

Managing
RICH
NORTHERN
HARDWOOD
FORESTS

*for Ecological Values
and Timber Production*



Recommendations
for Landowners in
the Taconic Mountains

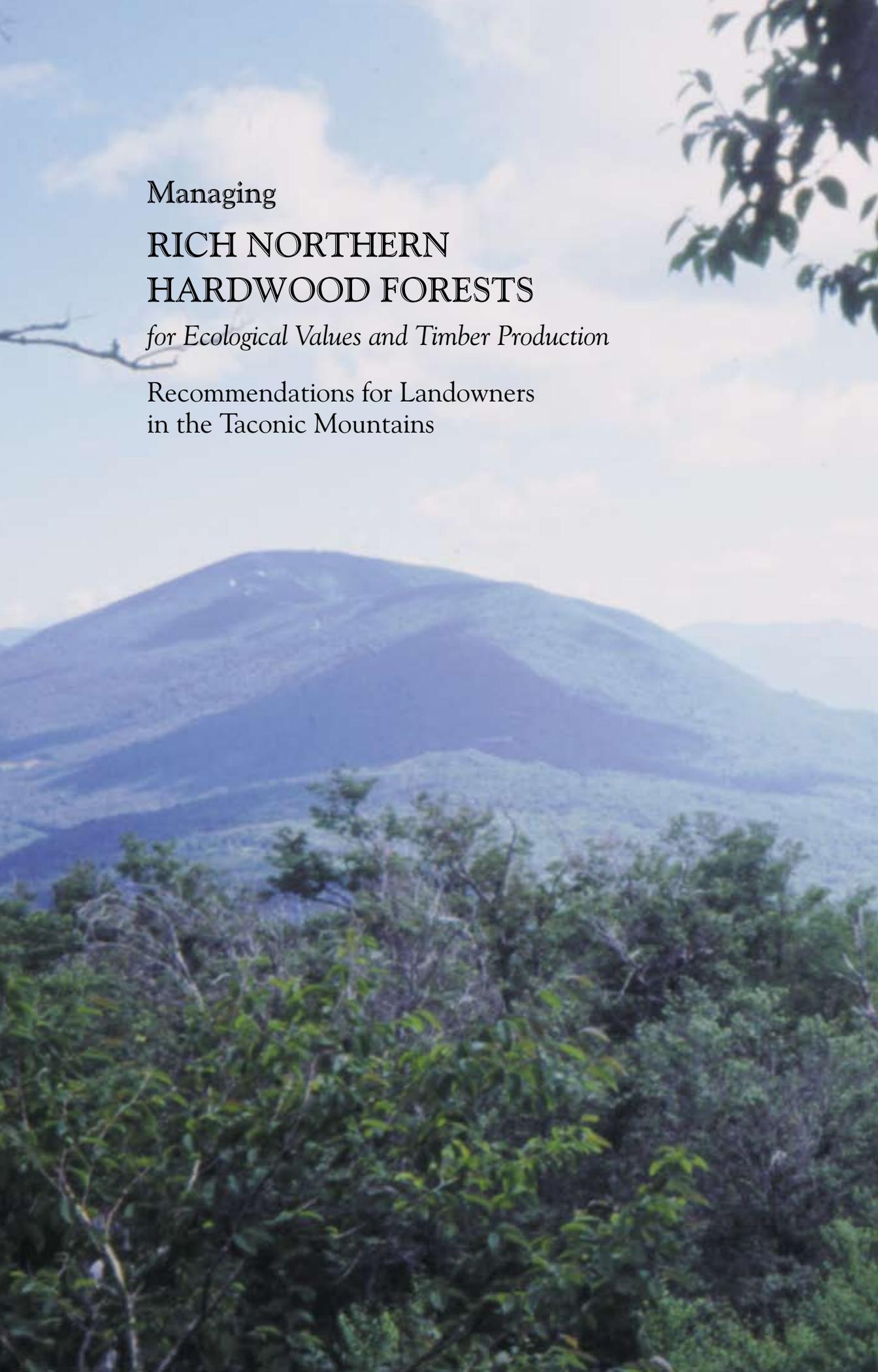
Acknowledgements

These ideas were developed over several years by a large and enthusiastic group of ecologists, foresters, and conservation planners who continue to collaborate on research and management in the northern Taconic Mountains. Although we've reached consensus on most of this document, some of the ideas remain a source of debate and healthy disagreement, and participation in the group doesn't imply endorsement of the product. Special thanks to Chris Olson for authoring the first draft. Thanks also to Alan Calfee, Chris Casey, Charlie Cogbill, Nate Fice, Marc Lapin, Lexi Shear, Michael Snyder, Eric Sorenson, Julie Sperling, Charlie Thompson, Robert Turner, Jim White, and Kerry Woods for their contributions, review, and comments. Gale Lawrence provided insightful editorial assistance.

