THE OAK RIDGE RESERVATION, BIODIVERSITY, AND THE COMMON GROUND PROCESS

Final Report

October 1995

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for
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for the
Common Ground Process
Oak Ridge Reservation
managed by
Lockheed Martin Energy Systems, Inc.
for the
U.S. Department of Energy
under
contract DE-AC05-84OR21400

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GLOSSARY

Note: This glossary defines terms only in the context of this report.

biodiversity - the variety of plant and animal species and natural communities found in a specific geographic area

biodiversity data - standard information that is collected on plant and animal species and natural communities

biological elements - plant and animal species and natural communities

biological inventory - the process of determining the biodiversity of an area through literature searches and field inventory

conservation significance - the importance of protecting a particular biological element

conservation value - the relative importance of a site for the protection of biodiversity

defensibility - the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it; both direct impacts (e.g., vandalism, invasion by exotics from surrounding lands) and indirect impacts (e.g., air or water pollution) are included; landscape configuration, watershed lines, points of possible entry, and related matters are carefully considered

dicot - a plant whose embryo has two cotyledons (Raven et al. 1981)

disjunct species - a geographically separated population that is assumed to be genetically different from other populations of the same species

fern allies - both ferns and fern allies are vascular plants that do not produce flowers or seeds but instead reproduce by spores (normally one-celled structures that are capable of germinating to form new individuals, without fertilization); true ferns are different from the other pteridophytes because of their conspicuous, typically large leaves (the fern allies' leaves are scale-like)

flood plain - the area of lowland along a water course that is subject to periodic flooding and sediment deposition (Lincoln et al. 1982)

gymnosperm - a seed plant with seeds not enclosed in an ovary; the conifers are the most familiar group (Raven et al. 1981)

high-quality community - stands of an undisturbed vegetation type

imperiled range-wide - biological elements that are threatened everywhere that they occur

landscape complex - an area encompassing several BSR (biodiversity significance rank) sites on the ORR; its boundaries are based on concentrations of rare species occurrences, concentrations of rare

community occurrences, large stands of relatively high-quality vegetation (of more common communities), and principles of conservation site design

mesic - pertaining to conditions of moderate moisture or water supply; used of organisms occupying moist habitats (Lincoln et al. 1982)

monocot - a plant whose embryo has one cotyledon (Raven et al. 1981)

natural area - locations that have been identified by the state as being in need of preservation because they contain rare plant populations or communities unique to the area; or areas established to provide protection for state and/or federally listed rare species (or species under status review for federal listing) that are known to occur on the ORR (Parr and Pounds 1987)

natural community - a distinct and recurring assemblage of populations of plants, animals, bacteria, and fungi naturally associated with each other and their physical environment, characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, substrate, and soil moisture and reaction

preliminary conservation site - initially designated areas having conservation importance

ranking - the act of placing biological elements and sites in a prioritized system for conservation action

range - the geographic extent of the occurrences of a species or community

rare species - a plant or animal that is imperiled globally, having 20 or fewer occurrences

reference area - areas on the ORR that are representative of the vegetational communities of the southern Appalachian region or that possess unique biotic features (Parr and Pounds 1987)

targeted element - a plant or animal species or natural community that has been selected for conservation because of its rarity or representativeness

viability - the long-term prospects for continued existence of this occurrence at the indicated level of quality; factors of size and surroundings, as well as nature of the element and its reproductive biology and the factors which limit the element at the site, are considered

watershed - an elevated boundary area separating tributaries draining into different river systems (Lincoln et al. 1982)

wetland - an area of low lying land, submerged or inundated periodically by fresh or saline water (Lincoln et al. 1982)

1. PROJECT DESCRIPTION

1.1 INTRODUCTION

As one of the federal properties across the United States, the Department of Energy's (DOE's) Oak Ridge Reservation (ORR) contains a wealth of biodiversity and provides an excellent opportunity for inventory and conservation. Since its purchase in 1942, the ORR, at 35,300 acres one of the largest of DOE's multi-program facilities, has been undisturbed except for DOE missions that consumed land and some timber. Large undeveloped areas of native vegetation that provide habitat for many plants, animals, and natural communities are disappearing from surrounding lands because of agricultural uses, development, and encroaching development.

By 1994, DOE and its representatives recognized the need for organized and consistent biodiversity data on the ORR to assist with the Common Ground Process of identifying future use alternatives. The environmental analysis component of Common Ground involves amassing and standardizing existing ORR biodiversity data, bolstering those data with further field inventory, and mapping ORR sites with conservation values. ORR's Environmental Sciences Division alone has published hundreds of biological studies, but a methodical and comprehensive inventory of plant and animal life covering the entire reservation has never been made. Historic inventories and current field investigations, though they lack common objectives (e.g., developing a comprehensive plan for ORR natural areas based on updatable biodiversity data), are gathering important, if piecemeal, information. Important habitats such as floodplains and wetlands have not been thoroughly identified, and data collection on ORR's invertebrates, birds, mammals, reptiles, and amphibians has not been completed. Plant surveys have progressed further than any other type of survey, yet provide a basis for only about one-third of ORR's area (King et al. 1994).

To address the needs of managers and stewards of the ORR lands, personnel from the reservation have joined The Nature Conservancy (TNC Home Office, Southeast Regional Office, and Tennessee Field Office) and the Tennessee Ecological Services Division (State Heritage botanists, zoologists, and ecologists) to assist in the Common Ground Process. Our task in support of the Common Ground Process was designed to be a two-phase process. The objective of the first phase was to use existing information to identify the known rare species and natural areas on the ORR and, using this information, identify preliminary sites of conservation importance. The objective of the second phase of the project is to conduct further biological inventory of ORR to allow a more detailed analysis of the important biological elements on the reservation and to improve the ability to designate conservation sites that would adequately protect them.

The Nature Conservancy's Tennessee Field Office and Tennessee Heritage scientists have completed the first phase, and the results are described in this report.

Prepared as part of the first phase and published separately are eight ArcInfo Geographic Information System large-format color plots for the following features:

1. Preliminary Conservation Sites (BSR 2) in Oak Ridge Reservation, TN
2. Preliminary Conservation Sites (BSR 3) in Oak Ridge Reservation, TN
3. Preliminary Conservation Sites (BSR 4) in Oak Ridge Reservation, TN
4. Preliminary Conservation Sites in Oak Ridge Reservation, TN

5. Rare Species and Community Element Occurrences with ORNL Natural and Reference Areas in Oak Ridge Reservation, TN
6. Species Element Occurrences in Oak Ridge, TN
7. Aquatic Natural and Reference Areas in Oak Ridge Reservation, TN
8. Springs and Seeps in Oak Ridge Reservation, TN

1.2 METHODS

Existing information on the rare species and natural communities at the ORR was gathered from the site's Environmental Sciences Division, the Tennessee Natural Heritage Program, and other sources (see Section 1.5). Species and communities were considered rare if they fit within the state and federal rare species ranking system (Tables 1 and 2) or The Nature Conservancy's and Network of Natural Heritage Program's ranking system (Tables 3 and 4). The federal and state listing processes assign statuses to species by evaluating their rarity and threats. The ranking system developed by TNC and various state heritage programs provides a means of comparing the state and global abundance of these species. High-quality examples of more common communities were also considered to be of high conservation value and were included in the study.

Each rare species and community was described and their conservation significance at ORR noted (see Section 2), and all known occurrences of the rare species and communities and other important features were identified and mapped (see large maps).

Using the information on the occurrences of the rare species and communities and other important features (e.g., caves, springs, previously designated natural areas and reference areas), preliminary conservation sites were identified. These sites generally were located around clusters of important species or community occurrences, with special emphasis placed on those species and elements designated as G1, G2, or G3 (see Table 3) in The Nature Conservancy and Natural Heritage Network ranking system. The sites also include the landscape features and ecological processes (e.g., watersheds) believed to be important for sustaining the occurrences. Conservation sites were ranked based on their conservation significance (Table 5). The importance of the ORR to Tennessee and the region is explored, and the regional survival and health of the species and communities are discussed.

Landscape complex boundaries were based on concentrations of rare species occurrences, concentrations of rare community occurrences, large stands of relatively high-quality vegetation (of more common communities), and principles of conservation site design. The Oak Ridge Reservation is one of the largest remaining areas in the Southern Ridge and Valley with relatively intact natural communities (especially those of valley bottoms and lower slopes), and it therefore offers an unusual opportunity to conserve landscape-scale patterns and processes. Larger-scale conservation areas may in some cases prove to be necessary to achieve long-term biodiversity conservation.

For example, Landscape Complex One contains a large number of highly ranked BSR (biodiversity significance rank) sites that coincide with rare communities, rare species, hardwood forests of over 100 acres (40 hectares), and the watershed containing one of the most important populations of Tennessee Dace (Phoxinus tennesseensis). Boundaries were based on ecological considerations and include most of the watershed of Bear Creek, considered critical for the long-term survival of Tennessee Dace.

Landscape complex boundaries are based on available information; additional work, including field investigation, is necessary to refine them. Furthermore, a variety of uses within the boundaries may be feasible without compromising their conservation values, but these uses need to be carefully considered in relation to the habitat needs of the species involved.

Table 1. Federal status designations

Endangered:	The species is threatened by extinction throughout all or a significant portion of its range. Example: Eastern Cougar *(Felis concolor couguar)*
Threatened:	The species is likely to become endangered in the foreseeable future. Example: Bald Eagle (*Haliaeetus leucocephalus*)
Candidate, Category 2	Enough information is available to list the species as threatened or endangered, but substantial information regarding biological vulnerability and threat(s) is not currently known or on file to support a proposed rule. May also be defined as "under consideration for listing." Example: Spreading False-foxglove *(Aureolaria patula)*

Table 2. Tennessee status designations

Endangered:	The species is in danger of becoming extinct in Tennessee because of (1) the species' rarity in Tennessee or (2) the species' rarity in Tennessee as a result of sensitive habitat destruction or restricted area of distribution. Example: Bachman's Sparrow *(Airnophila aestivalis)*
Threatened:	The species is likely to become endangered in the immediately foreseeable future as a result of rapid habitat destruction or commercial exploitation. Example: Appalachian Bugbane (*Cimicifuga rubifolia*)
Special Concern:	The species requires concern in Tennessee because (1) it is rare in Tennessee because the state represents the limit or near limit of the species' geographic range, or (2) the species' status is undetermined because of insufficient information. Example: Heavy Sedge (*Carex gravida)*
Deemed in Need of Management:	Any species or subspecies of nongame wildlife that the executive director of the Tennessee Wildlife Resources Agency believes should be investigated in order to develop information relating to population, distribution, habitat, needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully. Example: Cooper's Hawk (*Accipiter cooperii)*

Table **3.** Global conservation status designations **of**
The Nature Conservancy and the Network of Natural Heritage programs

Basic Rank:

G# = numeric rank

G1 = critically imperiled globally (typically 5 or fewer occurrences) - example: Orangefoot Pimpleback
G2 = imperiled globally (6 to 20 occurrences) - example: Spreading False-foxglove
G3 = rare or uncommon (21 to 100 occurrences) - example: Bachman's Sparrow
G4 = widespread, abundant, and apparently secure, but with cause for long-term concern (usually more than 100 occurrences) - example: American Ginseng
G5 = demonstrably widespread, abundant, and secure - example: Osprey

G#G# = numeric range rank

G? = unranked
GU = unrankable
GH = historical - example: Nuttall's micranthemum
GX = extinct - example: Passenger pigeon
HYB = hybrid

Subrank:

T = taxonomic subdivision (trinomial) - example: Mississippi sandhill crane

Qualifiers:

? = inexact numeric rank
Q = questionable taxonomy - example: Pond pine
C = captive or cultivated only - example: Franklinia

Table 4. State conservation status designations of
The Nature Conservancy and the Network of Natural Heritage programs

Basic Rank:

S# = numeric rank

S1 = critically imperiled in the state (typically 5 or fewer occurrences) - example: Northern White Cedar Woodland
S2 = imperiled in the state (6 to 20 occurrences) - example: Tennessee Dace
S3 = rare or uncommon in the state (21 to 100 occurrences) - example: Paddlefish
S4 = widespread, abundant, and apparently secure, but with cause for long-term concern (usually more than 100 occurrences) - example: Meadow Jumping Mouse
S5 = demonstrably widespread, abundant, and secure

S#S# = numeric range rank

S? = unranked - example: Whorled Horsebalm
SU = unrankable
SH = historical - example: Eastern Cougar
SX = extirpated - example: Mendocino Bush Mallow*
HYB = hybrid
SSYN = synonym

Breeding Status:

B = breeding status
N = nonbreeding status

Qualifiers:

? = inexact or uncertain
C = captive or cultivated only

*This state conservation status example is taken from California.

Table 5. Site biodiversity significance ranks (BSRs) of
The Nature Conservancy and the Network of Natural Heritage programs

BSR-1: Outstanding significance—such as the only known occurrence of any Element, the best or an excellent (A-ranked) occurrence of a G1 Element, or a concentration (4+) of high-ranked (A- or B-ranked) occurrences of G1 or G2 Elements. Site should be viable and defensible for targeted Elements and ecological processes contained.

BSR-2: Very high significance--such as one of the most outstanding occurrences of any community Element (regardless of its element rank). Also includes areas containing any other (B-, C-, or D-ranked occurrence of a G1 Element, a good (A- or B-ranked) occurrence of a G2 Element, an excellent (A-ranked) occurrence of a G3 Element, or a concentration (4+) of B-ranked G3 or C-ranked G2 Elements.

BSR-3: High significance—such as any other (C- or D-ranked) occurrence of a G2 Element, a B-ranked occurrence of a G3 Element, an A-ranked occurrence of any community, or a concentration (4+) of A- or B-ranked occurrence of (G4 or G5) S1 Elements.

BSR 4: Moderate significance—such as C-ranked occurrence of a G3 Element, a B-ranked occurrence of any community, an A- or B-ranked or only state (but at least C-ranked) occurrence of a (G4 or G5) S1 Element, an A-ranked occurrence of an S2 Element, or a concentration (4+) of good (B-ranked) S2 or excellent (A-ranked) S3 Elements.

BSR 5: Of general biodiversity interest—or open space. This category is not used in *Oak Ridge Reservation, Biodiversity and the Common Ground Process: Preliminary Biodiversity Report on the Oak Ridge Reservation*, although forested land on Oak Ridge Reservation would fit into this or an above category.

A = excellent B = good C = marginal D = poor

When assigning these ranks, the following criteria are considered:

1. Quality	Size (e.g., number of individuals, number of nests, number of acres), maturity, and/or population density
2. Condition	Damage or alteration of the element occurrence and surrounding area from its optimal condition or character (e.g., degree of disturbances from logging, grazing, invasion of exotics, changes in hydrology)
3. Viability	Long-term prospects for continued existence of the occurrence; productivity or evidence for successful reproduction (e.g., survival probability as reflected by distance to neighboring occurrences and/or estimated probability of genetic interchange with other occurrences)
4. Defensibility	Threat manageability (i.e., the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it)

1.3 RESULTS

1.3.1 Significant Species and Communities

The total number of plant species on the ORR is 1,063, of which 7 are fern allies, 36 are ferns, 7 are gymnosperms, 298 are monocots (20 orchids), 724 are dicots, and 170 are woody (84 trees). The total number of animal species documented on the ORR includes 64 fish, 26 amphibians, 33 reptiles, 169 birds, and 39 mammals.

Section 2 contains descriptions of the 21 rare plants, 8 rare invertebrates, 33 rare animals, and 11 rare communities documented on ORR lands and waters. Among the globally rare species of plants found on the ORR are Tall Larkspur (Delphinium *exaltatum*), Spreading False-foxglove (Aureolaria patula), Mountain Witch-alder (Fothergilla major), Appalachian Bugbane (*Cimicifuga rubifolia*), Carey's Saxifrage (*Saxifraga careyana*), Whorled Horsebalm (Collinsonia verticillata), and Butternut (Juglans cinerea). Globally rare animals occurring on the ORR include Tennessee Dace (Phoxinus tennesseensis) and Bachman's Sparrow (Aimophila *aestivalis*). Many additional globally rare animals are no longer present, owing to the impoundment of the Clinch River (mussels and fish) and to the widespread alteration of the regional landscape (Eastern Cougar). Extant globally rare species comprise the most important reservoir of biodiversity present on the ORR, and for some of these species such as Tennessee Dace, Tall Larkspur, Spreading False-foxglove, Appalachian Bugbane, and Witch-alder, populations on the ORR are critical for the continued long-term survival of the species. See the end of Section 2 for range-wide distribution maps for these species.

Other rare plant and animal species on the Oak Ridge Reservation are not imperiled range-wide, but their continued existence is important for their contribution to the natural heritage of Tennessee. Furthermore, many are designated as endangered or threatened species in Tennessee. Those include plant and animal species at the edge of their distribution in eastern Tennessee, disjunct species in eastern Tennessee from a wider range elsewhere, or species suffering declines range-wide for a variety of reasons. Peripheral and disjunct populations often serve as important reservoirs of genetic material and are important to the long-tern viability of species.

Other rare species on the ORR, in some cases overlapping with other groups, are those collected or exploited by humans, including attractive wildflowers or medicinal plants for commercial or home use. On the ORR, these include Canada Lily (Lilium *canadense*), Golden Seal (Hydrastis *canadensis*), Ginseng (Panux quinquefolius), Pink Lady's-slipper (*Cypripedium acaule*), and Purple Fringeless Orchid (Platanthera peramoena). Because of restricted access, the ORR affords additional protection for these species by reducing collection pressure.

1.3.2 Preliminary Conservation Sites

A total of 88 preliminary conservation sites and three landscape complexes were identified. These sites represent clusters of rare/endangered species, significant communities, and other important landscape features. Based on these occurrences of significant species and communities, 27 of the conservation sites were ranked BSR 2, very high significance; 54 were ranked BSR 3, high significance; and 7 were ranked BSR 4, moderate significance. These sites represent a total of 272 occurrences of significant species and communities. Sections 3 and 4 describe the conservation sites identified and lists the occurrences of rare/endangered species and significant communities contained within them. See the end of Section 1 for a map of the preliminary conservation sites.

1.4 DISCUSSION

Information on biodiversity elements of conservation importance is critical to the exploration of alternative land uses for the Oak Ridge Reservation. In order for DOE to make sound and informed land management decisions, the biological and ecological resources of the area must be understood and considered. This report presents a preliminary account of the plants, animals, and natural communities that have been identified as occurring on the reservation. As stated previously, 21 rare plants, 8 rare invertebrates, 33 rare animals, and 11 rare communities are currently recognized for their occurrence on the reservation (though some are no longer on the ORR or their current status is unknown or unclear). Additional high-quality communities occur on the reservation and represent forest types that have been more heavily altered on surrounding lands in the Southern Ridge and Valley. This document is a starting point for developing a comprehensive plan, but an exhaustive inventory of the reservation will be needed to adequately characterize the regional and national importance of the ORR for biodiversity protection. The conservation design that will protect the important biodiversity resources at the ORR can then be fully integrated into the overall land use plan for the reservation.

