



# Northern Hardwood Forest Formation

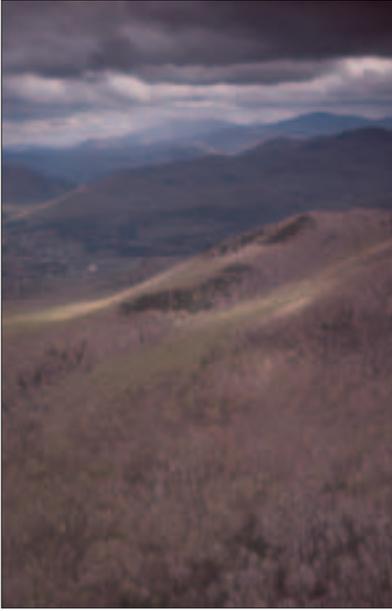
## *Forests of Widespread Distribution in Vermont's Moderate Climate Areas*

The Northern Hardwood Forest Formation of Vermont is part of a broad forest region where sugar maple, American beech, yellow birch, and hemlock predominate. This region ranges from the upper-Midwest states of Wisconsin and Michigan east to Maine and southeastern Canada. The Northern Hardwood Forest Formation makes a transition to the Spruce-Fir-Northern Hardwood Forest Formation in colder areas, to the north and at higher elevations. It makes a transition to the Oak-Pine-Northern Hardwood Forest Formation where warmer and/or drier conditions prevail to the south and also locally on south-facing dry knobs or regionally, as in the Champlain Valley. The climate of the Northern Hardwood Forest Formation is cool-temperate and moist. Summers are warm and winters can be severely cold. Average annual temperatures range from 37° to 52°F. Annual precipitation ranges from 35 to 50 inches in most areas and is distributed more or less evenly throughout the year. Average annual snowfall is about 100 inches. Growing season length averages 100 to 110 days.

The Northern Hardwood Forest Formation is characterized by soils that are neither extremely dry nor extremely wet. Soil moisture varies with parent material, topography, and depth to a restricting layer. Soils are mostly developed from glacial till, and bedrock is close to the surface in some areas. Sandy or gravelly soils derived from glacial outwash are found only locally, as are soils formed in lake bed deposits. Bedrock varies from granite to schist or limestone.

Broad-leaved deciduous trees are the dominant life form in this forest formation. These trees lose their leaves each fall and are almost completely dormant for the winter months, when cold temperatures and short days minimize the benefit a tree might gain from photosynthesis. This broad-leaved deciduous habit is in striking contrast to the needle-leaved evergreen life forms that prevail in Spruce-Fir Forests, where the growing season is so short that it is necessary to photosynthesize whenever there is a chance and the cost of producing an entirely new set of leaves each year is simply too great. It is also in striking contrast to the broad-leaved evergreen habit of the moist tropics, where there is no season of dormancy and therefore no need to shed all leaves for a number of months.

Forests of the Northern Hardwood Forest Formation have several distinctive characteristics. Fall colors are one of the most remarkable. The northeastern United States has arguably the most striking display of fall foliage in the Americas, a display that attracts millions of tourists each autumn. The only other place in the world that features a comparable show is eastern Asia, where the climate is much like that of the northeastern United States. There are places in Japan that could easily be mistaken for New England, with closely related species, similar forest structure, and equally striking fall colors.



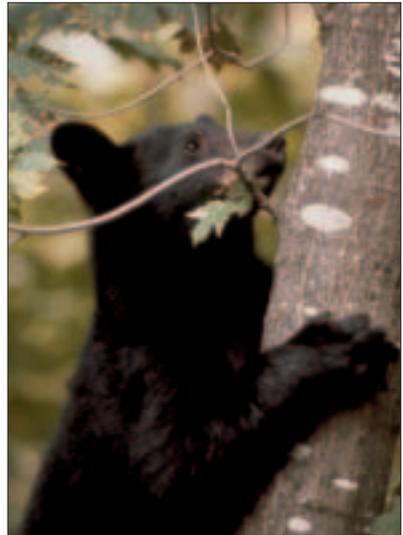
*Patterns in the distribution of forest types in the Northern Hardwood Forest Formation can be seen in this spring view of the Northern Green Mountains.*

The fall colors result from the loss of green pigment, chlorophyll, as the trees slow down their photosynthesis and prepare to enter dormancy. When the chlorophyll is gone, previously masked pigments such as xanthophylls and carotenoids become visible. The trees of the Northern Hardwood Forest Formation, sugar maple and red maple in particular, are full of colorful pigments. The weather here in the fall – cool nights with plenty of moisture – provide the perfect conditions for the gradual exposure and heightening of color.

Spring wildflowers are another striking characteristic of the Northern Hardwood Forest Formation, as they are in the Central Hardwoods, the large forest region that dominates the Southern Appalachians. Most of the herbaceous plants in these forests are long-lived perennials, a life form that is well suited to stable systems where catastrophic disturbance is rare. Perennials store significant amounts of food in their roots, tubers, or bulbs. Most of this food is manufactured in the early spring, and some in the fall, when leaves are off the trees

and sunlight reaches the forest floor. In fact, many of these perennials, like wild leeks, Dutchman's breeches, and trout lily, photosynthesize only in early spring, going partially or completely dormant for the remainder of the summer. This is a good strategy. When trees are fully leafed out, they intercept as much as 99 percent of the light that strikes the canopy, leaving the forest floor in relative darkness.

Some forest communities in the Northern Hardwood Forest Formation are dominated by evergreens, in particular eastern hemlock. Hemlock Forests have very sparse herb layers because there is essentially no good season for photosynthesis on the forest floor. It is dark all the time. The few herbs that can grow in these dark forests, like partridgeberry and wintergreen, are evergreens that photosynthesize at a slower rate but for a longer period. Saprophytes such as Indian pipes are also common in Hemlock Forests.



*The Northern Hardwood Forest Formation is home to black bear. The nuts of American beech, an abundant tree here, are a favorite fall food of black bear.*

Sugar maple, beech, yellow birch, and hemlock are the most abundant species in the Northern Hardwood Forest Formation but other common species, roughly in order of abundance, include white ash, basswood, red maple, white pine, red oak, red spruce, and balsam fir. White ash and basswood, both somewhat shade-intolerant, are most common in areas of enrichment, or in moist areas created by shallow impermeable layers in the soil, or in areas where mineral-rich bedrock or till influences soil chemistry. Red maple (most commonly a wetland species in Vermont) is also present in nutrient-poor upland areas, particularly if there has been some disturbance in the past. It is shade intolerant, and so does not generally persist in closed upland forests. White pine is most common where there has been some disturbance, but can persist naturally where soils are well drained. Red oak reaches its northern limit here. It is most common on dry, warm sites but can also appear as a successional tree on moist sites.

Red spruce and balsam fir are most common in cooler, moister areas with shallow soils.

## ► HOW TO IDENTIFY

### Northern Hardwood Forest Formation Natural Communities

Read the short descriptions that follow and choose the community that fits best. Then go to the page indicated to confirm your decision.

**Northern Hardwood Forest:** A variable community, generally dominated by beech, sugar maple, and yellow birch. Go to page 132.

**Rich Northern Hardwood Forest :** High diversity hardwood forests of sugar maple, white ash, and basswood, with excellent productivity and high herb diversity. Maidenhair fern, blue cohosh and wood nettle are characteristic herbs. Go to page 138.

