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**Plant Species on the Department of
Energy-Oak Ridge Reservation
That Are Rare, Threatened
or of Special Concern**

Patricia D. Parr
Fred G. Taylor, Jr.

ENVIRONMENTAL SCIENCES DIVISION
Publication No. 1144

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PLANT SPECIES ON THE DEPARTMENT OF ENERGY-OAK RIDGE RESERVATION
THAT ARE RARE, THREATENED OR OF SPECIAL CONCERN

Patricia D. Parr and Fred G. Taylor, Jr.

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ABSTRACT

PARR, P. D., and F. G. TAYLOR, Jr. 1978. Plant species on the Department of Energy-Oak Ridge Reservation that are rare, threatened or of special concern. ORNL/TM-6101. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 44 pp.

The need to protect endangered organisms has gained increased awareness during the past decade. These efforts have only recently been expanded to include plants. Lists of candidate species have been compiled for review and status designation by appropriate governmental actions. The Report on Endangered and Threatened Plant Species of the United States presented to Congress by the Secretary of the Smithsonian Institution (U.S. Congress 1975) recommended that the preservation of critical habitats be adopted as a major management practice to ensure the survival of endangered and threatened plant species.

In compliance with federal guidelines, plants occurring on the Department of Energy (DOE) Oak Ridge Reservation that are considered rare, threatened, or of special concern have been located, identified, and provided protection (Oak Ridge Operations 1975). At present nine candidate species are known to occur on the area. Efforts are being made to locate additional species that have been casually observed and reported but not verified by voucher specimens. The purpose of this activity is to summarize present knowledge of the occurrence and distribution of threatened and endangered plant species for long-range management decisions of the DOE-Oak Ridge Reservation.

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INTRODUCTION

In 1973 the Endangered Species Act (U.S. Congress 1973) was expanded to include plants in addition to fish and wildlife already protected. As stated, "the purposes of this act are to provide a means whereby ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth ..."

Sharp (1974) of the University of Tennessee published a list of "Rare Plants of Tennessee" in July 1974. He stated that "the only satisfactory way of avoiding the extinction of rare plants is the selection and maintenance of areas in which are found the peculiar habitats necessary to their survival." Life history studies and propagation may be alternative methods of not only avoiding plant extinction but also for obtaining knowledge necessary for selection and maintenance of the habitats of the plants.

The "Report on endangered and threatened plant species of the United States" was presented to Congress by the Secretary of the Smithsonian Institution in December 1974 (U.S. Congress 1975). It included the first national tabulation of candidate species for designation as endangered, threatened, recently extinct, or commercially exploited plant species of the United States (including Alaska and Hawaii). Recommendations to Congress were presented, along with discussion of the value of retaining diverse plant species, causes of rarity,

and preservation. The major recommendation made concerned the preservation of the habitats of endangered and threatened species of plants.

In May 1975 the U.S. Department of Agriculture, Soil Conservation Service, published "Rare, threatened, or endangered plant species of Tennessee." The report (Soil Conservation Service 1975) emphasized the importance of plant habitat consideration in land-use planning.

The U.S. Department of the Interior, Fish and Wildlife Service, printed the Smithsonian Report in 1975 (Federal Register 1975). The Director, U.S. Fish and Wildlife Service, has proposed that the approximately 1700 native, U.S. vascular plant taxa on the Smithsonian list be considered as endangered species.

A workshop on rare Tennessee plants was held November 18, 1976, to discuss and incorporate comments on a preliminary list of Tennessee rare plants prepared by members of the Tennessee Committee for Rare Plants (Tennessee Committee for Rare Plants, in press). In addition to discussing the list, concern was expressed regarding the need for accurate information regarding the status of Tennessee's rare plants in order to achieve environmentally sound land-use planning and development in the future.

Habitat and Species Preservations

The establishment of several natural areas on the Oak Ridge Reservation reflects the DOE concern for the preservation of unique or representative biotic features. In response to a request by the DOE Division of Biomedical and Environmental Research personnel, the Environmental Sciences Division at Oak Ridge National Laboratory reviewed the Fish and

Wildlife Service Endangered Species list with regard to the DOE Oak Ridge Reservation. Most of the rare plants on the DOE Oak Ridge Reservation that have been located are in Environmental Research Park natural areas (Kitchings and Mann 1976). In order to ensure protection of additional species, efforts are being made to locate species that have been seen at one time but not verified by voucher specimens or species whose habitat requirements suggest there is a high probability they occur on the DOE Oak Ridge Reservation.

