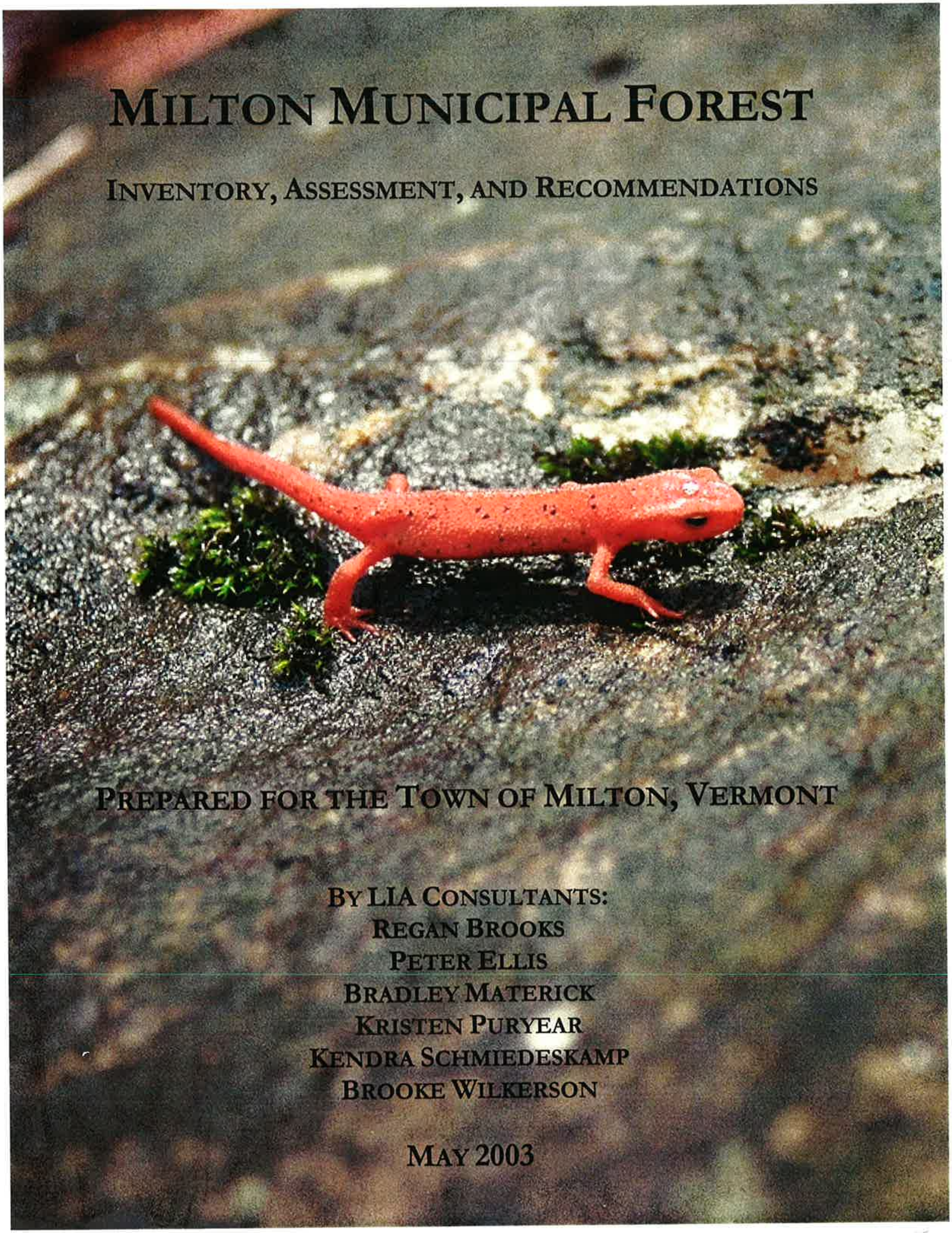

MILTON MUNICIPAL FOREST

INVENTORY, ASSESSMENT, AND RECOMMENDATIONS

PREPARED FOR THE TOWN OF MILTON, VERMONT

BY LIA CONSULTANTS:
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MAY 2003

