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Botanical Reconnaissance of Nancy Brook Research Natural Area

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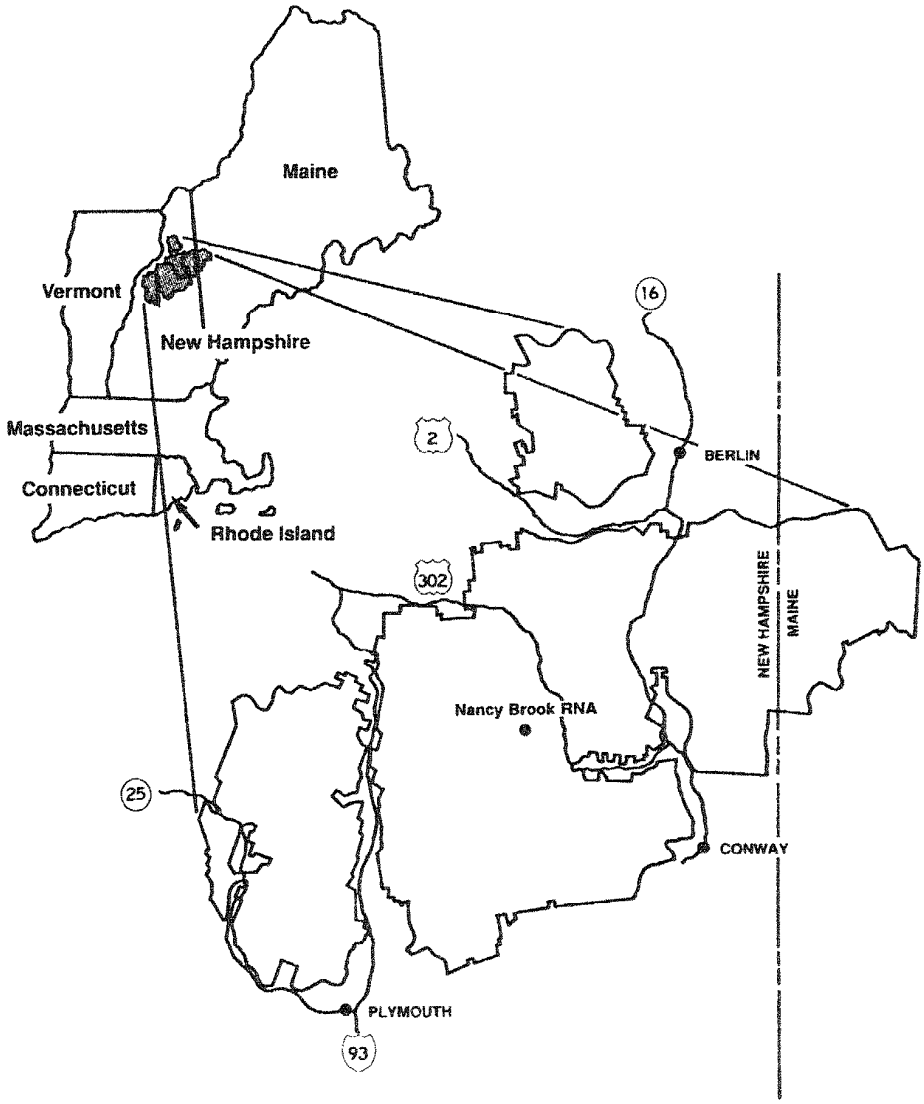

Abstract

A survey of the flora and natural communities of Nancy Brook Research Natural Area (RNA), Crawford Notch, White Mountain National Forest, New Hampshire, was conducted during the summer and fall of 1992. Nancy Brook RNA is noted for being the largest, virgin mountain spruce-fir forest in New Hampshire, and one of the few remaining large examples in the northeastern United States. The primary goal was to characterize major natural community associations observed across representative areas within the RNA and document the flora contained therein. The area was surveyed by walking transects across community and landscape types that were delineated using aerial photographs and geologic, topographic, cover type, maturity class, and Ecological Land Type maps. Eleven community types or variants were differentiated, based on observed differences in vegetation physiognomy, and species composition and abundance. A series of temporary plots was used to sample eight of the communities more quantitatively. A total of 167 species of vascular plants in 43 families, and 29 species of mosses and liverworts were recorded. Two state-threatened species, Wiegand's sedge (*Carex wiegandii*) and mountain avens (*Geum peckii*), were inventoried at previously documented locations. Searches in 1992 revealed populations of the state-threatened Pickering's reed-grass (*Calamagrostis pickeringii*) in small stream-side acidic fen communities. Two alpine-subalpine plants were also discovered: mountain sandwort (*Arenaria groenlandica)* on a rock slide just west of the RNA boundary, and alpine bilberry (*Vaccinium uliginosum* var. *alpinum*) at a few high-elevation stations within the study area. A pair of northern three-toed woodpeckers (*Picoides tridactylus*) observed in the spruce-fir blow-down forest confirmed historic observations of this rare species. Descriptions and discussion of all community types and rare plants, an annotated checklist of the flora, and a discussion of phytogeographic affinities of the RNA are provided.

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Botanical Reconnaissance of Nancy Brook Research Natural Area

Foreword

The Forest Service 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, education, and to maintain natural diversity and ecological processes.

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

Although the RNA program began more than 65 years ago, research and monitoring on RNA's only began recently. As the Forest Service moves in the direction of ecological management, information on RNA's will serve a vital role in forest management.

In an effort 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. The program began in 1991 with funding support from the RNA Matching Grant Program sponsored by the Chief of the Forest Service.

The first three reports in the series are:

Botanical Reconnaissance of
Mountain Pond Research Natural Area

Botanical Reconnaissance of
The Bowl Research Natural Area

Botanical Reconnaissance of
Nancy Brook Research Natural Area

Study Area

Nancy Brook Research Natural Area (RNA) is located in the White Mountain National Forest in Carroll and Grafton Counties, New Hampshire. The RNA is 601 ha in size. It includes the watershed of Nancy Brook west of the western boundary of Harts Location, and the upper watershed of Halfway Brook above 426 m. The upper boundaries of the two watersheds reach the summits of Mount Bemis (1129 m) to the north, Mount Nancy (1190 m) to the northwest, the east shoulder of Mount Anderson (1060 m) to the west, and Duck Pond Mountain (1001 m) to the south, including the southeast shoulder named Mount Saunders (~952 m). The area contains the brooks mentioned above, Nancy Pond in the west, several acidic fens near the pond, a beaver pond to the north, and Nancy Cascade, which is roughly in the center of the RNA. One of the acidic fens close to Nancy Pond contains a rare northern sedge, Wiegand's sedge (*Carex wiegandii*). The cascade is of special note for its scenic qualities and for the population of the globally rare mountain avens (*Geum peckii*) that grows in moist rock crevices there.

The Nancy Pond Trail runs from Route 302 in Crawford Notch across Halfway Brook and Nancy Brook before it climbs up to the Nancy Brook cascade. The trail climbs the steep slope south of the cascade through some old forest before reaching the major portion of old-growth forest found on more level terrain above the cascade. It then passes just north of a small acidic fen before coming within view of Nancy Pond, then passes a second fen north of Nancy Pond just before ascending a height of land that marks the boundary between the RNA and the Pemigiwasett Wilderness Area. This boundary is the divide between the Saco River and the Merrimack River watersheds.

The terrain varies from the relatively gentle slopes of the valley above the cascade between Mount Bemis and the summit of Duck Pond Mountain, to the rugged slopes (40 degrees to vertical) of Mount Nancy, Mount Bemis, and the lower sides of Duck Pond Mountain. The combination of steep terrain and blow-down forest makes travel difficult through much of the area.

Much of the bedrock of Nancy Brook RNA is part of the Littleton Formation which, in this area, is chiefly composed of gray gneiss. Small slivers of Littleton Formation lime-silicates are mapped in the Halfway Brook drainage. East of the cascades is a section of Mount Lafayette Granite Porphyry. The northwestern third of the RNA is underlaid by Mount Osceola and Conway granites. Henderson and others (1977) describe the geology of this quadrangle in greater detail.

Surficial deposits are largely composed of shallow to deep, well-drained, bouldery, sandy loam or loamy sand tills, with locally derived boulders comprising large percentages of the volume. Poorly drained soils and peat deposits are found locally within the more prominently featured permeable tills. Ecological Land Type (ELT) descriptions provide further information on geomorphic and substrate conditions.[1] Bailey and Hornbeck (1992) demonstrated that till composition could be reasonably well predicted by estimating the proportions of bedrock contributions within a wedge-shaped source area. Casual observation of bedrock maps indicate that the lithological composition of tills within the RNA consists primarily of low base-cation yielding drift indicative of the nearby bedrock source areas.

The predominant natural community type in the Nancy Brook RNA is the Mountain Spruce-Fir Forest. This forest type is dominated by red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) forests, with heartleaf birch (*Betula cordifolia*) as a common subdominant tree species. Much of the variation seen in the vegetation in the spruce-fir zone relates to disturbance events of various extents and ages. In areas with severe blow-down, fire, or spruce budworm damage, heartleaf birch may become locally dominant. Some areas are influenced by finer scale gap dynamics, generating single tree openings. Thus, several of the community types described herein are disturbance related variants of the more broadly defined Mountain Spruce-Fir Forest Community. The upper slopes of Duck Pond Mountain, the shoulder north and east of this summit, and the eastern arm of Mt. Bemis experienced catastrophic blow-down during the 1938 hurricane. These areas are dominated by dense birch, red spruce, and balsam fir seedlings. Protected areas around and above Nancy Brook cascades and the upper basin of Halfway Brook harbor the remains of a nationally significant virgin spruce forest. These stands are noted for old-growth spruce, a multi-layered canopy, and significant accumulation of organic matter on the forest floor. This forest and the adjacent blow-down areas are habitat for the rare northern three-toed woodpecker (*Picoides tridactylus*).

The forest below 731 m in areas with eastern exposure (higher with southern exposures and lower with northern) contains northern hardwood forests dominated by American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*). Most of this forest below 793 m was logged both before and after the 1938 hurricane.

Methods

Aerial photographs of the RNA were overlaid with maps of Ecological Land Types (ELTs), bedrock geology, topographic position and elevation, stand types, maturity classes and known unique features. Transects intersecting most combinations of these various vegetation and environmental parameters were laid out on a topographic base map. Transects were located in the field and followed using a Silva Ranger compass, a photocopied topographic

[1] U.S.Department of Agriculture. 1986. Establishment record for Nancy Brook Research Natural Area within the White Mountain National Forest, Grafton County, New Hampshire. 6200-M7(10/73). Durham, NH: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

base map, and an altimeter (Casio Alti-Depthmeter watch).[2] Observation points were documented in field notes and on The Nature Conservancy (TNC)/Natural Heritage Reconnaissance Forms each time the vegetative structure or species composition changed. Information recorded included brief descriptions of community type, soil type, vegetation physiognomy, and dominant and other species. After traversing each transect, and investigating other communities illuminated through further landscape analysis, eight communities were selected for more intensive description. These samples were used to provide more substantial descriptions of the major natural community patterns readily observed and no attempt was made to analyze the data quantitatively.

