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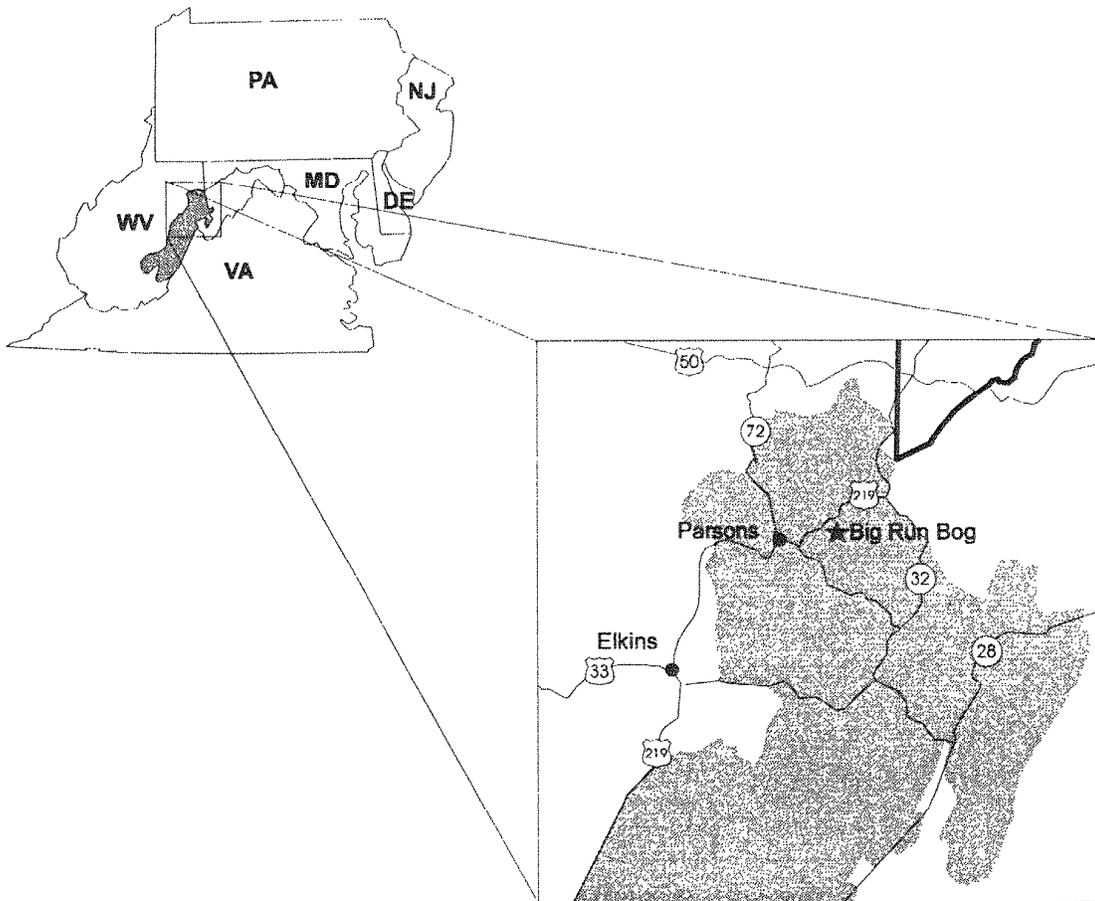
Northeastern Forest
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General Technical
Report NE-223



Botanical Reconnaissance of Big Run Bog Candidate Research Natural Area

Rose-Marie Muzika
Robert Hunsucker
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Abstract

To document the botanical diversity of the Big Run Bog candidate Research Natural Area on the Monongahela National Forest in West Virginia and thus provide data on its suitability for RNA establishment, a botanical survey was conducted in 1993-94. The survey identified 193 species in 118 genera and 52 families. Six species of rare vascular plants were found. Vascular plant families with the most species present were Cyperaceae (24), Asteraceae (23), Poaceae (16), and Ericaceae (14). Exotic species accounted for only 0.02 percent of the total vascular flora. For each taxon, family, species, habitat, and estimated abundance are reported. Nonvascular plants (liverworts and mosses) totaled 87 species in 55 genera and 33 families. For each taxon, family, species, and habitat are reported.

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Foreword

The USDA Forest Service's Research Natural Areas Program maintains a network of 289 established areas and more than 300 candidate areas representing typical and unique natural ecosystems on national forests in the United States. These areas are managed in minimally disturbed conditions for research, monitoring, and education, and to maintain natural diversity and ecological processes.

Within the 14-state territory of the Northeastern Forest Experiment Station, six Research Natural Areas (RNA's) have been established, and 29 candidate areas are being considered for establishment within the next few years. Several of these areas have been the scene of active field research for many years while others are virtually unstudied.

Although the RNA program began more than 65 years ago, systemic research and monitoring on RNA's began only recently. As the Forest Service moves in the direction of ecological management, RNA's will provide essential information for comparison of similar areas managed for the production of commodities.

To encourage and expedite research on RNA's, the Northeastern Forest Experiment Station is commissioning a series of botanical reconnaissance surveys for each of the established and candidate RNA's. This program began in 1991 with funding support from the RNA Matching Grant Program sponsored by the Chief of the Forest Service.

Introduction

The Big Run Bog candidate Research Natural Area (cRNA) is located in the Cheat Ranger District, Monongahela National Forest, Tucker County, West Virginia. The geographic center is approximately lat 39°07'N, long 79°35'W. Ecologically, the area falls within a landtype association known as Allegheny Plateau Blocks,¹ and is characterized by a relatively flat mountain summit (Backbone Mountain) with rolling, gentle slopes of 2 to 25 percent. Big Run Bog falls within a small basin forming the headwaters of Big Run, a tributary of the Blackwater River. Elevations range from 970 to 1,100 m (3,190 to 3,620 ft). The cRNA has a total area of 256 ha (632 acres) (USDA For. Serv. 1987).

The research area is in the Appalachian Plateau physiographic province, Allegheny Mountains section (Fenneman 1938). The region is underlain by alternating sequences of shale, siltstone, sandstone, and coal of the Pottsville Group and Allegheny Formation (W.Va. Geol. Surv. 1923).

Surrounding soils on slopes of 0 to 5 percent are Lickdale very stony silt loam, and soils on slopes of 3 to 15 percent are Ernest extremely stony silt loam (USDA Soil Conserv. Serv. 1967). In the bog itself, peat is found to a maximum depth of 225 cm. The surface of the bog slopes inward gently (1 to 2 percent) in all directions. Water and nutrients drain into the bog from the surrounding watershed, making it a minerotrophic fen rather than a true ombrotrophic bog. The surface waters have an average pH of 4.02 (Wieder 1985).

The climate is continental. In winter there are frequent and often severe snow and ice storms; in warmer seasons, showers and thunderstorms are frequent. Cold air drains from the surrounding ridges and slopes into the bowl-like basin. Frost may occur at any time of the year (Horn and McGuire 1960; Wieder et al. 1981). The following climatic conditions for the research area (Wieder and Lang 1983; NOAA 1985) are estimated from data collected over a 34-year period at a national weather station located 15 km away at Canaan Valley (elevation 991 m). The mean annual temperature is 7.9°C. July is the warmest month, with a mean of 18.3°C. December, January, and February are the coldest months with mean monthly temperatures below freezing 0°C (32°F). Mean annual precipitation is 133 cm. June is the wettest month, with an average maximum of 12.7 cm; November is the driest with an average minimum of 9.0 cm. On average, there are about 97 frost-free days from 2 June through 7 September (Horn and McGuire 1960; Wieder et al. 1981; Wieder and Lang 1983; NOAA 1985).

