



MID-ATLANTIC REGION

DIVISION OF NATURAL SCIENCES

RESEARCH/RESOURCES MANAGEMENT REPORT

MAR-9

Endangered, Threatened, Vulnerable and
Rare Vascular Plants of the Pennsylvania
Portion of the Delaware Water Gap
National Recreation Area

U.S. DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE



MID-ATLANTIC REGIONAL OFFICE
143 SOUTH THIRD STREET
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National Recreation Area

Final Report to the Mid-Atlantic Region
National Park Service

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TABLE OF CONTENTS

Acknowledgements	1
Abstract	2
Introduction	3
Purpose.	3
Description of the Study Area.	4
Geology	4
Vegetation.	5
Plant List	7
Nomenclature	8
Methods.	9
Herbarium Investigations	9
Field Survey	9
Results.	11
Annotated Species List	12
Conclusions.	38
Table 1	40
References	42

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ABSTRACT

The Pennsylvania section of the Delaware Water Gap National Recreation Area was studied to determine the presence of endangered, threatened, vulnerable, and rare plant species. Pennsylvania Plants of Special Concern, a list compiled by the Western Pennsylvania Conservancy, was the basis for the investigation which included herbarium studies and determination of current status in the field. One or more populations of 14 special concern species were located. Although herbarium records for nine additional species were found, they could not be located in the field. At least one was a case of misidentification of the original specimen.

I. INTRODUCTION

Purpose

This study was undertaken to determine the occurrence of endangered, threatened, vulnerable and rare species of vascular plants within the Pennsylvania section of the Delaware Water Gap National Recreation Area. It is intended to provide National Park Service resource managers with the information they need to protect important natural features and make informed decisions regarding land use and facility siting.

This study was carried out in conjunction with the Pennsylvania Natural Diversity Inventory (PNDI) being conducted by the Nature Conservancy and the Western Pennsylvania Conservancy under the sponsorship of the Pennsylvania Department of Environmental Resources. All data collected on special concern plants has become part of the state-wide PNDI data base.

Description of the Study Area

The study area, the Pennsylvania portion of the Delaware Water Gap National Recreation Area (DWGNRA), extends approximately 35 miles along the Delaware River from Slateford, PA to just north of Milford, PA. The width of the area varies from less than 1,000 feet at Shawnee to approximately 3.5 miles near Shoemakers. It includes portion of the river valley, adjacent highlands, and ravines formed by tributary streams.

Geology - In the northern two-thirds of the study area the Delaware River flows along the eastern edge of the Devonian formations which comprise the Pocono Plateau. The valley, which ranges from one-half mile to about a mile wide, is sharply defined on the west by nearly vertical cliffs rising to a height of 500 feet above the valley floor. The valley wall is of Mahantango shale, and is dissected at intervals by streams. Because of the abrupt change in elevation, waterfalls are a frequent feature as tributary streams drop down into the valley. Shale barrens occur at intervals along the rim and face of the escarpment.

The southern third of the study area has a more complex geology. At Wallpack Bend the river cuts across a hogback ridge composed of Devonian Buttermilk Falls limestone and then follows the southeastern edge of the Silurian Bossardsville limestone formation to where it cuts through the Shawangunk Formation at Kittatiny Mountain to form the Delaware Water Gap.

The entire area was ice covered during the last Wisconsinan glaciation. The valley of the Delaware and the larger tributary streams (Brodhead Creek and Bushkill Creek) are characterized by thick glaciofluvial deposits which comprise an outwash terrace.

Kames and kame terraces occur intermittently at the base of the valley walls, formed as the ice front retreated north up the valley. Other features of glacial origin include an area of sand dunes along the river just south of Dingmans Ferry and a cluster of drumlins near Bushkill. Valley deposits consist of coarse sands, gravels, and silt carried down by the ice and later by torrents of melt water from the north. Weathering of the vertical valley walls from Bushkill north has produced a mantle of colluvium along the lower slopes which partially covers the glacial deposits on the valley floor.

Alluvial fans occur at the mouths of Bushkill Creek and Brodhead Creek. There are a number of islands in the river, ranging in size from approximately one acre to several hundred acres. They are composed of alluvial sand and gravel deposits. For a more complete description of Pleistocene geology in the Delaware Valley see Crowl (1971).

Vegetation - the DWGNRA lies within the Appalachian oak forest section of the eastern deciduous forest zone (Kuchler, 1964). Within the study area, ridgetops and dry slopes are forested with a xeric association of chestnut, northern red and white oaks (Quercus prinus, Q. rubra, Q. alba). On the steep valley wall and rim of the escarpment, barrens communities characterized by scrub oak (Q. ilicifolia), dwarf chinquapin oak (Q. prinoides) and drought tolerant grasses occur intermittently.

Mesic uplands and lower slopes include sugar maple (Acer saccharum), red maple (A. rubrum), white pine (Pinus strobus), and northern red oak. Steep ravines along the streams are characterized by dense stands of eastern hemlock (Tsuga canadensis).

Most of the level land in the river valley has been farmed since the late 1700's (Brodhead 1870), however under administration of the area by the National Park Service some of the fields have been allowed to undergo old field succession. Eastern red cedar (Juniperus virginiana) and white ash (Fraxinus americana) are frequent pioneer species. Throughout the Recreation Area, abandoned home sites are marked by remnants of domestic landscaping.

Along the river and lower portions of the tributary streams is found a floodplain forest which includes sycamore (Platanus occidentalis), silver maple (Acer saccharinum), and willows (Salix spp.). These same species predominate on the lower elevation portions of the islands in the Delaware where they often form dense thickets due to the frequent scouring by flood waters and ice. Several islands also contain mature forest on slightly higher ground. Depue Island contains the only stand of mature tuliptree (Liriodendron tulipifera) forest in the Recreation Area.

