

ECOLOGICAL INVENTORY
OF THE MONIQUE AND LESTER ANDERSON LANDS
LINCOLN, VERMONT

FOREST AND WETLAND ECOSYSTEMS AND FLORA

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Scope of Work

Initial ecological inventory of the Guthrie-Bancroft, Pierce, and Wells Farms, in the Quaker Street and Colby Hill areas of Lincoln and Bristol, Addison County, Vermont, was undertaken June through September 1998. Ecosystem and floristic surveys were conducted by Marc Lapin and are the focus of this summary; herpetological and mammalian inventory was conducted by Jeremy Herzig and bird surveys were conducted by Warren King.

The intent of the research was to provide introductory information about ecosystems and some of their biota. Ecosystem components that were observed include topography and landform, soils, vascular flora, and in a broad manner forest history.

The products of the 1998 ecosystem and floristic fieldwork include general descriptions of the forest and wetland ecosystems and a species list of vascular flora. Forest management stand units have been correlated with ecosystem descriptions to suggest the variety of ecosystem types included within the various management units. Ecosystem descriptions document topography, physiography and soils, as well as vegetation composition (dominant plants of the tree canopy, understory, shrub and herb layers) and, briefly, vegetation structure (sizes of dominant trees and abundances of the various layers). Observations regarding forest history and wildlife use are noted.

What are Ecosystems?

To aid the reader, I provide a brief paragraph outlining my perspective on ecosystems, also commonly referred to as natural communities. An *ecosystem* is the expression on the land of interrelationships among climate, bedrock geology, geomorphology, soil and biota (plants, animals, fungi, microbes). As such it is spatial in nature, that is, it occupies a certain space on earth. It is defined by stable physical factors (i.e. geology, climate) to which living organisms respond, and it is a geographical unit that can be described and mapped for any given piece of land or water. The spatial units--the ecosystems--occur repeatedly within the landscape, and ecosystems with very similar to nearly identical characteristics (both physical and biotic) form an *ecosystem type*. Characteristics of some of Vermont's ecosystem types have been documented in "Natural Communities of Vermont" (Thompson, 1995). Ecosystems come in a wide range of sizes; size is dependent upon physical factors, particularly, the shape of the land and the underlying rock and soil. For instance, a red maple swamp or an open bog may be large or small, depending upon the physical shape and the hydrology of the basin in which it occurs. Similarly a rich northern hardwood forest is usually small in area, but if soil, topographic and hydrologic factors are right, the rich forest may be more extensive.

The science of landscape interpretation and ecosystem classification and description requires repeated observation of the landscape and its vegetation, and repeated re-working of the classification and maps to reflect new understanding in the relationships among what appear to be discrete, repeating ecosystem units. The relationships to which I refer may be thought of as ecologically meaningful similarities and differences in ecosystem characteristics, such as topography, soil, vegetation, microclimate and landscape position.

LOCATION, GEOLOGY and SOILS

Location: The Anderson Lands, on the western slope of the Green Mountains in central Vermont, consist of four farms, two of which are adjacent; total acreage is 715.5. The bulk of the land is in the town of Lincoln, Vermont; the northernmost 121 acres are in Bristol, Vermont. Topographic coverage is on the following 3 USGS 7.5' quadrangles: Bristol, VT (1963), Mount Ellen, VT (1971) and South Mountain, VT (photinspected 1972). The property is approximately centered on 44°08'30" north latitude, 73°01' west longitude. The lowest elevation on the properties is approximately 238m (780') above sea level, at a point in the stream valley of Baldwin Creek. The highest place on the lands is 564m (1850') on the west slope of Mount Pleasant. Although the properties are not contiguous, they are all within one-half mile of each other and all lie within the New Haven River watershed, which is part of the Otter Creek and Lake Champlain watersheds. The lands drain into both Baldwin Creek and Isham Brook, and all the terrain is between Baldwin Creek on the north and the New Haven River on the south. The area is within the southern portion of the Northern Green Mountains biophysiological province.

Bedrock Geology: The land lies within the Lincoln Anticline and consists predominantly of the following rock types (Doll, 1961):

- Pinnacle formation--schistose graywacke (quartz-albite-sericite-biotite-chlorite rock predominates), with quartz-cobble and boulder conglomerate common.
- Fairfield Pond member of Underhill formation--quartzitic schist and sericite-quartz-chlorite phyllite.
- Forestdale member of Underhill formation--sandy dolomite and limestone.

The Pinnacle formation occupies the east, the Fairfield Pond member occupies the west, and the calcareous rock of the Forestdale member occurs in a narrow slice between the two. Although no geologist has examined the rock for this project, floristic evidence suggests that outcropping ledges common on the east and especially northeast parts of the Guthrie-Bancroft Farm are Forestdale member sandy dolomite and limestone rocks. Herb composition of the species-rich ledge ecosystem type has many affinities with vegetation on the ledges of the Champlain thrust fault.

Surficial Geology: The lands were ice-covered during the Wisconsin glaciation of the Pleistocene. As the ice sheets retreated, ablation till was deposited in the Lincoln area (Calkin and MacClintock, n.d.). Ablation till predominantly comes from the top and within the melting ice and is, thus, frequently partially sorted and contains high proportions of sand and gravel. Calkin and MacClintock note that the distribution of ice-contact features, such as kame terraces and kame fields (or kame moraine), in the area indicates that the melting glacier left stagnant ice blocks across the landscape. As these ice blocks melted, much of the fine particles, such as clay and silt, was washed out and the remaining local deposits were mostly sands, gravel and cobbles.

The observation that a substantial portion of the Anderson Lands has fine sandy loam surface soil indicates that much of the parent material is ablation till. Sorting, although not clearly seen in large soil pits or cuts, is indicated in the common occurrence of a stony or very stony layer underlying the less rocky topsoil. There is a noticeable kame field one mile or so east of the property, on the east side of Mount Pleasant (Downingville

Road at the Starksboro-Lincoln townline) (Calkin and MacClintock, n.d.), but all of the topography of the Anderson Lands appears to be related to bedrock features rather than kamic ones. Nevertheless, it is very reasonable to imagine ice blocks of all sizes stranded and down-wasting there in the late Pleistocene. There was surely a lot of water and pulverized rock moving throughout this local peri-glacial landscape.

Soils: The USDA Soil Conservation Service (Griggs, 1971) classified the soils on the property as the following:

- Berkshire and Marlow stony loams--Deep, well-drained spodosols that formed in glacial till deposits derived mainly of schistose and quartzitic rocks; Berkshire and Marlow soils were mapped in undifferentiated units. Marlow differs from Berkshire in the presence of a hard layer (fragipan), at a depth of 38-76cm, that drastically slows downward movement of water. The surface soil of both series is thin, black fine sandy loam; lower horizons are gray, reddish-brown and yellowish brown fine sandy loam, gravely below 13cm or so.
- Berkshire and Marlow extremely stony loams--Similar to the above, but with a gravely loam surface layer.
- Lyman-Berkshire very rocky complex--Lyman are excessively and somewhat excessively drained spodosols; they are shallow to schist or phyllite bedrock, which lies at a depth of 25-50cm. Texture is loam to fine sandy loam. Surface soil is a moderately shallow black loam; subsurface layers are dark reddish-gray, reddish-brown, brown and dark brown. A small piece of Lyman-Berkshire rocky complex was mapped on the property also.
- Peru extremely stony loam--Moderately well drained loamy spodosols that formed in glacial till deposits derived from schistose rocks. A fragipan begins at 30-76cm deep. The surface soil is deep, dark reddish-brown loam; subsurface horizons are loam to sandy and fine sandy loam and are weak red, very dark gray, dark reddish-brown, strong-brown and pale-brown. Mottling is common below 30-46cm.
- Cabot extremely stony loam--Poorly drained and somewhat poorly drained inceptisols that formed in glacial material derived from schistose and limestone rocks; they have a fragipan beginning at 30-60cm deep. The surface soil is deep black loam; lower horizons are dark gray and olive-gray, prominently mottled loam.

All these soils are extremely to strongly acid, except for the Cabot series which may approach neutral.

Ecological investigations found there to be much more variety in the soil profiles than what is described in the published soil survey. This is not surprising, for soils are very variable over short spaces and what is of interest ecologically is much more detailed than what has traditionally been of interest for agricultural crop and forestland management, and for land development. The native flora responds in a much more refined way to soil variations than do crop species, and much of the science of understanding ecological relationships among biota and physical components of the ecosystem is expressed in detailed differences in soil profile characteristics.

With specific regard to the Anderson Lands, that which is mapped as Berkshire-Marlow extremely stony loam is greatly variable across this fragment of landscape, and this soil variability is clearly seen in vegetation differences. Also, those areas mapped as Cabot extremely stony loams are similarly variable and significantly different from an ecological perspective.

Literature Cited

Calkin, Parker E. and P. MacClintock. no date. Surficial geology of the Lincoln Mountain quadrangle. Open-File Report No. X-2. Vermont Geological Survey, Waterbury, VT.

Doll, Charles, G. 1961. Centennial Geologic Map of Vermont. Vermont Geological Survey, Waterbury, VT.

Griggs, John E. 1971. Soil Survey of Addison County, Vermont. USDA Soil Conservation Service, US Government Printing Office, Washington, D.C.

Thompson, Elizabeth. 1995. Natural communities of Vermont, Uplands and wetlands, July 1995 draft. Vermont Nongame and Natural Heritage Program, Waterbury, VT.

1998 RESULTS

The results presented herein are of three types. One is a partial vascular plant species list for the three properties. The list is divided into woody species and herbaceous species. Although no serious identification and inventory of bryophytes was undertaken, a ridiculously short list of mosses is also included. Species counts at this time are 64 species of woody plants and 235 species of herbaceous plants. The great majority of species have been identified to the species level, but the reader will find a number of genera in which identification to the species level is lacking.

The second type of result presented is a narrative description of the landscape and ecosystems of each farm. The third type are relatively detailed ecosystem descriptions that include information about dominant plant species, soils, and topography.

Although the three properties are in close proximity and are part of the same landscape-- west slope of the Green Mountains in the New Haven River watershed-- ecosystem descriptions are reported on a farm by farm basis. Further investigation and analysis can provide insight into a more comprehensive, ecologically oriented picture of the properties as an entirety, and from this a classification of ecosystem types can be constructed that ignores farm boundaries and is relevant to the entire local landscape.

Partial Species List
Alphabetical by Species

Woody Plants

<i>Abies balsamea</i>	balsam fir
<i>Acer pensylvanicum</i>	striped maple
<i>Acer rubrum</i>	red maple
<i>Acer saccharum</i>	sugar maple
<i>Acer spicatum</i>	mountain maple
<i>Alnus incana</i>	speckled alder
<i>Amelanchier sp.</i>	shadbush
<i>Berberis vulgaris</i>	European barberry
<i>Betula alleghaniensis</i>	yellow birch
<i>Betula lenta</i>	sweet birch
<i>Betula papyrifera</i>	paper birch
<i>Betula populifolia</i>	gray birch
<i>Carpinus caroliniana</i>	musclewood
<i>Cornus alternifolia</i>	alternate-leaved dogwood
<i>Corylus cornuta</i>	beaked hazel
<i>Crataegus sp.</i>	hawthorn
<i>Dirca palustris</i>	leatherwood
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus americana</i>	white ash
<i>Fraxinus nigra</i>	black ash
<i>Hamamelis virginiana</i>	witch-hazel
<i>Juglans cinerea</i>	butternut
<i>Larix laricina</i>	tamarack
<i>Lonicera canadensis</i>	Canada fly-honeysuckle
<i>Lonicera morrowii</i>	Morrow's honeysuckle
<i>Malus sp.</i>	apple
<i>Ostrya virginiana</i>	hophornbeam
<i>Parthenocissus quinquefolia</i>	Virginia creeper
<i>Picea rubens</i>	red spruce
<i>Pinus resinosa</i>	red pine
<i>Pinus strobus</i>	white pine
<i>Populus balsamifera</i>	balsam poplar
<i>Populus grandidentata</i>	bigtooth aspen
<i>Populus tremuloides</i>	trembling aspen
<i>Prunus pensylvanica</i>	pin cherry
<i>Prunus serotina</i>	black cherry
<i>Prunus virginiana</i>	choke cherry
<i>Quercus rubra</i>	red oak
<i>Rhamnus alnifolia</i>	alder-leaved buckthorn
<i>Rhamnus cathartica</i>	European buckthorn
<i>Ribes cf. hirtellum</i>	smooth gooseberry

<i>Ribes cynosbati</i>	prickly gooseberry
<i>Rubus alleghaniensis</i>	common blackberry
<i>Rubus flagellaris</i>	northern dewberry
<i>Rubus hispidus</i>	swamp dewberry
<i>Rubus idaeus</i>	red raspberry
<i>Rubus pubescens</i>	dwarf raspberry
<i>Salix spp.</i>	willow
<i>Sambucus pubens</i>	red elderberry
<i>Sambucus racemosa</i>	black elderberry
<i>Sorbus americana</i>	mountain-ash
<i>Spiraea alba</i>	meadowsweet
<i>Spiraea tomentosa</i>	steeplebush
<i>Thuja occidentalis</i>	northern white-cedar
<i>Tilia americana</i>	basswood
<i>Toxicodendron radicans</i>	poison-ivy
<i>Tsuga canadensis</i>	eastern hemlock
<i>Ulmus americana</i>	American elm
<i>Vaccinium angustifolium</i>	early low blueberry
<i>Viburnum acerifolium</i>	maple-leaved viburnum
<i>Viburnum alnifolium</i>	hobblebush
<i>Viburnum lentago</i>	nannyberry
<i>Viburnum opulus var. americanum</i>	highbush-cranberry
<i>Viburnum recognitum</i>	arrowwood

