

Ecosystems and Ecological Significance  
of  
Lincoln's Colby Hill Town Forest  
Lincoln, Addison County, Vermont

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## **Purpose**

The ecosystems and ecological significance of the Colby Hill Town Forest on Colby Hill and Bald Hill were determined by means of a rapid ecological inventory of the forest parcel, and by landscape analysis of the surrounding lands. Rapid ecological inventory serves to give landowners an initial summary of the ecological values and integrity of a piece of land. The method, in a variety of forms, is now routinely used worldwide to evaluate ecological and biological characteristics for the purpose of providing information for management planning. The inventory of the Town Forest was undertaken to document and assess the ecological integrity and conservation significance of the forest and wetland ecosystems of the municipally owned forest. Another important part of ecological assessment is to understand how different land uses of a parcel are augmented by or conflict with land uses of adjacent and nearby parcels. Therefore, a landscape analysis of the local area is included.

This report is based on the findings of a one-day botanical-ecological rapid assessment of the town forest in 2000, with updates from observations in 2003. Wildlife information is being gathered by a winter tracking transect that is part of a separate effort under the umbrella of Keeping Track, Inc. Therefore, currently available information for the town forest includes this report and any information available from the managers of the tracking transect. In 2000, no information was available regarding insects, amphibians, reptiles, birds or other groups of organisms, but rapid assessments of small mammals and amphibians were conducted in 2003.

Use of the town forest appears to be primarily for recreation, education and biological study (mammal tracking). Lincoln school students are the known educational users of the parcel.

## **Overview**

The 175-acre Colby Hill Town Forest is located at approximately 1,400 to 1,600 feet on the lower west slope of the Green Mountains. The area is at the northern end of the Southern Green Mountains biophysiographic province (Thompson and Sorenson, 2000). The bedrock is schist and phyllite of the Fairfield Pond member of the Underhill Formation, and possibly some Cheshire quartzite (Doll 1961). The site includes both upland and wetland forests on a variety of soil types, including deep, well drained sandy loams; shallow, excessively drained, excessively rocky loams; and poorly drained loams.

The forest extends over parts of two hills and the saddle that lies between them. In general, the ecosystems on the hills are types of well-drained northern hardwood and northern hardwood-red oak forests, while the moister saddle has moderately well drained to poorly drained northern hardwood and mixed hardwood-red spruce swamp forests. The northern hill also includes a ledgy ridgetop and upper west slope where red spruce is co-dominant with northern hardwoods and red oak. Throughout this report, the terms “natural community” and “ecosystem” are both used; natural communities are classified somewhat more broadly than the ecosystems described herein. Table 1 shows how some natural community types may include different parts of the landscape, such as hilltops and slopes, that have different ecological characteristics that are significant to plants and animals.

One rare to uncommon species, loose sedge (*Carex laxiculmis*), was observed in the parcel. The grass-like plant is most common in Vermont on the clay soils of the southern Champlain Valley, but has also been found in other relatively warm and fertile ecosystems in the mid- to mid-northern portion of the Green and Taconic mountains.

The northern hill may not have been cleared for agricultural use, whereas the forest on the east slope of the southern hill has clearly succeeded from old pasture. Therefore, although the natural communities may be of the same type, the present cover of tree and herbaceous vegetation may appear very different as a result of differing land-use history.

### **Landscape Context**

Colby and Bald hills are adjacent and near to regionally important conservation lands. These lands occur both in the Champlain Valley and in the Green Mountains. The lower Green Mountain slope of which the town forest is a part, therefore, is an important forested connection between these two landscapes—the Champlain Valley and the Green Mountains.

The closest conserved lands to the town forest are adjacent on the northeast and nearly adjacent on the southeast. These approximately 600 acres are protected by a “forever forested” easement and will insure that the town forest, at least on its northeastern side, will not be surrounded by residential or cleared lands, but rather will persist in a forested landscape. One and one-quarter miles south of the town forest is Bristol Cliffs Wilderness, a 3,740-acre area of predominantly second-growth forest and rare cliff and talus natural communities that are federally protected to remain free from direct human disturbances. One and one-half miles to the west of the town forest are conserved parcels of land on Deer Leap, one of the few Peregrine Falcon nesting sites and natural red pine forests in Vermont. In addition, to the northwest lies Bristol Pond with 215 acres of calcareous wetland conserved by the State of Vermont. Approximately 2\_ miles east of the town forest, cloaking the main spine of the Green Mountains, is national forest land.

