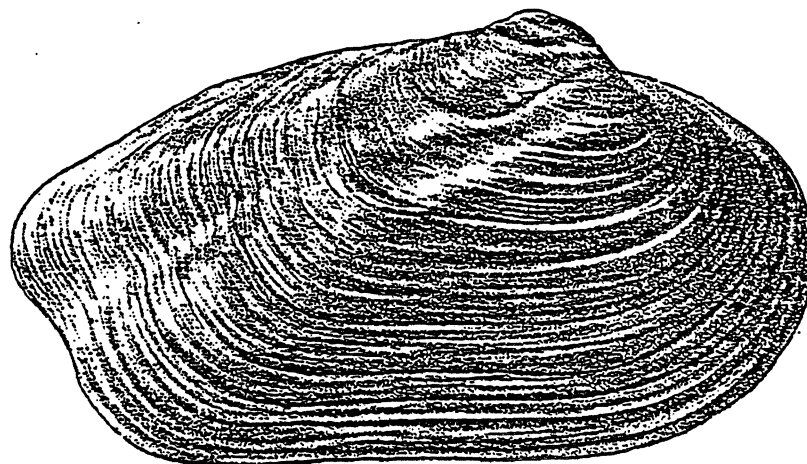


**COOPERATIVE INVENTORY OF
ENDANGERED, THREATENED,
SENSITIVE AND RARE SPECIES,
DANIEL BOONE NATIONAL FOREST,
BEREA RANGER DISTRICT**



Cooperators:

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

March 1991

Cover illustration is of *Pegias fabula*, Little-wing pearlymussel (x4). One of the best populations of this Federally Endangered Species is in Horse Lick Creek, draining the south-central part of Berea Ranger District, Rockcastle and Jackson Counties.

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

Cooperators:

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

March 1991

PROJECT PERSONNEL

Investigators

Julian J.N. Campbell, Botanist
The Nature Conservancy

Joseph E. Flotemersch, Zoologist
Eastern Kentucky University

John R. MacGregor, Biologist
U.S. Forest Service, Berea
(formerly Ky. Dept. Fish and Wildlife Resources)

Dale Noe, Botanist
Eastern Kentucky University

Allen C. Risk, Botanist
Morehead State University

Michael D. Studer, Zoologist
Eastern Kentucky University

D. Timothy Towles, Zoologist
The Nature Conservancy

Project Coordinators

Brian Knowles
United States Forest Service

Julian J.N. Campbell
The Nature Conservancy

Richard R. Hannan
Kentucky State Nature Preserves Commission

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); Brad Condley and Jeff Hohman (East Kentucky Power); Branley Branson, Ron Jones and Guenter Schuster (Eastern Kentucky University); Brenda Hamm, Dale Lynch and David Yancy (Kentucky Department of Fish and Wildlife Resources); Tom Bloom, Ron Cicerello, Laurel McNeil and Brainard Palmer-Ball (Kentucky State Nature Preserves Commission); Danny Barrett (U.S. Army Corps of Engineers); Melody Angel, Junior Gay, Beth Kennedy, David Taylor and Rick Wilcox (U.S. Forest Service, Berea); Greg Sievert (University of Alabama); and Max Medley (University of Louisville).

TABLE OF CONTENTS

LIST OF FIGURES	vi
LIST OF TABLES	vii
INTRODUCTION	1
DESCRIPTION OF THE STUDY AREA	3
Physical Environment	3
Geology and Topography	3
Climate	3
Soils	5
Biogeography	8
Flora	8
Fauna	12
METHODS	14
Flora	14
Fauna	15
RESULTS	17
Flora	23
Listed Species	23
Other Species of Interest	34
Fauna (mussels, crustaceans, fishes, amphibians, reptiles, mammals)	42
Significant Areas	49
SUMMARY	84
LITERATURE CITED	85
APPENDICES	93
A. Significant Areas adjacent to the Berea District (with maps)	95
1. Zion Mountain Ridge System	
2. Anglin Falls Area	
3. Rocky banks of Rockcastle River below Livingston	
B. Terrestrial Vertebrate Lists for the Berea District	107
1. Herptiles	109
2. Breeding Birds	115
3. Mammals	121

LIST OF FIGURES

1.	Map of Kentucky showing the Berea Ranger District within the Daniel Boone National Forest	2
2.	Map of Berea Ranger District (Proclamation Boundary) showing county boundaries, USGS Quadrangles and other important features	4
3.	Map of the Berea Ranger District showing approximate locations of rare species occurrences	18
4.	Map of the Berea Ranger District showing approximate locations of significant areas	48
5.	Map of the Horse Lick Creek Watershed and Corridor showing significant area	74
6.	Map of the Roundstone Sinks/Waterfall Cave Area showing significant area	75
7.	Map of the Crooked Creek/Humongous Cave Area showing significant area	76
8.	Map of the Smokehole/Goochland Cave Area showing significant area	77
9.	Map of the Mill Creek Streamheads showing significant area	78
10.	Map of the Sturgeon Creek Corridor showing significant area	79
11.	Map of the Station Camp Creek Corridors showing significant area	80
12.	Map of the War Fork Corridor showing significant area	81
13.	Map of the Hole-in-Rock Ravines showing significant area	82
14.	Map of the Long Branch Knobs showing significant area	83
15.	Map of the Anglin Falls area showing significant area	102

LIST OF TABLES

1. Classification of upland soil series in the central Cliff Section 6
2. Pre-1900 stands in the Berea District: USFS type and distribution 9
3. Composition of forests ca. 1900 in some counties of Berea District. 10
4. Occurrences of listed rare species known from the Berea District 19

— — — — —

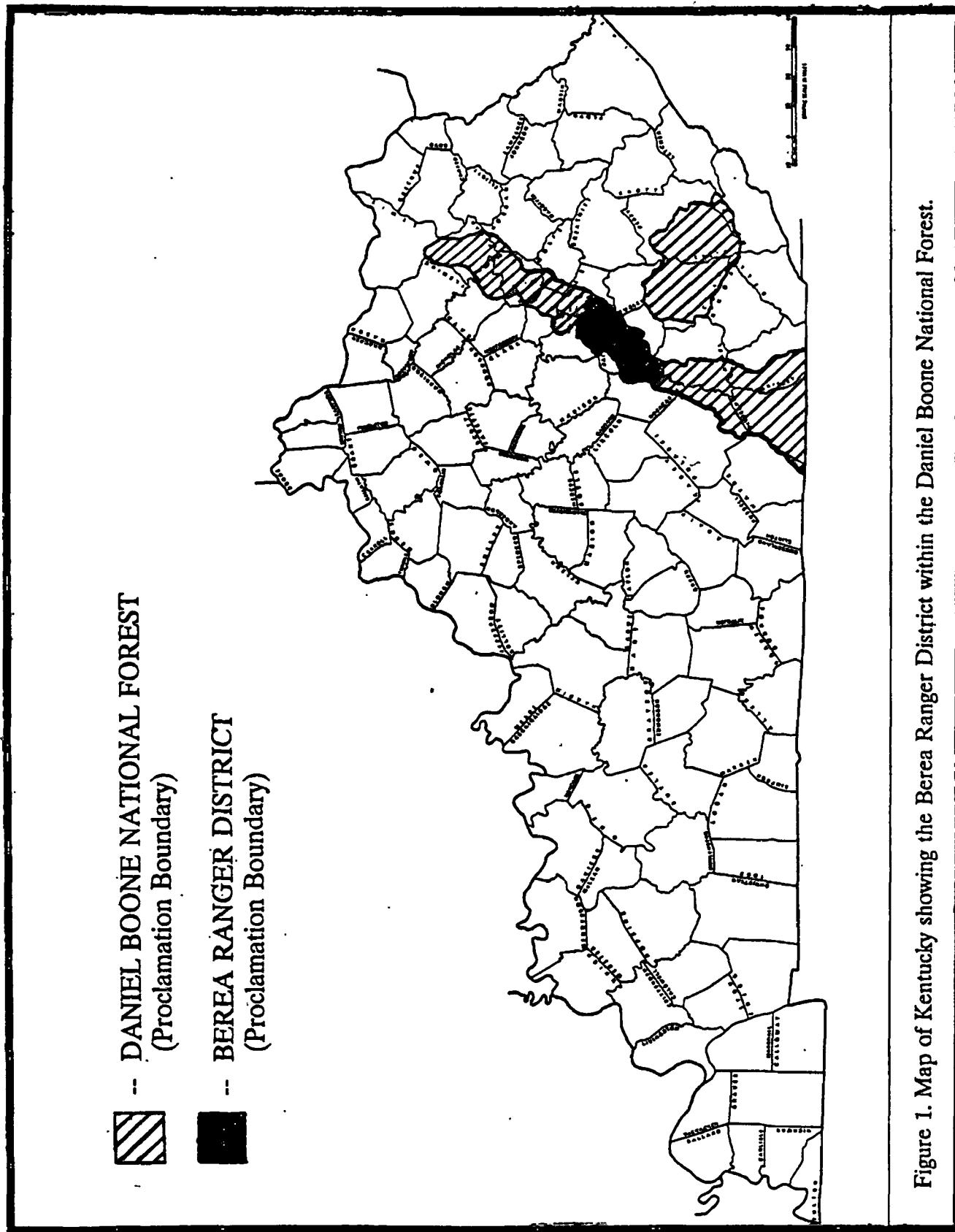
INTRODUCTION

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 1987-1989 inventories of the Somerset, Stanton and Stearns Ranger Districts (Palmer-Ball et al. 1988, Campbell et al. 1989, 1990), TNC provided \$10,000 for a public lands inventory in cooperation with other agencies. This was matched with a \$26,500 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 Berea Ranger District of the Daniel Boone National Forest. The Kentucky Department of Fish and Wildlife Resources (KDFWR) provided an additional \$7500 for zoological work.

The inventory funds were used to support three botanists and three zoologists for various parts of the inventory, and to cover travel, supplies, and expenses. Administrative coordination was provided by USFS and TNC. Berea Ranger District 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. This partnership of federal, state and private agencies continues to be highly productive.

The general nature of this inventory was much influenced by the relatively low numbers of rare plant occurrences, the considerable prior documentation of rare mussels, and the large number of caves with potential habitat for rare bats. The distribution of field effort reflected these trends. Relatively few "Significant Areas" are identified in this report, though some of these are rather large. Because the Horse Lick Creek watershed, with its rare mussel fauna, is currently being targeted for extensive conservation efforts by TNC and USFS, special emphasis is placed on that site in this report. Also, to add comparative data, some information is appended on two Significant Areas just outside the district boundaries, which have recently been studied by TNC personnel.



DESCRIPTION OF THE STUDY AREA

The Berea Ranger District is one of the seven management units within the proclamation boundary of the Daniel Boone National Forest, Kentucky (Fig. 1). This district contains approximately 120,000 acres and lies in eastern Rockcastle, northern and central Jackson, southern Estill, southern Lee, and small parts of Madison and Owsley Counties (Fig. 2). The USFS tracts cover approximately 72,000 acres, and are concentrated in the lower Horse Lick Creek, Mill Creek and War Fork watersheds. There is little or no USFS ownership from Station Camp Creek north and west to the Kentucky River.

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 47-49 inches, with little variation over the region. Average annual snowfall is about 15 inches. The mean annual temperature is about 56° F. Average July temperature is about 75-76° F, and average January temperatures is 35-36° F. The average frost free period is about 178 days, with the average date of first fall freeze, October 16-17, and the average date for final spring freeze, April 21-22 (Karan and Mather 1977).

Geology and Topography

The Berea Ranger District lies mostly within Braun's (1950) "Cliff Section" of the Appalachian Plateaus Physiographic Province (Fenneman 1938; Figs 1 and 2). However, it also extends into several adjacent regions. The northern boundary extends into the Knobs Region; the western boundary extends into the Highland Rim; and the eastern boundary extends into Braun's "Low Hills Belt". On the northeast side of the district, the Low Hills Belt is indistinct, and just be considered a relatively undissected transition from the Cliff Section to the "Rugged Eastern Area", but on the southeast side it is flatter and may be considered the northern terminus of the undissected Cumberland Plateau, *sensu stricto* (R. Cranfill et al., in preparation). In addition, this DBNF district is distinct from all others because it straddles the divide between Cumberland and Kentucky River watersheds.

Along the western edge of the district, Mississippian shales, siltstones and limestones form the predominant bedrock, especially in the watersheds of Roundstone Creek and Red Lick Creek. There are many cave systems in this limestone (Rebmann and O'Dell 1972, Dougherty 1985), more so, indeed, than in any other district of DBNF. However,

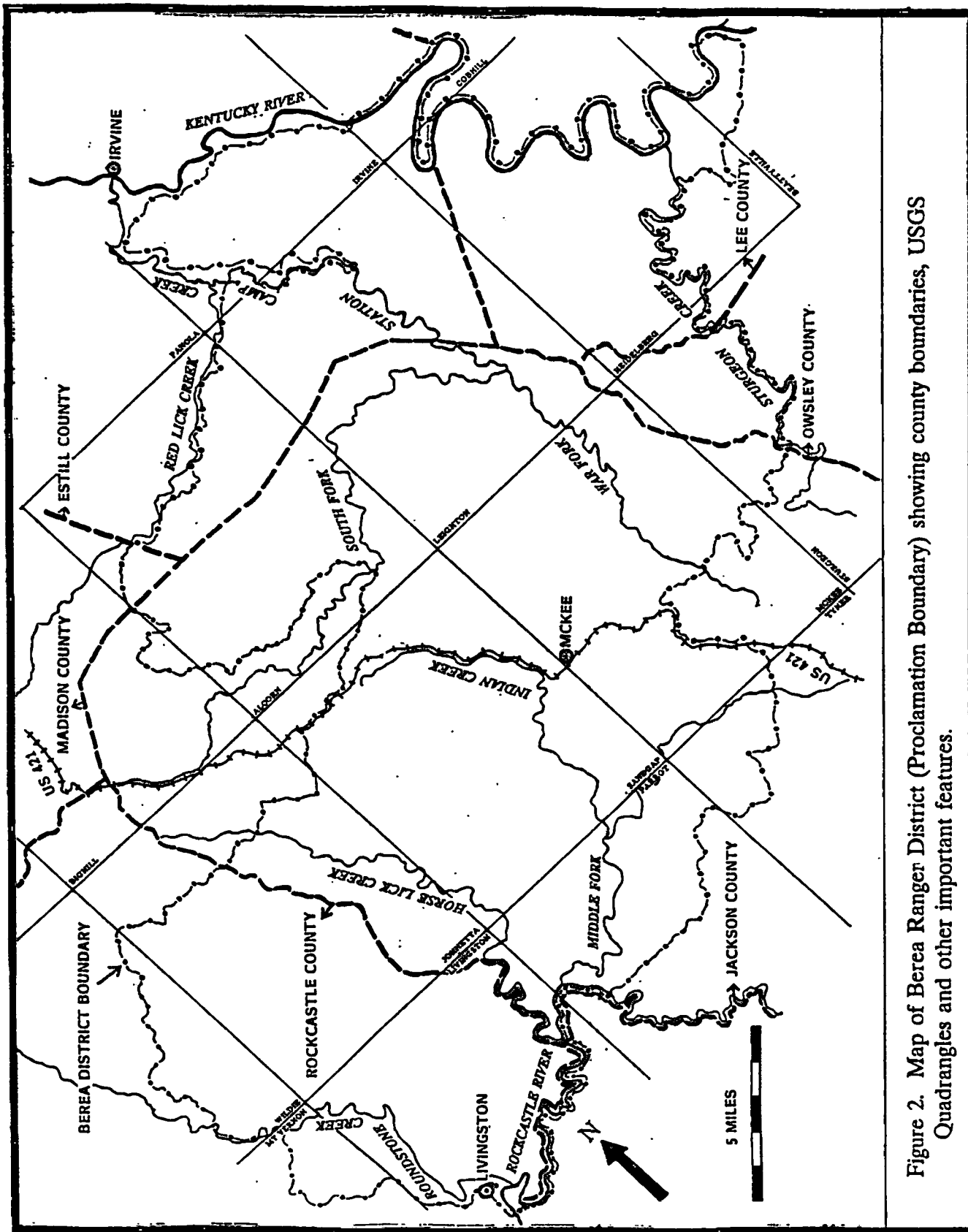


Figure 2. Map of Berea Ranger District (Proclamation Boundary) showing county boundaries, USGS Quadrangles and other important features.

the district is mostly underlain by Pennsylvanian rocks, which are mostly sandstone and shale, but with some conglomerate, siltstone and coal. The Pennsylvanian rocks are divisible into the Lee Formation and the largely overlying Breathitt Formation, but these interdigitate in a complex manner, which has been described in different ways (see U.S. Geological Survey Quadrangle Maps). The Lee Formation predominates in the Cliff Section, at least on slopes, but it is completely covered by the Breathitt Formation further east. The Lee Formation has extensive sandstone beds, especially at its upper levels. The Breathitt Formation is mostly composed of shale, with less sandstone and more coal than the Lee Formation.

Compared to other parts of the Cliff Section in Kentucky, there are fewer large streams flowing through the Berea District, and the topography is only moderately rugged, with less extensive cliffines. At the northern edge of the district, the Appalachian Plateau divides into narrow ridges at 1200-1400 feet a.s.l., which project into the Knobs Region above deforested valleys at 600-700 feet a.s.l. At the western edge of the district, there are low, rounded sandstone-capped "monadnock" hills about 1300-1400 feet a.s.l., and limestone-based, largely deforested valleys at 900-1000 feet a.s.l. Within the central Cliff Section, the upper ridgelines of the plateau are generally 1300-1400 feet a.s.l., and the streams, fringed in places with sandstone cliffs, cut down to valley-bottoms at 900-1100 feet a.s.l. To southeast, in the Low Hills Belt, the topography is relatively flat and undissected in places, with most land at 1150-1350 feet a.s.l., and largely deforested.

Soils

The Berea Ranger District is covered by the soil surveys of Estill and Lee Counties (Newton et al. 1974), Laurel and Rockcastle Counties (Ross et al. 1981), and Jackson and Owsley Counties (Hayes et al. 1989). However, the names of several soil series have changed through the years. An attempt to summarize the classification of upland soils in Daniel Boone National Forest is presented in Table 1. Major trends in soil characteristics are related to bedrock, from acid sandy soils to calcareous soils, and to topographic position, from residual soils on ridges to colluvial soils on lower slopes.

Braun's (1950) division of the Appalachian Plateaus into Cliff Section, Low Hills Belt and Rugged Eastern Area, which has much botanical significance, can also be related to major geographic trends in upland soils (Campbell et al. 1990). An additional trend is evident within the Cliff Section. The central part of the Cliff Section, as represented by the Berea District, is typified by the topographic catena of soils derived from a mixture of sandstone, siltstone and shale (Shelocta, Gilpin and Rayne/Whitley), plus residual soil derived from shale on upper slopes (Sequoia/Latham) and colluvial soil derived from limestone on western lower slopes (Bledsoe/Brookside). In contrast, areas north and south of the Berea District have more soil derived primarily from sandstone (Rigley, Steinsburg and Lily). On the east side of the district, the Low Hills Belt is generally typified by soils derived from shale-sandstone mixtures or, on upper slopes, from shale alone.

Table 1. Classification of upland soil series in Appalachian Kentucky*: (a) non-calcareous soils.

TYPICAL TOPOGRAPHY	PREDOMINANT SOIL PARENT MATERIAL									
	SANDSTONE (±SILTS./SHALE)			SANDS./SILTS./ ACID SHALE			ACID SHALE (±SILTS./SANDS.)		MISSISSIPPIAN SILTSTONE	
0-2% slopes:				Fragiaquult/pd						
				<i>Mullins</i>					sil	
				0-2	4+	1-2				
RESIDUUM OR ALLUVIUM ON BROAD RIDGES (SOME LOESS)				Fragiudult/spd						
				<i>Johnsburg</i>					sil	
				0-4	4+	1				
2-12% slopes:	Fragiudult/mwd			Fragiudult/mwd						
	<i>Monongahela lom</i>			<i>Tilsit</i>					sil	
	2-6	2-4	1	2-12	3-5	1				
1-6% slopes:	Hapludult/mwd									
	<i>Cotaco lom</i>									
RESIDUUM ON BROAD RIDGES (SOME LOESS)	1-6	3-4+	1-2							
	Hapludult			Hapludult						
	<i>Lily (m)</i>			<i>Rayne</i>					sil	
2-35% slopes:	2-25	2-4	0-1	2-35	3-5	1-2				
2-60% slopes:	Dystrochrept			Hapludult			Hapludult			
	<i>Steinsburg</i>			<i>Gilpin</i>			<i>Sequoia (md)</i>		sicl	
	6-60	2-3	1	2-60	2-3	1	6-25	2-3	1-2	
RESIDUUM ON UPPER SLOPES	Dystrochrept/ewd			Dystrochrept/ewd			Dystrochrept/ewd			
	<i>Ramsey</i>			<i>Weikert (JM)</i>			<i>Colyer (D)</i>		sil	
	sal			sil			sil			
12-80% slopes:	12-20	1-2	1	12-80	1-2	1-2	6-50	1	1	
							40-70	1-3	1	
COLLUVIUM ON LOWER SLOPES	Hapludult			Hapludult			Hapludult			
	<i>Rigley</i>			<i>Shelocia</i>			<i>Muse</i>		sicl	
	sal			sil						
20-60% slopes:	20-60	5-8	1-2+	20-60	4-10	2	20-60	3-6	2	
							2-60	4+	1-3	
North-faces and coves, 20-60% slopes:	Haplumbrept			Hapludalf						
	<i>Cutshin lom</i>			<i>Renox (J)</i>						
	1-5			3-5						
	20-60			40-60						
	4-6+									
	Paleudult									
	<i>Allen (M)</i>									
2-20% slopes:	2-20	5+	1-2							
				fsal						

* Compiled from data in Soil Conservation Soil Surveys for most counties in DBNF. The subgroup of each series in the current SCS classification is shown above each series name. These soil series name are italicized; approximate synonyms are given in key below. Series on this page are largely derived from the Pennsylvanian Lee Formation unless indicated in parentheses by M = Mississippian; D = Devonian; J = Jellico Mountains (Pennsylvanian Breathitt Formation); lower case indicates a less pronounced trend.

Table 1. Continued: (b) calcareous soils (all on Mississippian bedrock).

TYPICAL TOPOGRAPHY	PREDOMINANT SOIL PARENT MATERIAL									
	LIMESTONE-SHALE/SANDST.			LIMESTONE-SHALE-CHERT			LIMESTONE-CHERT		LIMESTONE	
0-2% slopes:	<i>Fragiaquilt</i> /pd								Insert <i>Pem.</i> +	
	<i>Robertsville</i>	sil							<i>Cum.</i> after	
	0-2 5+ 0-1								<i>Cri.</i> + <i>Hag.</i> , resp.	
RESIDUUM OR ALLUVIUM ON BROAD RIDGES (SOME LOESS)	<i>Fragiudalf</i> /spd								Paleudalf	
	<i>Lawrence</i>	sil							<i>Pembroke</i>	sil
	0-4 4-6 1-3								2-12 5-9 4	
2-12% slopes:	<i>Fragiudult</i> /mwd			<i>Fragiudult</i> /mwd					Paleudalf	
	<i>Dickson</i>	sil		<i>Tarklin</i>	chil				<i>Cumberland</i>	sil
	2-6 5+ 1			2-12 5+ 2					2-20 5-8 5	
2-12% slopes:	Paleudult			Paleudult			Paleudalf		Paleudalf	
	<i>Mountview</i>	sil		<i>Bewleysville</i>	sil		<i>Britwater</i>	chsil	<i>Crider</i>	sil
RESIDUUM ON BROAD RIDGES (SOME LOESS)	2-12 6-8 1-2			2-6 5+ 1-2			2-12 6+ 2-3		2-12 5+ 2	
	Paleudult			Paleudult			Paleudalf		Hapludalf	
	<i>Frederick</i>	sil		<i>Clarksville</i>	cbsil		<i>Baxter</i>	cbsil	<i>Hagerstown</i>	sil
2-20% slopes:	2-20 6+ 1-3			2-20 5+ 0-2			4-20 5+ 1-2		6-20 3-5 4	
6-35% slopes:	Hapludalf			Hapludalf					Hapludalf	
	<i>Talbott</i>	sicl		<i>Needmore</i>	sicl				<i>Caneyville</i>	sil
	6-30 2-3 2-3			6-25 2-4 1(5)					6-35 2-3 1-5	
RESIDUUM ON UPPER SLOPES	Hapludalf			Eutrochrept					Hapludalf	
	<i>Faywood</i>	sicl		<i>Garmon</i>	sil				<i>Opequon</i>	sil
12-80% slopes:	12-65 2-3 3-5			12-80 2-3 3-5					12-65 1-2 3-4	
COLLUVIUM ON LOWER SLOPES				Paleudult					Hapludalf	
				<i>Trimble</i>	chsil				<i>Bledsoe</i>	sil
				2-80 5-8 1-2+					20-60 5-7 3-5	

*Synonyms: *Baxter* = *Frankstown*; *Bledsoe* = *Brookside*; *Caneyville* = *Fredonia*; *Clarksville* = *?Etowah*; *Dickson* = *Bedford*; *Gilpin* = *Berea*/*?Wernock*; *Lily* = *Chlymer*/*Hartsells*; *Needmore* = *?Colbert*; *Rayne* = *Wellston*/*Whitley*; *Rigley* = *Jefferson*/*Tate*; *Sequoia* = *Latham*/*?Trappist*; *Steinsburg* = *Dekalb*. Residual "Muse" is with *Sequoia* and *Gilpin*.

All soils are "well drained" except if noted as: pd = poorly drained; spd = somewhat poorly drained; mwd = moderately well drained; ewd = somewhat excessively well drained.

Typical soil texture in A horizon is coded after each soil series name as follows:

lom = loam; sal = sandy loam; fsal = fine sandy loam; sil = silt loam; sicil = silty clay loam; r = rocky; ch = cherty; cb = cobbly.

On line below each soil series name is shown: on left side, typical percent slope; in center, typical depth in feet; at right side, typical A horizon pH, from 1 = pH 4.5-5 to 5 = 6.5-7.

BIOGEOGRAPHY

Flora

There is virtually no previous botanical literature from the Berea District. However, much previous work in the Cliff Section as a whole has already been summarized in the Somerset and Stanton District reports (Palmer-Ball et al. 1988, Campbell et al. 1989). Vegetation types in DBNF have been described in Palmer-Ball et al. (1988) and Campbell et al. (1989; see also Campbell 1987). Table 2 summarizes the current distribution of forest stands in the Berea District 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.

The forest types are essentially the same as to the north and south, except for the absence of the southern variant of "basic subxeric" or oak-ash forest type, with characteristic *Carya carolinae-septentrionalis*, and the rarity of the northern variant of the "acid mesic" or hemlock-birch forest type, with characteristic *Pinus strobus*. There is also a general reduction in "acid mesic" forest, with *Tsuga* the climax dominant, relative to "typic mesic" forest, with *Fagus* the climax dominant. On USFS land in the Berea District, *Tsuga* dominates only about 3% of the pre-1900 stands (Table 2), whereas it dominates about 15-25% in the Stanton, Somerset and Stearns Districts. Barton's (1919) data indicate that *Tsuga* comprised only 0.3% of the standing timber in most of the Berea District (Table 3), compared to 1.5-7.7% in counties to the north or south (Palmer-Ball et al. 1988, Campbell et al. 1989). Together with regional vegetation-soil relationships (Campbell 1987) and local edaphic trends (see above), this reduction in *Tsuga* forest may be related to a slightly higher average base status in the soils of the Berea District, compared to the more rugged, sandstone-dominated districts to the north and south.

There is a general mixture of northern, southern and Appalachian species in the flora of the Cliff Section. It might be expected that the Berea District would provide a particularly good example of this mixture, since it lies along the divide between the Cumberland and Kentucky river basins. However, although the flora is similar to other districts, there are relatively few rare or geographically restricted species. This paucity is probably related to the smaller extent of unusual or extreme habitats. (Parenthetic notes in the following lists are supplied for species not covered in the Results section.)

Species that occur in or near this district that are typical of the southern Cliff Section, at least in Kentucky, include *Asclepias amplexicaulis*, *Calamagrostis cinnoides*, *Carex picta*, *Carya pallida* (three sites known on ridges in Rockcastle, Jackson and Owsley Counties), *Chasmanthium laxa* (wet cliffbases in Rockcastle County, collected by D. Noe), *Danthonia compressa*, *Eupatorium luciae-brauniae*, *Helianthus atrorubens*, *Hexastylis arifolia* var. *ruthii*, *Itea virginica*, *Physostegia virginiana*, *Rhododendron arborescens* (last four species found as far north as Sturgeon or Station Camp Creeks) and *Vaccinium arboreum* (north to at least Billows area).

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

Forest type	Number of stands	Acres (approx.)	Note on distribution
Yellow pine (32)	10	200	Mostly on ridges and dry slopes in less rugged areas E of Horse Lick Cr and S of McKee, e.g., near Raccoon Cr and Alum Cave Cr
Yellow/pitch pine-oak (12,15)	4	50	
Chestnut oak-scarlet oak-pine (45)	17	370	Mostly on ridges and dry slopes, scattered throughout with good examples along Horse Lick Cr, Indian Cr and Brushy Cr (of Sturgeon Cr)
Chestnut oak-scarlet oak (59,60)	11	240	
White/black oak-yellow pine (47)	15	360	Mostly on dry to moist slopes and ridges in the SW third of the district, especially near Horse Lick Cr, also Wolf Cr, Indian Cr and War Fk
Red oak-hickory-yellow pine (48)	2	80	
White oak (54)	2	70	Scattered on average slopes and moister ridges, especially near Horse Lick Cr and sections of Station Camp Cr, also Indian Cr, Brushy Cr and Elisha Br
White oak-red oak-hickory (53)	81	2230	
Hemlock-hardwood (8)	3	140	Mostly on moist sandstone slopes, e.g., Laurel and McCammon Fk
Yellow poplar-oak (56)	11	360	Throughout on moist slopes; good examples along Horse Lick Cr, Cavanaugh Cr and Buck Lick Cr

*Data are from files at the Berea District 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 Berea District.*

SPECIES	COUNTIES		
	Rockcastle	Jackson	Owsley
Yellow Pine (<i>Pinus</i>)	10.7%	9.7%	1.7%
Cedar (<i>Juniperus</i>)	0.7	—	—
Chestnut oak (<i>Q. montana</i>)	6.4	16.6	6.5
Chestnut (<i>Castanea</i>)	9.3	14.6	5.7
White oak (<i>Q. alba</i> , etc.)	12.9	25.4	30.7
Black oak (<i>Q. velutina</i> , etc.)	15.9	17.8	5.4
Hickory (<i>Carya</i>)	9.7	6.7	5.7
Ash (<i>Fraxinus</i>)	1.6	0.1	0.5
Locust (<i>Robinia</i> , <i>Gleditsia</i>)	0.9	—	—
Hemlock (<i>Tsuga</i>)	—	0.1	0.3
Cucumber (<i>Magnolia</i>)	0.7	—	—
Poplar (<i>Liriodendron</i>)	7.2	3.7	6.5
Beech (<i>Fagus</i>)	2.9	1.8	17.4
Basswood (<i>Tilia</i>)	3.0	0.5	1.5
Buckeye (<i>Aesculus</i>)	1.8	0.4	0.6
Walnut (<i>Juglans</i>)	0.8	0.3	—
Maple (<i>Acer</i>)	3.6	0.7	3.0
Gum (<i>Nyssa</i> , <i>Liquidambar</i>)	9.8	1.2	0.8
Sycamore (<i>Platanus</i>)	2.2	—	—
Other	—	0.3	1.0
Total (thousand board feet measure)	246,425	709,485	316,863

* Taken from Barton (1919); this sequence of counties traverses the Berea District from west to east; for data from Estill and Lee Counties, see Campbell et al. (1989).

Northern or montane species include *Agastache scrophulariaefolia*, *Allium burdickii*, *Betula allegheniensis* (ravines from Ice Cave to Waterfall Cave), *Carex pedunculata*, *C. scabrata*, *Cimicifuga americana*, *Dryopteris spinulosa*, *Glyceria melicaria*, *Iris verna* (scattered on ridges west of Sturgeon Creek), *Oryzopsis racemosa*, *Oxalis montana*, *Phlox stolonifera*, *Pinus strobus* (SE Madison County and SW Estill County), *Poa alsodes* (locally frequent in central Cliff Section), *Symphoricarpos albus*, *Taxus canadensis* and *Ulmus thomasii*.