¹DeMeo, T.; Tracy, L. M.; Wright, L. 1995. **Preliminary landtype associations of the Monongahela National Forest.** Unpublished report on file at the USDA Forest Service Supervisor's Office, Elkins, West Virginia. 2 p.

Literature Review

Wieder et al. (1981) analyzed the vegetation of the bog, reporting 36 species of vascular plants and mosses. They concluded that the bog was dominated by *Sphagnum* and *Polytrichum*, together accounting for 85 percent of the surface. Vascular herbaceous species covered about half of the bog surface. Leading dominants were *Eriophorum virginicum*, other sedges, rushes, and *Solidago uliginosa*. They defined four bog communities: *Sphagnum-Eriophorum virginicum*, *Sphagnum*-shrub, *Polytrichum*-shrub, and *Polytrichum-Carex canescens*. The authors described the vegetation of each community as well as its spatial distribution in the bog. Trees and upland shrubs generally were limited to the wetland borders. Shrub cover ranged from trace amounts to more than 11 percent. When these results are combined with those of Walbridge (1982), the Big Run tally is 9 species of mosses and 58 species of vascular plants.

Wieder (1985) reported radiocarbon dates of 13,080 ± 420 years BP for the peat deposits. Walbridge (1982) described several plant communities for Big Run Bog. Chief among these were: (1) Coniferous swamp forest, dominated by red spruce or eastern hemlock, with minor red maple and yellow birch; (2) A *Hypericum densiflorum* community, dominated by shrubby St. Johnswort, with an herbaceous cover of sedges, grasses, mosses, and dewberry; (3) *Rubus hispidus*-mixed shrub community, consisting of the dominant dewberry with various shrubs, dwarfed trees, and an herbaceous cover of sedges, grasses, rushes and mosses; and (4) three major types of communities dominated by mosses: *Sphagnum*, *Polytrichum*, and mixed *Polytrichum* hummock-*Sphagnum* hollow communities. Herbaceous communities included *Leersia oryzoides* communities and a *Carex canescens* meadow community.

Wieder et al. (1984) studied the flowering phenology of 21 species in four plant communities. Of these, 10 were wind-pollinated monocots, 10 were insect-pollinated dicots, and one species of dicot (*Drosera rotundifolia*) was primarily self-pollinated. Flowering occurred from mid-May through late September. The growing season was 136 days. The average length of flowering for the 21 species was 30 days.

Big Run Bog receives water and nutrients from surrounding slopes and ridges. Although the bog resembles a minerotrophic fen, chemically it is more like an ombrotrophic bog (Wieder 1985), because it is nutrient depauperate.

Wieder et al. (1989) concluded that both cover and production in Big Run bog is dominated by mosses. Mosses covered 68 percent of the bog surface while herbaceous species covered 42 percent. Trailing shrubs, mostly *Rubus hispidus*, covered 43 percent and upright shrubs 21 percent. Wieder and Lang (1983) reported annual net primary production of *Sphagnum magellanicum*, *S. recurvum*, and *Polytrichum commune* as 5.4, 6.1, and 7.9 g dry mass dm⁻², respectively.

Methods

A reconnaissance of Big Run Bog cRNA was conducted in September 1993. From late March through early October 1994, the area was visited every 2 to 3 weeks for at least 2 consecutive days to observe and gather data on plants and their habitat. The sampling was segregated into surrounding forest, bog, and transition zone.

To systematically sample the area, we established six line transects that were spaced evenly at intervals of 190.5 m. Lines were oriented to a randomly chosen bearing of 96 degrees, thus extending across the landscape from east-southeast to west-northwest. In the forested portion of the cRNA, 400-m² plots were sampled at 60-m intervals. On each plot, each plant species and its estimated abundance (using areal percent cover) were recorded. Aspect, slope, and landform also were noted. In all, 130 plots of this size were sampled.

The bog and the transition zone between bog and forest were sampled using The Nature Conservancy relevé (plot) method (Sneddon 1993). This method was more detailed and quantitative than the sampling conducted in the forest. A single line transect on a randomly chosen bearing of 304 degrees extended nearly the length of the bog from southeast to northwest. Eight sample plots of 64 m² each were sampled at subjectively chosen locations along the transect. In these plots, the following data were recorded: species present, estimated abundance of each, and average height of plant strata. Abundances were estimated using the following scale: 1 = rare, 2 = infrequent, 3 = common, 4 = frequent, and 5 = abundant (Tyrrell et al. 1994). The transition zone was sampled with a 400-m² plot about midway through the transition on both the eastern and western sides of the bog.

Herbarium specimens were collected in duplicate and air dried. Voucher specimens are located at the Forest Service Supervisor's Office in Elkins, West Virginia.

Scientific names of vascular plants in Table 1 follow Gleason and Cronquist (1991); a few exceptions follow Fernald (1950). Common names tend to follow Strausbaugh and Core (1977). The names of liverworts (Table 2) follow Schuster (1966). The names of mosses and lichens (Table 2) follow Crum and Anderson (1980).

Description of Individual Habitats Surveyed

The forest surrounding Big Run Bog is second growth. Vegetation of the area is placed in three cover types: Bog, Northern Hardwood Forest, and Spruce Forest. A fourth type was defined as a transition zone from bog to forest (Braun 1950; Core 1966; Eyre 1980; Walbridge 1982).

Bog

The bog covers an estimated 18 ha (44 acres) and is approximately 1.2 km long and up to 180 m wide. The bog is an irregular mosaic of several plant communities growing on hummocks (small elevations above the level surface) and in the valleys between. There is a considerable amount of

surface water (the extent not measured) in two beaver dam ponds, in small streams entering the bog, and in the central main channel; however, most of the surface is vegetated (Figs. 1-2). There was no evidence of recent beaver activity. The hummocks support mostly dwarf trees, shrubs, seedlings, low ericaceous plants, perennial ferns, and several nonvascular species. Characteristic vascular plant species are *Rhododendron maximum*, *Ilex verticillata*, *Picea rubens*, *Acer rubrum*, *Virburnum cassinoides*, *Nemopanthus mucronatus*, *Kalmia latifolia*, *Aronia melanocarpa*, *Gaultheria hispidula*, *Vaccinium angustifolium*, *V. myrtilloides*, and *Osmunda cinnamomea*. Dominant mosses are species of *Polytrichum* and *Sphagnum*. Lichens are chiefly species of *Ciadonia*.