Within each forest community three to five temporary 20- x 20-m plots were established in representative areas, as detailed in TNC field form instructions (The Nature Conservancy 1991 - Habitat/Vegetation Description Form 3). Stream shore communities were sampled using 10- x 10-m plots, and open wetlands were sampled using 5- x 5-m plots. Sample data recorded included landscape position, site homogeneity, surface characteristics, slope, aspect, and erosion potential. Vegetation was described in nine strata based on height and life-form (tree, shrub, herbaceous, or moss/lichen). The total projected ground surface area covered by the foliage of each species (percent cover) was estimated within each strata. Special notes were made on tree diameters in old-growth plots. Because the abundance and distribution of dead wood, accumulation of organic matter and the abundance of mosses, liverworts and lichens appeared to be characteristic of some old-growth forests, notes on these features were included on field forms. Unknown mosses, liverworts, and lichens were described in the field and collected for identification by more qualified non-vascular taxonomists. Soil profiles were described from pits excavated up to a 40-cm depth, when possible, using a hand trowel and pruning shears for clipping roots.

The population of mountain avens along the cascades was inventoried by climbing along both sides of the cascade to its top. Individuals were counted within clumps of this plant. Other stretches of stream containing similar habitat were searched for additional occurrences of mountain avens. The historic location for Wiegand's sedge was surveyed as well as additional appropriate habitat within the RNA. Population data were collected for the only extant population found. While hiking transects and describing sample plots, field ecologists listened and watched for the northern three-toed woodpecker. Birds were observed using 7.5 x 45 binoculars, and behavior was noted in field notebooks. Plants that were not readily identifiable in the field were collected for later determination using regional floras. New stations for rare plants were documented with a specimen donated to the Hodgdon Herbarium (NHA) at the University of New Hampshire. Natural Heritage Special Plant and Animal forms were completed for each rare species occurrence.

A list of all plants encountered along the transects, in between plots, and in plot descriptions was compiled. A relative frequency was assigned to each taxon based on how often and how abundantly the species was observed in each community described below.

Results and Discussion

Data were collected from twenty-eight plots (Appendix A) and along five transects traversed (Appendix B) during July, August, and September 1992. Reconnaissance forms were used to document different communities observed along the transects. Eleven natural communities were differentiated from transect data based on the physiognomy, and species composition, abundance, and distribution of the vegetation. These communities include: Northern Hardwood Forest, Mountain Spruce-Fir Forest (consisting of four variants: Spruce-Fir Forest, Old-Growth Spruce Forest, Spruce-Fir Blow-down Forest, and Dwarf Spruce-Fir Forest), Forest Seep, Beaver Flowage, Stream Shore, Acidic Fen, Acidic Fen (Pond Shore variant) and Rock Slide communities. Twenty-eight temporary plots were established in representative areas within 8 of the 11 communities or variants sampled using 3 to 5 plots per community. The Northern Hardwood Forest, Rock Slide and Beaver Flowage communities were documented in field notes and on Reconnaissance Forms. Several finer scale communities (micro-habitats) were sampled as they were encountered repeatedly within a larger community type.

In all, 167 species of vascular plants in 43 families, 29 species of bryophytes (mosses and liverworts), and at least 7 species of lichens were recorded from the RNA. Species

Table 1.—Species richness by taxonomic group and community type

Community	Vascular plants	Bryophytes	Lichens	Total
Northern Forest Hardwood	119	24	4	143
Spruce-Fir (all types)	87	26	5	113
Rock Slide	38	8	5	51
Wetlands (all types, excluding Stream Shore)	89	12	0	101
Total for study area[a]	167	29	7	203

[a]Numbers for each community within a group do not sum to the total number of species for the study area since many species occur in more than one community type. Lichen numbers are certainly incomplete as they are based on coarse field observations and do not include investigation of tree boles or canopies.

[2] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

richness by taxonomic group within each community type is given in Table 1.

See Appendix C for a checklist of these species by family. The taxonomy and phylogenetic order are those presented in Gleason and Cronquist (1991). Minor modifications in species treatment are observed according to Kartesz and Kartesz (1980). Each species is annotated according to frequency within the 11 community types. An alphabetized checklist of vascular plants with authors and common names, and an alphabetized list of Bryophytes with authors are found as Appendix D. Common names presented in Seymour (1982) are given for taxa with no common name noted in Gleason and Cronquist (1991).

Rare Species

Mountain avens (*Geum peckii*)—The globally rare mountain avens was inventoried at the historic Nancy Brook Cascade location and searched for along tributary streams and Halfway Brook in similar habitats. The population was first observed in 1986 (Frankie Brackley, New Hampshire Natural Heritage Program (NHNHP)). No other populations of mountain avens were found in the study area, though scattered patches were found along the entire length of the cascade. Approximately 670 whorled rosettes were counted in 84 clumps from the bottom of the cascade to the top of the steep slope at approximately 853 m. Plants tended to be clustered in rock crevices in areas with no overhanging vegetation. Associated species included sharp-leaved (*Aster acuminatus)* and rough-leaved aster (*A. radula*), three-leaved rattlesnake root (*Prenanthes trifoliata*), and heartleaf birch seedlings. The number of individuals per clump ranged from 1 to 80 with an average number of 10. Each rosette or whorl of stems was considered an individual, though individuals within a clump were probably clonal. The avens was flowering from early July through the third week in August. The population was documented with photographs. Mountain avens is a near-endemic, known only from the White Mountains of New Hampshire and a few bogs in Nova Scotia. Most populations are in the alpine zones of the Presidential and Franconia ranges.

Wiegand's sedge (*Carex wiegandii*)—This state-threatened sedge was documented from the "bog at east end of Nancy Pond" in the 1961 by Albion Hodgdon. The historic station and similar habitats were searched, including forest seeps, the acidic fen adjacent to Nancy Pond, and the fen northeast of the pond. Only one extant population of Wiegand's sedge was found, consisting of four small clonal patches growing in the floating mat of the acidic fen east of Nancy Pond. Two patches were approximately 12 cm in diameter, and the other two were smaller. Associated species included few-flowered sedge (*Carex pauciflora*) and few-seeded sedge (*Carex oligosperma*), all found growing in a saturated mat of *Sphagnum magellanicum* and *S. papillosum.* Tracks indicated that this small fen is occasionally visited by moose. It is probable that the beaver activity in recent decades, apparent at the east end of the pond, is responsible for its disappearance from the site, although it may remain in the seed bank. A partial specimen is deposited at the Hodgdon Herbarium (Sperduto #2258). Wiegand's sedge is a rare boreal sedge of peatlands known from Newfoundland and Labrador south to Massachusetts (disjunct) and northern Pennsylvania (disjunct) and west to northern Michigan and Ontario. The few New Hampshire stations represent disjunct populations at the southern margin of the species range. Many northern *Carex* species in New England have been displaced to the north and to higher elevations following deglaciation and typically occur at disjunct locations, in contrast to relatively abrupt range limits for most southern species (Reznicek 1989). This implies that northern sedges, such as Wiegand's sedge, are under greater threat of extirpation than most southern species (Reznicek 1989).

Pickering's reed-grass *(Calamagrostis pickeringii)*—This rare grass was identified along the northwest branch of Nancy Brook. The grass was growing on shallow, seepy peat mats extended over bare bedrock along the stream. Two sites were found along the stream drainage. One extended downstream for approximately 200 to 250 m (slope distance) from just above a 20-foot water fall at an elevation of approximately 945 m and consisted of 250-300 flowering stems. The other station was found at approximately 884 m elevation in a small acidic fen immediately adjacent to and above the stream channel, into which it drained. This smaller population consisted of at least 50 flowering stems. Associated species include mountain holly (*Nemopanthus mucronata*), witherod *(Viburnum cassinoides*), sharp-leaved aster, rough-leaved aster, and bog sedge (*Carex paupercula*). The dominant sphagnum was *Sphagnum centrale.* Specimens are deposited at the Hodgdon Herbarium at UNH (Sperduto #2259 and #2262). Pickering's reed-grass is found from Newfoundland to the mountains of Massachusetts and New York, with disjunct locations in New Jersey and Long Island.

Northern three-toed woodpecker (*Picoides tridactylus*)—Two northern three-toed woodpeckers were observed in the blow-down forest on Duck Pond Mountain between an elevation of 914 and 926 m. One female was observed twice along a plot transect route. She was joined by a male at the higher elevation. The two birds were chipping bark off large red spruce snags, which were adjacent to vegetation plot number B-2, for about 15 minutes. The pair flew northeast, where they were heard but not seen over the next hour. Northern three-toed woodpeckers are at the southern limit of their breeding range in New Hampshire.

General Ecology of Spruce-Fir and Northern Hardwood Forest Communities

A discussion of the general ecology of spruce-fir and northern hardwood forests is reviewed here, followed by descriptions and discussion of each community type surveyed in the RNA. Community nomenclature, for the most part, follows that used by NHNHI.[3] Reference to other classifications is provided as appropriate.

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[3] Sperduto, Daniel 1992. Natural Communities of New Hampshire, draft May 1992. Unpublished document on file: Concord, NH: New Hampshire Natural Heritage Inventory, Department of Resource and Economic Development.

Classification—Variation in forest vegetation in the northeastern United States has been attributed to various combinations of controlling factors including climate, mineralogy, topography, and soil materials. The northern coniferous forests and adjacent northern hardwood community of New England fall within the Spruce-Fir-Northern Hardwoods and Northern Hardwoods-Hemlock-White Pine Zones described by Westveld and others (1956). Within these zones, many investigators have recognized changes in forest communities along an altitudinal gradient, attributing this change to climate (expressed elevationally) or corresponding gradients of environmental factors (Bormann and others 1970; Cogbill and White 1991; Siccama 1974; Siccama and others 1970). Bormann and others (1970) compare a number of classification schemes proposed by earlier authors. In New England, the transition zone near an elevation of 762 m from the northern hardwood to spruce-fir forest is the only fairly clear, generally agreed upon boundary among these classification schemes. Cogbill and White (1991) refer to these two units as the Deciduous (Northern hardwood) formation (with Hemlock and Spruce Phases recognized) and the Spruce-Fir formation (with Spruce and Fir Phases recognized). They suggest that there also may be a biological feedback in producing a fairly sharp ecotone, where spruce-fir forests modify and perpetuate conditions to which they are better adapted than hardwoods.

Several authors have delineated units within and among the two broadly defined formations based largely on overstory composition in relation to soil materials (Fincher 1991; Leak 1982). Ecological Land Types have been mapped on the White and Green Mountain National Forests, emphasizing major landforms, geomorphic history, soil materials and late successional forest associations. Smith (1992) delineated habitat types in the Green Mountains based on total floristic composition and soil materials.

Sneddon and Metzler[4] provide a draft hierarchical classification of all palustrine, terrestrial, and estuarine communities for the northeastern United States, and cross-reference the state natural heritage program community classifications and Society of American Forests types of the region to this hierarchy. The various state Natural Heritage program classifications in New England are adapted from Rawinski's[5] classification of New England natural communities.

In this study, a coarse scale classification of forest communities was adopted to reflect the goal of characterizing all major terrestrial and palustrine plant habitats and documenting the flora therein. More intense sampling necessary for finer scale classification or ordination of units through quantitative analyses was not attempted. However, sampling was stratified on the basis of general disturbance histories as this appeared to be responsible for much of the structural and compositional variation observed within the spruce-fir forest.