Herbs

<i>Achillea millefolium</i>	common yarrow
<i>Acorus calamus</i>	sweet flag
<i>Actaea pachypoda</i>	white baneberry, doll's eyes
<i>Actaea rubra</i>	red baneberry
<i>Adiantum pedatum</i>	maidenhair fern
<i>Agrimonia gryposepala</i>	agrimony
<i>Allium tricoccum</i>	wild leek
<i>Amphicarpaea bracteata</i>	hog-peanut
<i>Anaphalis margaritacea</i>	pearly everlasting
<i>Anemone quinquefolia</i>	wood-anemone
<i>Anemone virginiana</i>	thimbleweed
<i>Anthoxanthum sp.</i>	grass
<i>Apocynum androsaemifolium</i>	spreading dogbane
<i>Arabis sp.</i>	rock-cress
<i>Aralia nudicaulis</i>	wild sarsaparilla
<i>Arenaria lateriflora</i>	broad-flowered sandwort
<i>Arisaema triphyllum</i>	jack-in-the-pulpit
<i>Asarum canadensis</i>	wild-ginger
<i>Asplenium trichomanes</i>	maidenhair spleenwort
<i>Aster acuminata</i>	whorled mountain aster
<i>Aster divaricatus</i>	white wood aster
<i>Aster lanceolatus</i>	eastern lined aster
<i>Aster lateriflorus</i>	goblet aster
<i>Aster macrophyllus</i>	big-leaved aster
<i>Aster puniceus</i>	bristly aster
<i>Athyrium filix-femina</i>	lady fern
<i>Athyrium thelypteroides</i>	silvery spleenwort
<i>Bidens cernua</i>	nodding beggar's-ticks
<i>Botrychium sp.</i>	grape-fern
<i>Botrychium virginianum</i>	rattlesnake-fern
<i>Brachyletrum erectum</i>	short-husk grass
<i>Bromus cf. ciliatus</i>	fringed brome
<i>Callitriche cf. palustris</i>	water-starwort
<i>Caltha palustris</i>	marsh-marigold
<i>Cardamine pensylvanica</i>	Pennsylvania bitter-cress
<i>Carex appalachica</i>	sedge
<i>Carex arctata</i>	sedge
<i>Carex blanda</i>	sedge
<i>Carex bromoides</i>	sedge
<i>Carex cf. deflexa</i>	sedge
<i>Carex communis</i>	sedge
<i>Carex complanata var. hirsuta</i>	hirsute sedge
<i>Carex debilis</i>	sedge

<i>Carex deweyana</i>	sedge
<i>Carex disperma</i>	two-seeded sedge
<i>Carex echinata</i>	sedge
<i>Carex flava</i>	sedge
<i>Carex gracillima</i>	slender sedge
<i>Carex granularis</i>	sedge
<i>Carex gynandra</i>	awned sedge
<i>Carex intumescens</i>	bladder sedge
<i>Carex laxiflora</i>	sedge
<i>Carex leptalea</i>	lima-bean sedge
<i>Carex leptonervia</i>	two-nerved sedge
<i>Carex lurida</i>	sedge
<i>Carex pallescens</i>	sedge
<i>Carex pedunculata</i>	stalked sedge
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Carex plantaginea</i>	plaintain-like sedge
<i>Carex platyphylla</i>	broad-leaved sedge
<i>Carex prasina</i>	sedge
<i>Carex radiata</i>	sedge
<i>Carex rosea</i>	sedge
<i>Carex rostrata</i>	sedge
<i>Carex scabrata</i>	scabrous sedge
<i>Carex section ovales</i>	ovales sedge
<i>Carex stipata</i>	sedge
<i>Carex stricta</i>	tussock sedge
<i>Carex tenera</i>	sedge
<i>Carex tribuloides</i>	sedge
<i>Carex trisperma</i>	three-seeded sedge
<i>Carex umbellata</i>	sedge
<i>Carex virescens</i>	sedge
<i>Carex vulpinoidea</i>	sedge
<i>Caulophyllum thalictroides</i>	blue cohosh
<i>Cerastium sp.</i>	chickweed
<i>Chelone glabra</i>	turtleheads
<i>Chimaphila umbellata</i>	pipsissewa
<i>Chrysanthemum leucanthemum</i>	daisy
<i>Chrysosplenium americanum</i>	golden-saxifrage
<i>Cinna latifolia</i>	drooping woodreed
<i>Circaea alpina</i>	dwarf enchanter's-nightshade
<i>Circaea lutetiana</i>	enchanter's-nightshade
<i>Cirsium sp.</i>	thistle
<i>Claytonia caroliniana</i>	spring beauty
<i>Clematis virginiana</i>	virgin's bower
<i>Clintonia borealis</i>	bluebead lily
<i>Coptis trifolia</i>	goldthread

<i>Corallorhiza trifida</i>	northern coral-root
<i>Cornus canadensis</i>	bunchberry dogwood
<i>Cypripedium acaule</i>	pink lady's-slipper
<i>Cystopteris bulbifera</i>	bulblet bladder-fern
<i>Cystopteris fragilis</i>	fragile fern
<i>Danthonia spicata</i>	poverty grass
<i>Dennstaedtia punctilobula</i>	hay-scented fern
<i>Dentaria diphylla</i>	broad-leaved toothwort
<i>Dentaria laciniata</i>	cut-leaved toothwort
<i>Dicentra canadensis</i>	squirrel-corn
<i>Dicentra cucullaria</i>	Dutchman's breeches
<i>Dryopteris carthusiana</i>	toothed wood-fern
<i>Dryopteris clintoniana</i>	Clinton's wood-fern
<i>Dryopteris cristata</i>	crested wood-fern
<i>Dryopteris intermedia</i>	intermediate wood-fern
<i>Dryopteris marginalis</i>	marginal wood-fern
<i>Echinocystis lobata</i>	wild cucumber
<i>Elymus hystrix</i>	bottlebrush grass
<i>Epifagus virginiana</i>	beech-drops
<i>Epilobium glandulosum</i>	northern willow-herb
<i>Epilobium leptophyllum</i>	narrow-leaved willow-herb
<i>Epipactis helleborine</i>	hellebore
<i>Equisetum arvense</i>	common horsetail
<i>Equisetum fluviatile</i>	water-pipes
<i>Equisetum scirpoides</i>	dwarf scouring rush
<i>Equisetum sylvaticum</i>	woodland horsetail
<i>Erythronium americanum</i>	trout lily
<i>Eupatorium maculatum</i>	spotted joe-pye-weed
<i>Eupatorium perfoliatum</i>	boneset
<i>Eupatorium rugosum</i>	white snakeroot
<i>Festuca obtusa</i>	nodding fescue
<i>Fragaria sp.</i>	wild strawberry
<i>Galium asprellum</i>	cleavers
<i>Galium circaezans</i>	wild-licorice
<i>Galium palustre</i>	marsh bedstraw
<i>Galium triflorum</i>	sweet-scented bedstraw
<i>Geranium robertianum</i>	herb-robert
<i>Geum canadense</i>	white avens
<i>Geum rivale</i>	water avens
<i>Geum sp.</i>	avens
<i>Glyceria canadensis</i>	rattlesnake-mannagrass
<i>Glyceria grandis</i>	American mannagrass
<i>Glyceria melicaria</i>	northeastern mannagrass
<i>Glyceria striata</i>	fowl-mannagrass
<i>Goodyera pubescens</i>	downy rattlesnake-plantain

<i>Gymnocarpium dryopteris</i>	oak-fern
<i>Habenaria hyperborea</i>	tall northern bog-orchid
<i>Hepatica acutiloba</i>	sharp-lobed hepatica
<i>Hepatica americana</i>	round-lobed hepatica
<i>Hieracium sp.</i>	hawkweed
<i>Hydrocotyle americana</i>	marsh-pennywort
<i>Hydrophyllum virginianum</i>	Virginia waterleaf
<i>Hypericum punctatum</i>	spotted St. John's-wort
<i>Impatiens capensis</i>	spotted touch-me-not
<i>Impatiens pallida</i>	yellow touch-me-not
<i>Juncus effusus</i>	soft rush
<i>Laportea canadensis</i>	wood-nettle
<i>Leonorus cardiaca</i>	motherwort
<i>Ludwigia palustris</i>	common water-purslane
<i>Luzula acuminata</i>	wood-rush
<i>Luzula multiflora</i>	wood-rush
<i>Lycopodium annotinum</i>	stiff clubmoss
<i>Lycopodium clavatum</i>	running clubmoss
<i>Lycopodium complanatum</i>	running-pine
<i>Lycopodium lucidulum</i>	shining clubmoss
<i>Lycopodium obscurum</i>	princess-pine
<i>Lycopus uniflorus</i>	northern bugleweed
<i>Lysimachia ciliata</i>	fringed loosestrife
<i>Maianthemum canadense</i>	Canada mayflower
<i>Matteuccia struthiopteris</i>	ostrich fern
<i>Medeola virginiana</i>	indian-cucumber
<i>Mentha cf. arvensis</i>	wild mint
<i>Mitchella repens</i>	partridgeberry
<i>Mitella diphylla</i>	two-leaved mitrewort
<i>Muhlenbergia sp.</i>	grass
<i>Onoclea sensibilis</i>	sensitive fern
<i>Oryzopsis asperifolia</i>	rough-leaved ricegrass
<i>Osmorhiza claytonii</i>	bland sweet cicely
<i>Osmunda cinnamomea</i>	cinnamon-fern
<i>Osmunda claytoniana</i>	interrupted fern
<i>Osmunda regalis</i>	royal fern
<i>Oxalis montana</i>	mountain wood-sorrel
<i>Oxalis sp.</i>	Eurasian wood-sorrel
<i>Phalaris arundinacea</i>	reed canary-grass
<i>Pilea pumila</i>	clearweed
<i>Poa compressa</i>	flat-stemmed bluegrass
<i>Poa sp.</i>	bluegrass
<i>Polistichum acrostichoides</i>	Christmas fern
<i>Polygala paucifolia</i>	gaywings
<i>Polygonatum pubescens</i>	Solomon's-seal

<i>Polygonum cilinode</i>	fringed bindweed
<i>Polygonum hydropiper</i>	water-pepper
<i>Polygonum sagittatum</i>	arrow-leaved tearthumb
<i>Polypodium virginianum</i>	rock polypody
<i>Potentilla simplex</i>	old-field cinquefoil
<i>Potentilla sp.</i>	cinquefoil
<i>Prenanthes trifoliolata</i>	fall rattlesnake-root
<i>Prunella vulgaris</i>	heal-all
<i>Pteridium aquilinum</i>	bracken
<i>Pyrola cf. chlorantha</i>	green shinleaf
<i>Pyrola elliptica</i>	common shinleaf
<i>Pyrola secunda</i>	one-sided wintergreen
<i>Ranunculus abortivus</i>	small-flowered crowfoot
<i>Ranunculus acris</i>	common buttercup
<i>Ranunculus hispidus var. caricetorum</i>	bristly buttercup
<i>Ranunculus recurvatus</i>	hooked crowfoot
<i>Rumex acetosella</i>	red sorrel
<i>Sanicula marilandica</i>	black snakeroot
<i>Saxifraga pensylvanica</i>	swamp saxifrage
<i>Saxifraga virginiana</i>	early saxifrage
<i>Scirpus atrovirens</i>	black bulrush
<i>Scirpus cyperinus</i>	wool-grass
<i>Scutellaria lateriflora</i>	skullcap
<i>Sedum purpureum</i>	live forever
<i>Senecio schweinitzianus</i>	Robbin's ragwort
<i>Sisyrinchium montanum</i>	blue-eyed-grass
<i>Smilacina racemosa</i>	false Solomon's-seal
<i>Solanum dulcamara</i>	climbing nightshade
<i>Solidago flexicaulis</i>	zig-zag goldenrod
<i>Solidago gigantea</i>	late goldenrod
<i>Solidago juncea</i>	blue-stemmed goldenrod
<i>Solidago rugosa</i>	wrinkled goldenrod
<i>Stachys palustris var. pilosa</i>	hedge-nettle
<i>Streptopus roseus</i>	rosy twisted-stalk
<i>Taraxacum officinalis</i>	dandelion
<i>Thalictrum polygamum</i>	tall meadow-rue
<i>Thelypteris noveboracensis</i>	New York fern
<i>Thelypteris palustris</i>	marsh fern
<i>Thelypteris phegopteris</i>	narrow beech-fern
<i>Tiarella cordifolia</i>	foamflower
<i>Tragopogon cf. pratensis</i>	showy goat's-beard
<i>Triadenum fraseri</i>	marsh St. John's-wort
<i>Trientalis borealis</i>	starflower
<i>Trillium erectum</i>	wakerobin
<i>Trillium undulatum</i>	painted trillium

<i>Uvularia grandiflora</i>	big-flowered bellwort
<i>Uvularia sessilifolia</i>	sessile-leaved bellwort
<i>Veratrum viride</i>	false hellebore
<i>Veronica officinalis</i>	common speedwell
<i>Vicia sp.</i>	vetch
<i>Viola cf. cucullata</i>	marsh violet
<i>Viola pubescens</i>	yellow wood-violet
<i>Viola renifolia</i>	kidney-leaved violet
<i>Viola rotundifolia</i>	round-leaved violet
<i>Viola spp.</i>	violet
<i>Waldsteinia fragarioides</i>	barren-strawberry
<i>Woodsia ilvensis</i>	rusty cliff-fern

Mosses

<i>Climacium dendroides</i>
<i>Hylocomnium splendens</i>
<i>Mnium sp.</i>
<i>Polytrichum sp.</i>
<i>Rhytidiadelphus triquetrus</i>
<i>Thuidium delicatulum</i>

Guthrie-Bancroft Farm

Overview

The Guthrie-Bancroft Farm lies adjacent to Baldwin Creek, a major tributary to the New Haven River. The topography is gently to very steeply sloping; the land includes a shallow, ledgy knoll, a series of parallel, rich, wooded ledges, a seepy, very steep slope down to Baldwin Creek and two tributary streams. The vegetation on this varied landscape includes quite an assortment of northern hardwood and transition hardwood forest ecosystems, hemlock-ravine forest, wet-mesic spruce-fir-yellow birch forest, mixed conifer-hardwood swamp and open shrub-sedge wetland. The predominant soil types are classified as Berkshire, Marlow, Cabot and Peru, but this simplification of the soil profiles in no way indicates the variability of the forest ecosystems and their characteristic soil profiles. Large portions of the woodlands have been selectively harvested in recent decades, but there remains a number of stands that have not been actively managed for many years. A significant portion of the forestlands have probably historically been permanently wooded, for these areas are either too steep or too wet to have been useful for agriculture. The more level, better drained terrain is post-agricultural forest.