Several of the islands were farmed in the past and this may account for the extensive stands of exotic species such as Japanese knotweed (Polygonum cuspidatum) and reed canary grass (Phalaris arundinacea) which occur in some areas. Another exotic species, purple loosestrife (Lythrum salicaria) forms an almost continuous band along the river's edge.

A complete vegetation map of the Recreation Area has been prepared by Meyers and Irish (1981).

Plant List

The basis for the herbarium investigation and field survey was the list, Pennsylvania Plants of Special Concern, prepared by Paul Weigman of the Western Pennsylvania Conservancy in consultation with botanists throughout the state (Weigman, 1983). It must be stressed that the list is an evolving document which has undergone several revisions during the period of this project. All Pennsylvania state status designations are in accord with the October 1983 revision. This list will become the official state rare plant list in 1984, however as of this writing all state status recommendations are listed as "proposed."

Proposed endangered refers to species which are in imminent danger of extirpation throughout their range in Pennsylvania and are limited to a single biogeographic region or specialized habitat outside the state. Proposed threatened is applied to species for which available evidence indicates that they may become endangered in the foreseeable future throughout their range in Pennsylvania. The category, proposed vulnerable, is applied to species and subspecies which may become endangered or threatened because they have some economic value and are thus subject to over-collecting. Proposed rare is used to distinguish species with five or fewer occurrences within the boundaries of Pennsylvania but greater abundance outside the state. The status, temporarily undetermined, is applied to species with ten or fewer historical localities in Pennsylvania, those restricted to specialized habitats and others for which more current information is necessary before a permanent status can be assigned (Weigman, 1983).

References to New Jersey status are based on Snyder and Vivian (1981).

Nomenclature

Kartesz and Kartesz (1980) provided the standard for nomenclature of all species discussed in this report. Relevant synonymy is included in the section on each species.

II. METHODS

Herbarium Investigations

The records from which the Atlas of the Flora of Pennsylvania (Wherry et al. 1979) was compiled were searched for all collections of special concern species from the study area. The Atlas records, which are kept at the Morris Arboretum of the University of Pennsylvania, include references to herbarium specimens from the Academy of Natural Sciences in Philadelphia, the Carnegie Museum herbarium in Pittsburgh, the State Herbarium in Harrisburg, and the herbarium at the Pennsylvania State University. These herbaria were rechecked for specimens added since work on the Atlas was completed. In addition herbaria at Muhlenberg College and East Stroudsburg State University were searched for relevant collections. Several individuals with specific knowledge of the local flora were consulted including Franklin Buser of East Stroudsburg State University, Dr. Robert Shaeffer of Muhlenberg College, Dr. James Parks of Millersville State University and Vincent Abraities of Stockton, New Jersey.

Field Survey

During the spring and summer seasons of 1982 and 1983, fourteen field trips were made to the DWGNRA. The first priority was to relocate collection sites documented in the herbarium records and to confirm other recent information regarding the occurrence of specific plants. Additional populations of most species were sought by visiting areas with habitats similar to those of the recorded sites. United States Geological Survey

topographic maps were used to identify and record sites, and to locate additional potential habitat areas. Plant identification was accomplished using keys and descriptions in Fernald (1950), Gleason (1952), Fassett (1957) and Ogden (1974). Field notes were made using site forms and special plant forms developed by the Pennsylvania Natural Diversity Inventory. Voucher specimens were taken where this could be done without further endangering the population. All voucher specimens have been deposited in the Morris Arboretum herbarium. Photography was used whenever possible to record the nature of each site and the condition of the plant populations of interest.

III. RESULTS

The herbarium search resulted in records for twenty species from the Pennsylvania Plants of Special Concern list found within the DWGNRA. Thirty extant populations including fourteen species, four of which were not represented in the herbarium records, were recorded during the field survey. Ten species collected in the area in the past could not be found. Table 1 summarizes the status of all twenty-four species for which herbarium records and/or extant populations were found. The annotated species list includes information on the status and significance of each species. Species are arranged alphabetically by genus.

Sand dune and drumlin formations located in the Recreation Area were visited on the chance that they might contain unusual plant communities. However, in both cases long-term agricultural use has eliminated the native flora.

ANNOTATED SPECIES LIST

Aster ericoides L. (white heath aster)

FAMILY: Asteraceae

SYNONYMS: A. multiflorus Ait.

A. multiflorus var. exiguus Fern.

A. polycephalus Rydb.

STATUS:

Federal: None

PA: Temporarily undetermined

NJ: Rare

Other States: DE - probably extirpated

DESCRIPTION: Herbaceous perennial, rhizomatous, with stiff, erect, bushy branched stems 3-10 dm tall. Numerous small, sessile, linear leaves with ciliate margins and small white flowering heads crowded in elongate 1-sided racemes. Stems densely cinereous-hirsute or pilose with appressed or spreading hairs.

May be confused with A. pilosus upon casual inspection but the densely hairy stems, small sessile leaves and ciliate phyllaries with green spreading tips are distinctive characteristics.

HABITAT: Dry, rocky exposed sites, limestone outcrops along the river.

DISTRIBUTION:

Total: New England south to AL and MS, west to AZ.

PA: Reported from 12 sites in 6 counties, primarily along the Delaware, Lehigh and Susquehanna Rivers.

DWGNRA:

Herbarium Records:

Pike County - "Bushkill" - 1917

Northampton County - "on the Delaware above Easton" - 1899

Field Survey: Two populations found along the Delaware River within the Recreation Area.

SIGNIFICANCE OF LOCAL POPULATIONS: At present the 2 DWGNRA populations are the only confirmed extant sites in the state, however further field work in Bucks, Lancaster, Perry and Huntingdon Counties will likely turn up more.