The Mountain Spruce-Fir Forest Community referred to in this study[3] is synonymous with Rawinski's[5] New England High Elevation Spruce-Fir Forest, and is included in Sneddon and Metzler's[4] "series" level Terrestrial *Picea rubens-Abies balsamea* Forests and included within Cogbill and White's (1991) Appalachian Region Spruce-Fir Formation. This later source provides a cross-reference to previously published classifications. Society of American Foresters climax or sub-climax forest types included in the Mountain Spruce-Fir Forest Community are the red spruce—balsam fir, red spruce, balsam fir, paper birch—red spruce—balsam fir, and red spruce—yellow birch. All of these cover types occur within the RNA. Transition zones between the spruce-fir forest and northern hardwood communities are frequently characterized by red spruce—yellow birch or red spruce—sugar maple—beech cover types. ELT types 2, 6, 6E, 06 and 14 correspond to this community type within the RNA.

The Northern Hardwood Forest Community referred to here[3] is synonymous with Rawinski's[5] Northern New England Mesic Hardwood Forest on Acidic Bedrock or Till, and included in Sneddon and Metzler's[4] "series" level Terrestrial *Acer saccharum - Fagus grandifolia - Betula lutea* Forests and also included within Cogbill and White's (1991) Appalachian Region Deciduous (Northern hardwood) Formation. Climax and sub-climax Society of American Foresters types corresponding to the Northern Hardwood Forest Community found in the RNA is limited to the sugar maple—beech—yellow birch type. No ELT types corresponding to northern hardwood associations are mapped in the RNA, however, northern hardwood forests documented probably correspond to inclusions of land type 105.

General Ecology of Mountain Spruce-Fir Forests—New England's spruce-fir forests are a southern extension of the transcontinental boreal forest to the north and approach the northern margin of the Appalachian spruce-fir forest. Mountain spruce-fir forests in New Hampshire typically occur between an elevation of 762 and 1490 m (Cogbill and White 1991; Leak and Graber 1974). Spruce-fir forests also occur at lower elevations on shallow or poorly drained soils (Cogbill and White 1991; Flaccus 1959; Leak 1982) and in topographic situations influenced by cold-air drainage (Cogbill and White 1991). "Inverted" spruce-fir forests located at an elevation below northern hardwoods are often found in association with lake basins, streamsides, or peatlands (Cogbill and White 1991).

The Mountain Spruce-Fir Forest Community differs from the transcontinental boreal forest both climatically and floristically. The ecotone roughly corresponds to the 2° C isotherm (Cogbill and White 1991). The various spruce-fir

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[4] Sneddon, L.; Metzler, K. 1992. Eastern Regional Community Classification, organizational hierarchy, and cross-reference to State Heritage Community Classifications: terrestrial, palustrine and estuarine systems. Unpublished document on file: Boston, MA: The Nature Conservancy, Eastern Heritage Task Force. 124 p.

[5] Rawinski, Thomas J. 1984. New England natural community classification. Unpublished document on file: Boston, MA: Eastern Heritage Task Force, The Nature Conservancy.

forest communities in New England support a vascular flora of approximately 280 species (20 more than boreal forests), 25 of which are ubiquitous (Cogbill 1987). A number of species prominent in Appalachian spruce-fir forests have Alleghanian distributions (glaciated northeastern United States and Lake States, adjacent southern Canadian Provinces, and southern extensions along the Appalachians). These include red spruce, heartleaf paper birch, yellow birch (*Betula alleghaniensis*), white pine (*Pinus strobus*), bigtooth aspen (*Populus grandidentata*), mountain maple (*Acer spicatum*), and striped maple (*Acer pensylvanicum*). Thus, the dominant red spruce of montane forests are replaced by black spruce (*Picea mariana*) and white spruce (*Picea glauca*) in the boreal forest, and heartleaf birch of montane forests is replaced by paper birch (*Betula papyrifera*) to the north. Balsam fir occurs in both forests. Deciduous shrubs and trees tend to be more prevalent in montane spruce-fir forests than in boreal forests to the north (La Roi 1967).

Fire and insect dieback are major disturbances in the boreal forest (Cogbill 1985). In contrast, Appalachian spruce-fir forests lack significant fire regimes and are characterized by large blow-down disturbances resulting from hurricanes and smaller area, single-tree mortality phenomena (Foster and Reiners 1983; Reiners and Lang 1979). Cloud intercept is significantly higher in mountain spruce fir than that in lower elevation hardwood forests.

General Ecology of Northern Hardwood Forests—The northern hardwood forest formation is characterized by species with distributions corresponding to the Eastern Deciduous Forest, though more northern species are frequently present. It is positioned latitudinally and elevationally between the spruce-fir and transitional hardwood forest formations (Westveld and others 1956). Northern hardwoods commonly include American beech, sugar maple, and yellow birch. The ecotone to spruce-fir forest is marked by increased prominence of conifers and yellow birch whereas the ecotone to transitional hardwoods is typically accompanied by more oaks (red oak (*Quercus rubra*) and white oak (*Quercus alba*), white pine, ironwood (*Ostrya virginiana*) and decreased dominance of American beech, yellow birch, and sugar maple together (Sperduto;[3] Westveld and others 1956). White ash (*Fraxinus americana*), red oak, hemlock (*Tsuga canadensis*), and basswood (*Tilia americana*) are occasional or frequent on the lower reaches of northern hardwood forests. Bormann and others (1970) summarize approximate limits of elevation for some trees in New Hampshire including white pine 455m, hemlock 610m, and red oak 457m. Numerous herbs are common to both transitional and northern hardwood forests such as wild sarsaparilla (*Aralia nudicaulis*) and Canada starflower (*Trientalis borealis*). Species of the northern hardwood forests generally not found in transitional forests include mountain wood fern (*Dryopteris campyloptera*), Canada honeysuckle (*Lonicera canadensis*), Braun's holly fern (*Polystichum braunii*), and other northern herbs also found in the spruce-fir forest.

Much of the northern hardwood forest in New Hampshire is characteristic of the oligotrophic end of the spectrum due to the prominence of granitic and other low base-cation yielding drift (Bailey and Hornbeck 1992; Leak 1982). Enriched northern hardwood forests are often confined to small areas of certain topographic positions and/or drift areas with higher base-cation contributions to the soil (Leak 1982; Sperduto[3]). These habitats have numerous herbaceous species restricted to such conditions, which is in contrast to the more ubiquitous herbs of typical northern hardwood forests.

Descriptions of Natural Communities of Nancy Brook RNA

Terrestrial Communities

Mountain Spruce-Fir Forest Community

This community was represented by four distinct variants that reflect different disturbance histories. Eighty-seven species of vascular plants and 26 species of mosses and lichens were identified in this community complex.

Old Growth Spruce/Fir Forest—In the protected upper stream valleys around Nancy Brook and Halfway Brook are stands of virgin spruce-fir forest. Much of this forest was damaged by the 1938 hurricane, cyclic balsam fir senescence (fir wave development), spruce budworm infestation, and fire (at least some of the area burned). The remaining standing virgin forest covers approximately 9 to 10 ha in the upper Nancy Brook stream valley (Hill 1989) and approximately 1 ha in several small stands in the headwater area of Halfway Brook (personal observation). The community was characterized by an uneven aged (including old growth), multi-tiered red spruce canopy with multiple stems of dead standing and fallen spruce. A thick organic layer occurred in this forest, with dead wood in various stages of decomposition, and thick moss and liverwort accumulations. This community has been described by Carbonneau (1986), Hill (1989), Leak (1975), and Oosting and Billings (1951) as well as in several USDA Forest Service qualifying reports for the establishment of Nancy Brook as a Research Natural Area.

The upper canopy between 20 and 25 m contained old-growth spruce. These trees were between 150 and 438 years old (Hill 1989; Leak 1975; personal observation) with d.b.h. between 30 and 80 cm. Trees with diameters of 40 cm were common. In most areas, this canopy was relatively sparse (10 to 15 percent canopy closure) and contained 3 to 10 percent standing dead stems. A more intact canopy, with 60 percent closure, was found in a sheltered drainage along the main tributary of Nancy Brook. In lower canopy strata (5 to 20 m), red spruce and balsam fir were co-dominants covering an average of 25 percent of the strata. Heartleaf birch was a widely spaced subdominant in this stratum among the red spruce and balsam fir. These mid-canopy birch averaged 20 cm d.b.h. In the shrub strata, young spruce and balsam fir dominated with mountain ash (*Sorbus decora*), hobblebush (*Viburnum alnifolium*), velvet-leaved blueberry (*Vaccinium myrtilloides*), witherod, mountain holly, and serviceberry (*Amelanchier bartramiana*) present in sparse patches. Shrubs and young birch were more prevalent in areas where dead standing or

fallen red spruce created light gaps. While heartleaf birch may persist in the canopy, disturbance appears to be necessary for initial establishment (Hill 1989). The herbaceous stratum was relatively sparse (5 to 30 percent coverage) apparently due to shading and dense bryophyte coverage. The most common herb strata species included mountain wood sorrel (*Oxalis acetosella*), creeping snowberry (*Gaultheria hispidula*), goldthread (*Coptis trifolia*), and blue bead lily (*Clintonia borealis*). Balsam fir, red spruce, and birch seedlings were locally dominant in the herb strata.

In the Halfway Brook old-growth stands, balsam fir seedlings were much more abundant. The mosses *Bazzania trilobata* and *Pleurozium shreberi* were found on decomposing logs (nursery logs). Mosses and liverworts covered between 30 and 80 percent of the forest floor in mats up to 12 cm thick. Bryophytes were found growing on decaying logs, on forest peat, and in thick mats directly on the boulder substrate. Younger spruce-fir forests and blow-down forests rarely had such extensive moss coverage. Only in the stunted spruce-fir forest on the summit of Mount Nancy was there comparable moss and liverwort growth. Other dominant or common species found here include *Brotherella recurvans*, *Dicranum scoparium*, *Brachythecium acuminatum*, *Plagiothecium laetum*, and *Polytrichum ohioensis*.

The slow rate of decomposition at this elevation due to decreased temperatures, higher moisture levels, low levels of light penetration, slow decomposition, and low nutrient/high lignin levels of the coniferous duff has created a thick organic layer. The soils in most of the research natural area had deep (15 to 40 cm) moss-covered organic layers, interspersed with partially decomposed stems and roots on top of boulders on top of a thin layer of coarse sandy loam on bedrock. In several soil pits, some spodosol development was observed. Often an E horizon was present, however, illuviated material was absent. This may have been due to lateral transport of leached soil minerals between stones and bedrock.