Selected groups of these and other infrequent to rare, or geographically restricted species are characteristic of special habitats in the Berea District or nearby. Most of these patterns have been described in previous inventories. The following notes from the Berea District are supplementary, and emphasize differences from other districts.

(a) Rocky banks of larger streams. South of the Berea District along the Rockcastle River and beyond, there are many additional species in this habitat, including several rarities. Characteristic species that extend up into the district include *Clematis glaucophylla*, *Erigeron pulchellus* var. *brauniae*, *Physostegia virginiana* ssp. *virginiana*, *Rhododendron arborescens* and *Trautvetteria carolinensis*. In addition, *Solidago rupestris* and *Zizia aurea* are characteristic of banks with more limestone influence.

(b) Well-drained terraces along medium-sized streams. A few species that are uncommon in Kentucky appear to be characteristic of such terraces in the Berea District. These include *Panax trifolius* and *Phlox stolonifera* (see notes under these species and the Horse Lick Creek section). Possibly, the abundance of these species in this district is related to the more rolling topography, with more extensive alluviation along streams.

(c) Seasonally wet streamheads on Pennsylvanian bedrock. Again, there are many more rare species known from such habitats further south in DBNF. Those of interest in the Berea District include *Calamagrostis cinnoides**, *Carex leptalea**, *C. atlantica* ssp. *capillacea*, *Gentiana saponaria**, *Isoetes engelmannii** and *Lorinseria areolata*. West of the Berea District, some of these species (shown by *) and others (*Hypericum canadense*, *Ranunculus pusillus*, *Dryopteris spinulosa*) have been found in swampy woods on the Highland Rim, with Mississippian bedrock (e.g., Brodhead swamp in Rockcastle Co. and Hazel Dell swamp in Pulaski Co.). East of the district, the landscape is relatively undissected in places, but most forest has been cleared. Nevertheless, R. Hannan (1979 field notes) noted *Quercus palustris* and *Q. imbricaria* in a small woodlot along Pond Creek (near Welchburg, Tyner Quad.).

(d) Roadsides. A few species are virtually restricted to roadsides on ridges, where they may be relics from grassy pine-oak "barrens" maintained by fire before settlement (see also Campbell et al., in press). These include *Asclepias amplexicaulis*, *A. exaltata*, *A. variegata*, *Cirsium carolinianum*, *Danthonia compressa* (old logging roads near Mill Creek) and *Lilium philadelphicum*. A few others are typical of limestone roadsides: *Echinacea purpurea*, *Phaseolus polystachios*, *Veronicastrum virginicum* (west of Mill Creek and, according to R. Jones, pers. comm., near Conway) and possibly *Castilleja coccinea* (R. Hayes, pers. comm.).

(e) Sandstone cliffs and glades. Along the relatively restricted clifflines of the Berea District, few rare species have been found. *Eupatorium luciae-brauniae* is the only notable example of a rare rockhouse species; others of interest in this habitat include *Cystopteris fragilis* var. *mackayi* [*C. tenuis*], *Specularia biflora* and *Thalictrum clavatum* (= "*mirabile*"). On top of cliffs, few flat rock outcrops are known in the district, and characteristic rare species may be lacking (but see notes on *Dichanthelium* spp. and *Minuartia glabra* in Results section). The best examples, though with no more than 1/2 acre openings, are "Bald Rock" and elsewhere in the Brushy Ridge-Lakes Creek area (McKee Quad.); the narrow saddle north of Waneta (Sandgap Quad.); and the eroded roadbed (USFS 463) 0.5 miles east of Sinks (Livingston Quad.). Typical species of these "glades" include *Hypericum gentianoides*, *Andropogon scoparius*, *Panicum linearifolium*, *Danthonia sericea*, *Aster surculosus*, *Tephrosia virginiana*, *Gaultheria procumbens*, *Gaylussacia baccata*, *Amelanchier arborea*, *Pinus virginiana* and *Quercus* spp.

(f) Limestone cliffs and glades. In marked contrast to the paucity of rare species on sandstone outcrops, there are several rare species on or near limestone cliffs in this region, especially in the Zion Mountain ridge system just north of the Berea District (see Appendix A for details). These species are mostly at the edge of more northern or western ranges, but a few are at the edge of calciphilous Appalachian ranges (*Pachistima canbyi*, *Phlox subulata* and *Solidago harrisii*).

(g) Borden Siltstone outcrops. Below the limestone cliffs, there is usually a bench, then below this there are often small exposures of siltstone in the Borden Formation. There are several infrequent to rare species characteristic of these sites, especially on dry, south- or west-facing slopes and points: *Cheilanthes lanosa*, *Comandra umbellata*, *Liatris aspera*, *Lithospermum latifolium*, *Phlox subulata* and *Silphium terebinthinaceum* (see note on this species below). The dry, open woods on these sites are often dominated by *Pinus virginiana* and *Juniperus*; other frequent species include *Quercus stellata*, *Q. marilandica*, *Carya glabra*, *Ostrya*, *Rosa carolina*, *Monarda* cf. *russeliana*, *Solidago sphacelata*, *Antennaria plantaginifolia* (sensu lato), *Carex pensylvanica*, *Danthonia spicata*, *Andropogon scoparius* and *Houstonia canadensis*. Where the overlying limestone has eroded completely off the ridge, more acidophilous species like *Quercus montana* and *Vaccinium vacillans* are abundant.

Fauna

The fauna of this region of Kentucky includes a diverse mixture of northern and southern components. Among aquatic organisms, the diverse mussel fauna of the Cumberland River system extends up into the Berea District, and a smaller group of species occurs in the Kentucky River system. The district also has fishes of the Cumberland River drainage (e.g., *Percina squamata*, *Etheostoma cinerea*) and fishes of the Kentucky River drainage (e.g., *E. sagitta spilatum*). Examples of southern terrestrial species include Red-eyed Vireo (*Vireo olivaceus*), Ovenbird (*Seiurus aurocapillus*), and Eastern Wood Rat (*Neotoma floridana magister*). Northern terrestrial species include

Black-throated Green Warbler (*Dendroica virens*), Ruffed Grouse (*Bonasa umbellus*), Smoky Shrew (*Sorex fumeus*), and Pygmy Shrew (*Microsorex hoyi winnemana*).

Larger streams in the Berea District, with the diverse and rare aquatic organisms they support, have long been of considerable interest to aquatic biologists. Because many of the resulting publications have been summarized or discussed in two Kentucky State Nature Preserves Commission publications (Harker et al. 1979, 1980), the following review focused on literature published after Harker et al. conducted in-depth aquatic biota and water quality studies of several streams within the District. These efforts were undertaken to provide background information to assess coal mining impacts and to identify the best remaining streams in the upper Cumberland River drainage of Kentucky. Because of their exceptional biological or physio-chemical characteristics, the Kentucky State Nature Preserves Commission recommended several streams within the Berea District for Outstanding Resource Water status under Kentucky Surface Water Standards (Hannan et al. 1982).

Publications about the severely decimated Mollusca of the area deal either with description of the fauna and its distribution, or conservation of remnant taxa and communities. Efforts to define the current distribution and status of some rare Cumberlandian unionids were reported by Call and Parmalee (1981), Clarke (1981) and Ahlstedt (1986). The life histories and ecological relationships of numerous unionids known from the Berea District were reviewed by Gordon and Layzer (1989), and this has been followed by ongoing research in Horse Lick Creek (Anderson 1989; J. Layzer, pers. comm.). The diverse mussel faunas of the Rockcastle River and Horse Lick Creek have been studied by Thompson (1985) and DiStefano (1984), respectively.

Several crayfish in or near the district have received special taxonomic and distributional study. These include the cave crayfish, *Orconectes australis*, and some *Cambarus* spp. (Hobbs 1976, 1989, Hobbs et al. 1977).

Studies of the ichthyofauna known at least in part from the District parallel those of the Mollusca. Branson (1977) provided a general study of rare fishes in the DBNF, and details of several species in the Berea District or nearby were reported by Carter (1954, 1970), Warren (1981), Williams (1985), Branson and Batch (1983), Kuehne and Barbour (1983), Kornmann (1985) and Jones (1987). Burr and Warren (1986) thoroughly defined the known ranges of the state's fishes.

The terrestrial vertebrate fauna of the Berea District has not previously been studied as a whole. Small studies have been conducted by a number of investigators, but the details remain largely unpublished. Barbour (1971) and Barbour and Davis (1974) included a few county records for herptiles and mammals, respectively. Information compiled by the Nongame Wildlife Program of the Kentucky Department of Fish and Wildlife Resources accounts for the presence of many other species in the vicinity (J. MacGregor and D. Yancy, pers. comm.). This source is particularly important for data on rare bats that use the caves and cliffines of this region. There is a concentration of

caves in eastern Rockcastle County and western Jackson County that has great biological significance. The invertebrates that inhabit these caves have small ranges in many cases, and have been the subject of intensive study by T. Barr (pers. comm.) and others.

METHODS

Several sources of information were used to identify potentially significant sites. At the onset, 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 Academy of Science and the Kentucky State Nature Preserves Commission (KAS-KSNPC; Warren et al. 1986), and the few additional species listed as Sensitive by the U.S. Forest Service (USFS; 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 prioritized the inventory effort using the lists of potential high interest species and sites.

Field work began in February 1990 and was mostly finished by October 1990. However, cave surveys and small mammal trapping continued into January 1991. Approximately 80 man-days in the field were devoted to botanical inventory, and approximately 90 man-days to zoological inventory.

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.

Most rare species were concentrated along watercourses, from riverbanks to streamheads, and along cliffines, together with other nearby outcrops. Accordingly, most time was devoted to these areas, but, in traveling to many of them, much of the more typical upland forest was covered as well. In addition, many roadsides were searched for the small group of rare species that are characteristic of such sites.

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 Berea 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

Rare aquatic species were sought in larger streams of the Berea District. All Mollusca were sampled by scanning shallows with viewing buckets, searching the bottom with hands and feet, or searching the banks for shells. Shells of mollusca found were retained as voucher specimens and deposited at Eastern Kentucky University (G. Schuster). Nomenclature for mussels follows Turgeon et al. (1988). Distributional statements are based on Cicerello et al. (in press).

Fishes were sampled by about 120 hours of seining. Most of this effort was in the Station Camp Creek drainage, including War Fork. Sampling was also undertaken in Sturgeon Creek, Horse Lick Creek and Rockcastle River. All specimens will be deposited at Eastern Kentucky University. Nomenclature for fishes follows Burr and Warren (1986).

In terrestrial habitats, herptiles were sampled by overturning rocks and logs in a variety of habitat types. Herptile specimens will be deposited at Eastern Kentucky University. Bird species were recorded using visual and auditory identification. An emphasis was placed on the nesting population of the District, although migratory species

were also recorded. Small mammals were sampled using 492 32 oz cups placed flush with the soil surface as pitfall traps. A total of 350 live traps were also set, including 130 Museum Special traps, 80 Victor snap traps, and 140 Sherman live traps. This trapping was conducted at 11 sites in a variety of habitats, i.e., mesic forests, upland forest, subxeric and xeric forests, and boggy streamhead forests. This effort resulted in about 88,000 trap-nights of sampling time, though leaf litter reduced the effective time during part of the fall. Small mammal specimens will be deposited at Eastern Kentucky University. Road-killed animals were identified and collected when found in suitable condition.

Throughout the inventory, there was a special emphasis on censusing bats and other vertebrates associated with caves and cliffines. This effort included at least half of the zoological man-hours, and occurred mostly in the winter and early spring. Almost all known caves with potential for rare bats were checked, except for some pits that require vertical climbing techniques. These pits include Silver Mine Pit and Blowing Spring Cave (Alcorn Quad.); Boiling Springs Caves (Wildie Quad.); Miller's Pit, pit south of Mullins and "Deep and Splendid" pit (Livingston Quad.). Bats were also sampled during the summer using about 144 man-hours of mist netting at night. Nets were placed at several sites in potential foraging corridors along streams and roads.

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-, KAS-KSNPC- and USFS-listed rare species from the Berea District, 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.

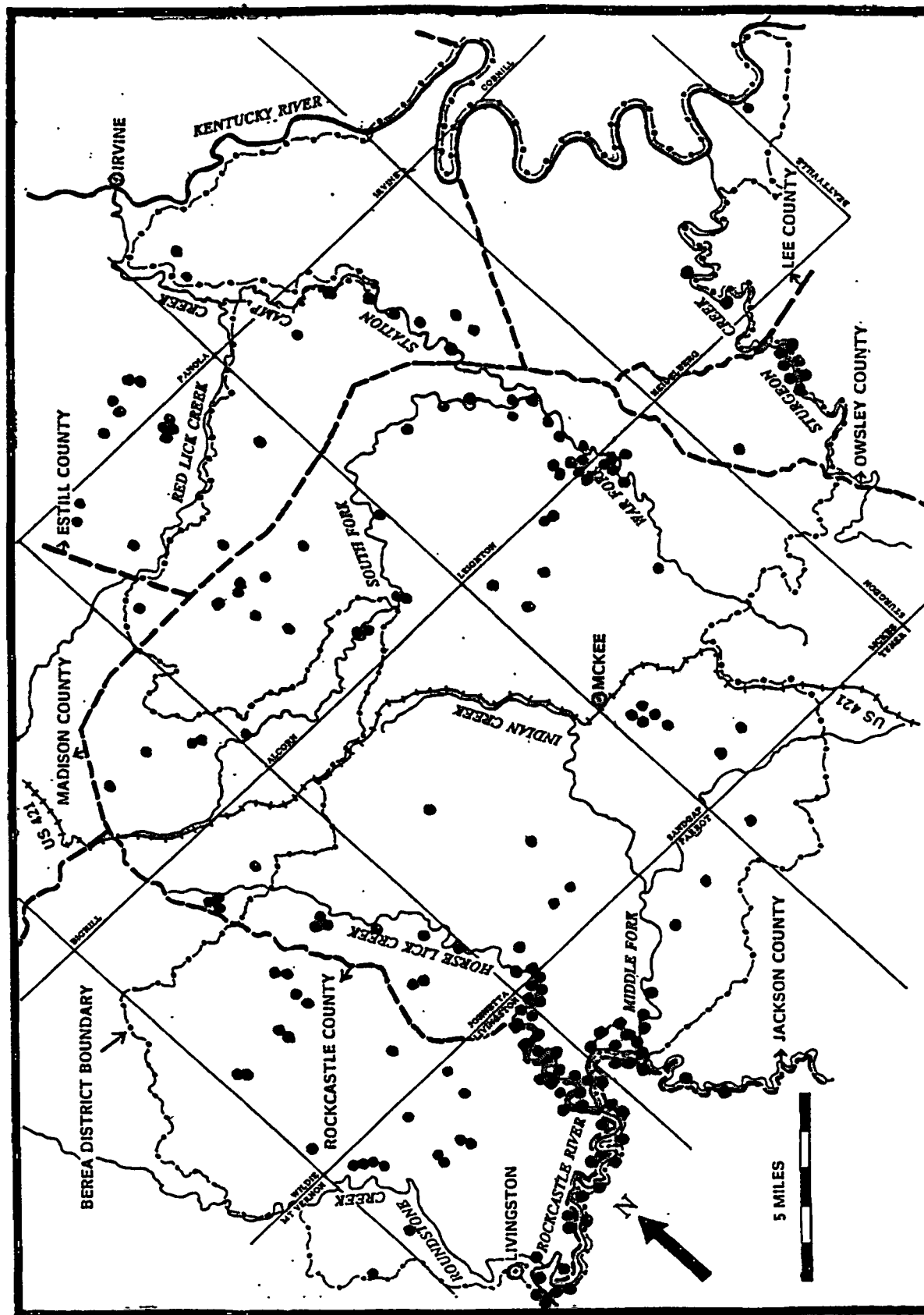


Figure 3. Map of Berea Ranger District (Proclamation Boundary) showing approximate locations of listed species occurrences.

Table 4. Occurrences of listed rare species known from the Berea District.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Sig- nificant Areas
FLORA			
<i>Calamagrostis cinnoides</i> Cinna-like Reed Grass	--	1	1
<i>Carex leptalea</i> Sedge	--	5	2
<i>Carex picta</i> Sedge	--	1	--
<i>Carex tenera</i> Sedge	--	(3)	(2)
<i>Cleistes divaricata</i> Spreading Pogonia	--	1	--
<i>Clematis glaucophylla</i> Leather Flower	--	2	1
<i>Cypripedium kentuckiense</i> Kentucky Lady's Slipper	1	--	1
<i>Cystopteris fragilis</i> var. <i>mackayi</i> Fragile Fern	--	2	--
<i>Dichanthelium acuminatum</i> v. <i>villosum</i> Panic Grass	--	>1	--
<i>Dichanthelium sabulorum</i> Panic Grass	--	>1	--
<i>Eupatorium luciae-brauniae</i> Lucy Braun's White Snakeroot	--	1	1
<i>Glyceria melicaria</i> Manna Grass	--	1	1
<i>Hedeoma hispidum</i> Hairy Pennyroyal	1	--	--
<i>Helianthus atrorubens</i> Sunflower	--	2	2
<i>Lilium philadelphicum</i> Wood Lily	--	2	2
<i>Muhlenbergia cuspidata</i> Prairie Satin Grass	--	2	--
<i>Oryzopsis racemosa</i> Black-seeded Rice Grass	--	2	2
<i>Panax quinquefolius</i> Ginseng	>5	8	>5

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Sig- nificant Areas
<i>Polemonium reptans</i> var. <i>villosum</i>			
Hairy Jacob's Ladder	—	>15	>10
<i>Solidago rupestris</i>			
Goldenrod	—	1	1
<i>Spiranthes lucida</i>			
Shining Ladies' Tresses	2	1	2
<i>Symphoricarpos albus</i>			
Snowberry	1	[2]	1
<i>Synandra hispidula</i>			
Synandra	2	4	6
<i>Taxus canadensis</i>			
Canadian Yew	1	3	2
<i>Viola tripartita</i>			
Yellow Violet	—	6	2
FAUNA			
Molluscs (unionids)			
<i>Alasmidonta atropurpurea</i>			
Cumberland elktoe	(1)	—	(1)
<i>Alasmidonta marginata</i>			
Elktoe	5	—	1
<i>Fusconaia s. subrotunda</i>			
Long-solid	1	—	—
[<i>Lampsilis ovata</i>]			
Pocketbook	[1x]	—	—
<i>Pegias fabula</i>			
Little-wing pearl mussel	12	—	5
<i>Pleurobema oviforme</i>			
Tennessee clubshell	10	—	3
<i>Ptychobranhus subtentum</i>			
Fluted kidneyshell	5	—	2
[<i>Quadrula cylindrica</i>]			
Rabbitsfoot	[1x]	—	—
<i>Toxolasma lividus</i>			
Purple lilliput	11	—	5

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Sig- nificant Areas
<i>Villosa lienosa</i>			
Little spectaclecase	5	--	5
<i>Villosa trabalis</i>			
Cumberland bean	32	--	5
Crustaceans			
<i>Cambarus batchi</i>			
Crayfish	--	1	1
<i>Orconectes australis</i>			
Crayfish	2	1	1
Fishes			
<i>Etheostoma cinereum</i>			
Ashy darter	1	--	--
<i>Etheostoma sagitta spilatum</i>			
Arrow darter	3	--	[1]
<i>Percina squamata</i>			
Olive darter	4	--	1
[<i>Phenacobius uranops</i>]			
Stargazing minnow	[1]	--	--
Amphibians			
<i>Aneides aeneus</i>			
Green Salamander	2	2	2
<i>Cryptobranchus alleganiensis</i>			
Hellbender	2	--	2?
Reptiles			
[<i>Eumeces a. anthracinus</i>]			
Northern Coal Skink	[1]	--	--

Table 4. Continued.

Species	Number of formerly known sites	Number of sites added by inventory	Number of sites in Sig- nificant Areas
Mammals			
<i>Lutra canadensis</i> River Otter	—	1	—
<i>Microsorex hoyi winnemana</i> [Sorex h.w.] Pygmy Shrew	—	10	5
<i>Myotis septentrionalis</i> [M. keenii] Northern Long-eared Bat	5	7	10
<i>Myotis sodalis</i> Indiana Bat	13	26	22
<i>Neotoma floridana magister</i> Eastern Wood Rat	7	>20	>20
<i>Plecotus rafinesquii</i> Rafinesque's Big-eared Bat	12	22	30
<i>Plecotus townsendii virginianum</i> Virginia Big-eared Bat	4	8	12
<i>Spilogale putorius</i> Spotted Skunk	—	>1	?
<i>Ursus americanus</i> Black Bear	1	—	—

Key:

() — uncertain record

[] — occurrences near boundaries of district (within a 1/4 mile).

x — species not relocated; perhaps extirpated.

FLORA

Listed Species

The following accounts summarize data on the 41 listed rare species that have been reported from the Berea District or nearby. The 12 species in square brackets [] have not been recorded in the district but there are records from within five miles of the boundary; see also Campbell et al. (1989) for extra marginal records to the north. These species are included because they can be expected within the district, and some of the notes represent addenda to previous inventory reports. The four species in parentheses only have tentative records, and their presence requires confirmation. Plants that key to two state-listed species, *Monarda russeliana* and *Thalictrum mirabile*, was excluded for taxonomic reasons (Campbell et al. 1989). Following each species' name, its listed status is shown as follows: (1)/(2)/(3).

(1) Status in Kentucky according to the Kentucky Academy of Science and the Kentucky Nature Preserves Commission (KAS-KSNPC; Warren et al. 1986):

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; "+" = KAS-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 (1985, 1990a); E = Endangered; C1 or C2 = candidate for listing, Category 1 or 2; C2C3 = species removed from consideration in 1990. Only two of these have been definitely found within the district: *Cypripedium kentuckiense* and *Eupatorium luciae-brauniae*. Some others have been recorded nearby (*Pachystima canbyi*), or are suspected within the district but with identification uncertain (*Helianthus cf. eggertii* and, historically, *Trifolium stoloniferum*).

The recently revised USFWS (1990a) listed is not followed here in order to maintain some consistency with previous district inventory reports, and because this survey began before that publication's date. *Polemonium reptans* var. *villosum* and *Synandra hispidula* are the only species from the Berea District that have now been removed from the list of candidates. *Carex purpurifera* and *Juglans cinerea* have been reinstated as candidates, but these are not included below because there are many records from the Berea District and elsewhere in DBNF; their Kentucky records were apparently overlooked in the USFWS relisting. However, healthy, nut-producing trees of *J. cinerea* may indeed be rare and the species deserves special propagation efforts.

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.

[*Allium burdickii* Narrow-leaved Wild Leek: E/+/- (7/11).] This taxon has sometimes been called a variety of the more common *A. tricoccum*, but Jones (1979) concluded that full species status is warranted. Both taxa have north-central to mid-western ranges, but *A. burdickii* is more mid-western and usually occurs on slightly drier sites, transitional from sugar maple forest to oak forest. In Kentucky, *A. burdickii* is known from scattered sites on limestone bedrock in north-central regions. It has probably been frequently overlooked due to its omission from most botanical manuals. In 1990, it was collected by D. Noe (No. 874) about 2 miles west of the Berea District near Mount Vernon, Rockcastle County, in a small tributary ravine of Town Branch of Roundstone Creek. A patch of at least 25 plants was noted here on a limestone talus slope near a wet-weather stream.

Calamagrostis cinnoides Cinna-like Reed Grass: S/+/- (6/30). In Kentucky, this southern and east-coastal species is virtually restricted to the southern Cliff Section, where it is locally frequent in thinly wooded acid streamheads. It was found at only one site in the Berea District, the Mill Creek Streamheads (see Significant Areas). Here about 20 plants were found in a shrubby open forest with much *Acer rubrum*, *Liriodendron*, *Nyssa*, *Ilex verticillata*, *Rhododendron nudiflorum*, *Osmunda cinnamomea*, *O. regalis*, *Carex intumescens* and other *Carex* spp. The only other record from north of the Billows area is in the Red River Gorge (Campbell et al. 1989).

[*Carex hystericina* Sedge: S/-/- (2/2?).] The few records of this north-central (to west coast) species of swamps and wet meadows from Kentucky are mostly obscure. There is a C.W. Short collection from "Ky." at Univ. of Cincinnati. There is a 1980s D. Webb collection from Fulton County at Murray State Univ. In the 1970s, KSNPC records indicate there was a 1940 collection of F.T. McFarland et al. at Univ. of Kentucky (verified by M. Medley, pers. comm.) from "near Conway", Rockcastle County. This and two records from two masters theses (Rogers 1941, Hannan 1978) are not now supported by accessible specimens.

Carex leptalea Sedge: S/+/- (7/10). This widespread North American species of swampy woods and openings is represented in Kentucky by the southern ssp. *harperi* (Fernald) W. Stone. It is known from scattered localities in the southern half of the state, all in relatively undisturbed seasonal swamps or seeps. During this survey, it was found in five streamhead localities, with at least 50-100 clumps in each case. These areas are on some of the least dissected land in the Berea District, between the watersheds of Station Camp Creek and the upper Rockcastle River. At the Mill Creek locality, four distinct patches were found. The vegetation was typically open forest with such species as *Acer rubrum*, *Nyssa*, *Liriodendron*, *Osmunda cinnamomea*, *O. regalis*, *Solidago rugosa*, *Aster umbellatus*, *Chelone glabra*, *Lycopus virginicus*, *Carex debilis*, *C. rosea*, *C. crinita*, *Platanthera* spp. and *Sphagnum lescurii*. In one area (East Fork, Elisha Branch), another abundant species was *Lorinseria areolata*, which was not found elsewhere in the district. Some patches of *C. leptalea* appeared to be concentrated at the edge of streams, where the cover of *Osmunda* spp. and other tall herbs was less dense.

Carex picta Sedge: E/+/- (7/40). In Kentucky, this south-central interior species is known from scattered sandstone-based localities in the west and southeast (Cliff Section). It was found at only one locality in the Berea District, with three patches (totaling no more than 1000 sq. feet) on ridges and upper slopes on the south side of the Kentucky River between Heidelberg and Beattyville. Major tree species included *Quercus alba*, *Q. velutina*, *Liriodendron* and *Fagus*. Several other sites were previously found on the north side of the river (Campbell et al. 1989), but all other Appalachian records are in the main Cumberland River valley and further south.

Carex tenera Sedge: E/-/- (7/10?). This northern species is poorly known in Kentucky; it appears similar to the more widespread *C. festucacea*. The taxonomy of these and other species in the Ovales group needs revision. Three collections made in the Berea District during 1990 were identified as this species; all were in the Sturgeon Creek drainage, from the main creek bottom up into a streamhead tributary of Brushy Creek. Current reassessment of all specimens in Kentucky provides the following county records: Ballard, Shelby, ?Whitley, Owsley, ?Powell, ?Montgomery and Bath.

(*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 Counties). Raymond Hayes (SCS, Jackson, pers. comm.) reported that he saw this species along a road near Sandgap (Jackson Co.) some years ago, but no confirmation of this was possible in 1990. The closest confirmed record is from Leslie County, 4.5-5 miles west of Hyden on a dry grassy bank along US 421, at "Buffalo Hill"; this population was destroyed by a new trailer-site in 1985 but some plants were moved to cultivation (Rufous Fugate, retired SCS, Hyden, pers. comm.).

[*Cladrastis kentukea* Yellow-wood: -/S/- (11/>50).] This species of central eastern states is known from several regions of Kentucky, but it is rare except along the Palisades of the Kentucky River. The only record from the Knobs Region is a collection at Eastern Kentucky University with the following data: Berea Woods, rich moist woodland, 3 May 1968, S. Call No. 329. S. Call (Ky. Div. Water, pers. comm.) remembers that this came from the west side of the Cowbell Creek ravine near or beyond the reservoir. Apparently, this was a wild tree. However, the forest in this valley was heavily logged by Berea College in subsequent years. North of the Cumberland River valley (Palmer-Ball et al. 1988, Campbell et al. 1990), there are no records of *Cladrastis* from DBNF or elsewhere in Appalachian Kentucky. However, there is much suitable habitat on moist rocky slopes along limestone cliffs.

Cleistes divaricata Spreading Pogonia: S/+/- (12/22). In Kentucky, this southern species 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 adjacent clearings (with larger populations). It was found at only one site in the Berea District, on a sandstone clifftop above a small sinking tributary of Roundstone Creek. Two patches with at least 20 plants in total were found, growing mostly 20-100 feet back from the clifftop in a recently burnt and clearcut area, with a thick growth of *Vaccinium vacillans*, with some

Gaylussacia baccata, *Andropogon scoparius* and scattered *Pinus virginiana*.

Clematis glaucophylla 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, especially on sandstone. Typically with glabrous lower leaf and sepal surfaces, it is closely related to the pubescent *C. viorna* of limestone sites, and may deserve only varietal rank. In the Berea District, glabrous or sparsely pubescent plants were found on the floodplains of Roundstone Creek (near Conway), lower Horse Lick Creek, a tributary (Brushy Creek) of Sturgeon Creek, and, just south of the district, along the Rockcastle River near Livingston. Plants were generally in thickets or forest edges next to streams, roads or fields. The terrain was not particularly rocky. Typical glabrous plants have also been found further south on rocky sections of the Rockcastle River near Big Trace Branch and from the Billows area downstream (Palmer-Ball et al. 1987).

Cypripedium kentuckiense Kentucky Lady's-Slipper: S/S/C2 (11/25). This southern species has a center of distribution in the Cliff Section of Kentucky, mostly on somewhat sandy floodplains along a few of the larger streams. It is also scattered to the southwest as far as Texas. The only well-documented site in the Berea District is along Sturgeon Creek, discovered by D. Barrett & Son. In 1987-90, at least 200 plants (in 15 patches) have been found along the one mile corridor between the mouths of Little Sturgeon Creek and Brushy Creek. A few plants have also been seen downstream, near Hale Ridge (D. Barrett, pers. comm.). The Sturgeon Creek population was found to be unlike others known in Kentucky, due its extending out of the floodplain up onto lower slopes, which have been disturbed by logging and farming. The forest was generally young second growth (ca. 20-30 years), with such species as *Platanus*, *Liriodendron*, *Liquidambar*, *Quercus alba*, *Carpinus*, *Lonicera japonica*, *Parthenocissus*, *Rhus radicans*, *Impatiens capensis*, *Senecio aureus*, *Solidago rugosa* and *Polemonium reptans* var. *villosum*. The largest patch (with over 50 plants in 1990) was found on a gentle slope with abundant *Liriodendron*, *Liquidambar* and *Lonicera japonica*. The forest is about 20 years old, and the land was probably cropped before that (D. Barrett, pers. comm.). This species was also reported from Rockcastle and Estill Counties by Reed (1981), but no collections or further details are available (C. Reed, pers. comm.). There may be similar habitat along Station Camp Creek and Horse Lick Creek, though there is more calcareous influence in these streams. Intensive searches of these streams' banks in 1990 were unsuccessful.

Cystopteris fragilis var. *mackayi* [= *C. tenuis*] Mackay's Fragile Fern: S/+/- (11/30). In Kentucky, this northern species (Moran 1983) is known from western and eastern areas with sandstone, generally growing under overhanging cliffs. It is relatively frequent in such habitat to the north in ravines of the Red River drainage, and to the south in ravines of the Cumberland River drainage. However, it was found at only two sites in the Berea District. Both populations (ca. 10 and 100 plants) were along third order streams in moderately dissected land south and east of McKee. The taxonomy of this genus remains somewhat difficult, and R. Cranfill (pers. comm.) considers that some of the DBNF specimens are *C. tennesseensis*.

Dichanthelium acuminatum var. *villosum* [= *Panicum villosissimum*] Panic Grass: S/+/- (18/>30). This taxon has been found at many sites during the DBNF Inventory, and is not really rare. It was not searched for rigorously during 1990, but it is known to be present. It generally grows along roads and trails on dry sandstone ridges (e.g., southwest of Mullins along the glade-like roadbed eroded down to bedrock).

Dichanthelium sabulorum [= *Panicum columbianum* var. *thinium*] Panic Grass: S/+/- (8/>30). This species is similar to *D. acuminatum* var. *villosum* in its distribution within Kentucky and DBNF, though not as frequent. It was searched for rigorously in 1990, and was noted only once, on the narrow saddle north of Waneta in the small (< 1/10 acre) sandstone "glade" (see Significant Area).

[*Dryopteris spinulosa* Spinulose Wood Fern: S/-/- (4/4).] The correct name for this northern (circumboreal) species should be *D. carthusiana*, according to Cranfill (1980). There are only four records from Kentucky, ranging from west to east and in dry to wet woods. The only eastern record is from the Brodhead swamp, about 5 miles west of the Berea District (central Rockcastle Co.). It was "common" here in the 1970s, but given the subsequent logging and grazing of this site, this species' presence needs checking.

