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**ENVIRONMENTAL  
RESTORATION  
PROGRAM**

**Survey of Protected Vascular Plants  
on the Oak Ridge Reservation,  
Oak Ridge, Tennessee**

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## PREFACE

This technical report was prepared as the final report of the Threatened and Endangered Vascular Plants Project of the Environmentally Sensitive Areas Surveys Program. This work was conducted under Work Breakdown Structure 1.4.12.2.3.04.03.01 (Activity Data Sheet 8304) and the milestone titled *Final Report of Baseline Threatened and Endangered Vascular Plant Species Conditions on the Oak Ridge Reservation*.

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## ABBREVIATIONS

<b>CERCLA</b>	<b>Comprehensive Environmental Response, Compensation, and Liability Act</b>
<b>CFR</b>	<i>Code of Federal Regulations</i>
<b>CWA</b>	<b>Clean Water Act</b>
<b>DOE</b>	<b>U.S. Department of Energy</b>
<b>EM</b>	<b>Environmental Restoration and Waste Management Program</b>
<b>ESA</b>	<b>Endangered Species Act</b>
<b>FWS</b>	<b>U. S. Fish and Wildlife Service</b>
<b>GIS</b>	<b>geographic information systems</b>
<b>GWOU</b>	<b>groundwater operable unit</b>
<b>NEPA</b>	<b>National Environmental Policy Act</b>
<b>NRDA</b>	<b>National Resource Damage Assessments</b>
<b>OREIS</b>	<b>Oak Ridge Environmental Information System</b>
<b>ORNL</b>	<b>Oak Ridge National Laboratory</b>
<b>ORR</b>	<b>Oak Ridge Reservation</b>
<b>OU</b>	<b>operable unit</b>
<b>T&amp;E</b>	<b>threatened and endangered</b>
<b>TDEC</b>	<b>Tennessee Department of Environment and Conservation</b>
<b>TNC</b>	<b>The Nature Conservancy</b>
<b>TVA</b>	<b>Tennessee Valley Authority</b>
<b>UT</b>	<b>The University of Tennessee</b>
<b>WAG</b>	<b>waste area grouping</b>





## EXECUTIVE SUMMARY

Vascular plant surveys were initiated during fiscal year 1992 by the environmentally sensitive areas program to determine the baseline condition of threatened and endangered (T&E) vascular plant species on the Oak Ridge Reservation (ORR). T&E species receive protection under federal and state regulations. In addition, the National Environmental Policy Act (NEPA) requires that federally-funded projects avoid or mitigate impacts to listed species.

T&E plant species found on or near the U. S. Department of Energy's (DOE) Oak Ridge Reservation (ORR) are identified. Twenty-eight species identified on the ORR are listed by the Tennessee Department of Environment and Conservation as either endangered, threatened, or of special concern. Four of these have been under review by the U.S. Fish and Wildlife Service for possible listing (listed in the formerly-used C2 candidate category). Additional species listed by the state occur near and may be present on the ORR. A range of habitats support the rare taxa on the ORR: river bluffs, sinkholes, calcareous barrens, wetlands, utility corridors, and forests. The list of T&E plant species and their locations on the ORR should be considered provisional because the entire ORR has not been surveyed, and state and federal status of all species continues to be updated.

The purpose of this document is to present information on the listed T&E plant species currently known to occur on the ORR as well as listed species potentially occurring on the ORR based on geographic range and habitat availability. For the purpose of this report, "T&E species" include all federal- and state-listed species, including candidates for listing, and species of special concern. For project planning purposes, this report is most useful in alerting planners and site managers that T&E species are known to exist in certain areas. Consideration of T&E plant habitats is an important component of resource management and land-use planning; protection of rare species in their natural habitat is the best method of ensuring their long-term survival.



# 1. INTRODUCTION

The U.S. Department of Energy's (DOE's) Oak Ridge Reservation (ORR) encompasses approximately 15,000 ha in the Ridge and Valley physiographic province of Tennessee. Threatened and endangered (T&E) plant species on the ORR may receive protection under federal and state laws.

The federal Endangered Species Act of 1973 (ESA), as amended, provides for the listing and protection of species in danger of becoming extinct and conservation of the habitats on which such species depend. ESA makes it illegal to kill, collect, remove, harass, import, or export an endangered or threatened species without a permit from the Secretary of the Interior. Federal regulations that implement Sect. 7, "Interagency Cooperation," of the ESA (16 U.S.C. 1531 et seq.) require federal agencies to assess the impacts of their actions on plant and animal species listed by the U. S. Fish and Wildlife Service (FWS) as threatened or endangered and on areas designated or proposed for designation as critical habitat. FWS recommends that federal agencies also consider species that are candidates for listing during environmental planning since candidate species may eventually be listed.

The National Environmental Policy Act (NEPA) requires that federally-funded projects avoid or mitigate impacts to listed species. DOE NEPA implementing regulations (10 *CFR* 1021) require consideration of adverse effects to "environmentally sensitive resources" including "federally listed threatened or endangered species or their habitat (including critical habitat), federally proposed or candidate species or their habitat, or state-listed endangered or threatened species or their habitat."

Plant species listed by the Tennessee Department of Environment and Conservation (TDEC) are also provided limited protection by the Tennessee Rare Plant Protection and Conservation Act of 1985 (Tennessee Code Annotated Title 11-26, Sects. 201-214). This act protects listed plant species from removal or destruction without the consent of the landowner. DOE supports the protection of state-listed species on the ORR.

The DOE Environmental Restoration and Waste Management Program (EM) has supported a program to survey the ORR for species listed as T&E. Vascular plant surveys were initiated during fiscal year 1992 by the Environmentally Sensitive Areas Program to determine the baseline condition of T&E vascular plant species on the ORR. The primary concern of the T&E plant survey project is the identification of vascular plant species occurring on the ORR that are federally listed as endangered or threatened, candidate species for federal listing, listed by the State of Tennessee, or are of special concern (considered at risk) based on other sources. Additionally, the surveys allow the identification of potential habitat for such species on the ORR and the identification of potential threats to such species on the ORR.

Data collected during these surveys aids in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial investigations on the ORR. The surveys also provide data for EM decision documents, ensure that remedial decisions have legal defensibility, provide a baseline for ensuring compliance with principal legal requirements [including ESA, NEPA, CERCLA, National Resource Damage Assessments (NRDA), and the Clean Water Act (CWA)] and will increase public confidence in DOE's adherence to all related environmental resources rules, laws, regulations, and instructions.

## 2. METHODS

The ORR T&E plant survey project can be broken down into three primary tasks: compilation of existing data, field surveys, and documentation.

### 2.1. COMPILATION OF PRE-EXISTING DATA

Data existing prior to the initiation of this project was compiled and published during Fall 1993 (Cunningham et al. 1993; Pounds, Parr, and Ryan 1993). Updated state and federal rare plant lists were obtained from TDEC and the *Federal Register*. Data from previous plant surveys on the ORR were reviewed and evaluated for completeness. A preliminary map of areas for which rare plant data was available and was prepared using geographic information systems (GIS); this coverage was then overlaid onto the EM waste areas map to determine the availability of rare plant data for the waste areas. The following data sets were compiled:

- Vascular plants documented to occur on the ORR
- T&E vascular plant species not documented from the ORR but known to exist in areas near the ORR
- T&E vascular plant species occurring in the Ridge and Valley Physiographic Province of Tennessee which potentially occur in habitat types found on the ORR
- Characterization data for T&E vascular plant species occurring on the ORR, near the ORR, or potentially within habitats present on the ORR (i.e., range information; habitat requirements; life cycle characteristics such as dates of emergence, flowering, and setting of fruit or seed; and distinguishing morphologic features)
- Descriptions of environmentally sensitive areas on the ORR known to contain rare plants or rare communities
- Landscape elements frequently associated with rare species on the ORR (landscape elements are land types and formations which provide the underlying structure for the development of biological habitats and communities; many T&E species are associated with or restricted to certain land types/formations)

### 2.2. FIELD SURVEYS

Field surveys were conducted to locate and identify T&E plant species and sensitive habitats on the ground. Areas of the ORR lacking sufficient information concerning rare plants and sensitive habitats were ranked for urgency of field surveys and selected for site visits in a roughly descending order based on the following priorities: (1) EM waste areas, (2) areas where projects have been proposed, (3) areas most likely to be impacted in the near future, (4) areas containing landscape elements and natural communities associated with T&E species, (5) remaining areas of the ORR. In addition, selected areas with known rare plant populations were visited to collect baseline data on those populations.

Field surveys were conducted by trained biologists familiar with the regional flora who have familiarized themselves with the distinguishing morphologic characteristics, life cycles, and habitats of the rare plant species occurring or potentially occurring in the area investigated. Field surveys sometimes required multiple site visits when taxonomic identifications required plant parts available during other seasons ("seasonal identification") when environmental conditions were unfavorable for the growth and/or observation of a species during the initial visit or when population monitoring efforts were undertaken. Types of records produced in the course of field surveys included species lists, data sheets, maps, photos, herbarium specimens, and written reports. The following types of methods were applied in the course of field surveys and are presented in order of decreasing areal scale and increasing level of detail of data provided: exploration, systematic search, and population monitoring.

### **2.2.1 Exploration**

Exploration is the least costly and labor intensive survey method, and is generally applied over areas on a scale of 10–1000 acres. In an exploration, landscape features frequently associated with T&E species present on the ORR are sought out and identified during the site visit, and ground coverage is skewed towards those areas most likely to yield important results. Sensitive landscape elements potentially associated with T&E species on the ORR include wetlands, springs and seeps, barrens, steep slopes, rock outcrops, sinkholes, cliffs, streams, and large unfragmented native forest tracts. In addition, some artificial habitats may be associated with T&E species: in particular, unusual disturbances, anthropogenic impoundments, and areas where woody growth is suppressed but natural vegetation dominates, such as under power lines.

### **2.2.2 Systematic Search**

A systematic search is the method of choice when intensive disturbance is planned for a specific site, and increased documentation is required for legal purposes. A systematic search is generally applied over a scale of 1–10 acres. During a systematic search, the entire area is walked and searched for T&E plant species in a pattern of transects. This allows a more complete visual coverage of the site, taking into account topographic features (such as hills and obstacles) and existing sight range limiting conditions (such as light level, fog, and vegetation density). The surveyor develops and maintains mental search images of the potential T&E species occurring on the ORR by visiting sites where they have been found and by viewing photographs prior to the search. The surveyor also must maintain an alertness to unusual conditions or features which may signal the presence of a T&E species.

### **2.2.3 Population Monitoring**

Population monitoring is used to provide detailed baseline population data for selected rare species. Monitoring is generally applied on a scale of less than 1 acre to 2 acres. The level of detail involved in a monitoring effort ranges from simply checking for the continued existence and reproduction of a species at a site to population estimates, direct population counts, or determination of age, size, and /or sexual structure of the population. In addition, ancillary information about the site, such as topographic position, slope, aspect, light conditions, moisture levels, disturbances, and presence of pollinators, may also be collected.

## 2.3 DOCUMENTATION

Documentation of vascular plant species occurring on the ORR was accomplished by combining specimens, photography, and the ORR vascular flora data base. Taxonomic identification of vascular plant species was performed using appropriate regional guides (Radford et al. 1968, Wofford 1989, Cronquist 1980, Kral 1983, Massey et al. 1983, Gleason 1952, Gleason and Cronquist 1991). Difficult to identify specimens and specimens which potentially represented T&E species were then referred to appropriate taxonomic experts at the University of Tennessee (UT), the Tennessee State Heritage Program, and other universities, herbaria, and museums for identification. Voucher specimens were collected as physical documentation for vascular plant species when removal of the specimen was not deemed to jeopardize the population. When collection of a voucher specimen was deemed unacceptable, a photograph was taken in its place. Voucher specimens were collected for both listed and nonlisted vascular plant species occurring on the ORR. Baseline documentation for currently non-T&E species as well as T&E species were provided, since species may be added to federal and state lists in the future. Voucher specimens were mounted on nonacidic herbarium paper, labeled with the location found, the collector's name, and the collection date, and then filed in the ORR herbarium. Species which were not vouchered through removal of a physical specimen were instead vouchered by mounting and filing a photograph of the specimen taken on-location. In addition, all T&E species were photographed on location. Photographs were supplied with ORNL Photography Department numbers, and the negatives are maintained by the ORNL Photography Department. All vascular plant species identified from the ORR were entered into the ORR vascular flora data base, along with supporting information. An explanation of the data contained in the ORR vascular flora data base, along with a printout of the data base, is provided in Appendix A.

Documentation of surveys and field sample sites for T&E species, their habitats, and associated sensitive landscape elements was accomplished through mapping using a GIS. Environmentally sensitive areas on the ORR are delineated by combining data from multiple sources to identify the extents of sensitive species, their habitats, and necessary buffer zones. Spatial data is input into the GIS through digitizing and/or use of global positioning systems. Mapped coverages of T&E plant species and sensitive habitat locations are being provided to the Oak Ridge Environmental Information System (OREIS). Access to some kinds of information (e.g., actual locations of T&E species) will be restricted.

### 3. RESULTS

#### 3.1 SURVEY COVERAGE

During 1991–1994, approximately 12,000 acres of the ORR were surveyed for T&E vascular plants (Figure 1); summary data for 1992–1994 is presented in Table 1. During 1995 and 1996, field surveys for T&E vascular plants were conducted on approximately 2,000 acres of the ORR (Figs. 1, 2). Field survey data for 1995–1996 is presented in Table 2. Approximately 14,000 acres of the ORR have been surveyed for T&E vascular plants as of May 1996. Approximately 21,000 acres of the ORR have not been surveyed for T&E vascular plant species; survey coverage gaps are shown in fig. 3.

#### 3.2 T&E SPECIES ON THE ORR

Of the 28 listed vascular plant species identified on the ORR to date (Table 3), 18 were reported prior to 1993 (Cunningham et al. 1993, Pounds 1993), and an additional 10 were reported between 1993 and 1996. Fig. 4 shows identified point occurrences for T&E vascular plant species on the ORR based on field survey sample sites (this data should not be interpreted as indicating the areal extent of these species). T&E vascular plant species have been identified from a total of 267 sites on the ORR to date. T&E vascular plant sites identified at existing sources and field surveys prior to 1995 total 82. An additional 185 T&E vascular plant sites were identified as a result of field surveys conducted during 1995 through May 1996.

Specific locations of rare plants on the ORR are kept on file by the Oak Ridge National Laboratory (ORNL) area manager. The occurrence of T&E species within operable units (OUs) and waste area groupings (WAGs), environmentally sensitive areas, and other areas on the ORR, is presented in Table 4. Environmentally sensitive areas, including the extent of T&E plant species as currently known, their habitats, and necessary buffer zones, are shown in Fig. 5. Occurrence sites (Fig. 4) and ranges, associated rare natural communities (TNC 1995, Grossman et al. 1994), environmentally sensitive landscape elements, and appropriate buffer zones based on local topography were used to delineate environmentally sensitive areas.

##### 3.2.1 Federal T&E Species

No federally listed vascular plant species have been found on the ORR during this survey. Four vascular plant species reported from the ORR are of "special concern" at the federal level because not enough information is currently available to determine their status; these four species were listed on the formerly used C2 federal candidate list [*Aureolaria patula*, *Cimicifuga rubifolia*, *Delphinium exaltatum*, *Juglans cinerea* (Table 3)]. *Juglans cinerea* has been attacked by butternut canker throughout its range; identifiable (mature) growth of *Juglans cinerea* was not found on the ORR during this survey although rootstocks and sprouts which may represent this species are present.

##### 3.2.2 Tennessee T&E Species

Twenty-eight vascular plant species that have been listed by the state of Tennessee have been reported as occurring within the current ORR boundaries to date; these species are listed in Table 3 along with their status. Two of the species, *Lilium michiganense* and *Carex oxylepis* var.

*pubescens* have been identified from the ORR in the past but were not found during this survey. *Lilium michiganense* may have been extirpated from the ORR by the impoundment at Melton Hill dam. Also included in Table 3 is a nonlisted vascular plant species found on the ORR, *Collinsonia verticillata*, which is ranked highly by The Nature Conservancy (TNC) and may be a potential candidate for listing in Tennessee.

### 3.2.3 Other T&E Species Which May Be Present on the ORR

The following vascular plant species listed by the state of Tennessee were reported from sites which are no longer part of the ORR: *Agalinis auriculata* (also listed under the formerly used federal C2 candidate designation), *Gnaphalium helleri*, *Liatris cylindracea*, and *Solidago ptarmicoides*. These species may be present within the current ORR boundaries but were not found during this survey. Other listed vascular plant species deemed as potentially occurring on the ORR (occurring near the ORR and/or occurring in habitat found on the ORR) which may be present on the ORR but were not found during this survey are listed in Table 5.

## 3.3 VOUCHERS

Over 1,100 species of vascular plants have been identified on the ORR to date (Appendix A). Approximately 983 of these species were recorded prior to 1993 (Cunningham et al. 1993). An additional 144 species were recorded and vouchered (specimens placed in the ORR herbarium) as a result of field surveys during 1992–1996 (Table 6). Other institutional herbariums (in addition to the ORNL herbarium) that maintain vascular plant voucher specimens from the ORR are listed in Appendix A. Voucher photographs of Tennessee state-listed and federal “special concern” vascular plant species and their habitats on the ORR are filed with the ORNL Photography Department. A list of voucher photographs and their ORNL Photography Department numbers is provided in Table 7.

## 3.4 CHARACTERIZATION ABSTRACTS

Information for the following species characterization abstracts was taken from the following sources: Radford et al. 1968, Wofford 1989, Cronquist 1980, Kral 1983, Massey et al. 1983, Gleason 1952, Gleason and Cronquist 1991, Pyne and Shea 1994a,b,c. Range information was compiled from these sources and Chester et al. (1993). A discussion by TNC (1995) of the conservation significance of ORR populations of rare plants has been quoted in the abstracts when available. Table 8 provides abbreviations for U.S. states used in these abstracts.

### 3.4.1 T&E Vascular Plant Species Found on the ORR

#### 3.4.1.1 *Aureolaria patula* (Chapm.) Pennell

**Common name:** Spreading false-foxglove

**Family:** Scrophulariaceae

**Federal status:** Special Concern (listed under the formerly used C2 candidate designation)



**Tennessee status:** Threatened

**Location on ORR:** Bethel Valley groundwater operable unit (GWOU), K-25 GWOU, Melton Valley GWOU, NA1, NA3, NA6, NA14, NA16, NA17, NA19, NA20, NA30, NA32, NA33, NA37, NA45

**Habitat:** Wooded, calcareous, river and creek bluffs (Kral 1983)

**Habitat on ORR:** In shade on calcareous bluffs and talus slopes along the Clinch River and several tributaries (often at the edge of a lake or large stream)

**Range:** Central KY to north GA and AL

**Tennessee counties:** Anderson, Coffee, Knox, Morgan, and Roane

**Description:** Erect to decumbent perennial herb with stems up to 12 dm in length. Stem not glaucous somewhat hairy. Lower leaves lobed. Corolla yellow, pedicels 15 to 25 mm long, capsule glabrous

**Similar species:**

1. *Aureolaria virginica* has short pedicels (1–3 mm)
2. *Aureolaria laevigata* and *A. flava* lack hairs

**Flowering date:** Late July through early October

**Fruiting date:** October–November

**Comments:** Other rare or uncommon species co-occurring with *A. patula* on the ORR are *Cimicifuga rubifolia*, *Diervilla lonicera*, *Thuja occidentalis*, and a mat-forming variant of *Blephilia ciliata*

**Threats on ORR:** Habitat destruction, excessive reservoir water level fluctuations, recreational activity on river banks, and tree canopy removal. Overgrowth by kudzu, an aggressive exotic vine, threatens at least one population.

**TNC ORR conservation significance:** “A number of populations of this species occur on ORR. Many of these sites adjoin the Clinch River, and often occur near the water’s edge. It is possible that it is being dispersed by water. Spreading false-foxglove has a small range, and is rare and scattered within it. All remaining viable populations are important to its survival.”