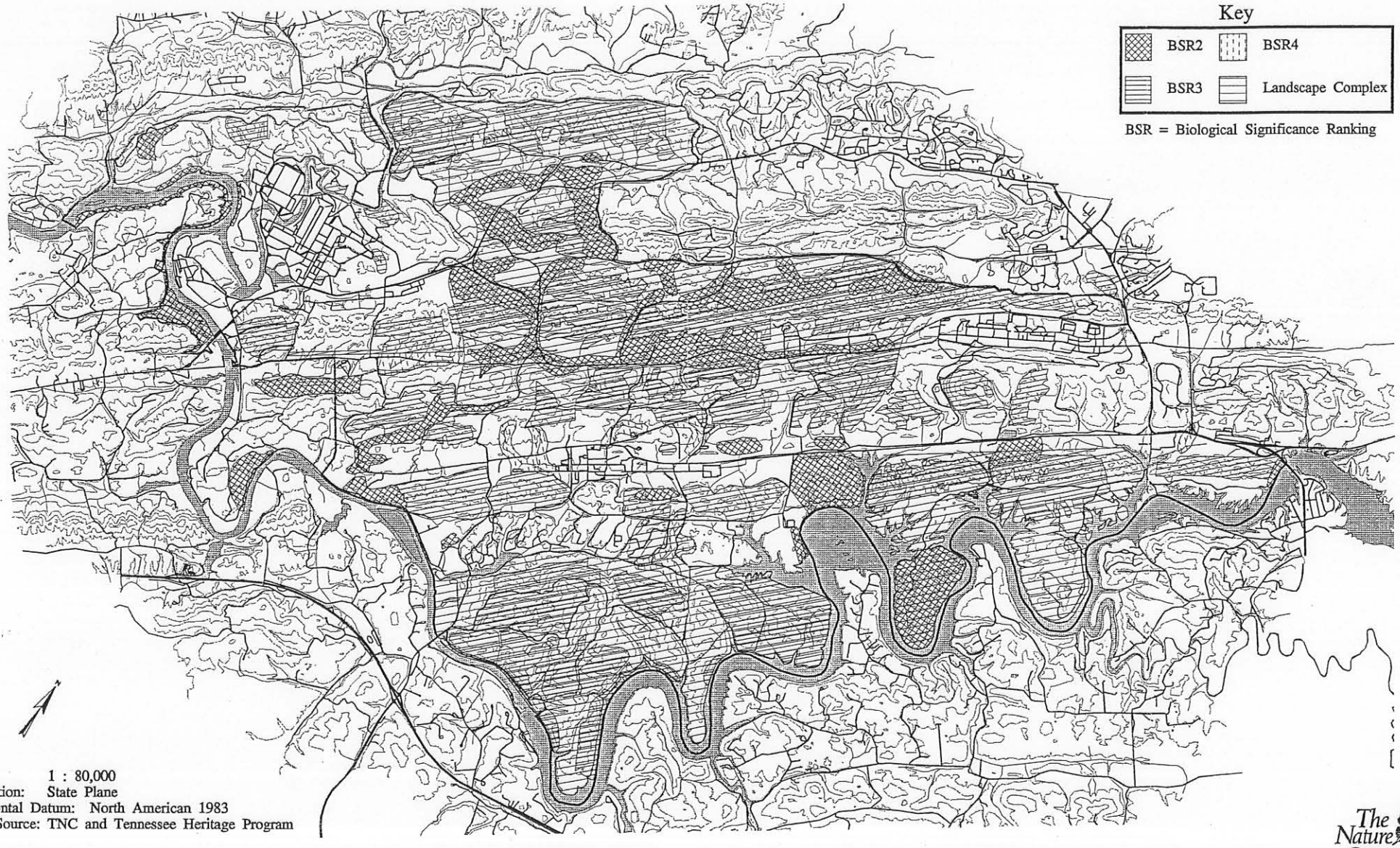
Although the ORR landscape is not pristine—reflecting centuries of human use—it is a large and well-preserved landscape in the Southern Ridge and Valley. Following its acquisition by the federal government, small portions of the reservation were developed intensively. Much of the remainder was allowed to revert to regional forest types. Simultaneously, land outside the ORR has been subjected to increasingly intensive agricultural and urban uses, resulting in profound alteration of the biotic communities in the surrounding region. These changes have resulted in serious declines of many native species of plants and animals, which evolved over millions of years in response to conditions that prevailed in the region before recent drastic human alteration.

The intact landscape of the Oak Ridge Reservation offers a continuing opportunity and challenge to conserve a representative landscape of the Southern Ridge and Valley province, with its representative communities of plant and animal species, including many rare species. Conservation at large scales offers considerable economies of effort, since management can be generalized to the ecosystems, rather than focused in detail on individual rare plants and animals. Much remains to be learned about the biodiversity resources of the ORR, however. Further inventory and analysis would allow a more authoritative and detailed account and prioritization of the biodiversity resources on site. Additional inventory and conservation planning, building on the information summarized in this report, can best provide for conservation compatible with potential uses of the reservation.

Common Ground

Future Land Use Process for the Oak Ridge Reservation

Preliminary Conservation Sites in Oak Ridge Reservation, TN



Scale: 1 : 80,000
Projection: State Plane
Horizontal Datum: North American 1983
Data Source: TNC and Tennessee Heritage Program

The Nature Conservancy

Map prepared by The Nature Conservancy, 8/28/95

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2. DESCRIPTIONS OF RARE/ENDANGERED SPECIES ON THE ORR

2.1 RARE/ENDANGERED PLANTS

1. **Spreading False-foxglove** (Aureolaria *patula*)
GROUP: Plant
GLOBAL RANK: G2
TENNESSEE RANK: S2
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Central Kentucky to northern Georgia, in the Cumberlands and Ridge and Valley provinces

HABITAT REQUIREMENTS: Spreading False-foxglove occurs on limestone bluffs and cliffs, often near or associated with streams or rivers that may or may not be impounded, as at the ORR. It is hemiparasitic, receiving some of its nutrition through attachment to the roots of oaks.

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: A number of populations of this species occur on the ORR. Many sites adjoin the Clinch River; they often occur near water's edge. It is possible that the species is being dispersed by water. Spreading False-foxglove has a small range, and is rare and scattered within that range. All remaining viable populations are important to its survival.

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2. **Heavy Sedge** (Carer gravida)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S1
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Ohio and southwest Ontario west to Minnesota, South Dakota and Wyoming, south to Tennessee and Texas

HABITAT REQUIREMENTS: Dry open soil, open disturbed areas, prairies

THREATS TO SURVIVAL: Habitat loss

ORR CONSERVATION SIGNIFICANCE: The populations on the ORR are at the eastern range limit of this primarily midwestern species. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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3. **Hairy Sharp-Scaled Sedge** (Carer *oxylepis* var. *pubescens*)
GROUP: Plant
GLOBAL RANK. G5T?
TENNESSEE RANK: S?
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: This variety of a widespread species was first described in Tennessee. Its taxonomic status needs additional study.

HABITAT REQUIREMENTS: Low moist forests

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: The current status of this species at the ORR is uncertain; it has not been seen in recent years.

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4. Appalachian Bugbane (*Cimicifuga rubifolia*)
GROUP: Plant
GLOBAL RANK: G3
TENNESSEE RANK: S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Southwest Virginia south to Tennessee; also disjunct in western Kentucky and southern Illinois

HABITAT REQUIREMENTS: Appalachian bugbane prefers limestone substrates on wooded bluffs, coves and ravines. All ORR occurrences are found on slopes flanking the Clinch River.

THREATS TO SURVIVAL: Habitat destruction. This species occurs in shaded hardwood forests and is damaged by exposure to excess light.

ORR CONSERVATION SIGNIFICANCE: This species is scarce throughout its narrow range. Important populations of this species occur on the ORR.

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5. Whorled Horsebalm (Collinsonia verticillata)
GROUP: Plant
GLOBAL RANK. G2G3
TENNESSEE RANK: S?
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Southern Virginia south to Georgia and Alabama; also disjunct in southern Ohio

HABITAT REQUIREMENTS: Moist, nutrient-rich forests, especially over calcareous or mafic rocks

THREATS TO SURVIVAL: Destruction of habitat

ORR CONSERVATION SIGNIFICANCE: The ORR is apparently near the center of the narrow range of this species; the significance of recently discovered populations is being evaluated.

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6. Pink Lady's-Slipper (Cypripedium acaule)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK. S4
FEDERAL STATUS: None

TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Newfoundland and Quebec west to Alberta, south to North Carolina, South Carolina, Tennessee, into northern Indiana, and north to Minnesota

HABITAT REQUIREMENTS: Forests and woodlands, and bogs in the northern extent of its range

THREATS TO SURVIVAL: Commercial exploitation

ORR CONSERVATION SIGNTFICANCE: The significance of ORR populations of this widespread and common species is minor. It grows in several ORR locations, mostly in moist to dry acidic woods, especially in successional pine forests. Occurrences on the ORR are more protected from collection (one of the main threats to the species) than populations on private or unrestricted public land.

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7. **Tall Larkspur** (Delphinium *exaltatum*)
GROUP: Plant
GLOBAL RANK: G3
TENNESSEE RANK: S1
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Pennsylvania and Ohio south to North Carolina, Tennessee, and Missouri, mostly west of the Blue Ridge

HABITAT REQUIREMENTS: Dry to moist soils over calcareous or mafic rock, especially in limestone woodlands, woodland edges, glades, and open areas (such as power line rights-of-way)

THREATS TO SURVIVAL: Habitat destruction and fire suppression leading to successional woody species invasion of its habitat

ORR CONSERVATION SIGNIFICANCE: One of the largest populations of this species range-wide occurs on the ORR. Several additional populations are also important to this species' survival.

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8. **Northern Bush-honeysuckle** (*Diervilla* lonicera)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Newfoundland west to Saskatchewan, south to western North Carolina, eastern Tennessee, Indiana, and Iowa

HABITAT REQUIREMENTS: Moist forests, especially around rock outcrops

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: Populations on the ORR and nearby represent a somewhat disjunct concentration of populations of this northern shrub. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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9. Branching Whitlow-grass *(Draba ramosissima)*
GROUP: Plant
GLOBAL RANK: G4
TENNESSEE RANK: S1
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Western Maryland and eastern West Virginia south to western North Carolina and eastern Tennessee

HABITAT REQUIREMENTS: Crevices of rock outcrops and dry talus slopes

THREATS TO SURVIVAL. Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species is very rare in Tennessee and has only a narrow distribution in the Central and Southern Appalachians.

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10. Nuttall's Waterweed *(Elodea nuttallii)*
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Maine and Quebec west to Minnesota and Nebraska, south to North Carolina, Mississippi, and Missouri; also scattered in the western United States

HABITAT REQUIREMENTS: Lakes, ponds, and sluggish streams for submersion

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: Nuttall's waterweed has established itself at the ORR in artificial ponds and embayments of the Clinch River. It may be dispersed by waterfowl. The ORR lies at the edge of the range of this species. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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11. Mountain Witch-alder *(Fothergilla major)*
GROUP: Plant
GLOBAL RANK: G3
TENNESSEE RANK: S2
FEDERAL STATUS: None (under consideration to be added to Candidate list)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Central North Carolina west to Tennessee, south to Alabama; also disjunct in Arkansas

HABITAT REQUIREMENTS: Rocky woodlands and bluffs

THREATS TO SURVIVAL: Destruction of habitat

ORR CONSERVATION SIGNIFICANCE: Currently known from a single site on the ORR, Mountain Witch-alder is rare and scattered throughout its range. In Tennessee, it is primarily in the Blue Ridge province, and its occurrence on the ORR is somewhat isolated. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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12. Goldenseal (Hydrastis canadensis)
GROUP: Plant
GLOBAL RANK: G4
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Vermont and Maine south to north central North Carolina, Tennessee, and Arkansas

HABITAT REQUIREMENTS: Moist nutrient-rich forests, under hardwood canopy, on slopes or in bottomlands, especially over calcareous rocks

THREATS TO SURVIVAL: Habitat destruction and collection for the herbal medicine trade

ORR CONSERVATION SIGNIFICANCE: ORR populations are more protected from collection pressures (one of the main threats to the species) than populations on private or unrestricted public land. The importance of these populations needs further assessment.

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13. Butternut (*Juglans* cinerea)
GROUP: Plant
GLOBAL RANK: *G3*
TENNESSEE RANK: S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: New Brunswick west to Minnesota, south to Georgia and Arkansas

HABITAT REQUIREMENTS: Moist forests, especially where nutrient-rich

THREATS TO SURVIVAL: Butternut is declining severely owing to a fatal canker disease. The U.S. Forest Service has placed a moratorium on harvest of this species.

ORR CONSERVATION SIGNIFICANCE: The importance and health of these populations need additional assessment. Reproducing populations are extremely rare.

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14. Short-Headed Rush (*Juncus* brachycephalus)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Maine to northern Ontario west to Wisconsin, south to Pennsylvania, Virginia, Tennessee, north Georgia, Ohio, and Indiana

HABITAT REQUIREMENTS: Seepage-fed or mineral-rich calcareous wetlands

THREATS TO SURVIVAL: Destruction of habitat

ORR CONSERVATION SIGNIFICANCE: This species is rare in Tennessee. The ORR population is one of very few known in the Ridge and Valley Province of Tennessee. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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15. **Canada Lily** (Lilium canadense)
GROUP: Plant
GLOBAL **RANK:** G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Var. *editorum* is distributed from Pennsylvania west to southern Indiana, south to Alabama. The yellow-flowered var. *canadense* is more northern.

HABITAT REQUIREMENTS: Moist areas, either forested or open (flowers and fruits best in open, sunny sites). On the ORR, Canada Lily grows in moist meadows, boggy areas, and power line openings.

THREATS TO SURVIVAL: Habitat destruction and collection for gardens

ORR CONSERVATION SIGNIFICANCE: Occurrences on the ORR are more protected from collection (one of the main threats to the species) than populations on private or unrestricted public land. Wetlands in the Ridge and Valley province are rare and often in poor condition, while those on the ORR are in better condition. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.

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16. **Fen Orchid** (Liparis *loeselii*)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S1
FEDERAL STATUS: None
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Nova Scotia and Quebec west to Mackenzie and British Columbia, south to northeast North Carolina, southwest North Carolina, Alabama, Arkansas, Kansas, Nebraska, and Washington; Rare in the southern portions of its range

HABITAT REQUIREMENTS: Seepage-fed wetlands, especially fens, bogs, and seeps

THREATS TO SURVIVAL: Habitat destruction.

ORR CONSERVATION SIGNIFICANCE: This species has fewer than 10 occurrences state-wide. It grows in ORR wetlands sheltered by immature woods. Wetlands in the Ridge and Valley province are rare and often in poor condition, while those on the ORR are in better condition.

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17. **American Ginseng** (*Panax quinquefolius*)
GROUP: Plant
GLOBAL RANK: G4

TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Quebec west to Minnesota and South Dakota, south to eastern Virginia, eastern North Carolina, north central South Carolina, Georgia, central Alabama, Louisiana, and Oklahoma

HABITAT REQUIREMENTS: Moist to fairly dry forests in somewhat acid to circumneutral soils

THREATS TO SURVIVAL: Now depleted in much of its range, owing to habitat destruction and strong collection pressure by herb collectors for the herbal medicine trade

ORR CONSERVATION SIGNIFICANCE: Ginseng occurs sporadically across ORR lands. ORR populations are more protected from collection pressures (one of the main threats to the species) than populations on private or unrestricted public land. The importance of these populations needs further assessment. Populations on the ORR are probably able to maintain a normal age structure.

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18. Tubercled Rein-orchid (*Platanthera flava* var. ***herbiola)***
GROUP: Plant
GLOBAL RANK: G4T4.
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Newfoundland west to Minnesota, south to North Carolina, Tennessee, and Missouri; Var. ***Java*** is more southern

HABITAT REQUIREMENTS: Marshes, wet meadows, and moist woods

THREATS TO SURVIVAL: Destruction of habitat

ORR CONSERVATION SIGNIFICANCE: This variety grows in several ORR wetlands; these occurrences are the largest known in Tennessee. ORR occurrences are at the southern range periphery, and may represent unique genetic material. Wetlands in the Ridge and Valley province are rare and often in poor condition, while those on the ORR are in better condition.

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19. Purple Fringeless Orchid ***(Platanthera peramoena***)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: New Jersey, southern Pennsylvania, Ohio, central Illinois, and southeast Missouri, south to northwestern South Carolina, northern Alabama, central Mississippi, and central **Arkansas**

HABITAT REQUIREMENTS: A variety of wetlands, including stream banks and moist woods or meadows (ORR populations appear in stream drainages on power line openings)

THREATS TO SURVIVAL: Habitat destruction, collection by wildflower enthusiasts

ORR CONSERVATION SIGNIFICANCE: Wetlands in the Ridge and Valley province are rare and often in poor condition, while those on the ORR are in better condition. ORR populations are more protected from collection pressures (one of the **main** threats to the species) than populations on private or unrestricted public land.

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20. Carey's Saxifrage (*Saxifraga careyana*)
GROUP: Plant
GLOBAL RANK: G3
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Southwest Virginia and Tennessee south to North Carolina and northwestern South Carolina; distribution is somewhat obscured by difficulty of separation from the related Carolina Saxifrage (*Saxifraga caroliniana*)

HABITAT REQUIREMENTS: Moist rock outcrops and cliffs

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: The ORR represents an important concentration of populations of this narrowly distributed endemic.

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21. Lesser Ladies'-tresses (Spiranthes *ovalis*)
GROUP: Plant
GLOBAL RANK: G5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Special Concern

RANGE AND DISTRIBUTION: Var. erostellata ranges from southern Pennsylvania, Illinois, Michigan, south to panhandle Florida, southern Mississippi, and southern Louisiana. Var. *ovalis* is more western.

HABITAT REQUIREMENTS: Thickets, swamp edges, and shady, moist woods

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: The significance of these populations needs further assessment.

2.2 RARE/ENDANGERED INVERTEBRATES (MUSSELS)

Note that most of the invertebrate species listed below are no longer extant on the ORR. They are included here for historic interest and can be identified by the ORR Conservation Significance section that lists their significance as "None."

1. Fine-rayed Pigtoe (Fusconaia cuneolus)
GROUP: Mussel
GLOBAL RANK: G1
TENNESSEE RANK: S1
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: This extremely rare mussel is restricted to the Tennessee River drainage.

HABITAT REQUIREMENTS: This species attaches to firm cobble and gravel substrate in streams with moderate current. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or similar practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A good-quality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None. The fine-rayed pigtoe, Fusconaia cuneolus, was located below Melton Hill Dam, and its record (1919 or earlier) is pre-impoundment for both Watts Bar and Melton Hill dams. Another occurrence of Fusconaia cuneolus, located above Melton Hill Dam, was documented in 1914, which is also before the impoundment of both dams. These occurrences are not extant (Bogan and Parmalee 1983).

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2. Shiny Pigtoe (*Fusconaia* edgariana = Fusconaia *cor*)
GROUP: Mussel
GLOBAL RANK: G1
TENNESSEE RANK: S1
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Relict populations exist in the Clinch, Powell, North Fork Holston, and Paint Rock rivers in northeast Tennessee and southwest Virginia.

HABITAT REQUIREMENTS: This species is found in shoal and riffle areas of clear streams with a moderate to fast current and sand or gravel substrates. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides a habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices, and decreased water quality from coal mining activity or similar practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution

detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A goodquality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None. This mussel was located below Melton Hill Dam, and its record of 1919 or earlier is before the impoundment of both Melton Hill and Watts Bar dams. The shiny pigtoe is not extant on the ORR (Bogan and Parmalee 1983).

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3. **Dromedary** Pearlymussel *(Dromus dromas)*
GROUP: Mussel
GLOBAL RANK: G1
TENNESSEE RANK: S2
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Historically this species is found throughout the Cumberland region. Currently it is known from the Clinch and Powell drainages in Tennessee and Virginia and the Cumberland and Tennessee Rivers in Tennessee.

HABITAT REQUIREMENTS: This species mostly dwells in riffles and sandy and gravelly shoals with moderate stream flow velocity, but it is also found in deeper, slower channels and pools in Tennessee. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides a habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or other practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A goodquality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Often, rare species are found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None. The dromedary pearlymussel, *Dromus dromas*, was located above Melton Hill Dam, and its 1914 record predates impoundment of both Watts Bar and Melton Hill dams. The dromedary pearlymussel is not extant on the ORR (Bogan and Parmalee 1983).