[*Elymus svensonii* Wild rye: +/-/C1 (8/20).] Except for the site noted below, this species is endemic to the Bluegrass Region of Kentucky and the Central Basin of Tennessee, where it is locally abundant on dry limestone slopes in open woods (Church 1967; J. Campbell and M. Medley, unpublished; L. McKinney and R. Thompson, pers. comm.). Most Kentucky sites are in and around Franklin County, along the Kentucky River and its major tributaries. In 1990, a disjunct population was found in Estill County on a narrow limestone ridge near Preacher Estes Mountain, a mile north of the Berea District. At least 20 plants were seen, in open oak-ash-cedar woods on a narrow saddle near an old home site. Outlying populations of this species are often hybridized with *E. hystrix* (= *H. patula*), but there was little if any indication of that in this case. However, the spike rachis internodes were unusually short (3-5 mm), which might be attributed to genes from the *E. virginicus* group.

[*Erigeron pulchellus* var. *brauniae* Lucy Braun's Robin Plantain: S/+/- (10/30?).] This glabrous variety of the common species is virtually restricted to the Cliff Section, and most records are from Kentucky. Its typical habitat is on the rocky banks of larger streams and rivers, near the upper floodplain limit, often in partial shade. It has been found along a section of the Rockcastle River with sandstone boulders about 5 (air) miles SW of Livingston.

Eupatorium luciae-brauniae Lucy Braun's White Snakeroot: E/S/C1 (6/32). This species of sandstone rockhouses is endemic to the Cliff Section of Kentucky and Tennessee, with only 40-50 known sites. Only two sites are known north of the lower Rockcastle River. One of these was found in the Berea District, along the most pronounced cliffline in the district, above lower Horse Lick Creek in Jackson County. At least 50 plants were found, scattered along 1000 feet at the base of a south-facing cliff. They were growing on ledges and

among boulders with little sandy fill, whereas the usual habitat is on deeper, moister sand. The forest was dominated by *Quercus montana*; other associates included *Sassafras*, *Nyssa*, *Fagus*, *Oxydendron*, *Rhododendron maximum*, *Silene rotundifolia*, *Heuchera parviflora*, *Specularia cf. biflora* and *Chenopodium cf. album*.

[*Gentiana decora* Showy Gentian: T/-/-] In Kentucky, this Southern Appalachian species is known from a few sites in the Cumberland Mountains, plus a recent sighting by D. Barrett in Owsley County, about 4 miles southeast of the Berea District. This surprising range extension should stimulate further attention in DBNF to this often neglected, late-flowering genus.

Glyceria melicaria Manna Grass: S/+/- (6/12). In Kentucky, this northern species is known from a few sites in the Cumberland Mountains and the northern Cliff Section, typically in rather open forest on sandy terraces of first or second order streams. Several sites were found in the Stanton District, but only one in the Berea District. The latter site, with two patches of ca. 100-300 sq. m, was along a small tributary of Cavanaugh Creek (see Hole-in-Rock Ravines in Significant Areas). Associates included *Osmunda cinnamomea*, *Impatiens capensis*, *Sagittaria* sp. and *Panicum clandestinum*.

Hedeoma hispidum Hairy Pennyroyal: E/+/- (4/4). This widespread mid-western species is typical of plains, sands and rocky banks" (Fernald 1950). In Kentucky, where it may only be adventive, it has been reported from four scattered sites on dry or rocky disturbed ground, in Bullitt, Hickman, Rockcastle and Warren Counties. The Rockcastle County site is a strip-mine near the southern edge of the Horse Lick Creek watershed (Thompson and Wade 1991). It is possible that this species was native in fire-maintained "barrens" before settlement, but this must remain conjecture.

Helianthus atrorubens Sunflower: E/S/- (6/>50). In Kentucky, this southeastern and Appalachian species is known only from sandy soils in the southern Cliff Section and its less dissected eastern border. Typically occurring on roadsides, it may be a relic from grassy pine-oak "barrens" formerly maintained by fire (Campbell et al. 1991). It was previously unknown north of the lower Rockcastle River valley, but in the Berea District it was found at two sites, with about 30 plants each, on south-facing banks along gravel roads in the Mill Creek Wildlife Management Area (see also *Lilium philadelphicum*). Associates at one site (McKee Quad.) included *Andropogon virginicus*, *Senecio anomalous*, *Desmodium glabellum*, *Asclepias variegata* and *Cirsium carolinianum* (part of an extensive population). Associates at the other site (Sandgap Quad.) included *Erianthus* and *Ceanothus* (frequent), *Lespedeza intermedia*, *Helianthus divaricatus*, *Panicum commutatum*, *Euphorbia corollata*, *Solidago odora*, *Asclepias variegata* and *A. amplexicaulis* (one of the few Berea District sites for this species).

(*Helianthus eggertii* Eggert's Sunflower: E/+/-C2 (3-5/3-5).) This species is known from no more than 25 sites in the Interior Low Plateaus and perhaps the western edge of the Appalachian Plateaus (R. Jones, pers. comm.). However, its taxonomy is somewhat unclear. In Kentucky, there are about five records, all from south-central regions. Most of these plants may be intermediate between true *H. eggertii* (as typified further south and west) and *H. strumosus*, a poorly defined, complex species that is more widespread, though still infrequent. In 1988, J. Abner found a small patch of possible *strumosus-eggertii* intermediates in the Berea District, along a dirt road south of Sandgap. Identification of these plants is currently receiving detailed study by R. Jones (Eastern Ky. Univ.).

Lilium philadelphicum Wood Lily: S/+/- (9/14). In Kentucky, this species is known only along the Cliff Section, as the Appalachian var. *philadelphicum*. Documented populations are mostly small, declining or now lost. The only definite records from the Berea District are some recent sightings along gravel roads on ridges between Sandgap and the Rockcastle River. In 1990, D. Taylor found one site (between White Oak Creek and Trace Branch of Horse Lick Creek), and A. Risk was able to confirm another site (N of S-Tree Recreation Area reported by B. Goodrich of SCS and M. Angel of USFS). In both cases, only one flowering and one non-flowering stems were found. There is also an 1889 collection from Jackson County, without detail (G.M. Sullivan, UK Dept. of Agronomy).

[(*Malus angustifolia* Crab Apple: S/+/- (7/20).)] This southern species is reported from scattered non-calcareous areas of Kentucky in the west and southeast, but it is often difficult to distinguish from the widespread north-central species, *M. coronaria*. Some intermediate plants appear to match the description of *M. coronaria* var. *lancifolia*. In 1990, D. Noe (No. 106) collected a plant that may be var. *lancifolia* on bottomland near the Old State Road in central Rockcastle County.

(*Minuartia glabra* Sandwort: E/+/-.) This Appalachian species is known in Kentucky from the Cumberland Mountains and the southern Cliff Section. Seedlings that may be this species were found at the edge of a relatively flat sandstone outcrop 0.5 miles east of Sinks. This exposure is at least partly caused by the unpaved roadbed of USFS 463.

Muhlenbergia cuspidata Prairie Satin Grass: E/+/- (4/12). In Kentucky, this Great Plains species is known only from a few extremely dry, south- or west-facing, open limestone cliff-tops. Most of these sites are on two systems of narrow limestone ridges, northwest (centered on Grassy Knob) and southwest (centered on Zion Mountain) of Irvine, in Estill County. Five sites, with 2-200+ clumps, have been found in the Preacher Estes Mountain ridge system, but only two of these, outlying on the eastern side of Station Camp Creek, are within the Berea District. Typical associates included *Aster oblongifolius* and *Andropogon scoparius* (abundant), *Andropogon gerardii*, *Panicum flexile*, *M. sobolifera*, *Setaria viridis* (an exotic), *Bromus japonicus* (another exotic!), *Allium cernuum*, *Houstonia nigricans*, *Arenaria patula*, *Isanthus*, *Euphorbia corollata*, *Lespedeza virginica*, *Asclepias viridiflora*, *A. verticillata*, *Lithospermum canescens*, *Helianthus divaricatus*, *H. hirsutus*, *Aster patens*, *Smilax rotundifolia*, *S. bona-nox*, *Rhus aromatica*, *Cercis*, *Celtis tenuifolia*, *Juniperus*, *Fraxinus quadrangulata* and *Quercus muhlenbergii*. *Phlox subulata* was locally abundant at

the edge of adjacent woods. At one site (SW of Locust Branch School), *Liatris squarrosa* was frequent.

Oryzopsis racemosa [= *Piptatherum racemosum*] Black-seeded Rice Grass: T/+/- (6/16). In Kentucky, this northern species is known from scattered sites on limestone cliffs in and around the Bluegrass Region. Half of these are in the Grassy Knob and Preacher Estes Mountain ridge systems (see also *Muhlenbergia cuspidata*). Only two sites, southeast of the Preacher Estes Mountain area, are within the Berea District. Both are along Station Camp Creek, at the base of limestone cliffs and up to 5 feet out from the dripline, with populations of only 10-30 clumps. Associates included *Acer saccharum*, *Aesculus octandra*, *Staphylea*, *Hamamelis*, *Cercis*, *Asarum*, *Solidago flexicaulis*, *Polymnia canadensis* and *Rhus radicans*. In contrast, the Preacher Estes Mountain populations are mostly larger, with hundreds of plants at some sites, and they occur on relatively dry clifftop ledges as well as cliff-bases. Their typical associates include *Quercus muhlenbergii*, *Fraxinus quadrangulata*, *Juniperus*, *Solidago harrisii*, *Symphoricarpos albus*, *Carex pensylvanica* and *C. eburnea*, as well as more mesic species.

[*Pachistima canbyi* Mountain Lover: E/S/C2 (7/11).] In Kentucky, this largely Appalachian species is known from a few scattered sites on limestone cliffs, mostly along the western edge of the Cliff Section. One site was found by D. Taylor (in preparation) in 1990 a half-mile north of the Berea District boundary, on top of the south end of a narrow ridge projecting from Preacher Estes Mountain. The plants were in two patches, only 20 and 50 sq. feet in area. The associated vegetation was a shrubby or slightly open forest of *Juniperus*, *Quercus muhlenbergii*, *Fraxinus quadrangulata*, *Ostrya*, *Chionanthus* (locally frequent on this point), *Rhus aromatica*, *Carex pensylvanica* and *Solidago harrisii*. Another site, with a much larger population of *Pachistima* and *S. harrisii*, has been found by D. Taylor (in preparation) 3 miles west of the district on a narrow ridge south of Owsley Fork (Jackson County).

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 1990, it was found at eight sites scattered in the Berea District, and at another four within 2 miles of the district. Only 1-4 plants were seen at each site, except for one population of over 100 that had been enhanced by cultivation. Sites were in mesophytic forest, mostly on north-or east-facing slopes below cliffs, with abundant *Liriodendron* and other common species.

Polemonium reptans var. *villosum* Hairy Jacob's Ladder: S/-/C2C3 (13/>30). This taxon is largely restricted to the western edge of the Appalachian Plateaus. The Berea District appears to be close the center of its range, and it is relatively frequent. Removal of var. *villosum* from the list of federal candidates seems to have been justified. It was found in at least 15 localities, especially in forest on moist, fertile soil of stream terraces and slope benches. Typical var. *reptans* was noted only along War Fork (A. Risk coll. at Morehead State Univ.). Most sites with var. *villosum* were on or near limestone but with added sandy colluvium or alluvium. A particularly large population, with over 1000 plants, was noted on an east-facing bench below a small sandstone cliff along War Fork. The forest was

dominated by small trees of *Liriodendron*, together with *Carya cordiformis*, *Juglans nigra*, *Acer saccharum*, *Lindera*, *Viola striata*, *Sedum ternatum*, *Diarrhena*, *Poa cuspidata* and *Carex* spp. (*oligocarpa*, *jamesii*, *hirtifolia*, etc.). Just north of the district, another large population was found in similar forest north of Reeves Mountain (see Appendix A: Zion Mountain Ridge System).

[*Ranunculus allegheniensis* Allegheny Crowfoot: T/+/- (5/7).] In Kentucky, this Appalachian species is known from a few scattered sites, mostly in moist forest of the Rugged Eastern Area and Cumberland Mountains. However, it is an inconspicuous species that is only identifiable during a short fruiting season. In 1990, it was found for the first time in the Cliff Section, just south of the Berea District along the unnamed branch of Rockcastle River opposite Hawk Branch, in Rockcastle County. Only two plants were seen, growing on the mossy streambank in forest dominated by *Platanus*, *Carpinus* and *Fagus*.

[*Silphium terebinthinaceum* var. *lucy-brauniae* Lucy Braun's Prairie Dock: S/+/- (6/10).] This variety (with glabrous upper leaf surface) of the common western prairie species mostly occurs in the Knobs Region of north-central Kentucky and southeastern Ohio. In 1990, two small populations (each with ca. 5-15 plants) were found 0.5-1 mile north of the Berea District in the Zion Mountain ridge system. Both sites, like those in the Grassy Knob ridge system (Campbell et al. 1989), were on narrow ridges or south-facing slopes near outcrops of shale or siltstone in the Borden formation. The forest was open and shrubby, with indications of frequent fire. It seems likely that fire formerly promoted the species. The plants did not appear vigorous, and no flowering was observed. Associated tree species included *Pinus virginiana*, *Juniperus*, *Quercus stellata* and *Q. marilandica*. Herbaceous species on the south end of Preacher Estes Mountain (with ca. 12 *Silphium* plants) included *Danthonia spicata* and *Solidago sphacelata* (abundant), *S. erecta*, *Aster oblongifolius*, *Helianthus divaricatus*, *Antennaria plantaginea* (*sensu lato*), *Liatris aspera*, *Monarda* cf. *russeliana*, *Cunila*, *Asclepias tuberosa*, *Phlox subulata* (also present at the other site), *Penstemon* cf. *canescens*, *Lespedeza intermedia*, *Comandra*, *Allium cernuum*, *Agave*, *Panicum boscii* and *Polypodium polypodioides*.

Solidago rupestris Goldenrod: E/+/- (16/22). In Kentucky, most records of this east-central species are from limestone banks of the Kentucky River, but it has recently been found along several other rivers and may be more frequent than previously thought. In the Berea District, it was found at a single site in Rockcastle County (D. Noe No. 924), along lower Horse Lick Creek about a mile from its mouth. Also, a possible hybrid with *S. gigantea* was collected a mile to the west near White Oak Creek.

Spiranthes lucida Shining Ladies' Tresses: T/+/- (7/7). In Kentucky, this northern species is known only from a few limestone streambanks along the western edge of the Cliff Section. In the Berea District, it is known only from about two miles of Station Camp Creek upstream from the mouth of War Fork (in Jackson and perhaps Estill Counties), and along one site on Middle Fork. At least 150 plants were seen here in 1990, restricted, as elsewhere in Kentucky, to muddy alluvium, 0-1 feet above normal water level, stabilized by limestone, either bedrock or, in this case, bouldery talus. Associates in this 1-5 feet

wide zone included *Cornus obliqua*, *Salix caroliniana*, *Physocarpus*, *Carex torta*, *C. granularis* and *Lysimachia nummularia*. *Justicia* dominated the lower zone next to riffles in the creek, while *Andropogon gerardii* was typical of an upper herbaceous zone on the better drained cobbles and boulders. [The record of this species from the Stanton District (see Campbell et al. 1989) has been traced to a sight record of Larry Pounds (Univ. of Tenn.) in the 1970s; he saw 1-2 plants on a limestone rock by Indian Creek near the mouth of Flat Rock Branch, Menifee County.]

Symphoricarpos albus Snowberry: E/+/- (2/8). In Kentucky, this northern species, as var. *albus*, is known only from Estill and Madison Counties, on narrow limestone ridges extending westward from the Appalachian Plateau. Two sites are known 1-2 miles north of the Berea District in the Preacher Estes Mountain area, and one site is known in the northwestern corner of the district, on the knob west of Long Branch. These sites are all on the narrowest ridges or points, in open oak-ash-cedar forest and thickets, with clonal patches of ca. 1000-10,000 sq. ft. Typical associates included *Fraxinus quadrangulata*, *Quercus muhlenbergii*, *Cercis*, *Ostrya*, *Viburnum rufidulum*, *Rhamnus caroliniana*, *Rhus aromatica* (often abundant on drier sites), *Smilax bona-nox*, *Rosa carolina*, *Elymus hystrix*, *Danthonia spicata*, *Allium cernuum*, *Carex pensylvanica*, *Aster oblongifolius*, *Solidago harrisii*, *Monarda* cf. *russeliana*, *Houstonia nigricans* and *Arenaria patula*. At the north end of Preacher Estes Mountain, the slightly less xeric, more shady vegetation was dominated on the ground by *Solidago harrisii*, together with *Oryzopsis* (frequent), *Bromus altissimus*, *Carex pensylvanica*, *Sedum ternatum*, *Parthenocissus*, *Monarda* cf. *russeliana* and *Solidago ulmifolia*.

Synandra hispidula Synandra: -S/C2C3 (35/>100). This east-central species is generally rare throughout its range, except in central Kentucky where it is locally frequent in forests and edges on moist-to-wet, fertile soil of lower slopes and bottoms, especially on or below limestone. In the Berea District, it has been found along a mile of lower Horse Lick Creek, and at scattered sites along Station Camp Creek and its major tributaries. These populations consisted of 100 to over 1000 plants. There was extensive flowering in 1990, as elsewhere in eastern Kentucky. Plants appeared to be most frequent in moderately open, disturbed forest or near edges. Associates at some larger populations included *Acer saccharum*, *Liriodendron*, *Fagus*, *Aesculus*, *Carpinus*, *Impatiens* cf. *capensis* (often abundant), *Poa sylvestris*, *Prenanthes altissima*, *Viola canadensis*, *Hydrophyllum canadense*, *Solidago flexicaulis*, *Polemonium reptans* var. *villosum* and *Valeriana*.

Taxus canadensis Canadian Yew: S/S/- (6/15). In Kentucky, this northern species is known only from eight general localities along low north-facing limestone cliffs in ravines of the Cliff Section, mostly near cave entrances. In the Berea District, it is known only in the Station Camp Creek drainage, with at least five distinct patches along War Fork, and two smaller patches along South Fork. The patches generally run along ledges and talus below the cliffs, about 10-100 feet wide by 30-800 feet long. The bedrock is limestones but with much non-calcareous colluvium. Typical associates include *Tsuga*, *Liriodendron*, *Magnolia tripetala*, *Acer saccharum*, *Tilia*, *Quercus rubra*, *Waldsteinia*, *Hepatica acutiloba*, *Tiarella*, *Trillium* spp., *Aster divaricatus*, *Polystichum*, *Adiantum* and *Dryopteris marginalis*.

[*Trichomanes boschianum* Filmy Fern: S/-/-.] This Appalachian species is scattered in eastern and western Kentucky on sandstone cliffs in damp crevices. The only record that could be from the Berea District or nearby is a literature record from Rockcastle County, as noted by Cranfill (1980, probably based on J. Williamson's work). It should be looked for along larger cliffs near the Rockcastle River and its major tributaries.

(*Trifolium stoloniferum* Running Buffalo Clover: E/+/E. (6/14).) This species is largely restricted to the Ohio Valley, where it was formerly associated with trails used by buffalo, elk and deer (Campbell et al. 1988). It has apparently declined greatly since settlement, and historical records have been used to indicate its former distribution and environment. The place name "Clover Bottom" in Jackson County suggests that this species occurred there at the time of settlement; a similar case is better documented in Woodford County (Campbell et al. 1988). Other "Clover" place names in Appalachian Kentucky are in Breathitt County (Clover Branch of Upper Twin Creek), Perry County (Clover Fork of Leatherwood Creek) and Harlan County (Clover Fork of Cumberland River, Clover Gap and Clovertown); a few more names occur along the western margin. There is also a historical indication from Harlan County, near Middlesborough: "...we moved 7 miles along the Indian Road, to Clover Creek. Clover and Hop Vines are plenty here." (Walker 1749-50). [This opportunity is taken to correct a misinterpretation in Campbell et al. (1988). The associated "rich-weed" of early accounts was probably *Eupatorium rugosum*--not *Pilea*, as indicated by C.W. Short's note on his collection of *E. rugosum* at the Univ. of Ky.: "'rich-weed", 1-4 feet high, one of Ky signs of good land".]

Viola tripartita Yellow Violet: E/+/- (6/15). In Kentucky, this southeastern and Appalachian species is known only from scattered sites in the Cliff Section. All plants are var. *glaberrima*, except in Carter County with var. *tripartita*. In the Berea District, six sites were found, all in the southeastern sector on non-calcareous, moist or moderately dry sites along tributaries of the Rockcastle River. In most cases, only 1-5 plants were seen, but groups of at least 10-20 were seen along Trace Branch of Horse Lick Creek and the unnamed hollow opposite Hawk Branch. Typical associates included *Liriodendron*, *Quercus alba*, *Q. velutina*, *Acer rubrum*, *Tsuga*, *Oxydendron* and other common species.

Other Species of Interest

The following 29 species are not currently listed by KAS-KSNPC (Warren et al. 1986) or the Daniel Boone National Forest (B. Knowles, pers. comm.), though several of them deserve consideration for listing. Two species, shown in parentheses (), have been tentatively identified. Six species, shown in square brackets [], were not found within the Berea District, but are known from within a few miles of the boundary. 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 Berea District and thus of special local interest. Not all of these species deserve consideration for listing, but their presence at least gives extra floristic interest to the areas where they occur.

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 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, at least in the Berea District. Therefore, they are not listed below. These include *Asclepias amplexicaulis*, *Cardamine rotundifolia*, *Carex communis*, *C. laxiculmis*, *C. lucorum*, *C. projecta*, *C. purpurifera*, *Carya pallida*, *Cirsium muticum*, *Danthonia compressa*, *Geum virginianum*, *Ilex montana* var. *beadleyi* (doubtfully distinct from var. *montana*), *Panicum yadkinense*, *Rhododendron arborescens*, *Viburnum dentatum* and *Viola rotundifolia*.

Agastache scrophulariaefolia Purple Giant Hyssop (6/7). This northern species is known from only 5-10 Kentucky sites, mostly scattered in hilly areas surrounding the Bluegrass Region. Three sites have been found since 1985 near the western edge of the Berea District (Rockcastle and Jackson Counties): roadside near Conway (D. Noe No. 1003); mouth of tributary hollow in Barnett Valley (D. Noe No. 854); near Owsley Fork (D. Taylor, grown from seed). All plants were growing on bottomland below limestone slopes, in small groups (ca. 3-5 plants) along brushy roadsides or forest edges near fields. The only other Kentucky record since 1960 is a collection from Campbell County.

(*Aster schreberi* Smooth Large-leaf Aster (5/10?)). The distribution of this northern species in Kentucky is poorly documented, partly because of infrequent flowering, and also confusion with the closely related *A. macrophyllus*. No flowering specimens have been found in the Berea District, but some plants that have the characteristic broad basal leaf sinus of this species were found along War Fork in 1990. They were growing in several patches, covering at least 300 sq. feet, between Resurgence Cave and Cedar Post Cave, mostly on low slopes and terraces, often in association with *Waldsteinia*.

(*Carex atlantica* ssp. *capillacea* (2/2?).) Reznicek and Ball (1980) recently reduced *C. howei* Bailey to this subspecies. This widespread eastern taxon is distinguished from normal *C. atlantica* by its narrower leaves. In Kentucky, it has been recorded from a wooded seep in Calloway County (M. Woods 479), and the Mill Creek streamheads in Berea District.

Carex hirtifolia Hairy Rich-wood Sedge (12/22). In Kentucky, this northern species is known from scattered areas, mostly in woods on moist fertile soil. In the Berea District, it was found at two sites on the bottomland along lower Horse Lick Creek, and at one site on a bench below limestone cliffs along central War Fork (see note under *Polemonium reptans* var. *villosum*). Less than 10 plants were found at each site. The forest was generally young, with abundant *Liriodendron*, and disturbed by old dirt roads.

Carex pedunculata Red-based Tussock Sedge (9/38). In Kentucky, this northern species is known only from the Cliff Section (especially the Red River Gorge), plus Lawrence County (A. Cusick, pers. comm.). In the Berea District, it has found at five sites: along lower Horse Lick Creek (Rockcastle County), Laurel Fork of Rockcastle River (near *Oxalis montana*), Steer Fork and South Fork of Station Camp Creek (Jackson County), and Cave Branch of Kentucky River (Lee County). The plants were growing on mossy limestone boulders or steep talus slopes below limestone cliffs. The forest was generally dominated by *Liriodendron* or *Fagus*. Only about 5-20 plants were seen at each site, except along the South Fork, where two larger populations were found, one of which contained over 100 plants. The latter population was on a steep slope in *Fagus* forest with frequent *C. purpurifera* and *Waldsteinia*, which was also frequent at Cave Branch. The paucity of records for *C. pedunculata* from the DBNF Inventory south of the Red River Gorge (Campbell et al. 1989) probably indicates a real trend, since, unlike most sedges, this species is identifiable throughout the growing season.

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. In the Berea District, it was found at only two sites, both in Jackson County: one patch along Raccoon Creek and two sites with three patches in the Hole-in-Rock Ravines (see Significant Areas). Patches ranged from about 4 to 100 sq. feet. Another site was found just south of the district near Livingston in Rockcastle County. Major associates at Hole-In-Rock were *Osmunda cinnamomea*, *Lycopodium lucidulum* and *Carex prasina*.

Cimicifuga americana Mountain Bugbane (11/25). In Kentucky, this Appalachian species is known only from the Cumberland Mountains and the Cliff Section (especially Red River Gorge). In the Berea District, it was found only at two Jackson County sites in the Horse Lick Creek valley: slopes opposite Wolf Pen Branch; and upstream from Little Clover Creek. It has also been found near the Berea District at Anglin Falls, Rockcastle County. In all cases, the plants were growing on moist, N- or NE-facing sandstone or limestone talus-slopes. Associates included *Liriodendron* (abundant), *Asarum* and several ferns (*Polystichum*, *Dryopteris intermedia*, *Osmunda cinnamomea*, etc.). Because this species is not reliably distinguishable from the common *C. racemosa* for most of the growing season, it may occur much more frequently than records suggest.

Cirsium carolinianum Carolina Thistle (9/25). This southern species is reported from scattered areas of Kentucky, mostly in the Cliff Section and other regions with transition from Pennsylvanian to Mississippian bedrock. In the Berea District, it was found in four localities (Jackson and Lee Counties), all along open roadbanks on flatter uplands in the divide between the Kentucky River (especially War Fork) and the Rockcastle River (especially Mill Creek) watersheds: USFS 20 at head of Old Field Branch, with about 40 plants; USFS 480 east of Mill Creek, with over 100 plants along a road mile, and along other roads nearby; KY 587 near head of Hughes Fork, with about 5 plants; and a mile east of forks of Upper Sinking Creek, with about 30-50 plants. The vegetation was generally typical for roadsides in the area, with frequent exotic species, but *Lilium philadelphicum* was reported near the USFS 20 population and *Helianthus atrorubens* was found at the north end of the USFS 480 population.

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 1990 survey, it was seen at only three sites in the Berea District: Sinks of Roundstone area, Middle Fork of Station Camp and Hale Ridge. There are previous records from at least two other sites in the district, including a small hollow near Sturgeon Creek where it is relatively frequent (D. Barrett, pers. comm.) and Hog Branch (R. Phillippe in KSNPC files). It was also been found in 1990 just outside the district: hollow S of Livingston; N and S of Anglin Falls; and Turner Hollow of Red Lick Creek. In most of these cases only 1-2 plants were seen.

[*Eupatorium hyssopifolium* var. *hyssopifolium* Thoroughwort (4/4).] There are only four records of this southern variety from Kentucky, all in the southern Cliff Section or the Highland Rim. One of these records is a 1990 D: Noe (No. 988) collection from a small population in an old bottomland field near Conway, Rockcastle County, in the Highland Rim 4 miles west of the Berea District.

Hydrastis canadensis Goldenseal (>60/>100). This north-central species is known from many forested areas of Kentucky, especially in moist to somewhat dry, moderately base rich soil. However, it is generally rare due to harvesting for medicinal use. In the Berea District, it is reported to be relatively frequent along Sturgeon Creek (D. Barrett, pers. comm.). During 1990, it was also found in the Station Camp Creek drainage (Reeves Mountain N of Red Lick Creek, Middle Fork, main stem and War Fork), along Mill Creek and Dry Branch of Horse Lick Creek, and along the Rockcastle River opposite Hawk Branch. These patches were mostly on soils derived partially from limestone strata, except perhaps along Sturgeon Creek, and they were mostly on lower slopes, especially north- or east-facing, or occasionally on bottomland terraces. More than one patch was found at some sites, but those seen in 1990 covered no more than 200 sq. feet each. Associates included *Acer saccharum*, *Liriodendron*, *Quercus rubra*, *Q. alba*, *Carya cordiformis*, *Carpinus*, *Hamamelis*, *Polymnia canadensis*, *Sanicula gregaria*, *Viola canadensis*, *Laportea*, *Meehania* and *Monarda clinopodia*.

[*Hypericum canadense* St. John's Wort (6/6).] In Kentucky, this northern species has been recorded only six times, mostly from broad bottomlands just west of the Appalachian Plateaus, between the Knobs and other low hills. In 1990, D. Noe (No. 778) collected this species from a population of at least 25 plants on a roadside pine thicket near the head of Copper Creek, near the northwestern boundary of Rockcastle County.

Isoetes engelmannii Quillwort (12/20?). This southern and east-coastal species of forested pond and stream shores is known from scattered non-calcareous regions of Kentucky, mostly in the Cliff Section or the eastern Highland Rim. Even within the Cliff Section it is apparently not widespread, since there are no records from districts already covered by the DBNF Inventory (Stearns, Somerset and Stanton). In contrast, six sites were found during 1990 in the Berea District (Jackson, Owsley and Lee Cos.), all in relatively undissected areas east of McKee: in the headwaters of Sturgeon Creek along Brushy Creek, Grassy Fork and Cooperas Creek branch; Pigeon Roost Creek (see Mill Creek streamheads); and Short Hollow near Heidelberg. Plants were found in small streambeds with much bare muddy or gravelly soil, and with forest canopy but few associated herbaceous plants. They were generally downstream from the seeping streamheads dominated by mosses, ferns and sedges. Populations ranged from 1 to over 100 plants.

[*Melica nitens* Glade Melic-grass (10/15?).] This mid-western species has been found in scattered Kentucky locations on limestone cliffs and glades, or rarely on sandstone. Most records are from the western Highland Rim. In 1990, its known Kentucky range was extended east to Estill County, about a mile north of the Berea District at the head of Turner's Hollow along Red Lick Creek. This population consisted of several clumps scattered along a 50 x 3 feet ledge on a north-facing limestone clifftop. The thin tree canopy was mostly of *Fraxinus quadrangulata*, and there was dense *Rhus aromatica* on the upper side of the ledge. Associates on the ground included *Aster oblongifolius*, *Solidago ulmifolia*, *S. harisi*, *Sedum ternatum*, *Carex pennsylvanica* and *F. quadrangulata* seedlings.

Oxalis montana White Wood-sorrel (9/30). In Kentucky, this northern species is known only from the Cumberland Mountains and the Cliff Section, mostly in the Red River Gorge. In the Berea District, it was found only in the Laurel Fork ravine, 0-10 feet out from the base of a north-facing sandstone cliff with a deep fissure emitting cool air. There were several patches of 5-10 sq. feet, and scattered smaller patches. Associated species included *Tsuga*, *Betula lenta*, *Rhododendron*, *Dryopteris intermedia* and *Heuchera parviflora*.

Panax trifolius Dwarf Ginseng (10/25). In Kentucky, this northern species is known mostly from moist lower slopes and terraces along larger streams in the Cliff Section. There are only three records from the Berea District, but it appears to be locally frequent or even dominant on the ground here and to the south, often along second and third order streams rather than the larger ones more typical elsewhere. Most records are from tributary ravines along the Rockcastle River: Hog Branch, Trace Branch of Horse Lick Creek; and downstream of the district along Pine Creek, in Dugar Hollow and the unnamed hollow opposite Hawk Creek. A small patch was also found along War Fork near Cedar Post Cave. It occurs with common species such as *Liriodendron*, *Platanus*, *Fagus*, *Tsuga*, *Acer*

rubrum, *A. saccharum*, *Tiarella*, *Hepatica americana*, *Aster divaricatus*, *Meehania* and *Polemonium reptans* var. *villosum*. In some areas, less widespread species like *Phlox stolonifera*, *Viola tripartita*, *Waldsteinia* and *Aster schreberi* are present, giving these areas special floristic interest (see Introduction).

