fistulosum Barratt 1, 4; O. *T & R 88-2424*
E. rotundifolium L. 2; I. *T 88-2164*
E. rugosum Houtt. 1, 2, 3; F. *T 88-2736*
E. serotinum Michx. 4; O. *T & R 88-2406*
E. sessilifolium L. 2; R. *T 88-2187*
Gnaphalium obtusifolium L. 1; I. *T & R 88-2411*
Helianthus decapetalus L. 2; O. *R 953*
H. microcephalus Torr. & Gray 1, 2; O. *T & R 88-2437*
H. tuberosus L. 1; R. *T 96-439*
Hieracium gronovii L. 2; I. *T & R 88-2432*
H. paniculatum L. 1; I. *T 88-2161*
H. venosum L. 1, 2; O. *T & R 88-443*
Lactuca canadensis L. 3; I. *T 88-2120*
L. floridana (L.) Gaertn. 2, 3; O. *T 88-2193*
**L. serriola* L. 2; R. *T 88-2186*
Prenanthes altissima L. 2, 3; O. *T 88-2738*
Rudbeckia fulgida Ait. 2; I. *T 88-2116*
R. hirta L. 2; R. *T 96-435*
Senecio anonymus Wood 1; O. *R 873*
Silphium trifoliatum L. 1, 2; I. *T 88-2110*
Solidago arguta Ait. 1, 2; F. *T & R 88-2459*
S. bicolor L. 1, 2; I. *T & R 88-2453*
S. caesia L. 1, 3; F. *R 594*
S. erecta Pursh 1, 2; O. *T & R 88-2733*
S. flexicaulis L. 3; F. *T & R 88-2413*
S. gigantea Ait. 3, 4; F. *T 88-2103*
S. nemoralis Ait. 1, 2; F. *T & R 88-2420*
S. rugosa P. Mill. 2; O. *T & R 88-2421*
**Sonchus asper* (L.) Hill 1; R. *R 894*
**Taraxacum officinale* Weber 2; I. *T & R 86-14*
**Tussilago farfara* L. 1, 4; I. *T & R 93-166*
Verbesina occidentalis (L.) Walt. 1; I. *T & R 88-2401*
Vernonia gigantea (Walt.) Trel. 4; O. *T 88-2141*

Balsaminaceae
Impatiens capensis Meerb. 4; A. *R 536*
I. pallida Nutt. 1, 4; A. *T 88-2197*

Berberidaceae
Caulophyllum thalictroides (L.) Michx. 3; O. *T & R 89-523*
Podophyllum peltatum L. 1, 3; O. *T & R 86-516*

Bignoniaceae
**Paulownia tomentosa* (Thunb.) Steud. 1; R. *T & R 93-157*

Brassicaceae
Arabis laevigata (Muhl.) Poir. 3; I. *T 01-31*
**Barbarea vulgaris* R. Br. 2; O. *T 01-45*
Cardamine concatenata (Michx.) O. Swartz. 2, 3; F. *T 01-40*
**C. hirsuta* L. 2; O. *T & R 86-15*

Caesalpiniaceae
Cercis canadensis L. 1, 2; I. *T & R 86-20*
Chamaecrista nictitans (L.) Moench 1, 2; O. *T 88-2112*

Campanulaceae
Campanula americana L. 2; I. *T 96-431*
C. divaricata Michx. 1; I. *T 88-2150*
Lobelia inflata L. 2; O. *T 88-2181*
L. siphilitica L. 4; I. *T 88-2137*

Caprifoliaceae
Sambucus canadensis L. 1, 2, 4; F. *T 89-1642*
Triosteum perfoliatum L. 1; R. *T & R 88-451*

Caryophyllaceae
**Cerastium vulgatum* L. 2; I. *T & R 93-177*
Paronychia canadensis (L.) Wood 3; R. *R 882*
Stellaria pubera Michx. 2; O. *T 01-30*

Chenopodiaceae
**Chenopodium album* L. 2; R. *T & R 88-2436*

Clusiaceae
Hypericum mutilum L. 4; O. *R 963*
H. punctatum Lam. 2; I. *R 929*

Convolvulaceae
Ipomoea pandurata (L.) G.F.W. Meyer 2, 3; O. *T 88-2198*

Cornaceae
Cornus florida L. 2, 3; O. *T 01-38*
Nyssa sylvatica Marsh. 1, 2, 3; F. *T 89-1643*