In the intervals or valleys between the hummocks the dominant plants are perennial sedges, rushes, low-growing ericaceous shrubs, dewberry, and mosses. The characteristic species of vascular plants are *Carex canescens*, *C. folliculata*, *C. trisperma*, *C. interior*, *C. scoparia*, *Eriophorum virginicum*, *Rhynchospora alba*, *Scirpus atrocinctus*, *Dulichium arundinaceum*, *Vaccinium macrocarpon*, *V. oxycoccus*, *Gaultheria hispidula*, *Rubus hispidus*, *Aronia melanocarpa*, *Juncus subcaudatus*, *J. effusus*, *Solidago uliginosa*, *Gentiana linearis*, and *Drosera rotundifolia*. Characteristic species of mosses are *Sphagnum fallax*, *S. girgensohnii*, *S. imbricatum*, *S. magellanicum*, *S. recurvum*, *Polytrichum commune*, and *P. Ohioense* (Tables 1-2).

Estimated percent cover of each species varied widely from one area of the bog to another. For example, abundance ranges for some vascular plants are: *Carex canescens*, 2 to 60 percent; *C. folliculata*, 2 to 80 percent; *Rhynchospora alba*, 2 to 60 percent; *Rubus hispidus*, 5 to 30 percent; *Vaccinium macrocarpon*, 2 to 50 percent; *V. oxycoccus*, 2 to 70 percent; *Eriophorum virginicum*, 2 to 5 percent; and *Aronia melanocarpa*, 2 to 3 percent. Ranges for some of the mosses were *Sphagnum* spp., 50 to 95 percent, and *Polytrichum* spp., 2 to 95 percent. Percent cover for shrubs 1.0 to 2.0 m tall ranged from 3 to 12 percent. The herbaceous layer (<1 m tall, excluding mosses) ranged from 30 to 95 percent, and the moss layer from 25 to 95 percent. Classification of plant communities was not an objective of this survey (see literature review).

Northern Hardwood Forest

The Northern Hardwood Forest occupies the upland slopes and ridges and contains the largest area (234 ha) of Big Run Bog cRNA (Fig. 3). This forest has been characterized as a "Black Cherry-Maple type with small inclusions of Sugar Maple-Beech-Yellow Birch and Hemlock-Yellow Birch" (Braun 1950; Core 1966; Eyre 1980; USDA For. Serv. 1987). At Big Run Bog the characteristic species of trees are dominants *Prunus serotina*, *Acer rubrum*, *Fagus grandifolia*, *Betula allegheniensis*, *B. lenta*, *Tsuga canadensis*, and *Magnolia fraseri*, and associated species *Quercus rubra*, *Acer saccharum*, *Magnolia acuminata*, and *Amelanchier laevis*. The characteristic species of shrubs are *Acer pensylvanicum*, *Hamamelis virginiana*, *Ilex montana*, and *Rhododendron maximum*. The latter species often form dense, nearly impenetrable thickets. The herbaceous layer of vegetation (both herbs and woody plants) has a rich

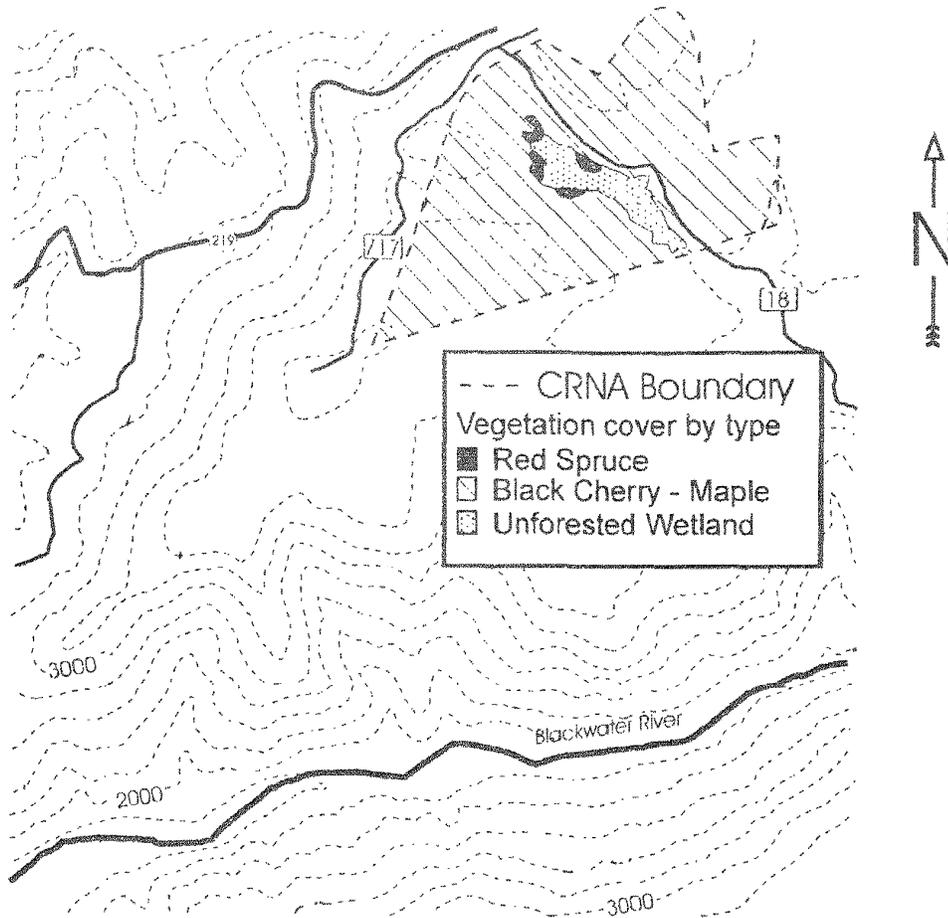


Figure 1.—Boundary area and cover types of Big Run Bog candidate RNA.

diversity of lycopods, ferns, and seed plants. Characteristic species of vascular plants are *Carex intumescens*, *C. debilis*, *C. laxiflora*, *C. pensylvanica*, *Lycopodium obscurum*, *L. digitatum*, *L. annotinum*, *L. clavatum*, *Oxalis montana*, *Smilax rotundifolia*, *Thelypteris noveboracensis*, *Dryopteris intermedia*, *Trillium undulatum*, *Gaultheria procumbens*, *Medeola virginiana*, *Erythronium americanum*, *Claytonia caroliniana*, *Dennstaedtia punctilobula*, *Epifagus virginiana*, *Mitchella repens*, *Maianthemum canadense*, *Trientalis borealis*, *Agrostis perennans*, *Anemone quinquefolia*, *Brachyelytrum erectum*, *Viola rotundifolia*, and *V. blanda*.



Figure 2.—View of the bog, with open unvegetated wetland in the background and cottongrass and moss hummocks dominating the foreground.

Spruce Forest

Spruce Forest (Braun 1950; Core 1966; Eyre 1980) occurs in patches on the north and north-northwest borders of the bog (Fig. 4) and occupies an area of about 4 ha (10 acres). *Picea rubens* is dominant or codominant with *Acer rubrum*, *Betula lenta*, *B. allegheniensis*, *Prunus serotina*, and *Tsuga canadensis*. The shrub layer is dominated by *Rhododendron maximum* with minor *Ilex montana*. The herbaceous layer supports a sparse growth of *Oxalis montana*, *Mitchella repens*, *Lycopodium annotinum*, *Maianthemum canadense*, *Carex debilis*, and *Gaultheria hispida*. Frequent bryophytes are *Bazzania trilobata* and species of *Sphagnum*.

