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A Description of the Terrestrial Ecology of the Oak Ridge Environmental Research Park

T. Kitchings
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Environmental Sciences Division
Publication No. 779

OAK RIDGE NATIONAL LABORATORY
OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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T. Kitchings and L. K. Mann

ENVIRONMENTAL SCIENCES DIVISION

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ABSTRACT

KITCHINGS, J. T. and L. K. MANN. 1976. A description of the terrestrial ecology of the Oak Ridge Environmental Research Park. ORNL/TM-5073. Oak Ridge National Laboratory, Oak Ridge, Tennessee. pp. 58

The Environmental Sciences Division at Oak Ridge National Laboratory has begun to develop research and administrative foundations necessary to establish and operate an Environmental Research Park (ERP) on the Energy Research and Development Administration Reservation at Oak Ridge, Tennessee. Important in developing a functional research area is a description and inventory of the species and ecosystems which comprise the Research Park.

This report describes some of the floral and faunal components of the Oak Ridge Reservation. Emphasis is placed on the relationship of faunal communities to the vegetation type in which they occur. Unique vegetational areas and rare and endangered species are also discussed.

INTRODUCTION

Establishment of ERDA lands as National Environmental Research Parks (NERP) has progressed as an outgrowth of the National Environmental Policy Act of 1969 and the Administration's Legacy of Parks programs. Two such Parks have been designated previously, one at the ERDA facilities at the Savannah River Plant near Aiken, South Carolina, and one at the site of the Idaho National Engineering Laboratory, Idaho Falls, Idaho. The objectives of these programs have been (1) to develop methods for the continuous and quantitative assessment of man's activities on the environment, (2) to develop models to predict the response of environmental components to proposed technological activities, (3) to provide land-use plans which make preservation of representative regional natural areas compatible with technological activities, and (4) to conduct research, training, and education.

In July, 1975, the ERDA facility at Oak Ridge received official sanction to initiate the development of such a program within the boundaries of the ERDA Oak Ridge Reservation. The preparation of this document represents a compilation of previous work at Oak Ridge by a large number of Environmental Sciences Division staff members and will serve as background information for future, more-detailed studies within the goals of the Oak Ridge NERP.

The Energy Research and Development Administration Oak Ridge Reservation consists of approximately 15,000 ha of land in Anderson and Roane Counties, Tennessee. The land is part of an original 92-square-mile tract purchased in 1942 to serve as an atomic development and

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production center by the Manhattan Project, U.S. Corps of Engineers. The Reservation is located 15 miles west of Knoxville, Tennessee. The Tennessee Valley Authority's (TVA) Melton Hill and Watts Bar Reservoirs on the Clinch River form southern, western, and eastern boundaries of the area while the city of Oak Ridge forms the northern boundary.

Four separate nuclear production and research facilities are operated within the Reservation. Three of these, Oak Ridge National Laboratory (ORNL), Y-12, and Oak Ridge Gaseous Diffusion Plant (ORGDP), are operated for the Energy Research and Development Administration by Union Carbide Corporation. The fourth, the Comparative Animal Research Laboratory (CARL), is operated by the University of Tennessee. Additional Federal facilities are located within the city of Oak Ridge. Table 1 summarizes the land allocation among these facilities.

The area has been under government control for thirty years, and has not been unduly disturbed except for experimental use, regulated forest management, highways, and transmission lines.

Geology

The Oak Ridge Reservation is within the Ridge and Valley Province of the Southern Appalachians and is characterized by parallel southwest-northeast-oriented ridges of sandstone, shale, and cherty dolomite, separated by valleys underlain by less weather-resistant limestone and shale. Topography of the area is due to differential erosion of severely folded and faulted rocks ranging in age from Early Cambrian to Early Mississippian. Elevations range from 230 to 410 m above mean sea level with a maximum relief of 190 m. The area includes gently sloping valleys, rolling to steep slopes, and ridges. Soils developed from the weathered geologic substrate are members of the ultisol group, which includes the red and yellow podzolic soils.

Climate

The climate is typical of the humid Southern Appalachian region. The mean annual rainfall is 136 cm, and the mean annual temperature is 14.3°C. Storms generally follow a northwest-southeast track; and the seasonal precipitation pattern is characterized by wet winters, dry summers, wet springs, and dry autumns.

Soils

Soils have developed under forests and contain an A-horizon that is typically light-colored and covers a tougher, clayey subsoil of red, yellow, or mottled color. The major soils are generally silty rather than sandy or clayey. However, considerable clay may be present in the B-horizon. The Knox soils contain kaolinite as their principal clay, whereas illite and vermiculite constitute the bulk of Conasauga clay.

Table 1. Allocation of land use among installations on the ERDA Oak Ridge Reservation[a]

Administrative Unit	Hectares
Environmental Research and Management	16,043
ORNL plant and support facilities	3,537
Y-12 plant and support facilities	1,453
K-25 plant and support facilities	2,258
CARL research land and facilities	1,516
TOTAL	14,807

[a]Data taken from Task Force Report FY-1972, Surveys of Real Property Holdings, AEC-ORO, June 1972, and "Oak Ridge Land-Use Plan", August 1975, ORO, USERDA, ORO-748, 47 pp.

Most of the Chickamauga clay occurs as kaolinite and illite, although patches with significant amounts of montmorillonite have been noted. The soils of the Oak Ridge area are relatively infertile and ill-suited to agriculture. Approximately 15% of the land is favorably productive, 35% is characterized by medium productivity, and the remaining 50% is not suitable to agriculture. Their extensive clay subsoils channel most of the hydrological input into surface flow. As such, they are characteristic of many forested soils found in the Valley and Ridge Province.

Flora

The dominant oak-hickory association in the Ridge and Valley Province contains elements of the mixed mesophytic association commonly found in the adjacent Cumberland Mountains. Plant communities of the Oak Ridge Reservation are characteristic of those found in the intermountain regions of Appalachia from the Allegheny Mountains in southern Pennsylvania to the southern extension of the Cumberland Mountains in northern Alabama(1). On the Reservation, the oak-hickory association is typified by extensive stands of mixed yellow pine and hardwoods as well as oak and hickory. Yellow poplar often forms nearly pure stands on well-drained bottomlands and lower slopes while willow, sycamore and boxelder border streams and are dominant on poorly drained floodplains. Species more commonly found in the mixed mexophytic association, such as beech, sugar maple, magnolias, buckeye, and basswood, often occur in coves and sheltered slopes. In addition, approximately 2000 ha of the Reservation were planted in loblolly pine between 1947 and 1956 while smaller acreages have since been planted in loblolly pine, black walnut, river birch, sycamore, and poplar.

Forest Communities

Within the 12,000 forested hectares on the Reservation, there are 184 continuous forest inventory (CFI) plots which have been used to define forest types within the Reservation. These plots are 0.08 ha each; the 184 plots constitute approximately 0.1% of the total area of the Reservation. While not sufficient to identify small-scale unique features, these plots are useful to define broad forest type distribution. Forest types, represented by the CFI plots, were defined by using two classification (clustering) techniques based on basal area density (m^2/ha).(2) These analyses defined the 16 forest types shown in Fig. 1. Stand types on the right side of the figure are those usually considered typical of the oak-hickory association while those on the left represent either seral stages, plantations, or bottomland stand types not normally included in the oak-hickory association. An earlier study(2) on Walker Branch Watershed for which 25% of the total watershed area was surveyed identified four major stand types (pine, yellow poplar, oak-hickory, and chestnut oak); all of which were also identified in this study.

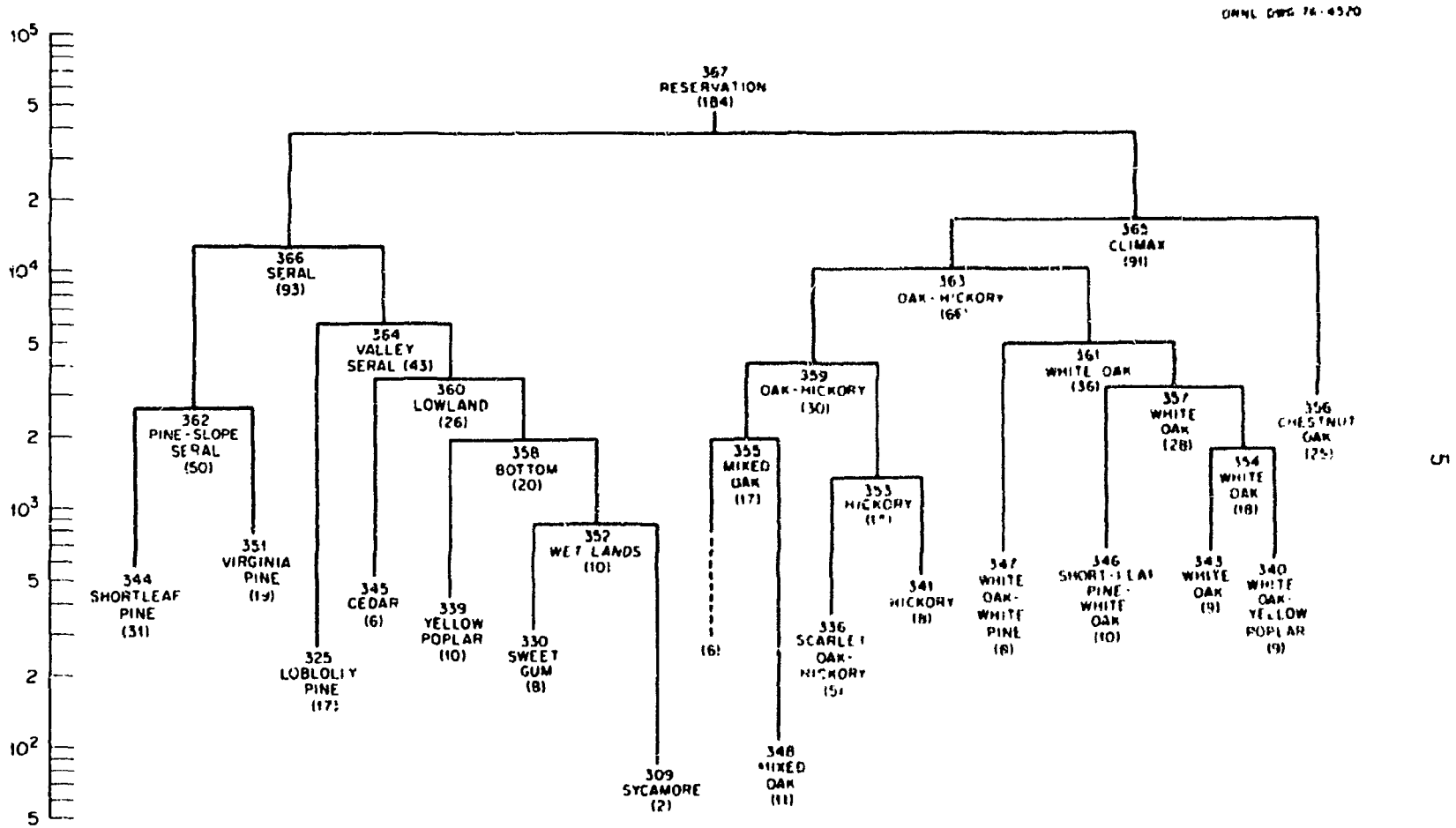

Fig. 1. Dendrogram showing results of numerical classification of 184 Continuous Forest Inventory plots on the basis of basal area of the overstory layers.

Plots representative of the climax vegetation of the oak-hickory association fall into three general groupings: chestnut oak, oak-hickory, and white oak (Fig. 1). The oak-hickory group is subdivided into a mixed oak group and a hickory group while the white oak group is subdivided into a white oak-white pine group, a shortleaf pine-white oak group, a white oak-yellow poplar group, and a predominantly white oak group. Appendix I (Tables 1-16) summarizes the basal area composition of the various stand types on the Reservation for overstory and understory trees. These groupings are the result of the two classification techniques and the authors consider them fairly accurate descriptions of most of the stand types on the Reservation which fall into the "typical" oak-hickory association. The understory within these plots (understory defined as trees with dbh greater than 9.0 cm and less than 24.4 cm measured on 0.04 ha plots at the same location) are usually of the same species composition as the overstory although not necessarily of the same densities. Exceptions occur in the white oak-white pine and white oak-yellow poplar plots where white oak is the dominant overstory tree but does not occur at all as an understory tree. These stand types are probably better represented as a white pine type and a hickory-yellow poplar type, respectively.

Herbaceous species which occur in these and other communities on the Reservation have not been inventoried by forest stand type. However, a comprehensive listing of plant species categorized by seral stage and moisture requirements, which potentially occur on the Reservation, has been compiled.(3) Commonly occurring species include rattlesnake plantain (Goodyera pubescens), pipsissewa (Chimaphila maculata), greenbriar (Smilax spp.), and bracken fern (Pteridium aquilinum).

Seral forest stand types which occur on the Reservation are categorized by the groupings shown on the left-hand side of Fig. 1. Shade intolerant pine, loblolly pine plantations, cedar, and successional hardwoods form the major groups with the pines further grouped into relatively pure stands of the two most commonly occurring native species and the hardwoods dominated by yellow poplar, sweet gum, and sycamore. Herbaceous species found in seral forest types are similar to those found in oak-hickory stands except that honeysuckle (Lonicera japonica) often is the only herbaceous vegetation visible. Although cedar, yellow poplar, sweet gum, and sycamore are abundant old field species, they also occur in other locations. Cedar is abundant on shallow limestone soils, both in open fields and in forested areas, and will be discussed later in this paper. Yellow poplar is a very common species on moist slopes and drainages while yellow poplar, sweet gum, and sycamore often dominate bottomland floodplain communities.