Colby and Bald hills are in a part of the landscape, a lower mountain slope, which is currently particularly prone to residential development. The existence of large pieces of natural forest lands interrupted by few openings and relatively few residences (or none in the case of Bristol Cliffs Wilderness), makes this part of the Green Mountains west slope of particular landscape-level conservation importance. One compelling reason for maintaining the integrity of a lower-slope forest is its function as a connection between the Champlain Valley landscape and ecosystems and the Green Mountains landscape and ecosystems. Without such large, forested areas on the lower slopes, the valley and the mountains become essentially separate islands for many of the species that live in these ecosystems.

The forest ecosystems of Colby Hill Town Forest are representative of the northern hardwood, northern hardwood-red oak and northern hardwood-red spruce forests that occur along the lower western slopes of the Green Mountains. They are not particularly unique or different from other ecosystems in that part of the landscape, but this adds to the conservation importance of such lands. Generally, conserved natural lands, and especially large chunks of conserved natural lands, are located at higher elevations or are centered upon features that are unique, such as the cliffs and talus of Bristol Cliffs and Deer Leap. The “regular” part of the landscape, particularly in lower elevation zones, is often overlooked when it comes to conservation prioritizing.

### **Why Describe and Map Forest Ecosystems/Natural Communities?**

Forest ecosystems are defined by integrating information on geology, geomorphology, soils, physiography (slope steepness, direction of slope (aspect), position on the land (e.g., upperslope, ridgetop), shape of the land (e.g., concave versus convex)) and vegetation. The vegetation is interpreted as a measure of the ecological relevance of the physical characteristics of any given piece of land. Some ecosystem differences are quite clear, such as the distinction between a floodplain forest and a high-elevation spruce-fir forest. Other differences are not so obvious to casual observers, but can be determined by careful observation, documentation, and analysis of ecosystem characteristics. In the descriptions that follow, there are a number of different types of northern hardwood and northern hardwood-red oak ecosystems described. These are differentiated one from another by physical and vegetation characteristics, such as where on a slope they occur and what types of herbs occur; they are also different in the way they function in the larger landscape, which in this case is the lower west slope of the central Green Mountains.

Describing and mapping natural communities provides information regarding a variety of aspects of ecological function and ecosystem characteristics. Some examples of items for which knowledge of ecosystem composition and diversity is useful are: determining composition of presettlement forest, determining biomass production, understanding natural disturbance patterns (and the effect of human forest fragmentation on these regimes), understanding the native biological and ecological diversity of a landscape, determining potential for occurrence and conservation of rare species, and understanding the effects of human management on forest composition and productivity.

Of course, a natural community map is also a great tool that allows users of the land to gain more familiarity with and appreciation of a landscape in all its complexity.

### **Forest Ecosystems of Colby Hill Town Forest**

The forest areas are named in two ways (Table 1). The first is by detailed forest ecosystem types that are described in a very site-specific way. The second is a cross-referencing of the site-specific forest ecosystem types to the more familiar names of the Vermont natural community classification, a statewide system that classifies and describes in more general terms the different forest and wetland types known to occur in the state (Thompson and Sorenson, 2000). The Vermont natural community types do not always adequately describe the unique combinations of ecological characteristics and attributes that one observes on the ground; it is through accumulating more information via inventories such as the current one that the statewide classification becomes refined to better represent and characterize the diversity of natural community types that occurs in Vermont.

The following descriptions are organized geographically by Bald and Colby hills, which feature twin 1,580-foot summits on the former and a maximum elevation of 1,643 feet on the latter, and the saddle between these two hills. The north summit of Bald Hill was not visited, so the ecosystem types are interpolated from knowledge of the surrounding landscape, topography, and slope aspect.