**Mesic Red Oak-Northern Hardwood Forest:** Northern hardwood species and red oak codominate. Mostly on south-facing slopes in the northern parts of Vermont. Go to page 142.

**Hemlock Forest:** Dominated by hemlock, often on shallow soils. Go to page 145.

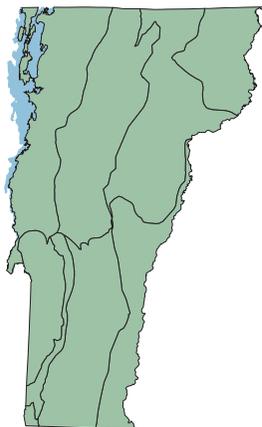
**Hemlock-Northern Hardwood Forest:** Mixed forest of hemlock and northern hardwoods. Go to page 148.

**Northern Hardwood Talus Woodland:** Characteristic species are mountain maple, Appalachian polypody, red-berried elder, and Northern Hardwood species. Go to page 150.



## DISTRIBUTION/ ABUNDANCE

Northern Hardwood Forests are found throughout the state at elevations below 2,700 feet, although the upper elevation limit is lower in the north.



## ECOLOGY AND PHYSICAL SETTING

This is Vermont's most abundant forest, the forest that truly characterizes the Northern Hardwood Forest Formation. It blankets hills in every biophysical region of the state and creates a background setting, a so-called matrix, for the smaller communities – the swamps, fens, outcrops, and meadows. It is a broadly defined community type, encompassing a great deal of variation. But there are some things that all expressions of this community share in common. Beech and yellow birch are almost always present. Sugar maple is usually present, but in some cases red maple is more prominent. Most soils are formed in ablation or basal till and are loamy, cool, and moist. These forests are found at elevations below 2,700 feet on gentle to steep slopes.

Northern Hardwood Forests are only uncommon in the lower elevations of the Champlain Valley, where clay and sand prevail as parent materials, and in other places where soils are specialized. Such places include alluvial soils along streams and rivers, glaciofluvial deposits of sand or gravel terraces, rocky or bedrock-controlled soils, and wet soils in depressions. Vermont's warmest climate areas also have other forest communities.

The variations within this community type stem from differences in climate, slope, landscape position, chemistry of the underlying bedrock and till, stoniness, depth to basal till or bedrock, and past land use. Upper elevation Northern Hardwood Forests have lower overall diversity, smaller trees, and sometimes lush fern populations. Forests on convex slopes tend to have more beech and red maple, whereas concave slopes yield more sugar maple and white ash. Yellow birch is dominant where stony soils and natural disturbance provide the right conditions for that species to germinate and grow. White pine occurs in areas of shallow or sandy soils. These variations are often small in scale: a beech-dominated knob may only be a few hundred square feet within a forest otherwise dominated by sugar maple.

Therefore, we describe variants of this one community rather than individual communities. A large area, then, may be mapped as Northern Hardwood Forest, with the recognition that there is variability within it. Foresters will find it useful to map the variants as stands, so that each can be managed appropriately.

Natural disturbances in Northern Hardwood Forests include death of individual trees, which can create small canopy gaps; wind, which can cause small or large gaps depending on the nature and intensity of the storm; ice loading, which can thin the canopy enough to significantly increase light to the forest floor; snow loading, which can have the same effect, especially when snow falls while leaves are on the trees; downslope movement of soil; and insects and disease including forest tent caterpillar, saddle prominent, and ash yellows.

The variation in vegetation and physical factors in Northern Hardwood Forests was studied by Marie-Louise Smith (1992) and James Fincher in two separate studies in the Green Mountains. William B. Leak et al. (1987) has described variation in this forest type based on habitat types, mostly in New Hampshire. The references cited below will provide more insight into Northern Hardwood Forests, their variations, and their ecology.

## VEGETATION

Variations in vegetation are described under "Variants." The following generalizations hold for most late-successional Northern Hardwood Forests. Beech, yellow birch, and sugar maple are dominant in the canopy. Sometimes red maple replaces sugar maple. Hemlock, red spruce, white ash, red oak, butternut, basswood,

hophornbeam, and other species can be present as well. The shrub layer is moderately well-developed, with striped maple, hobblebush, and shadbush among the common components. The herb layer is usually neither lush nor sparse, but there are local variations. Herbs are long-lived perennials and many of them flower and fruit early in the year, before the forest canopy leafs out. Many of the species found in these forests are also found in Montane Spruce-Fir Forests.



*Trout lily derives its name from its brown speckled leaves.*

## ANIMALS

As this is the dominant matrix-forming community in Vermont, large expanses of intact forest are critical for many animal species that are sensitive to human disturbance, including birds that nest in the forest interior and some wide-ranging mammals. Some characteristic birds are hermit thrush, rose-breasted grosbeak, ovenbird, red-eyed vireo, eastern wood pewee, black and white warbler, black-throated blue warbler, veery, and scarlet tanager. Characteristic mammals include

masked shrew, eastern cottontail, red squirrel, southern flying squirrel, northern flying squirrel, white-footed mouse, woodland jumping mouse, deer mouse, chipmunk, porcupine, black bear, and white-tailed deer. Northern Hardwood Forests also provide habitat for a number of salamanders, including redback salamander, spotted salamander, eastern newt, and along brooks, northern two-lined salamander, dusky salamander, and spring salamander. Wood frogs and northern redbelly snakes are common here as well.

## SUCCESSIONAL TRENDS

Since this is such a variable community type, its early-successional stages are variable, too. Post-agricultural succession is often to pure stands of white pine, which are eventually replaced by hardwoods. Thus stands that are pine dominated today

may actually be Northern Hardwood Forests. It is necessary to look at soils to predict whether pine will persist or not. Coarse soils are more likely to support pine over long periods of time.

White pine is not the only post-agricultural successional species, however. Other candidates are gray birch (on shallower soils), bigtooth aspen, quaking aspen, black cherry, pin cherry, and in the north, white spruce, red spruce, balsam fir, and northern white cedar. The tree species that become established in an old field depend on the soils, the nature of the agricultural disturbance (pasturing vs. cropland), the duration and intensity of the disturbance, and the local seed sources.

Invasive non-native species can affect the successional pathway, too. Although there is no direct evidence, scientists suspect that dense populations of invasive shrubs such as Morrow's honeysuckle can slow the return of native trees to an area. Even when native trees become re-established, honeysuckle can persist in the understory for long periods of time, replacing native shrubs and herbs.

Where logging is the major disturbance to a Northern Hardwood Forest, the most common early-successional trees are yellow birch, white ash, bigtooth aspen, quaking aspen, sugar maple, pin cherry, paper birch, and white pine. Pin cherry and paper birch are especially prevalent in large openings left by logging.

Large scale natural disturbances can have a similar effect on the canopy. For example, the species that come in after logging will also come in after a large disturbance such as a blowdown caused by a hurricane. In the case of the more common small scale disturbances, such as the death or blowdown of individual trees, yellow birch, white ash, and sugar maple tend to come into openings.

Beech has its own story. In addition to producing seeds, it reproduces vegetatively, sending up root suckers, or new sprouts from older trees. A beech that has been cut still has the potential, for at least the first year, to produce a thicket of young new

sprouts. Where beech does well (on drier microsites within Northern Hardwood Forests), it can, following logging, remain the dominant species or become more abundant because of this strategy.