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Pictured right: Vermont's Taconic Mountains viewed from the summit of Red Mountain. Photo by Brian Carlson.



Managing

**RICH NORTHERN
HARDWOOD FORESTS**

for Ecological Values and Timber Production

Recommendations for Landowners
in the Taconic Mountains

A Marriage of Ecology and Forestry

In the forests of Vermont's Taconic Mountains, beautiful sugar maples reach straight and tall towards the sky. Underfoot, vibrant wildflowers herald the arrival of spring each year.

Residents and visitors to this region know the forests here are special. Rich in species and highly productive, these forests are admired as the finest and most extensive of their kind in the Northeast.

But they are also under threat. Second home development, fragmentation, intensive logging, invasive species, and overabundant deer populations all place the future of these special forests in jeopardy. Concerned

about these issues, a group of foresters and ecologists has gathered periodically in southwestern Vermont since 1997 to discuss the ecology and management of these woods, called **Rich Northern Hardwood Forests**.

To conserve Rich Northern Hardwood Forests and the numerous species they harbor in the northern Taconic Mountains, we need natural areas free from human disturbance. But we also need areas managed for timber in order to meet regional timber demands, generate income for landowners, and protect these forests from further fragmentation and development. Existing forestry guidelines are based on broad forest types over a wide regional distribution, with the primary goal to maximize timber production. Protecting sensitive species and ecological values is generally a secondary goal. This group of foresters and ecologists imagined another approach to forest management based first on the unique, local ecology of Rich Northern Hardwood Forests in the northern Taconic Mountains and second on timber production. This approach would add a new and valuable option for conservation-minded landowners making management decisions in Rich Northern Hardwood Forests.

Based on years of experience studying and working in Rich Northern Hardwood Forests, we have developed a set of forestry recommendations based on the ecological characteristics (species presence and abundance patterns, growth rates, and natural disturbance, for example) of this exceptional forest type as it occurs in Vermont's Taconic Mountains. Described here, our recommendations are designed for use by landowners, foresters, loggers, and others who have an interest in managing forestland for ecological values as well as timber production.



*Dominated by sugar maple and graced by spectacular spring wildflower displays, **Rich Northern Hardwood Forests** in Vermont's Taconic Mountains are admired as the finest and most extensive of their kind.*

LIBBY DAVIDSON

What's In a Name?

Ecologists call these woods **Rich Northern Hardwood Forests**, honoring the nutrient-rich soils that support them as well as the characteristic hardwoods – sugar maple, white ash, and many others – that flourish overhead. The Society of American Foresters refers to this forest type as **Sugar Maple-Basswood Forest** (SAF Type #26) or as a subtype of **Sugar Maple Forest** (SAF Type #27, subtype 3). In the language of the locals, these forests are often called “maple woods.” But no matter the name, the meaning's the same – these woods, teeming with life, are lovely places in which to work or play!



What Makes Rich Northern Hardwood Forests Unique?

DESCRIPTION –

Rich Northern Hardwood Forest (RNHF) is a quintessential Vermont forest type, dominated by sugar maple. White ash and basswood are common as well. Additional tree species that may be present include sweet birch, bitternut hickory, black cherry, yellow birch, hophornbeam, and butternut. American beech occurs locally, under specialized conditions and in older forests.

Rich Northern Hardwood Forest can be found growing from the midwest through Ontario, New England, and south to Virginia. In the northeastern United States RNHF is a widespread but locally distributed forest type, and some of the region's largest and finest examples occur in the Taconic Mountains. This forest type supports an exceptional number of tree and herbaceous plant species and is renowned for high biological diversity and productivity. In addition, more than 10 rare or uncommon plants such as Goldie's wood fern, wood millet, puttyroot, and Hooker's orchis occur here.



