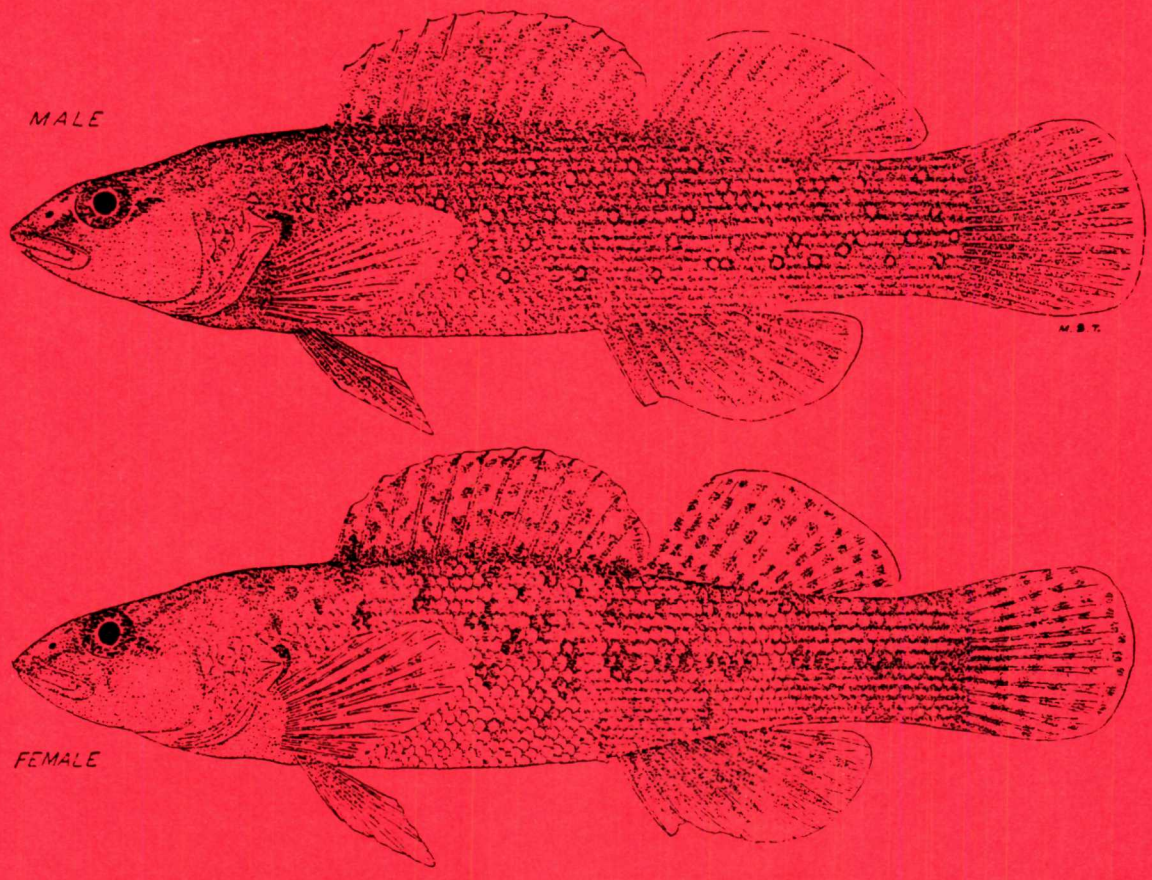
COOPERATIVE INVENTORY OF ENDANGERED, THREATENED, SENSITIVE AND RARE SPECIES, DANIEL BOONE NATIONAL FOREST, REDBIRD RANGER DISTRICT



Cooperators:

United States Forest Service
The Nature Conservancy
Kentucky State Nature Preserves Commission
Kentucky Department of Fish and Wildlife Resources

March 1993

Cover illustration is of *Etheostoma maculata*, the Spotted darter (from M.B. Trautman. 1981. The Fishes of Ohio. Ohio State University Press). This globally rare species was once reported from Greasy Creek, a tributary of Middle Fork Kentucky River. The Middle Fork watershed has been adversely affected by pollution from coal-mining. There are no other records from the Redbird Ranger District, but the South Fork Kentucky River may still have suitable habitat.

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ACKNOWLEDGEMENTS

Appreciation is extended to the following individuals and their respective agencies or institutions for providing information and assistance during this effort: Ralph Thompson (Berea College); Branley Branson, Ron Jones and Guenter Schuster (Eastern Kentucky University); Rene Jiminez, Brenda Hamm, Dale Lynch, Danny Parks, Rip Rhorer, Doug Stephens, John Williams and David Yancy (Kentucky Department of Fish and Wildlife Resources); Richard Cassell (Kentucky Native Plant Society, Lousiville); Tom Bloom, Laurel McNeil, William Moore and Brainard Palmer-Ball (Kentucky State Nature Preserves Commission); Leslie Hubricht (Meridian, Mississippi, for help with snails); Jamie Hitchcock (Payne Gap, Letcher Co.); Kinnie Ray Belcher and Tammy Heazlett (Pine Mountain Cave Survey); Ben Begley, Paul Hayes, Mary & Burton Rogers (Pine Mountain Settlement School); Johnny Angelucci, Danny & Scott Barrett and Joe Williams (U.S. Army Corps of Engineers); Dennis Daniel, Chris Frisbee*, Howard Hann, Danny Hill, Pam Hinkle*, Linda Perry*, Steve Phillips*, Harold Sizemore and David Taylor (U.S. Forest Service, *mist-netting); Jane & Rufous Fugate (U.S. Soil Conservation Service, retired); and Max Medley (University of Louisville).

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INTRODUCTION

An important first step in the responsible stewardship of land, regardless of the purpose, is an inventory of the natural resources of the area to be managed. The information derived can be used to implement conservation goals in coordination with other uses planned for the area. The Daniel Boone National Forest (DBNF), United States Department of Agriculture Forest Service (USFS), is committed to recovering federally listed species on the Forest and to ensuring that sensitive species do not become threatened or endangered as a result of planned management activities. The Nature Conservancy (TNC) is an international conservation organization committed to preserving natural diversity by identifying and protecting lands and water supporting the best examples of all components of the natural world.

Following the 1987-1991 inventories of the Somerset, Stanton, Stearns, Berea and Morehead Ranger Districts (Palmer-Ball et al. 1988, Campbell et al. 1989, 1990, 1991, 1992), TNC provided $15,500 for a public lands inventory in cooperation with other agencies. This was matched with a $31,000 Challenge Cost Share from the U.S. Forest Service (USFS) to fund an inventory of the endangered, threatened, sensitive, and rare plants and animals of the Redbird Ranger District (RRD) of the Daniel Boone National Forest. The Kentucky Department of Fish and Wildlife Resources (KDFWR) provided an additional $3000 for zoological work. The inventory funds were used to support two botanists and two zoologists for various parts of the inventory, and to cover travel, supplies, and expenses. Administrative coordination was provided by USFS and TNC. RRD staff arranged lodging for the biologists and assisted with some field work. State agencies played a critical role in supporting the inventory. The Kentucky State Nature Preserves Commission (KSNPC) assisted with expenses, provided some part-time zoological help, coordinated data processing, and printed the final report. The rare species database maintained by KSNPC, and their earlier studies of eastern Kentucky (Harker et al. 1979a, 1981), provide an invaluable foundation for the DBNF inventory. KDFWR assisted with some project field expenses, provided biologists with appropriate collecting permits, and contributed some part-time zoological assistance. This partnership of federal, state and private agencies continues to be highly productive.

Although the RRD contains about twice the area of each ranger district elsewhere in DBNF, it was suspected from previous field work (e.g., Harker et al. 1979. Campbell & Medley 1990) that this area had less potential for rare species and unusual habitats, except for Pine Mountain and some stream corridors (especially South Fork Kentucky River). Elsewhere there were few obvious places on which to focus sampling. No attempt was made to systematically sample the whole area, but there was a concentration of effort on the less disturbed blocks of forest, mostly with USFS ownership, and along the major rivers and streams, and along Pine Mountain (with very little USFS ownership). Relatively few "Significant Areas" are identified in this report, though some of these are rather large. The small section of Pine Mountain in the RRD is distinct in many ways from the rest of the study area--it includes the only limestone (and proper caves) and it rises to higher elevation. In order to evaluate the significance of this section in a broader context, information on the rest of Pine Mountain is appended to this report.

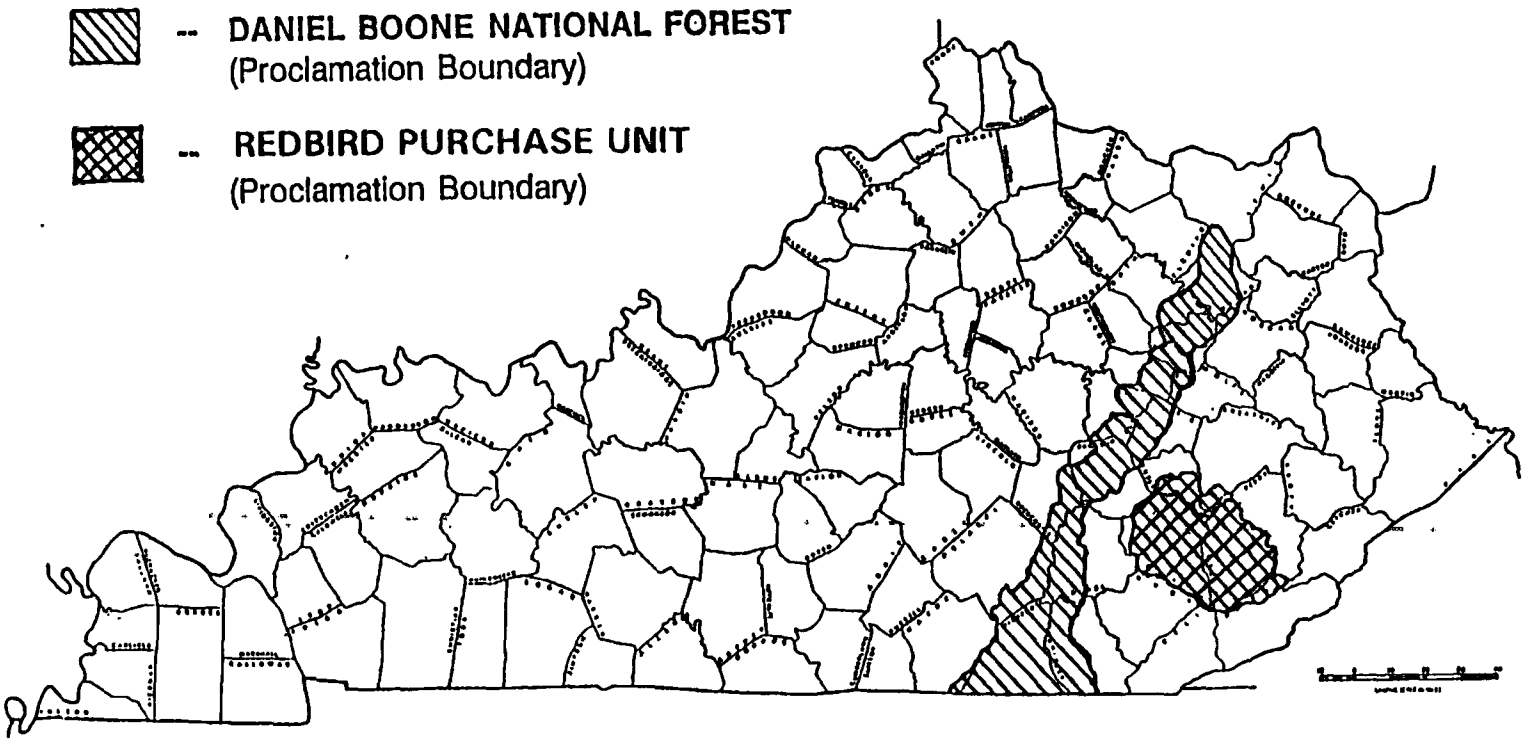

FIGURE 1: Map of Kentucky showing the Redbird Purchase Unit within the Daniel Boone National Forest.

DESCRIPTION OF THE STUDY AREA

The Redbird Ranger District is one of the seven management units within the proclamation boundary of the Daniel Boone National Forest, Kentucky (Fig. 1). The proclamation boundary includes approximately 680,000 acres, covering all of Leslie County, most of Clay, and parts of Bell, Harlan, Owsley and Perry Counties (Fig. 2). Its borders lie almost entirely along the watershed divides of the South Fork and Middle Fork of Kentucky River, upstream of Conkling and Buckhorn, respectively. The USFS tracts cover approximately 144,000 acres and are concentrated in the South Fork watershed (especially the Redbird River watershed). About 24,000 acres of this USFS land forms the Redbird Wildlife Management Area (RWMA).

PHYSICAL ENVIRONMENT

Climate

The climate of the Appalachian Plateaus Physiographic Province is humid mesothermal, characterized by mild temperate rainy climates with no distinct dry season (Trewartha 1954). Precipitation in this region is generally a result of moisture-bearing low pressure formations which move from the western Gulf of Mexico and travel in a northeasterly direction across Kentucky. The fall is generally the driest season and the spring the wettest. The average annual precipitation is about 50 inches, with little variation over the region. Average annual snowfall is about 15-17 inches. The mean annual temperature is about 54-56° F. Average July temperature is about 73-74° F, and average January temperatures is 34-38° F. The average frost free period is about 170-175 days, with the average date of first fall freeze about October 14-20, and the average date for final spring freeze about April 26-28 (Karan and Mather 1977).

Geology and Topography

The RRD lies almost entirely within Braun's (1950) "Rugged Eastern Area" of the Appalachian Plateaus Physiographic Province (Fenneman 1938; Figs 1 and 2). Its western borders are in the transition to her "Low Hills Belt", but this is a gradual transition that is not fully attained within this study area. The only other physiographic province represented here is the Cumberland Mountains, part of which is included along the southeastern border of the RRD, as a section of the northwest-facing slope of Pine Mountain. The Cumberland Mountains are composed of the same strata as the Appalachian Plateaus, but faulting and folding of these strata have created a variety of topographic distinctions.

The district is almost entirely underlain by Pennsylvanian rocks of the Breathitt Formation, which are mostly shale and sandstone with smaller amounts of conglomerate, siltstone and coal. Pine Mountain is exceptional, with Mississippian shales and limestone on the northwest side. On the crest of Pine Mountain, and on the southeast side, just outside the RRD, the bedrock is the Pennsylvanian Lee Formation, which consists of massive cliff-forming sandstone and lesser amounts of shale.

The topography is moderately rugged in general, but with much less extensive clifflines than in the rest of DBNF (the "Cliff Section"). The major river valleys are at 700-1000 feet a.s.l. These valleys are up to 1000-3000 feet wide. There are a few terraces, oxbows and other swampy areas that are still forested. However, the rivers are generally entrenched, with limited first bottoms. Also, bottomlands in these valleys and along smaller tributaries almost throughout the RRD have

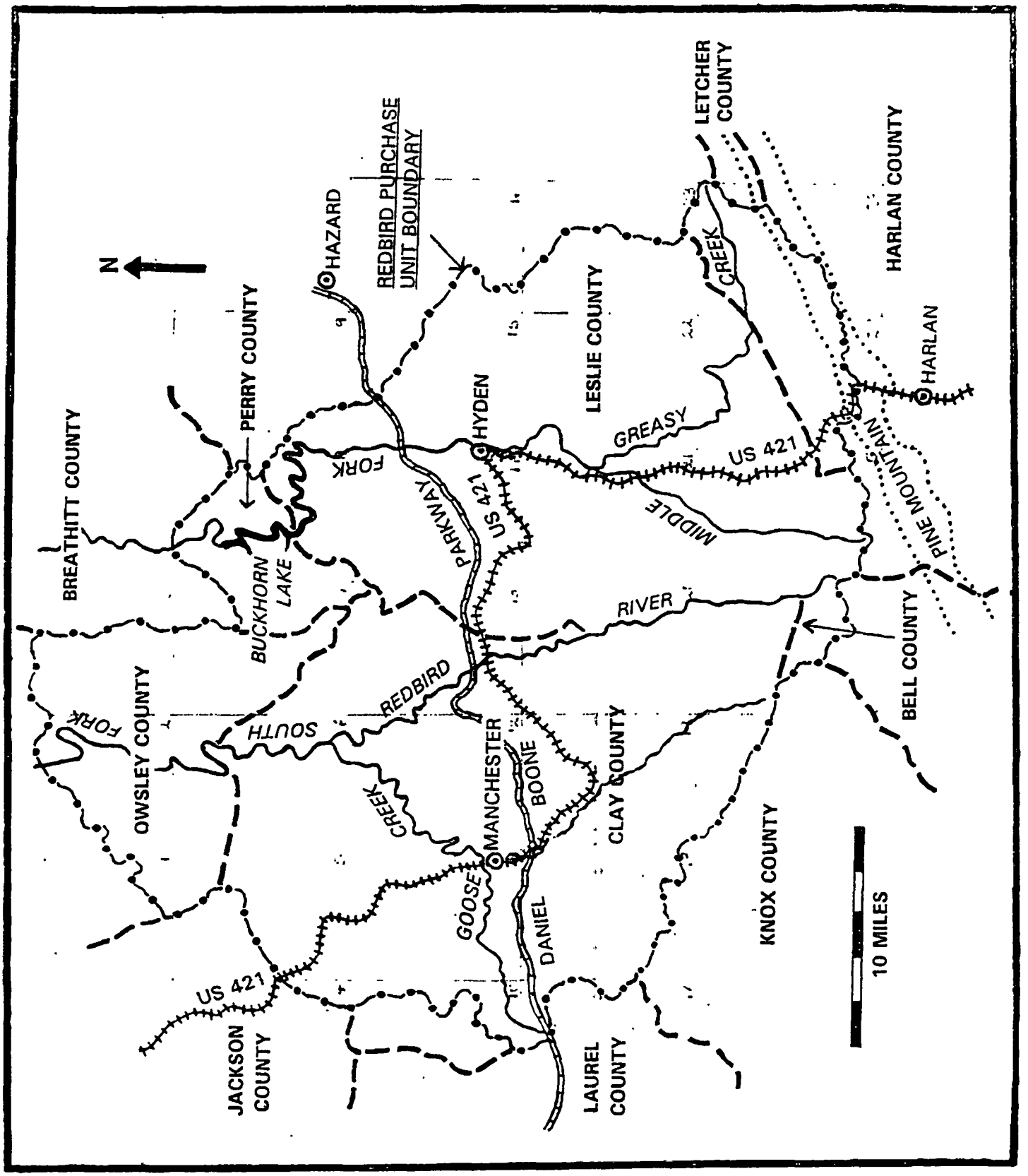

Figure 2. Map of Redbird Ranger District (Proclamation Boundary) showing county boundaries, USGS Quadrangles and other important features; see p. 5 for USGS Quadrangle numbers.

largely been cleared for agricultural use. In contrast, the hillsides are largely covered with forest, which are mostly third-growth. The only significant interruptions in these upland forests are the extensive contoured strip-mines. The ridgelines are mostly at 1700-2300 feet a.s.l. Pine Mountain is exceptional, rising to 2600-2800 feet a.s.l. along its sandstone ridge (along the "Little Shepherd Trail"). The northwest-facing slope of Pine Mountain is particularly steep. This slope has openings to limestone cave systems that appear to be extensive but difficult to explore due to the angle of the faulted bedrock, the small size and obscurity of the openings, the general difficulty of access to the limestone, and the extreme vertical nature of many passages. Deep pits are the rule, rather than the exception, in many Pine Mountain caves.

Soils

The RRD has been partly covered by the soil survey of Leslie and Perry Counties (Hayes et al. 1982), and that of Jackson and Owsley Counties (Hayes et al. 1989). There is an ongoing survey of Clay and Laurel Counties. Interpretation of the physical characteristics and changing nomenclature of soils in the Rugged Eastern Area and Pine Mountain is also aided by the recent survey of Knox and eastern Whitley Counties (Love et al. 1988), and that of Pike County (Kelley et al. 1990). A summary of the classification of upland soils in the Rugged Eastern Area is presented in Table 1. Major trends in soil characteristics are related to the underlying bedrock, from sandy soils to silty soils (or calcareous on Pine Mt.), and to topographic position--from residual soils on ridges, to colluvial soils on lower slopes, to alluvial soils on bottoms.

Braun's (1950) division of the Appalachian Plateaus into Rugged Eastern Area, Low Hills Belt and Cliff Section, which has much botanical significance, can also be related to major geographic trends in upland soils (Campbell et al. 1990). The Rugged Eastern Area is typified by soils derived from shale, siltstone, sandstone or mixtures of these rocks. On ridges and convex slopes, major residual soils are Dekalb (dystrochrept mainly on sandstone), Gilpin (dystrochrept on mixed parent material) and Latham (hapludult on shale). Major colluvial soils on sandy parent material are Marrowbone and Kimper (dystrochrepts); those on mixed parent material are Fedscreek (dystrochrept) and Shelocta (hapludult), or on north/northeast-facing slopes, Cutshin (haplumbrept). Alluvial soils are differentiated by such factors as frequency of flooding and terrace position. Along the western margin of the district, the Low Hills Belt generally has similar soils, though there are deeper beds of gray shales and thinner beds of sandstone. Thus, there is much less of Dekalb and other soils derived mainly from sandstone. In general, most soil series of the Rugged Eastern Area (including RRD) are shared with non-calcareous sections of the Cliff Section. However, the following overall differences are evident. There is a greater proportion of shale-derived soils in the Rugged Eastern Area, and this is reflected in slightly greater average soil pH. The north-facing slopes, in particular, appear to be more base-rich and generally more fertile. This is pronounced in the Cutshin soil series, which is not present in the Cliff Section. There is also a much smaller extent of excessively well-drained soils near sandstone cliffs (e.g., Ramsey and Steinsburg series).

Figure 2 (contd.). USGS Quadrangles are numbered: 1 = Sturgeon; 2 = Boonesville; 3 = Cowcreek; 4 = Tyner; 5 = Maulden; 6 = Oneida; 7 = Mistletoe; 8 = Buckhorn; 9 = Krypton; 10 = Portersburg; 11 = Manchester; 12 = Barcreek; 13 = Big Creek; 14 = Hyden West; 15 = Hyden East; 16 = Hazard South; 17 = Blackwater; 18 = Hima; 19 = Ogle; 20 = Creekville; 21 = Hoskinston; 22 = Cutshin; 23 = Leatherwood; 24 = Scalf; 25 = Beverly; 26 = Helton; 27 = Bledsoe; 28 = Nolansburg.

Table 1. Classification of soil series in the Rugged Eastern Area of the Appalachian Plateau.

DERIVED MOSTLY FROM SANDSTONE, WITH LESSER AMOUNTS OF SILTSTONE AND SHALE												
1/B HAPLUDALF			B DYSTROCHREPT			B DYSTROCHREPT			3/B DYSTROCHREPT			UPLAND SOILS
Caneyville		sil	*/Marrowbone		fsal	Dekalb		cfsal	Berks		csil	
50-120	2-3	1-5	6-120	2-3	1-4	30-70	2-3	0-2	50-120	2-3	0-2	
1/B HAPLUDALF			B UMB DYSTROCHR.			B DYSTROCHREPT						
*Bledsoe		gsil	*Kimper		chlom	Steinsburg		fsal				
15-60	>5	4-6	30-80	5-8	2-5	12-80	2-3	0-2				
2/B HAPLUMBREPT			B HAPLUDULT			B HAPLUDOLL			B HAPLUDULT			
*Cutshin		clom	*Rigley		fsal	*Sharondale		cfsal	Lily		lom	
15-60	3-7	3-5	30-60	5-8	0-2	30-80	>5	2-5	6-30	2-3	0-2	
			B HAPLUDULT			B FLU HAPLUDOLL			B PALEHUMULT			D AER FLUVAQUENT
			Allegheny		lom	Combs		fsal	Shelbiana		lom	Stokly		lom
			2-20	5-10	0-2	0-4	5-6+	3-5	0-2	>5	3-5	2-3	>5	0-2
			B DYSFLU EUTROCH.			B FLU DYSTROCH.			CD AQU HAPLUDULT			
			Grigsby		lom/sal	Pope		gfsal	Cotaco		lom			
			0-4	>5	3-5	0-2	>5	1-2	0-2	>5	0-2			
			A UDIFLUVENT			B UDIFLUVENT						LOWLAND SOILS
			Potomac		lom	Yeager		lom				
			2-3	>5	2-6	0-2	>5	1-5				

DERIVED MOSTLY FROM SILTSTONE AND SHALE WITH LESSER AMOUNTS OF SANDSTONE												
B DYSTROCHREPT			4/B HAPLUDULT			4/BC AQU HAPLUDULT						UPLAND SOILS
Muskingum		chsil	*/Muse		sil	Latham		sil				
30-80	2-3	1-2	15-50	3-7	1-2	6-60	2-3	0-3				
B DYSTROCHREPT			B HAPLUDULT									
*Fedscreek		clom	Gilpin		csil							
20-80	3-7	1-3	10-60	2-3	0-2							
B HAPLUDULT			B HAPLUDULT			C FRAGIUDULT						
*Shelocta		sil	Wernock		sil	Clarkrange		sil				
15-60	4-10	1-3	2-20	2-4	0-2	2-6	3-8	1-2				
B ULT HAPLUDALF			B HAPLUDULT			CD AQU HAPLUDULT			D AER FLUVAQUENT			E TYPIC FLUVAQUENT
*/Hayter		lom	Whitley		sil	Morehead		sil	Stendal		sil	Bonnie		sil
4-30	4-7	2-4	0-12	5-10	1-2	0-4	5-10	1-2	0-2	>5	1-2	0-2	5-10	1-2
B DYSFLU EUTROCHR			5/B FLU HAPLUDOLL						5/D AER FLUVAQU.			5/E TYP FLUVAQUENT		
Nolin		lom	Huntingdon		sil				Newark		sil	Melvin		sil
0-2	>5	3-7	0-4?	>5	3-6				0-2	5-20	3-6	0-2	5-20	3-6
B MOLL UDIFLUVENT			B FLU DYSTROCHREPT									LOWLAND SOILS		
Nelse		lom	Rowdy/Cuba		lom/sil									
4-25	5-7+	2-5	0-6	5-10	1-3									

Data are condensed from Soil Conservation Service county surveys (Hayes et al. 1982, Love et al. 1988, Kelley et al. 1990). Soil series are arranged according to parent material/texture (upper and lower panels); poor drainage to right; and from upland residuum, to colluvium (= *; mixed coll./res. = */) to lowland alluvium. Soils with different parent material are coded at left by following numbers: 1 = limestone (Pine Mt.); 2 = mixed colluvium on cool slope aspects; 3 = siltstone/fine sandstone; 4 = acid clay shale/siltstone (including Devonian Shale on Pine Mt.); 5 = mixed alluvium, in some cases derived partly from limestone. Soil series are coded as follows:
First line: soil class following National Cooperative Soil Survey; AER = aeric; AQU = aquic; DYS = dystric; FLU = fluventic; ULT = ultic; UMB = umbric. A = somewhat excessively well drained; B = well-drained; C = moderately well-drained; D = somewhat poorly drained; E = poorly drained.
Second line: Soil series name, with typical A horizon texture: (c/g/r/s/)sil = (cherty/gravelly/rocky/shaley) silt loam; (c)lom = (channery) loam; sic = silty clay; scl = silty clay loam; lfs = loamy fine sand; (g)fsal = (gravelly) fine sandy loam.
Third line: left numbers = typical slope percent; central numbers = typical depth to bedrock in feet; right numbers = typical A horizon pH (unlimed) as follows:
0 = 4-4.5; 1 = 4.5-5; 2 = 5-5.5; 3 = 5.5-6; 4 = 6-6.5; 5 = 6.5-7; 6 = 7-7.5; 7 = 7.5-8.

BIOGEOGRAPHY

Flora

There has been little previous botanical research in the Redbird Ranger District. Even within the whole Rugged Eastern Area of Appalachian Kentucky, there have been few studies. Data on the original forests of the Rugged Eastern Area and Pine Mountain can be gleaned from Crandall (1884), Shaler and Crandall (1884), Defriese (1884) and Barton (1919). Braun (1935, 1942) described the vegetation of Pine Mountain, which runs along the southeastern edge of the RRD. She also collected some plants in the RRD (Braun 1943), including the *Silphium* later described as *S. wasiotense* (Medley 1989, Campbell and Medley 1990). More recent studies in the Rugged Eastern Area are mostly from two study areas in the watershed of North Fork, Kentucky River: Robinson Forest (Hutchins 1972, Carpenter 1976, Carpenter and Rumsey 1976, Phillipi and Boebinger 1986) and Lilley-Cornett Woods (Martin and Shephard 1973, Martin 1975, Romme and Martin 1981, Muller 1982, Sole et al. 1983).

Vegetation types in the main block of DBNF have been described in Palmer-Ball et al. (1988) and Campbell et al. (1989; see also Campbell 1987), but supplementary notes are needed to outline differences between this main block (or the "Cliff Section") and the RRD (or elsewhere in the "Rugged Eastern Area"). Table 2 summarizes the current distribution of forest stands in the RRD that date from before 1900, based on data on file at the district office. Table 3 provides data on forest composition in about 1900, taken from Barton's (1919) survey.

In comparison with the main block of DBNF, there appears to have been a much lower conifer (*Pinus* and *Tsuga*) component in the original forests. On USFS land in the RRD, *Pinus* is dominant in only about 0.1% of the pre-1900 forest area (Table 2), as compared to 1-10% or more in the rest of DBNF (Campbell et al. 1988-92). *Tsuga* dominates in none of the pre-1900 area, as compared to 3-5% in Berea and Morehead Districts or about 15-25% in Stearns, Somerset and Stanton District. Barton's (1919) data also indicate that in about 1900-1910 the RRD had much less *Pinus* (0.2-1.6 vs. 4-16%), *Tsuga* (1-2 vs. 1.5-7.7%) and *Quercus velutina/rubra* group (3-6 vs. 10-29%) than in most other DBNF counties (Campbell et al. 1988-92). In contrast, *Q. montana* (14-26 vs. 4-16%), *Q. alba* group (26-38 vs. 12-25%) and *Fagus* (6-14 vs. 2-6%) appear to have been much more abundant. Together with regional vegetation patterns (Campbell 1987) and soil patterns (see above), these shifts may be interpreted in terms of somewhat higher average base status in the soils of the RRD, compared to the more sandstone-dominated districts in the Cliff Section. Also, the lesser amount of *Pinus* in the RRD, and perhaps some of the *Q. velutina* group, may also be attributed to a lower fire frequency in previous centuries (see also Campbell et al. 1991). Two other successional species in the modern landscape--*Juniperus* and *Robinia*--were not listed by Barton at all in the RRD, in contrast to other DBNF counties.

Current distribution patterns of less disturbed forest types in the Rugged Eastern Area are generally similar to some of those in and near the Cliff Section. However, there is usually a lower diversity of habitat types due to less expression of dry and wet extremes, and due to the absence of limestone except on Pine Mountain. Widespread forest types in less disturbed areas on mesic sites are dominated by *Tsuga*, *Fagus* and *Acer saccharum*. There is considerably less *Tsuga* than in the Cliff Section, where this species is typical of the extensive sandstone ravines. In the Rugged Eastern Area, *Tsuga* is concentrated on steep rocky lower slopes in ravines and on low points. *Acer*

saccharum is most abundant on the relatively fertile soil at the heads of "hollows" (especially on Cutshin soils), and it or *A. nigrum* may have been abundant formerly on the agricultural bottomlands. Widespread types in less disturbed areas on subxeric sites are characterized by *Quercus montana/Q. coccinea/*formerly *Castanea* on more rocky slopes and ridges, and by *Q. alba/Q. velutina/Carya* spp. on average middle to upper slopes. *Pinus* spp., especially *P. echinata*, are locally dominant in relatively undisturbed forest on dry ridges and upper south- to west-facing slopes. These types all intergrade considerably.

Relatively high soil fertility on some sites in the RRD, compared to non-calcareous parts of the Cliff Section, may be indicated by the occurrence of some mesophytic species that are typical of fertile soils in more western regions like the Bluegrass. For example, *Stellaria corei, Jeffersonia diphylla, Synandra hispidula* and *Polymnia canadensis* are locally abundant within forest or at edges on fertile lower slopes. Less common species include *Carex oligocarpa* (found in 1992 along Indian Grave Br. of Goose Cr.), *Trillium sessile* (lower slopes along South Fork south of Booneville), *Isopyrum biternatum* (slope-base along South Fork south of Booneville), *Saxifraga virginiensis* (scattered in rocky areas), *Phacelia purshii* (fields or mowed areas south of Hyden and south of Booneville), and *Prenanthes crepidinea* (see Results: Flora). In addition, considerable ecological similarity between the Bluegrass uplands and RRD bottomlands is evident in the frequent occurrence of cane (*Arundinaria gigantea*), wild-ryes (including *Elymus macgregorii*), *Juglans nigra, Morus rubra, Quercus muhlenbergii, Carya cordiformis, Acer nigrum* and other typical species of the Bluegrass. Even some ridges in the RRD appear to have remarkably moist and fertile soil as indicated by the local abundance of *Acer saccharum, Quercus rubra* and *Ulmus rubra* in addition to the usual oaks and hickories. Some ridges still have fairly luxuriant herb cover with *Podophyllum, Cimicifuga, Eupatorium rugosum*, etc., plus, on drier ground, basiphilous species like *Taenidia integerrima, Solidago sphacelata* and *Diarrhena americana.*

Many forested uplands of the RRD have been frequently burned, even on relatively mesic sites, largely due to man, either as arson fires set from valley roads, or as escaped fires from burning of gardens. Fire in general makes the herb layer denser, and this is most noticeable in oak forests that otherwise would have relatively thin ground cover. Species that appear to respond most strongly include *Amphicarpaea bracteata, Potentilla* spp., *Aureolaria* spp., *Cunila origanoides, Helianthus microcephalus*, some *Aster* spp. (*infirmus, paternus*, etc.), *Poa cuspidata, Panicum dichotomum, P. clandestinum* and, in the most open areas, *Andropogon scoparius* (see also notes on *Silphium wasiotense* in Results: Flora). *Rubus* spp. are also abundant. Woody species that can resprout vigorously after fire, and often become more abundant than the oaks and hickories, include *Robinia pseudoacacia, Sassafras, Ulmus rubra, Acer rubrum, Oxydendron* and *Vaccinium* spp.

On bottomland, there is generally a strip of streamside forest with *Platanus* and *Betula nigra*, plus *Acer negundo* on more fertile terraces of larger floodplains, and some *A. saccharinum* on muddy banks of the deeper rivers. Otherwise there are few forest remnants on bottomland, but these suggest that *Fagus*- and *Acer saccharum*-dominated mesophytic forest may have been widespread on the well-drained soils, with *Tsuga* largely confined to more acid, sandy terraces. On the driest bottomland, *Quercus alba* and *Q. velutina* may even have been frequent. Disturbance from flooding, cutting and farming has largely converted the remaining forest to *Liriodendron*-dominance, with locally frequent *Juglans nigra.* The few swampy places are characterized by an admixture of *Liquidambar, Acer rubrum* var. *trilobum* and *Fraxinus pennsylvanica*, as well as the common streamside species noted already.

Table 2. Pre-1900 stands in the Redbird Ranger District: USFS type and distribution.*

Forest type	Number of stands	Acres (approx.)	Note on distribution
Yellow pine (32)	1	15	
Chestnut oak-scarlet oak-pine (45)	1	17	Ridges/upper slopes, mostly near Left Fork Buffalo Cr., and on divides of Redbird Rv.
Chestnut oak/scarlet oak (52,59,60)	9	260	either side of Creekville-Redbird area (and on Greasy Cr. and on Bull Cr.).
White oak (54)	3	40	Average slopes/moister ridges near Big Double Cr./Flat Cr.
White oak-red oak-hickory (53)	220	6350	Average slopes/moist ridges; widespread, much in/near Buffalo Cr. heads.
Yellow poplar-oak (56)	65	2000	Moist slopes; mostly E of Redbird Rv. (Henry Fk.-Upper Jacks Cr.) and Buffalo Cr. to Buckhorn Lake
Sugar maple-beech-birch (81)	70	2030	Moist slopes; widespread, much W of Redbird Rv. (Big Cr.-Redbird Sch.).

*Data are from files at the RRD office; they refer only to land owned by USFS. The USFS type numbers are in parentheses after each type's name.

Table 3. Composition of forests ca. 1900 in some counties of Redbird Ranger District.*

SPECIES	COUNTIES			
	Knox	Clay	Leslie	Perry
Yellow pine (*Pinus*)	0.2%	0.6%	0.9%	1.6
Chestnut oak (*Q. montana*)	14.5	26.6	15.1	13.7
Chestnut (*Castanea*)	13.8	9.4	7.8	12.1
White oak (*Q. alba*, etc.)	26.0	38.1	28.3	34.0
Black oak (*Q. velutina*, etc.)	22.8	6.7	5.5	3.0
Hickory (*Carya*)	4.3	6.1	3.4	4.7
Ash (*Fraxinus*)	0.5	0.2	0.4	0.4
Birch (*Betula*)	---	---	0.6	0.1
Hemlock (*Tsuga*)	---	0.1	4.0	0.9
Cucumber (*Magnolia*)	---	---	1.1	---
Poplar (*Liriodendron*)	4.3	1.2	7.6	5.8
Beech (*Fagus*)	5.9	7.4	10.0	14.3
Basswood (*Tilia*)	2.0	0.9	4.9	2.9
Buckeye (*Aesculus*)	0.5	0.6	1.0	2.4
Walnut (*Juglans*)	---	0.1	0.1	0.3
Maple (*Acer*)	2.7	1.4	5.6	3.0
Gum (*Nyssa, Liquidambar*)	1.4	0.5	2.5	0.5
Sycamore (*Platanus*)	---	---	1.0	0.3
Other	1.1	0.3	0.3	---
Total (million board feet measure)	371	676	1123	859

* Taken from Barton (1919); this sequence of counties traverses the RRD from southwest to northeast; for data from Owsley County, see Campbell et al. (1991).

Oaks and hickories characteristic of mature swamp forest or swamp edges further west in Kentucky are virtually unknown in the Rugged Eastern Area, except in the Cumberland River drainage (Campbell et al. 1990). Just north of the RRD, small remnants of forest with *Quercus palustris* have been found ("The Sag" near Booneville; and with *Q. imbricaria* near Welchburg on Pond Creek--R. Hannan field notes of 1979). *Q. palustris* may have been more widespread with *Liquidambar* and *Acer rubrum* var. *trilobum* on somewhat poorly drained acid soils before settlement. Near Manchester, a few trees of *Q. shumardii* and *Carya laciniosa* were found next to bottomland fields. These two species might have been expected with *Fraxinus pennsylvanica* and *Q. bicolor* on somewhat poorly drained base-rich sites before settlement, as in the Bluegrass Region (Campbell 1980), but *Q. bicolor* is currently unknown in the Rugged Eastern Area.

There is a general mixture of southern, northern and Appalachian components in the flora of Appalachian Kentucky, but there are much lower numbers of rare or geographically restricted species in the Rugged Eastern Area than in the Cliff Section. Southern (to east-coastal) species in or near the RRD, which are mostly distributed in the Cumberland River watershed within Kentucky, include *Calamagrostis cinnoides* (only on Pine Mt.), *Danthonia compressa, Hexastylis arifolia* var. *ruthii, Isoetes engelmannii, Lysimachia tonsa, Physostegia virginiana ssp. virginiana, Rhododendron arborescens* and *Thermopsis mollis* (a remarkable disjunct from the southeast). Northern or montane species include *Anemone quinquefolia, Carex pedunculata, C. scabrata, Lathyrus venosus, Panax trifolius, Pinus strobus* (a fallen 24 inch dbh tree plus 50 saplings on a ridge near Booneville), *Poa alsodes* (scattered widely), *Trautvettaria caroliniensis*, and several others found just on or near Pine Mountain (see j below). Unexpected in the RRD was a small group of species typical of the deep, moist, fertile soils in the Bluegrass and other mid-western regions (see above, this section).

Selected groups of these and other infrequent to rare, or geographically restricted, species are characteristic of certain habitats in the RRD or nearby (see also preceding notes on species typical of Bluegrass Region).

(a) Wetlands on bottomland. There are almost no natural wetlands or even seasonally wet habitats left on the bottomlands, but a few characteristic species have been found in or near the RRD. In addition to the swamp oaks noted above, rare species include *Polygonum arifolium* and *Sium suave* (in "The Sag"--a slough remnant near Booneville), and *Platanthera lacera* (in wet meadows near Big Cr. and Cawood Br.). These species' ranges are mostly centered in the Ohio and Mississippi Valleys. Further details are noted in the Significant Sites section under "South Fork Watershed".

(b) Rocky banks of larger streams. South and west of the RRD, in the Cumberland River system, there are many additional species in this habitat, including several rarities. The few characteristic species that extend up into the RRD include *Clematis glaucophylla, Physostegia virginiana* ssp. *virginiana, Rhododendron arborescens* and *Trautvettaria carolinensis*. Also typical of this habitat in much of Appalachian Kentucky is *Panicum yadkinense*. Within the RRD, these species were found only along the South Fork of Kentucky River. These species are mostly typical of the southern Appalachians in a broad sense. *Chasmanthium latifolium* is a frequent distinctive species in transitions from rocky riverbanks to adjacent forest, and often on lower slopes along bottomland roads.

(c) Well-drained, sandy, forested terraces along larger streams (often with *Tsuga* and associates). A few species that are uncommon in Kentucky appear to be characteristic of such sites in the RRD. These include *Panax trifolius* and *Anemone quinquefolia*--both with northern distributions.

(d) Roadsides and burned woods, especially on lower slopes. A few uncommon or rare species are virtually restricted to roadsides, where they may be relics from open woods maintained by fire and browsing before settlement (see also Campbell et al. 1991). These include *Asclepias exaltata?, Castilleja coccinea, Cirsium muticum* (scattered widely), *Phaseolus polystachios, Helianthus strumosus* (found along Gilberts Big Cr. and US 421 along Rockhouse Br.), *Silphium trifoliatum* (found at several sites in less rugged land north/east of Big Creek and Manchester), *S. wasiotense* and *Veronicastrum virginicum*. These species of mesic to subxeric sites mostly have wide eastern distributions, except for the Appalachian Plateau endemic, *S. wasiotense*.

(f) Forest on mesophytic slopes. Three uncommon species are typical of moist to damp lower slopes that are steep and rocky in places. These include two northern species--*Carex pedunculata* and *Waldsteinia fragarioides*, plus the undescribed broad-leaved *Solidago* sp. (see Results: Flora). Also on such sites are *Lonicera dioica* (Braun colls. near Redbird Rv.--Nolan Br., Clay Co., and Beverly, Bell Co.), *Anemone quinquefolia* and *Magnolia fraseri* (both near Middle Fk.; also c, j).

(g) Ridges, especially along paths and roads. Three rare legumes have been found at such sites in the Rugged Eastern Area: *Thermopsis mollis* (in RRD, see below), *Lathyrus venosus* (in RRD and elsewhere), and *Astragalus canadensis* (found north of RRD, but to be expected here). Somewhat more frequent species typical of such sites are *Asclepias variegata, Tradescantia virginiana* (found at one site in the RRD, near Booneville), *Danthonia compressa* (also scattered along dirt roads on lower slopes) and *Lysimachia tonsa* (scattered in more rugged land S of Big Creek and Hyden). These are mostly southeastern species, except for the *Astragalus* and *Lathyrus*. Some of these species may have been maintained by fire before settlement of this region. However, there is no record of the several other rare species that appear to be relictual from fire-maintained pine-oak barrens in the southern Cliff Section (Campbell et al. 1991b).

(h) Seasonally wet streamheads. There are many more rare species known from such habitats in southeastern districts of DBNF. The only notable species in the RRD is *Isoetes engelmannii*. Among *Platanthera* spp., only *P. flava* (including var. *herbiola*), *P. clavellata* and *P. ciliaris* were found. For details see notes under South Fork watershed in Significant Sites section.

(i) Rock outcrops. Sandstone cliffs and glades are much less extensive here than in the rest of DBNF. On dry clifftops, typical species include *Hypericum gentianoides, Andropogon scoparius, Panicum linearifolium, Danthonia sericea, Aster surculosus, Tephrosia virginiana, Gaultheria procumbens, Gaylussacia baccata, Amelanchier arborea, Pinus virginiana* and *Quercus* spp. No rare species were found in this habitat. Under cliffs, the only characteristic species are not particularly rare--*Heuchera parviflora* and *Silene rotundifolia*. On more shaley outcrops, two unusual species for the Rugged Eastern Area were discovered by R. Hannan and L. Phillipe in 1979 (KSNPC site files) on an open, southwest-facing slope, 1 mile east of Buckhorn, and also found by them at another Perry County site (Tilford Qd.): *Polypodium polypodioides* and *Cheilanthes lanosa*. Two additional sites for *P. polypodioides* were found by J. MacGregor and J. Kiser in 1992: a large population on a boulder near mouth of Guy Camp Branch, Left Fork Buffalo Creek (Owsley Co., Mistletoe Qd.); and another in Wolfpen Branch (Clay Co., Creekville Qd.).

(j) Pine Mountain and nearby (various habitats). In the RRD, several species have been found only on or near Pine Mountain, except for a few with rare or disjunct occurrences on the Appalachian Plateau. These species include: *Baptisia tinctoria, Cypripedium parviflorum?, Gentiana decora* and *Rhododendron catawbiense* (open pine/oak woods on crest of Pine Mt.); *Calamagrostis cinnoides, Carex stricta, Rumex altissimus, Chrysosplenium americanum, Glyceria melicaria, Liparis loesellii, Lycopodium inundatum, Solidago patula* and *Xyris torta* (in various seeps along the northern base of Pine Mt. or in streamheads on the southeast side); *Corallorhiza maculata, Disporum maculatum, Magnolia fraseri, Rubus odoratus* and *Solidago curtisii* (various sites in mesophytic forest or at edges--locally frequent except *C. maculata*). These species mostly have northern or high Appalachian distributions, except for the southeastern *Calamagrostis* and *Xyris*.

Aquatic Fauna

The Redbird Ranger District is located within and includes most of the drainage basins of the Middle and South forks of the Kentucky River (Fig. 3), which are probable pre-Pleistocene tributaries to the Teays River (Burr and Page 1986). The Middle and South Forks historically supported diverse faunas, but pollutants from coal and petroleum development and agriculture have greatly modified streams within these drainages and impaired some of their uses as warmwater aquatic habitat and primary contact recreation (Kentucky Division of Water 1992).

Very little has been published about the mollusca of the study area. Danglade (1922) studied the commercial potential of Kentucky River unionids, but only briefly mentioned the presence of small unionid beds in the South Fork within the District. Williams (1975) also investigated the commercial unionid resources in the Kentucky River and found a total of 21 species, including the United States Fish and Wildlife Service (1991) candidate for listing *Epioblasma triquetra*, at unspecified collection sites in the Middle and South forks. Schuster (1988) compiled Kentucky unionid collection records, including those for the District, and Cicerello et al. (1991) summarized this and other information in a unionid checklist. Information about aquatic snails is limited to county distributional records presented in Branson's (1970) checklist, and a few records from selected sites in the District sampled by Branson and Batch (1981).

Information about crayfishes in the District also is limited. Harker et al. (1979) collected three species from three Middle and South fork site during an extensive study of eastern Kentucky streams. Additional information is limited to general distributional information presented by Rhoades (1944) and Hobbs (1989).

Rafinesque (1819, 1820a,b) made the earliest examinations of Kentucky River fishes but did not provide specific collection localities. Woolman (1892) sampled at five South Fork and three Middle Fork (one now inundated by Buckhorn Lake) sites and secured specimens of two rare fishes, *Etheostoma pellucidum* and *E. sagitta spilotum*. Kuehne and Bailey (1961) provided additional occurrence records for *E. sagitta* within the study area and presented evidence supporting its introduction into the South Fork via headwater piracy of a Cumberland River tributary. Important distributional records for about 60 species, including *Lampetra appendix, E. pellucidum, E. maculatum*(?), and *Percina evides*, resulted from a pre-impoundment study of Middle Fork fishes by Turner (1967). The Kentucky Department of Fish and Wildlife Resources conducted a series of primarily sportfish-oriented examinations of the Middle and South forks that provided important information about non-game fishes (Jones 1973, Jones and Stephens 1984, Prather 1985). Seehorn

(1975) prepared a list of DBNF fishes, and Branson (1977) prepared the first list of rare fishes in the forest. Branson and Batch (1983, 1984) subsequently reported the results of extensive examinations of the Middle and South fork faunas. Aquatic biota and water quality surveys of several sites in these drainages by Harker et al. (1979b) yielded, among other information, a range extension for *Ichthyomyzon fossor* into the South Fork (i.e., Goose Creek) (Warren 1981). Much of the taxonomic and distributional information from the aforementioned studies was included in Clay's (1975) book on the fishes of Kentucky, which was updated and supplanted by Burr (1980) and Burr and Warren (1986). Much of the biological literature was summarized by Bradfield and Porter (1990).

Several sites in the drainages were identified as potentially eligible for Outstanding Resource Water Status (Hannan et al. 1982). Some of these and others were subsequently included on a list Kentucky rivers recognized for their important ecological, fish, water quality, and wildlife resources (Kentucky Division of Water and National Park Service 1990).

Terrestrial Fauna

The rarer components of the terrestrial fauna of the Redbird Ranger District consist primarily of an assortment of Appalachian species that reach the edges of their ranges along the north face of Pine Mountain and, in some cases, the adjacent sections of the Rugged Eastern Area of the Cumberland Plateau. Such species include the Masked Shrew (*Sorex c. cinereus*), Rock Shrew (*Sorex dispar*), Cumberland Red-backed Vole (*Clethrionomys gapperi maurus*), and Cloudland Deermouse (*Peromyscus maniculatus nubiterrae*) among the mammals; the Common Raven (*Corvus corax*) and Chestnut-sided Warbler (*Dendroica pensylvanica*) among the birds; the Mountain Dusky Salamander (*Desmognathus ochrophaeus*) and probably (found nearby) Wehrle's Salamander (*Plethodon wehrlei*) among the amphibians; and Cupped Vertigo (*Vertigo clappi*) and the Glassy Grapeskin (*Vitrinizonites latissimus*) among the land snails.

Less geographically restricted though still of interest in this region are some other generally rare or hard to find species, including the Northern Coal Skink (*Eumeces a. anthracinus*), found in Clay County during the inventory, and perhaps the Northern Pine Snake (*Pituophis m. melanoleucus*), reported long ago in the literature from Harlan County and in the 1970s reported from Letcher County (J. MacGregor, database)--it may or may not occur on the RRD. Three rare species found on the Redbird Ranger District - the Hispid Cotton Rat (*Sigmodon hispidus*), Spotted Skunk (*Spilogale putorius*), and Rafinesque's Big-eared Bat (*Plecotus rafinesquii*) - are southeastern forms that reach the northern limits of their distributions on or near the DBNF.

The Hispid Cotton Rat is perhaps the most interesting of the small mammals encountered during the RRD Inventory. It is one of the most abundant small mammals of the Coastal Plain and Piedmont of the Southeastern United States, where it typically occurs in non-forested wetland habitats, along ditch margins, and in pastures and old fields. The species also extends northward along the Mississippi Embayment into western Kentucky, however, and northward through the southern Appalachians into southeastern Kentucky and nearby sections of eastern Tennessee and western North Carolina. A single Hispid Cotton Rat was collected during the Inventory (see Results Section). Previous Kentucky records for this species have come from the Jackson Purchase region of far western Kentucky, from Breathitt County (collected by Thane Robinson at University of

Louisville and later cited in Davis and Barbour, 1974), and from Cumberland Gap National Historical Park in Bell County (Barbour, Davis, and Kuehne, 1979). In the Jackson Purchase, the Hispid Cotton Rat was thought to have been fairly common in the early 1970's (Wayne H. Davis, pers. comm.) but had become extremely scarce by 1990-91 (William D. Hendricks, pers. comm.). The Biological Inventory of the Jackson Purchase Region of Kentucky (KSNPC 1991) that was conducted by KSNPC and KDFWR during 1990 and 1991 resulted in the taking of only a single Hispid Cotton Rat despite a very intensive small mammal field effort. The current status of the colonies that have been found in southeastern Kentucky remains unknown.

Several endemic animal species (those which are entirely or largely confined to the Cumberland Plateau and Appalachian Plateau Regions of southeastern Kentucky) occur on the Redbird Ranger District and/or on adjacent portions of Pine Mountain. Endemic vertebrate species and subspecies include the Cumberland Redbacked Vole, found only in the Cumberland Mountains section of Kentucky and adjacent southwestern Virginia, and three forms that are somewhat more widely distributed. The Arrow Darter (*Etheostoma sagitta spilotum*) is endemic to streams within the Kentucky River drainage that are located on the Cumberland Plateau. The Cumberland Plateau Salamander (*Plethodon kentucki* - not listed) is endemic to the Cumberland Plateau and Cumberland Mountains. It is a terrestrial species which ranges from the Morehead area southward and westward to the Jellico Mountains (Stearns RD) and occurs throughout much of eastern Kentucky (with slight extensions into western West Virginia, extreme southwestern Virginia, and extreme northern Tennessee). The Black Mountain Salamander (*Desmognathus welteri* - not listed) is nearly endemic to the Cumberland Plateau and Cumberland Mountains. This large semiaquatic salamander dwells in and along high quality, high gradient, rocky headwater streams in mountainous terrain and ranges from the Morehead area in the north to the southern end of Pine Mountain in Tennessee, eastward into the Cumberland Mountains in southwestern Virginia and the southern section of the Ridge and Valley of West Virginia. In Kentucky, where it is most common and widely distributed, the best populations occur in the Cumberland Mountains and in the Cliff Section along the western edge of the Cumberland Plateau.

Endemic invertebrates include a land snail (*Anguispira rugoderma*) (no common name) and several small species of blind troglobitic beetles. The snail *A. rugoderma* was thought prior to this inventory to be endemic to the north side of Pine Mountain (Bell and Harlan Counties) but during the inventory it was found by J. D. Kiser at two Leslie County stations. It remains endemic to southeastern Kentucky. At least four species of cave beetles are endemic to Pine Mountain. Two of these, the Rogers' Cave Beetle (*Pseudanophthalmus rogersae*) and the Schoolhouse Cave Beetle (*P. scholasticus*) are known only from Sawmill Hollow Cave in Harlan County (within the Redbird RD proclamation boundary and located on property owned by the Pine Mountain Settlement School). There are undoubtedly several additional troglobitic invertebrates that are endemic to the Pine Mountain caves that are located in Harlan County.

Several kinds of rare cave-dwelling bats - the Indiana Bat (*Myotis sodalis*), the Eastern Small-footed Bat (*Myotis subulatus leibii* = *M. leibii*), and the previously-mentioned Rafinesque's Big-eared Bat - are known to utilize the caves on Pine Mountain as hibernation sites and/or forage over streams and ponds or along clifflines on the RRD for night-flying insects. Sandstone caves and natural rock shelters along clifflines, as well as abandoned coal mines, are used by Rafinesque's Big-eared Bats, Northern Long-eared Bats (*Myotis septentrionalis*), and probably other bat species

as daytime roosts. A Gray Bat (*Myotis grisescens*) was caught nearby in October, 1987 in a mistnet set over the Poor Fork of the Cumberland River in Harlan County near the city of Cumberland (H. Bryan and J. MacGregor, obs. in 1988). At the time, it was assumed that this bat was captured during migration from a maternity cave in Lee County, Virginia to the large Gray Bat hibernaculum located in Edmonson County in west-central Kentucky. The insight that has been gained into the large size, pristine condition, vertical nature, and extreme complexity of some of the limestone cave systems on Pine Mountain during this inventory, however, suggests that there may be one or more very significant bat hibernacula for the Gray Bat and/or Indiana Bat in the area.

Notes on small mammals. The overall small mammal fauna of the Cumberland Plateau and Cumberland Mountains of Kentucky includes about 25 species of shrews, moles, and small rodents. Throughout the DBNF and RRD, there are 10 fairly common and widespread species that can be expected to occur in just about any forested area. Included here are the Short-tailed Shrew, Smoky Shrew, Pygmy Shrew, Hairy-tailed Mole, White-footed Mouse, Eastern Woodrat (generally restricted to caves, clifflines, old mines, and rock talus areas), Pine Vole, Woodland Jumping Mouse (mostly along stream and seepage margins and in similar moist habitats), Eastern Chipmunk, and Southern Flying Squirrel. Within this group, the Hairy-tailed Mole and Woodland Jumping Mouse are confined (in Kentucky) to the Appalachian region while the others are more widespread in distribution.

An additional set of 11 DBNF small mammal species can be found in various disturbed and/or bottomland habitats. Included in this group are the Least Shrew, Southeastern Shrew, Eastern Mole, Golden Mouse, Eastern Harvest Mouse, Prairie Vole, Meadow Vole, Southern Bog Lemming, Hispid Cotton Rat, and the introduced House Mouse and Norway Rat. The Southeastern Shrew, Eastern Mole, Prairie Vole, and Meadow Vole are all fairly rare and local in the DBNF and in southeastern Kentucky; these species have apparently utilized broad river bottoms as invasion routes into the Cumberland Plateau and Cumberland Mountains from the north and west. The Hispid Cotton Rat, with three isolated occurrences in the region Bell, Breathitt, and now Harlan Counties), has apparently moved into southeastern Kentucky by advancing northward through the southern Appalachians - an unusual and perhaps unique dispersal situation for what is typically a coastal plain/piedmont species.

A third set of small mammals found within the DBNF consists of four species - the Masked Shrew, Rock Shrew, Cloudland Deermouse, and Cumberland Red-backed Vole - that are basically limited, in Kentucky, to the Cumberland Mountains section. The center of distribution for each of these is located in northern and northeastern North America, but each ranges southward at high elevations (where climates are cooler) along the higher mountains of the Appalachian chain into Kentucky, Tennessee, North Carolina, or even extreme northern Georgia. The Cumberland Red-backed Vole is an isolated subspecies (*Clethrionomys gapperi maurus*) of the wide-ranging Red-backed Vole; it occurs only in the Cumberland Mountains of Kentucky, adjacent Virginia, and (probably) adjacent Tennessee.