## VARIANTS

The "core" community described above is dominated by sugar maple, beech, and yellow birch. We recognize four variants:

***Beech-Red Maple-Hemlock Northern Hardwood Forest:*** This variant differs from the core Northern Hardwood Forest in that in mid-successional stands beech and red maple are the most common canopy components. Yellow birch and sweet birch can be present, depending on climate (sweet birch is restricted to the warmer areas of the state). This variant occurs on convex knobs, where soils are well drained to somewhat excessively well drained. Soils may be coarser than in other Northern Hardwood Forests. These sites can be shallow to bedrock, or are moderately deep to basal till. They are on gentle to moderate slopes. Late-successional examples of this variant may be dominated by beech and hemlock, whereas red maple (a shade-intolerant tree) will decline as a stand matures. Common herbs in Beech-Red Maple-Hemlock Northern Hardwood Forests are starflower, Canada mayflower, shining clubmoss, beech drops, and Indian pipes.

***Sugar Maple-White Ash-Jack-in-the-pulpit Northern Hardwood Forest:***

This variant shows slight enrichment. Sometimes it is found in concavities in the slope, where nutrients accumulate. Or as is common in the Southern Vermont Piedmont, it occurs on ridgetops. Foresters and ecologists believe that it occurs where there is nutrient enrichment, either nutrient accumulation or enriched bedrock or till. Mid-successional trees are white ash, sugar maple, black cherry, and yellow birch with occasional butternut, hophornbeam, basswood, and red oak. Minor components are red maple, hemlock, and red spruce.

Late-successional trees are sugar maple and beech. Characteristic herbs are Jack-in-the-pulpit, white baneberry, red trillium, Christmas fern, blue cohosh, early yellow violet, lady fern, and wild oats. This variant deserves more study to determine the variety of factors that favor white ash over other species and to learn more about the potential longevity of white ash.

### **Yellow Birch Northern Hardwood**

**Forest:** This variant occurs where yellow birch is stable as a canopy dominant. In general, yellow birch is considered an early to mid-successional tree, capable of persisting long term only when occasional local disturbances create the mineral soil seedbed or supply the nurse logs that this species needs to germinate. But where rocks and boulders are common at the surface, there may be a perpetual source of good sites for yellow birch seeds to germinate, and the species may therefore persist here long term as a dominant in the canopy. We have seen sites that appear to be functioning in this way, but they need more study.

### **White Pine-Northern Hardwood**

**Forest:** This variant was recognized as a distinct community in our earlier classification (Vermont Nongame and Natural Heritage Program (Thompson 1996)) but was removed because white pine in Northern Hardwood Forests is often a result of past disturbance, at least in Vermont. White pine is a natural component of Northern Hardwood Forests, however, where soils are coarser and more well drained. This variant describes those areas where white pine is a significant canopy component – but not because of past human use. Wherever white pine is

common, it should be evaluated to determine whether it is likely to persist over time by looking at soils and the regeneration of pine in the understory.

## RELATED COMMUNITIES

### **Rich Northern Hardwood Forest:**

This community is most like Sugar Maple-White Ash Northern Hardwood Forest (see “Variants”), but it is more enriched, with greater overall diversity, better productivity, and more biomass in forest floor herbs. It is usually associated with enriched bedrock or till.

### **Hemlock-Northern Hardwood Forest:**

This community is most like the Beech-Red Maple-Hemlock-Northern Hardwood Forest variant in that soils are shallow and well drained. In this case,

hemlock is co-dominant in the canopy.

### **Mesic Red Oak-Hardwood Forest:**

This community occurs in regions where oak is common. Where there is a steady seed supply for red oak, it may persist as a component of Northern Hardwood Forest, even though conditions are not necessarily those we associate with red oak.

**Northern Hardwood Talus Woodland:** Especially steep, rocky examples of Northern Hardwood Forests can be similar to this community.

### **Mesic Maple-Ash-Hickory Forest:**

This community occurs in warmer climate areas where hickories are common in the forest canopy. Its ground vegetation also shows its southern affinities, but in many respects it is similar to Northern Hardwood Forest, with beech, sugar maple, and red maple common in the canopy.



*Spring beauty is typically found in Northern Hardwood Forests with greater mineral and nutrient enrichment.*

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

There are very few Northern Hardwood Forests that have not been logged or cleared at some time. Even those few areas that were spared clearing or logging were probably used for maple sugar production. But the encouraging conservation story is that Northern Hardwood Forests have recovered amazingly well from the 19th century clearing of the land. Natural ecological processes are once again predominant, and in most places native species once again prevail. Today, the human disturbances in these forests include forestry, sugaring, fragmentation from roadbuilding and development of rural residential housing, and complete conversion to other uses. Human activities have brought non-native pathogens such as beech scale disease, gypsy moth, and hemlock woolly adelgid.

There are many human activities that are compatible with conservation in Northern Hardwood Forests. While it is important to have some areas that are free from human disturbance for long periods of time, carefully managed Northern Hardwood Forests can also serve as conservation areas. Foresters managing Northern Hardwood Forests should first understand what they have by inventorying and mapping natural communities and variants. Management should encourage the species that naturally occur in an area, in their natural proportions. For example, if white pine is present because of former agricultural practice, it does not make sense to artificially maintain it. Red oak can also be present because of past disturbance. It should only be encouraged if the soils and seed sources suggest that it would persist over time naturally. On dry knobs, beech, red maple, and hemlock are the species that should be favored, whereas it might be advantageous to reduce beech in a moist cove where sugar maple will do well.

## PLACES TO VISIT

Camels Hump State Forest, Huntington and Duxbury, Vermont Department of Forests, Parks, and Recreation (VDFPR)  
Mount Mansfield State Forest, Stowe and Underhill, VDFPR  
Coolidge State Forest, Plymouth, VDFPR  
Lord's Hill Natural Area, Groton State Forest, Groton, VDFPR  
Gifford Woods State Park, Sherburne, VDFPR  
Green Mountain National Forest, U.S. Forest Service

## SELECTED REFERENCES AND FURTHER READING

- Fincher, James M. 1988. The relationship of soil-site factors to forest plant communities in the Green Mountain and White Mountain National Forests. Master of Science Thesis, University of New Hampshire.
- Leak, William B., Dale Solomon, and Paul DeBald. 1987. Silvicultural guide for northern hardwood types in the Northeast (revised). U.S.D.A. Forest Service Northeastern Forest Experiment Station, Research Paper NE-603.
- Smith, Marie-Louise. 1992. Habitat type classification and analysis of upland northern hardwood forest communities on the Middlebury and Rochester Ranger Districts, Green Mountain National Forest, Vermont. Master of Science Thesis, University of Wisconsin.
- Woods, Kerry D. 1987. Northern hardwood forests in New England. *Wild Flower Notes* 2:2-10.

## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Sugar maple – *Acer saccharum*  
 Yellow birch – *Betula alleghaniensis*  
 American beech – *Fagus grandifolia*

#### Occasional to Locally Abundant Species

Eastern hemlock – *Tsuga canadensis*  
 Red maple – *Acer rubrum*  
 White ash – *Fraxinus americana*  
 White pine – *Pinus strobus*  
 Black cherry – *Prunus serotina*  
 Sweet birch – *Betula lenta*  
 Basswood – *Tilia americana*  
 Red spruce – *Picea rubens*

### SHRUBS

#### Abundant Species

Hobblebush – *Viburnum alnifolium*  
 Striped maple – *Acer pensylvanicum*  
 Shadbush – *Amelanchier* spp.