NEW ENGLAND WILD FLOWER SOCIETY

*Uncommon elsewhere in Vermont, several rare plant species such as **Goldie's wood fern** are associated with Rich Northern Hardwood Forest.*

SITE CONDITIONS –

Rich Northern Hardwood Forests are called “rich” because they grow in deep, moist, nutrient-rich soil where plants receive an abundant supply of nutrients and water. Two features of the Taconic Mountains – chemistry and landform – promote these conditions better than any other region in Vermont. Limestone and marble bedrock in the Taconic Mountains weathers rapidly and provides important plant nutrients such as calcium and magnesium. In addition, downslope movement of nutrients, water, and soil plays an important role. The largest and most characteristic RNHF examples are associated with lower slopes, benches, coves, gullies, and other sites in the rugged Taconic Mountains that benefit from topographically-induced nutrient enrichment. Here organic matter and plant nutrients accumulate over time, forming a compost-like soil.

THE TACONIC MOUNTAINS IN VERMONT



Extending along a narrow north-south axis in southwestern Vermont, the Taconic Mountains are low, rounded mountains formed from a jumble of limestone, marble, shale, and slate. The range continues south from Vermont along the Massachusetts-New York border and into Connecticut, punctuated by well-known peaks such as Mount Greylock and Mount Everett.

ELEVATION –

In the Taconic Mountains, RNHF generally occur at elevations between 1,000 and 2,500 feet. Above this range, climate is more severe, and montane forest types such as Montane Spruce-Fir Forest or Yellow Birch-Red Spruce Forest predominate. At lower elevations in valley bottoms and on gentle foothills, wetlands, development, or cleared agricultural lands tend to dominate.



TNC PHOTO ARCHIVES

HERBACEOUS PLANTS –

The herbs in these forests are one of their most distinguishing features. Wild leeks, maidenhair fern, Dutchman's breeches, hepatica, Canada violet, wild ginger, blue cohosh, wood nettle, and pale touch-me-not are characteristic. These and other herbs are often abundant on the forest floor, forming a continuous carpet of lush vegetation in mid-summer. Where moisture is plentiful, silvery glade fern and ostrich fern grow together in fern glades.

Most of the herbs that are common in Rich Northern Hardwood Forests are long-lived perennials. Of these, many 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 blue cohosh and 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 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 a representative Rich Northern Hardwood Forest in Vermont had an average of 48 herb species in one-quarter acre, while other hardwood forest types in the Adirondacks had an average of 27 species. Other studies show similar results.

The shrub layer varies from being almost absent in dense shade to well-developed in sunny openings. Where shrubs are present, typical species include striped maple, alternate-leaved dogwood, and maple-leaf viburnum.



BETSY BRIGHAM

*More than 60 native herbaceous plant species find a home in Rich Northern Hardwood Forests. Species like **blue cohosh** (right) emerge early in the season to take advantage of plentiful sunlight before tree leaves unfurl overhead. At the height of summer, late-emerging species like **wood nettle** (left) form lush carpets of greenery on the forest floor.*

TREE CHARACTERISTICS –

Exceptional tree height, excellent tree form quality, high average basal area, high board foot volumes, and exceptional annual diameter growth are all distinguishing characteristics of the RNHF. In a nutshell, trees grow fast, straight, and tall in these forests. Canopy age is moderate since sugar maple, the dominant tree species, is moderately long-lived and rarely grows to more than 250 years of age.

ANIMALS –

RNHFs offer a diversity of habitats for many animal species, from wide-ranging mammals such as moose, bobcat, black bear and fisher to more diminutive forest denizens such as short-tailed weasel, chipmunk, and masked shrew. Among the amphibians are eastern red-backed salamander, spotted salamander, eastern newt, wood frog, northern two-lined salamander, dusky salamander, and spring salamander. Breeding bird surveys have documented that more than 40 bird species use these forests for summer nesting habitat, including some spectacular long-distance migrants such as scarlet tanager, black and white warbler, and rose-breasted grosbeak. Some invertebrates – such as land snails and millipedes – may be especially abundant in these forests due to the calcium-rich soils.

NATURAL DISTURBANCE DYNAMICS –

Small canopy gaps from single-tree blowdowns and slope slippage are common in RNHFs. Larger-scale disturbances such as landslides and microbursts occur irregularly and infrequently, affecting areas that may range from several acres to hundreds of acres. Other forms of severe natural disturbance such as fire occur rarely, in part because these forests typically grow in moist, lush sites that resist ignition. On average, historical data suggest that non-catastrophic natural disturbance events remove 1/2 to 1% of the forest canopy annually in Rich Northern Hardwood Forests.