**Table 1. Ecosystem and Natural Community Types of Colby Hill Town Forest**

<b>Map Code</b>	<b>Ecosystem Type</b>	<b>Vermont Natural Community Type</b>
1	STEEPLY SLOPING, WELL-DRAINED, ACID, SANDY LOAM, NORTHERN HARDWOOD-RED OAK FOREST	MESIC RED OAK-NORTHERN HARDWOOD FOREST
2	STEEPLY SLOPING, SEEPY, MODERATELY WELL DRAINED TO WELL DRAINED, ACID, LOAM, RED OAK-NORTHERN HARDWOOD-WHITE ASH FOREST	SUGAR MAPLE-WHITE ASH NORTHERN HARDWOOD FOREST
3	LEVEL TO GENTLY SLOPING HILLTOP, WELL-DRAINED, ACID, SANDY LOAM, NORTHERN HARDWOOD-RED OAK FOREST	MESIC RED OAK-NORTHERN HARDWOOD FOREST
4	BEDROCK KNOLL/ACIDIC LEDGE OUTCROP, SOMEWHAT EXCESSIVELY DRAINED, VERY SHALLOW SANDY LOAM, RED SPRUCE-RED MAPLE-RED OAK-WHITE PINE FOREST	RED SPRUCE-NORTHERN HARDWOOD FOREST
5	CONCAVE BASIN, MODERATELY RICH, WELL DRAINED TO MODERATELY WELL DRAINED, MODERATELY ACID, SANDY LOAM, NORTHERN HARDWOOD FOREST	SUGAR MAPLE-WHITE ASH NORTHERN HARDWOOD FOREST
6	GENTLY SLOPING, SOMEWHAT POORLY TO POORLY DRAINED, ACID, MUCKY SANDY LOAM, RED MAPLE-YELLOW BIRCH-RED SPRUCE FOREST	RED MAPLE-BLACK ASH SWAMP
7	MODERATELY SLOPING, WELL DRAINED TO MODERATELY WELL DRAINED, ACID, LOAM, NORTHERN HARDWOOD-RED OAK FOREST	MESIC RED OAK-NORTHERN HARDWOOD FOREST
8	MODERATELY TO STEEPLY SLOPING, WELL DRAINED, ACID, LOAM, NORTHERN HARDWOOD FOREST	NORTHERN HARDWOOD FOREST (GENERAL TYPE)

**Bald Hill Ecosystems**

The south and west slopes of Bald Hill are influenced by long hours of warming sunshine and are among the first of the mountain slopes to feel the predominant winds from the south and west. The ecosystems, therefore, tend to include tree species that are favored by warmer or drier conditions—red oak, white pine and red pine. The different forest types on Bald Hill are differentiated by depth to bedrock (e.g., soil depth), texture of the soil, and hydrology (i.e., presence and abundance of springs and seeps).

The ecosystem of the south- and southeast-facing slopes of Bald Hill is a red oak-northern hardwood forest type – STEEPLY SLOPING, WELL-DRAINED, ACID, SANDY LOAM, NORTHERN HARDWOOD-RED OAK FOREST. The sizes and species mix of the trees indicate a mid-successional forest, one that is regrowing from a previous stand-regenerating

disturbance. The trees include sugar and red maple (*Acer saccharum*, *A. rubrum*, respectively), paper and yellow birch (*Betula papyrifera*, *B. alleghaniensis*, respectively), red oak (*Quercus rubra*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), red spruce (*Picea rubens*) and the small tree, hophornbeam (*Ostrya virginiana*), also known as hardhack and ironwood. In this ecosystem, white pine (*Pinus strobus*), and to a lesser extent red pine (*P. resinosa*), are also common. The pines, which typically grow faster than hardwoods, are the largest trees in the forest. Since both white and red pine need the abundant light of large openings to establish in the forest, the pines clearly indicate a former large-scale clearing event, which may have been the result of a windstorm, fire, clearing by humans or a combination of these.

The forest contains two size-classes of trees. For the pines, the size classes are 20-25 inches dbh (diameter at breast height) and 13-18 inches dbh. Hardwood size classes are 13-15 inches dbh and 8-10 inches dbh. Recent blowdown demonstrates that wind is one of the dominant forces in the ecosystem. Some large pines lay upslope pointing north, blown down by the strong south winds that periodically hit the hillside. Such large, dead trees are known as “forest legacies,” named to indicate that they are part of the older forest’s bequest to the current and future generations of organisms. Forest legacies are important in the natural functioning of an ecosystem; they serve vital roles in nutrient retention and cycling, and as food and habitat resources for numerous organisms.

Herb diversity in the ecosystem is relatively low, due to acid soils, the further acidifying effect of pine needles, and the low capacity of the soil to retain moisture. Canada mayflower (*Maianthemum canadense*), starflower (*Trientalis borealis*), sessile-leaved (*Uvularia sessilifolia*), and wild sarsaparilla (*Aralia nudicaulis*) are characteristic of the ecosystem. Hay-scented fern (*Dennstaedtia punctilobula*) thrives in areas of higher light. A rare sedge, loose sedge (*Carex laxiculmis*) was found in this ecosystem, even though it seems an odd place for a species most often seen in moist and nutrient rich situations.