[*Phaseolus polystachios* Wild Bean (17/22).] This south-central species is known from widely scattered areas of Kentucky, but with a low density of records. It has recently been collected from Rockcastle County 1 mile west of the Berea District, in young woods on lower (calcareous?) slopes below Anglin Falls (R. Thompson, pers. comm.).

Phlox stolonifera Running Mountain Phlox (8/25). In Kentucky, this Appalachian and Piedmont species is known only parts of the Appalachian Plateau, mostly in the transition from the northern Cliff Section to the more rolling landscape on its southern and eastern sides. In the Berea District, this species appears to be particularly abundant. In 1990, it was found in at least 10 localities, all on forested terraces or low, steep banks along streams of moderate size. Soils were all below the main sandstone strata, but they did not extend far below the limestone strata onto pure calcareous soils. Several records are from the Station Camp Creek drainage, including War Fork, and others are from tributaries of the upper Rockcastle River: Mill Creek; lower Horse Lick Creek including Raccoon Creek; and as far south as the Billows area. Curiously, it was found at only one site in the Sturgeon Creek drainage: Grassy Fork of Upper Sinking Creek. The terrace vegetation with this species appears to be a particularly well developed feature of the Berea District (see Introduction for details). Typical associates included *Liriodendron*, *Fagus*, *Tsuga*, *Carpinus*, *Hamamelis*, *Meehania*, *Iris cristata*, *Thelypteris noveboracensis*, *Polystichum*, *Tiarella*, *Panax trifolius*, *Viola conspersa*, *V. affinis*, *Senecio aureus*, *Poa alsodes* and *Carex laxiculmis*. *Phlox divaricata* was generally absent.

Phlox subulata var. *australis* Moss Phlox (5/15). In Kentucky, this Appalachian species is known as a native plant only from scattered knobs and narrow ridges in the transition from the eastern Knobs Region to the northern Cliff Section. It is known from seven localities near the northern boundary of the Berea District (* = within district): knobs west* and north of Long Branch mouth; Turner Hollow; Big and Little Round Mountain; ridge west of Turkey Pen Branch; south point of Preacher Estes Mountain with *Pachistima*; and small point northeast of Scrivner Cemetery* with *Muhlenbergia cuspidata*. It was found on ledges or steep slopes on or above limestone cliffs, exposures of the Borden siltstone, and, in one case on Little Round Mountain, Devonian black shale. Forming extensive mats in places, the plants occurred in thickets or open woods, usually with *Juniperus*, *Pinus virginiana*, *Quercus* spp., *Carya glabra*, *Rhus aromatica* (on limestone), *Carex pennsylvanica*, *C. eburnea* (on limestone), *Danthonia spicata*, *Monarda* cf. *russeliana* and *Comandra*.

Physostegia virginiana ssp. *virginiana* False Dragonhead (7/30). In Kentucky, this southeastern subspecies is known only from large streams in the southern Cliff Section, and a few old or uncertain records along the Ohio River. In the Berea District, it was found only along Horse Lick Creek, in a section near Dry Branch. The creek bed is lined with limestone in this section, and part of it dried up during the 1990 summer. The plants were

growing at the edge of woods along 2000 feet of the rocky creek bank, with patches totaling at least 1000 sq. feet in area. This population is ecologically distinct and disjunct from the several patches of this subspecies along the sandstone boulder-cobble bars of the Rockcastle River (Appendix A).

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 Berea District, the only record is from a single plant seen in 1990 by A. Risk, growing on a wet bottom of Sturgeon Creek, Owsley County, below the large group of *Cypripedium kentuckiense*. In this 20-40 year old forest (with scattered older trees), frequent woody species included *Acer rubrum* and *Betula nigra* (codominant), *Platanus*, *Carpinus*, *Alnus* and *Cephalanthus*. The ground covered included *Climacium americanum* (an abundant moss), *Onoclea*, *Athyrium asplenoides*, *Carex* Section *Ovales*, *C. laevivaginata*, *C. crinita*, *C. rosea*, *C. amphibola*, *C. gracillima*, *Glyceria striata*, *Elymus* cf. *riparius*, *Juncus effusus*, *Platanthera flava*, *Thalictrum pubescens*, *Saururus*, *Tovara*, *Cardamine rotundifolia*, *Apios*, *Rhus radicans*, *Parthenocissus*, *Cryptotaenia*, *Ligusticum*, *Viola cucullata*, *Senecio aureus*, *Aster prenanthoides* and *Solidago rugosa*.

Prenanthes crepidinea Large Wood-lettuce (4/6). This species has been rarely reported throughout its mid-western range, and may deserve study for federal listing. In Kentucky, it was previously known only from Fayette County (Campbell and Ruch 1990) and Graves County (Athey No. 2767). In the Berea District, one patch of three clumps totalling only 5-10 sq. feet, was found at the base of a slope next to the dirt road along Horse Lick Creek, 1000 feet north of White Oak Creek. The plants were under a small canopy opening in forest with *Acer saccharum*, *A. nigrum*, *Ulmus rubra*, *Carpinus*, *Hydrangea*, *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, a mile north of the district in Estill County.

Solidago harrisii Harris' Goldenrod (3/>20). *S. harrisii* has been treated as a species (Morton 1973), or as a variety (Cronquist 1980) or subspecies (Cusick 1990) of *S. arguta*. Most records are from the shale-barrens of Virginia and adjacent states. Some plants have recently been found on limestone in Virginia and Kentucky, and these may deserve taxonomic distinction (T. Wiebold, pers. comm.; Campbell et al. 1989). In Kentucky, it appears largely restricted to the western edge of the north-central Cliff Section, and adjacent knobs, in areas drained by the Kentucky River. Braun's (1943) record from Pike County was erroneous, and is based on a collection of another poorly known species in the *arguta* group. There is also a single record from the Inner Bluegrass in Fayette County (Campbell and Ruch 1990). Within 2-3 miles either side of the northern boundary of the Berea District, it has been found in at least 15 sites, all on narrow limestone ridges and knobs. A more southern site was also found along Big Buck Branch of War Fork. Most populations contain hundreds or thousands of plants and four sites were found with at least 10,000 plants (Long Branch Knob, Brooks Mountain, point S of Preacher Estes Mountain, point E of Reeves School). It generally was found in moderately open, dry woods,

especially on south-facing slopes, with *Quercus muhlenbergii*, *Q. rubra*, *Fraxinus* spp., *Juniperus*, *Acer saccharum*, *Polymnia canadensis*, *Elymus hystrix* and *Monarda cf. russeliana*.

[*Ulmus thomasi* Rock Elm (12/>100).] In Kentucky, this north-central species is largely restricted to steep limestone slopes along the Kentucky River in the Inner Bluegrass Region. There are also reports from further west and elsewhere (K. Nicely, pers. comm.). The only three confirmed records from the Appalachian Plateau are from narrow limestone ridges at the western edge of the central Cliff Section in Estill County. Two sites are in the Stanton District (Grassy Knob Ridge System, by Campbell et al. 1989; and near Cottage Furnace, by D. Dourson, pers. comm.). The other site is a mile north of the Berea District (ridge E of Turner Hollow), where at least 10 trees (10-25 cm dbh) plus saplings and seedlings were found within a half acre on a west-facing clifftop and nearby ledges. Associates included *Fraxinus quadrangulata* and *Staphylea* (abundant), *Quercus muhlenbergii*, *Juniperus*, *U. rubra*, *Rhus aromatica*, *Rosa carolina*, *Diarrhena*, *Carex pensylvanica*, *Monarda cf. russeliana*, *Heuchera villosa* and *Asplenium resiliens*.

Uvularia sessilifolia Sessile Bellflower (ca. 12/60). In Kentucky, this north-central species has been recorded from several eastern and western localities, but it appears to be frequent only along some tributaries of the Cumberland River and its South Fork (Campbell et al. 1990). In the Berea District, it was found in only three localities: near Horse Lick Creek (ca. 1 mile from mouth), Rolling Fork of McHammon Branch, and the Brushy Creek tributary of Sturgeon Creek.

Veronica anagallis-aquatica Water Speedwell (7/10?). In Kentucky, this north-central (circumboreal) species of calcareous streambanks is known from no more than 10 sites, all in the Bluegrass Region or nearby (Beal and Thieret 1986). It is possible that some plants in eastern North America are naturalized (Fernald 1950). In 1990, D. Noe (Nos. 103 and 359) collected it on the banks of Roundstone Creek near Waterfall Cave (within the Berea District), and along the shores of its impounded tributary, Renfro Creek, forming Lake Linville (outside the district).

Viburnum molle Round-leaved Arrow-wood (15/>20). This mid-western species has been reported from several region of Kentucky, but most records are from limestone ravines along the Kentucky River in the Inner Bluegrass. Population density is generally low. The only verifiable record from Appalachian Kentucky is a 1989 collection (by J. Campbell, at Univ. of Ky.) from Cave Branch of Kentucky River, Lee County. About 10 plants, including seedlings, were found in and adjacent to the limestone ravine with mature mesophytic forest (see notes introducing Significant Areas).

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 Berea District, as var. *fragarioides*, it is known from several sites in the Station Camp Creek drainage (especially War Fork, also including Cavanaugh Creek and Rock Lick Creek), plus Cave Branch of Kentucky River (Lee County) and Alum Cave Branch of Laurel Fork of Rockcastle River (Jackson County). It is generally restricted to moist

limestone talus slopes and terraces, in forest with a variety of mesophytic species (often with mixed *Acer saccharum*, *Tsuga* and *Fagus*). The Alum Cave site is exceptional, with a small patch, about 10 feet across, on a shaley slope below a small sandstone rockhouse. Associates at this site included *Tilia*, *Tsuga*, *Magnolia tripetala*, *Lindera*, *Thelypteris*, *Hepatica americana* and *Viola blanda*. The small patch on Rock Lick Creek was found in *Tsuga-Fagus* forest, with frequent *Meehania* and *Carex purpurifera* in the herb layer.

FAUNA

The following accounts summarize regional data for all listed rare species that have been reported from the Berea 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 []. In addition, a few notes are included on other taxa of interest, which have been listed in the past (*Aneides aeneus*) or which may deserve consideration for listing in the future (*Cambarus dubius* variants and *Cambarus* sp. nov.) Following each species' name, its listed status is shown as follows: (1)/(2)/(3).

(1) Status in Kentucky according to the Kentucky Academy of Science and the Kentucky Nature Preserves Commission (KAS-KSNPC; Warren et al. 1986): 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; "+" = KAS-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 (1989, 1990b); E = Endangered; C1 or C2 = candidate for listing, Category 1 or 2; C2C3 indicates that the species was removed from consideration during 1990.

Mussels (unionids)

(*Alasmidonta atropurpurea* Cumberland elktoe: E/S/C2.) This is a rare Cumberlandian species, a member of a group of unionids restricted to the upper Cumberland and Tennessee river basins. The lone record from the Berea District, at one locality in Horse Lick Creek (Ahlstedt 1986), may represent a misidentification; whether a verified collection exists remains uncertain.

Alasmidonta marginata Elktoe: T/-/-. This unionid is known in Kentucky from the lower Cumberland River drainage and the upper Green and Barren rivers east to the Licking and Little Sandy rivers. DiStefano (1984) documented the presence of *A. marginata* in Horse Lick Creek, and it is likely to be present in Middle Fork Rockcastle River and the Kentucky River drainage (e.g., Station Camp and Sturgeon creeks).

Fusconaia s. subrotunda Long-solid: T/-/-. In Kentucky, this species is known from the Tennessee River eastward. The only record from the district is a collection from Middle Fork Rockcastle River by Ahlstedt (1986) that requires verification.

[*Lampsilis ovata* Pocketbook: E/-/-.] There is one old record of this species from the southern boundary of the district, a 1911 collection from Livingston Shoals. Its continued existence is doubtful.

Pegias fabula Little-wing pearlymussel: E/E/E. This Cumberlandian species is a rare member of the highly important Horse Lick Creek fauna, and has also been reported from Middle Fork Rockcastle River (in the Berea District). In Kentucky, it also persists in Kennedy Creek, Little and Big South Fork of Cumberland River, and Whippoorwill Creek. Its distribution was studied intensively by Ahlstedt (1986).

Pleurobema oviforme Tennessee clubshell: E/S/C2. This is another Cumberlandian species that is known from Roundstone Creek, Horse Lick Creek, Indian Creek, Laurel Fork and Middle Fork of Rockcastle River. Elsewhere in Kentucky, it persists in Big and Little South Fork of Cumberland River, Kennedy Creek, Buck Creek, and Whippoorwill Creek.

Ptychobranhus subtentum Fluted kidneyshell: T/-/-. Records for this rare Cumberlandian unionid in the district are available for Horse Lick Creek (DiStefano 1984) and Middle Fork Rockcastle River (Ahlstedt 1986). In Kentucky, it also occurs in a few other upper Cumberland tributaries.

[*Quadrula cylindrica* Rabbitsfoot: E/S/C2.] There is one old record from the southern boundary of the district, a 1911 collection from the Rockcastle River near Livingston. Its continued presence is dubious, given recent impacts on water quality.

Toxolasma lividus Purple lilliput: E/S/C2. This species is known in Kentucky from the Ohio, Cumberland (below the Falls), Green, and Salt rivers. Specimens have been collected from Horse Lick Creek (DiStefano 1984) and Middle Fork Rockcastle River (Thompson 1985).

Villosa lienosa Little spectaclecase: S/-/-. This unionid is distributed almost statewide, but is very rare in the Cumberland River system. In the Berea District, it has been collected once from Middle Fork Rockcastle River, and several times in Station Camp Creek (from Alumbaugh upstream to Drip Rock), most recently in 1988.

Villosa trabalis Cumberland bean: E/E/E. This Cumberlandian species persists in only a few streams of the upper Cumberland drainage. In the district, it is known from Horse Lick Creek, Indian Creek, Roundstone Creek and Middle Fork Rockcastle River.

Crustaceans

Cambarus [Jugicambarus] batchii Crayfish: E/+ /C2. The known range of this recently described crayfish was initially limited to its type locality: Central Kentucky Wildlife Management Area, near US 421 in SE Madison County, Kentucky (Schuster 1976). Further field work has expanded this range (Burch 1990; J. Flotermersh, unpublished). During 1990, specimens were collected just north of the Berea District: south of the type locality to Owsley Lake on Owsley Fork Creek near Bighill (Madison County); east along Red Lick Creek to Irvine (Estill County); and along the Clear Creek tributary of Station Camp Creek west of Irvine. Specimens were also collected southwest of Irvine along

Station Camp Creek, upstream as far as Alumbaugh, which is just inside the Berea District. Ongoing research is expected to extend the range still more.

Cambarus [Jugicambarus] dubius Crayfish: -/-/. The range of this poorly understood crayfish (Hobbs 1989) extends southward from the Allegheny Mountains in southwestern Pennsylvania to Kentucky, southwestern Virginia, northwestern North Carolina and eastern Tennessee (to the junction of the Clinch and Holston rivers, and westward on the Cumberland Plateau to the headwaters of the South Fork of the Cumberland and Caney Fork rivers in Fentress and Cumberland counties). Whitney Stocker (Newark, Ohio, pers. comm.) suggests that this species will be split into several subspecies. Some specimens collected during the inventory exhibited bright blue and red coloration. This color pattern in *Cambarus dubius* appears unique to this part of its range.

Cambarus sp. nov. Crayfish: -/-/. At least one crayfish species new to science has been discovered in the Berea District (Whitney Stocker, pers. comm.). Other specimens may represent new taxa, but they need further study.

Orconectes australis packardii Crayfish: T/-/. There are now three records from the Berea District for this upper Cumberlandian cave-dweller. It was collected in the 1960s from Pine Hill Cave, at the west edge of the district, and from Teamer's Cave (in Crooked Creek/Humongous Cave Area) (Hobbs 1989). In 1990, it was found in New Hope Cave, west of Dry Fork of Crooked Creek. Just west of the district, it has also collected in Fletchers Spring Cave and Devalt Cave. These are the most northern records of these species. It is likely that this species occurs elsewhere in the district, but it is difficult to observe during normal cave exploration and bat surveys.

Fishes

Etheostoma cinereum Ashy darter: T/-/. This species of the Cumberland River system has been found in the Rockcastle River upstream to two miles east of Livingston in 1981, but seining in this area during 1990 yielded no individuals.

Etheostoma sagitta spilotum Arrow darter: S/-/. This subspecies is known only from larger streams in the upper Kentucky River drainage. The only records from the Berea District are from the Sturgeon Creek drainage in 1887 (Little Sturgeon Creek near Travellers Rest), 1967 (location unknown) and 1978 (KY 587 bridge). Given the continuing impacts on water quality in this stream, the existence of this species in the district is somewhat doubtful. However, it should be looked for in Station Camp Creek.

Percina squamata Olive darter: E/S/C2. In Kentucky, this rare fish of the Cumberland River system is only known from the upper Rockcastle River basin, including Horse Lick Creek, and also one site in the Big South Fork of Cumberland River. It inhabits mainstream channels and deep cobble or boulder-strewn riffles in upland streams. No new records resulted from this inventory.

[*Phenacobius uranops* Stargazing minnow: S/-/-.] In the Berea District, this species of the Cumberland River system is known from the Rockcastle River near Livingston. However, no individuals were caught during the 1990 sampling of this area, and the most recent record is from 1936. Given the continuing impacts on water quality in this river, the existence of this species in the district remains uncertain.

Amphibians

Aneides aeneus Green Salamander: -S/C2C3. This Appalachian species is relatively frequent along sandstone cliff in more rugged parts of DBNF. However, there are only four records from the Berea District. These include one from limestone, i.e., at the mouth of Lester Collins Cave No. 1 (Alcorn Quad.) in 1990. There are also records from the Anglin Falls area, a mile or so northwest of the district.

Cryptobranchus a. alleganiensis Hellbender: -S/C2. This southeastern species is known from two records in the Berea District, or along its boundaries. These are somewhat imprecise records from Roundstone Creek at Livingston, and from Sturgeon Creek (Ky. Dept. Fish and Wildlife Resources database).

Reptiles

[*Eumeces a. anthracinus* Northern Coal Skink: S/-/-.] In Kentucky, most records of this Appalachian species are from shaley hills on the west side of the Cliff Section, especially on the Devonian black shale. A number of specimens were found by J. MacGregor and T. Towles during the 1980s at a site in the Berea College Forest, southwest of Berea. However, this site has recently been destroyed by earth-moving equipment. In addition, a coal skink was recently caught by Brad Reynolds (Eastern Kentucky Univ.) in Rockcastle County, on dry burned hills three miles south of Berea near I-75. Although this species has been reported only along these northwestern borders of the district, it is likely to occur on rocky slopes throughout most of the area.

Mammals

Lutra canadensis, River Otter: S/+/-/. This species has a wide range in North America, but, historically, has declined in much of the east. River otters have begun to make a comeback in western Kentucky during the past decade, but there are still few records further east. The Berea District inventory yielded one record, from near Indian Creek south of McKee in 1990. It is likely that this species occurs in the adjacent watersheds of Horse Lick Creek and Rockcastle River.

Microsorex hoyi winnemana [= *Sorex h.w.*] Pygmy Shrew: -S/C2. This widespread Appalachian subspecies is known from about 20 counties in the eastern and central

Kentucky, excluding the Bluegrass Region. Extensive pitfall trapping by Dale Lynch (Ky. Dept. Fish and Wildlife Resources) in 1989, and by inventory zoologists in 1990, yielded 10 records scattered through the Berea District. Most of these records are from forests on ridges or less dissected parts of the Appalachian Plateaus. Dale Lynch and Brad Reynolds (pers. comm.) have also trapped animals at several sites west of the district in Rockcastle County, including some relatively dry, open woods that have burned in recent years.

Myotis septentrionalis [*M. keenii*] Northern Long-eared Bat: S/-/. This northern species has been found in 39 Kentucky counties, mostly in limestone regions. In the Berea District, it was known from five sites before 1990, but is now known from 12. However, no more than six individuals were found in any one cave.

Myotis sodalis Indiana Bat: E/E/E. This highly colonial bat was once found locally throughout the eastern United States. It is widespread in cave regions of Kentucky, with 20 county records, but populations have declined greatly in recent decades. With this inventory, the number of caves known to be used for hibernation in the Berea District increased from 13 to 26, and the total known population to over 3000. Three caves contained about 1000 or more (Smokehole Cave, Waterfall Cave and War Fork Cave). In contrast, the total hibernating population counts from the Station Camp Creek Corridors was only 81, and the total count from the Horse Lick Creek caves was only about 210.

Neotoma floridana magister Eastern Wood Rat: -S/C2. This southern species is known from many cliffs and caves in Appalachian Kentucky, plus Mammoth Cave and some other cave areas in west-central Kentucky. Sudden drastic declines have occurred during the past decade or so in many states bordering Kentucky (MO, IL, IN, OH) and to the northeast. DBNF probably has the best remaining populations of this subspecies. It has been found at over 30 sites within the Berea District, mostly in caves and along cliffines. It has sometimes been caught in house basements (Anne Gabbard, pers. comm.).

Plecotus rafinesquii Rafinesque's Big-eared Bat: T/S/C2. This species occurs locally in much of the southeastern United States. Its habitats include limestone caves, sandstone overhangs, hollow trees, abandoned mines and old buildings. In Kentucky, there are widespread records from 31 counties and 110 individual sites, but the total known population is only about 1400. Only 15 hibernacula have 20 or more bats. In the Berea District, the known number of caves used by this species was increased from 12 to 34 during the 1990-91 inventory. No major hibernacula or maternity colonies are known in the district, though five caves with about 10-20 bats were found, mostly in or near the upper Station Camp Creek drainage. The best populations were found in Johnson Cave and Lester Collins Cave No. 2. In the Horse Lick Creek caves, only three single individuals were found in early 1990, and the last record from Bowman Saltpeter Cave was in 1983.

Plecotus townsendii virginianus Virginia Big-eared Bat: E/E/E. Isolated populations of this declining subspecies are known from gypsum and limestone caves in several areas of the southeastern United States. In Kentucky, almost all records are from the northern Cliff Section, in nine counties and 50 individual sites. In the Berea District, the number of caves known to be used by this species was increased from four to 12 during 1990. Only small groups of 1-11 individuals were found, totaling less than 100. In the Horse Lick Creek caves, only 12 individuals were found, 11 of which were in Bowman Saltpeter Cave.

Spilogale putorius Spotted Skunk: S/-/. This southeastern species has been reported from the Berea District, near McKee, by Dale Lynch (Ky. Dept. Fish and Wildlife Resources) and USFS personnel.

Ursus americanus Black Bear: E/-/. There were two bear sightings on the Berea District by local residents in 1987. Near Cave Creek on USFS 375, two miles north of KY 89 in Jackson County (Leighton Quad.), Julie Isaacs (pers. comm.) reported a mother and two cubs in May, and two individuals in August. This report is just one of several recent indications that the Black bear is moving back into Kentucky from the central Appalachians (see also Campbell et al. 1989, 1990). Further south in DBNF during 1990, there were also several sightings of a mother and cub(s) from the Bee Rock area by the Rockcastle River (L. Andrews, USFS, Somerset, pers. comm.), and one was photographed in the Great Meadow area by Rock Creek, western McCreary County (D. Stephens, pers. comm.).

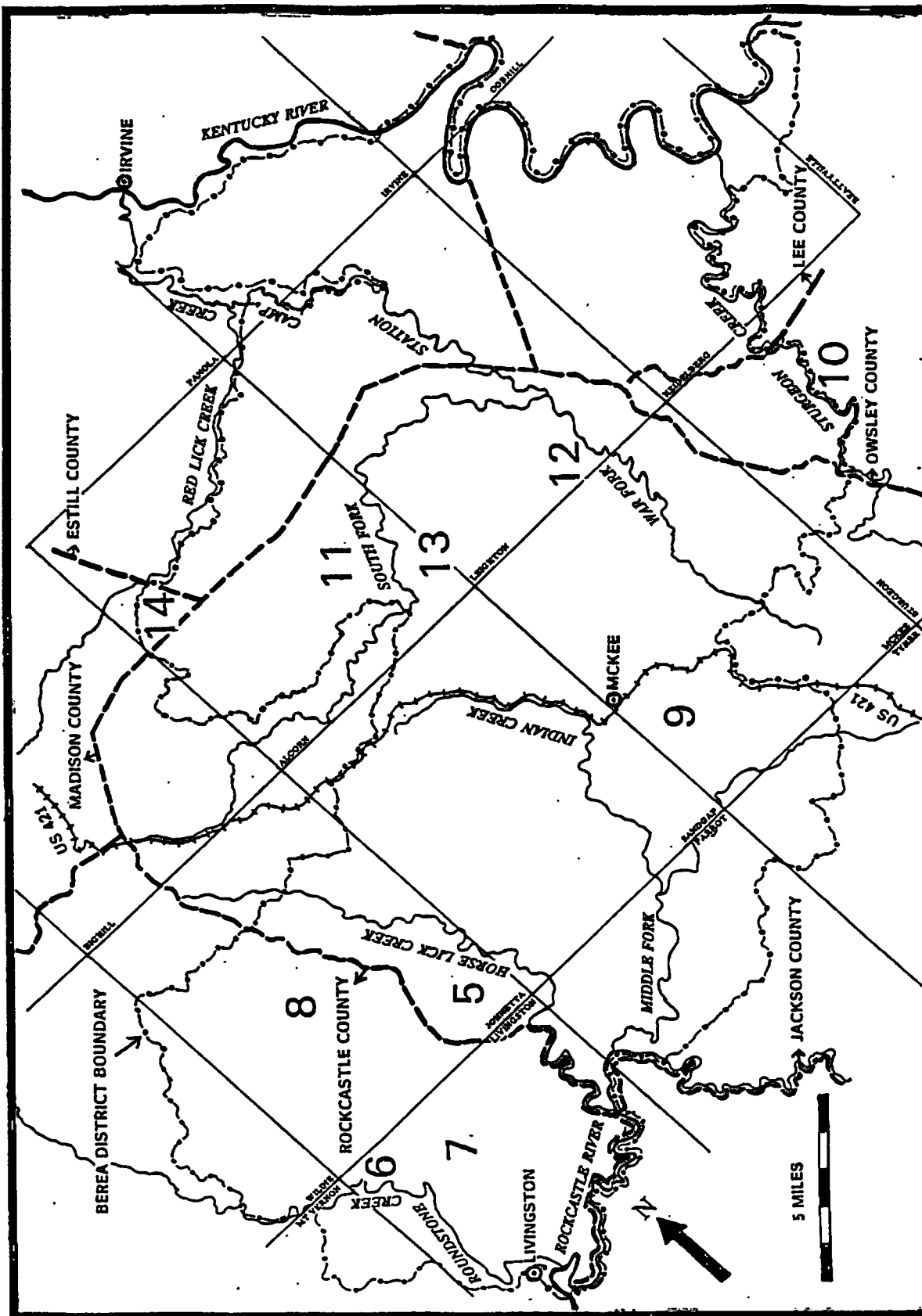


Figure 4. Map of Berea Ranger District (Proclamation Boundary) showing approximate locations of significant areas. Numbers on the map correspond to figure numbers in the following section.

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) a special ecological feature. These areas therefore have relatively high contribution to overall biodiversity within the Berea District. Together, they contain a majority of the rare species occurrences within only a quarter of the total district area. General locations of these areas are shown in Fig. 4, and individual boundaries in Figs. 5-13. 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. Also, some clusters of caves are extended to include caves where rare bats are not currently documented, since cave ecosystems of all types have potential for rare invertebrates as well as bats (T. Barr, pers. comm.; Dougherty 1985).

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 relatively widespread in the region, and are not included under each site description. These include *Cypripedium pubescens*, *Hydrastis canadensis*, *Panax quinquefolius* and *Polemonium reptans* var. *villosum*.

Before detailing the areas of obvious importance, a few notes are needed concerning some other sites of interest. These deserve more study in regard to possible conservation efforts, though most of them are probably not as significant as those detailed in the expanded descriptions, beginning with Horse Lick Creek.

(a) **Rockcastle River Corridor** (Jackson and Rockcastle Cos.; Livingston and Parrot Quads.). The river runs along the southern boundary of the Berea District. It is the source for many records of rare aquatic organisms, including all of those present in Horse Lick Creek (see below), plus others, including two fishes (*Etheostoma cinereum* and *Phenacobius uranops*) and two mussels (*Lampsilis ovata* and *Quadrula cylindrica*). It certainly deserves protection for this reason, but the practical problems are immense and beyond the scope of this report. Some mussels, reported nowhere else in the district, have not been collected here for over 30 years. Notes on some sites of botanical interest along the river downstream of Livingston are provided in Appendix A.

(b) **Boiling Springs Cave area** (Rockcastle Co., Wildie Quad.). The south end of the ridge between Clear Creek and its Cane Branch is riddled with at least eight cave entrances. Some of these are pits and need further exploration.

(c) **Laurel Fork Ravine** (Jackson Co., Tyner Quad.). The central, narrow section of the sandstone ravine has one of the most extensive, mature hemlock-beech stands in the Berea District. The ravine is relatively cool in places, and has the only *Oxalis montana* population known in the district (see note in section on rare flora). *Carex pedunculata* is also present.

(d) **Grassy Fork-Hale Ridge area** (Lee Co., Heidelberg Quad.). The Grassy Creek section 0.5-1 miles upstream of Goosey Fork has bottomland that has been logged but not farmed.

There is a small picturesque waterfall in the fork 0.5 miles west of Goosey Fork. There are also a few plants of interest: *Cirsium carolinianum* (>30 on ridge to N), *Cypripedium pubescens* (only 2 plants seen), *Iris verna* (scattered on ridges), *Isoetes engelmannii* (>100 in streamhead south of Hale Ridge) and *Phlox stolonifera* (patches on bottom).

(e) **Cave Branch** (Lee Co., Heidelberg Quad.). This creek has a limestone ravine with small caves and a 20-30 acre strip of uneven forest, with a good scattering of 50-70 cm dbh trees (*Acer saccharum*, *Aesculus octandra*, *Fagus*, *Tilia*, *Fraxinus americana*, *Quercus rubra*). Plants of interest include *Waldsteinia fragarioides*, *Viburnum cf. molle* and *Carex pedunculata*. The caves are probably not extensive, but have not been checked for bats in the winter.

(f) **Kentucky River bluffs, Ross Creek area** (Estill and Lee Cos., Heidelberg Quad.). These may deserve further exploration. The north-to-east-facing bluff west of Ross Creek has 20-30 inches (50-80 cm) dbh canopy of *Fagus*, with some *Quercus rubra*, *Acer saccharum* (understory), *Tsuga* (steep low slopes); also frequent *Asarum*, *Smilacina*, *Aster divaricatus*, *Solidago flexicaulis*, *S. cf. flaccidifolia* and *Astilbe*. The SE-facing slope west of Lock No. 13 has some exceptionally pronounced cliffs, but it is rather disturbed and no rare species are known.

(g) **Wolf Pen Branch old-growth** (Lee Co., Heidelberg). A. Risk found a 10 acre area on the southwest side of Wolf Pen Branch, Ross Creek that had relatively mature forest. The canopy trees were up to 28-35 inches (60-90 cm) dbh, and were mostly *Quercus velutina*, *Q. rubra* and *Q. alba* with lesser numbers of *Liriodendron* (though up to 40 inches or 100 cm dbh). However, aerial photographs indicate that these trees are mostly confined to a narrow band along the ridge.

(h) **Brushy Ridge area** (Jackson Co., McKee Quad.). This area covers about 1 square mile at the head of Lakes Creek, including the ridges. Features of interest are the "Bald Rock" area (0.3 miles NE of BM 1402) and other narrow rocky ridges with dry open forest, two populations of *Carex leptalea* in streamheads (one with *Lorinseria*), and relatively extensive sandstone cliffline with potential for bat use; a single *Myotis septentrionalis* was found near Bald Rock. The area deserves further exploration.

(i) **Middle Fork, Station Camp Creek** (Estill Co., Alcorn and Leighton Quads.). There is a previous record of a few *Spiranthes lucida* plants here. This area was not covered intensively during 1990, and it is possible that further habitat for this orchid exists, similar to the main stem of Station Camp Creek.

(j) **Curtis Mountain/Scrivner Branch area** (Estill Co., Irvine Quad.). The limestone ridges around the hollow above Scrivner Cemetery have two dry, open points with large populations of some rare plants: *Muhlenbergia cuspidata* and *Phlox subulata* in the center; and *Solidago harrisii* on the southern west-facing point. However, the rest of the watershed has unexceptional forests or farmland.

(k) **The head of Kiskey Branch** (Estill Co., Alcorn Quad.). A small cave here (Lester Collins No. 2) had a good population of *Plecotus rafinesquii* (20 on 27 Nov 1990).