POPULATION STATUS AND THREATS: A. ericoides is a fairly long-lived perennial species, however, due to their river bank locations, these populations are subject to scouring by ice and flood waters. For this reason, individual populations may shift over the years.

Visitor use facilities should not be located near these areas since trampling would pose a severe threat to individual populations.

Carex bebbii (Bailey) Fern.

(Bebb's sedge)

FAMILY: Cyperaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Proposed threatened

NJ: Not listed

Other States: NA

DESCRIPTION: A cespitose sedge with flowering culms longer than the linear leaves. Perigynia ovate, two-fifths to half as long as it is wide, narrowly winged to the base and tapering to the acuminate beak.

HABITAT: Wet or dry meadows, especially in calcareous soils.

DISTRIBUTION:

Total: Occurs across Canada and the northern tier of states.

PA: Reported from Monroe, Centre, Huntingdon and Erie Counties, a total of 7 sites.

DWGNRA:

Herbarium Records: None from within Park boundaries, but two records from nearby Monroe County sites.

Field Survey: Found at one site west of Bushkill, Monroe County. Identification was made later of a specimen collected at the site and consequently complete data was not obtained. The species could not be located at the two Monroe County sites for which herbarium records exist.

SIGNIFICANCE OF LOCAL POPULATIONS: This species reaches the southern limit of its range in northern PA. Status at Centre, Huntingdon and Erie County sites unknown at this time.

POPULATION STATUS AND THREATS: Further field work needed to evaluate population status.

Carex bicknellii Britt.

(Bicknell's sedge)

FAMILY: Cyperaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Proposed rare

NJ: Not listed

Other States: NA

DESCRIPTION: Herbaceous sedge forming tussocks, flowering culms to 1 m tall, 3-7 obovoid to subglobose spikes per flowering stem. Perigynia thin and membraeous, ovate, about 10 nerved on each face.

HABITAT: Dry grassy prairies, serpentine barrens.

DISTRIBUTION:

Total: ME to Saskatchewan and south to DE, OH, IN, IL, AR, OK and NM.

PA: Reported from serpentine barrens of southeastern PA.

DWGNRA:

Herbarium Records:

Pike County - "Bushkill" - 1916

Monroe County - "sandy field near Brodhead Creek" - 1947

Northampton County - "1.5 mi nw of Slateford" - 1947

Field Survey: Not found

SIGNIFICANCE OF LOCAL POPULATIONS: A prairie species; may not persist for long at a particular site in the humid climate of the DWGNRA region due to succession.

POPULATION STATUS AND THREATS: NA

Carex cephalantha (Bailey) Bickn. (lesser prickly sedge)

FAMILY: Cyperaceae

SYNONYMS: C. laricina MacKenzie

C. muricata L. var. cephalantha Bailey

C. muricata var. laricina (MacKenzie) Gleason.

STATUS:

Federal: None

PA: Temporarily undetermined

NJ: Not listed

Other States: NA

DESCRIPTION: Herbaceous, densely caespitose with slender angled culms 0.2-1.4 dm tall. Inflorescence of 3-7 subglobose and well spaced spikes each 4-10 mm. long. Perigynia ovate, yellow-green to pale brown, nerved on both faces.

HABITAT: Acid, peaty swales, swamps and shores.

DISTRIBUTION:

Total: Newfoundland to Ontario and south to NJ, PA, MD, IN, WI and MN.

PA: Reported from 18 counties across northern PA.

DWGNRA:

Herbarium Records:

Pike County - "Bushkill, north" - 1918

Field Survey: Not found.

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: NA

Carex tetanica Schkuhr.

(Wood's sedge)

FAMILY: Cyperaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Temporarily undetermined.

NJ: Not listed

Other States: Listed in CT and MA.

DESCRIPTION: Stoloniferous perennial, culms tufted with brown to purple bases, slender 1.2-7 dm tall. Leaves green, submembranaceous. Pistillate spikes 0.7-4.0 cm long and 3-5 mm thick, loosely flowered at the base. Perigynia strongly tapering to the base and outwardly curving tip. Flowers in May.

HABITAT: Calcareous bogs, meadows, swales and low woods.

DISTRIBUTION:

Total: Eastern MA to Manitoba, south to CT, VA, OH, IN, IL, IA and SD.

PA: Reported from six counties however many former sites have been destroyed.

DWGNRA:

Herbarium Records:

Pike County - "Bushkill" - 1897

Field Survey: Not found

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: NA

Cypripedium parviflorum Salisb.

(small yellow lady's-slipper)

FAMILY: Orchidaceae

SYNONYMS: C. calceolus L. ssp. parviflorum (Salisb.) Hurten

STATUS:

Federal: None

PA: Proposed vulnerable

NJ: Not listed

Other States: Listed in NH, RI, and VT.

DESCRIPTION: Herbaceous perennial, stem 1.5-5.5 dm high with 3 or 4 alternate leaves largest 2-9 cm broad. Flowers terminal, 1 or 2 per plant. Sepals purple, descending or drooping, spirally twisted. Petals yellow, 3.5-5 cm long, lip 2-4 cm long. Flowers strongly fragrant. Flowering time May.

HABITAT: Calcareous bogs, mossy swamps and woods, wet shores and damp rocks.

DISTRIBUTION:

Total: Across Canada and south to New England, NJ, PA and to the mountains of GA and TN. Also in the midwest and TX, NM, UT and WA.

PA: Records exist from 23 counties scattered across the state but most date from the 1800's.