ROD & BETTY VALLEE

Wild ginger's maroon flowers emit a vague odor of rotting flesh. Lying on the forest floor, the flowers attract ground beetles who become inadvertent pollinators in their search for a meaty meal.

CURRENT CONDITION –

Today, areas of old-growth RNHF that were never logged or cleared for agriculture are extremely rare in Vermont. Timber harvests in these productive forests began as early as the 1760s as the area was chartered and settled. In the mid to late 1800s, the northern Taconic Mountains supported a booming sheep industry, and RNHFs were cleared from the mountain slopes up to elevations of 2300 feet or more for sheep pasture. Near the turn of the century this trend reversed and many pastures were gradually abandoned.



BRIAN CARLSON

In the 1800's, many Rich Northern Hardwood Forests were cleared for sheep pasture.

Currently, most RNHFs in the Taconic Mountains are second-growth forests growing on abandoned pastures or woodlots. Most stands show signs of logging during the last fifty years, and most are even-aged. Although some RNHFs have developed two-aged or irregularly uneven-aged stand structure as a result of previous logging or thinning, large areas of uneven-aged RNHF are not common. In addition to disturbance by logging, most stands have also experienced large natural disturbances within recorded history, such as the 1938 hurricane, the 1951 hurricane, the October 1987 snow storm, and the June 1993 microburst.

The Big Picture: General Guidelines for Forest Management

What's the best way for a landowner to harvest trees yet still conserve the RNHF on his or her property? Recommendations for the "better" sites described in existing forestry guides for Northern Hardwood Forests provide a place to start. Drawing also on the experience of ecologists and managers who have worked in these forests for many years, we offer here a range of options and identify some recommended measures.

☛ **Forest Composition** - Maintain the mix of tree and herb species naturally found in the RNHF (see page 14) and use forestry techniques that promote the natural development or restoration of this community. After harvest, stands should represent the normal dominant species and other associated species typical of the forest community. Of course, forests are dynamic systems that change naturally in composition over time due to disturbance, long-term species migrations and range shifts, disease, and other factors. Climate change and introduced pests may also alter the vegetation patterns found in these forests. Forest managers should be attuned to these changes and adapt to them.

☛ **Forest Age Structure** - Maintain or develop a balance of age classes, including a multi-story canopy and old, large-diameter trees. Old trees provide numerous services in these forests, such as wildlife habitat, seeds for forest regeneration, and large pools of nutrients and moisture. Management should aim to create an uneven-aged forest, emulating natural structural conditions. Even-aged management techniques should be used only to regenerate stands whose vigor and diversity has been degraded through successive high-grading, or to respond to stand-destroying fire, wind, ice, insect infestations, or disease outbreaks.



CHRIS FICHTEL

Management Objectives

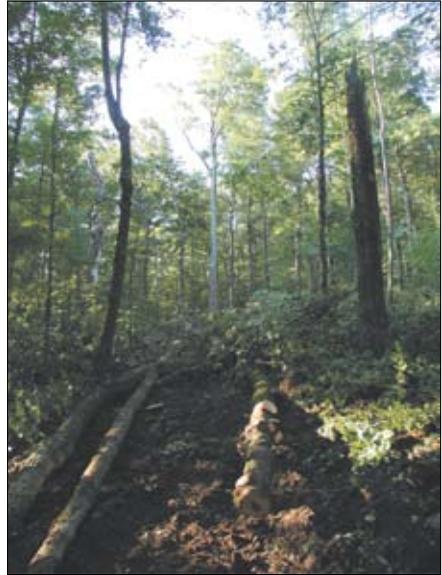
Forestry based on natural forest dynamics aims to maintain a high degree of ecological integrity while still allowing for the extraction of timber. In general, sustainable forest management in the Rich Northern Hardwood Forest should pursue the following objectives:

- ~ Protect the physical attributes and processes unique to the RNHF, including downslope movement of nutrients and water, high native species diversity, high biomass, excellent quality trees, productive soils, and rapid decomposition of dead material