The Forested Landscape

Two types of rich northern hardwood forest occur on the farm. The smaller type is associated with a schist knoll at the south end of which is the remnant foundation of an old farmhouse. This ledgy, mesic, rich northern hardwood forest is dominated by sugar maple, with white ash, basswood and butternut as associates; hophornbeam is a common understory tree, and European buckthorn is unfortunately all too common in this high edge:interior ratio stand. The herbs are characteristic of ledgy, rich woods throughout western Vermont; the spring wildflower display is impressive.

The other type of rich northern hardwood forest occurs on the seepy slope adjacent to Baldwin Creek. It is seepy, corrugated, pit-and-mound terrain where numerous springs trickle through the bedrock and create glades of rich-woods flora. The tree canopy is diverse with sugar maple, beech, white ash, black cherry, red oak, yellow birch, sweet birch and butternut that average approximately 35cm dbh (diameter at breast height) and are commonly as large as 50cm. The herb layer is a rich assortment of ferns and forbs; species are distributed in a pattern related to the moist rises and wet, seepy swales.

On parts of the lower slope of the Baldwin Creek ravine is a forest of hemlock, yellow birch and white ash. The lower slope is not seepy, is heavily shaded by hemlock foliage, and does not have the herb richness of the seepy upper and mid-slope. Some of the hemlock are large; the greatest measured was 69cm dbh. This forest ecosystem is neither as extensive nor as densely hemlock-dominated as the Isham Brook hemlock ravine (described in the Pierce Farm section).

Above the seepy slope is a knoll with very shallow soil. The species poor community is dominated by red maple, red oak and red spruce, in addition to the pioneer bigtooth aspen. Acid-woods species dominate the forest floor. The western extent of the knoll is a dry-mesic, west-facing hardwood forest on fine sandy loam which features beech, red maple, red oak, white ash and sweet birch, and a sparse herb layer. A similar

forest grows on the south-facing slope below the knoll. The south-facing community grows on loam soil and is dominated by red oak, red maple, paper birch and white ash, and even features a handful of red pine.

The southern part of the Guthrie-Bancroft property is very different from the northern woods described above. The south is gently sloping to level and is dominated by moderately well to poorly drained soils with shallow fragipans (Cabot and Peru series). The most widespread ecosystem here is a conifer-hardwood mixed forest dominated by red spruce, balsam fir and yellow birch; the wetter depressions have vegetation characteristic of swamps, whereas the drier mounds feature more of a northern-hardwood-type ground flora. Where the gentle slope levels to a flat, a hardwood-conifer swamp occurs, with red maple, yellow birch, balsam fir and red spruce on shallow muck over a rocky fragipan layer. Dwarf raspberry, robust wetland ferns and sphagnum and brown mosses dominate the ground vegetation. A similar, although less coniferous forested swamp occurs in a more central location on the farm; small patch and selection tree harvest has been recent there.

The property contains some open wetlands also. The largest consists of a wet sedge meadow with scattered alder and willow shrubs surrounded by a ring of denser willows and scattered gray birch. A nearby patch dominated by alder and willow is likely recovering from a history of use as wet pasture; white ash and black cherry are common small trees throughout the patch and the vegetation has a successional feel to it. Another small open wetland lies close to Guthrie Road; common horsetail, sedges and sensitive fern dominate along with meadowsweet and scattered trembling aspen, balsam poplar and white ash; this patch also may be recovering from clearing for pastureland.

A substantial portion of the northeast and central part of the Guthrie-Bancroft Farm is dominated by white pine. The old-field white pine forest masks the true nature of the potential forest vegetation on such lands. Much of it is forest on silt loam or stony silt loam and with uninterrupted succession appears likely to grow into beech, sugar and red maple northern hardwood forest. Some parts of the old-field pine forest are moister and would likely develop into wet-mesic red maple-dominated ecosystems.

ECOSYSTEM DESCRIPTIONS--GUTHRIE-BANCROFT FARM

RICH, SEEPY, MESIC NORTHERN HARDWOOD FOREST--Stands 7 & 9 Steep slope, North aspect, Relatively shallow loam soil

The steep northern slope south of Baldwin Creek (and Vermont Route 17) is predominantly a rich, seepy northern hardwood forest ecosystem. Groundwater emerges through the bedrock in many places on the upper- and mid-slope and has created a corrugated microtopography of seepy swales coursing downhill and moist, flat-topped ridges between swales. The tree canopy is diverse and trees 25-35cm dbh dominate, but many individuals measure 38-45cm dbh. Sugar maple, yellow birch, white ash, red oak, beech, butternut, paper birch, black cherry and red maple all occur in the overstory. The understory is sugar maple, beech and striped maple. The herb flora responds dramatically to the pattern of seeps and general terrain. Richness is apparent throughout the slope. Typical seep herbs are blue cohosh, wood-nettle, maidenhair fern, wild leek, ostrich fern, touch-me-not and golden saxifrage. Dominant herbs in general are plaintain-leaved sedge,

blue cohosh, lady fern, New York fern, wakerobin, silvery spleenwort, white wood aster, intermediate wood-fern and Christmas fern. Many other species are present also.

Soil on the slope has 10-20cm of a blackish loam A horizon. Decomposition and mixing are rapid in the rich forest and each season's leaf litter is rapidly decomposed and mixed into the organic-rich A. The B_s horizon ranges from 15 to 40cm and is a dark reddish brown loam; beneath this the soil is stonier, with common small gravel in the B/C and C horizons. In seeps, mottling is present at approximately 60cm. The soil depth varies on the slope. Near the top of the rich, mesic forest, seepy, sloping pavement outcrops occur, while soil mid- and lower-slope appears to be 80cm or so atop the bedrock. Slope averages approximately 35%.

Some of the larger trees are white ash--56cm dbh, red oak--51cm, butternut--46cm, sugar maple--46cm. A cored 56cm white ash was found to be approximately 65 years old. Herb coverage is high, and the forest has nicely developed stratification of overstory and understory trees, saplings and tall shrubs, low shrubs and herbs. There is a fair amount of deadwood on the forest floor. Relatively recent tip-ups are numerous, and, as is now common throughout its range, canker has infected the butternut, and they are commonly dead and standing. At the upslope limits of the ecosystem, where the rich forest meets acidic, knoll-top forest, two heavily bear-scarred, 64cm-dbh beech trees stand on the property line.

RICH, MESIC, BEDROCK KNOLL, NORTHERN HARDWOOD FOREST--Stand 4
Rocky knoll, Much exposed ledge, East and West aspects, Stony loam soil

Adjacent to the old farmhouse, now a well-preserved foundation, is a rocky, rich forest with a wonderful array of spring wildflowers. The ecosystem is clearly related to the chemical composition of the outcropping bedrock (presumably Forestdale member sandy dolomite and limestone), for the richness of the forest ends abruptly to the north where the outcrop sinks beneath deep soil. The rich bedrock outcrops in other places on the northeast portion of the Guthrie-Bancroft Farm, and the limy-ledge herb flora grows there as well. In fact, there is a series of several more-or-less parallel outcropping ledges on this part of the property and east of the woods road that forms the northeast boundary of the farm.

Sugar maple is the dominant tree; probably this stand adjacent to the farmhouse was formerly managed as a sugarbush; other common trees are white ash, butternut, basswood, black cherry and American elm; hophornbeam is abundant in the understory, and near the pasture edge European buckthorn is also common. Dominant overstory trees measure 20-35cm dbh, with a few larger butternut trees. Common herb species include lady fern, blue cohosh, enchanter's-nightshade, Dutchman's breeches, squirrel-corn, yellow violet, wild ginger, trout lily, bulblet bladder fern, and many others.

The northeast corner of the Guthrie Farm has a series of parallel ledges that trend northerly/southerly. Richness of the exposed rock is nicely displayed in the composition and diversity of herb species growing upon it. Species on these shaded, 2-6m-tall ledge outcrops include bulblet bladder-fern, two-leaved mitrewort, large-flowered bellwort, wild ginger, zig-zag and bluestem goldenrods, herb-robert, dwarf enchanter's-nightshade, wild leek, nodding fescue, jack-in-the-pulpit, sharp-lobed hepatica, blue cohosh, fragile fern, marginal wood-fern and maidenhair spleenwort. The most common shrubs on the

ledges are mountain maple and red raspberry. Atop the largest ledge is a shallow-soil, dry forest of red oak, red maple and white pine, with white ash, hemlock and hophornbeam. Early low blueberry is common, and the herb species are few, in stark contrast to the rich ledge below. Wild strawberry, Canada mayflower, poverty grass, marginal wood-fern, rough-leaved rice-grass, wild sarsaparilla and partridgeberry are present.

MESIC, NORTHERN HARDWOOD FOREST, LOAM OVER STONY LOAM--Stands 5, 6 & 9

Gently to moderately sloping, All aspects, Loam over stony loam soil

A "general" northern hardwood forest type occurs in various parts of the Guthrie-Bancroft Farm. These forest stands have varied histories, are in different stages of succession, and presently may look quite different based on dominant trees. What holds these places together as an ecosystem type is similarity in soil, herb flora, and potential vegetation. The three dominant trees of the northern hardwood forest--sugar maple, yellow birch and American beech--are usually present in these stands, although in some of the old-field forest on the farm, these species have not yet entered the canopy, nor the understory in some places. The younger stands contain high percentages of white pine, red maple and, perhaps, trembling aspen and paper birch. The trees of the mature forest, in addition to the three dominants noted above, include white ash, black cherry, red spruce and hemlock. These associates may or may not occur in any given part of this ecosystem, and their presence and absence in a mid-successional to mature forest are related to factors such as slope, soil depth and chemistry, stoniness, and historical events related to germination and establishment of the various trees (environmental stochasticity, or chance coincidence of events). Along with saplings of the dominant northern hardwoods, the understory may contain hemlock, spruce, striped maple and hophornbeam; in especially moist microsites musclewood may be present. Beaked hazel is often the only shrub in substantial numbers. The ground-cover vegetation has a mix of ferns and forbs. Intermediate wood-fern, lady fern, New York fern, interrupted fern and Christmas fern all may be common; hay-scented fern is often abundant in younger and more recently disturbed stands. Herb species are substantially fewer in this hardwood forest ecosystem than in the richer and moister hardwood types. Canada mayflower, starflower, foamflower, partridgeberry and slender sedge are the most common species; short-husk grass is common in patches.

A typical soil profile shows 2-6cm dark brown, loam or silty loam A horizon and a stony loam B horizon 20-30cm thick. Where there is a plow layer, the A horizon may extend 30cm deep. pH throughout the horizon is typically 5.0-5.6.

Forest structure varies considerably due to successional and management history. In general, the forest has an immature to mid-successional structure; that is, it lacks well developed stratification characteristic of mature northern hardwood forests. Often the overstory and sapling layers are developed, while the understory stratum is absent. The herb layer is often heavily dominated by ferns, with forb coverage and abundance substantially less than in the richer northern hardwood ecosystems.

MESIC, NORTHERN HARDWOOD FOREST, DEEP SILT LOAM--Stands 2 & 9
Gently sloping, West and northwest aspects, Silt loam soil, Deep A horizon

The eastern edge of the Guthrie-Bancroft Farm has active deposition of silty alluvium on a gentle slope where numerous rivulets both run in gullies and fan out on the forest floor. A growth of sugar maple and white ash proliferates above a ferny ground cover. At least the southern part and perhaps all of this ecosystem was agricultural land, and the tree flora indicates the successional status. Species such as tamarack, white pine, gray birch, balsam fir, trembling aspen and pin cherry will die out as the forest matures. Sugar maple and white ash are the dominants currently and are likely to remain so; yellow birch, red maple, red spruce, American elm and black cherry are associate trees. Ferns and mosses paint the forest floor; lady fern, interrupted fern, New York fern, sensitive fern, avens and slender sedge are the dominant herbs, whereas *Thuidium delicatulum* and hairy-cap moss (*Polytrichum* sp.) spot the brown silt soil. Bare soil, however, predominates in this system of rapid decomposition and mixing; little leaf litter accumulates on the surface of the silt loam A horizon (pH 5.8-6.0), which is 30-35cm thick above a silt loam, medium brown B horizon (pH 5.6-5.8) or a cobbly, stony loam B/C or C horizon. Scattered cobbles are common on the surface, likely the deposits of periodic large storm and flood events. The ecosystem is likely highly productive; in the north part of it grows a grove of beautiful white ash, straight, tall and 16" in diameter. Most of the forest in this ecosystem is too young to reveal the potential stature of the trees.