This type is classified as Mesic Red Oak-Northern Hardwood Forest in the Vermont natural community classification (Thompson and Sorenson, 2000).

The upper west slope of Bald Hill is significantly moister and steeper than the south, southwest and east slopes. The land is seepier, that is springs are common, and the soils are loamier, shallower in places, and have greater nutrient availability. These factors combine to create a forest ecosystem with greater plant diversity and more surface waters—STEEPLY SLOPING, SEEPY, MODERATELY WELL DRAINED TO WELL DRAINED, ACID, LOAM, RED OAK-NORTHERN HARDWOOD-WHITE ASH FOREST. The Vermont natural community type for this forest is Sugar Maple-White Ash-Jack-in-the-Pulpit Northern Hardwood Forest. The trees in this ecosystem include red and sugar maples, paper and sweet birches (*Betula lenta*), red oak, white ash, white pine, bigtooth aspen (*Populus grandidentata*), and red spruce, as well as hophornbeam. Although many of these species are similar to the trees of the south-facing forest ecosystem on well drained, acid, sandy loam soil, the herb layer differs significantly between these two types and demonstrates the importance of understanding soils, hydrology and herbaceous plants to interpreting ecosystems. The herbs in the loamy, seepy forest ecosystem include most of those listed above—Canada mayflower, starflower, sessile-leaved bellwort, and wild sarsaparilla—with the addition of herbs that typically require more moisture and more

nutrients, such as round-leaved violet (*Viola rotundifolia*), Indian cucumber-root (*Medeola virginiana*), lady fern (*Athyrium filix-femina*), wakerobin (*Trillium erectum*), trout lily (*Erythronium americanum*), slender sedge (*Carex gracillima*), Christmas fern (*Polystichum acrostichoides*), cut-leaved toothwort (*Cardamine laciniata*), and interrupted fern (*Osmunda claytonii*). Charcoal in the soil indicates former fires, but rather than regenerating to predominantly pines and red oak, the moister, richer forest ecosystem has regenerated to a forest with a very different appearance and greater plant diversity in both the tree and herb layers. Small patches in the woods, however, do feature hay-scented fern, an indicator of a previously very open canopy.

Part of the slope is very shallow to bedrock and has a forest floor of slick rock that is covered by wet, slippery leaves; the active emergence of groundwater is in evidence there. It flows in a somewhat unorganized manner to coalesce in a larger spring that is the source of a Baldwin Creek tributary.

Dominant trees measure 15-20 inches dbh; one of the largest in the town forest is a 33-inch red oak. Although there is currently much bigtooth aspen and paper birch in the woods, these early successional trees are at a stage of decline, and it is estimated that within 20 years the dominant trees in the ecosystem will be red and sugar maples, red oak and sweet birch. In the seepy areas, white ash is particularly prominent.

The forest on the top of Bald Hill is dominated by sugar maple, red oak and white ash, with an understory of hophornbeam and red spruce (*Picea rubens*). Being on a nearly level summit, rather than a slope, this ecosystem is not subjected to the moisture stress from the intensity of warming and drying sunshine on the south slope. Neither does it possess the active hydrology of the seepy west slope. The herb layer features a few more species than the south-slope ecosystem, but not as many as the west-slope forest. The ecosystem type is LEVEL TO GENTLY SLOPING HILLTOP, WELL-DRAINED, ACID, SANDY LOAM, NORTHERN HARDWOOD-RED OAK FOREST. Although differing in soil texture, moisture, and nutrient content compared to the south-slope forest, the low-summit ecosystem is also Mesic Red Oak-Northern Hardwood Forest in the Vermont natural community classification.

An interesting feature on top of Bald Hill is two sizable limestone erratics perched on outcrops of the local schist bedrock. These two boulders, carried by a glacier from nearby outcrops of limestone north of Bald Hill, have bits of fragile fern (*Cystopteris fragilis*), lady fern and marginal wood-fern (*Dryopteris marginalis*)—lime-loving plants that are common on limy ledges in the Champlain Valley.