- ~ Promote the development and/or maintenance of natural forest composition and a high forest canopy with an uneven-aged forest structure
- ~ Maintain natural volumes of standing and downed dead trees
- ~ Promote herbaceous plant species characteristic of the RNHF, including rare species associated with this forest type
- ~ Develop and/or maintain stable economic conditions for the landowner over the long-term

☞ **Woody Debris** - Within a natural range of variability, maintain volumes and distributions of downed logs, large woody debris, and standing dead trees, including large-diameter trees of a variety of species. Dead wood provides a source of energy and nutrients for the forest. In addition, large woody debris may be used for food, shelter, and reproduction by numerous wildlife species including amphibians, reptiles, mammals, and invertebrates. The availability of large logs for wildlife habitat is of particular concern in RNHFs because decomposition occurs rapidly and some methods of timber harvest can severely reduce numbers of large trees. Typical volumes of dead wood in RNHFs under natural conditions have been measured between 65 and 85 m³ per hectare, or between 930 and 1215 ft³ per acre. On average, this represents 15 or more large downed logs and 10 or more standing dead trees per acre.

☞ **Soil Productivity** - Maintain soil productivity by minimizing soil erosion and soil compaction. RNHFs are especially vulnerable because they tend to occur on steeper sites or at the base of slopes where nutrients accumulate. Forest seeps, springs, and vernal pools are common within these forests and are very sensitive to soil disruption. On these and other matters, Vermont Accepted Management Practices (AMPs) provide excellent advice, such as working in winter when the ground is frozen. Logging dormant trees over frozen, snow-covered ground generally means less soil compaction, less erosion, less channelization, and less damage to roots and small plants, in addition to less damage to the trees that remain. Careful design, layout and construction of skid roads and haul roads can minimize disruption of key natural processes in this forest type, such as downslope movement of nutrients and water. For example, roads may be less damaging when placed on ridgetops rather than benches, flats, or slopes.



ALAN CALLEE

Standing dead trees and downed woody debris are an essential source of energy, nutrients, and habitat for the forest. Timber management should aim to maintain natural volumes of dead wood.

☞ **Ecological Zones** - Working with an ecologist or field biologist, identify ecologically sensitive areas including seeps, sink holes, springs, fen-like areas, wetlands, vernal pools, oak knolls, calcareous outcrops, rare and endangered species, and unique or fragile areas designated by the Vermont Fish and Wildlife Department's Nongame and Natural Heritage Program. Establish protection zones and areas of minimal tree removal to protect these important ecological features. Strict adherence to Vermont AMPs and careful design, layout and construction of skid roads and haul roads will also help to protect such areas. Relocate existing roads and avoid construction of truck or skidder roads that will disturb ecologically sensitive areas.

☞ **Hydrologic Features** - Due to the unique characteristics of the region's limestone and marble bedrock, seeps, sink holes, and springs occur frequently. To protect these features as well as streams and ponds, maintain wind-firm buffer areas of at least one tree length with complete canopy closure and minimal soil disturbance. No logging slash, soil, or other debris should be placed within them.

☞ **Invasive Non-Native Species** - Morrow's honeysuckle, common buckthorn, and Japanese barberry are invasive non-native species that are established in the Taconic Mountains of Vermont and in some areas of RNHF. Where these invasives are present, no-cut buffer areas of at least one tree length should be maintained to isolate them from uninfested areas and prevent vegetative spread. Minimizing soil disturbance by logging in winter and by limiting openings in the canopy to one or two times the height of adjacent trees will also help to minimize invasion and spread. In addition, where these species are established and represent a threat to successful natural regeneration, pre-harvest treatment may be used to reduce their density. In areas of light infestation, mechanical removal of invasive shrubs and trees – including their roots – will halt or slow the pace of invasion. Other possible treatment techniques include cutting and applying herbicides such as glyphosate directly to cut stumps, or applying foliar herbicide. To maintain natural forest composition in RNHFs, no non-native or genetically-engineered species of trees or shrubs should be planted.



ELIZABETH THOMPSON

☞ **Deer** - Deer populations have exploded in many areas of Vermont's Taconic Mountains due to an absence of natural predators and an abundance of food – including suburban backyard shrubbery as well as early successional forest saplings. Large numbers of deer in many RNHFs threaten tree regeneration and herbaceous plants through selective browsing on favored species. Hunting may have a positive impact on forestry and ecological objectives by helping to keep these hungry herbivores under control. In addition, leaving tree tops on the forest floor during timber harvests may provide a mechanical barrier that protects tree seedlings from deer for several years. In some cases this may be enough time for saplings to grow to four or five feet tall, out of browsing range.