SOMEWHAT POORLY DRAINED, RED SPRUCE-BALSAM FIR-YELLOW BIRCH
FOREST--Stand 2

Gently sloping, West aspect, Silt loam soil, Shallow fragipan

The most widespread ecosystem on the south part of the Guthrie-Bancroft Farm is a hummocky, mixed forest, generally wet, but with raised, better drained mounds. Red spruce, balsam fir, yellow birch and red maple are the most common trees, yet diversity is high because of both the forest management history and the microtopography. Nearer to the mowed meadow, where white pine is the dominant tree, the forest is younger and contains more early successional species such as trembling aspen, balsam poplar, apple and hawthorn. Farther from the prime farmland, the woods is more mature, and red spruce, yellow birch, balsam fir and hemlock are most common. The microtopography is very hummocky; raised mounds are preferred by the trees and mesic-forest herbs, and low, swampy depressions are viney and herbiferous. The depression herbs include sensitive fern, spotted and yellow touch-me-nots, marsh bedstraw, skullcap, wrinkled goldenrod, arrow-leaved tearthumb and fowl-mannagrass. Shrubs, such as red raspberry, meadowsweet, and dwarf raspberry, are common also. Herb flora on the mounds is dominated by lady fern, intermediate wood-fern, New York fern, slender sedge, foamflower, sharp-lobed hepatica, dwarf enchanter's-nightshade and stalked sedge. The most raised area is dominated by yellow birch, white ash and beech, with hemlock common in the subcanopy; hophornbeam grows on the highest mounds as well.

The soil has a nearly impermeable fragipan that perches the water table and has created the poor soil drainage. Above the olivey gray-brown, mottled fragipan (pH 6.4-6.6) lies 20-35cm of black silt loam A horizon (pH 6.8). This forest appear to be highly

productive and very dynamic. Blowdowns are common and trees show rapid growth. Approximate ages for a few trees were: 51cm white pine--38 years; 61cm white ash stump--56 years; 38cm red spruce--70 years; 36cm trembling aspen--35 years. Recent small patch cuts in this ecosystem have created numerous scattered openings.

POORLY DRAINED, BALSAM FIR-HEMLOCK-NORTHERN HARDWOODS--
Stand 2

Nearly level, Mucky loam over fragipan soil

Adjacent to "Guthrie Swamp" is a swamp-edge community that has characteristics of both the swamp and the somewhat poorly drained spruce-fir-yellow birch forest upslope. It may be considered part of the swamp, for the soil has 25cm of saturated, organic-rich mucky loam (pH 6.0-6.2). In the heart of the swamp, however, the muck is supersaturated and the water-table is at 0-20cm deep, whereas in this ecosystem water is greater than 30cm down. Balsam fir and hemlock dominate the canopy; red spruce, sugar maple, yellow birch and white ash are common associates. Diameters are generally in the 20-30cm dbh range. Foamflower, goldthread, mountain wood-sorrel, lady fern, narrow beech-fern, oak-fern and intermediate wood-fern are the common ground cover species. *Thuidium delicatulum* is abundant on the mossy forest floor.

VERY POORLY DRAINED, RED MAPLE-YELLOW BIRCH-BALSAM FIR-RED
SPRUCE SWAMP FOREST ("Guthrie Swamp")--Stand 2

Level to nearly level, Shallow muck over stony fragipan soil

Guthrie Swamp is a mosaic of hardwood swamp and conifer swamp--here an area of red maple and yellow birch, there a place where spruce and fir are thick. The dominant hardwood trees are 25-41cm dbh; the fir average 20cm dbh, and spruce trees range from 20-36cm. Characteristic swamp hummocks dot the ground; barren strawberry, big-leaf aster, lady fern and dwarf raspberry are common on the mounds, along with the ubiquitous hardwood swamp mound herbs, Canada mayflower, mountain wood-sorrel, three-flowered bedstraw and bluebead lily. In the depressions grow sensitive fern, cinnamon fern, northern bugleweed, fowl-mannagrass, swamp saxifrage, marsh-marigold, purple fringed orchid, and many other species. Mosses common in the swamp include *Sphagnum* spp., stair-step moss (*Hylocomnium splendens*), *Ptilium crista-castrensis* and *Thuidium delicatulum*. The swamp is relatively narrow and linear; it sits in the divide between Isham Brook and a Baldwin Creek tributary. As in a swamp forest on the Pierce Farm, a northern white cedar rarely graces the tree subcanopy.

VERY POORLY DRAINED, RED MAPLE-RED SPRUCE-YELLOW BIRCH SWAMP
FOREST--Stand 5

Level to nearly level, Shallow muck over sand and gravel soil

A small bit of swamp forest occurs in the center of the farm. It has been recently logged and likely has seen repeated human disturbance, unlike the more remote swamp in the south corner which has probably only been occasionally disturbed by human activity. Red maple, red spruce, yellow birch, white pine and trembling aspen grow in the overstory, which is open from selective logging. At least part of this shallow-muck swamp was probably wet pasture during the history of the active farm. The current state

of the ecosystem is open-canopy and shrubby--alder, meadowsweet, beaked hazel and willow all grow in the successional swamp forest. The herb flora is an assemblage of tall herbs, such as tall flat-topped white aster, bristly aster, false hellebore, wrinkled goldenrod, and robust ferns, such as cinnamon and interrupted ferns, sensitive fern, ostrich fern and lady fern. Other herbs include water avens, Robbin's ragwort, and wild strawberry. The muck depth is 20cm.

DRY MESIC, ACID KNOLL, RED MAPLE-RED OAK-RED SPRUCE FOREST--
Stand 6

Rocky knoll, Shallow soil

The mid-portion of stand six is occupied by a small but distinctive knoll-top ecosystem. On this shallow, acid soil, among a few large erratics, is a forest of red maple, red oak, red spruce, white birch and bigtooth aspen. Both a 33cm red oak and a 33cm bigtooth aspen were aged at approximately 50 years; the north slope of the knoll is younger and features a small-diameter growth of paper birch. The flora on the ledgy knoll is species poor in comparison to surrounding ecosystems. Hay-scented fern, Canada mayflower, wild sarsaparilla, intermediate wood-fern, northern ground-cedar and rock polypody are the common herbs. The soil is very shallow; in some spots pavement outcrop lies just beneath a thin layer of leaf litter.

STREAMSIDE FORESTS--Stands 2 & 3

Sand, gravel, cobble stream floodplain, and Saturated, mucky, level, seepage forest.

Moisture is abundant next to the small permanent stream that flows along the southwest property line. Moisture-loving herbs are common on the two to 20m-wide sandy, gravely and cobbly streamside flats. Scabrous sedge, tall meadow-rue, zig-zag goldenrod, New York fern, wild leek, silvery spleenwort, false hellebore, bottlebrush grass and maidenhair fern are just some of the herbs that grow beside the brook. Trees include yellow birch, white ash, trembling aspen, sugar maple, black cherry and hophornbeam.

Adjacent to the coarse stream deposits, a low, wet woods parallels both banks of the brook. Yellow birch, red maple and balsam fir dominate; hobblebush and beaked hazel form a well developed shrub layer. The herbs are mostly tall and robust, such as northeastern mannagrass, interrupted fern, sensitive fern, lady fern and scabrous sedge. This forest type occurs on level seeps adjacent to the stream; the surface soil is soupy, saturated muck or mucky silt.

DRY MESIC, BEECH-RED MAPLE-RED OAK-SWEET BIRCH (TRANSITION
HARDWOOD) FOREST--Stands 8 & 6

Steep to moderately sloping, West and southwest aspects, Fine sandy loam soil, Well developed B_s horizon

A limited extent of "transition hardwoods" forest grows on west and southwest slopes at the western extent of the Guthrie-Bancroft Farm. The tree flora includes the warmer climate elements--red oak and sweet (black) birch. Sweet birch is scattered as an associate tree, red oak is co-dominant with beech and red maple. The co-dominance of red maple is perhaps related to the logging history of the site. Along with these trees are

white ash, sugar maple and paper birch (another indicator of the periodic logging). The understory of the ecosystem is dominated by beech saplings, and there is some striped maple and hophornbeam also. Common herbs are Canada mayflower, Christmas fern, starflower, sessile-leaved bellwort, white wood aster, partridgeberry and marginal wood-fern; other species include New York fern and pink lady's-slipper. The herb species richness and herb coverage are both noticeably less extensive than in the richer, moister ecosystems.

The soil has a relatively thin A horizon (6cm) and a deep (to 70cm), very brightly colored B_s horizon. Soil texture is fine sandy loam, and drainage is rapid due to the slope and the sandiness.

In stand 6, this ecosystem type is sandwiched between a swampy trough upslope and a moister forest downslope towards the stream. This strip of drier forest contains a handful of red pines, the largest are 30cm dbh. The red pine and abundant white birch on the slope probably seeded in after a small fire.

VERY POORLY DRAINED, SHRUB SWAMP/SEDGE MEADOW--Stand B

Level to nearly level, Muck over gleyed sand and gravel soil

The center of the open wetland is a wet sedge meadow with several centimeters of standing water. Dominant are *Carex rostrata*, *Carex stricta*, boneset, spotted joe-pye-weed and wool-grass. Among these are scattered shrub clumps of speckled alder, willow, steplebush and gray birch saplings. Peripheral to the open center, the wetland is succeeding to gray birch and willow. The dominant herbs beneath are spotted joe-pye-weed, eastern lined aster, sedges (*Carex gynandra*, *C. bromoides*), fowl-mannagrass and arrow-leaved tearthumb. More investigation is needed to glean the history of this open wetland and to understand how its use and management may have led to its current condition. Succession seems to be rapidly taking place at this time, and appears to have been held back, perhaps by grazing or mowing, in the past.

Two other small shrub/open wetlands occur in the central portion of the farm, on the east and west sides of the northern meadow. The eastern wetland is mostly open, with common horsetail, sensitive fern, sedges (*Carex gynandra*, *C. stipata*) and bristly aster; meadowsweet is abundant in portions of the site, and scattered trembling aspen, balsam poplar and white ash grow also. This wetland appears to receive seepage waters from upslope and appears to be a natural feature.

The other non-forested wetland is alder and willow dominated and appears not to be a natural shrub swamp, but rather a post-agricultural successional one. The area may have been a wet pasture in the past, but it has not been explored fully and this is just conjecture. Among the dominant speckled alder and willow are saplings of white ash and black cherry. The herb flora consists principally of sensitive fern, intermediate wood-fern, water avens, wrinkled goldenrod and bristly aster; low shrubs red and dwarf raspberries common.

MESIC, RAVINE-BOTTOM, HEMLOCK FOREST--Stand 7

Very steeply sloping, Shallow to bedrock, Loam soil

The lower-slope forest adjacent to Baldwin Creek is in places hemlock-dominated. Below the seepy, rich hardwood forest described previously, the slope

steepens and is not seepy; slopes are greater than 45% and as much as 78%. Eastern hemlock very often establishes dense forest in such terrain, creates a very acidic soil, and casts a dense shade that is inhospitable to most forbs. This ecosystem has a hemlock overstory that averages 41cm dbh, with maximum to nearly 76cm. Yellow birch and white ash are associate tree species. The understory is primarily hemlock saplings and the sparse ground cover is composed nearly entirely of the following ferns: marginal and intermediate wood-ferns, Christmas fern, narrow beech-fern and oak fern.

Fred Pierce Farm

Overview.

The Fred Pierce Farm is located along Isham Brook and ranges from approximately 457m to 305m (1500-1000') above sea level; topography is flat to very steeply sloping. The upland soils are dominated by fine sandy loams (Berkshire series), most of which are not stony in the top 50cm, but may be stony to very stony in the subsoil. Lower parts of the landscape feature abundantly mottled, very stony soils (Cabot and Peru series). One hundred thirty-six and one-half acres of the 167.5 acre farm are forest or shrub communities. The forestlands are an assortment of second-growth on agriculturally abandoned lands, second-growth on historically timber-harvested lands, and conifer plantations. Upland forest ecosystem types include several types of upland hardwood forests (all currently red maple-dominated), steep hemlock forest and ridgetop red spruce-white pine forest. Among the wetland ecosystems are forested swamps (hemlock-yellow birch, as well as red maple-yellow birch), alder shrub swamps and recently drained beaver meadow.

The Forested Landscape

The south portion of the Pierce Farm descends into the steep-banked valley of Isham Brook. Hemlock-dominated ravine forest occurs on the steep, slopes. Spodosol soil profiles are evident in the fine sandy loam soils. Hemlock is strongly dominant and, as is this species custom when it occurs in dense concentrations, the forest ecosystem is largely defined by the acidity and deep shade created by hemlock. Overstory tree diameters generally range from 30-40cm; the largest hemlock measured was 58cm dbh. On flatter areas adjacent to Isham Brook, several different wet, hemlock-dominated ecosystem types occur. One is a swamp on muck soil, and the other is a wet-mesic forest on a cobble-laden former streambed.

On coarser, gently to moderately sloping soils upstream from the steep hemlock forest, the forest is dominated by white pine, with red maple, red spruce and black cherry associates. The dominance of white pine is certainly an artifact of past land use practices, but the exact history has yet to be worked out; a plow layer in the soil was not evident in the few spots sampled; therefore, it may be that this area was pastured historically, but not plowed, or was only shallowly plowed. Whether this area differs significantly from some of the hardwood forest types is not yet understood; the soil, however, does appear to have a higher percentage of sand and a lower percentage of finer particles, and gravel is common in the topsoil.

To the west of the steep-banked Isham Brook valley, the land is nearly level to steeply sloping; ecosystem types are differentiated by landscape position and soil

drainage. On a ridge between Isham Brook and a small seepy draw that drains into the brook is a forest of white pine, red spruce, red maple and paper birch. This spot is apparently prone to receiving high winds, and the numerous tree blowdowns testify to the dominant dynamic force in this forest ecosystem. The upper east slope of the small ridge is lined with well-rotted hemlock trees; all fell upslope, an indication that the forest was probably felled by hurricane winds.

The terrain around the small ridge is predominantly a red maple-yellow birch forest on fine sandy loam that is stony below 60cm. Red spruce is a common understory tree in these forests, as is beech. The flat to moderately sloping ecosystems vary from fern- to herb-dominated and likely constitute at least two ecosystem types which are differentiated by differences in landscape position, soil drainage and ground-cover vegetation. These hardwood forest stands have been harvested at different times, and all stands are young forest; the overstory is typically 15-25cm dbh, with large trees measuring only 38cm.