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Acknowledgements

On April 30, 2003, a day when we could escape our other classes for an afternoon of fieldwork, our Landscape Inventory and Assessment team descended upon the Milton Municipal Forest en force. One team struck out to map critical wildlife habitat features, while a second team combed the beaver meadows identifying plants by their buds. A third team hopped in a canoe with aquatic specialist Kellie Merrill and more than $10,000 worth of water quality testing equipment. We were also accompanied by landowner Geof Plunkett. Such a day was typical of the kind of attention that has been lavished on the Milton Municipal Forest between January and May of 2003. Each of us on the LIA Consultants team carried with us into the field the naturalist insight and skills gained from our UVM instructors and mentors, as well as from numerous experts in diverse fields of natural history and scientific study. Without the time and attention that was given to us by these individuals, we would not have been able to give the forest the thoughtful and compassionate attention it deserves. At the same time, we would not have been able to take advantage of the opportunities this experience provided us to gain knowledge and skills that will serve us for the rest of our lives and careers as naturalists.

We would especially like to thank Walter Poleman
for organizing and guiding us through this experience.

We would also like to thank our UVM mentors and instructors, Jeffrey Hughes
and Deane Wang, directors of the Field Naturalist and Ecological Planning Programs.

The following is a list of folks whose time and expertise were critical,
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The Milton Conservation Commission – Aaron Henson – Janet Hurley – Karen Bates – Colby Brochs – John Crock – Emile Desranleau – Laurie DiCesare – Duane Dickensen – Scott Dillon – Jeffrey Disorda – Jane Dorney – Brett Engstrom – Jane Fitzgerald – Roger Hunt – Neil Kamman – Rich Langdon – Ellen Marsden – Kellie Merrell – Rick Paradis – Donna Parrish – Howard Pidgeon – Geoffrey and Connie Plunkett – Jodi Shippe – Mike Snyder – Elizabeth Thompson – Chris Burns – John Cushing – David and Kelly Rybicki – Harold and Rebecca Torre – Ernest Strong – Yancey Martell – Donald and Nancy Turner – Donald, Jr., and Gail Turner – Raymond Bernier – Suzanne Levine – Steve Fiske – Breck Bowdin – Joe Reznik – Lesley-Ann Dupigny-Giroux – Thom Villars – Caroline Alves – Barry Doolan – Mark Twery – Ernest Buford – Peter Dombrowski – Michelle Johnson – Randy Barrows

Table of Maps

Executive Summary

The town of Milton, Vermont contracted LIA Consultants* to conduct an inventory and assessment of the natural features of the Milton Municipal Forest (MMF) in spring 2003, and provide recommendations regarding compatible forest uses. This report, the central product of that work, serves to inform the development of a management plan for the MMF.

The MMF is a 350-acre parcel of land located in the eastern portion of the town of Milton in Chittenden County, Vermont (See Map 1). It lies within the Champlain Valley biophysical region, an area that stretches from Lake Champlain up into the foothills of the Green Mountains. Milton Pond, the 24-acre centerpiece of the property, lies at the base of a 267-acre watershed that forms the headwaters of Malletts Creek. The topography of the forest is hilly, with elevations ranging from 840 feet above sea level at Milton Pond to 1,200 feet at the forest's southern boundary. A steep north-south ridge bisects the property, separating the pond to the west from a large beaver wetland to the east. The bedrock is dominated by acidic rocks of the Cheshire and Pinnacle-Fairfield Pond Formations, although a small area of calcium-rich dolostone of the Dunham Formation is located in the south end of the forest. Abundant bare rock outcrops are a prominent feature of the landscape. In other places, glacial till covers the bedrock, forming rocky and infertile soils.

The MMF has a long history of supporting multiple uses. Settlers began farming the area of the present day MMF in the late eighteenth century; by the middle of the nineteenth century, it is likely that much of the land had been cleared for pasture or to grow hay or grain for livestock. From 1923 to 1993, the pond provided the town with a source of drinking water. Agricultural uses of the forest decreased as the Milton Water Corporation acquired land around the pond from 1923 to 1963. The town of Milton purchased the current area of the forest from the Water Corporation in 1969.

A poorly executed timber harvest in 1986 raised citizen concern about the future of the pond and the surrounding forest. At the recommendation of the Milton Pond Study Group, the Milton Select Board designated the area a municipal forest in 1991. Current uses of the forest include hiking, dog walking, bird watching, skiing, snowshoeing, hunting, fishing, driving off road vehicles, camping, snowmobiling, horseback riding, and mountain biking.