### 3.4.1.2 *Carex gravida* Bailey

**Common name:** Heavy sedge

**Family:** Cyperaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** Bethel Valley GWOU, K-25 GWOU, Melton Valley GWOU, NA 32, NA 42, NA51

**Habitat:** Dry, open areas

**Habitat on ORR:** Wooded, rocky slopes

**Range:** Southeast MI, south IA, and KS; south to TX and further east (TN, NC) perhaps as a recent introduction

**Tennessee counties:** Knox, Meigs, Montgomery, and Roane

**Description:** An inconspicuous sedge. Difficult to identify in the field below genus level. Expert consultation is required for positive identification. May sometimes be detected in the field by noting that the fruiting culms are leaning over close to the ground and thus the common name but other *Carex* species may do this also.

**Fruiting date:** Summer

**Comments:** *C. grvida* is growing in surprisingly shady and undisturbed locations on the ORR. Radford et al. (1968) describe the species habitat in the Carolinas as waste places.

**Threats on ORR:** Habitat destruction

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

**3.4.1.3 *Carex howei* Mack (*Carex atlantica* L.H. Bailey var. *capillacea* (L.H. BAILEY) Reznicek )**

**Common name:** Howe's Sedge

**Family:** Cyperaceae

**Federal status:** None

**Tennessee status:** Endangered

**Location on ORR:** NA55

**Habitat:** Shaded wetlands

**Habitat on ORR:** Shaded wetlands

**Range:** Mainly on the coastal plain but occasionally inland to OH, southern Ontario, southern MI, and northern IN

**Tennessee counties:** Hardeman, Chester, Hardin, Lewis, Hickman, Maury, Putnam, White, Roane

(ORR), Cocke[ Great Smoky Mountains National Park (GSMNP)]

**Description:** culms 2.5–5.5 dm tall, blades usually about 1mm (less than 1.3 mm), perigynia spreading, staminate flowers mostly at the base of the terminal spike

**Similar species:**

1. *Carex interior* differs in having no nerves on the perigynia (rarely a few) while *C. howei* has several.
2. *Carex incompta* (*Carex atlantica* var. *atlantica*) differs in having blades 1.5–4 mm rather than less than 1.3 mm

**Flowering date:** May–June

**Threats on ORR:** This species could be negatively effected by canopy opening, change in hydrological regime and/or siltation

**TNC ORR conservation significance:** This species was discovered on the ORR after TNC report

**3.4.1.4 *Carex oxylepis* Torr. & Hook. var. *pubescens* J.K. Underw.**

**Common name:** Hairy sharp-scaled sedge

**Family:** Cyperaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** Melton Valley GWOU, WAG 2, CMA 5

**Habitat:** Shaded wetland

**Habitat on ORR:** Shaded wetland.

**Range:** Southeastern VA to northern FL, west to east and southeastern TX, northward in the interior to OK, AK, MO, TN

**Tennessee counties:** Cheatham, Davidson, Perry, Roane, Rutherford

**Description:** A sedge similar to the more common *Carex debilis*. Expert consultation is required for positive identification.

**Fruiting date:** Late spring and summer

**Comments:** *Carex* expert V. McNeilis (UT herbarium) does not consider this to be a valid taxon, but it is recognized by TDEC. The only specimen of this variety taken from the ORR is in the Smithsonian Institute herbarium (Washington, D.C.). The other variety of the species (*Carex oxylepis* var. *oxylepis*) has been collected several times on the ORR.

**Threats on ORR:** Habitat destruction and habitat invasion by *Microstegium vimineum*

**TNC ORR conservation significance:** "The current status of this variety at ORR is uncertain; it has not been seen in recent years."

#### 3.4.1.5 *Cimicifuga rubifolia* Kearney

**Common name:** Appalachian bugbane

**Family:** Ranunculaceae

**Federal status:** Special Concern (was listed under the formerly used C2 candidate designation)

**Tennessee status:** Threatened

**Location on ORR:** NA1, NA3, NA11, NA 15, NA19, NA23

**Habitat:** Wooded bluffs, ravines, coves, north-facing talus slopes; prefers limestone or calcareous shale (Massey et al. 1983)

**Habitat on ORR:** Wooded talus slopes along Clinch River and Grassy Creek, a tributary of Clinch River

**Range:** AL, IL, IN, KY, NC, PA, TN, and VA

**Tennessee counties:** Anderson, Claiborne, Grainger, Hamblin, Hancock, Hawkins, Jefferson, Knox, Loudon, Meigs, Montgomery, Roane, Stewart, and Sullivan

**Description:** Perennial herb with mostly basal, compound leaves of three to nine leaflets. Base of terminal leaflet is deeply cordate. Solitary, wand-like flowering stem up to 14 dm tall. Flowers are white.

**Similar species:**

1. *Astilbe biternatum* is vegetatively very similar and grows in the same habitat. It is useful to look for old flowering stalks to aid the identification.
2. Other *Cimicifuga* have 15 or more leaflets per leaf while *C. rubifolia* normally has 3–9.

**Flowering date:** July–October

**Fruiting date:** September–October

**Comments:** Other rare species co-occurring with *C. rubifolia* on the ORR are *Saxifraga careyana*, *Diervilla lonicera*, and *Aureolaria patula*.

**Threats on ORR:** Habitat destruction, tree canopy removal, invasion of habitat by competing exotic species (which may result from forest fragmentation)

**TNC ORR conservation significance:** "This species is scarce throughout its narrow range."

Important populations of this species occur on ORR.”

#### 3.4.1.6 *Collinsonia verticillata* Baldwin ex Elliot

**Common name:** Whorled horse-balm

**Family:** Lamiaceae

**Federal status:** None

**Tennessee status:** None

**Location on ORR:** BCOU4, K-25 GWOU, Melton Valley GWOU, NA39, NA41, NA44, NA45, NA52, NA54

**Habitat:** Wooded slopes.

**Habitat on ORR:** Mature mesic forest.

**Range:** AL, GA, NC, SC, TN, VA (disjunct), OH (disjunct).

**Tennessee counties:** Blount, Cumberland, Hamilton, Knox, McMinn, Meigs, Rhea, Roane, Sevier, possibly Anderson

**Description:** Perennial herb (2–8 dm) with upper leaves appearing whorled. Flowers are lavender, light pink, or white.

**Similar species:**

1. *Collinsonia canadensis* might be confused with *C. verticillata* when flowers are absent, but usually the leaves do not appear whorled on *Collinsonia canadensis*.

**Flowering date:** Late April through early June

**Fruiting date:** June–July

**Comments:** Highly ranked by TNC

**Threats on ORR:** Habitat loss

**TNC ORR conservation significance:** Not described in the ORR report

#### 3.4.1.7 *Cypripedium acaule* Ait.

**Common name:** Pink lady-slipper

**Family:** Orchidaceae

**Federal status:** None

**Tennessee status:** Endangered (due to commercial exploitation)

**Location on ORR:** BCOU4, Bethel Valley GWOU, Melton Valley GWOU, HA2, HA4, HA7, NA4, NA6, NA14, NA20, NA24, NA25, NA42, NA46, NA47, RA 6, RA9

**Habitat:** Bogs and dry, acid pine woods (Radford et al. 1968)

**Habitat on ORR:** Moist to dry acid woods with pine trees

**Range:** East US; south to SC and AL

**Tennessee counties:** Perhaps in all counties of East Tennessee, but not found west of the eastern Highland Rim

**Description:** Two large, ribbed ovate leaves are at the base of a single flowered scape. Flower pink, fissured in front

**Similar species:** *Cypripedium acaule* is rarely white flowered, possibly leading to confusion, but the pair of large basal leaves is unique among our *Cypripedium*.

**Flowering date:** April–July

**Comments:** *C. acaule* is a showy species much prized in the wildflower trade. Evidence to date indicates that not only is the species being removed from its habitat in large numbers across the state, but also, no propagation techniques are known to be successful. For this reason, TDEC lists the species as endangered in Tennessee.

**Threats on ORR:** Habitat loss, tree canopy removal, and illegal digging

**TNC ORR conservation significance:** “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 ORR are more protected from collection (one of the main threats to the species) than populations on private or unrestricted public land.”

#### 3.4.1.8 *Delphinium exaltatum* Ait.

**Common name:** Tall larkspur

**Family:** Ranunculaceae

**Federal status:** Special Concern (listed under the formerly used C2 candidate designation)

**Tennessee status:** Endangered

**Location on ORR:** Bethel Valley GWOU, NA7, NA8, NA35, NA36, NA43

**Habitat:** Rich, moist, loamy soils of open, calcareous, wooded ravines (Kral 1976)

**Habitat on ORR:** Open, rocky, calcareous woods, barrens, and utility right of ways

**Range:** IN, MO, NC, OH, PA, TN, VA, WV, IA, and ME

**Tennessee counties:** Anderson, Hamilton, and Roane

**Description:** Erect, solitary stems to 15 dm in height. Branched racemes with blue flowers late in season

**Similar species:**

1. *Aconitum uncinatum* in the early stages (basal leaves) before the stem develops is very similar and should be differentiated at a later stage.
2. Other species of *Delphinium* which might be confused with *D. exaltatum* are hairy on the stem below the inflorescence.

**Flowering date:** August–September

**Fruiting date:** September–October

**Threats on ORR:** Habitat destruction, invasion of habitat by woody species, shade, fire suppression

**TNC ORR conservation significance:** “One of the largest range–wide populations of this species occurs on ORR. Several additional populations are also important to this species’ survival.”

#### **3.4.1.9 *Diervilla lonicera* P. Mill.**

**Common name:** Northern bush–honeysuckle

**Family:** Caprifoliaceae

**Federal status:** None

**Tennessee status:** Threatened

**Location on ORR:** NA11, NA14

**Habitat:** Woodlands and rocky bluffs (Radford et al. 1968)

**Habitat on ORR:** Calcareous, rocky bluffs along the Clinch River

**Range:** AL, CT, DE, GA, IA, IL, IN, KS, MA, ME, MI, MN, NC, NH, NY, OH, PA, SC, TN, VA, VT, WI, and WV

**Tennessee counties:** Anderson, Cheatham, Polk, and Sevier

**Description:** Deciduous shrub to 20 dm tall. Simple, opposite, lanceolate leaves. Light–yellow flowers resembling honeysuckle that turn red with age

**Similar species:**

1. Shrubby honeysuckles (*Lonicera*) do not have teeth on the leaves.

2. *Diervilla sessilifolia* has sessile leaves.

**Flowering date:** June–July

**Fruiting date:** August–October

**Comments:** Other rare or uncommon species co-occurring with *D. lonicera* on the ORR are *Thuja occidentalis*, *Cimicifuga rubifolia*, and *Aureolaria patula*.

**Threats on ORR:** Habitat destruction.

**TNC ORR conservation significance:** “Populations on 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.”

### 3.4.1.10 *Draba ramosissima* Desv.

**Common name:** Branching whitlow–grass

**Family:** Brassicaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** K–25 GWOU, NA37

**Habitat:** Dry, usually calcareous bluffs (Wofford 1989)

**Habitat on ORR:** Dry limestone ledges along Watts Bar Lake

**Range:** VA, WV, eastern KY, NC, and TN

**Tennessee counties:** Anderson, Blount, DeKalb, Hancock, Polk, Putnam and Roane

**Description:** Mat-forming perennial. Basal rosettes with oblanceolate, toothed leaves. Petals entire, style persistent, and fruit twisted. Flowering stems (1–4 dm). Flowers are white.

**Flowering date:** April–May

**Fruiting date:** May–July

**Threats on ORR:** Habitat destruction, habitat invasion by competing exotic species following forest fragmentation

**TNC ORR conservation significance:** “This species is very rare in Tennessee and has only a narrow distribution in the Central and Southern Appalachians.”



**3.4.1.11 *Elodea nuttallii* (Planch.) St. John****Common name:** Nuttall waterweed**Family:** Hydrocharitaceae**Federal status:** None**Tennessee status:** Special Concern**Location on ORR:** Bethel Valley GWOU, Melton Valley GWOU, NA6, NA47, RA28**Habitat:** Lakes, ponds, and sluggish streams (Radford et al. 1968)**Habitat on ORR:** Clinch River embayment, ponds**Range:** MA to VA; west to MN, MO, and OR; now known from TN and NC**Tennessee counties:** Lake, Montgomery, Obion, and Roane**Description:** Submerged aquatic with whorls of three leaves. Leaves are linear, acute, and densely imbricate at growing tips. The miniscule staminate flowers are free floating, sometimes appearing as a white powder on the surface of the water.**Similar species:**

1. *Elodea canadensis* does not have the free floating flowers

**Flowering date:** July–September**Comments:** No other rare species are known to co-occur with *E. nuttallii* on the ORR. Probably a recent introduction**Threats on ORR:** Habitat destruction, draining of ponds, water temperature change, water pollution**TNC ORR conservation significance:** “Nuttall’s waterweed has established itself at ORR in artificial ponds or 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.”**3.4.1.12 *Fothergilla major* (Sims) Lodd.****Common name:** Mountain witch–alder**Family:** Hamamelidaceae**Federal status:** None**Tennessee status:** Threatened**Location on ORR:** NA12

**Habitat:** Rocky woodlands (Wofford 1989)

**Habitat on ORR:** On west-facing slope in woods

**Range:** AL, AR, GA, NC, SC, and TN

**Tennessee counties:** Anderson, Grainger, Greene, Scott, and Sevier

**Description:** Stoloniferous shrub or small tree. Alternately arranged, deciduous leaves are pinnately veined. Flowers are white and epetalate and occur in terminal spikes.

**Similar species:**

1. *Hamamelis virginica* is similar when flowers and fruit are absent but lacks stellate hairs on the undersides of the leaves

**Flowering date:** April–May

**Fruiting date:** July

**Comments:** No other listed species are known to occur with *F. major* on the ORR

**Threats on ORR:** Habitat destruction, severe fire, and tree canopy removal

**TNC ORR conservation significance:** “Currently known from a single site on 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 ORR is somewhat isolated. Populations peripheral to the main range of a species often indicate unusual habitats and represent unique genetic material.”

#### 3.4.1.13 *Hydrastis canadensis* L.

**Common name:** Golden seal

**Family:** Ranunculaceae

**Federal status:** None (was listed under the formerly used 3C category)

**Tennessee status:** Threatened

**Location on ORR:** NA2, NA6, NA10, NA21, NA47, NA52, RA8

**Habitat:** Rich woods (Radford et al. 1968)

**Habitat on ORR:** Rich, moist woods

**Range:** AL, AR, CT, DE, GA, IA, IL, IN, KY, MA, MI, MN, MO, MS, NC, NY, OH, PA, TN, VA, VT, WI, and WV

**Tennessee counties:** Anderson, Blount, Campbell, Cannon, Carter, Clay, Coffee, Cumberland, Davidson, DeKalb, Fentress, Franklin, Grundy, Hancock, Hardin, Jackson, Knox, Loudon, Marion,

Montgomery, Morgan, Obion, Putnam, Rhea, Roane, Scott, Shelby, Stewart, Sullivan, Sumner, Tipton, Van Buren, Warren, Wayne, and White

**Description:** Erect, perennial herb with thick yellow rhizomes. Stems 1.5–5 dm tall. Solitary, greenish–white, epetalate flowers with numerous stamens

**Similar species:** None

**Flowering date:** April to May

**Fruiting date:** June–July

**Comments:** *Hydrastis canadensis* is a valued medicinal herb on both national and international markets. Like ginseng, its rarity is primarily the result of herb collectors digging the plants. Other rare species that co-occur with *H. canadensis* on the ORR are *Spiranthes ovalis* and *Lilium canadense*.

**Threats on ORR:** Habitat destruction, unauthorized digging to remove plants, tree canopy removal, invasion of habitat by competing exotic species following forest fragmentation, erosion and siltation related to upslope timber salvage activities

**TNC 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.”

#### 3.4.1.14 *Juglans cinerea* L.

**Common name:** Butternut, white walnut

**Family:** Juglandaceae

**Federal status:** Special Concern (was listed under formerly used C2 candidate designation)

**Tennessee status:** Threatened

**Location on ORR:** Melton Valley GWOU, WAG 2, NA32 (These specimens are most likely *Juglans cinerea* L., but they cannot be confirmed because of immature specimen growth.)

**Habitat:** Rich woods

**Habitat on ORR:** Slopes near major streams

**Range:** New Brunswick to Ontario; south to MI and ND; south to VA, GA, AR, and KS

**Tennessee counties:** Anderson, Blount, Campbell, Carter, Chester, Cooke, Cumberland, Franklin, Hamilton, Hawkins, Hickman, Houston, Lewis, Monroe, Polk, Roane, Sevier, Stewart, Sumner, Tipton, Van Buren, Wayne, and Williamson

**Description:** A walnut tree that can be distinguished from the common black walnut by its

elongated fruit (ellipsoidal vs. spherical) and smoother bark. Pith color and hairiness above the leaf scar characteristics appear to be difficult to apply.

**Similar species:** see "Description" and "Comments"

**Flowering date:** April–May

**Fruiting date:** October

**Comments:** Butternut was previously listed under formerly used C2 candidate designation by the U. S. Fish and Wildlife Service (USFWS) because of the threat of a fatal disease— butternut canker. We have observed no nut production in butternut on the ORR. The identification of walnut species at two locations is in question. The identification of these young trees was based on pith color, which may not be reliable. The ORR herbarium has a specimen from 1965. M. W. Bierner verified the identification in 1974. There is a possibility that Manchurian walnut has been introduced on the ORR. It could be confused with the other two species of walnut.

**Threats on ORR:** Habitat destruction, cutting

**TNC ORR conservation significance:** "The importance and health of these populations needs additional assessment. Reproducing populations are extremely rare."

#### 3.4.1.15 *Juncus brachycephalus* (Engelm.) Buchenau

**Common name:** Small-head rush

**Family:** Juncaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** Bethel Valley GWOU, NA24, NA38

**Habitat:** Fens

**Habitat on ORR:** Open wetlands

**Range:** ME to northern Ontario and WI, south to PA, OH, and IN. Disjunct in TN.

**Tennessee counties:** Cheatham, Claiborne, Humphrey, Lewis, Maury, Roane, Warren, Wayne

**Description:** Rushes are grass-like plants. This species bears mature fruits after the other rushes on the ORR

**Fruiting date:** Late July, Aug., possibly Sept.

**Threats on ORR:** Habitat destruction from project development, hydrologic regime change, and at one site, possible disturbance related to the adjacent highway

**TNC ORR conservation significance:** "This species is very 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."

**3.4.1.16 *Lilium canadense* L.**

**Common name:** Canada lily

**Family:** Liliaceae

**Federal status:** None

**Tennessee status:** Threatened

**Location on ORR:** BCOU4, Bethel Valley GWOU, Melton Valley GWOU, NA2, NA8, NA13, NA22, NA25, NA26, NA29, NA31, NA34, NA35, NA36, NA42, NA50, NA56

**Habitat:** Wet meadows, bogs, and balds (Radford et al. 1968)

**Habitat on ORR:** Moist woods, forest edges, and power line openings through moist forest

**Range:** Quebec and ME to MN; AL, CT, DE, DC, IA, IN, KS, KY, MA, ME, MI, MO, NE, NH, NY, OH, OK, PA, RI, SC, SD, TN, VT, VA, WV, and WI

**Tennessee counties:** Anderson, Campbell, Claiborne, Cumberland, Davidson, DeKalb, Johnson, Montgomery, Morgan, Overton, Putnam, Roane, Rutherford, Scott, Sevier, and Stewart

**Description:** Stems to 20 dm tall with whorls of 5–11 leaves. Flower segments are yellow–orange to red, spotted, and slightly recurved to spreading. Petals and sepals more than 6 cm long

**Similar species:**

1. *Lilium michiganense* is very similar but can be distinguished when in bloom. *Lilium canadense* has anthers held close together, barely, or not at all exerted from the only slightly or moderately recurved tepals rather than anthers well separated on strongly divergent filaments with the tepals strongly recurved–reflexed.

2. *Lilium superbum* has smooth leaf margins rather than spiculate–scabrous.

**Flowering date:** June–July

**Fruiting date:** July–September

**Comments:** This species is very similar vegetatively to and may be confused with *Lilium michiganense*, which is also a Tennessee state–listed threatened species. These native lilies rarely bloom on the ORR. It is possible that the populations which have not been seen to flower include *Lilium michiganense*.