Two races of the Masked Shrew occur in Kentucky. The northern race (*Sorex c. cinereus*) ranges over a large area of the northern U.S. and Canada and extends southward in the higher mountains into extreme northern Georgia (?). This is the form that can be found on cool moist slopes at high elevations in the Cumberland Mountains of southeastern Kentucky. A midwestern race (*Sorex c. leseuerii*) - which will likely prove eventually to be a separate species - occurs in the

swampy lowlands of the Western Coal Field in northwestern Kentucky. Two races of the Deermouse occur in Kentucky as well. The Cloudland Deermouse (*Peromyscus maniculatus nubiterrae*), like the northern race of the Masked Shrew, occurs in the northeastern U.S. and ranges southward only at high elevations in the mountains. The Prairie Deermouse (*Peromyscus maniculatus bairdii*) has been found at scattered locations in the Bluegrass Region, Mississippian Plateau, and Jackson Purchase of central and far western Kentucky.

Southeastern Shrews and Eastern Moles are common and widespread along river bottoms to the west of DBNF but are rare or absent in the Cumberland Plateau and Mountains. Both of these species have managed to invade the DBNF along the Licking River corridor on the Morehead Ranger District (Campbell et al, 1992). To the south of the Morehead District, the Eastern Mole has been found along the floodplain of the Red River on the Stanton Ranger District (D. Dourson and J. MacGregor, pers comm) and in the bottomlands along the Cumberland River as far east as Cumberland Gap in Bell County (Barbour, Davis and Kuehne 1982). Southeastern Shrews have been collected on the floodplain of Watts Creek (Cumberland River drainage) in Whitley County and a creek in Breathitt County (H. Bryan and R. Caldwell, 1981, pers. comm.).

Notes on salamanders. The overall salamander fauna of the Cumberland Plateau and Cumberland Mountains of Kentucky currently includes 24 species. Two of these (Hellbender, Mudpuppy) are aquatic forms that occur only in permanent waterways such as reservoirs, rivers, and the larger streams. The remaining 22 species are primarily forest dwellers.

Within or adjacent to the DBNF, there are six species (Green, Slimy, Cumberland Plateau, Ravine, Zigzag, and Wehrle's Salamanders) that are completely terrestrial - even to the point that they lay their eggs on land and complete their larval development within the egg prior to hatching. Another group of six species (Spotted, Marbled, Jefferson, Streamside, and Four-toed Salamanders plus the Red-spotted Newt) includes those which utilize ponds, temporary pools, wetlands, water holes, or water-filled road ruts for egg-laying and/or larval development. The other 10 species (Northern Dusky, Seal, Black Mountain Dusky, Mountain Dusky, Southern Two-lined, Longtail, Cave, Kentucky Spring, Northern Red, and Midland Mud Salamanders - and occasionally the Four-toed Salamander and Streamside Salamander as well - use small headwater streams, springs, and underground waterways for larval development.

Species that can be found on every Ranger District of the DBNF include the Green, Slimy, Ravine, Spotted, Marbled, Four-toed, Northern Dusky, Seal, Black Mountain Dusky, Southern Twoline, Longtail, Kentucky Spring, Northern Red, and Midland Mud Salamanders and the Red-spotted Newt. Some of these - the Green, Ravine, Seal, Black Mountain Dusky, and Kentucky Spring Salamanders - are essentially restricted to the Cumberland Plateau and Cumberland Mountains in Kentucky (although the range of the Ravine Salamander extends slightly westward into the Bluegrass Region, the Kentucky Spring Salamander has followed the Kentucky and Cumberland Rivers into the Bluegrass and Mississippian Plateau, and the Black Mountain Dusky and Green Salamanders have moved westward along the Cumberland River into the Mississippian Plateau Region).

Among the remainder, the Jefferson and Streamside Salamanders occur in scattered locations in the three northern Ranger Districts (apparently having invaded eastward from the Bluegrass Region to the west); the Cave Salamander (a species largely restricted to areas with exposed

limestone) has been found in all Ranger Districts except the Redbird; and the Zigzag Salamander occurs on the Berea, London, Somerset, and Stearns Ranger Districts along the western margin of the southern portion of the Cliff Section. Two primarily Appalachian species and one Cumberland Mountain/Cumberland Plateau endemic species are also of interest in the RRD, and notes are provided below (see Results: Fauna).

METHODS

Several sources of information were used to identify potentially significant sites. At the outset, lists of species for inventory were generated from information from the Kentucky State Nature Preserves Commission's Natural Heritage Database and a literature review. These species included the few federally Endangered or Threatened species, candidates for federal listing by the U.S. Fish and Wildlife Service (USFWS), those listed as Endangered, Threatened, or Special Concern by the Kentucky State Nature Preserves Commission (KSNPC 1991, updating Warren et al. 1986), and the few additional species listed as Sensitive or Proposed Sensitive by the U.S. Forest Service (USFS; J. MacGregor and B. Knowles, pers. comm.).

Using 7.5 minute U.S. Geological Survey (USGS) topographic maps, aerial photographs, USFS Continuous Inventory of Stand Conditions (CISC), Soil Conservation Service (SCS) surveys, and personal communication with knowledgeable people, potential sites for rare species and ecologically significant habitats were identified and ranked for inventory. Maps and aerial photographs were used to identify areas with wetlands, cliffs and other outcrops, sinkholes and other uncommon topographic features. Forest stands estimated to exceed 100 years old were identified using CISC data and aerial photographs. In addition, USFS personnel and others familiar with the area suggested further sites for visitation. A field schedule was then devised that focused the inventory on the potentially more interesting sites and species, in their appropriate seasons.

Field work began in April 1992 and was mostly finished in October 1992. However, cave surveys and small mammal trapping continued into January 1993. Approximately 80 man-days in the field were devoted to botanical inventory, plus much additional time working on specimens. At least 100 man-days were devoted to zoological inventory, plus some additional time working on specimens.

FLORA

Botanical field work was conducted in areas scattered throughout the district and encompassing as many vegetation types as possible. The primary goals were to relocate previously recorded populations of rare species and to discover new ones. There were few repeated visits to the same sites, due to the limited time. However, through an accumulation of notes made during the year, a qualitative description of the overall vegetation composition was made, with special emphasis on the areas containing rarer species. These notes include comments on dominant species, and general species lists, though incomplete and with seasonal limitations. In addition, population estimates were made for some of the rarer species.

In marked contrast to other districts of DBNF, rare species are scattered widely within the RRD, and were found in various habitats without special concentrations: riverbanks, bottomland forest, slope forest, clifflines, roadsides, streamheads and ridgelines. A special effort was made to search along the rivers and major streams, and special topographic features such as oxbow sloughs, steeper ravines, larger cliffs and swampy streamheads, and the geologically distinct Pine Mountain. Otherwise, the sites visited were generally upland woods that appeared to be more mature than average, based on aerial reconnaissance. This resulted in most work being done on USFS-owned tracts.

Plant specimens were selectively collected throughout the inventory work, focusing on the listed rare species, other rare species of interest, and plants that could not be readily identified in the field. Duplicates of the rare species will be deposited at the University of Kentucky, Eastern Kentucky University or Berea College. Photographs were taken of many rare species and are being deposited at the Winchester and Redbird offices of the Daniel Boone National Forest.

The vascular plant nomenclature used in this report generally follows Kartesz & Kartesz (1980). The listed rare species' names all follow this source, though a few currently used synonyms have also been given in brackets [ ], as discussed briefly in the species accounts. For the rest of the flora, no strict standard has been followed, though virtually all names preferred here have been used in at least one of the standard manuals (Fernald 1950, Gleason and Cronquist 1963, Radford, Ahles and Bell 1968). In the short lists of associated species that are provided in the text below, there is no strict order, but species are generally in life-form and taxonomic groups. Species with no congeners in DBNF are referred to by genus name only. A complete floristic list is not included with this report. However, much information on the DBNF flora is already available from earlier inventory reports, and further data are being incorporated into the Atlas of the Kentucky Flora, a database compiled by J. Campbell and others.

FAUNA

The general location of 61 collecting sites and tables listing fresh water mussels and fishes collected during this effort are presented in Appendix D. Streams were sampled by from one to six persons on 14-16 July; 5-7, 14, and 18-21 August, and 2 October 1992. Fresh water mussels were sought by scanning stream bottoms with viewing buckets, searching stream bottoms with hands and feet, and examining muskrat (*Ondatra zibethicus*) midden and/or shorelines for shells. Shells retained as voucher specimens will be deposited at Eastern Kentucky University. Fishes were sampled by seining or electrofishing in all available habitats at a site. In some cases, easily identified specimens were released at the sample site. Others were fixed and preserved, identified, and have been deposited at Southern Illinois University at Carbondale. Nomenclature follows Turgeon et al. (1988) for mussels, and Robbins et al. (1991) and Page and Burr (1991) for fishes. Distributional statements are based on Burr and Warren (1986), Cicerello et al. (1991), and Kentucky State Nature Preserves Commission (1992b).

In terrestrial habitats, small mammals were surveyed by using pitfall traps (32 oz. cups), pitfall buckets with drift fence, snap traps (mouse traps and museum specials), sherman traps and discarded bottles along roads. Pitfall traps were partially filled with 10 % formalin (9:1 water: formalin), so that complete specimens could be obtained. These traps were set using a posthole digger, in areas with frequent signs of small mammal activity. A total of 14 sites were selected with at least one site per county in the Proclamation Boundary of the RRD. These sites covered a variety of habitats, such as the high elevation mesophytic forest with boulder talus, low elevation mesophytic forest with boulder talus, bottomland swamps and streamside forest. Snap traps and sherman traps baited with peanut butter and sunflower seeds were set in similar areas at 15 sites. These traps were set for a 3 to 4 day interval and were checked on a daily basis. These trapping efforts resulted in 77,658 trap-nights of sampling time, though leaf litter reduced the effective time for pitfall traps during late fall. Amphibians and reptiles were also captured in pitfall traps, but were usually sampled by (patrolling roads or walking around) overturning rocks and logs during or shortly after a rain. Snails were captured in pitfall traps, but were usually sampled by raking through leaves, or

by overturning rocks and logs. All specimens collected from traps or by field investigators during the inventory have been identified, catalogued and will be deposited in a museum to be determined. Birds were identified from auditory and visual criteria, but there was no directed search for bird species. Using data from the Kentucky Breeding Bird Atlas, a list of breeding birds was generated (Appendix C).

Because several of the rare species in the area were associated with high elevation, limestone caves and sandstone cliffs, a special effort was made to census the bats and other animals on or close to Pine Mountain. During the summer and early fall, sites that might harbor rare species were chosen. Mist nets were placed across ridgetop logging roads, bottomland logging roads, streams, rivers and road-rut ponds. In December, an intensive search for hibernating bats in virtually all known sandstone rockshelters, limestone caves, abandoned mine portals, and in attics of buildings was conducted. Due to complex cave systems and deep pits within these caves, two caves on Pine Mountain were not checked. These remaining two cave entrances will be mist-netted during April 1993.

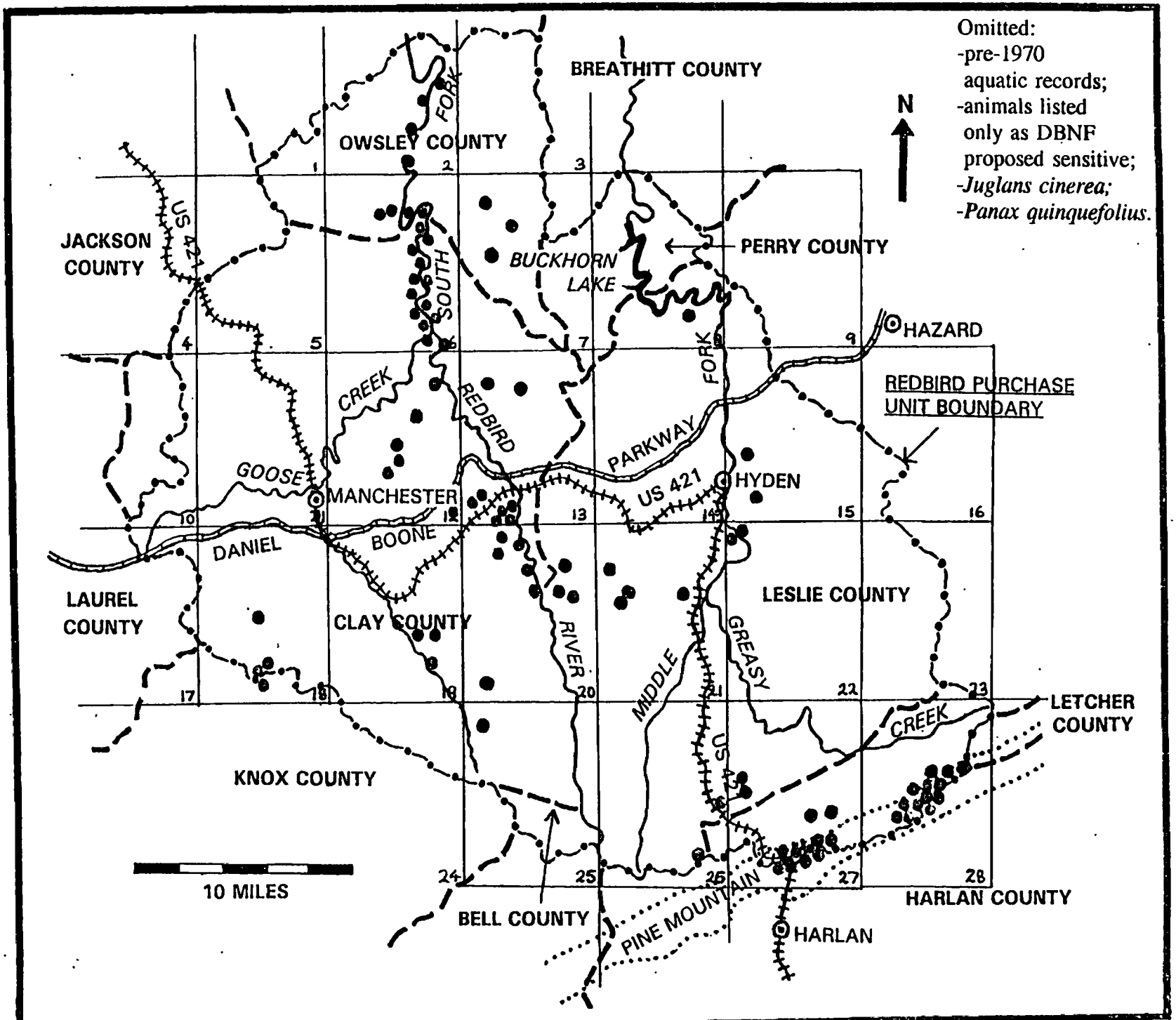

Figure 3. Map of the Redbird Ranger District showing locations of listed rare species occurrences.

RESULTS

This section has been divided into three parts: notes on the rare flora, rare fauna, and "Significant Areas". Table 4 presents total numbers of old and new records for USFWS-, KSNPC- and USFS-listed rare species from the RRD, excluding those plant species for which only uncertain or marginal records are available. It also indicates numbers of records within "Significant Areas". The distribution of all these listed rare species records, combined, is shown in Fig. 3.

Table 4. Occurrences of listed rare species known from the Redbird Ranger District.*

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Significant Areas
FLORA			
[*Baptisia tinctoria*]			
Yellow Wild Indigo	--	[1]	[1]
[*Calamagrostis cinnoides*]			
Cinna-like Reed Grass	--	[1]	[1]
Calycanthus floridus			
Sweet Shrub	--	1?	1?
[*Carex leptalea*]			
Sedge	--	[1]	[1]
Carex stricta			
Sedge	--	1	1
Castilleja coccinea			
Indian Paintbrush	1x	--	--
Chrysosplenium americanum			
Golden Saxifrage	1	2	3
Cleistes divaricata			
Spreading Pogonia	--	1	1
Clematis glaucophylla			
Leather Flower	--	2	2
Corallorhiza maculata			
Spotted Coral-root	1	1	2
[*Corydalis sempervirens*]			
Pale Corydalis	[1]	[1]	[2]
Cypripedium parviflorum			
Small Yellow Lady's-Slipper	--	1?	1
[*Gentiana decora*]			
Showy Gentian	--	[1]	[1]
[*Glyceria melicaria*]			
Manna Grass	--	[1]	[1]
Lathyrus venosus			
Bushy Vetch	--	1	--
Liparis loesellii			
Bog Twayblade	1	--	1
[*Listera smallii*]			
Small's Twayblade	--	[1]	[1]
Panax quinquefolius			
Ginseng	+	14	>14

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Significant Areas
Podostemum ceratophyllum Riverweed	--	30	28
Prenanthes crepidinea Giant Wood-lettuce	--	5	2
Ranunculus allegheniensis Allegheny Crowfoot	3	3	4
Solidago curtisii Curtis' Goldenrod	--	5	3
Solidago roanensis Roan Mountain Goldenrod	1	--	--
Thermopsis mollis Bush Pea	1	2	3
Vallisneria americana Tape Grass	2	--	(2)
FAUNA			
Insecta (coleopterans)			
Pseudanophthalmus rogersae Rogers' Cave Beetle	1	--	1
Pseudanophthalmus scholasticus Schoolhouse Cave Beetle	1	--	1
Molluscs (gastropods)			
Mesomphix rugeli Wrinkled Button	--	>1	>1
Vertigo clappi Cupped Vertigo	1	--	1
Vitrinizonites latissimus Glassy Grapeskin	--	3	3
Molluscs (unionids)			
Epioblasma triquetra Snuffbox	9	--	8
Villosa lienosa Little spectaclecase	4	1	(2)

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Significant Areas
Fishes			
Etheostoma maculatum Spotted darter	1x	--	--
Etheostoma pellucidum Eastern sand darter	6	--	4
Etheostoma sagitta spilotum Arrow darter	12	1	2
Etheostoma tippecanoe Tippecanoe darter	3	1	4
Ichthyomyzon fossor Northern brook lamprey	4	--	1?
Lampetra appendix American brook lamprey	2x	--	--
Percina evides Gilt darter	3	1	3
Percina macrocephala Longhead darter	2x	--	1?
Noturus stigmosus Northern madtom	3	--	1
Amphibians			
Aneides aeneus Green Salamander	>3	6	3
Cryptobranchus a. alleganiensis Eastern Hellbender	1	--	--?
Reptiles			
Eumeces a. anthracinus Northern Coal Skink	--	1	--
Birds			
Corvus corax Common Raven	--	1	1

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Significant Areas
Mammals			
Clethrionomys gapperi maurus			
Kentucky Red-backed Vole	--	3	3
Myotis leibii			
Eastern Small-footed Bat	--	1	1
Myotis septentrionalis [M. keenii]			
Northern Long-eared Bat	--	6	3
Myotis sodalis			
Indiana Bat	--	1	1
Neotoma floridana magister			
Eastern Wood Rat	>5	20	>5
Plecotus rafinesquii			
Rafinesque's Big-eared Bat	2	2	2
Sorex cinereus			
Masked Shrew	--	5	5
Sorex dispar			
Long-tailed Shrew	1	1	2
Sorex [Microsorex] hoyi winnemana			
Pygmy Shrew	--?	5	4
Spilogale putorius			
Spotted Skunk	--	1	--
Ursus americanus			
Black Bear	--	2	1

* -- plant species based on KSNPC (1991); animal species based on KSNPC (1992a).

Key to Table 4:

? -- uncertain record

( ) -- occurrences mostly in less significant or less protectable parts of South Fork drainage (Collins Fork, Goose Creek, etc.)

[ ] -- occurrences only near boundaries of district along crest of Pine Mountain.

x -- not relocated in recent years; possibly extirpated.

FLORA

The Results section below has notes on all rare species found in the Rugged Eastern Area and Pine Mountain sections of the Kentucky River watershed. Included are a few records from the North Fork drainage, which lies outside the RRD, but no additional rare species are known from that drainage. The following rare species occur within a few miles of the RRD, but are not detailed here. To the south, in the Rugged Eastern Area of the Cumberland River drainage (including Jellico Mountains), there are regionally rare species that are unknown north of the watershed divide; these include *Cladrastis kentukea, Porteranthus trifoliata (Gillenia t.)*, and others known on the broader bottomlands, where remnants of forest with *Quercus phellos* and *Q. michauxii* occur (see Campbell et al. 1990). Just 3-5 miles west of the RRD, in the Laurel River valley, there are several rare southern species in wet meadows (L. McKinney, pers. comm.), which are not detailed here. To the north, in the upper watersheds of the Licking River and Big Sandy River, there are also a few that may not occur in the upper Kentucky River watershed; these include *Astragalus canadensis, Hydrophyllum virginianum, Erythronium rostratum, Iris verna, Carex hirtifolia, Cyperus albomarginatus* and *C. polystachios* var. *texensis* (KSNPC 1992b, and unpublished data of M. Medley, pers. comm.). Finally, several other rare species occur on Black Mountain, in the Cumberland Mountain Region.

Listed Species

The following accounts summarize data on the 26 listed rare species that have been reported from the RRD or nearby. The seven species in square brackets [ ] have not been recorded in the district but there are records from within a mile or two of the boundary, and they probably occur within the district or along its Pine Mountain boundary. Following each species' name, its listed status is shown as follows:

(1) Status in Kentucky according to the Kentucky State Nature Preserves Commission (KSNPC 1991): E = Endangered; T = Threatened; S = Special Concern; U = listed but status undetermined; "-" = not listed.

(2) Status in Daniel Boone National Forest as listed by the USFS at the beginning of 1992 (B. Knowles, pers. comm.); E = Endangered; S = Sensitive; PS = Proposed Sensitive (in review at Atlanta); "-" = not listed; "+" = KSNPC listed species that the DBNF inventory has documented on USFS land.

(3) Federal Status as designated by the United States Fish and Wildlife Service (1990a,b); E = Endangered; T = Threatened; C1 or C2 = candidate for listing, Category 1 or 2; C2C3 = species removed from consideration in 1990. No species here are E or T. *Juglans cinerea* is the only current candidate known from the RRD, but it is not thoroughly treated here due to the large number of records and its special disease problem; a summary of data on this species from the DBNF inventory will be possible after 1993. Three other species have potential to become candidates: *Prenanthes crepidinea* (see below), *Silphium wasiotense* and *Solidago* sp. nov. (for latter two, see "Other Species of Interest").

In parentheses after each species' name and status is shown the number of Kentucky counties where it is known, followed by the approximate number of individual occurrences. These data are filed at Kentucky State Nature Preserves Commission. They may be used to help reassess the listed status of some species.

The record of one listed species, *Styrax grandifolia*, is not accepted. A specimen at Vanderbilt University Herbarium (Gonsoulin 1974, Chester 1991) is labelled: G. Gonsoulin 1204, 16 Jul 1969, ca. 2.5 miles SE of Spurlock on KY 66, Clay Co. There are reasons to doubt the native status of Gonsoulin's five evenly spaced records in the state: (1) his five collections are all dated 16 or 17 July, 1969, and no other collection is known from Kentucky; (2) some of these localities have now been rechecked, with no plants found and, in one case, not even suitable habitat; (3) it seems unlikely that this southern species occurs in Kentucky, especially with scattered disjunctions in unexceptional roadside habitats.

[*Baptisia tinctoria* Yellow Wild Indigo: E/-/- (4/>10).] This species is widespread and locally common in southeastern states, but in Kentucky it is known only from Pine Mountain, plus an old record from Todd County. On Pine Mountain it occurs in open pine/oak woods, and can become frequent in burned areas. In 1992, M. Evans found several plants a few hundred yards outside the RRD near the Little Shepherd Trail between US 421 and KY 2010 (Harlan Co.).

[*Calamagrostis cinnoides* Cinna-like Reed Grass: S/+/- (6/30).] In Kentucky, this southern and east-coastal species is largely restricted to the southern Cliff Section, where it is locally frequent in thinly wooded acid streamheads. It is also known from scattered sites in the sandy streamheads of Pine Mountain (including a E. Carr coll. from Pine Mt. State Pk, Bell Co.). In 1992, it was found about 3 miles east of the RRD near the head of Banks Branch (Harlan Co.), a small stream that flows southeast through a large treeless, sandstone outcrop. Over 100 plants were seen, in mossy grassland with *Andropogon glomeratus*, *Panicum* spp., *Carex* spp., etc. Part of this area has been disturbed by quarrying and ponding, but most of the plants were growing in the undisturbed areas.

Calycanthus floridus Sweet Shrub: T/S/- (4/15). In Kentucky, this southeastern to Appalachian species (as var. *laevigatus*) is largely restricted to sandy slopes along the Big South Fork. A few disjunct patches have been found as far north as Powell Co. (in dry woods in Boyd Hollow, a tributary of South Fork Red River; J. Falconer, pers. comm.). In the RRD, a large bush was found along South Fork, Kentucky River, 0.5 mile NW of Big Rooster Branch (Clay Co.). However, this was near some old home sites, on cleared bottomland, and it may have been planted. Northeast of the RRD, in Knott County, apparently native plants have also been found along Laurel Fork of Quicksand Creek, in the transition from *Tsuga* forest on a terrace to *Alnus-Cornus* thicket on a gravel bar. These disjunctions may result from long-distance dispersal, and the species could occur elsewhere along large streams in the upper Kentucky River watershed.

[*Carex leptalea* Sedge: S/+/- (7/15?)]. In Kentucky, this widespread North American species of swampy woods and openings is known from scattered southern localities, in all cases as the southern ssp. *harperi* (Fernald) W. Stone. In 1992, M. Evans found it just outside the southeastern margin of the RRD in a streamhead on Pine Mountain (Harlan Co.).

Carex stricta Big-tussock Bog Sedge: E/+/- (3/5). In previous inventory reports, this species was combined with *C. emoryi* (= *C. stricta* var. *elongata*), which occurs along rivers and large streams. *C. stricta* (sensu stricto) is a widespread species of wet, boggy meadows in eastern North America, but it is rare inland. In Kentucky, it is known only from swampy woods in the Pennyroyal Karst Plain (Hundred Acre Pond, Hart Co.), a boggy streamhead in the southern Cliff Section (with *Platanthera integrilabia* at the Railroad Fork site, McCreary Co.), and from two sites along the Pine

Mountain boundary of RRD (Harlan Co.). One of the latter sites is a small wet meadow at the northern base of Pine Mountain, in the grounds of Pine Mountain Settlement School. The other is in a boggy streamhead on the southeast side of Pine Mountain (for details see Significant Sites).

Castilleja coccinea Indian Paintbrush: E/-/- (4/5). In Kentucky, this east-central species is known from a few scattered prairie remnants and roadsides (Larue, Lewis, Carter and Leslie Cos.). The only confirmed Appalachian records are from Carter Caves State Park on or near limestone, and from Leslie County in the RRD. In the latter case, several plants were found by Jane Fugate 4.5-5 miles west of Hyden on a dry grassy bank along US 421, at "Buffalo Hill". This population was destroyed by bulldozing for a new trailer site in 1985, but some plants were been successfully moved, after initial failures, to a utility right-of-way near the house of Jane & Rufous Fugate (SCS, retired, Hyden) on KY 80 at the head of Hurricane Creek. The salvaged plants had increased to at least 50 in 1992, when they displayed a remarkable range in flowering season, mostly from June to August, but with a few flowers even in October. Species found at the original site in 1992 included *Quercus alba* (dominant in adjacent woods), *Q. velutina, Robinia pseudoacacia, Cercis, Lespedeza cuneata, Angelica venenosa, Helianthus microcephalus, H. strumosus, Ambrosia trifida, Lactuca floridana* and *Festuca arundinacea.*

Chrysosplenium americanum Golden Saxifrage: E/+/- (4/5?). In Kentucky, this northern species is known only from a few sites in the Cumberland Mountains, plus a disjunct site in Leslie County discovered by A. Risk in 1992. It grows on wet acid soil in seeps or along small sluggish streams, usually in fairly deep shade with little other ground vegetation. This species has been known for many years in a seep at the base of Pine Mountain on the grounds of the Settlement School (Harlan Co.). This patch covers up to 100 sq. ft, and is currently associated with *Impatiens biflora* (dense), *Scirpus polyphyllus, Carex lurida* and *Eulalia viminea* (also becoming dense). Perhaps due to competition from these associates, this patch has been declining in recent years, necessitating some weeding (B. Begley, pers. comm.). Another patch of about 10 sq. ft. was found in 1992 along the stream exiting the low rockhouse (old mine?) by the old trash-dump ca. 500 ft NW of the School entrance. The Leslie County site, about 10 miles north of Pine Mountain, was discovered by A. Risk in 1992, at the base of a steep seeping shaley north-facing slope, 5-12 ft above Bowen Creek. It was found in two dense patches, about 6 x 8 ft and 8 x 10 ft, about 20 ft apart and connected by an area with fewer plants. Associates included *Tiarella, Impatiens* sp., *Viola blanda* and the liverwort, *Conocephalum conicum.* The tree canopy consisted of *Tsuga, Fraxinus americana, Magnolia tripetala, Tilia americana, Acer saccharum* and *Fagus.*

Cleistes divaricata Spreading Pogonia: S/+/- (12/22). In Kentucky, this southern species is present only as var. *bifaria* Fernald, which has recently been elevated to species status by Catlin and Gregg (1992). This taxon is known only from the Cliff Section and the Cumberland Mountains, generally in open pine-oak woods, though often with only single plants observed, and in adjacent clearings, occasionally with larger populations. It has been reported from only one site in the RRD, by D. Taylor (pers. comm.) in 1992, along the old logging road on the ridge south of Fish Trap Branch (Clay Co.), where *Thermopsis mollis* also occurs. Only a single plant was seen. It is also known from several places along the crest of Pine Mountain (including Harlan Co., M. Evans, pers. comm.), and probably occurs along the RRD boundary here, though there are no precise records.

Clematis glaucophylla Smooth Leather Flower: E/+/- (8/20). This southern taxon has been reported from a few scattered areas of Kentucky, mostly on or near rocky river banks in the Cliff

Section on sandstone. Typically with glabrous lower leaf and sepal surfaces, it is otherwise similar to the pubescent *C. viorna* of limestone sites, and may deserve only varietal rank. In the RRD, it was found at a few sites along the South Fork in Clay County (Narrows NE of Teges, and road-bank on KY 66, the latter from R. Fugate, pers. comm.) and its tributary, Collins Fork (road-bank along Whites Br.).

Corallorhiza maculata Spotted Coral-root: E/-/- (1/2). In Kentucky, this widespread northern species is known only from the Pine Mountain area in Harlan County. J. MacGregor discovered a small population on the Settlement School grounds in 1980. The population has fluctuated between about 5 and 12 individuals. In 1992, only seven could be found. These plants were found on a low bench in forest of *Tsuga* (dominant), *Acer rubrum, Quercus alba, Rhododendron maximum, Carpinus, Magnolia fraseri, Cornus florida, C. alternifolia*, etc. Herbaceous associates included *Hexastylis arifolia, Tiarella, Mitchella, Viola rostrata, V. tripartita, Chimaphila maculata*, etc. The plants have been found mostly in slightly disturbed ground or along paths up to 100 feet from an old stone fire-place, though some plants were also in undisturbed areas. This site was formerly a regular picnic area, but has been used less during the past 10-15 years. In October 1992, J. Kiser and J. MacGregor also found a single plant in mesic woods on the crest of Pine Mountain (S of Pods Br., Bledsoe Qd.), near the Little Shepherd Trail.

[*Corydalis sempervirens* Pale Corydalis: S/-/- (4/>15).] In Kentucky, this Appalachian species is known only from Pine Mountain, where it occurs in on sandstone outcrops. It has been found at several sites along Pine Mountain, including along the boundary of the RRD in Harlan County: on an outcrop where the Little Shepherd Trail goes west from KY 2010 (J. MacGregor, pers. comm.); above Pine Mountain Settlement School (B. Begley, pers. comm.); and between Ponley and Banks Branch (M. Evans, pers. comm.).

?*Cypripedium parviflorum* Small Yellow Lady's Slipper: E/-/- (8/11?). This northern species is sometimes considered just a small flowered form of *C. pubescens*, but the Kentucky plants, located mostly in the central Cliff Section, have not been thoroughly studied. Along the Little Shepherd Trail above Pine Mountain Settlement School (Harlan Co.), B. Begley (pers. comm.) discovered in 1992 a plant with a flower about 0.7 inches long. He salvaged it from road improvement, and transplanted it to the School Grounds next to some typical plants of *C. pubescens*. Hopefully, we will be able to study this plant in 1993 and make a final determination.

[*Gentiana decora* Showy Gentian: T/-/- (3/12).] In Kentucky, this Southern Appalachian species is known from the Cumberland Mountains. It occurs in open pine/oak woods, generally on sandy soils. There are several records from the crest of Pine Mountain, including along the boundary of RRD in Harlan County. At least five plants were seen along the old path between the heads of Ponley and Banks Branch (i.e., the path to the quarry with *Lycopodium inundatum*). A recent report by D. Barrett from Owsley County, about 4 miles north of the RRD remains unconfirmed. The site was rechecked in 1992, but only *G. villosa* was found.

[*Glyceria melicaria* Manna Grass: S/+/- (11/20?).] In Kentucky, this northern species is known only from the Cumberland Mountains and the Cliff Section (mostly Red River Gorge), typically in rather open forest on sandy terraces of first or second order streams. About 1000 ft south of the RRD boundary, a patch of about 10 sq. ft was found in 1992 in a boggy streamhead on Pine Mountain (I mile N of Rhea, Bledsoe Qd.). Several sites are known elsewhere on Pine Mountain.

Juglans cinerea Butternut: -/-/C2 (>100/>50). This north-central species was once widespread in Kentucky, but has declined greatly due to diseases in the bark. Although recently declared a federal candidate, it has not yet been thoroughly mapped as an element in the Natural Heritage Program (KSNPC). A summary of data on this species from the complete DBNF inventory will be possible after 1993. It is still widely scattered in DBNF, and appears to be more frequent in the RRD than other districts. At least 20 occurrences were found during the 1992 inventory. In most cases, only 1-3 small or diseased individuals were seen, but along some sandy floodplains a few groups of 5-15 trees were found. The best, with 15-20 vigorous trees ca. 4-16 inches dbh, was located on the west bank of Redbird River on the north side of the KY 149 bridge (mouth of Dry Br., Big Creek Qd.).

Lathyrus venosus Bushy Vetch: S/-/- (6/8). In Kentucky, this northern species (as var. *intonsus*) is known only from a few ridges in the Appalachian regions. One population, with at least 50 stems in three patches, was discovered in the RRD during 1991, on the south side of Buckhorn Lake at the head of Spring Branch (Middle Fork, Kentucky River, in Leslie Co.). The plants were growing along 500 ft of a logging road that had been heavily used within the previous year. The remaining woody species included *Quercus velutina* (with cut 2-3 ft dbh stems of 150-200 years), *Acer rubrum, Cornus florida, Ostrya, Vaccinium vacillans*, etc. The thin ground cover included *Rhus radicans, Silene virginica, Vicia caroliniana, Viola hirsutula, Taenidia* (nearby), *Solidago caesia, Coreopsis major, Helianthus microcephalus* and *Danthonia spicata*. There were no other unusual species.

Liparis loeselii Bog Twayblade: S/-/- (5/5). In Kentucky, this northern species has been reported from a few sites in the Cumberland Mountains, Appalachian Plateaus, and one in the Cliff Section (near Middle Fork, Red River). In 1982 and 1984, J. MacGregor discovered a few in an old field at the northern base of Pine Mountain, on the grounds of the Settlement School (Harlan Co.). Nine plants were seen in 1984, with only two flowering. Another rare orchid, *Platanthera lacera*, was found nearby. Both species are often associated with seasonally wet conditions, but this field did not appear unusually wet (J. MacGregor, pers. comm.). Neither species has been observed here in recent years. Northeast of the RRD, three more sites, one with 200 plants, are known from stripmines and roadsides in the Carr Fork valley, Knott County (B. Goodrich, pers. comm. to KSNPC). There is some uncertainty whether this species is truly native or just adventive in the state, since none of its sites appear to be in natural vegetation types.

[*Listera smallii* Small's Twayblade: E/-/- (2/9).] In Kentucky, this southern Appalachian species is known only from the crests of Pine and Cumberland Mountains. It occurs in damp to wet ground, generally with *Rhododendron maximum* and other shrubs in or near boggy streamheads. In 1992, M. Evans found some plants just south of the RRD boundary on Pine Mountain (Harlan Co.).

Panax quinquefolius Ginseng: -/S/- (50/>100). This north-central species is widespread in Kentucky but continues to be much exploited for its medicinal roots. During 1992, it was found at over 14 sites scattered in the RRD, with a total of over 30 plants. Only 1-5 plants were seen in most cases. At one exceptional site, over 15 plants were seen, scattered over several acres of relatively young mesic forest, which had apparently not yet been discovered by diggers (Mistletoe Qd.). Most sites were in mesophytic forest, more often on north- or east-facing slopes, with abundant *Liriodendron* and other common species, e.g., *Fraxinus americana, Cercis, Cimicifuga racemosa, Caulophyllum*, etc. However, occasional plants were found on upper slopes with more oak. The number of sites and plants seen in the RRD inventory (15 and >50, respectively) was almost as

many as in the Stanton District Inventory. Given the similar number of survey days each year, these two districts appear to have about double the density of *P. quinquefolius* as in other DBNF districts (Campbell et al. 1991).

Podostemum ceratophyllum Riffleweed: T/+/- (13/30). Also known as riverweed or threadfoot, this species occurs in the riffles of Appalachian rivers and other rocky riverbeds in eastern North America. It is a remarkable flowering plant, that superficially resembles a benthic filamentous alga. In Kentucky, it is known mostly from the Cliff Section, and appears to have been extirpated further west in the Kentucky and Ohio Rivers. In the RRD, a large vigorous population was found in the South Fork, Kentucky River. Plants were seen at some 28 riffles between Oneida (Clay Co.) and Booneville (Owsley Co.). Smaller patches were also found at one site each in Goose Creek and the Redbird River, within a mile of their confluence. Plants were particularly dense and robust at some sites, with stems up to 12-20 inches long upstream of the "Narrows" near Teges. At a few riffles, most of the riverbed was green with this species, bank to bank, for 100-200 ft along the river.

Prenanthes crepidinea Giant Wood-lettuce: S/+/- (4/6). This species appears to be rare and declining throughout its mid-western range, except in Illinois and Missouri. It may deserve study for federal listing (for details see Appendix A). It is typical of open woods on moist fertile soils. In Kentucky, the only previous records are from Fayette (Campbell and Ruch 1990, and historical collections), Graves (Athey No. 2767), Rockcastle and perhaps Estill Counties (Campbell et al. 1991). In the RRD, it was discovered at three localities in Clay County and one in Leslie County (Cawood Br.). All of these sites are at forest edges along bottomland clearings, up to 15 ft into the shade. At two sites (mouth of Cawood Branch of Beech Fork; Gum Branch of Bear Creek), only a single plant or a cluster of seedlings was found. The two other localities, each with about 30-50 plants, are a mile apart at the edge of mowed grassy areas (with picnic tables) along Big and Little Double Creeks near the Redbird Ranger Station (a few more plants were found upstream on Big Double Cr.). None of the plants found in 1992 flowered, although several began to send up flowering stalks. Mowing cut down several plants. One stem with flowering buds was virtually chewed in two by a stem-boring insect larva, which had left when the damage was found. Many small plants and those in deeper shade did not appear to send up flowering stalks at all. Associated woody species included *Liriodendron* (generally dominant in adjacent woods), *Acer saccharum, Magnolia* spp., *Juglans* spp., *Sassafras, Lindera, Cornus florida* and *Lonicera japonica*. Associates in the herb layer included *Onoclea, Jeffersonia, Agrimonia pubescens, Desmodium paniculatum, Parthenocissus, Rhus radicans, Oxalis grandis, Impatiens capensis, Viola conspersa, Cryptotaenia, Osmorhiza longistylis, Phlox paniculata, Galium aparine, Aster prenanthoides, Eupatorium rugosum, Elephantopus, Verbesina* spp., *Cacalia atriplicifolia, Lactuca floridana, Arundinaria, Festuca obtusa, Panicum clandestinum, Eulalia*, etc.

Ranunculus allegheniensis Allegheny Crowfoot: T/+/- (7/10). In Kentucky, this Appalachian species is known from several scattered sites, mostly in moist forest of the Rugged Eastern Area and Cumberland Mountains. In the RRD, it is now known from six scattered sites (Clay and Leslie Cos.), all in moist woods on lower slopes, and usually along small paths or in somewhat open areas. These sites are in watersheds of upper Goose Creek (Mud Lick Fk., Ashers Fk.), Redbird River (Elisha Cr., D. Taylor, pers. comm.) and Middle Fork (opposite Hardy Bottom, Hoskin Br., Cawood Br.). Only 1-10 plants were seen in each locality. This is an inconspicuous species that is only identifiable during a short fruiting season. It can probably be expected throughout the Rugged Eastern Area, and may not really be rare.

Solidago curtisii Curtis's Goldenrod: T/-/- (3/6?). In Kentucky, this Appalachian species is known only from the Cumberland Mountains and adjacent areas on the Appalachian Plateaus. It generally occurs in typical mesophytic forest, and may be more frequent along trails and under somewhat open canopy. In the RRD, it is locally frequent on Pine Mountain's ridgeline and northwest slope (Harlan Co.), and in hollows of the Appalachian Plateau up to a mile or so from Pine Mountain (Bill Br., Franks Br.). One small patch (5-10 stems) was found on Big Double Creek about 15 miles N of Pine Mountain (Clay Co.). Its closest relative is *S. caesia*, which is generally much more common in the RRD, except in some sections of Pine Mountain. These two species generally occurs in similar habitat, i.e., on mesic to subxeric sites with frequent *Fagus, Liriodendron, Acer* spp., *Quercus rubra, Q. velutina, Parthenocissus, Desmodium nudiflorum, Aster divaricatus, A. lateriflorus, Poa cuspidata*, etc.

Solidago roanensis Roan Mountain Goldenrod: T/-/- (3/5?). This Southern Appalachian Species has been found at a few sites along the Cumberland Mountains in Kentucky. It is similar to the common *S. erecta*, and may have been overlooked. In 1981, J. Campbell collected this species, or a hybrid with *S. erecta*, within the RRD. This site was along a right-of-way in hills just north of Pine Mountain near the Settlement School (Harlan Co.).

Thermopsis mollis Bush Pea: E/S/- (1/2). In Kentucky, this southeastern (especially Piedmont) species, as var. *mollis*, is known only from two localities in the RRD, on ridges east and west of Bear Creek in Clay County. One locality (Town Mountain) was discovered in 1979 by R. Hannan and L. Phillippe, and the other (head of Fish Trap Branch) by D. Taylor in 1992. Several hundred plants were found at both localities in 1992, with the populations extending for up to a mile or so in various patches along these ridge systems. The plants were all within 10-30 feet of the crest of these ridges, and were most abundant in open areas, especially along the logging road at the head of Fish Trap Branch. Flowering or fruiting was only observed on about 20-30 plants, and these were all in more open situations. Frequent woody species in these localities included *Quercus velutina* and *Q. coccinea* (these oaks dominant), *Q. montana, Carya* spp., *Acer rubrum, Sassafras* (common in shrub layer), *Cornus florida, Vaccinium vacillans, Smilax rotundifolia* and *Rubus allegheniensis*. The scattered herbs included *Ascyrum hypericoides, Desmodium nudiflorum, Lespedeza hirta, Solidago caesia, Panicum dichotomum*, etc., There were no other uncommon species discovered except for one plant of *Cleistes* (see above).

Vallisneria americana Tape Grass: S/+/- (5/16). In Kentucky, this widespread eastern species is known from a few sites in the Ohio River; a small lake in Morehead; the Kentucky River (extirpated?); Little South Fork of Cumberland River (abundant); Clear Fork of Marsh Creek (McCreary Co.); and Collins Fork of Goose Creek (near Low Gap Br.). The latter locality is at the southeastern boundary of the RRD. In 1979 and 1992, aquatic biologists from KSNPC discovered plants at 2-3 places in Clay and Knox Counties (near the county line). Only 5-10 individual clumps were seen by R. Cicerello during 1992. As elsewhere in Kentucky, *Vallisneria* occurs here in water about 2-3 ft deep, near riffles but not in them. This stream has a particularly low gradient; for further details see South Fork Watershed in Significant Sites section.

Other Species of Interest (with a note on mosses)

The following 38 species are not currently listed by KSNPC (1991) or the Daniel Boone National Forest (B. Knowles, pers. comm.), though several of them deserve consideration for listing. Nine of them, shown in square brackets [ ], were not found within the RRD, but are known from within a mile or two of the boundary, mostly on Pine Mountain. These species have been reported widely in the state but with a low density of records, or they are restricted to small sections but are locally common. Some are more frequent in other parts of the state, but are near the edge of their range in the RRD and thus of special local interest. Though these species do not all deserve consideration for listing, their presence at least gives extra floristic interest to the areas where they occur. A final note is also provided on some rare mosses found by A. Risk in the RRD.

In parentheses after each species' name, is given the number of Kentucky counties where it is known, followed by the approximate number of individual records. These data have been collected by the Kentucky State Nature Preserves Commission, and by J. Campbell and M. Medley (unpublished). They can be used to compare the rarity of these species with the listed species above. Several species that were considered "of interest" in the previous DBNF Inventory reports appear now to be more frequent. Therefore, they are not listed below. Those found in the RRD include *Cardamine rotundifolia, Carex communis, C. laxiculmis, C. lucorum, C. projecta, C. purpurifera, Cirsium muticum, Danthonia compressa, Geum virginianum, Panicum yadkinense* and *Viola rotundifolia.*

[*Acer pennsylvanicum* Striped Maple (5/>50?). In Kentucky, this northeastern species is known only from the Cumberland Mountains, plus a few sites along the Big South Fork. It is scattered along the crest and southeast side of Pine Mountain, including the Settlement School are (B. Begley, pers. comm.). In 1992, about 5 saplings were noted near the Little Shepherd Trail at the old road to the Banks Branch quarry (Harlan Co., Louellen Qd.).

Anemone quinquefolia var. *quinquefolia* Wood Anemone (9/20?). In Kentucky, the typical variety of this Appalachian species is known from the Cumberland Mountains and southern sections of the Appalachian Plateaus. It generally occurs in mesophytic forest on moist, acid soils with *Fagus* and *Tsuga*. *A. quinquefolia* var. *interior* is known from four additional counties in the northern Cliff Section. In the RRD, this species is locally frequent, with patches covering up to 100 sq. ft on lower slopes or sandy terraces of the Middle Fork (Leslie Co.) and up to a mile into tributary valleys (opposite Mosley Bend, Hurricane Cr,, near Camp Cr., Corn Br., Greasy Cr., Beech Fk.--Big Br. and Cawood Br., Greasy Hollow). These sites are all within a mile of rivers or larger streams, and generally on north- or northeast-facing slopes. It is only known from three sites in the South Fork drainage (Clay and Leslie Cos.): along Indian Grave Br. of Goose Creek; Gilberts Big Creek; and on a river terrace between Rocky and Big Roster Branches, where it appears to have been destroyed by bulldozing since the late 1980s (D. Barrett, pers. comm.). It has also been found on the southeast slope of Pine Mountain, just south of the RRD (streamhead E of Middleton Br., Harlan Co.). Associated woody species included *Fagus, Liriodendron, Tsuga, Rhododendron maximum, Magnolia macrophylla, Viburnum acerifolium, Euonymus americanus*, etc. Herbs included *Adiantum, Polystichum, Podophyllum, Hexastylis arifolium, Stellaria pubera, S. corei, Claytonia caroliniana, Tiarella, Aster divaricatus, Smilacina, Viola blanda, Erythronium americanum, Disporum lanuginosum, Carex lucorum*, etc.

Carex bromoides Medium Tussock Bog Sedge (12/25). This widespread eastern species is known from scattered sites in Kentucky, mostly in the Cliff Section. It is typical of boggy, acid soil in woods along small streams and especially in streamheads. In 1992, it was discovered for the first time on Pine Mountain, at the head of Banks Branch (Harlan Co.). A few clumps were found in hummocks of moss and grass on the large seeping sandstone outcrop (see also *Calamagrostis cinnoides*).

Carex pedunculata Red Tussock Sedge (9/38). In Kentucky, this northern species is known only from the Cliff Section (especially the Red River Gorge), and a few sites elsewhere in the Appalachian Plateaus. In the RRD, it was found at only one locality, with two patches of 20-50 plants each on steep rocky lower slopes along the Middle Fork, between Camp Creek and Johns Creek (Leslie Co.). Other rare species nearby in similar habitat were *Waldsteinia fragarioides* and the undescribed broad-leaved *Solidago* sp. (see below).

Carex scabrata Rough Running Sedge (9/20). In Kentucky, this northern species is known mostly from the Cliff Section, colonizing bare sand and gravel along smaller streams and seeps, generally with forest cover. In the RRD, it was found at only one site, along Merrill Branch, Right Fork, Buffalo Creek (Owsley Co.). The only other site known in the Rugged Eastern Area is along a small branch of Laurel Creek (Knott Co.).

?*Catalpa bignonioides* Catalpa (3/5?). The status of this southern species in Kentucky is not clear. It is sometimes planted as an ornamental and occasionally escapes from cultivation. It has been found on or near rocky banks of the Cumberland River. In the RRD, one small tree was found on rocky banks of the South Fork, Kentucky River, near Rocky Branch, 0.5 mile east of Teges (Clay Co.). Further research on the distribution of this species is needed to make a better judgement on its origin here.

Cypripedium pubescens Yellow Lady's Slipper (45/>100). This widespread eastern species is known from many areas of Kentucky in forest on moist, moderately acid soil, but populations are mostly small and potentially threatened by people digging for horticultural or herbal use. During the 1992 survey, not a single plant was seen in the RRD, except at one site--the USFS tract on the calcareous north-facing slope of Pine Mountain (obs. by J. Kiser). However, there are previous reports from the following sites, mostly on private land: Bear Creek (only site on USFS land) and Glade Branch of Buzzard Creek (both Clay Co., R. Hannan and R. Phillippe, KSNPC notes, 1979); Lick Fork and next branch east of Stinnett Creek (Leslie Co., A. Garrison, pers. comm.); and near Thousand Sticks (NW of Hyden, Leslie Co.), where Rufous Fugate (pers. comm.) has found a population of 50 or more; and Pine Mountain Settlement School (Harlan Co., B. Begley and M. Rogers, pers. comm.). There are scattered records of this species from the Rugged Eastern Area, and it may well have been much more frequent before settlement, disturbance and collection in the lower slopes and hollows where its prime habitat would have been.

Disporum maculatum Spotted Mandarin (8/20). In Kentucky, this Appalachian species is known only from the central Cliff Section, where it is largely restricted to the Red River drainage, and the Cumberland Mountains, where it is more widely scattered. In the RRD, it is known only from a few scattered sites: Glade Branch of Buzzard Creek (Clay Co., R. Phillippe, 1979 notes, KSNPC); and the northwest slope of Pine Mountain, in the Settlement School ground (Harlan Co., B. Begley, pers. comm.). Elsewhere in the Rugged Eastern Area, there are also reports from Perry County (sight

record of Braun 1943) and Letcher County (near Kona, J. Kiser, pers. comm.).

Hydrastis canadensis Goldenseal (>60/>100). This north-central species is known from many forested areas of Kentucky, especially on mesic to subxeric sites in moderately base-rich soil. However, it is generally rare due to harvesting for medicinal use. In the RRD, at least seven populations were found, scattered widely in mesophytic forest. At least three large patches of over 100 sq. ft were discovered (Buckhorn Qd., Helton Qd., Mistletoe Qd.). Associates included *Liriodendron* (usually dominant), *Laportea, Cimicifuga, Caulophyllum, Jeffersonia, Hydrophyllum canadense, Hybanthus, Monarda clinopodia*, etc.

Isoetes engelmannii Quillwort (12/20?). This southern and east-coastal aquatic species of woodland pools and shallow slow-moving streams is known from scattered non-calcareous regions of Kentucky, mostly in Appalachian regions and the adjacent Mississippian Plateaus. In the RRD, it was found in two boggy streamhead openings on the broad ridges between Sugar Creek and Spencer's Branch of Big Creek (Leslie Co.); and at a similar place in the Flatwoods area (head of Dry Br., Redbird Rv., Clay Co.). It was also found in wet fields and dirt road ruts in hollows within a mile north of Pine Mountain (Bill Br., Pods Br., Harlan Co.). Just outside the RRD, it is known from streamheads on the southeast side of Pine Mountain, just outside the RRD. Some populations had at least 30-50 plants (e.g., Bill Br.).

**Isopyrum biternatum* False Rue Anemone (>30/>100). This eastern species is widespread in forest on moist, fertile soils, especially west of the Appalachians. In 1992, it was documented for the first time in the Appalachian Plateaus of Kentucky. A patch of about 100 sq. ft was discovered next to an old dirt road at the base of a slope along the South Fork, Kentucky River, about 1.5 miles downstream from Buffalo Creek (Clay Co.). These plants were growing 10-30 ft from several plants of *Jeffersonia diphylla*, a species of similar habitat that is more frequent but still uncommon in Appalachian sections of the state. A few miles downstream, two more species with similar distributions in the state have been found--*Phacelia purshii* and *Trillium sessile* (see below).

Lycopodium clavatum Running Clubmoss (2/2). This northern (circumboreal) species was first discovered in Kentucky by W. Meijer on 23 Apr 1985, within the RRD: "open sandy stripmine bench and slope, SW of Bledsoe [School], Harlan Co." The second record is due to A. Garrison (pers. comm.), who found it about two years ago along a dirt road along the base of a southwest-facing slope at the head of Left Fork, Elisha Creek (Leslie Co.). About 10 small clumps were noted here in 1992, from about 10 ft into the woods to about 5 ft down the roadbank. The forest was relatively young and brushy, though not burned for at least 10 years; associates included *Kalmia* and other shrubs, *Quercus alba, Q. coccinea, Acer rubrum, Fagus, Oxydendron*, etc.

[*Lycopodium inundatum* Bog Clubmoss (1/1).] *Lycopodiella inundata* is the name preferred by some recent authors. This northern (circumboreal) species was first discovered in Kentucky during 1992, by M. Evans and subsequently identified from a fertile shoot by J. Campbell. *L. inundatum* was formerly treated to include *L. adpressum* (as var. *bigelovii*) and *L. X copelandii* (as var. *robustum*), which are known from only 1-2 sites each further west in Kentucky (Cranfill 1980, pers. comm.). The site with *L. inundatum* is about 2 miles east of the RRD on the southeast side of Pine Mountain, on the wet floor of an old sandstone quarry at the head of Banks Branch (Harlan Co.). The plants cover only 2-3 sq. ft, with about 10 erect, fertile shoots. The vegetation is treeless, and open even on the ground, with scattered clumps of *Andropogon glomeratus* and *Kalmia latifolia*.

This species is also known from sandstone quarries in Virginia (T. Wieboldt, pers. comm.). Whether it can be expected in similar natural vegetation of Kentucky, like the boggy streamheads of Pine Mountain, remains to be seen.

**Magnolia fraseri* Fraser's Magnolia (9/>30). In Kentucky, this Appalachian species is known only from the Cumberland Mountains, plus a few extensions and disjunctions on the Appalachian Plateaus. It is frequent on non-calcareous substrates of Pine Mountain, including sections in the RRD and nearby. The western extensions are along the Rockcastle River (Palmer-Ball et al. 1987), Middle Fork of Kentucky River (Leslie Co.), and Laurel Fork of Quicksand Creek (Knott Co.). It has also been reported from Laurel Creek in Elliott Co. (Joe Conley, pers. comm.). The Middle Fork sites are all in the RRD, and the species is locally frequent here on mesic to subxeric slopes and ridges. Characteristic associates include *Tsuga, Quercus montana, Acer rubrum, Rhododendron maximum, Hexastylis arifolia, Mitchella, Solidago arguta*, etc. *M. fraseri* is generally much less common than other *Magnolia* spp., but on many parts of Pine Mountain, it is the most frequent species in the genus.

Panax trifolius Dwarf Ginseng (10/25). In Kentucky, this northern species is known mostly from the Cliff Section. It occurs on moist forested lower slopes and terraces along larger streams, especially on sandy soils and on north- to east-aspects. There are four records from the RRD: along Buckhorn Lake (Mosley Bend of Middle Fork) and Middle Fork south of Wendover (Leslie Co.); Gilberts Big Creek; and the South Fork between Rocky Branch and Big Rooster Branch (Clay Co.). The latter site was discovered by D. Barrett in the 1980s, but in 1992 it appeared to have been bulldozed. At all sites, the populations covered only 10-100 sq. ft. The forest generally had frequent *Tsuga, Fagus* and *Liriodendron*. At all sites *Anemone quinquefolia* was present or, in one case, found 0.5 mile away in similar habitat (see above). This species is inconspicuous, dying down for most of the summer, and it may be overlooked. However, its lowland habitat has probably been greatly altered by settlement.

**Phacelia purshii* Miami Mist (>30/>100). This mid-western species is locally abundant in open woodland on moist, fertile soil in the Bluegrass Region of Kentucky and further west. The only Appalachian records are from bottomland and low, gentle slopes along the South and Middle Forks of the Kentucky River. These sites are all at the edge of disturbed woods and in meadows that are infrequently mowed. There are several sites along the South Fork in Owsley County (1-2 miles S of Booneville, D. Barrett, pers. comm.), but only one site is known along the Middle Fork--below the Frontier Nursing Service headquarters at Wendover.

Phaseolus polystachios Wild Bean (17/22). This south-central species is know from widely scattered areas of Kentucky, but with a low density of records. There is only one record from the RRD, a sight record of Braun (1943) from Clay County.

**Physostegia virginiana* ssp. *virginiana* False Dragonhead (9/35). In Kentucky, this southeastern subspecies is locally common along open rocky banks of rivers and large streams in the southern Cliff Section. There are also a few old records from the Ohio River, and in 1992, a few sites were discovered along the South and North Forks of the Kentucky River. Along South Fork, only one patch was found, with over 100 stems in ca. 50 x 500 ft, at the back of a cobble bar in the rocky section near the "Narrows" close to Teges (Clay Co.). Along the North Fork (outside the RRD), four sites have been found in the rocky section between Jackson and Beattyville. At all sites, plants

were growing in cracks of the rocky banks, about 3-5 ft above normal water level. Associates in the sparse, treeless vegetation included *Andropogon gerardii, A. scoparius, Lespedeza cuneata, Apocynum cannabinum, Campsis, Ambrosia trifida*, etc.