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4. **Spiny Riversnail** (*Io fluvialis*)
GROUP: Snail
GLOBAL RANK: G2
TENNESSEE RANK: S2
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Endemic to the upper reaches of the Tennessee River drainage; restricted to the lower Nolichucky River in Tennessee, and the Powell and Clinch Rivers in Tennessee and Virginia

HABITAT REQUIREMENTS: This species is found in riffles and shoals, with water depths from a few centimeters to about 1 meter, in rapid or moderately flowing, well-oxygenated rivers. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides a habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or other practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals.

A goodquality occurrence of a population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Relict populations that are not reproducing successfully will consist only of larger individuals.

ORR CONSERVATION SIGNIFICANCE: None; believed extirpated by impoundment; 59 total records in Tennessee

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5. **Pink Mucket** (Lampsilis abrupra = L. *orbiculata*)
GROUP: Mussel
GLOBAL RANK: G2
TENNESSEE RANK: S2
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Mississippi, Ohio, Tennessee, and Cumberland river systems in Central and Eastern U.S. At present, this species is most frequently found in the Tennessee and Cumberland River systems in Kentucky, Tennessee and Virginia, the Meramec River in Missouri, and in West Virginia's Kanawha River below Kanawha Falls. It appears to be reproducing in those areas. It is found at TNC Pendelton Island Preserve on Clinch River.

HABITAT REQUIREMENTS: A large river species, the Pink Mucket is able to survive and reproduce in impoundments with river-like conditions, that is, reservoirs that undergo frequent and wide-scale changes

in water level. It prefers moderate to fast flowing currents over cobbles, gravel, sand, or silt bottoms, and is usually found in water up to about 1 meter deep, but may sometimes occur in deeper waters with slower currents. Populations are rarely if ever found in extremely slow moving or standing water. In general, mussel populations and communities are healthier when found in areas with submerged or floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides a habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or other practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Coal-washing operations are a particular threat to this species. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A good-quality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None. Species believed extirpated by impoundment (not seen in the lower Clinch River since 1970). It was located above Melton Hill Dam, and its record of 1920 or earlier is before the impoundment of both Melton Hill and Watts Bar Dams. All known extant populations are of old, nonreproductive, relict individuals (Bogan and Parmalee 1983).

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6. **Orangefoot Pimpleback** (*Plethobasus* cooperianus)
GROUP: Mussel
GLOBAL RANK: G1
TENNESSEE RANK: S1
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Lower Holston, Clinch, French Broad, Tennessee, Cumberland rivers in Tennessee; also the Ohio River, Wabash River, and possibly other river systems in Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, and Illinois

HABITAT REQUIREMENTS: This species is found in large rivers with sand and gravel substrate. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides a habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or similar practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and

increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A good-quality occurrence of a mussel population consist. of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None. This species was located below Melton Hill Dam, and its 1960 record is after the impoundment of Watts Bar Reservoir but before the construction of Melton Hill Dam. The orangefoot pimpleback is no longer extant on the ORR (Bogan and Parmalee 1983).

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7. **Pyramid Pigtoe** (Pleurobema *rubrum*)
GROUP: Mussel
GLOBAL RANK: G2G3
TENNESSEE RANK: S2S3
FEDERAL STATUS: Candidate (C2).
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Widespread but rare in the Mississippi, Wabash, Tennessee, and Ohio River drainages

HABITAT REQUIREMENTS: This species is found on mud or sand bottoms in large, deep rivers but may also be found on the coarse substrates of shoals and sandbars in shallower water. In general, mussel populations and communities are healthier when found in areas with submerged/floating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or similar practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. This species may be targeted by collectors for use in button and jewelry making. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A good-quality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: The pyramid pigtoe, Pleurobema *rubrum*, was found below Melton Hill Dam, and its 1983 record occurs after the construction of both Melton Hill and Watts Bar dams. This species is apparently extant on the ORR (Bogan and Parmalee 1983).

8. Rough Rabbitsfoot (*Quadrula cylindrica* strigillata)
GROUP: Mussel
GLOBAL RANK: G4T2T3
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Clinch, Powell, and Holston Rivers of Tennessee and Virginia

HABITAT REQUIREMENTS: This species is found in creeks and rivers with moderate to swift currents. In general, mussel populations and communities are healthier when found in areas with submergedlfloating and emergent aquatic vegetation. The vegetation apparently stabilizes stream substrates and provides habitat for fish, which are important in the reproductive portion of the mussel life cycle.

THREATS TO SURVIVAL: Immediate threats to populations include increased sediment load in runoff due to improper mining, construction, and agricultural practices and decreased water quality from coal mining activity or similar practices. Sedimentation may also result from decreases in current velocity caused by decreased flow volumes or impoundment. Pollution from mining, from agricultural runoff of herbicides, pesticides, and fertilizers, and from industrial and residential wastes is a threat. Pollution detrimentally alters habitats by decreasing dissolved oxygen levels, elevating ammonia concentrations, and increasing levels of metals and other toxic substances. Dredging destroys habitat and often removes individuals. Collection of non-threatened species often is done indiscriminately, harming threatened species. Elimination of host fishes necessary for completion of the reproductive cycle can be a particular threat to isolated populations.

A good-quality occurrence of a mussel population consists of a wide range of sizes of individuals in a single habitat, indicating successful reproduction within the population. Rare species are often found in association with a diversity of other mussel species. Relict populations that are not reproducing successfully will consist only of larger individuals. Such populations often are associated with recent habitat alterations, such as dam construction or increased sediment loading from soil disturbance within the watershed.

ORR CONSERVATION SIGNIFICANCE: None (no longer extant at the ORR). An individual of this species was located below Melton Hill Dam in the portion of Clinch River impounded by Watts Bar Dam. Although its 1960 discovery is post-impoundment, this record is not extant (Bogan and Parmalee 1983). It lived on the ORR before the impoundment of Watts Bar and Melton Hill dams.

2.3 RARE/ENDANGERED VERTEBRATES (BIRDS, REPTILES, AMPHIBIANS, FISH, MAMMALS)

1. Cooper's Hawk (Accipiter cooperii)
GROUP: Bird
GLOBAL RANK: G4
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Southern Canada to northern Mexico

HABITAT REQUIREMENTS: Cooper's hawks prefer deciduous woods interrupted by meadows and other clearings, but can occupy a wide range of habitats. Midsuccessional conditions are favorable. Considered an extremely common species in the 1930s, the Cooper's hawk has declined seriously.

THREATS TO SURVIVAL: Human development of habitat, loss of food sources, and possibly pesticides

ORR CONSERVATION SIGNIFICANCE: The ORR represents one of the largest contiguous areas of high-quality habitat in the Southern Ridge and Valley.

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2. Sharp-Shinned Hawk (*Accipiter striatus*)
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Canada to southern United States

HABITAT REQUIREMENTS: Woodland and early successional upland habitats

THREATS TO SURVIVAL: Human development of habitat, loss of food sources, and possibly pesticides

ORR CONSERVATION SIGNIFICANCE: The ORR represents one of the largest contiguous areas of high-quality habitat in the Southern Ridge and Valley.

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3. Bachman's Sparrow (*Aimophila aestivalis*)
GROUP: Bird
CLOBAL RANK: G3
TENNESSEE RANK: S2
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: The species is widely distributed but local. The breeding range was formerly from southern Missouri, Illinois, and Indiana, to central Ohio, southwestern Pennsylvania, and Maryland, south to south-central Florida, and west along the Gulf Coast to eastern Texas. Currently it is not present in the extreme northeastern part of this range and is extirpated from Maryland and Pennsylvania. Winter ranges extend across the southeastern United States from east Texas to southeastern North Carolina in the Outer Coastal Plain and, rarely, in the Inner Coastal Plain.

HABITAT REQUIREMENTS: Historically, the species is found in mature pine woodlands with a well-developed herbaceous stratum and low density in the shrub and midstory layers. Now it is found in areas of dense herbaceous vegetation with briars and scattered trees and shrubs, including recently clear-cut forests and early successional stages of old fields. It is also found in dry oak woodlands in western portions of its range, and in limestone glade habitats with scattered red cedar and other shrubs and small trees. It avoids broad open areas and wooded habitats with a dense understory.

THREATS TO SURVIVAL: Loss of breeding habitat through conversion of open pine woodlands to more dense pine plantations, and lower abundance of early successional stages of old fields due to urbanization and shortages of newly abandoned farmland; loss of open habitat due to fire suppression; brood parasitism by brown-headed cowbirds, and possibly other detrimental interactions with other bird species, such as increased competition for breeding habitat, and nest disturbance by crows, snakes, and other predators.

Immediate threats to populations include overgrazing in herbaceous habitats and sharp increases in density of woody species in herbaceous habitats because of fire suppression. Specifically, increases in shrubs and midstory trees in an otherwise open understory in mature pine and oak woodlands result in habitat loss.

ORR CONSERVATION SIGNIFICANCE: Maintenance of grassy field conditions provides habitat for this species in the region, which is primarily distributed in the southeastern Coastal Plain. Old fields and power line rights-of-way in early successional stages, as well as other sites, can provide habitat. Large declines have occurred in Tennessee from the 1950s through the early 1980s as early successional habitats have given way to urbanized land and forests.

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4. Mole Salamander *(Ambystoma talpoideum)*

GROUP: Amphibian
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: South Carolina west to southern Illinois and southeastern Oklahoma, south to northern Florida and east Texas; disjunct in Virginia, North Carolina, South Carolina, Georgia, Alabama, Tennessee, and Kentucky

HABITAT REQUIREMENTS: Moist, low forests, logs, burrows

THREATS TO SURVIVAL: Loss of breeding habitat

ORR CONSERVATION SIGNIFICANCE: Mole salamanders require damp, low woodlands with ponds for breeding. The ORR represents one of the largest contiguous areas of high-quality habitat in the Southern Ridge and Valley. The present status of this species on the ORR needs additional investigation.

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5. Grasshopper Sparrow (*Ammodramus savannarum)*

GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Southern Canada to southern United States; also West Indies and southern Mexico to northern South America

HABITAT REQUIREMENTS: Open grassy areas, such as weedy meadows and open grasslands

THREATS TO SURVIVAL: Loss of habitat

ORR CONSERVATION SIGNIFICANCE: Minor. Maintenance of grassy field conditions provides habitat for this species. Old fields and power line rights-of-way in early successional stages, as well as other sites, can provide habitat. Declines have occurred in Tennessee since the 1950s as early successional habitats have given way to urbanized land and forests.

---

6. Green Salamander (*Aneides aeneus)*

GROUP: Amphibian
GLOBAL RANK: G4

TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: In the Cumberland/Allegheny Mountains of southwestern Pennsylvania, northeastern West Virginia, western Maryland, and southern Ohio to northern Alabama and northeastern Mississippi; also disjunct in southwest North Carolina, northwestern South Carolina and northeastern Georgia

HABITAT REQUIREMENTS: Crevices in moist rocks in forests; less typically species is found under bark or logs.

THREATS TO SURVIVAL: Loss of habitat, timber cutting

ORR CONSERVATION SIGNIFICANCE: This species is rare throughout its range, and ORR populations represent important populations of this species. The present status of this species on the ORR needs additional investigation.

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7. Red-shouldered Hawk ***(Buteo lineatus)***
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Widespread in North America

HABITAT REQUIREMENTS: Primarily mature hardwood forests, especially bottomlands where forests are more likely to remain in good condition

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species was seen during an FY 1994 ORR avian survey. The ORR represents one of the largest contiguous areas of high-quality habitat in the Southern Ridge and Valley.

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8. Highfin Carpsucker (*Carpiodes velifer*)
GROUP: Fish
GLOBAL RANK: G4G5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Widespread in central United States, primarily in the Mississippi River drainage

HABITAT REQUIREMENTS: Pools in larger rivers with moderate to swift currents or in quiet sloughs or oxbows adjacent to rivers

THREATS TO SURVIVAL: Impoundments, water quality degradation, sedimentation

ORR CONSERVATION SIGNIFICANCE: Possibly none. It is unlikely that this species persists in the Clinch River adjacent to the ORR.

---

9. Six-lined Racerunner (Cnemidophorus sexlineatus)
GROUP: Reptile
GLOBAL RANK: G5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Maryland west to Missouri, south to southern Florida and eastern Texas

HABITAT REQUIREMENTS: Open, rocky, dry areas

THREATS TO SURVIVAL: Destruction of habitat

ORR CONSERVATION SIGNIFICANCE: Minor. The importance of ORR populations of this species requires additional investigation.

---

10. Black Vulture (*Coragyps atratus*)
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Pennsylvania west to Ohio, south to southern South America

HABITAT REQUIREMENTS: This species hunts in open country and chooses tall trees or cliff ledges for night-time roosting.

THREATS TO SURVIVAL: Uncertain

ORR CONSERVATION SIGNIFICANCE: Black vultures have a large and thriving population on the ORR, partly owing to the abundance of deer and the organized disposal of deer carcasses. The importance of populations of Black Vultures on the ORR requires additional assessment.

---

11. Hellbender (Cryptobranchus alleganiensis)
GROUP: Amphibian
GLOBAL RANK: G4
TENNESSEE RANK: S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: South central New York west to southern Illinois, south to western North Carolina, northern Georgia, northern Alabama, and northeastern Mississippi; disjunct in east central Missouri

HABITAT REQUIREMENTS: Aquatic: rivers and large streams with rocky cover

THREATS TO SURVIVAL: Impoundments, water quality degradation, sedimentation

ORR CONSERVATION SIGNIFICANCE: Additional inventory work is needed for this species on the ORR. Hellbenders are members of the ancient family Cryptobranchidae, distributed only in central and eastern North America (broadly Appalachian) and eastern Asia.

12. Blue Sucker (*Cycleptus* elongatus)
GROUP: Fish
GLOBAL. RANK: G3
TENNESSEE RANK: S2
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: From the Rio Grande/Pecos drainage of Texas, New Mexico, and adjacent states in Mexico, north and east to the Mississippi, Missouri, and Ohio river drainages, and the Mobile Bay basin in Alabama

HABITAT REQUIREMENTS: This species inhabits channels and flowing pools with a moderate current in large rivers and is occasionally found in artificial impoundments. It spawns in riffle areas in the upper reaches of larger stream systems.

THREATS TO SURVIVAL: Construction of impoundments, siltation, and pollution; decreases in surface runoff. Immediate threats to populations include construction of impoundments, construction, mining, and agricultural practices that increase sediment load in runoff, decreased water quality from sewage effluent and agricultural runoff, dams that create barriers to upstream migrations for spawning, and stranding of individuals in irrigation canals.

ORR CONSERVATION SIGNIFICANCE: The significance of the ORR population of this fish requires additional investigation; the record is from 1960. Blue Sucker reaches weights of up to 10 pounds and was a popular commercial fish before its decline. The blue sucker prefers large rivers with moderate current, and the adults migrate upstream in salmon-like fashion to spawn in the spring. Some potential spawning habitat may occur on the ORR.

13. Cerulean Warbler (Dendroica cerulea)
GROUP: Bird
GLOBAL RANK: G4
TENNESSEE RANK : S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Eastern United States (wintering in northern South America)

HABITAT REQUIREMENTS: Large tracts of undisturbed deciduous forest on slopes or in bottomlands; possibly also canebrakes

THREATS TO SURVIVAL: Loss and fragmentation of extensive hardwood forests

ORR CONSERVATION SIGNIFICANCE: The ORR, with its extensive tracts of hardwood forest, may furnish important habitat for this critically rare and declining warbler. Additional investigation of its status on the ORR is needed.

14. Eastern Cougar (Felis *concolor* couguar)
GROUP: Mammal

GLOBAL RANK: G4TH
TENNESSEE RANK: SH
FEDERAL STATUS: Endangered
TENNESSEE STATUS: Endangered

RANGE AND DISTRIBUTION: Eastern North America (formerly), now believed to be extinct

HABITAT REQUIREMENTS: Cougars have large home ranges (often exceeding 100 square miles) and require extensive and remote tracts of forest. White-tailed deer are an important part of this species' diet. The eastern subspecies is believed to be extinct.

THREATS TO SURVIVAL: Believed extinct

ORR CONSERVATION SIGNIFICANCE: None. **An** eastern cougar was sighted at the ORR many years ago. There is no credible recent evidence of surviving populations in Tennessee.

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15. **Bald Eagle** (Haliaeetus leucocephalus)
GROUP: Bird
GLOBAL RANK: G4
TENNESSEE RANK: S1
FEDERAL STATUS: Endangered (proposed for downlisting to Threatened)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Throughout North America in suitable habitats

HABITAT REQUIREMENTS: Lakes, rivers, and oceans with forested fringes

THREATS TO SURVIVAL: Human disturbance of nesting sites, loss of habitat (especially suitable nesting trees); formerly serious decline was related to pesticides

ORR CONSERVATION SIGNIFICANCE: The ORR represents an extensive stretch of undeveloped shoreline along two reservoirs that have good food supplies.

---

16. **Flame Chub** (Hemitremia *flammea*)
GROUP: Fish
GLOBAL RANK: G4
TENNESSEE RANK: S4
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Tennessee, northern Alabama, and northern Tennessee, in the Cumberland and Tennessee River drainages

HABITAT REQUIREMENTS: Small spring-fed streams with gravel substrates

THREATS TO SURVIVAL: Destruction of habitat, especially pollution, siltation, and other alterations of natural stream systems

ORR CONSERVATION SIGNIFICANCE: Additional investigation of its status on the ORR is needed. The one record is old, but suggests a thriving population at that time; much potentially suitable habitat is present.

---

17. Northern River Otter ***(Lutra canadensis)***
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Widespread in North America

HABITAT REQUIREMENTS: Northern river otters inhabit wooded streams in large riparian forested tracts, rivers, and lakes, and they eat a variety of aquatic and terrestrial prey species.

THREATS TO SURVIVAL: Loss of habitat, including areas that are inundated by impoundment, and declines in water quality; historically also exploited by trappers

ORR CONSERVATION SIGNIFICANCE: Uncertain. The current status of this species on the ORR needs investigation.

---

18. Red-headed Woodpecker (*Melanerpes erythrocephalus*)
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Widespread in eastern North America

HABITAT REQUIREMENTS: Open and mature hardwood forests with large trees and snags

THREATS TO SURVIVAL: Loss of habitat

ORR CONSERVATION SIGNIFICANCE: Its status requires additional investigation. This species has been recently reported for the ORR; whether or not the record is a breeding record is uncertain.

---

19. Woodland Jumping Mouse ***(Napaeozapus insignis)***
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Labrador west to Minnesota, south to West Virginia and Wisconsin, and in the Appalachians south to Georgia and Alabama

HABITAT REQUIREMENTS: This species occupies a wide variety of sites, especially moist evergreen forests such as hemlock-hardwood.

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: Records of this species have been reported from a number of sites; its current status on the ORR needs additional investigation. The ORR's varieties of moist and wetland habitats in the Ridge and Valley are likely important for this species.

---

20. Black-crowned Night Heron (*Nycticorax nycticorax*)
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S1S2
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Widespread in eastern North America

HABITAT REQUIREMENTS: Large marshy areas and margins of large lakes

THREATS TO SURVIVAL: Loss of wetland habitats and development along lake and reservoir shores

ORR CONSERVATION SIGNIFICANCE: The ORR offers extensive undeveloped lake shoreline, suitable habitat for this species. There is a recent report of this species on the ORR; the importance of the species' presence requires additional investigation.

---

21. Eastern Slender Glass Lizard ***(Ophisaurus attenuatus longicaudus)***
GROUP: Reptile
GLOBAL RANK: G5T5
TENNESSEE RANK: S3
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Southeastern Virginia south to Florida, west to Louisiana, north to Tennessee and Kentucky

HABITAT REQUIREMENTS: Open, dry areas

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species has been recorded at several ORR locations. Its importance on the ORR requires additional investigation.