Crassulaceae
Sedum ternatum Michx. 1, 3; F. *T & R 89-510*

Cuscutaceae
Cuscuta pentagona Engelm. 4; O. *T 96-441*

Ericaceae
Oxydendrum arboreum (L.) DC. 1, 2, 3; F. *T & R 88-2464*

Rhododendron cumberlandense E.L. Braun 1; R. *T & R 93-156*
Vaccinium corymbosum L. 1, 3; O. *R 639*
Euphorbiaceae
Acalypha rhomboidea Raf. 2; I. *T 88-2188*
Euphorbia corollata L. 1; R. *T 88-2111*
E. maculata L. 2; R. *T 88-2749*
Fabaceae
Amphicarpaea bracteata (L.) Fern. 3, 4; F. *T & R 88-2400*
**Coronilla varia* L. 2; R. *T & R 93-164*
Desmodium glabellum (Michx.) DC. 1, 2; O. *T & R 88-2426*
D. nudiflorum (L.) DC. 3; I. *T 88-2104*
D. paniculatum (L.) DC. 2; O. *T & R 88-2431*
**Lespedeza cuneata* (Dum. Cours) G. Don 1, 2; I. *T & R 88-2402*
L. intermedia (S. Wats.) Britt. 1, 2; F. *T & R 88-2422*
**L. stipulacea* Maxim. 2; O. *T 88-2106*
**L. striata* (Thunb.) Hook. & Arnott 2; O. *T 88-2203*
**Medicago lupulina* L. 2; R. *T & R 93-163*
**Melilotus albus* Medic. 2; R. *T 89-1346*
Robinia pseudoacacia L. 2, 3; F. *T & R 88-439*
**Trifolium hybridum* L. 2; R. *T & R 93-171*
**T. pratense* L. 2; I. *R 918*
Vicia caroliniana Walt. 1, 2; I. *T 01-32*
Fagaceae
Quercus prinus L. 3; O. *T 88-2205*
Q. rubra L. 1, 2, 3; O. *T & R 93-158*
Q. velutina Lam. 2, 3; I. *T 96-427*
Fumariaceae
Dicentra cucullaria (L.) Bernh. 1, 3; O. *T 01-44*
Gentianaceae
Gentiana decora Pollard 4; R. *T 88-2708*
Geraniaceae
Geranium maculatum L. 2, 3; O. *T 01-41*
Hippocastanaceae
Aesculus flava Ait. 2, 3; O. *R 897*
Hydrangeaceae
Hydrangea arborescens L. 1, 2; F. *R 901*
Hydrophyllaceae
Hydrophyllum virginianum L. 3; F. *T & R 89-511*
Juglandaceae
Carya glabra (P. Mill.) Sweet 2; R. *T 89-1632*
Juglans nigra L. 1; R. *T & R 88-2452*
Lamiaceae
Collinsonia canadensis L. 2, 3; I. *T & R 88-2405*
Lycopus virginicus L. 4; O. *T & R 88-2428*
Monarda clinopodia L. 2; I. *R 936*
**Prunella vulgaris* L. 1, 2; O. *T 88-2175*
Pycnanthemum pycnanthemoides (Leavenw.) Fern. 1, 2; I. *R 544*
Salvia lyrata L. 2,4; I. *T & R 93-165*
Scutellaria elliptica Muhl. 1, 2; I. *R 890*
S. ovata Hill 3; R. *R 965*
Stachys nuttallii Shuttlw. ex Benth. 1, 3; O. *R 877*
Lauraceae
Sassafras albidum (Nutt.) Nees 1, 3; I. *R 908*
Linaceae
Linum striatum Walt. 4; I. *R 917*
L. virginianum L. 4; R. *T 96-433*
Magnoliaceae
Liriodendron tulipifera L. 1, 2, 3; F. *R 875*
Magnolia acuminata L. 2; R. *R 898*
Oleaceae
Fraxinus americana L. 1, 2, 3; O. *T & R 88-460*
Onagraceae
Circaea lutetiana L. var. *canadensis* L. 3; O. *T 87-833*
Epilobium coloratum Biehler 4; O. *T & R 88-2404*
Ludwigia alternifolia L. 4; O. *T 88-2119*
Oenothera biennis L. 1; I. *T 88-2185*
Oxalidaceae
Oxalis grandis Small 1; O. *R 893*
O. stricta L. 2; I. *T 88-2192*
O. violacea L. 3; I. *T & R 89-517*
Papaveraceae
Sanguinaria canadensis L. 1, 3; O. *T 01-37*
Phytolaccaceae
Phytolacca americana L. 1, 3; O. *R 944*
Plantaginaceae
**Plantago lanceolata* L. 2; I. *R 906*
P. rugelii Decne. 2; O. *T 88-2127*
Platanaceae
Platanus occidentalis L. 3; I. *R 593*
Polemoniaceae
Phlox amplifolia Britt. 2; I. *R 738*
Polygalaceae
Polygala senega L. 2; I. *T 87-822*
Polygonaceae
**Polygonum cespitosum* Blume var. *longisetum* (DeBruyn) Stewart 4; O. *T & R 88-2444*
P. punctatum Ell. 4; F. *T & R 88-2408*