Locating and identifying endangered species are important first steps to be taken in species preservation. Long-term protection of sensitive species is potentially hampered by the lack of knowledge concerning species biology. Protection of endangered species in their native habitat is considered by some as the best method of ensuring their survival (Forest Service 1977). Indiscriminant modification or destruction of habitat could not only cause a reduction of the population but could also result in a restriction of the population's expansion and recovery. Many species, however, are rare because they occupy unusual, often temporary habitats and may be dependent on some type of interference. Natural history studies and propagation of sensitive species are important in determining the plants' environmental requirements. Careful management of the habitat might be necessary to maintain the species, but before any habitat can be managed to protect a species, it is necessary to determine whether the species is reproducing and its reproductive potential. Once propagules are dispersed it is essential to know the processes active in establishing the species. Thus, the

species autecology must be studied to plan for scientific and beneficial management of the habitats where the species survive.

Methods

A combined rare plant list was compiled incorporating all candidate species included on each of the following lists: Soil Conservation Service (1975), Federal Register (1975), Tennessee Committee for Rare Plants (in press), and Sharp (1974). The computer output was an alphabetical listing of the species, the lists on which they occurred, and their current status.

The "combined rare plant list" was then compared to the species listed in "Oak Ridge, Tennessee, flora: Habitats of the vascular plants — Revised inventory" (Mann and Bierner 1975). Species included in the Mann-Bierner report are recorded from Anderson, Knox, Loudon, Morgan, and Roane Counties. Species listed as occurring in Anderson and Roane Counties were checked in the Oak Ridge National Laboratory (ORNL) and University of Tennessee (UT) herbaria to verify their identity and occurrence on the Oak Ridge Reservation.

A summary of the status of rare plants on the DOE Oak Ridge Reservation is presented in Table 1. The three categories (rare, threatened, and special concern) are defined as follows:

Rare — species which presently occur infrequently and are few and widely separated (possibly due to habitat destruction or commercial exploitation).

Threatened — as described by Tennessee Committee for Rare Plants (1978), species likely to become

Table 1. Plants of the Oak Ridge Reservation that are rare, threatened or of special concern

Genus species authority	Family	Common name	List	Status	Flower	Seed	Habitat
<i>Cimicifuga rubi- folia</i> Kearney	Ranuncu- laceae	Bugbane	USDI-Fed, Reg ^a USDA-SCS ^b	Threatened Threatened	August	August	Rich, sheltered steep limestone bluff
<i>Delphinium exaltatum</i> Ait.	Ranuncu- laceae	Tall Larkspur	TCRP ^c	Special concern	July- August	October	Dry, calcareous, open woodland
<i>Fothergilla major</i> (Sims) Lodd	Hamamelid- aceae	Large Fothergilla	TCRP ^c Sharp ^d USDA-SCS ^b	Threatened Rare Rare	April- May	July- October	Dry woods
<i>Hydrastis canadensis</i> L.	Ranuncu- laceae	Goldenseal	Sharp ^d	Rare	April- May	July	Rich woods
<i>Lilium canadense</i> L.	Liliaceae	Canada Lily	TCRP ^c	Threatened	June- July	July- August	Edge of woods
<i>Panax quinque- folius</i> L.	Araliaceae	Ginseng	Sharp ^d USDA-SCS ^b	Rare Rare	June- July	August- October	Rich, cool, moist woods
<i>Philadelphus sharpianus</i> Hu	Saxifra- gaceae	Sharp's Mock-Orange	Sharp ^d	Rare	May	June- September	Wooded, limestone bluff
<i>Saxifraga careyana</i> Gray	Saxifra- gaceae	Carey's Saxifrage	USDI-Fed, Reg ^a USDA-SCS ^b	Threatened Threatened	April	June	Wooded, limestone bluff
<i>Spiranthes ovalis</i> Lindley	Orchidaceae	Lesser Ladies' Tresses	TCRP ^c USDA-SCS ^b	Special Concern Rare	August- October	November	Moist, shady, rich woods

^aFederal Register - Threatened or Endangered Fauna or Flora, Vol. 40, No. 127, 1975.