Site Name: HORSE LICK CREEK WATERSHED AND CORRIDOR; Fig. 5
Size: watershed is 62 sq. miles (40,000 acres); corridor is 24 sq. miles (15,000 acres)
Counties: Jackson and Rockcastle
USGS Quadrangles: Livingston, Parrot, Sandgap and Johnetta, Ky.
(and small areas on Big Hill and Alcorn, Ky.)

Location. About 85% of the watershed of Horse Lick Creek lies within the Berea District. The 1-3 mile wide corridor outlined in Fig. 5 extends from the creek's mouth at the Rockcastle River, between Lamero and Cruise, almost up to its source between Threelinks and Clover Bottom. US 421 and KY 1955 run through the northern section of the watershed, and KY 89 crosses the mouth of Horse Lick Creek. There are several good gravel roads within the watershed, mostly on the ridges and maintained by USFS. In contrast, dirt roads and off-road-vehicle (ORV) trails run along almost all the bottomland of Horse Lick Creek and its major tributaries, and there are several crossings.

General Description. This area is in the central part of the Cliff Section of the Appalachian Plateaus. The uplands are all underlain by the Breathitt and Lee Formations of Pennsylvanian age, which consist of shale, siltstone, sandstone and coal. The lower or middle slopes along Horse Lick Creek and its major tributaries are underlain by rocks of Mississippian age: at lower levels, the Pennington Formation, which consists of sandstone, siltstone, shale, dolomite and limestone; and at higher levels, the Newman Limestone. There has been some extensive coal-mining in the tributary watershed of Clover Bottom Creek, especially near Sandgap. About 10% of this tributary watershed is strip-mined, and a plethora of 50 or more shaft mines occur 1-5 miles south of Sandgap. Overall forest cover is about 65%. In the lower (southern) half of the watershed, the land is almost all forested, except for some broader ridges and bottomlands along the larger streams. No exceptionally old forest is known in the watershed, but in the southern half there are a few 10-50 acre stands with canopy trees up to about 100 years. The only significant sandstone cliffs in the watershed occur in the southern half, and the rare mussels are restricted to riffles in the lower half of the creek. In the upper (northern) half of the watershed, the land is generally less rugged, and only half is well-forested, but more limestone is exposed and caves are virtually restricted to the upper corridor.

Listed Aquatic Animal Species

?Alasmodonta atropurpurea, Cumberland elktoe (possibly a misidentification)
Alasmodonta marginata, Elktoe (a mussel)
Pegias fabula, Little-wing pearlymussel
Percina squamata, Olive darter (a fish)
Pleurobema oviforme, Tennessee clubshell (a mussel)
Ptychobranhus subtentum, Fluted kidneyshell (a mussel)
Toxolasma lividus, Purple lilliput (a mussel)
Villosa trabalis, Cumberland bean (a mussel)

Listed Mammal Species

Lutra canadensis, River Otter (found nearby along Indian Creek)
Microsorex hoyi winnemana, Pygmy Shrew
Myotis septentrionalis, Northern Long-eared Bat
Myotis sodalis, Indiana Bat
Neotoma floridana magister, Eastern Wood Rat
Plecotus rafinesquii, Rafinesque's Big-eared Bat
Plecotus townsendii virginianus, Virginia Big-eared Bat

Listed Plant Species.

Clematis glaucophylla, Leather-flower
Eupatorium luciae-brauniae, Lucy Braun's White Snakeroot
Helianthus atrorubens, Sunflower (outside stream corridor)
Helianthus cf. eggertii, Sunflower (outside stream corridor)
Lilium philadelphicum, Wood-lily (outside stream corridor)
Solidago rupestris, Goldenrod
Synandra hispidula, Synandra
? *Trifolium stoloniferum*, Running Buffalo-clover (extirpated?)
Viola tripartita, Yellow Violet

Other Plants of Interest.

Carex hirtifolia, Hairy Rich-wood Sedge
Carex scabrata, Rough Running Sedge
Cimicifuga americana, Mountain Bugbane
Panax trifolius, Dwarf Ginseng
Phlox stolonifera, Running Mountain Phlox
Prenanthes crepidinea, Giant Wood-lettuce

Biological Significance. The Horse Lick Creek watershed supports a diverse fauna with several nationally significant organisms and is protectable if USFS, TNC, KSNPC and other state and federal agencies make this area a priority for conservation.

A. Aquatic systems. The freshwater unionid (mussel) fauna of North America is the richest in the world, with approximately 297 recognized taxa (Turgeon et al. 1988). The bulk of this fauna occurs east of the Rocky Mountains and is centered in Tennessee, Alabama and Kentucky. It is here that the widespread Mississippi River or Interior fauna intermingles with the highly diverse Cumberlandian fauna, with many endemics, in the upper Cumberland and Tennessee river basins. Unfortunately, our mussel fauna is also perhaps the most endangered group of animals in North America. USFWS has listed, is considering for listing, or has deemed extinct, 121 species—40% of the whole North American fauna (USFWS 1989, 1990b). Approximately 50% of the Kentucky fauna is rare, including most of the unique Cumberlandian fauna. Of the 73 species that historically inhabited the upper Cumberland River basin in Kentucky, 36 have been extirpated from the area, and 11 of the 37 that persist are rare at the state or federal level. The Cumberlandian fauna, a subset of these 73 species, has been decimated.

Nineteen of the 22 members of this fauna that occurred in Kentucky are rare, extirpated or extinct; only three are common. These losses are a result of habitat alteration attributable to dam building, mineral resources development, agriculture, and the other demands placed on aquatic resources by our population.

Throughout the Cumberland river basin in Kentucky, Tennessee, Alabama and Virginia, only a limited number of streams continue to support remnant populations of Cumberlandian species (e.g., *Epioblasma brevidens*, *E. capsaeformis*, *Pegias fabula*, *Pleurobema oviforme*, *Ptychobranthus subtentum* and *Villosa trabalis*). Many of these streams are unprotectable, while others will require a significant commitment of manpower and money with little guarantee of success. In Kentucky, these streams include the Big and Little South Forks of the Cumberland River, Buck Creek, and the Rockcastle River drainage, including Horse Lick Creek. The Big South Fork is largely in federal ownership, with a very large mineral-rich watershed and a limited amount of significant mussel habitat. The Little South Fork recently was seriously impacted by coal mining and an unsuccessfully reclaimed mine site. The rather large Buck Creek watershed (296 square miles) supports excellent mussel and fish faunas but most is privately owned, with extensive agriculture and some coal mining. The Rockcastle River itself has a very large watershed, with extensive coal-mining, agriculture, towns and major highways, though part is owned by USFS.

This leaves Horse Lick Creek, a headwater tributary of the Rockcastle River. Approximately 30% of its remote 62 square mile watershed is owned by the USFS. The major land use is timber production, and few people live within the watershed. Horse Lick Creek has for the most part excellent water quality and provides for diverse mussel and fish faunas, including federally listed or candidate species (*Pegias fabula*, *Pleurobema oviforme*, *Percina squamata*, *Toxolasma lividus*, *Villosa trabalis*) and other rare species (Harker et al 1980, DiStefano 1984). At least 22 species of mussels have been found in the creek. The population densities are as high as can be found anywhere in the upper Cumberland river-basin, and some locations (e.g., 400 m below Raccoon Creek) may have record densities (J. Layzer, Tenn. Tech. Univ., pers. comm.). Several researchers have already recommended that this stream be protected for its faunal diversity (Harker et al., 1980, Hannan et al. 1982, Anderson 1989).

The following threats exist to the Horse Lick Creek unionid fauna.

1. Run-off from Off-Road-Vehicle (ORV) trails. Several ORV trails enter the watershed and cross the stream. These are open sores on the landscape that in some cases erode extensively and deeply. As the trails erode, they contribute silt and sediment that is detrimental to healthy aquatic communities. Wooded areas are also degraded when vehicles are driven around badly eroded trails.
2. Run-off from coal-mining. Various pollutants emanate from coal mine sites (e.g., acid and alkaline drainage, metals and sediment), adversely affecting unionids and other aquatic species. Acidity itself does not generally worsen in the long-term (months/years),

though short pulses (days) of acute acidity may be serious. The major long-term chemical alterations include increases in dissolved metals, especially aluminum and iron. These and other effects have recently been studied in Horse Lick Creek and elsewhere in the Cumberland river basin by Anderson (1989) and others at Tennessee Technological University, under the direction of J. Layzer (pers. comm.). Anderson's study indicated that the endangered *Pegias fabula* is exceptionally sensitive to the pollution from mines. He concluded that: "Current surface mine regulations are providing inadequate protection for endangered and threatened freshwater mussels in the Cumberland River drainage". A conservation plan for the whole Horse Lick Creek watershed could provide an excellent opportunity to apply results of mine reclamation and pollution controls to a pressing biological problem, i.e., the rare mussels.

3. Run-off from logging practices. Runoff from improperly located, designed, or conducted logging operations can also adversely impact stream resources. Although of lesser importance, serious erosion due to poor logging practices has continued in the lower Horse Lick valley. This has largely been due to roads and log-slides being run up and down rather than along contours. Such practices are limited to private land, and are prohibited on USFS land.

4. Other potential water pollution from inhabited areas on ridges.

5. Exotic species and predation. Exotic organisms may adversely affect unionids. *Corbicula fluminea* (Asian clam), a member of the molluscan Order Veneroida, is endemic to southeast Asia but now is widely distributed in the United States. This bivalve has been implicated in the decline of native unionids (Kraemer 1979, Clarke 1988). The zebra mussel, *Dreissena polymorpha*, an exotic bivalve from Eurasia, has entered the Great Lakes and is expected to invade the Mississippi and Ohio river drainages. This bivalve appears to compete directly for resources with native unionids and has the potential to drastically alter aquatic systems. Non-native fishes such as the rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) may impact unionid populations directly by preying on juveniles or indirectly by preying on or competing with unionid host fish species. Natural predators such as muskrats (*Ondatra zibethicus*) may impact rare unionid populations. For example, in the Green River in Mammoth Cave National Park, muskrats consume large numbers of small fanshell unionids (*Cyprogenia stegaria*), a federally endangered species (Cicerello and Hannan 1990). The river otter (*Lutra canadensis*) can also eat unionids, but its density is very low in this region.

B. Cave systems. The upper half of Horse Lick Creek lies within one of the most significant clusters of caves in Kentucky, centered on the Roundstone Creek drainage to the west and the Station Camp Creek drainage to the north (Dougherty 1985). In addition to rare bats, many invertebrate species with small ranges occur in these caves (T. Barr, pers. comm.; Dougherty 1985). The Horse Lick Creek caves may have special significance as the most northern cave system in the Cumberland river drainage.

Rare bat species have found hibernating at six sites in this watershed: Bowman

Saltpeter Cave, John Henry Cave, John Coffee Cave, John Griffin Cave, Lakes Cave and String Cave. These are in the upper half of the Horse Lick Creek valley, above the rare mussel sites, and they are only 200-2000 feet from the creek. Several other caves are known in this corridor, and some still have not been searched for bats. The population counts for rare bat species are low enough that not one of these caves has priority for conservation on its merits. However, the total Indiana bat population—210 in early 1990—is high enough that, if conservation plans for all these caves systems are implemented, then much reproduction and recovery could result. Lakes Cave, in particular, appears to contain excellent habitat for Indiana bats, and their population was probably much larger in this cave before human disturbance (J. MacGregor, pers. comm.). The adjacent John Griffin Cave is also frequently visited.

The population of *Plecotus rafinesquii* using the Horse Lick Creek caves appears to very small, since only three single individuals were found in early 1990. The last record from Bowman Saltpeter Cave was in 1983. Counts of *Plecotus townsendii virginianus* have been small as well. However, its counts have increased from 2 to 11 in Bowman Saltpeter cave during the past decade.

Some of the caves are currently receiving visitation that appears detrimental to the rare bat species. Much of the effect is simply due to people waking them from hibernation, with consequent exhaustion of stored energy reserves in the animals. Direct vandalism and killing of bats has not been documented in this area, but it is likely to have occurred and may well occur in the future unless caves are protected. Whether there have also been hydrological effects on the caves due to human activities is unknown, but worthy of investigation. Conservation of these caves, within the context of the whole watershed, would provide a invaluable opportunity to investigate recovery of bat populations and associated ecological features, after disturbance has been reduced or removed. The following measures would need to be implemented for adequate protection of the bat population: (1) reduction of access to critical sites; (2) restriction of visits during critical periods; (3) prohibition of fires at cave entrances; (4) monitoring of mineral extraction; (5) maintenance of foraging habitat around caves.

C. Terrestrial Systems. The vegetation is not particularly unusual, though small remnants of old-growth forest or other special vegetation types do exist, and small populations of a few globally rare species are present: *Eupatorium luciae-brauniae*, *Helianthus cf. eggertii*, *Prenanthes crepidinea* and *Lilium philadelphicum* var. *p.*

1. Old-growth forests. There appear to be no significant (>10 acre) stands in the watershed that have completely escaped logging. The upper half of the watershed has received more disturbance from logging, settlement, agriculture and mining, and most canopy trees are probably no more than 50 years old. The lower half of the watershed seems more remote and is less disturbed today, with much USFS ownership, but there was formerly much settlement on the bottomland and the forests were cut extensively in the 1930s. Some areas appear to date from earlier logging, with a general age of ca. 50-75 years. These slightly more mature areas are concentrated in the lower half of the

watershed, especially near Horse Lick Creek and its major tributaries, but even here they cover only 20-40% of the area.

There are only two or three small stands (10-50 acres) in the watershed where the canopy trees appear generally more than 100 years old. Perhaps the best of these small old-growth stands (with an uneven canopy of 30-100 cm dbh trees) is on the north-facing slope of the narrow sandstone ridge southeast of the mouth of Dry Fork. The trees here include *Fagus* (abundant), *Quercus rubra*, *Q. alba*, *Tsuga*, *Betula lenta*, *Acer rubrum*, *Carya ovata*, *Cornus florida* and *Rhododendron maximum*; *Liriodendron* is abundant in adjacent younger forest. The herb layer includes many ferns (*Dryopteris intermedia*, *Thelypteris noveboracensis*, *Osmunda cinnamomea*, *Phegopteris*, *Adiantum*, *Polystichum*), also sedges (especially *Carex lucorum*) and other herbs (e.g., *Cimicifuga* spp., *Viola blanda*, *Tiarella*). On the south side of this ridge is the only known population of *Eupatorium luciae-brauniae* known in the Berea District, disjunct by 20 miles from its main range to the south. This stand would be a mixture of "typic" and "acidic mesophytic forest" in the Allard's (1990) classification. There is less mature timber on drier (subxeric or xeric) sites. One of the best is a stand of about 20 acres on the east side of White Oak Creek, with 16-32 inches (40-80 cm) dbh oaks (*Quercus coccinea*, *Q. montana*, *Q. alba*, *Q. velutina*) and pines (*Pinus rigida*, *P. echinata*), which is referable to Allard's (1990) "chestnut oak forest".

These old-growth sites do not harbor significant clusters of rare species, but there are several state rarities typical of these widespread slope forest types, especially on moister sites (*Carex hirtifolia*, *C. pedunculata*, *Cimicifuga americana*, *Cypripedium pubescens*, *Hydrastis canadensis*, *Panax quinquefolius*, *Synandra hispidula*, *Viola tripartita*). None are endangered or threatened globally; most have wide north-central to Appalachian ranges. Some of these have been excessively harvested in Kentucky for medicinal or herbal uses, or are so threatened (*Cypripedium*, *Hydrastis* and *Panax*). The potential for economic cultivation of these species is illustrated by a large population of *Panax quinquefolius* already established on a privately owned tract in the watershed.

The most obvious human disturbance in this area is the logging of forests and clearance for agriculture, though the latter has now been reduced considerably and many fields have been abandoned, especially near the creek. All of the watershed has been cut-over to various degrees. However, selective cutting, without clearance, has generally left no obvious long-term damage to the vegetation. The rare plant species listed here are not concentrated in older stands, and some need at least partial opening of the canopy. The potential for recovery of forests to a natural old-growth condition is excellent in all of the watershed except the strip-mines.

2. Rare vegetation types of floristic interest. The flora of this watershed has relatively few unusual features, compared to some other parts of the Cliff Section. However, the area is at the northern or western extent of several species that are more or less associated with the Cumberland River drainage in Kentucky. Some vegetation types with a distinctive group of such species are the shrubby forest-streamside transitions that occur

on rocky banks of larger streams and rivers in the Cumberland River drainage. Although much better expressed in the lower Rockcastle River valley and further south, some of the characteristic species extend up into the Horse Lick Creek drainage, especially on or near sandstone boulders. These include *Rhododendron arborescens*, *Itea virginica*, *Clematis glaucophylla*, *Uvularia sessilifolia*, *Trautvetteria caroliniensis* and *Physostegia virginiana* ssp. *virginiana*. In addition, *Solidago rupestris* and *Zizia aurea* are particularly characteristic of streambanks with limestone. The species of rocky stream banks, like those of clifflines, have received relatively little human disturbance, since these areas have generally been less heavily logged, and they cannot be cleared for agriculture.

On less frequently or intensely flooded streambanks, the above vegetation often grades into a somewhat unusual variant of "typic" to "acidic mesophytic forest" (Allard 1990). This is typical of terraces and lower slopes along medium-sized streams in some moderately dissected, northwestern parts of the Appalachian Plateaus in Kentucky. The trees are typical mesophytic species, with an admixture of *Platanus*, *Liquidambar*, *Nyssa* and *Acer rubrum*. It has a distinctive herb layer, with frequent *Aster divaricatus*, *Senecio aureus*, *Phlox stolonifera*, *Meehania*, *Panax trifolius*, *Viola affinis*, *V. conspersa*, *Tiarella*, *Hepatica americana*, *Iris cristata*, *Carex laxiculmis*, *C. gracilescens*, *Poa alsodes*, *Polystichum* and *Thelypteris*. On the gravelly banks of these medium-sized streams, small patches of *Carex scabrata* and *Cardamine rotundifolia* add further interest. On slightly more basic soils, the Cliff Section endemic, *Polemonium reptans* var. *villosum*, is locally frequent on similar terraces and benches.

Another natural community with a biogeographically distinctive group of species may have been a grassy "pine-oak barrens" type on the ridges (or "southern pine-oak woodland" of Allard, 1990). Such vegetation would have been maintained by fire before settlement. There is substantial evidence that, before suppression of annual fires, such a community existed further south in Daniel Boone National Forest, where several rare plants and the Endangered Red-cockaded woodpecker still survive as remnants of this ecosystem (Campbell et al. 1991). Horse Lick Creek lies within the historical range of this bird, though there are no records from this particular area (Campbell et al. 1989).

The only living evidence that such vegetation existed in this watershed are the small populations of some characteristic, rare or uncommon plants on roadsides, especially *Lilium philadelphicum* var. *philadelphicum*, *Helianthus atrorubens*, *H. cf. eggertii*, *Cirsium carolinianum* and *Asclepias amplexicaule*. Some of these roadsides are still dominated by native plants, especially *Andropogon* spp., and might be restored and expanded by appropriate management with fire. Before settlement these species probably occurred in areas that were frequented by bison, elk and deer, and often burned by Indians. A kind of human "disturbance" after settlement may have occurred due to reduction in natural disturbance from animals and Indians. Today, fires are generally suppressed by the state and USFS, though so-called "arson" is frequent along roadsides.

Explanation of Boundaries. The primary boundary is a 1-3 mile wide corridor along the creek itself, from its mouth to its source (see map). This corridor includes all of the sites

with rare mussels, all known caves in the watershed, and most of the more mature (ca. 50-100 year old) forest in the watershed. The secondary boundary is the whole watershed, within which water quality can hopefully be controlled in the future to ensure survival of the mussels.

Site Name: ROUNDSTONE SINKS/WATERFALL CAVE AREA; Fig. 6

Size: 1540 acres

County: Rockcastle

USGS Quadrangle: Livingston, Ky.

Location. This area lies along Roundstone Creek, from 1000 feet south of Sinks upstream for 2 miles to the Waterfall Cave area. The lower part is crossed, with a bridge over the creek, by a paved road to Mullins (USFS 465), about 4 miles north of Livingston off US 25. A railroad right-of-way runs along the western creek bank.

General Description. This rugged area is in the western Cliff Section. There are sandstone exposures on upper slopes, with large cliffs towards the northern end, above Waterfall Cave. Also, there are extensive limestone exposures on middle to lower slopes, with several caves, including some in pits or sinks below sandstone cliffs. This close proximity of limestone sinks to sandstone cliffbases may be developed more frequently in this area than in any other part of the Cliff Section in Kentucky. There is a quarry near Mullins, and a stripmine to the west. The area is 90% forested, except for some bottomland along the creek. Some grazing extends into the woods below Waterfall Cave. Most land is privately owned, except for USFS tracts above Waterfall Cave and on the slopes east of Sinks.

Listed Animal Species.

Cryptobranchus alleganiensis, Hellbender (found downstream)

Microsorex hoyi winnemana, Pygmy Shrew (found upstream)

Myotis septentrionalis, Northern Long-eared Bat

Myotis sodalis, Indiana Bat

Neotoma floridana magister, Eastern Wood Rat

Plecotus rafinesquii, Rafinesque's Big-eared Bat

Plecotus townsendii virginianus, Virginia Big-eared Bat

Pleurobema oviforme, Tennessee clubshell (a mussel, found upstream)

Villosa trabalis, Cumberland bean (a mussel)

Listed Plant Species.

?*Minuartia glabra*, Sandwort (nearby; tentative identification)

Other Plants of Interest.

Veronica anagallis-aquatica, Water Speedwell

Biological Significance. Although parts are disturbed by rights-of-way, farming, mining and quarrying, this area appears to have more biological interest than any other section of the Roundstone Creek valley, none of which currently has definitive management for conservation. Waterfall Cave is one of the largest hibernacula for *M. sodalis* in the Berea District (with 1138 bats counted on Mar 27, 1990; and 891 on Jan 3, 1991). Other caves nearby (Waterfall Cave No. 2 and Twin Springs Cave) had low numbers of rare bats in 1990/91. There are other caves further downstream which have had rare bats (10-50 *M.*

sodalis in Sinks of Roundstone during 1980s) or have great potential for rare bats (e.g., Miller's Pit at mouth of Boone Hollow). The forests are generally not of above-average maturity, but there are some 20-30 acre patches of older forest, with 1-2 feet dbh trees of *Tsuga*, *Fagus*, *Liriodendron* and *Acer saccharum*, near Waterfall Cave and Miller's Pit. The creek itself may still support populations of *Villosa trabalis* (collected here and upstream in 1985-86) and perhaps other rare mussels.

Explanation of Boundaries. The standard stream corridor approach is applied, including land up to the watershed divide, except for major tributaries. However, the important caves are widely scattered, and a core area might be restricted to the watershed around Waterfall Cave. A minor extension, shown by dashed line on Fig. 6 and not included in the above acreage, could include the sandstone outcrop 0.5 miles east of Sinks along Piney Branch and USFS 463. Perhaps caused by this old road, bare rock is exposed for at least an acre, and seedlings that may be *Minuartia glabra* were found.

Site Name: CROOKED CREEK/HUMONGOUS CAVE AREA; Fig. 7

Size: 1650 acres

County: Rockcastle

USGS Quadrangle: Livingston, Ky

Location of Site. This area lies on the east side of Crooked Creek, a tributary of Roundstone Creek. A gravel road (USFS 465) runs just west of the area, and a paved road (KY 1955) runs along the eastern boundary, about 5 miles north of Livingston.

General Description. This moderately rugged area lies in the western Cliff Section. Sandstone and limestone exposures are not extensive; cliffs are generally interrupted and no more than 10-20 feet high. The area is mostly forested, except for some of the ridges, benches and bottoms. However, the forests are mostly young or cutover, and none of the area is owned by USFS.

Listed Animal Species

Myotis sodalis, Indiana Bat

Neotoma floridana magister, Eastern Wood Rat

Orconectes australis, a cave crayfish

Plecotus rafinesquii, Rafinesque's Big-eared Bat

Biological Significance. There are several caves where Indiana bats have been found: Humongous Canyon Cave (327 on 28 Dec 1990); Teamer's Cave (2 on 22 Feb 1990), Crooked Creek Ice Cave (30 on 3 Mar 1990); and Great Saltpeter Cave (10 on 10 Jan 1978, none in 1990). In addition, a pit, "Deep and Splendid" (J. MacGregor's name), has not yet been explored for bats, but has great potential. Humongous Canyon Cave may also have paleontological significance; extensive deposits of bat bones in mud or guano suggest that the cave formerly had a much larger bat population. There are indications that rare bat populations have declined greatly during recent decades in Teamer's Canyon Cave and Crooked Creek Ice Cave, probably due to human disturbance, and increases would be likely with protection. However, Great Saltpeter cave is probably less suitable for the rare bat species. Teamer's Cave also has supplied one of the few Berea District records of the cave crayfish, *Orconectes australis*.

Explanation of Boundaries. These include the cluster of caves and the watersheds around them, down to Crooked Creek.

Site Name: SMOKEHOLE/GOOCHLAND CAVE AREA; Fig. 8

Size: 1250 acres

County: Rockcastle

USGS Quadrangle: Johnetta, Ky.

Location. This area lies along 1.5 miles of Crooked Creek, a tributary of Roundstone Creek, from Johnetta to Goochland. It can be reached from US 421 at Morrill, to KY 1912, to KY 1797, to a gravel road that runs up the Crooked Creek valley bottom.

General Description. This valley lies in a moderately rugged western zone of the Cliff Section transitional to the Highland Rim. Pennsylvanian rocks underlie upper slopes, but with no significant cliffs. Mississippian rocks underlie lower slopes, with extensive 10-30 foot high limestone cliffs, and several extensive cave systems. There are some small strip-mines on ridges west of the creek. The area is almost all forested except for the 300-500 foot wide strip of farmland along the creek. Most of the land is privately owned, and there are about four houses on the bottom. USFS land occurs on the ridges to east and west of the creek, and overlies much of the cave systems though not the entrances.

Listed Animal Species.

Orconectes australis, a cave crayfish (nearby)

Myotis septentrionalis, Northern Long-eared Bat

Myotis sodalis, Indiana Bat

Neotoma floridana magister, Eastern Wood Rat

Plecotus rafinesquii, Rafinesque's Big-eared Bat

Plecotus townsendii virginianus, Virginia Big-eared Bat

Biological Significance. Smokehole Cave and Goochland Cave are two of the most extensive caves in the Berea District, with among the largest hibernacula for *Myotis sodalis*. During 1990/91, these caves harbored 1858 and 226 overwintering *M. sodalis*, respectively. Two smaller cave systems occur to the south (JARC cave and Owen's Saltpeter Cave), but few bats have been found there in recent years. None of the cave entrances are on USFS land, and visitation may well have disturbed the bat populations. In contrast to *M. sodalis*, very low numbers of *M. septentrionalis* and *Plecotus* spp. have been found in these caves

Explanation of Boundaries. The area includes the cluster of caves and the stream corridor, which is potentially important for bat foraging. It extends up to the watershed divide, except for the larger tributaries above Smokehole Cave and Goochland Cave. To the west of the area drawn here, there is another cluster of caves, along Dry Fork of Crooked Creek. Few rare bats were found here in 1990, probably due to human disturbance; the area is much more densely settled. Miller's Cave, for example, "used to have large clusters of bats" according to owner, but only three Indiana bats were found in 1990. If disturbance can ever be controlled, recovery of the bat populations might become possible, and this area added to the Smokehole/Goochland Cave Area. The record of *Orconectes australis* comes from the New Hope Caves just west of the Dry Fork watershed.

Site Name: MILL CREEK STREAMHEADS; Fig. 9.

Size: 775 acres

County: Jackson

USGS Quadrangle: McKee, Ky.

Location. This area is 1-1.5 miles southeast of McKee, within the Mill Creek Wildlife Management Area, at the head of Mill Creek and its Rolling Fork, plus a small area drained by Pigeon Roost Creek. A gravel road, USFS 448, runs through the area, connecting US 421 and KY 290.

General Description. These streamheads are within a relatively undissected eastern part of the Cliff Section, which might be considered transitional to the Low Hills Belt. It contains about 10 distinct streamheads with strips of poorly drained ground that are 500-1500 feet long and 50-200 feet wide. All the land is forested, except for the road, and all is owned by USFS.

Listed Animal Species.

Microsorex hoyi winnemana, Pygmy Shrew

Listed Plant Species.

Calamagrostis cinnoides, Cinna-like Reed-grass.

Carex leptalea, a sedge

Carex tenera, a sedge (tentative identification)

Helianthus atrorubens, Sunflower

Other Plants of Interest.

Carex atlantica ssp. *capillacea*, a narrow leaved sedge (tentative id.)

Cirsium carolinianum, Carolina thistle

Danthonia compressa, Poverty Grass (old logging roadbed nearby)

Gentiana saponaria, Soapwort Gentian (only site in district).

Isoetes engelmannii, Quillwort

?*Styrax americana*, Storax (tentative identification of D. Taylor).

Veronicastrum virginicum, Culver's Root (roadside W of Mill Creek)

Biological Significance. This area has the best example of the streamhead forests type that occurs on relatively undissected land in the Berea District. Similar topography occurs along the southeastern borders of the district, but this is mostly cleared for farmland. Further south in DBNF, this type of land and its vegetation are more extensive, and there are more rare species. However, the Mill Creek streamheads, and similar, smaller areas in the district, still have special significance due to their disjunct or biogeographically marginal location, and due to the following minor differences in composition: (a) *Rhododendron perichymenoides* [= *R. nudiflorum*] is particularly frequent in some shrubby areas; (b) *Arisaema cf. triphyllum*, *Lilium canadense* and *Platanthera flava* are relatively frequent at some sites; (c) *Carex leptalea* and *Gentiana saponaria* are present, but unknown in streamheads further south. *Sphagnum* spp. are less abundant than is typical further south.

It seems likely that the soils are slightly more base-rich.

The uneven forest canopy at these sites differs little in composition from the uplands, though the dominant species is usually *Acer rubrum*, often var. *trilobum* (mostly 40-60 cm dbh, but up to 110 cm). Other trees include *Nyssa*, *Liriodendron*, *Quercus alba*, and *Oxydendron*. In the wettest spots, the canopy has open patches, allowing particularly dense shrub and herb layers. It is these lower strata that are most distinct in composition. Shrubs include *Ilex verticillata* (frequent), *Alnus*, *Viburnum cassinoides*, *Lindera*, *Rhododendron perichymenoides*, *Aronia melanocarpa* and *Vaccinium corymbosum*. Frequent herbaceous species include ferns (*Osmunda cinnamomea*, *O. regalis*, *Thelypteris noveboracensis*), sedges (*Carex intumescens*, *debilis*), grasses (*Glyceria striata*, *Panicum microcarpon*) and others (*Aster umbellatus*, *Solidago rugosa*, *Senecio aureus*, *Chelone glabra*, *Lycopus virginicus*, *Arisaema cf. triphylla*—unusually small, non-flowering plants). Others include *Athyrium asplenoides*, *Viola primulifolia*, *Oxypolis*, *Phlox maculata*, *Gentiana saponaria*, *Lilium canadense*, *Platanthera flava* var. *f.*, *P. clavellata*, *Carex rosea*, *C. crinita*, *C. leptalea*, *C. cf. albolutescens*, and *C. cf. tenera*. Though generally not as mossy as further south in DBNF, there are frequent small patches of *Sphagnum lescurii*, *S. palustre* and *Polytrichum commune*. *Isoetes* is limited to one site (with 32 plants found in 1990).

The rest of the watershed area is covered by typical upland forests with no unusual features. However, the open roadsides provide another potentially important feature, i.e., habitat for a few rare plants that may have been characteristic of a kind of pine-oak "barrens" before settlement (see Introduction and notes on Horse Lick Creek watershed). Only two such species were found here in 1990, i.e., *Helianthus atrorubens* and *Cirsium carolinianum*, but others are known nearby in similar habitat and could be introduced, e.g., *Lilium philadelphicum* and *Veronicastrum*.

Explanation of Boundaries. This site includes the group of adjacent streamheads that have particularly swampy conditions or rare species, plus their complete watersheds. It is likely that acid ground water is needed to maintain the characteristic vegetation, and disturbance from roads or erosion could probably change water quality. In addition, the site runs along the roadside where rare plants have been found, and it includes adjacent forest on flatter ground. Thus, the site could be appropriate for restoration of a "barrens" condition in the district.

Site Name: STURGEON CREEK CORRIDOR; Fig. 10

Size: 850 acres

County: Lee

USGS Quadrangle: Sturgeon, Ky.