Transition Zone

One aspect of the Transition Zone, the distinctive irregular narrow band between the bog and forests around it, occurs mostly along the north-northeast to south side of the bog where several plant species achieve their best growth (Fig. 5). The dominant trees are *Acer rubrum*, *Picea rubens*, *Prunus serotina*, and *Tsuga canadensis*. The dominant shrubs of the shrub layer characterize this zone: *Nemopanthes mucronatus*, *Ilex verticillata*, and *Viburnum cassinoides*. Other species of woody plants include *Hamamelis virginiana*, *Rhododendron maximum*, *Kalmia latifolia*, *Taxus canadensis*, *Vaccinium angustifolium*, *V. myrtilloides*, *V. corymbosum*, *Rubus hispida*, *Lycopodium obscurum*, *Osmunda cinnamomea*, *O. claytoniana*, and *Carex folliculata*. Mosses here are chiefly species of *Sphagnum* and *Polytrichum*.

Plants of Special Interest

Of special interest are six species of vascular plants that are rare in West Virginia but are found in Big Run Bog² (W.Va. Nat. Heritage Prog. 1994). They are:

Grass-pink (*Calopogon tuberosus*). This wide-ranging species of orchid extends from Canada south to Florida and Texas in acid bogs and swamps. In West Virginia, grass-pink has been reported in Hampshire, Hardy, Mineral, Pocahontas, Tucker, and Webster Counties. Several dozen plants grow on the east side of Big Run Bog.

Hoary sedge (*Carex canescens*). This northern plant extends from boreal regions south to Virginia, Ohio, Minnesota, Arizona, and California. In West Virginia, hoary sedge is found in acid sphagnum bogs at high elevations in Pocahontas and Tucker Counties.

Appalachian twayblade (*Listera smallii*). This species of orchid is found in the Appalachian Mountains from southern Pennsylvania and West Virginia to eastern Kentucky, and south to Georgia, South Carolina and east Tennessee. In

West Virginia Appalachian twayblade is found in damp woods and thickets at elevations of 2,000 to 3,000 feet. It has been reported in Pocahontas, Mercer, Randolph, and Tucker Counties. At Big Run Bog, six plants were growing on the east side of the bog under great laurel (rhododendron).

Buckbean (*Menyanthes trifoliata*). This northern species extends from boreal regions south to New Jersey, Virginia, West Virginia, Ohio, Indiana, Missouri, and California. In West Virginia buckbean populations were reported at several sites in Pocahontas and Tucker Counties. At Big Run Bog, about 50 plants were growing in a small area about midway on the east side of the bog.

Grass-of-Parnassus (*Parnassia asarifolia*). This chiefly mountain species extends from Virginia and West Virginia to Georgia, and west to Arkansas and east Texas. It grows in bogs, springs, and along small streams. In West Virginia, Grass-of-Parnassus is found in Greenbrier, Pocahontas, Randolph, Tucker, Upshur, and Webster Counties at elevations mostly above 2,000 feet. Fewer than a dozen plants grow in a small area on the east side of Big Run Bog.

Rose pogonia (*Pogonia ophioglossoides*). This wide-ranging orchid grows in bogs and wet meadows from Newfoundland to Minnesota, and south to Florida and Texas. In West Virginia, rose pogonia is found in sphagnum bogs in Fayette, Hampshire, Monongalia, Pocahontas, Preston, Randolph, Tucker, and Upshur Counties. More than 50 plants were growing on the east side of the bog.

Potential Threats to Big Run Bog Ecosystems

In recent years, informal monitoring of Big Run Bog has revealed an apparent increase in the abundance of the pitcher plant (*Sarracenia purpurea*). According to Strausbaugh and Core (1977), pitcher plant is an exotic at Big Run Bog, having been introduced in 1946. Should this species continue to expand, it could threaten the abundance of other plant species. Yet, significant soil damage could result from its removal. Also, arguments from both a scientific and aesthetics perspective can be made for retaining the pitcher plant at Big Run, at least at current population levels.

A second potential threat to Big Run Bog is overvisitation by students and researchers. While this level of interest is encouraging in that direct observation is a major reason for establishing research natural areas, damage to the bog's fragile soil is a genuine concern. Current informal policy of the Monongahela National Forest is to direct researchers and students to other bogs on the Forest so long as these alternate areas meet scientific and educational objectives.

One long-term option is to construct a modest boardwalk for observations of the Big Run Bog. This approach seems to work well at Cranberry Glades, another bog on the Monongahela. A management plan for Big Run Bog will be included in the establishment record that is being prepared in connection with the formal establishment of the bog as an RNA.

²West Virginia Department of Natural Resources, 1984-1986. Site survey summaries and special plant survey forms. Unpublished wildlife/heritage data base on file at Wildlife Resources Division of West Virginia Department of Natural Resources at Elkins, West Virginia.

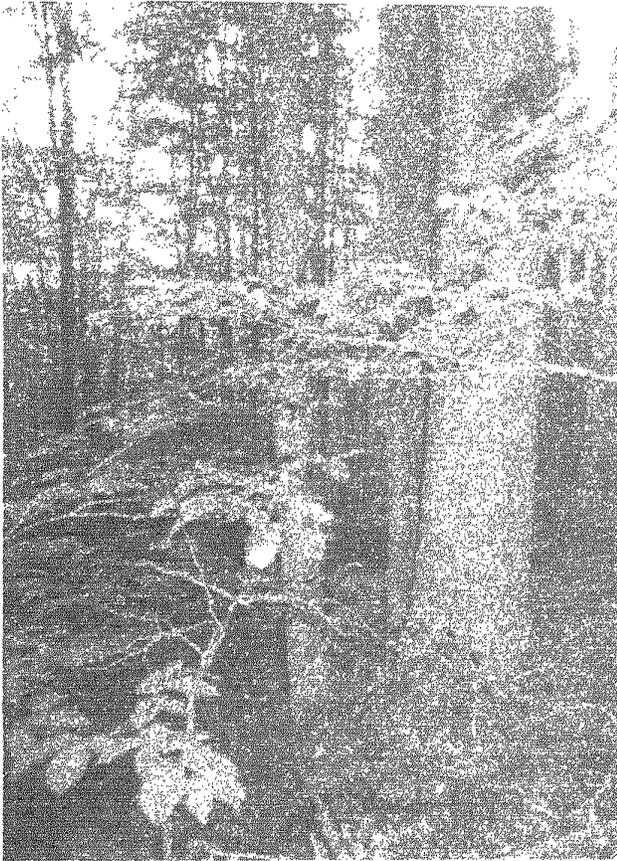


Figure 3.—The Northern Hardwood Forest surrounding the bog; it consists primarily of black cherry and sugar maple.



Figure 4.—View of red spruce forest.



Figure 5.—The transition zone forms the border between the bog and surrounding forests.