Spruce-Fir Forest—The steep side slopes of Mounts Nancy and Bemis, and the mid-elevation slopes of Duck Pond Mountain, were forested in dense spruce and balsam fir. In these areas, topography was rugged with slopes up to 35 percent. Several areas contained vertical ledges. Canopy heights were uniformly lower (10 to 20 m) and denser (65 to 85 percent) than those in the old-growth forest. Balsam fir was the dominant tree species making up to 80 percent of the canopy; however red spruce and heartleaf birch were common (±5 percent). The understory vegetation in these forests was sparse (5 to 20 percent) due to the dense canopy. The shrub stratum was composed primarily of red spruce and balsam fir with scattered heartleaf birch and mountain ash. The herbaceous strata (<1 m) was sparse (0 to 5 percent), contained low herb diversity, and was responsive to local light gaps. The most common species were mountain wood sorrel, creeping snowberry, shining clubmoss (*Lycopodium lucidulum*), Canada starflower, and mountain wood fern. Moss and liverwort coverage varied from 30 to 75 percent. Although not statistically tested, moss coverage seems to be related to soil moisture (near the soil surface) and incident sunlight.

Much of the spruce-fir hill sides experienced wind damage from the 1938 hurricane, and from regular senescence of balsam fir. The west slope of Bemis, the south slope of Mount Nancy, and the north and northeast slopes of Mount Saunders all had bands of balsam fir blow-down and all had regeneration similar to fir-wave development. A fir-wave is characterized by swaths of blown down balsam fir and spruce, generally along contours, with intense balsam fir, red spruce and birch regeneration among blown down and standing dead canopy trees. Generally, balsam fir was the most prolific of these, with coverage well over 100 percent in the 1- to 2-m stratum. The community in these balsam fir waves was distinct from the large blow down areas on Duck Pond Mountain and eastern Mount Bemis, because of a strong balsam fir dominance within the entire gap, and a relatively even-aged regeneration at progressive levels through and between waves.

Spruce-Fir Blow-down Forest—This transitional community covered the largest area in the Nancy Brook RNA. It was the result of intense wind damage during and after the 1938 hurricane. This community extends from Nancy Pond, east across the northeastern shoulder of Duck Pond Mountain, over the summits of Duck Pond Mountain and Mount Saunders. Also affected by the hurricane was the eastern shoulder of Mount Bemis, including the ridgetop extending southeast of the summit. Although most of the forest north of Nancy Brook below the cascades was logged in salvage cuts following the hurricane, much of the blow-down area remains as virgin, though toppled, forest. This community was extremely variable from one location to the next. The areas affected by the hurricane are still vulnerable to blow-down due to their exposed nature. Fire scars were observed on several trees on the south ridge of Duck Pond Mountain.

In most of the blow-down area, canopy coverage reached 25 percent. This included standing living and dead relict trees that reached into the 20+ m canopy stratum. Standing snags and living canopy trees had diameters averaging 38 cm at breast height. The densest regeneration was in the middle to upper shrub stratum (1 to 5 m) where coverage was between 65 and 85 percent. The species composition of this layer varied from largely fir-spruce with birch inclusions to largely birch with fir-spruce inclusions. Inter- and intra-specific competition was apparently intense in these areas. The upper ridges on Duck Pond Mountain had large areas where dense birch and balsam fir (85+ percent) were between 1.5 to 2 m tall. The herbaceous stratum, though often dominated by tree seedlings, contained openings where herbaceous diversity more typical of the northern hardwood forest was present. Species in these gaps included: bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), blue bead lily, mountain wood sorrel, Canada starflower, painted trillium (*Trillium undulatum*), and mountain wood fern. Moss and liverwort coverage was generally sparse (5 to 10 percent) in these areas. Low coverage of these plants was probably

caused by dense regeneration patches, increased soil drying in the canopy openings, rapid accumulation of litter from dead fall, and the increase in leaf litter from deciduous competition.

Dwarf Spruce-Fir Forest—This forest type was documented on the summit cone of Mount Nancy. It was similar to spruce-fir forest of the adjacent side slopes, except for a stunted canopy; the average canopy height above an elevation of 1158 m was 2.4 to 3 m. The canopy was predominantly balsam fir though spruce and less frequently heartleaf birch were present. Mountain ash, mountain holly, and velvet-leaf blueberry were present, though sparse (2 to 6 percent) in the < 1-m stratum. The lower shrub stratum was dominated (20 to 30 percent) by young spruce and balsam fir. The ground cover consisted of patches of herbaceous plants (3 to 15 percent) speckled throughout a moss/liverwort mat that covered up to 85 percent of the forest floor. Herbaceous species included creeping snowberry, mountain wood sorrel, Canada starflower, and Canada mayflower. The dominant moss and liverwort species were *Bazzania trilobata*, *Mylia taylori*, *Hypnum imponens*, and *Dicranum scoparium*. Moss was found growing on root crowns and on decaying organic matter. Lichen grew on tree roots, stems, lower branches, and decaying logs. Tufts of *Cladonia* spp. were spotted throughout this forest type. A thick layer of organic matter (9 to 16 cm) overlaid bedrock or boulders in each of the dwarf spruce-fir plots. The low temperatures and the acidic coniferous duff of these upper slopes greatly reduces the rates of decomposition. This forest type corresponds to the higher elevation balsam fir forests referred to by Cogbill and White (1991) and Sneddon and Metzler.[4]

Northern Hardwood Forest Community

A total of 119 vascular plants, 24 bryophytes, and 4 lichen species were documented in this community. Northern Hardwood Forests were present in the lower elevations of the Nancy Brook RNA along the south and eastern slopes of the Nancy Brook and Halfway Brook stream valleys below approximately 732 m. The slopes range from average to steep (6 to 38 percent). Most of this forest was cut at least once before the 1938 hurricane, and once after. A swath of hardwoods found on the ridge north of Halfway Brook was probably not cut because of the steep slope and extremely rocky terrain. This area has sustained extensive blow-down damage.

The northern hardwood forest was dominated by American beech, sugar maple, or paper birch. White ash, yellow birch, balsam fir, and ironwood were common sub-dominants in the canopy and sub-canopy. In areas with older growth, large yellow birch (40 to 50 cm d.b.h.) occurred as dominant canopy trees with extensive though often damaged crowns. Shrub species in this community included witch-hazel (*Hamamelis virginiana*), young striped maple, and hobblebush. In areas dominated by American beech, saplings made up the majority of the sub-canopy, shrub, and herb strata. Thick deciduous leaf duff covered most of the forest floor precluding extensive herbaceous growth. The herb and moss strata were sparse (2 to 25 percent), however, they contained a higher diversity of herbaceous species than the spruce-fir forests. Common herbs included Canada mayflower, Indian cucumber (*Medeola virginiana*), partridge berry (*Mitchella repens*), painted trillium, sessile-leaved bellwort (*Uvularia sessilifolia*), flat-topped aster (*Aster umbellatus*), and rosey twisted stalk (*Streptopus roseus*).

Rock Slide Community

There were two large rock slides just northeast of the base of the cascades and along the steep stream valleys of Nancy Brook and Halfway Brook. A series of large rock slides followed the southwest slopes of Mount Nancy west of the RNA. In one rock slide just west of the RNA boundary, mountain sandwort (*Arenaria groenlandica*) was found growing in an otherwise bare scree field. The rock slides within the RNA were between 2 and 10 m wide, and between approximately 5 and 152 m long. Small rock slides were found in the steep stream valleys where slopes were often rocky and wet. In these smaller slides, sharp-leaved aster, rough-leaved aster, large leaved goldenrod, and hay-scented fern (*Dennstaedtia punctilobula*) were common. The larger slides were mostly unconsolidated areas of boulders and scree. Vegetation has been slow to colonize these slides because of continuous erosion. The early colonizers were predominantly species that were present in adjacent forests such as balsam fir and birch. Patches of seedlings were clustered around the slide edges and head walls. Flaccus (1959) studied the vegetation of landslides of the White Mountains in various stages of succession.

Palustrine Communities

Acidic Fen Community

Acidic fens are broadly defined, oligotrophic to submesotrophic peatland complexes characterized by relatively low pH and nutrient availability. They differ from dwarf shrub bogs because of the influence of somewhat increased ground or surface water movement through the peatland, and have an increased prominence of sedges and grasses, and often a decreased dominance of dwarf heath shrubs.[3] Several to many plant associations or zones are frequently present in any one example. Two variants were identified in the RNA: the more oligotrophic variant is described here as a typical acidic fen; the more minerotrophic variant associated with Nancy Pond is described as the pondshore variant. The high-elevation softwater pond communities in the RNA (such as Nancy Pond) are typical of those found in the White Mountains and have very few submerged or floating-leaved aquatics (see ponds described later under Beaver Flowage Community).

Oligotrophic Acidic Fen communities were found in a small ~0.4-ha depression east of Nancy Pond, north of Nancy Pond, along streamside locations of upper Nancy Brook, and along the south shore of Nancy Pond where a shrub and sphagnum mat developed. These areas were sphagnum-based communities with various combinations of open water, grass, sedge, heath, tall shrub, and dwarf tree zones.

North of Nancy Pond the fen was approximately half overgrown with shrub and dwarf tree islands. Shrub islands

consisted of leatherleaf (*Chamaedaphne calyculata*), mountain holly, and witherod with rhodora (*Rhododendron canadense*), Labrador tea (*Ledum groenlandicum*), and pale laurel (*Kalmia polifolia*). Black spruce and larch (*Larix laricina*) were common components of the shrub islands. The open peat areas between shrub islands were dominated by tawny cotton grass (*Eriophorum virginicum*) and few-flowered sedge. Sundew (*Drosera rotundifolia*), pitcher plant (*Sarracenia purpurea*), and three-leaved Solomon's seal (*Smilacina trifolia*) were also common herbs in these open peat areas.

The depression east of Nancy Pond had each of the above fen components in the classic bog configuration; open water ringed by a peat mat with sedge and grass patches; a low heath; and an adjacent tall shrub band. Dwarf spruce and larch grew along the upland edge. *Carex utriculata* grew in the shallow water near the mat edge, and tawny cotton grass, few-fruited sedge (*C. oligosperma*), and beakrush (*Rhyncospora alba*) grew in the partially emerged quaking mat. The dominant mat-forming sphagnums that made up most of these open communities were *Sphagnum magillanicum* and *S. papillosum*. The rare Wiegand's sedge was found in a few small patches within this zone. A dense thicket of rhodora and sweet gale (*Myrica gale*) ringed the western edge of the floating peat mat.

A small acidic fen adjacent to the northwest tributary of Nancy Brook was found with a population of the state-listed Pickering's reed-grass. In shrub-free areas along the seep edges, Pickering's reed-grass made up to 25 percent of the coverage. Other vegetation included many of the species listed above along with interior sedge (*Carex interior*), bog sedge, Indian poke (*Veratrum viride*), and rough-leaved aster.

This community corresponds to Acidic Fen and Peatland Lagg Communities in Maine (Maine Natural Heritage Program 1991), and Poor Fen Community in New York (Reschke 1990) and Vermont.[6]

Acidic Fen Community - Pondshore variant—This community is essentially a variant of the broadly defined Acidic Fen Community and differs by the presence of vegetation characteristic of somewhat more minerotrophic conditions than those associated with Acidic Fens described previously.[3] These more minerotrophic portions of the shore of Nancy Pond consisted of dense shrub thickets and floating sphagnum mats dominated by sedges and grasses. This shore community ranged from 1 to 12 m wide. The vegetation was similar to the upper shrub zone of the acidic fen east of Nancy Pond where dense shrub thickets dominated by leatherleaf and sweet gale are found. Common subdominant shrubs included Labrador tea, pale laurel, rhodora, and gray birch seedlings (*Betula populifolia*). Open sedge and grass areas were common along the northeast shore, covering between 5 and 50 percent of the mat along the shore. In these areas, northern manna grass (*Glyceria canadensis*) and tawny cotton grass commonly covered between 40 and 60 percent of the openings. Associated species included Atlantic sedge (*Carex atlantica*), two-seeded sedge (*C. disperma*), few-seeded sedge, silvery sedge (*C. canescens*), and sundew. These communities were growing in a deep sphagnum mat dominated by *Sphagnum magellanicum*, *S. papillosum*, and *S. cuspidatum*. In plots along the east shore, peat deposits were between 14 and 35 cm deep. Beaver activity affecting water levels has likely altered the vegetation of the pond in recent decades.