DWGNRA:

Herbarium Records:

Monroe County - "Slateford" - no date

Monroe County - "Delaware Water Gap" - 1872

Pike County - "Bushkill Falls" - 1887

Pike County - "Indian Rock" - 1897

Field Survey: Not found. Shaeffer indicated that the Slateford record may have been misidentified.

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: NA

Dicentra eximia (Ker-Gawl.) Torr. (wild bleeding-heart)

FAMILY: Papaveraceae

SYNONYMS: Bicuculla eximia (Ker-Gawl.) Millsp.

STATUS:

Federal: None

PA: Proposed rare

NJ: Vulnerable

Other States: MD-rare, NC-rare.

DESCRIPTION: Herbaceous perennial, stemless with finely divided glaucous leaves and pinkish to purple drooping flowers on a scape 2-3 dm tall.

HABITAT: Rocky woods and cliffs.

DISTRIBUTION:

Total: GA and TN north to WV and western NY.

PA: Reported from Carbon and Northampton Counties, a total of 10 sites, although some may be escapes from cultivation.

DWGNRA:

Herbarium Records:

Northampton County - "Delaware Water Gap" - 1933

Northampton County - "Delaware Water Gap" - 1969

Field Survey: Found at the Delaware Water Gap in Northampton County.

SIGNIFICANCE OF LOCAL POPULATIONS: Reaches the northern limit of its range in northeastern PA. At present the stand at the Delaware Water Gap is the only confirmed extant population in PA. Further field work in Carbon County may turn up additional populations.

POPULATION STATUS AND THREATS: This population is in good condition and appears to be reproducing by seed.

Galearis spectabilis (L.) Raf. (showy orchid)

FAMILY: Orchidaceae

SYNONYMS: Galeorchis spectabilis (L.) Rydb.

Orchis spectabilis L.

STATUS:

Federal: None

PA: Proposed vulnerable

NJ: Not listed

Other States: Listed in ME, NH, VT

DESCRIPTION: Herbaceous perennial, stemless, with 2 rather fleshy, obovate to broadly elliptic leaves 8-15 cm long. Scape 1-2 dm tall, stout, with foliaceous bracts 15-50 mm long, exceeding the flowers. Sepals and lateral petals pink to pale purple, lip white, spur stout about equalling the lip. Flowers in May-early June.

HABITAT: Rich, moist woods.

DISTRIBUTION:

Total: Eastern Canada south to GA, AL, TN, MO.

PA: Scattered throughout the state.

DWGNRA:

Herbarium Records: None

Field Survey: One population found in a wooded area in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: Although widespread in the state, this species has been declining due to overcollection for wildflower gardens.

POPULATION STATUS AND THREATS: A population of about a dozen scattered plants was observed at one site. There are very likely more in the Recreation Area.

Galium labradoricum (Wieg.) Wieg. (Labrador marsh bedstraw)

FAMILY: Rubiaceae

SYNONYMS: Galium tinctorium L. var. labradoricum Wieg.

STATUS:

Federal: None

PA: Proposed threatened

NJ: Endangered

Other States: Listed in CT, MA, NH, and VT.

DESCRIPTION: Low growing herbaceous plant with erect or ascending stems and leaves in whorls of 4. Flowers terminal, small, white, soon overtopped by elongating branches.

HABITAT: Bogs, thickets, and woods; cool, damp northern locations.

DISTRIBUTION:

Total: Eastern Canada south to NJ, PA and the Great Lakes states.

PA: Reported from one site each in Monroe and Bedford Counties.

DWGNRA:

Herbarium Records: None

Field Survey: Collected at one site in Pike County.

SIGNIFICANCE OF LOCAL POPULATIONS: Reaches the southern limit of its range in northern PA. This is the only PA site on which we have current information however, the other recorded sites have not been checked recently.

POPULATION STATUS AND THREATS: Further field work needed.

Isoetes riparia Engelm.

(riverbank quillwort)

FAMILY: Isoetaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Proposed rare

NJ: Not listed

Other States: NA

DESCRIPTION: Herbaceous perennial to 2 dm. Leaves tufted from the base, linear upright or recurving, leaf bases swollen and containing sporangia. Species are separated on the basis of the surface markings on the megaspores.

HABITAT: Fresh or tidal shores of rivers in shallow water with muddy to gravelly substrate.

DISTRIBUTION:

Total: Ontario to ME and south to PA and DE.

PA: Found along the Delaware and Susquehanna Rivers.

DWGNRA:

Herbarium Records: None

Field Survey: Found at five island and shore sites along the river.

SIGNIFICANCE OF LOCAL POPULATIONS: This species is well represented along the upper Susquehanna and lower Delaware Rivers in addition to the DWGNRA sites.

POPULATION STATUS AND THREATS: Populations are limited to a few plants at each site.

Isotria medeoloides (Pursh) Raf.

(small whorled pogonia)

FAMILY: Orchidaceae

SYNONYMS: None

STATUS:

Federal: Endangered

PA: Endangered

NJ: Endangered

Other States: Listed in CT, MA, MD, ME, NH, NY, RI, VA and VT.

DESCRIPTION: Herbaceous perennial with a single whorl of leaves above which the 1 or 2 flowers appear. Leaves rhombic, elliptic gray with bloom. Flower greenish-yellow, sepals arching 1.5-2.5 cm long, petals 1.2-1.5 cm long, lip narrowly obovate with 3 subequal lobes.

HABITAT: Dry, acidic woodlands.

DISTRIBUTION:

Total: NH and VT south to NC and southeastern MD.

PA: Reported from 4 counties (4 sites) in PA.

DWGNRA:

Herbarium Records:

Monroe County - "Delaware Water Gap" - 1871

Monroe County - "Blooms Hill" - 1871

Field Survey: Not found

SIGNIFICANCE OF LOCAL POPULATIONS: There are no extant populations known in PA at this time, however, this species is known at sites in Warren and Sussex Counties, NJ, outside the boundaries of the Recreation Area.