The western rim of the south summit is defined by outcrops of schist and/or phyllite. The ecosystem is to a large extent shaped by the outcropping ledge and the very shallow, acid soil. Plant diversity is very low, since few species are able to establish and persist in the stressful environment where soil is a scarce commodity and nutrients are continually being leached and carried downslope. The ecosystem is BEDROCK KNOLL/ACIDIC LEDGE OUTCROP, SOMEWHAT EXCESSIVELY DRAINED, VERY SHALLOW SANDY LOAM, RED SPRUCE-RED MAPLE-RED OAK-WHITE PINE FOREST. Sugar maple is also common where the slope is a little less steep. Among the few common herb species are Canada mayflower, hay-scented fern, bracken fern (*Pteridium aquilinum*), and wild sarsaparilla. This ecosystem

type is classified as Red Spruce-Northern Hardwood Forest in the Vermont natural community classification.

It was noted in 2003 that quite a few red spruce are dead or in decline on the upper west slope. The cause of this was not investigated, but it is hypothesized that stress from several droughty years may have combined with other environmental effects such as acid precipitation to cause a lack of vigor in the trees. The change is leading the forest to dominance by red oak and red and sugar maples, with scattered white pine.

The northeast-facing slope of the Bald Hill receives neither the long hours of warming sun, nor the drying effects of the predominant south and west winds; the forest therefore lacks the species that characterize warmer, drier forests. The ecosystem is MODERATELY TO STEEPLY SLOPING, WELL DRAINED, ACID, LOAM, NORTHERN HARDWOOD FOREST. It is what is often thought of as the most typical variety of northern hardwood forest in Vermont. Lower down the slope, on private lands, the ecosystem is a seepier northern hardwood forest type; the springs are headwater areas of Baldwin Brook tributaries.

The natural community correlate for this type is the general Northern Hardwood Forest natural community (i.e., not one of the described “variants”).

### Saddle Ecosystems

The west side of the saddle between the two hills is moist and nutrient rich and features a very nice example of a CONCAVE BASIN, MODERATELY RICH, WELL DRAINED TO MODERATELY WELL DRAINED, MODERATELY ACID, SANDY LOAM, NORTHERN HARDWOOD FOREST. Sugar Maple-White Ash-Jack-in-the-Pulpit Northern Hardwood Forest is the Vermont natural community classification correlate for this ecosystem. The concave shape of the land, the abundance of moisture, and the relatively good moisture- and nutrient-retaining capacity of the sandy loam soil are important factors in differentiating this forest type. Noticeable vegetation differences include the abundance of fern cover and the size and stature of the white ash trees. Along with the stately ashes, the canopy trees are sugar and red maples, and paper and yellow birches. The ferns that are so prominent in the herb layer are interrupted, sensitive (*Onoclea sensibilis*), lady, and maidenhair (*Adiantum pedatum*) ferns. Jack-in-the-pulpit (*Arisaema triphyllum*), a sensitive indicator of soil moisture and fertility, is common as well. Diameter range of the dominant ash is 20-25 inches dbh. This ecosystem is very productive for white ash, sugar maple and yellow birch, and, if allowed to grow, individuals can attain very large sizes in this moist, protected, relatively nutrient-rich situation.

The east side of the saddle has only a gentle slope, and the abundance of moisture captured by the concavity and welling up from the groundwater tends to move slowly through the soil. Therefore, the east side of the saddle is moister and swampier. The better drained portions on the east side are CONCAVE BASIN, MODERATELY RICH, WELL DRAINED TO MODERATELY WELL DRAINED, MODERATELY ACID, SANDY LOAM, NORTHERN HARDWOOD FOREST like that described in the paragraph above, but perhaps somewhat moister. Again, Sugar Maple-White Ash-Jack-in-the-Pulpit Northern Hardwood Forest is the Vermont natural community classification correlate for this ecosystem. The leveler lands on the east side were more hospitable to agricultural uses than those of the steep western slopes, and a southerly portion of the sugar maple-white ash ecosystem was

cleared of forest for use as farmland and orchard. Despite the clearing, the soils, shape of land, and species that make up the early successional forest all indicate that the natural ecosystem is that of a moderately well drained, moderately nutrient rich, northern hardwood-white ash forest. The intact portion of the sugar maple-white ash forest tends to be moister than that ecosystem example on the west side of the saddle. Springs and intermittent streams are common. There are also some herb and shrub species that were not observed on the west side; among these are barren-strawberry (*Waldsteinia fragarioides*), false hellebore (*Veratrum viride*), short-husk grass (*Brachyeletrum erectum*), and witch-hazel (*Hamamelis virginiana*).