**Threats on ORR:** Digging up for transplanting, habitat destruction, indiscriminate use of herbicides, fire suppression

**TNC ORR conservation significance:** "Occurrences on 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."

#### **3.4.1.17 *Lilium michiganense* Farw.**

**Common name:** Michigan lily

**Family:** Liliaceae

**Federal status:** None

**Tennessee status:** Threatened

**Location on ORR:** Not currently known to exist on the ORR. See "Threats on ORR" below.

**Habitat:** Wetlands

**Habitat on ORR:** Wetlands

**Range:** Western NY and southern Ontario to Manitoba, south to TN and AL

**Tennessee counties:** Shelby, Lewis, Steward, Montgomery, Dickson, Davidson, White, Warren, Van Buren, Bledsoe, Coffee, Grundy, Sequatchie, Anderson

**Description:** Stems to 20 dm tall with whorls of 5–11 leaves. Flower segments are yellow–orange to red, spotted, and slightly recurved to spreading. Petals and sepals more than 6 cm long.

**Similar species:**

1. *Lilium superbum* has smooth leaf margins rather than spiculate-scabrous.
2. *Lilium canadense* has anthers held close together, barely, or not at all exerted from the only slightly or moderately recurved tepals rather than anthers well separated on strongly divergent filaments with the tepals strongly recurved-reflexed.

**Flowering date:** June–July

**Fruiting date:** Late summer

**Threats on ORR:** Digging up for transplanting, habitat destruction, indiscriminate use of herbicides, fire suppression. May have been extirpated from the ORR by the impoundment at Melton Hill Dam.

**TNC ORR conservation significance:** This species was not described in the ORR report

#### **3.4.1.18 *Liparis loeselii* (L.) L. C. Rich**

**Common name:** Fen orchid

**Family:** Orchidaceae

**Federal status:** None

**Tennessee status:** Endangered

**Location on ORR:** NA24

**Habitat:** Cool ravines and moist seepage slopes (Radford et al. 1968)

**Habitat on ORR:** Wetland in immature forest with wetland shrubs overstory

**Range:** Nova Scotia and Quebec to Manitoba; south to NJ, AL, OH, IN, and NE

**Tennessee counties:** DeKalb, Carter, Unicoi, and Roane

**Description:** Scapose herb with two basal leaves. Stem slender, 6–26 cm tall. Flowers yellowish–green to white. Pedicels 3–6 mm long.

**Similar species:** *L. liliifolia* has purple flowers

**Flowering date:** May–July

**Fruiting date:** July–August

**Comments:** *L. loeselli* typically does not occur at low elevations as far south as the ORR

**Threats on ORR:** Habitat destruction, change in hydrologic regime (drainage or flooding), and tree canopy removal

**TNC ORR conservation significance:** “This species has fewer than ten occurrences statewide. 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.”

#### **3.4.1.19 *Panax quinquefolius* L.**

**Common name:** Ginseng

**Family:** Araliaceae

**Federal status:** None (was listed under the formerly used 3C candidate category)

**Tennessee status:** Threatened

**Location on ORR:** BCOU4, Bethel Valley GWOU, Melton Valley GWOU, HA1, HA3, HA5, HA6, NA4, NA6, NA11, NA12, NA36, NA44, NA47, NA51, NA52, NA54, NA56, RA14

**Habitat:** Rich woods (Radford et al. 1968)

**Habitat on ORR:** Rich, moist to dry woods

**Range:** AL, AR, CT, DE, GA, IA, IL, IN, KY, LA, MA, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, SC, SD, TN, VA, VT, WI, and WV

**Tennessee counties:** Virtually all counties

**Description:** Glabrous, perennial herb arising from tuberous roots. Stems erect, 1.5–6 dm tall. Petiolate, palmately compound leaves in a whorl at apex of the solitary stem

**Flowering date:** May–June

**Fruiting date:** August–October

**Comments:** Ginseng is prized in this country and abroad for its reputed medicinal properties and is highly sought by herb collectors. Its rarity in Tennessee is the result of commercial exploitation. Tennessee state law specifies a harvest season (August 15–December 31) and landowner permission to dig ginseng (ginseng berries should be replanted on site).

**Harvesting of ginseng in Tennessee:**

According to the “Ginseng Harvest Season Act of 1985” (Acts 1985, Ch. 177, 1; Tennessee Code Annotated 11–26–101) it is unlawful in Tennessee for any person to dig, harvest, collect or remove wild ginseng from any land for the purpose of sale or export under the following circumstances:

- (a) On any date not within the ginseng harvest season (harvest season is Aug. 15–Dec. 31)
- (b) Plants with green berries or less than three prongs
- (c) To remove the berries of wild ginseng from the approximate location harvested
- (d) Plants that were harvested from any state other than Tennessee unless such ginseng has been approved for export by the state from which it was harvested
- (e) Without permission of the landowner

Penalties for violation of this law, upon conviction, are a fine not to exceed \$250 and forfeiture of all ginseng harvested, collected, removed, or sold in violation of the law.

Ginseng dealers must be registered and obtain a permit from the Department of Environment and Conservation, 701 Broadway, Nashville, Tennessee 37243. Monthly records and an annual report must be filed with this department. Dealers exporting ginseng from Tennessee must attach a Tennessee ginseng export certificate with each sale of roots.

**Threats on ORR:** Digging to remove plants, habitat destruction, and tree canopy removal. There has been a recent (1995) increase in the price of ginseng; this may increase the demand and the frequency of poaching.

**TNC 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 ORR are probably able to maintain a normal age structure.”



**3.4.1.20 *Platanthera flava* var. *herbiola* (R.Br.) Luer**

**Common name:** Tubercled rein-orchid

**Family:** Orchidaceae

**Federal status:** None

**Tennessee status:** Threatened

**Location on ORR:** BCOU4, Melton Valley GWOU, NA4, NA13, NA28, NA48, NA50, NA52

**Habitat:** Alluvial woods, wet meadows, and marshes (Radford et al. 1968)

**Habitat on ORR:** Forested wetlands and wet meadow site

**Range:** Nova Scotia to southern Ontario; central MN; south to MO; east to mountains of NC, VA, and TN

**Tennessee counties:** Anderson, Campbell, Cocke, and Roane

**Description:** Erect, glabrous plant with lanceolate leaves sheathing the stem, reduced to bracts on upper stem. A spike of yellow-green flowers on stems to 5 dm in height. Floral bracts much exceed the flowers

**Similar species:**

1. *Platanthera flava* var. *flava* (also state listed) is not as leafy in the inflorescence.

**Flowering date:** May–August

**Comments:** Variety *herbiola* is the northern variety of *P. flava* and is more rare in Tennessee than the southern variety, *flava*. It is noteworthy that the Bear Creek wetland and Hembree Cemetery marsh both support typically northern taxa that are rare in Tennessee. *Liparis loeselii*, the northern counterpart of *Liparis lilifolia*, occurs in the forested wetland adjoining Hembree Cemetery marsh.

**Threats on ORR:** Habitat destruction, change in hydrologic regime (draining or flooding), and tree canopy removal

**TNC 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.”

**3.4.1.21 *Platanthera peramoena* (A.Gray) A.Gray**

**Common name:** Purple fringeless orchid

**Family:** Orchidaceae

**Federal status:** None (was listed under the formerly used 3C candidate category)

**Tennessee status:** Threatened

**Location on ORR:** BCOU4, Melton Valley GWOU, CMA1, NA13, NA27, NA29

**Habitat:** Moist woods, meadows, and stream banks (Radford et al. 1968)

**Habitat on ORR:** Wet depressions in utility right of ways

**Range:** North to OH and MO; south to NC, AL, and TN

**Tennessee counties:** Benton, Bledsoe, Carroll, Dyer, Fayette, Henry, Johnson, McNairy, Roane, Robertson, Shelby, and Weakley

**Description:** Erect, glabrous herb with elliptic to lanceolate leaves. Inflorescence is a showy raceme of purple flowers up to 10.5 dm tall.

**Similar species:**

1. Other pinkish flowered *Platanthera* have fringed flowers

**Flowering date:** July–August

**Comments:** *P. flava* occurs with *P. peramoena* at one site on the ORR

**Threats on ORR:** Habitat destruction, indiscriminate use of herbicides, invasion of woody vegetation, change in hydrologic regime (drainage or flooding), and digging by collectors

**TNC 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.”

#### 3.4.1.22 *Pycnanthemum verticillatum* (Michx.) Pers. (species cluster)

**Common name:** Whorled mountain–mint

**Family:** Lamiaceae

**Federal status:** None

**Tennessee status:** Endangered, possibly extirpated (this may be changed because of specimens from ORR)

**Location on ORR:** Bethel Valley GWOU, HA8

**Habitat:** Woodlands and woodland borders (Radford et al. 1968)

**Habitat on ORR:** Wetlands and barrens

**Range:** VT to OH; south to west VA; CT, MN, NY, OH, PA, TN, VA, WV, MA, MI, NJ, RI, VT, and NC

**Tennessee counties:** Anderson, Fentress, and Roane

**Description:** Pubescent and canescent perennial herb to 8 dm in height. Stems branched in the upper part, pubescence spread over the stem surface and not confined to the angles of the square stem. Leaves narrowly lanceolate, leaf bases rounded. Reportedly entirely apomictic

**Similar species:** See "Comments"

**Flowering date:** July–September

**Fruiting date:** August–October

**Comments:** This confusing species cluster includes three rare and difficult to separate species of *Pycnanthemum*: *P. verticillatum*, *P. virginiana*, and *P. torrei*. Expert consultation is required for positive identification. *Pycnanthemum verticillatum* has not been identified recently in Tennessee and was listed as possibly extirpated. *Pycnanthemum torrei* has been identified in Tennessee only from a recent collection at one site in Oak Ridge. Both *P. verticillatum* (in the broad or narrow sense) and *P. torrei* are very rare in Tennessee. *Pycnanthemum virginianum* is not currently listed by the state but is also considered rare in Tennessee (personal communication, Paul Somers, TDEC, to L. Pounds, ORR Research Park, 1989).

**TNC ORR Conservation significance:** This species was not described in the ORR report.

### 3.4.1.23 *Rhynchospora colorata* (L.) Pfeiffer

**Common name:** White-topped sedge

**Family:** Cyperaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** NA46

**Habitat:** "Damp, often sandy soil" (Gleason and Cronquist 1991)

**Habitat on ORR:** Limestone quarry, just above water line

**Range:** VA to Mexico and West Indies

**Tennessee counties:** Roane

**Description:** Tufted perennial herb with solitary terminal inflorescence atop triangular stem,

5–6 dm tall. The inflorescence is distinctive, surrounded by 4–6 bicolored bracts which are white at the bases and green at the tips. The bracts are unequal in length. The narrowly linear leaves are usually shorter than the stem.

**Similar species:**

White-topped sedges are distinctive and all are rare or unknown in Tennessee

**Flowering date:** May–September

**Fruiting date:** July–October.

**Comments:** Currently the only verified population for Tennessee

**Threats on ORR:** Habitat destruction, digging up for transplanting

**TNC ORR conservation significance:** This species was not described in the ORR report

**3.4.1.24 *Ruellia purshiana* Fern.**

**Common name:** Pursh's wild-petunia

**Family:** Acanthaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** Melton Valley GWOU, NA51, NA53

**Habitat:** Rocky upland woods

**Habitat on ORR:** Partly shaded rocky limestone slope

**Range:** Appalachian region from MD to GA and AL

**Tennessee counties:** Hawkins, Roane

**Description:** A blue-flowered herb (3–7 dm tall). Leaves petiolate and flowers short-pedicelated on peduncles from middle nodes. Stem equally hairy on all sides.

**Similar species:**

1. *R. strepens* has wider calyx lobes (2mm or more).
2. *R. humilis* has shorter petioles (3mm or less).
3. *R. carolina* has two sides of the stem hairier than the other two.

**Flowering date:** June–August

**Comments:** Taxonomic problems may exist within this genus (*Ruellia*)

**Threats on ORR:** Habitat destruction

**TNC ORR conservation significance:** This species was identified on the ORR after the ORR report

**3.4.1.25 *Saxifraga careyana* A. Gray**

**Common name:** Carey saxifrage

**Family:** Saxifragaceae

**Federal status:** None (was listed under the formerly used 3C candidate category)

**Tennessee status:** Special Concern

**Location on ORR:** NA1, NA3, NA5, NA11, NA15, NA16, NA17, NA18, NA21, NA23

**Habitat:** Moist rocks and seepage slopes (Radford et al. 1968)

**Habitat on ORR:** Rocky, calcareous bluffs and sinks along the Clinch River

**Range:** GA, MA, NC, PA, TN, and VA

**Tennessee counties:** Anderson, Bledsoe, Blount, Carter, Cocke, Franklin, Grainger, Hamilton, Hancock, Knox, Loudon, Marion, Monroe, Pickett, Polk, Rhea, Roane, Sevier, Sullivan, Unicoi, and Van Buren

**Description:** Small, perennial herb forming rather fleshy rosettes and short offsets from the crown. Hairy leaves are slightly concave on the upper surface, rounded and frequently reddish on the underside. White to pale-pink flowers with scapes up to 3 dm tall

**Similar species:**

1. *S. caroliniana* is similar but it has clavate filaments

**Flowering date:** April–June

**Fruiting date:** May–June

**Comments:** The taxonomy of *S. careyana* and *S. caroliniana* is confusing, so much so that the species have been called "the *careyana*–*caroliniana* complex." *S. caroliniana* is a federal "Species of Concern" (listed under the formerly used C2 candidate category) and is listed as endangered in Tennessee. Some of the populations on the ORR have not been surveyed in the flowering stage, a stage necessary to distinguish the two species. *Saxifraga caroliniana* is not reported to occur in the Ridge and Valley Province in eastern Tennessee, so these populations are most likely *S. careyana*. Rare species that co-occur with *S. careyana* on the ORR are *Aureolaria patula*, *Cimicifuga rubifolia*, and *Diervilla lonicera*.

**Threats on ORR:** Habitat destruction, tree canopy removal, erosion and siltation related to upslope timber removal or development

**TNC ORR conservation significance:** "ORR represents an important concentration of populations of this narrowly distributed endemic."

**3.4.1.26 *Scirpus fluviatilis* (Torr.) A. Gray**

**Common name:** River bulrush

**Family:** Cyperaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** Melton Valley GWOU, WAG 2, CMA5

**Habitat:** Open wetland

**Habitat on ORR:** Wetland at the edge of White Oak Lake

**Range:** Northern U.S. and southern. Canada, south to VA, MO, KS and now disjunct to TN

**Tennessee counties:** Henry, Roane

**Description:** Grass-like plant with stout triangular shaped stem (6–15 dm tall). Normally does not fruit in consecutive years

**Flowering date:** June–August

**Fruiting date:** Summer

**Comments:** The ORR occurrence of this species is the second known for the southeastern U.S.

**Threats on ORR:** Habitat destruction; the habitat could be destroyed during contamination remediation projects on White Oak Lake.

**TNC ORR conservation significance:** This species was discovered prior to the ORR report but was apparently overlooked by TNC

**3.4.1.27 *Spiranthes lucida* (H. Eaton) Ames**

**Common name:** Shining ladies'-tresses

**Family:** Orchidaceae

**Federal status:** None

**Tennessee status:** Threatened

**Location on ORR:** NA33

**Habitat:** Moist calcareous sites

**Habitat on ORR:** Wetland under shrub cover

**Range:** Canada south to KY, TN, WV

**Tennessee counties:** Claiborne, Franklin, Johnson, Lewis, Roane

**Description:** Ladies'-tresses are small orchids. Shining ladies'-tresses is distinguished by its bright yellow lip and spring blooming

**Flowering date:** May-July

**Threats on ORR:** Habitat destruction, change in hydrologic regime (drainage or flooding). This species is currently (1995) near construction activity.

**TNC ORR conservation significance:** This species was discovered on the ORR after TNC report.

#### 3.4.1.28 *Spiranthes ovalis* Lindl.

**Common name:** Lesser ladies'-tresses

**Family:** Orchidaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** CROU2, Melton Valley GWOU, WAG 2, CMA4, CMA5, NA9, NA10

**Habitat:** Moist, shady woods, thickets, and swamp margins (Radford et al. 1968)

**Habitat on ORR:** Moist second-growth woods

**Range:** AR, DC, FL, GA, IL, IO, KS, KY, LA, MI, MS, MO, OH, OK, PA, SC, TN, VA, WI, and WV

**Tennessee counties:** Anderson, Cannon, Franklin, Lake, Lewis, Montgomery, Obion, Putnam, Roane, Sevier, Tipton, and Warren

**Description:** Erect stems to 4.5 dm tall with two-four basal oblanceolate leaves. Small white flowers are congested on the slender spike

**Similar species:**

1. *S. cernua* has larger flowers (over 7.5 mm)
2. *S. lacera* has greenish lip.

**Flowering date:** August-November

**Fruiting date:** October–November

**Comments:** Ginseng and goldenseal co–occur with *S. ovalis* on the ORR.

**Threats on ORR:** Habitat destruction and tree canopy removal

**TNC ORR conservation significance:** “The significance of these populations needs further assessment.”

**3.4.1.29 *Viola tripartita* Elliot var. *tripartita***

**Common name:** Three–parted violet

**Family:** Violaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Location on ORR:** NA51

**Habitat:** Rich woods

**Habitat on ORR:** Cherty soil under mixed white pine and hardwoods in an area of shallow sinkholes

**Range:** (the following is the range of the species rather than the range of this variety) southwestern PA and southern OH to NC and SC, GA, AL, and northeastern MS

**Tennessee counties:** Roane (ORR) and possibly Hamilton

**Description:** A yellow-flowered violet with a “leafy stem,” the early leaves are dissected into three leaflets in this variety

**Similar species:**

1. *Viola tripartita* var. *glaberrima* may have cleft leaves but not so deeply cleft as to form leaflets.

**Flowering date:** April–May

**Comments:** Both varieties of *Viola tripartita* are found on the ORR. On the ORR these varieties are distinct, showing no tendency to intergrade, and are found in different habitats with var. *tripartita* found in a drier habitat.

**Threats on ORR:** Habitat destruction, removal of tree canopy (and subsequent erosion of substrate)

**TNC ORR conservation significance:** This species was discovered on the ORR after TNC report.



### **3.4.2 Additional T&E Vascular Plant Species That Occur Near And May Be Present on the ORR**

#### **3.4.2.1 *Berberis canadensis* Mill.**

**Common name:** Barberry

**Family:** Berberidaceae

**Federal status:** None

**Tennessee status:** Special concern

**Habitat:** Rocky bluffs, creek banks and roadsides (Radford et al. 1968)

**Habitat near ORR:** Rocky bluff on Tennessee River

**Range:** VA and WV to GA and AL; MO and IN

**Tennessee counties:** Cumberland, Hawkins, Knot, Knox, Morgan, Sullivan, and Washington

**Description:** Deciduous shrub 2–20 dm in height with three-pronged thorns. Leaves alternate, ovate or elliptic to obovate. Berries scarlet, 5–7 mm long

**Flowering date:** April–May

**Fruiting date:** September–October

**Locations near ORR:** Rocky bluffs along Tennessee River in Knox Co.

**Comments:** An immature specimen of *B. canadensis* or a similar species was collected on the ORR in 1983. It is not possible to positively identify the specimen collected, and in a subsequent search for *B. canadensis* in the area of collection, no individuals were observed. The species may be present on the ORR on rocky bluffs along Clinch River or on creek banks.

#### **3.4.2.2 *Gnaphalium helleri* Britt.**

**Common name:** Catfoot

**Family:** Asteraceae

**Federal status:** None

**Tennessee status:** Special Concern

**Habitat:** Openings in woods and woodland borders (Radford et al. 1968)

**Habitat near ORR:** Dry woodland edge

**Range:** ME to GA; IN, AR, and TX

**Tennessee counties:** Blount, Grundy, and Roane

**Description:** Annual with lanceolate leaves not decurrent on stem. Green, conspicuously hairy stem with greater than 15 leaves below the inflorescence

**Flowering date:** September–October

**Fruiting date:** September–October

**Locations near ORR:** Dry, calcareous soil adjacent to the Clinch River, formerly part of the ORR, now owned by Boeing Tennessee, Inc.

**Comments:** Specimen collected in 1983 on Campbell Bend. The species may be present on the ORR on barren openings or dry woodland edges.