P. sagittatum L. 4; F. *T & R 88-2425*
P. scandens L. 2, 3; F. *R 964*
P. virginianum L. 2; R. *T 89-1634*
**Rumex acetosella* L. 1, 2; F. *R 957*
**R. crispus* L. 4; I. *R 885*
**R. obtusifolius* L. 4; O. *R 871*

Portulacaceae
Claytonia caroliniana Michx. 2; I. *T 01-34*

Primulaceae
Lysimachia quadrifolia L. 1; O. *R 874*
L. tonsa (Wood) Kunth 1; I. *R 923*

Pyrolaceae
Chimaphila maculata (L.) Pursh 1; I. *T 87-821*

Ranunculaceae
Anemone quinquefolia L. 3; I. *T & R 86-05*
A. virginiana L. 2; O. *R 914*
Anemonella thalictroides (L.) Spach. 3; F. *T 01-28*
Cimicifuga racemosa (L.) Nutt. 1; R. *T 96-438*
Clematis virginiana L. 1, 3, 4; F. *R 549*
Delphinium tricorne Michx. 3; O. *T 01-36*
Ranunculus abortivus L. 2; O. *T & R 86-13*
R. hispidus Michx. 2, 4; O. *T 01-23*
R. recurvatus Poir. 3; I. *T & R 86-40*
Thalictrum dioicum L. 2, 3; O. *T 01-42*

Rosaceae
Agrimonia parviflora Ait. 4; O. *T 89-1635*
A. rostellata Wallr. 2; R. *T 88-2170*
Aruncus dioicus (Walt.) Fern. 1; R. *R 899*
Fragaria virginiana Duchesne 2; I. *R 946*
Geum canadense Jacq. 2, 3; O. *R 928*
Porteranthus trifoliatus (L.) Britt. 3; R. *T & R 93-155*
Potentilla canadensis L. 1, 2; F. *T &R 86-07*
P. simplex Michx. 1, 2; O. *T & R 86-34*
Prunus serotina Ehrh. 2, 3; I. *T & R 88-456*
**Rosa multiflora* Thunb. 2; I. *T &R 88-431*
Rubus allegheniensis Porter 1, 2, 3; F. *T & R 93-174*
R. flagellaris Willd. 2; O. *T & R 86-25*
R. occidentalis L. 2, 3; O. *T & R 88-468*

Rubiaceae
Galium aparine L. 2, 3; F. *T & R 86-35*
G. lanceolatum Torr. 1; I. *T & R 93-159*
G. latifolium Michx. 3; I. *T 88-2114*
G. tinctorium L. 4; O. *R 967*
G. triflorum Michx. 3; F. *T 88-2113*
Hedyotis purpurea (L.) Torr. & Gray 2; I. *R 888*

Salicaceae
Salix nigra Marsh. 4; O. *T & R 88-448*
S. sericea Marsh. 4; O. *T & R 88-474*