Platanthera lacera Ragged Orchid (12/16). This widespread eastern species is known from several areas of eastern Kentucky, but with a low density of records. In the RRD, there are three records: from a wet meadow on a broad terrace of the Redbird River near Lower Jacks Branch, Clay County (near *Silphium trifoliatum* along KY 66, obs. by D. Barrett in 1992); a bottomland ditch along Cawood Br., Beech Fork, Leslie County (obs. by A. Risk in 1992); and a wet meadow at Pine Mountain Settlement School, Harlan County (obs. by J. MacGregor in 1980s). In each case only 1-5 plants were seen.

*[*Polygonum arifolium* Tearthumb (8/12?).] In Kentucky, this north-central species is known mostly from the extensive western bottomlands. The only sites in eastern Kentucky are two sloughs near Salt Lick (Bath Co.) and a newly discovered site in a disturbed slough remnant north of Booneville--"The Sag" (Owsley Co.). At the latter site, at least 100 plants were found along a ditch with brush and tall herbs (see introduction to Significant Sites). In eastern Kentucky, *Sium suave* is also known from exactly the same three sites (see below).

**Rhododendron arborescens* Smooth Azalea (7/>30). In Kentucky, this Appalachian shrub is locally common along rocky banks of rivers and large streams of the Cumberland River drainage, in the southern Cliff Section. The only previous records from the Kentucky River drainage were from War Fork of Station Camp Creek and Sturgeon Creek in the Berea Ranger District, with only a few plants at each site (Campbell et al. 1991). In 1992, it was also discovered along South Fork of Kentucky River in Clay and Owsley Counties, where at least 10 plants have been seen in each of three rocky sections from Crane Creek to Hacker Branch (the latter from D. Barrett, pers. comm.). Another plant was seen along Upper Teges Creek half a mile from the river (M. Rock, pers.comm.).

[*Rhododendron catawbiense* Mountain Rose-bay (7/>30).] This Appalachian species is locally common on sandstone outcrops on Pine Mountain and Cumberland Mountain, and several sites have also been found in the southern Cliff Section (Palmer-Ball et al. 1988, Campbell et al. 1990). It generally occurs on northerly aspects, at the edge of subxeric forest. No plants are known within the RRD, but several were found in 1992 on the crest of Pine Mountain, just 100-1000 ft south of the boundary (Harlan Co.).

Robinia hispida var. *rosea* Rose-acacia (4/11?). In Kentucky, native plants of this species should not be confused with var. *fertilis*, which is commonly planted. They are var. *rosea* (McCreary, Whitley, Bell and Harlan Cos.) and var. *hispida* (Pike Co.). The only native localities known in the state are in the southern Cliff Section (especially the Natural Arch area) and in the Cumberland Mountains (Cumberland and Pine Mts.). It occurs in open woods and thickets, and has probably been favored by fire. There are several records from the crest of Pine Mountain. In 1992, a few non-flowering plants were found on the path between Ponley Branch and Banks Branch (see also *Gentiana decora*), three miles east of the RRD.

**Rubus odoratus* Purple-flowering Raspberry (10/>30). In Kentucky, this northeastern and Appalachian species is rare except in the Cumberland Mountains. On the northwest slope of Pine Mountain in the RRD, it is locally abundant in rocky openings, slumps and roadsides, and it also

occurs under some shade in rocky woods. Further west, there are a few records from open siltstone hillsides in Meade, Hardin and Taylor Counties; and there are also a few from the northeast, in Mason, Rowan, Elliott and Greenup Counties. In the Kentucky River watershed, there is only an old report from Clay County (Braun 1943), and during the RRD Inventory, it was found on a roadbank at the base of a northeast-facing slope near Hector Branch of Redbird River, in Clay County. The species may be adventive at the latter site, where only about five stems were found.

Senna hebecarpa [= Cassia h.] Swamp Senna (>5?/>5?). This east-central species of bottomland meadows and streambanks is poorly documented in Kentucky, with a few widely scattered records (Bath?, Bullitt, Franklin, Todd and Whitley Cos.). In the RRD, it was found in open streamside vegetation at three sites along the Redbird River (mouth of Upper Bear Cr., and from Richland Br. to Blue Hole Cr., both in Clay Co.), one site along the South Fork, Kentucky River (Clay Co.), and one along Rockhouse Creek (a tributary of Middle Fk. in Leslie Co.). At all sites it was growing on sand or gravel bars, with scattered brush and other tall herbs. Plants were not fruiting, but the leaves are distinct from the common *S. marilandica*, due to their elongated clavate glands, long hairs along the petiole, and paler glaucous leaflets.

Silphium wasiotense Cumberland Rosinweed (5/30-60). This species was first described by Medley (1989, with the grammatically incorrect epithet *wasiotensis*). However, it was collected earlier by Braun (1936), but misidentified as *S. brachiatum* and later *S. incisum* (Braun 1943). Braun's collection was from "ridge near Peabody", perhaps where it was rediscovered by A. Risk in 1992. In the 1980s (Campbell and Medley 1990) and in 1992, many new sites have been found. The global total is about 30 localities, with over 60 individual patches, mostly containing only 1-10 plants, but at least four sites have 100-1000+ plants (Little Goose Cr., Portersburg Qd.; upper Goose Cr., Ogle and Beverly Qds.; Ashers Fk., Creekville Qd.). The sites are all in the Rugged Eastern Area of Kentucky north of the Cumberland River watershed (Clay, Leslie, Perry, Knott and Pike Cos.), with one exception in Tennessee. The Kentucky sites are mostly in the South Fork, Kentucky River watershed along Goose Creek and its tributaries (Little Goose Cr., Horse Cr., Whites Br., Belles Fk., Billys Br., Mud Lick Br., Ashers Fk.), and Redbird River and its tributaries (Bear Cr., Hector Br., Jacks Cr., Elk Cr., Big Double Cr., Gilberts Little Cr., Spring Cr., Elisha Cr., Bowen Cr., Upper Jacks Cr.). Another site in the RRD is known in the Middle Fork drainage, along Squabble Creek; and several are known from the North Fork outside the RRD. In 1992, A. Risk discovered one site with about 12 non-flowering plants in Tennessee, in the transition from Appalachian Plateaus to Ridge and Valley Province north of Norris (Campbell Co.). Details of the global distribution are presented in Appendix A.

Most sites are on roadsides at the base of forested slopes, usually just above bottomland. Plants are more frequent on south- or west-facing slope bases, which are relatively mesic but often prone to fires spreading down from drier slopes above. All of the 100-1000+ populations are on such aspects. A few small (1-10 plant) patches have been found on upper slopes, saddles or ridges (especially the Redbird Crest Trail near Peabody), but these sites are no more than transitional from mesic (with *Fagus, Liriodendron* and *Acer saccharum* dominant) to subxeric (with *Quercus* spp. dominant). The plants are generally on well-drained shaley soil, above the most heavily disturbed roadside zone and ditch with such frequent plants as *Impatiens capensis, Ambrosia trifida, Festuca arundinacea* and other weedy exotics. At almost all sites, the only flowering plants were in more or less open vegetation at the forest edge, while non-flowering plants were often be found 100-1000 ft back into the woods.

The most abundant associates in general appeared to be *Cercis canadensis* and *Helianthus microcephalus*, which may resprout relatively well after fires. Other typical woody associates on roadsides included *Liriodendron, Acer saccharum, Fraxinus americana, Ulmus rubra, Quercus alba, Carpinus, Cornus florida, Robinia pseudoacacia* and *Sassafras*. Common associates in the ground-layer included *Boehmeria, Desmodium* spp. (especially *paniculatum-perplexum-glabellum* group), *Amphicarpaea, Rhus radicans, Parthenocissus, Oenothera tetragona, Pycnanthemum pycnanthemoides, Aster cordifolius, Erigeron annuus, Eupatorium fistulosum, Cacalia atriplicifolia, Lactuca floridana, Festuca arundinacea* and *Eulalia*. Some sites are along old roads and paths higher on the slopes, and a few plants have been found well within the forest.

Near the western margin of the RRD, in the transition to the Low Hills Belt, a particularly vigorous population with hundreds of plants was discovered that extended from the roadside up into the woods. There was an unusually high flowering percentage, ranging from virtually 100% on the roadbank to 50% in lower slope woods to 25% in mid-slope woods. This population was in an area along Little Goose Creek that had clearly been burned within the previous year or two, and may have been frequently burned before that. The major tree species here were *Quercus alba* (dominant), *Q. rubra, Acer saccharum, Pinus echinata*, etc. The shrub layer was thin, but the herb layer was remarkably dense for a woodland, dominated by *Helianthus microcephalus*, and with frequent *Aureolaria* spp., *Desmodium* spp., *Amphicarpaea, Solidago arguta, Panicum dichotomum* (upper slopes), in addition to *Silphium wasiotense*.

One other population was found that included flowering plants on an upper slope. This was a group of only 3 plants, in open brushy woods near Hector. The area had been burned frequently (D. Daniels, pers. comm.). Frequent species included *Oxydendron* (abundant), *Acer rubrum, Quercus montana, Q. coccinea, Fagus, Nyssa, Robinia; Vaccinium* spp. (especially *corymbosum*), *Amelanchier, Rubus allegheniensis, Cunila* (abundant), *Potentilla* spp. (especially *canadense*), *Lespedeza hirta, Euphorbia corollata, Helianthus microcephalus, Aster* spp. (especially *paternus, infirmus*), *Solidago erecta, Antennaria plantaginifolia, Poa cuspidata, Andropogon scoparius* and *Panicum dichotomum*.

Campbell and Medley (1990) discussed the possible factors that may have maintained this relatively mesophytic species within the largely forested Appalachian landscape before settlement. It seems increasingly obvious that this species depends on disturbance for its indefinite persistence and reproduction. Roadsides and fires appear to be the major factors maintaining it today. Before settlement by Virginians, it is possible that similar factors were the trampling and browsing of large herbivores on these fertile lowlands, followed by Indians with fire and also some settlements. There is increasing evidence that Indians located many village sites on the bottomlands in this region during the 3000-5000 years before 1700 (D. Pollack, Kentucky Heritage Council, pers. comm.).

*[*Sium suave* Water-parsnip (7/11?).] This species is widespread in North America, but the few Kentucky records are mostly from broad bottomlands of the Shawnee Hills and Mississippian Embayment. The only records from eastern Kentucky are from two sloughs near Salt Lick (Bath Co.; Campbell et al. 1992), and from a disturbed slough remnant north of Booneville--"The Sag" (Owsley Co.). Within eastern Kentucky, *Polygonum arifolium* is also known from exactly the same three sites (see above; also introduction to Significant Sites).

Solidago bootii Boot's Goldenrod (3/5?). In Kentucky, this southeastern taxon may only be known from the southeastern Knobs (Garrard Co., E. Ky. Univ. Herbarium; Madison Co., Berea), the Cumberland Mountains (Bell Co., U.S. National; Harlan Co., Univ. of Ky.), and perhaps the southern Cliff Section (McCreary Co., U.S. National). Plants that appear to be this taxon were found in 1992 on the path between Ponley and Banks Branch in Harlan County (see also *Gentiana decora*). It was frequent along this trail, and it may be scattered along all of Pine Mountain in similar habitat. However, distinction of *bootii* from *arguta* and other relatives has not been thoroughly studied in this region. Seed pubescence and leaf thickness/pubescence are said to be key characters, but these vary considerably. Morton (1973, and determinations at US) indicated that some or all of the above Kentucky plants should be named be *S. arguta* spp. *australis*, and that *S. bootii* is absent. Further collection and study is needed to determine the status of these taxa in the Kentucky.

Solidago patula var. *patula* Swamp Goldenrod (8/12?). In Kentucky, this northern variety is known from a few sites, in open forest or shrubby vegetation, on boggy acid soils in the southeast and southwest. The var. *strictula* (= *S. salicina*) is mostly on the Coastal Plain, and is unknown in Kentucky. In the RRD, this species is known only from a wet meadow at the base of Pine Mountain's northwestern slope (Harlan Co.), within the grounds of the Settlement School (see Significant Sites). It is also known from several streamheads on the southeast side of Pine Mountain, though none of these are close to the RRD boundaries.

Solidago sp. nov. An undescribed species of broad-leaved Goldenrod (6/20). Braun (1943) made the first collections of this species in Kentucky, and perhaps the first anywhere. She called the plants *S. harrisii*, but recent examination by M. Medley (University of Louisville) and T. Wieboldt (Virginia Polytechnic Institute) have shown them to be distinct, and apparently a species new to science (Appendix A). This species is closely related to *S. arguta* and *S. harrisii*. Until the late 1980s, this species was only collected from Pike County, Kentucky, but it has subsequently been found in five other Kentucky counties and several areas of Virginia. About 20 sites are now known in Kentucky (Clay, Knott, Leslie, Letcher, Perry and Pike Cos.), with 15 in the RRD (excepting the unverified report of S. harrisii by Braun from Carter Co.). All these Kentucky sites are in the Rugged Eastern Area of the Appalachian Plateaus, and all except the Pike County plants (Wolfpen Branch of Russell Fork at the Breaks) are in the Kentucky River watershed: Redbird Rv. (between Bowen Cr. and Blue Hole Cr.); Middle Fk. (Trace Br., between Muncy Cr. and Johns Cr. and between Rye Cove Br. and Spruce Pine); Beech Fk. (from Big Cr. to Cawood Br.); North Fork (near Oldhouse Br. and Carr Fk. Lake).

All sites are on steep, somewhat seeping, low rocky slopes and adjacent terraces in the valleys of rivers, larger tributaries, and up to a mile or two into smaller branches. A large population along Spring Creek, which is a smaller stream (near Rocky Mt., Creekville Qd.), may have been this species or just unusually large leaved *S. arguta*. Plants were more abundant on north- or northeast-facing slopes, but this was not a pronounced trend. At most sites, clonal patches of 10-100 plants were found, and populations with over 1000 crowns were found at several sites, though mostly non-flowering. More flowering occurs at forest edges, such as along roadsides. The species occurs generally in shadier and more strictly mesophytic sites than *Silphium wasiotense*.

Frequent woody associates included *Fagus* (often dominant), *Tsuga, Acer saccharum, Tilia, Magnolia tripetala, Carpinus, Cornus florida* and *Rhododendron maximum*. However, the species

was generally absent from areas dominated by *Tsuga* and *Rhododendron*. Frequent herbs included *Adiantum, Dryopteris marginalis, Polystichum, Rhus radicans, Asarum, Sedum ternatum, Tiarella, Heuchera villosa, Viola rostrata, Meehania, Solidago flexicaulis* (or transition to *S. cf. flaccidifolia*), *Aster divaricatus* and, locally, *Trillium grandiflorum*. Infrequent species that also appear characteristic of this habitat include *Waldsteinia fragarioides* and *Carex purpurifera*. Plants are often just above a zone of dense *Impatiens pallida* and *Laportea* at the slope base.

Synandra hispidula Synandra: -/S/C2C3 (35/>100). This east-central species is generally uncommon throughout its range, except in central Kentucky where it is locally frequent in forests, thickets and occasionally old-fields, on moist-to-wet, fertile soil of lower slopes and bottoms, especially on or below limestone. In the RRD, it is locally frequent, and has been found at about 10 scattered sites in Clay and Leslie Counties (along Glade Br. of Buzzard Cr., Bear Creek, Little and Big Double Creek, Redbird Rv. at Bowen Cr. mouth, Middle Fork slopes at Hurricane Cr.). Curiously, it has not yet been found on Pine Mountain, which has much suitable habitat on the north side. In eastern Kentucky, there was extensive flowering of this biennial species in 1992, 1990 and 1988 (Campbell et al. 1991, 1990), with little or none in the odd years. However, in the Bluegrass region, 1989 and 1987 were major flowering years (J. Campbell, pers. obs.). Associates in the RRD were *Liriodendron* (usually abundant), *Fagus, Acer saccharum* (and some *A. nigrum*), *Juglans* spp., *Athyrium thelypteroides, Dryopteris* spp., *Cimicifuga, Caulophyllum, Jeffersonia, Sanguinaria, Oxalis grandis, Rhus radicans, Amphicarpaea, Impatiens* spp., *Thaspium barbinode, Hydrophyllum* spp., *Cynoglossum, Solidago flexicaulis, Aster prenanthoides, Arisaema triphylla, Festuca obtusa*, etc. On floodplains, it also occurred with *Platanus, Betula nigra* and *Acer negundo*.

**Trautvettaria caroliniensis* False Bugbane (11/>50). This southeastern species (also west-coastal and East Asian) is common along the rocky banks of rivers and larger streams in the Cumberland River system of the southern Cliff Section, and it also occurs in the Cumberland Mountains. The only records from the Kentucky River watershed are from a swamp forest near Clay City (Powell Co., W. Meijer, pers. comm.), and from the rocky banks of the South Fork in the RRD. At the latter locality, at least 50 plants were seen in three patches along the river between Crane Creek and a mile down from Buffalo Creek (all Clay Co.). All sites were on north-facing banks.

**Trillium sessile* Wake-robin (>30/>100). This widespread mid-western species is common in forest on moist, fertile soils of the Bluegrass Region and further west in Kentucky. However, the only Appalachian records in Kentucky are from Rowan County (A. Risk coll. at Morehead), low slopes along Indian Creek (Powell Co., D. Dourson, pers. comm.), and low slopes along South Fork, Kentucky River--opposite Hacker Branch and in Blackpool Hollow (both Owsley Co., D. Barrett, pers. comm., and collected in 1992). The South Fork records are the only ones well within non-calcareous Appalachian areas. This species is another in the group typical of the Bluegrass Region with disjunct records in the RRD (see Introduction).

Veronicastrum virginicum Culver's Root (>15/>30). This widespread eastern species is scattered through much of Kentucky, but there are only three records from the Rugged Eastern Area. These are from roadsides in Whitley (D. Taylor, pers. comm.), Breathitt (on KY 15 near Wolfe Co. line, D. Barrett, pers. comm. and coll.), and Owsley Counties (coll. in 1992). The latter site, in the RRD, was along a gravel road on a lower south-facing slope in the Buffalo Creek valley. Also of interest at this site was *Silphium trifoliatum*, a widespread species of barrens and open woods in western and central Kentucky that is infrequent in the east. *Veronicastrum* often occurs in mesic to

subxeric areas that may have been brushy or grassy before settlement, based on prehistorical interpretations. Perhaps, like *Silphium wasiotense* and *Castilleja coccinea*, this species is another indication that such conditions used to occur along lower slopes and bottoms in the Rugged Eastern Area.

Viburnum rafinesquianum var. *r.* (3/4?). This species, as the glabrous var. *affine*, is frequent on limestone cliffs along the Kentucky River Palisades and along some sections of the Cumberland River. In Kentucky, the pubescent var. *rafinesquianum* was previously known only from Mississippian limestone clifftops in Carter and Rowan Counties (Campbell et al. 1992), and perhaps Pulaski County (Palmer-Ball et al. 1988). In 1992, var. *rafinesquianum* was found on the narrow ridge ("Sally Ridge") along the South Fork bend west of Indian and Cow Creeks (Owsley Co.). This is the only record of the species in Appalachian Kentucky east of the Cliff Section. At least 30 plants were seen along the crest of the ridge and in dry woods on the steep shaley upper slopes. No other unusual species were found here. The forest was composed of *Acer saccharum, Liriodendron, Fagus, Quercus rubra, Q. montana, Q. alba, Fraxinus americana, Viburnum acerifolium*, etc.

Viola tripartita Yellow Violet: E/+/- (6/15). In Kentucky, this southeastern and Appalachian species is known only from scattered sites in the Cliff Section, especially in the Cumberland River watershed. All plants are var. *glaberrima*, except in Carter County with var. *tripartita*. In the RRD, three populations were found, with up to 15 plants seen at each, on or near Pine Mountain (Harlan Co.) and up to 3 miles north of this mountain (Cawood Br., Bledsoe Qd., Leslie Co.). It was also found next to a streamhead on the southeast side of Pine Mountain (E of Middleton Br., Bledsoe Qd.), and at the same site as *Corallorhiza maculata* near the base of Pine Mountain (see above). At one site on the base of Pine Mountain, there appeared to be hybrids with *V. pubescens* var. *eriocarpa*. *V. tripartita* is somewhat inconspicuous, and often confused with *V. pubescens*. It seems to reach the northern edge of its range in this study area, and it may not be distributed throughout the upper Kentucky River watershed..

Waldsteinia fragarioides Barren Strawberry (17/25). This north-central species is known from 17 Kentucky counties, and is locally abundant, but its populations are widely separated. In the RRD, it was found initially by Braun (1943; No. 1635, 7/23/1937, Rockhouse Cr., Leslie Co.). With others discovered in 1992, it is now known from six sites, all on steep low slopes near major streams: Redbird Rv. (a mile E of Big Double Cr., and near Blue Hole Cr., both Clay Co.); and Middle Fork (Rockhouse Cr., near Camp Cr., Beech Fk. at Big Br., Cawood Br., all Leslie Co.). These sites are all, except Rockhouse Creek, near rivers or large streams, in forest on steep rocky lower slopes that are moist or sometimes seeping. At most sites, only 10-50 plants were seen, scattered over no more than 1000 sq. ft. However, over 100 were seen at Blue Hole Creek. Common woody associates included *Fagus, Liriodendron, Carpinus*, etc. Herbaceous associates included *Asplenium rhizophyllum, Adiantum, Dryopteris marginalis, Sedum ternatum, Arabis laevigata, Viola rostrata, Solidago* sp. nov. (at four sites, see above), *S. cf. flaccidifolia, Carex purpurifera*, etc. Bryophytes included *Climacium americanum, Bryoandersnoia illecebra, Thuidium delicatulum, Anomodon rostratus* and *Brachythecium* sp.

Xyris torta Yellow-eyed Grass (11/15?). This south-central species is known from scattered sites in southern Kentucky, with a concentration in or near the Appalachian Plateaus. It generally grows with native grasses, sedges, herbs and brush on acid, seasonally wet soil. In the RRD, it has been found at only one site, by B. Begley, in the wet meadow at the base of Pine Mountain on the

grounds of the Settlement School (Harlan Co, see also Significant Sites). This area is unusually wet and could have been partially open even before settlement.

In addition to the above vascular plants, three boreal peat mosses (*Sphagnum* spp.) were discovered in the RRD during 1992.

(1) *S. squarrosum*, an associate of spruce-fir forests in the Southern Appalachians and a frequent peat moss in New England and Canada, was found on a wet strip mine bench on the east side of Henry Fork (Hals Br., Leslie Co.). *S. squarrosum* is also known in Kentucky from a wet road cut in Letcher County and a wet area near a clay mine in Rowan County.

(2) *S. fuscum*, a prominent hummock-former in New England and Canadian bogs, which previously had its southernmost known locality in West Virginia, was found in two sites, both on unreclaimed strip mine benches. One site is in the same area as *S. squarrosum* mentioned above, and the second is near Hoskins Branch (Beech Fk., Leslie Co.).

(3) *S. recurvum* var. *brevifolium* was also found at the Henry Fork site. This taxon is currently known from another strip mine bench in Letcher County and in natural habitats at Bad Branch Nature Preserve (Pine Mt., Letcher Co.).

The occurrence of *S. squarrosum* and *S. fuscum* in Kentucky is surprising, and at present they are only known from non-natural habitats. Perhaps propagules (spores, gametophytic fragments) have been brought into the RRD by migrating birds. The strip mine bench at Hoskins Branch also had a large population of the aquatic peat moss *S. cuspidatum* var. *cuspidatum*. This species is also rare in Kentucky, being known only from wet areas below a powerline and a natural ridgetop pond in McCreary County, and a wet roadcut and strip mine bench in Letcher County.

FAUNA

The following accounts summarize regional data for all listed rare species that have been reported from the Redbird Ranger District or within five miles of its boundaries. Species with only tentative records are listed in parentheses ( ), while those with only marginal records are listed in brackets [ ]. A few included species, marked by an asterisk (*), are not listed by KSNPC, DBNF or USFWS, but are still of considerable local interest and may deserve at least informal listing. Following each species' name, its official status is shown as follows: (1)/(2)/(3).

(1) Status in Kentucky according to the Kentucky Nature Preserves Commission (KSNPC 1992a): E = Endangered; T = Threatened; S = Special Concern; "-" = not listed.

(2) Status in Daniel Boone National Forest as listed by the USFS at the beginning of 1990 (B. Knowles, pers. comm.); S = Sensitive; E = Endangered; "-" = not listed; "+" = KSNPC listed species that the DBNF inventory has documented on USFS land.

(3) Federal Status as designated by the United States Fish and Wildlife Service (1990b, 1991); E = Endangered; C1 or C2 = candidate for listing, Category 1 or 2; C2C3 indicates that the species was removed from consideration during 1990.

Coleoptera: Carabidae (cave beetles)

Pseudanophthalmus rogersae Rogers' cave beetle: S/-/C2; and
Pseudanophthalmus scholasticus Schoolhouse cave beetle: S/-/C2.

Both of these blind troglobitic beetles are single-cave endemics and both live in Sawmill Hollow Cave, located on the north side of Pine Mountain (elev. about 2300 feet) on property owned by Pine Mountain Settlement School (Harlan County). The Schoolhouse cave beetle was named by T.C. Barr (1981) to honor the Pine Mountain Settlement School, an important center of environmental education here in Kentucky and an institution that manages a number of unique and uncommon natural features that occur on its land holdings. Dr. Barr (1981) also described Rogers' cave beetle, naming it in honor of Mrs. Mary Rogers, who has been involved with the Settlement School and its programs for the past half-century. The Schoolhouse cave beetle is known from only two specimens (collected 23 August 1979); Rogers' cave beetle is known only from a single specimen (likewise collected on 23 August 1979). Like other troglobitic trechine carabids, both of these cave beetles are relatively small (total length 3-5 mm), eyeless, reddish brown in color, inconspicuous to the casual cave visitor, and strictly limited to the constant temperatures and near-saturation humidity levels that are found only within caves. Despite their small size, troglobitic trechines tend to be top predators in the terrestrial cave environment, feeding primarily on micro-oligochaetes that inhabit damp silt banks in caves but also eating other small invertebrates that are drawn to bat guano, raccoon feces, and organic material that has fallen into cave passages or has been carried in by mice or woodrats. Sawmill Hollow Cave is unique among the Pine Mountain caves in that it harbors two endemic troglobitic trechine beetles; all of the other Pine Mountain caves with these beetles have only a single species each. If the passages in Sawmill Hollow Cave are eventually found to connect with other caves that are found nearby along the north face of Pine Mountain, then one or both of these beetles may eventually turn up at additional locations on the

mountain. According to Barr (pers. comm.), the major threats to populations of endemic cave beetles include land development on the surface above inhabited caves and the physical closure of cave entrances by land owners (both of these activities may result in the loss of sources of organic material needed to maintain populations of prey species upon which the beetles feed). Other threats include the spillage of oil or other poisonous materials on the cave floor, fire building in caves or cave entrances, and the dumping of spent carbide in caves by cave explorers. All of these activities can result in the creation of toxic zones within caves that provide permanent threats to both cave beetles and their prey species.

Gastropods (land snails)

**Anguispira rugoderma* (no common name): -/-/-. The land snail *Anguispira rugoderma* was originally discovered and described from a site along the north side of Pine Mountain in Bell County, Kentucky by Leslie Hubricht in 1938. During the 40-odd years that Mr. Hubricht collected and studied the native land snails and slugs of the Eastern United States, he found *A. rugoderma* at only three locations - the type locality, a second Bell County site on Pine Mountain near Pineville, and one location on Pine Mountain in Harlan County near Harlan (Hubricht 1985, and pers. comm.). All three of his sites were within a 15-mile stretch along the steep north side of Pine Mountain between the city of Pineville and the point where U.S. 421 crosses Pine Mountain just to the north of Harlan. During the fall of 1991, just prior to the initiation of the RRD inventory, a large colony of *A. rugoderma* was discovered on a tract of Forest Service land along U.S. 421 on the north side of Pine Mountain just over the crest from Harlan (Bledsoe Quadrangle). The habitat here was a high elevation (2600-2800 feet) stand of fairly old hardwood forest with scattered accumulations of damp, mossy rock talus and a large amount of fallen woody debris. Most of the snails were found on or immediately adjacent to large snags and large downed logs. Other rare species taken at this site included the glassy grapeskin snail, rock shrew, masked shrew, Cumberland red-backed vole, and cloudland deermouse. This single tract of land--the only section of Pine Mountain that is currently under Forest Service ownership--contains the densest known populations of three very rare species in Kentucky (*A. rugoderma*, the glassy grapeskin, and the rock shrew). During the RRD inventory, specimens of *A. rugoderma* were also found just below and east of U.S. 421, extending the known limits of this colony slightly to the east. In addition, a single specimen was taken in a pitfall trap set for small mammals in beech-hemlock woods with scattered white walnut along a low rocky slope in Gilberts Big Creek on the Redbird WMA (Creekville Quadrangle) in Leslie County (new county record and the first record from off of Pine Mountain!). This site was revisited during midwinter and two additional shells were found in about 45 minutes of searching. Finally, one shell was taken under leaf litter at yet another site in Leslie County, also on the Redbird WMA, on a steep slope well above the mouth of Henry Branch (Big Creek Quadrangle). These six total sites--two each in Bell, Harlan, and Leslie Counties--represent the total known range of *A. rugoderma*.

Mesomphix rugeli Wrinkled button: T/-/-. Like the closely-related glassy grapeskin, *M. rugeli* is a species of the Blue Ridge Mountains that ranges from extreme northern Georgia into southwestern Virginia. Outlying (relict?) populations are known from the Cumberland Mountains in Harlan County, Kentucky (Black Mountain) and Lee County, Virginia (Hubricht, 1985). During the RRD inventory, two specimens were taken in pitfall traps set for small mammals on the north side of Pine Mountain at Shell Gap just east of KY 2010 above Pine Mountain Settlement School (Harlan County). Other shells that may be this species were collected along Pine Mountain from the U.S.

421 site eastward nearly to the Letcher County line (Harlan County), and at several pitfall trapping sites in Clay and Leslie Counties. Final identification of these shells will have to be made later.

Vertigo clappi Cupped vertigo: E/-/-. Although the cupped vertigo was not taken during the RRD inventory, there is a single record for this species - the only Kentucky record - from the north side of Pine Mountain just above and to the west of the large quarry that adjoins the USFS tract along U.S. 421. According to Ron Caldwell (Lincoln Memorial Univ., pers. comm.), who collected these specimens, shells were found in damp moss on a rock talus slope in cool old woods along the gravel road that runs up the north side of Pine Mountain from just below the quarry. The cupped vertigo has a total known U.S. range of only five counties (Hubricht, 1985). Four of these counties are in high mountains along the Virginia/ West Virginia border; the Harlan County site is about 200 miles disjunct from these to the west.

Vitrinizonites latissimus Glassy grapeskin: E/-/-. Prior to the RRD inventory, the glassy grapeskin (also listed in the literature as the Blue Ridge snail) was known in Kentucky from several locations on Black Mountain (at elevations approaching 4000 feet) near the Kentucky- Virginia border and from two sites along the north side of Pine Mountain near Harlan (including the U.S. 421 site mentioned above, where it was discovered in 1991). During the RRD inventory, records were obtained from three more sites along the north side of Pine Mountain from U.S. 421 eastward toward Railroad Gap. On Pine Mountain, this rare snail appears to be confined to a relatively narrow band of habitat ranging from just above the limestone to just below the massive sandstone outcrops. It occurs almost exclusively in old woods on or adjacent to damp mossy rock talus. Individuals of this species can be found crawling about on rock talus by day in wet weather (or by night when humidity is high) during the warm season. Live specimens of several sizes plus a few dead shells that were dug out of a well-rotted tree stump at the base of a talus slide 1.9 miles east of the U.S. 421 crossing in mid-October indicate that this species may leave the rock talus in autumn to overwinter in old, decaying woody debris. All Kentucky records for the glassy grapeskin are from Harlan County; efforts to find it in good rock talus habitat in Letcher County (Kingdom Come State Park and Pine Mountain WMA) and further eastward in Harlan County (above Pine Mountain Settlement School) have proven unsuccessful to date. The overall range of the glassy grapeskin extends along the Blue Ridge Mountains from extreme northern Georgia to near Mountain Lake, Virginia (perhaps 20-25 counties total), with outlying populations on the Appalachian Plateau in northern Alabama (one county) and in the Cumberland Mountains in Harlan County, Kentucky (Hubricht 1985).

Mussels (unionids)

Epioblasma triquetra Snuffbox: S/-/C2. The snuffbox is broadly distributed but uncommon in Kentucky. Only a single collection record is available for the Middle Fork (Schuster 1988), and in the South Fork drainage the snuffbox was collected historically (prior to 1970) from only four sites (in South Fork and Goose Creek). Additional specimens of unknown quality were collected from these streams during 1970-1971 (Schuster 1988). Based on the discovery of 10 fresh-dead and one living specimens at three sites in 1988, Red Bird River joined the Red River as the only streams known to support extant populations of this rare mussel in the Kentucky River drainage. In 1992, we found only weathered-dry *E. triquetra* specimens in the Middle (one site) and South forks (two sites). High water adversely affected the search for mussels, and heavy, prolonged rain deposited sand on areas that previously had supported diverse mussel communities, including *E. triquetra*. We

assume that floods will redistribute these deposits, but are concerned about the role that various watershed land uses may play in elevating Red Bird River sediment levels. The Red Bird and the entire South Fork should be searched for *triquetra* during low water conditions in 1993.

Villosa lienosa Little spectaclecase: S/-/-. The status of this mussel in the district is similar to that of *E. triquetra*. A single 1973 record is available for the Middle Fork (Schuster 1988). Known historically from the South Fork and Goose Creek, these records were verified with collections of unknown quality from the South Fork and Redbird in 1970 (Schuster 1988), and by fresh-dead specimens from Redbird River in 1988. We collected only a weathered-dry specimen from Middle Fork, but found in Collins Fork what appears to be among the best *V. lienosa* population known in Kentucky. This populations should be protected and others sought in both drainages.

Fishes

Etheostoma maculatum Spotted darter: T/S/-. Clay's (1975) unsubstantiated Greasy Creek records (probably collections made by Turner 1967) were the only Kentucky River drainage records until the spotted darter was discovered in North Fork Kentucky River (Cicerello and Warren 1984). Rediscovery of the spotted darter in the Middle Fork drainage is possible but unlikely. The construction and operation of Buckhorn Reservoir beginning in 1959-1961 (United States Army Corps of Engineers 1991) and the explosive increase in eastern Kentucky coal production by strip mining beginning in the 1960's (Currens and Smith 1977) greatly degraded swift cobble and boulder habitat in large streams and probably made conditions in the drainage unsuitable for this bottom-dweller. However, the South Fork and Red Bird River include excellent habitat that may yield this often difficult to collect darter.

Etheostoma pellucidum Eastern sand darter: S/S/C2. The eastern sand darter inhabits medium to large-size streams with moderate current and sand and small gravel substrates (Kuehne and Barbour 1983, Burr and Warren 1986). In the Middle Fork drainage, specimens were last collected in 1967 from a segment of the river now inundated by Buckhorn Reservoir and from Greasy Creek. It may be extirpated from the drainage because of habitat degradation and destruction. South Fork collections were made near Cow Creek in 1971, at Oneida in 1970, and at Sexton Creek in 1972 (Jones 1973), and from Red Bird River near Big Creek in 1890 (Woolman 1892) and 1949 (Williams 1975), and Goose Creek in 1967 (Williams 1975). None were collected in 1992, but suitable habitat in South Fork proper may yield specimens.

Etheostoma sagitta spilotum Arrow darter: S/S/-. This Kentucky River endemic is restricted to the South, Middle, and North forks, and a single locality in the Red River drainage. Rocky riffles and pools in headwater streams are preferred, but larger streams are sometimes used (Kuehne and Barbour 1983, Page 1983, Burr and Warren 1986). Woolman (1892) documented the arrow darter from Cutshin Creek, Middle Fork, Hector Creek, Red Bird River, and Big Creek well before many streams in the district had been seriously degraded or destroyed. The remaining district records are from 1969-1973 and include only two additional records for the Middle Fork drainage (Greasy and Raccoon creeks), and several for the South Fork drainage (Bray, Buffalo (2 sites), Horse, Laurel (2 sites), and Sexton creeks and Red Bird River) (Kuehne and Bailey 1961, Branson and Batch 1983). During 1992, we sampled more than 50 sites including many from which *sagitta* had been collected. We reconfirmed only two records, both in Buffalo Creek where two additional occurrences were

found, and also found a population in Right Fork Elisha Creek. Single specimens also were collected in 1990 from two Upper Bear Creek sites (V. Bishop, pers. comm.). In the Middle Fork drainage, Woolman's (1892) arrow darter collection localities were inundated by Buckhorn Reservoir and habitat in Greasy Creek has been degraded by coal mining. These results suggest that the arrow darter has declined within the district, but this fish can be difficult to collect from small, rocky streams and we may have missed specimens. Remaining high quality streams in both drainages require further sampling.

Etheostoma tippecanoe Tippecanoe darter: S/S/-. This diminutive darter has been collected from the South Fork at Sexton Creek in 1956 (Zorach 1969), Lower Wolf Creek in 1985, and Cow Creek in 1971 (Branson and Batch 1983). During 1992, we confirmed the existence of the Tippecanoe darter at Lower Wolf and Cow creeks, and found additional specimens in the South Fork at Hacker Branch. Additional records from the early 1970's are available for the South and Middle forks downstream from the district. Tippecanoe darters inhabit large rivers with clean gravel riffles and moderate current where they over-winter in pools. They may occur in such habitat throughout the South Fork proper, but probably have been extirpated from the Middle Fork by impoundment, sediment, and other pollutants.

Ichthyomyzon fossor Northern brook lamprey: T/-/-. This lamprey is a rare inhabitant of eastern Kentucky streams and has been collected twice in both the South and Middle fork drainages within the District. Although not collected during this effort, specimens were secured rather recently (1978) from Goose Creek near the Mud Lick confluence (Harker et al. 1979, Warren 1981). Adults inhabit small to medium-size streams with clean gravel/sand riffles and raceways, while ammocoetes require quiet areas with mixed sand, silt, and debris (Burr and Warren 1986). This fish probably persists in the RRD, most likely in the South Fork drainage, and may be encountered in appropriate habitat during spring, when ascending spawning streams.

Lampetra appendix American brook lamprey: T/-/-. An inhabitant of raceways, riffles, and flowing margins of medium to large-size upland rivers (Burr and Warren 1986), the American brook lamprey has been collected twice in the district. Turner (1967) collected specimens from Middle Fork at the present site of Buckhorn Reservoir and from Greasy Creek. Habitat degradation and destruction may have extirpated this rare fish from the Middle Fork drainage. Although previously uncollected in the drainage, this lamprey as well as the Northern brook lamprey should be sought in the South Fork.

Noturus stigmosus Northern madtom: S/-/-. In Kentucky, northern madtoms live in large rivers with swift current and gravel/sand bottoms, sometimes in pondweed (*Potamogeton* sp.) beds or debris (Burr and Warren 1986). This fish was collected twice from the Middle Fork and once from the South Fork. Middle Fork collections were made in 1958 and 1959, prior to the construction of Buckhorn Reservoir and the dramatic increase in coal strip mining in the 1960's. A single specimen was collected from the South Fork near Wolf Creek in 1985, but none were collected in 1992. Suitable habitat in the South Fork from Red Bird River downstream probably continues to support a population of this rare fish.

Percina evides Gilt darter: S/-/-. Prior to this inventory, district records for the gilt darter included the Middle Fork in Leslie County, a site now inundated by Buckhorn Reservoir, and the South Fork at Sexton Creek and near Booneville. We successfully collected the gilt darter at only one site, South Fork at lower Wolf Creek, where one specimen was taken. Additional individuals probably

live in sand, gravel, and cobble riffles with moderate current in the South Fork proper. The gilt darter may have been extirpated from the Middle Fork drainage.

Percina macrocephala Longhead darter: T/S/C2. The only substantiated record for the longhead darter in the Kentucky River drainage is an undated collection from Red Bird River at Big Creek (Bailey and Gosline 1955). An additional though unsubstantiated record for the same approximate location is Page's (1978) reinterpretation of a collection apparently erroneously reported by Woolman (1892) from Levisa Fork. This rare darter inhabits pools and chutes of medium-size streams and rivers with steep gradient and clean substrates (Kuehne and Barbour 1983, Page 1983). Although apparently extirpated from the Kentucky River drainage (Burr and Warren 1986), appropriate habitat in the South Fork and Red Bird River should be sampled periodically in an effort to rediscover this rare and difficult-to-collect darter.

Amphibians

**Aneides aeneus* Green Salamander: -/-/C2C3. This Appalachian species occurs in three population centers. The Blue Ridge population (still under federal status review as C2) occurs in scattered small disjunct colonies in the southern Blue Ridge of western North Carolina and adjacent states and occurs primarily on metamorphic rock outcrops, The Ridge and Valley population (now C3) of eastern Tennessee, northwestern Georgia, and northeastern Alabama lives in crevices in limestone; and the wide-ranging Appalachian Plateau/Cumberland Mountains population (now C3) ranges from extreme eastern Mississippi through parts of northern Alabama, southern and east-central Tennessee, and eastern Kentucky (30 Counties including virtually the entire DBNF) northward into extreme southern Pennsylvania. This latter population typically lives in crevices in sandstone outcrops but occasionally can be found in adjacent limestone or shale, under loose bark on standing or fallen dead trees, in tree cavities, or in the entrances of caves and coal mines. On the RRD, the green salamander is uncommon but had previously been recorded from Clay (J. MacGregor, K. Phillips, and B. Graham, 1991, pers. comm.), Leslie (K. Prather, 1983 and J. MacGregor and J. Moriarty, 1984, pers. comm.), and Harlan Counties (numerous museum records from Pine Mountain Settlement School and vicinity dating back into the 1920's, including some of the first specimens ever taken of this species). During the RRD inventory, specimens were found at six additional sites: Cawood Branch and Wendover in Leslie County; Long Fork, Hector Creek and Indian Grave Branch in Clay County; and Old Field Branch in Perry County.

Cryptobranchus a. alleganiensis Eastern Hellbender: -/S/C2. The hellbender occurs in two large disjunct populations - one centered in the Ozark Mountains to the west of the Mississippi River and one in the Ohio, Cumberland, and Tennessee River systems in the east. Throughout its range, the hellbender lives mainly in larger streams and rivers containing relatively clean, well-oxygenated waters. The 32 county records for this species in Kentucky include specimens from all major drainages east of the Mammoth Cave region. Very few specimens have been found on the DBNF. The only available record from the RRD is based upon a photograph that appeared in the Thousandsticks News in the early 1980's - the specimen shown had been taken by a local fisherman in Leslie County. Hellbenders are difficult to collect even in areas where they are relatively common. Although none were found during the RRD inventory, conditions in the South Fork Kentucky River and the lower portions of some of its larger tributaries appear suitable for them and it is likely that they are present in good numbers there.

**Desmognathus ochrophaeus* Mountain Dusky Salamander -/-/-. The mountain dusky salamander, an abundant species throughout the central and southern Appalachians, is common on cool damp mountain slopes, mostly at high elevations, in the Cumberland Mountains of Kentucky. In the Cumberlands, as in the other mountain ridges of the Appalachian chain, the mountain dusky is by far the most terrestrial of the dusky salamander complex, often living in woodlands well removed from permanent water sources. On the Appalachian Plateau to the north of the Cumberland Mountains, the mountain dusky becomes decidedly rare and local in occurrence and is restricted to cool mossy seepages and wet rock faces. To date, this species has been found at only one location each on the Stearns and London Ranger Districts, in fewer than a half-dozen locations each on the Stanton and Morehead Ranger Districts, and at a few scattered sites to the east of Morehead in Carter, Morgan, and Elliott Counties. During the Redbird Inventory, mountain dusky salamanders were found at about a dozen sites in the Rugged Eastern Area in central and southern Harlan and Leslie Counties and extreme southern Clay County.

**Plethodon kentucki* Cumberland Plateau Salamander: -/-/-. The Cumberland Plateau salamander is endemic to the Cumberland Mountains and Appalachian Plateau of Kentucky, southern West Virginia, and small sections of adjacent southwestern Virginia and northeastern Tennessee. Within the DBNF, this salamander is fairly common in portions of the Morehead Ranger District but seems restricted to a few isolated populations on the Stanton (three sites), London (one site), Somerset (one site), and Stearns (one site) Ranger Districts. On the RRD, the Cumberland Plateau salamander becomes quite common in the Rugged Eastern Area of Leslie and Harlan counties - and is particularly abundant along and adjacent to the north face of Pine Mountain. The type locality for this species is located along KY 2010 near the crest of Pine Mountain above the Pine Mountain Settlement School.

[*Plethodon wehrlei* Wehrle's Salamander: E/-/-. Wehrle's salamander is fairly common in portions of the Appalachians and the adjacent Ridge and Valley Province in New York, Pennsylvania, Virginia, and West Virginia but abruptly becomes rare and local on the western and southern edges of its range (two localities total in Ohio and one each in Kentucky, Tennessee, and North Carolina). The single Kentucky location lies along a natural shale outcrop on a terrace above Line Fork in Letcher County, just north of Pine Mountain and just a few miles to the east of the RRD boundary. The Tennessee locality lies along the base of a massive sandstone outcrop in a narrow ravine on the south side of Pine Mountain, just two miles from Jellico, Tennessee and just south of the border of the Stearns Ranger District. In Kentucky, Tennessee, and at two locations near Hinton, West Virginia, a unique and unusual yellow-spotted color variant of Wehrle's salamander occurs. Here, the species is characterized by having large, paired dorsal yellow spots reminiscent of those of the unrelated Spotted Salamander (*Ambystoma maculatum*). It is likely that Wehrle's salamander will eventually be found inhabiting caves, old mines, or rock crevices on the Redbird and Stearns Ranger Districts.]

Reptiles

Eumeces a. anthracinus Northern Coal Skink: T/-/-. In Kentucky, most records of this Appalachian species are from the central and southwestern portions of the Appalachian Plateau (Powell, Breathitt, Harlan, Knox, Laurel, and McCreary counties) and from the Black Shale Belt (Knobs) to the west of the DBNF (Madison, Rockcastle, Garrard, and Boyle counties); there are additional records from the Mammoth Cave area (Edmonson Co.). In nearly all of these counties the coal skink has been

found only at a single location, one time, and only on the Berea College Forest does there appear to be a viable, stable population. During the Red Bird inventory, one gravid female was found under a log along an old dirt road in a recently burned, oak-dominated ridgetop forest located near the head of Dry Branch in Flatwoods (Clay Co.).

[*Pituophis m. melanoleucus* Northern Pine Snake: T/S/C2. The pine snake is one of the rarest of Kentucky's reptiles. Despite its large size (to well over six feet), its bold black and white coloration, and the fearsome display of hissing that it exhibits when cornered, this reptile is unfamiliar to most residents in the state and may now be extirpated from much of its former range here. All of the recent (since 1980) records for the northern pine snake in the state have come from the western section of the state, and viable populations still apparently exist only in Hart, Edmonson, Trigg, Calloway, and perhaps Marshall counties. The pine snake is included here on the basis of several unsubstantiated records that have come to the attention of biologists over the years. Funkhouser (1925, 1941) listed the species from Corbin (Whitley County) and from Harlan County (location not stated); Jim Harrison of the Ohio Valley Serpentarium (pers. comm.) reported a road-killed pine snake from Wolf Knob (Whitley County) that he had seen in 1975; and a former Kentucky Department of Fish and Wildlife Resources biologist (pers. comm. to J. MacGregor) observed a road-killed pine snake east of Cumberland on US 119 in Letcher County in the 1970's (exact details are buried in J. MacGregor's field notes). All of these reports, taken together, suggest that there may be a small population of northern pine snakes in the vicinity of the RRD.]

Birds

Corvus corax Common Raven: E/-/-. This northern species occurs south through the Appalachian Mountains, and its range reaches the Cumberland Mountains of southeastern Kentucky. Although there is considerable evidence that ravens formerly were more widespread in the state (Mengel 1965), they disappeared from Kentucky during the early part of the 20th Century. The species was rediscovered in the Cumberland Mountains in 1969 (Croft 1970), where it has subsequently been recorded regularly from Pike County to Bell County. The species has been observed along the crest of Pine Mountain as far south as Pine Mountain State Park, Bell County, including the DBNF tract on the north slope of the mountain near Harlan, and it probably nests regularly, but in very small numbers, at scattered points along the crest.

**Dendroica pensylvanica* Chestnut-sided Warbler: -/-/-. Although the bulk of the nesting range of this woodland warbler lies well to the north of Kentucky in southern Canada and the northeastern United States, it extends south through the Appalachian Mountains and barely reaches the Cumberland Mountains of southeastern Kentucky. Recent data generated by the Kentucky Breeding Bird Atlas have also shown that the species can be found in early successional habitat at scattered points throughout the Appalachian Plateau. The atlas generated a confirmed nesting record of Chestnut-sided Warblers in Leslie County, and the species could occur in suitable habitat within the Redbird District.

Mammals

Clethrionomys gapperi maurus Kentucky [Cumberland] Red-backed Vole: S/-/C2. This endemic race of a wide-ranging northern species is restricted to the Cumberland Mountains of extreme southeastern Kentucky and adjacent Virginia (Barbour et al, 1979). Other subspecies of red-backed voles have been found southward through the Appalachian Mountains in Tennessee and North Carolina. In Kentucky, this form has been found in cool, damp woodlands and in shaded rock talus at high to moderate (1700 feet and above) elevations on Black, Little Black, Pine, and Cumberland Mountain in Bell, Harlan, and Letcher Counties. During the RRD inventory, it was collected from three different locations along the north-facing slope of Pine Mountain in Harlan County. These voles seemed particularly abundant on the rock talus at Railroad Gap; seven were caught in a series of 20 live traps that were set there for one night only in late September, 1992.

**Lasiurus cinereus* Hoary Bat: -/-/-. This species ranges over much of North America, and is occasionally found in Kentucky. The hoary bat, like the closely-related and much more common red bat (L. borealis), roosts in trees during the summer months. It apparently migrates south as winter approaches. This species usually forages over waterways, old roads, and other well-defined corridors and seems most active during the later hours of the night. During the RRD inventory, Hoary Bats were netted over the Redbird River in front of the ranger station in Clay County, over Redbird Creek near the mouth of Blue Hole Creek in Clay County, and on top of Pine Mountain at Railroad Gap, 3.0 miles west on KY 1679 from the junction of KY 1679 and KY 2010, in Harlan County.

**Lasionycteris noctivagans* Silver-haired Bat: -/-/-. This species ranges across most of the northern United States and Canada during the summer months, migrating southward as winter approaches.

It is occasionally found in Kentucky during the winter in tree snags, buildings, rock crevices or the entrances of caves. Silver-haired bats are most easily caught by mist-netting over streams and ponds during spring and fall migration. There is only one summer record from Kentucky - a male that was captured in a mist-net stretched over the Little Shepherd Trail at Scuttlehole Gap on Pine Mountain in Letcher County in July, 1989 (J. MacGregor and D. Yancy, pers. comm.). In the Redbird District, Silver-haired Bats were caught over water-filled ruts in an old logging road at Railroad Gap at the crest of Pine Mountain (Harlan County), 3.0 miles east on KY 1679 from junction of KY 1679 and KY 2010.

Myotis leibii Eastern Small-footed Bat: E/S/C2. This species is rare in Kentucky, and is one of the rarest bats in Eastern North America (Barbour and Davis, 1974). In Kentucky, small-footed bats have been found roosting in sandstone rock shelters, in crevices along sandstone clifflines, in limestone caves, under bridges, in and under old buildings, and even beneath flat rocks on open ground. Small-footed bats are occasionally mist-netted over streams and old logging roads but most recent records have come from netting activities carried out in sandstone rockhouses and shelters. Prior to this study, the nearest records to the RRD for this species were a male mist-netted on the top of Black Mountain in Harlan County in 1991 (J. Kiser, J. MacGregor, W. Hendricks et al, pers. comm.), a group of 18 hibernating individuals found in the "Dungeon" entrance to Line Fork Cave in Letcher County in 1992 (J. MacGregor, pers. comm.), and a cluster of six bats that was roosting under the KY 192 bridge over the Rockcastle River in Pulaski County in 1992 (J. Kiser and J. MacGregor, pers. comm.). Until the Redbird District inventory, all summer records from Kentucky were males. On August 6, 1992, a post-lactating female was netted on Pine Mountain in Harlan County over a road rut pond at Railroad Gap (3.0 miles west on KY 1679 from junction of KY 1679 and KY 2010). This is the first observation of reproduction for this species in Kentucky.

Myotis septentrionalis [= M. keenii] Northern Long-eared Bat: S/-/-. This widespread species has been found in 41 Kentucky counties, mostly in limestone regions in the winter but throughout the state in summer. It occurs in a wide variety of habitats: limestone caves, sandstone shelters, along sandstone clifflines, within abandoned mine portals, and along stream and old logging road corridors and in forested wetlands. During the 1992 inventory, individuals were mist-netted in six sites: Railroad Gap of Pine Mountain (Harlan Co.), the head of Hoskins Branch, Cawood Branch Picnic Area, and Gilberts Big Creek in Redbird WMA (all Leslie Co.), and near Negro Hollow along Redbird River and South Fork of the Kentucky River (Clay Co.).

Myotis sodalis Indiana Bat: E/E/E. This highly colonial bat was once found in scattered areas throughout the eastern United States. It is widespread in hibernation in cave regions of Kentucky, with 21 winter county records, but populations have declined greatly in recent decades. Documented decreases in winter numbers over the years have seen the hibernating population plunge from about 300,000 in the early 1960's to about 84,000 in 1991 (MacGregor, 1993). Although the bulk of Kentucky's winter Indiana bat population migrates northward for the summer months, mist-netting studies in recent years have resulted in the documentation of maternity evidence in a number of counties (Fulton, Carlisle, Daviess, Breckinridge, Edmonson, Bullitt, and Jefferson) in central and western Kentucky. Because this species uses bottomland woods as maternity sites, and because the summer whereabouts of the large winter colony that hibernates in Line Fork Cave (Letcher County) is unknown, project personnel mist- netted over the Redbird River intensively during the months of June and July, unfortunately without capturing any Indiana bats. In an attempt to determine whether or not a large hibernaculum might be present on Pine Mountain in Harlan County, project personnel

also netted intensively along the crest of Pine Mountain during the months of August, September, and October. This work resulted in the first record for the Indiana Bat from the RRD. An adult male was netted over a road rut pond at Railroad Gap (3.0 miles west on KY 1679 from the junction of KY 1679 and KY 2010) in Harlan County.

Neotoma floridana magister Eastern Wood Rat: -/S/C2. This species is known from clifflines, limestone caves and abandoned mine portals in Appalachian Kentucky and from similar habitats in the Mammoth Cave region and along the Dripping Springs Escarpment in west-central Kentucky. A small population also occurs along the Kentucky River palisades of the Inner Bluegrass. Drastic declines in numbers have occurred during the past 10- 30 years in many states bordering Kentucky (MO, IL, IN, OH) and to the northeast. Daniel Boone National Forest probably has the best remaining populations of this subspecies. In the RRD, because of the shortage of limestone caves and continuous sandstone cliffline, this species is most often found in abandoned mine portals and along undercut or broken down sandstone outcrops. During 1992, this subspecies was observed in only 20 new locations, but relatively fewer new sites were added than in most previous inventories. Most observations were made by field investigators from fresh sign (droppings, vegetation middens or nests). The middens often contained such items as acorns, leaves, fern fronds, dried fungi, chestnut burrs and bones.

**Peromyscus maniculatus nubiterrae* Cloudland Deermouse: -/-/-. This Appalachian mouse ranges from Pennsylvania southward along the Appalachian mountains into northern Georgia. In Kentucky, the cloudland deermouse has been found in four counties (Pike, Letcher, Harlan, and Bell) at moderate to high elevations in the Cumberland Mountains in rich woodlands, rock talus areas, and along rock outcrops and old strip mine benches. During the RRD inventory, this species was collected in three places, all in Harlan County along or near the crest of Pine Mountain. These sites include the north-facing slope of Pine Mountain above US 421, Railroad Gap (3.0 miles west on KY 1679 from the junction of KY 1679 and KY 2010), and 1.5 miles south on KY 2010 from the junction of KY 2010 and KY 221 near Shell Gap.

Plecotus rafinesquii Rafinesque's Big-eared Bat: T/S/C2. This species occurs locally in small, scattered populations across much of the southeastern United States. It has been found in numbers only in eastern Kentucky and southern Arkansas, however, and is considered to be "threatened" or "endangered" in nearly every state within its range. Historical declines have been documented for this species in Tennessee, but elsewhere in its range it is too rare or poorly known for any reasonable assessment of population trends to be made. Habitats which harbor Rafinesque's big-eared bats are varied but include limestone caves, sandstone shelters, hollow trees, abandoned mine portals, cisterns, the undersides of bridges, and old buildings. In Kentucky, there are records from 31 counties and at least 110 individual sites. More than 90 of these records and most of these counties are within the DBNF. Populations on the Daniel Boone alone probably exceed those from the rest of the species' range combined, making the Forest critical to its continued survival. In the Redbird District, only one known hibernaculum exists (at Elisha Creek in the Redbird Wildlife Management Area, Leslie County). During the inventory, project personnel netted lactating females in Little Double Creek and Indian Grave Branch in Clay County and documented females with young at both the Elisha Branch site (a sandstone cave) and the Owls Nest Road Mine (also in Leslie County). These records show that this species is reproducing in the district.

**Sigmodon hispidus* Hispid Cotton Rat: -/-/-. This southern species was apparently fairly common

(although poorly documented!) at one time in far western Kentucky in the Jackson Purchase and at Land Between the Lakes, where it occurred in weedy roadside ditches and fencerows (Barbour and Davis 1974). It has since declined, apparently, in the Jackson Purchase region (KSNPC, 1991). In eastern Kentucky, the Cotton Rat had previously been documented in two counties: near Quicksand in Breathitt County (Barbour and Davis, 1974) and at Cumberland Gap in Bell County (Barbour et al, 1979). During the 1992 inventory, a specimen was deposited on B. Begley's porch at the Pine Mountain Settlement School by a domestic cat, providing the first Harlan County record for the species as well as the first record from within the DBNF proclamation boundary.

Sorex c. cinereus Masked Shrew S/-/-. The typical race of this northern/Appalachian species is only found at high elevations in Kentucky. An additional race (*S. c. lesueurii*), which also bears the common name "masked shrew" occurs in swampy low woodlands in the Shawnee Hills section of western Kentucky. Prior to 1992, *S. c. cinereus* had been found at a number of sites in SE Kentucky but these were concentrated in only two counties (Letcher and Harlan) along the Poor Fork headwaters, on Pine Mountain, and on Black Mountain. During the inventory, masked shrews were collected at five locations. Four of these were on Pine Mountain (Harlan Co.); the fifth was at Cawood Branch, two miles north of Pine Mountain (Leslie Co.).