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Table 1.—Checklist of vascular plants and their habitat and occurrence in Big Run Bog candidate Research Natural Area, Monongahela National Forest, West Virginia (all are of native origin except where noted; NHF = Northern Hardwood Forest, TZ = Transition Zone)

Scientific name	Common name	Location and abundance
	ACERACEAE	
<i>Acer pensylvanicum</i>	Striped maple	Abundant in NHF
<i>Acer rubrum</i>	Red maple	Abundant in NHF, frequent in TZ, and as dwarfed individuals on hummocks in Bog
<i>Acer saccharum</i>	Sugar maple	Infrequent in NHF
	AQUIFOLIACEAE	
<i>Ilex montana</i>	Mountain winterberry	Abundant in NHF
<i>Ilex verticillata</i>	Winterberry	Abundant in TZ, frequent to abundant in portions of Bog
<i>Nemopanthus mucronatus</i>	Appalachian mountain holly	Abundant in TZ, frequent as diminutive plants on hummocks in Bog
	ARACEAE	
<i>Arisaema triphyllum</i>	Indian-turip	Infrequent in NHF
<i>Orontium aquaticum</i>	Golden club	Rare in small streams in Bog
	ARALIACEAE	
<i>Aralia nudicaulis</i>	Wild sarsparilla	Infrequent in open NHF
<i>Aralia spinosa</i>	Devil's walkingstick (Hercules' club)	Infrequent in NHF and at borders of forests
<i>Panax trifolium</i>	Dwarf ginseng	Infrequent in NHF
	ASPLENIACEAE	
<i>Athyrium filix-femina</i>	Lady fern	Infrequent in moist NHF, edges of streams and borders of Bog
<i>Dryopteris campyloptera</i>	Mountain woodfern	Rare in NHF
<i>Dryopteris intermedia</i> (<i>D. spinulosa</i>)	Spinulose (Fancy wood fern)	Frequent in NHF
<i>Polystichum acrostichoides</i>	Christmas fern	Infrequent in NHF
<i>Thelypteris noveboracensis</i>	New York fern	Frequent in NHF
	ASTERACEAE (COMPOSITAE)	
<i>Aster acuminatus</i>	Mountain aster (Whorled aster)	Infrequent in NHF
<i>Aster divaricatus</i>	White heart-leaved aster	Infrequent in open NHF
<i>Aster lateriflorus</i>	Goblet aster	Infrequent in open NHF
<i>Aster macrophyllum</i>	Big-leaved aster	Rare in open NHF
<i>Aster prenanthoides</i>	Zigzag aster	Infrequent in moist open NHF
<i>Bidens frondosa</i>	Devil's beggarticks	Infrequent in open wet NHF
<i>Erigeron annuus</i>	Annual fleabane	Infrequent in open NHF
<i>Erigeron philadelphicus</i>	Philadelphia daisy	Infrequent in disturbed areas of NHF
<i>Erigeron pulchellus</i>	Robin's plantain	Infrequent in open NHF
<i>Erigeron strigosus</i>	Rough fleabane	Infrequent in disturbed areas of NHF
<i>Eupatorium fistulosum</i>	Joe pye plant	Infrequent in moist open NHF
<i>Eupatorium perfoliatum</i>	Boneset	Infrequent in wet open NHF and borders of TZ and Bog
<i>Eupatorium rugosum</i>	White snakeroot	Frequent in NHF
<i>Euthamia graminifolia</i> (<i>Solidago graminifolia</i>)	Flattopped goldenrod (Grass-leaved goldenrod)	Infrequent in moist open NHF
<i>Hieracium paniculatum</i>	Panicled hawk plant	Infrequent along roads in NHF
<i>Hieracium scabrum</i>	Sticky hawk plant	Rare along roads in NHF
<i>Prenanthes altissima</i>	Tall white lettuce	Rare in open NHF
<i>Senecio aureus</i>	Golden ragwort	Infrequent in moist open NHF
<i>Solidago caesia</i>	Wand goldenrod	Frequent in NHF

Continued

Scientific name	Common name	Location and abundance
<i>Solidago bicolor</i>	Silver rod	Infrequent in open dry NHF
<i>Solidago erecta</i>	Goldenrod	Infrequent in open dry NHF
<i>Solidago rugosa</i>	Wrinkle-leaved goldenrod	Common in moist open NHF
<i>Solidago uliginosa</i>	Northern bog goldenrod	Frequent in Bog
BALSAMINACEAE		
<i>Impatiens capensis</i>	Orange touch-me-not	Infrequent in open wet NHF
<i>Impatiens pallida</i>	Yellow touch-me-not	Infrequent in moist open NHF
BERBERIDACEAE		
<i>Podophyllum peltatum</i>	May apple	Infrequent in NHF
BETULACEAE		
<i>Betula alleghaniensis</i>	Yellow birch	Abundant in NHF, infrequent in TZ
<i>Betula lenta</i>	Sweet birch (Cherry birch) (Black birch)	Frequent in NHF, infrequent in TZ and Spruce Forest
CAMPANULACEAE		
<i>Lobelia inflata</i>	Indian tobacco	Infrequent in openings in NHF
CAPRIFOLIACEAE		
<i>Viburnum alnifolium</i>	Witchhobble (Hobblebush)	Infrequent in NHF
<i>Viburnum nudum</i> var. <i>cassinoides</i>	Wild raisin (Witherod)	Frequent in TZ, infrequent in hummocks of Bog
CARYOPHYLLACEAE		
<i>Stellaria pubera</i>	Great chick plant (Star chick plant)	Infrequent in NHF
CLUSIACEAE (GUTTIFERAE)		
<i>Hypericum canadense</i>	St. Johnswort	Frequent in lower end of Bog and in wet ditches
<i>Hypericum densiflorum</i>	Shrubby St. Johnswort	Frequent mostly in lower portion of Bog and TZ
<i>Hypericum punctatum</i>	Spotted St. Johnswort	Infrequent in open NHF
<i>Triadenum virginicum</i>	Marsh St. Johnswort	Infrequent on beaver dams in Bog
CYPERACEAE		
<i>Carex baileyi</i>		Infrequent in Bog
<i>Carex brunnescens</i>		Rare on sandstone boulders in NHF
<i>Carex canescens</i>	Hoary sedge	Abundant in portions of Bog
<i>Carex communis</i>		Infrequent in NHF
<i>Carex crinita</i>		Frequent in portions of Bog and TZ
<i>Carex debilis</i> var. <i>rudgei</i>		Frequent in NHF
<i>Carex digitalis</i>		Frequent in NHF
<i>Carex folliculata</i>		Abundant in portions of Bog
<i>Carex interior</i>		Frequent in Bog
<i>Carex intumescens</i>		Frequent in NHF
<i>Carex laxiflora</i>		Frequent in NHF
<i>Carex lurida</i>		Infrequent in Bog and TZ
<i>Carex pennsylvanica</i>		Frequent in NHF
<i>Carex radiata</i>		Infrequent in NHF
<i>Carex rosea</i>		Infrequent in NHF
<i>Carex scoparia</i>		Infrequent in Bog
<i>Carex stipata</i>		Infrequent in Bog
<i>Carex trisperma</i>		Frequent in Bog
<i>Dulichium arundinaceum</i>	Three-way sedge	Frequent in Bog
<i>Eleocharis tenuis</i>	Spike rush	Infrequent in Bog
<i>Eriophorum virginicum</i>	Tawny cottongrass	Frequent in Bog