This community corresponds to Acidic Fen and Peatland Lagg Communities in Maine (Maine Natural Heritage Program 1991), and Poor or Medium Fen Community in New York (Reschke 1990) and Poor Fen Community in Vermont.[6]

Forest Seep Community

Seeps occurred throughout the RNA in both forested and unforested areas; those occupying larger canopy gaps (larger than single tree gaps) had closer affinities to Acidic Fens previously described, and those in forested areas or with only small canopy gaps are described here as Forest Seeps. Most seeps observed were small (<0.08 ha). In these forested seeps, black spruce (*Picea mariana*) created a dense 3- to 5-m high canopy with very little understory woody vegetation. New York fern (*Thelypteris noveboracensis*), two-seeded sedge, and delicate sedge (*C. leptalea*) were common in several seeps, though coverage was usually low due to dense peat growth and a thick forest canopy. The common sphagnums in forest seeps were *Sphagnum girgensohnii*, *S. centrale*, *S. russowii*, and *S. squarrossum*. Other plants include inflated sedge (*Carex intumescens*), Indian poke, tall meadow rue (*Thalictrum pubescens*), and cinnamon and interrupted ferns.

Beaver Flowage Community Complex

Even though beaver sign was evident along lake and stream shores, only one area in the RNA had beaver dams, new ponds, old ponds, and wet meadows with emergent vegetation collectively referred to here as a beaver flowage. Beaver flowages are characterized by impermanent wetland types that change with the progression of siltation, organic matter accumulation, vegetational succession, and changes in water levels. This community complex was found in the saddle between Mount Bemis and Mount Nancy. The flowage consisted of a current beaver pond, and a series of abandoned and filled-in ponds, which occurred downstream to the southeast. The upper pond was approximately 0.5 ha in size with a narrow shrub and sedge/grass edge. Alga pondweed (*Potamogeton confervoides*) was found floating along the south shore of this pond. Pond shore species included few-seeded sedge, bog sedge, Canada blue-joint grass (*Calamagrostis canadensis*), tawny cotton grass, leatherleaf, and sheep laurel (*Kalmia angustifolia*). The abandoned pond had shallow open water and recently exposed mud flats. The mud flats were mostly bare with dense patches of narrow

[6] Thompson, E. 1989. Natural communities of Vermont. Unpublished document on file: Waterbury, VT: Vermont Natural Heritage and Non-game Program.

rush (*Juncus brevicaudatus*) found only on slightly higher ground. Sedges and grasses dominated the upper edges of the mud flat between patches of fen-like islands. Between the lower pond and the stream outlet to the south, several old ponds have filled in with tall herbs and shrub species. Common herbaceous plants included wrinkled goldenrod (*Solidago rugosa*), cinnamon and interrupted ferns (*Osmunda cinnamomea* and *O. claytoniana*), tall meadow rue, flat-topped aster, the sedge *Carex gynandra*, and silvery sedge.

Various portions of this complex would most closely correspond to monomictic soft-water pond aquatic communities, wet meadow, and shallow emergent and deep emergent marsh communities (Maine Natural Heritage Program 1991; Reschke 1990; Sperduto[3]).

Stream Shore Community

The stream shore community had components of many of the above communities depending on the nature of the shore, and include both terrestrial and palustrine (wetland) micro-habitats. Thirty-eight vascular and 27 bryophyte species were identified in this community complex. Much of the stream shore was exposed rock with small pockets of vegetation growing in rock crevices and between boulders. Rough-leaved aster was a dominant late summer herb in these areas along with sharp-leaved aster, twisted stalk (*Streptopus amplexifolius*), three-leaved rattlesnake root, and broad beech fern (*Thelypteris phegopteris*). Along the entire length of the Nancy Cascades were scattered pockets of mountain avens. This site is one of only a few non-alpine populations for this globally rare species in New Hampshire. A few small peat-based areas along some of the stream shores are more appropriately classified as small acidic fens. These small fens account for the presence of approximately 15 vascular plants otherwise largely absent from the streamside community complex, including several sedge, sphagnum moss and heath shrub species. Such complexes of micro-habitats along stream banks have not been classified clearly in regional or state community classifications, but have similarities to riverside alluvial shrub thickets, cliff seep, and high-energy riverbank communities described by Sperduto.[3]

Phytogeographic Affinities

The floristic composition of the Nancy Brook RNA consists of several phytogeographic elements. Each element is represented by groups of species with similar geographic distributions. Following deglaciation, species migrations into the region occurred at different rates and from different source areas (Davis 1976). Many distributions have not yet equilibrated. Hemlock and American beech, for instance, withdrew from more northern extensions some 5,000 to 8,000 years ago, but continue to expand their western extents today (Davis 1976). However, distinct distributional patterns are recognized, and within the Nancy Brook RNA the most important of these are the boreal, Alleghanian, and eastern deciduous forest elements. These elements consist of many species close to their northern, southern, or eastern range limits in New England. A brief discussion of each affinity and several corresponding examples are presented here. A more detailed review of the these elements and other relevant literature can be found in Weatherbee and Crow (1990).

Many species of the northern hardwood forest are members of the **eastern deciduous forest** element. This element consists of species typically distributed throughout the Eastern United States. These species approach or reach the northeastern extent of their range somewhere in New England or the adjacent Canadian Maritimes. Many reach their northern extent in central New England and are not significant components of the northern hardwood forest community. Those which do extend farther north (and into the RNA) include sugar maple, American beech, red oak, white ash, ironwood, cinnamon and interrupted ferns, bracken fern (*Pteridium aquilinum*), shining clubmoss, witch-hazel, maleberry (*Lyonia ligustrina*), Christmas fern (*Polystichum acrostichoides*), hay-scented fern, and wood nettle (*Laportea canadensis*).

Plants with more northern centers of distributions are part of the **boreal** element (including boreal, circumboreal, circumpolar and North American boreal distributions). Peatlands of Nancy Brook RNA (and elsewhere in New England) have a particularly high proportion of boreal species. This element is represented by such species as eastern larch (*Larix laricina*), black spruce, bog laurel (*Kalmia polifolia*), leatherleaf, quaking aspen (*Populus tremuloides*), creeping snowberry, broad beach fern, bog sedge, few-flowered sedge, Wiegand's sedge, silvery sedge, three-toothed cinquefoil (*Potentilla tridentata*), Canada yew (*Taxus canadensis*), and many of the mosses and lichens. Alpine bilberry (*Vaccinium uliginosum*) and mountain sandwort have arctic-alpine affinities, both largely restricted to high elevations in New England. Mountain sandwort is restricted to eastern North America and Greenland.

The **Alleghanian** element was discussed previously as being an important component of the Appalachian montane spruce-fir forests. Species include red spruce, yellow birch, heartleaf birch, bigtooth aspen (*Populus grandidentata*), and mountain and striped maple (*Acer pensylvanicum*). The rare Pickering's reed grass and the more common rhodora are not true boreal species as they are restricted to northeastern United States and adjacent Canada, and more closely approximate the northeastern portion of typical Alleghanian distributions.

The **endemic** element is represented only by mountain avens, which is restricted to the White Mountains and a few bogs in Nova Scotia.

Alien species include bent grass (*Agrostis gigantea*), hellaborine (*Epipactis hellaborine*), and Devil's paintbrush (*Hieracium aurantiacum*).

Cosmopolitan (globally widespread) species include field-horsetail (*Equisetum arvense*) and lady fern (*Athyrium filix-femina*).

Coastal Plain and midwestern elements found in southern New Hampshire are not represented in the RNA.