Northwest of the hemlock ravine a wetland, the largest on the three farms, occupies a significant portion of the terrain. Surrounding an alder shrub swamp is a red maple-yellow birch swamp. The ground cover is typical of hardwood swamps, with a diverse assortment of robust ferns, sedges and forbs, and the ubiquitous creeping shrub, dwarf raspberry.

Northeast of the intersection of Colby Hill and Isham Hollow roads, the forest is predominantly conifer plantation, with some old-field white pine forest. The northeast corner of the property lies in a recently drained beaver flowage in the upper reaches of Isham Brook. A band adjacent to Isham Brook is a shrubland, the northern part of which is meadowsweet-dominated, the southern half alder-dominated. Hardwood forest in the northwest corner of the farm was not visited.

ECOSYSTEM DESCRIPTIONS--FRED PIERCE FARM

MESIC TO DRY MESIC, WHITE PINE-RED MAPLE-RED SPRUCE FOREST, LOAMY SAND--Stand 1A

Nearly level, Acid loamy sand soil

This part of the property was not extensively investigated. The overstory is dominated by white pine of two size classes, 40cm and 25cm dbh; the largest trees are nearly 50cm. Associate canopy species are red maple, red spruce and black cherry. The understory is open and is composed principally of striped maple, red spruce and beech. Herb diversity is very low, even though there has been some tree girdling and openings are present. The disturbance-related ferns, bracken and hay-scented fern are common, as is intermediate wood-fern. Canada mayflower is abundant, while starflower is common. The few other herb species present include partridgeberry, Indian cucumber-root and pink lady's-slipper. The soil here is, perhaps, the coarsest found on the three farms, and thus it rapidly drains. Both the tree and herb flora are indicative of the acid pH of the sandy soil. The soil profile shows a 5cm layer of well decayed leaf litter (O_a), a 7cm loamy sand, dark brown A horizon and a bright orangey-brown, pebbly loamy sand B_s horizon. Stand 1B may be the same type of ecosystem; it was not visited.

MESIC RED MAPLE-DOMINATED NORTHERN HARDWOOD FOREST, FINE SANDY LOAM SOIL--Stands 3 & 4

Nearly level to steeply sloping, all aspects

A variety of red maple-dominated hardwood and hardwood-spruce forests occurs in the southern part of the Pierce Farm. All of these grow on fine sandy loam soils; they are differentiated by landscape position.

Near the wetland is a forest that is somewhat richer than the woods adjacent to the south. The richness is likely due to a lower, moister position in the landscape--a short slope abutting the swamp. Red maple and yellow birch co-dominate, with a strong red oak presence also. Red spruce, beech, shadbush and beaked hazel grow in the lower strata. The herb layer is dominated by interrupted fern, intermediate wood-fern, hay-scented fern, New York fern, Canada mayflower, goldthread and sessile-leaved bellwort. As one rises to a higher, nearly level area to the south, the community stays much the same, but for the noticeable absence of interrupted fern. Hay-scented fern is a strong dominant in that portion of the woods, and there is much paper birch in the canopy; two signs of a previous heavy timber harvest. Tree diameters are in the 15-25cm dbh range. The soil has a thin, dark brown, fine sandy loam A horizon and a bright orangey fine sandy loam B_s horizon.

Continuing south, one crosses a long, narrow seepy area that is west of a coniferous ridge. Beyond it lies steeply sloping, mesic northern hardwood forest. This stand is slightly more mature, with diameters to 33cm dbh common, and it has a substantial understory of hemlock. The ground on the southeast-facing slope is quite seepy, and the herbaceous vegetation is a mix of ferns and sedges.

Back to the north, adjacent to the alder shrub swamp, is a similar forest on a shelf slightly raised above the wetland. Because of landscape position and lack of slope, it is more mesic than the other northern hardwood stands mentioned, and the vegetation responds accordingly. Red maple and yellow birch remain the dominant trees; white pine, red spruce, black cherry, hemlock and paper birch are canopy associates. Musclewood is abundant in the understory, and herb coverage is dense--coverage is noticeably greater than in the nearby, similar forest types.

WET MESIC TO HYDRIC, HEADWATERS SEEP HARDWOOD FOREST--Stand 3

Nearly level, Organic-rich silt loam soil over cobbles

Near the head of the Isham Brook hemlock ravine is a broad, gently sloping forest seep. Plant diversity is very high in the seep and the ground displays a pronounced hummock-hollow microtopography. The soil is a black, organic-rich silt loam A horizon over a layer of cobbles. Although the tree canopy is hardwood-dominated, conifers are intermixed. Common trees are white ash, sugar maple, yellow birch, American elm and red maple. The conifers present are white pine, hemlock and balsam fir. Mountain maple and alternate-leaved dogwood are common in the tall shrub stratum, and one clump of leatherwood was observed in this ecosystem. Leatherwood, a shrub of medium height that prefers rich and at least seasonally moist soils was not seen elsewhere on the properties. The seep is a ferny place; cinnamon fern, royal fern, sensitive fern and lady fern are common. Some of the more common herbs are foamflower, turtleheads, tall meadow-rue, Robbin's ragwort, woodland horsetail and barren strawberry. The seep is not large

(woodland seeps usually are not extensive), but it is a unique and interesting place, unlike other ecosystems on the properties.

MESIC, RAVINE, HEMLOCK FOREST, FINE SANDY LOAM--Stand 2

Steeply to very steeply sloping, Acid fine sandy loam soil

The hemlock forest is one of the least disturbed and least accessible portions of the farms. It has both east-facing and west-facing slopes, both of which are very steep and border Isham Brook. One of the steepest parts of the ravine has 70% slopes. Hemlock trees are strongly dominant and average 30-41cm dbh, the largest being just under 63cm. Other trees in the woods include yellow birch, red maple, red spruce and balsam fir. There is little in the way of an understory, for hemlock tends to cast such a deep shade and create a deep, strongly acidic litter layer that few trees and shrubs can survive beneath a closed hemlock canopy. Likewise the herb flora is very patchy and generally open; there are, however, scattered denser patches of mountain wood-sorrel and goldthread, usually with Indian cucumber-root and intermediate wood-fern intermixed. Despite the low coverage of herbs, the diversity of species is respectable. Among those that grow beneath the hemlocks are shining clubmoss, partridgeberry, Canada mayflower, bluebead lily, foamflower, painted trillium, wakerobin, pipsissewa, and several species of sedges (*Carex* spp.). The soil in this dark, acid woods is a good example of a spodosol, well developed from the constant acid leachate from the tannin-rich hemlock needles. The litter layers total 6cm or so. Mineral soil begins with a black, fine sandy loam A horizon measuring 10cm; the heavily leached E horizon is 5-6cm of ashy gray, fine sandy loam. The B horizons can be split into at least two layers--a 45cm dark reddish brown B_{s1} beneath which is a lighter reddish brown B_{s2} that grades gradually to the C horizon. There is a discontinuous, chocolate-brown, humic-acid-rich B_h horizon.

Isham Brook is about five meters wide where it flows through the ravine; occasionally there is a 10-20m wide streamside flat adjacent. In such places one finds kidney-leaved violet, common shinleaf, two-leaved mitrewort, tall meadow-rue, rosy twisted-stalk and a mossy carpet of *Mnium* and other mosses.

Forest management in the forest has created small openings beneath girdled trees. Regeneration of hemlock is dense in the openings.

WET MESIC, SOMEWHAT POORLY DRAINED, HEMLOCK FOREST--Stand 2

Nearly level, Hummocky, Loam soil over cobbles

At the south end of the property, beyond the hemlock-ravine forest, are two wet hemlock-dominated ecosystems. One is truly a swamp forest, while the type described here is swamp-like, but does not have an organic soil. Rooting is very shallow, only 20cm of loam soil sit above a layer of cobbles and the hemlocks have thus created large hummocks. The ecosystem is narrow and the soil profile and ecosystem shape suggest a former stream channel. Along with hemlock, the overstory trees are white pine, red maple, trembling aspen and several yellow and paper birches also. Canada mayflower, foamflower and New York fern are the common herbs.

VERY POORLY DRAINED, HEMLOCK-YELLOW BIRCH SWAMP FOREST--
Stand 2

Nearly level, Muck soil

In the southeast corner of the Pierce Farm is a swamp that continues south onto the adjacent property. Hemlock and yellow birch are the canopy trees; the subcanopy is composed of American elm, black ash and hemlock; tall shrub speckled alder is also present. Sedges and ferns dominate the herb flora. *Carex bromoides*, *Carex prasina* and *Carex disperma* are common, as are cinnamon fern, sensitive fern, lady fern and interrupted fern. Among the herbs are two-leaved toothwort, Robbin's ragwort, jack-in-the-pulpit, swamp saxifrage and spotted touch-me-not. The creeping shrubs dwarf raspberry and poison-ivy occur here as well. Swamp mosses cover some of the muck surface, among these are stair-step moss, *Thuidium delicatulum*, *Climacium dendroides* and *Mnium* sp.

VERY POORLY DRAINED, ALDER SHRUB SWAMP--Stand 7A

Level to nearly level, Mucky silt soil

The largest wetland on the property is an open shrub swamp dominated by speckled alder and meadowsweet. Scattered red maple are common, while yellow birch, white pine and white ash occur occasionally. The trees are on mounds approximately 20cm high. Sedges and ferns dominate the herb layer; virgin's bower twines over everything. The dominant ferns are cinnamon fern, sensitive fern and marsh fern; dominant sedges are *Carex gynandra*, *Carex echinata* and *Carex stipata*. Among the more common herbs are water avens, common horsetail, spotted touch-me-not, false hellebore and wrinkled goldenrod. Parts of the swamp had standing water in late May, while towards the southwest there were watery channels, but not generally standing water. Alder cover averages 50-60% throughout the swamp. The soil varies from 20 to 75cm mucky silt over mottled silt or, in some areas, cobbles.

VERY POORLY DRAINED, RED MAPLE-YELLOW BIRCH SWAMP FOREST--
Stand 3 & 1A

Nearly level to very gently sloping, Mucky silt over mottled and gleyed silt and cobbles

On the margins of the alder shrub swamp grows a fringe of swamp forest. The nature of this wetland woods varies from place to place around the open wetland, but red maple and yellow birch remain the dominant trees. In general, the swamp forest is narrow and has characteristics of forest that is typical on the edges where wetland forest or shrubland meets upland forest. For instance, on the east side of the shrub swamp, the forest is gently sloping and muscledwood is a common small tree; in a finger of swamp on the south side, lady fern and shadbush are common. This southern finger of swamp also has a northern white cedar tree; although uncommon in dense concentrations in the Green Mountains, northern white cedar was found to occur here and there in wetlands on the Anderson lands. Other trees here are white pine and red spruce; beaked hazel is a common shrub and the dominant herbs are lady fern, goldenrod, woodland horsetail, sensitive fern, northern bugleweed and sedges (*Carex gynandra*, *C. stipata*). On the eastern side, the associate trees are hemlock and black ash and the dominant herbs are cinnamon fern, sensitive fern, tall meadow-rue, spotted joe-pye-weed and sedges (*Carex*

bromoides, *C. echinata*). Soil in the swamp is 10-30cm mucky silt, mottled at the surface, over silt that is both gleyed and mottled.

RIPARIAN BEAVER MEADOW

Level to nearly level, Recently drained, Open wetland

Beaver damming of the upper portion of Isham Brook, in the far northeast corner of the Pierce Farm, has created a broad, open meadow, only part of which is on the Anderson property. The pond has only been recently drained, apparently within the past three years. Typical beaver meadow succession in Vermont suggests that grasses and sedges will dominate the meadow, as shrubs slowly colonize. Characteristic beaver meadow herbs are bluejoint grass, tussock sedge and, in wetter areas, bur-reeds. Early successional shrubs are willows, alder and meadowsweet. Since Isham Brook has a substantial flow, I expect that beaver will recolonize the area within two to three decades. If they do not return in that time frame, the system is likely to become forested with gray birch, trembling aspen and red maple.

WET MESIC, RIPARIAN SHRUBLAND

Nearly level, Narrow, Streambank-associated

Along the northern part of Isham Brook, downstream from the beaver meadow, the riparian zone is a combination of tall shrubland, dominated by speckled alder, and shrub/herbaceous openings dominated by meadowsweet, intermediate wood-fern, wrinkled goldenrod and Canada Mayflower. Alder shrubland predominates in the southern part; highbush-cranberry, nannyberry and hawthorn are associate tall shrubs, and the herb layer is dense and "rank." Common herbs include slender, bladder and ovales sedges, false hellebore, New York, hay-scented and lady ferns, and cinquefoil.

This riparian strip was likely previously tractor road adjacent to the brook and, inland, part of cropped fields. Adjacent lands to the west currently are hayfield, conifer plantation and old-field white pine forest. Old-field white pine forest is on fine sandy loam soil, which suggests that this part of the land will succeed to mesic northern hardwood forest.

Wells Farm

Overview

The Wells Farm is on the west side of Mount Pleasant, but it does not extend up to the 610m (2,000') summit. The parcel is a rectangular, compact representation of a westerly facing landscape; it has quite a bit of topographic diversity including a ledgy ridgetop, an east-facing upper slope, west- and southwest-facing slopes, and a small, low, wet bench adjacent to Quaker Street. The 75 acres of woodlands contain a surprising diversity of northern hardwood and northern hardwood-spruce forest ecosystem types. The land rises from 442m (1450') at Quaker Street, to 564m (1850') atop the ledgy ridge near the farm's eastern boundary. The dominant soil types are Berkshire and Marlow; Lyman soil occupies the ridgetop. Two areas of enriched northern hardwood forest occur on the property, and both are ecologically intact. Seeps are common throughout the woods, and one especially large ledge and seep system lies on the upper west slope of the ridge. The northern part of the farm, adjacent to the mowed meadow, has so much

seepage water running down the slope that the forests there are wet-mesic and wet hardwood forests. At the base of these wet woods, near Quaker Street, is a bit of swamp that has been disturbed by former land-clearing; it is now in a willowy successional stage, but indications are that it might naturally be a strip of hardwood swamp forest.