POPULATION STATUS AND THREATS: NA

Leiophyllum buxifolium (Berg.) Ell. (sand-myrtle)

FAMILY: Ericaceae

SYNONYMS: L. buxifolium var. hugeri (Small) Schneid

L. b. var. prostratum (Loud.) Gray

L. hugeri (Small) K. Schum.

L. lyonii Sweet

Dendrium buxifolium (Berg.) Desv.

STATUS:

Federal: None

PA: Temporarily undetermined

NJ: Not listed

Other States: NA

DESCRIPTION: Low, branched, evergreen shrub with small, crowded, nearly sessile leaves. Flowers small, white, in terminal umbelliform clusters appearing in May and June.

HABITAT: Sandy pine barrens.

DISTRIBUTION:

Total: Coastal plain NJ to SC and mountain crests of NC, SC and eastern KY.

PA: The only PA record is from Monroe County.

DWGNRA:

Herbarium Records:

Monroe County - "Delaware Water Gap" - 1880

Field Survey: Not found

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: NA

Lobelia kalmii L.

(brook lobelia)

FAMILY: Lobeliaceae

SYNONYMS: L. kalmii L. var. strictiflora Rydb.

L. strictiflora (Rydb.) Lunell

STATUS:

Federal: None

PA: Proposed threatened

NJ: Not listed

Other States: NA

DESCRIPTION: Herbaceous plant with slender stem 1-4 dm tall, smooth. Leaves linear, entire. Flowers blue, 10-15 mm long on slender pedicels which are bracteolate above the middle.

HABITAT: Damp calcareous soils; wet meadows, shores and bogs.

DISTRIBUTION:

Total: Across Canada and the northern tier of states.

PA: Reported from Butler, Erie, Lancaster and Northampton Counties but most sites have been destroyed in recent years.

DWGNRA:

Herbarium Records:

Monroe County - "near Bushkill" - 1982.

Field Survey: Found at one site near Bushkill in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: Reaches the southern limit of its range in northern PA. This is one of 4 sites confirmed during 1982-83 field survey of eastern PA. Several other former sites have been destroyed.

POPULATION STATUS AND THREATS: This is a small population which may be declining due to competition from other herbaceous species.

Lycopodium porophilum Lloyd and Underw. (rock clubmoss)

FAMILY: Lycopodiaceae

SYNONYMS: L. lucidulum Michx. var. porophilum (Lloyd and Underw.) Robins and Fern.

L. selago L. var. porophilum (Lloyd and Underw.) Clute

Huperzia selago L. Berkh. ex Shrank and Mart ssp. lucidula var.

porophilum (Lloyd and Underw.) Love and Love

Urostachys porophilum (Lloyd and Underw.) Herter.

STATUS:

Federal: None

PA: Proposed rare

NJ: Not listed

Other States: Listed in VA.

DESCRIPTION: Perennial evergreen with tufted leafy stems 0.5-1.7 dm high. Leaves green, linear lanceolate, entire, loosely ascending or spreading, 5-8 mm long. Bands of longer sterile leaves alternating with shorter but otherwise similar sporophylls. Sporangia kidney shaped and axillary.

HABITAT: Vertical cliff faces within mist zone of waterfalls.

DISTRIBUTION:

Total: WV and OH to WI and south to AL, TN, and MO.

PA: Reported from Carbon and Pike Counties.

DWGNRA:

Herbarium Records:

Pike County - "Raymondskill Falls"-no date

Pike County - "Dingmans Falls"-no date

Field Survey: Found at two sites in Pike County.

SIGNIFICANCE OF LOCAL POPULATIONS: The two DWGNRA populations and one in Carbon County are the only known extant populations of this species in the state.

POPULATION STATUS AND THREATS: Populations are small but protected by their inaccessibility.

Lycopodium selago L.

(mountain clubmoss)

FAMILY: Lycopodiaceae

SYNONYMS: Huperzia selago (L.) Bernh.

Urostachys selago (L.) Herter.

STATUS:

Federal: None

PA: Proposed endangered

NJ: Not listed

Other States: Listed in CT, MA, ME NH, VA, and VT.

DESCRIPTION: Perennial, evergreen plant with tufted stems 0.3-3 dm high. Leaves 8-ranked, appressed, entire and hollow at the base. Bands of sterile leaves alternate with bands of similar appearing sporophylls with kidney-shaped sporangia in their axils.

HABITAT: Mountain tops.

DISTRIBUTION:

Total: Newfoundland to MN and south along the coast to the mountains of VA.

PA: Only one report from the Delaware Water Gap.

DWGNRA:

Herbarium Records:

Monroe County - "Delaware Water Gap" - 1870

Field Survey: Not found despite extensive searches of Mt. Minsi in the vicinity of the old fire tower.

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: Trampling by Appalachian Trail users may be a problem.

Opuntia humifusa (Raf.) Raf. var. humifusa (prickly pear cactus)

FAMILY: Cactaceae

SYNONYMS: O. calcicola Wherry

O. compressa (Salisb.) J. F. Macbr.

O. compressa var. microsperma (Engelm. and Bigelow) L. Benson

O. opuntia (L.) Karst.

O. rafinesquei Engelm.

STATUS:

Federal: None

PA: Temporarily undetermined

NJ: Not listed

Other States: NA

DESCRIPTION: Prostrate or spreading, stem segments strongly flattened and jointed, armed with prickles. Flowers solitary, yellow, 5-9 cm across with 8-12 petals. Fruit ovoid, green to dull purple, edible.

HABITAT: Dry sandy and rocky barrens.

DISTRIBUTION:

Total: MA to MN south to SC, GA, AL, MS, and MO.