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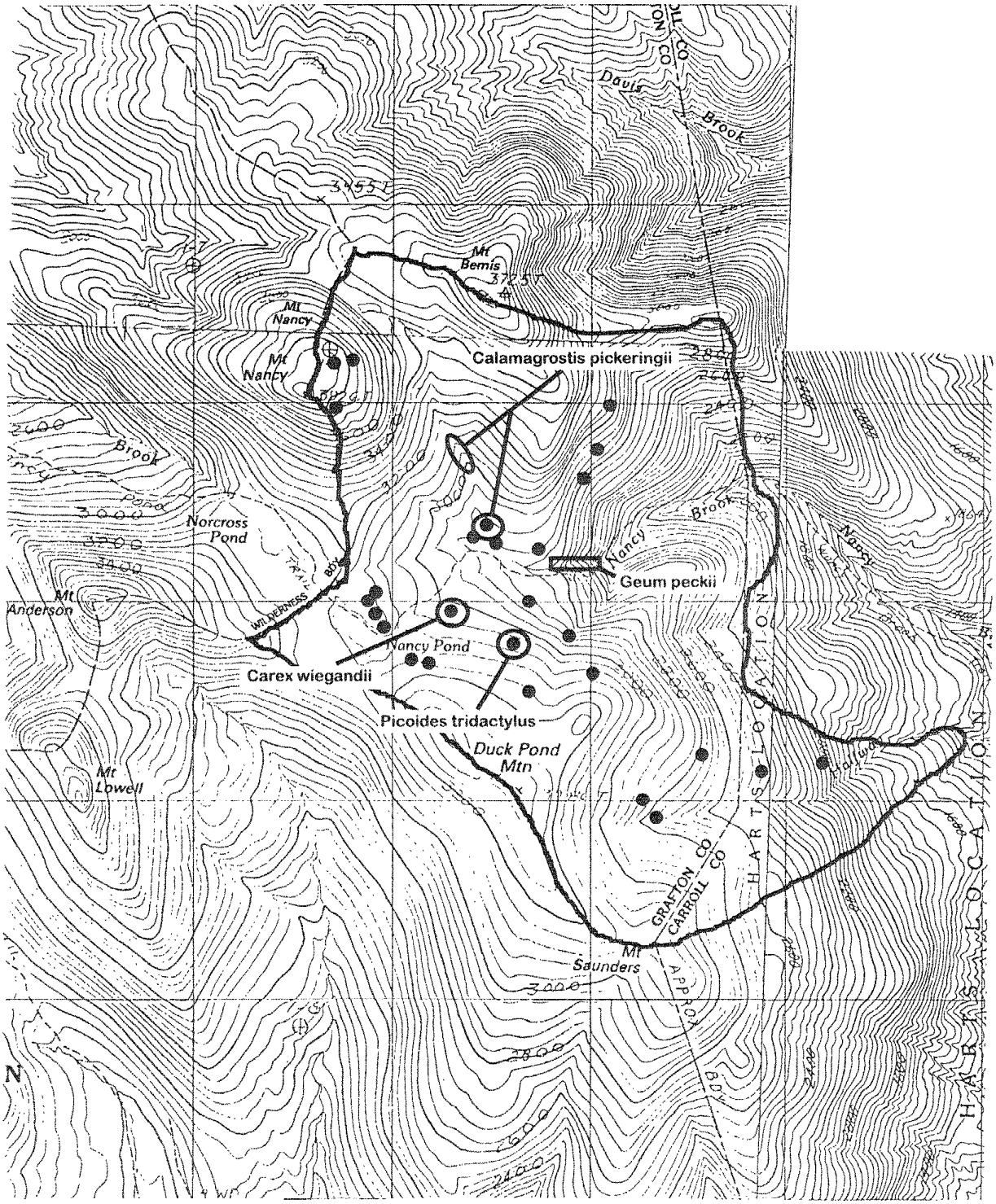
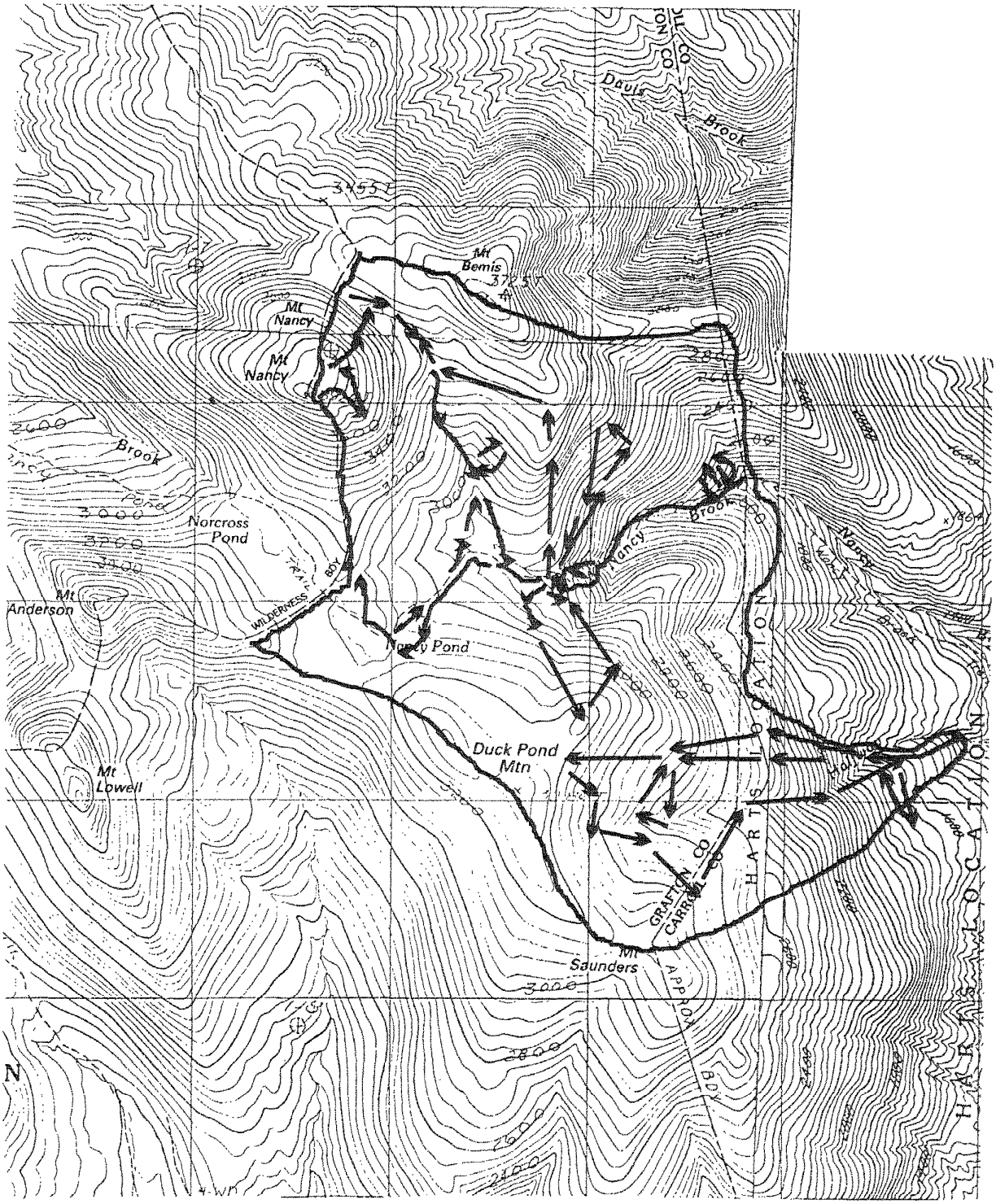
Appendix A—Nancy Brook Research Natural Area



Approximate plot locations and rare species found during the 1992 botanical reconnaissance.

Appendix B—Nancy Brook Research Natural Area



Approximate location of transects hiked for plot and reconnaissance data during the 1992 botanical reconnaissance.

Appendix C—Checklist of the Flora of Nancy Brook Research Natural Area

Frequency of taxon within a community:

A-Absent (0%), R-Rare (1-5%), O-Occasional (5-20%), C-Common (20-70%), D-Dominant (70-100%), U-Uncertain.

Communities:

NH-Northern Hardwood, OG-Old Growth, SF-Spruce/Fir, SB-Spruce Blowdown, DS-Dwarf Spruce/Fir, AF-Acidic Fen, FS-Forest Seep, BF-Beaver Flowage, SS-Stream Shore, PS-Acidic Fen (Pond Shore Variant), RS-Rockslide

Taxa	Community										
LICHENS	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
(Cladonia cf. coneocrea)	O	O	O	R	C	A	A	A	A	A	O
(C. cf. pixidata)	O	O	O	R	C	A	A	A	A	A	R
(C. cf. subsecunda)	R	O	O	R	C	A	A	A	A	A	O
(cf. Parmelia)	R	O	O	O	C	A	A	A	A	A	A
(Gray-green squamulose)	A	C	O	R	C	A	A	A	A	A	A
(cf. Rhinodina)	A	A	A	A	A	A	A	A	A	A	C
(Orange crustose)	A	A	A	A	A	A	A	A	A	A	C
BRYOPHYTES	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Bazzania trilobata	C	D	C	C	C	A	O	A	O	A	R
*B. denudata**	U	O	O	O	C	A	A	A	R	A	R
*Brachythecium acuminatum**	U	C	O	O	R	A	A	A	O	A	A
*Brotherella recurvans**	C	C	C	C	C	A	A	A	O	R	A
Dicranum scoparium	C	C	C	C	C	A	A	A	O	A	R
*D. viride**	O	O	O	O	U	A	A	A	U	A	A
*Drepanocladus uncinatus**	O	C	R	R	A	A	A	A	U	A	A
Hylocomnium splendens	O	O	O	R	O	A	O	A	O	A	A
*Hypnum imponens**	U	C	C	C	C	A	A	A	O	A	A
Leucobryum glaucum	C	O	O	R	O	A	A	A	R	A	R
*Luphozia heterocolpos**	U	O	R	R	O	A	A	A	O	A	A
*Mylia taylori**	U	O	O	O	C	A	A	A	R	A	A
*Neckera pennata**	U	R	O	R	U	A	A	R	O	A	A
*Paraleucobryum longifolium**	O	O	O	O	O	A	A	A	O	A	R
*Plagiothecium laetum**	U	C	O	O	R	A	A	A	O	A	A
Pleurozium schreberi	O	C	C	C	C	A	A	A	A	A	O
*Pohlia nutans**	O	R	R	O	A	A	A	A	R	A	A
Polytrichum ohioensis	O	O	O	O	O	A	A	A	O	A	O
P. piliferum	R	R	O	R	O	A	A	A	R	A	O
Ptilium crista-castrensis	O	O	O	O	C	A	A	A	R	A	A
*Scapania nemoria**	U	R	O	R	C	A	A	A	U	A	A
Sphagnum centrale	A	O	A	A	A	O	C	R	O	R	A
*S. capillifolium**	A	A	A	A	A	C	O	O	R	C	A
S. cuspidatum	A	A	A	A	A	C	O	O	A	C	A
S. girgensohnii	A	O	A	R	R	O	D	O	O	O	A
S. magellanicum	A	A	A	A	A	D	O	C	R	C	A
S. papillosum	O	R	O	O	A	D	O	O	R	C	A
S. russowii	O	O	O	R	O	O	D	O	O	O	A
S. squarossum	R	O	R	R	A	O	C	R	R	A	A

* species identity determined by Howard A. Crum

FERNS AND FERN ALLIES

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Lycopodiaceae											
Lycopodium lucidulum	C	O	O	R	O	A	A	A	O	A	A
L. annotinum	C	A	O	R	A	A	A	A	A	A	A
Equisetaceae											
Equisetum arvense	O	O	R	R	A	R	D	C	O	O	A
Osmundaceae											
Osmunda cinnamomea	O	O	O	R	A	C	C	C	C	O	A
O. claytoniana	O	O	O	R	A	O	C	C	C	O	A
Polypodiaceae											
Polypodium virginianum	O	R	R	R	A	A	A	A	O	A	R
Dennstaedtiaceae											
Dennstaedtia punctilobula	O	A	O	O	A	A	O	R	R	A	O
Pteridium aquilinum	C	O	O	O	A	A	A	O	O	A	A
Aspleniaceae											
Athyrium filix-femina	O	A	A	A	A	A	A	C	O	A	A
Dryopteris campyloptera	O	O	C	O	O	R	O	R	O	A	R
D. intermedia	C	R	O	O	R	A	A	A	O	A	R
Gymnocarpium dryopteris	O	R	R	R	A	A	R	A	A	A	A
Polystichum acrosticoides	C	R	R	R	A	A	A	A	O	A	R
Thelypteris noveboracensis	C	A	A	A	A	A	C	C	O	R	A
T. phegopteris	C	O	O	O	R	A	O	O	C	R	R
T. palustris	R	A	A	A	A	R	O	C	R	O	A
Woodsia ilvensis	R	A	O	A	A	A	A	A	R	A	R
Onocleaceae											
Onoclea sensibilis	R	A	A	A	A	R	O	C	O	O	A

GYMNOSPERMS

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Pinaceae											
Abies balsamea	C	D	D	D	D	C	C	C	C	O	C
Larix laricina	R	R	R	R	A	D	O	O	O	C	A
Picea rubens	O	D	D	C	C	R	O	O	O	R	O
P. mariana	R	O	O	R	C	D	O	O	C	C	R
Tsuga canadensis	C	R	R	R	A	A	R	A	C	A	A
Pinus strobus	O	A	A	R	A	R	R	R	O	R	O