### 3.4.2.3 *Liatris cylindracea* Michx.

**Common name:** Slender blazing star

**Family:** Asteraceae

**Federal status:** None

**Tennessee status:** Endangered

**Habitat:** Dry, open places (Gleason 1952)

**Habitat near ORR:** Open, dry, calcareous barrens

**Range:** West NY and south Ontario to south OH; north IN, MI, MN, then south to north AR

**Tennessee counties:** Decatur, Marion, Roane, and Rutherford

**Description:** Glabrous perennial with numerous stiff, linear leaves. Pink–purple, discoid flowers on stalks to 6 dm tall. Involucral bracts appressed, broadly rounded, and mucronate

**Flowering date:** August–September

**Fruiting date:** September–October

**Locations near ORR:** Dry, calcareous barren at Campbell Bend on the Clinch River, locally called the Crowder Cemetery Barren. Formerly part of NA1 the land is now owned by Boeing Tennessee, Inc. The barren is protected by an agreement between TDEC and Boeing and is a registered Tennessee Natural Area. Last observed in 1990. Roane County

**Comments:** Other rare species that co-occur with *L. cylindracea* at the Crowder Cemetery Barren are *Tomanthera auriculata*, *Solidago ptarmicoides*, and *Delphinium exaltatum*. *Liatris squarrosa*

also occurs at this site, and an apparent blending of morphological characteristics suggests that it may be hybridizing with *L. cylindracea*. *Liatris cylindracea* may be present on the ORR on barrens.

#### **3.4.2.4 *Lonicera dioica* L.**

**Common name:** Mountain honeysuckle

**Family:** Caprifoliaceae

**Federal status:** None

**Tennessee status:** Special Concern

**Habitat:** Woodlands and thickets (Radford et al. 1968)

**Habitat near ORR:** Rocky river banks

**Range:** Southwest ME and southwest Quebec to Manitoba; south to GA and MO

**Tennessee counties:** Anderson, Cheatham, Johnson, Polk, Marion, and Roane

**Description:** Climbing vine with glabrous stems. Leaves glaucous beneath. Inflorescence a terminal spike, corollas less than 3 cm long. Ovaries not fused

**Flowering date:** June–August

**Fruiting date:** August–September

**Locations near ORR:** Rocky banks of the Emory River near Harriman

**Comments:** The species may be present on the ORR on rocky banks and bluffs on Clinch River and its tributaries.

#### **3.4.2.5 *Meehania cordata* (Nutt.) Britt.**

**Common name:** Heartleaf meehania

**Family:** Lamiaceae

**Federal status:** None

**Tennessee status:** Threatened

**Habitat:** Rich, wooded slopes and coves (Radford et al. 1968)

**Habitat near ORR:** Wooded, calcareous slope along Clinch River

**Range:** Southwest PA and south OH to TN and NC; IL

**Tennessee counties:** Anderson

**Description:** Perennial herb spreading by stolons and forming carpets. Erect flowering stems to 2 dm tall. Four anther-bearing stamens, four-parted ovary, basal style, and flowers more than 2 cm long

**Flowering date:** May–June

**Fruiting date:** June–July

**Locations near ORR:** On a wooded slope near Norris Lake on Clinch River. Anderson County

**Comments:** The species may be present on the ORR on rich, wooded slopes along Clinch River and its tributaries.

#### **3.4.2.6 *Pedicularis lanceolata* Michx.**

**Common name:** Swamp lousewort

**Family:** Scrophulariaceae

**Federal status:** None

**Tennessee status:** Threatened

**Habitat:** Wet meadows on basic soils (Radford et al. 1968)

**Habitat near ORR:** Wet meadow/seep at base of ridge

**Range:** MA to MI, MN, MAN, and ND; south to NC, MO, and NE

**Tennessee counties:** Roane and Union

**Description:** Perennial with basal rosette. Stems to 8 dm in height. Leaves sessile, lanceolate and shallowly, crenately lobed. Corolla yellow

**Flowering date:** August–October

**Fruiting date:** September–October

**Location near ORR:** Wet meadow off Highway 72 south of Kingston. On private property. Last observed in 1992. Roane County

**Comments:** No other listed plant species co-occur with *P. lanceolata* at this site. This species may be present on the ORR on wet meadows and on seeps.

#### **3.4.2.7 *Solidago ptarmicoides* (Nees) Boivin**

**Common name:** Prairie goldenrod

**Family:** Asteraceae

**Federal status:** None

**Tennessee status:** Endangered

**Habitat:** Prairies and open dry places (Gleason 1952)

**Habitat near ORR:** Dry, calcareous barren

**Range:** VT and west Quebec to GA; west to Saskatchewan, WY, CO, and AR; CT, CO, GA, IA, IL, MA, MN, MO, NC, ND, NY, OK, PA, SD, TN, WI, KS, WY, NE, OH, and VT

**Tennessee counties:** Anderson, Rhea, and Roane

**Description:** Scabrous perennial to 7 dm tall. Leaves stiff, linear-oblong to linear. Inflorescence corymbiform, rays and disk of flowers are white

**Flowering date:** July–September

**Fruiting date:** September–October

**Locations near ORR:**

1. Dry, calcareous barren on Campbell Bend in Clinch River, locally called the Crowder Cemetery Barren. Formerly part of NA1, the land is now owned by Boeing Tennessee, Inc. The barren is protected by an agreement between TDEC and Boeing and is a registered Tennessee Natural Area. Last observed in 1990. Roane County
2. Dry, calcareous opening at the Oak Ridge Barrens, a registered Tennessee Natural Area owned by the City of Oak Ridge, next to Jefferson Junior High School. Last observed in 1990. Anderson County

**COMMENTS:** Other rare species that co-occur with *S. ptarmicoides* at sites near the ORR are *Liatrix cylindracea*, *Tomanthera auriculata*, and *Delphinium exaltatum*. *Solidago ptarmicoides* may be present on the ORR on barrens. *Solidago ptarmicoides* was planted in the Environmental Sciences Division's (ORNL) Barrens Research Garden and has been reproducing very successfully.

**3.4.2.8 *Tomanthera auriculata* (Michx.) Raf.**

**Common name:** Earleaf foxglove

**Family:** Scrophulariaceae

**Federal status:** SPC

**Tennessee status:** Endangered

**Habitat:** Dry or moist soil, in prairies or open, upland woods (Gleason 1952)

**Habitat near ORR:** Calcareous barren

**Range:** OH to WI and MN; south to MO and KS; also locally in southern states; AR, PA, MO, MS, KS, IA, IL, OH, TN, and SC

**Tennessee counties:** Bledsoe, Carroll, and Roane

**Description:** Hemiparasitic, annual herb to 8 dm in height. Foliage purple-green when in full sun. Upper leaves with divergent basal auricles. Flowers sessile in leafy spikes, corolla pink with purple spots on throat

**Flowering date:** August–September

**Fruiting date:** September–October

**Locations near ORR:** Bottom of gentle slope on dry, calcareous barren near Clinch River. Population size estimated to be 2400. Last observed in 1990. Roane County

**Comments:** *Tomanthera auriculata* is a hemiparasite that forms haustoria on roots of *Helianthus occidentalis*, *Solidago rigida*, and *Rudbeckia fulgida*. In the field a host is apparently necessary for normal growth and flowering (Cunningham and Parr 1990). Other rare species that co-occur with *T. auriculata* at this site are *Liatris cylindracea*, *Solidago ptarmicoides*, and *Delphinium exaltatum*. *Tomanthera auriculata* may be present on the ORR on barrens.

## 4. RECOMMENDATIONS

### 4.1 FOLLOW-UP SURVEYS

#### 4.1.1 Future Surveys at Environmental Restoration Remediation Sites

Systematic T&E vascular plant surveys are necessary prior to initiation of remediation or other project activities at a site when any of the following conditions apply:

- The area has never been surveyed using systematic ground coverage.
- The area has not been surveyed in multiple seasons.
- The area has not been surveyed within 5 years prior to the commencement of activities at the site.

#### 4.1.2 Additional Surveys

Follow-up surveys may be required in the future. Follow-up surveys for T&E vascular plants are recommended for the following reasons:

- Detailed T&E vascular plant surveys (which include systematic ground coverage and multiple season site visits) have not been performed for large areas of the ORR. The existence of additional sites for T&E vascular plant species, which were not detected during this survey, is likely.
- Additional species (not investigated in this survey) may be added to state and federal lists in the future.
- Under certain environmental conditions, some rare plants, including T&E species that have been found on the ORR, may undergo prolonged periods of dormancy in which the individual or population exists for many years either as rhizomes (underground) or as propagules in soil seedbanks. Such species may not have been detected during this survey and may "re-appear" after extended intervals.
- Plants, including T&E species, will sometimes occur in atypical habitats. An example of a rare taxon occurring in an atypical habitat on the ORR is heavy sedge (*Carex gravida*), a prairie species typical of open sites, which has been found at two forested sites on the ORR. Rare taxa in atypical habitats may be less likely to be discovered because (1) the habitat is not identified during the initial survey as potential habitat for the taxon, (2) the field botanist might not be using that particular search image if the taxon is not expected to occur in the habitat, or (3) the taxon might have an unusual growth form because of habitat location and thus differ from the botanist's search image.

### 4.2 MAINTENANCE AND UPDATE OF DATABASES AND VOUCHER COLLECTION

The following data generated during this project will be submitted to OREIS:

- Sample point locations for T&E vascular plant species (GIS coverage)
- ORR environmentally sensitive areas (GIS coverage)

- T&E vascular plant survey coverage data (GIS coverage)
- ORR vascular flora data base (spreadsheet data)

Data bases and collections documenting T&E species on the ORR that are not submitted to OREIS (because they do not fit OREIS data requirements) are also valuable resources. Readily available access to updated T&E data sources would facilitate future compliance with environmental regulations. Specifically, the following resources should be maintained:

- Voucher specimen collection (ORNL herbarium)
- T&E photographic collection (negatives maintained by ORNL Photography Department)
- ORR Heritage data base (maintained by ORNL area manager)

### 4.3 AVOIDANCE OF ORR ENVIRONMENTALLY SENSITIVE AREAS

Protection of T&E species in their natural habitats is the most effective method of ensuring their long-term survival. ORR environmentally sensitive areas include T&E species and their habitats, sensitive landscape elements and rare natural communities associated with T&E species, as well as necessary buffers. Project planners should seriously consider avoiding altogether or taking extra precautions in areas designated as ORR environmentally sensitive areas (Fig. 5).

## 4.4 IMPACT ASSESSMENT

### 4.4.1 Scale of Concern

Impacts to T&E species on the ORR should be considered at both local and regional scales. Impacts to sensitive species and natural communities on the ORR may have regional consequences. Although the original forests had been cleared, and the land was in agriculture at the time the ORR was purchased by the U.S. government in 1942, much of the ORR has been relatively undisturbed since 1942, and many areas have been allowed to undergo natural succession. In contrast, the land surrounding the ORR has either remained in agriculture or been developed for commercial, industrial, and residential purposes. As a result, the natural vegetation on the ORR has become increasingly significant in relation to regional biodiversity. TNC reports that ORR natural habitats “provide a refuge for many plants, animals and natural communities that are disappearing from surrounding lands...” (TNC 1995). This significance is evident in the significant number of T&E vascular plant species (Table 3) and rare natural communities (TNC 1995; Grossman, Goodin, and Reuss 1994) found on the ORR. One T&E plant species on the ORR (*Rhynchospora colorata*) is currently known from no other location in the state of Tennessee.

### 4.4.2 Threats to T&E Vascular Plant Species

Project activities on the ORR may have the potential to adversely impact T&E species both directly and indirectly. Adverse impacts to T&E plants, both to T&E plants on site (direct) and to T&E plants off site (indirect) may occur on the ORR as a result of :

- predevelopment site monitoring and characterization activities;
- installation of equipment (for monitoring or infrastructure);



- use of earth-moving equipment;
- road building;
- site preparation, grading, and landscaping;
- construction of facilities;
- disposal of waste materials;
- alteration of hydrologic regime (drainage of water or flooding);
- timber removal;
- mowing; and
- pesticide application.

Direct threats to T&E plants include removal, burial, poisoning, or otherwise physically damaging the plants themselves, and direct disturbance or destruction of their habitats. Indirect impacts to T&E species occur as a result of project activities but do not involve direct contact or interference with the plants themselves. Indirect threats to T&E plants include the following.

- **Habitat fragmentation:** loss of landscape connectivity between areas of natural habitat. Habitat connectivity may be necessary to allow genetic exchange between populations or to support or allow access to the habitat by animals which carry the seeds.
- **Creation of disturbed openings and additional forest edges:** these openings provide an entry route for the invasion of T&E species habitats by competing weedy species.
- **Planting of aggressive or persistent exotic (also known as "non-native" or "introduced") species (for erosion control, site stabilization, reforestation, landscaping, etc.):** exotic species may subsequently migrate from the target site and compete with T&E species. Over 190 species of vascular plants that are not native to this region have been found growing wild on the ORR to date. Exotic plant species currently associated with adverse impact to T&E species or have a high potential to adversely impact T&E species are listed in Table 9.
- **Exposure of T&E plants to damaging agents (including insect pests, diseases, grazing by deer, and picking or digging of plants by humans) as a result of increasing access to the site.**
- **Reduction of pollinators (through loss of supporting habitat or poisoning):** loss of pollinators may result in reproductive failure in the plant species. Many types of insects, and some birds and mammals (such as bats) may act as plant pollinators.
- **Creation or loss of shade:** plant species are adapted to growth under particular light levels, and within particular microclimates. Changes in light level directly affect a plant's ability to photosynthesize and grow and drive other changes in the site microclimate such as increasing dryness or humidity. Such changes may allow competing weedy species to invade the site.
- **Fire suppression:** some T&E plant species, particularly those associated with calcareous barrens, may require fire to maintain their habitat open.
- **Changes in maintenance activities in T&E plant zones (such as those within utility corridors and hay fields):** timing of mowing and/or other maintenance activities to avoid blooming and fruiting periods may be critical to the survival of populations of T&E plants in maintained areas.

- **Erosion and/or siltation resulting from up-slope activities (including facility maintenance, timber removal, and excavations):** adverse impacts of site runoff and sediment movement to nearby T&E plant may include burial, drowning, root exposure, scouring, or up-rooting.
- **Chemical changes:** input or diversion of nutrients may adversely affect sensitive species.

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**Appendix A**

**TABLES**



**Table 1. T&E Vascular Plant Surveys on the ORR Fiscal Years 1992-1994, Summary Data (King, et al., 1994)**

Survey Name	Month (s) of Survey	Year (s) of Survey	Estimated Area Covered (acres)	Method*	Number of Rare Species	Sensitive Habitats*	Priority for Revisit*	Records*	Investigators*	Comments
Operating Units (OU):										
CR OU 1		91	10	S	0		4	r,m	L.P.	
CR OU 2		91	10	S	1	We,Ot	3	r,m	L.P.	Ot=Ash
CR OU 3		91	1	S	0		4	r,m	L.P.	
CR OU 4		91	5	S	0	Ro	3	r,m,h	L.P.	
Bethel Valley GW OU	4,5,6,9/8	93/94	1650	S, M	7	Ro, Ba, Sp, We	3	r,m,h	L.P.	
Melton Valley GW OU	4,5,6,7,8	93	2000	S	7	We	1	r,m	L.P.,R.C.	
UEFPC OU 1	4,9	93	200	S	1		4	r,m	L.P.	Seasonal identification needed
South Campus Facility OU	6	93	45	S	0		1	r,m	L.P.	Seasonal identification needed
Freels Bend OU	6,7,8	93	20	S	0		3	r,m	L.P.,R.C.	
Bear Creek OU 4	7,8,9	93	1800	S	5	We,Ro,Sp,Ot	3	r,m	L.P.,R.C.	Ot=Beech/Mtn.Laurel
K-25 GW OU	7,8,9/4,7	93/94	2100	S	3	Ro, Ba, We	1	r,m,p,h	L.P.,R.C.	
Requested Surveys:										
Pine Plantations	8 to 5	93/94	3000+	E, S	1	We,St,Sp,Ba,Ro	1	r,m	L.P.,D.A.,B.R.,B.W	Seasonal identification needed
Poplar Creek	8	94	150	E	1	We	2	n,l	D.A.,B.R.	
E. TN Natural Gas	8	94	3	S	1	We	3	r	D.A.,L.P.	
Special Interest Areas:										
West HPRR area	4,6	94	8	E	0		3	n,h	L.P.	
K-25 Pumping Station	4,7	94	6	S	3	Ba,Ro	2	n,p,h	L.P.,D.A.	
Bearden Embayment	6	94	2	M	1	We	3	n,h	L.P.	
Pine Ridge (West end)	4,7,8	94	50	E	0		3	n,h	L.P.	
Black Oak Ridge (West end)	4,8	94	17	E	2	We	2	n,h	L.P.	
Area around Natural Area 7	8	94	9	E	1	Ro	2	n,h	L.P.	
Area West of Reference Area 1	8	94	15	E	0		2	n,h	L.P.	

Table 1. (continued)

Survey Name	Month (s) of Survey	Year (s) of Survey	Estimated Area Covered (acres)	Method*	Number of Rare Species	Sensitive Habitats*	Priority for Revisit*	Records*	Investigators*	Comments
National Environmental Research Park Sensitive Areas:										
Natural Area 22	6	94	3	S,M	2	Ro	2	r,d	R.C.,D.A.	
Natural Area 25	6	94	9	S,M	1	St	1	r,d	R.C.,D.A.	
Natural Area 26	6	94	2	S,M	2	Ro	1	r,d	R.C.,D.A.	
Reference Area 29	6	94	6	S,M	1	We	4	r,d	R.C.,D.A.,L.P.	
Natural Area 11	7	94	2	S,M	1	St	4	r,d	R.C.	
Natural Area 13	7	94	1	S,M	1	We	3	r,d	R.C.,D.A.	
Natural Area 14	7	94	5	S,M	1	We,Ot	4	r,d	R.C.,D.A.	Ot=upland grasslands
Natural Area 21	7	94	3	S,M	0	Ot	4	r,d	R.C.,D.A.	Ot=rocky limestone forest
Natural Area 2	7,8	94	10	S,M	1	Ba	4	r,d	R.C.	
Natural Area 10	8	94	2	S	4	Ra, Ot	4	r,d	R.C.,D.A.	Ot=mature mesic hardwood
Natural Area 27	8	94	1	S	1	We, Ba	1	n	R.C.,D.A.	
Natural Area 7	8	94	4	S	1	Ba	4	r,d	R.C.	
Natural Area 8	8	94	5	S	3	Ro, We	1	n	D.A.,L.P.	Seasonal identification needed
Natural Area 24	8	94	2	M	1	We	3	n,h	L.P.	
Reference Area 1	8	94	5	E	1	Ro	2	n,h	L.P.	
Natural Area 19	8	94	10	E,M	1	Ro	3	n	L.P.	

\* Explanation of Codes

Methods:  
 E=Exploratory Survey  
 S=Systematic Survey  
 M=Population Monitoring

Sensitive Habitats:  
 We=Wetlands  
 St=Stream  
 Sp=Spring  
 Ba=Barrens  
 Ro=Cliff/Rock Outcrop  
 Ot=Other

Priority for Revisit:  
 1=Highest  
 4=Lowest

Records:  
 r=report  
 m=maps  
 d=data sheets  
 h=herbarium specimen  
 p=photographs  
 n=field notes  
 l=species list

Investigators:  
 B.R.= Barbara Rosensteel  
 B.W.=Beth Wade  
 D.A.=Deborah Awl  
 L.P.=Larry Pounds  
 R.C.=Rebecca Cook



Table 1. (continued)

Survey Name	Month (s) of Survey	Year (s) of Survey	Estimated Area Covered (acres)	Method*	Number of Rare Species	Sensitive Habitats*	Priority for Revisit*	Records*	Investigators*	Comments
National Environmental Research Park Sensitive Areas:										
Natural Area 22	6	94	3	S,M	2	Ro	2	r,d	R.C.,D.A.	
Natural Area 25	6	94	9	S,M	1	St	1	r,d	R.C.,D.A.	
Natural Area 26	6	94	2	S,M	2	Ro	1	r,d	R.C.,D.A.	
Reference Area 29	6	94	6	S,M	1	We	4	r,d	R.C.,D.A.,L.P.	
Natural Area 11	7	94	2	S,M	1	St	4	r,d	R.C.	
Natural Area 13	7	94	1	S,M	1	We	3	r,d	R.C.,D.A.	
Natural Area 14	7	94	5	S,M	1	We,Ot	4	r,d	R.C.,D.A.	Ot=upland grasslands
Natural Area 21	7	94	3	S,M	0	Ot	4	r,d	R.C.,D.A.	Ot=rocky limestone forest
Natural Area 2	7,8	94	10	S,M	1	Ba	4	r,d	R.C.	
Natural Area 10	8	94	2	S	4	Ra, Ot	4	r,d	R.C.,D.A.	Ot=mature mesic hardwood
Natural Area 27	8	94	1	S	1	We, Ba	1	n	R.C.,D.A.	
Natural Area 7	8	94	4	S	1	Ba	4	r,d	R.C.	
Natural Area 8	8	94	5	S	3	Ro, We	1	n	D.A.,L.P.	Seasonal identification needed
Natural Area 24	8	94	2	M	1	We	3	n,h	L.P.	
Reference Area 1	8	94	5	E	1	Ro	2	n,h	L.P.	
Natural Area 19	8	94	10	E,M	1	Ro	3	n	L.P.	