Continued

Scientific name	Common name	Location and abundance
<i>Rhynchospora alba</i>	White beakrush	Abundant in Bog
<i>Scirpus atrocinctus</i>		Frequent in portions of Bog
<i>Scirpus atrovirens</i>	Bulrush	Infrequent in open wet NHF and in ditches
DENNSTAEDTIACEAE		
<i>Dennstaedtia punctilobula</i>	Hay scented fern	Frequent or abundant in NHF
<i>Pteridium aquilinum</i> var. <i>latiusculm</i>	Bracken fern	Infrequent in open NHF
DIOSCOREACEAE		
<i>Dioscorea quaternata</i>	Yam	Infrequent in NHF
DROSERACEAE		
<i>Drosera rotundifolia</i>	Sundew	Frequent in Bog
ERICACEAE		
<i>Chimaphila maculata</i>	Spotted wintergreen	Frequent in NHF
<i>Gaultheria hispida</i>	Creeping snowberry	Frequent on hummocks in Bog, infrequent in Red Spruce Forest and TZ
<i>Gaultheria procumbens</i>	Mountain tea (Teaberry)	Frequent in NHF
<i>Gaylussacia baccata</i>	Black huckleberry	Infrequent in open NHF and on hummocks in Bog
<i>Kalmia latifolia</i>	Mountain laurel	Frequent in NHF and TZ and on hummocks in Bog
<i>Menziesia pilosa</i>	Minniebush	Infrequent in open NHF and on hummocks in Bog
<i>Oxydendrum arboreum</i>	Sourwood	Rare in NHF
<i>Rhododendron maximum</i>	White laurel (Great laurel)	Abundant in portions of NHF, Spruce Forest, and TZ, and infrequent as dwarfed plants in Bog
<i>Vaccinium angustifolium</i>	Low sweet blueberry	Frequent on hummocks in Bog and TZ, infrequent in NHF
<i>Vaccinium corymbosum</i>	Highbush blueberry	Rare in TZ and on hummocks in Bog
<i>Vaccinium macrocarpon</i>	Large cranberry	Common in portions of Bog
<i>Vaccinium myrtilloides</i>	Sourtop (Velvet-leaf blueberry)	Frequent in portions of Bog and TZ
<i>Vaccinium oxycoccos</i>	Small cranberry	Abundant in portions of Bog and extending into TZ
<i>Vaccinium pallidum</i>	Hillside blueberry	Infrequent in NHF and TZ
FAGACEAE		
<i>Fagus grandifolia</i>	American Beech	Abundant in NHF
<i>Quercus rubra</i>	Northern red oak	Infrequent or locally several in NHF
GENTIANACEAE		
<i>Gentiana linearis</i>	Narrow-leaved gentian	Frequent in portions of Bog
HAMAMELIDACEAE		
<i>Hamamelis virginiana</i>	Witch hazel	Abundant in NHF and TZ
ISOETACEAE		
<i>Isoetes engelmannii</i>	Engelmann's quillwort	Rare in small shallow stream on east side of Bog
JUNCACEAE		
<i>Juncus effusus</i>	Soft rush	Frequent in portions of Bog and open wet forests
<i>Juncus brevicaudatus</i>	Fern rush	Infrequent in lower end of Bog
<i>Juncus subcaudatus</i>	Blake rush	Frequent in Bog
<i>Juncus tenuis</i>	Path rush	Infrequent along trails and roads in NHF

Continued

Scientific name	Common name	Location and abundance
	LAMICEAE (LABIATAE)	
<i>Lycopus uniflorus</i>	Northern water horehound	Infrequent in open wet NHF
	LAURACEAE	
<i>Sassafras albidum</i>	Sassafras	Infrequent in NHF
	LILIACEAE	
<i>Disporum lanuginosum</i>	Fairy bells	Infrequent in NHF
<i>Erythronium americanum</i>	Trout lily (Fawn lily)	Frequent in NHF
<i>Maianthemum canadense</i>	Canada mayflower	Frequent in NHF, infrequent in Spruce Forest
<i>Medeola virginiana</i>	Indian cucumber root	Infrequent in NHF
<i>Smilacina racemosa</i>	Plume lily	Infrequent in NHF
<i>Smilax herbacea</i> var. <i>herbacea</i>	Carrion flower	Infrequent in NHF
<i>Smilax hispida</i>	Bristly greenbrier	Infrequent in NHF
<i>Smilax rotundifolia</i>	Greenbrier	Frequent in NHF
<i>Trillium erectum</i>	Purple trillium	Infrequent in NHF
<i>Trillium undulatum</i>	Painted trillium	Infrequent in NHF and Spruce Forest
	LYCOPODIACEAE	
<i>Lycopodium annotinum</i>	Stiff clubmoss	Frequent in NHF and Spruce Forest
<i>Lycopodium clavatum</i>	Running pine	Abundant in portions of NHF
<i>Lycopodium digitatum</i> (<i>L. flabelliforme</i>)	Southern ground-cedar	Abundant in portions of NHF
<i>Lycopodium inundatum</i>	Bog clubmoss	Locally abundant in small area on east side of Bog
<i>Lycopodium lucidulum</i>	Shining clubmoss	Rare in NHF
<i>Lycopodium obscurum</i>	Ground-pine (Tree clubmoss)	Abundant in portions of NHF and TZ
	MAGNOLIACEAE	
<i>Liriodendron tulipifera</i>	Tuliptree (yellow-poplar)	Infrequent, mostly as seedlings or saplings, in NHF
<i>Magnolia acuminata</i>	Cucumbertree	Frequent in NHF
<i>Magnolia fraseri</i>	Mountain umbrella tree	Frequent in NHF
	MENYANTHACEAE	
<i>Menyanthes trifoliata</i>	Buckbean	Rare (about 60 plants near small stream) on east side of Bog
	MONOTROPACEAE	
<i>Monotropa uniflora</i>	Indian pipe	Infrequent in NHF
	ONOGRACEAE	
<i>Circaea lutetiana</i> (<i>C. quadrisulcata</i> var. <i>canadensis</i>)	Common enchanter's nightshade	Rare in NHF
	OPHIOGLOSSACEAE	
<i>Botrychium dissectum</i>	Lacefrond grapefern	Infrequent in NHF
<i>Botrychium virginianum</i>	Rattlesnake fern	Infrequent in NHF
	ORCHIDACEAE	
<i>Calopogon tuberosus</i>	Grass-pink	Rare in small area on east side of Bog
<i>Corallorhiza wisteriana</i>	Coralroot	Rare in NHF
<i>Habenaria clavellata</i>	Club-spur orchid	Frequent in small area on east side of Bog
<i>Listera smallii</i>	Appalachian twayblade	Rare in small area of TZ, under <i>Rhododendron maximum</i> on east side of Bog
<i>Pogonia ophioglossoides</i>	Rose pogonia	Rare in eastern side of Bog
	OROBANCHACEAE	
<i>Conopholis americana</i>	Cancer-root (Squaw-root)	Infrequent root parasite on red oak in NHF