Sorex dispar blitchi Long-tailed Shrew: E/-/C2. The long-tailed shrew, also known as the rock shrew, is a species that extends nearly throughout the length of the Appalachian mountains. It is usually found at high elevations in deep, dark recesses among boulders or boulder talus slopes. In Kentucky, prior to the initiation of small mammal trapping on the RRD, rock shrews had previously been found only twice: in the headwaters of Poor Fork and at Bad Branch Nature Preserve (both on the south-facing slope of Pine Mountain in Letcher County). In the summer of 1991, J. MacGregor (USFS) collected two specimens on an isolated tract of Forest Service land on the north-facing slope of Pine Mountain near the crest above US 421 in Harlan County. During the Redbird District inventory, project personnel collected three additional specimens. The only new site was on Pine Mountain near Shell Gap, 1.5 miles south on KY 2010 from the junction of KY 2010 and KY 221 in Harlan County.

Sorex hoyi winnemana [= Microsorex h.w.] Pygmy Shrew: -/S/C2. This widespread Appalachian form is known from about 20 counties in eastern and central Kentucky (excluding the Bluegrass Region), including about 3/4 of the counties included within the DBNF. This species was not collected nearly as frequently on the RRD as it has been on the Morehead and (post-inventory) Stearns Ranger Districts. During 1992, pygmy shrews were found at Railroad Gap and Shell Gap in Harlan County, Upper Bear Creek and Big Double Creek in Clay County, and Old Field Branch in Perry County. The Forest Service tract near the crest of Pine Mountain along US 421 (Harlan Co.) yielded several during summer and fall trapping in 1991.

Spilogale putorius Eastern Spotted Skunk: S/-/-. The spotted skunk, also known as the "civet cat", is generally considered to be a southeastern species. In Kentucky, it has been found only in the in Appalachian region where the rugged terrain features sandstone cliffs and large boulder talus slopes which provide shelter and foraging habitat. Spotted skunks will occasionally live and forage under and around buildings. Several have been live-trapped or observed around cabins in the Red River Gorge area on the Stanton Ranger District in Powell County (D. Dourson and D. Sasser, pers. comm.), and Barbour et al (1979) found spotted skunk sign at several buildings in Cumberland Gap National Historical Park (Bell County). There is only one record from the Redbird District: a visual

record of an adult eating a dead frog on a dirt road in Leslie County in the Redbird Wildlife Management Area (R. Jiminez, pers. comm.). An additional spotted skunk report, from Harlan County several miles outside the DBNF proclamation boundary, was brought to the attention of J. MacGregor and J. Kiser during the summer of 1991. A Virginia man who works at the radio tower atop Black Mountain, and who seemed to be an accomplished and observant naturalist, reported that a stray dog that was adopted by the radio tower staff had killed several spotted skunks there during 1975-85.

Ursus americanus Black Bear: S/-/-. The black bear is an animal primarily found in large forested regions with little human presence. Black bears are usually wary and somewhat nocturnal, and thus rarely seen by man. An average home range is about 14,000 acres (Lowman 1975). During the Redbird District inventory project, personnel found bear feces near Shell Gap off of KY 2010 in Harlan County; Conservation Officer Roy Harris (pers. comm.) estimated that there were at least 15 resident black bears living along or near Pine Mountain in Harlan County as of late fall, 1992. There was also an animal seen and videotaped in the Booneville (Owsley County) early in 1992 (D. Barrett, pers. comm.). Together with reports of several sightings in the Morehead District during 1991 (Campbell et al. 1992), additional new reports from the Stanton District in 1992 (D. Dourson, pers. comm.), and the finding of tracks in Rock Creek in the London District in 1992 (observed by J. Kiser), there is ample evidence that this species is moving back into Kentucky and the DBNF from the central Appalachians.

SIGNIFICANT AREAS

The following areas were deemed "significant" because each has one or more of the following attributes: (a) a concentration of several rare species; (b) a particularly good population of a rare species; (c) some other special ecological feature. These areas together, therefore, have a relatively high contribution to overall biodiversity within the RRD. The river corridors, Pine Mountain section and smaller sites together contain a majority of the rare species occurrences within only about 15% of the total RRD area, or about 23% if the Redbird Corridor is extended to its watershed divide. Addition of all remaining South Fork watershed as buffer in a megasite concept around the South Fork and Redbird River corridors (as outlined below), would bring this areal proportion to about 50%. This concept should be viewed within the context of the whole Kentucky River drainage--the South Fork is the least disturbed major section of the whole Kentucky River watershed. General locations of these areas are shown in Fig. 4, and individual boundaries are shown in Figs. 5-11. Wherever justified, boundaries include broad corridors along major streams or whole watershed units, so as to suggest some ecological integrity in any future management plan.

These areas' important features are described below as a basis for any management and acquisition plans aimed at conservation of rare species and special habitats. Rare species are listed for each area. These species include a few that may be extirpated, or that have been recorded only nearby but which are likely to occur within the area. Some plant species treated in the preceding sections are widely scattered in the region, and are not included under each site description. These include *Cypripedium pubescens*, *Hydrastis canadensis*, *Juglans cinerea* and *Panax quinquefolius*. Species found only along the margins of a site are listed in brackets [ ]. Several rare aquatic animals were not relocated in the RRD during 1992, but in several areas there is reason to believe they are still present. In other areas, changes in water quality and impoundment have probably caused their extirpation. These situations are noted in the lists below.

Before detailing the areas of obvious importance, a few notes are needed concerning another large site of potential interest--the Buckhorn Lake area (including Leatherwood Creek, Otter Creek and Squabble Creek). This area deserves more study in regard to possible conservation efforts, though it is probably not as significant as those detailed in the expanded descriptions. There appears to have been an exceptionally mature stand, as judged from aerial photographs of 1979, in Bear Fork of Otter Creek, but this USFS tract was logged in the 1980s.

(1) Perhaps the most mature stands remaining along the lake are between Tantrough Branch and Spring Fork. Part of the ridge here has been recently cutover, but in 1991-92 some 30-50 acres still had 12-36 inches dbh *Quercus montana*, with frequent *Pinus echinata* on a recently burned ridgeline. A cut 30 inch dbh *Q. montana* here was ca. 250 years old, which is comparable with the Elisha Creek area (see below). This site had the only *Lathyrus venosus* found in RRD. On the north-face along the lake, there were still 20 acres of 12-28 inches dbh trees, dominated by *Fagus*, with frequent *Liriodendron* and *Tsuga*. In the ground-layer there was frequent *Impatiens pallida* (dominant to mid-slope), *Cimicifuga racemosa*, *Aster divaricatus*, *Carex purpurifera* and *Athyrium pycnocarpon*.

(2) Another relatively mature area is about 1 mile east of Turkey Branch. On lower south-facing slopes some 50-100 acres of older growth were dominated by *Fagus* (up to 24-36 inches dbh). Other species included *Aesculus*, *Asimina*, *Lindera*, *Cornus florida*, *Bignonia*, *Polystichum*, etc. Upper

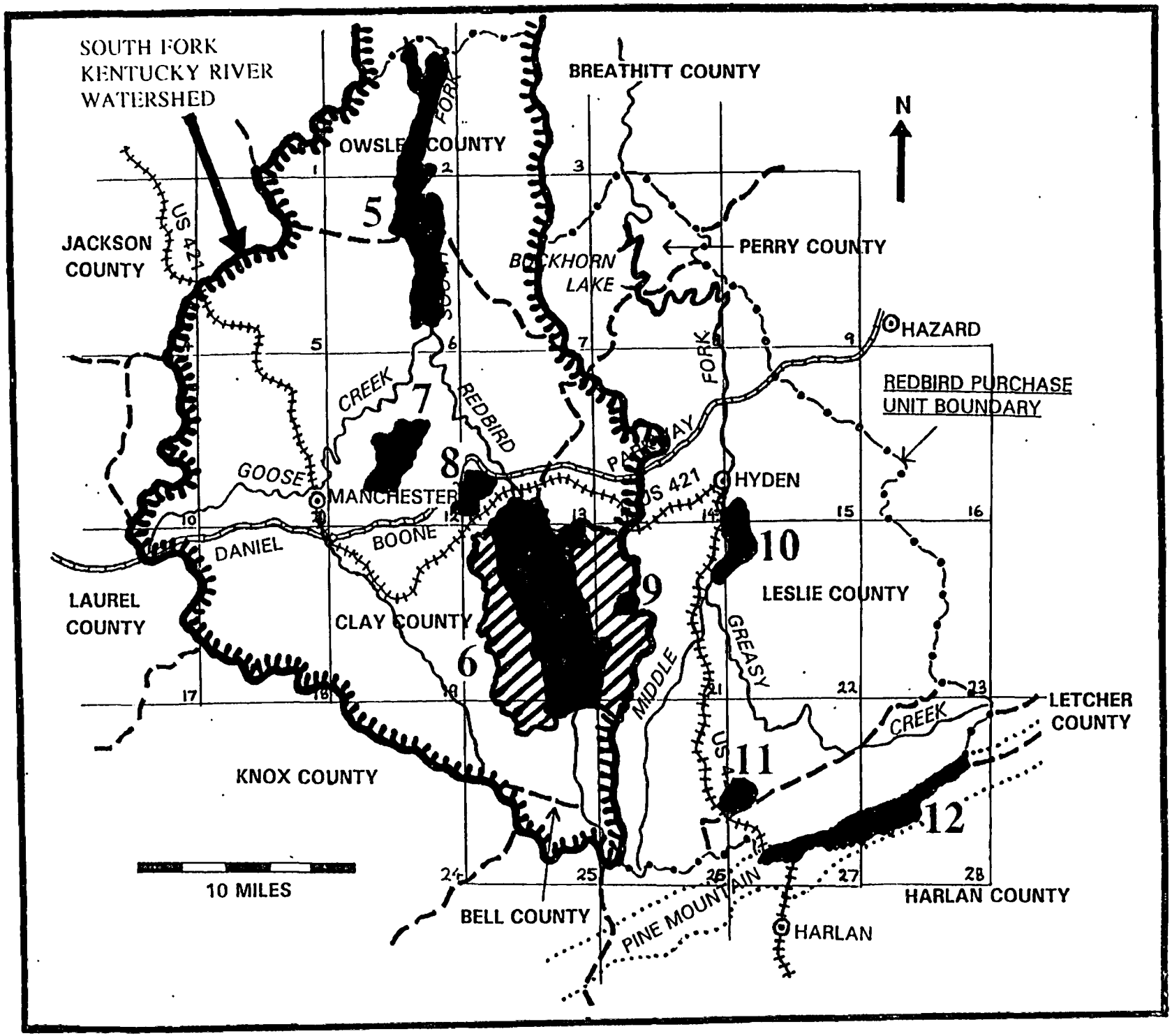

Figure 1. Map of the Redbird Ranger District showing locations of significant areas.

slopes have uneven timber (to 24 inches) of *Quercus montana, Q. rubra* and *Q. coccinea*, with subcanopy of *Acer rubrum, Cornus florida* and *Carya ovata.* *Ulmus alata* was abundant on the ridges. The east-facing slope above the unnamed branch south of Bowling Branch also had relatively mature timber (to 24 inches), dominated by *Quercus rubra* and *Carya ovata*, with more mesic areas of *Acer saccharum, Tilia, Fraxinus americana* and *Fagus*, plus a large patch of *Hydrastis* (200 stems).

(3) Other significant stands were on the steep lower north face opposite Mosely Bend, with ca. 10 acres of 12-24 inches dbh *Tsuga-Fagus* forest, with some *Anemone quinquefolius* and *Panax trifolius*; Old Field Branch 30-50 acres of 12-20 inches dbh (occasionally 28-40 inches) *Fagus-Tsuga-Acer saccharum* forest; Trace Branch south of boat ramp, with at least 10 acres of 12-28 inches *Fagus-Tsuga* forest.

A few other sites may deserve attention as distinct sites. Some of these are noted under "Notes on Vegetation" in the initial section on the South Fork Watershed. However, more sampling is needed to define sites in this region where rare species are thinly distributed, and the ecological condition of the landscape is relatively uniform.

Site Name: SOUTH FORK KENTUCKY RIVER WATERSHED (MEGASITE); Fig. 4.
(including Redbird River watershed)
Size: ca. 300 square miles
Counties: Leslie, Clay, Owsley and a small part in Knox.
USGS Quadrangles: Beverly, Helton, Ogle, Creekville, Hoskinston, Barcreek, Big Creek, Hyden West, Oneida, Mistletoe and Booneville, Ky.
Location. The South Fork Kentucky River watershed includes the western half of the RRD, plus a minor area along Collins Fork in Knox County. There is also a section downstream of the RRD, but further work is needed to determine is this should be considered significant as well.

General Description. This watershed lies mostly in the Rugged Eastern Area of the Appalachian Plateaus. The section downstream of the RRD, including watersheds of Sexton Creek and Cow Creek, is partly in the Low Hills Belt, though the transition is gradual. Virtually all of the uplands are forested, except for scattered strip-mines. Virtually all of the bottomland has been cleared, except for narrows strips of riparian forest, a few poorly drained areas, and a few old fields. Most of the watershed is in the RRD, but only about one third of the land is owned by USFS.

Note: The following species include only those additional species not yet found within the five subsequent standard sites nested within this megasite.

Listed Animal Species.
Eumeces a. anthracinus, Northern Coal Skink.
Spilogale putorius, Eastern Spotted Skunk

Listed Plant Species.
Vallisneria americana, Tapegrass

Other Plants of Interest.
Carex scabrata, Rough Running Sedge
Platanthera lacera, Ragged Orchid
Veronicastrum virginicum, Culver's Root

Biological Significance. Among the three forks of the Kentucky River, the South Fork drainage is the least impacted from human activities (e.g., coal mining, stream impoundment, highway development, sewage pollution, etc.). As a consequence, the South Fork drainage has the best water quality (Kentucky Division of Water 1992, Smoot et al. 1991), and freshwater mussel and fish diversity may be greater than in the Middle and North Forks (See Jones and Stephens 1984, Prather 1985; and Appendix D below). The South Fork drainage can act as a refugium from which aquatic organisms can disperse to recolonize streams in the Middle and North Forks that have recovered from habitat degradation. Several of the mussels and fishes in the South Fork drainage are globally rare, and two are candidates for federal protection: Snuffbox (*Epioblasma triquetra*) and Eastern sand darter (*Etheostoma pellucidum*). High quality tributary streams such as Bowen, Elisha and Sugar Creeks are also important, especially for the Arrow darter (*Etheostoma sagitta spilotum*), which is restricted to the upper Kentucky River watershed.

This large site (a "megasite" in Natural Heritage Program terminology) is unusual within DBNF, since its significance is moderate but widely dispersed. The Redbird River watershed, with much USFS ownership, could be viewed as the most important area to continue focusing watershed protection efforts on, but the rest of the watershed should also be carefully assessed for potential action. There are some narrowly defined sections of the whole watershed that deserve particularly concentrated attention for conservation, and these are outlined as the five sites subsequent to this overview. The notes immediately below concern other sections that may deserve special action, but which deserve much more study before commitments are made.

Notes on Subsections and their Vegetation.

A. Some tributaries of the South Fork other than sites covered in subsequent sections may still deserve special attention for forest conservation and maintenance of natural water quality.

(1) Buffalo Creek appeared to have relatively good water quality, and a good population of *Etheostoma sagitta spilotum*--one of only two sites for this species discovered during the 1992 survey. The watershed is almost all forested, with much USFS ownership and very few mines. There may be no outstandingly mature timber stands, but a few areas were noted with above-average quality. Examples include Bill Oak Branch (ca. 10 acres of 10-32 inches *Tsuga-Fagus* forest on lower north-face near mouth); Merrill Branch (ca. 30 acres of 16-24 inches *Fagus*, etc. on lower west-face near mouth, plus only *Carex scabrata* found in RRD). Similar forest may also occur on northeast-facing slopes of lower Newfound Creek, just south of Buffalo Creek. USFS data (CISC) indicate that there is a concentration of pre-1900 stands at the head of this watershed, and in adjacent parts of the Squabble Creek and Little Bullskin Creeks.

(2) Collins Fork, Goose Creek. This stream is notable for having a population of a rare mussel, *Villosa lienosa*, that is among the best in Kentucky. It is also the only site in the RRD where the rare aquatic plant, *Vallisneria americana*, is known. This stream has a particularly low gradient, and flows north apparently due to stream-capture by the Kentucky River watershed from the Cumberland River watershed. Also unusual in this section of the stream are several patches of *Nuphar advena*. Otherwise only common streamside species were noted: *Justicia* (common in riffles), *Ludwigia palustris, Polygonum sagittatum, P. caespitosum, Mimulus alatus, Bidens cf. comosa, Eleocharis obtusa, Sparganium* sp. (often submerged in riffles), *Leersia oryzoides, Panicum agrostoides, P. dichotomiflorum*, etc. Woody plants include *Salix nigra* (common next to riffles), *Platanus, Betula nigra, Alnus, Juglans nigra, Ulmus americana* and *Arundinaria*.

B. Several oxbow lakes (sloughs), or remnants of these natural features, still occur in the South Fork drainage, but are all small (1-10 acres) and in various states of human disturbance. Examples (with codes used below) were found on Goose Creek (GC, 1.5 miles SE of Garrard, Ogle Qd.), Redbird River (BC, 2 miles NW of Big Creek, Big Creek Qd.), Sexton Creek (SC, near Sizemore Cem. at Clay/Owsley Co. line), South Fork opposite Pooter Branch (PB, Oneida Qd.), South Fork at mouth of Sexton Creek (TF, near Taft, Oneida Qd.), and, just north of the RRD, near the South Fork at Booneville (TS, "The Sag", Booneville Qd.). The wetter open places in some of these sites (coded as above) had *Nuphar advena* (TF), *Polygonum arifolium* (TS), *Sium suave* (TS), *Ludwigia palustris, L. decurrens* (TS), *Polygonum hydropiperoides, Galium tinctorium, Alisma, Sagittaria longirostris, S. latifolia* (TS), *Juncus effusus, Scirpus cyperinus, Carex tribuloides, C. lupulina, C. lurida, Leersia oryzoides*, and usually thickets of *Cephalanthus, Alnus* and *Salix nigra*. Other woody species in

these areas included *Betula nigra* (locally dominant), *Fraxinus pennsylvanica, Acer rubrum* var. *trilobum, Platanus, Liquidambar, Rosa palustris* and *Sambucus*. "Swamp oaks" were only found at two sites: *Quercus palustris* (TS) and *Q. shumardii* (GC), with *Carya laciniosa* (GC) near the latter. Common herbs in this fringing forest included *Saururus cernuus, Boehmeria, Impatiens capensis, Aster ontarionis, Helianthus decapetalus, Carex projecta, C. typhina, C. louisianica, Leersia virginica, Cinna arundinacea*, etc. Others included *Polygonum sagittatum, P. caespitosusm, P. punctatum, Penthorum, Amphicarpaea, Apios, Cicuta, Lobelia cardinalis, Lysimachia nummularia, Scutellaria lateriflora, Lycopus virginicus, Mimulus alatus, Galium obtusum, Solidago gigantea, Bidens comosa, Glyceria striata* and *Carex crus-corvi* (GC). Better-drained fertile soil on some adjacent sites had frequent *Acer negundo* and *Liriodendron*, with some *Cornus florida, Carpinus, Carya ovata*, etc.; herbs include *Thalictrum pubescens, Viola conspersa, Monarda clinopodia, Valerianella* sp., *Phlox paniculata, Aster prenanthoides, Rudbeckia laciniata, Verbesina alternifolia, Panicum clandestinum* and the exotic *Eulalia.*

C. A few streamhead areas of interest occur on flatter ridges, mostly in the Redbird River Corridor (see below). Another, drier streamhead in the Flatwoods area (Big Creek Qd.) was also notable due to the presence of *Isoetes engelmannii.* Other species included *Thelypteris noveboracensis* (abundant), *Lysimachia quadrifolia, Chelone glabra, Gratiola neglecta, Lobelia cardinalis, Lilium canadense, Medeola, Uvularia perfoliata, Hypoxis, Cypripedium acaule, Isotria, Carex debilis, C. swanii, C. cf. laxiflora, C. lurida, Glyceria cf. striata, Polytrichum commune* and *Sphagnum lesquirii* (thick beds). Woody species included *Liriodendron, Castanea dentata, Quercus alba, Q. coccinea, Viburnum acerifolium*, etc.

D. A few areas of significantly older growth were identified in the South Fork drainage outside of the sites detailed in subsequent sections (mostly in Redbird River Corridor). These stands have generally been selectively cut 50-100 years ago, leaving highly uneven canopy tree sizes of about 8-32 inches dbh. Examples are as follows.
(1) Big Branch of Hector Branch (Barcreek Qd.) had at least 30 acres of 12-32 inches dbh forest: lower north-face with *Fagus-Quercus rubra* forest, subcanopy of *Acer saccharum*, shrub layer of *Ulmus rubra*; upper slopes with *Q. montana-Carya* spp. forest.
(2) Mud Lick Creek, Left Fork (Ogle Qd.) had ca. 50 acres of 12-32 inches dbh *Fagus* on the north-face, plus *Ranunculus allegheniensis* and *Silphium wasiotense* at the slope bases.

E. Some roadsides with large populations of *Silphium wasiotense* should also be noted. Two of the most concentrated populations found were along Little Goose Creek, and the Goose Creek-Ashers Fork area (see Results: Flora).

Explanation of Boundaries. The boundaries are simply defined as the watershed boundaries. The Redbird River watershed is the least disturbed section, with a concentration of USFS ownership, and, currently, it acts as the focus of management for watershed protection. However, in the long-term, there are reasons to promote such management in the rest of the watershed.

Site Name: SOUTH FORK KENTUCKY RIVER CORRIDOR; Fig. 5.
(a section of South Fork Watershed; see above)
Size: ca. 18 square miles (11,500 acres).
Counties: Clay and Owsley
USGS Quadrangles: Oneida, Ky.; Booneville, Ky.

Location. This site includes the South Fork valley, from Oneida downstream at least to Booneville, which is about 12 miles (20 river-miles). The most significant section may be the southern half, upstream of the county line at KY 11. The corridor generally runs up to adjacent ridgelines, and is about 1 mile wide.

General Description. This sites is distinguished by the relatively rocky sections of riverbed, though there are no serious rapids. The corridor includes largely forested slopes and cleared bottoms. Much of the bottomland in the southern half, however, lacks paved roads and is not heavily settled. None of the forest is unusually mature. Most of the land, including all the river frontage, is privately owned.

Listed Aquatic Animal Species.

Epioblasma triquetra, Snuffbox (a mussel/unconfirmed 1992)
Etheostoma pellucidum, Eastern Sand Darter (unconfirmed 1992)
Etheostoma tippecanoe, Tippecanoe Darter
Ichthyomyzon fossor, Northern Brook Lamprey (unconfirmed 1992)
Noturus stigmosus, Northern Madtom (unconfirmed 1992)
Percina evides, Gilt Darter
Villosa lienosa, Little Spectaclecase (a mussel/unconfirmed 1992)

There is also a reasonable chance that the following occur:
Etheostoma maculata, Spotted Darter
Lampetra appendix, American Brook Lamprey
Percina macrocephala, Longhead Darter

Listed Mammal Species

Myotis septentrionalis, Northern Long-eared Bat
Neotoma floridana magister, Eastern Wood-rat

Listed Plant Species.

Clematis glaucophylla, Smooth Leather Flower
Podostemum ceratophyllum, Riffleweed

Other Plants of Interest.

Anemone quinquefolia, Wood Anemone (extirpated?)
Isopyrum biternatum, False Rue-anemone
Panax trifolius, Dwarf Ginseng (extirpated?)
[*Phacelia purshii*, Miami Mist; fields/edges near Booneville]
Physostegia virginiana ssp. *virginiana*, False Dragonhead
Rhododendron arborescens, Smooth Azalea
Senna hebecarpa, Swamp Senna

Trautvettaria caroliniensis, False Bugbane
Trillium sessile, Wake-robin (only Rugged Eastern Area record)
Viburnum rafinesquianum var. *r.*, Arrow-wood

Biological Significance. This river is important due to its relatively good water quality, with numerous riffles and several rare aquatic species (see general notes under South Fork Watershed). This corridor appears to have by far the largest and healthiest population of *Podostemum* known in the state. Also, the area is of interest due to the unusual vegetation along rocky riverbanks, and the potential for restoration of bottomland forest.

Notes on Vegetation.

A. In addition to *Podostemum*, the aquatic mosses *Fontinalis* sp. and *Fissidens fontanus* were frequent in the riffles. *Justicia* was abundant along the shore of these riffles. Low open cobble-bars, such as the large (1+ acre) bar at mouth of Buffalo Creek, and other open banks had frequent *Salix caroliniana, S. nigra, Cornus obliqua, Alnus, Betula nigra* and *Platanus*; others include *Albizzia julibrissin* and *Vitis vulpina*. Common species in the ground layer included *Apocynum cannabinum* (locally dominant), *Campsis radicans, Lespedeza cuneata* and *Andropogon gerardii*. Others included *Clematis* spp., *Polygonum* spp., *Trifolium pratense, Hypericum prolificum, Daucus, Diodia virginiana, Asclepias syriaca, Phlox maculata, Physostegia virginiana* (one site), *Vernonia, Verbesina alternifolia, Helianthus tuberosus, Coreopsis tripteris, Bidens frondosa, B. cf. comosa, Eupatorium fistulosum, Aster simplex, Solidago gigantea, Erigeron canadensis, Ambrosia* spp., *Xanthium* and *Panicum clandestinum. Onoclea* and *Osmunda regalis* occur in more shady thickets.

B. Sandstone shelves had frequent *Andropogon gerardii* (abundant), *A. scoparius, Eulalia, Panicum sphaerocarpon, P. acuminatum* var. *fasciculatum, Elymus glabriflorus* var. *australis, Pycnanthemum tenuifolium, Oenothera tetragona* and the exotic *Lespedeza cuneata.* Other species included *Polygonum sagittatum, Potentilla simplex, Geum virginianum, Saxifraga virginiensis, Psoralea psoralioides, Linum striatum, Euphorbia corollata, Hypericum prolificum, Ludwigia alternifolia, Salvia lyrata, Ruellia caroliniensis, Campsis, Helianthus decapetalus, Coreopsis tripteris, Eupatorium fistulosum, E. serotinum, Solidago gigantea, S. nemoralis, Aster patens, A. dumosus, Sisyrinchium graminoides, Juncus dudleyi, J. tenuis, Carex lurida, C. vulpinoidea, C. projecta* and *Danthonia compressa.* In the transition from shelves to adjacent slope forest, frequent species included *Quercus alba, Liquidambar, Juniperus, Ulmus alata, Rhododendron* spp. (especially *R. nudiflorum*), *Rhus radicans* and *Panicum yadkinense.* Others included *Fraxinus americana, Diospyros, Alnus, Ipomoea pandurata, Helianthus microcephalus, Heliopsis, Trautvettaria* (N-facing banks only), *Chasmanthium latifolium, Panicum polyanthes*, etc.

C. The riverine forest in general was dominated by *Platanus, Betula nigra* and *Acer negundo*, but had almost no *A. saccharinum.* A few forested islands and broader strips of bottomland forest had well-developed ground vegetation, including much *Sambucus canadensis, Arundinaria, Chasmanthium latifolium, Elymus* spp., *Allium canadense, Amphicarpaea, Cryptotaenia* and *Aster simplex*, plus smaller amounts of characteristic species like *Chaerophyllum procumbens* and *Mertensia.*

D. A notable feature is the slough opposite Pooter Branch (Oneida Qd.). This ca. 5 acre area was dominated by *Liquidambar, Betula nigra, Alnus* and *Cephalanthus*, with typical dense growth of

grasses, sedges and tall herbs (see South Fork watershed notes).

E. One area of adjacent slopes was found with special interest--"Sally Ridge", west of Indian Creek and Cow Creek (Booneville Qd.). The north-facing slope had relatively mature timber, though the extreme steepness and instability of the slope appears to increase the turning over of trees. Most canopy trees were only 12-16 inches dbh, with a few 20-24 inches (occasionally to 36 inches). Frequent species along the ridge included *Q. montana, Q. coccinea* and *Q. alba*; on the slope, *Fagus* was dominant, with lesser amounts of *Liriodendron, Q. rubra, Acer saccharum, Tilia, Fraxinus americana, Aesculus flava, Viburnum acerifolium, Hydrangea*, etc. Also, this is the only site in the RRD where *Viburnum rafinesquianum* has been found. Common herbs included *Aster divaricatus* (abundant) and *Cystopteris protrusa* on upper slopes; and *Hepatica acutiloba* and *Parthenocissus* on lower. On the steep upper slopes on the south side of this ridge there was a half-acre open area, apparently caused by seepage and slumping. The exotic grass, *Eulalia viminea*, however, dominated this area and, together with much *Impatiens pallida*, it also covered some steep gullies and seeps within the woods. Other species in the opening include *Scirpus cyperinus* (common), *Andropogon virginicus* (frequent), *A. gerardii, Epilobium ciliatum, Solidago altissima, Eupatorium serotinum*; adjacent trees include *Fagus* and the exotic *Ailanthus*.

Explanation of Boundaries. The downstream limit is arbitrarily placed at the RRD boundary, but further study may justify extension to the forks of the Kentucky River at Beattyville. The upstream limit is at the confluence of the Redbird River, with a relatively undisturbed watershed, and Goose Creek, with a more disturbed watershed centered on the city of Manchester. The width of the corridor generally extends up to adjacent ridgelines, and is 0.5-1 mile wide.

Site Name: REDBIRD RIVER CORRIDOR; Fig. 6.
(a section of the South Fork Watershed; see above).
Size: ca. 90 square miles, with 35 square miles in central corridor.
Counties: Clay and Leslie
USGS Quadrangles: Big Creek, Ky.; Creekville, Ky.

Location. The broad concept of this site includes the whole watershed of the Redbird River from Little Double Creek to Blue Hole Creek. The central corridor, some 2-4 miles wide, consists of the bottomlands and adjacent slopes along about 12 miles (17 river-miles) from Peabody to Creekville to Queendale, and it includes 1-2 miles along Little Double Creek, Big Double Creek, Bowen Creek and Spring Creek. KY 66 runs through the eastern side of this site, about 14 miles east of Manchester on US 421, with one bridge over the river.

General Description. The bottomlands are mostly cleared for farmland or other fields, but there are several forested areas as well, especially on USFS land. The slopes are all forested. A few 10-100 acre stands are relatively mature (with many trees 20-32 inches dbh). Such stands are concentrated in the central corridor, mainly in the Big Double Creek watershed (e.g., N-face south of Peabody, and the W-face 1.4 mile up Big Double Creek) and north of Upper Jacks Creek (USFS data). Outside the corridor, such stands are mostly scattered in the Redbird Wildlife Management Area, including the Right Fork Elisha Creek area detailed separately below. USFS owns most of the slopes, but only 10-20% of the bottomland.

Listed Land Snail Species
[*Anguispira rugoderma* (a land snail)] (two sites E of corridor)
?*Mesomphix rugeli* (a land snail), tentative id.

Listed Aquatic Animal Species.
Epioblasma triquetra, Snuffbox (a mussel)
[?*Etheostoma maculata*, Spotted Darter, possible--see species section]
Etheostoma pellucidum, Eastern Sand Darter (possibly extirpated)
Etheostoma sagitta spilotum, Arrow Darter (unconfirmed 1992)
Percina macrocephala, Longhead Darter (possibly extirpated)
Villosa lienosa, Little Spectaclecase (a mussel/unconfirmed 1992)

Listed Mammal Species.
Myotis septentrionalis, Northern Long-eared Bat
Plecotus rafinesquii, Rafinesque's Big-eared Bat
Sorex hoyi winnemana, Pygmy Shrew

Other Mammal of Interest
Lasiurus cinereus, Hoary Bat

Listed Plant Species.
Chrysosplenium americanum, Golden Saxifrage
Solidago curtisii, Curtis's Goldenrod
Prenanthes crepidinea, Giant Wood-lettuce

Other Plants of Interest.

Senna hebecarpa, Swamp Senna
Silphium wasiotense, Wasioto Rosinweed
Synandra hispidula, Synandra
Waldsteinia fragarioides, Barren Strawberry

Biological Significance. In addition to its importance for aquatic species (see general notes under South Fork watershed), the central corridor contains the two largest populations of *Prenanthes crepidinea* found in the RRD (with ca. 30-50 plants in each case). It also has potential for restoration of bottomland forest along the Redbird River and several tributaries. The slopes have continuous forest cover, with a few unusually mature areas (see below). The section south of Creekville, with much USFS ownership, has more potential than any other part of the RRD for restoration of extensive bottomland forest. There are already several strips of forest connecting the river front with adjacent slopes, and most of the land is owned by USFS. The river probably has several rare aquatic species, which are currently known elsewhere in the South Fork drainage, but there needs to be more sampling in this particular section. Two globally restricted plant species also occur here--the undescribed *Solidago* sp., in large numbers, and *Silphium wasiotense* in small populations. Adjacent sections of the tributaries here include several features of interest: (1) more strips of bottomland forest along these lower order streams; (2) steep, rocky ravines with sandstone and shale outcrops in places, especially Spring Creek; and (3) a few additional rare plants, most notably *Chrysosplenium americanum* along Bowen Creek. This is the only site in Kentucky where the latter species has been found west of the Cumberland Mountains.

Notes on Vegetation.

A. On the banks of Redbird River, *Platanus, Betula nigra* and *Acer negundo* were usually dominant. Others included *Liriodendron, Magnolia tripetala, Juglans* spp., *Ulmus americana, Carpinus, Asimina, Lindera, Sambucus*, etc. In a few places, small groups of *Juglans cinerea* were found; one site just downstream from this corridor (mouth of Dry Branch) had 15-20 trees of 4-16 inches dbh, somewhat diseased but still vigorous. *Populus deltoides* was seen at one site. In less disturbed areas, frequent herbaceous species include *Impatiens* spp. (locally dominant), *Ranunculus* spp., *Thalictrum pubescens, Stellaria media, Geum canadense, Viola papliionacea, V. striata, Phlox paniculata, Valerianella* sp., *Rudbeckia laciniata, Helianthus tuberosus, H. decapetalus, Solidago gigantea, Verbesina* spp., *Aster prenanthoides, A. ontarionis, A. simplex, Ambrosia trifida, Festuca obtusa, Elymus macgregorii, E. riparius*, etc. However, most bottomland forest is highly disturbed, with exotics like *Rosa multiflora, Lonicera japonica* and *Discorea batatas* abundant. On the more open, gravelly banks of the river south of Blue Hole, there were open areas dominated by *Festuca arundinacea* and *Melilotus* sp. Other exotics included *Trifolium pratense, Lespedeza cuneata, Daucus carota, Chrysanthemum leucanthemum* and *Lonicera japonica.* Native species included *Equisetum arvense, Cassia hebecarpa, C. cf. fasculatum, Desmodium canescens, Linum cf. striatum, Plantago rugelii, Eupatorium fistulosum, Aster prenanthoides, Solidago candensis, Erigeron annuus, Carex torta*, etc. Woody species included *Platanus, Salix sericea* and *Ulmus rubra.*

B. At least three stands of significantly older growth have been found along tributaries around the margins of the corridor: (1) Big Double Creek, west-face about 1.4 miles southeast of its mouth (Big Creek Qd.), had upper slopes with ca. 10 acres of 20-32 inches dbh *Fagus* forest, some *Acer saccharum* and *Carya glabra*, and lower slopes with 12-24 inches dbh *Fagus*.

(2) Sugar Creek ravine, 1-3 miles east of its mouth (Big Creek, Creekville Qds.), had uneven 12-36 inches dbh *Fagus-Tsuga* forest (plus much *Fraxinus americana* and *Acer saccharum*), mixed with younger areas of *Liriodendron/Betula lenta*. The best sections had most canopy trees 16-28 inches dbh, with some 32-36 inches. There was little or no *Rhododendron maximum*.
(3) The tributary of Sugar Creek north of Venus Branch (Gilberts Big Creek, Creekville Qd.) had ca. 30 acres of older growth. Larger trees included frequent *Fagus, Quercus rubra* and *Q. montana* (all to 24-36 inches dbh) and *Liriodendron* (to 24 inches). Other species included *Magnolia acuminata, Carya ovata* and *Juglans nigra* (to 24 inches). One standing dead tree (*Quercus* or *Castanea*) was ca. 50 inches dbh and 80 ft tall. There were several plants of *Panax quinquefolius*.

C. On broader ridges, especially in the Redbird River watershed, there are several streamheads that are poorly drained. These have boggy, acid soil, with up to 0.5-2 acres of dense ground cover of ferns, sedges and grasses under a somewhat open tree canopy. Examples include the streamhead of Sugar Creek just north of Peters Branch, Gilberts Big Creek (Hoskinston Qd.). This area is particularly open, with much *Sphagnum* on leached whitish sandy soil. Two others in the RWMA were found about 2.5 miles south of the mouth of Bear Branch (Big Creek Qd.). Two more smaller areas were found in the Rocky Mountain area (Creekville Qd.). In such sites, woody species composition was found to be highly variable. Frequent woody species in and around these areas included *Acer rubrum* (codominant with *Liquidambar* in a the wettest areas), *Betula nigra* (codominant with *Carpinus* in a floodplain area), *Tsuga, Ilex opaca* and *Kalmia*. Others included *Quercus alba, Liriodendron, Carpinus, Betula lenta, Liquidambar, Nyssa, Oxydendron, Rhododendron maximum, Lyonia ligustrina* (head of Sugar Cr., Hyden West Qd.) and *Euonymus americanus*. In the herb layer, common species included *Osmunda cinnamomea, Thelypteris noveboracensis, Athyrium asplenioides, Impatiens capensis* and *Carex lurida* var. *gracilis*. Others included *Osmunda regalis, Onoclea, Lygodium, Selaginella apoda* (both sites near Rocky Mt.), *Boehmeria, Polygonum sagittatum, Apios, Rhus radicans, Polygala senega, Hypericum mutilum, Viola cucullata, Ludwigia* spp., *Oxypolis, Phlox maculata, Lycopus virginicus, Chelone glabra, Mimulus ringens, Gratiola* sp., *Galium cf. tinctoria, Lobelia cardinalis, Aster prenanthoides, A. umbellata, A. lateriflorus, Solidago rugosa, S. gigantea, Senecio aureus, Eupatorium fistulosum, Bidens comosa, Platanthera clavellata, P. ciliaris, P. flava* (var. *herbiola* at both sites near Rocky Mt.), *Juncus effusus* var. *solutus, Scirpus polyphyllus, Carex vulpinoidea, C. laevivaginata, C. stipata, C. cf. albolutescens, C. projecta, C. gracilescens, C. gracillima, C. debilis, C. prasina, C. crinita, C. torta, Leersia* spp., *Glyceria striata, Panicum clandestinum, polyanthes, P. microcarpon, Eulalia* (both sites near Rocky Mt.). Mosses included *Sphagnum imbricatum, S. palustre, S. recurvum* var. *r., S. sub.* var. *rufescens, Polytrichum commune, P. ohioense, Leucobryum albidum, Aulacomnium palustre, Atrichum undulatum, A. crispum, Thuidium delicatulum, Mnium affine* var. *ciliare*. The largest area (ca. 2 acres, S of Bear Br., Big Cr. Qd.), dominated by *Acer rubrum* and *Liquidambar*, had at least 200 plants of *Isoetes engelmannii*. Some of the flatter streamheads, however, have little or no poorly drained section. For example, in the tributary of Sugar Creek 3 miles east of its mouth (Creekville Qd.), the young forest had frequent *Liriodendron, Magnolia macrophylla, Quercus coccinea, Acer rubrum, Ilex opaca* and *Kalmia*. There were no extensive fern areas along the streams, though a few typical sedges, especially *Carex debilis* were locally abundant.

Explanation of Boundaries. The site is centered on the populations of *Prenanthes crepidinea* and *Solidago* sp. nov., together with the strips of bottomland forest. The upstream and downstream boundaries are determined largely by the extent of USFS-owned land. The lateral boundaries run along ridges wherever convenient.

Site Name: BEAR CREEK/TOWN MOUNTAIN AREA; Fig. 7.
(a section of the South Fork Watershed; see above)
Size: ca. 3300 acres
County: Clay
USGS Quadrangle: Barcreek, Ky.

Location. This site consists of the central portion of the Bear Creek watershed, from Town Branch to Gum Branch. Town Mountain is on the west side of Bear Creek between Town Branch and Little Graveyard Hollow. This site is about 5 miles east of Manchester, and can be reached from KY 149 to USFS 1510, which runs along Bear Creek.

General Description. The site is largely forested, though there are some small clearcuts, and the bottomland of Bear Creek is mostly cleared. No unusually mature timber occurs here, but the land is almost all owned by USFS and there appears to be little long-term influence from past logging or farming.

Listed Animal Species

?*Mesomphix rugeli* (a land snail), tentative id., two nearby sites
Neotoma floridana magister

Listed Plant Species.

Prenanthes crepidinea, Giant Wood-lettuce
Thermopsis mollis, Bush Pea

Other Plants of Interest.

Silphium wasiotense, Wasioto Rosinweed
Synandra hispidula, Synandra
Waldsteinia fragarioides, Barren Strawberry

Biological Significance. Town Mountain and the nearby Fish Trap Branch Ridge (see below) include the only populations of *Thermopsis mollis* known in Kentucky. The plants occur along the ridgelines, mostly near trails. Also, there is a good population of *Silphium wasiotense* by the road along Bear Creek. Both of these rare species probably benefit greatly from fire, and the area has potential for experimental restoration of a fire regime on upper slopes and ridges. Another globally rare species, *Prenanthes crepidinea*, was found in 1992, but with only a single plant; further searching for this species is needed.

North of Town Mountain, there are some areas of relatively mature timber, including some pre-1900 oak-hickory forest, according to USFS data. At the north end of the site, there are two small ravines with relatively old mesophytic forest, as follows.
(1) Main Branch of Bear Creek (Barcreek Qd.) had ca. 30 acres of 16-32 inches dbh *Fagus-Liriodendron* forest.
(2) Gum Branch of Bear Creek (Barcreek Qd.) had ca. 10 acres of 12-32 inches dbh *Fagus-Liriodendron-Acer saccharum* forest, including a few 12-20 inches trees of *Juglans cinerea* in fairly healthy condition, plus much *Hydrophyllum canadense, Jeffersonia, Synandra* (thousands) and *Prenanthes crepidinea* (1 plant).

This watershed is relatively undisturbed for the region. A recent stream survey indicated that it may have potential for monitoring as a control watershed to compare with more disturbed areas (John Walker, pers. comm.). However, there are trash and sewage problems from residents, and there is a stripmines on each side of the creek near the center of this area.

Explanation of Boundaries. Although the known features of interest in this site are widely scattered, the site was defined as a large central section of the Bear Creek watershed. Watershed integrity should be a goal in proposing natural areas whenever possible, and it may be desirable in the future to consider the whole watershed for study. A core section should perhaps be defined around the *Thermopsis* and *Silphium wasiotense* populations on Town Mountain, where restoration of a fire regime might be relatively feasible.

Site Name: FISH TRAP BRANCH RIDGE; Fig. 8.
(a section of the South Fork Watershed; see above)
Size: ca. 1000 acres (or 1700 acres with whole Fish Trap watershed)
County: Clay
USGS Quadrangle: Barcreek, Ky.

Location. Fish Trap Branch is a tributary of the Redbird River a few miles west of Big Creek and 10 miles east of Manchester. The ridges around the head of this creek can be reached from KY 149 (along Hector Branch) to USFS 1736.

General Description. This site is largely forested, though some clearcuts are also included. No unusually mature timber occurs here, but the land is almost all owned by USFS and there appears to be little long-term influence from past logging or farming. In the Fish Trap Branch watershed below the ridge there are two strip mines.

Listed Animal Species

?*Mesomphix rugeli* (a land snail), tentative id., nearby site

Listed Plant Species.

Cleistes divaricata, Spreading Pogonia
Thermopsis mollis, Bush Pea

Other Plants of Interest.

Rubus odoratus, Purple-flowering Raspberry
Silphium wasiotense, Wasioto Rosinweed

Biological Significance. This site, plus the nearby Bear Creek/Town Mountain, include the only populations of *Thermopsis mollis* known in Kentucky. The Fish Trap population is the larger, with thousands of plants along roads and trails on ridges. This species probably would benefit greatly from fire (see Introduction: Biogeography and Results: Flora). The area has potential for experimental restoration of a fire regime on upper slopes and ridges. Fire was probably more frequent on such sites before settlement, with many influences on forests other than just the maintenance of one rare species. The ridges here have relatively little relief, approaching the nearby Flatwoods area in this respect, and it may be relatively easy to spread and control fire here. In addition, there is intrinsic interest in studying forest-soil relationships on flatter, broader ridges, with deeper soils and occasionally poorer drainage.

Explanation of Boundaries. The exact boundaries remain flexible, since there is a need for more detailed botanical survey and management planning. The rest of the Fish Trap watershed, below the ridge, may also deserve inclusion, though this has not been checked on the ground.

Site Name: ELISHA CREEK RESEARCH NATURAL AREA; Fig. 9.
(a section of the South Fork Watershed; see above)
Size: ca. 440 acres (including ca. 70 acres of older growth)
County: Leslie
USGS Quadrangle: Hoskinston, Ky.

Location. This site lies at the head of Right Fork Elisha Creek, on "Windmill Branch" (local name of Afton Garrison, pers. comm.). It extends up to the divide between South Fork and Middle Fork drainages. Access is by gravel roads (USFS 1529, 1710) off KY 66 or KY 406.

General Description. A stand of about 70 acres here is unusually mature for the region. Being mostly on ridges and south/west facing slopes, the soils are relatively dry and there is a large proportion of oak. This site is all owned by USFS, though some adjacent land is privately owned.

Listed Fish Species.
[*Etheostoma sagitta spilotum*, Arrow Darter, in Right Fk Elisha Cr.]

Listed Mammal Species.
Plecotus rafinesquii, Rafinesque's Big-eared Bat
Sorex hoyi winnemana, Pygmy Shrew

Listed Plant Species.
Ranunculus allegheniensis, Allegheny Crowfoot

Other Plants of Interest.
[*Lycopodium clavatum*, Running Ground Pine]

Biological Significance. This site was first described by Hannan and Phillippe (in Harker et al. 1979), who did quantitative sampling of the trees. It probably has the best example of upper slope and ridge forest in the RRD, in terms of the size of trees and their extent over at least 70-80 acres. Sampling showed that the ridge and south-facing slope was dominated by *Quercus montana* (16-36 inches dbh) in places; based on coring and cut stems observed in the region, such trees are probably ca. 100-250 years old. Other large trees included *Fagus* (frequent 16-20 inches trees plus larger dying ones), *Liriodendron* (28-44 inches dbh), *Aesculus*, *Tilia* (ca. 16-24 inches dbh), *Quercus alba, Q. velutina, Q. coccinea* and *Pinus echinata* (including the state champion reported by Ken Powers, Steve Roark and Bob Corder at 28 inches dbh; Ky. Div. Forestry 1985). The subcanopy was dominated by *Acer rubrum*, with *Carya tomentosa, Oxydendron* and *Nyssa* also frequent. A few small trees of *Juglans cinerea* (no more than 8 inches dbh) were also seen. The shrub layer had frequent *Amelanchier, Cornus, Smilax* and *Vitis*, while the herb layer was sparse. *Castanea* sprouts were still frequent, indicating that this species was formerly important as well. The lower slope had younger forest, with much *Liriodendron* in addition to *Fagus, Tsuga* and *Acer saccharum*.

Right Fork Elisha Creek also has some globally rare animals. At the lower side of the older growth, D. Taylor discovered a small maternity colony and hibernaculum of Rafinesque's Big-eared Bats, in a small sandstone cave. In the stream below the older growth, a population of the Arrow darter was discovered in 1992. This species was found in only one other stream during the RRD survey in 1992.

Notes on Vegetation. A full description of the flora and vegetation here is being prepared by D. Taylor (USFS, pers. comm.). R. Hannan and R. Phillippe (in Harker et al. 1979) have already outlined the forest composition and structure.

Explanation of Boundaries. The site includes the ca. 70-80 acre old-growth core, plus enough adjacent land to ensure some watershed integrity in an area for research and conservation.

Site Name: MIDDLE FORK KENTUCKY RIVER CORRIDOR; Fig. 10.
(including Mary C. Breckinridge Memorial Preserve)
Size: ca. 2400 acres
County: Leslie
USGS Quadrangle: Hoskinston, Cutshin, Hyden West, Hyden East, Ky.

Location. This site lies along about 4 river-miles of Middle Fork, Kentucky River, 3-5 miles south of Hyden. The corridor is about 1 mile wide. The Wendover-Hurricane Creek road, between US 421 and KY 80, runs through the site.

General Description. This site is the least disturbed section of the Middle Fork valley. Although paved or gravel roads enter northern and southern sections, there is no connection through, except for a dry-weather ford at Hardy Bottom. For about one river mile, the forest is continuous from riverbanks to slopes, though there is an old home site even here. Elsewhere the bottomland is mostly cleared. The forest is unusually mature in places, especially near Wendover. None of the land is owned by USFS, but 164 acres have recently been acquired by The Nature Conservancy, and a similar acreage, including the most mature woods at Wendover, is owned by the Frontier Nursing Service.

Listed Animal Species.

Aneides aeneus, Green Salamander

The following aquatic species have been recorded from the Middle Fork or its larger tributaries but all may have become extirpated within the past 50 years:
Epioblasma triquetra, Snuffbox (a mussel)
Etheostoma maculatum, Spotted Darter
Etheostoma pellucidum, Eastern Sand Darter
Etheostoma sagitta spilotum, Arrow Darter
Etheostoma tippecanoe, Tippecanoe Darter
Ichthyomyzon fossor, Northern Brook Lamprey
Lampetra appendix, American Brook Lamprey
Noturus stigmosus, Northern Madtom
Percina evides, Gilt Darter
Villosa lienosa, Little Spectaclecase (a mussel)

Other Animal of Interest

Desmognathus ochrophaeus, Mountain Dusky Salamander

Listed Plant Species.

[*Lathyrus venosus*, Bushy Vetch] (downstream near Buckhorn Lake)
Ranunculus allegheniensis, Allegheny Crowfoot

Other Plants of Interest.

Anemone quinquefolia, Wood Anemone
Carex pedunculata, Purple-based Tussock Sedge
Lysimachia tonsa, Smooth Loosestrife
Magnolia fraseri, Fraser's Magnolia

Panax trifolius, Dwarf Ginseng
Phacelia purshii, Miami Mist (only site in Leslie Co.)
Solidago sp. nov., a broad-leaved Goldenrod.
Synandra hispidula, Synandra
Waldsteinia fragarioides, Barren Strawberry

Biological Significance. This site has about 100 acres of some of the most mature mesophytic forest found in the RRD, plus other forest of above-average natural quality. This acreage largely consists of two stands on either side of the river at Wendover (Frontier Nursing Service). The whole 4 river-mile corridor is also important as the least disturbed section of the Middle Fork, with no current clearings along the central mile. Several uncommon to rare plant species occur on the lower slopes in this valley, including a large population of *Synandra*, several patches of the undescribed *Solidago* sp., and the only *Carex pedunculata* found in the RRD. Within the forest, the only common exotic species are *Polygonum cuspidatum* and *Eulalia viminea*, which are locally abundant on floodplains.

Notes on Vegetation. The following notes are based mainly on the Wendover area, especially the older growth. The two most mature stands, each ca. 30-40 acres, are on both side of the river at Wendover. Most canopy trees here were noted as 16-32 inches dbh, with a few to 48 inches. *Fagus* was dominant and *Tsuga* was also abundant. Frequent species on the ground included *Euonymus americanus* (abundant), *Geranium, Polystichum*, etc., on upper slopes; and *Impatiens pallida, Stellaria corei*, etc., on lower slopes. Other older growth in this corridor included the north-slope upstream of Hardy Bottom, with ca. 20 acres of 12-40 inches dbh *Fagus-Tsuga* forest. These stands stood in marked contrast to the typical younger growth of 8-12 inches dbh *Liriodendron*.

In general, mesic lower slopes along this corridor were dominated by *Fagus*, with frequent *Tsuga* on more rocky or residual soil of convex slopes and *Acer saccharum* (plus some *A. nigrum*) in more fertile colluvial soil in concave slopes. Other woody species included *Liriodendron, Quercus alba, Q. rubra, Aesculus octandra, Tilia, Quercus muhlenbergii, Ulmus rubra, Morus, Euonymus americanus, Aristolochia macrophylla*, etc. In forest with *Tsuga* as the main associate of *Fagus*, other species included *Magnolia tripetala, Ilex opaca, Rhododendron maximum, Kalmia*, etc.

The ground vegetation is highly variable. At slope bases and similar places, there was a dense ground layer of tall herbs, with locally abundant *Impatiens pallida, Phacelia bipinnatifida, Astilbe*, etc. Other species included *Cystopteris protrusa, Caulophyllum, Sanguinaria, Dicentra canadensis, Stellaria corei, Claytonia caroliniana, Aruncus, Viola canadensis, Hydrophyllum canadense, Mertensia, Synandra, Solidago flexicaulis, Trillium sulcatum, Polygonatum pubescens, Uvularia grandiflora, Disporum lanuginosum, Carex plantaginea*, etc. Some other common species were more frequent in younger forest, e.g., *Cimicifuga racemosa, Sedum ternatum* and *Galium aparine*. Steep, rocky, often seeping but generally well-drained slopes just above the zone previously described had several patches of *Solidago* sp. nov. (for details see Species section). Parts of these slopes were noted as actively slumping, and these places often had especially luxuriant wildflowers (e.g., *Synandra*) under the slightly more open tree canopy.

In forest with more *Tsuga*, the ground vegetation was less tall and dense, with *Polystichum, Anemonella, Stellaria pubera, Tiarella, Geranium, Meehania, Mitchella, Aster divaricatus, Erigeron pulchellus, Iris cristata, Luzula echinata, Carex lucorum, Poa cuspidata*, etc. The abundance of *Euonymus americanus* in such woods at Wendover, may reflect a long period of forest development

and low rates of browsing by deer, which often prefer this species.

On the drier (but more fertile?) bench above the old-growth ravine at Wendover, the forest was still dominated by *Fagus* (20-32 inches dbh) in places, but much is slightly younger with *Liriodendron* dominant (mostly 16-24 inches dbh, rarely to 32 inches). Other woody species included *Acer saccharum* (frequent), *A. rubrum, Ulmus rubra, Juglans nigra, Quercus rubra, Q. alba, Q. velutina* (one at 40 inches dbh), *Carya cordiformis, C. ovalis*, etc. The ground was still dominated by *Euonymus* under *Fagus*, but, especially in the younger woods, there were large beds of *Podophyllum*, together with frequent *Geranium, Tiarella* and *Monarda clinopodia*. Other species included *Ranunculus hispidus, R. recurvatus, Sedum ternatum, Oxalis violacea, Viola sororia, V. cf. affinis, V. hirsutula, Cynoglossum, Conopholis, Solidago caesia, Arisaema triphylla, Carex laxiflora, C. cf. digitalis, Brachyelytrum*, etc.

The upper slopes and ridges had abundant *Quercus velutina* (many trees up to 28-32 inches dbh, but decadent), *Q. coccinea, Kalmia* and *Smilax rotundifolia. Castanea* was formerly present, with dead trees at least 28 inches dbh. Other woody species include *Q. montana, Acer rubrum, Rhododendron maximum* and *Vaccinium* spp. The ground vegetation was thin, with *Viola hirsutula, Gaultheria, Antennaria plantaginifolia, Carex cf. pennsylvanica*, etc.

The narrow section of the valley south of Wendover, with no paved road, several rare plants were found. These include much *Solidago* sp. nov., *Waldsteinia fragarioides, Anemone quinquefolia, Ranunculus allegheniensis, Panax trifolius* and *Carex pedunculata.*

Strips of less disturbed bottomland forest were dominated by *Liriodendron*, with frequent *Fagus, Platanus, Betula nigra* and, locally, *Tsuga* (* below indicates associates of *Tsuga*, probably on more sandy, infertile/acid soil). Most trees were no more than 12-16 inches dbh, but a few were up to 24-36 inches. Other woody species included *Aesculus, Tilia, Acer rubrum, Magnolia macrophylla** and a few saplings of *M. fraseri** and *Dirca*. The ground vegetation had abundant *Podophyllum, Stellaria corei* and *Solidago flexicaulis*, with frequent *Oxalis violacea, Galium aparine*, etc. Other species included *Ophioglossum pycnostichum** (also frequent under Tsuga at Indian Grave Branch, Scalf Qd.), *Laportea, Ranunculus abortivus, R. allegheniensis* (rare), *Dicentra* sp., *Panax trifolius**, *Viola striata, V. conspersa, V. blanda**, *Phlox divaricata, Helianthus decapetalus, Erythronium americanum, Cypripedium acaule**, *Luzula acuminata, Carex lucorum**, *C. amphibola, C. gracillima, Poa alsodes**, *Festuca obtusa*, etc. The exotic grass, *Eulalia viminea*, was locally frequent on floodplains and seeping rocky slopes. Japanese Knotweed, *Polygonum cuspidatum* (so-called "bamboo"), was locally dominant on the sandy banks of the river. Unfortunately *Arundinaria* (a true bamboo) appears to have been largely grazed out of these bottoms.

In general, the riverbanks were lined by *Betula nigra* (abundant), *Platanus, Acer saccharinum, Liriodendron, Lindera, Rhus radicans*, etc. Some limited sections of the river banks are relatively open due to boulders, cobbles and gravel-bars. These areas had frequent *Alnus* and *Salix sericea*. Other characteristic species included *Osmunda regalis, O. cinnamomea, Eupatorium fistulosum, Aster prenanthoides, Carex torta, C. lupulina* and *Glyceria striata.*

Explanation of Boundaries. The length of the corridor corresponds to the relatively undisturbed bottomland section, with less habitation and roads. The width is generally up to the ridgeline.

Site Name: CAWOOD BRANCH; Fig. 11.
Size: ca. 1400 acres
County: Leslie
USGS Quadrangle: Bledsoe and Helton, Ky.