Location. This area lies along Sturgeon Creek, from the mouth of Little Sturgeon Creek upstream for about 1.5 miles to the mouth of Brushy Creek. The corridor is 0.5-1 mile wide. Access is possible from KY 30 to gravel or dirt roads down Little Sturgeon Creek.

General Description. This stream runs through a part of the Low Hills Belt with moderately rugged topography. Sandstone cliffs are relatively low and interrupted. The creek has several riffles, gravel bars and occasional sandstone boulders. The corridor is largely forested, including abandoned farmland on the bottoms. However, it is all privately owned, and strip-mines have been developed recently on the west side.

Listed Species.

Carex tenera, a sedge (identification tentative)

Cryptobranchus alleganiensis, Hellbender (found nearby in stream?)

Cypripedium kentuckiense, Kentucky Lady's Slipper

Etheostoma sagitta spilotum, Arrow darter (downstream)

Other Plants of Interest.

Platanthera lacera, Ragged Orchid

Biological Significance. The most significant feature of this area is the large population of *Cypripedium kentuckiense*, which is the only known population of the species between the lower Rockcastle River and the Tygarts Creek drainage. The area also has some of most extensive bottomland forest that remains in the Berea District. However, a two acre patch of old-growth *Liriodendron*, *Liquidambar* and *Fagus* was recently logged (D. Barrett, pers. comm.). The forest generally has frequent *Liriodendron*, *Platanus*, *Liquidambar*, *Acer rubrum* and *Betula nigra*. The ground vegetation varies greatly, with tall herbs (*Impatiens* spp., *Rudbeckia laciniata*, *Poa sylvestris*, *Festuca obtusa*, *Elymus* spp., etc.) on well-drained silty soils, sedges on wetter soils (see note on *P. lacera*), or thickets of *Xanthorhiza* on well-drained sandy alluvium. For further details of forest composition where *C. kentuckiense* and *P. lacera* occur, see the notes above on these and other rare species. The gravel bars have *Cornus obliqua* thickets, *Carex torta* tussocks and *Justicia* riffles. In areas with sandstone boulders, two shrubs, *Itea virginica* and *Rhododendron arborescens*, reach their northernmost range in Kentucky. The southern *Hexastylis arifolia* var. *ruthii* is also present. The arrow darter has been recorded from Sturgeon Creek as recently as 1978, but its continued presence remains uncertain given recent impacts on water quality.

Explanation of Boundaries. The corridor includes most of the known patches of *C. kentuckiense* along Sturgeon Creek. Its lateral boundaries run along the watershed divide for Sturgeon Creek, except for the major tributaries.

Site Name: STATION CAMP CREEK CORRIDORS; Fig. 11 (a)

Size: 16 sq. miles (ca. 10,000 acres)

Counties: Jackson and Estill

USGS Quadrangles: Alcorn, Ky.; McKee, Ky.

Location. This site is a corridor system with the downstream end on the main stem of Station Camp Creek near Clay Hill, between the old school and church sites. It extends upstream along all major forks, except War Fork, which is a Significant Area by itself (see below), and Cavanaugh Creek. These forks are South Fork, Rock Lick Creek and some smaller branches: Sinking Valley, Cane Branch and Big Hollow. There are no paved roads, or even good gravel roads, on the bottoms of these creeks, except along Station Camp Creek below War Fork, where KY 1209 runs. Also, KY 89 crosses the creek (north of McKee). Access to the upper sections is generally by foot or dirt road from the county roads to Brazil and Alcorn, north of Sandgap on US 421.

General Description. This corridor system lies in a moderately dissected western part of the Cliff Section, with Pennsylvanian bedrock on ridges and Mississippian bedrock on slopes. Limestone cliffs about 10-30 feet high run along most of the corridor, on both sides, and there are several caves in this cliffline. There is little sandstone exposure. There has been little coal-mining, and the water quality is relatively good, though there is concern about possible pollution from farmland and roadside dumps on the ridges. At least 90% is forested, but no more than 5% is owned by USFS. Most of the bottomland was formerly farmed but is now largely abandoned.

Listed Animal Species.

Cambarus batchi, a crayfish (in broader downstream bottomland)

Microsorex hoyi winnemana, Pygmy Shrew

Myotis septentrionalis, Northern Long-eared Bat

Myotis sodalis, Indiana Bat

Neotoma floridana magister, Eastern Wood Rat

Plecotus rafinesquii, Rafinesque's Big-eared Bat

Plecotus townsendii virginianus, Virginia Big-eared Bat

Villosa lienosa, Little Spectaclecase (a mussel)

Listed Plant Species.

Oryzopsis racemosa, Black-seeded Rice Grass

Spiranthes lucida, Shining Ladies Tresses

Synandra hispidula, Synandra

Taxus canadensis, Canadian Yew

Other Plants of Interest.

Physostegia virginiana var. *v.*, False Dragonhead (tentative record)

Phlox stolonifera, Running Mountain Phlox

Solidago harrisii, a broad-leaved goldenrod

Waldsteinia fragarioides, Barren Strawberry

Biological Significance. This large site has several significant features, but these are rather widely scattered.

Many caves occur along the limestone cliffline and, at upstream locations, in karst valleys. Some have been shown to harbor rare bats, though only two caves, Viney Bottom (= Misty?) Cave and Johnson Cave may be worthy of special efforts on their own merits, with populations of *Myotis sodalis* (55 on 1 Mar 1990) and *Plecotus rafinesquii* (19 on 28 Nov 1990), respectively. (During 1964-72 there were at least 40 *P. rafinesquii* but these appear to have reduced after a rock fell when the ridge to north was blasted for strip-mining.) Also, the only patches of *Taxus* in this Significant Area occur near the mouths of these two caves, which are 1.5 miles apart on the South Fork. Caves with smaller numbers of rare bats include Sinks and Rises Cave (18 *M. sodalis* on 12 Mar 1990), Durham Saltpeter Cave, Morning Hole Cave, Lainhart Cave No. 2 and Tom Rose Caves. In general, these caves are frequently visited, and it seems likely that the relatively small numbers of rare bats would rise if disturbance can be controlled.

Aquatic features of interest occur mostly in the central section of Station Camp Creek, where a series of riffles and limestone boulder-banks provide habitat for a rare mussel (*Villosa lienosa*) and orchid (*Spiranthes lucida*), respectively. A rare crayfish occurs (*Cambarus batchi*) on the more agricultural bottomland at the downstream end of the corridor. The open, shrubby or herbaceous vegetation on the boulder-cobble bars is a rare type. The local dominance of big bluestem grass (*Andropogon gerardii*) links this vegetation with rocky riverbank vegetation elsewhere in Kentucky, but the composition on these limestone dominated sites is distinct from the predominantly sandstone banks in the Cumberland River system. Frequent species include *Platanus*, *Cornus obliqua*, *Salix caroliniana*, *Equisetum* spp., *Zizia aurea*, *Senecio aureus*, *Andropogon gerardii*, *Solidago gigantea*, *Lysimachia ciliata*, *Melilotus albus* (exotic) and *Justicia* (in riffles). Other species include *Juglans nigra*, *Alnus*, *Salix sericea*, *Physocarpus*, *Rosa setigera*, *Parthenocissus*, *Rhus radicans*, *Thalictrum pubescens*, *Viola striata*, *Apios*, *Desmodium perplexum*, *Lespedeza cuneata* (exotic), *Lysimachia nummularia* (exotic), *Phlox paniculata*, *Monarda fistulosa*, *Helianthus tuberosa*, *Coreopsis tripteris*, *Vernonia*, *Eupatorium fistulosum*, *Aster prenanthoides*, *Solidago altissima*, *Cacalia muhlenbergii*, *Allium canadense*, *Panicum clandestinum*, *Carex granularis*, *C. torta* and *Spiranthes lucida*.

The slopes are mostly covered by young or cut-over forest, but there are a few 10-50 acres patches where most canopy trees are at least 75-100 years old. At the downstream end, the bottomland is mostly cleared. One of the best old-growth patches was found on the northwest-pointing ridge south of the old Clay Hill Church. On the point below the limestone cliff there are 5-10 acres of *Fagus* forest with canopy trees of 20-30 inches (50-80 cm) dbh; also present are *Liriodendron*, *Tilia*, *Quercus alba*, *Q. rubra* and, on upper slopes, *Q. montana*. Above the cliffs there are 10-20 acres of more uneven forest with a canopy of 12-28 inch (30-70 cm) dbh trees; these include frequent *Quercus alba*, also *Q. muhlenbergii*, *Q. velutina*, *Carya ovata*, *C. glabra*, *Fraxinus* spp., and an understory with much *Acer saccharum*. At the southern end of this area, on the west-facing clifftop, there was an extraordinary *Juniperus* that is 3-5 feet in diameter, with a compressed shape, but

at least 90% dead. Another 10-20 acre area of uneven old-growth was found on a north-face above the limestone cliffs of Cedar Point Ridge, near the knob. Canopy trees are mostly 12-40 inches (30-100 cm) dbh, with the largest mostly *Fagus*; also frequent were *Q. rubra*, *Q. alba* and *Ulmus rubra*.

The area would have been extended to include an adjacent 50 acre area on USFS land along Cavanaugh Creek, had not this been logged in 1990! This area was one of the two best old-growth stands found in the Berea District. Unlike most old-growth, it had much oak, being on a mesic to subxeric, west-facing slope above the limestone cliff. The canopy trees were mostly 20-40 inches (50-100 cm) dbh, with a few up to 45 inches (120 cm). Cut stumps of *Quercus velutina* and other oaks on upper slopes *had ages of* about 100-150 years, with one about 200; growth rings suggested a release about 90-100 years ago, which was probably after the first logging, plus 2-3 periods with fire scars. Major species were *Q. velutina*, *Q. rubra* and *Q. montana*; also frequent were *Carya glabra*, *Fagus* and *Liriodendron*.

Explanation of Boundaries. The corridor is generally only about 0.5 miles wide, which is sufficient to include almost all caves and most of the remaining old-growth forest in this section of the Berea District. It widens in the downstream extension to 1.5 miles, where it includes some relatively mature forest on the slopes, plus the agricultural bottomland, which could be restored to bear the most extensive bottomland forest in the district. The upstream limits are drawn to include all significant caves in the karst valleys.

Site Name: WAR FORK CORRIDOR; Fig. 12

Size: 2500 acres

County: Jackson

USGS Quadrangles: McKee, Ky.; Leighton, Ky.

Location. This corridor, about 3 miles long and 1 mile wide, runs along War Fork from its mouth to the Sinks of War Fork (about a mile downstream from the Turkey Foot Campground). Much of the area is relatively inaccessible. The upstream half can be reached from KY 89 or KY 587 along gravel roads to USFS 345, which runs along the west side of the valley. The downstream half can be reached from USFS 344 or KY 587 only along old dirt roads, if at all. However, a footpath, the Sheltoee Trace, runs along most of the valley.

General Description. This area lies in the Cliff Section, with Pennsylvanian bedrock on uplands and Mississippian bedrock on lowlands. Limestone cliffs about 10-20 feet high run along most of corridor, on both sides, and there are several caves in this cliffline. Sandstone cliffs only occur in a minor (<10%) portion of the corridor. There has been some coal-mining in the headwaters of War Fork, but not in the corridor outlined here. The area is at least 95% forested, and most is owned by USFS, but no exceptionally old (>100 year) stands are known. There are some farmed or recently abandoned bottomland areas in the lower 1.5 miles of the valley.

Listed Animal Species.

Aneides aeneus, Green Salamander
Microsorex hoyi winnemana, Pygmy Shrew
Myotis septentrionalis, Northern Big-eared Bat
Myotis sodalis, Indiana Bat
Neotoma floridana magister, Eastern Wood Rat
Plecotus rafinesquii, Rafinesque's Big-eared Bat
Plecotus townsendii virginianus, Virginia Big-eared Bat

Listed Plant Species.

Synandra hispidula, Synandra
Taxus canadensis, Canadian Yew

Other Plants of Interest.

Aster schreberi, Big-leaf Aster
Carex hirtifolia, Hairy Rich-wood Sedge
Panax trifolius, Dwarf Ginseng
Phlox stolonifera, Running Mountain Phlox
Rhododendron arborescens, White Azalea (N edge of range)
Waldsteinia fragarioides, Barren Strawberry

Biological Significance. This area includes some of the best caves in the Berea District for *Myotis sodalis* hibernation: Wind Cave (94 bats counted on 9 Mar 1990); War Fork Cave (946 on 19 Mar 1990); and Cedar Post Cave (113 on 18 Mar 1990). The Wind Cave population has declined from 250-300 in 1981-86, probably due to human disturbance. Declines are also suspected to have occur in "1813 Cave". Other rare bats occur in smaller numbers, and at least in Cedar Post Cave, a decline in *Plecotus* spp. is suspected to have occurred. Despite these declines in certain caves, the persistence of a few good populations, plus much USFS ownership, provides a good opportunity for recovery. The botanical significance of this area is primarily due to the several patches of *Taxus canadensis* on north-facing limestone talus slopes; the more extensive patches of *Waldsteinia* in similar habitat; and the lowest slopes and terraces with extensive patches of *Phlox stolonifera* and smaller patches of *Aster schreberi* and *Panax trifolius*.

Explanation of Boundaries. The core area of interest would be the square mile or so from Wind Cave upstream to Resurgence Cave near the mouth of Big Buck Lick. However, due to the need for a good bat-foraging corridor along the creek, some watershed integrity, and potential connection with the Station Camp Creek corridor, the boundary drawn in this report extends from the mouth of War Fork upstream for about 3 miles to the Sinks of War Fork. The corridor runs along the War Fork watershed divide wherever convenient, but excludes some major tributaries.

Site Name: HOLE-IN-ROCK RAVINES; Fig. 13

Size: 230 acres

County: Jackson

USGS Quadrangles: Alcorn, Ky.; Leighton, Ky.

Location. This area lies along two small tributaries of Cavanaugh Creek, which is a major tributary of Station Camp Creek. Access is from KY 89, which runs along the east side of the site north of Foxtown.

General Description. This area lies in the Cliff Section, and has highly rugged topography within the context of the Berea District. It is underlain by Pennsylvanian bedrock, including 20-100 feet high sandstone cliffs along most of the upper slope contours. The area is all forested, and mostly owned by USFS. A powerline runs along the eastern ridgetop.

Listed Plant Species.

Carex leptalea, a sedge

Glyceria melicaria, Manna Grass

Other Plants of Interest.

Carex scabrata, Rough Running Sedge

Sphagnum magellanicum, a peatmoss (2nd reliable KY record)

Biological Significance. This site has an assemblage of interesting features, though none of these have high significance individually. The forest is varied, with mesic and xeric extremes on the sandstone dominated soils. Although the forest is mostly not exceptional in its maturity, one area of at least 10-20 acres on east side of the central ridge is more mature, with canopy trees up to 24 inches (60 cm) dbh; these are mostly *Quercus montana*, *Q. velutina*, *Q. rubra* and *Liriodendron*. The xeric extreme is well-represented by a "heath-barrens" on the saddle north of the central ridge, consisting of naturally open and partly cut-over pine-oak forest, with thick *Gaylussacia baccata* on the ground.

The rare plants present are all typical of wetter areas: *Sphagnum magellanicum* on a seeping cliff ledge; *Carex scabrata*, in two seepage areas below cliffs; *C. leptalea*, with 50-70 clumps in an upper streamhead; and *Glyceria melicaria* in a lower streamhead (see species notes).

The sandstone ridges and cliffs contain several rockhouses, though mostly disturbed by people digging for Indian artifacts, and arches, of which two are in the central Hole-in-Rock ridge and one is on the western Bridge Rock ridge. These may provide habitat for rare animals, especially bats.

Explanation of Boundaries. These are drawn to include the miscellaneous features noted above, plus the complete watersheds.

Site Name: LONG BRANCH KNOBS; Fig. 14

Size: 340 acres

County: Madison and Estill

USGS Quadrangle: Alcorn, Ky.

Location. This area lies at the northwest corner of the Berea District, either side of the mouth of Long Branch of Red Lick Creek, a tributary of Station Camp Creek. It is about 5 miles east of US 421 near Big Hill, following KY 594, then onto increasingly poor roads to the base of "Long Branch Knob", the name invented here for the narrow knob west of the mouth of Long Branch. Some parts of adjacent knobs are also included.

Physical Description. This area is in the Knobs Region; it may be considered an outlier of the Zion Mountain Ridge System, which is described in Appendix A. The geology ranges from Devonian shales on lower slopes to Mississippian bedrock, including limestone cliffs along all upper slopes. Some slumped Pennsylvanian sandstone caps the knob itself. The area is mostly forested, except for the old fields on bottomland along Long Branch and saddles in "Anglin Hollow", the local name applied on south side of Long Branch Knob. The south and west sides of the knob are scrubby in places, and appear to have been burnt. All the area is privately owned.

Listed Plant Species.

Symphoricarpos albus, Snowberry

Other Plants of Interest.

Phlox subulata, Moss Phlox

Pinus strobus, White Pine (disjunct from Red River Gorge)

Solidago harrisii, a broad-leaved goldenrod

Biological Significance. A great range of vegetation types is represented in a small area, including some rare plants on dry sites and patches of old-growth forest on lower slopes.

On the knob, the clifftop at the southwest end is open for 300 sq. feet, and has a thin cover of *Arenaria patula*, *Houstonia nigricans*, *Setaria viridis*, *Sporobolus cf. vaginaeflorus* and *S. asper*. The adjacent forest is dry, open and remarkable for its population of *Symphoricarpos albus* scattered over 200 x 50 feet. The most abundant species in this forest are *Rhus aromatica*, *Juniperus* and *Fraxinus quadrangulata*; others include *Quercus muhlenbergii*, *Cercis*, *Viburnum rufidulum*, *Smilax bona-nox*, *Danthonia spicata*, *Elymus hystrix*, *Allium cernuum*, *Monarda cf. russelliana*, *Solidago harrisii*, *Helianthus microcephalus* and *Aster oblongifolius*. The top of the knob has some sandstone boulders, with forest of *Quercus montana* (up to 12-20 inches or 30-50 cm dbh), *Acer saccharum* (understory), *Q. rubra*, *Fraxinus americana* and other species.

Below the cliffs on the southwest-facing point, the siltstone (in the Borden Formation) has distinct vegetation, with open, stunted forest dominated by *Pinus virginiana*; other species include *Carya glabra*, *Q. marilandica*, *Q. stellata*, *Juniperus*, *Rosa carolina*,

Crataegus sp., *Andropogon scoparius*, *Danthonia spicata*, *Carex pensylvanica*, *Phlox subulata*, *Antennaria plantaginifolia*, *Solidago nemoralis* and *Aster patens*.

On the east side of Long Branch, at the base of the northwest-facing slope there are 10-20 acres of uneven old-growth. It is dominated by rather widely spaced trees of *Fagus*, 20-28 (35) inches or 50-70 (90) cm dbh, and there is much regeneration of *Fagus*. Other trees are mostly 8-15 (20) inches or 20-40 (50) cm dbh, including *Acer saccharum*, *Quercus rubra*, *Carya glabra*, *C. ovata*, *Aesculus octandra*, *Nyssa* and *Liriodendron* (mostly on lowest slopes). The understory also included *Magnolia tripetala*, *M. acuminata*, and *Fraxinus americana*. In addition, *Tsuga* and *Kalmia* occur on a well-drained bench above the creek.

A smaller, two acre patch of old-growth was reported by Jones and Thompson (1986) on the east-facing base of the small knob west of Long Branch Knob. This old-growth was dominated by 16-35 inches (40-90 cm) dbh *Fagus* and a subcanopy of *Tsuga*; other trees included *Q. alba*, *Liriodendron* and *Acer rubrum*. The presence of *Pinus strobus* here, and also north of Red Lick Creek along Spruce Pine Branch and Turner Hollow, adds local biogeographic interest. The *P. strobus* in this area appears disjunct from the large Red River Gorge population.

Explanation of Boundaries. These include Long Branch Knob, the old-growth patches on adjacent knob slopes, and the intervening bottomland. About half a mile to the south, another 40 acres or more of forest that may be relatively mature was identified from aerial photographs at the head of the east fork of Long Branch, immediately south of the junction of Madison, Estill and Jackson Counties. Further field work may justify extension of this site to include this forest, but there is unlikely to be additional rare species interest.

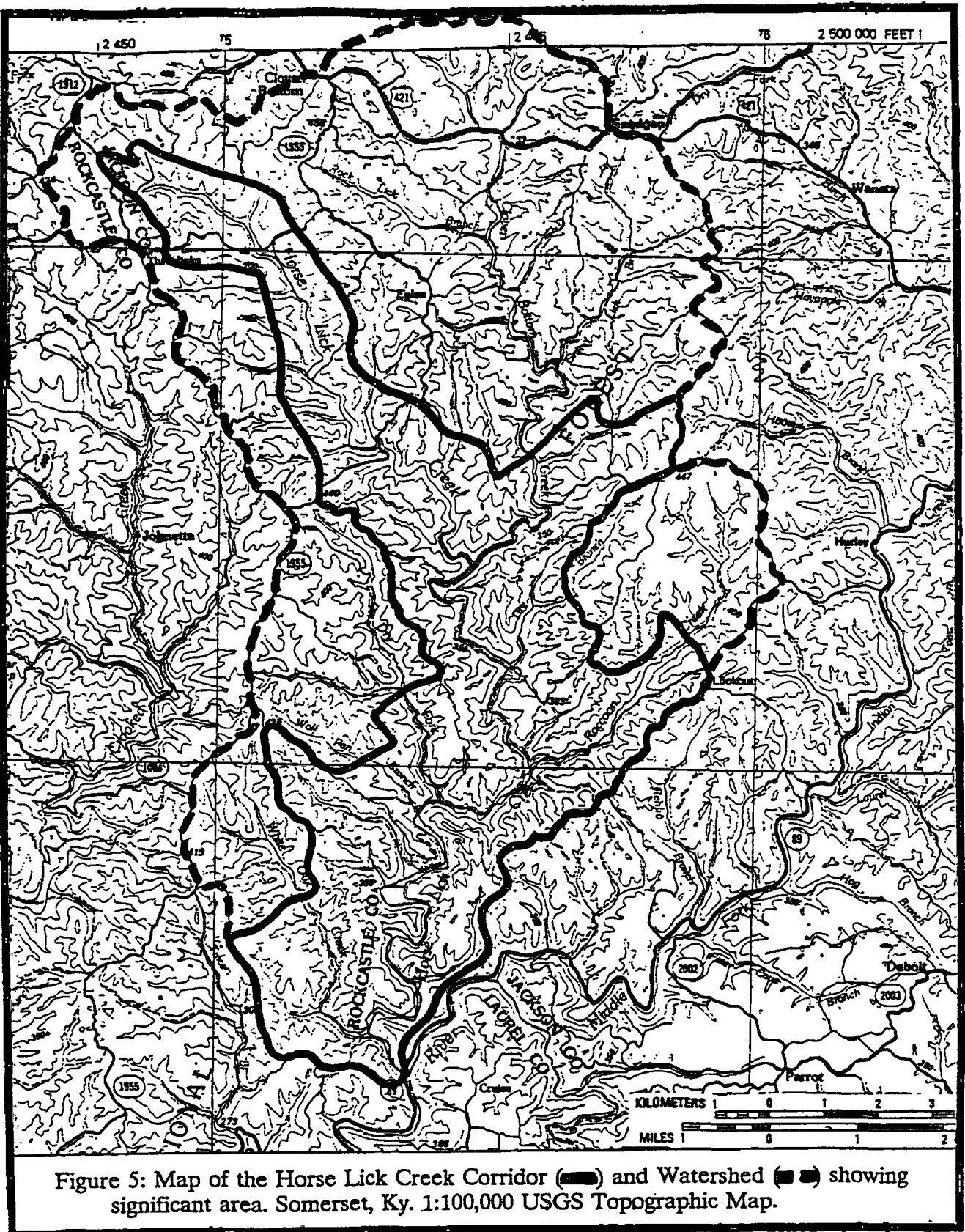
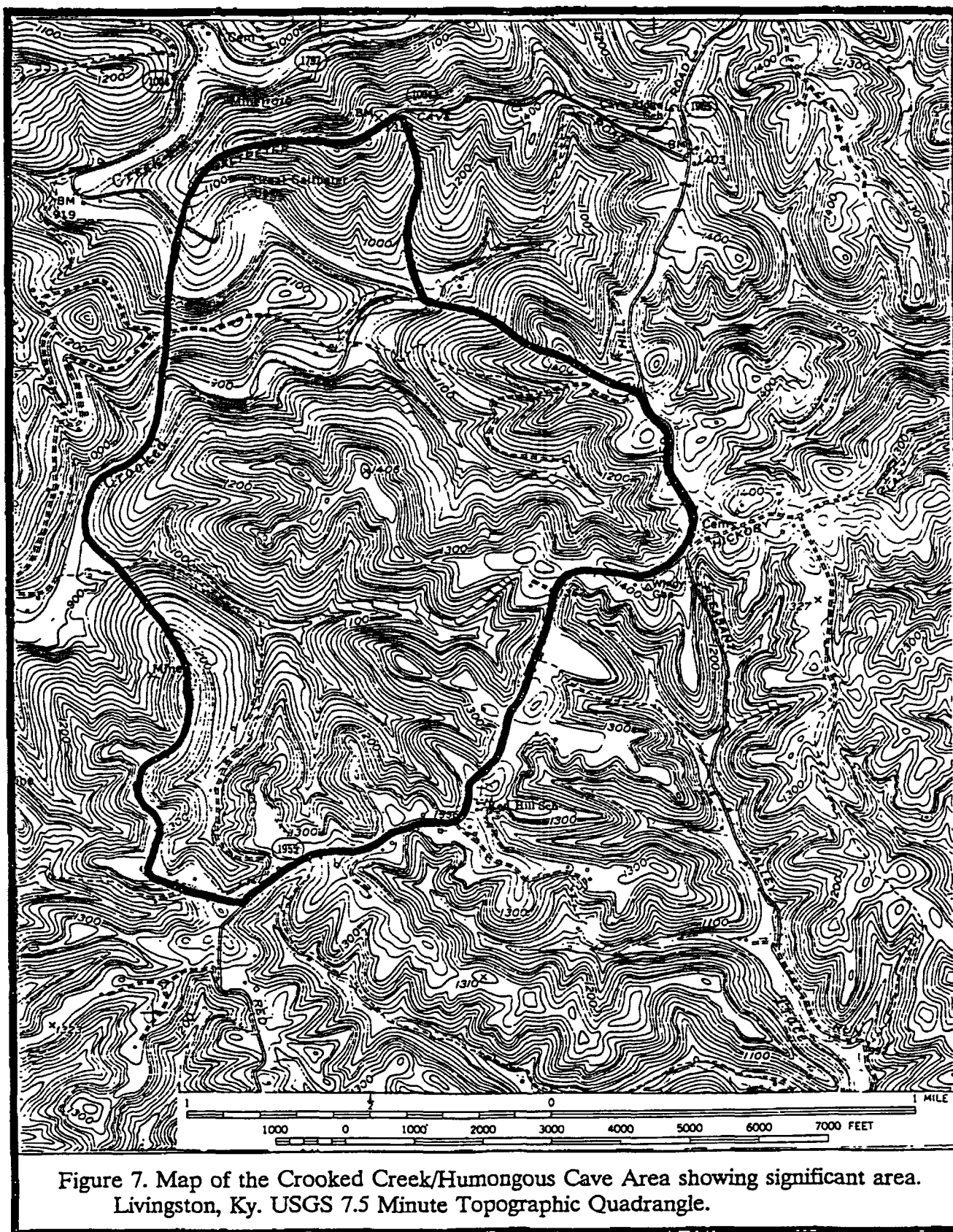


Figure 5: Map of the Horse Lick Creek Corridor (—) and Watershed (---) showing significant area. Somerset, Ky. 1:100,000 USGS Topographic Map.





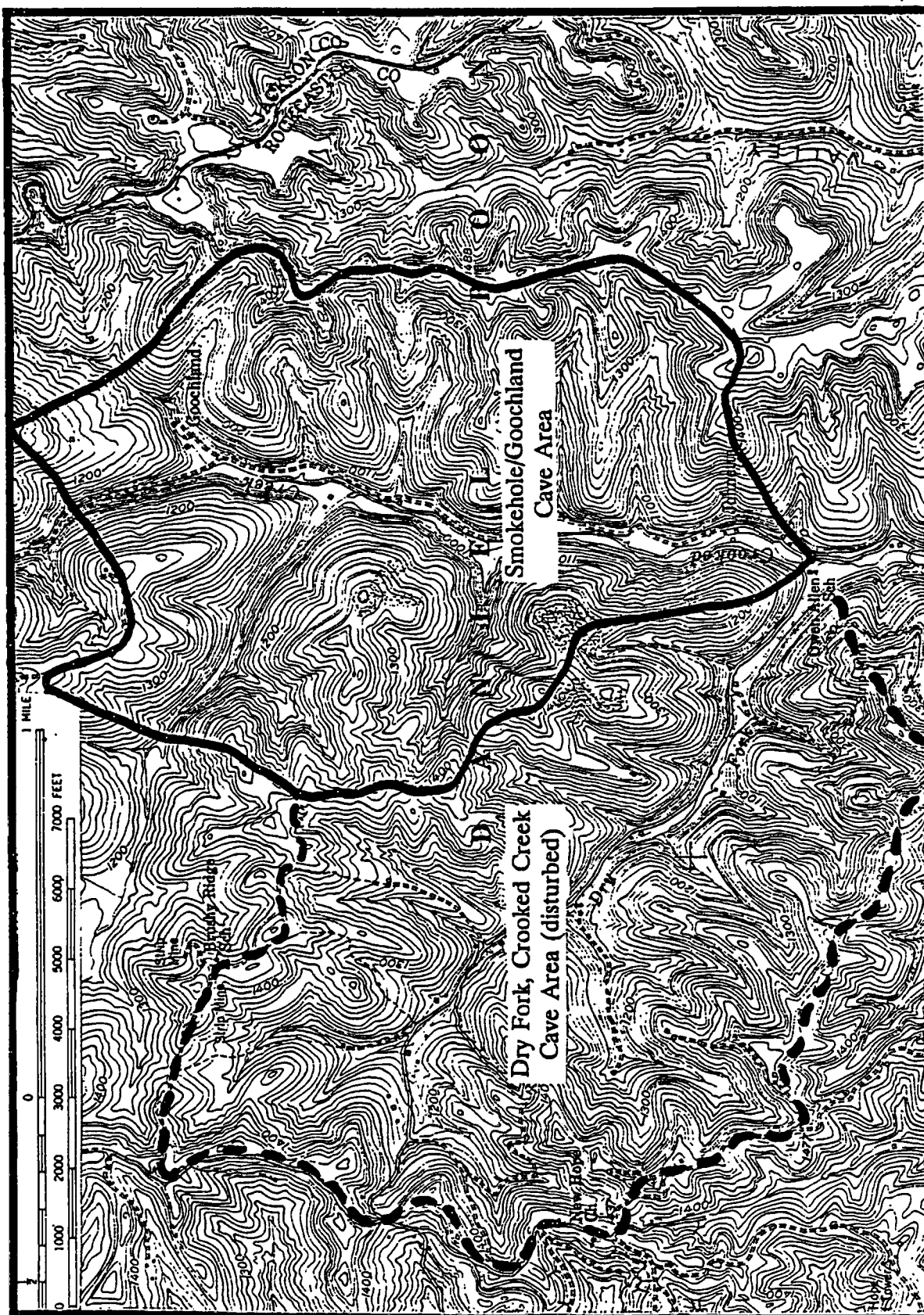


Figure 8. Map of the Smokehole/Gochland Cave Area showing significant area. Johnetta, Ky. USGS 7.5 Minute Topographic Quadrangle.