---

22. Osprey ***(Pandion haliaetus)***
GROUP: Bird
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Widespread in North America and other continents

HABITAT REQUIREMENTS: Shorelines of lakes, reservoirs, and/or extensive riverine systems, with large shoreline trees for roosting

THREATS TO SURVIVAL: Water quality problems and shoreline development; formerly pesticide residues

ORR CONSERVATION SIGNIFICANCE: The ORR offers extensive undeveloped lake shoreline, suitable habitat for this species. The species has been repeatedly and recently documented on the ORR and adjacent waters. State efforts to re-establish this bird in the Clinch River Valley have shown considerable success.

---

23. **Tennessee Dace** (Phoxinus *tennesseensis*)
GROUP: Fish
GLOBAL RANK: G2G3
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Small streams in the Ridge and Valley physiographic province of the upper Tennessee River drainage, from southwestern Virginia to near Chattanooga, Tennessee; scattered populations are also found in the adjacent Blue Ridge and Cumberland Plateau

HABITAT REQUIREMENTS: This species is found near cover of debris or undercut banks in slow moving pools in clear, first-order, predominantly spring-fed streams. Stream bottoms consist of silt, fine gravel, and cobbles. It breeds in riffles on clean gravel substrates.

THREATS TO SURVIVAL: Siltation that destroys required spawning habitat. Reduction in surface flow or groundwater recharge capability may reduce habitat. Channelization and impoundment eliminate habitat. It may also compete with an introduced species—*Phoxinus oreas* (mountain redbelly dace.) Immediate threats to populations include land uses that increase siltation in low-order streams. Landscape changes that reduce stream flow volume may reduce or eliminate available habitats. Bait seining removes individuals from populations, and bait fishing may introduce exotic species to a community, which may be detrimental to populations of this species.

ORR CONSERVATION SIGNIFICANCE: This species is found extensively on the ORR, one of its most important remaining populations, "abundant in portions of the East Fork Poplar Creek system, Roane County (on the Dept. of Energy Reservation (Ryon & Loar, 1988), which may offer a stronghold for the species)" (Etnier and Starnes 1993). A weir on Bear Creek has apparently created a large population in that drainage by limiting upstream movement of predators and competing species. Recommendations for management of this species include introductions to other appropriate habitats on the ORR. Spawning behavior and nests have been observed for several occurrences on the ORR, indicating the potential for successful reintroduction.

---

24. Northern **Pine Snake** (Pituophis melanoleucus melanoleucus).
GROUP: Reptile
GLOBAL RANK: G5T?
TENNESSEE RANK: S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: Threatened

RANGE AND DISTRIBUTION: Widespread in North America

HABITAT REQUIREMENTS: Open dry woodlands and forests, often at least partly pine-dominated, with little understory

THREATS TO SURVIVAL: Habitat loss

ORR CONSERVATION SIGNIFICANCE: The species is documented on many ORR sites. The occurrence of pine snakes at the ORR requires additional investigation.

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25. Paddlefish *(Polyodon* spathula)
GROUP: Fish
GLOBAL RANK: G4
TENNESSEE RANK: S3
FEDERAL STATUS: Candidate (C2)
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Central United States, primarily in the Mississippi drainage

HABITAT REQUIREMENTS: Paddlefish inhabit large, silty rivers and feed by filtering small organisms as they swim. Specimens weighing over 100 pounds have been documented. The species migrates upstream within large river systems to spawn in the upper reaches.

THREATS TO SURVIVAL: Primarily the damming of rivers and declines in water quality. Dams alter hydrology, change habitat, and serve as bamers to spawning migrations. Pursuit by commercial fisherman for its meat and caviar are also a factor in the decline of this species. Overfishing is a problem.

ORR CONSERVATION SIGNIFICANCE: This species was recently recorded as being in ORR waters. The paddlefish is one of only two species in the family, the other species (and genus) being endemic to the Yangtze River system of China. The family is ancient and relictual.

---

26. Cinereus Shrew or Masked Shrew *(Sorer* cinereus)
GROUP: Mammal
GLOBAL FUNK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Widespread in northern North America, south in eastern North America in the Appalachians to northern Georgia and northern Alabama

HABITAT REQUIREMENTS: Moist forests, thickets, and open areas

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: It is known from several ORR locations; its populations on the ORR need additional investigation.

---

27. Long-Tailed Shrew or Rock Shrew *(Sorer dispar)*
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S2
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Primarily Appalachian, from Maine south to North Carolina and Tennessee

HABITAT REQUIREMENTS: Moist deciduous and mixed deciduous-evergreen forests, especially where rocky

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This shrew is known from several ORR locations; its populations on the ORR need additional investigation.

28. Smoky Shrew (*Sorex fumeus*)
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL. STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Southeastern Canada, south in the Appalachians to North Carolina and Tennessee

HABITAT REQUIREMENTS: Moist hardwood or evergreen forests with abundant leaf litter and downed logs

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This shrew is known from several ORR locations; its populations on the ORR need additional investigation.

---

29. Southeastern Shrew ***(Sorer longirostris).***
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Virginia west to Illinois, south to Florida and Louisiana

HABITAT REQUIREMENTS: Moist forests and open areas

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species is known from several ORR locations; its populations on the ORR need additional investigation.

---

30. Southern Bog Lemming ***(Synaptomys cooperi)***
GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL. STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Southeastern Canada, south to North Carolina, northwestern South Carolina, eastern Tennessee, Arkansas and Kansas

HABITAT REQUIREMENTS: Wet meadows, bogs, swamps, and damp woods

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species is known from several ORR locations; its populations on the ORR need additional investigation.

---

31. Cumberland Slider (*Trachemys scripta troostii*)

GROUP: Reptile
GLOBAL RANK: G5T?
TENNESSEE RANK: S3S4
FEDERAL STATUS: None
TENNESSEE STATUS: None

RANGE AND DISTRIBUTION: Extreme southwestern Virginia and northeastern Tennessee

HABITAT REQUIREMENTS: Quiet waters of ponds and pools

THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: The importance of ORR populations of this turtle is uncertain, but this subspecies is very narrowly restricted in distribution. It is locally abundant within its narrow range.

---

32. Meadow Jumping Mouse (*Zapus hudsonius*)

GROUP: Mammal
GLOBAL RANK: G5
TENNESSEE RANK: S4
FEDERAL STATUS: None
TENNESSEE STATUS: Deemed in Need of Management

RANGE AND DISTRIBUTION: Widespread in northern North America

HABITAT REQUIREMENTS: The species prefers open fields with abundant herbaceous cover, and grass seeds compose most of its diet.

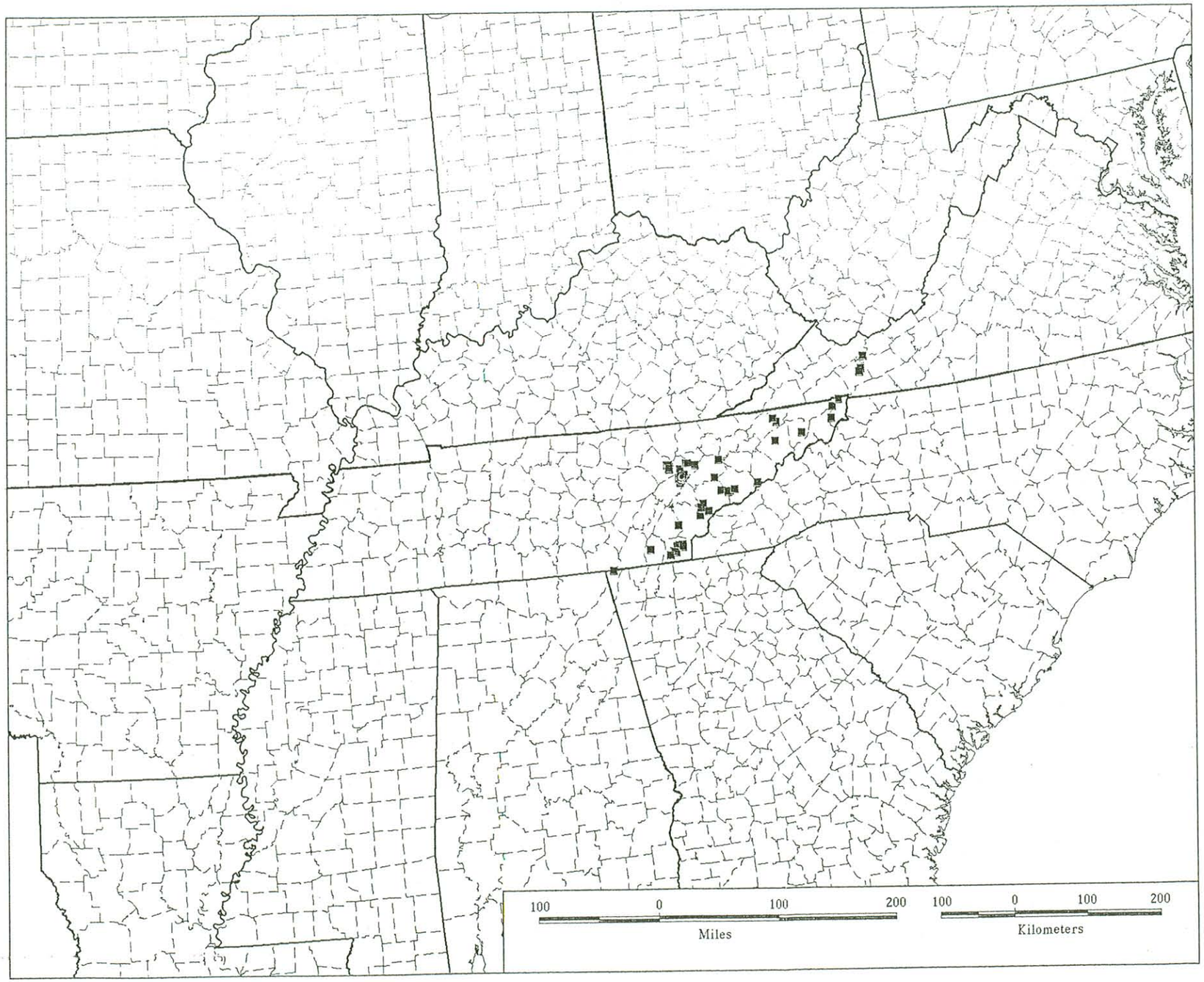
THREATS TO SURVIVAL: Habitat destruction

ORR CONSERVATION SIGNIFICANCE: This species has many documented occurrences at the ORR; their importance requires additional investigation.

---

33. Heron Rookery

Records indicate that three heron rookeries (communal nesting areas) are on the ORR. Great blue herons (Ardea *herodias*), tall, blue-gray birds with wing-spans of up to 6 feet, inhabit all three sites. One great egret (*Casmerodius albus*), a bird listed as Deemed in Need of Management in Tennessee, was also spotted near the great blue heron rookery on Lower Poplar Creek. Great egrets have snowy white plumage and live in marshes, ponds, swamps, lagoons, or weedy lakes. Although these species are not rare, rookeries are important conservation sites since they are critical to the breeding and reproduction of wading birds.