Shortleaf and Virginia pine dominate most old fields not planted in pines. Understory species associated with these yellow pines are more varied, as shown in Appendix I, Tables 7 and 11. There are no patterns in occurrence of successional hardwoods in the understory to forecast which stand types these plots will evenually occupy.

Although yellow poplar is an important long-lived component in several climax stand types, it also is a common abandoned field species. CFI plots contained only old field stands of poplar as evidenced by the abundance of pines and successional hardwoods in the understory, but more mature stands of poplar also are known to occur.(2)

Sweet gum and sycamore stands included in the CFI are of a successional nature, yet both are common dominants in floodplain and riparian communities found along most major streams within the Reservation. Willow, ash, red maple, black walnut, and boxelder are other typical dominants in these seasonally flooded communities. Red willow dogwood (Cornus ammomum) is the main shrub stratum species. Cane (Arundinaria gigantea) may dominate some sites. Grasses (Elymus sp., Panicum sp., etc.), poison ivy, rose (Rosa setigera), and asters make up the bulk of the ground cover in the better drained areas. The marshy areas have a characteristically dense vegetation of sedges (Carex sp.), rushes (Juncus sp.), and bullrushes (Scirpus sp.).

Old Field Communities

Although the majority of the Reservation is forested, there are many areas in which old field communities persist, including abandoned homesites, power line and pipeline rights-of-way, new plantations, and the areas around ERDA facilities. There are approximately 600 ha of pasture and cropland on the Reservation maintained by the Comparative Animal Research Laboratory.

The general pattern of succession on abandoned land on the Oak Ridge Reservation and throughout this region of the Southeast is one in which the earliest phase lasting one to several years is dominated by annual forbs and grasses such as ragweed (Ambrosia artemisiifolia) and crabgrass (Digitaria sp).(4) Biennial and perennial forbs such as horseweed (Conyza canadensis), primrose (Oenothera sp.), many species of Aster, and other composites dominate in the next phase which may last from four to ten years. The perennial grass phase, usually dominated by broomsedge (Andropogon virginicus), follows and may last as long as 20 years in badly eroded areas. Fertility, degree of erosion, light, available moisture, and proximity of seed source appear to be the principal determinants of rates of succession. The perennial grass phase is the most variable in terms of species dominance. Dominants can range from broomsedge to pine seedlings or honeysuckle and brambles (Rubus sp.) mixed with grasses (Andropogon sp., Panicum sp.). Fescue (Festuca elatior) is dominant at this stage in some areas, such as on power line corridors where it has been planted for erosion control.

Other introduced grasses dominate a few power line corridors where they were planted. Fence lines and road sides, which receive periodic mowing, are generally dominated by fescue or other grasses, rapidly growing weedy annuals, and low growing perennials.

The grass phase is generally followed by a shrub phase as the grassland is invaded by tree seedlings and rapidly growing shrubs and woody vines. Japanese honeysuckle, trumpet creeper (Campsis radicans), sumac (Rhus typhina and R. copallina), persimmon (Diospyros virginiana), sassafras (Sassafras albidum), red cedar (Juniperus virginiana), pines (Pinus virginiana and P. echinata), and various hardwood seedlings are the dominant species for 2 to 30 years after abandonment of a field. Periodic mowing (2- to 5-year cycle) maintains many of the transmission line corridors on the Reservation in this shrub phase. Areas within the Reservation that were logged 2 to 3 years ago are also in this phase. Revegetation of these disturbed (in hardwood) areas occurs from stump sprouts and seedling trees of the original forest. Ground cover species tend to remain those of the perennial grass phase with ecesis of some shade tolerant forest species.

In addition to species native to the area, many plants introduced at the homesites throughout the Reservation have persisted. White poplar (Populus alba) and hemlock (Tsuga canadensis) (which occurs rarely in the area) were often planted in yards. Periwinkle (Vinca minor) and daffodils (Narcissus pseudo-narcissus) mark the locations of virtually all homesites while bridal wreath (Spiraea sp.), rambling roses (Rosa sp.), and daylilly (Hemerocallis fulva) are also quite common.

Phenology of the Oak Ridge Site(5)

Within the major plant association of the oak-hickory complex phenological development can be related to particular communities or divided into various taxa. Phenodynamics of production within ecosystems at different locations represent the interactions of meteorology with growth processes. Similarities in phenological development between sites provide bench marks for productivity profiles across regional boundaries. Associated with the phenological development of species or communities are changes in biomass and rates of productivity. Short-term phenological events, such as inputs into the litter layer, subsequently affect the mineral cycle within the ecosystems.

Within the local forest ecosystems there are two periods of peak flowering (Fig. 2) during the first 6 months of the year, representing spring and early summer [mid-April (week 16) and early June (week 23)], respectively. The first major peak (week 16) is composed of woodland species, mainly herbaceous, while the second or early summer peak (week 23) is composed of species indigenous to thickets, roadsides, or openings within the forest. The peak in mid-March (week 11) is represented by those species which are probably most responsive to photoperiod, mostly mustards (Crucifers). Following the spring maximum in flowering, canopy development of tulip poplar, the dominant canopy species of the lower slope forests, is 75% complete and the transmission of incident radiation to ground level is reduced by 40%. At the time of total leaf emergence (week 24) light transmission is reduced to 11%. Within the more mesic sites of the oak-hickory forest association the period of peak flowering occurs before extreme reductions in solar radiation, thus maximizing

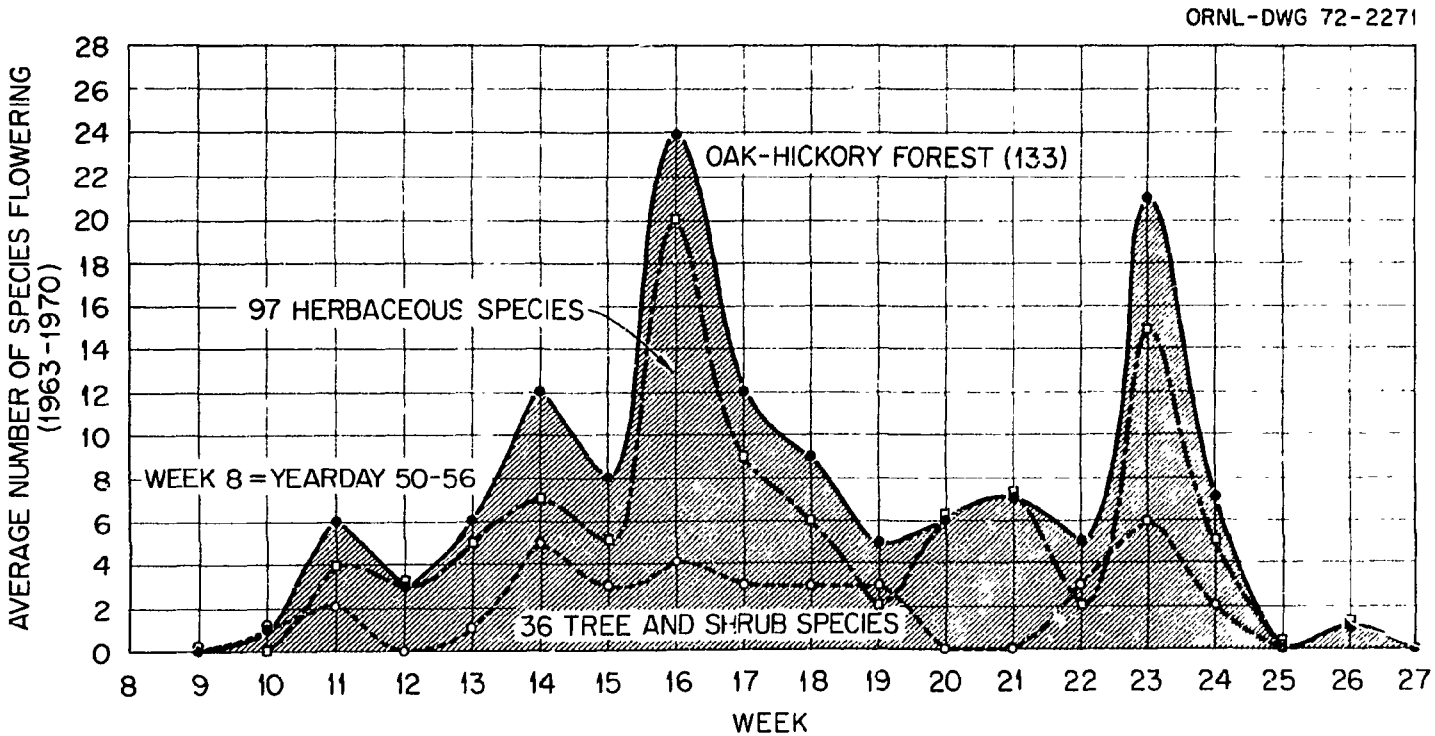

Fig. 2. Periods of peak flowering in local forest ecosystems.

photosynthetic efficiencies. The second peak flowering season (week 23) occurs after the canopy has closed. However, this floristic component in the development of the forest ecosystem is made up of species found in more open habitats (roadsides and forest edges) where light transmission is not significantly reduced.

Research Park Natural Areas

The development of a National Environmental Research Park on the Oak Ridge Reservation will result in the recognition and intensive study of several natural areas whose species composition and/or state of development make them of considerable scientific value (Fig. 3). On some areas, data for woody species have been collected (areas 1, 5, and 8, Fig. 3). Overstory stand types fall within those previously described, with the exception of the beech-maple type. Old field communities in various successional stages, most of them containing arboreal components, occur throughout the Reservation and are composed of different species, depending on edaphic factors as well as on the land use at the time of ERDA acquisition. Other areas, although not virgin timber, are mature second growth and are representative of forest types that were in the Ridge and Valley Province prior to settlement. These areas are important as reference areas and biological refugia in a heavily developed region.

Plant species found in Braun's mixed mesophytic forest association(1) commonly occur in cooler, more moist regions in the mountains and to the north, but are unusual in this area. Many of the relatively undisturbed steep, north facing slopes, steep sided coves, and some gently sloping sheltered coves on the Reservation contain some combination of these species. These and other (known) unique natural areas on the Reservation are described below. Descriptions of herbaceous composition in these areas are based on observations made in late Fall 1974, and are thus incomplete.

(1) Red cedar (areas 1 and 12, Fig. 3). These stands occur throughout the Reservation on calcareous soils, especially on the nearly level lower slopes on the south side of Chestnut Ridge. In one area cedar is the major woody species with some white pine and Virginia pine present. Associated tree species are winged elm, black walnut, oaks, redbud, hackberry, and ash. The area has a park-like appearance with trees widely spaced and the ground cover mostly grasses (Andropogon sp.). Scattered species of aster, goldenrod (Solidago sp.), beggar ticks (Desmodium sp.), and yucca (Yucca smalliana)are present also. Cacti (Opuntia compressa), aloe (Agave virginica), and rosinweed (Silphium terebinthinaceum) are other plants that occur in similar areas on other parts of the Reservation as do redbud and Carolina buckthorn. Limestone ledges outcrops in this and other areas support a rich flora of mosses, lichens, and algae (Nostoc sp.). Merry bells (Uvularia perfoliata) and larkspur (Delphinium tricorne) are common herbaceous species on these limestone ledges.