\* Explanation of Codes

Methods:  
 E=Exploratory Survey  
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 M=Population Monitoring

Sensitive Habitats:  
 We=Wetlands  
 St=Stream  
 Sp=Spring  
 Ba=Barrens  
 Ro=Cliff/Rock Outcrop  
 Ot=Other

Priority for Revisit:  
 1=Highest  
 4=Lowest

Records:  
 r=report  
 m=maps  
 d=data sheets  
 h=herbarium specimen  
 p=photographs  
 n=field notes  
 l=species list

Investigators:  
 B.R.= Barbara Rosensteel  
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 L.P.=Larry Pounds  
 R.C.=Rebecca Cook

Table 2. T&amp;E Vascular Plant Surveys on the ORR Fiscal Years 1995-1996, Summary Data

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
1	1/16/95	W of 0907		29.67	L.P.
2	1/17/95	E and S of 0907		37.47	L.P.
3	2/23/95	Pine Ridge		7.23	L.P.
4	2/23/95	LLWDF	Larry Cox/LLWDF	20.96	L.P., B.R.
5	3/4/95	Pine Ridge N of LLDWF		13.57	L.P.
6	3/9/95	NA36		4.6	L.P.
7	3/10/95	Walker Branch		4.02	L.P.
8	3/12/95	K-25 Beech-Laurel Area		2.5	L.P.
9	3/12/95	PRA-D (S of Dyllis Rd)		3.87	L.P.
10	3/12/95	W of PRA-D		16.52	L.P.
11	3/15/95	Pine Ridge (E of Bear Creek Gap)		2.54	L.P.
12	3/15/95	Pine Ridge W of Hwy 95		13.73	L.P.
13	3/17/95	W end of Pine Ridge		21.65	L.P.
14	3/18/95	Clinch River shore N of Bridge		0.78	L.P.
15	3/18/95	RA8		2.94	L.P.
16	3/21/95	NA20		2.79	L.P.
17	3/21/95	Barrens W of Herrel Rd		4.18	L.P.
18	3/21/95	McKinney Ridge		4.24	L.P.
19	3/21/95	Black Oak Ridge E of Poplar Creek		7.4	L.P.
20	3/24/95	Bottom along McNew Hollow Rd		1.76	L.P.
21	3/24/95	Pine Ridge W of Gum Hollow Rd		17.43	L.P.
22	3/25/95	Area along Old Bethel Valley Rd		2.46	L.P.
23	3/25/95	ROW along Old Bethel Valley Rd		5.05	L.P.
24	3/26/95	NA1 Mid-section		0.44	L.P.
25	3/26/95	NA1 Disturbed Area		0.5	L.P.
26	3/26/95	NA1 Rocky Slopes		0.93	L.P.
27	3/26/95	NA1 Low Areas (N)		1.09	L.P.
28	3/26/95	NA1 ROW Barren and S		2.89	L.P.
29	3/28/95	NA35		5.11	L.P.
30	3/29/95	NA18		23.07	L.P.
31	3/31/95	SA-A (Shepard Cemetary Area)		11.24	L.P.
32	4/7/95	NA23		6.67	L.P.
33	4/8/95	W of Mt Vernon Rd		9.94	L.P.
34	4/8/95	Walker Branch		47.37	L.P.
35	4/18/95	NA41		2.7	L.P.

Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g				Pp, Xh, Mh, Bu	unidentified mint
E	g			We, Or, Op, Wr	Ba, Pp, Xh, Mh, Bu	
E	g				Xh, Mh	search for sweet pinesap
S	g, r			Op, We	Xh, Mh, Mo	potential construction site
E	g				Mx, Mh, Xh	search for sweet pinesap
E	g		Lc	We	Mh	unknown lily-like plant
E	g			We	Mh, Xh	search for sweet pinesap
E	g				Mh	rare community: beech-laurel
E	g				Np, Xh	search for sweet pinesap
E	g				Np, Mh, Xh	search for sweet pinesap
E	g			Wr	Xh	vouchered lady's tresses fern
E	g			We	Xh, Mh	unknown orchid not yet evident
E	g				Xh, Mh, Np	search for sweet pinesap
E	g				Mh	used low water to search bank
E	g			Or, Op	Ba, Xh	
E	g		Ap	Cl	Mh	
E	g			Or, Op	Ba, Xh, Th	search for winter annuals
E	g			Cl, Mf	Mh, He	search for sweet pinesap
E	g				Xh, Mx	search for sweet pinesap
E	g				Bh	
E	g			Mf	Xh, Mh	search for sweet pinesap
E	g				Th	search for winter annuals
E	g			Op	Mo	search for winter annuals
E	g			We	Th	
E	g			Op	Th	search for winter annuals
E	g		Ap, Rp	Or, Cl, Op	Ba, Xh	search for winter annuals
E	g			We	Bh, Ma	
E	g			Ba, Or, We	Bu, Bh	search for winter annuals
E	g		De, Lc	Or, Op, We	Np, Pp, Bh, Xh, Ba	winter annual search
E	g	Sc	Sc	Cl, Wr	Mh, Xh	
E	g			Mf	Mh, Np	
E	g	Sc. (Cr?)	Sc	Cl, Mf	Mh	
E	g			Or, Op	Ba, Mh, Bh	
E	g			We	Mh	
E	g	Cv	Cv	Wr, Mf	Mh	

Table 2. (continued)

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
36	4/22/95	NA20		2.19	L.P.
37	4/22/95	Mckinney Ridge		14.66	L.P.
38	4/25/95	Walker Branch		10.87	L.P.
39	4/27/95	NA43		18.48	L.P.
40	5/4/95	Flashlight Cave Area		1.6	L.P.
41	5/4/95	RA21 and Vicinity		16.65	L.P.
42	5/5/95	W End of NA 41		13.7	LP
43	5/6/95	NA 18 and More		34.99	L.P.
44	5/7/95	NA2		5.61	L.P.
45	5/8/95	W of Scarboro Rd		2.27	L.P.
46	5/8/95	N of Rogers Quarry		2.45	L.P.
47	5/12/95	Haw Ridge SE of Scarboro Facility		10.3	L.P.
48	5/13/95	NA1 Open Slopes		0.95	L.P.
49	5/13/95	NA1 ROW Barren		2.04	L.P.
50	5/17/95	K-25 Filtration Plant Pond		0.7	L.P.
51	5/17/95	NA27		0.71	L.P.
52	5/17/95	New Platanthera flava Site		3.82	L.P.
53	5/21/95	S of Robotics Lab		12.3	L.P.
54	5/25/95	SA-A (SW end)		3.34	L.P.
55	5/25/95	SA-A (E end)		8.05	L.P.
56	5/27/95	ROW S of Bear Creek		0.46	L.P.
57	5/27/95	NA2		12.26	L.P.
58	5/28/95	S of ROW and N of NA2		10.4	L.P.
59	6/4/95	W End of NA41		8.97	L.P.
60	6/8/95	NA2 S Extension		10.45	L.P.
61	6/10/95	ROW N of NA2		16.07	L.P.
62	6/14/95	Upper Ish Creek Wetland (1)		3.8	L.P.
63	6/14/95	W Trans Chestnut Ridge ROW		4.99	L.P.
64	6/19/95	Melton Shore		57.56	L.P.
65	6/21/95	Grassy Creek Pumping Station and N		1.43	L.P.
66	6/21/95	N of K-25 Filtration Plant Pond		2.21	L.P.
67	6/21/95	SE of Gallaher Bridge Wetland		4.45	L.P.
68	6/22/95	Haw Ridge W of Solway Bridge		20.42	L.P.
69	6/23/95	NA2		0.24	L.P.
70	6/23/95	Outcrop Area Near NA2		6.09	L.P.
71	6/24/95	ROW at Gum Hollow Rd (W)		0.34	L.P.

Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g		Ap	Cl, Wr	Mh	
E	g	Ap, Cv		Cl, Wr	Mh	
E	g			We	Mh	
E	g		De	Cl, Op, Mf	Mh	
E	g			Wr	Mh	
E	g			We	Op, Mh	
E	g	Cv, Pq	Cv	Mf	Xh, Mh	
E	g	Sc	Sc	Cl, Mf	Mh	
E	g		Hc, Lc	Wr, Mf	Mh	
E	g			Wr	Ha	
E	g			We	Th, Ma	
E	g				Xh, Mh	
E	g	Rp	Ap	Or, Op	Xh, Ba	
E	g			Op	Bu, Ba	
E	g	Sl, Ap	Ap	We	Bh, Th	
E	g		Pp	We	Mo	
E	g	Pf		We	Bh	
E	g			We, Cl	Mh	
E	g			Mf	Mh	
E	g			Mf	Mh	
E	g			We, Op	Mh	
E	g	Hc	Hc, Lc	Mf	Mh	
E	g			Wr	Mh	
E	g	Cv	Cv	Mf	Mh	
E	g, h	Lc		We	Mh, Xh	unknown Juncus (later identified)
E	g				Bu	
E	g			We	Bh	
E	g			Op	Bu	
E	g	Ap, Sc	Ap, Sc, Cg	Cl, Mf	Mh	
E	g			We	Mh	
E	g			Op, We	Bu	
E	g, h			We	Bu, Pp	possible specimen of Carex echinata
E	g			Wr, Mf	Mh	
E	g		Lc, Hc	Mf	Mh	
E	g			Wr	Mh	
E	g			Op, We	Mo	

Table 2. (continued)

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
72	6/24/95	NA1 Open Slopes		1.12	L.P.
73	6/24/95	NA1 ROW Barren		1.72	L.P.
74	6/25/95	Chestnut Ridge Substation Wetland		0.3	L.P.
75	6/25/95	Chestnut Ridge ROWs		16.56	L.P.
76	6/26/95	A Pine Ridge Stream		23.01	L.P.
77	6/28/95	Wet ditch next to road near EFPC gaging station	Parcel ED-1	0.59	D.A.
78	6/28/95	Spring near Lambert's Quarry	Parcel ED-1	0.66	D.A.
79	6/28/95	Lower EFPC floodplain	Parcel ED-1	0.92	D.A.
80	6/28/95	East of Herrel Rd	Parcel ED-1	1.89	D.A.
81	6/28/95	RA3a	Parcel ED-1	1.94	D.A.
82	6/28/95	East Quarry Rd, tributary to EFPC	Parcel ED-1	3.04	D.A.
83	6/28/95	North of Bull Bluff Road		7.54	DA.
84	6/29/95	Lower EFPC Floodplain	Parcel ED-1	14.06	D.A., B.R.
85	6/30/95	RA21		2.82	L.P.
86	7/10/95	Beaver Pond EFPC	Parcel ED-1	0.27	L.P.
87	7/10/95	Herrel Rd Barrens	Parcel ED-1	0.88	L.P.
88	7/12/95	Lambert's Quarry	Parcel ED-1	4.21	L.P.
89	7/12/95	EFPC	Parcel ED-1	4.24	L.P.
90	7/13/95	K-25 Old Barracks Site		3.16	L.P.
91	7/13/95	Herrel Rd area (S area)	Parcel ED-1	31.99	R.C.
92	7/14/95	Lower EFPC	Parcel ED-1	44.35	D.A., B.R.
93	7/15/95	Hydrastis canadensis site EFPC	Parcel ED-1	0.34	L.P.
94	7/15/95	Beech-Maple Forest	Parcel ED-1	5.37	L.P.
95	7/15/95	EFPC	Parcel ED-1	7.08	L.P.
96	7/16/95	Stream E of Lambert Quarry	Parcel ED-1	2.16	L.P.
97	7/16/95	SE End of EFPC	Parcel ED-1	7.52	L.P.
98	7/18/95	SW End of EFPC	Parcel ED-1	1.95	LP
99	7/18/95	NA27		6.51	L.P.
100	7/18/95	Herrel Rd area (N area)	Parcel ED-1	18.76	R.C.
101	7/19/95	Lily Bloom Area (NA22)		0.99	R.C.
102	7/19/95	NW End of EFPC	Parcel ED-1	2.53	LP
103	7/20/95	Clearcut S of EFPC Rd.	Parcel ED-1	2.89	R.C.
104	7/20/95	Possible Plantation Covered Barren	Parcel ED-1	2.98	R.C.

Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g		Rp, Ap	Or, Op	Xh, Ba	
E	g			Or, Op	Bu, Ba	
E	g			We	Mo	
E	g			Op	Mo, Bu	
E	g			We	Mh	
E	g, r				clearcut	confusing Typha specimens
E	g, i			We	Bh	wetland around spring w/saprophytic muck. sweetflag & sycamore
E	g, r			We,	Bh	
E	g, r			Rs	clearcut, Mh	the sink is a southeastern shrew site
E	g, r			We	Bh, Cn	
E	g, r			We	Mh, Bh, clearcut	
M	p, g	Lc	Lc	Op	Mh, Mo	Lc in bloom
E	g, r			We	Bh, Ma, Cn	critical wetland, springs
E	g			We	Mh	
E	g, r			We	Bh	
E	g, r			Or, Op	Xh, Ba	
E	g, h, r	(Rc)		We, Cl	Xh	found Rhynchospora colorata (new for TN)
E	g, r			Cl	Mh	
E	g				Th	
E	g, r			Or, Op	Ba, Xh, Mh	
E	g, r			We, Cl	Bh, Mh, Th, Cn, Ma, Np, Pp, Wp, clearcut	(by canoe) cliffs/outcrops not evident from topo map
E	g, r	Hc			Mh	
E	g, r			Mf	Mh, Bm	beech-maple is unusual
E	g, r			Cl	Mh	
E	g, r			We	Mh	
E	g, r				Mh	
E	g, r				Mh	unidentified mint
E	g	Pp	Pp	We	Mo	
E	g, r	Hc	Hc	Mf	Xh, Mh	drainage enters rocky near mature forest
M	g, r	Lc	Lc	We	Mo	no seed formed following blooming
E	g, r				Mh	
E	g, r				clearcut	
E	g, r				Pp	no distinctive barren vegetation found

Table 2. (continued)

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
105	7/20/95	Lambert Quarry Pond (Canoe)	Parcel ED-1	4.24	L.P., D.A.
106	7/20/95	Bear Cr near EFPC	Parcel ED-1	25.35	R.C.
107	7/21/95	Upper Ish Wetland (2)		6.52	L.P.
108	7/23/95	ROW N of NA37		0.38	LP
109	7/23/95	NA37		1.04	LP
110	7/23/95	W End Fence-to-bound Strip B. O. R.		15.65	LP
111	7/30/95	Chestnut Ridge SDZ (E Bound.)		3.62	L.P.
112	7/30/95	Beaver Pond along Hwy 95		4.26	L.P.
113	8/1/95	Parcel ED-1 NE Boundary	Parcel ED-1	10.09	L.P.
114	8/2/95	NA46 and N		9.6	L.P.
115	8/3/95	NA36		3.57	L.P.
116	8/4/95	TSR (stream area)		4.07	L.P.
117	8/4/95	TSR (E end)		30.9	L.P.
118	8/6/95	NA1 Open Slopes		0.57	L.P.
119	8/6/95	NA1 ROW Barren		1.54	L.P.
120	8/9/95	NA2		41.82	L.P.
121	8/10/95	NA27 area		5.09	L.P.
122	8/10/95	RA13 and Vicinity (TSR)		45.08	L.P.
123	8/12/95	W of Lambert Quarry		5.23	L.P.
124	8/12/95	N of Lambert Quarry		30.47	L.P.
125	8/14/95	S of East Fork Ridge		12.32	L.P.
126	8/15/95	Leatherwood Bluffs (NA 41)		3.39	L.P.
127	8/17/95	Springs between Bethel Valley Rds		2.09	L.P.
128	8/17/95	N of Roger Quarry		2.27	L.P.
129	8/17/95	W of Deer Checking Staation		11.9	L.P.
130	8/18/95	W Walker Branch		9.83	L.P.
131	8/18/95	ROW W of Mt. Vernon Rd		19.61	L.P.
132	8/23/95	NA7		22.4	L.P.
133	8/24/95	Wetlands/Springs at Bear Cr, 95 Jct		4.31	L.P.
134	8/24/95	Chestnut Ridge E of HWY 95		10.39	L.P.
135	8/25/95	RA12		18.82	L.P.
136	8/31/95	Chestnut Ridge ROWs		5.46	L.P.
137	9/1/95	A Bethel Valley Pond		0.42	L.P.
138	9/1/95	Pond W of Deer Checking Station		0.71	L.P.
139	9/1/95	Fly Ash Area		5.51	L.P.
140	9/5/95	Pond N of Roger's Quarry		2.83	L.P.



Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g, r	Rc	Rc	We, Cl	Xh	
E	g, r				Mh	
E	g			We	Mh	
E	g			Op, Or, Op	Bu, Ba	
E	g		Ap, Dr	Cl, Or, Wr, Op	Mh, Xh, Ba	2 vouchers
E	g	Cv		Mf	Mh, Th	
E	g			Op	Mo, Mh	
E	g			We	Mh	
E	g, r			Mf	Mh, Np	
E	g	Cv		Mf	Xh, Np, Mh	
E	g			Mf, Wr, We	Mh	found Isoetes
E	g				Mh, Xh	
E	g				Mh, Xh	
E	g		Rp, Ap	Or, Op	Xh, Ba	checked Rp
E	g			Or, Op	Bu, Ba	
E	g			We, Wr	Mh, Xh	
E	g			We	Mh	
E	g	(see comment)		Rs	Mh, Xh	may have found Viola tripartita var. tripartita
E	g			We	Mh, Xh	unknown plant in sometimes wet disturbed open area
E	g	Ca	Ca	Mf	Mh, Xh, Np	more Ca sites
E	g				Mh, Xh	
E	g		Cv	Mf, Wr	Mh	unknown mint past flowering
E	g			We	Mh	
E	g			We	Th, Ma	beaver dam
E	g			We, Op	Bu, Ha	
E	g			Mh	Mh	
E	g			Or, Op	Bu, Ba	
E	g		De	Op	Mh, Xh, Bu	
E	g			We	Mh	
E	g				Mh, Xh	
E	g	Cg		Cl, Or	Xh	
E	g			Op	Bu, Mo	
E	g			We	Bu	unknown Sagittaria
E	g			We	Bu	
E	g		So	We	Th	
E	g			We	Pp	unknown Sagittaria found

Table 2. (continued)

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
141	9/6/95	NA36		2.35	L.P.
142	9/6/95	ROW SW of SA-A		3.68	L.P.
143	9/6/95	ROW SW of Katie's Kitchen (E)		5.04	L.P.
144	9/8/95	N of Pine Ridge Streag		0.7	L.P.
145	9/8/95	S of Bear Cr Mowed Area (Middle)		2.76	L.P.
146	9/9/95	ROW SW of 0907 (W)		27.38	L.P.
147	9/12/95	RA12		26.89	L.P.
148	9/13/95	Robert's Branch (RA24)		3.71	L.P.
149	9/14/95	S of Bear Cr Mowed Area (E End)		2.31	L.P.
150	9/14/95	E end of NA27		2.79	L.P.
151	9/14/95	NW end of NA2		6.55	L.P.
152	9/15/95	NA43 and ROW on N Side		24.3	L.P.
153	9/18/95	Bull Bluff Above the Cliff		13.65	L.P.
154	9/18/95	Bull Bluff Bend		22.28	L.P.
155	9/19/95	N End of NA23		4.18	L.P.
156	9/20/95	Slope Bottom NA41		4.22	L.P.
157	9/21/95	Chestnut Ridge ROW		1.85	L.P.
158	9/23/95	W Bethel Valley Pond		2.48	L.P.
159	9/25/95	Pine Ridge Gasline and Power ROW's		20.18	L.P.
160	9/26/95	RA19		1.82	L.P.
161	9/26/95	Hembree Marsh		2.55	L.P.
162	9/26/95	Red Barren E of 95		4.27	L.P.
163	9/27/95	Jct. 95 & Bear Cr (N)		1.19	L.P.
164	9/27/95	East Fork Ridge		6.69	L.P.
165	9/29/95	Mckinney Ridge near Popular Creek		5.81	L.P.
166	2/21/96	Outside Kerr Hollow Fence		4.36	L.P.
167	3/22/96	S end of Mckinney Ridge		36.19	L.P.
168	3/24/96	W of Hot Yard Rd		12.78	L.P.
169	3/26/96	Chestnut Ridge (cabin road)		6.97	L.P.
170	3/30/96	Rainy Knob		4.21	L.P.
171	3/30/96	S of Clark Center		6.65	L.P.
172	4/1/96	TSF southwest		19.12	L.P.
173	4/2/96	TSF W Copper Ridge		1.88	L.P.
174	4/2/96	TSF cave area		10.67	L.P.
175	4/2/96	TSF including bluffs		27.33	L.P.
176	4/3/96	Jct Poplar Cr & EFPC		1.05	L.P.
177	4/3/96	S of East Fork Ridge		7.01	L.P.
178	4/3/96	N of Lambert Quarry		20.05	L.P.
179	4/10/96	TSF upper west bluffs		14.25	L.P.

Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g		Lc	We, Mf	Mh	3rd cluster of lily like plant found but no flowers
E	g			Op	Bu	
E	g			Op, Or	Ba, Bu, Xh	
E	g			We	Bh	supposed Gentian was Phlox
E	g			We	Mo	
E	g			Op	Bu	
E	g		Cg	Cl, Mf-	Xh, Mh	
E	g			We	Bh	new embayment wetland discovered
E	g			We	Mo	
E	g		Pp	We, Op	Bu, Mo	
E	g	Hc	Hc	Wr, Mf	Mh, Bu	a possible Cr specimen apparently died back
E	g	De		Wr, Or, Op	Ba, Xh, Bu	found large new De population
E	g	Di	Di	Wr, Rs	Mh, Xh	possible new cave entrances
E	g				Mh, Th, Ha	
E	g	Cr		Wo, Mf	Mh, Xh, Ba	Cr presence confirmed
E	g			Wr, Cl	Mh	perhaps a new species of waterleaf (check in May)
E	g, h				Bu, Mo	Cyperus odorata (new for OR)
E	g			We	Bu	collected Sagittaria
E	g			Op	Bu, Mo	
E	g			We	Bh, Ma	
E	g	Li, Jb	Li	We	Bh, Ma	found new T&E sites
E	g			Op	Ba, Np	
E	g			We	Th	
E	g			Wr	Xh	
E	g		Ap,	We, Wr	Mh	
E	g			We	La, Mh	
E	g				Mh, Xh	pipeline to go into this area
E	g			We	Mh, Pp	
E	g				Mh, Xh	
E	g	Sc	Sc,	Cl, Rs, Wr	Mh	
E	g		Lc	Mf	Mh	
E	g		Cg	Wr	La, Mh, Xh	
E	g			Wr	Hh	
E	g			Rs, Or	La, Mh, Xh	
E	g			Wr	Mh, Xh	
E	g			Wr, We	Mh	mudflats checked
E	g			Wr	Mh, Xh	
E	g		Ca	Mf	Mx, Mh, Xh	
E	g		Cg	Wr	Mh, Xh	

Table 2. (continued)

INDEX	DATE	SITE	REQUEST	ACRES	INVESTIGATOR
180	4/10/96	TSF stream		24.17	L.P.
181	4/11/96	S slope East Fork Ridge		13.21	L.P.
182	4/11/96	NA19 plus		14.61	L.P.
183	4/12/96	S of Perimeter Rd		2.31	L.P.
184	4/12/96	N of Perimeter Rd		3.61	L.P.
185	4/12/96	Chestnut Ridge Creek		5.47	L.P.
186	4/12/96	Chestnut Ridge (cabin loop)		10.89	L.P.
187	4/13/96	N of NA19 and some of NA19		3.94	L.P.
188	4/15/96	Bear Creek triangle		2.43	L.P.
189	4/15/96	Ish Creek Branch		15.71	L.P.
190	4/18/96	E end of NA19		4.32	L.P.
191	4/18/96	NA39		17	L.P.
192	4/20/96	Upper Ish Creek		7.22	L.P.
193	4/25/96	Large new lily population		5.98	L.P.
194	4/25/96	Bull Bluff		22.52	L.P.
195	4/29/96	S slope East Fork Ridge		12.16	L.P.
196	4/29/96	Bear Ck. to Hot Yard Rd		15.56	L.P.
197	4/30/96	Freels Bend		23.47	L.P.
198	5/2/96	Inside Kerr Hollow Fence		4.82	L.P.
199	5/2/96	E of Bearden Creek		16.78	L.P.
200	5/6/96	Bear Creek		6.14	L.P.
201	5/8/96	SE of Gallaher Bridge		1	L.P.
202	5/9/96	Upper Chestnut Ridge Wetland		6.47	L.P.
203	5/10/96	E of Bull Bluff Rd.		12.86	L.P.
204	5/18/96	Robert's Branch Wetland		8.42	L.P.
205	5/20/96	E of 95 Copper Ridge		2.74	L.P.
206	5/20/96	RA12 and ROW		13.11	L.P.

## INVESTIGATOR

L.P. = Larry Pounds  
D.A. = Deborah Awl  
B.R. = Barbara Rosensteel

## METHOD

E = exploratory  
S = systematic  
M = monitoring

## RECORDS

p = photograph  
g = GIS map data  
h = herbarium specimen  
r = report

T&E OBSERVED = T&E species observed during visit  
T&E SITE LIST = all T&E species known from the site

Ap = *Aureolaria patula*  
Cg = *Carex gravida*  
Ch = *Carex howei*  
Co = *Carex oxylepis* var. *pubescens*  
Cr = *Cimicifuga rubifolia*  
Ca = *Cypripedium acaule*  
De = *Delphinium exaltatum*  
Dl = *Diervilla lonicera*  
Dr = *Draba ramosissima*  
En = *Elodea nuttallii*  
Fm = *Fothergilla major*  
Hc = *Hydrastis canadensis*  
Jc = *Juglans cinerea*  
Jb = *Juncus brachycephalus*  
Lc = *Lilium canadense*  
Ll = *Liparis loeselii*  
Pq = *Panax quinquefolius*  
Pf = *Platanthera flava* var. *herbiola*  
Pp = *Platanthera peramoena*  
Pv = *Pycnanthemum verticillatum*  
Rc = *Rhynchospora colorata*

Table 2. (continued)

METHOD	RECORDS	T&E OBSERVED	T&E SITE LIST	LANDSCAPE ELEMENTS	COMMUNITIES	COMMENTS
E	g			Rs	Np, Mh	
E	g			Wr	Mh, Xh	
E	g		Cr,	Wr, We	Mh, Mx	need to confirm Cr site
E	g			Cl, Wr	Mh, Xh	
E	g				Np, Mh	checking for sweet pine sap
E	g			We	Bh	
E	g			We	Mh, Xh	
E	g	Ap, Cv, Pq	Ap	Mf, Wr, Or	Mh, Xh	
E	g			We, Wr	Mh	
E	g			We	Bh	excellent wetland
E	g		Ap	Wr, Or, We	Mh, Xh	unknown plant flagged
E	g		Cv	Mf	Mh, Mx	Cv not yet up
E	g	Ca		We	Bh	
E	g	Lc		We	Mh	perhaps ORR's largest Lc
E	g	Pq, Dl	Dl,	Cl, Mf	Mh	
E	g			Wr	Mh, Xh	
E	g	Pf, Lc		We	Mh, Cn	
E	g				Xh, Mh	
E	g, h			Cl, We	La, Mh	
E	g	Pq	Lc	Or, We, Mf	Xh, Mh	
E	g	Cv, Hc, Pq		We, Wr	Mh, Mo	
E	g			We	Th, Mh	search for Carex muricata
E	g			We	Mh	possible rare sedge found
E	g	Lc, Pq		We, Mf	Mh	
E	g	Sc	Sc	We, Wr	Bh, Th, Pp, Ma	
E	g	Rp		Or, Op, Wr	Xh	
E	g	Rp	Cg	Or, Wr, Cl	Xh	

Rp = *Ruellia purshiana*  
 Sc = *Saxifraga careyana*  
 Sf = *Scirpus fluviatilis*  
 Sl = *Spiranthes lucida*  
 So = *Spiranthes ovalis*  
 Vt = *Viola tripartita var tripartita*

## LANDSCAPE ELEMENTS

Cl = Cliff  
 Wr = Wooded rock outcrop  
 Or = Open rock outcrop  
 Rs = Rocky sink  
 Mf = Mature forest  
 We = Wetlands, ponds, springs, seeps  
 Op = Open areas (natural or maintained)

## COMMUNITIES

Ba = Limestone barren  
 Np = Natural Pine  
 Pp = Pine Plantation  
 Wp = Walnut Plantation  
 Mh = Mesic Hardwoods  
 Xh = Xeric Hardwoods  
 Ha = Hay field  
 Bu = Bush-hogged  
 Mo = Mown  
 Bh = Bottomland Hardwoods  
 Th = Thicket  
 He = Hemlock  
 Mx = Mixed pine and hardwood  
 La = Lawn  
 Or = Ornamental (landscaping)



The current list of vascular plant species found on the Oak Ridge Reservation that are listed by state or federal agencies is posted on the National Environmental Research Park web site at:

[http://www.esd.ornl.gov/facilities/nerp/orr\\_rareplantlist.pdf](http://www.esd.ornl.gov/facilities/nerp/orr_rareplantlist.pdf)

Table 4. has been removed from this document as it contains environmentally sensitive information.

Contact **Pat Parr** ([parrpd@ornl.gov](mailto:parrpd@ornl.gov)) for questions and assistance.



**Table 5. T&E Vascular Plant Species Potentially Occurring on the ORR**

TAXON	COMMON NAME	HABITAT	TN STATUS	U.S. STATUS
<i>Arabis patens</i>	Spreading rockcress	Limestone slopes	E	
<i>Asplenium scolopendrium</i> var. <i>americana</i>	American hart's tongue fern	Cave entrance	E	T
<i>Aster ericoides</i>	White heath aster	Dry, open areas	T	
<i>Aster pratensis</i>	Aster	Dry prairies	T	
<i>Berberis canadensis</i>	American barberry	Rocky bluffs	S	
<i>Carex muricata</i> var. <i>angusta</i>	Little prickly sedge	Wetlands	T	
<i>Chrysogonum virginianum</i>	Green-and-gold	Rocky woodlands	T	
<i>Gnaphalium helleri</i>	Catfoot	Dry forest edge	S	
<i>Heuchera longifolia</i> var. <i>aceriodes</i>	Maple-leaf alumroot	Calcareous woods	S	
<i>Isotria medeoloides</i>	Small whorled pogonia	Under trees	E	E
<i>Liatris cylindracea</i>	Slender blazing-star	Barren	E	
<i>Lonicera dioica</i>	Mountain honeysuckle	Rocky river banks	S	
<i>Lonicera flava</i>	Yellow honeysuckle	Woodlands	S	
<i>Marshallia grandiflora</i>	Large-flowered Barbara's-buttons	Gravel bars	T	(C2)
<i>Meehania cordata</i>	Heartleaf meehania	River slopes	T	
<i>Pedicularis lanceolata</i>	Swamp lousewort	Wet meadow, seeps	T	
<i>Polymnia laevigata</i>	Tennessee leafcup	Woodlands	S	
<i>Rhamnus alnifolia</i>	Alderleaf buckthorn	Swamps, low woods	E	

**Table 5. (continued)**

<i>Rhynchospora capillacea</i>	Capillary beakrush	Limestone seeps	E-P	
<i>Silphium laciniatum</i>	Compass plant	Prairies	T	
<i>Silphium wasiotense</i>	Kentucky rosinweed	Forest edge	T	
<i>Solidago ptarmicoides</i>	Prairie goldenrod	Barren	E	
<i>Spiraea virginiana</i>	Virginia spiraea	Gravel bars	E	T
<i>Synandra hispidula</i>	Gyandotte beauty	Rich wooded slopes	T	
<i>Tetragonotheca helianthoides</i>	Pineland squarehead	Woods, thickets	E-P	
<i>Tomanthera auriculata</i>	Earleaf fox-glove	Barren	E	(C2)
<i>Trifolium calcaricum</i>	Running glade Glover	Barrens	E	(C2)
<i>Woodwardia virginica</i>	Virginia chainfern	Wet acid soils	S	

Status codes:

- (C2) Under review for federal listing; was listed under the formerly used C2 candidate designation. More information needed to determine status.
- E Endangered in Tennessee.
- E\* Endangered in Tennessee due to commercial exploitation.
- T Threatened in Tennessee.
- S Special Concern in Tennessee.
- none\* No status currently, but high state rank (Tennessee Natural Heritage Program) and under evaluation for state listing.

Table 6. Additions (144) to the ORR Vascular Flora, 1994 through May, 1996

GENUS	SPECIES	VARIETY	SYNONYM	ADD YEAR
<i>Ageratina</i>	<i>aromatica</i>	-	<i>Eupatorium aromaticum</i>	1994
<i>Allium</i>	<i>ampeloprasum</i>	-	-	1994
<i>Ambrosia</i>	<i>bidentata</i>	-	-	1994
<i>Anthoxanthum</i>	<i>odoratum</i>	-	-	1994
<i>Arabis</i>	<i>canadensis</i>	-	-	1994
<i>Aristida</i>	<i>dichotoma</i>	-	-	1994
<i>Asclepias</i>	<i>viridiflora</i>	-	-	1994
<i>Aster</i>	<i>divaricatus</i>	-	-	1994
<i>Aster</i>	<i>laevis</i>	-	-	1994
<i>Bidens</i>	<i>bipinnata</i>	-	-	1994
<i>Bromus</i>	<i>altiissimus</i>	-	<i>B. latiglumis</i>	1994
<i>Bromus</i>	<i>tectorum</i>	-	-	1994
<i>Carex</i>	<i>eburnea</i>	-	-	1994
<i>Carex</i>	<i>gracillima</i>	-	-	1994
<i>Carex</i>	<i>stipata</i>	-	-	1994
<i>Cirsium</i>	<i>arvense</i>	-	-	1994
<i>Commandra</i>	<i>umbellata</i>	-	-	1994
<i>Cornus</i>	<i>drummondii</i>	-	-	1994
<i>Crataegus</i>	<i>calpodenron</i>	-	-	1994

Table 6. (continued)

GENUS	SPECIES	VARIETY	SYNONYM	ADD YEAR
<i>Cyperus</i>	<i>pseudovegetus</i>	-	-	1994
<i>Desmanthus</i>	<i>illinoensis</i>	-	-	1994
<i>Desmodium</i>	<i>glutinosum</i>	-	-	1994
<i>Draba</i>	<i>ramosissima</i>	-	-	1994
<i>Eleocharis</i>	<i>parvula</i>	-	-	1994
<i>Elodea</i>	<i>canadensis</i>	-	-	1994
<i>Eragrostis</i>	<i>curvula</i>	-	-	1994
<i>Euphorbia</i>	<i>humistrata</i>	-	<i>Chamaesyce</i>	1994
<i>Festuca</i>	<i>subverticillata</i>	-	<i>F. obtusa</i>	1994
<i>Galax</i>	<i>urceolata</i>	-	<i>G. aphylla</i>	1994
<i>Gaultheria</i>	<i>procumbens</i>	-	-	1994
<i>Gnaphalium</i>	<i>purpureum</i>	-	-	1994
<i>Helianthus</i>	<i>decapetalus</i>	-	-	1994
<i>Hordeum</i>	<i>pusillum</i>	-	-	1994
<i>Hypericum</i>	<i>prolificum</i>	-	-	1994
<i>Iris</i>	<i>virginica</i>	-	-	1994
<i>Iva</i>	<i>annua</i>	-	-	1994
<i>Juncus</i>	<i>brachycephalus</i>	-	-	1994
<i>Lechea</i>	<i>racemulosa</i>	-	-	1994
<i>Linaria</i>	<i>canadensis</i>			1994

Table 6. (continued)

GENUS	SPECIES	VARIETY	SYNONYM	ADD YEAR
<i>Linum</i>	<i>sulcatum</i>	-	-	1994
<i>Muhlenbergia</i>	<i>tenuiflora</i>	-	-	1994
<i>Panicum</i>	<i>virgatum</i>	-	-	1994
<i>Phaseolus</i>	<i>polystachyus</i>	-	-	1994
<i>Phlox</i>	<i>stolonifera</i>	-	-	1994
<i>Poa</i>	<i>sylvestris</i>	-	-	1994
<i>Polygonum</i>	<i>cuspidatum</i>	-	-	1994
<i>Quercus</i>	<i>michauxii</i>	-	-	1994
<i>Rhexia</i>	<i>mariana</i>	var. <i>mariana</i>	-	1994
<i>Rhus</i>	<i>aromatica</i>	-	-	1994
<i>Rubus</i>	<i>phoenicolasius</i>	-	-	1994
<i>Salix</i>	<i>alba</i>	-	-	1994
<i>Scirpus</i>	<i>fluviatilis</i>	-	-	1994
<i>Sparganium</i>	<i>americanum</i>	-	-	1994
<i>Spiranthes</i>	<i>tuberosa</i>	-	<i>S. grayi</i>	1994
<i>Sporobolus</i>	<i>clandestinus</i>	-	-	1994
<i>Sporobolus</i>	<i>indicus</i>	-	<i>S. poiretii</i>	1994
<i>Stipa</i>	<i>avenacea</i>	-	-	1994
<i>Strophostyles</i>	<i>umbellata</i>	-	-	1994
<i>Tussilago</i>	<i>farfara</i>	-	-	1994

Table 6. (continued)

GENUS	SPECIES	VARIETY	SYNONYM	ADD YEAR
<i>Veronica</i>	<i>arvensis</i>	-	-	1994
<i>Viburnum</i>	<i>prunifolium</i>	-	-	1994
<i>Vinca</i>	<i>minor</i>	-	-	1994
<i>Alopecurus</i>	<i>carolinianus</i>	-	-	1995
<i>Amelanchier</i>	<i>laevis</i>	-	-	1995
<i>Aralia</i>	<i>racemosa</i>	-	-	1995
<i>Arctium</i>	<i>minus</i>	-	-	1995
<i>Arenaria</i>	<i>serpyllifolia</i>	-	-	1995
<i>Asclepias</i>	<i>quadrifolia</i>	-	-	1995
<i>Betula</i>	<i>nigra</i>	-	-	1995
<i>Buglossoides</i>	<i>arvense</i>	-	<i>Lithospermum</i>	1995
<i>Calystegia</i>	<i>spithamaea</i>	-	-	1995
<i>Cardamine</i>	<i>parviflora</i>	-	-	1995
<i>Carex</i>	<i>atlantica</i>	spp. atlantica	-	1995
<i>Carex</i>	<i>bromoides</i>	-	-	1995
<i>Carex</i>	<i>jamesii</i>	-	-	1995
<i>Carex</i>	<i>muhlenbergii</i>	var. muhlenbergii	-	1995
<i>Carex</i>	<i>platyphylla</i>	-	-	1995
<i>Carex</i>	<i>purpurifera</i>	-	-	1995
<i>Carex</i>	<i>styloflexa</i>	-	-	1995

Table 6. (continued)