#### Occasional to Locally Abundant Species

Canada honeysuckle – *Lonicera canadensis*  
 Beaked hazelnut – *Corylus cornuta*  
 Alternate-leaved dogwood – *Cornus alternifolia*

### HERBS

#### Abundant Species

Intermediate wood fern – *Dryopteris intermedia*  
 Christmas fern – *Polystichum acrostichoides*  
 Shining clubmoss – *Lycopodium lucidulum*  
 Sarsaparilla – *Aralia nudicaulis*

#### Occasional to Locally Abundant Species

Painted trillium – *Trillium undulatum*  
 Whorled aster – *Aster acuminatus*  
 Wild oats – *Uvularia sessilifolia*  
 Lady fern – *Athyrium filix-femina*  
 Canada mayflower – *Maianthemum canadense*  
 Red trillium – *Trillium erectum*  
 Spring beauty – *Claytonia caroliniana*  
 Trout lily – *Erythronium americanum*  
 False solomon's seal – *Smilacina racemosa*  
 Rose twisted stalk – *Streptopus roseus*  
 Starflower – *Trientalis borealis*  
 Indian cucumber root – *Medeola virginiana*  
 Indian pipes – *Monotropa uniflora*  
 Beech drops – *Epifagus virginiana*  
 Early yellow violet – *Viola rotundifolia*  
 Jack-in-the-pulpit – *Arisaema triphyllum*  
 Long beech fern – *Thelypteris phegopteris*  
 Zigzag goldenrod – *Solidago flexicaulis*  
 Common wood sorrel – *Oxalis acetosella*  
 Hay-scented fern – *Dennstaedtia punctilobula*

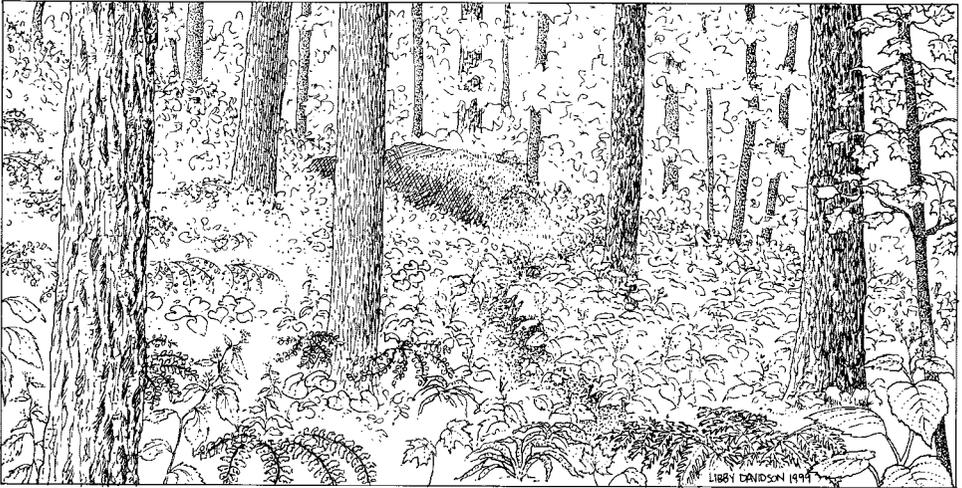
### INVASIVE NON-NATIVE PLANTS

Morrow's honeysuckle – *Lonicera morrowii*  
 Tartarian honeysuckle – *Lonicera tatarica*  
 Japanese barberry – *Berberis thunbergii*  
 Common buckthorn – *Rhamnus cathartica*

### RARE AND UNCOMMON PLANTS

Broad beech fern – *Thelypteris hexagonoptera*  
 Male fern – *Dryopteris filix-mas*  
 Three-birds orchid – *Tripbora trianthopbora*

# RICH NORTHERN HARDWOOD FOREST



## DISTRIBUTION/ABUNDANCE

Rich Northern Hardwood Forests occur throughout Vermont at low to moderate elevations, from approximately 300 to 2,500 feet. They are most common where the bedrock is calcareous but are also present in areas of nutrient-enriched till or topographically induced enrichment. This community occurs throughout the northeastern United States and adjacent Canada but is less common in neighboring states. Vermont may have the largest examples of this natural community type in the northeast.

## ECOLOGY AND PHYSICAL SETTING

Rich Northern Hardwood Forests are quintessentially Vermont. Sugar maple is abundant, making these forests vital to three of Vermont's economic staples: maple sugar production, forestry, and tourism. Rich Northern Hardwood Forests are places where colluvial processes (downslope movement) or mineral rich bedrock, or some combination of the two, provide plants with a steady supply of nutrients.

Colluvial processes prevail on lower slopes and benches and also in coves and gullies. Here organic matter and plant nutrients accumulate over time, forming a compost-like soil. If the bedrock or till on such a slope is enriched with calcium and other key plant nutrients, these nutrients will be washed from upper to lower slopes, giving the plants below the greatest advantage. Productivity is high on the lower slopes, as is the overall diversity of plant species. The upper slopes or the convex knobs on such a hill, where nutrients are leached from the soils, will have communities such as Northern Hardwood Forest, Hemlock Forest, Mesic Red Oak-Hardwood Forest, or Dry Oak-Hickory-Hophornbeam Forest, with lower species diversity and lower productivity.

Rich Northern Hardwood Forests can also be found on rolling terrain where calcium-rich bedrock, such as limestone or dolomite, is found close to the surface. Although soils on these sites can be shallow and droughty, the bedrock nevertheless provides ample plant nutrients. Pockets of rich soil are commonly mixed with the small outcrops of calcareous rock. These sites can be quite productive and diverse, with many plants that indicate mineral enrichment.

Overall, the soils in Rich Northern Hardwood Forests range from well drained to somewhat poorly drained. Sometimes there is dense basal till underlying the soil, generally about 18-24 inches from the surface. This

# RICH NORTHERN HARDWOOD FOREST

restricting layer can be a factor in keeping moisture and nutrients near the surface, where they are readily available to plants. Where soils are moist, productivity is higher, trees produce higher quality wood, and herbaceous plants are more abundant.

## VEGETATION

Rich Northern Hardwood Forests are high productivity forests: trees grow quickly, and they grow tall and straight. Sugar maple is dominant in the canopy, but basswood and white ash are common as well, and butternuts are scattered to occasionally abundant. The shrub layer varies from being almost absent in dense shade to well-developed in sunny openings. Herbs are often abundant on the forest floor, forming a continuous carpet of lush vegetation in mid-summer. Where moisture is plentiful, ferns such as ostrich fern, glade fern, and silvery glade fern grow together in fern glades. Most of the herbs are long-lived perennials. Many of them are spring ephemerals that flower and fruit early in spring before trees leaf out, when sunlight is plentiful. By mid-summer some of these plants, like Dutchman's breeches, have lost all their foliage and are completely invisible above ground. Other plants, like wood nettle and maidenhair fern, persist throughout the summer, displaying large canopies of leaves to gather the filtered light on the forest floor.

The overall diversity of species is high in Rich Northern Hardwood Forests, as is the sheer abundance of biomass on the forest floor. A study of forests in Vermont and New York showed that in plots of uniform size (0.1 hectare, or about 1/4 acre), a representative Rich Northern Hardwood Forest in the Green Mountains had an average of 48 herb species, while other hardwood forest types in the Adirondacks

had an average of 27 species. Other studies show similar results.