ELIZABETH THOMPSON



LESLIE MEHRHOF

☞ **Forest Fragmentation** - The most ecologically damaging sources of forest fragmentation are subdivision, development, and construction of major roads and highways. Maintaining or re-assembling large forest parcels will help to prevent these kinds of fragmentation. Logging roads can also be fragmenting features. Design roads, close roads and/or undertake management actions to minimize forest fragmentation while still allowing adequate access for timber harvesting. To avoid building major roads, consider the use of a forwarding system rather than traditional skidder technology when removing felled trees. Forwarders also minimize soil disturbance, thereby reducing the spread of invasive non-native species.

Morrow's honeysuckle (top), common buckthorn (middle), and Japanese barberry (bottom) are non-native shrubs that have invaded many Rich Northern Hardwood Forests. Their fruits are often dispersed by birds into sunny openings created when large patches of trees are removed from closed-canopy forests.

On the Technical Side: Specific Guidelines for Forest Management

Rich Northern Hardwood Forests are productive systems that grow big trees fast, and they can be excellent producers of high quality, large diameter trees. To perpetuate as much as possible the conditions occurring in a naturally-disturbed RNHF, follow an uneven-aged management system that emphasizes growing high quality trees and sustaining high proportions of sawtimber. Timber management should retain mature trees in the overstory through single tree and small group (less than 1 acre) selection harvests, consistent with canopy gaps created by small-scale natural disturbances.

The uneven-aged system relies on the selection method to establish and maintain a certain diameter distribution throughout each management area. Diameter distributions are generally approximated by a reverse J-shaped curve, with smaller diameter trees more abundant than larger size classes. The slope of the curve is defined by Q – the ratio between numbers of trees in successively smaller diameter classes. Stand structural goals for uneven-aged management are also specified by the maximum size tree left standing. Monitoring and managing the diameter distribution, and understanding the effects of faster growing species and faster growing individuals of a species on the diameter distribution, are critical to ensuring a sustained yield from each area. Individual tree selection is likely the most appropriate management approach in RNHFs, useful for thinning existing trees and releasing established regeneration. Group selection may be a more effective way to establish regeneration in some cases.

A Forestry Primer

Annual Diameter Growth: The increase in the girth of a tree during a given period – in this case, one year.

Basal Area: The basal area of an individual tree is the cross-sectional area of that tree's stem measured at 4.5 feet above the ground. The basal area of a stand of trees is simply the sum of all the individual trees' basal areas, expressed as square feet per acre.

Board Foot Volume: A measure of merchantable wood in trees and forests, a board foot is the amount of wood contained in an unfinished board 1 inch thick, 1 foot wide, and 1 foot long.

Even-aged management: A combination of actions that results in stands of trees of essentially the same age. In even-aged management, regeneration is usually established during a relatively short period near the time when a stand has reached its desired age or size and is harvested.

Q-Value: The ratio (or "quotient" and, therefore "Q") of numbers of trees in successively smaller diameter classes. The lower the Q-value, the higher the proportion of large-diameter trees in a stand.

Residual: The trees (and everything else) remaining in a stand after any management activity.

Sawtimber: Trees or logs cut from trees of some minimum size, length, and quality suitable for sawing into lumber (as opposed to smaller and poorer quality trees that would only qualify as fuelwood or pulpwood).

Stand composition: The mixture of tree species in a stand.

Stand structure: The complexity or arrangement of tree age and size classes in a stand.

Stocking: A measure of tree crowding in a stand, usually quantified by both basal area and number of trees per acre.

Uneven-aged management: A combination of actions that results in a stand with continuous high canopy cover and three or more tree age classes. In uneven-aged management, regeneration usually occurs throughout the stand on a repeated basis, through the creation of small gaps.



Silvicultural guides for northern hardwoods suggest that trees on the better sites may be easily grown to 24 inches in diameter or greater and that high proportions of residual sawtimber (Q=1.3 to 1.5) should be maintained to produce high quality sawtimber growth. In fact, evidence suggests that on good sites with an abundance of quality timber, residual basal areas above the suggested range should be specified. Residual basal areas below the suggested range may impair quality development. Recommendations presented here for RNHF are designed to maintain a dense canopy and high residual stocking, and also to grow trees to diameters larger than recommended in the silvicultural guides for other northern hardwood types.