The wetter portions in the saddle on the east side are a mineral-soil swamp ecosystem, GENTLY SLOPING, SOMEWHAT POORLY TO POORLY DRAINED, ACID, MUCKY SANDY LOAM, RED MAPLE-YELLOW BIRCH-RED SPRUCE FOREST. Because there is a slope to the land, and aerated soil-water flows downslope, rather than ponding and percolating slowly into the saturated soil, a muck or peat soil has not developed. Instead the soil is a mucky sandy loam, with patches that are poorly drained intermixed with patches that are somewhat poorly drained. The swamp forest features more shrub species and greater shrub cover than the drier forests, and has an herb layer dominated by wetland species. Among the common herbs are sensitive and cinnamon (*Osmunda cinnamomea*) ferns, spotted touch-me-not (*Impatiens capensis*), tall goldenrod (*Solidago altissima*), water avens (*Geum rivale*), turtleheads (*Chelone glabra*), and the sedges, *Carex prasina* and *Carex leptalea*. The creeping shrub, dwarf raspberry (*Rubus pubescens*), which is common in many swamp ecosystems throughout the region, is abundant. Common shrubs include meadowsweet (*Spiraea alba*), speckled alder (*Alnus incana*), and beaked hazelnut (*Corylus cornuta*). The tree canopy, in places relatively open and in others rather closed, is a mix of red maple, yellow, paper and gray (*Betula populifolia*) birches, red spruce and an occasional tamarack (*Larix laricina*). These wetland portions are intricately intermixed with the upland moderately well drained forest, and the mapped units are therefore an oversimplification of this part of the landscape.

The correlate to this ecosystem in the Vermont natural community classification is the broadly defined Red Maple-Black Ash Swamp.

### Ecosystems of Colby Hill

The west slope of the southern hill is really a continuation of the west slope of Bald Hill and is the same ecosystem type as described above for that area—STEEPLY SLOPING, SEEPY, ON MODERATELY WELL DRAINED TO WELL DRAINED, ACID, LOAM, RED OAK-NORTHERN HARDWOOD-WHITE ASH FOREST.

That portion of the ridgeline, or shoulder, which is within the bounds of the town forest has a forest cover that has formed fairly recently since the abandonment of pasture on the hill. An early successional forest of paper birch, red maple, trembling aspen (*Populus tremuloides*) and red spruce currently covers the hill. Red pine are also scattered throughout. Old field boundaries and existing forest vegetation patterns indicate that this northern shoulder of the hill was divided into two pastures, and it is apparent that the more northern field (lower on the shoulder) was more heavily pastured and perhaps more recently abandoned.

The hill-shoulder ecosystem is MODERATELY SLOPING, WELL DRAINED TO MODERATELY WELL DRAINED, ACID, LOAM, NORTHERN HARDWOOD-RED OAK FOREST. Paper birch is in decline and many individuals have or soon will die. The sapling layer presently consists of beech and sugar maple, and it is likely that under a natural disturbance pattern, the forest will come to be dominated by these species. It is common for low hills on the western slope of the Green Mountains to contain red oak also, and some amount of it will likely persist as the forest continues to mature. The herb layer features few species, and those present are typical of northern hardwood forests—Canada mayflower, starflower, sessile-leaved bellwort, and goldthread.

On the uppermost, west-facing portion of the hill shoulder red spruce is common. Many, if not most, of the spruce were seen to be dead or dying in 2003, similar to the condition on the steep, west-facing slope of Bald Hill. The spruce in this ecosystem which has deeper soils and more moderate slopes than those on Bald Hills upper west side most likely established during old-field succession. As they die out, they will be succeeded by the hardwood species that are more characteristic of the late successional vegetation of this ecosystem type.

The few red pine that occur on the hill are also unlikely to be succeeded by a future generation of red pine, unless a fire or major windstorm creates a very large opening. Those trees that are present, however, serve as convenient marking trees for black bear that use the area. The stripped bark on maples is a prominent sign of moose feeding.

The Vermont natural community classification correlate for this ecosystem is Mesic Red Oak-Northern Hardwood Forest.