OAK RIDGE RESERVATION

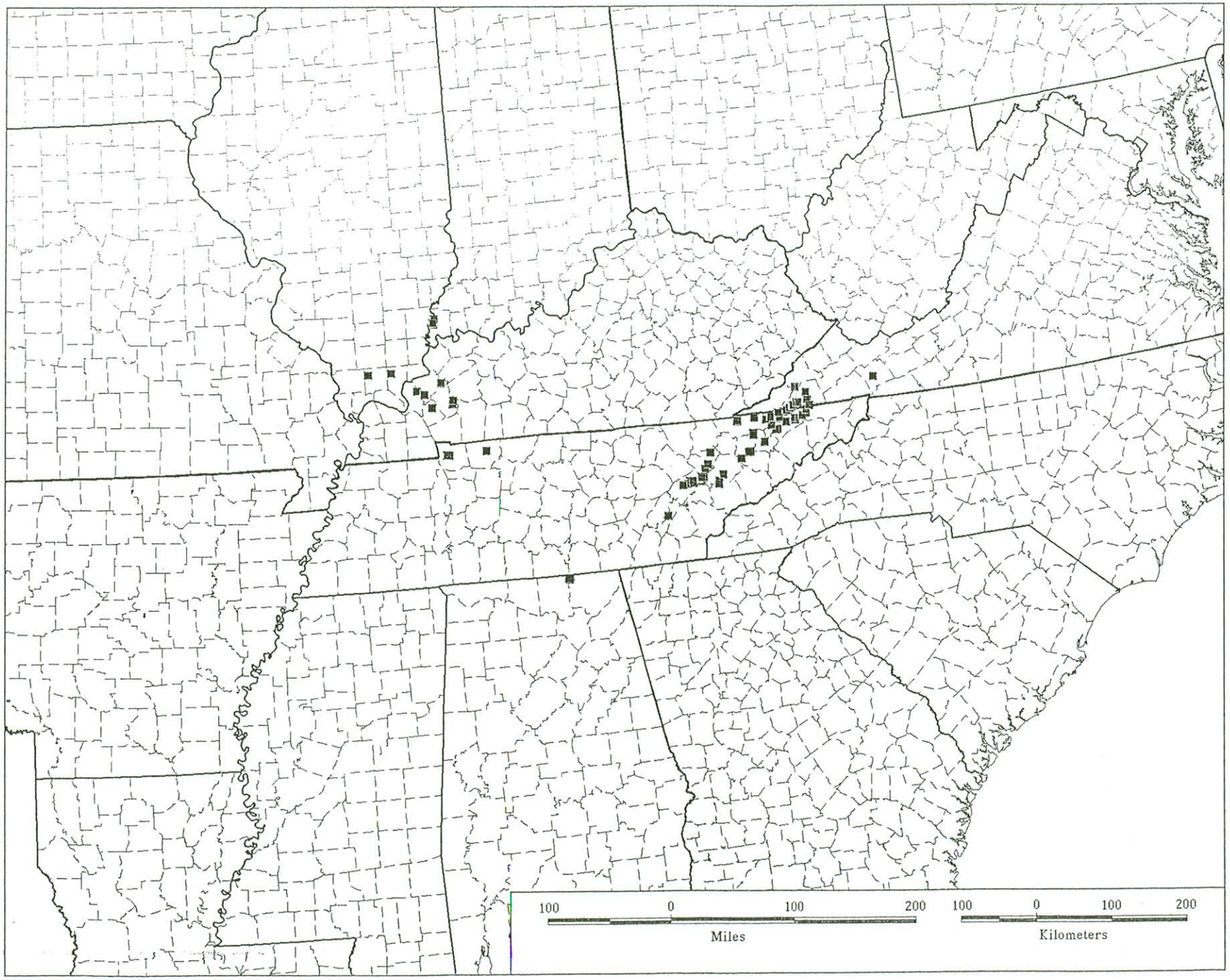
Species Distribution Map For

Phoxinus tennesseensis

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995



OAK RIDGE RESERVATION

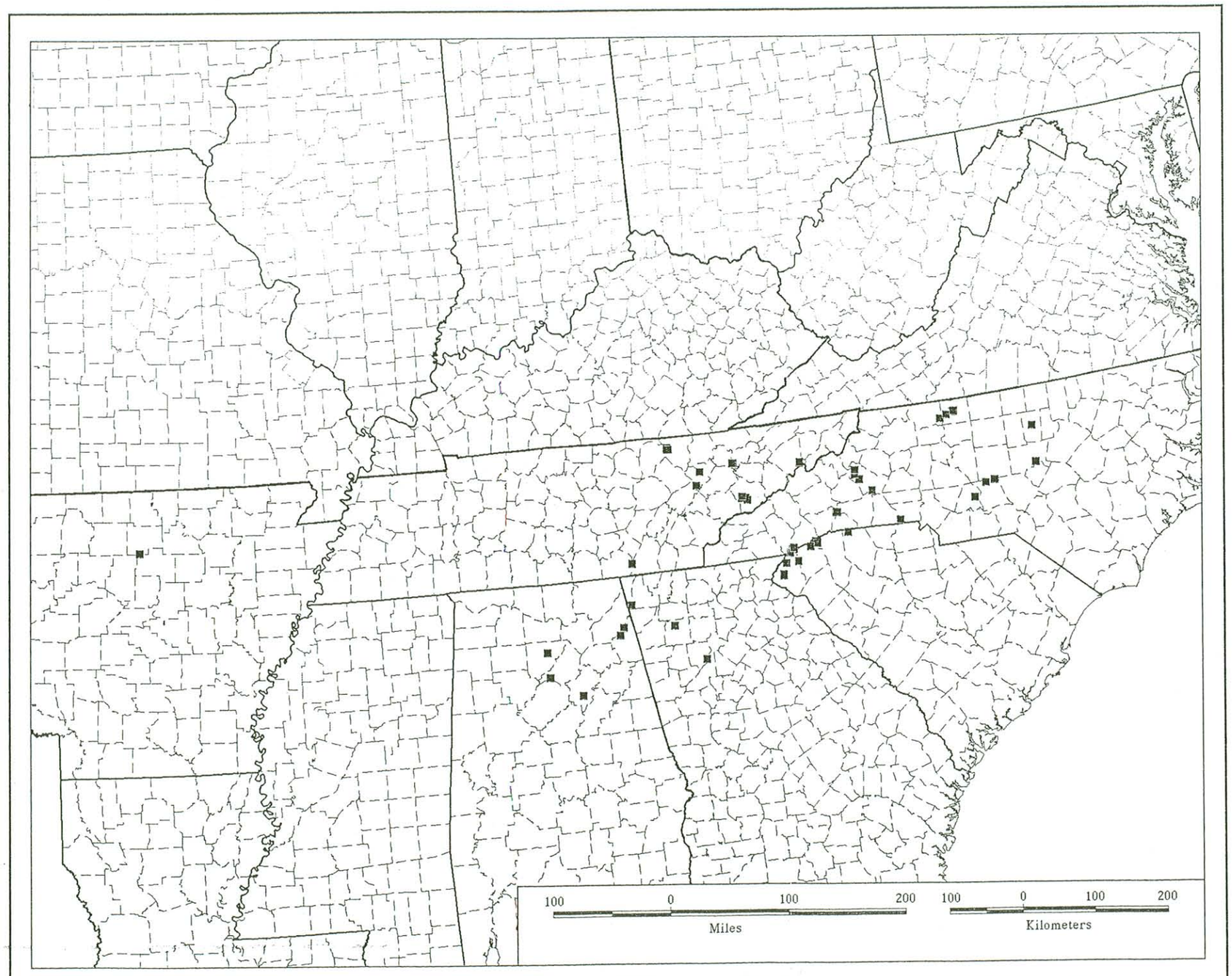
Species Distribution Map For

Cimicifuga rubifolia

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995



OAK RIDGE RESERVATION

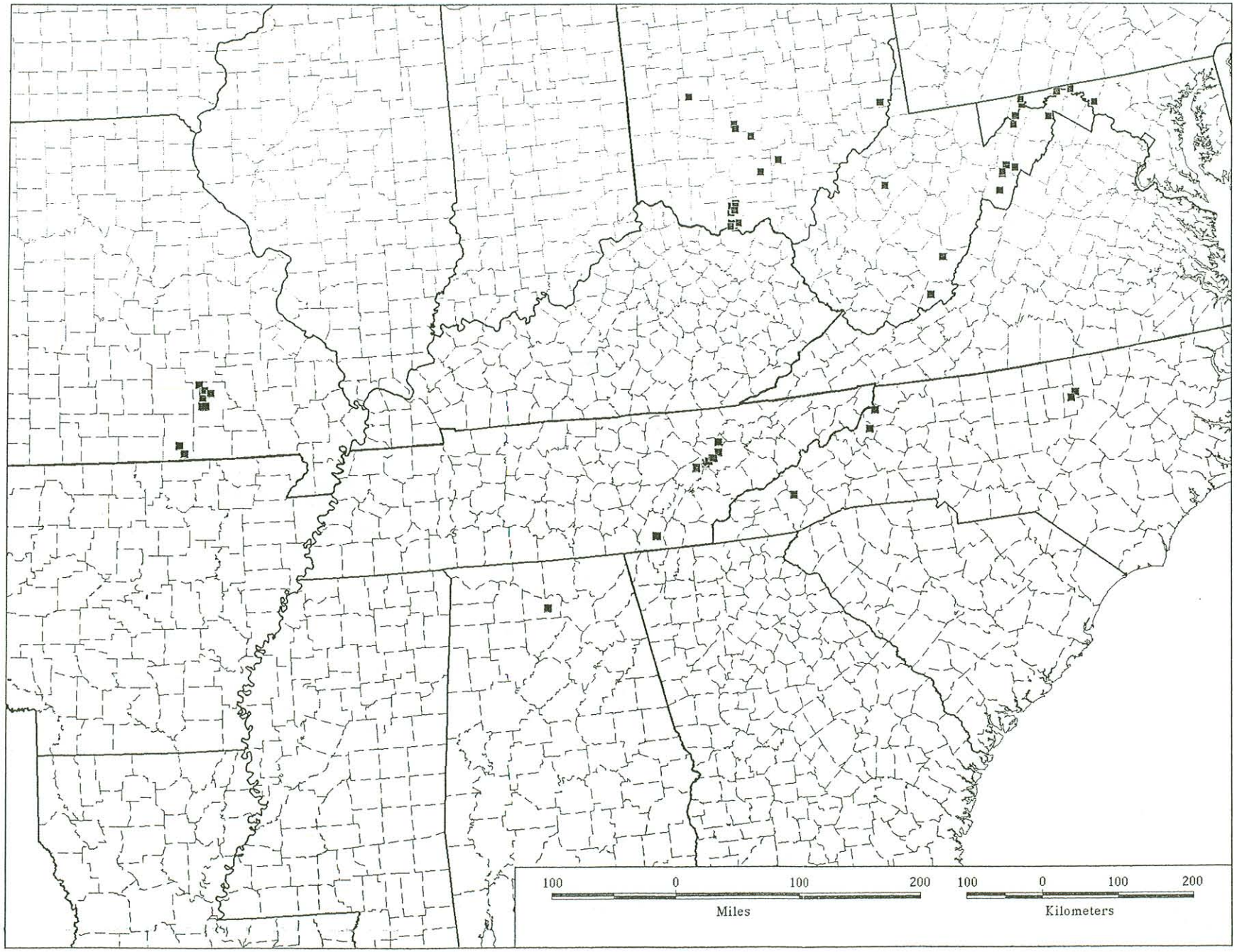
Species Distribution Map For

Fothergilla major

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995



OAK RIDGE RESERVATION

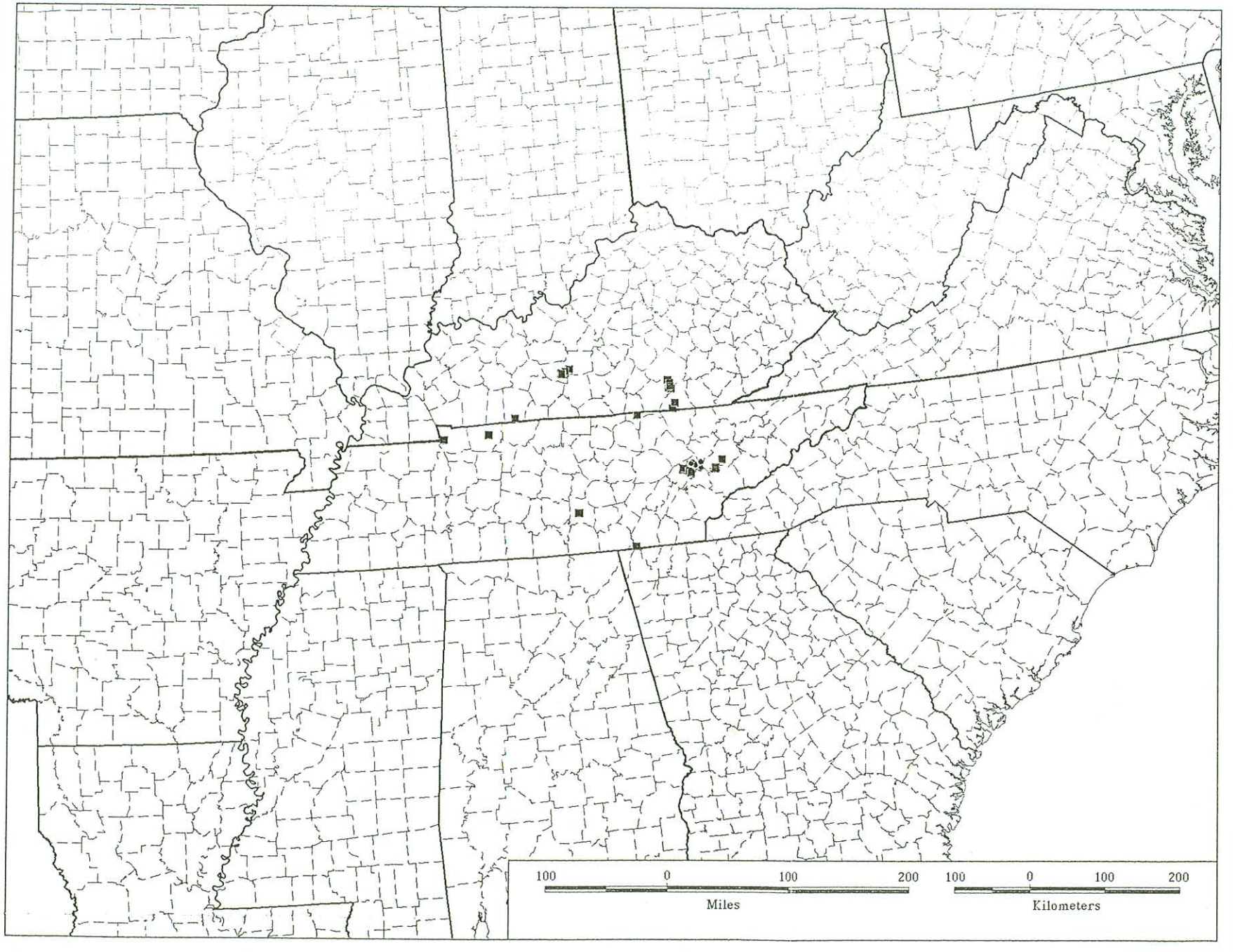
Species Distribution Map For

Delphinium exaltatum

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995



OAK RIDGE RESERVATION

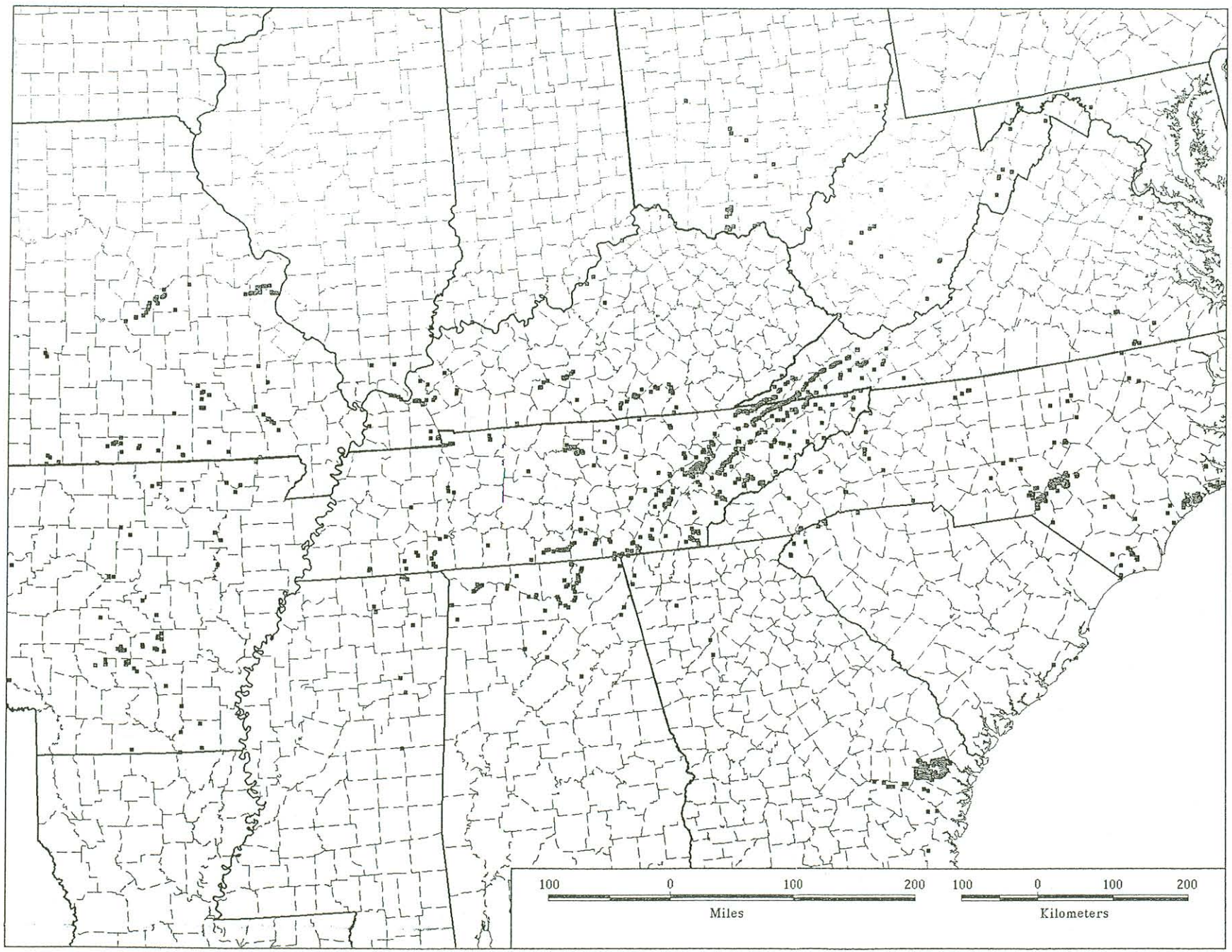
Species Distribution Map For

Aureolaria patula

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995



OAK RIDGE RESERVATION

Distribution Map Of All Records Submitted For This Study

Location information is from the following Natural Heritage Programs

Alabama Natural Heritage Program
Arkansas Natural Heritage Commission
Georgia Natural Heritage Program
Illinois Natural Heritage Division
Indiana Natural Heritage Data Center
Kentucky Heritage Program
Maryland Natural Heritage Program
Mississippi Natural Heritage Program
Missouri Natural Heritage Database
North Carolina Heritage Program
Ohio Natural Heritage Program
South Carolina Heritage Trust
Tennessee Ecological Services Division
TVA Regional Heritage
Virginia Division of Natural Heritage
West Virginia Natural Heritage Program

March 1995

3. SIGNIFICANT NATURAL COMMUNITIES

The following communities are tentatively considered to be rare types ("elements") on a range-wide basis. Information available is sketchy, however, and further assessment of these (and other) types is needed to develop an accurate and complete listing of rare communities present on Oak Ridge Reservation. Community distribution information can be found on the map of Rare Species and Community Element Occurrences with ORNL Natural and Reference Areas in Oak Ridge Reservation, TN, published separately.

3.1 RARE COMMUNITY TYPES

1. Northern White-Cedar Woodland
GROUP: Community
GLOBAL RANK: G1
TENNESSEE RANK: S1

DESCRIPTION: This community consists of rocky bluffs (primarily small shale cliffs) with Northern White-cedar (***Thuja occidentalis)*** as a major or dominant component.

RANGE AND DISTRIBUTION: This community is limited to xeric bluffs and cliffs of calcareous sedimentary rocks in the south-central portions of the Ridge and Valley physiographic province of Tennessee and Virginia. There is one documented occurrence on the ORR.

LANDSCAPE POSITION: Upland bluffs

THREATS TO SURVIVAL: Impoundment, clearing, erosion

ORR CONSERVATION SIGNIFICANCE: This is a globally rare community, restricted to a limited number of small occurrences on limestone or calcareous shale in Tennessee and Virginia.

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2. Oak-Hickory-Ash Limestone Woodland
GROUP: Community
GLOBAL RANK: G3?
TENNESSEE RANK: S3?

DESCRIPTION: These communities are xeric open woodlands with characteristic species including Chinquapin Oak ***(Quercus rnuehlenbergii),*** Shumard Oak ***(Quercus shurnardii),*** White Oak ***(Quercus alba),*** White Ash (***Fraxinus arnericana),*** Pignut Hickory (***Carya glabra),*** Eastern Red Cedar ***(Juniperus virginiana*** var. ***virginiana),*** Fragrant Sumac ***(Rhus arornatica),*** Rusty Black-haw ***(Viburnum rufidulum***), Coralberry (***Symphoricarpos orbiculatus***), Shrubby St. John's-wort ***(Hypericurn frondosum***), and Little Bluestem ***(Schizachyriurn scopariurn).***

RANGE AND DISTRIBUTION: Uncertain, but limited to calcareous and mafic situations in the southeastern United States. There are three documented occurrences on the ORR.

LANDSCAPE POSITION: Uplands

THREATS TO SURVIVAL: Clearing, logging, grazing, development, etc.

ORR CONSERVATION SIGNIFICANCE: The ORR contains some of the higherquality occurrences of this community known. This is a globally rare type, but additional investigation is needed to more accurately characterize it and its significance.

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3. Limestone Cliff
GROUP: Community
GLOBAL RANK. G3?
TENNESSEE RANK: S3?

DESCRIPTION: These communities are cliffs of limestone with scattered plants of complex physiognomic structure. Their affinities are probably with limestone cliffs of the Ridge and Valley physiographic province of Virginia, but additional study is needed.

RANGE AND DISTRIBUTION: Information not available. There is one documented occurrence on the ORR.

LANDSCAPE POSITION: Upland bluffs

THREATS TO SURVIVAL: Various disturbances

ORR CONSERVATION SIGNIFICANCE: The ORR contains some of the higherquality occurrences of these communities known. This is a globally rare type, but additional investigation is needed to more accurately characterize it and its significance.

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4. Limestone Sinkhole
GROUP: Community
GLOBAL RANK:
TENNESSEE RANK:

DESCRIPTION: These communities are humid limestone sinkholes. They are restricted to Tennessee, Alabama, and (perhaps) Virginia and Kentucky. Other sinkhole communities (in, for instance, Florida, Ontario, New York, Arkansas, Missouri, and Oklahoma) are floristically distinct.

RANGE AND DISTRIBUTION: Restricted to Tennessee, Alabama, and (perhaps) Virginia and Kentucky. There is one documented occurrence on the ORR.

LANDSCAPE POSITION: Uplands in limestone landscapes

THREATS TO SURVIVAL: Clearing

ORR CONSERVATION SIGNIFICANCE: The ORR apparently contains important occurrences of this globally rare community; further assessment of this community on the ORR is needed.

***5.* Limestone Barren (annual grass dominated)**
GROUP: Community
GLOBAL RANK:
TENNESSEE RANK:

DESCRIPTION: These communities occur on flaky limestone or calcareous mudstone substrates and are dominated by dropseeds (***Sporobolus ozarkanus*, *S. neglectus*,** and/or *S. vaginiflorus*), with other

characteristic species including Prairie Goldenrod (Solidago ptarmicoides), Prairie Dock (Silphium terebinrhinaceum), and Ear-leaved False-foxglove (Agalinis auriculata).

RANGE AND DISTRIBUTION: This type of limestone barren is believed to be restricted to the Ridge and Valley of southwestern Virginia, Tennessee, northwestern Gwrgia, and northern Alabama. There are four documented occurrences on the ORR.

LANDSCAPE POSITION: Uplands over limestone

THREATS TO SURVIVAL: Grazing, fire suppression, development

ORR CONSERVATION SIGNIFICANCE: The ORR contains important occurrences of this globally rare community, but additional investigation is needed to more accurately characterize the community and its significance.

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6. Limestone Barren (perennial grass dominated)
GROUP: Community
GLOBAL RANK: G2G3
TENNESSEE RANK: S2S3

DESCRIPTION: These communities usually occur in close association with the limestone barren (annual grass dominated), occupying deeper soils that retain moisture later in the growing season. They are dominated by perennial grasses such as Side-oats Grama (Bouteloua *curtipendula*). Typical shrubs include Buckthorn Bumelia (*Sideroxylon* lycioides).

RANGE AND DISTRIBUTION: This type of limestone barren is believed to be restricted to the Ridge and Valley of southwestern Virginia, Tennessee, northwestern Gwrgia, and northern Alabama. There are two documented occurrences on the ORR.

LANDSCAPE POSITION: Uplands over limestone

THREATS TO SURVIVAL: Grazing, fire suppression, development

ORR CONSERVATION SIGNIFICANCE: The ORR contains important occurrences of this globally rare community, but additional investigation is needed to more accurately characterize the community and its significance.

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7. Ridge and Valley Calcareous Mixed Mesophytic Forest
GROUP: Communities
GLOBAL RANK: G3?
TENNESSEE RANK: S3?

DESCRIPTION: These are mesic, diverse mixed hardwood forests of lower slopes and coves over limestone. Their classification is uncertain, and further assessment is needed to determine whether this community is distinctive. A characteristic species is the narrowly endemic species *Cimicifuga rubifolia.*

RANGE AND DISTRIBUTION: Restricted to the sedimentary rock physiographic provinces of the Southern Appalachians, in Tennessee, Kentucky, southwestern Virginia, and possibly other states. There are four documented occurrences on the ORR.

LANDSCAPE POSITION: Lower slopes and coves

THREATS TO SURVIVAL: Timber harvest, clearing, development, grazing, etc.

ORR CONSERVATION SIGNIFICANCE: The ORR likely includes some of the best remaining examples of this community type. This is apparently a globally rare type, but additional investigation is needed to more accurately characterize it and its significance.

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8. Floodplain Pool

GROUP: Community
GLOBAL RANK: G2?
TENNESSEE RANK: S2?

DESCRIPTION: These communities are semipermanently flooded wetlands in floodplains of rivers and large streams in the Ridge and Valley physiographic province.

RANGE AND DISTRIBUTION: Probably restricted to low elevations in the Southern Appalachians. There are three documented occurrences on the ORR.

LANDSCAPE POSITION: Floodplains of rivers and large streams

THREATS TO SURVIVAL: Impoundments, sedimentation, drainage, cropping or pasturing, etc.

ORR CONSERVATION SIGNIFICANCE: Few examples have survived the extensive impoundments and pasturing in the area. All natural wetland types in the Southern Ridge and Valley province have been seriously degraded, and few highquality examples remain. Examples on the ORR are among the best known. Floodplain pools serve as important amphibian breeding areas.

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9. Boggy Forested Wetlands

GROUP: Community
GLOBAL RANK: G3?
TENNESSEE RANK: S3?

DESCRIPTION: These communities also occur on floodplains but are on small stream floodplains where alluvial influence is minimal. They have extensive development of ***Sphagnum*** moss and acidophilic ferns.

RANGE AND DISTRIBUTION: Probably restricted to low elevations in the Southern Appalachians. There is one documented occurrence on the ORR.

LANDSCAPE POSITION: Small stream floodplains, with limited watersheds and hence less alluvial influence

THREATS TO SURVIVAL: Drainage, timber harvest, clearing, pasturage, sedimentation

ORR CONSERVATION SIGNIFICANCE: These (and other wetland types) are rarely found in relatively natural condition in the Ridge and Valley. All natural wetland types in the Southern Ridge and Valley province have been seriously degraded, and few highquality examples remain. Examples on the ORR are among the best known. Boggy forested wetlands serve as important amphibian breeding areas.

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10. Streamhead Seepage Swamps

GROUP: Community
GLOBAL RANK: G2?
TENNESSEE RANK: S2?