^bRare, Threatened or Endangered Plant Species of Tennessee, U.S. Dept. of Agriculture, Soil Conservation Service, Nashville, May 1975.

^cTennessee Committee for Rare Plants, J. L. Collins (TVA), H. R. DeSelm (UT), A. M. Evans (UT), R. Kral (Vanderbilt) and B. E. Wofford (UT), September 1976.

^dSharp, A. J. *Tennessee Conservationist*, July 1974.

endangered in the immediately foreseeable future as a result of present rapid habitat destruction or commercial exploitation.

Special Concern — plants listed by Tennessee Committee for Rare Plants (1978) as requiring particular attention because they are at the limit or near-limit of the geographic range in Tennessee, or because their status is undetermined due to insufficient information.

Information concerning common name, phenology, habitat, and basis for sketches was obtained from both reference materials and herbarium specimens. Actual habitat where each species was found was, of course, determined from the herbarium label or collector. A county occurrence map (obtained from U.T. herbarium collections) is provided for each species, annotated to incorporate ORNL records. Each species is provided with a brief description of identifying characters, habitat where collected, and the name of the investigator.

A list of some rare, threatened, or endangered plant species likely to occur on the Oak Ridge Reservation is presented in Table 2. Most plants included on this summary are those that have been found and verified in neighboring counties and have habitat requirements that may possibly be found on the Oak Ridge Reservation. Other plants on the list are those which have been seen, but not verified.

Three plant species, although not listed on any rare plant species lists for Tennessee, are of special interest in this area. Trailing arbutus (Epigaea repens L.) has become scarce or has disappeared over a

Table 2. Rare, threatened or endangered plant species likely to occur on the Oak Ridge Reservation

Genus species authority	Family	Common name	List	Status	Flower	Habitat
<i>Asplenium bradleyi</i> D. C. Eaton	Polypodiaceae	Bradley's Spleenwort	Sharp ^a	Rare	June- September	Crevices of acidic rocks and cliffs
<i>Aureolaria patula</i> (chapm.) Pennell	Scrophulariaceae	False Foxglove	USDI-Fed Reg ^b USDA-SCS ^c	Threatened	—	Woods
<i>Disporum maculatum</i> (Brickley) Britton	Liliaceae	Nodding Mandarin	Sharp ^a	Rare	May	Rich woods
<i>Echinacea purpurea</i> (L.) Moench	Compositae	Purple Cone- flower	Sharp ^a	Rare	June- October	Woodlands, prairies and road banks
<i>Lilium grayii</i> Watson	Liliaceae	Gray's Lily	USDI-Fed Reg ^b	Threatened	June- July	Rich, moist woods in mountains
<i>Orontium</i> <i>aquaticum</i> L.	Araceae	Golden Club	Sharp ^a	Rare	March- April	Swamps and shallow acidic streams
<i>Petalostemum</i> <i>foliosum</i> Gray	Fabaceae	Prairie Clover	USDI-Fed Reg ^b USDA-SCS ^c	Endangered	July- September	River banks
<i>Silene rotundi- folia</i> Nutt.	Caryophyllaceae	Round-leaved Catchfly	Sharp ^a	Rare	June-July	Exposed cliffs and banks
<i>Ulmus crassi- folia</i> Nutt.	Ulmaceae	Cedar Elm	Sharp ^a	Rare	—	—

^aSharp - *Tennessee Conservationist*, July 1974.

^bFederal Register - Threatened or Endangered Fauna or Flora, Vol. 40, No. 127, 1975.

^cRare, Threatened or Endangered Species of Tennessee, U.S. Department of Agriculture, Soil Conservation Service, Nashville, May 1975.

large part of its extensive range. In remote areas and in places where it is protected, it continues to thrive (Stupka 1965). This prostrate shrub occurs frequently on the DOE-Oak Ridge Reservation growing on gravelly, wooded, acidic slopes. Prickly pear [Opuntia compressa (Salisb.) Macbr.] is abundant in the cedar glades and limestone soil of Marshall and Rutherford Counties, Tennessee. Occurrence on the DOE-Oak Ridge Reservation is limited to cedar barrens of limestone outcroppings. Scarcity of prickly pear in this area is most likely due to absence of appropriate habitat substrata. Compass plant (Silphium terebrinthaceum Jacq.) is indicative of prairie. Its presence on the DOE-Oak Ridge Reservation may actually be increasing due to opening up and clearing of previously forested areas.