Saxifragaceae
Heuchera americana L. 1, 3; I. *T & R 88-434*

Scrophulariaceae
Chelone glabra L. 4; R. *T 88-2702*
Mimulus ringens L. 4; O. *R 933*
Pedicularis canadensis L. 2; I. *T & R 86-33*
**Veronica arvensis* L. 2; O. *T & R 88-440*
**V. officinalis* L. 2; R. *T & R 88-458*

Solanaceae
Physalis heterophylla Nees 2; R. *T & R 93-167*

Tiliaceae
Tilia americana L. 2, 3; I. *T & R 88-457*

Ulmaceae
Ulmus rubra Muhl. 2; R. *R 895*

Urticaceae
Laportea canadensis (L.) Wedd. 2, 3; F. *R 941*
Pilea pumila (L.) A. Gray 1, 4; O. *T 96-440*

Verbenaceae
Verbena urticifolia L. 4; I. *R 973*

Violaceae
Viola canadensis L. 1, 3; F. *T 01-33*
V. palmata L. 3; F. *T 01-39*
V. pubescens Ait. 3; O. *T 01-25*
V. sororia Willd. 1,2, 3; F. *T & R 89-522*

Vitaceae
Parthenocissus quinquefolia (L.) Planch. 3; O. *R 595*
Vitis aestivalis Michx. 2, 3; F. *R 550*

MAGNOLIOPHYTA—LILIOPSIDA

Araceae
Arisaema triphyllum (L.) Schott 3; R. *T & R 86-39*

Commelinaceae
**Commelina communis* L. 2; I. *T 88-2132*
Tradescantia subaspera Ker-Gawl. 2; I. *R 869*

Cyperaceae
Carex amphibola Steud. 3; O. *T & R 88-430*
C. debilis Michx. 4; O. *T & R 88-461*
C. frankii Kunth 4; R. *T 87-846*
C. laxiflora Lam. 3; O. *T 96-432*
C. lurida Wahl. 4; O. *T 87-824*
C. prasina Wahl. 4; F. *T 01-21*
C. purpurifera Mack. 1, 3; I. *T & R 88-455*
C. swanii (Fern.) Mack. 3; R. *T & R 93-161*
C. tribuloides Wahl. 4; I. *T 87-826*
C. vulpinoidea Michx. 4; O. *R 872*

Cyperus strigosus L. 4; I. *T 88-2154*
Eleocharis acicularis (L.) Roemer & Schultes 4; F. *T & R 86-45*
E. ovata (Roth) Roemer & Schultes 4; O. *T 88-2178*
Rhynchospora capitellata (Michx.) Vahl 4; O. *T 88-2184*
Scirpus cyperinus (L.) Kunth 4; O. *T 88-2711*
S. polyphyllus Vahl 4; O. *T 96-428*

Dioscoreaceae
Dioscorea quaternata (Walt.) J. F. Gmel. 1, 3; O. *T 88-2725*

Iridaceae
Sisyrinchium angustifolium P. Mill. 2; I. *T & R 88-423*

Juncaceae
Juncus acuminatus Michx. 4; O. *T 88-2183*
J. effusus L. var. *solutus* Fern. & Wieg. 4; O. *R 870*
J. tenuis Willd. 2; O. *T 88-2126*

Liliaceae
**Allium vineale* L. 2; R. *T & R 88-471*
Disporum lanuginosum (Michx.) Nichols. 1, 3; I. *T & R 89-519*
Erythronium americanum Ker-Gawl. 2; O. *T 01-22*
Polygonatum biflorum (Walt.) Ell. 1, 3; F. *T 01-24*
Smilacina racemosa (L.) Desf. 1, 3; O. *T 87-832*
Trillium erectum L. 3; O. *T 01-29*
T. grandiflorum (Michx.) Salisb. 3; O. *T 01-35*
Uvularia grandiflora J.E. Smith 1, 3; O. *T 01-26*

Orchidaceae
Aplectrum hyemale (Muhl.) Torr. 2; R. *T & R 86-17*
Habenaria clavellata (Michx.) Spreng. 4; R. *T 96-428*
Spiranthes cernua (L.) Rich. 4; R. *T 88-2742*