## ANIMALS

Mammals of Rich Northern Hardwood Forests include black bear, masked shrew, deer mouse, white-footed mouse, woodland jumping mouse, and chipmunk. Among the amphibians are redback salamander, spotted salamander, eastern

newt, wood frog, northern two-lined salamander, dusky salamander, and spring salamander. Invertebrates are not well studied in these forests; the careful study of snails and other invertebrate groups might yield some interesting results. Birds are similar to those found in Northern Hardwood Forests.



*The early spring flowers of hepatica range from purple to white.*

## SUCCESSIONAL TRENDS

Rich Northern Hardwood Forests that have been undisturbed for long periods of time will likely be dominated by sugar maple, basswood, and beech, whereas forests where natural or human disturbances have created openings may be dominated by a combination of sugar maple, bigtooth aspen, white ash, striped maple, black cherry, white pine, yellow birch, and pin cherry. Which of these species dominate, and for how long, will depend on climate, history, seed sources, and site conditions.

## VARIANTS

**Northern Hardwood Limestone Forest:** This is a Rich Northern Hardwood Forest on shallow-to-bedrock soils, where the bedrock is limestone or other calcium-rich rock such as dolomite. Soils are shallow and well drained. Hophornbeam is typically common in the canopy. This variant is very similar to Transition Hardwoods Limestone Forest, a variant of Mesic Maple-Ash-Hickory-Oak Forest.

## RELATED COMMUNITIES

**Northern Hardwood Forest:** This is the community most closely related to Rich Northern Hardwood Forest; the two differ in the availability of plant nutrients in the soils and in species diversity. Often the two communities interfinger, with Rich Northern Hardwood Forest occurring in rich coves or benches, surrounded by Northern Hardwood Forest.

**Mesic Red Oak-Northern Hardwood Forest:** These two communities can intergrade where oak is common. A predominance of red oak and drier site conditions distinguishes Mesic Red Oak-Northern Hardwood Forest.

**Mesic Maple-Ash-Hickory-Oak Forest:** This community can be very similar to Rich Northern Hardwood Forest, but differs in having southern species such as hickories and oaks.

**Mesic Maple-Ash-Hickory-Oak Forest, Transition Hardwoods Limestone Forest variant:** Found in areas of shallow soils over limestone in the Champlain Valley and other warm areas, this community has much in common with the Northern Hardwood Limestone Forest variant of Rich Northern Hardwood Forest, but species composition reflects a warmer climate and southern affinities.

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

Rich Northern Hardwood Forest is a common community in Vermont, although most examples are small. Exceptionally large examples occur in the eastern Taconic Mountains and are protected there. Several examples elsewhere are protected as natural areas, and a number of sites are under timber management that considers the long term ecological integrity of the natural community. The observations of foresters and ecologists indicate that this

community type can recover well from selective harvest, including long-term use as sugarbush, if patch cuts are kept small and precautions are taken against the encroachment of invasive non-native plants. On the other hand, clearing for agriculture probably has a long-term impact on these forests; the native flora may take a long time to return when a Rich Northern Hardwood Forest site used for agriculture is allowed to return to forest. In general, activities that alter the downslope movement of soil and nutrients, such as the building of roads across slopes, threaten the integrity of this community.

## PLACES TO VISIT

Mount Equinox, Manchester, Equinox Preservation Trust, The Nature Conservancy and Vermont Land Trust  
Gifford Woods, Sherburne, Vermont  
Department of Forests, Parks, and Recreation (VDFPR)  
Willoughby State Forest, Westmore and Sutton, VDFPR

## SELECTED REFERENCES AND FURTHER READING

Woods, Kerry D. 1987. Northern Hardwood forests in New England. *Wild Flower Notes* 2:2-10.

Blue cohosh – *Caulophyllum thalictroides*



## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Sugar maple – *Acer saccharum*  
 White ash – *Fraxinus americana*

#### Occasional to Locally Abundant Species

Basswood – *Tilia americana*  
 Sweet birch – *Betula lenta*  
 Bitternut hickory – *Carya cordiformis*  
 Yellow birch – *Betula alleghaniensis*  
 American beech – *Fagus grandifolia*  
 Black cherry – *Prunus serotina*  
 Butternut – *Juglans cinerea*  
 Hophornbeam – *Ostrya virginiana*

### SHRUBS

#### Abundant Species

Striped maple – *Acer pensylvanicum*  
 Alternate-leaved dogwood – *Cornus alternifolia*

#### Occasional to Locally Abundant Species

Maple-leaf viburnum – *Viburnum acerifolium*  
 Red-berried elder – *Sambucus racemosa*  
 Round-leaved dogwood – *Cornus rugosa*  
 Leatherwood – *Dirca palustris*

### HERBS

#### Abundant Species

Wood nettle – *Laportea canadensis*  
 Maidenhair fern – *Adiantum pedatum*  
 Blue cohosh – *Caulophyllum thalictroides*  
 Wild leeks – *Allium tricoccum*  
 Dutchman's breeches – *Dicentra cucullaria*  
 Hepatica – *Hepatica spp.*  
 Canada violet – *Viola canadensis*  
 Pale touch-me-not – *Impatiens pallida*  
 Wild ginger – *Asarum canadense*

Bulblet fern – *Cystopteris bulbifera*  
 Christmas fern – *Polystichum acrostichoides*  
 White snakeroot – *Eupatorium rugosum*  
**Occasional to Locally Abundant Species**  
 Squirrel corn – *Dicentra canadensis*  
 Early yellow violet – *Viola rotundifolia*  
 Silvery glade fern – *Athyrium thelypteroides*  
 White baneberry – *Actaea pachypoda*  
 Plantain-leaved sedge – *Carex plantaginea*  
 Zigzag goldenrod – *Solidago flexicaulis*  
 Black snakeroot – *Sanicula marilandica*  
 Rattlesnake fern – *Botrychium virginianum*  
 Waterleaf – *Hydrophyllum virginianum*  
 Herb Robert – *Geranium robertianum*  
 Carex sprengelii – *Sprengel's sedge*

### INVASIVE NON-NATIVE PLANTS

Morrow's honeysuckle – *Lonicera morrowii*  
 Tartarian honeysuckle – *Lonicera tatarica*  
 Japanese barberry – *Berberis thunbergii*  
 Common buckthorn – *Rhamnus cathartica*

### RARE AND UNCOMMON PLANTS

Ginseng – *Panax quinquefolius*  
 Goldie's wood fern – *Dryopteris goldiana*  
 Glade fern – *Athyrium pycnocarpon*  
 Wood millet – *Milium effusum*  
 Hitchcock's sedge – *Carex hitchcockiana*  
 Summer sedge – *Carex aestivalis*  
 Davis' sedge – *Carex davisii*  
 Hooker's orchis – *Habenaria bookeri*  
 Goldenseal – *Hydrastis canadensis*  
 Broad beech fern – *Thelypteris hexagonoptera*  
 Male fern – *Dryopteris filix-mas*  
 Puttyroot – *Aplectrum hyemale*



*Squirrel corn* is a characteristic species of Rich Northern Hardwood Forests. It is named for the corn-sized tubers growing on its underground shoots.