The MMF has many distinguishing natural features. Milton Pond is one of the largest ponds in the upper Champlain Valley with a watershed that is neither developed nor under agricultural use. The pond and the surrounding forest are relatively free of non-native invasive species that reduce biological diversity and aesthetic value. The presence of water, along with the abundance of ledges and outcrops, sets the stage for a variety of different plant communities. Particularly interesting communities are found at the margins of the wetlands, at the bases of outcrops, and on the tops of ledges. These areas also supply habitat for a diverse range of wildlife species. The pond, forests, and beaver wetland may support up to 25 species of amphibians and reptiles, 87 species of birds, and 39 species of mammals.

In our assessment, we identified features that are sensitive to negative impacts from certain activities, especially if the intensity or scale of these activities were to increase. The MMF has areas of soil that the U.S. Natural Resources Conservation Service has designated as "highly erodable" or "potentially highly erodable." Activities in these areas will have to be carefully managed or eliminated to avoid increased sedimentation and loss of water quality in the pond and wetland. The same level of care is called for in the case of the wet soils around the pond and beaver wetland and the various seeps located in the forest. Although currently the forest is relatively free of non-native invasive species, activities like timber harvesting or increased boating could open the way for their introduction and spread. Another area of concern is wildlife habitat modification and the disruption of behavioral patterns. Here the seasonality of the forest use becomes important. For example, many wild animals are particularly vulnerable to disturbance in winter, when every calorie counts towards survival.

We also assessed the degree to which one activity impacts the ability of other visitors to enjoy the forest. The impact of snowmobiles illustrates the complications that arise in assessing these impacts. While skiers and snowshoers might appreciate the packed trail that snowmobiles create, they may object to their noise. Research shows that off road vehicle use can have the greatest potential impacts in the MMF, eroding trails and degrading the experience of other recreationists.

Rather than offering a one-size-fits-all set of recommendations, we provide a menu of suggested management objectives, each with its own set of recommended management strategies. We encourage the town of Milton to select the management objectives which support its own vision for the MMF. These objectives can be found on page 115.

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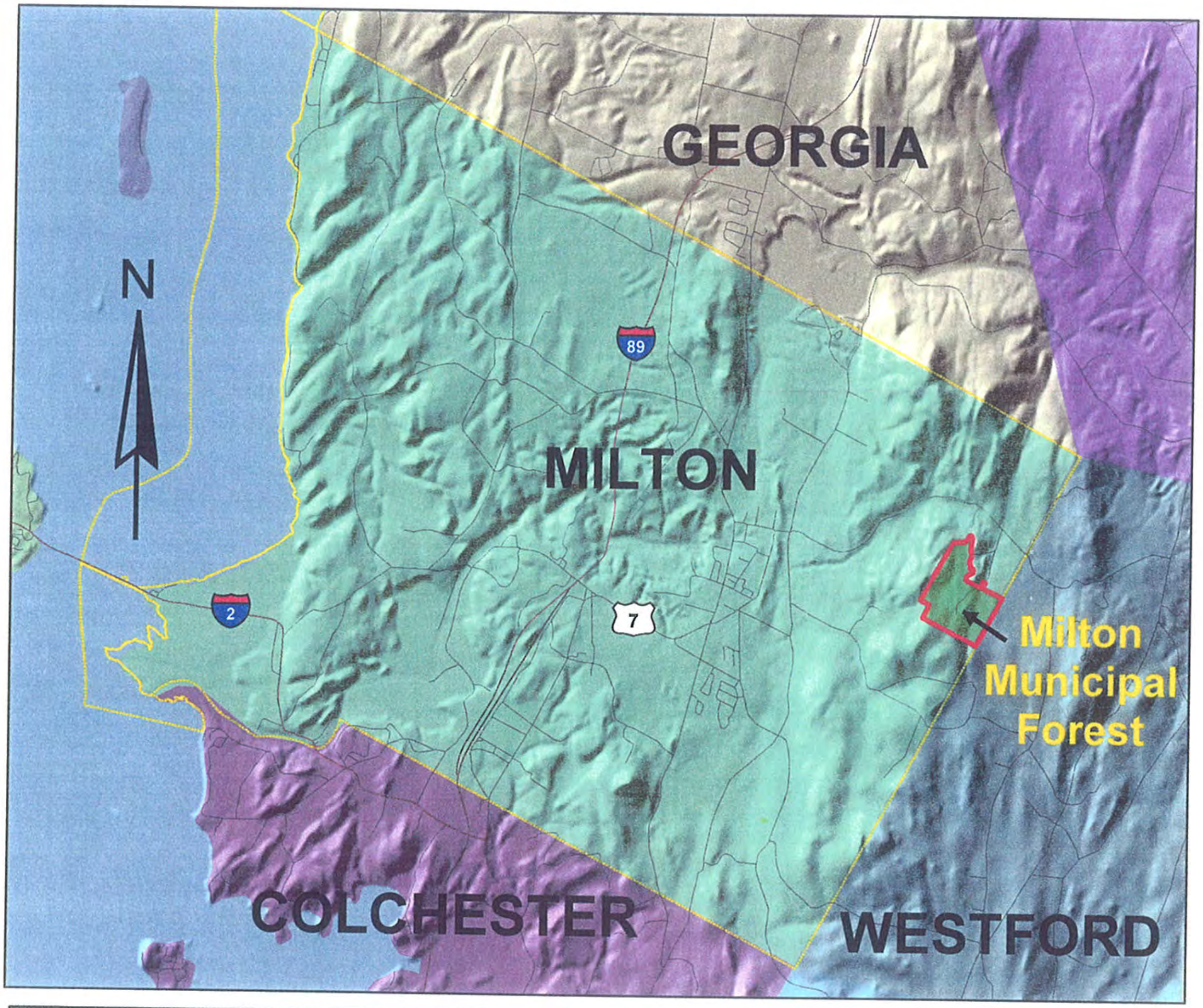
* The LIA Consulting Team is comprised of six graduate students in the University of Vermont Botany Department course, Landscape Inventory and Assessment, taught by Walter Poleman. This course is designed to provide Field Naturalist and Ecological Planning students with a real-world experience conducting natural resource inventories and assessments. For more information, please contact the Field Naturalist Program at (802) 656-2930.