The northeast-facing slope of Colby Hill has a young forest dense with sugar maple saplings and pole-sized trees. The ecosystem is MODERATELY TO STEEPLY SLOPING, WELL DRAINED, ACID, LOAM, NORTHERN HARDWOOD FOREST. The ecological differences between a low-hill ridgeline and a northeast-facing slope are that the slope receives a supply of moisture and nutrients from downslope flow and has a cooler microclimate. Therefore, there are differences in nutrient-cycling, forest productivity, and vegetation. At present, these differences are somewhat masked by the agricultural land use history of the hill.

The natural community correlate is the general Northern Hardwood Forest type.

## **Discussion**

Eight forest ecosystem types were observed in the Colby Hill Town Forest. The ecosystem diversity is due primarily to differences in depth to bedrock, groundwater seepage, and physiography or landscape position (slope orientation and shape (concave versus flat or convex)). All of these types are characteristic of the lower west slope of the central Green Mountains, a landscape that has succeeded to forest after agricultural abandonment in the late Nineteenth and early Twentieth centuries, but is now subject to increasing amounts of fragmentation by residential development. Most of the forest is even-aged and mid-successional; this means that it has regrown from disturbances that initiated an entire generation of trees, and that it is at a point where the natural processes of forest maturation are just beginning. As maturation continues and the forest grows toward a late-successional stage, the tree canopy will begin to be comprised of a mix of ages, there will develop a more complex array of tree sizes (both height and diameter),

and there will be more standing and down large dead-wood in the forest. In short, mature northern hardwood forests have an uneven-age mix of canopy trees and more vertical layers of trees and shrubs (such as, emergent trees, canopy trees, sub-canopy trees, understory trees and saplings, and low shrubs and seedlings). It also has a greater variety of dead-wood species and decay classes. The more mature forest, therefore, provides a greater variety of living spaces (niches) for a wide assortment of forest organisms, from bacteria and fungi to large mammals.

From a watershed perspective, it is important to recognize that Colby Hill Town Forest is a headwaters area for tributaries of Baldwin Brook and for Isham Brook. Activities in the town forest, therefore, should be mindful of the potential for erosion and undue siltation in the streams.

The town forest is part of a landscape with regional conservation importance. This importance is attributed to both the role that these lands play as a connection between the lowlands of the Champlain Valley and the upper elevations of the Green Mountains, and the importance of conserving intact parts—typical ones, not only oddballs of special interest—characteristic of the more threatened lower-elevation ecosystems. Bristol Cliffs Wilderness Area is the largest conserved piece of this lower-slope landscape, but the many smaller pieces of public and private conserved lands, along with other well managed lands, contribute to the extent and stability of the mountain-valley connection and to the overall integrity lower-slope forest.

The lower-slope landscape is important in and of itself, also. Compared to the higher elevations of the Green Mountains, the lower slope is warmer, supports a greater variety of species, and has higher diversity of soils and ecosystem types. The ecosystem types on the lower slopes are different from those in the mid- and upper-elevations, and their stewardship and conservation are therefore of regional importance.

The Green Mountains are comprised of different bedrock from both the White Mountains in New Hampshire and the Adirondack Mountains in New York (not to mention the differences with the Champlain and Connecticut River valleys). Compared to these neighboring ranges, the Green Mountain tend to have soils that are less acidic and have greater ability to provide and store nutrients and buffer acidity; such differences are important when considering regional conservation. One example of a functional importance of these differences is the recent finding that, with the increasing environmental acidification caused by acid precipitation (acid rain), sugar maple seedling and sapling survival has been greater in the Green Mountain forests than in the more acid soils of the White and Adirondack mountains. This is just one indication of the importance of recognizing ecosystem differences, and the wisdom of careful stewardship and conservation of the native diversity of ecosystem types which we live in and which surround us in all directions.

The linkages in the web of species and ecosystem interactions are more complex than we know. For this simple reason, it is important that we treat with care all parts of the landscape, including uplands and wetlands, high and low elevations, mountaintops and valley bottoms. Knowledge of what is on the landscape is a first step in wise stewardship.

## **Literature Cited**

Doll, C.G. 1961. Centennial Geologic Map of Vermont. Vermont Geological Survey, Montpelier, Vermont.

Thompson, E. and E. Sorenson. 2000. Wetland, Woodland, Wildland: Natural Communities of Vermont. The Nature Conservancy (Vermont) and the Nongame and Natural Heritage Program, Vermont Department of Fish and Wildlife. Montpelier and Waterbury, Vermont.