The Forested Landscape

Enriched northern hardwood forest occurs both on the upper slope on the east side of the ridge and on the south facing slope in the northwest corner of the property. Sugar maple, yellow birch, white ash and beech are the common overstory trees. Saplings of these and hophornbeam comprise the understory. The herb layer shows patchy dominance; moister, seepier spots tend to have one group of species, while other areas are dominated by other species; this pattern is more strongly developed in the upper slope stand. Common ground flora species include silvery spleenwort, New York fern, blue cohosh, zig-zag goldenrod, jack-in-the-pulpit and sedges. In the non-seep areas of the upper slope stand such species as intermediate wood-fern, sessile-leaved bellwort, foamflower and round-leaved violet are common.

Two forest ecosystems occur on the ridgetop. The southern piece of ridge is ledgy with soil very shallow to bedrock and much exposed rock. On this crest is a forest of sugar and red maples, white ash and gray birch; red spruce is scattered in the understory and occurs in small groups in the overstory. Rocky openings are shrubby with meadowsweet and blackberry or have stunted trees and an herb layer of marginal wood-fern, white wood aster, early saxifrage and sedges. North of the rocky area, the ridge has accumulated pockets of deeper soil where an organic-rich black loam topsoil covers relatively shallow fine sandy loam. Here stands a mixed forest of red spruce, yellow birch and sugar maple, with hophornbeam common in the understory. Lady fern, intermediate wood-fern and hay-scented fern strongly dominate; associate herbs include Canada mayflower and wood-sorrel. The spruce in these ridgetop positions are very prone to blowdown, and this makes for a very dynamic forest ecosystem.

A large, herb-covered ledge lies west of the ridge. Richness common to the Champlain Valley is in evidence in the ledge flora. Along with lady fern, dwarf enchanter's-nightshade and marginal wood-fern are fragile fern, herb-robert, zig-zag goldenrod, and white baneberry. Another, quite weedy, open ledge features sheep-sorrel, St. John's-wort, daisy and yarrow.

The Wells Farm displays three distinct stages of forest successional from agricultural fields. Highest on the slope is a woods of 10-25cm dbh sugar maple, with a predominantly sedge and scattered fern ground cover. Downslope is a forest dominated by 5-13cm dbh sugar maple with ferns that are common to wet mesic and wet soils dominant in the ground cover. The youngest successional stage is evident in the areas typed as "alder" on the forest stand map. These more recently abandoned wet pasturelands do not yet have a full forest cover, but rather are a mix of medium and tall shrub and scattered pockets of young successional trees such as gray birch, balsam fir and trembling aspen. Despite the confounding factors of differential times of agricultural abandonment, it is possible to understand the natural forest ecosystems of these lands. The higher, older forest stand is almost all a mesic northern hardwood forest ecosystem on deep fine sandy loam. The middle-stage successional lands are of several ecosystem types; a southerly

portion is likely also mesic northern hardwoods on deep fine sandy loam. To the north the young stand is moister and will probably be found to be a wet-mesic hardwood forest dominated by red maple and yellow birch with ferns such as sensitive, cinnamon and interrupted ferns common. Red spruce and American elm are also components of the overstory of this somewhat poorly drained ecosystem. Many of the herb species in this ecosystem are wetland herbs, such as skullcap, water avens, marsh bedstraw and many of the sedges; there appears to be a constant subsurface downslope flow of water perpetually wetting the soil.

At the base of this wet slope, adjacent to Quaker Street, lies a wetland. Both the downslope flow and a small brook coming off the south-facing, enriched northern hardwood forest contribute water to the wetland. Disturbances such as land clearing and power-line crossing have altered the wetland, and further investigation is needed to determine what the natural ecosystem type here is. I suspect if left alone the wet flat would develop into a small, hummocky red maple swamp, but perhaps there is enough water to prohibit development of a substantial tree canopy and the area will perpetually remain shrub swamp. Currently it is dominated in part by willow and robust wetland herbs, and in part by trembling aspen. The question is whether the willowy area will succeed to a tree cover.

ECOSYSTEM DESCRIPTIONS--WELLS FARM

RICH, MESIC, SEEPY NORTHERN HARDWOOD FOREST--Stands 5, 1 & 2

Moderately sloping, East and southwest aspects, Fine sandy loam to silt loam

Two areas of enriched northern hardwood forest occur on the Wells Farm. They exhibit some similarities and some differences, but for preliminary purposes they have been lumped in the same ecosystem type. The east-facing slope at the easternmost extent of the property is a beautiful two-aged forest featuring a cohort of 46-56cm dbh trees and a cohort of 15-25cm trees. Beech, sugar maple and yellow birch are the dominant trees; the associate species are those typical of richer forests, white ash, basswood and black cherry. The smaller class of trees is predominantly sugar maple and beech; striped maple and hophornbeam are common small trees. The ground-cover vegetation is patterned in relation to seepiness on the slope. Where the soil is not moistened by groundwater seeps, intermediate wood-fern, Canada mayflower, sessile-leaved bellwort, foamflower, round-leaved violet and hay-scented fern are common. In the moisture of the seeps, predominant species are silvery spleenwort, lady fern, blue cohosh, wood-nettle, jack-in-the-pulpit and touch-me-not. The overall herb dominants are silvery spleenwort, blue cohosh and intermediate wood-fern, which indicates that the majority of this upper slope tends toward seepy richness. Only the upper slope is on the Anderson property; beyond the boundary, the slope continues into a hollow before rising toward the low summit of Mount Pleasant. The soil profile on the upper slope displays 7cm black, fine sandy loam A horizon above a 30+cm brown, fine sandy loam B horizon; the C horizon has common, medium bright mottles at 40cm in fine sandy loam. pH of the A horizon was 5.0; pH at the top of the C horizon (between 40 and 50cm) was 5.4. The 35-40% slope faces east. The slope has some exposed ledges that are mostly smooth and do not project much above the soil surface. There is some pit-and-mound microtopography evident throughout the ecosystem. A 48cm dbh white ash was estimated by ring count to be approximately 100

years old, and this age is likely representative of the older class of trees in the two-aged stand. A fisher was seen along the eastern fenceline.

Most of stand 1, in the northwest corner of the Wells Farm is also rich, mesic northern hardwood forest. In contrast to the forest described above, this ecosystem has a south to southwest aspect and slopes approximately half as much; it has a silt loam over stony silt loam, higher pH soil, and has an organized stream flowing through the stand. Also, this piece is in a mid-to lower-slope position. The forest is also younger; the largest trees are 63cm dbh bigtooth aspen which appear to be nearing the end of their lives. There are also some sugar maple and beech near 50cm dbh, and some of these are dying as well, and at times create large tip-up mounds. A nice snapshot of forest succession shows a large bigtooth aspen on a mound with a smaller yellow birch beneath in position to replace the canopy tree when it dies. Aside from the scattered giants, average diameter in the stand is approximately 25cm. Sugar maple, beech, white ash and yellow birch dominate along with bigtooth aspen. Hemlock is a common tree in the mid-slope area, but is absent from the lower slope; hemlock is then abundant on the toeslope in a much wetter, heavily mounded ecosystem. The understory consists of sugar maple, yellow birch and hophornbeam. To the east, the rich forest continues in stand 2, although there it is much younger, with 5-13cm diameters most prevalent.

Dominant across the slope--that is, they are not patchily distributed in association with seepiness--are silvery spleenwort, blue cohosh, lady fern and slender sedge. Other species include New York fern, zig-zag goldenrod, stalked sedge, jack-in-the-pulpit, dwarf enchanter's-nightshade, maidenhair fern, herb-robert and the grasses short-husk and drooping woodreed. There are some wet seeps near the northern property line; in them one finds skullcap, sensitive fern, marsh bedstraw, touch-me-not, scabrous sedge, water avens and northeastern mannagrass.

The soil has a very deep (25cm) black, silt loam A horizon. The B horizon is very dark brown stony silt loam, through which the soil auger was having trouble penetrating. Surface pH was 6.0; pH at 40cm was 5.8. This rich, mesic forest on a moderate mid- and lower-slope receives abundant downslope flow; decomposition and mixing are rapid. The result is a deep, fertile A horizon which supports an abundance of rich-site herbs.

West of the brook that flows through this ecosystem, red spruce is a prominent tree and the ground flora is relatively depauperate. Although not investigated extensively, it appears that west of the brook the forest ecosystem is not rich and the soil type is expected to differ from that described above; one would expect to find a well developed spodosol, with an ashy gray E horizon and a reddish Bs horizon. The observed portion of the forest was dominated by red spruce and yellow birch, with New York fern and narrow beech-fern the dominant herbs. A cored 36cm red spruce was aged at approximately 65 years. The extent of this sprucey forest has not been documented.

WET-MESIC NORTHERN HARDWOOD FOREST--Stands 1 & 2

Moderately to gently sloping, West and southwest aspects, Mucky silt over stony loam

Abundant downslope flow from the east and northeast provides year-round moisture to this ecosystem. Although not covering a large area, different parts of this forest type are at different successional stages and furthermore have had different land-use histories; the time and land-use factors do confound clear interpretation of the

ecosystem types, but soil texture and moisture are useful in trying to see through the recent disturbances.

The upper portion of wet-mesic forest is young. It appears to have once been part of the large meadow north of the house and barn. The post-agricultural forest is still dominated by early successional trees, and it is probable that land-smoothing and plowing have altered the microtopography. Current overstory composition is red maple, gray birch, American elm, trembling aspen and red spruce. In the understory are yellow birch, black cherry, paper birch and hophornbeam. White ash seedlings are common. Wetland herbs predominate; most common are sensitive fern, fowl-mannagrass, cinnamon and interrupted ferns, sedges (*Carex gracillima*, *C. echinata*, *C. flava*, *C. tenera*, *C. lurida*, *C. leptalea* and *C. prasina*), foamflower, skullcap, goldenrod, lady fern and wild strawberry. There is some distinction between hummock and hollow in the young forest and one finds New York fern and partridgeberry common on the raised mounds. Black mucky silt comprises the 35cm A horizon; there are a thin (5cm) loamy B_s and what appears to be 20cm of a buried A horizon (A_p) above the stony sandy loam C. Water was at the soil surface this growing season, which has been an exceptionally wet one; judging from the soil and hydrology, nevertheless, it seems likely that runoff from heavy rains regularly deposits silt. pH is high; 6.0-6.2 at the surface and 5.8 at 60cm.

Downslope from the young woods is a stand that is older and has not been plowed. Hummock-hollow microtopography is very well developed and herb composition on the mounds differs substantially from the herbs prevalent in the wet hollows. Trees here are found on the mounds; species are sugar maple, beech and yellow birch, with some clusters of hemlock. The understory is composed of beech, yellow birch, hophornbeam and red spruce, with a well-developed sapling layer of beech, hophornbeam, sugar maple and white ash. Overstory tree diameters range from 25-64cm (aside from a large old hedgerow that contains 89cm sugar maples); the largest trees are sugar maple and hemlock. A 38cm dbh hemlock had 86 annual growth rings. Herb species common on the mounds include New York fern, Christmas fern, Canada mayflower, partridgeberry and sedges (*Carex gracillima*, *C. pedunculata*). Herbs in the wet hollows include fowl-mannagrass, skullcap, sensitive and lady ferns, foamflower, marsh bedstraw, turtleheads and sedges (*Carex lurida*, *C. stipata*). To a large extent, however, all the herb species are intermingled and do not necessarily sort out well between hummock and hollow. Soil on the mounds is stony loam and in hollows there is 20cm mucky silt over stony loam. Wet runs stream through this ecosystem; these tend to have cobbly subsoil.

DRY-MESIC, VERY SHALLOW TO BEDROCK, RIDGETOP HARDWOOD FOREST--Stand 6

Gently sloping, Abundant exposed ledge

Atop the ridge that is near the eastern property boundary are two forest types as well as open ledge ecosystems. The ecosystem type described herein includes both the very shallow-soil forest and shrub thickets and the west-facing ledges that descend from the ridgetop.

The area features a patchwork of open, shrubby, nearly level ledge and clusters of small diameter hardwood trees where the soil is deeper. Common trees are sugar and red

maples, white ash and gray birch; diameters are generally 5-15cm dbh. Other trees growing in the shallow loam and rock crevices include hophornbeam, black cherry, and yellow and paper birches; the small trees striped and mountain maples, hawthorn and shadbush are present also. Ground-cover in the wooded places is dominated by hay-scented fern, sedges (*Carex gracillima*, *C. pallescens*, *C. cf. laxiflora*, *C. appalachica*, *C. arctata*), intermediate wood-fern, Canada mayflower and sessile-leaved bellwort; an unidentified orchid occurs in the ridgetop hardwood forest and the population extends down the south slope to the adjacent property. Also present on the Anderson land on this bit of south slope is loose sedge (*Carex laxiculmis*), a rare to uncommon species which has been known primarily from the Champlain Valley clay-soil forests. Shrubby areas are typified by common blackberry, meadowsweet, striped and mountain maples and red elderberry, with an herb layer consisting of both native species and common herbs; among the species are common horsetail, wrinkled goldenrod, Eurasian wood-sorrel, hawkweed, St. John's-wort and yarrow. Maximum depth of soil above bedrock is approximately 50-60cm; the texture is fine sandy loam. Bear scat was observed in this ridgetop ecosystem.