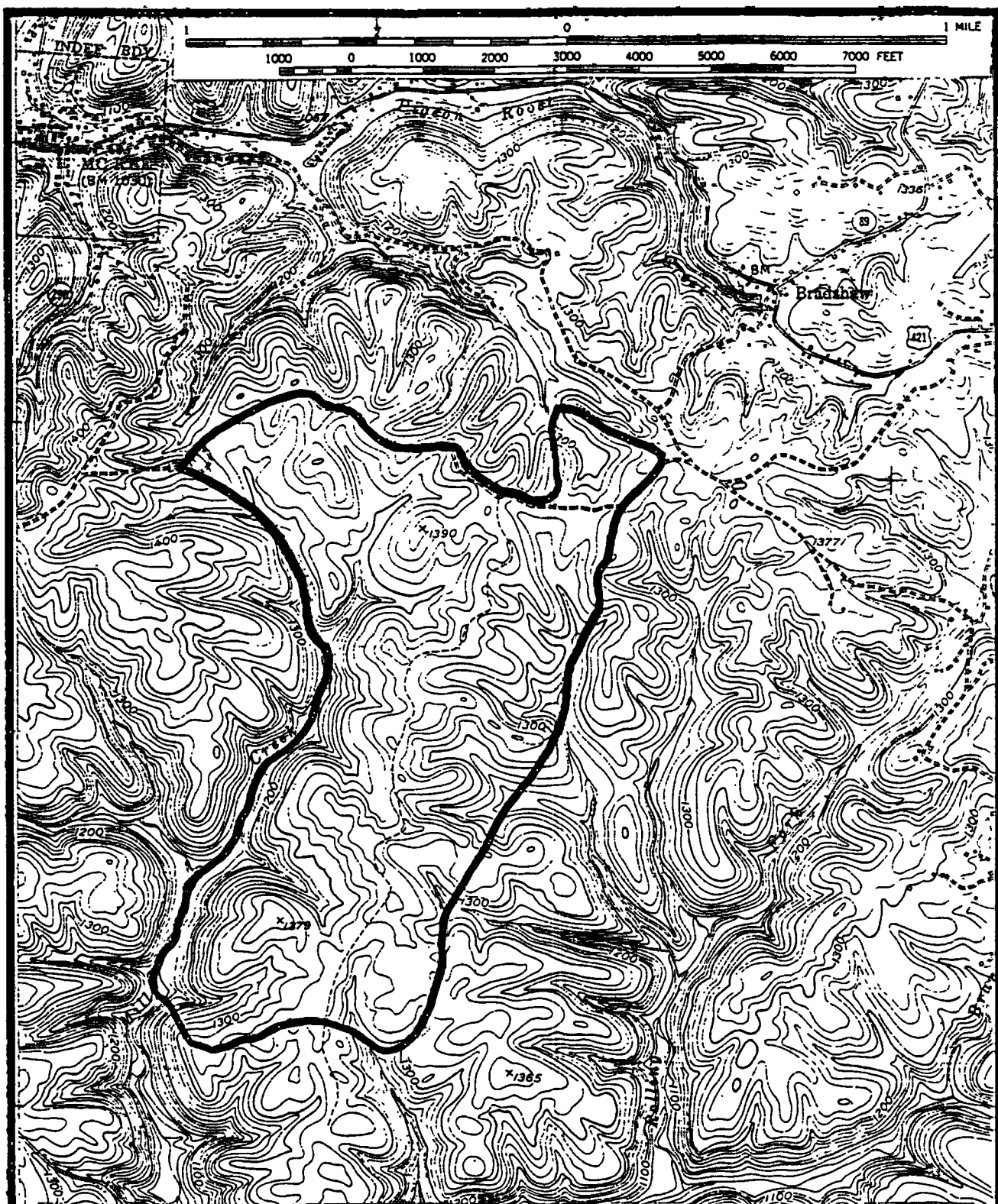


Figure 9. Map of the Mill Creek Streamheads showing significant area.
McKee, Ky. USGS 7.5 Minute Topographic Quadrangle.



Figure 10. Map of the Sturgeon Creek Corridor showing significant area.
Sturgeon, Ky. USGS 7.5 Minute Topographic Quadrangle.

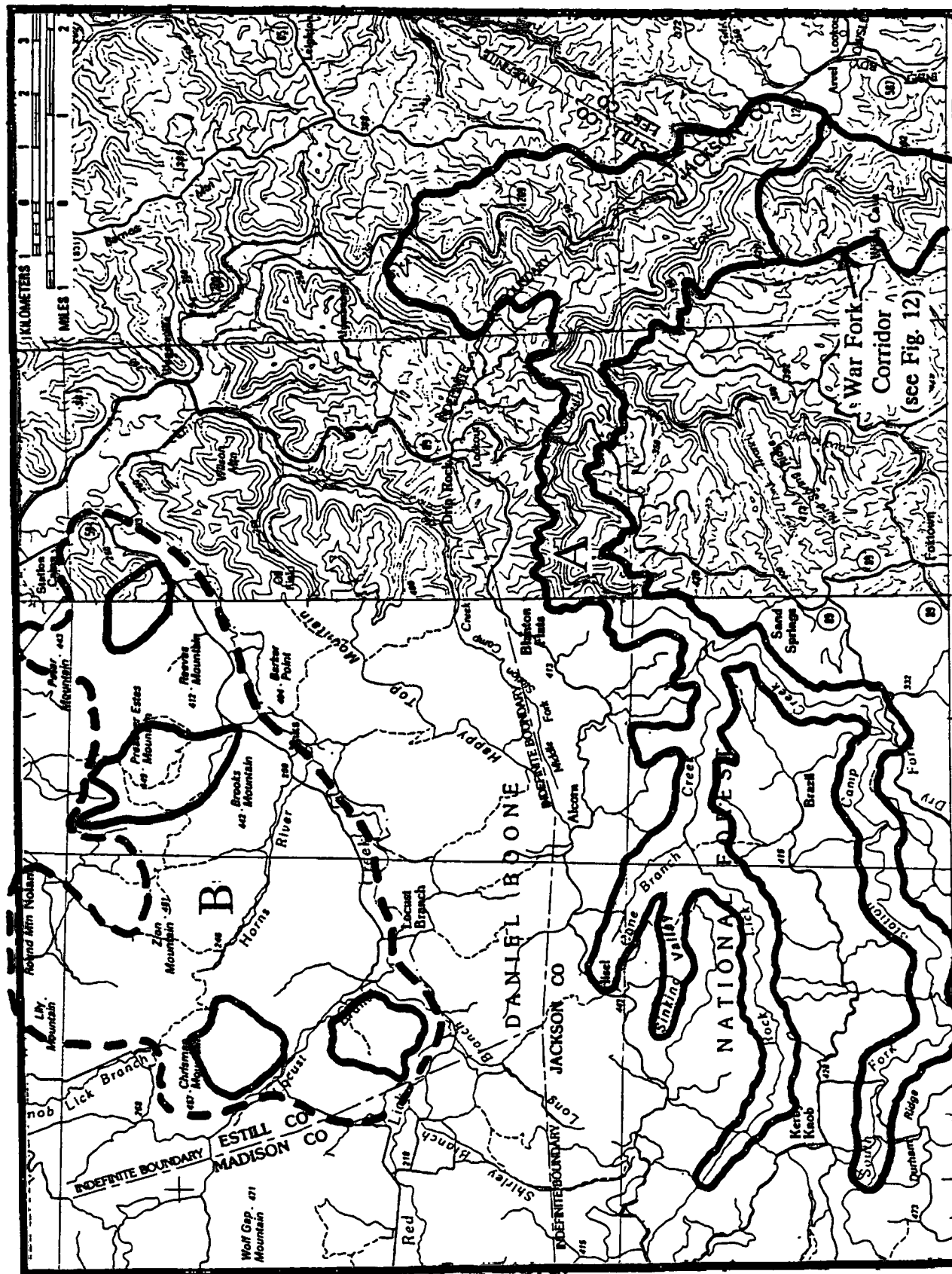
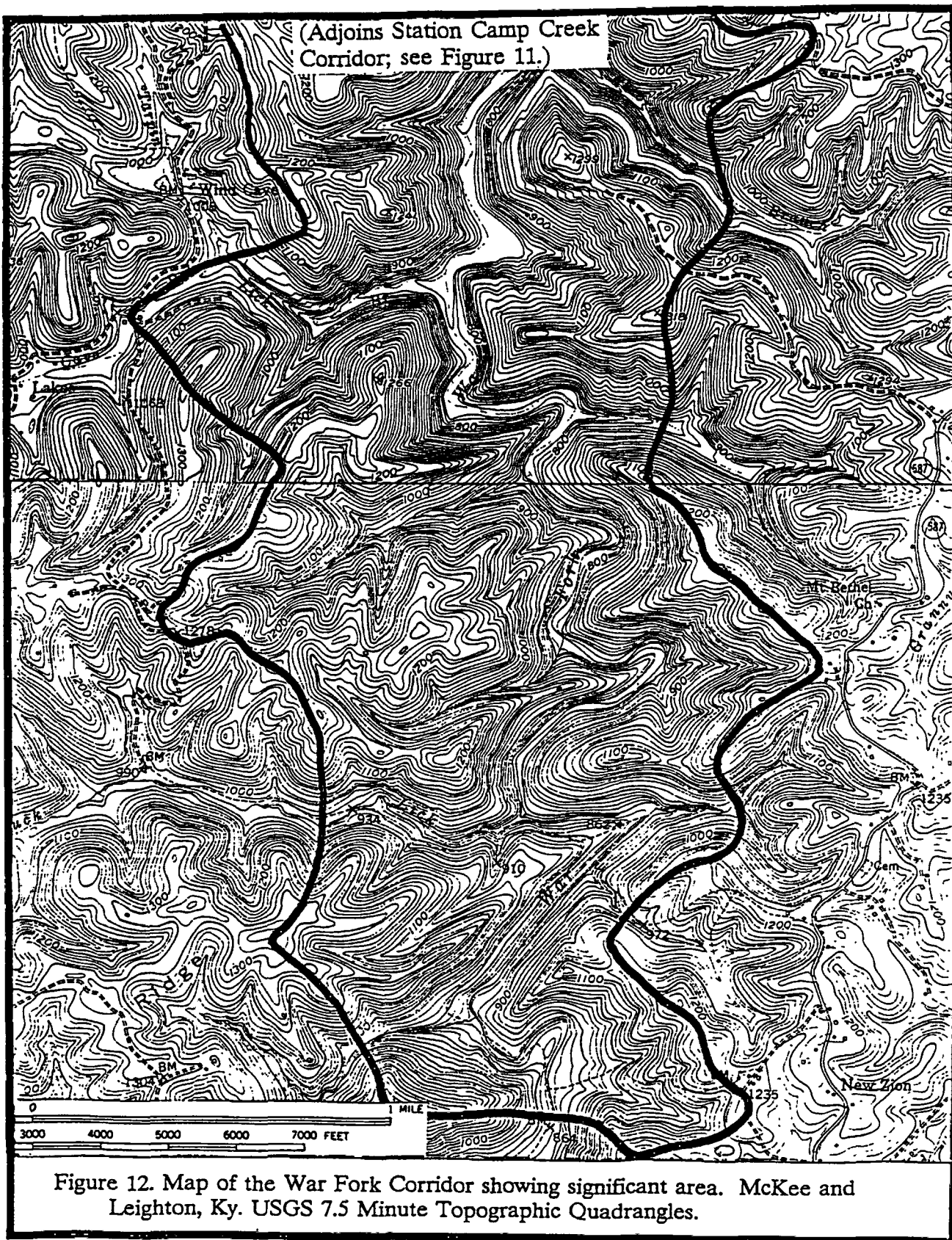


Figure 11. Map of (a) Station Camp Creek Corridor and (b) Zion Mountain Ridge System showing significant areas. Harrodsburg and Irvine, Ky. 1:100,000 USGS Topographic Maps.



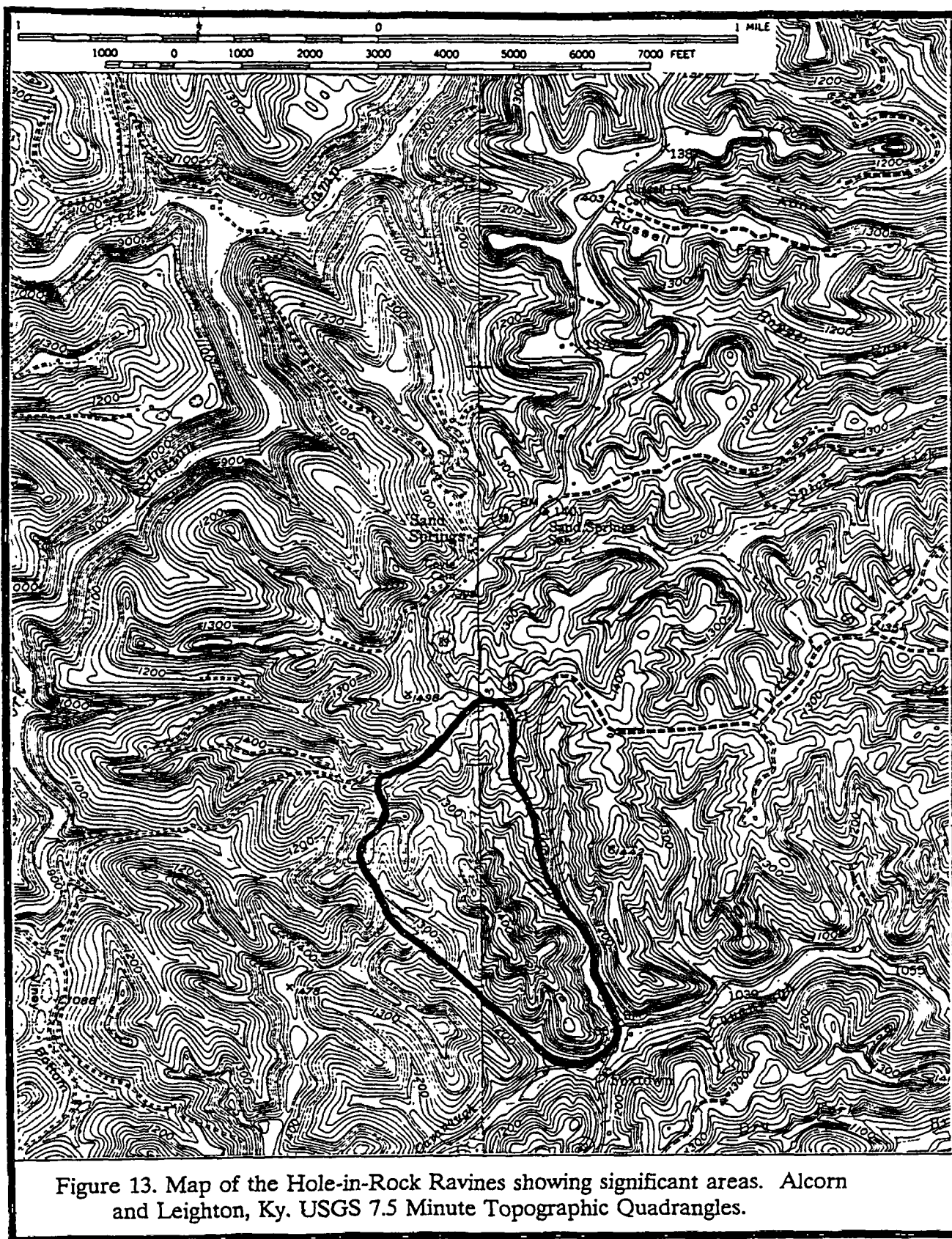


Figure 13. Map of the Hole-in-Rock Ravines showing significant areas. Alcorn and Leighton, Ky. USGS 7.5 Minute Topographic Quadrangles.

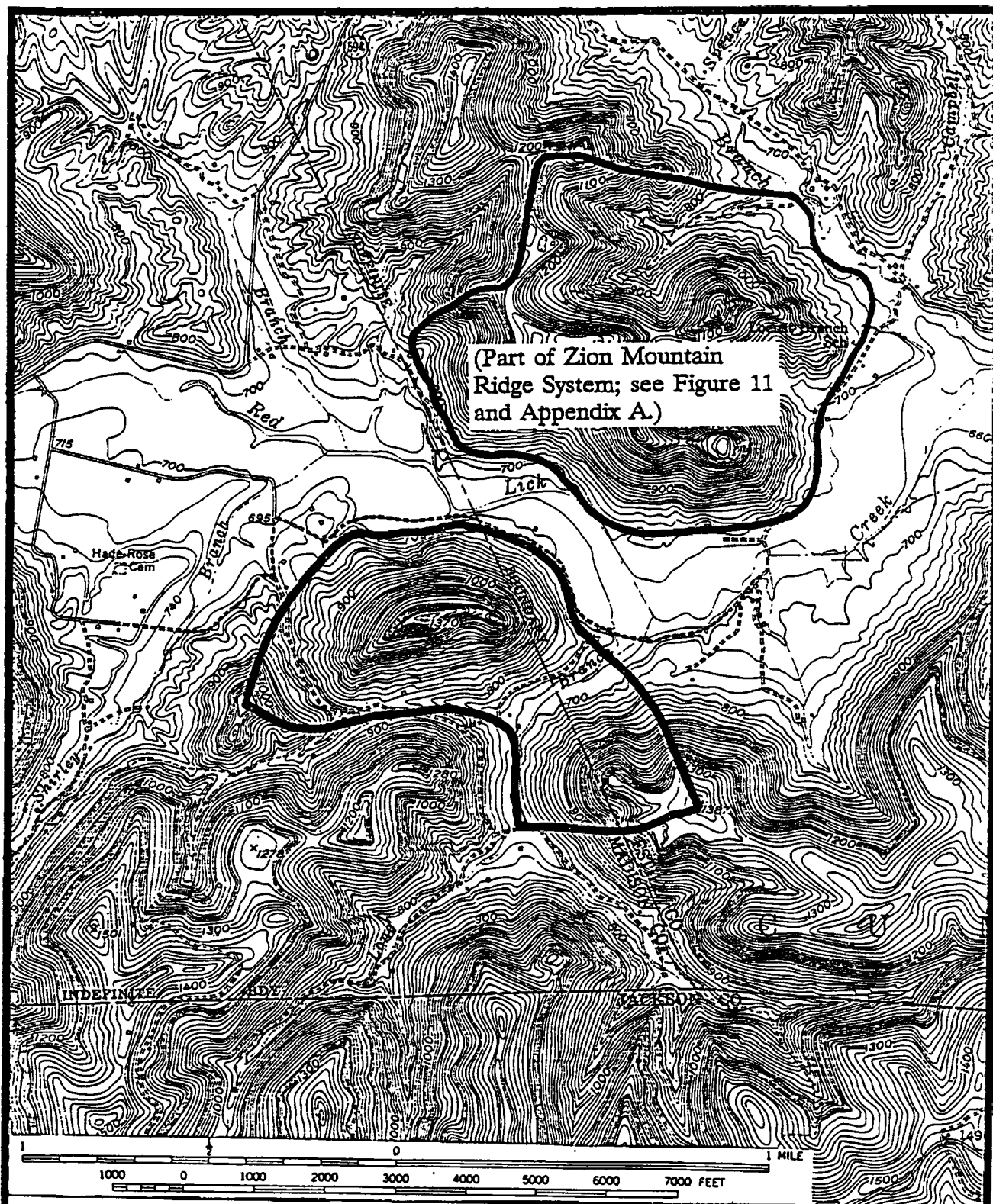


Figure 14. Map of the Long Branch Knobs showing significant area. Alcorn, Ky.
USGS 7.5 Minute Topographic Quadrangle.

SUMMARY

The results of the Cooperative Inventory of Endangered, Threatened, Sensitive and Rare Species in the Berea Ranger District 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 13 records for 7 species of endangered, threatened or other listed rare plants, 94 records for 17 listed aquatic species (mostly mussels), and 45 records for 8 listed species of terrestrial vertebrates (mostly bats) from the Berea District (Table 4). The inventory generated about 60 new records for listed rare plants, amounting to a five-fold increase in the total records, with 18 new species. It generated about 81 new records for animal species, mostly terrestrial. The overall increase in animal records was about 55%, with four new species. 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 KAS-KSNPC and USFS. No species new to Kentucky were found. However, a few plant species had been previously found in only two or three Kentucky localities (*Carex atlantica* ssp. *capillacea*, *Prenanthes crepidinea*, *Solidago harrisii*). In addition, some of the crayfish in this region have very small known ranges, and there continues to be some potential for species new to science.

This report also outlines "Significant Areas" within the Berea 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

- Ahlstedt, S. 1986. A status survey of the Little-wing pearly mussel *Pegias fabula* (Lea 1838). Report submitted to the Endangered Species Field Office, United States Fish and Wildlife Service, Asheville, North Carolina.
- Allard, D. 1990. The southeastern regional ecological community classification, version 1.2. The Nature Conservancy, Southeastern Regional Office, Chapel Hill, North Carolina.
- Anderson, R.M. 1989. The effect of coal surface mining on endangered freshwater mussels (Molluska: Unionidea) in the Cumberland River drainage. M.Sc. thesis, Tennessee Technological University.
- 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.
- 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.
- 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. 1983. Fishes of the South Fork of the Kentucky River with notes and records from other parts of the drainage. Southeast Fisheries Council Proceedings No. 4, p. 1-15.
- 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.
- Burch, P.R. 1990. The distribution of the crayfish *Cambarus (Jugicambarus) batchi* (Decapoda, Cambaridae). M.Sc. thesis, Eastern Kentucky University, Richmond.
- Burr, B.M., and M.L. Warren, Jr. 1986. A distributional atlas of Kentucky fishes. Kentucky Nature Preserves Commission Scientific and Technical Series Number 4, Frankfort, Kentucky.

- Call, S.M. and P.W. Parmalee. 1981. The discovery of extant populations of *Alasmidonta atropurpurea* (Rafinesque) (Bivalvia: Unionidae) in the Cumberland River basin. Bulletin of the American Malacological Union, Incorporated, 1981:42-43.
- 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, editors. Proceedings of the Central Hardwood Forest Conference, University of Tennessee, Knoxville, Tennessee.
- Campbell, J.J.N., M. Evans, M.E. Medley and N.L. Taylor. 1988. Buffalo clovers in Kentucky (*Trifolium stoloniferum* and *T. reflexum*): historical records, presettlement environment, rediscovery, endangered status, cultivation and chromosome number. Rhodora 90:399-418.
- 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., 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., 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., D.D. Taylor, M.E. Medley and A.C. Risk. 1991. Floristic and historical indications of fire-maintained, grassy pine-oak "barrens" before settlement in southeastern Kentucky. Fire and the Environment, Symposium Proceedings, University of Tennessee, Knoxville (in press).
- Carter, B.T. 1954. The movement of fishes through navigation lock chambers in the Kentucky River. Transactions of the Kentucky Academy of Science 15:48-56.
- Carter, J.R. 1970. Survey and classification of six Kentucky streams. Project F-35-2. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky.
- Church, G.L. 1967. Taxonomic and genetic relationships of eastern North American species of *Elymus* with setaceous glumes. Rhodora 69:121-162.
- Cicerello, R.R., and R.R. Hannan. 1990. Survey of the freshwater unionids (mussels) (Bivalvia: Margaritiferidae and Unionidae) in the Green River in Mammoth Cave

- National Park. Technical Report, Kentucky State Nature Preserves Commission, Frankfort.
- Cicerello, R.R., M.L. Warren, Jr. and G.A. Schuster. (in press). A distributional checklist of the freshwater unionids (Bivalvia: Unionacea) of Kentucky. American Malacological Union.
- Clarke, A.H. 1981. Determination of the precise geographical area occupied by four endangered species of freshwater mollusks. Report to United States Fish and Wildlife Service, Twin Cities, Minnesota. Ecosearch, Mattapoisett, Massachusetts.
- Clarke, A.H. 1988. Aspects of Corbiculid-Unionid sympatry in the United States. Malacology Data Net 2:57-99.
- Cranfill, R. 1980. Ferns and Fern Allies of Kentucky. Kentucky Nature Preserves Commission Scientific and Technical Series Number 1. Kentucky Nature Preserves Commission, Frankfort.
- Cronquist, A. 1980. Vascular flora of the southeastern United States: Asteraceae. University of North Carolina Press, Chapel Hill, North Carolina.
- DiStefano, R.J. 1984. Freshwater mussels (Bivalvia: Unionidae) of Horse Lick Creek, Rockcastle River, Kentucky. Nautilus 98:110-113.
- 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.
- Gordon, M.E., and J.B. Layzer. 1989. Mussels (Bivalvia: Unionoidea) of the Cumberland River. Review of life histories and ecological relationships. Biological Report 89(15). United States Department of the Interior, Fish and Wildlife Service, Washington DC.
- Hannan, R.R. 1978. An ecological study of an upland hardwood swamp in Rockcastle County, Kentucky. M.Sc. thesis, Eastern Kentucky University, Richmond.
- 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., Jr., 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., Jr., 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., M.L. Warren, K.E. Camburn, S.M. Call, G.J. Fallo and P. Wigley. 1980. Aquatic biota and water quality survey of the upper Cumberland River basin. Technical Report (Section 208, Public Law 92-500), Kentucky Nature Preserves Commission, Frankfort.
- Harker, D.F., R.R. Hannan, R.R. Cicerello, W.C. Houtcooper, L.R. Phillippe and D. Van Norman. 1981. Preliminary assessment of the ecology and ecological features of the Kentucky "Knobs" Oil Shale Region. Technical Report, Kentucky 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.
- Hobbs, H.H., Jr. 1976. Crayfishes (Astacidae) of North America and Middle America. Water Pollution Control Research Series, No. 18050 ELDOS/72, United States Environmental Protection Agency, Cincinnati, Ohio.
- Hobbs, H.H., Jr., H.H. Hobbs III and M.A. Daniel. 1977. A review of the troglobitic crustaceans of the Americas. Smithsonian Contributions to Zoology No. 244.
- Hobbs, H.H. 1989. An illustrated checklist of the American Crayfishes (Decapoda: Astacidae, Cambaridae and Parastacidae). Smithsonian Contributions to Zoology No. 480.
- Jones, A.R. 1987. Trout stream investigations. Pages 94-107 in Axon, J.R., W.N. McLemore, D.E. Bell, B.D. Laflin, K.W. Prather, L.E. Kornman, A.R. Jones and E.W. Carroll. Annual performance report for state fisheries management project. Part II of III. Subsection II, Stream Research and Management. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

- Jones, A.G. 1979. A study of the wild leek, and the recognition of *Allium burdickii* (Liliaceae). *Systematic Botany* 4:29-43.
- Jones, R.L., and R.L. Thompson. 1986. A beech-hemlock stand in the Knobstone Escarpment of Madison County, Kentucky. *Transactions of the Kentucky Academy of Science* 47:101-105.
- 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.
- Kentucky State Nature Preserves Commission. 1991. *Natural Heritage Database*. Kentucky State Nature Preserves Commission, Frankfort, Kentucky.
- Kraemer, L.R. 1979. Corbicula (Bivalvia: Sphaeriidae) vs. indigenous mussels (Bivalvia: Unionidae) in U.S. rivers: a hard case for interspecific competition? *American Zoologist* 19:1085-1096.
- Kornman, L.E. 1985. Muskellunge streams investigation in Red River, Station Camp Creek, and Sturgeon Creek. Kentucky Department of Fish and Wildlife Resources Fisheries Bulletin 77, Frankfort, Kentucky.
- Kuehne, R.B., and R.W. Barbour. 1983. *The American Darters*. The University of Kentucky Press, Lexington.
- Moran, R.C. 1983. *Cystopteris tenuis* (Michx.) Desv.: a poorly understood species. *Castanea* 48:218-223.
- Morton, G.H. 1973. The taxonomy of the *Solidago arguta-bootii* complex. Ph.D. dissertation, University of Tennessee, Knoxville.
- Newton, J.H., C.W. Hail, T.R. Leathers, P.M. Love, J.G. Stapp, V. Vaught and P.E. Avers. 1974. Soil survey of Estill and Lee Counties, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.
- 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.
- 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.

- Rebmann, J.R., and G.A. O'Dell. 1972. Caves of Rockcastle County, Kentucky. Blue Grass Grotto, Geology Department, University of Kentucky, Lexington.
- Reed, C.E. 1981. *Cypripedium kentuckiense* Reed, a new species of orchid in Kentucky. *Phytologia* 48:426-428.
- Reznicek, A.A., and P.W. Ball. 1980. The taxonomy of *Carex* Section *Stellulatae* in North America north of Mexico. *Contributions from the Michigan Herbarium* 14:153-203.
- Rogers, H.J. 1941. Flora of McCreary County, Kentucky. M.Sc. thesis, University of Kentucky, Lexington.
- Ross, J.C., A.S. Johnson and P.E. Avers. 1981. Soil survey of Laurel and Rockcastle Counties, Kentucky. United States Department of Agriculture, Soil Conservation Service and Forest Service.
- Schuster, G.A. 1976. A new primary burrowing crayfish of the subgenus *Jugicambarus* (Decapoda, Cambaridae) from Kentucky, with notes on its life history. *American Midland Naturalist* 95:225-230.
- Thompson, R.L., and G.L. Wade. 1991. Flora and vegetation of a 12-year old coal surface-mined area in Rockcastle County, Kentucky. *Castanea* 56(2), in press.
- Thompson, Y.L. 1985. The mussel fauna of the Rockcastle River system, Kentucky (Bivalvia: Unionidae). Thesis. Eastern Kentucky University, Richmond, Kentucky.
- 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.
- 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. 1989. Endangered and threatened wildlife and plants; animal notice of review. *Federal Register* 54:554-579.
- 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.
- 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(3-4):83-98.
- Williams, J.C. 1975. Commercial fishery investigations of the Kentucky River. Part I of II. Jobs 1 and 2. Fish population studies and mussel bed surveys. Department of Biological Sciences, Eastern Kentucky University, Richmond, Kentucky.

— — — — —

APPENDICES

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100

APPENDIX A

Significant Areas Adjacent to the Berea District

— — — — —

Site Name: ZION MOUNTAIN RIDGE SYSTEM; Fig 11 (b), p. 80

Size: primary areas totaling about 4 sq. miles

County: Estill

USGS Quadrangles: Alcorn, Panola, (Leighton and Irvine), Ky.

Location. This large area consists of the hills between Big Hill and South Irvine, drained on their south side by Red Lick Creek, and on their north side by Crooked Creek and Drowning Creek. The south side can be reached from KY 594, and the north side from KY 499.

General Description. This area is in the Knobs Regions, but with an unusually pronounced development of narrow, limestone-capped ridges instead of rounded knobs. It is mostly forested except for a few some old fields on the broader ridgetops, and some strips of farmland extending up the stream valleys. There is no government ownership.

Listed Plant Species:

Elymus svensonii, Svenson's Wild-rye

Muhlenbergia cuspidata, Prairie Satin Grass

Oryzopsis racemosa, Black-seeded Rice-grass

Pachistima canbyi, Mountain Lover

Silphium terebinthinaceum var. *lucy-brauniae*, Braun's Prairie Dock

Symphoricarpos albus, Snowberry

Other Plants of Interest.

Chionanthus virginicus, Fringetree (western edge of range)

Descurainia pinnata var. *brachycarpa*, Tansy-mustard (near SE edge of range)

Melica nitens, Shining Melic-grass

Phlox subulata, Moss Phlox

?*Prenanthes crepidinea*, Large Wood-lettuce (non-flowering plants)

Solidago harrisii, a broad-leaved goldenrod

Tortula norvegica, a moss (new for southeastern U.S.A.)

Ulmus thomasi, Rock Elm

Biological Significance. This area has many of the same features as the Grassy Knob Ridge System north of Irvine (Campbell et al. 1989). However, it has less open clifftop vegetation, and some rare grasses are absent. For details, see notes under individual rare species. In addition the following notes are appended to describe the more open clifftop glades without rare species, and the valley with relatively mature forest.

Two open areas of 20-50 by 100-200 feet were found on southwest-facing clifftops, both on the Alcorn Quadrangle: (a) on the west side of the ridge with *Pachistima*; and (b) on the point north of the saddle on west side of Spruce Pine Branch. They were both steep, with much talus, and were surrounded by stunted and dead trees; they appeared to have been burnt in recent years. These areas had similar composition, with frequent *Aster oblongifolius*, *Andropogon scoparius*, *A. gerardii*, *Sporobolus asper*, *Danthonia spicata* and

Phlox subulata (especially at south ends in brushy forest edges). Other species included *Pellaea atropurpurea*, *Allium cernuum*, *Uvularia perfoliata*, *Manfreda*, *Sisyrinchium albidum*, *Dioscorea quaternata*, *Carex eburnea*, *C. pensylvanica*, *Bromus altissimus*, *Elymus hystrix*, *Sporobolus* cf. *vaginaeflorus*, *Panicum linearifolium*, *P. boscii*, *Arenaria patula*, *Anemone virginiana*, *Euphorbia corollata*, *Comandra*, *Lespedeza virginica*, *Sanicula canadensis*, *Lithospermum canescens*, *Asclepias viridiflora*, *A. verticillata*, *Physostegia virginiana* ssp. *praemorsa*, *Monarda* cf. *russeliana*, *Ipomaea pandurata*, *Physalis virginiana*, *Ruellia humilis*, *Aureolaria flava*, *Penstemon* cf. *brevisepalus*, *Houstonia nigricans*, *Silphium trifoliatum*, *Helianthus divaricatus*, *H. microcephalus*, *Solidago ulmifolia*, *Antennaria amoglossa* and *Ambrosia artemisiifolia* (barer ledges). Woody species around the edges included *Smilax bona-nox*, *Rosa carolina*, *Rhus aromatica*, *Physocarpus*, *Rubus* Sect. *Flagellares*, *Cercis*, *Juniperus*, *Pinus virginiana*, *Carya glabra*, *Celtis tenuifolia*, *Chionanthus* (near *Pachistima* only), *Fraxinus quadrangulata* and *Quercus muhlenbergii*. In addition, *Ostrya*, *Ribes* cf. *cynosbati* and *Zanthoxylum* were found around smaller openings nearby. A less xeric variant of such vegetation, with abundant *Chasmanthium latifolium* in addition to *Andropogon* spp., *Danthonia*, *E. hystrix*, etc., was found around a small point on the east side of the hollow described in following paragraph.