DESCRIPTION: These communities are seepage-fed wooded wetlands flooded for part of the year, having species such as Carolina Quillwort (*Isoetes caroliniana).* Further analysis will likely reveal that there are several distinct types of communities represented within this broadly defined type.

RANGE AND DISTRIBUTION: Unknown; probably restricted to the southern Ridge and Valley province. There are five documented occurrences on the ORR.

LANDSCAPE POSITION: Wetlands at the heads of small streams emanating from slope bases

THREATS TO SURVIVAL: Drainage, timber harvest, sedimentation

ORR CONSERVATION SIGNIFICANCE: These are rare wetland communities, rare and endangered in the Ridge and Valley province. All natural wetland types in the Southern Ridge and Valley province have been seriously degraded, and few high quality examples remain. Examples on the ORR are among the best known. Streamhead seepage swamps serve as important amphibian breeding areas.

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11. Sweetflag Pond

GROUP: Community
GLOBAL RANK: G?
TENNESSEE RANK: S?

DESCRIPTION: This community is dominated by the emergent "graminoid" American Sweetflag (*Calamus americanus*). Its naturalness and distribution need further investigation.

RANGE AND DISTRIBUTION: Unknown. There are two documented occurrences on the ORR.

LANDSCAPE POSITION: Wetland

THREATS TO SURVIVAL: Drainage

ORR CONSERVATION SIGNIFICANCE: Only a few examples are known on the ORR. The significance of this wetland type needs additional investigation.

3.2 HIGH-QUALITY COMMON COMMUNITY TYPES

In addition to the above rare community types, other communities of conservation concern occur on the Oak Ridge Reservation. Many of the silvicultural and agricultural (crops and pasturage) land use practices common throughout the Southern Ridge and Valley province have not been practiced on the reservation. As a result, many communities, especially wet to mesic communities of flat to gently sloping topography, are present on the reservation in greater extent or are of better quality than anywhere else. Examples are bottomland hardwood forests, swamp forests, and moist mixed hardwood forests on slopes. The more common forested communities support numerous species that do not occur in the rare communities listed above. Conservation of these communities is an important part of an overall conservation plan for the ORR, for the broad area of the Ridge and Valley physiographic province, and for the state of Tennessee. Although these communities may be relatively common elsewhere, they are of conservation concern on the ORR because they may represent some of the best remaining ecologically functional examples of their types on landscapes across their natural range.

The communities listed above are coarsely defined. Oakdominated forests occur on drier ridges, mixed mesophytic forests occur in moister, more sheltered areas, and forests that are transitional between these types occur in large tracts on the ORR. They include species such as Chestnut Oak, Red Oak, White Oak, Tuliptree, Hickory, and Virginia Pine in various combinations. These types and others that may be present need substantial additional investigation to determine the classification, identification, and quality of individual units across the landscape of the reservation. Some high-quality community areas are reflected in the map of preliminary conservation sites. Additionally, at least 44 stands of intact hardwood forests in excess of 40 hectares (100 acres) have been identified on the ORR. This identification serves as a good first approximation of large blocks of relatively mature forest on the ORR, but assessment of the quality of these tracts, their boundaries, and their connections to other areas of conservation concern is still needed.

4.1 BSR 2 Sites

BSR 2, as defined earlier, means a biodiversity significance rank of very high significance.

Preliminary conservation sites are shown on three maps at the end of Section 4. A different map is included for each of the three BSR categories described in the sections below. Map areas in which a specific biodiversity significance rank appears are identified by number, so that BSR-2-16, for example, would indicate that category BSR-2 is found in area 16 of the map.

BSR 2-1

Number	Rank	Common Name
S28	G3/S3/3C/S	Carey's Saxifrage
S30	G5/S4/D	Southern Bog Lemming
S44	G5/S4/D	Meadow Jumping Mouse
S119	G3/S3/C2/T	Appalachian Bugbane
S173	G5/S2/D	Osprey
S179	G5/S4/D	Woodland Jumping Mouse
C59	G3?/S3?	Oak Hickory Ash Limestone Woodland
C62	G3?/S3	Ridge and Valley Calcareous Mixed Mesophytic Forest
RA44		ORR Reference Area

DESCRIPTION: This site is highly ranked because of its assemblage of four rare mammals. Ridge and Valley Calcareous Mixed Mesophytic Forests are mesic, diverse, mixed hardwood forests of lower slopes and coves over limestone. Oak-Hickory-Ash Limestone Woodlands are xeric, open woodlands with characteristic species including Chinquapin Oak, Shumard Oak, White Oak, White Ash, Pignut Hickory, Eastern Red Cedar, Fragrant Sumac, Rusty Blackhaw, Coralberry, Shrubby St. John's-wort and Little Bluestem. The site also encompasses wetlands and nearby open water.

BSR 2-2

Number	Rank	Common Name
NA-G		ORR Natural Area

BSR 2-3

Number	Rank	Common Name
S14	G2/S2/C1/T	Spreading False-foxglove
S85	G3/S3/C2/T	Appalachian Bugbane
S153	G2/S2/C1/T	Spreading False-foxglove
C55	G3/S3	Ridge and Valley Calcareous Mixed Mesophytic Forest
NA19		ORR Natural Area

DESCRIPTION: Three State-listed threatened plant species, including one candidate for federal listing, make this southeast-facing forested site biologically significant. Some limestone outcrops dot the area. Ridge and Valley Calcareous Mixed Mesophytic Forests are mesic, diverse mixed hardwood forests on lower slopes and coves over limestone.

BSR 2-4

Number	**Rank**	**Common** Name
S93	G4/S1/S	Branching Whitlow Grass
S132	G2/S2/C1/T	Spreading False-foxglove
NA-D		ORR Natural Area

DESCRIPTION: This site is biologically significant for its two rare plants, both observed spread across the site's rock outcrops and shoreline in 1994, and the diverse community types. Communities include rocky lake shore, wooded limestone cliffs and ledges, and cedar barrens. Other species of interest include *Dentaria multifida* (its only ORR site) and *Cornus drummondii* (also its only ORR site).

BSR 2-5

Number	**Rank**	**Common** Name
C66	G5/S5	Chestnut Oak-(N?) Red Oak-Tuliptree Forest
NA3		ORR Natural Area
RA22		ORR Reference Area

DESCRIPTION: This diverse site is considered biologically significant for its natural communities. There is a forested area with north-facing slopes, limestone outcrops, and grassy banks along a creek of the Clinch River embayment. Plant species found here that are uncommon to the ORR include Wild Ginger and Jacob's Ladder.

BSR 2-6

DESCRIPTION: These significant river bluffs were once part of the ORR but now belong to TVA.

BSR 2-7

Number	**Rank**	**Common** Name
S75	G2G3/S2/D	Tennessee Dace
S133	G4/S3/T	Goldenseal
SA-D		ORR Study Area

DESCRIPTION: This second-order, spring-fed stream supports a rare fish and has extremely high fish species richness. A State-listed threatened plant also graces the site. The stream, also called Ish Creek, flows through a mixed hardwood forest before joining the Clinch River.

BSR 2-8

Number	**Rank**	**Common** Name
S41	G5T?/S?	Cumberland Slider
S107	G5/S3	Six Lined Racerunner
S138	G5/S4/D	Mole Salamander
S150	G2/S2/C1/T	Spreading False-foxglove
S187	G4/S3/T	Goldenseal
C71	G2G3/S2	Limestone Barren (Annual Grass Dominated)
NA6		ORR Natural Area
RA8		ORR Reference Area

DESCRIPTION: This interesting area is biologically significant because of its rare plants, amphibians, and community type. The Annual Grass-Dominated Limestone Barren type occurs on flaky limestone or calcareous mudstone substrates and is characterized by annual dropseeds, Prairie Goldenrod, Prairie Dock, and Ear-Leaved

Foxglove. Other unusual plants inhabiting this cedar barren area are Prickly Pear Cactus, Side-Oats Grama, Ironwood, a Milk Vetch, and Adder's-Tongue Fern. Also included in this site is a north-facing, lower-slope forested area with limestone outcrops.

BSR 2-10

Number	Rank	Common Name
S8	G5/S3/3C/T	Purple Fringeless Orchid
S13	G4T4Q/S2/T	Tubercled Rein Orchid
S16	G5/S4/D	Southeastern Shrew
S29	G2G3/S2/D	Tennessee Dace
S42	G2G3/S2/D	Tennessee Dace
S50	G2G3/S2/D	Tennessee Dace
S65	G2G3/S2/D	Tennessee Dace
S70	G5/S2/T	Canada Lily
S79	G2G3/S2/D	Tennessee Dace
S89	G4/S3/3C/T	American Ginseng
S98	G5/S1/E	Fen Orchid
S100	G2G3/S2/D	Tennessee Dace
S102	G4T4Q/S2/T	Tubercled Rein Orchid
S110	G5/S4/D	Mole Salamander
S114	G4/S4/C2/D	Flame Chub
S127	G2G3/S2/D	Tennessee Dace
S136	G3/S2/C2/E	Bachman's Sparrow
S139	G5/S3/3C/T	Purple Fringeless Orchid
S140	G2G3/S2/D	Tennessee Dace
S145	G4T4Q/S2/T	Tubercled Rein Orchid
S147	G2G3/S2/D	Tennessee Dace
S178	G4T4Q/S2/T	Tubercled Rein Orchid
S183	G4T4Q/S2/T	Tubercled Rein Orchid
S190	G2G3/S2/D	Tennessee Dace
C27	G2G3/S2	Ridge and Valley Swamp Forest
C31	G2G3?/S?	Ridge and Valley Wet Meadow Shrub-Herb Complex
C39	G?IS?	Sweetflag Marsh/Swamp
C43	G2/G3/S2	Ridge and Valley Swamp Forest
C47	G2?/S2?	Streamhead Seepage Swamp
NA4		ORR Natural Area
NA13		ORR Natural Area
NA24		ORR Natural Area
RA4		ORR Reference Area
RA7		ORR Reference Area

DESCRIPTION: The variety of rare species occurrences and notable community types place this site in a high rank for biological significance. Rare fish, plants, birds, mammals and amphibians are all represented in this area, which encompasses aquatic natural area Bear Creek, the Bear Creek Wetlands, and Hembree Marsh State Natural Area. Along Bear Creek, the downstream sections are bordered by mature, deciduous forest. The benthic invertebrate community is rich and diverse in these downstream sections. The Tennessee Dace population here may be the largest throughout its range. In the Bear Creek Wetlands, an unusual variety of wetland habitats are formed by springs, seeps, and old streambeds in a flat basin. Hembree Marsh is also unique because it is not subject to changing water levels caused by TVA dams. One of the natural communities on site, the streamhead seepage swamp type, is a seepage-fed wooded wetland that floods for part of the year.

Number	Rank	Common Name
S33	G2/S2/C1/T	Spreading False-foxglove
C29	G3?/S?	Hemlock-White Oak-White Pine Limestone Cliff Forest
NA20		ORR Natural Area

DESCRIPTION: In addition to a State-listed threatened plant species on site, many other plants uncommon to the ORR, such as Rhododendron, Fringe Tree, Hemlock, Mock Orange and Spider Lily, inhabit this west-facing slope. The site is located in the Poplar Creek Gap in Blackoak Ridge.

BSR 2-12

Number	Rank	Common Name
S55	G2G3/S2/D	Tennessee Dace
S76	G2G3/S2/D	Tennessee Dace
S108	G5/S2/T	Canada Lily
S112	G2G3/S2/D	Tennessee Dace
S172	G4/S3/T	Goldenseal
C17		Ridge and Valley Floodplain Forest
C21	G5/S5	Chestnut Oak-White Oak-(N?) Red Oak Forest
C22	G2?/S2?	Streamhead Seepage Swamp
NA2		ORR Natural Area
RA3a		ORR Reference Area
SA-B		ORR Study Area
SA-C		ORR Study Area

DESCRIPTION: This site includes the East Fork Ridge Mesic Forest and two unnamed tributaries to and the lower stretches of East Fork Poplar Creek. The creek areas are biologically significant because of the high fish species richness; three are fish occurrences. The mesic forest is equally significant and shelters two State-threatened plant species. This forested area consists of a moist, maturing woodland of Beech, Maple, Basswood and others on north- and east-facing slopes. The Streamhead Seepage Swamp community present on site is a seepage-fed, wooded wetland that floods for part of the year and supports species such as Carolina Quillwort.

BSR 2-13

Number	Rank	Common Name
RA3b		ORR Reference Area

BSR 2-14

Number	Rank	Common Name
S21	G5/S4	Red-shouldered Hawk
S168	G2G3/S2/D	Tennessee Dace

DESCRIPTION: This site's benthic invertebrate fauna is rich and diverse, and the second-order stream contains a rare fish species as well. This area serves as a reference for benthic invertebrate tasks and Tennessee Dace life history studies.

BSR 2-15

Number	Rank	Common Name
S35	G2G3/S2/D	Tennessee Dace
S61	G2G3/S2/D	Tennessee Dace

DESCRIPTION: This stream is important for its rare fish occurrences and rich benthic invertebrate community.

BSR 2-17

Number	Rank	Common Name
C53	G3/S3	Rocky Limestone Woodland
C56	G5/S5	(N?) Red Oak-White Oak-Hickory Forest
RA29		ORR Reference Area

DESCRIPTION: This site is important for its potential Tall Larkspur habitat. It is located on Haw Ridge and surrounded by dry, rocky woods dominated by Oaks and Cedars.

BSR 2-18

Number	Rank	Common Name
S94	G5/S2/T	Canada Lily
S128	G3/S1/C2/E	Tall Larkspur
C40	G2G3/S2	Limestone Barren (Annual Grass Dominated)
NA-B		ORR Natural Area

DESCRIPTION: This site is considered highly significant for its two rare plant species, one of which is a candidate for federal listing, and its unmowed cedar barren community. Annual Grass-Dominated Limestone Barrens occur on flaky limestone or calcareous mudstone substrates and are dominated by annual dropseeds, Prairie Goldenrod, Prairie Dock, and Ear-Leaved Foxglove. This site's barren contains scattered rock outcrops, an extension of the cedar barren into a mown, right-of-way upland area, an unusually moist wet meadow right-of-way, and a forested wetland upstream and downstream from this wet meadow. Other species of interest on site are Stenanthiurn *graminum* var. *robustum* and Isoetes sp., which may be Isoetes carolinia, a species in need of protection.

BSR 2-19

Number	Rank	Common Name
S53	G3/S1/C2/E	Tall Larkspur
NA-K		ORR Natural Area

DESCRIPTION: This site is noted for its population of Tall Larkspur, federal candidate for listing as threatened or endangered. It is a large area with a variety of forest types and mowed sections along a pipeline and power line. The slopes are mostly north-facing with some limestone outcrops. Tall larkspur is scattered throughout the site. Nearby is Bear Creek, with downstream sections bordered by mature, deciduous forest. The benthic invertebrate community is rich and diverse in these downstream sections. The Tennessee Dace population here may be the largest in Tennessee.

BSR 2-20

Number	Rank	Common Name
S73	G3/S1/C2/E	Tall Larkspur
C32	G5/S5	Tuliptree-Chestnut Oak-N. Red Oak-Pine Forest
C33	G2G3/S2S3	Limestone Barren (Perennial Grass Dominated)
C34	G2G3/S2S3	Limestone Barren (Perennial Grass Dominated)
C37	G2G3/S2	Limestone Barren (Annual Grass Dominated)
C41	G3?/S3?	Oak-Hickory-Ash Limestone Woodland
NA7		ORR Natural Area
SA-A		ORR Study Area

DESCRIPTION:
In addition to its candidate species for federal listing, this site includes several significant communities. Two types of limestone barren are found here near mature hardwood forests. The Annual-Grass Dominated Limestone Barren occurs on flaky limestone or calcareous mudstone substrates and is dominated by annual dropseeds, Prairie Goldenrod, Prairie Dock, and Ear-Leaved Foxglove. The Perennial Grass-Dominated Limestone Barren usually occurs in association with the Annual-Grass Dominated type and occupies deeper soils that retain moisture later in the growing season. Perennial grasses such as Side-Oats Grama and shrubs such as Buckthorn Burnelia are common here.

BSR 2-21

Number	Rank	Common Name
S62	G5/S2/T	Northern Bush-honeysuckle
S109	G2/S2/C1/T	Spreading False-foxglove
S116	G5/S4/E*	Pink Lady's Slipper
NA14		ORR Natural Area

DESCRIPTION: This small, shaley cliff slopes steeply into Melton Hill Lake and is considered a biologically significant site because of its three rare plant species. White Cedar, a species that normally occurs in more northern latitudes, also inhabits the slope.

BSR 2-22

Number	Rank	Common Name
S15	G3/S3/C2/T	Appalachian Bugbane
S34	G3/S1/C2/E	Tall Larkspur
S92	G5/S4/D	Common Shrew
S118	G5T4/S3/C2/T	Northern Pine Snake
S123	G5T5/SU/D	Eastern Slender Glass Lizard
S125	G5/S4/D	Woodland Jumping Mouse
S148	G5/S4/D	Meadow Jumping Mouse
S164	G4/S3/3C/T	American Ginseng
S165	G5/S3	Six-lined Racerunner
S175	G5/S2/T	Northern Bush Honeysuckle
C38	G4/S4	Tuliptree-Red Cedar-White Oak-Hickory Forest
C46	G3?/S3	Ridge and Valley Calcareous Mixed Mesophytic Forest
NA11		ORR Natural Area

DESCRIPTION: Two candidate species for federal listing head the long list of rare elements and communities at this significant site. Habitats include immature, mesic forest dominated by Tulip Poplar, a steep, north-facing, wooded limestone bluff overlooking Melton Hill Lake, and a rocky ridge area dotted with sinks and cave entrances. The Ridge and Valley Calcareous Mixed Mesophytic Forest occurrence on site involves mixed, mesic, diverse hardwood forests of lower slopes and covers over limestone.

BSR 2-23

Number	Rank	Common Name
S34	G3/S1/C2/E	Tall Larkspur
S105	G3/S1/C2/E	Tall Larkspur
C11	G2G3/S3	Limestone Barren (Annual Grass Dominated)
C12		Oak-Hickory-Ash Limestone Woodland
NA8		ORR Natural Area

DESCRIPTION: This site is considered highly significant because of its large population of a federal candidate for listing, Tall Larkspur. It is a large area with a variety of forest types and mowed sections along a pipeline and power line. The slopes are mostly north-facing. Annual Grass-Dominated Limestone Barrens occur on flaky limestone or calcareous mudstone substrates and are dominated by annual dropseeds, with other characteristic species being Prairie Goldenrod, Prairie Dock, and Ear-Leaved Foxglove.

BSR 2-24

Number	Rank	Common Name
S154	G5/S3/3C/T	Purple Fringeless Orchid
C60	G2G3?/S?	Ridge and Valley Wet Meadow Shrub-Herb Complex
NA29		ORR Natural Area

DESCRIPTION: This site's State-listed threatened orchid earns the area significant status.

BSR 2-25

Number	Rank	Common Name
C73	G2G3/S2	Ridge and Valley Floodplain Swamp Forest
RA16		ORR Reference Area

DESCRIPTION: This site is considered significant for its uncommon Ridge and Valley Floodplain Swamp Forest community. This area contains a forested wetland that enters the Clinch River's floodplain.

BSR 2-26

Number	Rank	Common Name
S77	G5/S2/T	Canada Lily
NA26		ORR Natural Area

DESCRIPTION: This forested wetland supports a State-listed threatened lily, has vernal pool habitat, and may be a significant amphibian breeding area.

BSR 2-27

Number	Rank	Common Name
S167	G3/S3/3C/S	Carey's Saxifrage
NA23		ORR Natural Area

DESCRIPTION: This east-facing, rocky slope provides important habitat for a State-listed rare plant and other uncommon species such as Cancer Root.

4.2 BSR 3 SITES

BSR 3, as defined earlier, means a biodiversity significance rank of high significance.