GENUS	SPECIES	VARIETY	SYNONYM	ADD YEAR
<i>Carex</i>	<i>virescens</i>	-	-	1995
<i>Celastrus</i>	<i>orbiculatus</i>	-	-	1995
<i>Chaenorrhinum</i>	<i>minus</i>	-	-	1995
<i>Chaerophyllum</i>	<i>procumbens</i>	-	-	1995
<i>Croton</i>	<i>monanthogynus</i>	-	-	1995
<i>Cyperus</i>	<i>croceus</i>	-	-	1995
<i>Cyperus</i>	<i>odoratus</i>	-	-	1995
<i>Disporum</i>	<i>lanuginosum</i>	-	-	1995
<i>Elaeagnus</i>	<i>pungens</i>	-	-	1995
<i>Eragrostis</i>	<i>frankii</i>	-	-	1995
<i>Erythronium</i>	<i>americanum</i>	-	-	1995
<i>Festuca</i>	<i>rubra</i>	-	-	1995
<i>Geranium</i>	<i>columbinum</i>	-	-	1995
<i>Glechoma</i>	<i>hederacea</i>	-	-	1995
<i>Hedyotis</i>	<i>crassifolia</i>	-	<i>Houstonia</i>	1995
<i>Hemerocallis</i>	<i>fulva</i>	-	-	1995
<i>Hibiscus</i>	<i>trionum</i>	-	-	1995
<i>Hydrophyllum</i>	<i>macrophyllum</i>	-	-	1995
<i>Ilex</i>	<i>verticillata</i>	-	-	1995
<i>Iris</i>	<i>pseudacorus</i>	-	-	1995

Table 7. ORNL Photography Numbers for Photographs of T&amp;E Vascular Plant Species and Their Habitats

Species	ORNL Number	Photo View	Date	Witness
<i>Aureolaria patula</i>	4341-83	Close-up; flowers	9/19/81	P. D. Parr
<i>A. patula</i>	4342-83	Habitat; river bluffs	Sep-81	P. D. Parr
<i>A. patula</i>	7586-87	Entire specimen	9/30/87	P. D. Parr
<i>A. patula</i>	7593-87	Close-up	9/30/87	P. D. Parr
<i>A. patula</i>	7590-87	Close-up; leaves & flower	9/30/87	P. D. Parr
<i>A. patula</i>	7594-87	Close-up; leaves & flower	9/30/87	P. D. Parr
<i>A. patula</i>	7587-87	Close-up; leaves & seedheads	9/30/87	P. D. Parr
<i>A. patula</i>	7588-87	Entire specimen; no flowers	9/30/87	P. D. Parr
<i>A. patula</i>	7592-87	Partial specimen; leaves	9/30/87	P. D. Parr
<i>A. patula</i>	7591-87	Entire specimen	9/30/87	P. D. Parr
<i>Blephilia ciliata</i>	3796-95	Herbarium specimen	1995	L. R. Pounds
<i>Carex gravida</i>	3795-95	Herbarium specimen	1995	L. R. Pounds
<i>Cimicifuga rubifolia</i>	4340-83	Close-up; leaves	9/19/81	T. Patrick
<i>C. rubifolia</i>	4338-83	Close-up; flower spike	9/19/81	T. Patrick
<i>C. rubifolia</i>	4342-83	Entire specimen & habitat	Sep-81	T. Patrick
<i>C. rubifolia</i>	6825-87	Entire specimen with flowers		R. A. Cook
<i>C. rubifolia</i>	6823-87	Sampling sites		R. A. Cook
<i>C. rubifolia</i>	6824-87	Entire specimen; R. A. Cook		R. A. Cook
<i>Collinsonia verticillata</i>	3792-95	Entire specimen with flowers	1995	L. R. Pounds
<i>C. verticillata</i>	3789-95	Habitat	1995	L. R. Pounds
<i>C. verticillata</i>	3793-95	Habitat	1995	L. R. Pounds
<i>Cypripedium acaule</i>	3791-95	Entire specimens	1995	L. R. Pounds
<i>C. acaule</i>	3790-95	Entire specimens	1995	L. R. Pounds
<i>Delphinium exaltatum</i>	5357-85	Close-up; flower spike	8/2/79	P. D. Parr
<i>D. exaltatum</i>	4387-83	Habitat patch	8/2/79	P. D. Parr
<i>Diervilla lonicera</i>	7904-92	Partial specimen		R. A. Cook
<i>D. lonicera</i>	7903-92	Close-up; leaves and flowers		R. A. Cook
<i>Draba ramosissima</i>	2601-94	Specimen grouping	1994	L. R. Pounds
<i>D. ramosissima</i>	2600-94	Specimen grouping	1994	L. R. Pounds
<i>D. ramosissima</i>	2599-94	Habitat and specimens	1994	L. R. Pounds
<i>D. ramosissima</i>	2598-94	Habitat and specimens	1994	L. R. Pounds
<i>D. ramosissima</i>	2597-94	Habitat and specimens	1994	L. R. Pounds
<i>Elodea nuttallii</i>	7550-90	Pond habitat and plants	1990	L. R. Pounds
<i>E. nuttallii</i>	7549-90	Close-up; flowers	1990	L. R. Pounds
<i>Fothergilla major</i>	4379-83	Close-up; leaves & flowers	4/30/79	F. Taylor
<i>F. major</i>	4384-83	Habitat	May-79	P. D. Parr
<i>Hydrastis canadensis</i>	4386-83	Close-up; flower and leaves	4/15/79	P. D. Parr



Table 7. (continued)

<i>Juncus brachycephalus</i>	7055-94	Close-up; seedheads	1994	L. R. Pounds
<i>J. brachycephalus</i>	7054-94	Specimen grouping	1994	L. R. Pounds
<i>J. brachycephalus</i>	7053-94	Habitat	1994	L. R. Pounds
<i>Juglans cinerea</i>	3787-95	Herbarium specimen-1974		L. R. Pounds
<i>Lilium canadense</i>	4383-83	Entire specimen with flowers	7/12/78	P. D. Parr
<i>L. canadense</i>	4385-83	Close-up; flower	7/12/78	P. D. Parr
<i>L. canadense</i>	5177-94	Close-up; flower	1994	R. A. Cook
<i>L. canadense</i>	5170-94	Habitat and specimens	1994	R. A. Cook
<i>L. canadense</i>	5171-94	Entire specimens	1994	R. A. Cook
<i>L. canadense</i>	5173-94	Entire specimens	1994	R. A. Cook
<i>L. canadense</i>	5176-94	Close-up; flowers	1994	R. A. Cook
<i>L. canadense</i>	5174-94	Entire specimen	1994	R. A. Cook
<i>L. canadense</i>	5178-94	Entire specimen	1994	R. A. Cook
<i>L. canadense</i>	5172-94	Specimen group; R. A. Cook	1994	R. A. Cook
<i>L. canadense</i>	5175-94	Habitat	1994	R. A. Cook
<i>Liparis loeselii</i>	9051-91	Entire specimen	1991	P. D. Parr
<i>L. loeselii</i>	9052-91	Entire specimen	1991	P. D. Parr
<i>L. loeselii</i>	9049-91	Habitat	1991	P. D. Parr
<i>L. loeselii</i>	9050-91	Habitat	1991	P. D. Parr
<i>L. loeselii</i>	9046-91	Habitat	1991	P. D. Parr
<i>Panax quinquefolius</i>	4377-83	Close-up; leaves and fruit	Aug-78	P. D. Parr
<i>Platanthera peramoena</i>	7548-90	Habitat		L. R. Pounds
<i>P. peramoena</i>	7546-90	Close-up; flower head		L. R. Pounds
<i>P. peramoena</i>	7547-90	Close-up; flower head		L. R. Pounds
<i>Saxifraga careyana</i>	4380-83	Specimen group	5/2/78	P. D. Parr
<i>S. careyana</i>	4375-83	Habitat	Aug-77	P. D. Parr
<i>Scirpus fluviatilis</i>	3794-95	Herbarium specimen		L. R. Pounds
<i>Solidago ptarmicoides</i>		Close-up; flowers	8/5/81	T. Patrick
<i>S. ptarmicoides</i>	4336-83	Entire specimen	8/22/83	P. D. Parr
<i>S. ptarmicoides</i>	6248-86	Entire specimen		
<i>S. ptarmicoides</i>	4339-83	Habitat		P. D. Parr
<i>Spiranthes ovalis</i>	5653-83	Entire specimen	9/7/83	P. D. Parr
<i>S. ovalis</i>	5654-83	Close-up; flower stalk	9/7/83	P. D. Parr
<i>S. ovalis</i>	4382-83	Close-up; flower stalk	9/9/78	P. D. Parr
<i>S. ovalis</i>	4376-83	Entire specimen	9/9/78	P. D. Parr
<i>Tomanthera auriculata</i>	4337-83	Close-up; flower stalk	8/8/81	T. Patrick
<i>T. auriculata</i>	6249-86	Close-up; flowers		P. D. Parr
<i>T. auriculata</i>	6245-86	Close-up; flower stalk		P. D. Parr
<i>T. auriculata</i>	6251-86	Close-up; flowers		P. D. Parr
<i>T. auriculata</i>	6417-89	Partial specimen; leaves & stalk		P. D. Parr
<i>T. auriculata</i>	6250-86	Habitat; Monitoring plots	1987	P. D. Parr
<i>T. auriculata</i>	6252-86	Habitat; Monitoring plots	1987	P. D. Parr

Table 7. (continued)

<i>T. auriculata</i>	6247-86	Habitat	1987	P. D. Parr
<i>Trillium vaseyi</i>	3788-95	Entire specimen	1995	L. R. Pounds

Table 8. U.S. State Abbreviations

## USA

AK	Alaska	MT	Montana
AL	Alabama	NC	North Carolina
AR	Arkansas	ND	North Dakota
AZ	Arizona	NE	Nebraska
CA	California	NH	New Hampshire
CO	Colorado	NJ	New Jersey
CT	Connecticut	NM	New Mexico
DC	District of Columbia	NV	Nevada
DE	Delaware	NY	New York
FL	Florida	OH	Ohio
GA	Georgia	OK	Oklahoma
HI	Hawaii	OR	Oregon
IA	Iowa	PA	Pennsylvania
ID	Idaho	PR	Puerto Rico
IL	Illinois	RI	Rhode Island
IN	Indiana	SC	South Carolina
KS	Kansas	SD	South Dakota
KY	Kentucky	TN	Tennessee
LA	Louisiana	TX	Texas
ME	Maine	UT	Utah
MA	Massachusetts	VA	Virginia
MD	Maryland	VT	Vermont
MI	Michigan	WA	Washington
MN	Minnesota	WI	Wisconsin
MO	Missouri	WV	West Virginia
MS	Mississippi	WY	Wyoming

## CANADA

AB	Alberta	NS	Nova Scotia
BC	British Columbia	ON	Ontario
LB	Labrador	PE	Prince Edward Island
MB	Manitoba	PQ	Quebec
NB	New Brunswick	SK	Saskatchewan
NF	Newfoundland	YT	Yukon Territory
NT	Northwest Territories		

Table 9. Exotic Plant Species Associated with Adverse Impact to T&E Species  
or with High Potential to Adversely Impact T&E Species

GENUS	SPECIES	SYNONYM	COMMON NAME
Ailanthus	altissima	-	Tree-of-heaven
Albizia	julibrissin	-	Mimosa
Arthraxon	hispidus	-	(none)
Celastrus	orbiculatus	-	Oriental bittersweet
Coronilla	varia	-	Crown-vetch
Dioscorea	batatas	-	Chinese yam
Elaeagnus	pungens	-	Oleaster
Elaeagnus	umbellata	-	Oleaster
Festuca	arundinacea	F. elatior var. arundinacea	Meadow fescue
Festuca	pratensis	-	Fescue
Glechoma	hederacea	-	Ground-ivy
Kummerowia	stipulacea	Lespedeza	Korean bush-clover
Kummerowia	striata	Lespedeza	Japanese clover
Lespedeza	bicolor	-	Shrubby bushclover
Lespedeza	cuneata	-	Cuneate bus-clover
Ligustrum	sinense	-	Privet
Ligustrum	vulgare*	-	Privet
Lonicera	japonica	-	Japanese honeysuckle
Lythrum	salicaria	-	Purple loosestrife
Mahonia	bealei	-	Oregon grape
Mentha	spicata	-	Spearmint
Mentha	x piperita	-	Peppermint
Microstegium	vimineum	Eulalia viminea	Nepal grass
Murdannia	keisak	Aneilema	Alligator-weed
Myriophyllum	spicatum	-	European water-milfoil
Nasturtium	officinale	-	Watercress
Paulownia	tomentosa	-	Princess-tree
Plantago	lanceolata	-	Plantain

Table 9. (continued)

Poa	pratensis	-	Junegrass
Polygonum	persicaria	-	Smartweed
Poncirus	trifoliata	-	Trifoliate orange
Potamogeton	crispus	-	Pondweed
Pueraria	lobata	-	Kudzu
Rosa	multiflora	-	Multiflora rose
Rubus	phoenicolasius	-	Wineberry
Rumex	conglomeratus	-	Dock
Sorghum	halepense	-	Johnson grass
Tussilago	farfara	-	Coltsfoot
Urtica	dioica	-	Stinging nettle
Vinca	minor	-	Periwinkle



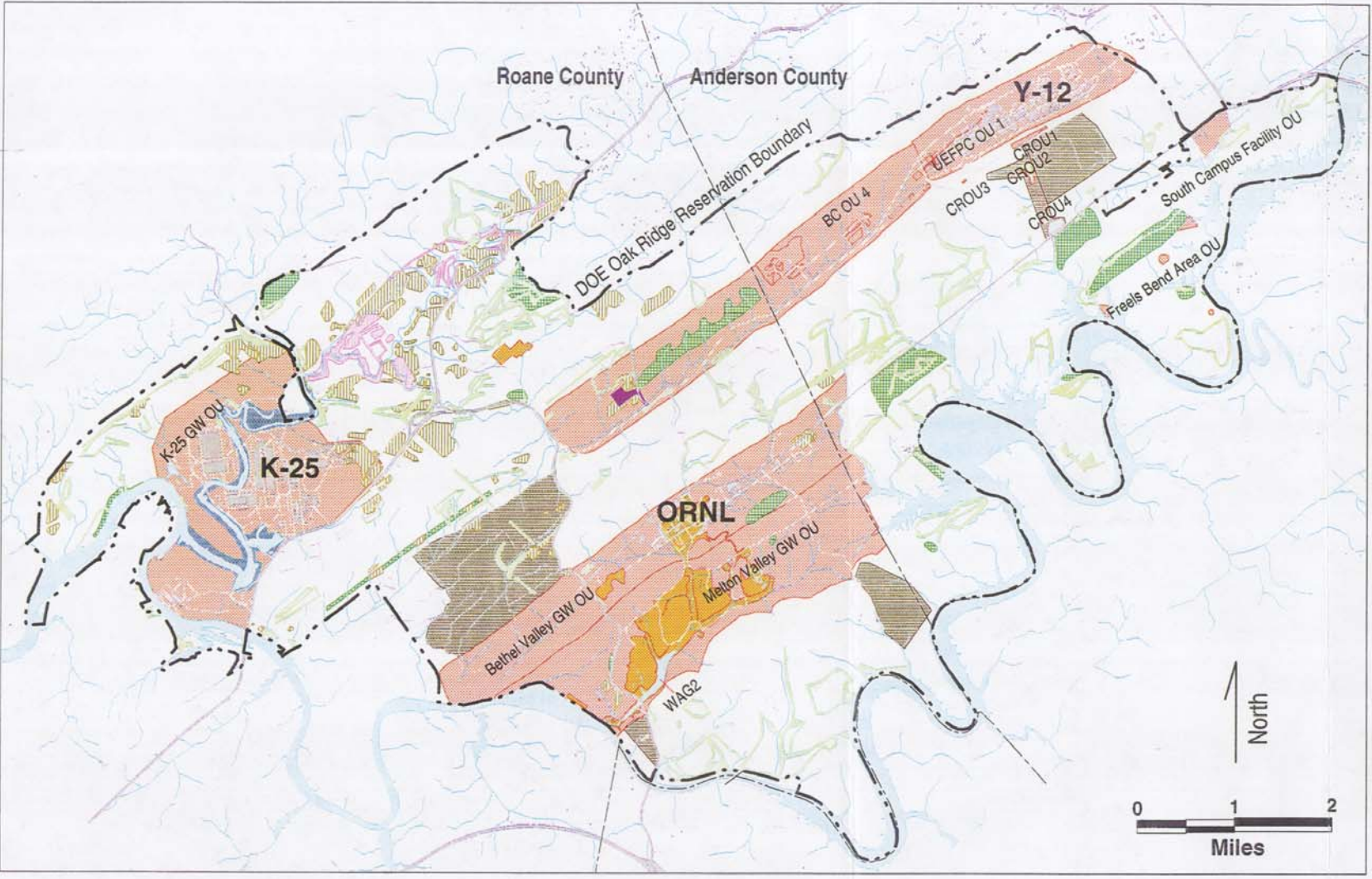
## **Appendix B**

### **FIGURES**

(8 ½ x 11)







**T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May, 1996)**

- Special Concern (1995-1996)
- Parcel ED-1 (1995)
- Low Level Waste Disposal Facility (1995)
- Poplar Creek (1994)
- Pine Plantations (timber salvage areas, 1993-1994)
- Natural & Reference Areas surveyed in 1994
- Waste Area Groupings (WAG; included in OU)
- Operable Units (OU; 1991-1994)
- Other Surveys (pre-1992)

**COORDINATE SYSTEM:**  
Tennessee State Plane (NAD 83)

**BASE DATA:**  
ORNL Shared Data Initiative (SDI)

**MAP COMPOSITION**  
Date: May, 1996  
Designer: D. Awl

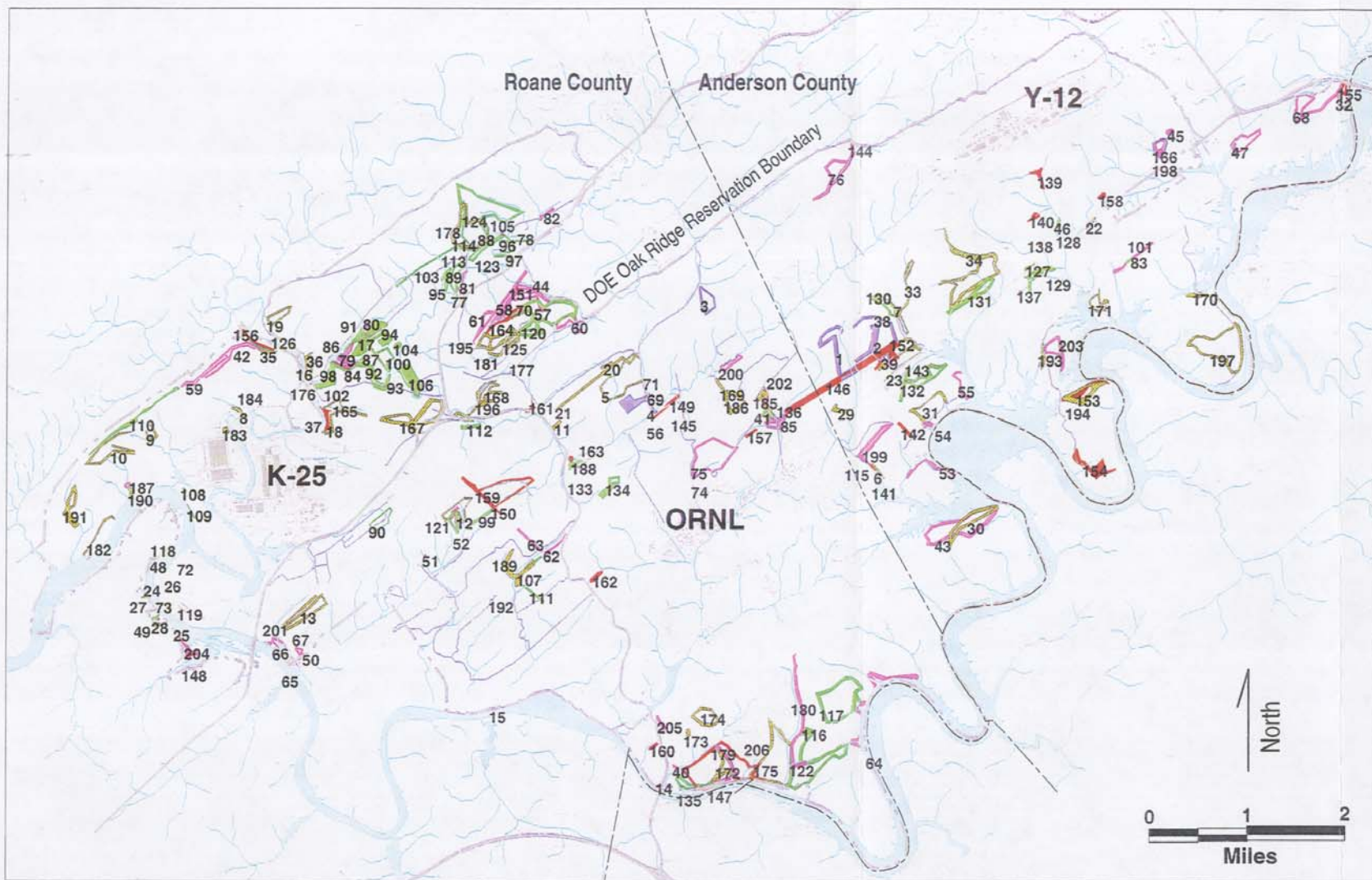
—JAYCOR Environmental—

Prepared for  
the Environmental Restoration Program  
by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 1 T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May, 1996)