The most mature forest in the Zion Mountain Ridge System was found in the hollow southwest of Rice Cemetery (mostly on Panola Quad.), though some recent logging had occurred (especially of *Quercus rubra*). Most of this hollow below the cliffs had a continuous or uneven canopy of trees up to 20-28 inches (50-70 cm) dbh. Frequent woody species included *Liriodendron* and *Fagus* (codominant), *Acer saccharum*, *Q. rubra*, *Tilia* and *Lindera*. Frequent herbs include *Smilacina*, *Erythronium americanum*, *Asarum*, *Caulophyllum*, *Erigenia*, *Phlox divaricata*, *Polemonium reptans* var. *villosum*; others included *Trillium grandiflorum*, *T. sulcatum*, *Stylophorum*, *Impatiens pallida*, *Viola canadensis*, *V. pensylvanica*, *V. rostrata*, *Meehania*, etc. Also of interest was a 15 x 5 feet patch of *Hydrastis*, and some *Arundinaria* in an unusually high slope position just below the cliff.

Explanation of Boundaries. Although the whole ridge system is outlined on the map below, only four areas may be worthy of special conservation efforts at this time. These areas have most of the rare species occurrences and most of the special vegetation areas. They are as follows.

(a) The southern half of the hills between Copperas Branch and Locust Branch of Red Lick Creek. This includes a large *Muhlenbergia cuspidata* site (with *Liatris squarrosa*) and a 20 acre patch of older growth forest.

(b) Turner Hollow and the ridges around it (i.e., the hollow west of Spruce Pine Branch). This includes *M. cuspidata*, *Symphoricarpos*, *Ulmus thomasi*, and, on limestone outcrop, a new moss for SE U.S.A.—*Tortula norvegica* (A. Risk coll at Morehead State Univ.). [In similar vegetation, A. Risk made the second Kentucky collection of another rare moss—*Thuidium abietinum*—during 1990 on Ravenna Knob in the Stanton District.]

(c) Preacher Estes Mountain and the ridges to north and south. This includes *Pachistima*, *Symphoricarpos* and small *M. cuspidata* patches.

(d) Rice Hollow and surrounding ridge, i.e., the hollow east of Henderson Branch. This includes the most mature middle to lower slope forest in the Zion Mountain Ridge System.

Site Name: ANGLIN FALLS AREA; Fig. 15 (see also Harker et al. 1981)

Size: 1350 acres

County: Rockcastle

USGS Quadrangles: Bighill, Ky; Johnetta, Ky.

Location. The site is defined by the relatively mature growth of timber in the ravines on the east side of Clear Creek (Pig Hollow, Hart Hollow and the Anglin Falls hollow) plus the north-facing slope along Anglin Fork. The western and eastern limits either side of the central Anglin Fork area are somewhat tentative, grading into less mature timber.

General Description. This site lies near the junction of the Cliff Section, the Highland Rim and the Knobs Region. It is completely forested, although the 100-1000 feet wide valley bottom of Anglin Fork is cultivated and divides the site in two. The headwaters of Anglin Fork, lying outside the primary preserve design, have only small or uneven timber and the ridges are cleared in several places. The upper slopes are rimmed by a line of sandstone cliffs; the mid-slopes have small limestone cliffs in places, but these are much less pronounced.

Listed Animal Species

Aneides aeneus, Green Salamander

Neotoma floridana magister, Eastern Wood Rat

Biological Significance. Some of this area has relatively mature timber, within the context of Rockcastle County, with canopy trees generally 16-28 inches (40-70 cm) dbh. About a third of the area has a fairly uniform cover of trees this size, but the rest is more uneven, with young stands mixed in with the larger trees. No endangered or threatened species plants have been found here, but the presence of *Carex purpurifera*, *Polemonium reptans* var. *villosum* and *Cypripedium pubescens* is of some interest. The most common species in more mature stands on moister sites include (in approximate descending order) *Fagus*, *Quercus rubra*, *Acer saccharum*, *Tilia*, *Aesculus octandra*, *Ulmus rubra*, *Fraxinus americana*, *Magnolia tripetala* and *Liriodendron*; the latter is much more abundant in younger stands. *Tsuga* is generally not present, except near Anglin Falls itself. Trees on drier sites include *Q. alba*, *Q. montana*, *Q. velutina*, *Carya ovata* and *Carya glabra* (or *C. ovalis*); on the driest sites, there are also some pines (*P. echinata*, *P. virginiana*) and heaths (*Vaccinium vacillans*, *Kalmia*). Common shrubby species include *Cornus florida*, *Staphylea*, *Asimina* and *Hydrangea*. Common species on the ground include *Dryopteris marginalis*, *Athyrium pycnocarpon*, *Osmunda claytoniana*, *Dioscorea quaternata*, *Brachyelytrum*, *Carex plantaginea*, *Asarum*, *Desmodium nudiflorum*, *Impatiens pallida*, *Parthenocissus*, *Hydrophyllum canadense*, *Solidago flexicaulis*, *S. caesia* and *Aster divaricatus*.

The following sections can be distinguished: (a) Pig Hollow, mostly uneven timber. (b) Hart Hollow, mostly with mature or uneven timber, but with some younger stands on upper and lower, gentle slopes; (c) Anglin Falls Hollow, with unexceptional forest, but with

no recent disturbance and currently conserved by landowner; and (d) north-face along Anglin Fork, with some mature patches, including oak stands, but mostly uneven and some small timber also.

Explanation of Boundaries. These include the hollows and slopes listed above, and the agricultural valley of Anglin Fork, but they exclude the farmland on the ridges above. In the foreseeable future, reforestation of the farmland in and around this site would probably be impractical.



Site Name: Rocky banks of Rockcastle River south of the Berea District
(between Livingston and Billows).

On Saturday, June 30, 1990, J. Campbell made a canoe trip from Livingston downstream to Billows. Although this section of the river lies south of the Berea District, these notes are appended here for convenience, and because they hold considerable comparative interest with upper and lower sections. They will ultimately be referred to in the anticipated inventory of the London Ranger District. Downstream of Billows, the extensive "boulder-cobble" bars have exceptionally unusual vegetation with many rare species (Palmer-Ball et al. 1988). Upstream of Livingston, there are virtually no rocky banks, and despite considerable searching, none of the rarer species associated with such sites were found. Between Billows and Livingston, there are a few boulder-cobble bars, plus a few exposures of limestone bedrock on the banks. The following notes were made at almost all of the sites suspected of harboring rare species; the areas are only ca. 1/10-1 acre. Generally, the non-rocky banks have *Acer saccharinum* and *Carpinus* (both frequent), *Platanus*, *Fraxinus pennsylvanica*, *Betula nigra*, *Acer negundo*, *Arundinaria*, *Cornus obliqua*, *Salix nigra*, *Tilia*, *Celtis occidentalis*, etc. The small, gentle riffles have beds of *Justicia*, and are generally lined with thickets of *Salix caroliniana*, *Cornus obliqua* (especially on limestone?), *Alnus* (especially on sandstone?), *Betula nigra* and *Platanus*.

(1) Livingston Quad. Island 1 mile ESE of Sand Hill Lookout Tower: brushy forest with tall herbs; frequent *Salix caroliniana*, *Platanus*, *Betula nigra*, *Ambrosia trifida*; also *Solidago gigantea*, *Eupatorium serotinum*, etc.

(2) Livingston Quad. Small boulder-bar and some limestone, on west bank E of 1318 feet peak at "Sandy": *Zizia aurea* (abundant), *Andropogon gerardii*, *Solidago gigantea*, *Betula nigra*, *Platanus*, *Salix caroliniana*, *Silphium perfoliatum*, *Hypericum prolificum* and occasional *Physostegia virginiana* ssp. *virginiana*.

(3) Bernstadt Quad. Small sandstone boulder-bar on south bank 0.25 miles downstream of Little Rockcastle River: *Alnus* (abundant), *Ilex verticillata*, *Itea*, *Celtis occidentalis*, *Crataegus* sp., *Rhododendron arborescens*, *Zizia aurea*, *Onoclea*, *Osmunda regalis*, *Erigeron pulchellus* var. *brauniae*, *Phlox maculata*, *Clematis glaucophylla* and *Trautvetteria*.

Remaining notes are from Billows Quad.

(4) Small sandstone-boulder bar on W bank 0.5 miles upstream from Big Trace Branch: brushy forest of *Platanus*, *Carpinus* and *Alnus*, with some *Betula nigra*, *Lindera*; herb layer of *Onoclea* and *Senecio aureus* (frequent), also *Trautvetteria*, *Osmunda regalis*, *Silphium perfoliatum*, *Eupatorium fistulosum*, *Solidago rugosa*, *Helianthus* cf. *decapetalus*, *Verbesina alternifolia*, *Aster prenanthoides*, *Cryptotaenia*, *Boehmeria*, *Lysimachia ciliata*, *Elymus villosus*, *E. virginicus* and occasional *Ranunculus septentrionalis*.

(5) Limestone shelf with 1/10 acre opening on north bank, 1000 feet downstream from Big Trace Branch: abundant *Andropogon gerardii*, but with much *Coronilla* (an exotic) spread down from adjacent field, frequent *Hypericum prolificum* and *Zizia aurea*; also *Fraxinus*

pennsylvanica, *Platanus*, *Melilotus* sp. and *Lespedeza cuneata* (two more exotic legumes), *Oenothera tetragona*, *Asclepias syriaca*, *Apocynum*, *Ipomaea pandurata*, *Pycnanthemum tenuifolium*, *Dasystoma*, *Campsis*, *Senecio aureus*, *Helianthus* cf. *decapetalus*, *Coreopsis tripteris*, *Aster pilosus*, *A. laevigata*, *Solidago altissima*, *S. gigantea*, *S. cf. speciosa*, *Erigeron annuus*, *Rudbeckia hirta*, *Scirpus lineatus* and *Allium canadense*.

(6) Low, muddy bar on W bank 1000 feet downstream from Skegg Creek: frequent *Silphium perfoliatum* and *Ambrosia trifida*; also *A. artemisiifolia*, *Helianthus tuberosus*, *Verbesina alternifolia*, *Erigeron canadensis*, *Melilotus* sp., *Impatiens* cf. *capensis*, *Convolvulus sepium*, *Plantago rugelii*, *Boehmeria*, *Panicum clandestinum*, *Vitis vulpina*, *Cornus obliqua*, *Platanus*, *Fraxinus pennsylvanica* and *Acer saccharinum*.

(7) Limestone shelf about 100 long and 7-10 feet above water, on S bank 0.4 miles upstream from Fish Trap Branch, about 2 (air) miles north of Billows (Rockcastle Co.). Here was found *Spiraea virginiana* (Virginia Spiraea), a federally "Threatened" species. This species is restricted to rocky river banks in the Appalachian Region. Three sites are now known in Kentucky, all along the Rockcastle River (misidentified as *S. corymbosa* in Palmer-Ball et al. 1988, but corrected by D. Ogle, pers. comm.). At least 100 stems were seen in two or three patches, mostly rooted in cracks of the rock. The vegetation was dominated by shrubby plants and herbs, including *Platanus*, *Acer saccharinum*, *Cornus obliqua*, *Hydrangea*, *Physocarpus*, *Rhus radicans*, *Trautvettaria*, *Potentilla simplex*, *Amphicarpaea*, *Impatiens capensis*, *Pilea*, *Zizia aurea*, *Lysimachia ciliata*, *Teucrium*, *Senecio aureus*, *Bidens frondosa*, *Eupatorium serotinum*, *Aster prenanthoides*, *A. ontarionis*, *Leersia virginica* and *Muhlenbergia frondosa*.

(8) Low cobble bars on W bank 1000-2000 feet downstream from Fish Trap Branch: a back-channel near upstream end had abundant *Physostegia virginiana* ssp. *virginiana*.

(9) Sandstone boulder-cobble bar on W bank at mouth of the unnamed branch opposite Hawk Branch (Rockcastle County). Here was found *Baptisia australis* var. *australis* (Blue False Indigo). In Kentucky, this eastern variety is known from 30-40 sites in seven counties, mostly southeastern, where it is restricted to short rocky sections of riverbanks in the southern Cliff Section. This particular bar is the most northern locality known in the Cliff Section. The zonation on this bar was roughly as follows.

(a) Shrubby waterfront, with frequent *Salix caroliniana*, *Cornus obliqua*, *Acer saccharinum*; also, *Betula nigra*, *Fraxinus pennsylvanica* and *Cephalanthus*.

(b) Grassy zone on well-drained cobbles, with frequent *Andropogon gerardii*, *Onoclea* and *Chasmanthium latifolium*; also, *Baptisia* and *Physostegia virginiana* ssp. *virginiana*.

(c) Tall herbs at back of bar: frequent *Zizia aurea*, *Lysimachia ciliata*, *Senecio aureus*, *Solidago gigantea*, *Silphium perfoliatum*; also *Phlox paniculata*, *Rhus radicans*, *Allium canadense*, *Eupatorium fistulosum*; some *Monarda clinopodia*, *Valeriana*, *Carex blanda*, *Viola conspersa* and *V. striata*.

(d) Forest on lower slope and terrace: frequent small *Liriodendron*, *Platanus*, *Lindera*, *Arundinaria* and *Solidago flexicaulis*; also, *Pachysandra*, *Poa sylvestris*, *P. autumnalis*, *Polymnia canadensis*; occasional *Senecio obovatus*, *Delphinium tricorne*, *Polemonium reptans* var. *villosum* and *Hydrastis*.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

APPENDIX B

Terrestrial Vertebrate Lists for the Berea District

- 1. Herptiles**
- 2. Breeding Birds**
- 3. Mammals**

— — — — —

APPENDIX B1: HERPTILES OF THE BEREA RANGER DISTRICT.

Species	Abundance	Habitat(s)
Amphibians		
Salamanders		
<i>Ambystoma maculatum</i> Spotted Salamander	fc	Woodlands.
<i>Ambystoma jeffersonianum</i> Jefferson Salamander	uc	Woodlands.
<i>Ambystoma opacum</i> Marbled Salamander	uc	Woodlands.
<i>Ambystoma texanum</i> Smallmouth Salamander	ra	Woodlands.
<i>Aneides aeneus</i> Green Salamander	uc	Sandstone outcrops.
<i>Cryptobranchus a. alleganiensis</i> Eastern Hellbender	uc	Streams; rivers.
<i>Desmognathus f. fuscus</i> Northern Dusky Salamander	fc	Headwater streams.
<i>Desmognathus m. monticola</i> Appalachian Seal Salamander	co	Headwater streams.
<i>Desmognathus ochrophaeus</i> Mountain Dusky Salamander	ra	Seepages.
<i>Desmognathus welteri</i> Black Mountain Salamander	fc	Headwater streams.
<i>Eurycea b. bislineata</i> Northern Two-lined Salamander	fc	Streams.

APPENDIX B1 Cont'd.

Species	Abundance	Habitat(s)
<i>Eurycea l. longicauda</i> Longtail Salamander	fc	Rock outcrops; caves; streams.
<i>Eurycea lucifuga</i> Cave Salamander	fc	Limestone outcrops; caves.
<i>Gyrinophilus porphyriticus duryi</i> Kentucky Spring Salamander	uc	Springs; seeps.
<i>Hemidactylium scutatum</i> Four-toed Salamander	uc	Woodlands.
[<i>Necturus m. maculosus</i>] Mudpuppy	ra	Rivers; streams.
<i>Notophthalmus v. viridescens</i> Red-spotted Newt	co	Woodlands.
<i>Plethodon d. dorsalis</i> Eastern Zigzag Salamander	uc	Woodlands.
<i>Plethodon g. glutinosus</i> Slimy Salamander	co	Woodlands.
[<i>Plethodon kentucki</i>] Cumberland Plateau Woodland Salamander	uc	Woodlands.
<i>Plethodon richmondi</i> Ravine Salamander	uc	Woodlands.
<i>Pseudotriton m. montanus</i> Eastern Mud Salamander	ra	Springs; seeps.
<i>Pseudotriton r. ruber</i> Northern Red Salamander	uc	Woodlands; springs.

APPENDIX B1 Cont'd.

Species	Abundance	Habitat(s)
Frogs and Toads		
[<i>Acris c. crepitans</i>] Northern Cricket Frog	ra	Marshes; ponds.
<i>Bufo a. americanus</i> Eastern American Toad	co	Ubiquitous.
<i>Bufo woodhousii fowleri</i> Fowler's Toad	co	Ubiquitous.
[<i>Gastrophryne carolinensis</i>] Eastern Narrow-mouth Toad	ra	
<i>Hyla chrysoscelis</i> Cope's Gray Treefrog	co	Woodlands; edges.
<i>Hyla c. crucifer</i> Spring Peeper	co	Edges; woodlands.
<i>Pseudacris brachyphona</i> Mountain Chorus Frog	fc	Woodlands.
<i>Pseudacris triseriata feriarum</i> Upland Chorus Frog	ra	Marshes; meadows.
<i>Rana catesbeiana</i> Bullfrog	co	Ponds; marshes; rivers.
<i>Rana clamitans melanota</i> Green Frog	co	Ponds; streams.
<i>Rana palustris</i> Pickerel Frog	fc	Ponds; caves; streams.
<i>Rana sphenoccephala</i> Southern Leopard Frog	ra	Marshes; ponds.
<i>Rana sylvatica</i> Wood Frog	co	Woodlands.

APPENDIX B1 Cont'd.

Species	Abundance	Habitat(s)
<i>Scaphiopus h. holbrookii</i> Eastern Spadefoot	ra	Woodlands with sandy soils.
Reptiles		
Turtles		
<i>Chelydra s. serpentina</i> Common Snapping Turtle	fc	Ponds; streams; rivers.
[<i>Chrysemys picta marginata</i>] Midland Painted Turtle	ra	Ponds.
<i>Graptemys geographica</i> Map Turtle	uc	Rivers; ponds.
<i>Sternotherus odoratus</i> Stinkpot	ra	Ponds.
<i>Trachemys</i> [= <i>Pseudemys</i>] <i>scripta elegans</i> Red-eared Slider	ra	Ponds; rivers.
<i>Terrapene c. carolina</i> Eastern Box Turtle	co	Ubiquitous.
<i>Trionyx s. spiniferus</i> Eastern Spiny Softshell	uc	Rivers; streams.
Lizards		
<i>Eumeces a. anthracinus</i> Northern Coal Skink	ra	Edges; outcrops.
<i>Eumeces fasciatus</i> Five-lined Skink	co	Edges; woodland openings
<i>Sceloporus undulatus hyacinthinus</i> Northern Fence Lizard	co	Edges; rock outcrops.

APPENDIX B1 Cont'd.

Species	Abundance	Habitat(s)
<i>Scincella lateralis</i> Ground Skink	fc	Edges; open woods.
Snakes		
<i>Agkistrodon contortrix mokasen</i> Northern Copperhead	fc	Ubiquitous.
<i>Carphophis amoenus</i> Worm Snake	fc	Ubiquitous.
<i>Cemophora coccinea copei</i> Northern Scarlet Snake	ra	Woodlands; edges.
<i>Coluber constrictor</i> Black Racer	co	Edges; fields.
<i>Crotalus horridus</i> Timber Rattlesnake	uc	Woodlands.
<i>Diadophis punctatus edwardsii</i> Northern Ring-necked Snake	co	Woodlands.
<i>Elaphe o. obsoleta</i> Black Rat Snake	co	Ubiquitous.
<i>Heterodon platirhinos</i> Eastern Hognose Snake	uc	Edges; fields.
<i>Lampropeltis getulus niger</i> Black Kingsnake	uc	Edges; fields.
<i>Lampropeltis t. triangulum</i> Eastern Milk Snake	uc	Edges; fields.
<i>Nerodia s. sipedon</i> Northern Water Snake	uc	Ponds; streams; marshy areas.

APPENDIX B1 Cont'd.

Species	Abundance	Habitat(s)
<i>Opheodrys aestivus</i> Rough Green Snake	uc	Woodlands; edges.
<i>Regina septemvittata</i> Queen Snake	ra	Streams.
<i>Storeria dekayi</i> Brown Snake	fc	Edges; fields.
<i>Storeria o. occipitomaculata</i> Northern Redbelly Snake	uc	Woodlands; edges.
<i>Thamnophis s. sirtalis</i> Eastern Garter Snake	co	Ubiquitous.
<i>Virginia v. valeriae</i> Eastern Earth Snake	ra	Edges; fields; rocky woods.

Key to Appendix B1:

[] -- indicates species not documented from the Berea District, but occurring nearby in adjacent counties.

Key to Abundances: co -- common; fc -- fairly common; uc -- uncommon;
ra -- rare.

APPENDIX B2: BREEDING BIRDS OF THE BEREA RANGER DISTRICT.

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

APPENDIX B2 Cont'd.

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

APPENDIX B2 Cont'd.

Species	Abundance	Habitat(s)
Barn Swallow	fc	Farmland.
Blue Jay	co	Woodlands; edges.
American Crow	co	Woodland edge; farmland.
Carolina Chickadee	co	Woodlands.
Tufted Titmouse	co	Woodlands.
White-breasted Nuthatch	fc	Woodlands.
Carolina Wren	co	Ubiquitous.
Blue-gray Gnatcatcher	fc	Woodlands.
Eastern Bluebird	uc	Farmland; settled areas.
Wood Thrush	co	Woodlands.
American Robin	fc	Farmland; settled areas.
Gray Catbird	uc	Woodland edge; settled areas.
Northern Mockingbird	fc	Farmland; settled areas.
Brown Thrasher	uc	Woodland edge; brushy areas.
Cedar Waxwing	uc	Pine/mixed woodlands.
European Starling	co	Farmland; settled areas.
White-eyed Vireo	fc	Clearcuts; successional habitats.
Yellow-throated Vireo	fc	Sub-xeric woodlands.
Red-eyed Vireo	co	Woodlands.
Blue-winged Warbler	uc	Clearcuts; successional habitats.

APPENDIX B2 Cont'd.

Species	Abundance	Habitat(s)
Northern Parula	fc	Mesic/riparian woodland.
Yellow Warbler	uc	Along streams; farmland.
Black-throated Green Warbler	fc	Wooded ravines with hemlocks.
Yellow-throated Warbler	fc	Pine/mixed woodlands.
Pine Warbler	fc	Pine/mixed woodlands.
Prairie Warbler	fc	Clearcuts; successional habitats.
Cerulean Warbler	ra	Mature mesic woodlands.
Black-and-white Warbler	fc	Sub-xeric woodlands.
Prothonotary Warbler	ra	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	fc	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 B2 Cont'd.

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

Key to Appendix B2:

Relative abundances: co -- common; fc -- fairly common; uc -- uncommon; ra -- rare.

[] -- indicates species not documented during inventory, but occurrence in the Berea District is likely.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

APPENDIX B3: MAMMALS OF THE BEREA RANGER DISTRICT.

Species	Abundance	Habitat(s)
<i>Blarina brevicauda</i> Short-tailed Shrew	co	Ubiquitous.
<i>Canis latrans</i> Coyote	uc	Farmland; open woods.
<i>Castor canadensis</i> Beaver	uc	Streams; rivers.
<i>Cryptotis parva</i> Least Shrew	ra	Edges; fields.
<i>Dama virginianus</i> White-tailed Deer	uc	Woodlands; edges.
<i>Didelphis virginiana</i> Virginia Opossum	co	Ubiquitous.
<i>Eptesicus fuscus</i> Big Brown Bat	co	Caves; buildings.
[<i>Felis concolor couguar</i>] Eastern Cougar	ra	Woodlands.
<i>Glaucomys volans</i> Southern Flying Squirrel	fc	Woodlands.
<i>Lasionycteris noctivagans</i> Silver-haired Bat	ra	Caves.
<i>Lasiurus [= Nycteris] borealis</i> Red Bat	co	Woodlands.
[<i>Lasiurus [= Nycteris] cinerea</i>] Hoary Bat	ra	Woodlands.
[<i>Lutra canadensis</i>] River Otter	ra	Rivers; large streams.

APPENDIX B3 cont'd.

Species	Abundance	Habitat(s)
<i>Lynx rufus</i> Bobcat	fc	Woodlands; caves.
<i>Marmota monax</i> Woodchuck	fc	Fields; edges.
<i>Mephitis mephitis</i> Striped Skunk	co	Ubiquitous.
<i>Sorex [= Microsorex] hoyi winnemana</i> Pygmy Shrew	uc	Woodlands.
[<i>Sorex longirostris</i>] Southeastern Shrew	ra	
<i>Microtus ochrogaster</i> Prairie Vole	ra	Fields; edges.
[<i>Microtus pennsylvanicus</i>] Meadow Vole	ra	Edges; fields.
<i>Microtus pinetorum</i> Pine Vole	fc	Edges; woodlands.
<i>Mus musculus</i> House Mouse	co	Habitations; fields.
<i>Mustela frenata</i> Long-tailed Weasel	uc	Edges; fields.
[<i>Mustela nivalis</i>] Least Weasel	ra	Edges; fields.
<i>Mustela vison</i> Mink	uc	Edges; fields.
<i>Myotis austroriparius</i> Southeastern Myotis	ra	Caves; clifflines.

APPENDIX B3 cont'd.

Species	Abundance	Habitat(s)
<i>Myotis grisescens</i> Gray Myotis	ra	Caves.
<i>Myotis lucifugus</i> Little Brown Myotis	co	Caves; woodlands and buildings in summer.
<i>Myotis septentrionalis</i> [= <i>keenii</i>] Northern Long-eared Bat	uc	Caves; rockhouses; woodlands.
<i>Myotis sodalis</i> Indiana Myotis	uc	Caves; woodlands.
<i>Myotis leibii</i> [= <i>M. subulatus leibii</i>] Small-footed Myotis	ra	Caves; woodlands.
<i>Napaeozapus insignis</i> Woodland Jumping Mouse	ra	Woodlands; edges.
<i>Neotoma floridana magister</i> Eastern Wood Rat	co	Caves; cliffines; rockhouses; woodlands.
[<i>Nycticeius humeralis</i>] Evening Bat	ra	Buildings?
<i>Ochrotomys nuttalli</i> Golden Mouse	uc	Thickets; old fields.
<i>Ondatra zibethicus</i> Muskrat	fc	Streams; ponds.
<i>Parascalops breweri</i> Hairy-tailed Mole	uc	Woodlands.
<i>Peromyscus leucopus</i> White-footed Mouse	co	Ubiquitous.

APPENDIX B3 cont'd.

Species	Abundance	Habitat(s)
<i>[Peromyscus maniculatus bairdii]</i> Prairie Deer Mouse	ra	Edges; fields.
<i>Pipistrellus subflavus</i> Eastern Pipistrelle	co	Caves; woodlands.
<i>Plecotus rafinesquii</i> Rafinesque's Big-eared Bat	uc	Caves; woodlands; buildings (summer)
<i>Plecotus townsendii virginianus</i> Virginia Big-eared Bat	uc	Caves; rockhouses.
<i>Procyon lotor</i> Raccoon	co	Ubiquitous.
<i>Rattus norvegicus</i> Norway Rat	uc	Habitations; dumps.
<i>[Reithrodontomys humulis]</i> Eastern Harvest Mouse	ra	Fields; edges.
<i>Scalopus aquaticus</i> Eastern Mole	fc	Ubiquitous.
<i>Sciurus carolinensis</i> Gray Squirrel	co	Woodlands.
<i>Sciurus niger</i> Fox Squirrel	fc	Open woodlands.
<i>Sorex fumeus</i> Smoky Shrew	co	Rich woodlands.
<i>Spilogale putorius</i> Spotted Skunk	ra	Woodlands; edges.
<i>Sylvilagus floridanus</i> Eastern Cottontail	co	Edges; fields.

APPENDIX B3 cont'd.

Species	Abundance	Habitat(s)
<i>Synaptomys cooperi</i> Southern Bog Lemming	uc	Fields; edges.
<i>Tamias striatus</i> Eastern Chipmunk	co	Woodlands; edges.
<i>Urocyon cinereoargenteus</i> Gray Fox	co	Woodlands; farmland.
<i>Ursus americanus</i> Black Bear	ra	Woodlands.
<i>Vulpes vulpes</i> Red Fox	uc	Farmland; woodlands.
[<i>Zapus hudsonius</i>] Meadow Jumping Mouse	ra	Edges; fields.

Key to Appendix B3:

[.] -- indicates species not documented from the Berea District, but occurring nearby in adjacent counties.

Relative abundances: co -- common; fc -- fairly common; uc -- uncommon; ra -- rare.

1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 26
 27
 28
 29
 30
 31
 32
 33
 34
 35
 36
 37
 38
 39
 40
 41
 42
 43
 44
 45
 46
 47
 48
 49
 50
 51
 52
 53
 54
 55
 56
 57
 58
 59
 60
 61
 62
 63
 64
 65
 66
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80
 81
 82
 83
 84
 85
 86
 87
 88
 89
 90
 91
 92
 93
 94
 95
 96
 97
 98
 99
 100
 101
 102
 103
 104
 105
 106
 107
 108
 109
 110
 111
 112
 113
 114
 115
 116
 117
 118
 119
 120
 121
 122
 123
 124
 125
 126
 127
 128
 129
 130
 131
 132
 133
 134
 135
 136
 137
 138
 139
 140
 141
 142
 143
 144
 145
 146
 147
 148
 149
 150
 151
 152
 153
 154
 155
 156
 157
 158
 159
 160
 161
 162
 163
 164
 165
 166
 167
 168
 169
 170
 171
 172
 173
 174
 175
 176
 177
 178
 179
 180
 181
 182
 183
 184
 185
 186
 187
 188
 189
 190
 191
 192
 193
 194
 195
 196
 197
 198
 199
 200
 201
 202
 203
 204
 205
 206
 207
 208
 209
 210
 211
 212
 213
 214
 215
 216
 217
 218
 219
 220
 221
 222
 223
 224
 225
 226
 227
 228
 229
 230
 231
 232
 233
 234
 235
 236
 237
 238
 239
 240
 241
 242
 243
 244
 245
 246
 247
 248
 249
 250
 251
 252
 253
 254
 255
 256
 257
 258
 259
 260
 261
 262
 263
 264
 265
 266
 267
 268
 269
 270
 271
 272
 273
 274
 275
 276
 277
 278
 279
 280
 281
 282
 283
 284
 285
 286
 287
 288
 289
 290
 291
 292
 293
 294
 295
 296
 297
 298
 299
 300
 301
 302
 303
 304
 305
 306
 307
 308
 309
 310
 311
 312
 313
 314
 315
 316
 317
 318
 319
 320
 321
 322
 323
 324
 325
 326
 327
 328
 329
 330
 331
 332
 333
 334
 335
 336
 337
 338
 339
 340
 341
 342
 343
 344
 345
 346
 347
 348
 349
 350
 351
 352
 353
 354
 355
 356
 357
 358
 359
 360
 361
 362
 363
 364
 365
 366
 367
 368
 369
 370
 371
 372
 373
 374
 375
 376
 377
 378
 379
 380
 381
 382
 383
 384
 385
 386
 387
 388
 389
 390
 391
 392
 393
 394
 395
 396
 397
 398
 399
 400
 401
 402
 403
 404
 405
 406
 407
 408
 409
 410
 411
 412
 413
 414
 415
 416
 417
 418
 419
 420
 421
 422
 423
 424
 425
 426
 427
 428
 429
 430
 431
 432
 433
 434
 435
 436
 437
 438
 439
 440
 441
 442
 443
 444
 445
 446
 447
 448
 449
 450
 451
 452
 453
 454
 455
 456
 457
 458
 459
 460
 461
 462
 463
 464
 465
 466
 467
 468
 469
 470
 471
 472
 473
 474
 475
 476
 477
 478
 479
 480
 481
 482
 483
 484
 485
 486
 487
 488
 489
 490
 491
 492
 493
 494
 495
 496
 497
 498
 499
 500
 501
 502
 503
 504
 505
 506
 507
 508
 509
 510
 511
 512
 513
 514
 515
 516
 517
 518
 519
 520
 521
 522
 523
 524
 525

Printed with State Funds