In general, the following recommendations can be applied in uneven-aged management of RNHF:

 **Maximum diameter** - In a RNHF the long-term emphasis can be focused on growing large diameter (24 inches and higher), high quality (veneer and high-grade sawtimber) trees. Within managed, uneven-aged stands, tree diameter correlates reasonably well with age. However, in previously unmanaged, poorly managed, high-graded, or even-aged stands, diameter and age may not be correlated and residual trees should be left based on vigor, health and quality rather than a specified diameter.

 **Stand structure (Q-Value)** - Long-term goals should be to establish a high percentage of sawtimber-sized trees (12 inches in diameter and higher). Residual stand structure in RNHFs should contain and be able to sustain high proportions of sawtimber. Q-values of 1.3 and lower are desirable. Some trees should be left to reach their age of natural mortality – up to 250 years for sugar maple. Some amount of standing and fallen dead wood, including large trees and logs, should remain in the stand to maintain soil nutrient levels and provide habitat for forest organisms.

 **Stocking level** - On most RNHF sites the residual square feet of basal area per acre can be higher than recommended in typical beech-birch-maple forests. Basal areas of 85-95 square feet may be used as a baseline minimum value. This is especially true in previously managed stands with high sawtimber stocking of acceptable quality.

Cutting cycle - In RNHFs, a cutting cycle between 20 and 30 years may be appropriate, depending upon the residual stand structure, mean stand diameter, and diameter distribution, as well as access conditions and operability limitations. Shorter cutting cycles of 10 to 20 years may permit less canopy disturbance at each treatment, increased control of stand structure, and better income opportunities. To emulate natural conditions, canopy removal should not exceed an average of 1/2 to 1% annually.



Using an increment borer, a forester checks tree growth in a Rich Northern Hardwood Forest in Rupert. In order to ensure that a landowner's management goals are met, we recommend working with credentialed, well-referenced foresters and loggers, guided by a contract that outlines harvest specifications.

ALAN CALLEE

 **Crown closure** - Residual crown closure should exceed 80% to reduce risk of invasion by non-native species such as honeysuckle and also to perpetuate conditions promoting establishment of shade tolerant hardwood seedlings (such as sugar maple and beech) and maintenance of characteristic herbaceous plants. The diameter of a canopy gap should be roughly one to two times the height of neighboring trees (less than one acre). Harvests should include complete removal of undesirable species (such as Norway maple, an invasive non-native tree) and trees of poor quality or form in the mid and lower canopy layer to promote establishment of desirable advanced regeneration. In some cases, these small gaps may not promote adequate regeneration to meet landowner objectives, particularly for shade intolerant species such as white ash and yellow birch. Consider using group selection up to two acres in size when regeneration is a concern.

 **Crown release** - Individual tree selection should promote partial or complete crown release of vigorous, high quality trees throughout the diameter classes to promote crown expansion, height growth, and diameter growth.



KEN SMITH

Rich Northern Hardwood Forests are productive systems that grow big trees fast. We recommend an uneven-aged management system that emulates natural disturbance dynamics, harvesting larger trees with less frequent entries.

Summary

Taconic Mountain residents whose lands are graced with Rich Northern Hardwood Forest have many management options. Some landowners may choose wilderness, letting natural processes prevail. Others may adopt more traditional timber management practices that focus on economic yield. Still others may manage for ecological values **and** timber production.

For landowners who choose to harvest timber from their Rich Northern Hardwood Forest, we encourage an approach that's grounded in the natural dynamics and ecological processes unique to this forest type. In these productive forests, where trees grow fast and straight and tall, timber management can focus on harvesting larger trees with less frequent entries. Smart forestry practices – such as logging on frozen ground in the winter months, leaving old dead trees both upright and fallen in the forest, planning roads and landings carefully in order to protect hydrologic features, and minimizing the size of canopy openings in order to prevent honeysuckle invasion – will help to protect the ecological processes that make these forests a special and celebrated feature of the Vermont landscape. With good stewardship of our Rich Northern Hardwood Forests, we can ensure these special forests remain here in Vermont's Taconic Mountains for our children and grandchildren to enjoy.