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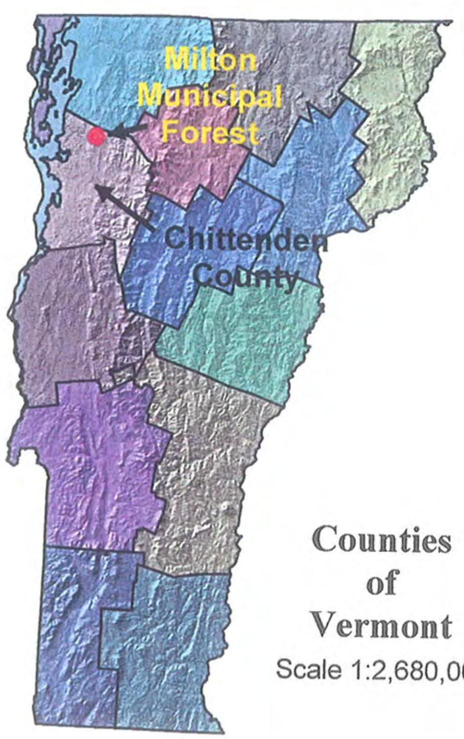

Counties
of
Vermont
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Location

Milton
Municipal Forest
Milton, Vermont
LIA Consulting Team

May 2003

Data Sources:
All layers produced by LIA team or provided by Vermont Center for Geographic Information

Map 1

SECTION 1: LANDSCAPE INVENTORY

This section of our report describes all of the features that together comprise the landscape of the Milton Municipal Forest (MMF). In order to efficiently perform this task, we group the features of the forest into six inventory categories, each category being addressed in a separate subsection of this Landscape Inventory. Our chosen inventory categories are the following:

- Physical Features
- Cultural Resources
- Vegetation
- Wildlife
- Aquatic Features
- Recreation

The complexity of the MMF's landscape cannot be easily fit into such categories. Where important relationships exist between categories, we will make these connections clear in our descriptions. Also due to the landscape's complexity, it is impossible to inventory every aspect of the Forest. Given our limits of time and resources, the information contained in this section represents our choice of features that we believe are most important to include in a thorough inventory of the Milton Municipal Forest.

Each subsection of our Landscape Inventory will begin with a clear definition of the inventory category being described, followed by a brief outline of the methods we used to study the category.

Physical Features

Introduction

The physical features of the Milton Municipal Forest form the foundation of the landscape. Understanding this foundation reveals much about the story of the rest of the living, growing landscape. Physical features can tell us about the possibility of Native American use, the kinds of plant communities we might find in the area, where we might be able to find rare and unique plants growing, and which areas are susceptible to erosion. These and other important links between the physical features of the MMF and other parts of the landscape will be explored in this section and throughout our report.