PA: Recorded from 9 counties across the state.

DWGNRA:

Herbarium Records:

Pike County - "1 mi. sw of Milford" - no date

Monroe County - "Shawnee on Delaware" - no date

Field Survey: Found at four sites in Pike County.

SIGNIFICANCE OF LOCAL POPULATIONS: Extant populations are known elsewhere in the state but this may be the largest single population.

POPULATION STATUS AND THREATS: Population is vigorous and healthy but excessive foot traffic could be a problem.

Panax quinquefolius L.

(wild ginseng)

FAMILY: Araliaceae

SYNONYMS: None

STATUS:

Federal: Interstate and international shipment and sale controlled under CITES regulations.

PA: Proposed vulnerable

NJ: Rare

Other States: Listed in CT, DE, MA, MO, ME, NH, NY, VA and VT.

DESCRIPTION: Herbaceous perennial with a large spindle-shaped forked root. Erect simple stem with a solitary whorl of 3 palmately compound leaves each with 5 leaflets. Flowers greenish-white, in an umbel, styles 2. Fruits bright red. Flowering time - June; fruiting - July, August.

HABITAT: Cool, moist woods in rich soil.

DISTRIBUTION:

Total: Occurs throughout the northeast and midwest.

PA: Found in all counties of the state.

DWGNRA:

Herbarium Records:

Monroe County - "near Bushkill" - 1977

Field Survey: One population was found in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: Although once widespread, this species is declining rapidly due to over-collection.

POPULATION STATUS AND THREATS: The one known population is small.

Potamogeton richardsonii (Benn.) Rydb. (red-head potamogeton)

FAMILY: Potamogetonaceae

SYNONYMS: P. perfoliatus L. ssp. richardsonii (Benn.) Hulten.

P. perfoliatus var. richardsonii Benn.

STATUS:

Federal: None

PA: Deleted

NJ: Not listed

Other States: NA

DESCRIPTION: Submersed aquatic with branched stem and sessile, clasping leaves and whitish stipules which soon disintegrate into stringy white fibers. Flower spikes with 6-12 whorls, in fruit to 4 cm long and 1 cm thick.

HABITAT: Shallow water of rivers and lakes, frequently in alkaline waters.

DISTRIBUTION:

Total: Across Canada and the northern US.

PA: Reported from five counties.

DWGNRA:

Herbarium Records:

Monroe County - "shallow rock channel west side Shawnee Island" - 1947

Field Survey: At the location indicated on the herbarium record we found P. perfoliatus, a similar species, but not P. richardsonii. The original collection may have been misidentified.

SIGNIFICANCE OF LOCAL POPULATIONS: P. richardsonii has been dropped from the most recent version of the PA list.

POPULATION STATUS AND THREATS: NA

Potentilla fruticosa L.

(shrubby cinquefoil)

FAMILY: Rosaceae

SYNONYMS: P. fruticosa ssp. floribunda (Pursch) Elkington

P. fruticosa var. tenuifolia Lehm.

Dasiphora fruticosa sensu auctt. non (L.) Rydb.

Pentaphylloides fruticosa (Pursch) A. Love

STATUS:

Federal: None

PA: Proposed rare

NJ: Not listed

Other States: NA

DESCRIPTION: Bushy branched deciduous shrub to 1 m tall. Leaves pinnately compound with 5-7 leaflets. Flowers yellow, 2-3 cm wide singly or in small clusters at the ends of the branches.

HABITAT: Wet meadows, bogs or shores, especially on calcareous soils.

DISTRIBUTION:

Total: Across Canada and south to NJ, PA, OH, IN, SD, CA, NM and AZ.

PA: Reported from one site each in Northampton and Monroe Counties.

DWGNRA:

Herbarium Records:

Monroe County - "Marsh near Bushkill" - 1982

Field Survey: Found near Bushkill in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: This species reaches the southern limit of its range in northeastern PA. This site is the only known PA location. The species could not be found at the Northampton County site during a 1982-83 field survey.

POPULATION STATUS AND THREATS: A vigorous population at present.

Prunus nigra Ait.

(Canada plum)

FAMILY: Rosaceae

SYNONYMS: P. americana Marsh. var. lanata Sudworth

P. americana var. nigra (Ait) Waugh

P. emarginata (Dougl. ex Houk) Walp. var. mollis (Dougl.) Brewer

P. lanata (Sudworth) MacKenzie and Bush

STATUS:

Federal: None

PA: Temporarily undetermined

NJ: Not listed

Other States: NA

DESCRIPTION: Deciduous shrub or small tree to 10 m. Leaves with gland tipped teeth and 2 apical glands on the petiole. Flowers in clusters of 3 or 4 on reddish pedicels, fruits ellipsoid, red to yellow, 2-3 cm long. Flowers in late April, fruits - June.

HABITAT: Alluvial thickets along river and stream banks or on islands.

DISTRIBUTION:

Total: Newfoundland to Ontario and south to NY, OH, IA and SD.

PA: Reported from Bedford County.

DWGNRA:

Herbarium Records: None

Field Survey: A preliminary identification from one site in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: Reaches southern limit of its range in PA. Status of Bedford County site unknown.

POPULATION STATUS AND THREATS: Further field work needed.

Prunus pumila L. var. depressa (Pursh) Gleason (prostrate sand cherry)

FAMILY: Rosaceae

SYNONYMS: P. depressa Pursh

STATUS:

Federal: None

PA: Proposed rare

NJ: Endangered

Other States: NA

DESCRIPTION: Prostrate deciduous shrub. Leaves oblanceolate to oblong with remotely serrate margins with glandular tipped teeth, pale green above and whitened below. Flowers in clusters of 3 or 4, white; fruit black, subglobose, 10-15 mm diameter.