# MESIC RED OAK-NORTHERN HARDWOOD FOREST



## ECOLOGY AND PHYSICAL SETTING

These forests are similar to Northern Hardwood Forests but differ in having significant amounts of red oak in the canopy. They are essentially northern in character, which is evidenced by the lack of white oak and hickories. In the northern part of the red oak range this community occurs mostly on warm, dry microsites such as south-facing slopes. Soils are well drained to moderately well drained and are derived from ablation till or basal till. Mesic Red Oak-Northern Hardwood Forests are found on slopes, generally below 1,500 feet elevation in the north and below 2,500 feet in the south. Ecological processes include single tree fall and downslope movement of soil, nutrients, and seeds. Ecologists and foresters theorize that red oak persists in these sites because natural red oak stands on drier ridgetop sites above them provide a constant seed source. Fire may play a role, too, but this needs investigation. Productivity can be high due to the constant inflow of nutrients from upslope.

This forest community needs more study. Questions about its ecology focus on soil-vegetation relationships, the origin of red oak and its longevity, natural disturbance regimes, and successional trends.

## VEGETATION

Mid-successional trees include red oak, sugar maple, basswood, beech, and hemlock, with occasional butternut. The canopy is closed and trees are usually tall and straight. The shrub layer is sparse, with maple-leaf viburnum, beaked hazel nut, witch hazel, and shadbush as common components. Herbs are sparse, too, and include Christmas fern, marginal wood fern, intermediate wood fern, Indian cucumber root, and blue-stemmed goldenrod.

## DISTRIBUTION/ ABUNDANCE

This forest type is occasional in all biophysical regions at low to moderate elevations (below 1,500 feet in the north, below 2,500 feet in the south). Similar communities are found commonly in neighboring states to the south.



## ANIMALS

Animal populations in these forests have not been studied, but they are likely to be similar to those in Northern Hardwood Forests and in Dry Oak-Hickory-Hophornbeam Forests.

## SUCCESSIONAL TRENDS

We know little about successional trends in these forests, but it may be that beech, hemlock, and sugar maple would dominate late-successional stands, with red oak present in certain situations where a stable seed source is provided.

## VARIANTS

None recognized at this time.

## RELATED

## COMMUNITIES

### *Northern*

**Hardwood Forest:** This is a closely related community, but has less red oak or none. The relationships between these communities need further study.

### *Dry Oak-Hickory-Hophornbeam*

**Forest:** This is a somewhat similar community, but has bedrock closer to the surface, drier and shallower soils, and generally lower productivity.

**Dry Oak Forest:** This community is found on ridgetops where soils are shallow and dry. Two or three species of oak dominate and other hardwoods are virtually absent.

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

There are no known examples of Mesic Red Oak-Northern Hardwood Forest that are free from human disturbance, though a few mature examples are known. With their sometimes high productivity and presence of high-quality red oak timber, these sites are vulnerable to the selective removal of high-quality timber, commonly referred to as “highgrading.”

Foresters managing these sites should evaluate them to gain as much information as possible about the natural successional trends and work with these trends in developing silvicultural plans. For example, if it appears that red oak is regenerating

naturally, it makes sense to work toward maintaining it. If, on the other hand, red oak appears not to be regenerating, other species should be favored. Care should be used in steep sites to avoid soil erosion.

## PLACES TO VISIT

Little Ascutney Mountain Wildlife Management Area, Weathersfield, Vermont  
Department of Fish and Wildlife (VDFW)  
Pine Mountain Wildlife Management Area, Topsham, VDFW



*Large whorled pogonia is a rare orchid of acidic woods. It can be found in Mesic Red Oak-Northern Hardwood Forests.*

## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Red oak – *Quercus rubra*  
Sugar maple – *Acer saccharum*  
American beech – *Fagus grandifolia*

#### Occasional to Locally Abundant Species

White ash – *Fraxinus americana*  
Basswood – *Tilia americana*  
Butternut – *Juglans cinerea*  
Eastern hemlock – *Tsuga canadensis*  
Sweet birch – *Betula lenta*

### SHRUBS

#### Occasional to Locally Abundant Species

Maple-leaf viburnum – *Viburnum acerifolium*  
Witch hazel – *Hamamelis virginiana*  
Shadbush – *Amelanchier* spp.  
Striped maple – *Acer pensylvanicum*  
Beaked hazel nut – *Corylus cornuta*  
Low sweet blueberry – *Vaccinium angustifolium*

### HERBS

#### Occasional to Locally Abundant Species

Indian cucumber root – *Medeola virginiana*  
Intermediate wood fern – *Dryopteris intermedia*  
Christmas fern – *Polystichum acrostichoides*  
White wood aster – *Aster divaricatus*  
Blue-stemmed goldenrod – *Solidago caesia*  
Blue cohosh – *Caulophyllum thalictroides*  
Starflower – *Trientalis borealis*  
Wild oats – *Uvularia sessilifolia*  
Canada mayflower – *Maianthemum canadense*  
Sarsaparilla – *Aralia nudicaulis*  
Bearded shorthusk – *Brachyelytrum erectum*  
Pointed-leaved tick trefoil – *Desmodium glutinosum*  
Hay-scented fern – *Dennstaedtia punctilobula*

#### RARE AND UNCOMMON PLANTS

Squawroot – *Conopcholis americana*  
Minnesota sedge – *Carex albursina*  
Ginseng – *Panax quinquefolius*  
Broad beech fern – *Thelypteris hexagonoptera*  
Summer sedge – *Carex aestivalis*  
Virginia spring beauty – *Claytonia virginica*  
Flowering dogwood – *Cornus florida*  
Large whorled pogonia – *Isotria verticillata*



## ECOLOGY AND PHYSICAL SETTING

This is an important community in the Northern Hardwood Forest Formation, although it occupies a small percentage of the landscape. Prior to European settlement, hemlock comprised about ten percent of the Vermont forest, but today it probably covers less than five percent of Vermont's land area. Hemlock was used widely for tanning leather in the 18th and 19th centuries, which is one of the factors leading to its decline in the state. It is a shade tolerant, long-lived species, capable of living up to 1,000 years. It is therefore a late-successional species, persisting under the shade of a hardwood canopy for decades, eventually becoming dominant.

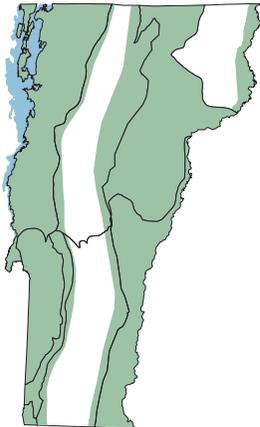
Hemlock Forests are more or less pure stands of hemlock, usually covering small areas of locally favorable conditions. These include steep-sided ravines, summits, and bedrock-controlled areas. Soils are derived from a variety of parent materials, including basal till, ablation till, outwash, bedrock, and lake-deposited sediments. A shallow pan is present in some places. Some soils are seasonally wet. Others tend to be droughty. As is true with other conifers, the needles of hemlock can acidify the soils on which they grow, causing minerals to be leached from the upper soil layers. A strong albic horizon, or ashy white layer, can result. Soil scientists in the northeast know that often the best expression of an albic horizon is under an old stand of hemlock.

Hemlock Forests generally occur below 1,800 feet elevation, but the elevation varies from north to south. Hemlock is nearly absent from the colder areas of the state, including the Northeastern Highlands.

Natural ecological processes include fire, which is especially common on ridgetops that attract lightning, and windthrow, which affects these shallow-rooted trees.

## DISTRIBUTION/ ABUNDANCE

Hemlock Forests are found in all biophysical regions except the Northeastern Highlands, at elevations generally below 1,800 feet. They are found throughout the northeastern United States and in the southern extremities of Québec and Ontario.