Costs & Benefits

A landowner's or land manager's choice to adopt the forestry recommendations presented here will depend on many variables, including property size, current forest condition, and surrounding land uses, as well as the landowner's ecological and economic goals. Models suggest that managing a parcel of Rich Northern Hardwood Forest as described in this document may yield less income than traditional management in the short term but similar levels of income in the long term as the forest produces larger, high quality veneer and sawtimber. Other "yields" from this approach have no concrete economic value but should also be considered – yields such as increased habitat for native plants and animals, improved water quality, and greater ecological health for your forest.



ROD & BETTY VALLEE

Maidenhair fern

Recommended Resources

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The following sources can provide more information about the ecology and management of Rich Northern Hardwood Forests:

The Nature Conservancy

27 State Street
Montpelier, VT 05602
(802) 229-4425

Bennington County Forester

Agency of Natural Resources
Department of Forests, Parks, and Recreation
478 Shaftsbury State Park Road
Shaftsbury, VT 05262
(802) 375-1217

Merck Forest and Farmland Center

Route 315, Rupert Mountain Road
PO Box 86
Rupert, VT 05768
(802) 394-7836

“Maple”

*It was the tree the autumn
fire ran through
And swept off leathern
leaves, but left the bark
Unscorched, unblackened,
even, by any smoke.*

– Robert Frost



WHITNEY BEALS

List of 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-leaved 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 cucularia*
 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*
 Sprengel's sedge – *Carex sprengei*



ROD & BETTY VALLEE



ROD & BETTY VALLEE



EVERETT MARSHALL

Bloodroot (top), **Dutchman's breeches** (middle), and **squirrel corn** (bottom) are common in Rich Northern Hardwood Forests. These spring wildflowers have seeds that are dispersed by ants. Consequently, they are extremely slow to re-colonize disturbed areas, moving as little as 10 cm per year.

► **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 hookeri*
- Goldenseal – *Hydrastis canadensis*
- Broad beech fern – *Thelypteris hexagonoptera*
- Male fern – *Dryopteris filix-mas*
- Puttyroot – *Aplectrum hyemale*

Many rare plants such as **ginseng** (below) and **summer sedge** (right) find a home in the Rich Northern Hardwood Forests of Vermont.



MARC DESMETTES



DOROTHY S. LONG

Places to Visit

The Mount Equinox Preserve

c/o Equinox Preservation Trust
(802) 362-7895

The Equinox Preservation Trust manages 955 acres on Mount Equinox in Manchester Village, including extensive areas of Rich Northern Hardwood Forest. Hiking trails are open to the general public and trail maps are available, at no cost, at The Equinox Hotel.

Merck Forest and Farmland Center

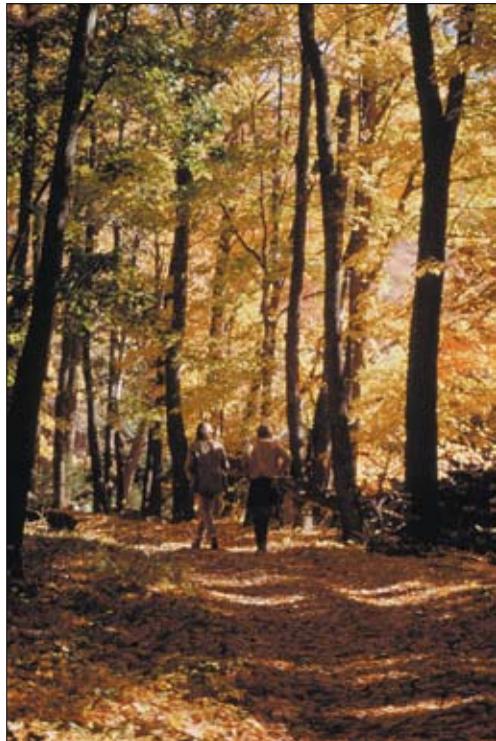
(802) 394-7836

Located on 3,130 acres of fields and forests in Rupert, the Merck Forest and Farmland Center is an environmental education organization that conducts demonstration forestry and agriculture. Several Rich Northern Hardwood Forest stands on the property are being managed for timber in accordance with the principles outlined in this document.

Equinox Highlands Natural Area

c/o The Nature Conservancy of Vermont
(802) 229-4425

The Nature Conservancy manages 1,500 acres of Rich Northern Hardwood Forest and other natural community types on Mount Equinox and Mother Myrick Mountain in Manchester and Dorset.



WHITNEY BEALS