Location. Cawood Branch is a small tributary of Beech Fork of Middle Fork, Kentucky River. Its mouth is crossed by US 421, about half a mile north of the Harlan/Leslie County line, and only 5 miles north of Pine Mountain. There is a gravel road into the lower bottom.

General Description. This small watershed is almost entirely forested, except for small strips of the bottomland, including a picnic area. About 90% is owned by USFS. Forest along lower slopes of both main branches is unusually mature in places.

Listed Animal Species.

Aneides aeneus, Green Salamander
Desmognathus ochrophaeus, Mountain Dusky Salamander
?*Mesomphix rugeli* (a land snail), tentative id.
Myotis septentrionalis, Northern Long-eared Bat
Sorex cinereus, Masked Shrew

Listed Plant Species.

Prenanthes crepidinea, Giant Wood Lettuce
Ranunculus allegheniensis, Allegheny Crowfoot

Other Plants of Interest.

Anemone quinquefolia, Wood Anemone
Solidago sp. nov., Broad-leaved Goldenrod
Magnolia fraseri, Fraser's Magnolia
Platanthera lacera, Ragged Orchid
Waldsteinia fragarioides, Barren Strawberry

Biological Significance. This site combines several features, each only of moderate importance, but which together make a convenient focus for conservation. These features are: (1) several rare plant species, including two that are globally restricted--*Prenanthes crepidinea* and *Solidago* sp. nov.; (2) some unusually mature forest on lower slopes in the steeper ravine sections; (3) a relatively undisturbed watershed with almost complete USFS ownership and no coal mining. Its close proximity to Pine Mountain may also give some logistical use in ecological research within the region, including comparison of Pine Mountain with adjacent Appalachian Plateaus. There is a narrow strip of older growth along the streams, with canopy trees mostly 16-32 inches dbh. Here, *Fagus* is generally dominant, but *Tsuga* and *Rhododendron maximum* are locally abundant. Other woody species include *Liriodendron* (dominant in younger forest on mid-slopes), *Acer saccharum, Tilia, Carya ovata, Cornus alternifolia* and *Euonymus americanus*. Frequent herbaceous species include *Tiarella* (abundant), *Polystichum, Laportea, Sedum ternatum, Geranium, Viola rostrata, Meehania* and *Solidago* sp. nov. The latter is locally dominant along the stream.

Explanation of Boundaries. These are simply placed along the watershed divide, in order to offer some ecological integrity in any conservation and research that may be undertaken here.

Site Name: PINE MOUNTAIN (megasite); Fig. 12.
Size: whole site is ca. 200 square miles; RRD section is ca. 3700 acres.
Counties: Whitley, Bell, Harlan, Letcher and Pike (plus Va. side)
USGS Quadrangles: Bledsoe, Ky.; Nolansburg, Ky.; and others outside RRD.

Location. Pine Mountain extends for about 110 miles from Tennessee, 17 miles SW of Jellico area, northeast to Russell Fork Big Sandy River, in the area of Breaks Interstate Park (Kentucky and Virginia). The section within the RRD extends from the US 421 crossing at the head of Beech Fork (Middle Fork, Kentucky River), northeast to the Harlan/Letcher County line on KY 510 at the divide between Isaac Creek (Middle Fork drainage) and Line Fork (North Fork drainage). The ridge of Pine Mountain has a paved or gravel road, known as the Little Shepherd Trail. The southeast side of the mountain can also be reached up the branches of the Cumberland River along US 119.

General Description. Pine Mountain is the result of geological faulting that tilted and pushed up lower Pennsylvanian (Lee and Pennington Formations) and underlying Mississippian (Newman Limestone and various shales, etc.) bedrock to the surface. The northwest slope thus has the only extensive limestone in Kentucky east of the Cliff Section, and it includes several cave systems; there are several entrances within the RRD. On the southeast side, the massive sandstone forms ruggedly dissected ridges, with large outcrops and deep ravines. Almost the whole mountain is forested, except for the bottomland on either side. In general the upper slopes have timber that is more mature than average for Appalachian Kentucky, and a few areas of old-growth are known.

Note. In the following lists, species with asterisks (*) are known only from the crest or southeastern side of Pine Mountain, mostly on sandstone. Animal species known more than five miles from the RRD are in square brackets [ ]. Not listed here are several other plant species known only from sections of Pine Mountain at least 5 miles NE of the Harlan-Letcher County Line, and 5 miles SW of the US 421 crossing, i.e., not close to the RRD. However, there is a fair chance that these asterisked species also occur in the section of Pine Mountain along the RRD boundary. For a complete listing of the rare plants of Pine Mountain, see Appendix B.

Listed Cave Beetle Species

[*Pseudanophthalmus calcareus*]
[*Pseudanophthalmus hypolithos*]
[*Pseudanophthalmus frigidus*]
Pseudanophthalmus rogersae, Rogers' Cave Beetle
Pseudanophthalmus scholasticus, Schoolhouse Cave Beetle

Listed Land Snail Species

Anguispira rugoderma (a land snail)
Mesomphix rugeli (a land snail)
Vertigo clappi, Cupped Vertigo
Vitrinizonites latissimus, Glassy Grapeskin

Listed Bird Species

**Corvus corax*, Common Raven

Listed Mammal Species.

Clethrionomys gapperi maurus, Kentucky Red-backed Vole
[?*Felis concolor cougar*, Mountain Lion, reported from Pike Co.]
Myotis leibii, Eastern Small-footed Bat
Myotis septentrionalis, Northern Long-eared Bat
Myotis sodalis, Indiana Bat
Peromyscus maniculatus nubiterrae, Cloudland Deer Mouse
[*Plecotus rafinesquii*, Rafinesque's Big-eared Bat]
Sorex cinereus, Masked Shrew
Sorex dispar, Long-tailed Shrew
Sorex hoyi winnemana, Pygmy Shrew
Ursus americanus, Black Bear

Other Animals of Interest.

Desmognanthus ochrophaeus, Mountain Dusky Salamander
Lasiurus cinereus, Hoary Bat
Lasionycteris noctivagans, Silver-haired Bat
Sigmodon hispidus, Hispid Cotton Rat

Listed Plant Species.

**Baptisia tinctoria*, Yellow Wild Indigo
**Calamagrostis cinnoides*, Cinna-like Reed Grass
**Carex leptalea*, Little Tussock Bog Sedge
Carex stricta, Big Tussock Bog Sedge
Chrysosplenium americanum, Golden Saxifage
Corallorhiza maculata, Spotted Coral-root
**Corydalis sempervirens*, Pale Corydalis
?*Cypripedium parviflorum*, Small Yellow Lady's Slipper
**Gentiana decora*, Showy Gentian
**Glyceria melicaria*, Bog Manna Grass
Liparis loesellii, Bog Twayblade
**Listera smallii*, Small's Twayblade
Solidago curtisii, Curtis's Goldenrod
?**Solidago roanensis*, Roan Mountain Goldenrod

Other Plants of Interest.

**Acer pennsylvanicum*, Striped Maple
Anemone quinquefolia, Wood Anemone
**Carex bromoides*, Medium Tussock Bog Sedge
Disporum maculatum, Spotted Mandarin
Isoetes engelmannii, Quillwort
**Lycopodium inundatum*, Bog Clubmoss
Magnolia fraseri, Fraser's Magnolia (frequent)
Platanthera lacera, Ragged Orchid
***Rhododendron catawbiense*, Mountain Rose-bay
**Robinia hispida* (var. *rosea*?), Rose-acacia

Rubus odoratus, Purple-flowering Raspberry (frequent)
Solidago arguta ssp. *bootii*, Boot's Goldenrod
Solidago patula var. *p.*, Swamp Goldenrod
Viola tripartita, Truncate Yellow Violet
Xyris torta, Yellow-eyed Grass

Biological Significance. This large area has high significance, for the following reasons.
(1) It is part of the Cumberland Mountains, a distinct biogeographic section of Kentucky that reaches higher elevation than elsewhere in the state, with cooler climate and particularly mesic conditions on some sites (especially on upper, north-facing slopes).
(2) It is a large area of forest, almost entirely unbroken by clearcuts, clearings, mines or settlements.
(3) It includes a great variety of natural communities, due to the variation in bedrock and topography, and there are major contrasts with adjacent Appalachian sections, i.e., the less ecologically diverse lands on the middle Pennsylvanian Breathitt Formation (Rugged Eastern Area).
(4) There is a major concentration of rare species occurrences, including several globally rare animals using the cave systems (beetles and bats), plus many northern or montane species (plants of boggy seeps and sandstone ravine, snails, rodents, etc.) that are more or less absent west of the Cumberland Mountains in Kentucky.

Notes on Vegetation. The ecological variety of Pine Mountain may be illustrated as follows, with miscellaneous examples from the RRD or nearby.

A. Bottoms and seeps on the northwest side. On the ground of the Settlement School, there is an unusually wet meadow of about 1/4 acre (300 x 30 ft), with a remarkable assemblage of regionally rare species. These included *Rumex cf. altissimus, Solidago patula, Xyris torta* and *Carex stricta*. Common species in this meadow include *Osmunda cinnamomea, Panicum clandestinum* and *Carex* spp. (especially *C. stricta*, also *C. scoparia*). Other species found here included *Polygonum sagittatum, Linum striatum, Cicuta maculata, Oxypolis rigidior, Aster umbellatus, Solidago rugosa, Eupatorium fistulosum, Verbesina alternifolia, Juncus effusus, J. marginatus, J. tenuis, Scirpus polyphyllus* and *Rhynchospora* sp., *Sphagnum palustre* and *S. lescurii*. Woody species were invading the meadow, especially the exotic, *Rosa multiflora*, which B. Begley (pers. comm.) has attempted to cut back; others included *R. palustris, Aronia melanocarpa, Cephalanthus* and *Sambucus canadensis*. In a bottomland field elsewhere on the school grounds, *Platanthera lacera* and *Liparis loeselii* have been found (J. MacGregor, pers. comm.). However, in general such areas are small and have much *Rosa multiflora. Tsuga, Fagus, Lindera* and *Laportea* dominate the less disturbed places on lower slopes and bottoms here. The Hispid Cotton Rat was found nearby.

B. Lower slopes on the northwest side. These generally had younger forest dominated by *Liriodendron*, with a variety of associates, depending on topographic position.

C. The zone along limestone outcrops and on limestone colluvium. This distinct zone has forest more uneven in stature (some trees 24-40 inches dbh), with abundant *Acer saccharum* and frequent *Quercus rubra*. Distinctive features included locally abundant *Aristolochia macrophylla* in tree fall gaps and openings near cliffs. Species characteristic of the cliffs were rather few, and include *Cystopteris bulbifera, Aquilegia canadensis, Heuchera villosa, Arabis laevigata*, etc. Surprisingly, no rare species were found here.

D. Slopes above the limestone. On fertile sandstone colluvium here also the herb layer is remarkably luxuriant. Frequent species included *Liriodendron* (dominant), *Quercus rubra, Acer saccharum, Hydrangea, Asarum, Caulophyllum, Astilbe, Thaspium barbinode, Solidago cf. flaccidifolia, Disporum lanuginosum, Smilacina racemosa*, etc. The composition was similar to mesic sites on lower slopes along major rivers in the RRD (see Middle Fork corridor).

E. The sandstone ridge. More mature areas were generally dominated by *Quercus rubra* (occasionally to 12-32 inches dbh) and *Acer saccharum* (generally as subcanopy), or, on drier sites, by *Q. montana* with much *Kalmia* in the shrub layer. Other frequent species included *Q. alba, Carya glabra, Magnolia fraseri, Rhododendron maximum*, etc. There is also much younger (often burned?) forest dominated by *Liriodendron*, with much *Acer rubrum, Sassafras* and, in the herb layer, *Amphicarpaea*. Also frequent were *Pyrularia, Solidago cf. flaccidifolia, S. arguta, Prenanthes altissima*, etc. Rare species that have been found in this habitat, especially in more open areas, include *Corydalis sempervirens, Robinia hispida, Baptisia tinctoria, Rhododendron catawbiense, Gentiana decora, Bartonia virginica, Solidago arguta* ssp. *bootii* and *Cleistes divaricata*.

F. Streamheads and seeps on the southeast side. Rare species that were found in these areas include *Lycopodium inundantum, Listera smallii, Carex stricta, Glyceria melicaria* and *Calamagrostis cinnoides*. An example just outside the RRD was found in the hollow east of Middleton Branch, in a rather open, cutover area. Species included *Osmunda cinnamomea, Thelypteris noveboracensis, Anemone quinquefolius, Ranunculus hirsutus, Viola triloba* (glabrate), *V. cucullata, V. tripartita, Oxypolis rigidior, Lobelia cardinalis, Clintonia, Lilium canadense, Platanthera* sp., *Juncus effusus, Luzula acuminata, Carex stipata, C. cf. stricta, C. prasina, C. blanda*, etc. (see Appendix B for further details). About a mile further east was found *Glyceria melicaria*. The large sandstone outcrop, and adjacent quarry, at the head of Banks Branch is notable for the occurrence of *Lycopodium inundatum*. The most abundant species in this 2-3 acre opening included *Andropogon glomeratus* (dominant on boggy ledges), *Aster surculosus, Gaylussacia baccata, Kalmia, Pinus virginiana* and *P. echinata*. Other species included *Osmunda cinnamomea, Platanthera ciliaris* (J. MacGregor, pers. comm.), *Calamagrostis cinnoides, Panicum microcarpon, Eupatorium rotundifolium* var. *ovalifolium, Viburnum cassinoides, Rhododendron maximum* and *Acer rubrum*. More mesic forest around the opening had frequent *Tsuga*, with much *Gaultheria* and *Mitchella* on the ground.

G. Sandstone ravines. See Appendix B for details.

Notes on Cave Systems. For more information on the cave systems of this region, the account of Dr. T.C. Barr (in Harker et al. 1979) should be consulted. The following passage is relevant here.

"The caves of Kentucky constitute one of the Commonwealth's important natural resources. They are known throughout the world for their size and number. No study of natural features or natural areas would be complete without an examination of the cave ecosystems"..."Caves in eastern Kentucky occur wherever the Newman (St. Louis/St. Genevieve equivalent) limestone outcrops"... "In Pike, Letcher, Harlan, Bell, and Whitley Counties, the Pine Mountain thrust fault has brought up the Newman Limestone, which occurs in a band some 250-600 feet thick and dips 25-30 degrees to the southeast. Cave patterns in Pine Mountain resemble those observed in caves of the Appalachian Valley of Virginia and Tennessee, with major passages paralleling the strike, an arch-shaped cross-section to large passages, and passages at different levels located downdip" (p. 1).

"The caves of eastern Kentucky are inhabited by an unusually rich fauna"... "Major categories of cavernicoles [cave animals] regularly occurring in eastern Kentucky caves are flatworms, pseudoscorpions, harvestmen, spiders, mites, amphipods, isopods, crayfishes, ostracods, millipedes, collembolans, diplurans, cave crickets, true flies (Diptera), beetles (especially troglobitic trechine carabids), fishes, salamanders, bats, pack rats [woodrats], and raccoons"..."the main emphasis in this report is on the irreplaceable biological and geological features" (p. 2).

"Eastern Kentucky can be divided into several distinct faunal regions with respect to assemblages of troglobitic species. The faunal distinctness of the regions is maintained by extrinsic barriers..." [These faunal regions include Carter Caves; Murder Branch Cave; Furnace (S. Powell/N. Estill/W. Lee Counties); Jackson County; Rockcastle/N. Pulaski County; Pulaski/McCreary Counties; N. Wayne County; Central/Southern Wayne County; and Pine Mountain] "...various cave systems with rather distinctive faunas of their own [occur] along the length of Pine Mountain"..."Principal extrinsic barriers [between the cave faunal regions of eastern Kentucky] are [the] stratigraphic discontinuity of the limestone and [the] large rivers (Cumberland, South Fork Cumberland and Kentucky)... (p. 3). "...Taxonomy of eastern Kentucky cave trechines [= troglobitic trechine carabids] is being investigated by T.C. Barr... Discovery of additional species is anticipated in caves of Pine Mountain" (p. 20).

A relatively diverse assemblage of bat species inhabit Pine Mountain. In addition to the limestone caves, there are many sandstone shelters that may be used on the south side of the mountain. The road corridors on the crest of the mountain, and the low gaps in the ridgeline from north to south, appear to act as excellent foraging corridors.

Explanation of Boundaries. Pine Mountain is largely defined by its faulted geological base. The boundaries of its width, as drawn here, lie along the bases of the northwest-facing and southeast-facing slopes of Pine Mountain. There are a few peripheral parts that are not strictly part of the faulted bedrock system, but these are included where there is continuous forest cover down to the valley bottoms. There is some settled land on these bottoms, and exact boundaries will have to be refined in detail at some future date.

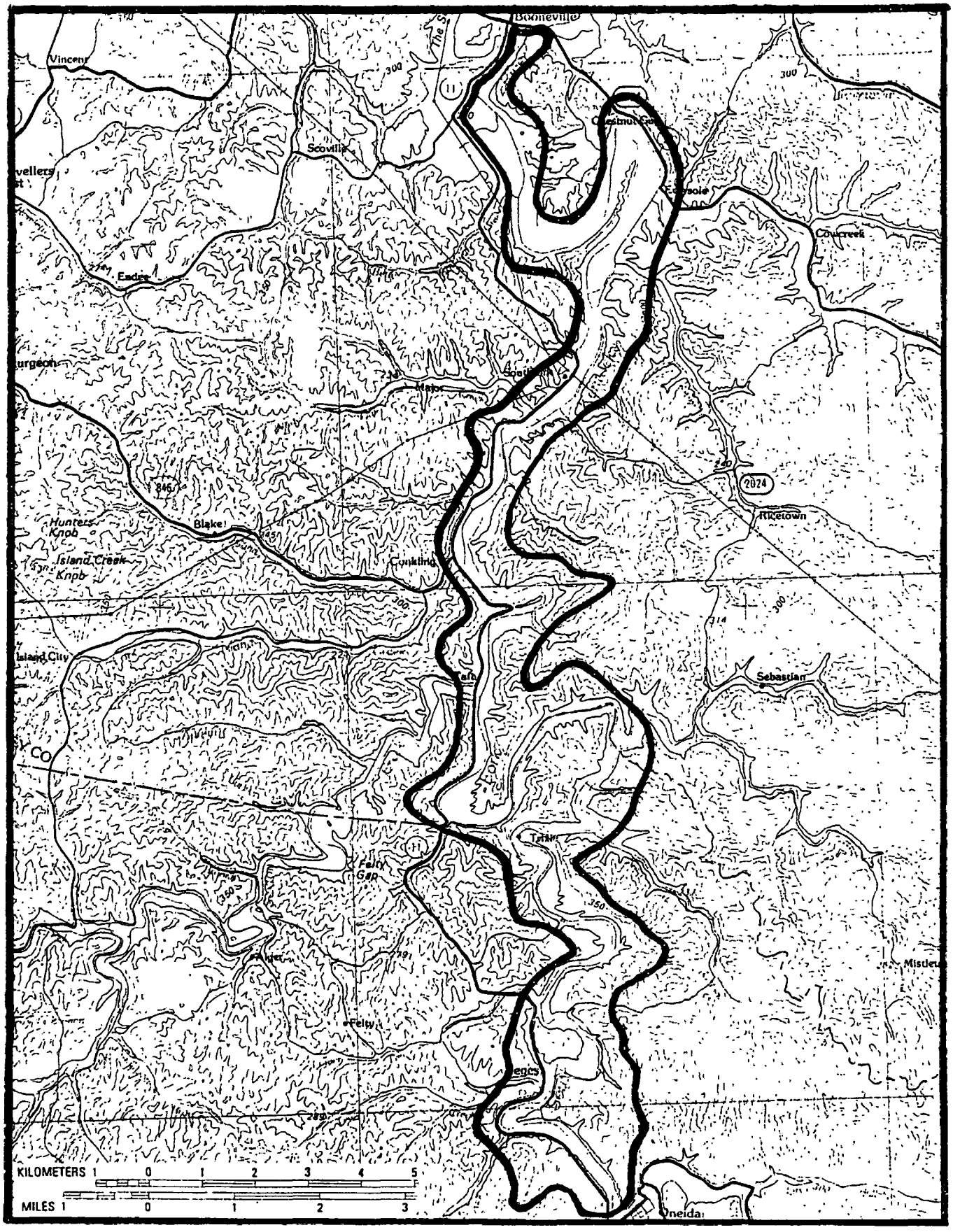

Figure 5. Map of the South Fork Kentucky River Corridor showing significant area.

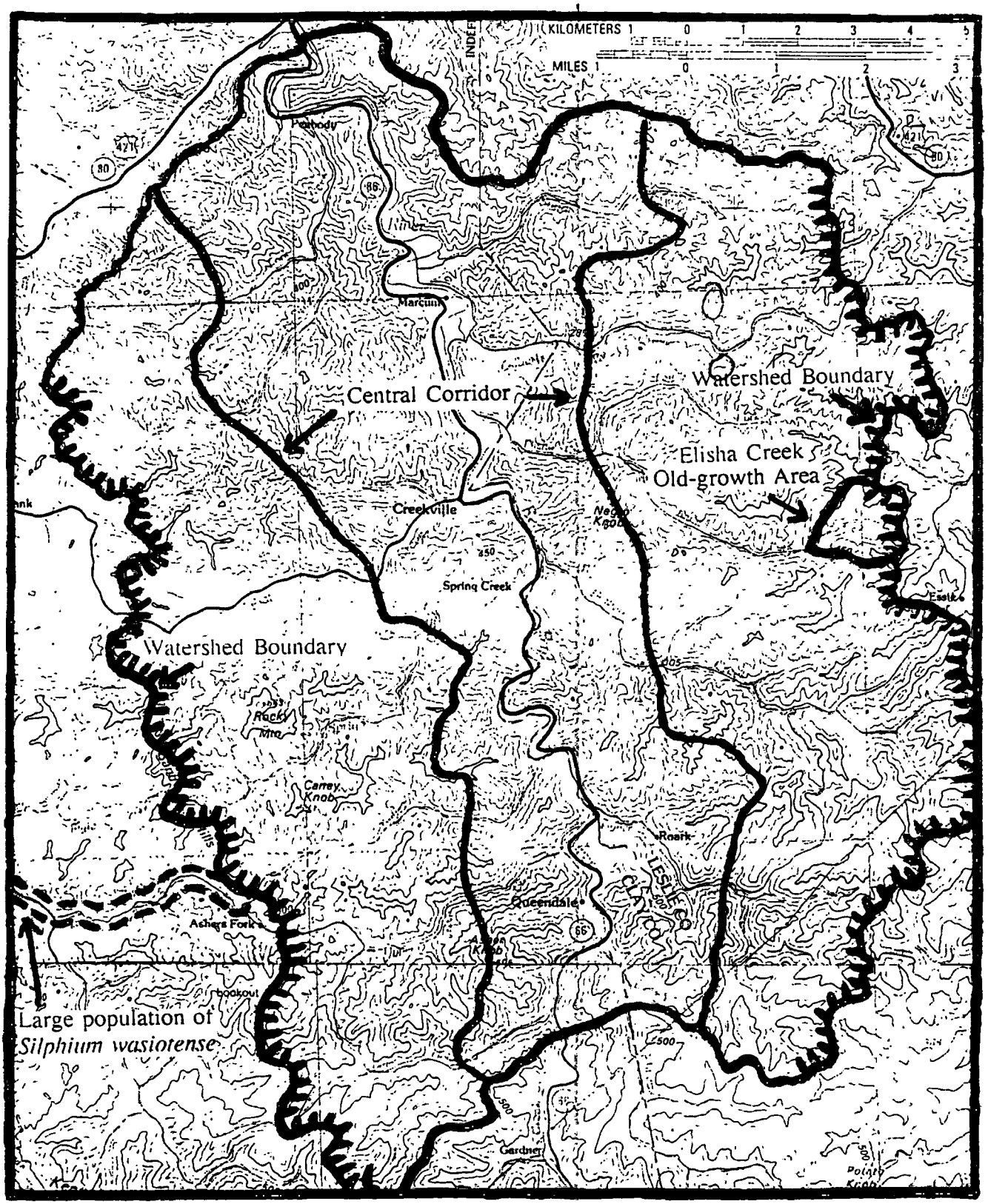

Figure 6. Map of the Redbird River Corridor showing significant area.

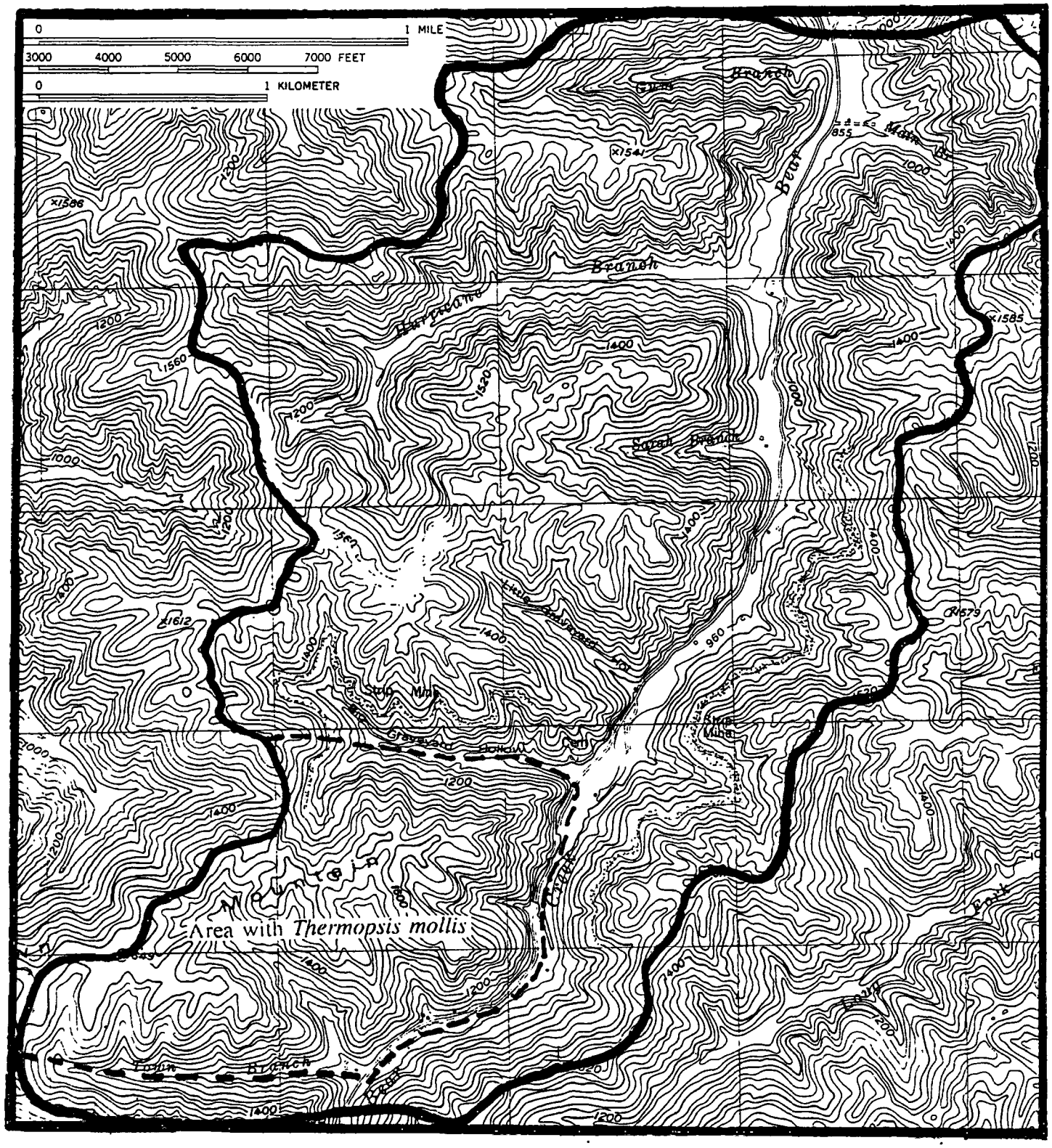

Figure 7. Map of the Bear Creek/Town Mountain Area showing significant area.

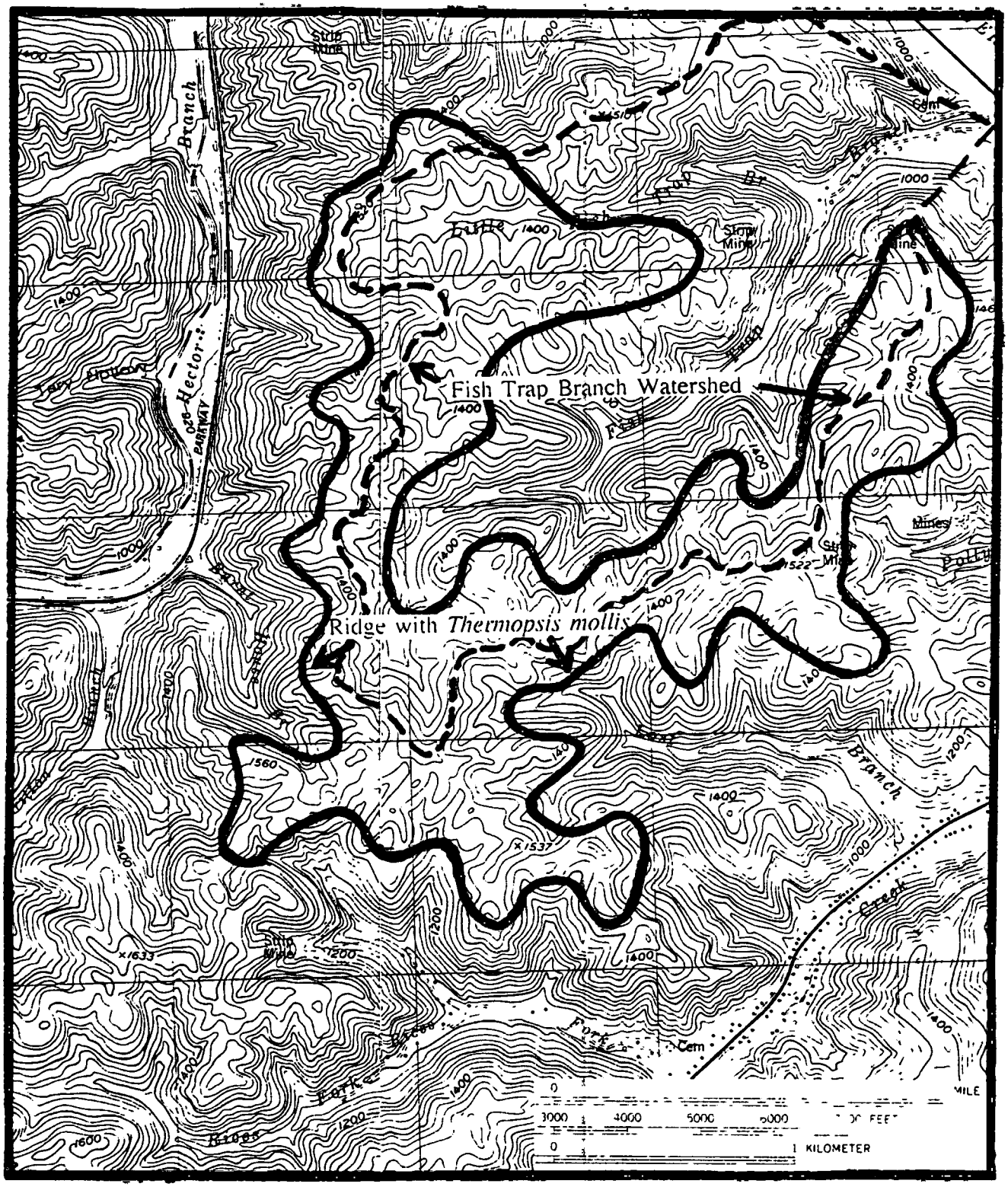

Figure 8. Map of the Fish Trap Ridge showing significant area.

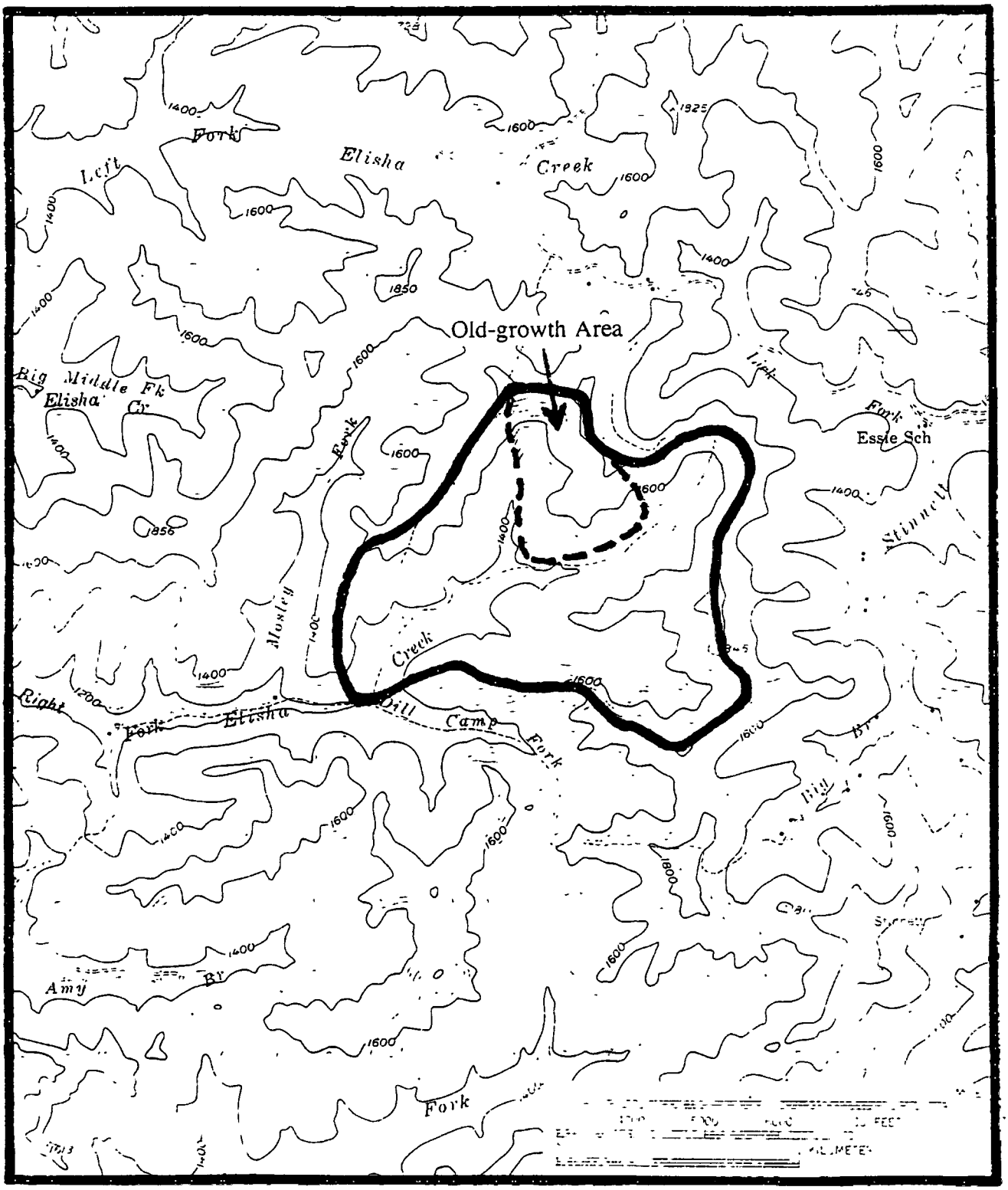

Figure 9. Map of the Elisha Creek Old-growth Area showing significant area.

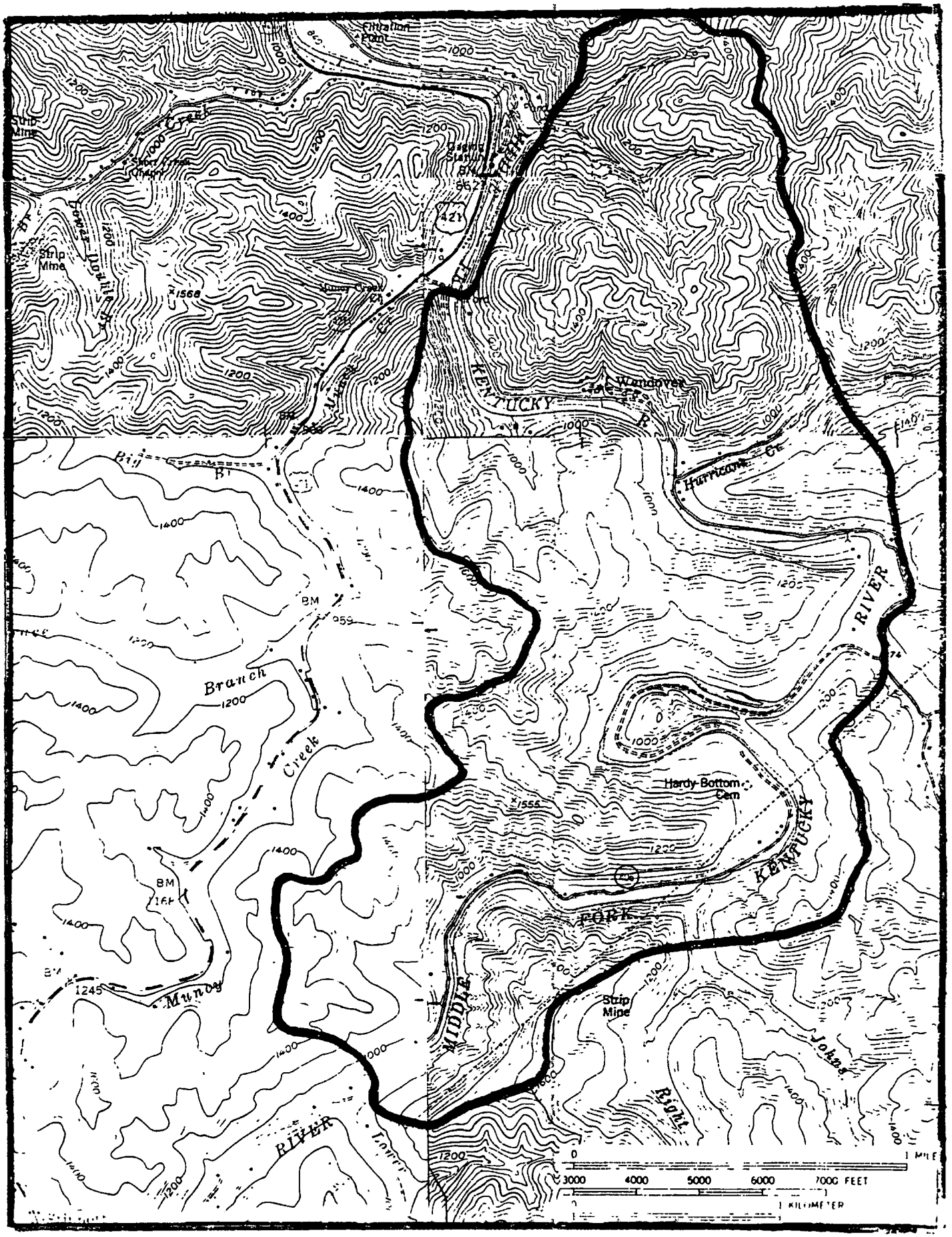

Figure 10. Map of the Middle Fork Kentucky River Corridor showing significant area.

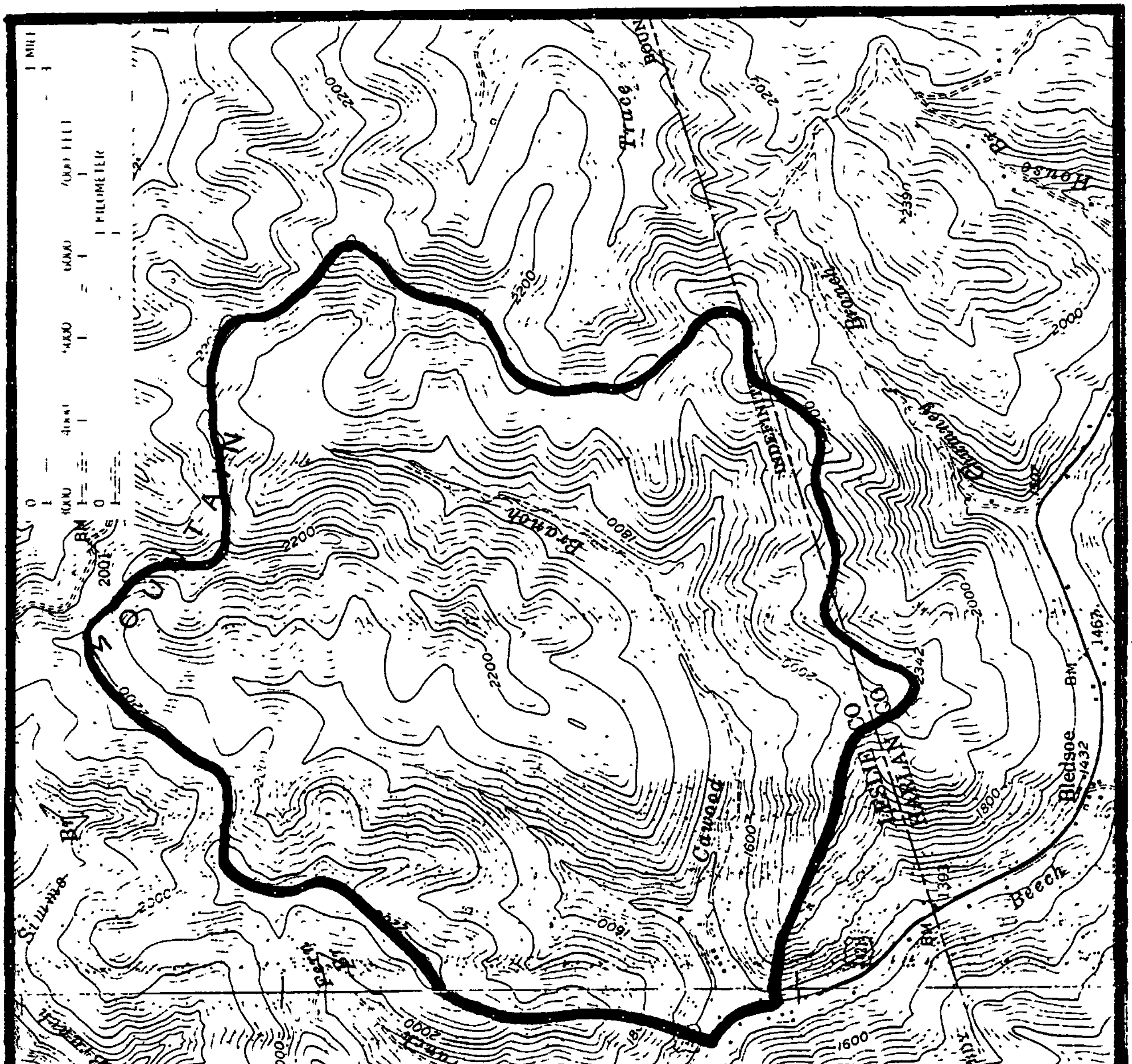

Figure 11. Map of the Cawood Branch Area showing significant area.

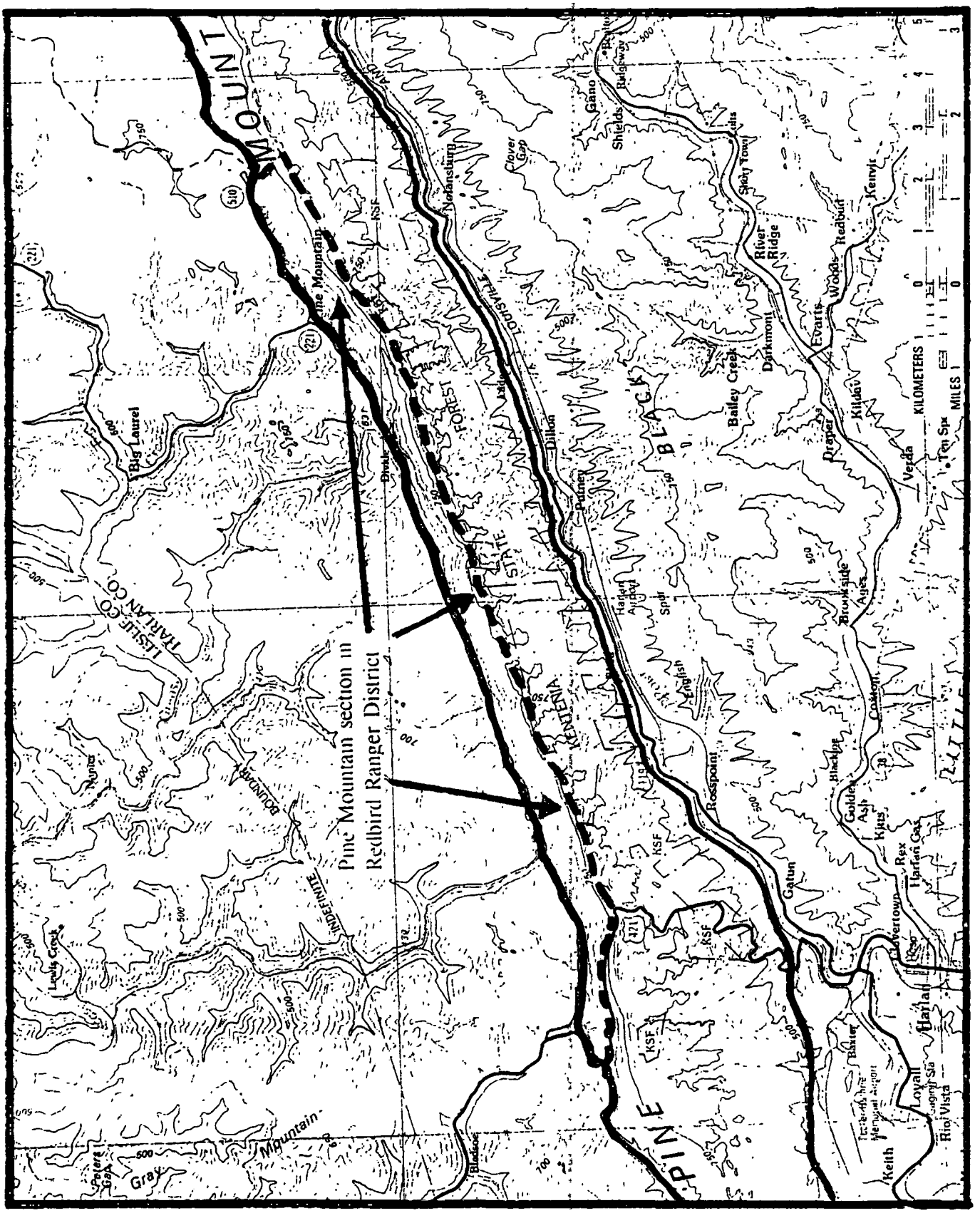

Figure 12. Map of Pine Mountain showing significant area.

SUMMARY

The results of the Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species in the RRD have greatly enriched the knowledge of rare flora, fauna and natural communities in this central portion of the DBNF. Information provided by the report will assist DBNF staff in making wise protection and management decisions.

Prior to the inventory, the Kentucky State Nature Preserves Commission had about 11 records for 8 species of endangered, threatened or other listed rare plants, 4 records for 4 species of terrestrial invertebrates, 49 records for 11 listed aquatic animals (mussels and fishes), and 12 records for 5 listed species of terrestrial vertebrates from the Redbird Ranger District (Table 4). The inventory generated about 55 new records for listed rare plants (not counting ginseng), amounting to five-fold increase, with 11 new species documented in the study area. Some 30 of these records were of *Podostemon ceratophyllum*, an aquatic plant that was found to have an outstanding population in the South Fork Kentucky River. The inventory generated about 7 new records for terrestrial invertebrates (with 2 new species), 4 new records for aquatic animal species (without new species), and 59 for terrestrial (with 12 new species), doubling the overall number of animal records. Distributional notes on these listed species are provided above.

In addition, much information was obtained for a number of other species of interest, including some which are in need of further study and consideration for listing by KSNPC and USFS. These include three of global interest: the recently described *Silphium wasiotense* (Cumberland Rosinweed), with records almost entirely confined to the upper watershed of the Kentucky River; an apparently undescribed species of broad-leaved *Solidago* (Goldenrod) with records only from eastern Kentucky, adjacent West Virginia and Virginia; and *Prenanthes crepidinea* (Giant Wood-lettuce), with several historical records in mid-western regions but very few currently known sites.

This report also outlines "Significant Areas" within the Redbird Ranger District (Fig 4.), based on the documented concentrations of rare species (Fig. 3), and other biological features. These areas contain about three-quarters of the rare species occurrences within only a quarter of the total district area. Conservation efforts can be profitably focused on these sites.

The inventory has been an excellent opportunity to combine the expertise and resources of several conservation agencies, forming a partnership that has made efficient use of the funds invested. It is estimated that less than one percent of the Commonwealth's land remains in a relatively undisturbed condition. Creative partnerships of public and private conservation agencies have a great opportunity, and responsibility, to maintain Kentucky's remaining natural treasures through cooperative ventures such as this inventory. It is hoped that this cooperative effort will continue to be funded and otherwise supported by these agencies. An inventory of all the districts will clarify the status of the Forest's rare species and unusual natural communities, and it will help the U.S. Forest Service and The Nature Conservancy to safeguard the most unique biological features of this area.

LITERATURE CITED

Allard, D. 1990. The southeastern regional ecological community classification, version 1.2. The Nature Conservancy, Southeastern Regional Office, Chapel Hill, North Carolina.

Bailey, R.M. and W.A. Gosline. 1955. Variation and systematic significance of vertebral counts in the American fishes of the family Percidae. Miscellaneous Publications No. 93, Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

Barbour, R.W. 1971. The amphibians and reptiles of Kentucky. The University of Kentucky Press, Lexington, Kentucky.

Barbour, R.W., and W.H. Davis. 1974. The mammals of Kentucky. The University of Kentucky Press, Lexington, Kentucky.

Barbour, R.W., W.H. Davis and R.A. Kuehne. 1979. The Vertebrate Fauna of Cumberland Gap National Historical Park. Unpublished Report to National Park Service: 82 pp.

Barr, T.C. 1981. *Pseudanophthalmus* from Appalachian caves (Coleoptera: Carabidae): the *engelhardti* complex. Brimleyana 5:37-94.

Barr, T.C. 1986. An eyeless subterranean beetle (*Pseudanophthalmus*) from a Kentucky coal mine (Coleoptera: Carabidae: Trechinae). Psyche 93:47-50.

Barton, J.E. 1919. The amount of standing timber in Kentucky. Pages 251-284 *in* The Mineral and Forest Resources of Kentucky. Volume I, Series V.

Beal, E.O., and J.W. Thieret. 1986. Aquatic and Wetland Plants of Kentucky. Kentucky Nature Preserves Commission Scientific and Technical Series Number 5. Kentucky Nature Preserves Commission, Frankfort.

Bradfield, A.D., and S.D. Porter. 1990. Summary of biological investigations relating to surface-water quality in the Kentucky River basin, Kentucky. United States Geological Survey Water-Resources Investigations Report 90-4051, Louisville, Kentucky, USA.

Branson, B.A. 1970. Checklist and distribution of Kentucky aquatic gastropods. Fisheries Bulletin 54, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

Branson, B.A. 1977. Threatened fishes of Daniel Boone National Forest, Kentucky. Transactions of the Kentucky Academy of Science 38:69-73.

Branson, B.A., and D.L. Batch. 1981. Distributional records for gastropods and sphaerid clams of the Kentucky and Licking River and Tygarts Creek drainages, Kentucky. Brimleyana 7:137-144.

Branson, B.A., and D.L. Batch. 1983. Fishes of the South Fork of the Kentucky River, with notes and records from other parts of the drainage. Southeastern Fishes Council Proceedings 4:1-14.

Branson, B.A., and D.L. Batch. 1984. Fishes of the Middle Fork of the Kentucky River, Kentucky. Southeastern Fishes Council Proceedings 4:4-9.

Braun, E.L. 1935. The vegetation of Pine Mountain, Kentucky. American Midland Naturalist 16:517-565.

Braun, E.L. 1940. *Silphium incisum* Greene in Kentucky. Castanea 5:6-7.

Braun, E.L. 1942. Forests of the Cumberland Mountains. Ecological Monographs 12:413-447.

Braun, E.L. 1943. An annotated catalogue of spermatophytes of Kentucky. John S. Swift and Company, Cincinnati, Ohio.

Braun, E.L. 1950. Deciduous forests of eastern North America. Blakiston Company, Philadelphia, Pennsylvania.

Burr, B.M. 1980. A distributional checklist of the fishes of Kentucky. Brimleyana 3:53-84.

Burr, B.M., and L.M. Page. 1986. Zoogeography of fishes of the lower Ohio-upper Mississippi basin. Pages 287-324 *in* C.H. Hocutt and E.O. Wiley, eds. The zoogeography of North American fishes. John Wiley and Sons, New York, New York.

Burr, B.M., and M.L. Warren, Jr. 1986. A distributional atlas of Kentucky fishes. Kentucky Nature Preserves Commission Scientific and Technical Series 4:1-398.

Campbell, J.J.N. 1980. Present and presettlement forest conditions in the Inner Bluegrass Region of Kentucky. Ph.D. dissertation, University of Kentucky, Lexington.

Campbell, J.J.N. 1987. Gradients of tree species composition in the Central Hardwoods Region. Pages 325-346 *in* R.L. Hay, F.W. Woods, and H. DeSelm, eds. Proceedings of the Central Hardwood Forest Conference, University of Tennessee, Knoxville, Tennessee.

Campbell, J.J.N., D.T. Towles, J.R. MacGregor, R.R. Cicerello, B. Palmer-Ball, M.E. Medley and S. Olson. 1989. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Stanton Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., and M.E. Medley. 1990. The largest known concentration of *Silphium wasiotensis*, a plant found only in the Rugged Eastern Area of Appalachian Kentucky. Transactions of the Kentucky Academy of Science 5:43-50.

Campbell, J.J.N., A.C. Risk, V.L. Andrews, B. Palmer-Ball and J.R. MacGregor. 1990. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Stearns Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., J.E. Flotemersch, J.R. MacGregor, D. Noe, A.C. Risk, M.D. Studer, D.T. Towles. 1991a. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Berea Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., D.D. Taylor, M.E. Medley and A.C. Risk. 1991b. Floristic and historical indications of fire-maintained, grassy pine-oak "barrens" before settlement in southeastern Kentucky. Pages 359-375 *in* S.C. Nodvin and T.A. Waldrop (eds.). Fire and the Environment: Ecological and Cultural Perspectives, Proceedings of an International Symposium. Southeastern Forest Experiment Station, Asheville, NC.

Campbell, J.J.N., S.A. Bonney, J.D. Kiser, L.E. Kornman, J.R. MacGregor, L.E. Meade and A.C. Risk. 1992. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Morehead Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., and D.G. Ruch. 1990. Botanical survey of the Raven Run Nature Sanctuary with recommendations for management. Lexington-Fayette Urban County Government.

Carpenter, S.B. 1976. Stand structure of a forest in the Cumberland Plateau of eastern Kentucky fifty years after logging and burning. Castanea 41:325-337.

Carpenter, S.B. 1976. Trees and shrubs of Robinson Forest, Breathitt County, Kentucky. Castanea 41:277-282.

Catling, P.M, and C.B. Gregg. 1992. Systematics of the genus *Cleistes* in North America. Lindleyana 7:57-73.

Chester, E.W. 1991. The Styracaceae of Kentucky. Transactions of the Kentucky Academy of Science 52:89-93.

Cicerello, R.R., and M.L. Warren, Jr. 1984. Range extensions and drainage records for four Kentucky fishes. Transactions of the Kentucky Academy of Science 45:158-159.

Cicerello, R.R., M.L. Warren, Jr. and G.A. Schuster. 1991. A distributional checklist of the freshwater unionids (Bivalvia: Unionoidea) of Kentucky. American Malacological Bulletin 8:113-129.

Clay, W.M. 1975. The fishes of Kentucky. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

Crandall, A.R. 1884. Report on the timber growth of Greenup, Carter, Boyd, and Carter counties in eastern Kentucky. Kentucky Geological Survey (Timber and Botany).

Cranfill, R. 1980. Ferns and Fern Allies of Kentucky. Kentucky Nature Preserves Commission Scientific and Technical Series Number 1. Kentucky Nature Preserves Commission, Frankfort.

Croft, J.E. 1969. Notes from the southeastern mountains. Kentucky Warbler 45:67-81.

Cronquist, A. 1980. Vascular flora of the southeastern United States: Asteraceae. University of North Carolina Press, Chapel Hill, North Carolina.

Currens, J.C., and G.E. Smith. 1977. Coal Production in Kentucky, 1790-1975. Information Circular 23, Kentucky Geological Survey, University of Kentucky, Lexington, Kentucky.

Danglade, E. 1922. The Kentucky River and its mussel resources. United States Bureau of Fisheries Document No. 934:1-8.

Defriese, L.H. 1884. Timbers in North Cumberland, Bell and Harlan counties, Kentucky. Kentucky Geological Survey (Timber and Botany).

Dougherty, P.H. (ed.) 1985. Caves and Karst of Kentucky. Kentucky Geological Survey Publication No. 12 (Series XI). University of Kentucky, Lexington.

Fenneman, N.M. 1938. Physiography of the eastern United States. McGraw-Hill, New York and London, England.

Fernald, M.E. 1950. Gray's manual of botany. Eighth Edition (corrected printing, 1970). D. Van Nostrand Company, New York.

Gleason, H.A., and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. D. Van Nostrand Company, New York.

Gonsoulin, S.J. 1974. A revision of *Styrax* (Styracaceae) in North America, Central America and the Caribbean. Sida 4:191-258.

Hannan, R.R., M.L. Warren, Jr., K.E. Camburn and R.R. Cicerello. 1982. Recommendations for Kentucky's outstanding resource water classification with water quality for protection. Technical Report, Kentucky Nature Preserves Commission, Frankfort, Kentucky.

Harker, D.F., L.R. Phillippe, R.R. Hannan and R.S. Caldwell. 1979a. Eastern Kentucky coal field: preliminary investigations of natural features and cultural resources. Volume II: Ecology and ecological features of eastern Kentucky. Volume III: Caves and associated fauna of eastern Kentucky. Technical Report, Kentucky Nature Preserves Commission, Frankfort, Kentucky.