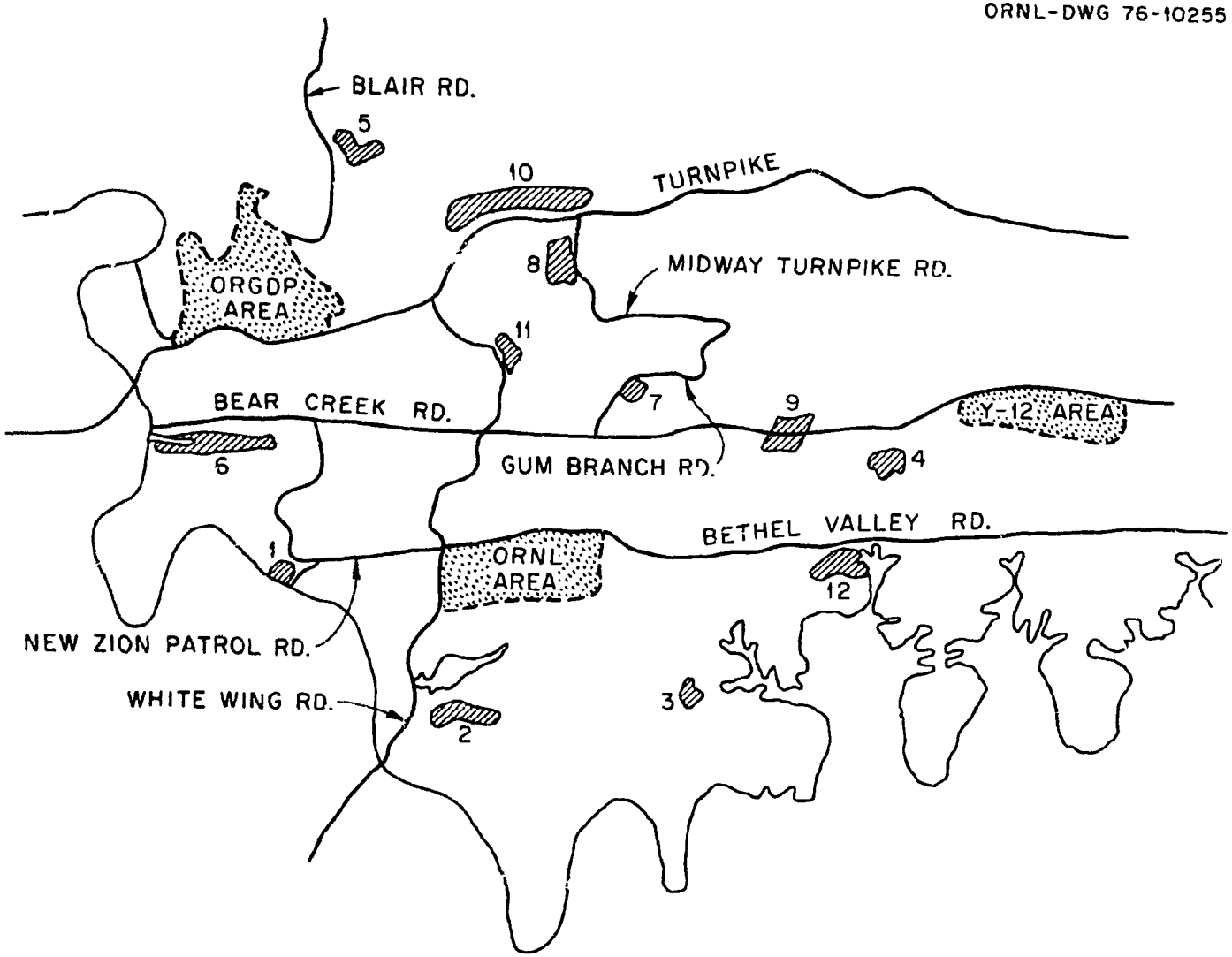

Fig. 3. Map of the location of the Research Park Natural Areas.

(2) Sassafras (area 2, Fig. 3). On the upper slope and top of Copper Ridge overlooking the western end of the Reservation is an extensive old field area containing several pure stands of sassafras, many of which are 12 cm in diameter or larger. Several mixed sassafras-black locust stands that contain an abundance of locust stump sprouts occur on the ridge top. Because sassafras is known to inhibit the invasion of many other species, these unusually extensive stands will probably be persistent.

(3) Old-field (area 3, Fig. 3). West of the Bearden Creek embayment is an unusual old field site dominated by pine, with extensive mats of lichens and mosses forming the dominant ground cover. This area is severely eroded with virtually no vascular herbaceous vegetation. Reindeer moss (Cladonia subtenius) is the most conspicuous lichen, but British soldiers (C. cristatella) and other Cladonia species (Cladonia verticellata and Cladonia chlorophaea) are abundant. Another lichen, old man's beard (Usnea sp.), is unusually abundant in this area, covering the lower branches of many of the trees. Windswept moss (Dicranum sp.) is the most common moss.

(4) White Oak (area 4, Fig. 3). A few areas have been located on the Reservation which are dominated by white oak, one of the original white oak communities which occur within the dominant oak-hickory association or the mixed mesophytic association of Braun.(1) The south slope of Chestnut Ridge north of Bethel Valley Quarry contains a watershed which is dominated by large specimens of second growth white oak. This area has evidently not been disturbed for many years, except perhaps by grazing livestock prior to 1942. The trees are widely spaced and not deformed by fire or wind damage. Pure stands of white oak and mixed white oak, chestnut-oak, black and red oaks, and sugar maple, all 30 to 60 cm in diameter, cover an area several hectares in extent.

(5) Mixed mesophytic forest associations (areas 5 and 6, Fig. 3). These are among the most varied and luxuriant in the Eastern deciduous forests and occur through the Reservation. Two areas contain species which are very rare locally and are typical of Braun's generalized mixed mesophytic association found in the Appalachian plateau.(1) Large yellow poplar, beech, and sugar maple are common in the first area (area 5, Fig. 3), and two species of magnolia (Magnolia acuminata and M. tripetala), basswood, white pine, and hemlock also occur. The understory is very dense with extensive thickets of locally rare maple leaf viburnum (Viburnum acerifolium), pawpaw (Asimina triloba), and one thicket of rhododendron (Rhododendron maximum). Herbaceous ground cover species observed in the fall include several species of ferns [maidenhair (Adiantum pedatum), walking fern (Asplenium rhizophyllum), Christmas fern (Polystichum acrostichoides)], hepatica (Hepatica americana), saxifrage, and many species of mosses and lichens, growing over the vertical limestone outcroppings.

On the lowest part of the slope of the second area (area 6, Fig. 3), basswood, sugar maple, and buckeye are dominant with magnolias, oaks, elm, cherry, and yellow poplar as codominants. The shrub layer is dense and is composed mainly of pawpaw and sugar maple seedlings. Herbaceous plants rare in the Oak Ridge area include wild ginger (Asarum canadense), blue cohosh (Caulophyllum thalictroides), bugbane (Cimicifuga racemosa), doll's eyes (Actaea pachypoda), and walking fern. Other ground cover species include several species of ferns, jack-in-the-pulpit (Arisaema triphyllum), rue anemone (Anemone quinquefolia), grape (Vitis sp.), hepatica, and Solomon's seal (Polygonatum biflorum).

Further up the slope, the overstory changes to sugar maple with a few hickories and oaks. There is an occasional beech, sweet gum, buckeye, and ironwood. The shrub layer is composed mainly of sugar maple seedlings, but also contains spice bush (Lindera benzoin), strawberry bush (Euonymus americanus), hydrangea, and buckeye seedlings. Ground cover in this area is composed of bugbane, foam flower (Tiarella cordifolia), and little brown jug (Hexastylis ruthii).

The upper slope is yet another climax community within the mixed mesophytic association dominated by beech and sugar maple. In this drier zone, cedars, hickories, yellow poplar, flowering dogwood, and sassafras also occur. The shrub layer is composed primarily of overstory tree seedlings. Extensive patches of parasitic beech-drops (Epifagus virginiana) occur under beech trees. The remaining ground cover is sparse and consists mainly of scattered Christmas ferns and Virginia creeper.

An unusual beech area occurs in a gap through Pine Ridge (area 7, Fig. 3). The canopy on this northwest facing slope is composed mainly of beech. Mountain laurel (Kalmia latifolia) forms dense thickets under the beech, oaks, tulip poplar, and sourwood. Herbaceous vegetation is excluded. Downslope from the laurel, witch hazel (Hamamelis virginiana) borders the small stream which drains the gap. This extensive laurel growth is one of the largest on the Reservation; laurel usually occurs as one to several individuals.

Beech, white oak, and white pine exceeding 76 cm in diameter are found on the lower slopes of a north facing watershed which drains into Poplar Creek (area 8, Fig. 3). Yellow poplar and chestnut-oak are also abundant in this area, and ash, sugar maple, cherry, hickories, sourwood, and hemlock are minor canopy species. Shrub and herbaceous species include beech and red maple seedlings, greenbrier, Christmas fern, foam flower, anemone, rattlesnake orchid (Goodyera pubescens), pipsissewa (Chimaphila maculata), and poison ivy (Rhus radicans).

(6) White pine occurs as an occasional canopy tree in most of the mixed mesophytic associations, but it assumes a dominant role in a few areas on the Reservation (area 9, Fig. 3). White pine is the dominant in these areas with tulip poplar and white oak as codominants. Many of these trees are over 60 cm in diameter, which is rare in this region

because of extensive lumbering. Other canopy trees include hickories, beech, oaks, red maple, and sugar maple. The understory is composed of strawberry bush and tree seedlings most of which are sugar maple and white pine. Holly (Ilex opaca) occurs frequently in the shrub stratum of some white pine areas on the Reservation.

(7) There are many small floodplain areas on the Reservation, but Poplar Creek floodplain is unique in that no trees have been harvested from it since the land was purchased in the early 1940's (area 10, Fig. 3). The banks of the main channel are lined with large sycamore and occasional oaks and sugar maples. Extensive stands of boxelder (Acer negundo), ash, willow, and sycamore with an occasional hackberry and black walnut cover the floodplain. Cane or dogwood (Cornus ammomum) form impenetrable thickets in some areas. The surface of the ground is sparsely covered with grass (Microstegium ad Elymus sp.) in the more open areas, with species of asters and other composites and lobelia (Lobelia cardinalis and Lobelia syphilitica) abundant in localized areas. This floodplain is probably one of the few of comparable size remaining in the eastern part of the State that is undisturbed by agriculture.

(8) Many swampy areas occur on the Reservation, but none are extensive. There is a swampy area on the Watts Bar floodplain below Gallahar Bridge, approximately half an acre in extent, that is probably the largest on the Reservation. Another less disturbed though much smaller marshy area occurs in McNew Hollow (area 11, Fig. 3).

(9) Many limestone sinkholes occur on the Reservation, but none are known to support the luxuriant herbaceous vegetation that often occurs in such geological formations. Usually sinkholes support yellow poplar or northern hardwood communities.

Caves

Caves are common in the limestones of east Tennessee; several are known to exist in the Knox dolomites of the Oak Ridge Reservation. Although some caves were inundated by the impoundment of the Clinch River to form Melton Hill Reservoir, at least three are still accessible on the Reservation. Although no sampling of animal species indigenous to caves has been done on the Reservation, many species of bats, invertebrates, fish, amphibians, and the Allegheny wood rat (Neotoma nagister) are known to occur in Tennessee caves. The animal life in Tennessee caves is discussed in considerable detail in Caves of Tennessee.(6)

Unique or Rare Plant Species

A phenological study of vascular plants found on the Oak Ridge Reservation(5) identified 17 species of special interest, rare or uncommon within the Reservation boundaries (Table 2). Additional species considered to be rare in the State of Tennessee(7,8) have been collected in the immediate five-county area around Oak Ridge (Table 3).

Table 2. Plant species of special interest or of limited distribution within the Oak Ridge Reservation(5)

Species	Habitat	Status			
		Reservation		State	
		Uncommon	Rare	Locally abundant	Rare
Arisaema dracontium (Green dragon)	Near ponds at Gaseous Diffusion Plant (K-25)		X	X	
Chionanthus virginicus (Old-Man's-beard)	Bluffs over Melton Hill Lake (CRM 26)		X	X	
Dicentra cucullaria (Dutchman's breeches)	Copper Ridge near Melton Hill Lake (CRM 25-26)		X	X	
Epigea repens (Trailing arbutus)	Chestnut Ridge near New Zion Cemetery		X	X	
Erythronium americanum (Dog's-Tooth violet)	Bottomlands along East Fork Poplar Creek		X	X	
Jeffersonia diphylla (Twinleaf)	Bluffs downstream from Melton Hill Dam (CRM 22.5)		X	X	
Lithospermum canescens (Puccoon)	Rocky Site near Clinch River (CRM 17.5)	X		X	
Magnolia tripetala (Greatleaf magnolia)	Haw Ridge at White Oak Creek and Walker Branch		X	X	
Orchis spectabilis (Showy orchid)	Copper Ridge adjacent to the Cesium Forest Area		X	X	

Table 2. (continued)

Species	Habitat	Status			
		Reservation		State	
		Uncommon	Rare	Locally abundant	Rare
Ornithogalum umbellatum (Star-of-Bethlehem)	Copper Ridge adjacent to the Cesium Forest Area		X	X	
Philadelphus hirsutus (Mock-orange)	Bluff above Melton Hill Lake		X	X	
Poncirus trifoliata (Trifoliate orange)	Home site near Haw Ridge and White Oak Circle		X	X	
Sanguinaria canadensis (Bloodroot)	Bluffs above Melton Hill Lake (CRM 25.5)		X	X	
Staphylea trifolia (Bladdernut)	Streams near Melton Hill Lake and Walker Branch		X	X	
Tilia americana (Basswood)	East end of Pine Ridge near Bear Creek		X	X	
Waldsteinia fragarioides (Barren strawberry)	Woods near Experimental Gas-Cooled Reactor site		X	X	
Wisteria sinensis (Chinese wisteria)	Abandoned homesite		X	X	

Table 3. Species rare or endangered in Tennessee or U.S. occurring in the Oak Ridge Area[7]

Species	County record
Asplenium bradleyi	Sight records only
Aureolaria patula	Roane
Cimicifuga rubifolia	Roane, Anderson, Knox, Loudon
Conradina verticillata	Morgan
Isoporum maculatum	Anderson, Morgan, Knox
Echinacea purpurea	Anderson
Potentilla major	Sight records only
Hydrastis canadensis	Roane, Anderson, Knox
Orontium aquaticum	Morgan, Roane
Panax quinquefolium	Roane, Anderson, Knox
Petalostemum foliosum	Knox
Philadelphus sharpianus	Anderson, Knox
Polygala paucifloria	Roane, Morgan
Saxifraga careyana	Anderson, Knox

Fauna

The variety of wooded and open areas as well as extensive edge communities create favorable habitats for a wide variety of bird species. Recent surveys of bird populations(9) showed density of individuals was correlated with vegetation cover. Also mammalian faunal composition of the area has been shown to correlate with vegetation type.(10) A categorization of the Reservation's herpetofauna by habitat type was completed in 1964.(11)

An important factor in determining whether a given species will in fact occur in a given area is the nature of the habitat in the area. Studies have identified individual habitat parameters or combinations of parameters which can be used in predicting species occurrence in different environments. Small mammals, such as rodents, may be confined to a single habitat type, while the larger-sized species may range over several habitats. The same can be said for avian populations. Even so, most of the animals found on the Oak Ridge Reservation have the capability to tolerate and adapt to a variety of habitats and, therefore, may be found in habitats other than those of which they are typical. Appendix II (Tables 1-3) indicates the typical habitat preference of the vertebrate and invertebrate species found or expected to range on the Reservation.