Poaceae
**Agrostis gigantea* Roth 4; O. *T & R 88-454*
A. perennans (Walt.) Tuckerm. 1, 2; F. *T & R 88-2460*
Andropogon virginicus L. 1, 2; F. *T 88-2701*
Aristida dichotoma Michx. 1, 2; F. *T 88-2741*
Bromus pubescens Muhl. 3; O. *T & R 93-175*
**Dactylis glomerata* L. 2; O. *T 96-427*
Danthonia compressa Aust. 1, 2; A. *T & R 93-168*
**Digitaria ischaemum* (Schreb.) Muhl. 2; I. *T 88-2182*
**Echinochloa crusgalli* (L.) Beauv. 4; O. *T 88-2138*
Elymus hystrix L. 1, 3; O. *T & R 93-181*
E. virginicus L. 1, 2, 3; O. *T 88-2704*
**Festuca elatior* L. 1, 2; F. *R 915*
F. subverticillata (Pers.) Alexeev. 3; O. *T & R 93-162*
Glyceria striata (Lam.) Hitchc. 4; F. *T & R 88-420*
**Holcus lanatus* L. 4; R. *T & R 93-154*
Leersia oryzoides (L.) Swartz 4; F. *T & R 88-2407*
L. virginica Willd. 4; F. *T 88-2131*
**Microstegium vimineum* (Trin.) A. Camus 1, 2, 3, 4; A. *R 537*
Muhlenbergia frondosa (Poir.) Fern. 4; F. *T & R 2410*
M. schreberi J.F. Gmel. 2; I. *T & R 88-2435*
M. sylvatica (Torr.) Torr. 4; R. *T 88-2730*
M. tenuiflora (Willd.) BSP. 1, 3; O. *T & R 88-2412*
Panicum boscii Poir. 1, 2, 3; F. *T & R 88-435*
P. capillare L. 2; I. *T & R 88-2441*
P. clandestinum L. 2, 4; F. *R 883*
P. commutatum Schultes 1, 2; F. *R 887*
P. dichotomiflorum Michx. 4; R. *T & R 88-2455*
P. dichotomum L. 1, 2; F. *R 904*
P. polyanthes Schultes 3; O. *R 925*
P. rigidulum Nees 4; O. *T 88-2163*
Paspalum laeve Michx. 2; I. *T & R 88-2403*
Poa alsodes A. Gray 2; I. *T 88-464*
**P. compressa* L. 2; O. *T & R 93-170*
P. cuspidata Nutt. 3; O. *T & R 89-505*
**P. pratensis* L. 1, 2; O. *T & R 88-422*
Sphenopholis obtusata (Michx.) Scribn. var. *major*
(Torr.) K.S. Erdman 2, 3; O. *T & R 88-464*

Smilacaceae
Smilax ecirrhata (Englem.) Wats. 3; R. *T 88-2703*
S. glauca Walt. 1, 2; F. *T & R 88-469*
S. rotundifolia L. 1, 2, 3; F. *T 88-2191*

Typhaceae
Typha latifolia L. 4; F. *T 88-2128*

CONCLUSIONS

Pre-SMCRA mining techniques on the Henderson Fork Road Surface-mined Area

created unique xeric, mesic, and hydric habitats that have contributed to high species richness and even served as a refugium for the presence of rare species. Flora and vegetation are progressing toward a young mixed mesophytic forest as a result of invading native species from the seed rain and seed bank in conjunction with the favorable habitats resulting from contour surface mining. HFR is well vegetated with plant associations that have developed through mid-successional seral stages of primary and secondary succession. The origin of most of the species are native and the exotics are being replaced as seral stages progress. HFR has a high Sørensen's Index of Similarity with a larger nearby prelaw coal mine. Species richness at HFR is comparable to that found on unmined areas of the same size in the Mixed Mesophytic Forest Region.

In summary, Henderson Fork Road Surface-mined Area is yet another representative of a reclaimed pre-SMCRA coal surface mine that now supports a rich flora and has developed several native plant associations through the process of natural plant succession. This study provides further evidence that pre-SMCRA surface mines do not necessarily result in barren waste areas incapable of supporting post-mining vegetation.

LITERATURE CITED

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, NY.

Browne, Jr., E. T. and R. Athey. 1992. Vascular plants of Kentucky: an annotated checklist. The University Press of Kentucky, Lexington, KY.