Harker, D.F., S.M. Call, M.L. Warren, Jr., K.E. Camburn and P. Wigley. 1979b. Aquatic biota and water quality survey of the Appalachian Province, eastern Kentucky. Technical Report, Kentucky Nature Preserves Commission, Frankfort, Kentucky.

Harker, D.F., R.R. Hannan, R.R. Cicerello, W.C. Houtcooper, L.R. Phillippe and D. VanNorman. 1981. Preliminary assessment of the ecology and ecological features of the Kentucky "Knobs" Oil Shale Region. Technical Report, Kentucky State Nature Preserves Commission, Frankfort.

Hayes, R.A., R.V. Rice, P.M. Love, S. Browning and J.D. McIntosh. 1989. Soil survey of Jackson and Owsley Counties, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.

Hayes, R.A., R.V. Rice and S.E. Jacobs. 1982. Soil survey of Leslie and Perry Counties, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.

Hobbs, H.H., Jr. 1989. An illustrated checklist of the American Crayfishes (Decapoda: Astacidae, Cambaridae and Parastacidae). Smithsonian Contributions to Zoology No. 480:1-236.

Hubricht, Leslie. 1985. The Distributions of the Native Land Mollusks of the Eastern United States. Fieldiana: Zoology New Series No. 24. 191 pp. Field Museum of Natural History, Chicago.

Hutchins, R.B. 1972. The influence of microclimate on the soils and vegetation of steep forested slopes in eastern Kentucky [Robinson Forest]. M.S. thesis, University of Kentucky, Lexington.

Johnson, M.C. 1960. A new evergreen grapefern discovered in Johnson County, Kentucky. Castanea 25:103-105.

Jones, A.R. 1973. Inventory and classification of streams in the Kentucky River drainage. Kentucky Department of Fish and Wildlife Resources Bulletin 56, Frankfort, Kentucky.

Jones, A.R., and D.E. Stephens. 1984. Muskellunge streams investigation in the South Fork Kentucky River drainage. Kentucky Department of Fish and Wildlife Resources Bulletin 71, Frankfort, Kentucky.

Karan, P.P., and C. Mather (eds). 1977. Atlas of Kentucky. The University Press of Kentucky, Lexington, Kentucky.

Kartesz, J.T., and R. Kartesz. 1980. A synonymized checklist of the vascular flora of the United States, Canada and Greenland. University of North Carolina Press, Chapel Hill, North Carolina.

Kelley, J.A., K.J. Bates and M.J. Horvath. 1990. Soil Survey of Pike County, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.

Kentucky Division of Forestry. 1985. Kentucky's Big Trees. Department of Natural Resources, Frankfort, Kentucky.

Kentucky Division of Water. 1992. 1992 Kentucky report to Congress on water quality. Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection, Frankfort, Kentucky.

Kentucky Division of Water and National Park Service. 1990. Kentucky rivers assessment: preliminary river evaluations. Kentucky Division of Water, Frankfort, Kentucky.

Kentucky State Nature Preserves Commission. 1991. Endangered, threatened, and special concern plants and animals of Kentucky. Kentucky State Nature Preserves Commission, Frankfort, Kentucky.

Kentucky State Nature Preserves Commission. 1992a. Endangered, threatened, and special concern plants and animals of Kentucky. Kentucky State Nature Preserves Commission, Frankfort, Kentucky.

Kentucky State Nature Preserves Commission. 1992b. Natural Heritage Database. Kentucky State Nature Preserves Commission, Frankfort, Kentucky.

Kuehne, R.A., and R.M. Bailey. 1961. Stream capture and the distribution of the percid fish *Etheostoma sagitta*, with geologic and taxonomic considerations. Copeia 1961:1-8.

Kuehne, R.B., and R.W. Barbour. 1983. The American Darters. The University Press of Kentucky, Lexington.

Lowman, G.E. 1975. A survey of endangered, threatened, rare, status undetermined, peripheral, and unique mammals of the Southeastern National Forests and Grasslands. U.S. Department of Agriculture, Forest Service, Atlanta. 132 pp.

Love, P.M., H.S. Evans, D.L. Lakner, R.V. Rice and J.B. Boyle. 1988. Soil Survey of Knox County and eastern part of Whitley County, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.

MacGregor, John R. 1993. Responses of Winter Populations of the Federal Endangered Indiana Bat (*Myotis sodalis*) to Cave Gating in Kentucky. Pp. 364-370 *in* Debra Foster editor. Proceedings of the 1991 National Cave Management Symposium. American Cave Conservation Association, Horse Cave, Kentucky.

Martin, W.H. 1975. The Lilley Cornett Woods--a stable mixed mesophytic forest in Kentucky. Botanical Gazette 136:171-183.

Martin, W.H. and C. Shephard. 1973. Trees and shrubs of Lilley Cornett Woods, Letcher County, Kentucky. Castanea 38:327-335.

Medley, M.E. 1989. *Silphium wasiotensis* (Asteraceae), a new species from the Appalachian Plateaus in Eastern Kentucky. Sida 13:285-291.

Mengel, R.M. 1965. The Birds of Kentucky. American Ornithologists' Union Monograph No. 3. The Allen Press, Lawrence, Kansas.

Morton, G.H. 1973. The taxonomy of the *Solidago arguta-bootii* complex. Ph.D. dissertation, University of Tennessee, Knoxville.

Muller, R.N. 1982. Vegetation patterns in the mixed mesophytic forest of eastern Kentucky. Ecology 63:1901-1917.

Palmer-Ball, B., J.J.N. Campbell, M.E. Medley, D.T. Towles, J.R. MacGregor and R.R. Cicerello. 1988. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species: Daniel Boone National Forest, Somerset Ranger District. Kentucky Nature Preserves Commission, Frankfort.

Page, L.M. 1978. Redescription, distribution, variation and life history notes on *Percina macrocephala* (Percidae). Copeia 1978:655-664..

Page, L.M. 1983. Handbook of darters. Tropical Fish Hobbyist, Incorporated, Neptune City, New Jersey.

Page, L.M. and B.M. Burr. 1991. A field guide to freshwater fishes, North America north of Mexico. Houghton Mifflin Company, Boston, Massachusetts.

Phillippi, M.A., and A. Boebinger. 1986. A vegetational analysis of three small watersheds in Robinson Forest, eastern Kentucky. Castanea 51:11-30.

Prather, K.W. 1985. Muskellunge streams investigation in the Middle Fork and North Fork Kentucky River drainages and upper Licking River. Kentucky Department of Fish and Wildlife Resources Bulletin 78, Frankfort, Kentucky.

Radford, A.E., H.E. Ahles and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press, Chapel Hill, North Carolina.

Rafinesque, C.S. 1819. Prodrome de 70 nouveaux genres d'animaux decouverts dans l'interieur des Etats Unis d'Amerique, durant l'annee 1818. Journal de Physique, de Chimie, d'Histoire Naturelle et Arts 88:417-429.

Rafinesque, C.S. 1820a. Description of the silures, or catfishes of the Ohio River. Quarterly Journal of Science, Literature, and Arts 9:48-52.

Rafinesque, C.S. 1820b. Ichthyologia ohiensis. W.G. Hunt, Lexington, Kentucky.

Rhoades, R. 1944. The crayfishes of Kentucky, with notes on variation, distribution and descriptions of new species and subspecies. American Midland Naturalist 31:111-149.

Robbins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea, and W.B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. Fifth edition. American Fisheries Society Special Publication 20:1-183.

Romme and W.H. Martin. 1981. Natural disturbance by tree-fall gaps in old growth mixed mesophytic forest in eastern Kentucky. Bulletin of the Association of Southeastern Biologists 28:89.

Schuster, G.A. 1988. The distribution of unionids (Mollusca: Unionidae) in Kentucky. Project No. 2-437R. Report to Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky. 1099 pp.

Seehorn, M.E. 1975. Fishes of southeastern National Forests. Annual Conference of the Southeastern Game and Fish Commissioners 29:10-27.

Shaler, N.S., and Crandall, A.R. 1884. Reports of the forest [or "timber growth"] of Greenup, Carter, Boyd, and Lawrence counties, Kentucky. Kentucky Geological Survey (Timber and Botany).

Smoot, J.L., T.D. Liebermann, R.D. Evaldi, and K.D. White. 1991. Surface water-quality assessment of the Kentucky River basin, Kentucky: Analysis of available water-quality data through 1986. Open File Report 90-360, United States Geological Survey, Louisville, Kentucky. 209 pp.

Sole, J.D., S. Lasseter and W.H. Martin. 1983. The vascular flora of Lilley Cornett Woods, Letcher County, Kentucky. Castanea 48:10-12.

Trewartha, G.T. 1954. An Introduction to Climate. McGraw-Hill Book Company, New York.

Turgeon, D.D., A.E. Bogan, E.V. Coan, W.K. Emerson, W.G. Lyons, W.L. Pratt, C.F.E. Roper, A. Scheltema, F.G. Thompson and J.D. Williams. 1988. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. American Fisheries Society Special Publication 16, American Fisheries Society, Bethesda, Maryland.

Turner, W.R. 1967. A pre- and post-impoundment survey of Middle Fork of the Kentucky River. Kentucky Department of Fish and Wildlife Resources Bulletin 51, Frankfort, Kentucky.

United States Army Corps of Engineers. 1991. Water resource development in Kentucky 1991. Corps of Engineers, United States Army, Cincinnati, Ohio.

United States Department of the Interior, Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50:39526-39527.

United States Department of the Interior, Fish and Wildlife Service. 1990a. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 55:6184-6229.

United States Department of the Interior, Fish and Wildlife Service. 1990b. Endangered and threatened wildlife and plants. 50 CFR 17.11 and 17.12. United States Department of the Interior, Washington, DC.

United States Department of the Interior, Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants; animal candidate review for listing as endangered or threatened species. Federal Register 56:58804-58836.

Walker, T. 1749-50. Journal. In J.S. Johnston (ed.). 1898. First Explorations of Kentucky. Filson Club Publication No. 13, p. 50-65.

Warren, M.L., Jr. 1981. New distributional records of eastern Kentucky fishes. Brimleyana 6:129-140.

Warren, M.L., Jr., W.H. Davis, R.R. Hannan, M. Evans, D.L. Batch, B.D. Anderson, B. Palmer-Ball, Jr., J.R. MacGregor, R.R. Cicerello, R. Athey, B.A. Branson, G.J. Fallo, B.M. Burr, M.E. Medley and J.M. Baskin. 1986. Endangered, threatened, and rare plants and animals of Kentucky. Transactions of the Kentucky Academy of Science 47:83-98.

Williams, J.C. 1975. Commercial fishery investigations of the Kentucky River. Part I of III, Jobs 1 and 2. Fish population studies and mussel bed surveys. Department of Biological Sciences, Eastern Kentucky University, Richmond, Kentucky. 64 pp.

Williams, J.D. 1975. Systematics of the percid fishes of the subgenus *Ammocrypta*, genus *Ammocrypta*, with descriptions of two new species. Bulletin Alabama Museum of Natural History 1:1-56.

Woolman, A.J. 1892. Report of an investigation of the rivers of Kentucky, with lists of the fishes obtained. Bulletin of the United States Fish Commission 10:249-288.

Zorach, T. 1969. *Etheostoma jordani* and *E. tippecanoe*, species of the subgenus *Nothonotus* (Pisces: Percidae). American Midland Naturalist 81:412-434.

APPENDICES

Appendix A: Notes on the three globally rare plant species known in the Rugged Eastern Area of the Appalachian Plateaus.

Recent work in the Daniel Boone National Forest and other parts of the Appalachian Plateaus of Kentucky has provided much new data and summarized floristic patterns and ecological relationships (Harker et al. 1979, Palmer-Ball et al. 1987, Campbell et al. 1988-1993). These notes summarize information on globally rare species in the Rugged Eastern Area of the Appalachian Plateaus (Figure A1), which were virtually unknown in this region before 1979. They were compiled by J. Campbell, with much information also provided by F. Levy, M.E. Medley, A.C. Risk and T.F. Wieboldt.

Before settlement, the Rugged Eastern Area appears to have been largely covered with mesic to subxeric forest, with relatively little wetland and rock outcrop (Braun 1950, Campbell et al. 1993). In contrast, the Cliff Section of the Appalachian Plateaus, with its transitions to Low Hills Belt and Knobs Sections, was highly diverse in its forest types, and there were grassy areas along some streams, clifflines and ridges. The lower habitat diversity in the Rugged Eastern Area seems to be reflected in a lower incidence of rare or unusual plant species. Only about 20 plant species found in this region are listed as endangered, threatened or for special concern by the Kentucky State Nature Preserves Commission (KSNPC database, 1992). Another 30 or so are rare--either with unusual habitat requirements or not widely distributed even within suitable habitat (Campbell et al. 1993). In contrast, over 90 species in the Cliff Section are listed by KSNPC (1991), and another 100 or more are rare. The Cliff Section covers less area than the Rugged Eastern Area, and details of individual rare species distributions reveal that the majority of them are associated with unusual habitats along watercourses, rock outcrops and in areas that may formerly have had frequent fires (Campbell et al. 1991b). The Cliff Section has several globally rare species, including Federally Endangered or Threatened Species (*Conradina verticillata, Minuartia cumberlandensis, Solidago albopilosa* and *Spiraea virginiana*) and several more candidates (*Aureolaria patula, Calamagrostis porteri* ssp. *insperata, Cypripedium kentuckiense, Eupatorium luciae-brauniae, Hexastylis contracta, Juglans cinerea, Marshallia grandiflora, Pachistima canbyi, Platanthera integrilabia* and *Schwalbea americana*). In contrast, the Rugged Eastern Area has only one current candidate for federal protection, which is not rare but declining due to disease--*Juglans cinerea.* (Until recently, other candidates, scattered through much of the Appalachian Plateaus, were *Polemonium reptans* var. *villosum* and *Synandra hispidula*).

Despite the lack of current federal candidates in the Rugged Eastern Area, there are three additional species--the subjects of this study--that appear to be globally rare, or restricted to a small geographic range. One of these species appears to be undescribed--*Solidago* sp. nov., another was described as recently as 1989--*Silphium wasiotense* Medley, and the third has a wider range but has been very rarely reported in Kentucky and most other states in its range--*Prenanthes crepidinea* Michx. All three species are in the family Asteraceae (Compositae). These notes summarize all we know of these species in Kentucky, reviews relevant data from outside the state, and discusses factors that may have influenced their distributions. Taxonomic nomenclature generally follows Kartesz and Kartesz (1980). Herbarium acronyms follow Holmgren et al. (1981).

PRENANTHES CREPIDINEA

Key characters

Prenanthes crepidinea Michx. (Giant Wood-lettuce) is the largest species of *Prenanthes* in North America (Milstead 1964). Flowering stalks reach a height of 1-2.5 m, and it has the largest leaves and flowering heads. It can be distinguished from other eastern North American species in this genus by the following characteristics:

-- principal involucral bracts 12-15, hairy (versus generally 6-10, hairy or smooth);
-- flowers mostly 20-35 per head (versus generally 5-20);
-- inflorescence corymbiform-paniculiform, with corymbose clusters (versus generally more elongate paniculiform or thyrsoid, with racemose or paniculate clusters)
-- cauline leaves ca. 15-30 cm long (versus ca. 10-20 cm), unlobed, mostly petioled (versus generally subsessile).
-- basal leaves of mature plants 30-60 cm long and 20-40 cm wide (versus no more than 25-35 x 10-20 cm), deltoid to hastate with irregular shallow lobes.
-- petioles broadly winged, 1-3 cm wide at summit (versus narrowly or not winged, < 1 cm).

Apparent hybridization has only been reported once--with *P. aspera* (Steyermark 1963).

Geographic distribution

Although this species has been widely collected throughout its mid-western range (Figure A2), many of these records are old, and the only states where it is not regarded as rare are Illinois and Missouri. In addition to being poorly represented in most herbaria, this species has a large proportion of its collections from 100-200 years ago. For example, at US there are collections from IL (1), KY (1), MO (5), PA (1), OH (2) and WV (2), but the latest of these was 1916. It is listed as threatened or endangered, or known only from historical records, in IN, KY, MN, NY, OH, PA, TN, WI and WV. It has been also reported from KA and VA (Cronquist 1980), but from sources unknown to us. In IN, Deam (1940) had records from at least 10 counties, but he stated: "I have never seen more than one specimen at a place"; and there have been no records since then, except near Chicago (Swink and Wilhelm 1979; M. Homoya, pers. comm.).

In Kentucky (Figure A3), the only recent records are from Graves (Athey No. 2767, MEMPHIS?), Fayette (Campbell and Ruch 1990; KY), Rockcastle (J. Campbell et al. 1991; BEREA), Estill (Campbell et al. 1991; sight record only), Clay and Leslie Counties (Campbell et al. 1993; KY). However, in about 1820-30, it was collected by C.S. Rafinesque (s.n. at PH) in Kentucky, with the following label data: "In many parts of Kentucky, near Hendersonville [Henderson Co.], Hardinsburg [Breckinridge Co.], Lexington [Fayette Co.], Stanford [Lincoln Co.], Harrodsburg [Mercer Co.], Bowling Green [Warren Co.], etc." (Stuckey 1971). It was also reported from Warren County by Price (1893; a coll. may be at MO). These records, and those from adjacent parts of neighboring states, are mostly from upper floodplains or lower slopes close to major rivers--Ohio, lower Cumberland, Rockcastle, South and Middle Fork Kentucky. Exceptions in Kentucky are the Fayette and Graves County records, which are from slopes along smaller hollows and tributaries.

Habitat

The species is typical of open woods on moist fertile soils, but appears to be associated with some disturbance, often at the edges of floodplains or fields. The Graves County record is a collection of R. Athey (No. 2767, 1 Sep 1974), from near Kaler: North Fork of Clarks River, 0.7 miles north on Mill Road from KY 131, "edge of wet woods". Another population was discovered in the Mississippian Embayment (or its transitions) during 1992 by J. Campbell and W. Chester in Stewart County, Tennessee, about 5 miles south of the Kentucky state line. Several hundred plants were discovered here in the Bear Creek Research Natural Area, within Land Between the Lakes. These were all on the floodplain in open woods with a dense herbaceous layer. They occurred in several patches scattered along at least half a mile of the creek. Associates in shady places included *Laportea canadensis, Claytonia virginica, Dentaria spp., Pachysandra procumbens, Mertensia virginica, Polemonium reptans, Hydrophyllum canadense, Nemophila microcalyx, Synandra hispidula, Trillium recurvatum, Erythronium americanum, Iris cristata, Elymus* spp., etc. However, a variety of taller herbs and old field species were also intermixed in more open places. Another rare plant--*Cacalia suaveolens*--was found in similar habitat, at a field edge nearby.

In Fayette County, C.W. Short (US, KY) and R. Peter (MI) collected it during the 1830s in "thickets" near Lexington. One of the several sheets at US states: "a common plant in the fencerows around Lexington, Ky.; 5-8 feet high; fl. Aug-Oct." J. Campbell rediscovered this species in Fayette County during 1979, at Raven Run Nature Sanctuary. Some 100-200 plants occur on S- to E-facing wooded slopes just above the steepest rocky section of Collinsia Creek, and a few more were reported about 200 ft west of the overlook. The forest was relatively mesic, but with a few subxeric species present. Woody species included *Acer nigrum* (dominant), *Carya cordiformis* (frequent), *Tilia americana, Ulmus rubra, U. thomasii, Celtis occidentalis, Quercus muehlenbergii, Q. shumardii, Fraxinus quadrangulata, Aesculus glabra, Prunus serotina, Ostrya, Lindera* and *Euonymus atropurpureus*. The herb layer was dominated by *Stellaria corei* and *Hydrophyllum macrophyllum*, with *Elymus villosus, Poa sylvestris, Galium aparine* and *Tradescantia subaspera* also frequent. Other species included *Collinsia, Viola pubescens, Sanguinaria, Polygonatum biflorum, P. canaliculatum, Chaerophyllum procumbens, Osmorhiza longistylis, Polymnia canadensis, Enemion, Erigeron philadelphicus, Eupatorium purpureum, Silene stellata, Aster shortii, Symphoricarpos, Bignonia, Smilax hispida, Smilax herbacea, Carex oligocarpa, C. jamesii* and *Festuca obtusa*. A remarkable feature of this population in recent years is that all leaves and stems died down in July, and there was no flowering. In 1977-79, however, J. Campbell did observe flowering. Roots transplanted in 1989 from Raven Run to rich garden soil in full sun produced 5-6 ft tall flowering stems and abundant, fertile seed in Aug-Oct of 1991 and 1992.

In the Berea District of DBNF (Campbell et al. 1991), only one patch of three clumps was found, totalling 5-10 sq. ft. This was at the base of a slope next to a dirt road along Horse Lick Creek, 1000 ft north of White Oak Creek and a mile from the Rockcastle River. The plants were under a small canopy opening in forest with *Acer saccharum, A. nigrum, Ulmus rubra, Carpinus caroliniana, Hydrangea arborescens, Poa sylvestris, Impatiens cf. capensis, Rudbeckia laciniata* and *Campanula americana*. Some non-flowering plants that were tentatively identified

as this species were found within similar forest in the hollow northeast of Reeves Mountain, Estill County, near Red Lick Creek, 2 miles west of Station Camp Creek.

In the Redbird Ranger District (Campbell et al. 1993), it was discovered at three localities in Clay County and one in Leslie County (Cawood Br.). All of these sites are at forest edges along bottomland clearings, up to 15 ft into the shade. At two sites (mouth of Cawood Branch of Beech Fork; Gum Branch of Bear Creek), only a single plant or a cluster of seedlings was found. The two other localities, each with about 30-50 plants, are a mile apart at the edge of mowed grassy areas (with picnic tables) along Big and Little Double Creeks near the Redbird Ranger Station (a few more plants were found upstream on Big Double Cr.). None of the plants found in 1992 flowered, although several began to send up flowering stalks. Mowing cut down several plants. One stem with flowering buds was virtually chewed in two by a stem-boring insect larva, which had left when the damage was found. Many small plants and those in deeper shade did send up flowering stalks at all. Associated woody species included *Liriodendron* (generally dominant in adjacent woods), *Acer saccharum, Magnolia* spp., *Juglans* spp., *Sassafras, Lindera, Cornus florida* and *Lonicera japonica.* Associates on the ground included *Onoclea, Jeffersonia, Agrimonia pubescens, Desmodium paniculatum, Parthenocissus, Rhus radicans, Oxalis grandis, Impatiens capensis, Viola conspersa, Cryptotaenia, Osmorhiza longistylis, Phlox paniculata, Galium aparine, Aster prenanthoides, Eupatorium rugosum, Elephantopus, Verbesina* spp., *Cacalia atriplicifolia, Lactuca floridana, Arundinaria, Festuca obtusa, Panicum clandestinum, Eulalia*, etc.

Elsewhere in its range, similar habitats have been reported for this species. In Illinois, although several large populations are known, scattered throughout the state, flowering is uncommon (J. Schwegman, pers. comm.) Near Chicago, typical associates on floodplains and lower slopes (combined) included *Allium canadense, Amphicarpaea, Arabis laevigata, Asarum, Circaea, Cryptotaenia, Ellisia nyctelea, Laportea, Mertensia virginica, Parthenocissus, Phlox divaricata, Polygonum virginianum, Polygonatum canaliculatum, Ranunculus septentrionalis, Smilacina racemosa* and *Trillium recurvatum*; woody species included *Celtis occidentalis, Cercis canadensis, Fraxinus americana, Lindera benzoin, Morus rubra, Prunus serotina, Pyrus ioensis, Quercus alba, Q. macrocarpa, Q. rubra, Tilia americana* and *Ulmus americana* (Wilhelm 1978, Swink & Wilhelm 1979). The single known extant site in Pennsylvania is along a perennial, ice-scoured stream on rich alluvial soil (P. Wiegman, pers. comm.). The population fluctuates greatly, with up to 30 plants flowering. Japanese beetles are a major consumer at this site.

Ecological summary

The common themes in the Kentucky records are as follows:
(1) Plants only occur on moist fertile soil, generally at the back of alluvial plains of second to third order streams or on the lowest adjacent slopes. In contrast, the Fayette County records suggest that the species may have occurred widely on the rolling upland plains of the Inner Bluegrass. These plains, however, are well known to be have exceptionally fertile soil, and were formerly covered with mesic to subxeric forest that was disturbed and open in places (Campbell et al. 1988b, Campbell 1989).
(2) Plants generally occur in open woods (with frequent *Acer saccharum/nigrum*) or at edges,

generally next to trails or other frequently disturbed areas.
(3) Plants mostly flower in sunny conditions; those in shade often die down above ground by July to August.
(4) Though a few populations contain 50-100 plants or more, the patches of plants are generally confined to areas of less than 10,000 sq. ft. The Bear Creek (Stewart Co., TN) population is exceptionally spread out.
(5) Exotic species are generally absent from the immediate associates of this species, with the notable exception of *Eulalia viminea* ("Japanese Grass").

SILPHIUM WASIOTENSE

Silphium wasiotense--Cumberland Rosinweed--was first described by Medley (1989), with the grammatically incorrect epithet *wasiotensis*.

Key characters

The following group of eastern North American species are distinguished by having: heads with only 4-21 rays (versus 13-34, fewer only in *S. compositum*); basal leaves with 3-15 cm petioles (versus 0-5 cm, more only in *S. laciniatum* group), and blade with broadly rounded to subcordate base (versus tapered to rounded), generally 8-25 cm wide (versus 5-15 cm), the blade 40-80% as wide as long (versus 20-40%); basal and lower cauline leaves generally larger than middle to upper cauline (or deltoid hastate in *S. brachiatum*); upper cauline leaves not abruptly decreasing, bractlike or pinnatifid. This experimental key is based on information in Perry (1937), Cronquist (1980), Patrick and Wofford (1980) and Medley (1989), plus some study of living and dried material.

1A. Rays pale sulphur-yellow?; involucral bracts scabro-ciliate to densely hispid; inflorescence generally with less than 15 heads (each with 9-21 rays); leaves opposite or alternate, with base obtuse to cuneate, margin entire or with shallow teeth.

-----2A. Heads 1-2 cm wide, with 8-13 rays 1-1.5 cm long; involucral bracts scabro-ciliate; leaves essentially glabrous, mostly opposite, entire or nearly so.
= *S. confertifolium* Small

-----2B. Heads 1.5-2.5 cm wide, with 8-21 rays 1.5-2.5 cm long; involucral bracts hispid; leaves evidently pubescent, mostly alternate, entire or toothed.

----------3A. Heads 1-few (rarely to 10?), with hispid acute involucral bracts; stem moderately hispid, with hairs $\leq$ 2 mm long.
= *S. gracile* A. Gray

----------3B. Heads several to rather numerous (rarely to 35?), with densely hispid obtuse involucral bracts; stem shaggy-hispid with many hairs 2-5 mm long.
= *S. mohrii* Small

1B. Rays sulphur-yellow?; involucral bracts glabrous or sparsely pubescent; inflorescence generally with 10-35 heads (each with 4-16 rays); leaves mostly opposite, with base truncate to cordate, margin with shallow or coarse teeth.

-----4A. Seeds winged (ca. 1-2 mm; apical notch shallow with small blunt teeth ca. 1 mm); rays 4-9; stems glabrous; leaves scabrous above, scabrous to hispid below (but petioles hispid-ciliate as in 4B); leaf margins irregularly shallow-toothed (ca. 1 per cm), except for the lower ones which are deltoid in overall shape and incised to subhastate-hastate at base; leaves largest at middle to lower stem positions, without basal rosettes.

= *S. brachiatum* Gattinger

-----4B. Seeds narrowly winged (ca. 0.5-1 mm?); rays up to 10-16; stems hirsute or hispid; leaves strigose to hispid above and below; leaf margin regularly deeply toothed (ca. 1-2 per cm), the lower ones rounded in outline at base; leaves largest at stem base, with basal rosettes.

---------5A. Seeds with deep apical notch, the teeth ca. 25-50% as long as body (ca. 2-4 mm long); rays "few"; stems and petioles hirsute, leaves strigose-hispidulous above and below; leaf margin more deeply, and often doubly, toothed to incised towards base; leaf base truncate, without sinus; cauline leaves lanceolate or elliptic-lanceolate; basal leaves ovate, 8-10 cm wide; rhizomes unknown.

= *S. incisum* Greene

---------5B. Seeds with or (less often?) without apical notch, the teeth 0-30% as long as body (0-2 mm); rays 10-16; stems, petioles and leaves coarsely strigose-hispid ("prickles" on stem easily rubbed off); leaf margin about equally coarse-toothed at middle and base; leaf base subcordate-cordate, the lower ones with deep rectangular sinus; cauline leaves broadly ovate; basal leaves 10-25 cm wide; rhizomes spreading up to 1 m or more.

= *S. wasiotense* Medley

Geographic distribution

This species is the only known vascular plant that appears to be endemic to the Rugged Eastern Area of the Appalachian Plateaus, based on current knowledge. It was first collected in Kentucky by Braun (1936), but misidentified as *S. brachiatum*, and later as *S. incisum* (Braun 1940, 1943). These two species are probably the closest relatives of *S. wasiotense*, but, together with *S. mohrii* and others, these potentially related species are apparently disjunct by at least 100 miles in southern Tennessee, Alabama and Georgia (Figure A4). These related species are restricted to open woods and natural grasslands of various types.

Braun's collection was from a ridge near Peabody, perhaps where it was rediscovered by A. Risk in 1992. In the 1980s (Campbell and Medley 1990) and in 1992, many new sites have been found. The global total is about 30 localities, with over 60 individual patches, mostly containing only 1-10 plants, but at least five sites have 100-1000+ plants--in Clay Co. (Little Goose Cr., upper Goose Cr. and Ashers Fk.), Perry Co. (Noble Br.) and Pike Co. (Open Fk.).

The known sites are all in the Rugged Eastern Area north of the Cumberland River watershed (Clay, Leslie, Perry, Knott and Pike Cos.), with one exception in Tennessee (Figure A5, A6). About 80% of known plants are in the upper South Fork Kentucky River watershed: along Goose Creek and its tributaries (Little Goose Cr., Horse Cr., Whites Br., Belles Fk., Billys Br., Mud Lick Br., Ashers Fk.), and Redbird River and its tributaries (Bear Cr., Hector Br., Jacks Cr., Elk Cr., Big Double Cr., Gilberts Little Cr., Spring Cr., Elisha Cr., Bowen Cr., Upper Jacks Cr.). Elsewhere, one site is in the Middle Fork drainage, along Squabble Creek (Perry Co.); a few sites are in the North Fork drainage, along Troublesome Creek (Perry Co.) and Laurel Fork (Knott Co.); and a few sites are in the Levisa Fork of Big Sandy River drainage (Pike Co.).

In 1992, A. Risk discovered one locality with about 12 non-flowering plants in Tennessee, in the transition from Appalachian Plateaus to Ridge-and-Valley Province north of Norris (Campbell Co.). A plant identified as *S. terebinthinaceum* and later *S. brachiatum* was collected in the same locality by Underwood & Sharp: No. 106, 7 Jul 1933 (GH), "Cove Creek, Elbert Faust place, limestone soil, moist cool woods" (Patrick and Wofford 1980). Remarkably, this was the same day on which Braun made her collection in Kentucky (see above).

Collections made earlier than 1989, when several new sites began to be documented (Medley 1989, Campbell & Medley 1989; Campbell et al. 1993), are as follows.

CLAY COUNTY: **E.L. Braun 586**, 7 Jul 1933: opening in dry oak woods, at top of steep south sloping ridge, near Peabody, Clay Co. [Big Creek Qd.] (US) (Braun 1940, 1943); **M. Medley 12318-84**, 2 Oct 1984: S facing roadcut with shaley soil 0.8 m W of KY 66 on KY 2000 ca. 5 miles S of Peabody [Creekville Qd.] (DHL).

PERRY COUNTY: **H.B. Lowell & H. Bishop 385**, 12 Aug 1940: dry open hillside near Stacy (GH); **M. Medley 11865-84**, 8 Sep 1984: KY 476 roadbank 0.1 mile S of unction with KY 276, near Rowdy (Stacy) [Noble Qd.?] (DHL); **M. Medley 11866-84**, 8 Sep 1984: roadbank E of KY 476, 30-40 yds upslope into old open oak-hickory forest ca. 4 miles S of junction with KY 267, near Rowdy (Stacy) [Noble Qd.?] (DHL); **M. Medley 12327-84**, 2 Oct 1984: about 300-400+ plants with 45-50% flowering; W-facing roadcut and in woods above 0.1-0.3 miles W of Stacy on Noble Br. Rd. (KY 267) [Noble Qd.] (DHL); **M. Medley 12328-84**, 2 Oct 1984: about 30 plants, half flowering; roadcut and thin logged woods E of KY 476 3.5-4.2 miles S of Stacy [Noble Qd.] (DHL); **M. Medley 12329-84**, 2 Oct 1984: roadcut and woods edge on E side of KY 476 4.2 miles S of Stacy [Noble Qd.] (DHL); **M. Medley 12330-84**, 2 Oct 1984: roadcut slope and woods edge E of KY 465 [?] 5.4 miles N of KY 80 [Noble Qd.] (DHL).

PIKE COUNTY: **Anon. s.n.**, 15 Aug 1938: Forsyth's Garden, said to have been found in the region of the Breaks (Pikeville College Herbarium); **R. Hannan & R. Phillippe 805**, 11 Oct 1978: drive up Winn Br. Rd. to stripmine on left; park above shed on left; plants in old field across from stripmine on right side of creek; lower woods have been strip mined and all the woods heavily timbered; 1000-1400 ft. a.s.l. [Meta Qd.] (DHL?); **M. Medley, J. Thieret & F. Levy 5872-82**, 8 Aug 1982: woods above and beyond coal mine at end of Winn Br. Rd. [Meta Qd.] (DHL); **M. Medley & F. Levy 6096-82**, 14 Aug 1982: open oak woods above and

just past strip mine area on Winn Br. at the end of Williamson Rd.; about 50 plants with 50% flowering [Meta Qd.] (DHL); **F. Levy & K. Carter s.n.**, 6 Oct 1982: large population behind Kelly Carter's house; head of Open Fork Rd. at base of Bent Mt. 2 miles from US 119; lower S-facing slope, woods edge [Metà Qd.] (Duke Univ./UNC Chapel Hill); **F. Levy & K. Carter s.n.**, 19 Oct 1982: only two basal rosettes, not flowering; first N-facing hollow on road from Kimper to Pond Cr. ca. 15 ft. upslope from dirt road in shaded woods near edge [Millard Qd.?] (Duke Univ./UNC Chapel Hill); **M. Medley 12334-84**, 3 Oct 1984: open woods above deep mine face and just past it at end of Winn Br. Rd. near Meta [Meta Qd.] (DHL); **M. Medley 12340-84**, 3 Oct 1984: about 500 plants with 10% flowering; mixed mesophytic forest [with no evidence of recent disturbance] at head of Open Fork ravine ca. 2.5 miles S of Meta and then 1 mile southeast to end of Open Fork Rd. [Meta Qd.] (DHL); Also, a resident in the county indicated to M. Medley that this species occurs near Marrowbone; **H. Bryan s.n.**, ...: Pike Co. (KYDOT/EKU); John MacGregor has data.

Habitat

Most sites are on roadsides and adjacent disturbed slopes on steep lower slopes, at the forest edge, usually on well-drained banks 1-10 feet above the slope base. Plants are generally found in clayey soil on shales of the Breathitt Formation, which is often exposed nearby in roadcuts or natural outcrops. A few other populations have been found on sandstone. Plants are more frequent on south- or west-facing slope bases, which are relatively mesic but often prone to fires spreading from drier slopes above or from open ground below. All of the 100-1000+ populations are on such aspects. A few small (1-10 plant) patches have been found on upper slopes, saddles or ridges (especially the Redbird Crest Trail near Peabody), but these sites are no more than transitional from mesic (with *Fagus, Liriodendron* and *Acer saccharum* dominant) to subxeric (with *Quercus* spp. dominant). The plants are generally on well-drained shaley soil, above the most heavily disturbed roadside zone and ditch with such frequent plants as *Impatiens capensis, Ambrosia trifida, Festuca arundinacea* and other weedy exotics. In general, the only flowering plants are found in more or less open vegetation at the forest edge, while non-flowering plants are often frequent 100-1000 ft back into the woods.

The most abundant associates in Clay and Leslie Counties appeared to be *Cercis canadensis* and *Helianthus microcephalus*, which may resprout relatively well after fires. Other typical woody associates on roadsides included *Liriodendron, Acer saccharum, Fraxinus americana, Ulmus rubra, Quercus alba, Carpinus, Cornus florida, Robinia pseudoacacia* and *Sassafras*. Common associates in the ground-layer included *Boehmeria, Desmodium* spp. (especially *paniculatum-perplexum-glabellum* group), *Amphicarpaea, Rhus radicans, Parthenocissus, Oenothera tetragona, Pycnanthemum pycnanthemoides, Aster cordifolius, Erigeron annuus, Eupatorium fistulosum, Cacalia atriplicifolia, Lactuca floridana, Festuca arundinacea* and *Eulalia viminea*. Some sites are along old roads and paths higher on the slopes, and a few plants have been found well within the forest.

In western Clay County, in the transition to the Low Hills Belt, a particularly vigorous population with 100s of plants was discovered that extended from the roadside up into the woods. There was an unusually high flowering percentage, ranging from virtually 100% on the

roadbank to 50% in lower slope woods to 25% in mid-slope woods. This population was in an area along Little Goose Creek that had clearly been burned within the previous year or two, and may have been frequently burned before that. The major tree species here were *Quercus alba* (dominant), *Q. rubra, Acer saccharum, Pinus echinata*, etc. The shrub layer was thin, but the herb layer was remarkably dense for a woodland, dominated by *Helianthus microcephalus*, and with frequent *Aureolaria* spp., *Desmodium* spp., *Amphicarpaea, Solidago arguta* and *Panicum dichotomum* (upper slopes), in addition to *Silphium wasiotense*.

One other population in Clay County was found that included flowering plants on an upper slope. This was a group of only 3 plants, in open brushy woods near Hector. The area had been burned frequently (D. Daniels, pers. comm.). Frequent species included *Oxydendron* (abundant), *Acer rubrum, Quercus montana, Q. coccinea, Fagus, Nyssa, Robinia pseudoacacia, Vaccinium* spp. (especially *corymbosum*), *Amelanchier arborea, Rubus allegheniensis, Cunila origanoides* (abundant), *Potentilla* spp. (especially *canadense*), *Lespedeza hirta, Euphorbia corollata, Helianthus microcephalus, Aster* spp. (especially *paternus, infirmus*), *Solidago erecta, Antennaria plantaginifolia, Poa cuspidata, Andropogon scoparius* and *Panicum dichotomum*.

In Perry County, some populations along or near KY 467 contained 100s of plants. Common woody associates included *Liriodendron, Fagus, Quercus alba, Q. rubra, Carya* spp., Betula nigra, *Oxydendrum, Acer rubrum* and *Cornus florida*; others included *Tsuga, Acer saccharum, Prunus serotina, Magnolia* spp., *Ulmus rubra, Carpinus, Cercis, Bignonia*, etc. Frequent herbaceous species included *Polystichum acrostichoides, Anemone virginiana, Heuchera* sp., *Desmodium paniculatum, Hedeoma pugelioides, Galium circaezans, Verbesina alternifolia, Aster cordifolius, Solidago flexicaulis* (sensu lato), *S. caesia, S. altissima, Ambrosia artesiifolia, Eupatorium fistulosum, E. rugosum, Prenanthes altissimia, Lactuca floridana, Tridens flavus* and *Eulalia viminea*.

In Pike County, the Open Fork population, with over 500 plants, was found in 25-30 year old mesophytic forest on lower slopes of various aspects. This site was not close to a road of with obvious recent disturbance, and only 1-5% of plants were flowering. Frequent species in the forest included frequent *Liriodendron, Magnolia tripetala, Acer saccharum, A. rubrum, Carpinus, Cornus florida, Lindera* and *Hydrangea*. The dense ground cover included much *Polystichum, Tiarella* and **Aster cf. cordifolius**. The Winn Branch population, with about 50 plants and half flowering, was partly in thin cutover woods, about 25-35 years old, on a subxeric to mesic, steep south-facing slope. Frequent associates included *Fagus, Quercus alba, Q. coccinea, Carya cf. cordiformis, Oxydendron arboreum, Acer rubrum* and *Cornus florida*. The sparse ground cover also included *Vitis sp., Desmodium nudiflorum, Vicia caroliniana, Helianthus microcephalus, Aster* spp. (especially *infirmus*), *Solidago* spp. (especially *caesia* and some *curtissii*) and *Panicum boscii*.

Ecological summary

General ecological features of this species can be summarized as follows.
(1) All KY populations are in the Rugged Eastern Area of the Appalachian Plateaus, with shales and sandstones of the Breathitt Formation; the TN population is in the transition to Ridge-and-

Valley Province, perhaps with some limestone.
(2) Most populations, except for scattered groups of 1-10 plants, have been found along roadsides or in disturbed woods up to 500 ft or so away.
(3) Most of these roads are on lower slopes, often in the transition to bottomland. Some are on mid-slopes, and a few are on ridges, but most of these are still mesic sites (with much *Liriodendron, Fagus*, etc.) or only transitional to subxeric (*Quercus*-dominated).
(4) In the few cases where vigorous populations occur well within the woods, there appears to have been a history of frequent fires, cutting or other disturbances.
(5) Flowering plants are generally restricted to sites where full sun is experienced for a major part of the day. However, non-flowering plants appear to survive for many years in fairly deep shade.
(6) Exotic species are generally absent from the immediate associates of this species, with the notable exception of *Eulalia viminea*. Occasionally *Festuca arundinacea, Melilotus* spp. and other exotics occur, but these are generally in the most disturbed zone within 5 ft or the roadside, as opposed to the adjacent banks and slopes with most *S. wasiotense*.

Campbell and Medley (1990) discussed possible factors that may have maintained this relatively mesophytic species within the largely forested Appalachian landscape before settlement. It seems increasingly obvious that this species depends on disturbance for its indefinite persistence and reproduction. Roadsides and fires appear to be the major factors maintaining it today. Before settlement by Virginians, it is possible that similar factors were fires (especially in bottomland canebrakes?), trampling and browsing of large herbivores on these fertile lowlands, followed by Indians with more fire and also some settlements. There is increasing evidence that Indians located many village sites on the bottomlands in this region during the 3000-5000 years before 1700 (D. Pollack, pers. comm.).

SOLIDAGO SP. NOV.

Drs. T.F. Wieboldt (Virginia Polytechnic Institute) and F. Levy (East Tennessee State University) are currently doing detailed taxonomic research on this species, including DNA analysis. It will be named in the near future.

Key characters

The species included in the following experimental key, modified from Morton (1973) and Cronquist (1980), form the *Solidago arguta* complex. This group has the following characters that together separate it from other members of the genus:
-- inflorescence terminal, paniculiform, with recurved-secund branches
-- leaves basally disposed on stem, not triple-nerved, not cordate
-- leaves tapering rather abruptly to a cuneate or truncate base
-- leaves generally glabrous, or somewhat scabrous to strigose
-- stem glabrous below inflorescence
-- rhizomes generally stout (at least 2/3 of stem width), not stoloniform.

1A. Seeds thinly or densely pubescent, at least on angles or summit; inflorescence with remote long (>15 cm) branches at base, or none; stems not purplish; leaves glabrous, or the upper surface somewhat strigose or scabrous; lower leaf blades with truncate base, generally 7-15 cm wide and 10-25 cm long.

-----2A. Involucres campanulate, ca. 3-5 mm wide (5-6 mm when pressed) and 5-6 mm long, the bracts with a midrib and generally two faint laterals, the tips brownish; primary inflorescence branches 1-15 (25) cm long, ascending, mostly from axils of much reduced leaves near center of inflorescence; ultimate inflorescence branches mostly 1-2 cm long, with clusters of 1-5 (10) heads not clearly recurved-secund in pressed material (needing careful examination); leaves generally thinly strigose above at least near margin, dull bluish-green with dark brownish veins when dried, the main network of areolae formed by 3rd order veins ca. 2-5 mm apart (more prominent than incomplete 4th order), the margin serrate with 2-4 teeth per cm; leaves with acute to prolonged acuminate tip, and mid-cauline ones with more tapered base than lower leaves; rhizomes of mature plants elongated, ca. 2-4 mm thick when dry.

= *Solidago* sp. nov.

-----2B. Involucres cylindric, ca. 2-3 mm wide (4-5 mm when pressed) and 4-5 mm long, the bracts with a midrib but no laterals, the tips glossy green when fresh; primary inflorescence branches up to 20-30 cm long, widely spreading, mostly from leaf axils at base of inflorescence; ultimate inflorescence branches ca. 1-5 cm, generally with 5-10 heads clearly recurved-secund; leaves glabrous or with upper surface scabrous, glossy green when fresh, more yellowish-green with pale brownish veins when dried, the main closed network of areolae formed by subequal 3rd and 4th order veins ca. 0.5-2 mm apart, the margin thick and generally doubly serrate with 3-6 teeth per cm; leaves with abruptly acuminate tip (ca. 1-2 cm), and mid-cauline ones with base about as truncate as lower leaves; rhizome of mature plants short, ca. 4-7 mm thick when dry.

= *Solidago harrisii*

----------3A. Leaves not clearly coriaceous, glabrous or (in Fayette Co.) slightly scabrous above; lower leaves 7-13 cm wide.

= West Appalachian *S. harrisii*

----------3B. Leaves coriaceous, scabrous above; lower leaves 5-10 cm wide.

= Ridge and Valley *S. harrisii*

1B. Seeds glabrous or pubescent; inflorescence generally with several long (ca. 15-30 cm) ascending branches; stems often purplish; leaves essentially glabrous, or slightly scabrous above within 1 cm of margin, or somewhat strigose on veins below; lower leaf blades with tapered base, generally no more than 5-10 cm wide and 5-15 cm long.

= *Solidago arguta* (sensu lato)

-----4A. Seeds glabrous.

= *Solidago arguta* ssp. *arguta*

-----4B. Seeds pubescent, at least distally.

---------5A. Leaves glabrous.

----------6A. Rays 2-5; disc corollas ca. 3 mm high; involucres 3.5-5 mm high?; lower leaves usually more than 5 cm wide.

= *Solidago arguta* ssp. *australis*

(Morton also separated *S. vaseyi*, with disc corollas $\geq$ 4 mm versus 2.5-3.8 mm in *australis*).

----------6B. Rays 4-8; disc corollas 4-4.5 mm high; involucres 5-6.5 mm high?; lower leaves usually less than 5 cm wide, with long attenuate base, "in fresh material the teeth of the basal leaves twisted".

= *Solidago pseudoyadkinense*

---------5B. Leaves strigose or strigillose on abaxial mid-vein, especially in lower cauline ones.

= *Solidago boottii*

This undescribed species of broad-leaved goldenrod was first collected in Kentucky by Braun (1943) in Kentucky, and hers may the first collection anywhere: E.L. Braun 2049, 2050; 26 Sep 1938; steep slopes, woods, near Midland, Pike Co. She called the plants *S. harrisii*, but recent examination by M. Medley (University of Louisville) and T. Wieboldt (Virginia Polytechnic Institute) have shown them to be distinct, and apparently a species new to science. This species is closely related to *S. arguta* and *S. harrisii*. Until the late 1980s, this species was only collected from Pike County, Kentucky, but it has subsequently been found in five other Kentucky counties and several sites in Virginia.

The relatively short inflorescence branches of this species often obscure the recurved-secund character of the *arguta* group. In this respect, and with other characters, this species appears similar to *S. squarrosa*, a large northern species in the *erecta* group. It is curious that *S. squarrosa*, a very rare species in Kentucky, was collected by Braun (No. 2048) at the same locality and date as her collection of the sp. nov. Possibly the sp. nov. diverged from most of the *arguta* group near an ancestral link with the *erecta* group. If *S. harrisii* also diverged with this sp. nov. at an early date, that might help us understand the great disjunctions between the forms of *S. harrisii*, from the limestone ridges of east-central Kentucky to the shale barrens of Virginia. A few collections from eastern Kentucky may be intermediate between this *Solidago* sp. nov. and *S. arguta*. One example is J. Campbell, 25 Sep 1990 (KY): below sandstone cliff, Hog Hollow, Parrott Quadrangle, Jackson County--this may be a robust form of *S. arguta*, but the basal leaves are broadly (8-12 cm) trunctate, leaves are slightly scabrous above, and the seeds are thinly pubescent.

Geographic distribution

About 20 sites (Figure A7-9) are known in Kentucky (Clay, Knott, Leslie, Letcher, Perry and Pike Counties), and others are known in Virginia (Buchanan, Dickinson, Giles, Lee and

Scott Counties) and West Virginia (Mercer Co.). About 15 of the Kentucky records came from the Redbird Ranger District (Campbell et al. 1993). All Kentucky sites are in the Rugged Eastern Area of the Appalachian Plateaus, and all except the Pike County plants (Wolfpen Branch of Russell Fork at the Breaks) are in the Kentucky River watershed, including Redbird River (between Bowen Cr. and Blue Hole Cr.); Middle Fork (Trace Br., between Muncy Cr. and Johns Cr. and between Rye Cove Br. and Spruce Pine); Beech Fork (from Big Cr. to Cawood Br.); and North Fork (near Oldhouse Br. and Carr Fk. Lake). Most or all Virginia sites are in the Ridge-and-Valley Province.

Habitat

All Kentucky sites are on steep, often seeping, low rocky slopes and adjacent terraces in the valleys of rivers or larger tributaries, or up to a mile or two into smaller branches. A large population along Spring Creek, which is a smaller stream (near Rocky Mt., Creekville Qd.), may have been this species or just unusually large leaved *S. arguta*. Plants were more abundant on north- or northeast-facing slopes, but this was not a pronounced trend. At most sites, clonal patches of 10-100 plants were found, and several sites had populations with over 1000 crowns, though mostly non-flowering. More flowering occurs at forest edges, such as along roadsides. The species generally occurs in shadier and more strictly mesophytic sites than *Silphium wasiotense*.

Frequent woody associates in the Redbird Ranger District included *Fagus* (often dominant), *Tsuga, Acer saccharum, Tilia, Magnolia tripetala, Carpinus, Cornus florida* and *Rhododendron maximum*. However, the species was generally absent from areas dominated by *Tsuga* and *Rhododendron*. Frequent herbs include *Adiantum, Dryopteris marginalis, Polystichum, Rhus radicans, Asarum, Sedum ternatum, Tiarella, Heuchera villosa, Viola rostrata, Meehania, Solidago flexicaulis* (sensu lato), *Aster divaricatus* and, locally, *Trillium grandiflorum*. Infrequent species that also appear characteristic of this habitat include *Waldsteinia fragarioides* and *Carex purpurifera*. Plants are often just above a zone of dense *Impatiens pallida* and *Laportea* at the slope base. Collections from Virginia and West Virginia are from similar habitats. However, in the Ridge and Valley Province, some populations are near limestone cliffs (Lee Co., VA).

Ecological summary

General ecological features of this species are as follows:

(1) All known populations are in the Rugged Eastern Area of the Appalachian Plateaus, or in Ridge and Valley Province.
(2) Most populations are on mesic, steep, lower slopes and slope bases.
(3) All populations are have at least partial forest cover.
(4) Large clonal patches in the shade often had little flowering (though more than *Silphium wasiotense*); flowering is more frequent in openings and edges.
(5) Exotic species are completely absent from the typical habitat.

Discussion

Not only are there many fewer rare plant species in the Rugged Eastern Area, compared to other sections of the Appalachian Plateaus, but the kind of habitat where these three globally rare species occur is quite different from the habitats of globally rare species in the other section. Globally rare species in the Cliff Section (see Introduction) are mostly restricted to unusual habitats associated with watercourses or rock outcrops, such as rocky or sandy streambanks, clifflines, rocky woods and boggy streamheads. One species--*Schwalbea americana*--may have been typical of pine-oak barrens maintained by fire before settlement (Campbell et al. 1991). In contrast, all three of the globally rare species in the Rugged Eastern Area are concentrated on mesic lower slopes at the edge of, or within, common forest types for the area. They are not directly influenced by watercourses or rock outcrops. *Prenanthes crepidinea* appears strictly mesophytic and *Silphium wasiotense* occurs on mesic or mesic-subxeric transitions with no unusual soil conditions. The habitat of *Solidago* sp. nov. is generally more shaded than the other two species, but it occurs in similar topographic situations. On average, *Solidago* sp. nov. is on steeper slopes and a little further up from slope bases, though still mostly within 500 ft of the base.

As noted above, a reasonable hypothesis for consideration is that the two species associated with forest edges today--*Prenanthes crepidinea* and *Silphium wasiotense*--were formerly associated with some combination of fire and grazing by large herbivores in the presettlement landscape. The Bluegrass Region appears to have large canebrakes and "savanna-woodlands" with a concentration of activity by buffalo, elk, deer and their predators before settlement (Campbell 1989). It is likely that larger Appalachian valleys also harbored concentrations of these animals, and that they used these valleys as migration routes through the less productive hills to the Ridge-and-Valley Province further east. The vegetation of larger valleys in the Rugged Eastern Area appears to have had several similarities to the Bluegrass Region before settlement (Campbell et al. 1993). The abundance of cane, in particular, could have had a major functional effect on these valleys, since large flammable fuel loads can build up in canebrakes every 10 years or so.

Such a hypothesis has also been developed for *Trifolium stoloniferum* (Campbell et al. 1988), and continues to make sense for this species as further distributional data are gathered (T. Bloom, pers. comm.). *T. stoloniferum* was primarily concentrated in the Bluegrass region, but there are indications that it may have occurred along some Appalachian valley bottoms (Campbell et al. 1990). One of the earliest pioneers in the state noted that near Middlesborough, Bell County: "...we moved 7 miles along the Indian Road, to Clover Creek. Clover and Hop Vines are plenty here." (Walker 1749-50). There are several other old place names with clover in Appalachian Kentucky and the Bluegrass Region (Figure A3; including Clover Hollow, Clay Co., Ogle Qd.), but few elsewhere in the state.

Much autecological research will be required to test such hypotheses. One obvious ecomorphological feature of all three species is their large basal leaves. In each case, these leaves are among the largest known in their respective genera. In *Prenanthes crepidinea* and *Silphium wasiotense*, their deltoid-cordate-hastate shape is also found, within the same forest

edge habitats, in *Cacalia atriplicifolia, Lactuca floridana* and *Tussilago farfara*. These large basal leaves may be able to photosynthesize effectively during shaded periods in these species' life-histories, and provide effective competition against neighboring plants. All these species are in Asteraceae, a family distinguished by sesquiterpenoids in their foliage. Are such chemicals able to protect these large conspicuous leaves from the large herbivores that would have frequented their habitats before settlement?

These three species appear to have unusual biogeographic relationships, within the otherwise rather cosmopolitan flora of the Rugged Eastern Area. Thus, one further question is of interest: to what extent are these species distinct in their distribution and ecology from their closest taxonomic relatives, and other there similar patterns of differentiation in other taxonomic groups?

1. *Prenanthes crepidinea.*

This species is the largest eastern North American species in the genus, and quite distinct in several characters. It also appears to be the most mesophytic species, rivalled only by *P. altissima*. The latter species occurs in mesic to subxeric sites, often on relatively infertile hapludults, though also overlapping with *P. crepidinea* on the fertile hapludalfs occupied by that species. Several other genera have a similar pattern of differentiation in eastern North America--with relatively robust, forest-dwelling (though flowering mostly in gaps and edges), mesophytic, basiphilic species centered in the mid-west. Examples include *Elymus macgregorii* (R. Brooks, in preparation), *Stellaria corei, Trifolium stoloniferum, Silphium perfoliatum, Rudbeckia umbrosa, Cacalia muhlenbergii, Aster schreberi* and perhaps some forms of *Solidago flexicaulis* (sensu stricto, versus Appalachian forms including *S. flaccidifolia*?).

2. *Silphium wasiotense.*

The closest relatives of this species, as noted above, probably lie among the following group, all of which have ranges and habitat that are distinct from *S. wasiotense.*
(a) *S. incisum.* This species is known only from the type specimen: G. McCarthy, 1888, near Rome, Georgia (US). This area is in the Ridge-and-Valley Province. There are dry hills, bluffs and bottomlands near Rome, where searches should be made.
(b) *S. brachiatum.* This species occurs in the transition from the southeastern Highland Rim to the southern Appalachian Plateaus (Cumberland Plateau). It occurs on rocky calcareous soils in open forest, with such species as *Quercus muhlenbergii, Carya glabra, Fraxinus americana, Juniperus, Rhus aromatica, Bromus purgans, Panicum boscii, Andropogon* spp., *Dasystoma* and other Heliantheae (Patrick and Wofford 1980). Less often it occurs in adjacent mesic sites with *Aesculus, Tilia, Ulmus, Celtis, Liquidambar, Platanus*, etc. Its sites generally have a history of fire, grazing or cutting.
(c) *S. mohrii.* This species occurs in the southeastern Highland Rim and southern Appalachian Plateau, mostly northwest and southeast of *S. brachiatum.* It occurs in open oak woods and associated grassy vegetation or roadsides, often on relatively flat ground that is somewhat poorly drained, with acid fragipan soils (M. Medley, pers. obs.). It was probably associated with fire before settlement. On the Highland Rim it occurs in the biogeographically unique "oak

barrens", with several species disjunct from the Coastal Plain. On the southern Appalachian Plateau, there is another endemic in similar habitats--*Sabatia capitata*.
(d) *S. confertifolium* occurs mostly in the Tombigbee River and Alabama River area, transitional from Ridge-and-Valley to Coastal Plain. It may be associated with the former "Black Belt" prairie region here (R. Kral, pers. comm.).
(e) *S. gracile* occurs in Coastal Plain. It occurs in open woods, pine savannas, roadsides, fields and other disturbed areas.
In contrast, data presented above on *S. wasiotense* indicate that it is the most mesophytic species in this group of species, and perhaps in the whole genus except for *S. perfoliatum*. It may also be more persistent in shade, though without flowering. Similar patterns of differentiation, from savannas of the Coastal Plain to mesophytic forests of the Appalachian Plateaus, are unknown to us, but they should be looked for in other Asteraceae.

3. *Solidago* sp. nov.