Hardwood Community

Mammals. Small mammal populations in the upland forest types (habitats 4, 5, and 6, Appendix II, Table 1) of the Reservation have been sampled sporadically, usually as a part of collection programs for laboratory experiments. In early 1973, nine 0.36-ha live-trapping grids (7x7 traps per grid on a 10-m interval) were established on sites representative of the three upland forest types on Walker Branch Watershed, oak-hickory, chestnut oak and pine.(12)

The six species observed and the cumulative numbers of individuals captured were: white-footed mouse (Peromyscus leucopus) (71), chipmunk (Tamias striatus) (14), golden mouse (Ochrotomys nuttalli) (9), short-tail shrew (Blarina brevicauda) (7), flying squirrel (Glaucomys volans) (2), and house mouse (Mus musculus) (1). Five species were captured on the oak-hickory sites, two on chestnut-oak, and four on pine. Short-tail shrew, flying squirrel, and house mouse were captured infrequently; white-footed mouse and golden mouse were captured throughout the year. Chipmunks, observed to be active from April through September, were captured from May through August.

The density estimates for the two most common species are: white-footed mouse, 8.4 ± 0.77 individuals per hectare on the oak-hickory site, 5.1 ± 0.85, chestnut; 4.2 ± 0.69, pine; and chipmunk, 2.4 ± 0.69, oak-hickory, 0.9 ± 0.30, chestnut oak, 1.2 ± 0.47, pine.

The red and the gray fox (Vulpes fulva and Urocyon cinereoargenteus, respectively) are common predators throughout the area. (Mephitis mephitis), bobcat (Lynx rufus), and weasel (Mustela frenata) inhabit numerous and varied areas throughout the Reservation, but also roam extensively through the upland forest areas. White-tail deer (Odocoileus virginianus) are also inhabitants of upland and bottomland forests. Rice rats (Oryzomys palustris) usually occur in wet areas along open waters that have a dense herbaceous growth of grasses and sedges. The stream or lake banks also offer suitable habitat for muskrats (Ondatra zibethica) (Appendix II, Table 1).

Birds. The upland forest provides habitat for a large number of resident bird species (habitats 4, 5, and 6, Appendix II, Table 1). Using univariate and multivariate analyses, a recent study(9) characterized specific habitat preferences for some typical upland forest inhabitants.

Yellow-shafted flickers (Colantes auratus) are found in habitats where there are many large trees and a well-developed canopy and subcanopy. Redbellied woodpeckers (Centurus carolinus) commonly are found on all parts of the upland forest. The hairy woodpecker (Dendrocopos villosus) shows a preference for areas with a large number of tall trees and associated high canopy biomass. Downy woodpeckers (Dendrocopos pubescens) select areas that have more than the average number of saplings.

The common crow (Corvus brachyrhynchos) and the blue jay (Cyanocitta cristata) select very different habitat variables. The crow, which is not found in large numbers, probably uses the deciduous forest as part of its search area. The only variable of apparent significance in areas frequented by crows is the number of small trees. Blue jays select areas with a dense understory and a well-developed canopy.

The Kentucky warbler (Oporonis formosus) is somewhat more specialized and selects areas which have a more open overstory and which generally have smaller understory plants. As opposed to the less-selective new world warblers, the pine warbler (Dendroica pinus), yellow-breasted chat (Icteria virens), and ovenbird (Seirus aurocapillus) are selective of habitats to a much greater degree. The pine warbler selects areas with an open overstory comprised of trees with larger than average canopy and with smaller than average trees in the lowest canopy layers. The yellow-breasted chat is found in habitats with dense overstory vegetation and an open subcanopy layer. Typically the understory plants are smaller than average. The ovenbird is found in habitats that have open canopy and subcanopy layers and dense understory. The trees in both the canopy and subcanopy were larger than average.

Carolina chickadee (Parus carolinensis) and tufted titmouse (Parus bicolor) are considerably less selective. The tufted titmouse habitat was not characterized by any of the variables used in the study, and the only unique characteristic of the Carolina chickadee habitat is that the understory trees are smaller than average.

The scarlet tanager (Piranga olivacea) is distributed on sites with dense canopies. The summer tanager has only three variables which are significant: average foliage, average stump size of trees under 8.4 cm in diameter, and slope. When the two species are compared, the scarlet tanager is distributed according to canopy density, and the summer tanager is distributed according to understory vegetation density. A large number of raptorial birds utilize the woodlands on the Reservation for nesting and hunting. The red-shoulder hawk (Buteo lineatus) and broad-winged hawks are common throughout the area (Appendix II, Table 1).

Arthropods. The majority of forest arthropods present during the year belong to 10 taxonomic groups: Araneae, Chilopoda, Coleoptera, Colembola, Diplopoda, Diptera, Hymenoptera, Lepidoptera (larvae), Orthoptera, and Pulmonata (habitats 4, 5, and 6, Appendix II, Table 2). Considerable data are extant for invertebrate density and biomass in hardwood stands on the Reservation.(13,14)

Reptiles and amphibians. The herpetofauna of the Oak Ridge Reservation was surveyed by Johnson in 1964.(11) His data collection was extensive and is summarized in habitats 4, 5, and 6 in Appendix II, Table 3.

Pine Plantations

Mammals. The pine areas (habitat 3, Appendix II, Table 1) of the Reservation, particularly the planted plantations, have not received as extensive a sampling as have the hardwood or grassland areas. A recent survey of the small mammal inhabitants of a pine stand and an associated transmission right-of-way(15) indicates that only three species use the pine habitat to any great extent. Over a four-week period, 2000 trap nights (over a 0.24-ha area) yielded 4 white-footed mice, 4 golden mice, and 4 short-tail shrews. Additional species were present, but their presence appeared to be a function of the edge community created by the transmission line right-of-way. Larger mammals, gray squirrels, oppossum, deer, and other predators (Table 7) probably use this habitat type to some extent (Appendix II, Table 1); however, no data are available on their diversity and density.

Birds. Bird species had a low preference for the pure pine areas bordering the transmission line corridor. Pine warblers (Dendroica pinus) and white-throated sparrows (Zonotrichia albicollis) were very common, but few other species were heard or seen during the early morning surveys. Additional probable inhabitants of pine areas are listed in Appendix II, Table 2 (habitat 3).

Reptiles and amphibians. Johnson(11) regarded the pine plantations as being totally devoid of reptiles.

Arthropods. Although no studies of invertebrate populations of species composition have been made for the loblolly pine (Pinus taeda) plantations on the Reservation, data are available for arthropod populations in shortleaf (Pinus echinata) and Virginia pine (Pinus virginiana)

stands in canopy and litter strata.(16,17) In mixed shortleaf and Virginia pine litter, 82.9% of the arthropods counted in one study were mites and 15.8% were insects. Collembolans made up 77.4% of the insects. The population density of arthropods was estimated at 102,000/m^2.

Old Field Grasslands

Mammals. Mammalian species inhabiting old field or disturbed areas are quite similar, whether the vegetative cover is grass, or tree seedlings and shrubs (habitat 2, Appendix II, Table 1). The small mammal community structure indicative of these habitats was determined for a 1-ha area in the vicinity of the Oak Ridge Gaseous Diffusion Plant.(18)

The 1-ha study area was in the ERDA Oak Ridge Reservation and was located approximately 20 m NW of Tennessee Highway 95 and 150 m NE of Watts Bar Lake. Dominant vegetation was tall fescue (Festuca elatior) and sericia lespedeza (Lespedeza cuneata), with blackberry (Rubus allegheniensis), Japanese honeysuckle (Lonicera japonica), Johnson grass (Sorghum halepense), aster (Aster pilosus), and other early-successional-stage vegetation scattered over the area. Small mammals trapped were cotton rats (Sigmodon hispidus) (31), white-footed mice (Peromyscus leucopus) (77), a golden mouse (Ochrotomys nuttalli), a rice rat (Oryzomys palustris), short-tail shrews (Blarina brevicauda) (23), and eastern harvest mice (Reithrodontomys humulis) (2).

Birds. Selection by bird species for old field areas similar to that found on many of the transmission rights-of-way is quite pronounced, particularly when the corridor runs through another habitat type. Sparrows, towhees, blue grosbeaks, and other field species tend to select for the vegetation within the line. Early grassland stages of old field areas are utilized by some game birds, such as quail for courtship displays and breeding purposes. Raptorial species generally utilize the old field areas for hunting purposes.

Arthropods. Data are available from the 0800 research area,(16) and indicate that the common homopteran families are Cicadellidae, Membracidae, Cercopidae, and Aphididae. The Miridae, Reduvidae, Coreidae, and Pentatonidae are common hemipteran families.

Reptiles and amphibians. According to Johnson,(11) amurans and most of the reptiles (order: Squamata) are found in the old field area.

Unique and Endangered Vertebrate Species

Two species considered endangered by the U.S. Department of the Interior(19) have been observed on or around the Reservation. The Indiana bat (Myotis sodalis) inhabits caves and hollow trees, and probably occurs on the area even though none have been collected or sighted. Numerous individuals have been observed at New Mammouth Cave in Campbell County, 55 miles from Oak Ridge.

The southern bald eagle (Haliaeetus l. leucocephalus) has been sighted numerous times, most recently along both Melton Hill Lake (June 1974) and Watts Bar Lake (May 1974).(20) It nests in large trees along waterways, but no nest has been observed and the species' status on the Reservation is unknown.

An American osprey (status undetermined) was sighted along the Clinch River in May 1974.(20) At the time, it was catching fish and carrying its prey to the bank opposite the Reservation boundary. Its status on the Reservation is also unknown.

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APPENDIX I

Tables 1-16.

Composition, average basal area and numbers of species comprising the overstory and understory of the 16 forest types identified by numerical analysis. STORY=OVER refers to trees with a diameter at breast-height (dbh) greater than 24.4 cm. STORY=UNDER refers to trees with a dbh greater than 9.0 cm and less than 24.4 cm. AVBAS is the mean basal area density (dm^2/h) for the particular species within the particular forest type.

Table 1

---------- STAND=CEDAR STORY=OVER ----------

TREE	AVBAS	TREES
SHORTLEAF PINE	97.656	1
VIRGINIA PINE	148.225	1
EASTERN RED CEDAR	792.171	32
SHUMARD OAK	99.225	1
SCARLET OAK	60.025	1
CHESTNUT OAK	84.062	2
POST OAK	312.625	3
SWAMP CHESTNUT OAK	120.756	1
SWAMP WHITE OAK	534.456	9
SWEET GUM	256.862	2
BLACK WILLOW	369.056	1
ASH	351.056	1
ELM	112.225	1
SUGAR MAPLE	490.000	1

N= 14

---------- STAND=CEDAR STORY=UNDER ----------

TREE	AVBAS	TREES
LOBLOLLY PINE	99.012	1
LONGLEAF PINE	98.162	2
VIRGINIA PINE	55.981	2
WHITE PINE	36.450	1
EASTERN RED CEDAR	283.415	27
SCARLET OAK	171.575	3
SWAMP WHITE OAK	195.700	3
SWEET GUM	78.012	1
ASH	46.512	1
ELM	97.206	3
HICKORY	166.212	2
BLACK WALNUT	94.612	1

N= 12

Table 2

------- STAND=CHESTNUT OAK STORY=OVER -------

TREE	AVBAS	TREES
SHORTLEAF PINE	230.447	10
VIRGINIA PINE	134.112	4
WHITE PINE	82.656	1
BLACK OAK	229.174	18
NORTHERN RED OAK	227.639	10
BLACKJACK OAK	93.025	1
SCARLET OAK	409.915	14
CHESTNUT OAK	950.675	143
POST OAK	141.616	8
WHITE OAK	360.970	34
BLACK GUM	135.141	6
SWEET GUM	97.656	1
RED MAPLE	159.854	11
YELLOW POPLAR	280.205	8
ASH	127.806	1
BEECH	168.812	2
HICKORY	332.192	25

N=17

------ STAND=CHESTNUT OAK STORY=UNDER -------

TREE	AVBAS	TREES
SHORTLEAF PINE	86.109	4
EASTERN RED CEDAR	82.012	1
BLACK OAK	148.237	4
NORTHERN RED OAK	49.612	1
SOUTHERN RED OAK	84.050	1
BLACKJACK OAK	103.512	1
SCARLET OAK	68.056	2
CHESTNUT OAK	103.248	25
POST OAK	84.050	1
WHITE OAK	139.177	13
BLACK GUM	66.329	7
SWEET GUM	64.800	1
RED MAPLE	104.085	10
YELLOW POPLAR	95.791	9
ASH	48.931	2
HICKORY	42.787	3
SUGAR MAPLE	49.612	1
SOURWOOD	51.729	6
HOPHORNBEAM	33.800	1