HABITAT: Alluvial islands and shores of the Delaware River.

DISTRIBUTION:

Total: Ontario south to the rivers of MA, PA and WI.

PA: Found along the Delaware River in Pike, Monroe and Northampton Counties.

DWGNRA:

Herbarium Records:

Northampton County - "near Stateford" - 1967

Field Survey: Found at 6 sites in Northampton, Monroe, and Pike Counties.

SIGNIFICANCE OF LOCAL POPULATIONS: This is the only area in the state where this variety is known.

POPULATION STATUS AND THREATS: All 6 populations are vigorous and healthy.

Prunus pumila L. var. pumila

(sand cherry)

FAMILY: Rosaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Proposed rare

NJ: Endangered

Other States: NA

DESCRIPTION: Erect, deciduous shrub, leaves narrowly oblanceolate. Flowers white, in clusters of 2-4 on pedicels 4-12 cm long. Sepals glandular serrate. Fruit black, subglobose 10-15 mm in diameter; seed ellipsoid.

HABITAT: Dry rocky ridgetop areas, rock outcrops.

DISTRIBUTION:

Total: Ontario south to NY and MN.

PA: Reported from mountain tops in Luzerne, Lackawanna, Wyoming, Perry, Schuylkill and Monroe Counties.

DWGNRA:

Herbarium Records:

Monroe County - "Kittatiny Mt. Delaware Water Gap" - 1920

Field Survey: Found on Mt. Minsi, Monroe County, at several locations.

SIGNIFICANCE OF LOCAL POPULATIONS: Reaches the southern limit of its range in northeastern PA. Found at 2 other sites in Monroe and Lackawanna Counties during 1982-83 survey.

POPULATION STATUS AND THREATS: Limited to a few plants at each location.

Rhynchospora capillacea Torr.

(capillary beaked-rush)

FAMILY: Cyperaceae

SYNONYMS: R. capillacea var. laeviseta E. J. Hill

R. smallii Britt.

STATUS:

Federal: None

PA: Proposed threatened

NJ: Not listed

Other States: Listed in CT, NH, VT.

DESCRIPTION: Herbaceous tussock-forming plant 0.5-4.5 dm tall. Narrow leaves overtopping the inflorescence. Culms very slender - with 1 terminal and 1 axillary fascicle each containing 1-10 spikelets. Achenes narrowly oblong-obovoid with bristles overtopping the tubercle. Flowering time - August-September.

HABITAT: Wet, calcareous meadows, fens.

DISTRIBUTION:

Total: Across Canada and south in the mountains to VA, TN and MO.

PA: Reported from 7 sites in 5 counties, however habitat destruction has eliminated all but a few.

DWGNRA:

Herbarium Records: None

Field Survey: Found near Bushkill in Monroe County.

SIGNIFICANCE OF LOCAL POPULATIONS: This site and 2 locations in Northampton County are the only known extant sites for this plant in PA as of the 1982-83 rare plant survey.

POPULATION STATUS AND THREATS: This species was collected too early in the season to make a complete evaluation of the status of the population. Open area must be maintained in order to perpetuate this species. Not tolerant of shading.

Scirpus smithii Gray.

(Smith's bullrush)

FAMILY: Cyperaceae

SYNONYMS: None

STATUS:

Federal: None

PA: Proposed rare

NJ: Not Listed

Other States: OH - endangered

DESCRIPTION: Herbaceous annual, cespitose with deep green culms 0.1-4.0 dm tall, subterete or somewhat angled. Flowers in a terminal cluster of 2 or 3 spikelets subtended by an involucre bract which appears as a continuation of the stem. Achene without bristles. Flowering and fruiting in late summer.

HABITAT: Wet shores including freshwater intertidal areas of the lower Delaware.

DISTRIBUTION:

Total: Quebec to MN and south to DE, VA, OH, IN.

PA: Reported from the lower Delaware and at Presque Isle in Erie County.

DWGHRA:

Herbarium Records:

Monroe County - "shore of Delaware River north of Delaware Water Gap" - 1956

Monroe County - "Brodhead Creek overflow area near Minisink Hills" - 1970

Field Survey: Both recorded locations were checked and the species was not found.

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: Scouring of river banks by ice and flood waters are a constant threat.

Trollius laxus Salisb.

(spreading globeflower)

FAMILY: Ranunculaceae

SYNONYMS: None

STATUS:

Federal: Under review, C1. Data is available to support listing as endangered or threatened and critical habitat information is being prepared.

PA: Proposed endangered

NJ: Rare

Other States: Listed in CT.

DESCRIPTION: Herbaceous perennial, 1-5 dm tall with 5-7 dissected leaves in a whorl. A solitary, pale yellow flower is produced above the leaves in late April or early May. The foliage enlarges after flowering and persists until the fall.

HABITAT: Calcareous swamps and wet alkaline meadows.

DISTRIBUTION:

Total: Western CT to MI and south to PA.

PA: Reported from the northeastern, central, and northwestern parts of the state, however, several former sites have been destroyed.

DWGNRA:

Herbarium Records:

Monroe County - "Minisink Hills" - no date

Monroe County - "wet grounds near Delaware Water Gap" - 1862

Monroe County - "wet meadow near Delaware Water Gap" - 1882

Monroe County - "1 mi. east of East Stroudsburg" - 1963

Field Survey: Not found. The 1963 site (1 mi. east of East Stroudsburg) has since been destroyed.