With increased demands on natural resources, land management decisions and practices have an added potential to influence the status of threatened and endangered plant species. The review of the status of plant species in any area is a logical first step in summarizing the present knowledge of the occurrence and distribution of rare or endangered species. A primary purpose of this activity has been to verify the identity and existence of endangered species on the Oak Ridge Reservation. A secondary objective has been to stimulate interest in species biology. Knowledge of species biology, combined with occurrence and distribution data, is essential to delineate maintenance strategies for land management decisions.

Bugbane

Cimicifuga rubifolia Kearney

Buttercup family (Ranunculaceae)

A perennial herb with 5 to 9 prominent veins arising at the base of a deeply cordate terminal leaflet. Flowers in elongate virgate racemes. Seeds scaly and cylindrical (Ramsey 1965).

Habitat of rich, sheltered, steep, limestone bluff. Flowers and fruit in August. Occurrence reported in 13 counties including Anderson and Roane (Fig. 1).

Listed in the U.S. Department of Interior-Federal Register as threatened and by the U.S. Department of Agriculture-Soil Conservation Service, Nashville, as threatened.

Collected by J. Wolfe and G. Ramsey in April 1963 and by L. K. Mann and P. D. Parr in July 1976.

Cimicifuga rubifolia

Tall Larkspur

Delphinium exaltatum Ait.

Buttercup family (Ranunculaceae)

A perennial herb with smooth, erect stems up to 2 m tall. Large leaves, pale beneath, are divided into a few cuneate to lanceolate segments, these with 1 to 4 coarse, sharp lobes above the middle. Often branched, elongate raceme with spurred blue flowers. Seeds 3-angled, wrinkled, and shining (Gleason and Cronquist 1967).

Habitat of dry, calcareous, open woods. Flowers mid-July to mid-August with fruit in October. Occurrence reported in Anderson county only (Fig. 2).

Listed by the Tennessee Committee for Rare Plants as a species of special concern due to danger of becoming extinct because of rarity throughout their range and as a result of sensitive habitat or restricted area of distribution.

Collected by W. H. Ellis in August 1961

Delphinium exaltatum and by L. K. Mann in July 1976.

Figure 2

MAP OF TENNESSEE BY COUNTIES

Delphinium exaltatum Ait.

Dots (●) indicate occurrence only
and not region of the county where
collected.

Large Fothergilla

Fothergilla major (Sims) Lodd

Witch-hazel family (Hamamelidaceae)

A medium-sized shrub 0.5 to 1.5 m tall with stiff, upright branches. Leaves 2 to 4 in. long, sometimes to 6 in., suborbicular, broad-elliptic or obovate. Flowers in clusters to 2 in. long (Viertel 1970).

Habitat of west-facing, open, wooded slope. Flowers April-May with fruit July-October. Occurrence is reported in 5 counties including Anderson (Fig. 3).

Fothergilla major

Listed by the Tennessee Committee for Rare Plants as a threatened species likely to become endangered in the immediately foreseeable future.

Observed and recorded by L. K. Mann
in April 1975.

Figure 3

MAP OF TENNESSEE BY COUNTIES

Fothergilla major (Sims) Lodd

Dots (●) indicate occurrence only
and not region of the county where
collected.

Goldenseal

Hydrastis canadensis L.

Buttercup family (Ranunculaceae)

A perennial herb 2 to 5 dm high bearing one basal leaf and two cauline leaves near the summit. Leaves rounded, cordate at the base, 5 to 7 lobed, doubly serrate and veiny. Flower about 15 mm wide. Fruit is a head of dark, red berries (Gleason 1952).

Habitat of narrow drainage, steep, north facing slope of old growth in rich woods, also open cedar-oak woods on a limestone outcropping. Flowers April-May with fruit in July. Occurrence reported in 12 counties including Anderson and Roane (Fig. 4).

This plant has been largely eliminated because it is much sought for medicine. A. J. Sharp lists this species as rare.

Observed and recorded by L. K. Mann in 1976 and by J. T. Kitchings 1976.

Hydrastis canadensis

Figure 4

MAP OF TENNESSEE BY COUNTIES

Hydrastis canadensis L.

Dots (●) indicate occurrence only and not region of the county where collected.

Canada Lily

Lilium canadense L.