N=19

Table 3

- STAND=HICKORY - YELLOW POPLAR STORY=OVER --

TREE	AVBAS	TREES
SHORTLEAF PINE	254.031	3
VIRGINIA PINE	78.400	1
WHITE PINE	136.900	1
BLACK OAK	238.977	3
NORTHERN RED OAK	220.753	3
POST OAK	144.400	1
WHITE OAK	109.804	3
RED MAPLE	193.312	5
YELLOW POPLAR	286.607	18
BEECH	461.281	2
BLACK CHERRY	124.256	1
HICKORY	487.048	26

N=12

- STAND=HICKORY - YELLOW POPLAR STORY=UNDER -

TREE	AVBAS	TREES
NORTHERN RED OAK	521.687	10
SCARLET OAK	56.112	1
WHITE OAK	64.800	1
BLACK GUM	114.412	2
SWEET GUM	110.450	1
RED MAPLE	75.017	3
YELLOW POPLAR	90.106	5
ASH	93.250	2
BEECH	63.012	1
DOGWOOD	80.000	1
HICKORY	114.029	4
BLACK WALNUT	46.512	1
SOURWOOD	87.625	2
SASSAFRAS	92.450	1

N=14

Table 4

------ STAND=LOBLOLLY PINE STORY=OVER -------

TREE	AVBAS	TREES
LOBLOLLY PINE	931.040	187
SHORTLEAF PINE	74.256	1
VIRGINIA PINE	201.156	2
ASH	146.306	1
BLACK CHERRY	58.806	1
ELM	345.156	1
SYCAMORE	371.475	3

N=7

------ STAND=LOBLOLLY PINE STORY=UNDER ------

TREE	AVBAS	TREES
LOBLOLLY PINE	659.508	145
SHORTLEAF PINE	199.769	7
VIRGINIA PINE	192.812	2
EASTERN RED CEDAR	64.800	1
SWEET GUM	221.850	3
BLACK CHERRY	48.906	2
SYCAMORE	169.912	3

N=7

Table 5

-------- STAND=MIXED OAK STORY=OVER ---------

TREE	AVBAS	TREES
SHORTLEAF PINE	184.736	11
VIRGINIA PINE	123.303	3
EASTERN RED CEDAR	161.231	3
BLACK OAK	282.435	16
NORTHERN RED OAK	119.250	2
SOUTHERN RED OAK	362.949	26
SCARLET OAK	273.266	8
POST OAK	120.756	1
WHITE OAK	386.868	19
BLACK GUM	105.625	1
SWEET GUM	163.656	3
RED MAPLE	259.791	5
YELLOW POPLAR	197.117	8
BEECH	286.225	1
HICKORY	153.037	5
BLACK WALNUT	140.625	1
WINGED ELM	79.606	1
SOURWOOD	130.162	2

N=18

---- --- STAND=MIXED OAK STORY=UNDER --------

TREE	AVBAS	TREES
SHORTLEAF PINE	32.512	1
VIRGINIA PINE	196.012	3
BLACK OAK	92.450	1
NORTHERN RED OAK	39.200	1
SOUTHERN RED OAK	102.406	2
SCARLET OAK	82.812	2
POST OAK	105.800	1
WHITE OAK	70.203	4
BLACK GUM	68.854	3
SWEET GUM	206.875	3
RED MAPLE	87.806	3
YELLOW POPLAR	71.994	5
ASH	68.462	2
BEECH	61.250	1
BLACK CHERRY	36.450	1
HICKORY	144.862	5
SUGAR MAPLE	61.250	1
SOURWOOD	59.512	1
RED MULBERRY	56.112	1

N=19

Table 6

-- STAND=SCARLET OAK - HICKORY STORY=OVER ---

TREE	AVBAS	TREES
VIRGINIA PINE	104.306	3
WHITE PINE	154.056	1
EASTERN RED CEDAR	159.725	2
BLACK OAK	384.400	1
SOUTHERN RED OAK	129.600	1
SCARLET OAK	353.227	7
WHITE OAK	114.753	2
BLACK GUM	67.600	1
HICKORY	910.937	21
SUGAR MAPLE	340.762	2
WINGED ELM	119.025	1
SASSAFRAS	91.506	1

N=12

-- STAND=SCARLET OAK - HICKORY STORY=UNDER --

TREE	AVBAS	TREES
SHORTLEAF PINE	45.000	1
VIRGINIA PINE	92.450	1
EASTERN RED CEDAR	112.531	3
BLACK OAK	76.050	1
SCARLET OAK	105.650	2
WHITE OAK	94.612	1
BLACK GUM	42.050	1
SWEET GUM	179.294	5
RED MAPLE	101.250	1
YELLOW POPLAR	88.200	1
ASH	40.612	1
BEECH	59.512	1
HICKORY	99.012	1
BLACK WALNUT	48.050	1

N=14

Table 7

------ STAND=SHORTLEAF PINE STORY=OVER ------

TREE	AVBAS	TREES
SHORTLEAF PINE	435.917	140
VIRGINIA PINE	222.681	15
WHITE PINE	228.006	1
EASTERN RED CEDAR	78.500	2
BLACK OAK	288.031	2
SOUTHERN RED OAK	114.250	2
CHESTNUT OAK	732.806	5
BLACK GUM	124.256	1
YELLOW POPLAR	222.810	10
ELM	60.025	1
HICKORY	117.306	1

N=11

----- STAND=SHORTLEAF PINE STORY=UNDER ------

TREE	AVBAS	TREES
SHORTLEAF PINE	390.116	145
VIRGINIA PINE	99.681	6
EASTERN RED CEDAR	113.098	11
BLACK GUM	50.931	2
SWEET GUM	211.667	11
RED MAPLE	105.931	3
YELLOW POPLAR	94.692	14
BLACK CHERRY	102.625	2
ELM	114.725	2
HICKORY	111.450	3
PERSIMMON	88.117	4
SOURWOOD	67.140	8

N=12

Table 8

-------- STAND=SWEET GUM STORY=OVER ---------

TREE	AVBAS	TREES
SHORTLEAF PINE	252.827	6
VIRGINIA PINE	133.498	6
EASTERN RED CEDAR	68.906	1
NORTHERN RED OAK	77.006	1
SOUTHERN RED OAK	199.628	3
SWEET GUM	331.593	21
YELLOW POPLAR	158.006	1
ASH	124.256	1
ELM	75.625	1
HICKORY	97.656	1
SUGAR MAPLE	361.062	2

N=11

-------- STAND=SWEET GUM STORY=UNDER --------

TREE	AVBAS	TREES
SHORTLEAF PINE	162.212	9
VIRGINIA PINE	209.137	11
EASTERN RED CEDAR	93.069	6
SWEET GUM	82.256	6
RED MAPLE	62.381	2
YELLOW POPLAR	92.337	3
ASH	79.306	2
ELM	181.850	2
SUGAR MAPLE	98.162	2
PERSIMMON	36.450	1
HACKBERRY	37.812	1
SOURWOOD	45.200	2

N=12

Table 9

--------- STAND=SYCAMORE STORY=OVER ---------

TREE	AVBAS	TREES
SHORTLEAF PINE	138.756	1
EASTERN RED CEDAR	210.825	2
POST OAK	635.631	2
YELLOW POPLAR	82.656	1
ELM	131.406	1
PERSIMMON	77.006	1
SYCAMORE	737.159	5

N=7

-------- STAND=SYCAMORE STORY=UNDER ---------

TREE	AVBAS	TREES
VIRGINIA PINE	112.812	1
EASTERN RED CEDAR	76.050	1
SWEET GUM	61.250	1
YELLOW POPLAR	417.875	7

N=4

Table 10

STAND=UNCLASSIFIED (TRANSITIONAL) STORY=OVER

TREE	AVBAS	TREES
SHORTLEAF PINE	61.256	1
BLACK OAK	187.056	1
SCARLET OAK	233.714	4
POST OAK	257.562	2
WHITE OAK	349.626	14
SWEET GUM	306.199	14
YELLOW POPLAR	207.024	13
BEECH	355.812	3
ELM	97.656	1
SUGAR MAPLE	162.006	1

N=10

STAND=UNCLASSIFIED (TRANSITIONAL) STORY=UNDER

TREE	AVBAS	TREES
NORTHERN RED OAK	46.512	1
SCARLET OAK	119.006	3
WHITE OAK	144.394	10
BLACK GUM	33.800	1
SWEET GUM	141.308	5
RED MAPLE	49.562	2
YELLOW POPLAR	85.562	2
ASH	106.031	4
BEECH	78.081	3
BLACK CHERRY	52.812	1
HICKORY	56.112	1
SOURWOOD	88.250	2

N=12

Table 11

------ STAND=VIRGINIA PINE STORY=OVER -------

TREE	AVBAS	TREES
SHORTLEAF PINE	302.464	33
VIRGINIA PINE	783.368	144
BLACK OAK	164.531	2
SOUTHERN RED OAK	85.556	1
CHESTNUT OAK	345.462	2
POST OAK	466.062	3
WHITE OAK	849.087	3
RED MAPLE	351.056	1
YELLOW POPLAR	179.655	4

N=9

------ STAND=VIRGINIA PINE STORY=UNDER ------

TREE	AVBAS	TREES
SHORTLEAF PINE	132.805	18
VIRGINIA PINE	277.682	51
EASTERN RED CEDAR	54.421	3
BLACK OAK	353.800	9
BLACK GUM	51.812	2
SWEET GUM	115.800	6
YELLOW POPLAR	52.603	4
BLACK CHERRY	43.512	1
DOGWOOD	82.144	4
SUGAR MAPLE	56.112	1
WINGED ELM	156.912	3
SOURWOOD	57.608	4
SASSAFRAS	80.912	3

N=13

Table 12

-------- STAND=WHITE OAK STORY=OVER ---------

TREE	AVBAS	TREES
SHORTLEAF PINE	88.127	3
EASTERN RED CEDAR	99.225	1
NORTHERN RED OAK	367.816	6
SOUTHERN RED OAK	164.025	1
SCARLET OAK	204.756	1
POST OAK	253.085	10
WHITE OAK	867.872	45
RED MAPLE	202.390	7
YELLOW POPLAR	143.112	3
BEECH	288.056	2
HICKORY	184.196	9
SUGAR MAPLE	330.625	1

N=12

-------- STAND=WHITE OAK STORY=UNDER --------

TREE	AVBAS	TREES
EASTERN RED CEDAR	63.012	1
BLACK OAK	32.512	1
NORTHERN RED OAK	101.125	6
POST OAK	112.812	1
WHITE OAK	137.225	9
BLACK GUM	55.162	6
SWEET GUM	98.019	3
RED MAPLE	161.762	3
YELLOW POPLAR	89.912	2
ASH	90.900	2
DOGWOOD	54.450	1
HICKORY	85.562	3
SUGAR MAPLE	96.800	1
SOURWOOD	51.692	3

N=14

Table 13

STAND=WHITE OAK - SHORTLEAF PINE STORY=OVER

TREE	AVBAS	TREES
SHORTLEAF PINE	384.712	37
VIRGINIA PINE	159.116	3
EASTERN RED CEDAR	124.256	1
BLACK OAK	119.025	1
NORTHERN RED OAK	189.281	2
SCARLET OAK	339.816	3
CHESTNUT OAK	82.656	1
POST OAK	115.600	1
WHITE OAK	448.727	17
SWEET GUM	112.225	1
RED MAPLE	116.585	3
YELLOW POPLAR	111.987	3
ASH	91.506	1
HICKORY	249.804	14

N=14

STAND=WHITE OAK - SHORTLEAF PINE STORY=UNDER

TREE	AVBAS	TREES
SHORTLEAF PINE	262.187	9
VIRGINIA PINE	45.000	1
EASTERN RED CEDAR	101.462	3
NORTHERN RED OAK	49.612	1
SOUTHERN RED OAK	138.925	2
SCARLET OAK	84.050	1
POST OAK	49.612	1
WHITE OAK	163.162	6
BLACK GUM	56.112	1
RED MAPLE	110.629	6
YELLOW POPLAR	189.944	9
ASH	68.056	2
BLACK CHERRY	51.400	2
HICKORY	121.441	8
SOURWOOD	70.312	1
HONEY LOCUST	86.312	2
RED MULBERRY	104.512	2

N=17

Table 14

-- STAND=WHITE OAK - WHITE PINE STORY=OVER --

TREE	AVBAS	TREES
SHORTLEAF PINE	164.400	8
VIRGINIA PINE	103.135	3
WHITE PINE	536.668	37
NORTHERN RED OAK	140.206	2
SOUTHERN RED OAK	210.206	2
CHESTNUT OAK	154.056	1
POST OAK	202.900	2
SWAMP WHITE OAK	203.731	2
WHITE OAK	605.175	16
SWEET GUM	78.400	1
YELLOW POPLAR	67.600	1
BEECH	718.025	5
HICKORY	91.506	1

N=13

- STAND=WHITE OAK - WHITE PINE STORY=UNDER --

TREE	AVBAS	TREES
SHORTLEAF PINE	48.050	2
VIRGINIA PINE	51.200	1
WHITE PINE	335.004	15
EASTERN RED CEDAR	47.058	3
POST OAK	86.112	1
SWEET GUM	99.012	1
YELLOW POPLAR	158.819	4
BEECH	61.250	1
SOURWOOD	76.050	1