Continued

Scientific name	Common name	Location and abundance
<i>Epifagus virginiana</i>	Beechdrops	Frequent as root parasite on beech in NHF
	OSMUNDACEAE	
<i>Osmunda cinnamomea</i>	Cinnamon fern	Frequent in moist open NHF, TZ, Spruce Forest, and portions of Bog
<i>Osmunda claytoniana</i>	Interrupted fern	Frequent in moist open NHF, TZ, and portions of Bog
	OXALIDACEAE	
<i>Oxalis acetosella</i>	Northern wood sorrel	Frequent in NHF
	Mountain wood sorrel	infrequent in Spruce Forest
<i>Oxalis stricta</i>	Common yellow wood sorrel	Infrequent in open NHF and along roads
	PINACEAE	
<i>Picea rubens</i>	Red spruce	Abundant in Spruce Forest, frequent in NHF, TZ, and on hummocks in Bog
<i>Pinus strobus</i>	Eastern white pine	Infrequent in NHF and Spruce Forest
<i>Tsuga canadensis</i>	Eastern hemlock	Frequent in NHF, TZ, and Spruce Forest
	PLANTAGINACEAE	
<i>Plantago rugelii</i>	American plantain	Infrequent in open disturbed NHF
	POACEAE (GRAMINEAE)	
<i>Agrostis gigantea</i> (<i>A. alba</i>) ^a	Redtop	Invasive grass planted along roads and in clearcuts
<i>Agrostis perennans</i>		Frequent in open NHF and Bog
<i>Brachyelytrum erectum</i>		Frequent in NHF
<i>Danthonia compressa</i>	Allegheny flybackgrass	Frequent in open NHF, TZ, and open areas
<i>Festuca elatiora</i> ^a	Meadow fescue	Infrequent invasive grass along roads and in clearcuts
<i>Glyceria melicaria</i>		Infrequent in open wet NHF, TZ, and Spruce Forest
<i>Glyceria canadensis</i>	Rattlesnake mannagrass	Infrequent in Bog
<i>Glyceria striata</i>	Fowl mannagrass	Infrequent in open wet NHF, TZ, and Spruce Forest
<i>Leersia oryzoides</i>		Infrequent in Bog
<i>Leersia virginica</i>	Whitegrass	Infrequent in open wet NHF
<i>Muhlenbergia schreberi</i>	Nimblewill	Infrequent in openings of NHF
<i>Panicum clandestinum</i>	Deer tongue grass	Frequent in moist open NHF, TZ, and along streams
<i>Panicum lanuginosum</i>		Infrequent in open NHF
<i>Panicum latifolium</i>		Infrequent in moist open NHF
<i>Poa alsodes</i>		Infrequent but may be locally abundant in open NHF
<i>Poa pratensis</i> ^a	Kentucky bluegrass	Infrequent invasive grass in Bog and other open areas
	POLYGONACEAE	
<i>Polygonum sagittatum</i>	Arrow-leaved tearthumb	Infrequent in open wet TZ, NHF, and Bog
<i>Rumex acetosella</i> ^a	Red sorrel	Infrequent in openings in NHF
	PORTULACAEAE	
<i>Claytonia caroliniana</i>	Spring beauty (Fairy spuds)	Frequent in NHF
	PRIMULACEAE	
<i>Lysimachia quadrifolia</i>	Whorled loosestrife	Infrequent in open NHF
<i>Trientalis borealis</i>	Starflower	Infrequent in NHF

Continued

Scientific name	Common name	Location and abundance
	RANUNCULACEAE	
<i>Anemone quinquefolia</i>	Wood anemone (Windflower)	Frequent in NHF
<i>Clematis virginiana</i>	Virgin's bower	Infrequent in moist open NHF
<i>Ranunculus abortivus</i>	Small-flowered buttercup	Infrequent in openings in NHF
<i>Ranunculus recurvatus</i>	Hooked buttercup	Infrequent in open NHF
	ROSACEAE	
<i>Amelanchier laevis</i>	Juneberry (Serviceberry) (Sarvis)	Frequent in NHF and TZ
<i>Aronia melanocarpa</i>	Black chokeberry	Frequent in portions of Bog
<i>Fragaria virginica</i>	Wild strawberry	Infrequent in openings in NHF
<i>Potentilla canadensis</i>	Running five fingers (Cinquefoil)	Infrequent in open NHF
<i>Prunus pensylvanica</i>	Pin cherry (Fire cherry) (Bird cherry)	Infrequent in open NHF
<i>Prunus serotina</i>	Wild black cherry	Abundant in NHF, frequent in TZ
<i>Rubus allegheniensis</i>	Common blackberry	Infrequent in open NHF
<i>Rubus canadensis</i>	Smooth blackberry	Infrequent in openings of NHF
<i>Rubus hispidus</i>	Swamp dewberry	Abundant in Bog and portions of TZ, infrequent in NHF
<i>Sorbus americana</i>	Mountain-ash	Infrequent in NHF and Spruce Forests, and on hummocks in Bog
	RUBIACEAE	
<i>Hedyotis michauxii</i> (<i>Houstonia serpyllifolia</i>)	Mountain bluets	Infrequent in NHF and Spruce Forest
<i>Mitchella repens</i>	Partridgeberry	Frequent in NHF and Spruce Forest
	SARRACENIACEAE	
<i>Sarracenia purpurea</i> ^b	Pitcher-plant	Frequent in small area on east side of Bog
	SAXIFRAGACEAE	
<i>Parnassia asarifolia</i>	Kidney-leaved grass-of-parnassus	Rare in small area on east side of Bog
<i>Ribes rotundifolium</i>	Round-leaved gooseberry	Rare in NHF
<i>Tiarolla cordifolia</i>	Foamflower	Rare in moist open NHF
	SCROPHULARIACEAE	
<i>Chelone glabra</i>	Turtlehead	Infrequent in open wet NHF and TZ
	SPARGANIACEAE	
<i>Sparganium chlorocarpum</i>	Small burreed	Infrequent in open water in Bog
	TAXACEAE	
<i>Taxus canadensis</i>	American yew	Rare in TZ and on hummocks in Bog
	URTICACEAE	
<i>Laportea canadensis</i>	Wood nettle	Infrequent in NHF
<i>Pilea pumila</i>	Clearweed	Infrequent in moist open NHF
	VIOLACEAE	
<i>Viola blanda</i>	Sweet white violet	Frequent in open wet NHF and TZ
<i>Viola rotundifolia</i>	Round-leaved yellow violet	Frequent in NHF
<i>Viola sororia</i>	Stemless blue violet	Frequent in moist open NHF

^a Exotic

^b Apparently transplanted by humans (William Wylie, pers. commun.)