T&E Vascular Plant Surveys on the  
Oak Ridge Reservation  
(1995 through May, 1996)  
Labeled by Survey Index Number



COORDINATE SYSTEM:  
Tennessee State Plane (NAD 83)

BASE DATA:  
ORNL Shared Data Initiative (SDI)

MAP COMPOSITION  
Date: May, 1996  
Designer: D. Awl

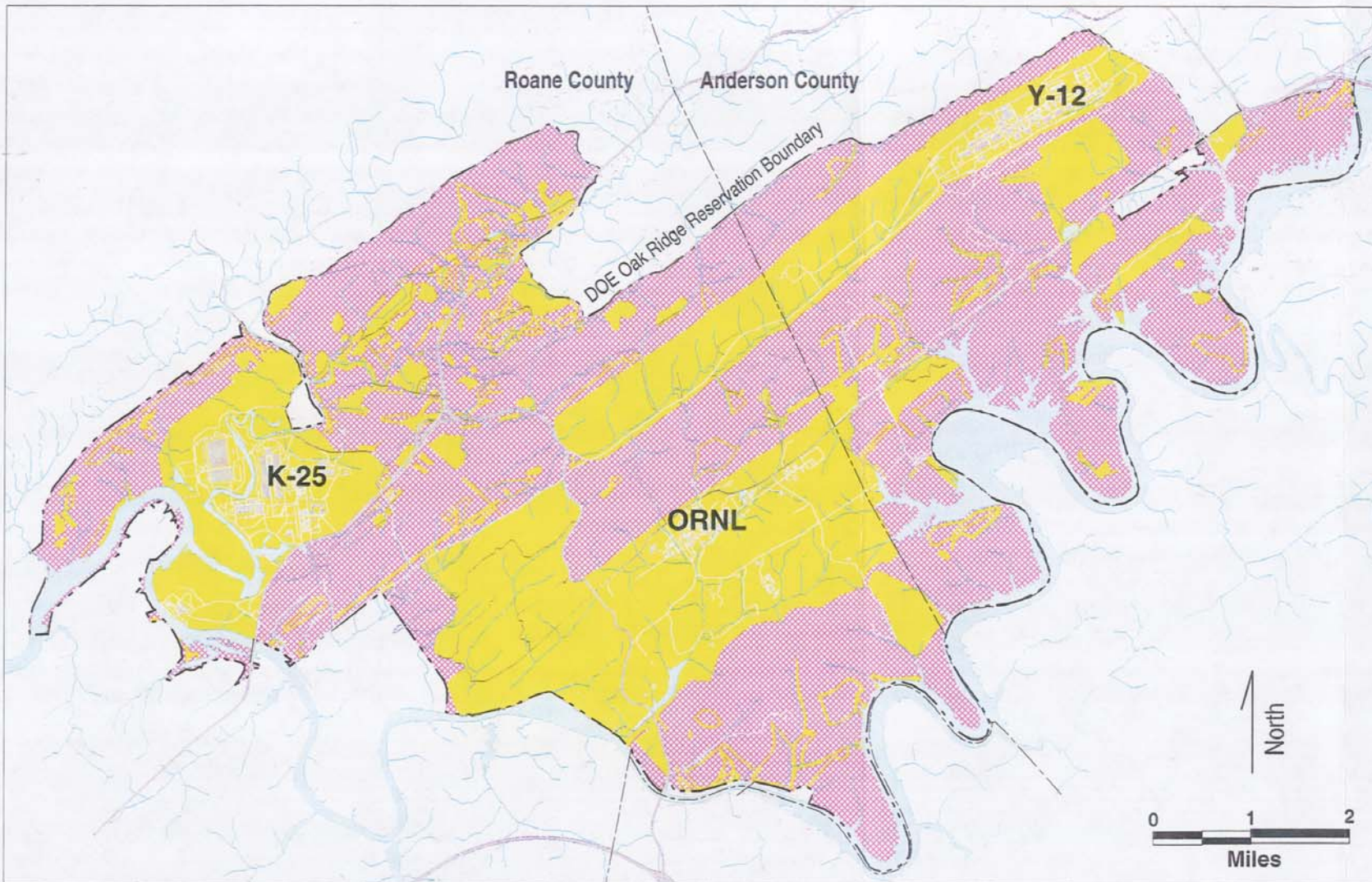
--JAYCOR Environmental--

Prepared for  
the Environmental Restoration Program  
by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 2 T&E Vascular Plant Surveys on the Oak Ridge Reservation (1995– May 1996)







Gaps in coverage of  
T&E Vascular Plant Surveys on the  
Oak Ridge Reservation  
(Through May, 1996)

Note: Small surveyed areas within  
the gaps may not be visible  
at this scale.

- ▨ T&E Vascular Plant Survey Coverage Gaps  
(areas requiring further surveys to document T&E sp)
- T&E Vascular Plant Survey Areas (1991- May, 1996)

COORDINATE SYSTEM:  
Tennessee State Plane (NAD 83)

BASE DATA:  
ORNL Shared Data Initiative (SDI)

MAP COMPOSITION  
Date: May, 1996  
Designer: D. Awl

--JAYCOR Environmental--

Prepared for  
the Environmental Restoration Program  
by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 3 Gaps in Coverage of T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May 1996)



Figures 4. and 5. have been removed from this document as they contain environmentally sensitive information.

Contact **Pat Parr** ([parrpd@ornl.gov](mailto:parrpd@ornl.gov)) for questions and assistance.





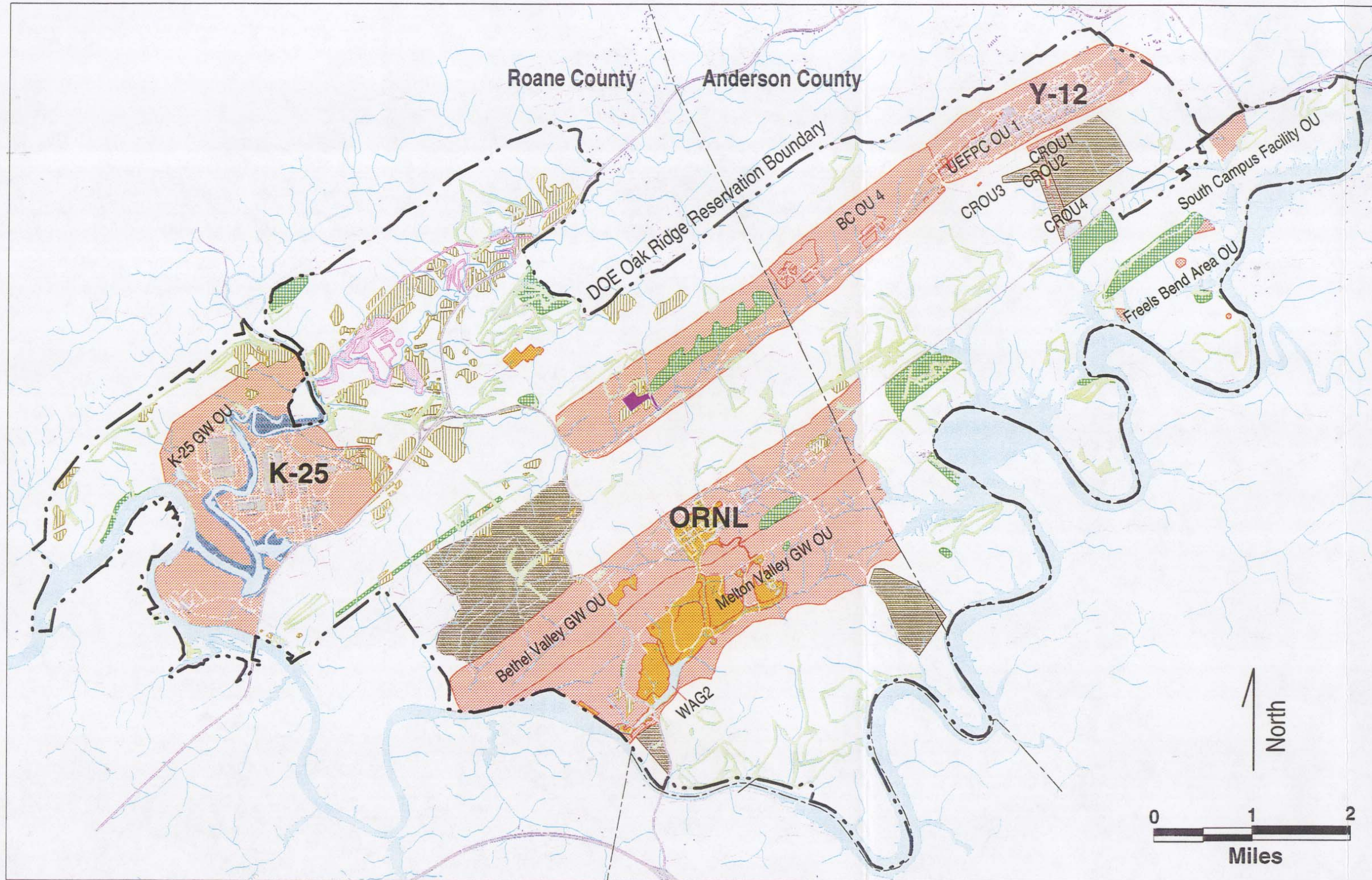
## **Appendix B**

### **FIGURES**

(11 x 17)







T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May, 1996)

- Special Concern (1995-1996)
- Parcel ED-1 (1995)
- Low Level Waste Disposal Facility (1995)
- Poplar Creek (1994)
- Pine Plantations (timber salvage areas, 1993-1994)
- Natural & Reference Areas surveyed in 1994
- Waste Area Groupings (WAG; included in OU)
- Operable Units (OU; 1991-1994)
- Other Surveys (pre-1992)

COORDINATE SYSTEM:  
Tennessee State Plane (NAD 83)

BASE DATA:  
ORNL Shared Data Initiative (SDI)

MAP COMPOSITION  
Date: May, 1996  
Designer: D. Awl

--JAYCOR Environmental--

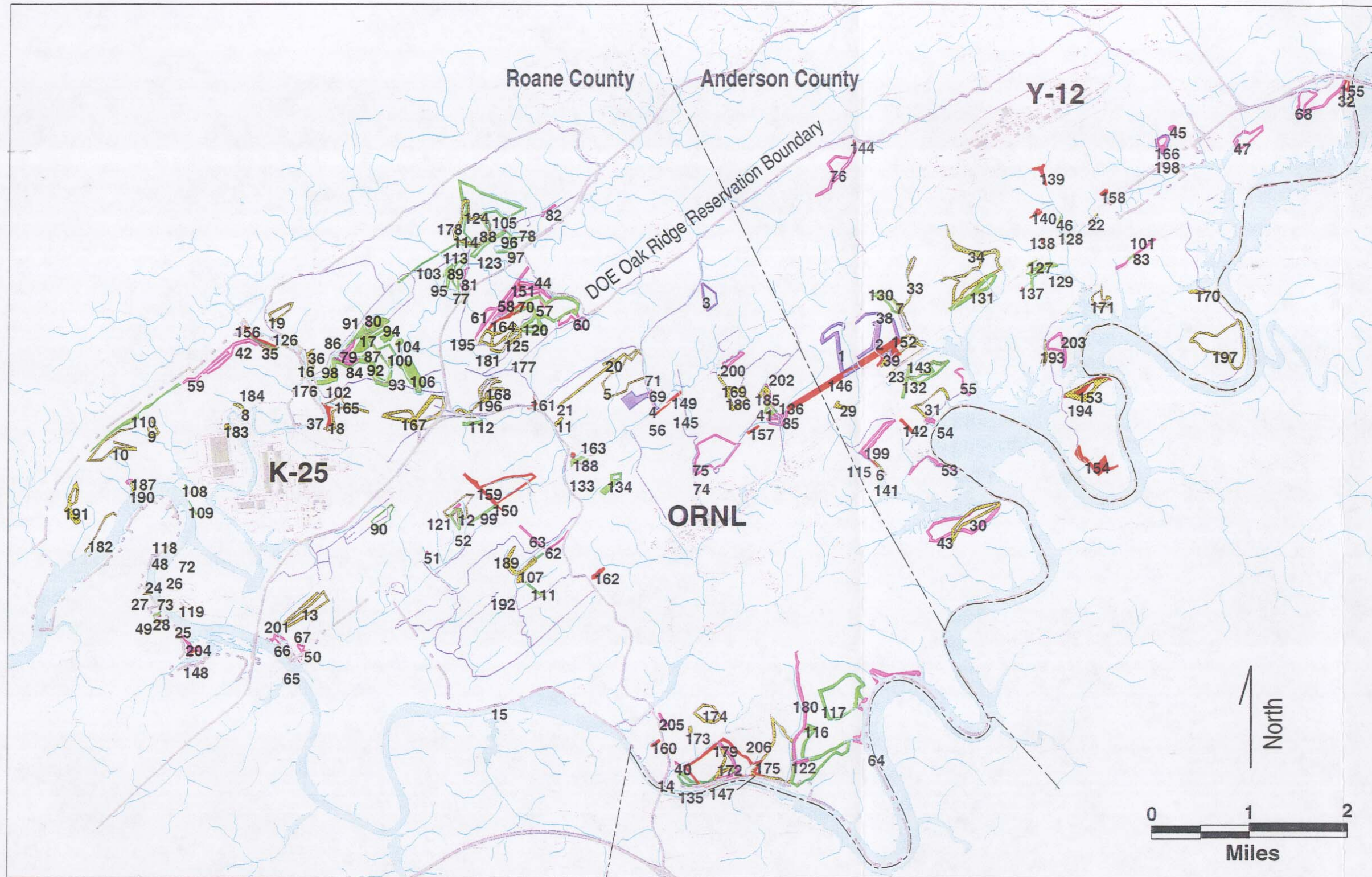
Prepared for  
the Environmental Restoration Program  
by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 1 T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May, 1996)









T&E Vascular Plant Surveys on the  
Oak Ridge Reservation  
(1995 through May, 1996)  
Labeled by Survey Index Number

- Summer
- Winter
- Early Spring
- Late Spring
- Fall

COORDINATE SYSTEM:  
Tennessee State Plane (NAD 83)

BASE DATA:  
ORNL Shared Data Initiative (SDI)

MAP COMPOSITION  
Date: May, 1996  
Designer: D. Awl

--JAYCOR Environmental--

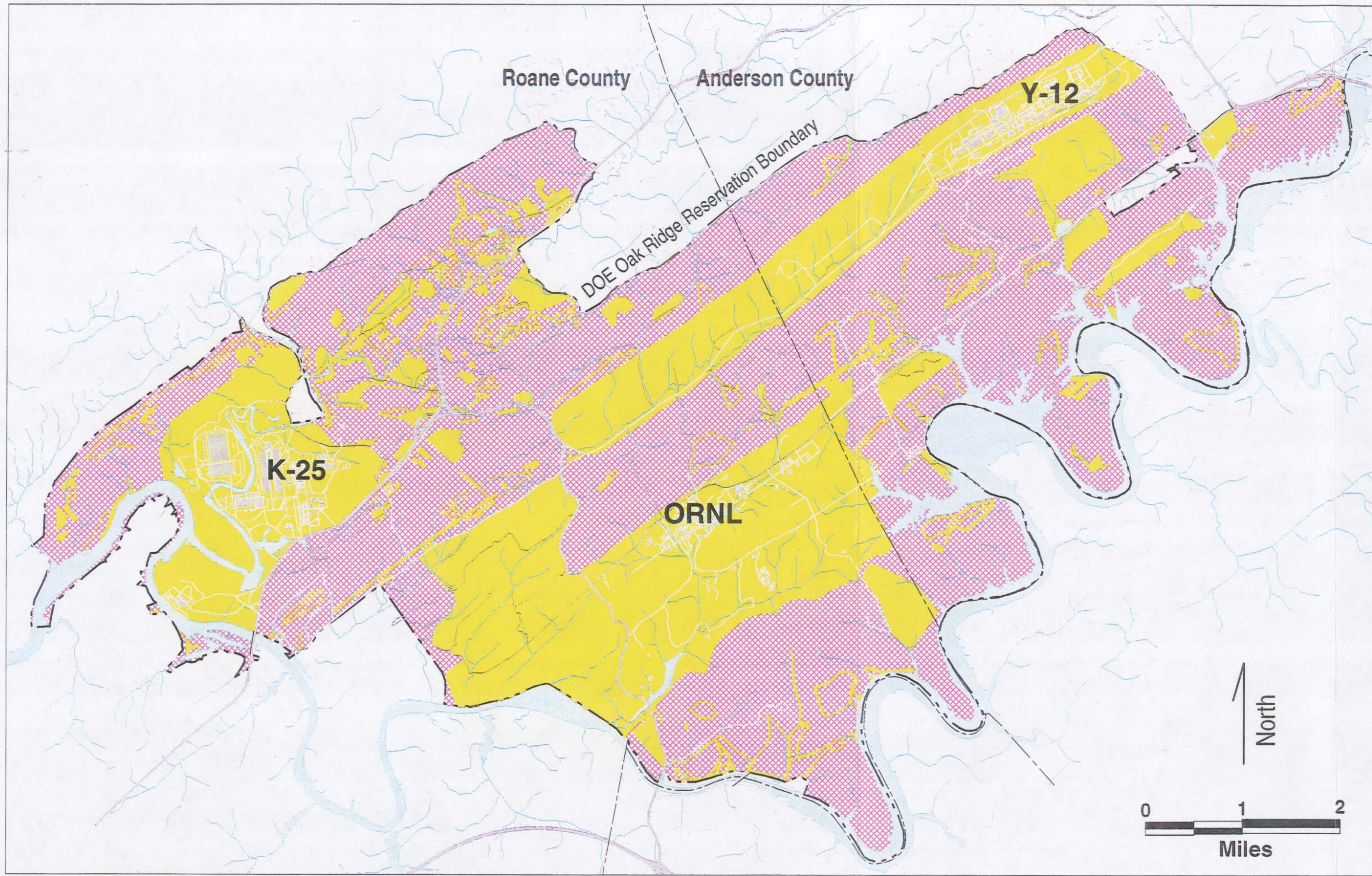
Prepared for  
the Environmental Restoration Program  
by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 2 T&E Vascular Plant Surveys on the Oak Ridge Reservation (1995- May 1996)











Gaps in coverage of  
T&E Vascular Plant Surveys on the  
Oak Ridge Reservation  
(Through May, 1996)

Note: Small surveyed areas within  
the gaps may not be visible  
at this scale.

-  T&E Vascular Plant Survey Coverage Gaps  
(areas requiring further surveys to document T&E species)
-  T&E Vascular Plant Survey Areas (1991- May, 1996)

---

COORDINATE SYSTEM:  
Tennessee State Plane (NAD 83)

BASE DATA:  
ORNL Shared Data Initiative (SDI)

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MAP COMPOSITION  
Date: May, 1996  
Designer: D. Awl

--JAYCOR Environmental--

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by  
Environmental Sciences Division  
Oak Ridge National Laboratory

Fig. 3 Gaps in Coverage of T&E Vascular Plant Surveys on the Oak Ridge Reservation (through May 1996)







Figures 4. and 5. have been removed from this document as they contain environmentally sensitive information.

Contact **Pat Parr** ([parrpd@ornl.gov](mailto:parrpd@ornl.gov)) for questions and assistance.



**Appendix C**  
**ORR VASCULAR FLORA DATA BASE**



The current version of the Oak Ridge Reservation Vascular Flora Data Base is posted on the National Environmental Research Park web site at:

<http://www.esd.ornl.gov/facilities/nerp/orrvflr1998.pdf>

See <http://www.esd.ornl.gov/facilities/nerp/dbfields.pdf> for descriptions of the data base fields.

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