N=9

Table 15

STAND=WHITE OAK - YELLOW POPLAR STORY=OVER -

TREE	AVBAS	TREES
BLACK OAK	135.212	2
NORTHERN RED OAK	216.916	2
SCARLET OAK	204.216	2
BUR OAK	135.056	1
CHESTNUT OAK	81.840	3
WHITE OAK	578.252	30
BLACK GUM	102.400	1
SWEET GUM	75.625	1
RED MAPLE	258.359	11
YELLOW POPLAR	410.389	26
ASH	204.756	2
HICKORY	165.976	8
SYCAMORE	245.025	1

N=13

STAND=WHITE OAK - YELLOW POPLAR STORY=UNDER

TREE	AVBAS	TREES
EASTERN RED CEDAR	36.450	1
CHESTNUT OAK	33.800	1
BLACK GUM	94.612	1
SWEET GUM	83.958	4
RED MAPLE	79.608	4
YELLOW POPLAR	132.525	6
BLACK CHERRY	75.650	2
ELM	76.050	1
HICKORY	106.600	6
SUGAR MAPLE	45.000	1
SOURWOOD	48.981	2
SYCAMORE	32.512	1
SASSAFRAS	42.050	1

N=13

Table 16

------ STAND=YELLOW POPLAR STORY=OVER -------

TREE	AVBAS	TREES
SHORTLEAF PINE	122.609	3
EASTERN RED CEDAR	70.225	1
NORTHERN RED OAK	126.025	1
SHUMARD OAK	168.100	1
SCARLET OAK	131.406	1
SWEET GUM	99.225	1
YELLOW POPLAR	418.390	29
ASH	337.528	5
ELM	154.806	6
HICKORY	99.225	1
PERSIMMON	67.600	1
BLACK WALNUT	240.100	1
BLACK LOCUST	58.806	1
SASSAFRAS	521.162	4

N=14

------ STAND=YELLOW POPLAR STORY=UNDER ------

TREE	AVBAS	TREES
SHORTLEAF PINE	317.506	24
VIRGINIA PINE	65.812	2
SWAMP CHESTNUT OAK	59.512	1
SWEET GUM	122.975	8
YELLOW POPLAR	113.530	9
ASH	75.781	2
HICKORY	80.000	1
SUGAR MAPLE	86.112	1
PERSIMMON	42.050	1
BLACK WALNUT	140.725	2
SOURWOOD	33.800	1
RED MULBERRY	88.200	1
SASSAFRAS	597.719	18

N=13

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APPENDIX II

Tables 1-3.

Animal listing by habitat types

Type 1 includes open water, streams and swampy areas.

Type 2 is old field including highly disturbed areas such as roadsides, regularly mowed areas, and shrub and tree invaded fields.

Type 3 is Loblolly pine (Pinus taeda) plantations and pine stands. These are hardwood forest types.

Type 4 is the wettest forest type mainly occurring in flood plain areas.

Type 5 occurs usually on north facing slopes, lower slopes, coves, and other areas that are fairly moist.

Type 6 occurs in relatively dry areas: upper slopes, ridges, south facing slopes, rocky and thin soiled area.

Table 1. Birds and Mammals

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
COMMON LOON	GAVIA	IMMER		X	X				
PIED-BILLED GREBE	PODILYMBUS	PODICEPS		X	X				
GREAT BLUE HERON	ARDEA	HERODIAS		X	X				
CATTLE EGRET	BUBULCUS	IBIS							
GREEN HERON	BUTORIDES	VIRESCENS		X	X				
COMMON EGRET	CASMERODIUS	ALBA		X	X				
WOOD DUCK	AIX	SPONSA		X	X				
PINTAIL	ANAS	ACUTA		X	X				
GREEN-WING TEAL	ANAS	CAROLINENSIS		X	X				
BLUE-WING TEAL	ANAS	DISCORS		X	X				
MALLARD	ANAS	PLATYRHYNCHOS		X	X				
BLACK DUCK	ANAS	RUBRIPES		X	X				
GADWALL	ANAS	STREPERA		X	X				
LESSER SCAUP	AYTHYA	AFFINIS		X	X				
REDHEAD	AYTHYA	AMERICANA		X	X				
RING-NECK DUCK	AYTHYA	COLLARIS		X	X				
CANVASBACK	AYTHYA	VALISINERIA		X	X				
CANADA GOOSE	BRANTA	CANADENSIS		X	X				
BUFFLEHEAD	BUCEPHALA	ALBEOLA		X	X				
COMMON GOLDENEYE	BUCEPHALA	CLANGULA		X	X				
HOODED MERGANSER	LOPHODYTES	CUCULLATUS		X	X				
AMERICAN WIDGEON	MARECA	AMERICANA		X	X				
COMMON MERGANSER	MERGUS	MERGANSER		X	X				
RED BREASTED MERGANSER	MERGUS	SERRATOR		X	X				
RUDDY DUCK	OXYURA	JAMAICENSIS		X	X				
COOPER'S HAWK	ACCIPITER	COOPERII		X	X	X	X	X	X
SHARP-SHINNED HAWK	ACCIPITER	STRIATUS		X	X	X	X	X	X
RED-TAILED HAWK	BUTEO	JAMAICENSIS		X	X	X	X	X	X
RED-SHOULDERED HAWK	BUTEO	LINEATOS		X	X	X	X	X	X
BROAD-WINGED HAWK	BUTEO	PLATYPTERUS		X	X				
TURKEY VULTURE	CATHARTES	AURA		X	X	X	X	X	X
MARSH HAWK	CIRCUS	CYANEUS		X	X				
BLACK VULTURE	CORAGYPS	ATRATUS		X	X	X	X	X	X
SPARROW HAWK	FALCO	SPARVERIUS		X	X	X	X	X	X
BALD EAGLE	HALIAEETUS	LEUCOCEPHALUS		X	X	X	X		
OSPREY	PANDION	HALIAETUS		X	X	X	X		
RUFFED GROUSE	BONASA	UMBELLUS		X			X	X	X
BOBWHITE	COLINUS	VIRGINIANUS		X			X	X	X
TURKEY	MELEAGRIS	GALLOPAVO		X			X	X	X
AMERICAN COOT	FULICA	AMERICANA		X	X				
COMMON GALLINULE	GALLINULA	CHLOROPUS		X	X				
SPOTTED SANDPIPER	ACTITUS	MACULARIA		X	X				
COMMON SNIPE	CAPELLA	GALLINAGO		X	X				
KILLDEER	CHARADRIUS	VOCIFEROUS		X	X				
BLACK TERN	CHLIDONIAS	NIGER		X	X				
HERRING GULL	LARUS	ARGENTATUS		X	X				
RING-BILLED GULL	LARUS	DELAWARENSIS		X	X				
AMERICAN WOODCOCK	PHILOHELA	MINOR		X	X		X		
ROCK DOVE	COLUMBIA	LIVIA			X				
MOURNING DOVE	ZENAIDURA	MACROURA			X				
YELLOW-BILLED DOVE	COCCYZUS	AMERICANUS					X	X	X
CHUCK-WILL'S-WIDOW	CAPRIMULGUS	CAROLINENSIS				X	X	X	X
WHIP-POOR-WILL	CAPRIMULGUS	VOCIFEROUS					X	X	X
COMMON NIGHTHAWK	CHORDEILIS	MINOR			X				
GREAT HORNED OWL	BUBO	VIRGINIANUS					X	X	X

Table 1. Birds and Mammals (continued)

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
SCREECH OWL	OTUS	ASIO			X				
BARRED OWL	STRIX	VARIA		X	X		X	X	X
BARN OWL	TYTO	ALBA		X	X				
RUBY-THROATED HUMMINGBIRD	ARCHILOCHUS	COLUBRIS			X				
RED-BELLIED WOODPECKER	CENTURUS	CAROLINUS					X	X	X
YELLOW-SHAFTED FLICKER	COLAPTES	AURATUS			X				
DOWNY WOODPECKER	*DENDROCOPUS*	PUBESCENS			X				
HAIRY WOODPECKER	DENDROCOPUS	VILLOSUS					X	X	X
PILEATED WOODPECKER	HYLATOMUS	PILEATUS				X	X	X	X
RED-HEADED WOODPECKER	MELANERPES	ERYTHROCEPHALUS					X	X	X
YELLOW-BELLIED SAPSUCKER	SPHYRAPICUS	VARIUS			X				
BELTED KINGFISHER	MEGACERYLE	ALCYON		X	X				
RED-WINGED BLACKBIRD	AGELAIUS	PHOENICEUS		X	X				
BACHMAN'S SPARROW	AIMOPHILA	AESTIVA			X				
GRASSHOPPER SPARROW	AMMODRAMUS	SAVANNARUM			X				
CEDAR WAXWING	BOMBYCILLA	CEDROSUM			X				
PURPLE FINCH	CARPODACUS	PURPUREUS			X				
BROWN CREEPER	CERTHIA	FAMILIARIS					X	X	X
EASTERN WOODPEWEE	*CONTOPUS*	*VIRENS*					X	X	X
COMMON CROW	CORVUS	BRACHYRHYNCHOS			X		X	X	X
BLUE JAY	CYANOCITTA	CRISTATA			X		X	X	X
BAY BREASTED WARBLER	DENDROICA	CASTANEA				X			
CERULEAN WARBLER	DENDROICA	CERULEA		X			X	X	
MYRTLE WARBLER	*DENDROICA*	CORONATA			X	X	X	X	X
PRAIRIE WARBLER	DENDROICA	DISCOLOR					X	X	X
YELLOW-THROATED WARBLER	DENDROICA	DOMINICA					X	X	X
MAGNOLIA WARBLER	DENDROICA	MAGNOLIA						X	
CHESTNUT-SIDED WARBLER	DENDROICA	PENSYLVANICA			X				
YELLOW WARBLER	DENDROICA	PETECHIA			X				
PINE WARBLER	DENDROICA	PINUS					X	X	X
CATBIRD	DUMATELLA	CAROLINENSIS			X				
LEAST FLYCATCHER	EMPIDONAX	MINIMUS			X				
ACADIAN FLYCATCHER	EMPIDONAX	VIRESCENS					X	X	X
HORNED LARK	EREMOPHILA	ALPESTRIS		X	X				
YELLOW THROAT	GEOTHLYPIS	TRICHAS			X				
BLUE GROSBEAK	GUIRACA	CAERULEA			X				
WORM EATING WARBLER	HELMITHEROS	VERMIVORUS					X	X	X
EVENING GROSBEAK	HESPERIPHONA	VESPERTINA				X			
BARN SWALLOW	HIRUNDO	RUSTICA		X	X				
HERMIT THRUSH	HYLOCICHLA	GUTTATA					X	X	X
WOOD THRUSH	*HYLOCICHLA*	*MUSTELINA*					X	X	
YELLOW-BREASTED CHAT	ICTERIA	VIRENS					X	X	X
ORCHARD ORIOLE	ICTERUS	SPURIUS			X				
SLATE-COLORED JUNCO	JUNCO	HYEMALIS					X	X	X
LOGGER-HEAD SHRIKE	*LANIUS*	*LUDOVICIANUS*			X				
SWAINSON'S WARBLER	LIMNOTHLYPIS	SWAINSONII		X	X			X	
RED CROSSBILL	LOXIA	CURVIROSTRA		X				X	X
SONG SPARROW	MELOSPIZA	MELODIA			X				
MOCKING BIRD	MIMUS	POLYGLOTTOS		X	X				
BLACK-AND-WHITE WARBLER	MNIOTILTA	VARIA					X	X	X
BROWN-HEADED COWBIRD	MOLOTHRUS	ATER			X				
GREAT CRESTED FLYCATCHER	MYIARCHUS	CRINITUS					X	X	X
WHISTLING SWAN	OLOR	COLUMBIANUS		X					
KENTUCKY WARBLER	OPOROBNIS	FORMOSUS					X	X	
PARULA WARBLER	PARULA	AMERICANA					X	X	X

Table 1. Birds and Mammals (continued)