As noted above, the closest relatives of this species appear to be *Solidago harrisii* and perhaps *S. arguta*. The known range of *S. harrisii* does not overlap with *Solidago* sp. nov., but it is two disjunct sections on either side: (1) in the Ridge and Valley Province along limestone cliffs and shale barrens; (2) in the West Appalachian section near Missippian limestone cliffs (most/all in Kentucky and Licking River drainages). The rocky woods where it occurs, e.g., with *Juniperus, Quercus muhlenbergii, Fraxinus quadrangulata*, etc., in Kentucky (Campbell et al. 1989-92), are habitats quite distinct from the steep shaley slopes where *Solidago* sp. nov. occurs. One of the few species that may be characteristic of both habitats, with some bimodality, is *Waldsteinia fragarioides*, which is however much more wide-ranging. The only other vascular plant taxa with a similar distribution to *S. harrisii* are *Calamagrostis porteri* (ssp. *porteri* and ssp. *insperata*), *Paxistima canbyi* and *Phlox subulata* vars. *australis* and *brittonii* (Figure A9). These four species occur in close proximity to each other in Estill and Powell Counties, Kentucky. In general, they occur in more or less open woodland near more or less calcareous rock outcrops, including the Virginian shale barrens. There are several other shale barren endemics that do not occur in western Appalachian regions (e.g., *Trifolium virginicum*).

Solidago arguta is a much more widespread species, with variants differentiated from north to south and mesic to xeric sites. Its habitat distribution may overlap considerably with *Solidago* sp. nov. and *S. harrisii*. However, it generally occurs on non-calcareous shales and sandstones in mesic to subxeric forest and edges, with such common trees as *Fagus, Tsuga, Quercus alba* and *Q. montana*. Quantitative work on habitat distributions will eventually be required, but it appears that the average habitat position of these species are well separated, and that *Solidago* sp. nov. is the most mesophytic species in the *S. arguta* group.

In conclusion, these rare species in the Rugged Eastern Area of the Appalachian Plateaus are all among the most robust, large basal-leaved, and most mesophytic species within their respective genera. Relatively mesic sites on lower slopes appear to offer these species suitable habitat, though for the *Prenanthes* and *Silphium*, one must infer that fire, grazing or other disturbance was also necessary before settlement. They flower more in gaps and edges, but their large basal leaves may allow considerable persistence in shade between disturbances. Despite

this ecological convergence, their patterns of biogeographic and taxonomic differentiation from congeners are all quite different: *Prenanthes crepidinea* is at the southeastern margin of a mid-western range; *Silphium wasiotense* appears to be endemic to the Rugged Eastern Area of the Appalachian Plateaus, with its closest relatives to the south; the *Solidago* sp. nov. also has a small central Appalachian range, but with its closest relatives more widely distributed in the Appalachian region. The situation of the *Solidago* sp. nov., in particular, is unique. It appears to form a link, perhaps ancestral, between the western and eastern forms of *Solidago harrisii*. Did these two forms evolve independently from something like this sp. nov., or did all evolve from something like *S. arguta*--the juxtaposition of their ranges being mere coincidence?

Literature Cited

Braun, E.L. 1936. Notes on Kentucky plants. I. Castanea 1:41-45.

Braun, E.L. 1940. *Silphium incisum* Greene in Kentucky. Castanea 5:6-7.

Braun, E.L. 1943. An annotated catalogue of spermatophytes of Kentucky. John S. Swift and Company, Cincinnati, Ohio.

Braun, E.L. 1950. Deciduous Forests of Eastern North America. Blakiston, Cincinnati.

Brooks, R.E. 1983. *Trifolium stoloniferum*, Running Buffalo Clover: description, distribution, and current status. Rhodora 85:343-354.

Campbell, J.J.N., D.T. Towles, J.R. MacGregor, R.R. Cicerello, B. Palmer-Ball, M.E. Medley and S. Olson. 1989. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Stanton Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., and M.E. Medley. 1990. The largest known concentration of *Silphium wasiotensis*, a plant found only in the Rugged Eastern Area of Appalachian Kentucky. Transactions of the Kentucky Academy of Science 5:43-50.

Campbell, J.J.N., and D.G. Ruch. 1990. Botanical survey of the Raven Run Nature Sanctuary with recommendations for management. Lexington-Fayette Urban County Government.

Campbell, J.J.N., J.E. Flotemersch, J.R. MacGregor, D. Noe, A.C. Risk, M.D. Studer, D.T. Towles. 1991a. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Berea Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., D.D. Taylor, M.E. Medley and A.C. Risk. 1991b Floristic and historical indications of fire-maintained, grassy pine-oak "barrens" before settlement in southeastern Kentucky. Pages 359-375 *in* S.C. Nodvin and T.A. Waldrop (eds.). Fire and the Environment: Ecological and Cultural Perspectives, Proceedings of an International Symposium. Southeastern Forest Experiment Station, Asheville, NC.

Campbell, J.J.N., S.A. Bonney, J.D. Kiser, L.E. Kornman, J.R. MacGregor, L.E. Meade and A.C. Risk. 1992. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Morehead Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Campbell, J.J.N., R. Cicerello, J. & R. Kiser, J.R. MacGregor and A.C. Risk. 1993. Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species, Daniel Boone National Forest: Redbird Ranger District. Kentucky State Nature Preserves Commission, Frankfort.

Cronquist, A. 1980. Vascular flora of the southeastern United States: Asteraceae. University of North Carolina Press, Chapel Hill, North Carolina.

Fernald, M.E. 1950. Gray's manual of botany. Eighth Edition (corrected printing, 1970). D. Van Nostrand Company, New York.

Field, T.P. 1991. A guide to Kentucky place names. Kentucky Geological Survey, Special Publication 15, Series XI. University of Kentucky, Lexington.

Greene, C.W. 1980. The systematics of *Calamagrostis* (Gramineae) in Eastern North America. Ph.D. thesis, Harvard University, Cambridge, Massachusetts.

Greene, E.L. 1899. New or noteworthy species--XXIV. Pittonia 4:35-45.

Holmgren, P.K., W. Keuken and E.K. Schofield. 1981. Index Herbariorum. Part I. The Herbaria of the World. Dr. W. Junk B.V., The Hague.

Kartesz, J.T., and R. Kartesz. 1980. A synonomized checklist of the vascular flora of the United States, Canada and Greenland. University of North Carolina Press, Chapel Hill.

Kral, R. 1980. *Silphium brachiatum*. Species No. 71 in A. Robinson (ed.), Endangered and Threatened Species of the Southeastern United States including Puerto Rico and the Virgin Islands. U.S.D.A. Forest Service General Report SA-GA7, Atlanta.

Medley, M.E. 1989. *Silphium wasiotensis* (Asteraceae), a new species from the Appalachian Plateaus in Eastern Kentucky. Sida 13:285-291.

Milstead, W.L. 1964. A revision of the North American species of *Prenanthes*. Ph.D. thesis, Purdue University, Indiana.

Mitchell, R.S., C.J. Sheviak and J.K. Dean. 1980. Rare and endangered vascular plant species in New York State. New York State Museum, Albany.

Morton, G.H. 1973. The taxonomy of the *Solidago arguta-bootii* complex. Ph. D. dissertation, University of Tennessee, Knoxville.

Patrick, T.S., and B.E. Wofford. 1980. *Silphium brachiatum* Gattinger. Status Report for U.S. Fish and Wildlife Service. Department of Botany, University of Tennessee.

Perry, L.M. 1937. Notes on *Silphium*. Rhodora 39:281-297.

Price, S. 1893. Flora of Warren County, Kentucky. New London, Wisconsin.

Steyermark, J.A. 1963. Flora of Missouri. Iowa State University Press, Ames.

Stuckey, R.L. 1971. C.F. Rafinesque's North American vascular plants at the Academy of Natural Sciences of Philadelphia. Brittonia 23:191-208.

Swink, F., and G.S. Wilhelm. 1979. Plants of the Chicago Region. Morton Arboretum, Lisle, Illinois.

Wherry, E.T. 1955. The genus *Phlox*. Morris Arboretum Monographs III. Philadelphia, PA.

Wilhelm, G.S. 1978. Kane County Natural Area Survey. Urban Development Division, Geneva, Illinois.

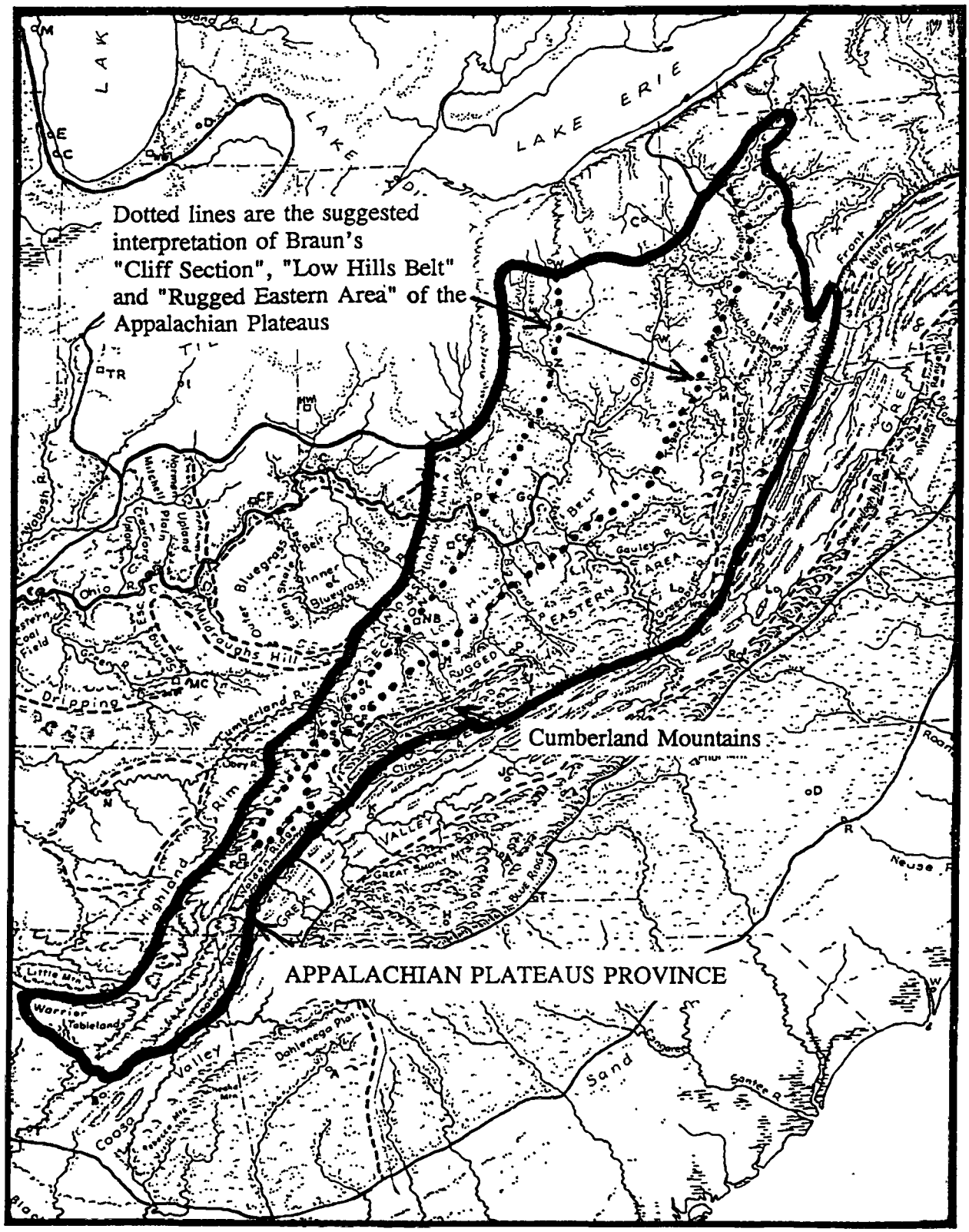

Figure A1. Map showing the Appalachian Plateaus and its divisons (based on Braun 1950).

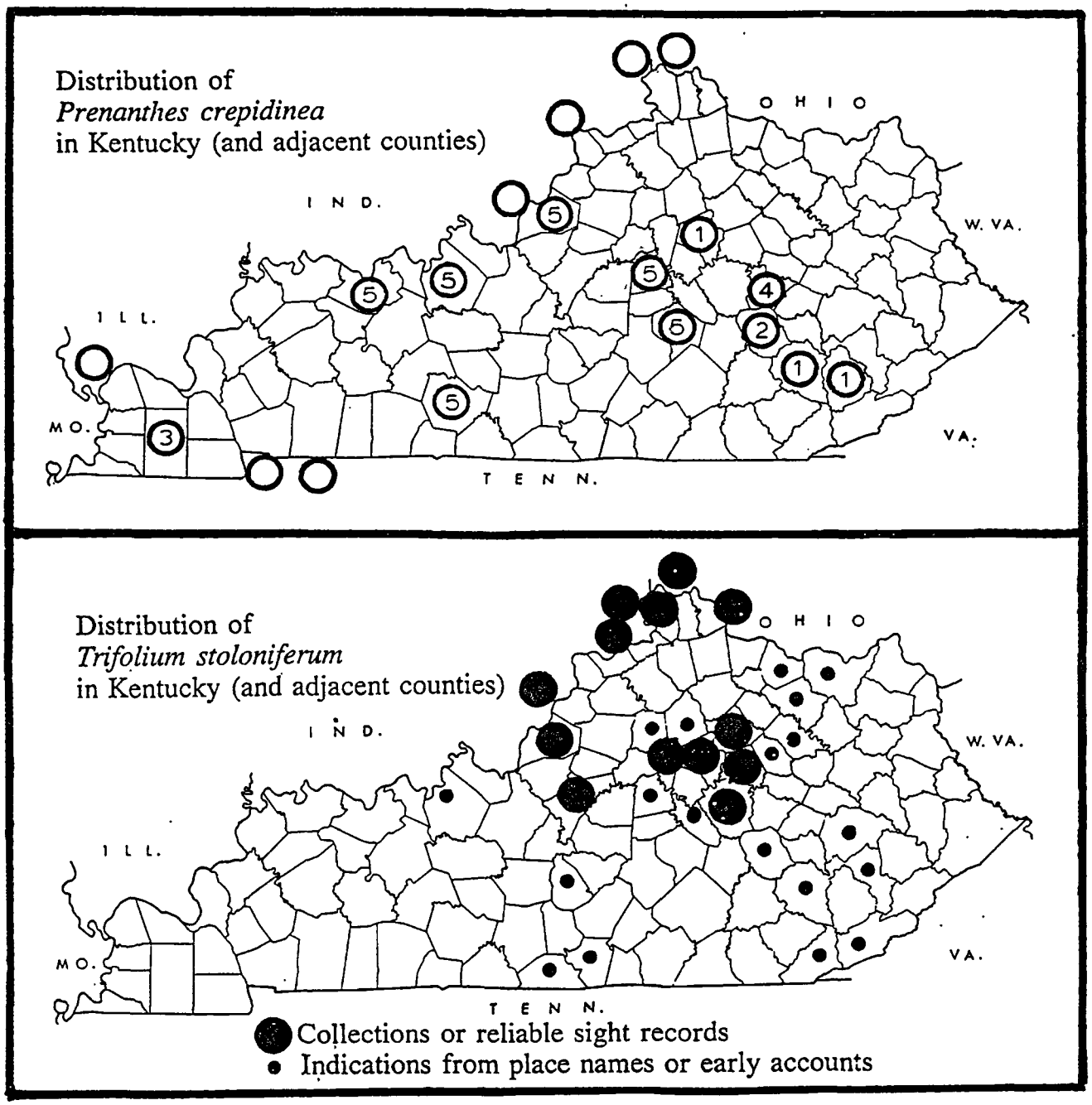

Figure A2.
(a) Distribution of *Prenanthes crepidinea* in Kentucky.
1 = J. Campbell collections at KY; 2 = D. Noe coll. at BEREA; 3 = R. Athey coll. at MEMPHIS?; 4 = J. Campbell sight record; 5 = C.S. Rafinesque colls. at PH. Data from adjacent counties in other states are from published atlases and Natural Heritage Programs.
(b) Distribution of *Trifolium stoloniferum* in Kentucky.
Large dots are from collections or recent sight records (Kentucky State Nature Preserves Commission). Small dots are historical indications from place names or documentary accounts.

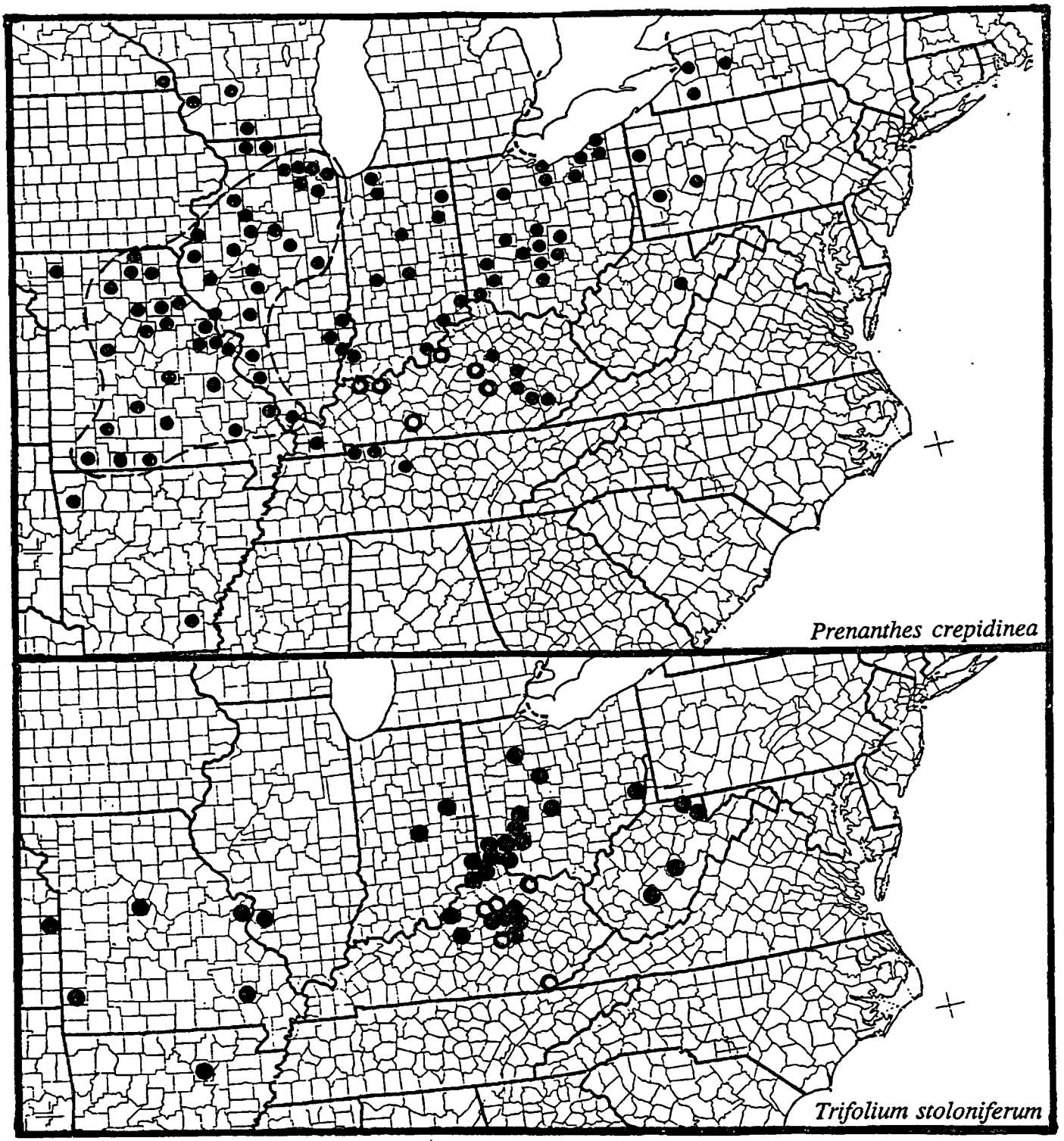

Figure A3.
(a) Total distribution of *Prenanthes crepidinea*. Data are from published atlases and Natural Heritage Program databases. Open dots are from Rafinesque's notes on a collection (PH). Dashed line indicates only area where this species is not regarded as rare.
(b) Total distribution of *Trifolium stoloniferum*. Data are from Brooks (1983) and Natural Heritage Programs. Open dots are based on good indications from historical accounts.

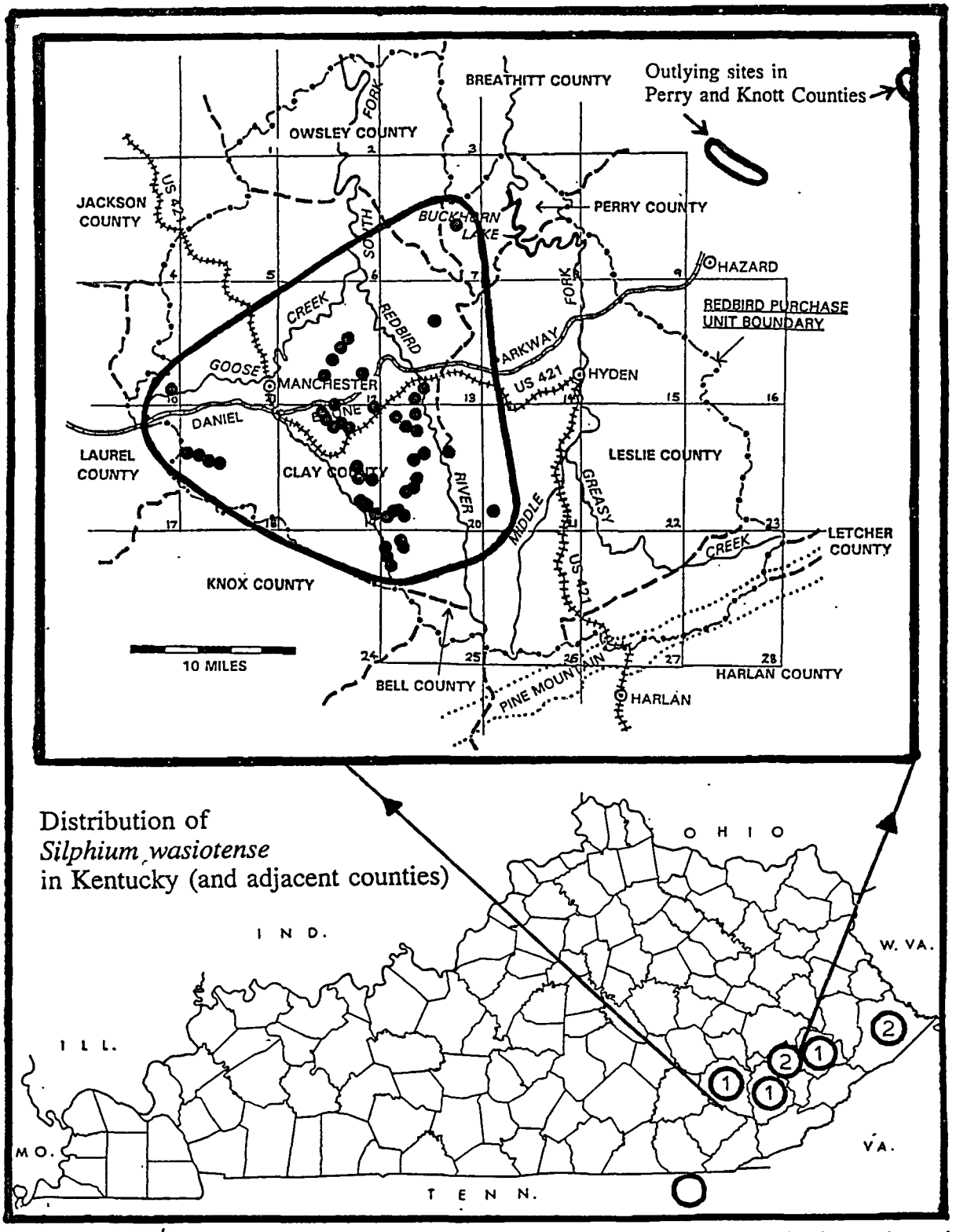

Figure A4. Distribution of *Silphium wasiotense* in the Redbird Ranger District and nearby.
Figure A5. Distribution of *Silphium wasiotense* in Kentucky.
1 = collections at KY.; 2 = collections of M. Medley at DHL.

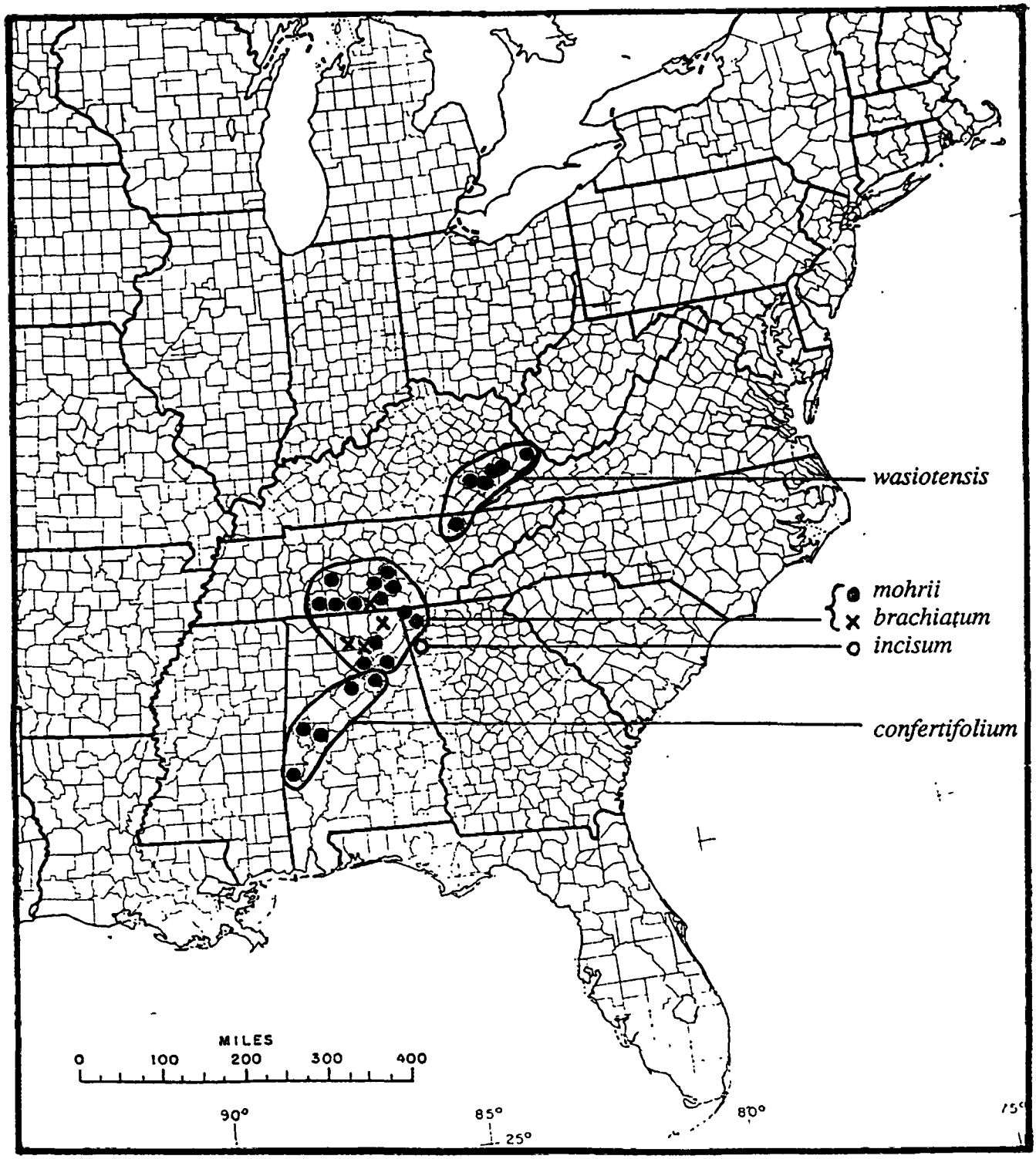

Figure A6. Total distribution of the *Silphium brachiatum* group and the *S. mohrii* group. Data are from published atlases and Natural Heritage Program databases, mostly put together already by Medley (1989).

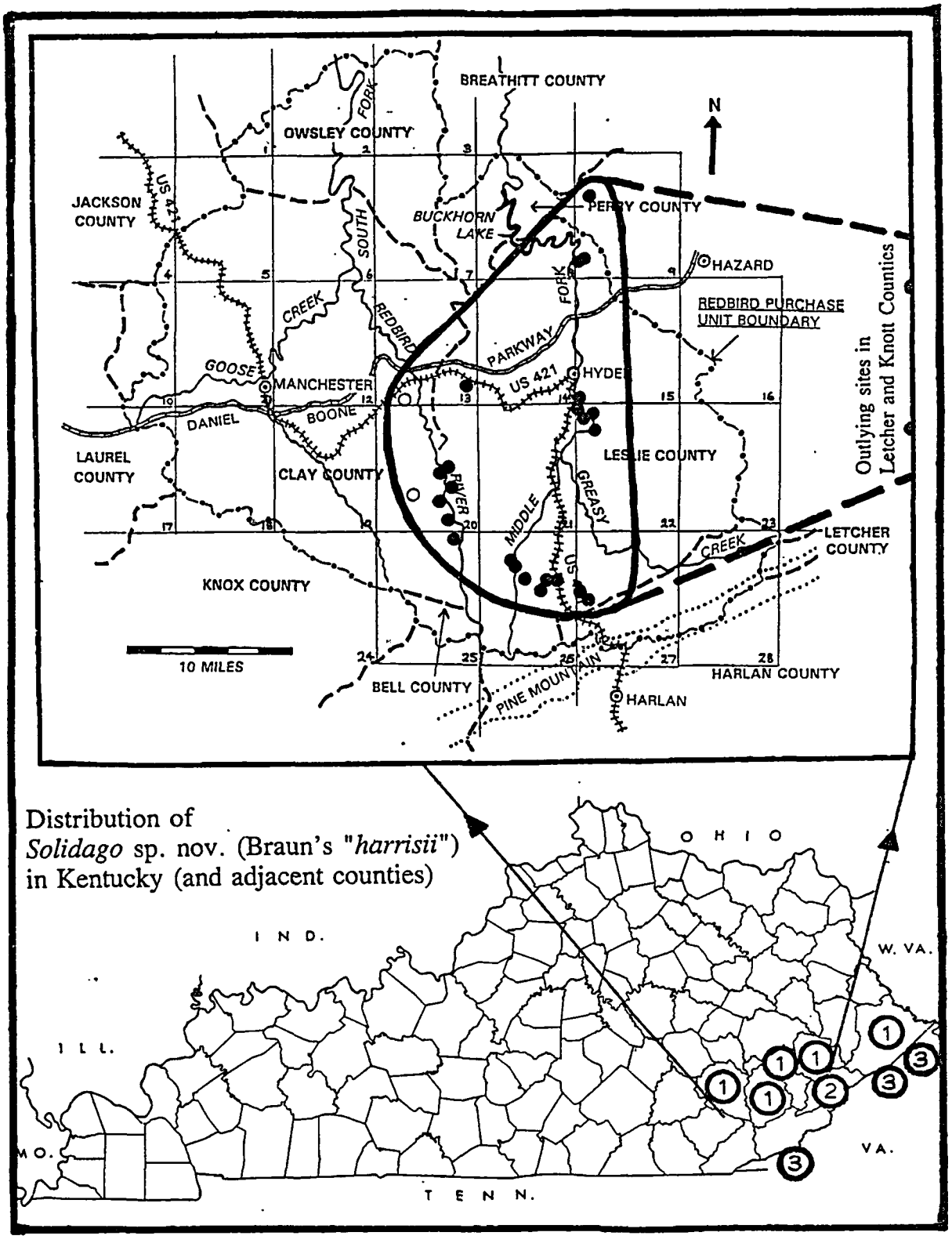

Figure A7. Distribution of *Solidago* sp. nov. in the Redbird Ranger District.
Figure A8. Distribution of *Solidago* sp. nov. in Kentucky.
1 = collections at KY; 2 = collections at EKU; 3 = collections at VPI (T.F. Wieboldt).

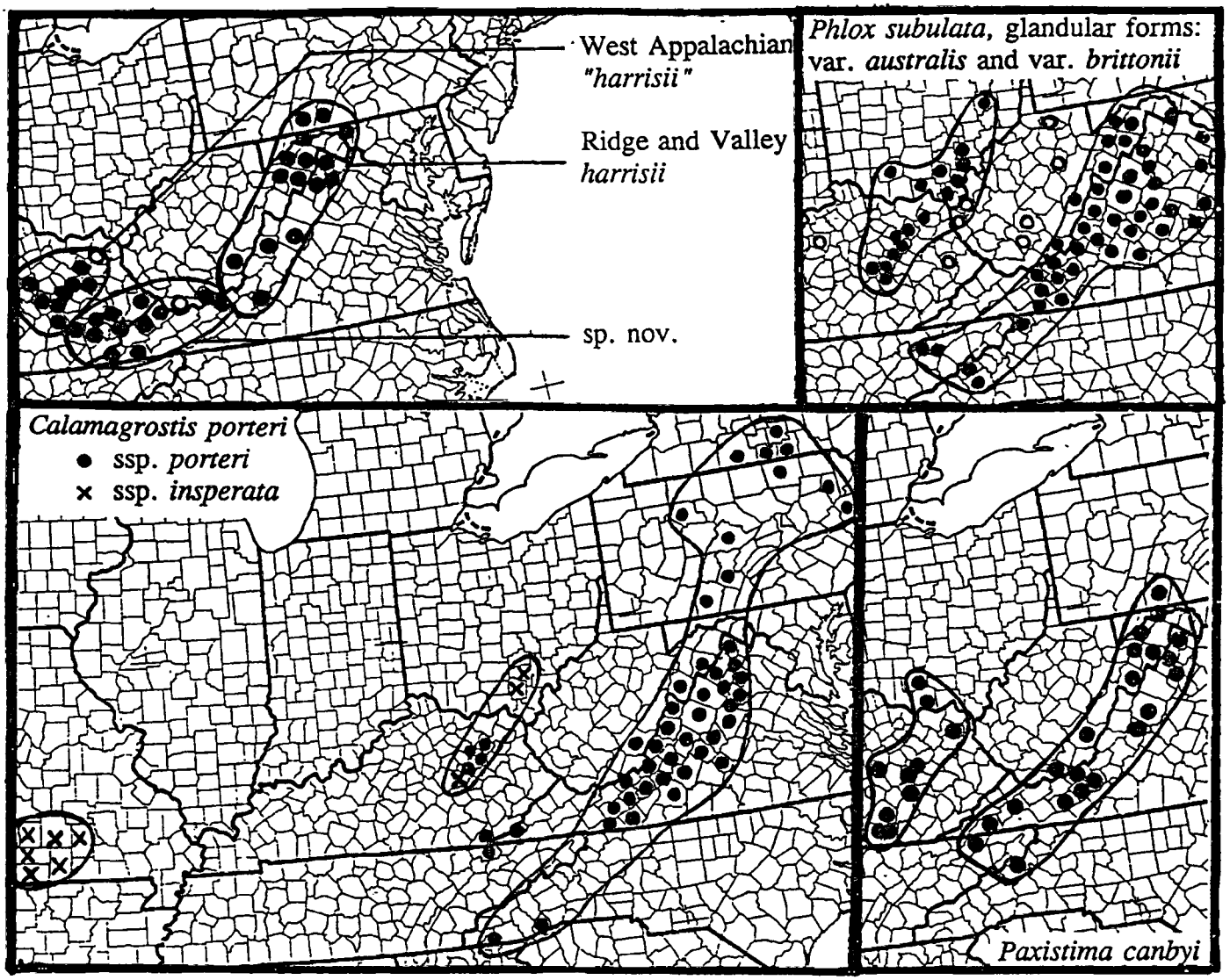

Figure A9.

(a) Total distribution of *Solidago* sp. nov. and *S. harrisii*. Data are from published atlases and Natural Heritage Program databases (see also sources cited in text), with new Kentucky data from Campbell et al. (1989, 1991, 1992, 1993). The open dots are based on specimens that need reexamination: E.L. Braun's collection of "*harrisii*" from Carter Co., KY (missing from US); and a collection from McDowell Co., WV, seen by R. Bartgis (West Virginia Univ.).

(b) Total distribution of *Phlox subulata* var. *australis* and var. *brittonii* (the glandular varieties). Data are from published atlases and floras, interpreted using the treatment of Wherry (1955). Open dots are questionable records, or probably escapes from cultivation.

(c) Total distribution of *Calamagrostis porteri*, ssp. *porteri* and ssp. *insperata*. Data are from published atlases and Natural Heritage Programs, largely put together already by Greene (1980), with new data from Campbell et al. (1989, 1992) and G. Yatskievitch (pers. comm.)

(d) Total distribution of *Paxistima canbyi*. Data are from published atlases and Natural Heritage Program databases, largely put together already by W. Stoutamire (pers. comm.).

Appendix B: Notes on the Flora and Vegetation of Pine Mountain

These notes were compiled by J. Campbell, with the assistance of M. Evans and M. Medley. The main sources were Braun (1935, with her A horizon pH data; 1945; and her collection catalogue), Harker et al. (1979), and more recent field notes and collections of Ben Begley, Julian Campbell, Elwood Carr, Marc Evans, Max Medley, Allen Risk and others (data mostly available at KSNPC). In the following lists, species with asterisks (*) are known only from the crest or southeastern side of Pine Mountain, mostly on sandstone. Species that appear localized to small sections of Pine Mountain are coded as follows (after common names).
B/H/L/P = Bell Co./Harlan Co./Letcher Co./Pike Co.
@ = Pine Mt. State Pk. in B; or Pine Mt. Settlement School area in H;
or Bad Branch in L; or the Breaks area in P.
elb/mem = records from Braun (1935, 1943, collection catalogue) or M.E. Medley (pers. comm.).

Listed Plant Species

Adlumia fungosa, Allegheny Vine; L(1940s F.T. McFarland coll.)
**Aster acuminatus*, Whorled Aster; L@mem
**Baptisia tinctoria*, Yellow Wild Indigo
**Bartonia virginica*, Screwstem; L(M. Evans)
**Botrychium matricariifolium*, Matricary Grape Fern; L@
**Boykinia aconitifolia*, Brook Saxifrage; L@/P@
**Calamagrostis cinnoides*, Cinna-like Reed Grass; B@/H(Banks Branch)
**Carex leptalea* ssp. *harperi*, Little Tussock Bog Sedge; H/L?(M. Evans)
Carex stricta (var. *stricta*), Big Tussock Bog Sedge; H@ and nearby
Castanea pumila, Chinquapin; formerly frequent?
Chrysosplenium americanum, Golden Saxifage; H@
**Cleistes divaricata* var. *bifaria*, Spreading Pogonia
**Calopogon tuberosus*, Grass Pink; Lelb
Corallorhiza maculata, Spotted Coral-root; H@ and nearby
**Corydalis sempervirens*, Pale Corydalis
?*Cypripedium parviflorum*, Small Yellow Lady's Slipper; H@/Lelb
**Gentiana decora*, Showy Gentian
**Glyceria melicaria*, Bog Manna Grass; H
**Hexastylis heterophylla*, Little Brown Jug; L@ and elsewhere?
**Houstonia serpyllifolia*, Thyme-leaved Bluets; B(Pineville)/L@
Hydrophyllum virginianum, Virginia Waterleaf; L?elb
**Leucothoe recurva*, Fetterbush; L@
Liparis loesellii, Bog Twayblade; H@
**Listera smallii*, Small's Twayblade
**Orontium aquaticum*, Golden Club; L, Elkins Branch
Podostemum ceratophyllum, Riffleweed; P@
**Pogonia ophioglossoides*, Rose Pogonia; L@
**Saxifraga michauxii*, Michaux's Saxifrage; L@
?**Saxifraga micranthidifolia*, Brook Lettuce; H?mem

**Silene ovata*, Ovate-leaved Catchfly; Bmem
Solidago curtisii, Curtis's Goldenrod
**Solidago roanensis*, Roan Mountain Goldenrod
**Solidago squarrosa*, Squarrose Goldenrod; L(Elkins Branch, A. Risk)
Spiraea alba, Meadow Sweet; P@
Thuja occidentalis, Northern White Cedar; P@
Trichomanes boschianum, Filmy Fern; P@?(Levy et al. 1983)
Woodsia scopulina var. *appalachiana*, Appalachian Cliff Fern; B@

Other Plants of Interest

**Acer pennsylvanicum*, Striped Maple
Anemone quinquefolia var. *q.*, Wood Anemone; frequent?
Arabis lyrata, Lyrate Rock Cress; P@mem
**Arisaema atrorubens* ssp. *quinatum*, Quinate Jack-in-the-Pulpit; L@elb/mem
**?Asarum canadense* var. *acuminatum*, Acuminate Wild Ginger; B@mem
**Aureolaria pedicularia* var. *austromontana*, Annual Yellow Foxglove; L?elb/mem
**Carex bromoides*, Medium Tussock Bog Sedge; H(Banks Branch)
Cladrastis kentukea, Yellowwood; WBelb
Disporum maculatum, Spotted Mandarin; H@/Lelb
Isoetes engelmannii, Quillwort
Lonicera dioica, Yellow Honeysuckle; Belb
**Lycopodium inundatum*, Bog Clubmoss; H(Banks Branch)
Lysimachia tonsa, Mountain Loosestrife; frequent?
Magnolia fraseri, Fraser's Magnolia; frequent
**Oenothera perennis*, Sundrops, glabrescent form; L@mem(coll. at KSNPC)
**Oxalis montana*, White Wood Sorrel; L@
**Phaseolus polystachios*, Wild Bean; H?/L?elb
Philadelphus hirsutus, Hairy Mock-orange; Belb
Platanthera lacera, Ragged Orchid; H@
**Rhododendron catawbiense*, Mountain Rose-bay; frequent
**Robinia hispida* (vars. *rosea*-B/H/L? and *hispida*-P), Rose-acacia
Rubus odoratus, Purple-flowering Raspberry (frequent)
Solidago arguta ssp. *bootii*, Boot's Goldenrod
Solidago patula var. *p.*, Swamp Goldenrod; H@(NW base)/L(Elkins Branch)
**Stipa avenacea (Piptochaetium a.)*, Porcupine Grass; B@
**Trichomanes intricatum*, Appalachian Filmy Fern Gametophyte; B@(Farrar 1985)
Viola tripartita (var. *glaberrima*), Truncate Yellow Violet; H@
Waldsteinia fragarioides ssp. *doniana*, Barren Stawberry; Belb
Xyris torta, Yellow-eyed Grass; H@(NW base)

Gaylussacia ursina was reported from Pine Mountain (Bell Co.) by Kearney (1893-94), but Fernald (1941) found that this was based on a misidentification of *Lyonia ligustrina* var. *salicifolia* (which should probably be combined under var. *foliosifolia*). Other records that need checking, both from Bell County, include *Ulmus serotina* (Braun 1943, coll. at US?), and *Polygala nuttallii* (coll. by E. Carr sent to Univ. of Louisville according to M. Medley).

The majority of rare species present on Pine Mountain are northern or high elevation Appalachian species, here near the southern or western edge of their range. A few southern or mainly Coastal Plain species are found near the northern edge of their range. They include *Cladrastis kentukea, Philadelphus hirsutus, Stewartia ovata, Baptisia tinctoria, Gillenia trifoliata, Solidago arguta* ssp. *bootii, Orontium aquaticum, Cleistes divaricata* var. *bifaria, Stipa avenacea* and *Calamagrostis cinnoides*. Most of these may be more frequent towards the south end of Pine Mountain in the Cumberland River drainage (a notable exception would be M. Medley's record of *Vitis rotundifolia* at the Breaks). They mostly occur in open rocky or grassy woods or streamheads, in contrast to the northern/Appalachian species, which are mostly concentrated along ravines and other moist, cool sites. Some other streamhead species have wider ranges, but mostly to the east (Coastal Plain), south and north of Kentucky--*Isoetes engelmannii, Bartonia virginica, Carex leptalea, C. bromoides, C. stricta, Xyris torta* and *Platanthera lacera.*

The following notes summarize the zonation of vegetation, from northwest slope to crest to southeast slope, noting predominant vegetation types and typical rare species.

A. River corridors. There are only two streams that traverse Pine Mountain.
(1) Russell Fork of Big Sandy River, at the north end, in Pike County. The Russell Fork ravine, known as "The Breaks", has high cliffs and rocky river banks. Kentucky rarities found here include *Thuja occidentalis* (cliffs), *Arabis lyrata* (cliffs), *Spiraea alba* (low ledges), *Boykinia aconitifolia* (rocky banks) and *Podostemum ceratophyllum* (rocky rapids). A southern species, *Vitis rotundifolia*, was reported by M. Medley (pers. comm.). On the uplands several other rare species have been found, including *Robinia hispida* var. *hispida* and *Cleistes divaricata* var. *bifaria.*
(2) Cumberland River, at Pineville, in Bell County. This area has been greatly altered by the town of Pineville, flood control structures and road building. The only rare plant reported from this area may be *Houstonia serpyllifolia* (Kearney 1893-94).

B. Open bottoms and seeps on the northwest side. The grounds of the Pine Mountain Settlement School are well known for their patches of *Chrysosplenium oppositifolium*, growing on mossy banks of small seeping streams. There is also an unusually wet meadow of about 1/4 acre (300 x 30 ft), with a remarkable assemblage of regionally rare species. These include *Rumex cf. altissimus, Solidago patula, Xyris torta* and *Carex stricta*. Common species in this meadow include *Osmunda cinnamomea, Panicum clandestinum* and *Carex* spp. (especially *C. stricta*, also *C. scoparia*). Other species here include *Polygonum sagittatum, Linum striatum, Cicuta maculata, Oxypolis rigidior, Aster umbellatus, Solidago rugosa, Eupatorium fistulosum, Verbesina alternifolia, Juncus effusus, J. marginatus, J. tenuis, Scirpus polyphyllus* and *Rhynchospora* sp., *Sphagnum palustre* and *S. lescurii*. Woody species are invading the meadow, especially the exotic, *Rosa multiflora*, which B. Begley (pers. comm.) has attempted to cut back; others include *R. palustris, Aronia melanocarpa, Cephalanthus* and *Sambucus canadensis*. In a bottomland field elsewhere on the school grounds, *Platanthera lacera* and *Liparis loeselii* have been found (J. MacGregor, pers. comm.).

C. Bottomland forest on the northwest side. Braun (1935) noted that the forest on the valley floor was dominated by *Fagus*, with frequent *Tsuga* and lesser amounts of *Tilia, Acer* spp., *Liriodendron, Magnolia* spp., *Fraxinus americana, Q. rubra, Nyssa, Juglans cinerea*, etc. The shrub layer had frequent *Cornus florida, Carpinus, Asimina* and locally *Rhododendron maximum*. She noted that this was a widespread forest type in Appalachian Kentucky but "it, however, is seldom represented by more than the merest fragments." She also noted that *Q. alba* was locally codominant with *Fagus*; additional species in the understory included *Ilex opaca* and *Amelanchier arborea*. Today, there is virtually no mature *Fagus* or *Fagus-Q. alba* forest on the bottomland. Most of the valley bottoms are cleared, and the successional forest patches are dominated by *Liriodendron*, though shade tolerant species like *Tsuga, Fagus, Lindera* and *Laportea* are frequent in less disturbed patches.

D. Lower slope forest on the northwest side. Braun (1935) noted that these slopes (pH 6.3) were covered with forest locally dominated by *Fagus*, and elsewhere with a mixture of *Fagus, Liriodendron, Acer saccharum, Aesculus* and *Tilia*. The herb layer was similar to mid-slopes, but with more *Phlox divaricata, Meehania* and *Bignonia*, and *Disporum maculatum* was absent. On low rocky ridges and sandstone slumps (pH 5.5), the forest had much *Tsuga, Castanea* and *Q. montana* in addition to *Fagus*; *Kalmia* and *Vaccinium vacillans* were common shrubs, and the herb layer was sparse. On drier slopes without sandstone influence, *Q. alba* was locally dominant instead, with frequent *Fagus, Tsuga, Liriodendron, Castanea, Acer* spp. and other *Quercus* spp. Today, these lower slopes generally have younger forest dominated by *Liriodendron*, with a variety of associates, depending on topographic position. Kentucky rarities found in these lower slope forests are *Corallorhiza maculata* (on a low bench with *Tsuga*), *Viola tripartita* var. *glaberrima* and *Solidago curtisii*.

E. Forest on limestone or calcareous colluvium. The zone along limestone outcrops and on limestone colluvium is at ca. 2000-2500 feet. Braun (1935) noted that most of the northwest slope was covered by deciduous "mixed mesophytic" forest dominated by *Acer saccharum, Tilia* spp., *Aesculus flava* and *Liriodendron* (less on higher slopes). Other species included *Quercus rubra* and *Castanea*, with lesser amounts of *Carya* spp., *Magnolia acuminata, Juglans nigra, Fraxinus [americana?], Ulmus [rubra?]* and a variety of common shrubs and vines. *Fagus* was notably absent at 2000-2200 feet a.s.l. In general, the herb layer was "more varied and luxuriant than encountered elsewhere" on Pine Mountain, with many ferns, Liliaceae and Magnoliidae. It included a few Kentucky rarities--*Disporum maculatum, Hydrophyllum virginianum* and *Panax quinquefolius*. On more convex slopes [with less calcareous material?], *Castanea* was locally dominant; *Liriodendron* and *M. acuminata* were more frequent; *Tilia* was less frequent, and *Aesculus* absent. Today, this distinct calcareous zone has forest of uneven stature (canopy trees 24-40 inches dbh), with abundant *Acer saccharum* and frequent *Quercus rubra*. Distinctive features include locally abundant *Aristolochia macrophylla* in tree fall gaps and openings near cliffs.

Near the limestone cliffs, Braun (1935) noted that a somewhat subxeric forest occurred, with distinctive shrubs including *Ostrya, Cercis, Celastrus* and *Rubus odoratus*, and distinctive herbs including *Elymus hystrix, Thalictrum dioicum, Polygala senega, Euphorbia corollata, Taenidia integerimma, Solidago ulmifolia* and *S. sphacelata*. She did not record the

characteristic trees of subxeric calcareous sites in Kentucky, though *Q. muhlenbergii* and *Juniperus* are scattered at low density on Pine Mountain. The usual species characteristic of limestone cliffs have been found, including *Asplenium rhizophyllum, Cystopteris bulbifera, Aquilegia canadensis, Heuchera villosa, Arabis laevigata*, etc. No really rare species have been found here, though a few species typical of calcareous slopes and cliffs were reported by Braun (1943, and collections) from Bell County--*Cladrastis kentukea* (also Whitley Co.), *Philadelphus hirsutus, Waldsteinia fragarioides* ssp. *doniana* and *Ulmus serotina* ("n[ea]r Pineville, a record that needs checking).

F. Upper slope forest, above the limestone. Braun (1935) noted that the forest here was similar to that on the limestone below, except that *Castanea, Magnolia acuminata* and *Oxydendrum* were more abundant; also present were *Prunus serotina* and *Acer pennsylvanicum*. Today, on fertile sandstone colluvium the herb layer is still remarkably luxuriant. Frequent species include *Liriodendron* (dominant), *Quercus rubra, Acer saccharum, Hydrangea, Asarum, Caulophyllum, Astilbe, Thaspium barbinode, Solidago cf. flaccidifolia, Disporum lanuginosum, Smilacina racemosa*, etc. The composition is similar to mesic sites on lower slopes along major rivers in the Rugged Eastern Area (for example, the Middle Fork Corridor).

G. The sandstone ridgeline. The ridgeline is a heterogeneous mixture of vegetation types, ranging from xeric rocky crests, to mesic saddles. Braun (1935) described areas of bare sandstone and stunted forest. Intermixed with the open forest of *Pinus* spp., *Q. montana, Betula lenta, Amelanchier, Clethra*, etc., these were dense thickets of ericaceous shrubs, including *Rhododendron catawbiense, R. maximum, Kalmia, Gaylussacia baccata* and *Vaccinium* spp. She also collected the rare *Robinia hispida* (var. *rosea*?). In open grassy vegetation around the rocks, she noted *Andropogon scoparius, Danthonia sericea, Chrysopsis graminifolia, Solidago odora, Aster solidagineus* and *A. surculosus*. Today, more mature areas are generally dominated by *Quercus rubra* (occasionally to 12-32 inches dbh) and *Acer saccharum* (generally as subcanopy), or, on drier sites, by *Q. montana* with much *Kalmia* in the shrub layer. Other frequent species included *Q. alba, Carya glabra, Magnolia fraseri, Rhododendron maximum*, etc. There is also extensive younger (often burned?) mesophytic forest dominated by *Liriodendron*, with much *Acer rubrum, Sassafras* and, in the herb layer, *Amphicarpaea*. Other frequent species include *Pyrularia, Solidago cf. flaccidifolia, S. arguta, Prenanthes altissima*, etc. Rare species that have been found on the ridgeline, especially in more open areas, include *Robinia hispida, Baptisia tinctoria, Gentiana decora, Bartonia virginica, Lysimachia tonsa, Solidago arguta* ssp. *bootii, Cleistes divaricata* var. *bifaria*, and on sandstone outcrops, *Woodsia scopulina, Corydalis sempervirens* and *Rhododendron catawbiense*.

H. Dry summits, ridges and slopes on the southeast side. On some rocky crests and cliffs (pH 3.9-4.0), Braun (1935) noted dense shrubby heaths, with frequent *Kalmia, Vaccinium corymbosum, Gaylussacia, Rhododendron calendulaceum* and *R. maximum*, plus a ground layer of *Gaultheria, Epigaea* and *Galax*. In forest on deeper sandstone soil (pH 3.9-4.8), *Pinus rigida, P. virginiana* or *P. echinata* (at lower elevations) were dominant, or locally *Quercus montana*, with lesser amounts of *Q. coccinea, Q. velutina, Q. alba, Castanea dentata, Nyssa* and *Oxydendrum*. The understory included *Diospyros, Sassafras, Acer rubrum, Amelanchier* and *Magnolia fraseri*. The shrub layer included *Gaylussacia, Vaccinium* spp., *Aronia melanocarpa,*

Rhus copallina, and, at lower elevation, *Castanea pumila*, which has now become very rare. Another Kentucky rarity, found in 1979 at Bad Branch on clifftops around the gorge, is *Leucothoe recurva*. The general absence of xerophytic oaks--*Q. marilandica* and *Q. stellata*--is remarkable. However, *Q. marilandica* was found by Harker et al. (1979) to be frequent in the *Quercus-Pinus* ecotone on Rocky Face Mountain, a southern outlier of Pine Mountain.

On less extreme slopes (pH 4.3-4.9), including lower slopes on shale, the forest was dominated by *Q. montana* or *Castanea dentata*, with lesser amounts of *Pinus* spp., other *Quercus* spp., *Liriodendron, Acer rubrum*, etc. The shrub layer included *Kalmia, Rhododendron maximum, R. calendulaceum, Vaccinium stamineum* and *Castanea pumila*, which was relatively common here. This vegetation can grade down into the forest of gullies or "troughs" (see below). A Kentucky rarity in this forest was *Gentiana decora* (*G. villosa* was also present but less restricted to acid sandy soils).

In places [especially after fire or chestnut blight?], the forest was grassy and savanna-like (pH 4.1), with a herb layer dominated by *Andropogon scoparius* and *Sorghastrum*, together with *Pteridium, Danthonia* spp., *Aletris, Hypoxis, Scleria triglomerata, Tephrosia virginiana, Lespedeza* spp., *Desmodium* spp., *Clitoria, Polygala curtisii, Ascyrum, Viola pedata, Helianthus* sp., *Coreopsis major, Chrysopsis* spp., *Eupatorium rotundifolium* (var. *lanceolatum*), *Solidago odora, S. bicolor* and *Aster* spp. (*solidagineus, linearifolius, surculosus, patens*). Kentucky rarities found in this grassy vegetation included *Calopogon tuberosus, Cleistes divaricata* var. *bifaria, Baptisia tinctoria, Aureolaria pedicularia* var. *austromontana* and, "on almost bare rock", *Corydalis sempervirens*. There are few recent records of these rare species, except perhaps the *Baptisia* and *Corydalis*.

I. Small gullies and saddles high on the southeast side. Braun (1935) noted that in relatively mesic "troughs" (pH 5.5-6.7), the forest was dominated by *Castanea, Liriodendron* and *Quercus* spp. (*montana, rubra, alba*), with lesser amounts of *Carya glabra, Fagus, Acer rubrum, Juglans nigra, Tilia, Magnolia acuminata, Betula lenta* and *Nyssa*. The understory included *Cornus florida, M. fraseri, A. pennsylvanicum*, etc. The varied shrub layer included *Pyrularia, Hamamelis, Lindera, Clethra, Rhododendron maximum, R. cumberlandense, Viburnum acerifolium, Hydrangea, Rubus allegheniensis, Vitis aestivalis* and *Aristolochia macrophylla*. The herb layer was luxuriant in places (especially at higher elevations), with many ferns (especially along streamheads, as noted below). A few relatively basiphilous species were present (*Disporum maculatum, Thalictrum dioicum, Asclepias quadrifolia*). Kentucky rarities included *Disprorum maculatum, Cypripedium parviflorum#, Phaseolus polystachios, Panax quinquefolius, Ascelpias exaltata (phytolaccoides), Solidago roanensis* (var. *monticola*) and *Lysimachia tonsa#* (#noted in the transition to ericaceous shrubbery, pH 4.4). Two other rare species may be expected in such habitat, especially near sandstone outcrops, but the few records from Pine Mountain have little or no habitat data--*Adlumia fungosa* and *Silene ovata*.

J. Lower slopes on southeast side. Braun (1935) noted forest varying from *Quercus-Castanea* or *Q. alba-Fagus* on drier slopes, to *Fagus-Q. alba-Acer rubrum* or *Fagus-Liriodendron-Tilia* on more north-facing slopes.