Exposed, west-facing ledge at the ridgetop varies from one-meter tall vertical ledges to a large, partially shaded, steeply sloping ledge that extends approximately 20m downslope. On the smaller ledges grow stunted individuals of the tree species mentioned above; common ledge herbs are early saxifrage, marginal wood-fern, rusty woodsia, white wood aster, violet, two-leaved mitrewort and sedges (*Carex rosea*, *C. deweyana*). The largest exposed ledge is seepy and steeply sloping; soil has accumulated in patches on the smooth rock and the flora is quite rich. Species include an abundant mint that is likely either hedge-nettle (*Stachys palustris*) or hemp-nettle (*Galeopsis tetrahit*), marginal wood-fern, lady and fragile ferns, dwarf enchanter's-nightshade, white baneberry, zig-zag goldenrod, herb-robert, early saxifrage and white wood aster.

MESIC, SHALLOW-SOIL, RIDGETOP RED SPRUCE-NORTHERN HARDWOOD FOREST--Stand 4

Nearly level to gently sloping, Loam to fine sandy loam

The northern part of the ridge has deeper soil and a more mature forest. Both the spruce and the hardwood trees measure to 33cm dbh. Hardwoods present are sugar and red maples, yellow and paper birches, beech, black cherry and white ash. Pin cherry is both standing dead and dead-down in the forest; this, of course, indicates that there was an event (logging, fire, or, perhaps, severe blowdown) that opened the forest canopy drastically. Pin cherry is short-lived and the canopy-opening event can be aged to approximately 30-40 years by the presence of the dead, but still standing pin cherry trees. This age is corroborated by a white ash core (30cm dbh) that showed 35 years growth. A cored 33cm red spruce was approximately 57 years old. The spruce-hardwood forest has an understory of hophornbeam, beech and striped maple. The ground cover is dominated by ferns; most abundant are hay-scented fern, lady fern and intermediate wood-fern. Also common are New York, cinnamon and interrupted ferns. The typical acidic northern hardwood forest herbs, Canada mayflower, starflower, and mountain wood-sorrel, are the most common forbs. The soil varies from just a few centimeters of black organic material (O_a) over bedrock, to 7cm black loam A horizon over reddish brown B_s . pH in the A

horizon was 4.8, and at 20cm in the B horizon pH was 5.2-5.4. The spruce on shallow soils are prone to blowdown, and prone spruce trees are scattered throughout the ecosystem. A barred owl was heard calling in the area.

MESIC, SLIGHTLY ENRICHED NORTHERN HARDWOOD-HOPHORNBEAM FOREST--Stands 3, 6 & 2

Moderately to steeply sloping, South and west aspects, Fine sandy loam

Deep fine sandy loam soil and south- and west-facing slopes that are well warmed by the sun characterize the ecosystem west of the ridgetop. The forest is generally mid- and early-successional, and sugar maple strongly dominates; associate trees are paper birch, trembling aspen and red maple, the presence of which is related to post-agricultural secondary succession, and yellow birch, white ash and red spruce. The understory is almost entirely hophornbeam and sugar maple saplings, although old-field remnant hawthorns are prominent also. The canopy of this ecosystem, were it more mature, would likely continue to be sugar maple, with a healthy admixture of yellow birch and white ash; the physical ecosystem characters do not suggest a true, natural sugar maple grove. Current ground-cover is an equal mix of ferns and sedges. Dominant species are intermediate wood-fern, lady fern, slender sedge and Pennsylvania sedge; less abundant are Christmas fern, jack-in-the-pulpit, hawkweed, common shinleaf, yellow violet, grapefern, hirsute sedge and loose sedge, which is an apparently uncommon species in Vermont and has been located primarily in the clay-soil forests of the Champlain Valley.

The soil texture is fine sandy loam throughout the profile. The medium brown A horizon is approximately 15cm deep, with a pH 5.0-5.2. The B_s horizon is quite deep and may be clearly divided into a 5-10cm reddish brown B_{s1} and a slightly orangey brown B_{s2} that extends over 60cm below the soil surface. pH at 60cm was 5.4-5.6.

In stand 3, the overstory trees measure 15-30cm, with the smaller end of the range more common. This ecosystem also extends downslope into stand 2, where the forest is significantly younger and, perhaps, more mesic due to the lower slope position. In the south portion of stand 2 the forest consists of 2-10cm dbh sugar and red maple saplings; associate trees are white ash, gray birch and white pine. The herb layer is ferny; cinnamon, sensitive and lady ferns dominate.

Stand 2 also includes an area of wetter forest, more or less due east of the house. More intensive sampling may find that this patch merits designation as a different ecosystem type. Currently this area is an open young forest of white ash and gray birch, with an understory of apple trees; red raspberry, common blackberry and meadowsweet create a low shrub thicket, and the herb flora is dominated by robust sensitive fern and wrinkled goldenrod. North of this stand is a small, wetter area where speckled alder is the common understory species.

VERY POORLY DRAINED WILLOW SHRUB SWAMP/SWAMP WOODLAND

Slightly sloping, Mucky silt over stony sandy loam

Northwest of the barn, in a toeslope position that receives both the brook flowing through stand 1 and the general seepiness flowing down stand 2, is a small, disturbed wetland. The most apparent disturbance is a powerline right-of-way; past disturbances include any combination of land-clearing, pasturing and plowing. Currently the wetland

has a shrub swamp portion and a wooded portion. It is unclear whether the entire swamp will succeed to a wooded wetland, or if the northern portion is too wet to permit substantial tree establishment.

Willow dominates the shrub swamp, with a moderately dense cover of meadowsweet. Scattered tamarack and red maple grow on hummocks. Herb species include spotted joe-pye-weed, Robbin's ragwort, sensitive fern, common horsetail, fowl-mannagrass, bristly aster, turtleheads, ostrich fern, water avens, goldenrod, touch-me-not and awned sedge. The soil is 15cm of mucky silt over stony sandy loam; there were 5cm standing water in early October.

The treed part of the wetland has a cover of trembling aspen, red maple, gray birch, American elm, white pine and tamarack. Wooded portions lie both south and north of the willow shrub swamp. The northern area appears to be a successional wet meadow, whereas the southern area has a better developed, more closed canopy and has been forested longer.

Two other patches are typed as "alder" on the forest management map. Neither of these other areas is a wetland, but rather they are successional wet mesic forestlands. In the larger and more southern of these patches, the soil has a black loam plow layer above very stony sandy loam; the water table was generally 40-60cm deep, but there were a few puddles of surface water toward the south boundary. Current cover consists of open to somewhat closed stands of red maple, trembling aspen, American elm, white ash, tamarack and gray birch. The shrub vegetation is principally willow and meadowsweet; speckled alder is common only near the south property line where a small stream flows. The central alder patch has been briefly discussed with adjacent ecosystems in the section "Mesic, slightly enriched, northern hardwood-hophornbeam forest."

CONCLUSIONS

Ecosystem Classification and Future Work

The Anderson Lands, as can be seen from the above ecosystem descriptions, contain a variety of forest and open wetland types. In characterizing forest ecosystems by geology, landform, soils and vegetation, it is possible to create a classification that is very detailed, with many ecosystem types differentiated by slight differences, and, likewise, it is possible to create a classification that is very broad, in which numerous differences are overlooked or judged to be insignificant for the purposes at hand. I feel that the ecosystem types described above represent a balance. The units are ecologically meaningful, based on response of vegetation to the physical components of the ecosystem, yet the classification is not so detailed as to be difficult to understand or to apply to land management. What is presented herein is a first approximation and represents an initial effort to understand the landscape under study. There is always room for improvement and revision.

An ecosystem classification is a descriptor of biological diversity at the ecosystem level. It goes beyond species lists and forest cover types as methods for understanding the biological richness and complexity of a landscape. Inasmuch, ecosystem classifications are powerful tools for conservation. Nevertheless, to get a more complete picture, it is necessary to both map the ecosystems and to add information about other biota and their

relation to ecosystem types. Data from investigations conducted in 1998 regarding amphibians and small mammals need to be collated with the ecosystem information. Breeding bird survey work could be expanded and related to ecosystem types, and research of invertebrates could be initiated in future years. Of course, the more one looks, the more is seen, and more information about plants and soils also will continue to enrich understanding of those elements of the ecosystem.

A Regional Context

The following observations are based on a personal knowledge of the natural history and conservation status of the western slopes of the Green Mountains in Rutland, Addison, Chittenden and Franklin counties; no formal regional analysis has yet been published, although several efforts are underway.

The Anderson properties have an important role in both ecological understanding and conservation of a low-elevation mountain landscape in the central and northern Green Mountains. The attention given to low-elevation landscapes in inland northern New England has been scant, aside from wetlands. "Typical" low-elevation landscapes--those where people live and work, log and farm--until recently have not been seen as priorities for conservation, nor, because of their largely disturbed nature, have they been viewed as fertile ground for studying ecosystems and their characteristics. These low- and mid-elevation lands, however, are the essence of the Vermont landscape; they are the most abundant and they are, thus, the most characteristic of the region.

I see the Anderson Lands as very representative of the low-elevation Green Mountain landscape. There are rock and ledge, shallow soil and deep soil, dry soil and saturated soil, fertile soil and less fertile soil. There are older forestlands, heavily managed but never cleared, and younger forestlands, recovering from a history of agricultural use. There are forested swamp and open shrub and graminoid swamp. There are meadows and historic cellar holes. In sum, the properties contain a good variety of hardwood and mixed conifer-hardwood forest ecosystems that have been subject to types of land use and management "typical" to Vermont's hill country.

The lands house a respectable proportion of the flora one would expect to find at such elevations in such bedrock and soil types. The current woody species count is 64 and herbaceous species currently total 235. Wildlife use--deer, moose, fisher, bear, squirrels, birds--appears to be ample. Additionally, Isham Brook provides a slice of medium- and high-gradient stream (that needs yet to be investigated), without which a major element of the landscape would be lacking. Certainly one could list ecosystem types missing from these lands, but that is the case with any circumscribed property on any landscape.

Few areas of similar elevation in the state are conserved as "forever wild" lands. Bristol Cliffs Wilderness Area is one such conserved area, and its nearby location does not diminish the importance of conserving more low-elevation forestland. Demographic patterns, particularly population increase and more dispersed housing in rural forestlands, indicate that low- and mid-elevation lands with a wooded and mountainous character will increasingly come under pressures of development. This is particularly true of lands close to the population centers of the Champlain Valley.

Conservation of the Anderson Lands for intrinsic value and ecological research fills an important need in a time of rapid rural development in the central and northern

Green Mountains. It is fortunate that the forests have been well managed and do have high ecological value at this time. It is also fortunate that the lands are as ecologically diverse as they are.

APPENDIX

Species by Common Name

Alphabetically arranged

Woody Plants

alder-leaved buckthorn	<i>Rhamnus alnifolia</i>
alternate-leaved dogwood	<i>Cornus alternifolia</i>
American beech	<i>Fagus grandifolia</i>
American elm	<i>Ulmus americana</i>
apple	<i>Malus sp.</i>
arrowwood	<i>Viburnum recognitum</i>
balsam fir	<i>Abies balsamea</i>
balsam poplar	<i>Populus balsamifera</i>
basswood	<i>Tilia americana</i>
beaked hazel	<i>Corylus cornuta</i>
bigtooth aspen	<i>Populus grandidentata</i>
black ash	<i>Fraxinus nigra</i>
black cherry	<i>Prunus serotina</i>
black elderberry	<i>Sambucus racemosa</i>
butternut	<i>Juglans cinerea</i>
Canada fly-honeysuckle	<i>Lonicera canadensis</i>
choke cherry	<i>Prunus virginiana</i>
common blackberry	<i>Rubus alleghaniensis</i>
dwarf raspberry	<i>Rubus pubescens</i>
early low blueberry	<i>Vaccinium angustifolium</i>
eastern hemlock	<i>Tsuga canadensis</i>
European barberry	<i>Berberis vulgaris</i>
European buckthorn	<i>Rhamnus cathartica</i>
gray birch	<i>Betula populifolia</i>
hawthorn	<i>Crataegus sp.</i>
highbush-cranberry	<i>Viburnum opulus var. americanum</i>
hobblebush	<i>Viburnum alnifolium</i>
hophornbeam	<i>Ostrya virginiana</i>
leatherwood	<i>Dirca palustris</i>
maple-leaved viburnum	<i>Viburnum acerifolium</i>
meadowsweet	<i>Spiraea alba</i>
Morrow's honeysuckle	<i>Lonicera morrowii</i>
mountain maple	<i>Acer spicatum</i>
mountain-ash	<i>Sorbus americana</i>
musclewood	<i>Carpinus caroliniana</i>
nannyberry	<i>Viburnum lentago</i>
northern dewberry	<i>Rubus flagellaris</i>
northern white-cedar	<i>Thuja occidentalis</i>
paper birch	<i>Betula papyrifera</i>
pin cherry	<i>Prunus pensylvanica</i>
poison-ivy	<i>Toxicodendron radicans</i>

prickly gooseberry	<i>Ribes cynosbati</i>
red elderberry	<i>Sambucus pubens</i>
red maple	<i>Acer rubrum</i>
red oak	<i>Quercus rubra</i>
red pine	<i>Pinus resinosa</i>
red raspberry	<i>Rubus idaeus</i>
red spruce	<i>Picea rubens</i>
shadbush	<i>Amelanchier sp.</i>
smooth gooseberry	<i>Ribes cf. hirtellum</i>
speckled alder	<i>Alnus incana</i>
steeplebush	<i>Spiraea tomentosa</i>
striped maple	<i>Acer pensylvanicum</i>
sugar maple	<i>Acer saccharum</i>
swamp dewberry	<i>Rubus hispidus</i>
sweet birch	<i>Betula lenta</i>
tamarack	<i>Larix laricina</i>
trembling aspen	<i>Populus tremuloides</i>
Virginia creeper	<i>Parthenocissus quinquefolia</i>
white ash	<i>Fraxinus americana</i>
white pine	<i>Pinus strobus</i>
willow	<i>Salix spp.</i>
witch-hazel	<i>Hamamelis virginiana</i>
yellow birch	<i>Betula alleghaniensis</i>