ANGIOSPERMS

Dicotyledons

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Nymphaeaceae											
Nuphar variegata	A	A	A	A	A	A	A	O	A	O	A
Ranunculaceae											
Actaea alba	O	A	R	A	A	A	A	A	O	A	A
Aquilegia canadensis	A	A	A	A	A	A	A	A	O	A	A
Coptis trifolia	O	C	C	O	C	O	O	O	O	R	A
Thalictrum pubescens	O	A	A	A	A	A	O	C	C	O	A
Hamamelidaceae											
Hamamelis virginiana	C	R	A	A	A	A	A	A	C	A	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Urticaceae											
Laportea canadensis	R	A	A	A	A	A	R	A	R	A	A
Myricaceae											
Myrica gale	A	A	A	A	A	C	R	D	O	D	A
Fagaceae											
Fagus grandifolia	D	A	R	R	A	A	A	A	R	A	A
Quercus rubra	R	A	A	A	A	A	A	A	A	A	A
Betulaceae											
Alnus incana	R	A	A	A	A	R	O	C	C	C	A
Ostrya virginiana	C	A	A	A	A	A	A	A	A	A	R
Betula alleghaniensis	C	R	R	R	A	A	A	R	R	A	O
B. cordifolia	R	C	C	D	C	R	O	O	C	R	C
B. papyrifera	C	R	O	R	A	A	R	R	O	A	O
B. populifolia	C	R	A	R	A	O	A	O	R	O	A
Caryophyllaceae											
Arenaria groenlandica	A	A	A	A	A	A	A	A	A	A	R
Sarraceniaceae											
Sarracenia purpurea	A	A	A	A	A	O	A	O	R	O	A
Droseraceae											
Drosera intermedia	A	A	A	A	A	A	A	O	A	A	A
D. rotundifolia	A	R	A	A	A	O	O	C	C	C	A
Violaceae											
Viola macloskeyi var. pallens	O	R	R	R	A	A	A	A	R	A	A
V. pensylvanica	O	O	O	O	R	A	O	C	C	A	A
V. cf. renifolia	O	A	A	A	A	A	A	O	O	A	A
Salicaceae											
Populus grandidentata	O	A	A	A	A	A	A	A	A	A	O
P. tremuloides	O	A	A	A	A	A	A	A	A	A	O
Ericaceae											
Andromeda glaucophylla	A	A	A	A	A	R	A	R	A	R	A
Chamaedaphne calyculata	A	A	A	A	A	D	O	C	O	D	A
Gaultheria hispidula	R	C	D	C	C	O	O	R	O	O	O
G. procumbens	C	O	O	O	R	A	A	A	A	A	A
Kalmia angustifolia	O	O	O	R	R	C	O	C	C	C	R
K. polifolia	A	R	A	A	A	O	O	O	R	O	A
Ledum groenlandicum	R	C	R	R	R	C	C	C	C	C	A
Lyonia ligustrina	A	R	A	A	A	C	O	C	C	C	A
Rhododendron canadense	R	O	R	R	R	C	O	C	C	C/D	A
Vaccinium angustifolium	C	R	O	R	A	A	A	A	O	A	A
V. myrtilloides	O	C	C	C	O	O	O	O	O	R	R
V. uliginosum	A	R	A	A	R	R	R	A	R	A	A
V. oxycoccos	A	R	A	A	A	C	R	C	R	C	A
Pyrolaceae											
Moneses uniflora	A	R	A	A	A	A	A	A	R	A	A
Pyrola elliptica	C	A	A	A	A	A	A	A	O	A	A
P. secunda	C	A	A	A	A	A	A	A	O	A	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Monotropaceae											
Monotropa uniflora	O	A	A	A	A	A	A	A	A	A	A
Primulaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Lysimachia ciliata	O	A	A	A	A	A	A	O	A	O	A
Trientalis borealis	C	O	O	O	O	R	R	O	O	A	A
Grossulariaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Ribes glandulosum	O	R	O	O	O	A	A	A	O	A	R
Rosaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Amelanchier bartramiana	O	C	O	O	O	O	O	R	C	R	R
Geum peckii	A	A	A	A	A	A	A	A	R	A	A
Prunus pensylvanica	O	R	R	O	R	A	A	A	A	A	O
P. serotina	O	A	A	R	A	A	A	A	A	A	R
Dalibarda repens	A	R	A	A	A	A	A	A	A	A	A
Rubus alleghaniensis	O	A	R	O	A	A	A	A	A	A	O
R. idaeus	O	A	R	O	A	A	R	O	O	A	R
R. pubescens	R	A	A	A	A	R	O	O	O	O	A
Sorbus decora	O	O	O	C	O	R	R	R	O	A	O
Potentilla simplex	O	A	A	A	A	A	A	A	A	A	A
P. tridentata	A	A	A	A	A	A	A	A	O	A	R
Cornaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Cornus canadensis	C	C	O	O	O	R	R	R	C	A	R
C. alternifolia	R	A	A	A	A	A	A	O	O	A	A
Aquifoliaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Nemopanthus mucronata	R	C	O	R	C	C	O	C	D	D	A
Aceraceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Acer pensylvanicum	C	O	O	O	A	A	O	A	O	A	O
A. rubrum	C	R	O	A	A	A	O	O	O	A	A
A. spicatum	C	R	O	A	A	A	R	A	A	A	O
A. saccharum	C	A	R	A	A	A	A	A	A	A	A
Oxalidaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Oxalis acetosella	O	C	C	C	C	A	A	A	R	R	A
Araliaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Aralia nudicaulis	C	O	O	C	A	O	O	O	C	A	A
Oleaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Fraxinus americana	C	A	A	A	A	A	A	A	A	A	A
Scrophulariaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Melampyrum lineare	O	A	A	A	A	A	A	A	A	A	A
Veronica officinalis	O	A	A	A	A	A	A	A	A	A	A
Campanulaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Campanula rotundifolia	A	A	A	A	A	A	A	A	O	A	A
Rubiaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Galium palustre	R	A	A	A	A	A	R	O	O	A	A
Mitchella repens	C	A	A	A	A	A	A	A	R	A	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Caprifoliaceae											
Diervilla lonicera	O	A	A	R	A	A	A	R	O	A	A
Linnaea borealis	O	R	O	R	R	A	A	A	R	A	A
Sambucus canadensis	O	R	R	O	A	A	A	R	O	A	R
S. racemosa	O	A	A	A	A	A	A	A	R	A	A
Viburnum alnifolium	C	O	O	O	A	O	O	C	C	O	A
V. cassinoides	R	O	R	R	A	O	O	C	C	O	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Asteraceae											
Aster acuminatus	C	C	O	C	R	O	C	C	C	R	O
A. cordifolius	O	A	A	A	A	A	R	R	O	A	A
A. macrophylla	O	A	A	A	A	A	A	A	O	A	A
A. novi-belgii	R	A	A	A	A	A	O	C	O	A	A
A. radula	O	O	O	O	A	O	C	C	C	R	O
A. umbellatus	O	R	A	R	A	A	O	C	C	R	A
Eupatorium rugosum	R	A	A	A	A	A	A	A	A	A	A
Euthamia graminifolia	O	A	A	A	A	A	A	O	A	A	A
Hieracium aurantiacum	O	A	A	A	A	A	A	A	A	A	A
Prenanthes trifoliata	O	A	A	O	A	A	A	R	O	A	O
Solidago canadensis	O	A	A	A	A	A	A	R	O	A	A
S. flexicaulis	O	A	R	R	A	A	A	A	O	A	A
S. macrophylla	O	A	A	R	A	A	A	A	O	A	A
S. rugosa	R	A	A	A	A	R	O	C	O	R	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Monocotyledons											
Potamogetonaceae											
Potamogeton confervoides	A	A	A	A	A	A	A	R	A	A	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Juncaceae											
Juncus brevicaudatus	A	A	A	A	A	A	A	C	A	A	A

	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Cyperaceae											
Carex arctata	O	O	R	O	A	A	A	A	O	A	A
C. atlantica	A	R	A	A	A	O	O	O	R	O	A
C. canescens	R	A	A	A	A	C	C	O	R	O	A
C. communis	C	A	R	A	A	A	A	A	A	A	A
C. gynandra	R	A	A	A	A	O	O	C	O	R	A
C. debilis	C	R	R	R	A	A	A	A	O	A	A
C. disperma	R	C	O	R	O	C	D	O	O	C	A
C. exilis	A	A	A	A	A	O	O	R	R	R	A
C. folliculata	O	O	O	O	R	R	R	R	R	A	A
C. interior	A	A	A	A	A	O	O	R	R	R	A
C. intumescens	O	A	A	A	A	O	O	C	O	O	A
C. leptalea	A	A	A	A	A	O	O	A	A	A	A
C. lurida	O	R	R	A	A	A	O	O	R	A	A
C. michauxiana	A	A	A	A	A	A	R	A	R	A	A
C. oligosperma	A	A	A	A	A	O	R	C	O	C	A
C. pauciflora	A	A	A	A	A	C	C	C	O	O	A
C. paupercula	A	A	A	A	A	C	C	O	O	C	A
C. utriculata	A	A	A	A	A	O	A	C	A	O	A
C. stipata	A	A	A	A	A	A	O	C	O	R	A
C. stricta	A	A	A	A	A	O	O	C	R	O	S
C. trisperma	A	O	O	O	R	O	O	O	O	O	A
C. wiegandii	A	A	A	A	A	R	A	A	A	A	A
Dulichium arundinaceum	A	A	A	A	A	O	O	C	O	C	A
Eriophorum tenellum	A	A	A	A	A	O	O	O	R	O	A

Cyperaceae, continued	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
E. virginicum	A	A	A	A	A	C	C	O	R	O	A
Rhyncospora alba	A	A	A	A	A	O	R	O	A	R	A

Poaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Agrostis gigantea	O	A	A	A	A	A	R	O	O	A	A
Brachyelytrum erectum	C	R	A	A	A	O	O	O	O	R	A
Calamagrostis canadensis	A	A	A	A	A	O	O	C	O	R	A
C. pickeringii	A	A	A	A	A	R	R	R?	R	A	A
Danthonia spicata	C	R	R	O	A	A	A	A	A	O	R
Glyceria borealis	A	A	A	A	A	A	A	C	O	C	A
G. canadensis	A	A	A	A	A	O	O	C	O	O	A
Oryzopsis asperifolia	R	A	A	A	A	A	A	A	A	A	A

Liliaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Clintonia borealis	C	O	O	O	O	A	R	A	O	A	A
Erythronium americanum	O	A	A	A	A	A	A	A	A	A	A
Maianthemum canadense	C	O	O	O	C	A	A	A	O	A	A
Medeola virginiana	C	O	O	O	A	A	O	R	O	A	A
Polygonatum pubescens	O	R	A	A	A	A	A	A	R	A	A
Smilacina racemosa	C	O	O	R	A	A	O	A	O	A	A
S. trifolia	R	R	R	A	A	C	O	R	R	R	A
Trillium erectum	O	R	R	R	A	A	A	A	A	A	A
T. undulatum	O	O	O	O	O	A	O	A	O	A	A
Streptopus amplexifolius	O	R	R	R	A	A	R	A	R	A	A
S. roseus	C	R	R	R	A	A	R	A	R	A	A
Uvularia sessilifolia	C	O	O	O	A	R	O	R	O	A	A
Veratrum viride	R	O	R	R	A	O	C	O	C	A	A

Orchidaceae	NH	OG	SF	SB	DS	AF	FS	BF	SS	PS	RS
Corallorhiza maculata	O	A	A	A	A	A	A	A	A	A	A
Cypripedium acaule	O	R	O	R	A	A	A	A	O	A	A
Epipactus helleborine	O	A	A	A	A	A	A	A	A	A	A