BSR 3-1

Number	Rank	Common Name
C1		Swamp Chestnut Forest

BSR 3-2

Number	Rank	Common Name
S16	G4T4Q/S2	Tubercled Rein-Orchid
C4		Chestnut Oak-Hickory-Tuliptree Forest
C5		Chestnut Oak-(N?) Red Oak-Tuliptree-White Oak Forest
C7		Chestnut Oak-(N?) Red Oak-Tuliptree-White Oak Forest
C8		Streamhead Seepage Swamp
C18		Chestnut Oak-(N?) Red Oak-White Oak Forest
C25		Beech-Mountain Laurel Forest
NA28		ORR Natural **Area**
RA5		ORR Reference **Area** (in part)
RA15		ORR Reference Area

BSR 3-3

Number	Rank	Common Name
C2		Chestnut Oak-White Oak-Tuliptree-Hickory Forest
C3		Chestnut Oak-White Oak-Tuliptree-Hickory Forest

BSR 3-4

Number	Rank	Common Name
C6		S. Red Oak-Tuliptree-White Oak-Pine-Hickory Forest
C15		Tuliptree-S. Red Oak-White Oak Forest

BSR 3-6

Number	Rank	Common Name
S6	G4/S3	American Ginseng
C9		Tuliptree-(N?) Red Oak-Chestnut Oak Forest
RA14		ORR Reference **Area**

BSR 3-7

Number	Rank	Common Name
S25	G5/S2	Canada Lily
S18	G5/S2	Canada Lily
S9	G5/S2	Canada Lily
S13	G5/S2	Canada Lily
C10		Chestnut Oak-Tuliptree-White Oak-Hickory Forest
C14		White Oak-N. Red Oak-Hickory Forest
NA22		ORR Natural Area

BSR 3-8

Number	Rank	Common Name
S33	G4/S3	Cerulean Warbler
S15	G3/S2	Mountain Witch-alder
C13		(N?) Red Oak-Tuliptree-Chestnut Oak-White Oak Forest
C20		Chestnut Oak-(N?) Red Oak-White Oak-Tuliptree Forest
NA12		ORR Natural **Area**
NA-L		ORR Natural **Area**

BSR 3-10

Number	Rank	Common Name
C16		Chestnut Oak-(N?) Red Oak-Hickory Forest

BSR 3-11

Number	Rank	Common Name
C23		N. Red Oak-Tuliptree-White Oak Forest
NA20		ORR Natural Area
NA-H		ORR Natural **Area**

BSR 3-12

Number	Rank	Common Name
C24		Chestnut Oak-White Oak-Tuliptree-Virginia Pine Forest

BSR 3-13

Number	Rank	Common Name
S26	G5T?/S?	Cumberland Slider
C19		Limestone Sinkhole
NA21a		ORR Natural Area

BSR 3-15

Number	Rank	Common Name
C26		Chestnut Oak-(N?) Red Oak-White Oak Forest

BSR 3-16

Number	Rank	Common Name
C28		Tuliptree-Chestnut Oak-White Oak Forest

BSR 3-17

Number	Rank	Common Name
NA-I		ORR Natural Area

BSR 3-18

Number	Rank	Common Name
C30		White Oak-(N?) Red Oak-Tuliptree Forest

BSR 3-19

Number	Rank	Common Name
C35		Chestnut Oak-White Oak-(N?) Red Oak Forest

BSR 3-22

Number	Rank	Common Name
C36		Tuliptree-Chestnut Oak-(N?) Red Oak Forest

BSR 3-23

Number	Rank	Common Name
PRA-D		ORR Proposed Reference Area

BSR 3-24

Number	Rank	Common Name
C44		Hemlock-Rhododendron Forest
RA17		ORR Reference Area

BSR 3-25

Number	Rank	Common Name
S76	G5/S3	Six-lined Racerunner
S75	G5/S4	Meadow Jumping Mouse
S73	G5T5/SU	Eastern Slender Glass Lizard
S74	G5/S4	Common Shrew
S72	G5T4/S3	Northern Pine Snake
C45		Tuliptree-Chestnut Oak-(N?) Red Oak Forest

BSR 3-27

Number	Rank	Common Name
S69		Heron Rookery
RA23		ORR Reference Area

BSR 3-28

Number	Rank	Common Name
S79	G5/S4	Southern Bog Lemming
S85	G5/S2	Canada Lily
C49		Tuliptree-White Oak-Hickory-Scarlet Oak-N. Red Oak Forest
NA-C		ORR Natural Area

BSR 3-29

Number	Rank	Common Name
S71	G5/S2	Small-headed Rush

BSR 3-30

Number	Rank	Common Name
C48		Chestnut Oak-White Oak-(N/S?) Red Oak-Hickory Forest

BSR 3-31

Number	Rank	Common Name
S84	G5/S2	Canada Lily

BSR 3-33

Number	Rank	Common Name
S95		Heron Rookery
RA30		ORR Reference Area

BSR 3-34

Number	Rank	Common Name
C52		Chestnut Oak-Hickory-Tuliptree Forest

BSR 3-35

Number	Rank	Common Name
S100	G5/S4	Mole Salamander
S101	G4/S?	Green Salamander
S103	G4/S?	Green Salamander
S104	G5/S4	Mole Salamander
C51		Chestnut Oak-White Oak-N. Red Oak-S. Red Oak Forest
C58		Ridge and Valley Wet Meadow Shrub-Herb Complex
NA27		ORR Natural Area
SA-E		ORR Study Area

BSR 3-36

Number	Rank	Common Name
RA29		ORR Reference Area

BSR 3-37

Number	Rank	Common Name
S114	G4/S3	Goldenseal
S99	G3/S3	Carey's Saxifrage
S112	G5/S3	Lesser Ladies'-tresses
C57		White Oak-Tuliptree-Hickory Forest
NA10		ORR Natural Area
NA18		ORR Natural Area
RA11		ORR Reference Area

BSR 3-40

Number	Rank	Common Name
S121	G5/S2	Canada Lily
S123	G5/S2	Canada Lily
S125	G5/S3	Six-lined Racerunner
C61		White Oak-(N?) Red Oak-Chestnut Oak-Tuliptree - Hickory Forest
NA31		ORR Natural Area

BSR 3-41

Number	Rank	Common Name
S127	G5/S2	Canada Lily
S126	G5/S1	Heavy Sedge
C63		N. Red Oak-White Oak-Tuliptree-Hickory-Chestnut Oak Forest
C65		Forested Wetland with Sphagnum Moss
RA20		ORR Reference Area

BSR 3-42

Number	Rank	Common Name
C64		White Oak-(N?) Red Oak-Tuliptree Forest
NA27		ORR Natural Area
NA33		ORR Natural Area
SA-E		ORR Study Area
SA-F		ORR Study Area

BSR 3-43

Number	Rank	Common Name
S130	G5/S3	Lesser Ladies'-tresses
NA9		ORR Natural Area

BSR 3-44

Number	Rank	Common Name
S162	G5/S2	Nuttall's Waterweed
S137	G5/S3	Six-lined Racerunner
C68		Chestnut Oak-(N?) Red Oak-White Oak Forest

NA6	ORR Natural Area
RA9	ORR Reference Area

BSR 3-45

Number	Rank	Common Name
S182	G5/S4	Smoky Shrew
S181	G5/S3	Six-lined Racerunner
S179	G5/S4	Common Shrew
S177	G5/SU	Long-tailed or Rock Shrew
S178	G5T4/S3	Northern Pine Snake
S180	G5T5/SU	Eastern Slender Glass Lizard
C70		Chestnut Oak-Tuliptree-N. Red Oak-Hickory Forest
C72		Chestnut Oak-Tuliptree-N. Red Oak-Hickory - White Oak Forest
RA31		ORR Reference Area

BSR 3-46

Number	Rank	Common Name
S140	G3/S3	Carey's Saxifrage
S141	G3/S3	Appalachian Bugbane
C67		Ridge and Valley Calcareous Mixed Mesophytic Forest
NA15		ORR Natural Area

BSR 3-47

Number	Rank	Common Name
NA3		ORR Natural Area (in part)

BSR 3-48

Number	Rank	Common Name
S156	G2/S2	Spreading False-foxglove
NA30		ORR Natural Area

BSR 3-49

Number	Rank	Common Name
S185	G3/S3	Carey's Saxifrage
C77		Tuliptree-Mixed Hardwood Forest with Pine
NA17		ORR Natural Area

BSR 3-50

Number	Rank	Common Name
C74		Tuliptree-N. Red Oak-Shortleaf Pine-Hickory - White Oak Forest

BSR 3-51

Number	Rank	Common Name
C75		N. Red Oak-Tuliptree-Hickory-White Oak-Chestnut Oak Forest

C78	Hickory-Red Cedar-Virginia Pine Forest
RA12	ORR Reference Area (in part)
RA13	ORR Reference Area

BSR 3-52

Number	Rank	Common Name
C76		Sweetflag Marsh/Swamp
RA19		ORR Reference Area

BSR 3-53

Number	Rank	Common Name
RA12		ORR Reference Area (in part)

BSR 3-54

Number	Rank	Common Name
S189	G5/S1	Heavy Sedge
NA32		ORR Natural Area

4.3 BSR 4 SITES

BSR 4, as described earlier, means a biodiversity significance rank of moderate significance.

BSR 4-2

Number	Rank	Common Name
S44	G5/S4	Meadow Jumping Mouse
S40	G5/S3	Six-lined Racerunner
S39	G5/S4	Woodland Jumping Mouse
S43	G5T5/SU	Eastern Slender Glass Lizard
S41	G5/S4	Common Shrew
S42	G5T4/S3	Northern Pine Snake

BSR 4-3

Number	Rank	Common Name
C42		Streamhead Seepage Swamp

BSR 4-4

Number	Rank	Common Name
RA21		ORR Reference Area

BSR 4-6

Number	Rank	Common Name
S119	G5/S4	Red-shouldered Hawk

4.4 LANDSCAPE COMPLEX SITES

Note: Sites followed by an asterisk denote partial BSR sites included in that landscape complex.

Landscape Complex 1 (37,000,816 m^2)

Sites	Size
BSR 2-7*	806,056 m^2
BSR 2-10	4,592,120 m^2
BSR 2-11	63,704 m^2
BSR 2-12	2,274,772 m^2
BSR 2-13	65,9446 m^2
BSR 2-14	259,636 m^2
BSR 2-15	1,335,276 m^2
BSR 2-16	582,528 m^2
BSR 3-2	4,129,683 m^2
BSR 3 4	2,324,960 m^2
BSR 3-8*	1,998,906 m^2
BSR 3-9	102,945 m^2
BSR 3-11	1,435,919 m^2
BSR 3-14	459,361 m^2
BSR 3-15	660,670 m^2
BSR 3-16	297,053 m^2
BSR 3-18*	609,937 m^2
BSR 3-19	848,864 m^2
BSR 3-20	22,617 m^2
BSR 3-22*	612,321 m^2
BSR 3-25	578,536 m^2
BSR 3-30*	676,766 m^2
BSR 3-34*	415,268 m^2
BSR 4-3	220,292 m^2

Landscape Complex 2 (17,796,374 m^2)

Sites	Size
BSR 2-25	61,198 m^2
BSR 3-36*	346,650 m^2
BSR 3-37	2,737,904 m^2
BSR 3-43	686,794 m^2
BSR 3 4 5	2,187,895 m^2
BSR 3-46	72,898 m^2
BSR 3-48	88,003 m^2
BSR 3-49	699,666 m^2
BSR 3-50	523,099 m^2
BSR 3-51	1,342,765 m^2
BSR 3-52	27,620 m^2
BSR 3-53	446,779 m^2
BSR 3-54	164,828 m^2
BSR 4-6	131,567 m^2

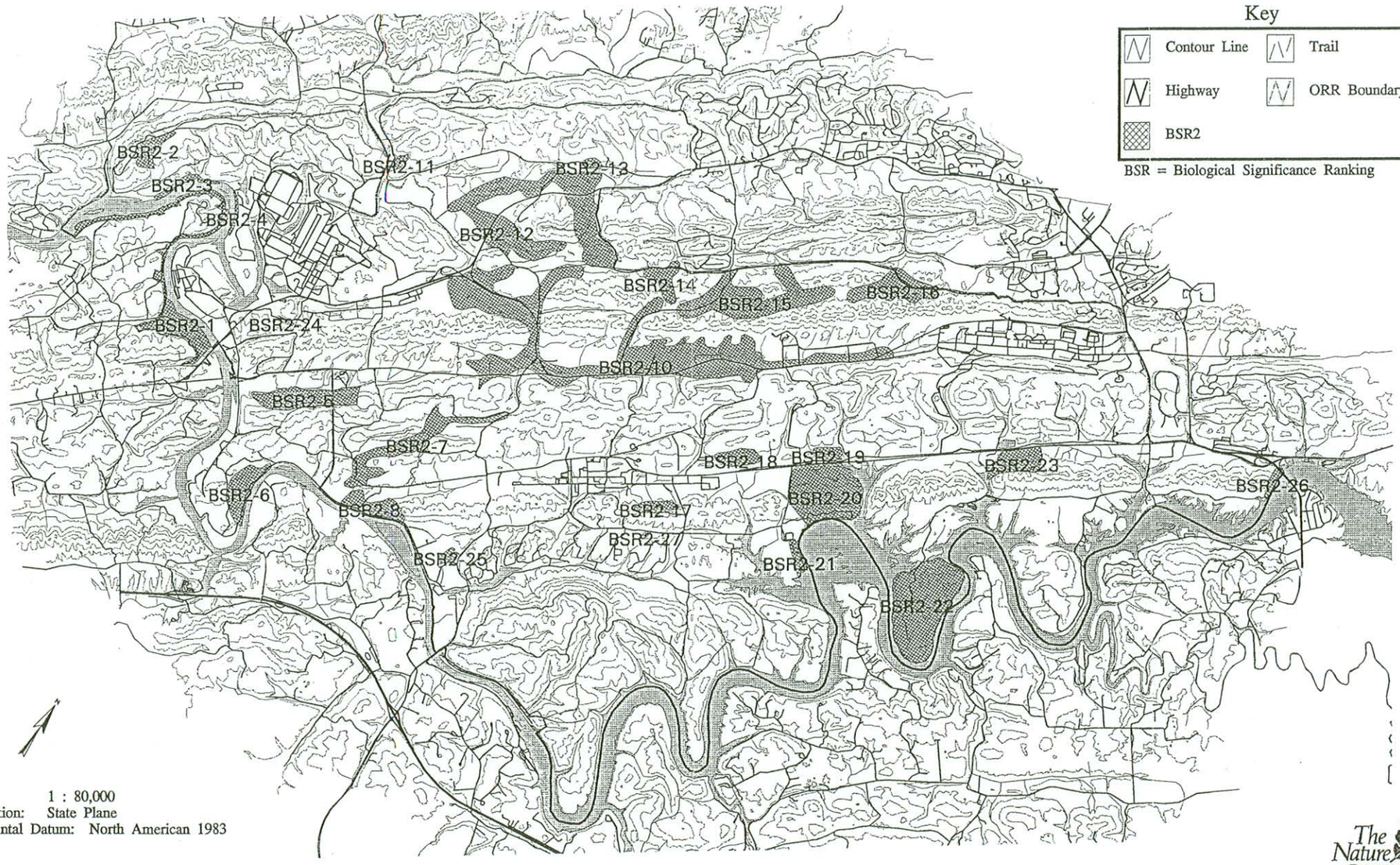
Landscape Complex 3 (10,558,756 m^2)

Sites	Size
BSR 2-22	1,712,740m^2
BSR 2-23*	373,906m^2
BSR 3-7	1,870,769m^2
BSR 3-12	1,248,591m^2
BSR 3-13	55,227m^2
BSR 4-2	634.631 m^2