Lily family (Liliaceae)

Perennial with slender stem, erect, 6 to 15 dm tall. Leaves mostly in whorls of 4 to 12. Flowers yellow or orange-yellow to red marked with purple spots within (Gleason and Cronquist 1967).

Roadside or edge of woods type of habitat. Flowers in June-July with fruit July-August. Occurrence reported in 9 counties including Roane (Fig. 5).

Listed as threatened by the Tennessee Committee for Rare Plants and considered likely to become endangered in the immediately foreseeable future.

Collected July 1966 by N. C. Griffin and observed and recorded by L. K. Mann the summer of 1976.

0 Lilium canadense

Figure 5

MAP OF TENNESSEE BY COUNTIES

Lilium canadense L.

Dots (●) indicate occurrence only
and not region of the county where
collected.

Ginseng

Panax quinquefolius L.

Ginseng family (Araliaceae)

A perennial herb 2 to 6 dm tall. Leaves 3 to 4 with 3 to 5 leaflets, elliptic or obovate, acuminate, serrate, and petiolulate (Radford et al. 1968). Flowers reddish-white. Bright red fruit.

Habitat of rich, cool, shaded, moist woods. Flowers June-July with fruit August-October. Recorded occurrence in 17 counties including Anderson and Roane (Fig. 6).

Much sought for the root used in medicine and is now in danger due to this exploitation. Listed by A. J. Sharp as rare and by the U.S. Department of Agriculture-Soil Conservation Service, Nashville as rare.

Collected by S. Cristofolini and G. Cristofolini July 1965.

Panax quinquefolius

Sharp's Mock Orange

Philadelphus sharpianus Hu

Saxifrage family (Saxifragaceae)

A shrub with simple, opposite, toothed leaves. Flowers usually with 4 rounded-ovate petals, solitary or in terminal cymes.

Habitat of a wooded limestone bluff facing the river and exposed limestone bluff at the surface of the water. Flowers in May with fruit June-September.

Recorded occurrence in 10 counties including Anderson and Roane (Fig. 7).

Listed by Sharp (1974)

as rare.

Collected by W. H. Ellis
in August 1961 and by F. G.
Taylor and P. D. Parr in
September 1976.

Philadelphus sharpianus

Figure 7

MAP OF TENNESSEE BY COUNTIES

Philadelphus sharpianus Hu

Dots (●) indicate occurrence only
and not region of the county where
collected.

Carey's Saxifrage

Saxifrage careyana Gray

Saxifrage family (Saxifragaceae)

A perennial herb 1 to 5 dm tall. Basal leaves which are ovate to slightly obovate. Calyx tube campanulate. Capsules usually 2.5 to 3mm long (Radford et al. 1968).

Habitat of wooded limestone bluff facing the river and dolomite bluffs above the river. Flowers April-May with fruit in June. Recorded occurrence in 18 counties including Anderson and Roane (Fig. 8).

Listed as threatened in the U.S. Department of the Interior-Federal Register and also by the U.S. Department of Agriculture-Soil Conservation Service, Nashville.

Collected by W. H. Ellis June 1961 and by B. Hale and E. E. C. Clebsch April 1974.

Saxifraga careyana

Figure 8

MAP OF TENNESSEE BY COUNTIES

Saxifraga careyana Gray

Dots (●) indicate occurrence only
and not region of the county where
collected.

Lesser Ladies' Tresses

Spiranthes ovalis Lindley

Orchid family (Orchidaceae)

A perennial herb 1.5 to 4 dm high. Leaves basal and cauline, deep green, oblanceolate, tapering to a long, petiolar base. Slender spike of several ranks of small, white flowers, 4 to 5 mm long, subacute to acute with an ovate lip (Fernald 1950).

Habitat of moist, rich, shady woods. Flowers August-October with fruit in November. Recorded occurrence in 3 counties including Roane and Anderson (Fig. 9).

Spiranthes ovalis

Listed as a species of special concern by the Tennessee Committee for Rare Plants because they are rare in Tennessee because the state represents the limit or near limit of their geographic range. The U.S. Department of Agriculture-Soil Conservation Service, Nashville, considers their status as rare.

Collected by F. G. Taylor October 1966 and by J. M. Klopatek and N. T. Edwards in October 1976.

Figure 9

MAP OF TENNESSEE BY COUNTIES

Spiranthus ovalis Lindley

Dots (●) indicate occurrence only
and not region of the county where
collected.

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