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
TUFTED TITMOUSE	PARUS	BICOLOR			X				
CAROLINA CHICKADEE	PARUS	CAROLINENSIS			X				
ENGLISH SPARROW	PASSER	DOMESTICUS			X				
HENSLOW'S SPARROW	PASSERHERBULUS	HENSLOWI			X				
INDIGO BUNTING	PASSERINA	CYANEA			X				
ROSE-BREASTED GROSBEAK	PHEUCTICUS	LUDOVICIANUS			X		X	X	X
RUFOUS-SIDED TOWHEE	PIPILO	ERYTHROPHTHALMU	S		X				
SCARLET TANAGER	PIRANGA	OLIVACEA					X	X	X
SUMMER TANAGER	PIRANGA	RUBRA					X	X	X
BLUE-GRAY GNATCATCHER	POLIOPTILA	CAERULEA					X	X	
PURPLE MARTIN	PROGNE	SUBIS		X	X				
PROTHONOTARY WARBLER	PROTONOTARIA	CITREA		X			X		
COMMON GRACKLE	QUISCALUS	QUISCULA			X				
RUBY-CROWNED KINGLET	REGULUS	CALENDULA						X	X
GOLDEN-CROWNED KINGLET	REGULUS	SATRAPA						X	X
CARDINAL	RICHMONDENA	CARDINALIS			X		X	X	X
BANK SWALLOW	RIPARIA	RIPARIS		X	X				
EASTERN PHOEBE	SAYORNIS	PHOEBE			X				
LOUISIANA WATER THRUSH	SEIURUS	MOTACILLA		X	X				
OVENBIRD	*SEIVURUS*	*AUROCAPILLUS*					X	X	X
AMERICAN REDSTART	SETOPHAGA	RUTICILLA					X	X	
EASTER BLUEBIRD	SIALIA	SIALIS			X				
WHITE-BREASTED NUTHATCH	SITTA	CAROLINENSIS					X	X	X
PINE SISKIN	SPINUS	PINUS					X	X	X
AMERICAN GOLDFINCH	SPINUS	TRISTIS			X				
CHIPPING SPARROW	SPIZELLA	PASSERINA			X				
FIELD SPARROW	SPIZELLA	PUSILLA			X				
ROUGH WINGED SWALLOW	STELGIDOPTERYX	RUFICOLLIS		X	X				
EASTERN MEADOWLARK	STURNELLA	MAGNA			X				
STARLING	STURNUS	VULGARIS			X				
BEWICK'S WREN	*THRYOMANES*	BEWICKII			X				
CAROLINA WREN	THRYOTHORUS	LUDOVICIANUS			X				
BROWN THRASHER	TOXOSTOMA	RUFUM			X				
HOUSE WREN	*TROGLODYTES*	AEDON			X				
ROBIN	TURDUS	MIGRATORIUS			X				
EASTERN KINGBIRD	TYRANNUS	TYRANNUS		X	X				
BLUE-WINGED WARBLER	VERMIVORA	PINUS			X				
YELLOW-THROATED VIREO	VIREO	FLAVIFRONS					X	X	
WHITE-EYED VIREO	VIREO	GRISEUS					X	X	X
RED-EYED VIREO	VIREO	OLIVACEOUS					X	X	X
HOODED WARBLER	WILSONIA	CITRINA					X	X	
WHITE-THROATED SPARROW	ZONOTRICHIA	ALBICOLLIS			X				
OPPOSSUM	DIDELPHIS	MARSUPIALIS						X	X
SHORT-TAILED SHREW	BLARINA	BREVICAUDA						X	X
LEAST SHREW	CRYPTOTIS	PARVA			X				
EASTERN MOLE	SCALOPUS	AQUATICUS			X				
SOUTHEASTERN SHREW	SOREX	LONGIROSTRIS						X	
BIG BROWN BAT	EPTESICUS	FUSCUS			X		X	X	X
SILVER HAIRED BAT	LASIONYCTERIS	NOCTIVAGANS			X		X	X	X
RED BAT	LASIURUS	BOREALIS			X		X	X	X
HOARY BAT	LASIURUS	CINEREUS			X		X	X	X
KEEN'S MYOTIS	MYOTIS	KEENII			X		X	X	X
LITTLE BROWN BAT	MYOTIS	LUAFUGUS			X		X	X	X
INDIANA MYOTIS	MYOTIS	SODALIS			X		X	X	X
EVENING BAT	NYCTICEUIS	HUMERALIS			X		X	X	X

Table 1. Birds and Mammals (continued)

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
EASTERN PIPISTRELLE	PIPISTRELLUS	SUBFLAVUS			X		X	X	X
EASTERN COTTONTAIL	SYLVILAGUS	FLORIDANUS			X		X	X	X
BEAVER	CASTOR	CANADENSIS		X	X		X	X	
SOUTHERN FLYING SQUIRREL	GLAUCOMYS	VOLANS						X	
WOODCHUCK	MARMOTA	MONAX			X				
WOODLAND VOLE	MICROTUS	PINETORUM			X				
HOUSE MOUSE	MUS	MUSCULUS			X				
GOLDEN MOUSE	OCHROTOMYS	NUTTALLI				X			X
MUSKRAT	ONDATRA	ZIBETHICUS					X		
MARSH RICE RAT	ORYZOMYS	PALUSTRIS		X	X				
WHITE-FOOTED MOUSE	PEROMYSCUS	LEUCOPUS						X	X
NORWAY RAT	RATTUS	NORVEGICUS			X				
EASTERN HARVEST MOUSE	REITHRODONTOMYS	HUMULIS			X				
GRAY SQUIRREL	SCIURUS	CAROLINENSIS					X	X	X
HISPED COTTON RAT	SIGMODON	HISPIDUS		X	X				
EASTERN CHIPMUNK	TAMIAS	STRIATUS						X	X
BOBCAT	LYNX	RUFUS		X	X		X	X	X
STRIPED SKUNK	MEPHITIS	MEPHITIS			X				
LONG-TAILED WEASEL	MUSTELA	FRENATA			X		X	X	
MINK	MUSTELA	VISON			X				
RACCOON	PROCYON	LOTOR		X	X		X	X	X
GRAY FOX	UROCYON	CINEREOARGENTIU		X	X		X	X	X
RED FOX	VULPES	FULVA		X	X		X	X	X
WHITE TAILED DEER	ODOCOILEUS	VIGINIANUS		X	X		X	X	X

N=189

Table 2. Arthropods

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
AGELENOPSIS	OKLAHOMA						X	
AGROECA	PRATENSIS						X	
ASIACHIPTERIA	AUSTRALIS			X	X			
ANAHITA	ANIMOSA						X	
ANTRODIAETUS	SHOEMAKERI						X	
AHYPHAENELLA	SALTABUNDA						X	
APOCHTHONIUS	MOESTUS			X	X			
BELBA	JACOTI			X	X			
BELBA	NIVALIS			X	X			
CAMISIA	BIVERRUCATA			X	X			
CAMISIA	SPINIFER			X	X			
CARABODES				X	X			
CASTIANEIRA	ALATA						X	
CERATICELUS				X	X			
CERATOPPIA	BIPILIS			X	X			
CERATOPPIA	MICROSETA			X	X			
CERATOZETES				X	X			
CHAMOBATES				X	X			
CICURINA	ARCUATA						X	
CIRURINA				X	X			
CLUBIONA	OBESA						X	
COBAS	TAUGYNUS						X	
CULTHORIBULA	JUNCTA			X	X			
DINOCHEIRUS				X	X			
DRASSYLLUS				X	X			
DRASSYLLUS	VIRGINIANUS						X	
ENIOCHTHONIUS				X	X			
EPERIGONE	TRIDENTATA			X	X			
EPIORIBATULA				X	X			
EPUOHMANNIA	CYLINDRICA			X	X			
EREMOBELBA				X	X			
ERIGONE	AUTUMNALIS			X	X			
GALUMNA	VIRGINIENSIS			X	X			
GNAPHOSA	FONTINALIS						X	
GNAPHOSA	SERICATA			X	X			
GYMNODAMAEUS				X	X			
HABROCESTUM	PARVULUM						X	
HAHNIA	CINEREA						X	
HERMANIELLA	ROBUSTA			X	X			
HYPOCHTHONIUS	RUFULUS			X	X			
LATHYS	IMMACULATA			X	X			
LATHYS	MASCULINA						X	
LEPTHYPHANTES	SABULOSA						X	
LIACARUS	AEQUIDENTATUS			X	X			
LIEBSTADIA	HUMERALIS			X	X			
LINYPHIA	MACULATA						X	
LITOPYLLUS	RUPICOLENS						X	
LOHMANNIA				X	X			
LYCOSA	AGILIS			X				
LYCOSA	AVARA						X	
LYCOSA	GULOSA						X	
LYCOSA	HELLUO			X				
LYCOSA	PUNCTULATA						X	
LYCOSA	RABIDA			X				
MEIONETA	ANGULATA						X	

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
MICROBISIUM	CONFUSUM			X	X			
MICROZETES	APPALACHICOLA			X	X			
MISUMENOPS							X	
NANHERMANNIA	AREOLATA			X	X			
NANHERMANNIA	ELEGANTULA			X	X			
NEOBISIUM				X	X			
NEONELLA	VINNULA			X	X			
NEOSCONA							X	
NOTHRUS	QUADRIPILUS			X	X			
NOTHRUS	SYLVESTRIS			X	X			
OPPIA	SUBPECTINATA			X	X			
OPPIA	TRANSLAMELLATA			X	X			
ORIBATULA				X	X			
OXYOPES				X				
PACHYLOMERIDES	AUDOUINI						X	
PARAKALUMMA	ROBUSTUM			X	X			
PARAPELOPS	BIFURCATUS			X	X			
PARAPHIDIPPUS	MARGINATUS						X	
PARDOSA				X	X			
PELOPS				X	X			
PELORIBATES				X	X			
PHIDIPPUS	CLARUS			X	X			
PHRUROTIMPUS				X	X			
PHRUROTIMPUS	ALARIUS						X	
PISAURINA							X	
PLATYNOTHRUS	PELTIFER			X	X			
PROTORIBATES	LOBOTRICHUS			X	X			
PSEUDOTRITIA	LORICATA			X	X			
RACHODRASSUS	ECHINUS						X	
ROSTROZETES				X	X			
SCHELORIBATES				X	X			
SCHIZOCOSA							X	
SPINTHARUS							X	
STEATODA	AMERICANA			X	X			
STEGANACARUS	TERRAPENAE			X	X			
SUCTOBELBA	PALUSTRIS			X	X			
TECTOCEPHEUS	VELATUS			X	X			
THIODINA	PUERPERA						X	
TRHYPOCHTHONIUS	AMERICANUS			X	X			
TYRANNOCHTHONIU	S			X	X			
UROPODA							X	
VELOPPIA				X	X			
WADOTES	HYBRIDUS						X	
XYSTICUS	AUCTIFICUS						X	
XYSTICUS	ELEGANS						X	
XYSTICUS	FRATERNUS						X	
ZELOTES	SUBTERRANEUS						X	
ZETOBCHESTES	EQUESTRIS			X	X			
ZYGORIBATULA				X	X			
GAMMARUS	BREVIRAMUS		X					
GAMMARUS	MINUS		X					
LIGIDIUM							X	
LINOTAENIA	BIDENS						X	
OTOCRYPTOPS	NIGRIDUS						X	
OTOCRYPTOPS	SEXPINOSUS						X	

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
THEATOPS	POSTICUS						X	
APHELORIA	MONTANA						X	
BRACHORIA	INITIALIS						X	
BRACHYCYBE	*LECONTEI*						X	
BRACHYCYBE	PETASATA						X	
CAMBALA	ANNULATA						X	
DIXIDESMUS	ERASUS						X	
EURYURUS	LERCHII	FRATERNUS					X	
GYALOSTETHUS	MONTICOLENS						X	
PTYOIULUS	IMPRESSUS						X	
SCYTONOTUS	GRANULATUS						X	
ALLOPAUROPUS	BOHNSACKI			X	X			
PAUROPUS	DUKENSIS			X	X			
STYLOPAUROPUS	QUADRISULCUS			X	X			
FOLSOMIA	ELONGATA						X	
FOLSOMIA	FIMETARIA						X	
FOLSOMIA	SENSIBILIS						X	
FOLSOMIDES	PARVUS						X	
HYPOGASTRURA							X	
HYPOGASTRURA	ARMATA						X	
ISOTOMA	OLIVACEA	VIOLACEA					X	
ISOTOMIELLA	MINOR						X	
LEPIDOCYRTUS							X	
MICRANURIDA	FURCIFERA						X	
MORULINA	CALLOWAYIA						X	
ODONTELLA	PSEUDOLAMELLIFE						X	
ODONTELLA	SCABRA						X	
ONYCHIURUS	COCKLEI						X	
ONYCHIURUS	FIMETARIUS						X	
ONYCHIURUS	MILLSI						X	
ONYCHIURUS	RAMOSUS						X	
PROISOTOMA							X	
PSEUDACHORUTES	SUBCRASSOIDES						X	
PSEUDOSINELLA	LEPIDOCYRTUS						X	
SINELLA							X	
SMINTHURINUS	ELEGANS						X	
TOMOCERUS	*LAMELLIFERUS*						X	
TULLBERGIA	KRAUSBAUERI						X	
EURYTHRIPS	WATSONI			X	X			
FRANKLINIELLA	TRITICI			X	X			
HOPLOTHRIPS	ANGUSTICEPS			X	X			
LISSOTHRIPS	MUSCORUM			X	X			
MACHILIS							X	
SERICOTHRIPS	ANNULIPES			X	X			
SERICOTHRIPS	APICALIS			X	X			
TRACHYTHRIPS	WATSONI			X	X			
BAETIS			X					
EPHEMERA			X					
HABROPHLEBIA			X					
HABROPHLEBIODES			X					
PARALEPTOPHLEBI			X					
PENTAGENIA			X					
STENONEMA			X					
ATLANTICUS	GIBBOSUS						X	
CEUTHOPHILUS	GRACILIPES						X	