Appendix D

Alphabetical List of Vascular Plants with Authors and Common Names

* Non-indigenous species

Abies balsamea (L.) Miller.	Balsam fir
Acer pensylvanicum L.	Striped maple
A. rubrum L.	Red maple
A. saccharum Marshall.	Sugar-maple
A. spicatum Lam.	Mountain maple
Actaea alba (L.) Miller.	Doll's eyes
*Agrostis gigantea** Roth.	Redtop
Alnus incana (L.) Moench (= *A. rugosa*)	Speckled alder
Amelanchier bartramiana (Tausch) Roemer.	Bartram's shadbush
Andromeda glaucophylla Link.	Bog-rosemary
Aquilegia canadensis L.	Canada-columbine
Aralia nudicaulis L.	Wild sarsaparilla
Arenaria groenlandica (Retz.) Sprengal. (= *Minuartia groenlandica.* (Retz.) Ostenf.)	Mountain sandwort
Aster acuminatus Michx.	Whorled aster
A. cordifolius L.	Common blue heart-leaved aster
A. macrophyllus L.	Big-leaved aster
A. novi-belgii L.	New York aster
A. radula Aiton.	Low rough aster
A. umbellatus Miller.	Flat-topped aster
Athyrium filix-femina (L.) Roth.	Lady-fern
Betula alleghaniensis Britton.	Yellow birch
B. papyrifera Marsh var. *cordifolia* (Regal) Fern. (= *B. cordifolia* Regal.)	Heartleaf or mountain paperbirch
B. papyrifera Marshall.	White or paper-birch
B. populifolia Marshall.	Grey birch
Brachyelytrum erectum (Schreber) P. Beauv.	Short husk
Calamagrostis canadensis (Michx.) P. Beauv.	Blue-joint
C. pickeringii A. Gray.	Pickering's reed grass
Campanula rotundifolia L.	Harebell
Carex arctata W. Boott.	Drooping wood sedge
C. atlantica L. Bailey.	Atlantic sedge
C. canescens L.	Silvery sedge
C. communis L. Bailey.	Colonial sedge
C. debilis Michx.	Stalked sedge
C. disperma Dewey.	Two-seeded sedge
C. exilis Dewey.	Bog sedge
C. folliculata L.	Follicled sedge
C. gynandra Schwein.	Northern awned sedge
C. interior L. Bailey.	Inland sedge
C. intumescens Rudge.	Inflated sedge
C. leptalea Wahlenb.	Delicate sedge
C. lurida Wahlenb.	Lurid sedge
C. michauxiana Boeheler.	Michaux's sedge
C. oligosperma Michx.	Few-seeded sedge
C. pauciflora Lightf.	Few-flowered sedge
C. paupercula Michx.	Bog sedge
C. utriculata F. Boott (*C. rostrata* Stokes, misapplied)	Beaked sedge
C. stipata Muhl.	Awl sedge
C. stricta Lam.	Tussock sedge
C. trisperma Dewey.	Three-seeded sedge
C. wiegandii Mackenzie.	Wiegand's sedge
Chamaedaphne calyculata (L.) Moench.	Leatherleaf
Clintonia borealis (Aiton) Raf.	Blue bead-lily

Coptis trifolia (L.) Salisb.	Goldthread
Corallorhiza maculata (Raf.) Raf.	Spotted coral-root
Cornus alternifolia L.f.	Pagoda or alternate-leaved dogwood
C. canadensis L.	Dwarf-cornel or bunchberry
Cypripedium acuale Aiton	Moccasin-flower or pink lady's slipper
Dalibarda repens L.	Dalibarda
Danthonia spicata (L.) F. Beauv.	Poverty-oatgrass
Dennstaedtia punctilobula (Michx.) Moore.	Hay-scented fern
Diervilla lonicera Miller.	Bush-honeysuckle
Drosera intermedia Hayne.	Spatulate-leaved sundew
D. rotundifolia L.	Round-leaved sundew
Dryopteris intermedia (Muhl.) A. Gray.	Fancy wood-fern
Dryopteris campyloptera Clarkson.	Mountain wood-fern
Dulichium arundinaceum (L.) Britton.	Three-way sedge
*Epipactis hellaborine** (L.) Crantz.	Hellaborine
Equisetum arvense L.	Common or field-horsetail
Eriophorum tenellum Nutt.	Conifer cotton-grass
E. virginicum L.	Tawny cotton-grass
Erythronium americanum Ker Gawler.	Trout-lily or dogtooth violet
Eupatorium rugosoum Houttuyn.	White snakeroot
Euthamia graminifolia (L.) Nutt. (= *Solidago graminifolia* (L.) Salisb.)	Common flat-topped or grassleaved goldenrod
Fagus grandifolia Ehrh.	American beech
Fraxinus americana L.	White ash
Galium palustre L.	Marsh-bedstraw
Gaultheria procumbens L.	Wintergreen
G. hispidula (L.) Muhl.	Creeping snowberry
Geum peckii Pursh.	White-mountain-avens
Glyceria borealis (Nash) Batchelder.	Northern mannagrass
G. canadensis (Michx.) Trin.	Rattlesnake-grass
Gymnocarpium dryopteris (L.) Newman.	Oak fern
Hamamelis virginiana L.	Witch hazel
*Hieracium aurantiacum** L.	Devil's paintbrush
Juncus brevicaudatus (Engelm.) Fern.	Narrow rush
Kalmia angustifolia L.	Sheep laurel
Kalmia polifolia Wangenh.	Bog laurel
Laportea canadensis (L.) Wedd.	Wood nettle
Larix laricina (Duroi) K. Koch.	Eastern larch
Ledum groenlandicum Oeder.	Labrador tea
Linnea borealis L.	Twinflower
Lycopodium annotinum L.	Stiff clubmoss
L. lucidulum Michx.	Shining clubmoss
Lyonia ligustrina E.D.	Maleberry
Lysimachia ciliata L.	Fringed loosestrife
Maianthemum canadense Desf.	Canada mayflower
Medeola virginiana L.	Indian cucumber
Melampyrum lineare Desr.	Cow wheat
Mitchella repens L.	Partridge berry
Moneses uniflora (L.) A. Gray.	One-flowered shinleaf
Monotropa uniflora L.	Indian pipe
Myrica gale L.	Sweet gale
Nemopanthus mucronata (L.) Trel.	Mountain holly
Nuphar variegata Durand.	Yellow pond-lily
Onoclea sensibilis L.	Sensitive fern
Oryzopsis asperifolia Michx.	Mountain rice
Osmunda cinnamomea L.	Cinnamon fern
O. claytoniana L.	Interrupted fern
Ostrya virginiana (Miller) K. Koch.	Hop-hornbeam
Oxalis acetosella L. (= *O. montana* Raf.)	Mountain wood sorrel
Picea mariana (Miller) BSP.	Black spruce
P. rubens Sargent.	Red spruce

Pinus strobus L.	White pine
Polygonatum pubescens (Willd.) Pursh.	Hairy Solomon's seal
Polypodium virginianum L.	Rock polypody
Polystichum acrostichoides (Michx.) Schott.	Christmas fern
Populus grandidentata Michx.	Bigtooth aspen
P. tremuloides Michx.	Quaking aspen
Potamogeton confervoides Reichb.	Alga pondweed
Potentilla simplex Michx.	Common cinquefoil
P. tridentata Sol.	Three-toothed cinquefoil
Prenanthes trifoliata (Cass.) Fern.	Three-leaved rattlesnake root
Prunus pensylvanica L.f.	Pin cherry
P. serotina Ehrh.	Black cherry
Pteridium aquilinum (L.) Kuhn.	Bracken fern
Pyrola elliptica Nutt.	Shinleaf
P. secunda L.	One-sided pyrola
Quercus rubra L.	Red oak
Rhododendron canadense (L.) Torrey.	Rhodora
Rhyncospora alba (L.) Vahl.	Beak rush
Ribes glandulosum Grauer.	Skunk current
Rubus alleghaniensis T.C. Porter.	Common blackberry
R. idaeus L.	Wild red rasberry
R. pubescens Raf.	Dwarf rasberry
Sambucus canadensis L.	Canada elder
S. racemosa L.	Red-berried elder
Sarracenia purpurea L.	Pitcher plant
Smilacina racemosa (L.) Desf.	False Solomon's-seal
Smilacina trifolia (L.) Desf.	Three-leaved Solomon's-seal
Solidago canadensis L.	Canada goldenrod
S. flexicaulis L.	Zig-zag goldenrod
S. macrophylla Pursh.	Large-leaved goldenrod
S. rugosa Miller.	Rough goldenrod
Sorbus decora Marshall.	Mountain ash
Streptopus amplexifolius (L.) DC.	Twisted stalk
S. roseus Michx.	Rosey twisted stalk
Thalictrum pubescens Pursh.	Tall meadow rue
Thelypteris novaboracensis (L.) Nieuwl.	New York fern
T. palustris Schott.	Marsh fern
T. phegopteris (L.) Slosson.	Broad beach fern
Trientalis borealis Raf.	Starflower
Trillium erectum L.	Wake-Robin
T. undulatum Willd.	Painted trillium
Tsuga canadensis (L.) Carriere.	Hemlock
Uvularia sessilifolia L.	Sessile-leaved bellwort
Vaccinium angustifolium Aiton.	Early low blueberry
V. myrtilloides Michx.	Velvet-leaved blueberry
V. oxycoccus L.	Small cranberry
V. uliginosum L.	Alpine bilberry
Veratrum viride Aiton.	Indian poke
Veronica officinalis L.	Speedwell
Viburnum alnifolium Marshall.	Hobblebush
Viburnum nudum L. var. *cassinoides* (L.) T. & G. (= *V. cassinoides* L.)	Witherod
Viola macloskyi Lloyd var. *pallens* (Banks) C.L. Hitch. (= *Viola pallens* (Banks ex DC.) Brainerd.)	Wild white violet
Viola pubescens Aiton (= *V. pensylvanica* Michx.)	Yellow forest violet
Viola cf. renifolia A. Gray.	Kidney shaped violet

Alphabetical List of Bryophytes with Authors

Bazzania trilobata S. Gray.
B. denudata (Torrey ex. Gott. et al.)Trev.
Brachythecium acuminatum (Hedw.)Aust.
Brotherella recurvans (Mx.)Fl.
Dicranum scoparium Hedw.
D. viride (Sull. & Lesq.)Lindb.
Drepanocladus uncinatus (Hedw.)Warnst.
Hylocomnium splendens Hedw.
Hypnum imponens Hedw.
Leucobryum glaucum Angustr.
Luphozia heterocolpos (Thed.)Howe.
Mylia taylori (Hook.)S. Gray.
Neckera pennata Hedw.
Paraleucobryum longifolium (Hedw.)Loeske.
Plagiothecium laetum BSG.
Pleurozium schreberi Brid.
Pohlia nutans (Hedw.)Lindb.
Polytrichum ohioensis Hedw.
P. piliferum Hedw.
Ptilium crista-castrensis Hedw.
Scapania nemoria (L.)Grolle.
Sphagnum centrale C. Jens.
S. capillifolium (Ehrh.)Hedw.
S. cuspidatum Ehrh.
S. girgensohnii Russ.
S. magellanicum Brid.
S. papillosum Lindb.
S. russowii Warnst.
S. squarossum Crome.