K. Streamheads and seeps on the southeast side. Braun (1935) and others have noted the following species on wetter ground at such sites: *Osmunda cinnamomea, O. regalis, Thelypteris noveboracensis, Anemone quinquefolius, Ranunculus hirsutus, Boehmèria, Apios tuberosa, Polygonum sagittatum, Impatiens capensis, Viola triloba* (glabrate), *V. cucullata, V. tripartita, Oxypolis rigidior, Phlox maculata, Chelone glabra, Mimulus alatus, Lobelia cardinalis, Eupatorium fistulosum, Solidago rugosa (var. aspera?), Aster prenanthoides, Senecio aureus, Sagittaria sp., Clintonia, Lilium canadense, Platanthera* sp., *Juncus effusus, Luzula acuminata, Scirpus* sp., *Eleocharis* sp., *Carex stipata, C. prasina, C. blanda, Glyceria* spp. Braun (1935) noted that the open forest along these streamheads was usually dominated by *Acer rubrum*, with some thickets of *Rhododendron maximum*. Kentucky rarities found in some of these areas include *Isoetes engelmannii, Lycopodium inundatum* (at Banks Branch quarry), *Orontium aquaticum* (at Elkins Branch swamp), *Pogonia ophioglossoides* (in *Sphagnum* patches at Bad Branch), *Listera smallii* (in *Rhododendron* thickets), *Carex leptalea, C. stricta, C. bromoides, Glyceria melicaria* and *Calamagrostis cinnoides*.

The large sandstone outcrop, and adjacent quarry, at the head of Banks Branch is notable for the discovery of *Lycopodium inundatum* in Kentucky. The most abundant species in this 2-3 acre opening included *Andropogon glomeratus* (dominant on boggy ledges), *Aster surculosus, Gaylussacia baccata, Kalmia, Pinus virginiana* and *P. echinata*. Other species included *Osmunda cinnamomea, Platanthera ciliaris* (J. MacGregor, pers. comm.), *Calamagrostis cinnoides, Panicum microcarpon, Eupatorium rotundifolium* var. *ovalifolium, Viburnum cassinoides, Rhododendron maximum* and *Acer rubrum*. More mesic forest around the opening had frequent *Tsuga*, with much *Gaultheria* and *Mitchella* on the ground.

L. Sandstone ravines. Braun (1935) noted that the heads of these ravines had forest with frequent *Tsuga, Liriodendron, Quercus alba* and *Castanea*, with occcasional *Betula allegheniensis* and *Magnolia fraseri*. In the understory, *Rhododendron maximum* and *Kalmia* were abundant, together with *Pyrularia, Clethra, Acer pennsylvanicum, Euonymus americanus, Viburnum cassinoides*, etc. In contrast to the upper gullies or "troughs", the herb layer was sparser [on acid infertile soils?], with *Thelypteris noveboracensis, Anemone quinquefolia, Chimaphila maculata, Viola rotundifolia, Goodyera pubescens*, etc.

In larger gorges, a more mesophytic *Tsuga* forest occurred, together with frequent *Liriodendron, Betula allegheniensis* and *Acer rubrum*, and generally lesser amounts of *Castanea* and *Quercus* spp. Other tree species included *Fagus, Magnolia* spp., *Oxydendrum*, plus occasional *Tilia* and *Aesculus*. The shrub and herb layer contained species typical of *Tsuga* or *Tsuga*-hardwood forest, but was dominated by *Rhododendron maximum* near some streambanks. Along sandstone cliffs were found the usual characteristic species--*Heuchera parviflora, Silene rotundifolia, Asplenium* spp., etc. Only on more clayey [shaley?], north-facing slopes did the dominance locally shift--to *Acer saccharum, Fagus* and *Q. alba*, with more ferns and tall herbs. In the secondary forest of Bad Branch, Harker et al. (1979) found that the original dominance of *Tsuga* had shifted to *Liriodendron*, though with *Betula* spp. and *Tsuga* still abundant.

Several Kentucky rarities have been found in such ravines, mostly at Bad Branch by Braun and others. These include *Hexastylis "virginica"* [all *heterophylla*?], *Ranunculus*

allegheniensis, Aster acuminatus, Arisaema atrorubens ssp. *quinatum, Trillium undulatum* (open areas under *Tsuga* at Bad Branch), *Botrychium matricariifolium* (under *Rhododendron*), and several others found on mossy wet cliffs and streambanks at Bad Branch--*Cymophyllus fraseri, Circaea alpina, Oxalis montana, Boykinia aconitifolia, Houstonia serpillifolia, Saxifraga michauxii* and *Sanguisorba americana*. Also, *Saxifraga cf. micranthidifolia* has been reported as growing in streambeds, by the local name "bear lettuce" (M. Medley, pers. comm.). Two northern/Appalachian grasses are common along trails--*Poa alsodes* and *Danthonia compressa*.

Literature Cited

Braun, E.L. 1935. The vegetation of Pine Mountain. American Midland Naturalist 16:517-565.

Braun, E.L. 1943. An annotated catalogue of spermatophytes of Kentucky. John S. Swift Company, Cincinnati, Ohio.

Farrar, D.R. 1985. Independent fern gametophytes in the wild. Proceedings of the Royal Society of Edinburgh 86B:361-369.

Fernald, M.L. 1941. Another century of additions to the flora of Virginia. Rhodora 43:485-553, 558-630, 635-657.

Harker, D.F., L.R. Phillippe, R.R. Hannan and R.S. Caldwell. 1979. Eastern Kentucky coal field: preliminary investigations of natural features and cultural resources. Volume II: Ecology and ecological features of eastern Kentucky. Technical Report, Kentucky State Nature Preserves Commission.

Kearney, T.H. 1893-94. Notes on the flora of southeastern Kentucky. Bulletin of the Torrey Botanical Club 20:474-485; 21:260-266.

Levy, F., V. King, C. Ousley, T. Phillips and D. White. 1983. The ferns and fern allies of Pike County. Transaction of the Kentucky of Science 44:14-16.

Appendix C
Terrestrial Animal Lists

C1: Larger Land Snails of the Redbird Ranger District
C2: Amphibians of the Redbird Ranger District
C3: Reptiles of the Redbird Ranger District
C4: Breeding Birds of the Redbird Ranger District
C5: Mammals of the Redbird Ranger District

Appendix C1. Larger Land Snails of the Redbird Ranger District.

Species	Hubricht (1985) Map No.	Comments on Distribution and Abundance in SE KY
Allogona profunda	519	Restricted to Pine Mtn limestone belt.
Anguispira alternata	158	Uncommon; old logs.
Anguispira mordax	160	Fairly common; dry woods and rock outcrops.
Anguispira rugoderma	163	Rare; endemic to SE KY; in cool mature woodlands with many downed logs.
Discus cronkhitei	171	?
Discus nigrimontanus	170	Rare; outcrops and talus.
Discus patulus	174	Common under bark on dead and fallen trees.
Haplotrema concavum	336	Very common in woodlands.
Hendersonia occulta	001	Restricted to Pine Mtn limestone belt.
Mesodon appressus	446	Abundant; everywhere.
Mesodon clausus	458	Common in disturbed floodplain habitats.
Mesodon inflectus	439	Uncommon; floodplains.
Mesodon kalmianus	477	Uncommon; disturbed floodplain habitats.
Mesodon normalis	475	Uncommon; old woods.
Mesodon panselenus (?)	447	Possible on Pine Mtn.; only known from Pike Co.

Appendix C1 cont'd.

Species	Hubricht (1985) Map No.	Comments on Distribution and Abundance in SE KY
Mesodon rugeli	461	Abundant; everywhere.
Mesodon sayanus	467	Abundant; everywhere.
Mesodon thyroidus	466	Abundant; favors disturbed floodplains.
Mesodon wetherbyi (?)	448	Possible on Pine Mtn.; closest record is Pine Mtn in Whitley County.
Mesodon zaletus	449	Fairly common; old woods.
Mesomphix cupreus	244	Common; lower slopes and wooded floodplains.
Mesomphix inornatus	237	Common on wooded slopes.
Mesomphix perlaevis	238	Uncommon; woodlands.
Mesomphix rugeli	243	Apparently rare; old woods.
Pomatiopsis lapidaria	011	Uncommon; wet rock outcrops and seeps.
Stenotrema edvardsi	397	Common; acid woods, with hemlock.
Stenotrema fraternum	428	Uncommon; roadsides.
Stenotrema hirsutum	413	Common; dry woods.
Stenotrema stenotrema	406	Common; woodlands.
Succinea cf. *ovalis*	118	Uncommon; seepages, jewelweed stands.
Triodopsis albolabris	500	Common; woodlands.
Triodopsis anteridon	482	Uncommon; rock outcrops and dry disturbed woods.

Appendix C1 cont'd.

Species	Hubricht (1985) Map No.	Comments on Distribution and Abundance in SE KY
Triodopsis denotata	493	Uncommon but widespread.
Triodopsis dentifera (?)	514	Possible on Pine Mtn.; only known from Black Mtn at present time
Triodopsis hopetonensis	511	Rare; degraded roadsides and RR tracks.
Triodopsis tennesseensis	490	Common; everywhere.
Triodopsis tridentata	510	Common; upland woods.
Triodopsis vulgata	488	Uncommon and local in rocky woodlands.
Ventridens intertextus	316	Uncommon; dry acid woods.
Vitrinizonites latissimus	249	Rare; steep moist talus slopes high on Pine Mtn. in older forest.

Appendix C2. Amphibians of the Redbird Ranger District.

Frogs, toads and relatives

*Bufo americanus americanus**
American Toad

*Bufo woodhousii fowleri**
Fowler's Toad

*Hyla chrysoscelis**
Cope's Gray Treefrog

*Pseudacris brachyphona**
Mountain Chorus Frog

*Pseudacris crucifer crucifer**
Northern Spring Peeper

*Rana catesbeiana**
Bullfrog

*Rana clamitans melanota**
Green Frog

*Rana palustris**
Pickerel Frog

*Rana sylvatica**
Wood Frog

Scaphiopus holbrooki holbrooki
Eastern Spadefoot

Salamanders

*Ambystoma maculatum**
Spotted Salamander

*Ambystoma opacum**
Marbled Salamander

*Aneides aeneus**
Green Salamander

Appendix C2 cont'd.

Cryptobranchus alleganiensis alleganiensis
Eastern Hellbender

*Desmognathus fuscus fuscus**
Northern Dusky Salamander

*Desmognathus monticola**
Seal Salamander

*Desmognathus ochrophaeus**
Mountain Dusky Salamander

*Desmognathus welteri**
Black Mountain Salamander

*Eurycea cirrigera**
Southern Two-lined Salamander

*Eurycea longicauda longicauda**
Longtail Salamander

*Gyrinophilus porphyriticus duryi**
Kentucky Spring Salamander

*Hemidactylium scutatum**
Four-toed Salamander

Necturus maculosus maculosus
Mudpuppy

*Notophthalmus viridescens viridescens**
Red-spotted Newt

*Plethodon glutinosus**
Slimy Salamander

*Plethodon kentucki**
Cumberland Plateau Salamander

*Plethodon richmondi**
Ravine Salamander

Appendix C2 cont'd.

Plethodon wehrlei (a)
Wehrle's Salamander

Pseudotriton montanus diastictus
Midland Mud Salamander

*Pseudotriton ruber ruber**
Northern Red Salamander

Key to Appendix C2:

* - denotes species found on Redbird RD during 1991 and/or 1992 field seasons.

(a) - Wehrle's Salamander is included on the basis of a site in Letcher County just east of the DBNF proclamation boundary (the only Kentucky locality for the species).

Appendix C3. Reptiles of the Redbird Ranger District.

Lizards

*Eumeces anthracinus anthracinus**
Northern Coal Skink

*Eumeces fasciatus**
Five-lined Skink

Eumeces laticeps
Broadhead Skink

Scincella lateralis
Ground Skink

*Sceloporus undulatus hyacinthinus**
Northern Fence Lizard

Snakes

*Agkistrodon contortrix mokasen**
Northern Copperhead

Carphophis amoenus ssp.*
Worm Snake

*Coluber constrictor constrictor**
Northern Black Racer

*Crotalus horridus**
Timber Rattlesnake

*Diadophis punctatus edwardsii**
Northern Ringneck Snake

*Elaphe obsoleta obsoleta**
Black Rat Snake

*Heterodon platirhinos**
Eastern Hognose Snake

Lampropeltis getula nigra
Black Kingsnake

Appendix C3 cont'd.

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*Lampropeltis triangulum triangulum**
Eastern Milk Snake

*Nerodia sipedon sipedon**
Northern Water Snake

*Opheodrys aestivus**
Rough Green Snake

Pituophis melanoleucus melanoleucus (a)
Northern Pine Snake

Storeria dekayi ssp.*
Brown Snake

*Storeria occipitomaculata occipitomaculata**
Northern Red-bellied Snake

*Thamnophis sirtalis sirtalis**
Eastern Garter Snake

Virginia valeriae valeriae
Eastern Earth Snake

Turtles

*Apalone spinifera spinifera**
Eastern Spiny Softshell

*Chelydra serpentina serpentina**
Common Snapping Turtle

*Graptemys geographica**
Common Map Turtle

Sternotherus odoratus
Common Musk Turtle

*Terrapene carolina carolina**
Eastern Box Turtle

Key to Appendix C3:

* - denotes species found on Redbird RD during 1991 and/or 1992 field seasons.

(a) - The Northern Pine Snake is included on the basis of an old record from Harlan County and a sighting in the 1970's in Letcher County that is believed to be reliable. Both of these records are probably outside of the DBNF proclamation boundary but the Pine Snake remains a possibility for the Redbird District.

Appendix C4: Breeding Birds of the Redbird Ranger District.*

Species	Abundance	Habitat(s)
Green-backed Heron	uc	River/streambanks, ponds.
Wood Duck	uc	Rivers, streams and ponds.
Turkey Vulture	fc	Farmland; over woodlands.
[Sharp-shinned Hawk]	ra	Woodlands.
Cooper's Hawk	uc	Woodland edge; farmland.
Red-shouldered Hawk	fc	Wooded ravines.
Broad-winged Hawk	fc	Woodlands.
Red-tailed Hawk	uc	Farmland and woodlands.
American Kestrel	uc	Farmland and roadsides.
Ruffed Grouse	fc	Woodlands.
Wild Turkey	ra	Woodlands; wildlife openings.
Northern Bobwhite	uc	Farmland; wildlife openings.
Killdeer	uc	Farmland; settled areas.
[American Woodcock]	uc	Successional woodlands; openings.
Rock Dove	uc	Cities; farmland.
Mourning Dove	fc	Farmland; open woodlands.
[Black-billed Cuckoo]	ra	Woodlands.
Yellow-billed Cuckoo	uc	Woodlands.
Eastern Screech-Owl	fc	Woodlands; edges.
Great Horned Owl	uc	Woodlands; farmland.

Appendix C4 cont'd.

Species	Abundance	Habitat(s)
Barred Owl	uc	Wooded ravines; bottomland.
Whip-poor-will	fc	Woodlands; edges.
Chimney Swift	fc	Farmland; settled areas.
Ruby-throated Hummingbird	fc	Woodlands.
Belted Kingfisher	uc	Rivers and ponds.
Red-bellied Woodpecker	uc	Woodland edge; farmland.
Downy Woodpecker	co	Woodlands.
Hairy Woodpecker	fc	Woodlands.
Northern Flicker	fc	Woodland edge; farmland.
Pileated Woodpecker	fc	Woodlands.
Eastern Wood-Pewee	fc	Woodlands; edges.
Acadian Flycatcher	fc	Mesic/riparian woodlands.
Eastern Phoebe	co	Streambanks; woodland openings; clifflines.
Great Crested Flycatcher	uc	Woodlands; edges.
Eastern Kingbird	uc	Farmland.
Purple Martin	uc	Settled areas; farmland.
Northern Rough-winged Swallow	uc	Roadcuts; farmland.
Barn Swallow.	fc	Farmland.
Blue Jay	co	Woodlands; edges.
American Crow	co	Woodland edge; farmland.

Appendix C4 cont'd.

Species	Abundance	Habitat(s)
Common Raven	ra	Pine Mountain.
Carolina Chickadee	co	Woodlands.
Tufted Titmouse	co	Woodlands.
White-breasted Nuthatch	co	Woodlands.
Carolina Wren	co	Ubiquitous.
Blue-gray Gnatcatcher	co	Woodlands.
Eastern Bluebird	uc	Farmland; settled areas.
Wood Thrush	co	Woodlands.
American Robin	co	Farmland; settled areas.
Gray Catbird	fc	Woodland edge; settled areas.
Northern Mockingbird	uc	Farmland; settled areas.
Brown Thrasher	uc	Woodland edge; brushy areas.
Cedar Waxwing	uc	Pine/mixed woodlands.
European Starling	fc	Farmland; settled areas.
White-eyed Vireo	fc	Clearcuts; successional habitats.
Solitary Vireo	ra	Woodlands, especially Pine Mt.
Yellow-throated Vireo	fc	Sub-xeric woodlands.
Red-eyed Vireo	co	Woodlands.
Blue-winged Warbler	uc	Clearcuts; successional habitats.
Northern Parula	fc	Mesic/riparian woodland.

Appendix C4 cont'd.

Species	Abundance	Habitat(s)
Yellow Warbler	fc	Along streams; farmland.
Chestnut-sided Warbler	ra	Successional habitats.
Black-throated Green Warbler	uc	Wooded ravines with hemlocks.
Yellow-throated Warbler	fc	Pine/mixed woodlands.
Pine Warbler	uc	Pine/mixed woodlands.
Prairie Warbler	fc	Clearcuts; successional habitats.
Cerulean Warbler	uc	Mature mesic woodlands.
Black-and-white Warbler	fc	Sub-xeric woodlands.
American Redstart	fc	Riparian or bottomland forest.
Worm-eating Warbler	co	Woodlands.
Swainson's Warbler	ra	Thick/wooded ravines.
Ovenbird	co	Woodlands.
Louisiana Waterthrush	fc	Woodlands; streams.
Kentucky Warbler	co	Woodlands.
Common Yellowthroat	co	Woodland edge; clearcuts.
Hooded Warbler	co	Woodlands.
Yellow-breasted Chat	fc	Woodland edge; clearcuts.
Summer Tanager	fc	Sub-xeric woodlands.
Scarlet Tanager	co	Mesic woodlands.
Northern Cardinal	co	Woodland edge; farmland.

Appendix C4 cont'd.

Species	Abundance	Habitat(s)
Blue Grosbeak	uc	Farmland; edges.
Indigo Bunting	co	Ubiquitous.
Rufous-sided Towhee	co	Woodland edge; farmland.
Chipping Sparrow	co	Settled areas; farmland.
Field Sparrow	fc	Farmland; brushy edges.
Grasshopper Sparrow	ra	Farmland; reclaimed mines.
Song Sparrow	co	Along streams; edges.
Red-winged Blackbird	uc	Farmland; ponds.
Eastern Meadowlark	uc	Farmland; reclaimed mines.
Common Grackle	uc	Farmland.
Brown-headed Cowbird	fc	Farmland; woodland edge.
Orchard Oriole	uc	Farmland; successional habitats.
House Finch	uc	Farmland; settled areas.
American Goldfinch	co	Successional habitats.
House Sparrow	fc	Farmland; settled areas.

[1] Based on data generated by the Kentucky Breeding Bird Atlas (1985-1991).

Key to Appendix C4: Relative abundances: co -- common; fc -- fairly common; uc -- uncommon; ra -- rare.

[ ] -- indicates species documented within the immediate vicinity of, but not within, the Redbird Ranger District.

Appendix C5. Mammals of the Redbird Ranger District.

Marsupials

*Didelphis virginiana**
Virginia Opossum

Insectivores

*Parascalops breweri**
Hairy-tailed Mole

*Blarina brevicauda**
Short-tailed Shrew

Cryptotis parva
Least Shrew

*Sorex cinereus cinereus**
Masked Shrew

*Sorex dispar**
Rock Shrew

*Sorex fumeus fumeus**
Smoky Shrew

Sorex [= *Microsorex*] *hoyi**
Pygmy Shrew

Bats

*Eptesicus fuscus**
Big Brown Bat

*Lasionycteris noctivagans**
Silver-haired Bat

*Lasiurus borealis**
Red Bat

*Lasiurus cinereus**
Hoary Bat

Appendix C5 cont'd.

Myotis grisescens
Gray Bat

Myotis leibii [= *Myotis subulatus leibii*]*
Eastern Small-footed Bat

*Myotis lucifugus**
Little Brown Bat

*Myotis septentrionalis**
Northern Long-eared Bat

*Myotis sodalis**
Indiana Bat

*Pipistrellus subflavus**
Eastern Pipistrelle

*Plecotus rafinesquii**
Rafinesque's Big-eared Bat

Mice, rats, voles, and jumping mice

*Clethrionomys gapperi maurus**
Cumberland Redback Vole

*Microtus pennsylvanicus**
Meadow Vole

*Microtus pinetorum**
Pine Vole

*Mus musculus**
House Mouse

*Napaeozapus insignis**
Woodland Jumping Mouse

*Neotoma floridana magister**
Eastern Wood Rat

Appendix C5 cont'd.

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*Ochrotomys nuttallii**
Golden Mouse

*Peromyscus leucopus**
White-footed Mouse

*Peromyscus maniculatus nubiterrae**
Cloudland Deermouse

*Rattus norvegicus**
Norway Rat

*Reithrodontomys humulis**
Eastern Harvest Mouse

*Sigmodon hispidus**
Hispid Cotton Rat

*Synaptomys cooperi**
Southern Bog Lemming

*Tamias striatus**
Eastern Chipmunk

Larger rodents, lagomorphs and other herbivores

Castor canadensis
Beaver

*Glaucomys volans**
Southern Flying Squirrel

*Marmota monax**
Woodchuck

*Odocoileus virginianus**
White-tailed Deer

*Ondatra zibethicus**
Muskrat

Appendix C5 cont'd.

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*Sciurus carolinensis**
Gray Squirrel

*Sciurus niger**
Fox Squirrel

*Sylvilagus floridanus**
Eastern Cottontail

Sylvilagus transitionalis (a)
New England Cottontail

Carnivores

Canis latrans
Coyote

Felis concolor couguar
Eastern Cougar [probably extinct]

Lutra canadensis
River Otter

*Lynx rufus**
Bobcat

*Mephitis mephitis**
Striped Skunk

Mustela frenata
Long-tailed Weasel

Mustela nivalis
Least Weasel

Mustela vison
Mink

*Procyon lotor**
Raccoon

Appendix C5 cont'd.

Spilogale putorius
Spotted Skunk

*Urocyon cinereoargenteus**
Gray Fox

*Ursus americanus**
Black Bear

Vulpes vulpes
Red Fox

Key to Appendix C5:

* - denotes species found on Redbird RD during 1991 and/or 1992 field seasons.

(a) The New England Cottontail is included in the basis of a Harlan County record from the 1940's on Black Mountain (Barbour and Davis 1974), a recent skull from an unknown location that was brought to Frankfort by KDFWR District Wildlife Biologist Larry Short, and a recent Lincoln County record (S. Bonney ex J. Sole, KDFWR, pers. comm.).

Appendix D
Aquatic sampling data

D1:Freshwater mussels collected from Middle and South Fork Kentucky River drainages
D2: Fishes collected from drainages within the South Fork Kentucky River
D3: Fishes collected from drainages within the Middle Fork Kentucky River
D4: Map showing sites for aquatic sampling in Redbird District during 1992

Appendix D1. Freshwater mussels collected from Middle and South Fork Kentucky River drainages in the Redbird RD during 1992.

Species	South Fork	Middle Fork
Actinonaias ligamentina	L	W
Alasmidonta viridis	F	-
Amblema plicata	L	W
Anodonta grandis	W	-
Cyclonaias tuberculata	W	-
Elliptio dilatata	L	F
Epioblasma triquetra	W	W
Fusconaia flava	L	W
Lampsilis cardium	L	W
Lampsilis fasciola	F	F
L. siliquoidea	L	W
Lasmigona costata	W	-
Obovaria subrotunda	F	W
Pleurobema coccineum	L	-
Potamilus alatus	L	F
Ptychobranchus fasciolaris	L	F
Quadrula pustulosa	L	-
Tritogonia verrucosa	F	W
Truncilla truncata	W	-
Villosa iris	F	-
V. lienosa	F	W

Key to Appendix D1:

Specimens were L = living, F = fresh-dead, or W = weathered-dry.

Appendix D2. Fishes collected from drainages within the South Fork Kentucky River in the Redbird District during 1992 (number of samples in parentheses).

Species	Sexton (2)	Goose (9)	Red Bird (18)	South Fork & Tribs (11)
Campostoma anomalum	X	X	X	X
Cyprinella spiloptera	-	X	X	X
C. whipplei	X	X	X	X
Ericymba buccata	X	X	X	X
Erimystax dissimilis	-	-	-	X
Extrarius aestivalis	-	X	-	X
Hybopsis amblops	-	-	X	-
Luxilus chrysocephalus	X	X	X	X
Lythrurus ardens	X	X	X	X
Nocomis micropogon	-	X	X	X
Notropis photogenis	-	-	X	X
N. rubellus	-	X	X	X
N. volucellus	-	X	X	X
Phoxinus erythrogaster	-	X	X	X
Pimephales notatus	X	X	X	X
P. vigilax	-	-	-	X
Rhinichthys atratulus	-	-	X	-
Semotilus atromaculatus	X	X	X	X
Catostomus commersoni	-	-	X	X
Hypentelium nigricans	X	X	X	X
Moxostoma duquesnei	-	-	X	-
M. erythrurum	-	X	X	-
M. macrolepidotum	-	-	X	-
Noturus flavus	-	-	X	X
N. miurus	-	X	-	X
Oncorhynchus mykiss	-	-	X	-
Labidesthes sicculus	-	X	-	-
Ambloplites rupestris	-	X	X	X
Lepomis cyanellus	-	-	-	X
L. macrochirus	X	X	-	X
L. megalotis	X	X	X	X

Appendix D2 cont'd.

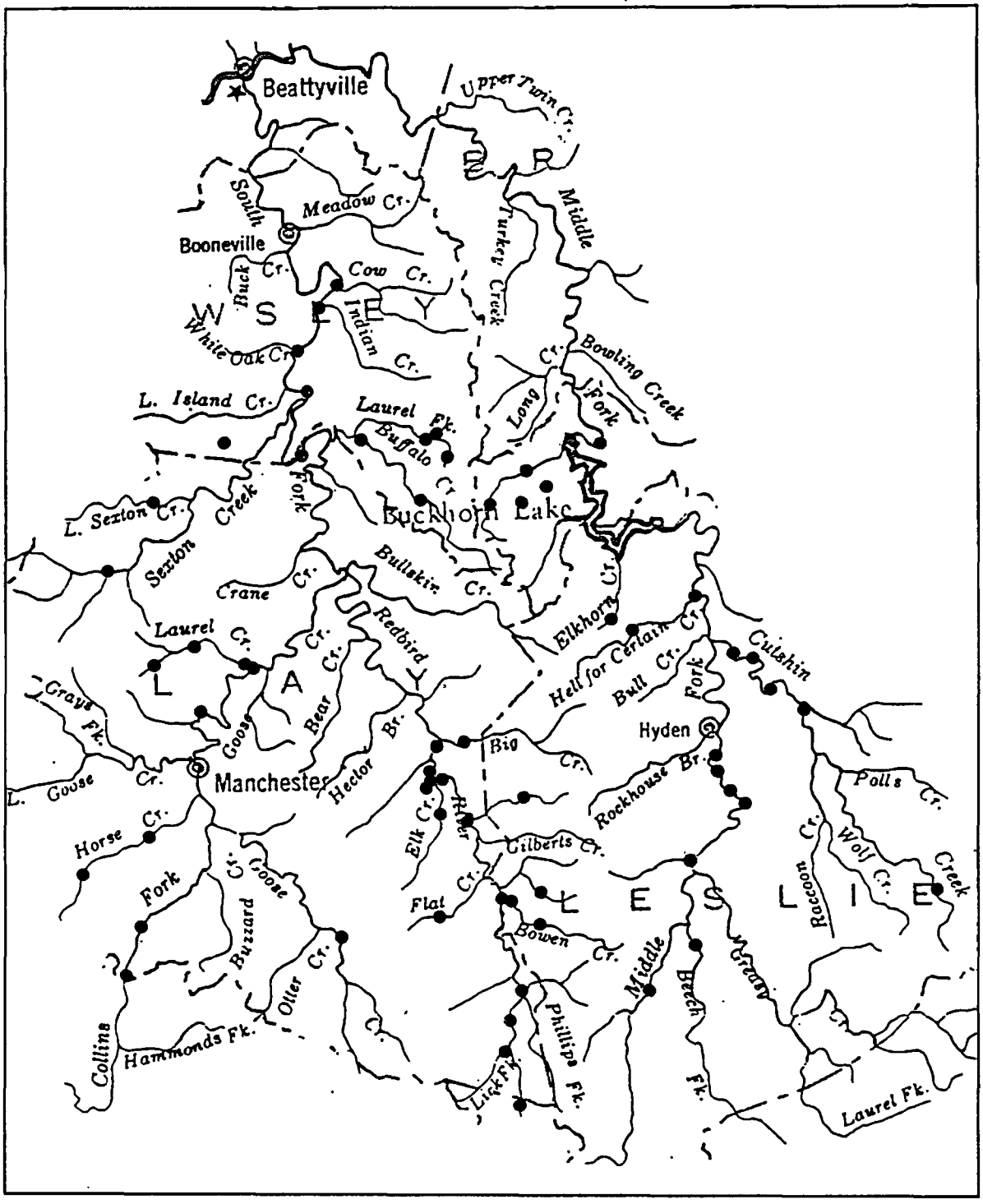
Species	Sexton (2)	Goose (9)	Red Bird (18)	South Fork & Tribs (11)
Micropterus dolomieu	-	X	X	X
Micropterus punctulatus	X	X	-	-
Etheostoma baileyi	X	X	X	X
E. blennioides	X	X	X	X
E. caeruleum	X	X	X	X
E. camurum	-	-	-	X
E. flabellare	X	X	X	X
E. nigrum	X	X	X	X
E. sagitta spilotum	-	-	X	X
E. tippecanoe	-	-	-	X
E. variatum	-	X	X	X
E. zonale	-	X	X	X
Percina caprodes	-	X	X	-
P. evides	-	-	-	X
P. maculata	-	X	X	-
P. sciera	-	-	-	X
P. sp.	X	X	X	X

Appendix D3. Fishes collected from drainages within the Middle Fork Kentucky River in the Redbird District during 1992 (number of samples in parentheses).

Species	Beech/Upper Middle (2)	Greasy (1)	Cutshin (5)	Middle Fk & Tribs (10)
Dorosoma cepedianum	-	-	-	X
Campostoma anomalum	X	X	X	X
Cyprinella spiloptera	-	X	X	X
C. whipplei	-	-	X	X
Ericymba buccata	-	-	X	X
Erimystax dissimilis	-	-	-	X
Extrarius aestivalis	-	-	-	X
Hybopsis amblops	X	-	X	-
Luxilus chrysocephalus	X	X	X	X
Lythrurus ardens	-	-	X	-
Nocomis micropogon	X	X	-	X
Notropis ariommus	-	-	-	X
N. photogenis	X	X	X	X
N. rubellus	X	X	X	X
N. volucellus	-	X	X	X
Phoxinus erythrogaster	-	-	-	X
Pimephales notatus	X	X	X	X
P. vigilax	-	-	X	X
Rhinichthys atratulus	-	-	X	X
Semotilus atromaculatus	X.	-	X	X
Catostomus commersoni	-	-	X	X
Hypentelium nigricans	-	X	X	X
Moxostoma duquesnei	X	-	-	-
M. erythrurum	-	-	-	X
Ameiurus natalis	-	-	-	X
Pylodictis olivaris	-	X	-	-
Labidesthes sicculus	-	-	X	X
Ambloplites rupestris	-	-	X	X
L. macrochirus	-	-	X	X
L. megalotis	-	-	X	X

Appendix D3 cont'd.

Species	Beech/Upper Middle (2)	Greasy (1)	Cutshin (5)	Middle Fk & Tribs (10)
Micropterus dolomieu	-	-	X	X
M. punctulatus	-	-	-	X
Etheostoma baileyi	X	X	X	X
E. blennioides	X	X	X	X
E. caeruleum	X	-	X	X
E. flabellare	X	-	X	X
E. nigrum	-	-	X	X
E. variatum	X	-	X	X
E. zonale	X	X	X	X
Percina caprodes	-	X	X	X
P. copelandi	-	-	X	X
P. maculata	-	-	-	X
P. sciera	-	-	-	X



1992 aquatic sampling sites in the South and Middle Forks of the Kentucky River in the Redbird Ranger District.

Appendix E
Terrestrial Sampling Data

E1: Results of Discarded Bottle Surveys
E2: Results of Pitfall Trapping
E3: Results of Sherman Live Trapping and Snap Trapping
E4: Results of Mist-netting

Appendix E1. Results of Discarded Bottle Surveys During Redbird Ranger District Rare Species Inventory, 1992.

COUNTY	QUADRANGLE	LOCATION	SPECIES FOUND
Clay	Barcreek	Hacker Fork 0.7 mi N on FS 1510 from KY 149.	*Blarina brevicauda*
Clay	Barcreek	Little Graveyard Hollow	*Blarina brevicauda* *Sorex fumeus*
Clay	Barcreek	Long Fork of Hector Branch.	*Blarina brevicauda*
Clay	Barcreek	Mouth of Eli Branch.	*Blarina brevicauda* *Sorex fumeus*
Clay	Barcreek	Nr mouth of Bar Creek at jct KY 66/ FS 1510.	*Blarina brevicauda* *Sorex fumeus*
Clay	Beverly	Indian Grave Branch.	*Blarina brevicauda*
Clay	Beverly	Red Bird Creek at Blue Hole Creek.	*Blarina brevicauda*
Clay	Beverly	Red Bird Creek, 0.2 mi N on KY 66 from KY 1524.	*Blarina brevicauda* *Peromyscus leucopus*
Clay	Big Creek	Big Double Creek 0.3 mi N on FS 1501.	*Blarina brevicauda*
Clay	Big Creek	E bank Red Bird River, old KY 66, 0.2 mi S of US 421.	*Blarina brevicauda*
Clay	Big Creek	Red Bird River at mouth of Big Double Creek.	*Blarina brevicauda* *Peromyscus leucopus*

Appendix E1 cont'd.

COUNTY	QUADRANGLE	LOCATION	SPECIES FOUND
Clay	Creekville	Banks of Red Bird River at mouth Sugar Creek.	*Blarina brevicauda*
Clay	Creekville	Flat Creek, KY 2000, 0.2 mi W from mouth of Wolf Pen Branch.	*Blarina brevicauda* *Sorex fumeus*
Clay	Creekville	Head of Panther Branch.	*Sorex fumeus*
Clay	Creekville	L Fk Ashers Crk 0.2 mi W of jct KY 1524/1508.	*Blarina brevicauda*
Clay	Creekville	Red Bird River 1.0 mi S of Millpond Hollow.	*Blarina brevicauda* *Synaptomys cooperi*
Clay	Creekville	Red Bird River near mouth of Katies Creek.	*Blarina brevicauda*
Clay	Ogle	Head of Belles Fork at Dog Gap.	*Blarina brevicauda*
Harlan	Bledsoe	Little Shepherd Trail (KY 1679) 1.9 mi E of US 421, N slope of Pine Mountain.	*Blarina brevicauda*
Harlan	Bledsoe	US 421, 0.4 mi N of KY 221.	*Blarina brevicauda* *Peromyscus leucopus*
Harlan	Nolansburg	Crest of Pine Mtn at Railroad Gap.	*Blarina brevicauda* *Sorex fumeus*

Appendix E1 cont'd.

COUNTY	QUADRANGLE	LOCATION	SPECIES FOUND
Harlan	Nolansburg	N slope of Pine Mtn on KY 2010 1.5 mi S of 221.	*Blarina brevicauda* *Sorex cinereus*
Harlan	Nolansburg	Pine Mountain at Shell Gap.	*Blarina brevicauda* *Sorex fumeus*
Leslie	Creekville	Red Bird River near Negro Hollow.	*Blarina brevicauda* *Sorex fumeus*
Leslie	Cutshin	Greasy Creek, 6.6 mi S from US 421 on KY 2009.	*Blarina brevicauda* *Peromyscus leucopus*
Leslie	Cutshin	Greasy Creek, 9.2 mi S from US 421 on KY 2009.	*Blarina brevicauda* *Sorex fumeus*
Leslie	Hyden West	Jct Cane Creek at Hals Fork.	*Blarina brevicauda*
Owsley	Mistletoe	Head of Buffalo Creek at jct FS 1531/ KY 2022.	*Blarina brevicauda*
Owsley	Mistletoe	Rt Fork Buffalo Creek nr mouth of Merrill Br.	*Blarina brevicauda* *Sorex fumeus*
Perry	Buckhorn	KY 1833, 0.1 mi E of Buckhorn Lake State Park boundary.	*Blarina brevicauda* *Peromyscus leucopus*

Appendix E2. Results of Pitfall Trapping on the Redbird Ranger District.

Clay County	Beverly Quadrangle	Indian Grave Branch Pitfalls

Indian Grave Branch, 0.5 miles northeast on FS 1517 from its junction with KY 2467. Beech-hemlock forest on a moderately mesic lower slope with scattered sandstone boulder talus.

Mammals	Amphibians
Blarina brevicauda	*Notophthalmus v. viridescens*
Sorex fumeus	*Plethodon glutinosus*
	Plethodon kentucki
Crustaceans	
Cambarus sp.	

Clay County	Big Creek Quadrangle	Flatwoods Pitfall Buckets

The southwestern portion of the Flatwoods area, 1.4 miles on FS A from its junction with KY 66. A xeric, oak-dominated ridgetop forest located above an abandoned strip mine bench that contains several small wet areas. Plastic buckets and drift fences were used at this site.

Mammals	Amphibians
Blarina brevicauda	*Bufo americanus*
Sorex fumeus	*Bufo woodhousei fowleri*
Microtus pinetorum	*Hemidactylium scutatum*
Napaeozapus insignis	*Notophthalmus v. viridescens*
Peromyscus leucopus	*Pseudacris brachyphona*
Tamias striatus	*Rana sylvatica*
	Reptiles
	Diadophis punctatus edwardsii
	Storeria d. dekayi
	Terrapene carolina

Clay County	Big Creek Quadrangle	Ulysses Creek Pitfalls

Ulysses Creek, 2.5 miles north on FS 1583 from its junction with US 421. Regenerating woodland on a moderately xeric lower slope; contains some sandstone boulder talus.

Mammals	Amphibians
Blarina brevicauda	*Notophthalmus v. viridescens*
Sorex fumeus	*Plethodon glutinosus*
	Rana sylvatica
Crustaceans	
Cambarus sp. (blue)	

Clay County	Creekville Quadrangle	Big Double Creek Pitfalls

Big Double Creek, 0.2 miles south on FS 1501 from the Big Double Creek Picnic Area. At midslope on a moderately xeric northwest facing hillside, dominated by beech and tuliptree, with sandstone boulder talus.

Mammals	Amphibians
Blarina brevicauda	*Eurycea cirrigera*
Sorex fumeus	*Gyrinophilus porphyriticus duryi*
Sorex hoyi	*Plethodon glutinosus*
Microtus pinetorum	*Plethodon kentucki*
	Plethodon richmondi
Crustacean	
Cambarus sp.	

Clay County	Creekville Quadrangle	Red Bird River Pitfalls

Along Red Bird River about 8.0 miles south on KY 66 from the Redbird Ranger Station, at the ford near Negro Hollow. A rich, mesic bottomland forest that is dominated by River Birch.

Mammals	Reptiles
Blarina brevicauda	*Terrapene carolina*
Sorex fumeus	
	Crustaceans
	Cambarus sp.

Clay County	Creekville Quadrangle	Upper Bear Creek Pitfalls

Upper Bear Creek, 0.5 miles southwest on FS 1507 from its junction with KY 66. A steep, mesic northeast facing lower slope, dominated by beech and hemlock, with numerous shale outcrops.

Mammals	Amphibians
Blarina brevicauda	*Desmognathus monticola*
Sorex fumeus	*Desmognathus ochrophaeus*
Sorex hoyi	*Eurycea cirrigera*
Microtus pinetorum	*Plethodon glutinosus*
Peromyscus leucopus	*Plethodon kentucki*
	Rana palustris
Crustaceans	
Cambarus sp. (blue)	
Cambarus sp. (brown)	

Harlan County	Bledsoe Quadrangle	US 421 Pine Mountain Site

North facing slope below crest of Pine Mountain, 0.2 miles north on US 421 from its junction with KY 1679 (Little Shepherd Trail). A high elevation (2600') rich wooded slope located upslope from US 421, clothed with mature mesophytic forest and featuring abundant mossy boulder talus and numerous downed logs. This tract includes a portion of the only Forest Service owned tract on Pine Mountain. Trapping efforts here in the autumn of 1991 and during the Redbird RD Inventory in 1992 yielded the first DBNF records for four species of small mammals - *Sorex cinereus, Sorex dispar, Clethrionomys gapperi maurus,* and *Peromyscus maniculatus nubiterrae.*

Mammals	Amphibians
Blarina brevicauda	*Bufo americanus*
Sorex cinereus	*Desmognathus ochrophaeus*
Sorex dispar	*Plethodon glutinosus*
Sorex fumeus	*Plethodon kentucki*
Sorex hoyi	
Clethrionomys gapperi maurus	Reptiles
	Thamnophis sirtalis
Microtus pinetorum	
Napaeozapus insignis	
Peromyscus leucopus	
Peromyscus maniculatus nubiterrae	
Synaptomys cooperi	

Harlan County	Nolansburg Quadrangle	Pine Mountain Settlement School Pitfalls

Swampy area at Pine Mountain Settlement School - located at the base of Pine Mountain (north side) across the valley from the junction of KY 510 and KY 221. The site consists of a weedy, open wet meadow with large patches of sphagnum and numerous wetland herbs.

Mammals	Amphibians
Blarina brevicauda	*Hemidactylium scutatum*
Sorex fumeus	*Plethodon glutinosus*
Microtus pinetorum	
Peromyscus leucopus	Reptiles
	Chelydra serpentina
Crustaceans	
Cambarus sp.	

Harlan County	Nolansburg Quadrangle	Railroad Gap Pitfalls

Railroad Gap (local name), 3.05 miles southwest along KY 1679 (Little Shepherd Trail) from its junction with KY 2010. High elevation (2400') slope on the north face of Pine Mountain in rich mesophytic forest with boulder talus below sandstone cliffs.

Mammals	Amphibians
Blarina brevicauda	*Desmognathus ochrophaeus*
Sorex cinereus	*Plethodon glutinosus*
Sorex fumeus	*Plethodon kentucki*
Sorex hoyi	
Clethrionomys gapperi maurus	Crustaceans
Napaeozapus insignis	*Cambarus* sp.

Appendix E2 cont'd.

Harlan County	Nolansburg Quadrangle	Shell Gap Pitfalls

Just below Shell Gap on the north facing slope of Pine Mountain, just east of the hairpin curve along KY 2010 that is located 1.5 miles south on KY 2010 from its junction with KY 221. A rich high elevation (2440') forest with abundant boulder talus - located below sandstone cliffs.

Mammals	Amphibians
Blarina brevicauda	*Bufo americanus*
Sorex cinereus	*Desmognathus ochrophaeus*
Sorex dispar	*Notophthalmus v. viridescens*
Sorex fumeus	*Plethodon glutinosus*
Clethrionomys gapperi maurus	*Plethodon kentucki*
Microtus pinetorum	
Napaeozapus insignis	
Peromyscus leucopus	
Peromyscus maniculatus nubiterrae	

Leslie County	Bledsoe Quadrangle	Cawood Branch Pitfalls

Cawood Branch, 0.4 miles north on US 421 from the Harlan/Leslie County line on the east side of US 421. Beech-hemlock forest with boulder talus on a rich mesophytic lower slope.

Mammals	Amphibians
Blarina brevicauda	*Bufo americanus*
Sorex cinereus	*Desmognathus ochrophaeus*
Sorex fumeus	*Eurycea cirrigera*
Microtus pinetorum	*Plethodon glutinosus*
Peromyscus leucopus	*Plethodon kentucki*
	Pseudotriton r. ruber
	Rana palustris

Leslie County	Creekville Quadrangle	Gilberts Big Creek Pitfalls

Gilberts Big Creek in Redbird Wildlife Management Area, about 3.0 miles east on FS 1533 from its junction with KY 66. Mesic lower slope forest dominated by beech and hemlock with some sandstone boulder talus.

Mammals	Amphibians
Blarina brevicauda	*Bufo americanus*
Sorex fumeus	*Plethodon glutinosus*
Peromyscus leucopus	
Myotis septentrionalis	Crustaceans
	Cambarus sp.

Owsley County	Mistletoe Quadrangle	Owsley County Pitfalls

Located along Buffalo Creek at the junction of KY 2022 and FS 1531. Regenerating oak forest below a sandstone cliff on a xeric south-facing middle slope.

Mammals	Amphibians
Sorex fumeus	*Bufo americanus*
	Notophthalmus v. viridescens
Crustaceans	
Cambarus sp.	Reptiles
	Carphophis amoenus
	Terrapene carolina

Perry County	Buckhorn Quadrangle	Old Field Branch Pitfalls

Old Field Branch, 2.5 miles northeast on KY 484 and FS 1681 near the Leatherwood Boat Ramp. In a hemlock woods on a moderately mesic northwest facing lower slope with sandstone boulder talus.

Mammals	Amphibians
Blarina brevicauda	*Aneides aeneus*
Sorex fumeus	*Desmognathus monticola*
Sorex hoyi	*Eurycea cirrigera*
	Notophthalmus v. viridescens
Crustaceans	*Plethodon glutinosus*
Cambarus parvoculus cf.	*Plethodon richmondi*
	Pseudotriton r. ruber

Appendix E3. Results of Sherman Live Trapping and Snap Trapping on the Redbird Ranger District.

Clay County	Barcreek Quadrangle	Hector Branch Snaptraps

Hector Branch field at the mouth of Eli Branch near the Daniel Boone Parkway. Around the edge of a small pond dominated by willow, sedges, and sweet flag, and in a nearby old field containing sedges.

Mammals	Amphibians
Blarina brevicauda	*Rana clamitans melanota*
Ochrotomys nuttallii	
Reithrodontomys humulis	

Clay County	Big Creek Quadrangle	Flatwoods Snaptraps

In the southwestern portion of Flatwoods, 1.4 miles north on FS A from its junction with KY 66. Among grasses, cattails, and sedges on an abandoned strip mine bench that contains many small pools and wet areas.

Mammals
Microtus pennsylvanicus
Microtus pinetorum
Peromyscus leucopus

Clay County	Big Creek Quadrangle	Granny's Branch Snaptraps

Granny's Branch, 2.3 miles north on FS 1604 from its junction with US 421. An open abandoned strip mine bench, dominated by white pine and lespedeza, with scattered seasonally wet areas.

Mammals	Reptiles
None	*Terrapene carolina*

Clay County	Big Creek Quadrangle	Little Double Creek Snaptraps

Behind the white barn at the mouth of Little Double Creek near the Redbird Ranger Station. In and near sedges and greenbriar along a small wet ditch at the edge of a mowed field.

Mammals	Amphibians
Peromyscus leucopus	*Hyla chrysoscelis*
Reithrodontomys humulis	
Synaptomys cooperi	

Clay County	Big Creek Quadrangle	Little Double Creek Shelter Snaptraps

Behind the white barn at the mouth of Little Double Creek near the Redbird Ranger Station. Inside an open wooden shelter at the edge of the field behind the white barn.

Mammals
Mus musculus

Clay County	Creekville Quadrangle	Big Double Creek Snaptraps

Big Double Creek, 0.1 miles north on FS 1501 from the Big Double Creek Campground. In a bottomland field with jewelweed, autumn olive, and black walnut, along a stream.

Mammals
None

Clay County	Creekville Quadrangle	Red Bird River Snaptraps

Along Red Bird River, 8.0 miles south on KY 66 from the Redbird Ranger Station, at the ford near Negro Hollow. Rich mesic floodplain forest dominated by river birch.

Mammals	Reptiles
Peromyscus leucopus	*Terrapene carolina*

Clay County	Ogle Quadrangle	Goose Creek Sherman Traps

Oxbow of Goose Creek, north from the mouth of Chop Bottom Branch, about 0.8 miles south on US 421 from its junction with KY 149. An oak-dominated bottomland forest and adjacent old oxbow featuring buttonbush, Carex spp., and various wetland herbs.

Mammals
Blarina brevicauda
Peromyscus leucopus

Harlan County	Nolansburg Quadrangle	Pine Mountain Settlement School Sherman Traps

Swampy area at Pine Mountain Settlement School - located at the base of Pine Mountain (north side) across the valley from the junction of KY 510 and KY 221. The site consists of a weedy, open wet meadow with large patches of sphagnum and wetland herbs.

Mammals
Blarina brevicauda
Ochrotomys nuttallii
Peromyscus leucopus
Synaptomys cooperi
Tamias striatus

Harlan County	Bledsoe Quadrangle	US 421 Pine Mountain Snaptraps

North facing slope below crest of Pine Mountain, 0.2 miles north on US 421 from its junction with KY 1679 (Little Shepherd Trail). A high elevation (2600') rich wooded slope located upslope from US 421, clothed with mature mesophytic forest and featuring abundant mossy boulder talus and numerous downed logs. This tract includes a portion of the only Forest Service owned tract on Pine Mountain. Trapping efforts here in the autumn of 1991 and during the Redbird RD Inventory in 1992 yielded the first DBNF records for four species of small mammals - *Sorex cinereus*, *S. dispar*, *Clethrionomys gapperi maurus*, and *Peromyscus maniculatus nubiterrae*.

Mammals
Blarina brevicauda
Sorex fumeus
Clethrionomys gapperi maurus
Peromyscus leucopus
Peromyscus maniculatus nubiterrae
Synaptomys cooperi

Appendix E3 cont'd.

Harlan County	Nolansburg Quadrangle	Railroad Gap Snaptraps and Sherman Traps

Railroad Gap (local name), 3.05 miles southwest along KY 1679 (Little Shepherd Trail) from its junction with KY 2010. High elevation (2400') area near the crest of Pine Mountain in rich mesophytic forest with a dense growth of jewelweed.

Mammals
Blarina brevicauda
Clethrionomys gapperi maurus
Peromyscus leucopus
Peromyscus maniculatus nubiterrae

Leslie County	Bledsoe Quadrangle	Cawood Branch Snaptraps

Near the mouth of Cawood Branch, just east of US 421, 0.4 miles north of the Harlan/Leslie County line. Thickets and young woods at the edge of a mowed bottomland picnic area among Joe-Pye-weed, multiflora rose, and young stands of tuliptree.

Mammals
Blarina brevicauda

Leslie County	Helton Quadrangle	Hoskin Branch Snaptraps

Five trapping sites were located here, ranging from a midslope silt pond to a ridgetop strip mine bench. The site contained young forest with small amounts of boulder talus and an abandoned strip mine bench with wet areas, vegetated with Virginia pine, blackberry, sedges, rushes, and sphagnum moss.

Mammals
Blarina brevicauda
Ochrotomys nuttallii
Peromyscus leucopus
Synaptomys cooperi
Tamias striatus

Amphibians
Rana catesbeiana
Rana clamitans melanota

Reptiles
Terrapene carolina

Appendix E3 cont'd.

Perry County	**Buckhorn Quadrangle**	**Buckhorn Lake Dam Snaptraps**

Three sites around the emergency spillway at Buckhorn Lake Dam. An open field with seasonally wet areas featuring lespedeza and black willow and with boulder riprap talus edges covered with Kudzu.

Mammals	Amphibians
Blarina brevicauda	*Rana clamitans melanota*
Ochrotomys nuttallii	
Peromyscus leucopus	
Reithrodontomys humulis	

Appendix E4. Results of Mist-netting on the Redbird Ranger District.

Clay County	Big Creek Quadrangle	Red Bird River 10 June 1992

Red Bird River at the mouth of Big Double Creek, at junction of KY 66 and FS 1501. Set was over a 30' wide shallow stretch of Red Bird River with a good overhanging tree canopy closure.

Lasiurus borealis
Pipistrellus subflavus

Leslie County	Hoskinston Quadrangle	Redbird WMA 17 June 1992

Redbird Wildlife Management Area; Gilberts Big Creek near the mouth of Peters Branch, 4.7 miles E on FS 1533 from its junction with KY 66. Set was over a gravel road with good tree canopy closure on a forested lower slope.

Eptesicus fuscus
Lasiurus borealis
Myotis septentrionalis
[*Glaucomys volans*]

Leslie County	Bledsoe Quadrangle	Cawood Branch 26 June 1992

Cawood Branch at the stream fork near the edge of Cawood Picnic Area, E side of US 421, 0.4 miles N of Harlan/ Leslie County line. Sets were over a small stream with good tree canopy closure, and over ORV trails at the edge of a large clearing.

Lasiurus borealis
Myotis septentrionalis

Clay County	Big Creek Quadrangle	Little Double Creek 7 July 1992

Little Double Creek drainage, 1.2 miles on FS 1500 from its junction with KY 66. Set was across an old road in a narrow strip of trees over a small stream between two recently mowed bottomland fields; good tree canopy closure over the nets.

Lasiurus borealis
Plecotus rafinesquii

Appendix E4 cont'd.

Clay County	Big Creek Quadrangle	Red Bird River 8 July 1992

Red Bird River at the mouth of Big Double Creek, at junction of KY 66 and FS 1501. Set was over a 30' wide shallow stretch of Red Bird River with a good overhanging tree canopy.

Eptesicus fuscus
Lasiurus borealis
Lasiurus cinereus
Pipistrellus subflavus

Leslie County	Helton Quadrangle	Hoskins Branch 9 July 1992

In the head of Hoskins Branch, on an abandoned strip mine, in young midslope forest. Set was over a dirt road with water-filled road ruts and good tree canopy closure. Many bats were present but netting effort was aborted early due to thunderstorms.

Myotis septentrionalis

Clay County	Beverly Quadrangle	Indian Grave Branch 14 July 1992

Indian Grave Branch, 0.5 miles NE on FS 1517 from its junction with KY 2467. Sets were in the bottom of a steep hemlock ravine over a dirt road with good canopy closure; one set was over water-filled road ruts and another set blocked the road corridor at a stream crossing.

Eptesicus fuscus
Plecotus rafinesquii

Leslie County	Helton Quadrangle	Beech Fork School 14 July 1992

Beech Fork behind Beech Fork Elementary School, in a broad bottomland area with numerous residences below a forested slope. One set was in a large shale rock shelter and another set was over Beech Fork (stream) with poor to moderate canopy closure.

Eptesicus fuscus
Lasiurus borealis
Pipistrellus subflavus

Clay County	Creekville Quadrangle	Red Bird River 16 July 1992

Red Bird River at a ford near the mouth of Negro Hollow, 8.0 miles S on KY 66 from the Redbird Ranger Station. Set was over a 60-foot wide stretch of river with good canopy closure and adjacent well-forested slopes.

Lasiurus borealis
Myotis septentrionalis
Pipistrellus subflavus

Clay County	Beverly Quadrangle	Red Bird Creek 20 July 1992

Red Bird Creek, 0.2 miles N from the mouth of Blue Hole Creek. Set was over a 40-foot wide stretch of river with good canopy closure adjacent to KY 66 below a well forested slope.

Lasiurus cinereus

Clay County	Barcreek Quadrangle	Red Bird River 28 July 1992

Red Bird River near the mouth of Bear Creek, at the junction of KY 66 and FS 1510. Set was over an 80-foot wide shallow stretch of the river with well forested banks and adjacent wooded slopes.

Lasiurus borealis
Pipistrellus subflavus

Clay County	Big Creek Quadrangle	Grannys Branch 30 July 1992

In Grannys Branch drainage on a ridgetop at the junction of FS 1604 and FS B. Set was over a gravel road at the top of a ridge, with good canopy closure, above a sandstone outcrop.

Eptesicus fuscus
Lasiurus borealis

Appendix E4 cont'd.

Harlan	Nolansburg	Railroad Gap
County	Quadrangle	6 August 1992

Railroad Gap (local name), a low gap at the crest of Pine Mountain along the Little Shepherd Trail (KY 1679), 3.05 miles W from its junction with KY 2010. Sets were located over old logging roads with water-filled ruts in mature open forest with good canopy closure on both sides of Little Shepherd Trail.

Eptesicus fuscus
Lasiurus borealis
Myotis leibii
Myotis septentrionalis
Pipistrellus subflavus
[*Glaucomys volans*]

Harlan	Nolansburg	Railroad Gap
County	Quadrangle	11 August 1992

Railroad Gap (local name), a low gap at the crest of Pine Mountain along the Little Shepherd Trail (KY 1679), 3.05 miles W from its junction with KY 2010. Sets were located over old logging roads with water-filled ruts in mature open forest with good canopy closure on both sides of Little Shepherd Trail.

Eptesicus fuscus
Lasiurus borealis
Myotis lucifugus
Myotis septentrionalis

Clay	Oneida	South Fk Kentucky River
County	Quadrangle	4 September 1992

South Fork of Kentucky River, about 0.3 miles N on FS 1565 from the mouth of Rocky Branch. Set was over a 65-foot wide, shallow stretch of river with sloping wooded banks in a broad agricultural bottom.

Myotis septentrionalis
Pipistrellus subflavus

Appendix E4 cont'd.

Perry County	Buckhorn Quadrangle	Buckhorn Lake Campground 17 September 1992

Middle Fork of Kentucky River at the mouth of Squabble Creek at Buckhorn Lake Campground, 300 feet below Buckhorn Lake Dam. Set was over the river and had good canopy closure.

[No bats - none were even seen!]

Harlan County	Nolansburg Quadrangle	Railroad Gap 24 September 1992

Railroad Gap (local name), a low gap at the crest of Pine Mountain along the Little Shepherd Trail (KY 1679), 3.05 miles W from its junction with KY 2010. Sets were located over old logging roads with water-filled ruts in mature open forest with good canopy closure on both sides of Little Shepherd Trail.

Lasionycteris noctivagans
Lasiurus borealis
Lasiurus cinereus
Myotis leibii
Myotis septentrionalis
Pipistrellus subflavus
[*Glaucomys volans*]

Clay County	Big Creek Quadrangle	Red Bird River 8 October 1992

Red Bird River at the mouth of Big Double Creek, at junction of KY 66 and FS 1501. Set was over a 30' wide shallow stretch of Red Bird River with a good overhanging tree canopy.

[No bats - heavy rains]

Appendix E4 cont'd.

Harlan	Nolansburg	Railroad Gap
County	Quadrangle	15 October 1992

Railroad Gap (local name), a low gap at the crest of Pine Mountain along the Little Shepherd Trail (KY 1679), 3.05 miles W from its junction with KY 2010. Sets were located over old logging roads with water-filled ruts in mature open forest with good canopy closure on both sides of Little Shepherd Trail.

Eptesicus fuscus
Lasionycteris noctivagans
Lasiurus borealis
Myotis septentrionalis
Myotis sodalis

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