## VEGETATION

Hemlock occupies 75 percent to 100 percent of the canopy in Hemlock Forests, with beech, yellow birch, sugar maple, red spruce, and white pine mixed in. Typically, hemlock forests are very dark and hence are almost devoid of flowering plants in the understory.

## ANIMALS

Northern saw-whet owl, red-breasted nuthatch, hermit thrush, black-throated green warbler, blackburnian warbler, and solitary vireo nest in Hemlock Forests. Common mammals are red squirrel, deer mouse, southern red-backed vole, porcupine, and white-tailed deer. Deer use Hemlock Forests for winter cover. Northern redbelly snakes also breed here.

## SUCCESSIONAL TRENDS

Eastern hemlock is a late-successional species. Hemlock Forests are considered to be stable over long periods of time, and many forests that are dominated by other species today will likely become hemlock dominated over time. Early-successional species in hemlock forests include red maple, paper birch, aspen, and white pine. Mid-successional species include hemlock, yellow birch, red spruce, and red maple.

## VARIANTS

### *Hemlock-Red Spruce Forest:*

Red spruce is common or co-dominant in the canopy. Balsam fir and beech may be present as well.

## RELATED COMMUNITIES

### *Hemlock-Northern Hardwood*

**Forest:** This community is similar but with a canopy composition of less than 75 percent hemlock.

**Northern Hardwood Forest:** Hemlock is present in most Northern Hardwood Forests but as a minor component of the canopy. Forests that appear to match the description of Northern Hardwood Forests should, however, be evaluated to determine whether they might succeed to Hemlock Forest over time. Soils and regeneration are the main clues.

**Lowland Spruce-Fir Forest:** Low elevation examples of Lowland Spruce-Fir Forest can have hemlock in significant quantities.

### *Limestone Bluff Cedar-Pine Forest:*

Hemlock is often common in these communities, which differ in having northern white cedar as a long-term component and several herbaceous species that characterize limestone in warm climate areas.

### *White Pine-Northern Hardwood*

**Forest:** This community has hemlock also, sometimes in abundance. It may be adjacent to Hemlock Forest and intergrade with it.

### *Temperate Acidic Cliff Community:*

Hemlock Forests often occur on steep, rocky slopes which grade into cliffs. Temperate Acidic Cliffs often have abundant hemlock.

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

Several mature Hemlock Forests are protected in conservation lands throughout the state. Most of these are small areas. Hemlock Forests should be managed keeping long term successional trends in mind. Hemlock woolly adelgid, a non-native insect pest, threatens these forests.

## PLACES TO VISIT

Old City Falls Ravine, Strafford, Strafford Town Forest  
Helen W. Buckner Memorial Preserve at Bald Mountain, West Haven, The Nature Conservancy  
Battell Biological Reserve, Middlebury, U.S. Forest Service  
Pine Mountain Wildlife Management Area, Topsham, Vermont Department of Fish and Wildlife

## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Eastern hemlock – *Tsuga canadensis*

#### Occasional to Locally Abundant Species

Yellow birch – *Betula alleghaniensis*

American beech – *Fagus grandifolia*

Red maple – *Acer rubrum*

White ash – *Fraxinus americana*

Red spruce – *Picea rubens*

White pine – *Pinus strobus*

#### Successional Species

Paper birch – *Betula papyrifera*

Quaking aspen – *Populus tremuloides*

White pine – *Pinus strobus*

### SHRUBS

#### Occasional to Locally Abundant Species

Striped maple – *Acer pennsylvanicum*

Hobblebush – *Viburnum alnifolium*

### HERBS

#### Occasional to Locally Abundant Species

Marginal wood fern – *Dryopteris marginalis*

Painted trillium – *Trillium undulatum*

Common wood sorrel – *Oxalis acetosella*

Partridgeberry – *Mitella repens*

Appalachian polypody – *Polypodium  
appalachianum*

Intermediate wood fern – *Dryopteris intermedia*

Indian pipes – *Monotropa uniflora*

Canada mayflower – *Maianthemum canadense*

Goldthread – *Coptis trifolia*

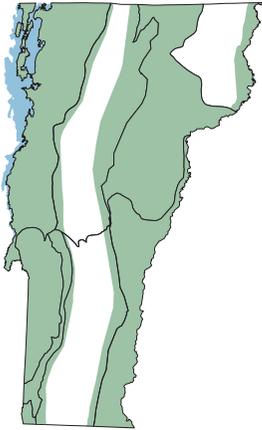
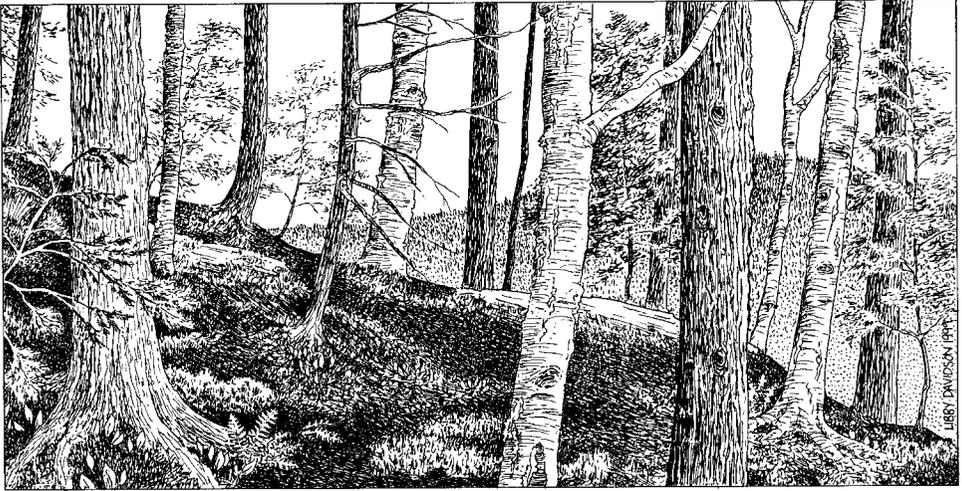
Shining clubmoss – *Lycopodium lucidulum*

Ground cedar – *Lycopodium digitatum*

#### RARE AND UNCOMMON PLANTS

Pinedrops – *Pterospora andromedea*

# HEMLOCK-NORTHERN HARDWOOD FOREST



## DISTRIBUTION/ABUNDANCE

This is a common community at elevations below 1,800 feet in Vermont in all biophysical regions except the Northeastern Highlands. It is common throughout the northeast.

## ECOLOGY AND PHYSICAL SETTING

Hemlock-Northern Hardwood Forest are mixed forests of hemlock, pines, and hardwoods that are not nutrient-demanding. They are found in areas of shallow bedrock or sandy to gravelly outwash, where soils are well drained to excessively drained. In many respects, they are similar to Hemlock Forests, but hardwoods comprise 25 to 75 percent of the canopy. Because of its shade tolerance, hemlock can survive under the hardwood canopy for long periods.

## VEGETATION

Eastern hemlock shares the canopy with one or more of the following species: red maple, beech, red pine, white pine, paper birch, and red spruce. The canopy components vary with climate and soils. Red oak, for example, can be a common associate in warmer regions. The herb composition has some similarities with that of acidic Northern Hardwood Forests.

## ANIMALS

Animal populations are similar to those found in Hemlock Forests and in Northern Hardwood Forests.

## SUCCESSIONAL TRENDS

Early-successional species include aspen and paper birch. These forests need more study to help us understand long term successional trends.