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
CHORTOPHAGA				X				
CONOCEPHALUS	FASCIATUS			X				
CONOCEPHALUS	STRICTUS			X				
CRYPTOCERCUS	PUNCTULATUS						X	
DISOSTEIRA				X				
GRYLLUS				X				
GRYLLUS	VERNALIS						X	
HIPPISCUS				X				
MELANOPLUS	DIFFERENTIALIS			X				
MELANOPLUS	FEMUR-RUBRUM			X				
MELANOPLUS	MEXICANA						X	
MELANOPLUS	SANGUINIPIES			X				
METALEPTA				X				
NEOCONOCEPHALUS				X				
OECANTHUS				X		X	X	
OECANTOUS	QUADRIPUNCTATUS						X	
ORCHELIUM				X				
PARCOBLATTA							X	
PTERONEMOBIUS	FASCIATUS			X				
PTERONEMOBIUS	MACULATUS						X	
PTERONEMOBIUS	NYMPHS						X	
SYRBULA	ADMIRABILIS			X				
ACRONEURIA			X					
ALLOPERLA			X					
ISOPERLA	SIMILIS		X					
LEUCTRA			X					
NEMOCAPNIA	CAROLINA		X					
NEMOURA			X					
PELTOPERLA			X					
PERLINELLA			X					
PHASGONOPHORA	CAPITATA		X					
ACANTHOCEPHALA	FEMORATA						X	
ALYDUS				X				
ARCHIMERUS				X				
EUCHISTUS				X				
LEPTOPTERNA				X				
PODISUS				X				
CLASTOPTERA				X				
DRACULA	CEPHALA			X				
PARAPHLEPSIUS				X				
SCAPHYTOPIUS				X				
TIBICEN							X	
CHAULIODES			X					
CHRYSOPA							X	
SIALIS			X					
ADALIA				X				
AEOLUS	MELILLUS						X	
AGRIOTES	OBLONGUS						X	
AHASVERUS	ADVENA			X	X			
ALATUS	OCULTATUS						X	
ANABOUS	BRUNNEUS			X	X			
ANASPIS							X	
ANTHICUS	CERVINUS			X	X			
ANTHICUS	FLORALIS			X	X			
ASTENUS	DISCOPUNCTATUS			X	X			

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
ASTENUS				X	X			
ATAENIUS	PROLIXUS			X	X			
ATHETA	SCHWARTZEI			X	X		X	
BATRISODES								
BEMBIDION	GLOBOSUS			X	X		X	
CALOSOMA				X	X			
CARPELIMUS				X				
CASSIDA				X	X			
CATOBAMA							X	
CHAULIOGNATHUS							X	
CHLAENIUS							X	
CHLAENIUS	EMARGINATUS						X	
CICINDELA	SEXGUTTATA							
CICINDELA	UNIPUNCTATA		X	X	X		X	
COPELATUS								
CORTICARIA	ELONGATA			X			X	
CTENICERA								
CYCLONEDIA		XCARINATUS		X	X		X	
DICAELUS	PORVUS							
DIOCHUS	NANUS			X	X			
DONACASCHEMA	NIGRUM							
ECHIASTER	BREVICORNIS		X	X	X			
ECTOPARIA				X	X		X	
EDAPHUS	NITIDUS						X	
EPITRIX	HIRTIPENNIS						X	
EVARTHRUS	AMERICANUS						X	
EVARTHRUS	SODALIS			X		X	X	
GALERITA	JANUS						X	
HARPALUS				X				
HARPALUS	COMPAR							
HOLOLEPTA	QUADRIDENTATA		X	X	X			
LABIDOMERA								
LACCOPHILUS	BIGOTTATUS		X	X	X		X	
LARCOPHLOEUS								
LISTRONOTUS	CONCAVUS			X	X			
MALTHODES				X	X		X	
MARONETUS	DISTINGUENDA							
MELANOPHTHALMA	SIMPLEX			X				
MELANOPHTHALMA	CASTANOPES			X	X			
MELANOTUS				X	X			
METRIONA	FULVIPES			X	X		X	
MONOTOMA	INFIMA						X	
MORDELLISTENA	FLAVIOCOLLIS						X	
MYCETOPORUS	CALCEATUS						X	
ODONTOPUS	PARMATUS			X	X			
OLISTHOPUS				X	X			
ONTHOPHAGUS				X	X		X	
OXYPODA	EXIGUUS						X	
OXYTALUS				X	X			
PALARINUS	DEPRESSUS							
PASIMACHUS	ELONGATUS			X	X			
PASIMACHUS	HEPATICUS			X	X		X	
PHILONTHUS	UMBRATILIS							
PHILONTHUS	SCINTILLANS							
PHOTINUS								

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
PSEPHENUS			X					
PTEROSTICHUS	OBSCURUS						X	
SCAPHINOTUS	ANDREWSII	GERMARI					X	
SCAPHINOTUS	UNICOLOR	HEROS					X	
SCOPAEUS				X	X			
SERICA							X	
SILPHA	NOVEBORACENSIS						X	
SPHAERODERUS	STENOSTOMUS						X	
STAPHYLINUS	BADIPES						X	
SUPHISELLUS			X					
TACHYS	LAEVUS			X	X			
THROSCUS	CHEVROLATI			X	X			
TOMARUS	PULCHELLUS			X	X			
TRIGONOGNATHA	CORACINA						X	
TROX							X	
TYPHAEA	STERCOREA			X	X			
AGATHIS							X	
AMBLYOPONE	PALLIPES			X	X			
APHAENOGASTER	RUDIS			X	X			
APIS	MELLIFERA						X	
BRACHYMYRMEX	DEPILIS			X	X			
CAMPONOTUS	PENNSYLVANICUS						X	
LEPTOTHORAX	CURVISPINOSUS			X	X			
MONOMORIUM	MINIMUM			X	X			
MYRMECINA	AMERICANA			X	X	X	X	X
MYRMICA	PINETORUM			X	X			
PARATRECHINA	MELANDERI			X	X			
PHEIDOLE	DENTATA			X	X			
PONERA	COARCTATA	PENNSYLVANICA		X	X			
PRENOLEPIS	IMPARIS						X	
SOLENOPUS	MOLESTO			X	X			
TAPINOMA	SESSILE			X	X			
ANAPETE				X	X			
ANTOCHA			X					
BRADYSIA				X	X			
BRADYSIA	TRITICI						X	
CHIRONOMUS			X					
CRICTOPUS				X	X			
CRYPTOCHIRONOMU			X					
CULICOIDES				X	X			
DICRANOTA			X					
DIXIA			X					
DRAPETIS				X	X			
HOLOBUSIA			X					
ITONIDA				X	X			
LASIOHELEA				X	X			
LEPTOCERA				X	X			
LEPTOMETOPA	LATIPES			X	X			
LESTODIPLOSIS				X	X			
MEGASELIA				X	X			
MYCODIPLOSIIS				X	X			
PEDICIA			X					
PNYXIA				X	X			
PSYCHODA	ALTERNATA			X	A			
TELMATOSCOPUS				X	X			

Table 2. Arthropods (continued)

GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
DIPLECTRONA			X					
GEORA			X					
GLOSSOSONA	NIGRIER		X					
HYDROPSYCHE	DEPRAVATA		X					
HYDROPSYCHE	MOROSA		X					
HYDROPSYCHE	SPARNA		X					
LEPIDOSTOMA	GRISEUM		X					
NEOPHYLAX	AUTUMNUS		X					
NEURECLIPSIS			X					
PARASYCHE			X					
POLYCENTROPUS			X					
PSILOTRETA			X					
PYCNOPSYCHE	ANTICA		X					
RHYACOPHILA	FENESTRA		X					
SNICRIDEA			X					
THELIOPSYCHE			X					
TRENTONIUS			X	X				

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Table 3. Reptiles and Amphibians

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
NORTHERN CRICKET FROG	ACRIS	CREPITANS	CREPITANS	X	X				
AMERICAN TOAD	BUFO	AMERICANUS	AMERICANUS		X		X	X	X
FOWLER'S TOAD	BUFO	WOODHOUSEI	FOWLERI		X		X	X	X
EASTERN NARROW-MOUTHED TOAD	GASTROPHRYNE	CAROLINENSIS	CAROLINENSIS		X		X	X	X
SPRING PEEPER	HYLA	CRUCIFER	CRUCIFER	X	X				
GRAY TREE FROG	HYLA	VERSICOLOR	VERSICOLOR					X	
UPLAND CHORUS FROG	PSEUDACRIS	TRISERIATA		X	X				
BULLFROG	RANA	CATESBEIANA		X					
BRONZE FROG	RANA	CLAMITANS		X					
PICKEREL FROG	RANA	PALUSTRIS					X	X	X
LEOPARD FROG	RANA	PIPIENS					X	X	X
WOOD FROG	RANA	SYLVATICA		X					
EASTERN SPADEFOOT	SCAPHIOPUS	HOLBROOKI	HOLBROOKI	X	X				
SPOTTED SALAMANDER	AMBYSTOMA	MACULATUM		X	X				
HELLBENDER	CRYPTOBRANCHUS	ALLEGANIENSIS		X					
DUSKY SALAMANDER	DESMOGNATHUS	FUSCUS		X	X				
RED SPOTTED NEWT	DIEMICTYLUS	VIRIDESCENS	VIRIDESCENS	X			X	X	X
SOUTHERN TWO-LINED SALAMANDER	EURYCEA	BISLINEATA		X					
THREE-LINED SALAMANDER	EURYCEA	LONGICAUDA		X	X		X	X	
CAVE SALAMANDER	EURYCEA	LUCIFUGA		X	X				
SPRING SALAMANDER	GYRINOPHILUS	PORPHYRITICUS		X			X	X	
MUDPUPPY	NECTURUS	MACULOSUS		X					
RED-BACKED SALAMANDER	PLETHODON	CINEREUS		X			X	X	
SLIMY SALAMANDER	PLETHODON	GLUTINOSUS	GLUTINOSUS	X					
NORTHERN RED SALAMANDER	PSEUDOTRITON	RUBER	RUBER	X	X				
SNAPPING TURTLE	CHELYDRA	SERPENTINA	SERPENTINA	X					
EASTERN PAINTED TURTLE	CHRYSEMYS	PICTA		X					
MAP TURTLE	GRAPTEMYS	GEOGRAPHICA		X	X				
OUACHITA MAP TURTLE	GRAPTEMYS	*PSEUDOGEOGRAPHI*	*OUACHITENSIS*	X	X				
SLIDER	PSEUDEMYS	CONCINNA	HIEROGLYPHICA	X	X				
YELLOW-BELLIED TURTLE	PSEUDEMYS	SCRIPTA		X	X				
STRIPED-NECK MUSK TURTLE	STERNOTHAERUS	MINOR	PELTIFER	X	X				
STINKPOT	STERNOTHAERUS	ODORATUS		X	X				
EASTERN BOX TURTLE	TERRAPENE	CAROLINA	CAROLINA		X		X	X	X
EASTERN SPINY SOFTSHELL TURTLE	TRIONYX	*SPINIFER*	*SPINIFER*	X					
NORTHERN COPPERHEAD	AGKISTRODON	CONTORTRIX	MOKESON			X	X	X	X
GREEN ANOLE	ANOLIS	CAROLINENSIS			X				
EASTERN WORM SNAKE	CARPHOPHIS	AMOENUS	AMOENUS		X		X	X	X
SCARLET SNAKE	CEMOPHORA	COCCINEA				X	X	X	X
SIX-LINE RACERUNNER	CNEMIDOPHORUS	SEXLINEATUS			X	X	X	X	X
NORTHERN BLACK RACER	COLUBER	CONSTRICTOR			X	X	X	X	X
TIMBER RATTLESNAKE	CROTALUS	HORRIDUS					X	X	X
NORTHERN RINGNECK SNAKE	*DIADOPHIS*	*PUNCTATUS*	*EDWARDSI*				X	X	X
CORN SNAKE	ELAPHE	GUTTATA	GUTTATA		X	X			
BLACK RAT SNAKE	ELAPHE	OBSOLETA			X	X	X	X	X
FIVE-LINED SKINK	EUMECES	FASCIATUS			X	X	X	X	X
BROADHEAD SKINK	*EUMECES*	*LATICEPS*					X	X	X
EASTERN HOGNOSE SNAKE	HETERODON	PLATYRHINOS			X	X			
MOLE SNAKE	LAMPROPELTIS	CALLIGASTER	RHOMBOMACULATA		X	X			
EASTERN MILK SNAKE	LAMPROPELTIS	DOLIATA	TRIANGULUM			X	X	X	X
BLACK KING SNAKE	LAMPROPELTIS	GETULUS	NIGER		X	X			
GROUND SKINK	LYGOSOMA	*LATERALE*			X	X	X	X	X
QUEEN SNAKE	NATRIX	*SEPTEMVITTATA*	*SEPTEMVITTATA*	X	X				
NORTHERN WATER SNAKE	NATRIX	SIPEDON		X	X				
ROUGH GREEN SNAKE	OPHEODRYS	AESTIVUS			X				

Table 3. Reptiles and Amphibians (continued)

NAME	GENUS	SPECIES	VARIETY	TYPE_1	TYPE_2	TYPE_3	TYPE_4	TYPE_5	TYPE_6
SLENDER GLASS LIZARD	OPHISAURUS	ATTENUATUS			X				X
FENCE LIZARD	SCELOPORUS	UNDULATUS	HYACINTHINUS		X	X	X	X	X
NORTHERN BROWN SNAKE	STORERIA	DEKAYI			X	X	X	X	X
NORTHERN RED-BELLIED SNAKE	STORERIA	OCCIPITOMACULAT	OCCIPITOMACULAT				X	X	X
SOUTHEASTERN CROWNED SNAKE	TANTILLA	CORONATA		X	X		X	X	X
EASTERN GARTER SNAKE	THAMNOPHIS	SIRTALIS	SIRTALIS	X	X		X	X	X

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