Table 2.—Checklist of nonvascular plants (liverworts) and mosses and their habitat in Big Run Bog candidate Research Natural Area, Monongahela National Forest, West Virginia (NHF = Northern Hardwood Forest)

Species		Habitat
HEPATICAE (LIVERWORTS)		
CALYPOGEEACEAE		
<i>Calypogeia trichomanis</i>		On sandstone boulders in NHF
CEPHALOZIIACEAE		
<i>Cephalozia lunulifolia</i>		On sandstone rocks in small stream in NHF
<i>Nowellia curvifolia</i>		On rotting, moist conifer logs in Conifer-Hardwood Forest
GYMNOMITRIACEAE		
<i>Marsupella sphacelata</i>		On sandstone rocks along stream in NHF
JUBULACEAE		
<i>Frullania eboracensis</i>		On trunks of deciduous trees in NHF
<i>Frullania tamarisci</i>		On trunks of deciduous trees in NHF
LEPIDOZIIACEAE		
<i>Bazzania trilobata</i>		Growing under red spruce in Spruce Forest
<i>Lepidozia reptans</i>		On base of deciduous trees in NHF
LOPHOCOLEACEAE		
<i>Lophocolea heterophylla</i>		On wet soil and humus in Transition Zone and Spruce Forest
PELLIACEAE		
<i>Pellia epiphlla</i>		On moist deciduous logs in NHF
PORELLACEAE		
<i>Porella platyphyloidea</i>		On base of deciduous trees growing along stream in NHF
SCAPANIACEAE		
<i>Scapania nemorosa</i>		On moist sandy margin of small stream at edge of Bog
TILIDIACEAE		
<i>Ptilidium pulcherrimum</i>		On lower trunk of red spruce tree in Spruce Forest
MUSCI (MOSESSES)		
AMBLYSTEGIACEAE		
<i>Amblystegium riparium</i>		On moist sandy soil in NHF
<i>Amblystegium tenax</i>		On wet sandstone cobbles in small stream in NHF
<i>Amblystegium varium</i>		On moist deciduous log in NHF
<i>Platydictya subtile</i>		On trunks of deciduous trees in NHF
AULACOMNIACEAE		
<i>Aulacomnium palustre</i>		On wet humus at edge of Bog
BARTRAMIACEAE		
<i>Philonotis fontana</i>		On conifer logs in Transition Zone
<i>Philonotis glaucescens</i>		On moist humus in open NHF
BRACHYTHECIACEAE		
<i>Brachythecium oxycladon</i>		On soil and rotting log in NHF
<i>Brachythecium salebrosum</i>		On humus in NHF
<i>Bryhnia novae-angliae</i>		On moist soil in NHF
<i>Boyoandersonia illecebra</i>		On humus in Hemlock-Hardwood Forest
<i>Eurhynchium hians</i>		On humus in NHF
<i>Eurhynchium riparioides</i>		On wet sand along small stream in NHF

Continued

Species		Habitat
	CLIMACIACEAE	
<i>Climacium americanum</i>		On moist soil in open NHF
	DICRANACEAE	
<i>Dicranella heteromalla</i>		On rotting deciduous logs in NHF
<i>Dicranum fulvum</i>		On base of red spruce trees in NHF
<i>Dicranum scoparium</i>		On soil and rotting wood in NHF
<i>Dicranum viride</i>		On soil in NHF
	ENTODONTACEAE	
<i>Entodon cladorrhizans</i>		On rotting hardwood logs and sandstone boulders in NHF
<i>Entodon seductrix</i>		On humus in open NHF
<i>Pleurozium schreberi</i>		On soil in NHF
	HEDWIGIACEAE	
<i>Hedwigia ciliata</i>		On sandstone rocks in NHF
	HYLOCOMIACEAE	
<i>Hylocomium brevirostre</i>		On humus in moist Hemlock-Hardwood Forest
<i>Hylocomium splendens</i>		On rotting deciduous logs in NHF
	HYPNACEAE	
<i>Homomallium adnatum</i>		On deciduous trees in NHF
<i>Hypnum cupressiforme</i>		On rotting logs in NHF
<i>Hypnum curvifolium</i>		On decaying logs in NHF
<i>Hypnum imponens</i>		On rotting logs in NHF
<i>Hypnum lindbergii</i>		On rotting logs in NHF
<i>Isopterygium elegans</i>		On snags of deciduous trees in NHF
<i>Isopterygium tenerum</i>		On soil at base of deciduous trees in NHF
<i>Platygyrium repens</i>		On deciduous logs in NHF
<i>Pylaisiella intricata</i>		On base of yellow birch trees in NHF
<i>Taxiphyllum deplanatum</i>		On rotting deciduous logs and moist soil in NHF
	LESKEACEAE	
<i>Leskea obscura</i>		On sandstone boulders in NHF
<i>Leskeella nervosa</i>		On sandstone rocks in small stream in NHF
<i>Lindbergia brachytera</i>		On decaying deciduous logs in NHF
	LEUCOBRYACEAE	
<i>Leucobryum glaucum</i>		On humus in Spruce Forest
	MNIACEAE	
<i>Mnium affine</i>		On wet forest litter and humus in NHF
<i>Mnium cuspidatum</i>		On rotting deciduous logs in NHF
<i>Mnium hornum</i>		On moist sandy soil along small stream in NHF
<i>Mnium punctatum</i>		On moist soil in NHF
	NECKERACEAE	
<i>Neckera pennata</i>		On decaying hardwood logs in NHF
	ORTHOTRICACEAE	
<i>Ulota crispa</i>		On bark of deciduous trees in NHF
	PLAGIOTHECIACEAE	
<i>Plagiothecium denticulatum</i>		On litter and humus in NHF
	POLYTRICHACEAE	
<i>Atrichum angustatum</i>		On soil in open NHF
<i>Atrichum crispum</i>		On hummocks in Bog
<i>Pogonatum pensilvanicum</i>		On soil in open NHF
<i>Polytrichum commune</i>		In open NHF, on soil, and on hummocks in Bog
<i>Polytrichum ohioense</i>		On soil in NHF
<i>Polytrichum juniperinum</i>		On hummocks and valleys between hummocks in Bog

Continued

Species		Habitat
	POTTIACEAE	
<i>Tortella humilis</i>		On soil in NHF
	RHYTIDIACEAE	
<i>Rhytidiadelphus triquetrus</i>		On soil and litter in NHF
	SEMATOPHYLLACEAE	
<i>Brotherella recurvans</i>		On base of conifers, on rotting logs, and on soil in NHF
<i>Heterophyllum affine</i>		On rotting logs in NHF
<i>Sematophyllum adnatum</i>		On base of deciduous trees in NHF
	SPHAGNACEAE	
<i>Sphagnum capillaceum</i>		On humus in open wet NHF
<i>Sphagnum compactum</i>		In shallow standing water in open NHF
<i>Sphagnum fallax</i>		In open wet NHF
<i>Sphagnum fimbriatum</i>		On hummocks in Bog
<i>Sphagnum girgensohnii</i>		In Bog
<i>Sphagnum henryense</i>		At edge of Bog and Transition Zone
<i>Sphagnum imbricatum</i>		On hummocks in Bog
<i>Sphagnum magellanicum</i>		In Bog
<i>Sphagnum palustre</i>		On humus in Bog
<i>Sphagnum recurvum</i>		In Bog and Transition Zone
<i>Sphagnum subtile</i>		On wet soil and humus at border of Spruce Forest
<i>Sphagnum subsecundum</i>		In humus along stream at lower end of Bog
	TETRAPHIDACEAE	
<i>Tetraphis pellucida</i>		On rotting logs and stumps in NHF
	THUIDIACEAE	
<i>Anomodon rostratus</i>		On soil over roots at base of deciduous trees in NHF
<i>Haplocladium virginianum</i>		On humus in Conifer-Birch Forest
<i>Haplohymenium triste</i>		On rotting conifer logs in Hemlock-Hardwood Forest
<i>Thuidium delicatulum</i> var. <i>delicatulum</i>		On rotting logs, stumps, and humus in NHF
<i>Thuidium recognitum</i>		On soil in NHF