Childress, J. D. 1992. Soil survey of Bell and Harlan Counties, Kentucky. U.S. Department of Agriculture, Soil Conservation Service, Washington, DC.

Fenneman, N. M. 1938. Physiography of eastern United States. McGraw-Hill, New York, NY.

Gleason, H. A., and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada, 2nd ed. New York Botanical Garden, Bronx, NY.

[KSNPC] Kentucky State Nature Preserves Commission. 2000. Rare and extirpated biota of Kentucky. J. Ky. Acad. Sci. 61:115–132.

Küchler, A. W. 1964. Potential natural vegetation of the conterminous United States. (Map and accompanying manual). American Geographical Society, Special Publication Number 36, New York, NY.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York, NY.

Rafaill, B. L. 1988. Soil characteristics and vegetational features of abandoned and artifically revegetated surface mines in the Cumberland Mountains. Ph.D. Dissertation. Southern Illinois University, Carbondale, IL.

Rice, C. L., and E. K. Maughan. 1978. Geologic map of the Kayjay Quadrangle and part of the Fork Ridge Quadrangle, GQ 1505, Bell and Knox Counties, Kentucky. U.S. Geological Survey, Reston, VA.

Strausbaugh, P. D., and E. L. Core. 1978. Flora of West Virginia, second edition. Seneca Books, Grantsville, WV.

Thompson, R. L., and R. L. Jones. 2001. Woody plants of Rock Creek Research Natural Area and watershed uplands, Laurel County, Kentucky. Castanea 66:275–287.

Thompson, R. L., and J. R. MacGregor. 1986. *Liparis loeselii* (Orchidaceae) documented in Kentucky. Trans. Ky. Acad. Sci 47:138–139.

Thompson, R. L., W. G. Vogel, and D. D. Taylor. 1984. Vegetation and flora of a coal surface-mined area in Laurel County, Kentucky. Castanea 49:111–126.

Thompson, R. L., W. G. Vogel, G. L. Wade, and B. L. Rafaill. 1986. Development of natural and planted vegetation on surface mines in southeastern Kentucky. Pages 145–153 in J. Harper and B. Plass (eds), Proceedings, 3rd Annual Meeting American Society for Surface Mining and Reclamation, March 17–20, 1986, Jackson, MS.

Thompson, R. L., and G. L. Wade. 1991. Flora and vegetation of a 12-year-old coal surface-mined area in Rockcastle County, Kentucky. Castanea 56:99–116.

Thompson, R. L., G. L. Wade, and R. A. Straw. 1996. Natural and planted flora of the Log Mountain Surface-mined Demonstration Area, Bell County, Kentucky. Pages 484–503 in W. L. Daniels, J. A. Burger, and C. E. Zipper (eds), Proceedings, 10th Annual Meeting American Society for Surface Mining and Reclamation, May 18–22, 1996, Knoxville, TN.

Trewartha, G. T. 1968. An introduction to climate, 4th edition. McGraw-Hill, New York, NY.

University of Kentucky Agricultural Weather Center. 1995. Interactive map for Kentucky climate data, 1960–1990. <http:www.ca.uky.edu/agcollege/agweather/analysis2/middlesboro.htm./>

Vogel, W. G. 1981. A guide for revegetating coal minesoils in the eastern United States. U.S. Department of Agriculture Forest Service, General Technical Report NE-68. Broomall, PA.

Wade, G. L., and R. L. Thompson. 1991. The species-area curve and regional floras. Trans. Ky. Acad. Sci. 52:21–26.

Wade, G. L., and R. L. Thompson. 1993. Species richness on five partially reclaimed Kentucky surface mines. Pages 307–314 in B. A. Zamora, and R. E. Connolly (eds), Proceedings, 13th Annual Meeting, American Society for Surface Mining and Reclamation, May 16–19, 1993, Spokane, WA.

Wade, G. L., and R. L. Thompson. 1999. Woody vegetation and succession on the Fonde Surface Mine Demonstration Area, Bell County, Kentucky. Pages 339–351 in S. A. Bengdon, and D. M. Bland (eds), Proceedings, 16th Annual Meeting of American Society for Surface Mining and Reclamation, August 13–19, 1999, Scottsdale, AZ.