Common Ground

Future Land Use Process for the Oak Ridge Reservation

Preliminary Conservation Sites (BSR2) in Oak Ridge Reservation, TN

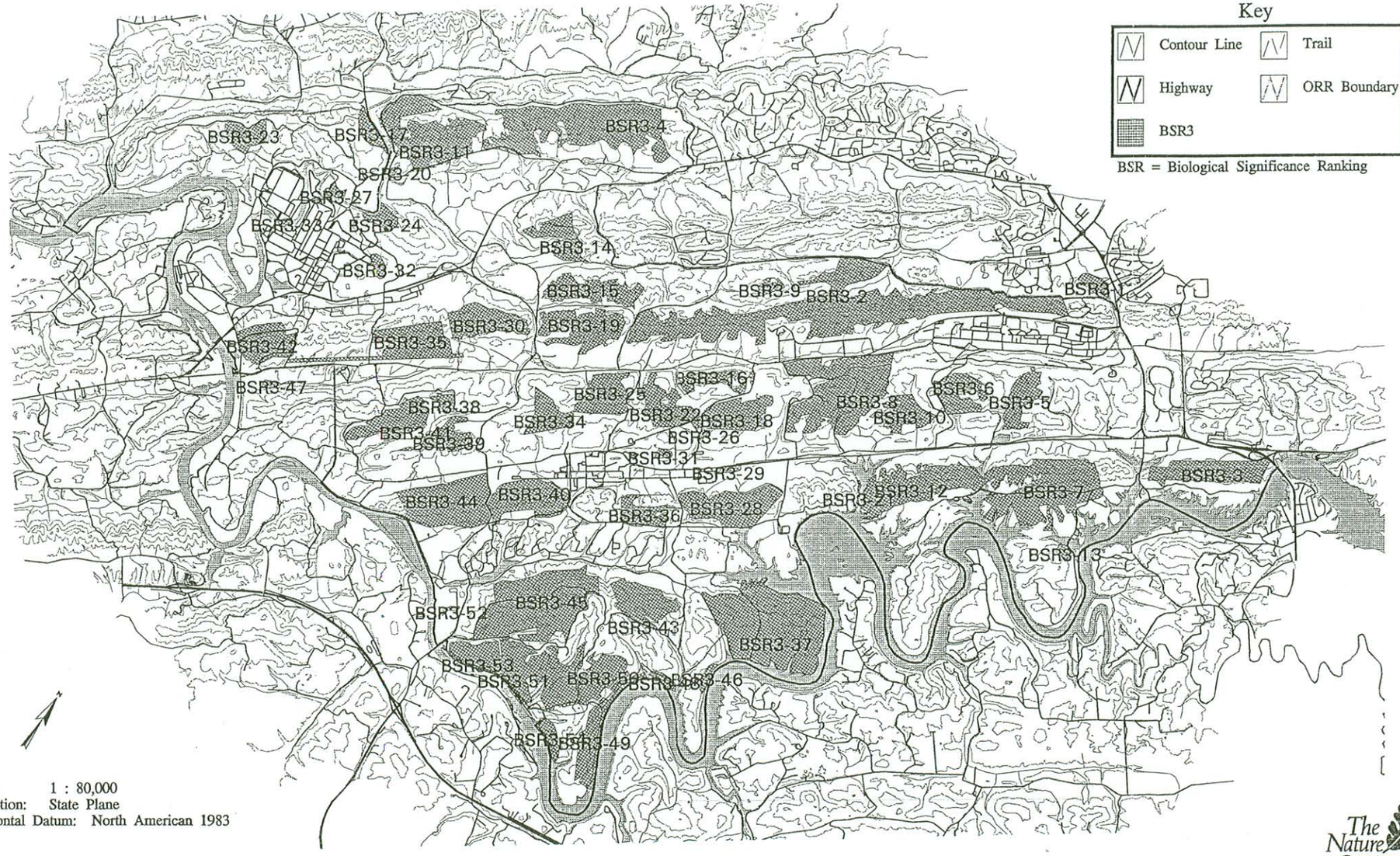


Map prepared by The Nature Conservancy, 8/28/95

Common Ground

Future Land Use Process for the Oak Ridge Reservation

Preliminary Conservation Sites (BSR3) in Oak Ridge Reservation, TN

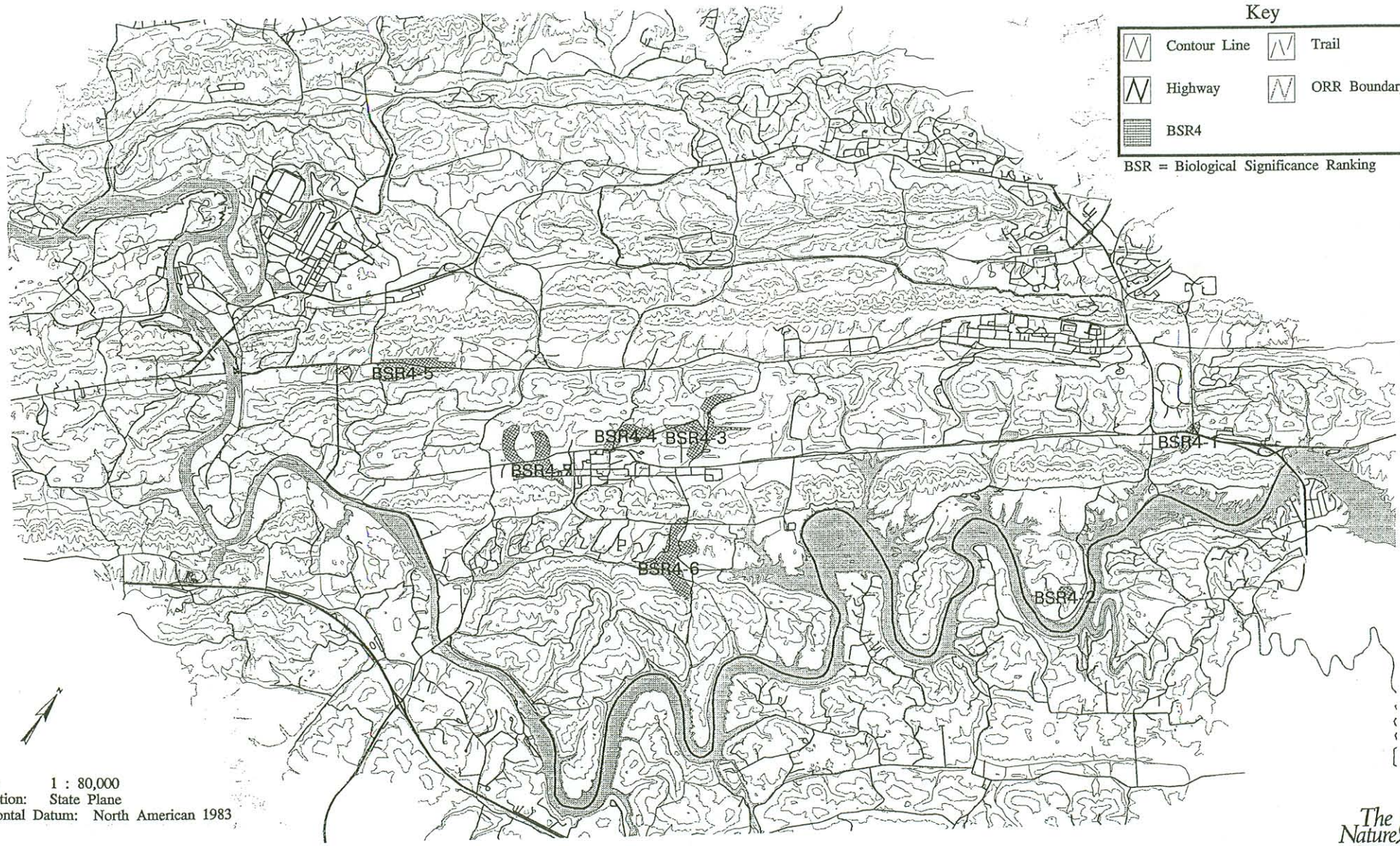


Map prepared by The Nature Conservancy, 8/28/95

Common Ground

Future Land Use Process for the Oak Ridge Reservation

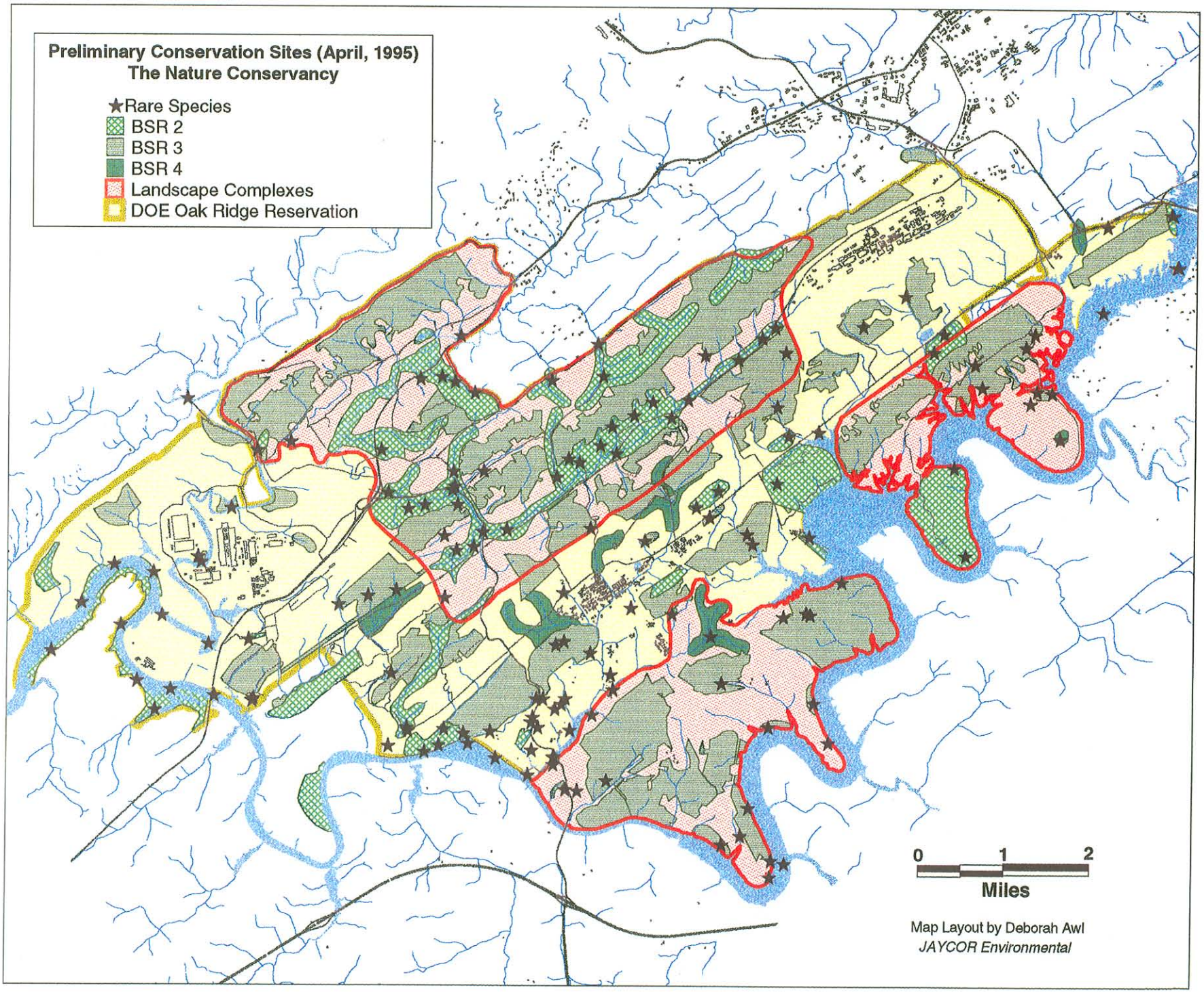
Preliminary Conservation Sites (BSR4) in Oak Ridge Reservation, TN

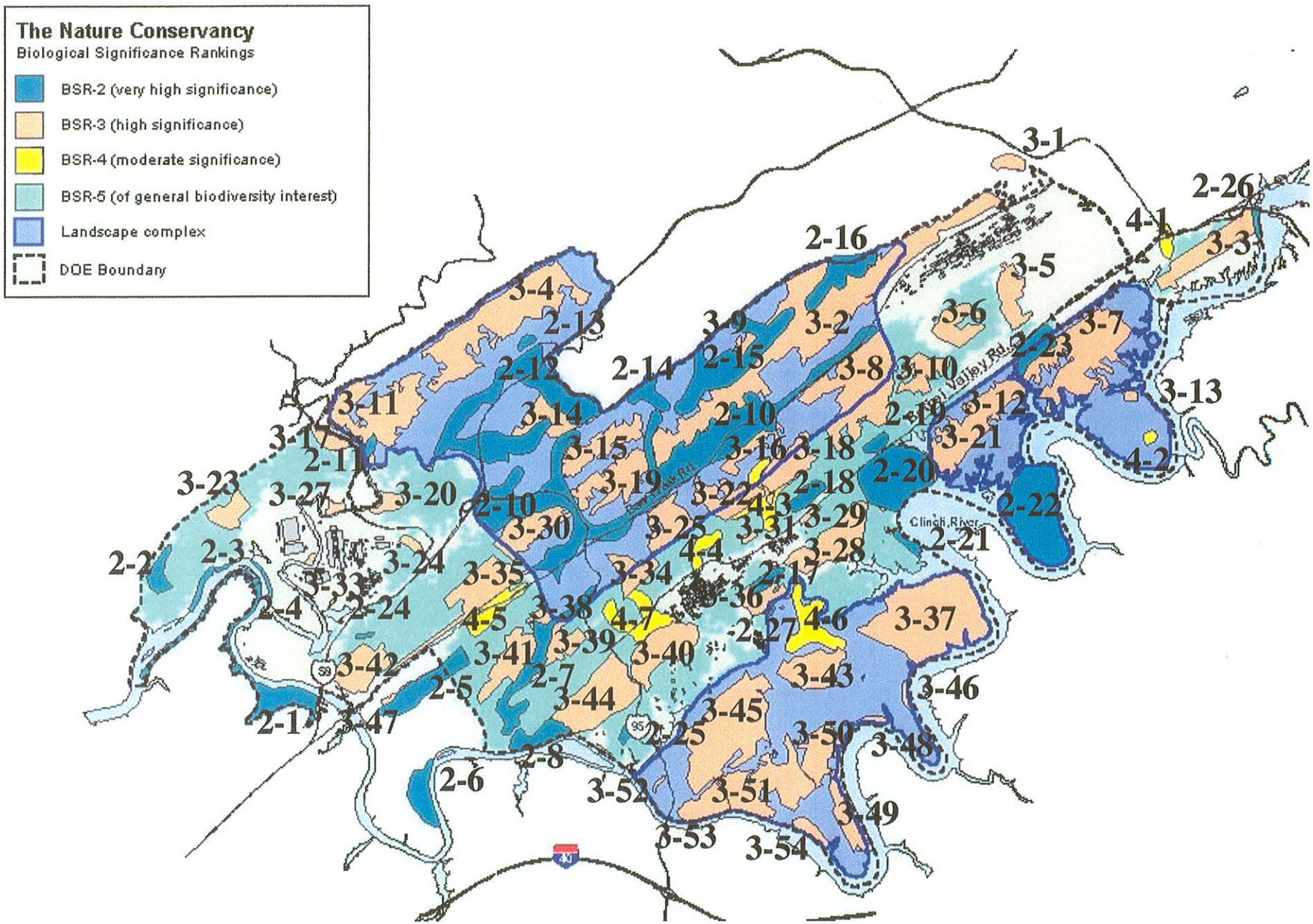


Scale: 1 : 80,000
Projection: State Plane
Horizontal Datum: North American 1983

The Nature Conservancy

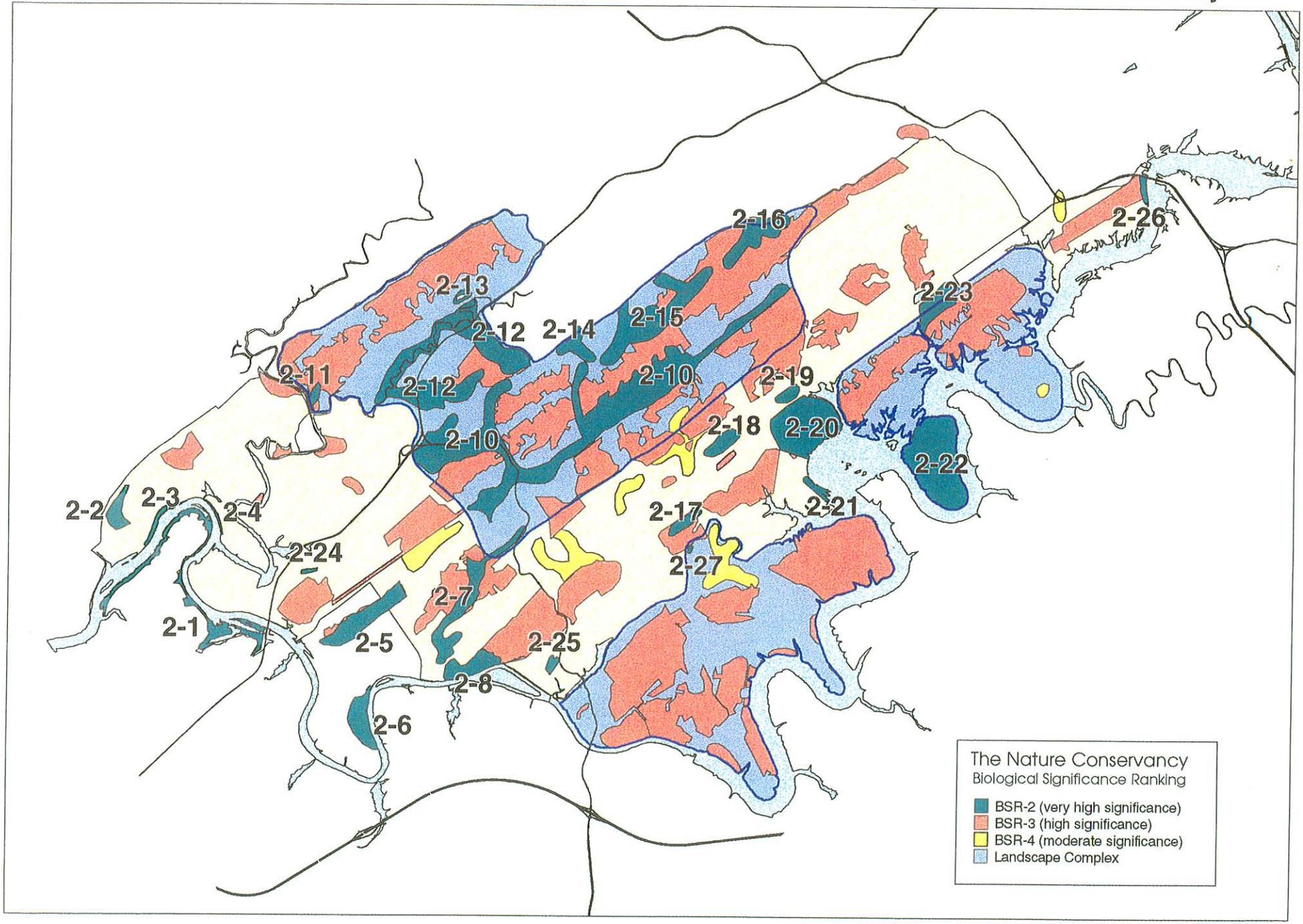
Map prepared by The Nature Conservancy, 8/28/95


Preliminary Conservation Sites (April, 1995)
The Nature Conservancy
★Rare Species
BSR 2
BSR 3
BSR 4
Landscape Complexes
DOE Oak Ridge Reservation
0
1
2
Miles
Map Layout by Deborah Awl
JAYCOR Environmental

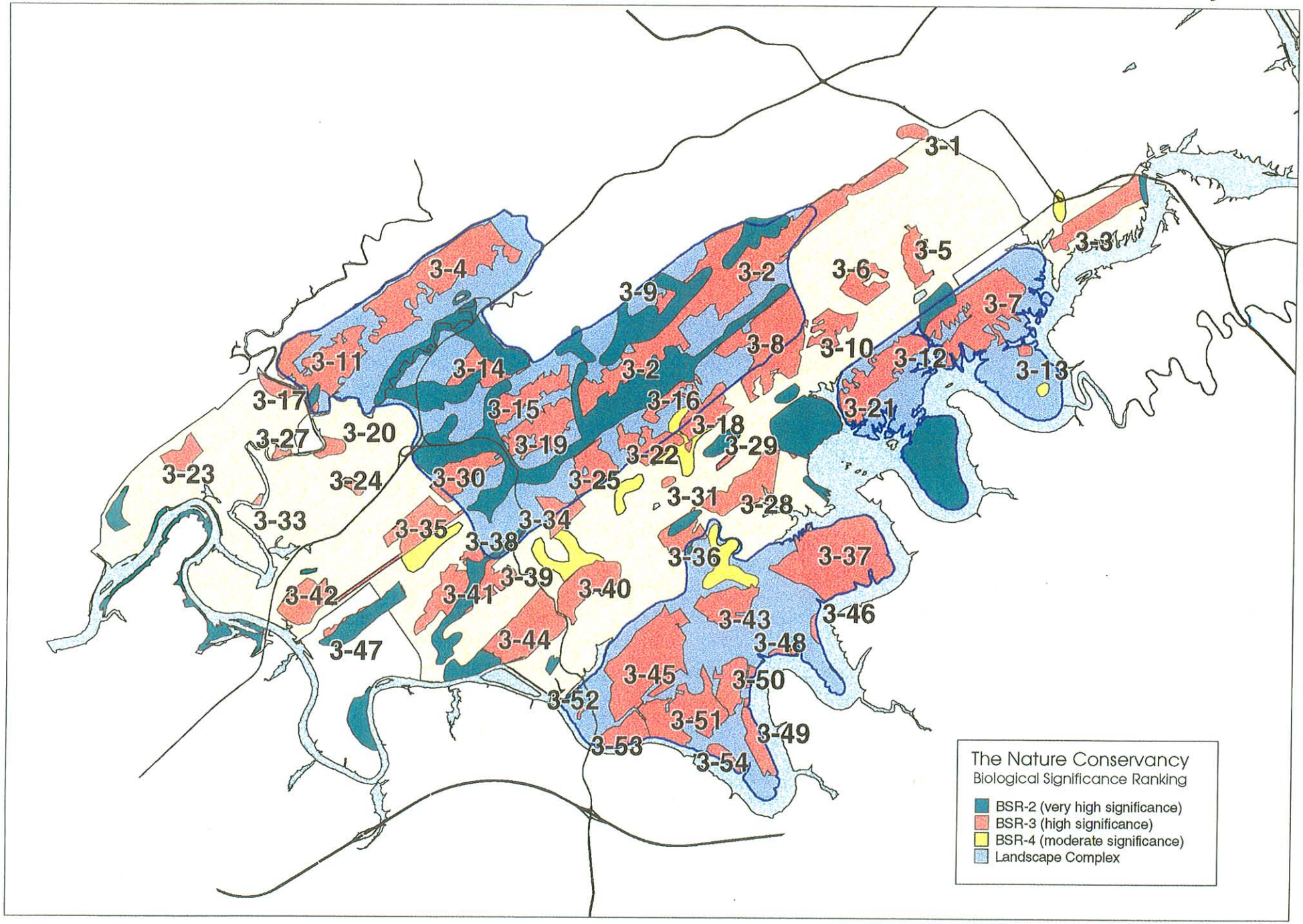


The Nature Conservancy biodiversity rankings and landscape complexes

1995 Preliminary Biodiversity Report on the Oak Ridge Reservation by The Nature Conservancy



1995 Preliminary Biodiversity Report on the Oak Ridge Reservation by The Nature Conservancy



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