SIGNIFICANCE OF LOCAL POPULATIONS: NA

POPULATION STATUS AND THREATS: NA

CONCLUSIONS

Field surveys conducted in 1982-83 failed to relocate ten species which were collected in the study area in the past. Sketchy location data made it impossible to determine the exact original collection site in some cases and it is possible that additional searching would result in finding the plants. This is true for Isotria medeoloides, the only federally listed species in the area. Acidic oak forest, which is the habitat of this species, occurs on the slopes of Mt. Minsi and in other areas of the park.

Other species such as Trollius laxus have been lost due to habitat destruction. Extensive limestone wetlands, the preferred habitat of this species, once occurred in the vicinity of Minisink Hills. Still others, such as Leiophyllum buxifolium and Lycopodium selago, have also disappeared in the past 80-100 years. Likely limited to a single station in the past, they may have suffered from overcollection or other disturbance.

In order to avoid loss of more species in the future, it is essential that all known rare plant sites be managed to assure preservation. An important aspect of management is to avoid uses which could lead to habitat degradation. Bridle trails, which cause severe trampling followed by erosion, should be very carefully sited. River access points should also be designated so as to minimize the threat to unusual plant species.

In addition to known rare plant sites other areas with unusual plant communities or potential habitat should be designated as natural areas and

protected from uses that might lead to habitat degradation.

In order to determine the true status of rare plant populations within the Park a monitoring program should be initiated. Only by making continued observations over a period of years can it be determined whether populations are increasing, declining or stabilized.

TABLE 1: SUMMARY OF STATUS OF ENDANGERED, THREATENED, VULNERABLE, AND RARE VASCULAR PLANTS IN THE PENNSYLVANIA PORTION OF THE DWGIRA

Species	Herbarium Records	# Sites Confirmed 1982-83	Date of Most Recent Sighting	Proposed PA State Status	Federal Status	Geographic Affinity**	Habitat Type	Potential Threats Within DWGNRA
<i>Aster ericoides</i>	2	2	1983	Temporarily Undetermined	None	-----	dry rocky soil	trampling
<i>Carex bebbii</i>	0	1	1983	Threatened	None	SLOR	calcareous meadows	successional changes, construction
<i>Carex bicknellii</i>	3	0	1947	Rare	None	ELOR	dry open prairie	successional changes
<i>Carex cephalantha</i>	1	0	1918	Temporarily Undetermined	None	SLOR	peaty swamps and shores	draining or flooding of wetlands
<i>Carex tetanica</i>	1	0	1897	Temporarily Undetermined	None	-----	calcareous bogs and meadows	draining or flooding of wetlands
<i>Cyrtopodium parviflorum</i>	3	0	1897	Vulnerable	None	-----	calcareous bogs and swamps	collectors
<i>Dicentra eximia</i>	1	1	1982	Rare	None	NLOR	rocky woods and cliffs	collectors
<i>Galearia spectabilis</i>	0	1	1982	Vulnerable	None	-----	rich, moist woods	collectors, trampling
<i>Galium labradoricum</i>	0	1	1983	Threatened	None	SLOR	bogs or cool, moist woods	trampling
<i>Isoetes riparia</i>	0	5	1983	Rare	None	-----	shallow water along river bank	trampling, competition by exotic species
<i>Isotria medeoloides</i>	2	0	1871	Endangered	Endangered	-----	dry, acidic woods	collectors
<i>Leptophyllum buxifolium</i>	1	0	1880	Temporarily Undetermined	None	NLOR	sandy pine barrens	collectors
<i>Lobelia kalmii</i>	1	1	1982	Threatened	None	SLOR	calcareous bogs and shores	draining or flooding of wetlands
<i>Lycopodium porophyllum</i>	2	2	1983	Rare	None	NLOR	wet cliffs	altered moisture conditions
<i>Lycopodium selago</i>	1	0	1870	Endangered	None	SLOR	mountain tops	trampling
<i>Opuntia humifusa</i>	2	4	1983	Temporarily Undetermined	None	-----	sandy or rocky barrens	trampling, erosion
<i>Panax quinquefolius</i>	1	1	1982	Vulnerable	None	-----	rich, moist woods	collectors
<i>Potamogeton richardsonii</i>	1	0	*	Deleted	None	SLOR	aquatic	-----

TABLE 1 (CONTINUED): SUMMARY OF STATUS OF ENDANGERED, THREATENED, VULNERABLE, AND RARE VASCULAR PLANTS IN THE PENNSYLVANIA PORTION OF THE DMGHRA

Species	Herbarium # Records	Sites Confirmed 1982-83	Date of Most Recent Sighting	Proposed PA State Status	Federal Status	Geographic Affinity**	Habitat Type	Potential Threats Within DMGHRA
<i>Potentilla fruticosa</i>	1	1	1983	Rare	None	SLOR	calcareous bogs and meadows	draining or flooding of wetlands
<i>Prunus nigra</i>	0	1	1983	Temporarily Undetermined	None	SLOR	alluvial thickets	clearing
<i>Prunus pumila</i> var. <i>depressa</i>	1	6	1983	Rare	None	SLOR	alluvial islands and shores	trampling
<i>Prunus pumila</i> var. <i>pumila</i>	1	1	1983	Rare	None	SLOR	dry cliffs and rock outcrops	trampling
<i>Rhynchospora capillacea</i>	0	1	1983	Threatened	None	SLOR	rock outcrops calcareous meadows	draining or flooding of wetlands
<i>Scirpus smithii</i>	2	0	1970	Rare	None	SLOR	wet shores	trampling, competition by exotic species
<i>Trollius laxus</i>	4	0	1963	Endangered	Under Review C1	SLOR	calcareous swamps	draining or flooding of wetlands

* A very similar species was found at the site in 1983, suggesting what the earlier collection may have been misidentified. This species has been deleted in the most recent version of the PA list.

** SLOR - southern limit of range
HLOR - northern limit of range
ELOR - eastern limit of range

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