## VARIANTS

### *Hemlock-White Pine-Northern Hardwood Forest:*

White pine is an important component of the canopy and is believed to be persistent over time. These forests occur on coarse outwash soils.

# HEMLOCK-NORTHERN HARDWOOD FOREST

**Yellow Birch-Hemlock Forest:** Found on rocky sites where there are suitable sites for yellow birch to germinate. Yellow birch may therefore be a major component of the canopy and be stable over time.

## RELATED COMMUNITIES

**Northern Hardwood Forest:** The more nutrient-poor variants of this community are perhaps the most similar to Hemlock-Northern Hardwood Forest, but they are more likely to be found on till-derived soils than on shallow-to-bedrock soils, and if they have hemlock, it is a minor component.

**Hemlock Forest:** Hemlock is dominant, comprising over 75 percent of the canopy.

**White Pine-Red Oak-Black Oak Forest:** Hemlock may be important locally in these forests, but they differ from Hemlock-Northern Hardwood Forests in having significant amounts of red oak and black oak. They are most likely to occur in sandy or gravelly outwash.

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

There are no known old growth examples of this community in Vermont, though there may be a few in Massachusetts. Silvicultural practices should consider the long term ecological trends of the site as well as the limitations due to steepness and thin soils.

## PLACES TO VISIT

Mount Mansfield State Forest, Stowe and Underhill, Vermont Department of Forests, Parks, and Recreation  
Roaring Brook Wildlife Management Area, Vernon, Vermont Department of Fish and Wildlife

## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Eastern hemlock – *Tsuga canadensis*

American beech – *Fagus grandifolia*

Yellow birch – *Betula alleghaniensis*

#### Occasional to Locally Abundant Species

Sugar maple – *Acer saccharum*

Red maple – *Acer rubrum*

Paper birch – *Betula papyrifera*

White pine – *Pinus strobus*

Red oak – *Quercus rubra*

### SHRUBS

#### Occasional to Locally Abundant Species

Striped maple – *Acer pensylvanicum*

Hobblebush – *Viburnum alnifolium*

### HERBS

#### Occasional to Locally Abundant Species

Painted trillium – *Trillium undulatum*

Partridgeberry – *Mitchella repens*

Appalachian polypody – *Polypodium*

*appalachianum*

Intermediate wood fern – *Dryopteris intermedia*

Indian pipes – *Monotropa uniflora*

Canada mayflower – *Maianthemum canadense*

Ground cedar – *Lycopodium digitatum*

Wintergreen – *Gaultheria procumbens*

Pink lady's slipper – *Cypripedium acaule*

Sarsaparilla – *Aralia nudicaulis*

Staghorn clubmoss – *Lycopodium clavatum*

### RARE AND UNCOMMON PLANTS

Pinedrops – *Pterospora andromedea*



## ECOLOGY AND PHYSICAL SETTING

Northern Hardwood Talus Woodlands are found in areas where large boulders have accumulated below cliffs or steep slopes. They occur as small, isolated features in the landscape and are often associated with Open Talus, which usually occurs higher on the slope. At the base of such slopes, soil accumulates in the spaces between the rocks or in small concavities on large boulders. Trees that do well in rocky soils, such as yellow birch and hemlock, are common.

## VEGETATION

Trees are scattered and most do not attain great size. Shrubs are mostly scattered, though mountain maple can form dense thickets locally. Vines are well adapted to talus and are therefore common. They root in shaded crevices but send their foliage out into open sun of the bare rocks. Very few herbs do well in these woodlands; Appalachian polypody is perhaps the most successful. Mosses and lichens are frequent, and they deserve more study.

The species composition of talus woodlands is especially interesting when compared with that of floodplain forests. A few species that seem very characteristic of floodplain forests, including ostrich fern and wood nettle, are also commonly found in Northern Hardwood Talus Woodlands. Both communities receive regular inputs of nutrients and soil, one from above and the other from upstream.

## ANIMALS

Little is known about animals inhabiting Northern Hardwood Talus Woodlands.

## VARIANTS

None recognized at this time.

## DISTRIBUTION/ ABUNDANCE

Northern Hardwood Talus Woodlands are found throughout Vermont, at elevations to 2,500 feet. They are found throughout the northeast as well.



## RELATED COMMUNITIES

**Boreal Talus Woodland:** This community is similar in structure to Northern Hardwood Talus Woodland but is found at higher elevations or more northern latitudes. Red spruce and heart-leaved paper birch are present. Basswood, white ash, and sugar maple are absent, and overall diversity is lower.

### **Transition Hardwood Talus**

**Woodland:** This community is found in areas of highly calcareous bedrock. It is richer in species than Northern Hardwood Talus Woodland and has several calciphilic species, including northern white cedar and climbing fumitory.

**Northern Hardwood Forest:** This community is usually adjacent to Northern Hardwood Talus Woodland and shares a number of species in common. It has a closed canopy and well-developed soils.

### **Rich Northern Hardwood Forest:**

This community is often associated with Northern Hardwood Talus Woodland that is found on calcareous bedrock, and the distinction between the two communities is not always clear. They share many species, including white snakeroot, wood nettle, and Goldie's fern.

## CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

In general, talus woodlands are not threatened communities because they are unsuitable for forestry, agriculture, or development. But because they are uncommon, representative examples should be protected. When trees are harvested, logging should be done with care to minimize soil erosion.

## PLACES TO VISIT

Marshfield Cliffs, Marshfield,  
Groton State Forest, Vermont  
Department of Forests,  
Parks, and Recreation  
Mount Moosalamoo, Salisbury,  
Green Mountain National  
Forest



## CHARACTERISTIC PLANTS

### TREES

#### Abundant Species

Yellow Birch – *Betula alleghaniensis*  
White Ash – *Fraxinus americana*  
Paper birch – *Betula papyrifera*

#### Occasional to Locally Abundant Species

Sugar maple – *Acer saccharum*  
Basswood – *Tilia americana*  
Eastern hemlock – *Tsuga canadensis*  
Red Oak – *Quercus rubra*  
Butternut – *Juglans cinerea*

### SHRUBS

#### Abundant Species

Mountain Maple – *Acer spicatum*  
Red-berried elder – *Sambucus racemosa*

#### Occasional to Locally Abundant Species

Canada yew – *Taxus canadensis*  
Bristly black currant – *Ribes lacustre*  
Purple-flowering raspberry – *Rubus odoratus*  
Red raspberry – *Rubus idaeus*

### HERBS AND VINES

#### Abundant Species

Virginia Creeper – *Parthenocissus quinquefolia*  
Appalachian polypody – *Polypodium  
appalachianum*

#### Occasional to Locally Abundant Species

Marginal wood fern – *Dryopteris marginalis*  
Rusty woodsia – *Woodsia ilvensis*  
Fringed bindweed – *Polygonum cilinode*  
Poison ivy – *Toxicodendron radicans*  
Wood nettle – *Laportea canadensis*  
White snakeroot – *Eupatorium rugosum*  
Clearweed – *Pilea pumila*  
Pale touch-me-not – *Impatiens pallida*  
Ostrich fern – *Matteucia struthiopteris*

### RARE AND UNCOMMON PLANTS

Northern stickseed – *Hackelia deflexa* var.  
*americana*  
Goldie's wood fern – *Dryopteris goldiana*

*Appalachian polypody* typically covers boulders and rocky outcrops on talus woodlands where sufficient soil has developed in cracks.