Herbs

agrimony	<i>Agrimonia gryposepala</i>
American mannagrass	<i>Glyceria grandis</i>
arrow-leaved tearthumb	<i>Polygonum sagittatum</i>
avens	<i>Geum</i> sp.
awned sedge	<i>Carex gynandra</i>
barren-strawberry	<i>Waldsteinia fragarioides</i>
beechn-drops	<i>Epifagus virginiana</i>
big-flowered bellwort	<i>Uvularia grandiflora</i>
big-leaved aster	<i>Aster macrophyllus</i>
black bulrush	<i>Scirpus atrovirens</i>
black snakeroot	<i>Sanicula marilandica</i>
bladder sedge	<i>Carex intumescens</i>
bland sweet cicely	<i>Osmorhiza claytonii</i>
blue cohosh	<i>Caulophyllum thalictroides</i>
blue-eyed-grass	<i>Sisyrinchium montanum</i>
blue-stemmed goldenrod	<i>Solidago juncea</i>
bluebead lily	<i>Clintonia borealis</i>
bluegrass	<i>Poa</i> sp.
boneset	<i>Eupatorium perfoliatum</i>
bottlebrush grass	<i>Elymus hystrix</i>
bracken	<i>Pteridium aquilinum</i>
bristly aster	<i>Aster puniceus</i>
bristly buttercup	<i>Ranunculus hispidus</i> var. <i>caricetorum</i>
broad-flowered sandwort	<i>Arenaria lateriflora</i>
broad-leaved sedge	<i>Carex platyphylla</i>
broad-leaved toothwort	<i>Dentaria diphylla</i>
bulblet bladder-fern	<i>Cystopteris bulbifera</i>
bunchberry dogwood	<i>Cornus canadensis</i>
Canada mayflower	<i>Maianthemum canadense</i>
chickweed	<i>Cerastium</i> sp.
Christmas fern	<i>Polistichum acrostichoides</i>
cinnamon-fern	<i>Osmunda cinnamomea</i>
cinquefoil	<i>Potentilla</i> sp.
clearweed	<i>Pilea pumila</i>
cleavers	<i>Galium asprellum</i>
climbing nightshade	<i>Solanum dulcamara</i>
Clinton's wood-fern	<i>Dryopteris clintoniana</i>
common buttercup	<i>Ranunculus acris</i>
common horsetail	<i>Equisetum arvense</i>
common shinleaf	<i>Pyrola elliptica</i>
common speedwell	<i>Veronica officinalis</i>
common water-purslane	<i>Ludwigia palustris</i>
common yarrow	<i>Achillea millefolium</i>
crested wood-fern	<i>Dryopteris cristata</i>
cut-leaved toothwort	<i>Dentaria laciniata</i>

daisy	<i>Chrysanthemum leucanthemum</i>
dandelion	<i>Taraxacum officinalis</i>
downy rattlesnake-plantain	<i>Goodyera pubescens</i>
drooping woodreed	<i>Cinna latifolia</i>
Dutchman's breeches	<i>Dicentra cucullaria</i>
dwarf enchanter's-nightshade	<i>Circaea alpina</i>
dwarf scouring rush	<i>Equisetum scirpoides</i>
early saxifrage	<i>Saxifraga virginiana</i>
eastern lined aster	<i>Aster lanceolatus</i>
enchanter's-nightshade	<i>Circaea lutetiana</i>
Eurasian wood-sorrel	<i>Oxalis sp.</i>
fall rattlesnake-root	<i>Prenanthes trifoliolata</i>
false hellebore	<i>Veratrum viride</i>
false Solomon's-seal	<i>Smilacina racemosa</i>
flat-stemmed bluegrass	<i>Poa compressa</i>
foamflower	<i>Tiarella cordifolia</i>
fowl-mannagrass	<i>Glyceria striata</i>
fragile fern	<i>Cystopteris fragilis</i>
fringed bindweed	<i>Polygonum cilinode</i>
fringed brome	<i>Bromus cf. ciliatus</i>
fringed loosestrife	<i>Lysimachia ciliata</i>
gaywings	<i>Polygala paucifolia</i>
goblet aster	<i>Aster lateriflorus</i>
golden-saxifrage	<i>Chrysosplenium americanum</i>
goldthread	<i>Coptis trifolia</i>
grape-fern	<i>Botrychium sp.</i>
grass	<i>Anthoxanthum sp.</i>
grass	<i>Muhlenbergia sp.</i>
green shinleaf	<i>Pyrola cf. chlorantha</i>
hawkweed	<i>Hieracium sp.</i>
hay-scented fern	<i>Dennstaedtia punctilobula</i>
heal-all	<i>Prunella vulgaris</i>
hedge-nettle	<i>Stachys palustris var. pilosa</i>
hellebore	<i>Epipactis helleborine</i>
herb-robert	<i>Geranium robertianum</i>
hirsute sedge	<i>Carex complanata var. hirsuta</i>
hog-peanut	<i>Amphicarpaea bracteata</i>
hooked crowfoot	<i>Ranunculus recurvatus</i>
indian-cucumber	<i>Medeola virginiana</i>
intermediate wood-fern	<i>Dryopteris intermedia</i>
interrupted fern	<i>Osmunda claytoniana</i>
jack-in-the-pulpit	<i>Arisaema triphyllum</i>
kidney-leaved violet	<i>Viola renifolia</i>
lady fern	<i>Athyrium filix-femina</i>
late goldenrod	<i>Solidago gigantea</i>

lima-bean sedge	<i>Carex leptalea</i>
live forever	<i>Sedum purpureum</i>
maidenhair fern	<i>Adiantum pedatum</i>
maidenhair spleenwort	<i>Asplenium trichomanes</i>
marginal wood-fern	<i>Dryopteris marginalis</i>
marsh bedstraw	<i>Galium palustre</i>
marsh fern	<i>Thelypteris palustris</i>
marsh St. John's-wort	<i>Triadenum fraseri</i>
marsh violet	<i>Viola cf. cucculata</i>
marsh-marigold	<i>Caltha palustris</i>
marsh-pennywort	<i>Hydrocotyle americana</i>
motherwort	<i>Leonorus cardiaca</i>
mountain wood-sorrel	<i>Oxalis montana</i>
narrow beech-fern	<i>Thelypteris phegopteris</i>
narrow-leaved willow-herb	<i>Epilobium leptophyllum</i>
New York fern	<i>Thelypteris noveboracensis</i>
nodding beggar's-ticks	<i>Bidens cernua</i>
nodding fescue	<i>Festuca obtusa</i>
northeastern mannagrass	<i>Glyceria melicaria</i>
northern bugleweed	<i>Lycopus uniflorus</i>
northern coral-root	<i>Corallorhiza trifida</i>
northern willow-herb	<i>Epilobium glandulosum</i>
oak-fern	<i>Gymnocarpium dryopteris</i>
old-field cinquefoil	<i>Potentilla simplex</i>
one-sided wintergreen	<i>Pyrola secunda</i>
ostrich fern	<i>Matteuccia struthiopteris</i>
ovales sedge	<i>Carex section ovales</i>
painted trillium	<i>Trillium undulatum</i>
partridgeberry	<i>Mitchella repens</i>
pearly everlasting	<i>Anaphalis margaritacea</i>
Pennsylvania bitter-cress	<i>Cardamine pennsylvanica</i>
Pennsylvania sedge	<i>Carex pennsylvanica</i>
pink lady's-slipper	<i>Cypripedium acaule</i>
pipsissewa	<i>Chimaphila umbellata</i>
plaintain-like sedge	<i>Carex plantaginea</i>
poverty grass	<i>Danthonia spicata</i>
princess-pine	<i>Lycopodium obscurum</i>
rattlesnake-fern	<i>Botrychium virginianum</i>
rattlesnake-mannagrass	<i>Glyceria canadensis</i>
red baneberry	<i>Actaea rubra</i>
red sorrel	<i>Rumex acetosella</i>
reed canary-grass	<i>Phalaris arundinacea</i>
Robbin's ragwort	<i>Senecio schweinitzianus</i>
rock polypody	<i>Polypodium virginianum</i>
rock-cress	<i>Arabis sp.</i>

rosy twisted-stalk	<i>Streptopus roseus</i>
rough-leaved ricegrass	<i>Oryzopsis asperifolia</i>
round-leaved violet	<i>Viola rotundifolia</i>
round-lobed hepatica	<i>Hepatica americana</i>
royal fern	<i>Osmunda regalis</i>
running clubmoss	<i>Lycopodium clavatum</i>
running-pine	<i>Lycopodium complanatum</i>
rusty cliff-fern	<i>Woodsia ilvensis</i>
scabrous sedge	<i>Carex scabrata</i>
sedge	<i>Carex appalachica</i>
sedge	<i>Carex arctata</i>
sedge	<i>Carex blanda</i>
sedge	<i>Carex bromoides</i>
sedge	<i>Carex cf. deflexa</i>
sedge	<i>Carex communis</i>
sedge	<i>Carex debilis</i>
sedge	<i>Carex deweyana</i>
sedge	<i>Carex echinata</i>
sedge	<i>Carex flava</i>
sedge	<i>Carex granularis</i>
sedge	<i>Carex laxiflora</i>
sedge	<i>Carex lurida</i>
sedge	<i>Carex pallescens</i>
sedge	<i>Carex prasina</i>
sedge	<i>Carex radiata</i>
sedge	<i>Carex rosea</i>
sedge	<i>Carex rostrata</i>
sedge	<i>Carex stipata</i>
sedge	<i>Carex tenera</i>
sedge	<i>Carex tribuloides</i>
sedge	<i>Carex umbellata</i>
sedge	<i>Carex virescens</i>
sedge	<i>Carex vulpinoidea</i>
sensitive fern	<i>Onoclea sensibilis</i>
sessile-leaved bellwort	<i>Uvularia sessilifolia</i>
sharp-lobed hepatica	<i>Hepatica acutiloba</i>
shining clubmoss	<i>Lycopodium lucidulum</i>
short-husk grass	<i>Brachyeletrum erectum</i>
showy goat's-beard	<i>Tragopogon cf. pratensis</i>
silvery spleenwort	<i>Athyrium thelypteroides</i>
skullcap	<i>Scutellaria lateriflora</i>
slender sedge	<i>Carex gracillima</i>
small-flowered crowfoot	<i>Ranunculus abortivus</i>
soft rush	<i>Juncus effusus</i>
Solomon's-seal	<i>Polygonatum pubescens</i>

spotted joe-pye-weed	<i>Eupatorium maculatum</i>
spotted St. John's-wort	<i>Hypericum punctatum</i>
spotted touch-me-not	<i>Impatiens capensis</i>
spreading dogbane	<i>Apocynum androsaemifolium</i>
spring beauty	<i>Claytonia caroliniana</i>
squirrel-corn	<i>Dicentra canadensis</i>
stalked sedge	<i>Carex pedunculata</i>
starflower	<i>Trientalis borealis</i>
stiff clubmoss	<i>Lycopodium annotinum</i>
swamp saxifrage	<i>Saxifraga pennsylvanica</i>
sweet flag	<i>Acorus calamus</i>
sweet-scented bedstraw	<i>Galium triflorum</i>
tall meadow-rue	<i>Thalictrum polygamum</i>
tall northern bog-orchid	<i>Habenaria hyperborea</i>
thimbleweed	<i>Anemone virginiana</i>
thistle	<i>Cirsium sp.</i>
three-seeded sedge	<i>Carex trisperma</i>
toothed wood-fern	<i>Dryopteris carthusiana</i>
trout lily	<i>Erythronium americanum</i>
turtleheads	<i>Chelone glabra</i>
tussock sedge	<i>Carex stricta</i>
two-leaved mitrewort	<i>Mitella diphylla</i>
two-nerved sedge	<i>Carex leptoneuria</i>
two-seeded sedge	<i>Carex disperma</i>
vetch	<i>Vicia sp.</i>
violet	<i>Viola spp.</i>
virgin's bower	<i>Clematis virginiana</i>
Virginia waterleaf	<i>Hydrophyllum virginianum</i>
wakerobin	<i>Trillium erectum</i>
water avens	<i>Geum rivale</i>
water-pepper	<i>Polygonum hydropiper</i>
water-pipes	<i>Equisetum fluviatile</i>
water-starwort	<i>Callitriche cf. palustris</i>
white avens	<i>Geum canadense</i>
white baneberry, doll's eyes	<i>Actaea pachypoda</i>
white snakeroot	<i>Eupatorium rugosum</i>
white wood aster	<i>Aster divaricatus</i>
whorled mountain aster	<i>Aster acuminata</i>
wild cucumber	<i>Echinocystis lobata</i>
wild leek	<i>Allium tricoccum</i>
wild mint	<i>Mentha cf. arvensis</i>
wild sarsaparilla	<i>Aralia nudicaulis</i>
wild strawberry	<i>Fragaria sp.</i>
wild-ginger	<i>Asarum canadense</i>
wild-licorice	<i>Galium circaezans</i>

wood-anemone	<i>Anemone quinquefolia</i>
wood-nettle	<i>Laportea canadensis</i>
wood-rush	<i>Luzula acuminata</i>
wood-rush	<i>Luzula multiflora</i>
woodland horsetail	<i>Equisetum sylvaticum</i>
wool-grass	<i>Scirpus cyperinus</i>
wrinkled goldenrod	<i>Solidago rugosa</i>
yellow touch-me-not	<i>Impatiens pallida</i>
yellow wood-violet	<i>Viola pubescens</i>
zig-zag goldenrod	<i>Solidago flexicaulis</i>