Physical features include all of the natural, non-living elements of the landscape. We include soils in this section, even though soils do contain living organisms that are essential to its function. We divide physical features into the following categories, and will describe each separately:

- Climate
- Topography
- Landforms
- Bedrock
- Surficial Materials
- Soil

Methods

Physical features were primarily inventoried by consulting preexisting sources of information and data that are referenced in the text. Limited ground-truthing verified the accuracy of these sources.

Climate

The Milton Municipal Forest lies in the Champlain Valley biophysical region (Figure 1). The biophysical regions of Vermont are large areas that share similar features of climate, geology, topography, soils, natural plant communities, and human history (Thompson and Sorenson 2000). Within the Champlain Valley, climate varies with elevation, which ranges from 95 feet at the shore of Lake Champlain to 1,800 feet in the foothills of the Green Mountains. Growing season varies from 150 days at the lakeshore to 130 days in the foothills. Average July temperature exceeds 70°F, and average January temperatures are between 18-20°F. Average annual precipitation ranges from 28 inches near the lake to 38 inches in the foothills. As moist air enters Vermont from the west, the foothills of the Green Mountains force this air to rise, expand and cool, forming clouds and precipitation. This "orographic lifting" accounts for the 10 inch increase in annual precipitation from lakeshore to foothills. With elevations ranging from 840 feet at Milton Pond to 1,200 feet on its southern boundary, the high ground of the MMF likely generates a noticeable orographic lifting effect. Thus, annual precipitation and snowpack depth are likely to be higher than in the surrounding lowlands.

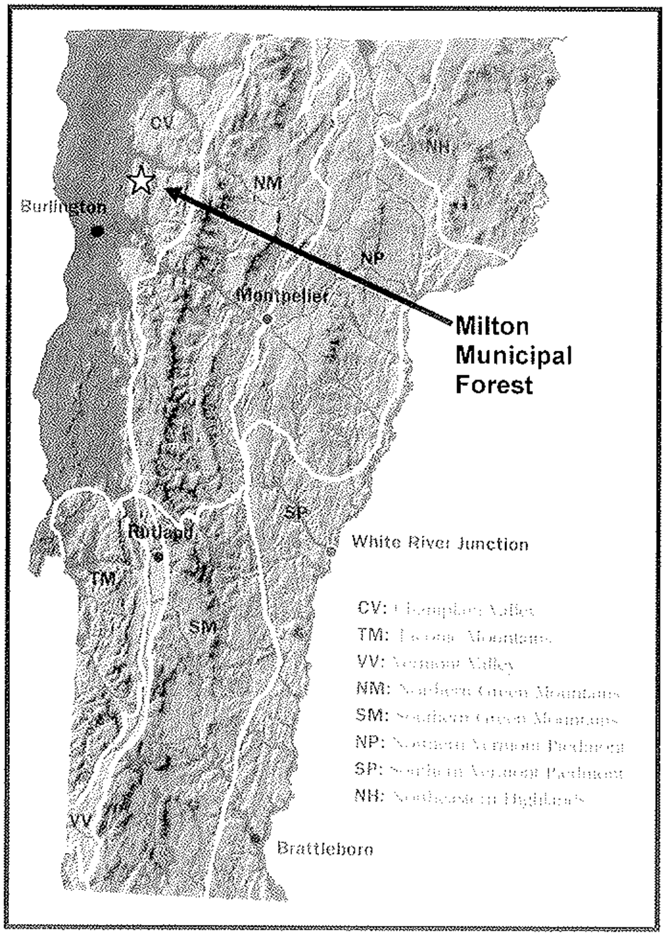


Figure 1: Biophysical regions of Vermont (Thompson and Sorenson 2000).

Topography

Many of the maps presented in this report include topographic contour lines to show the 3-dimensional shape of the landscape. These lines were computer generated from a Digital Elevation Model (DEM) for the state of Vermont and ground-truthed. Our maps show 5-foot contour intervals with an index contour labeled every 50 vertical feet. Figure 2 presents a recent aerial photograph with contour lines shown. The topography of the MMF shows a marked contrast between the steep slopes and ridges surrounding Milton Pond and the relatively gentle terrain of the beaver meadow and the eastern portion of the forest. The sharp terrain break between these areas is an interesting feature that will come into play in our discussion of the forest's geology.

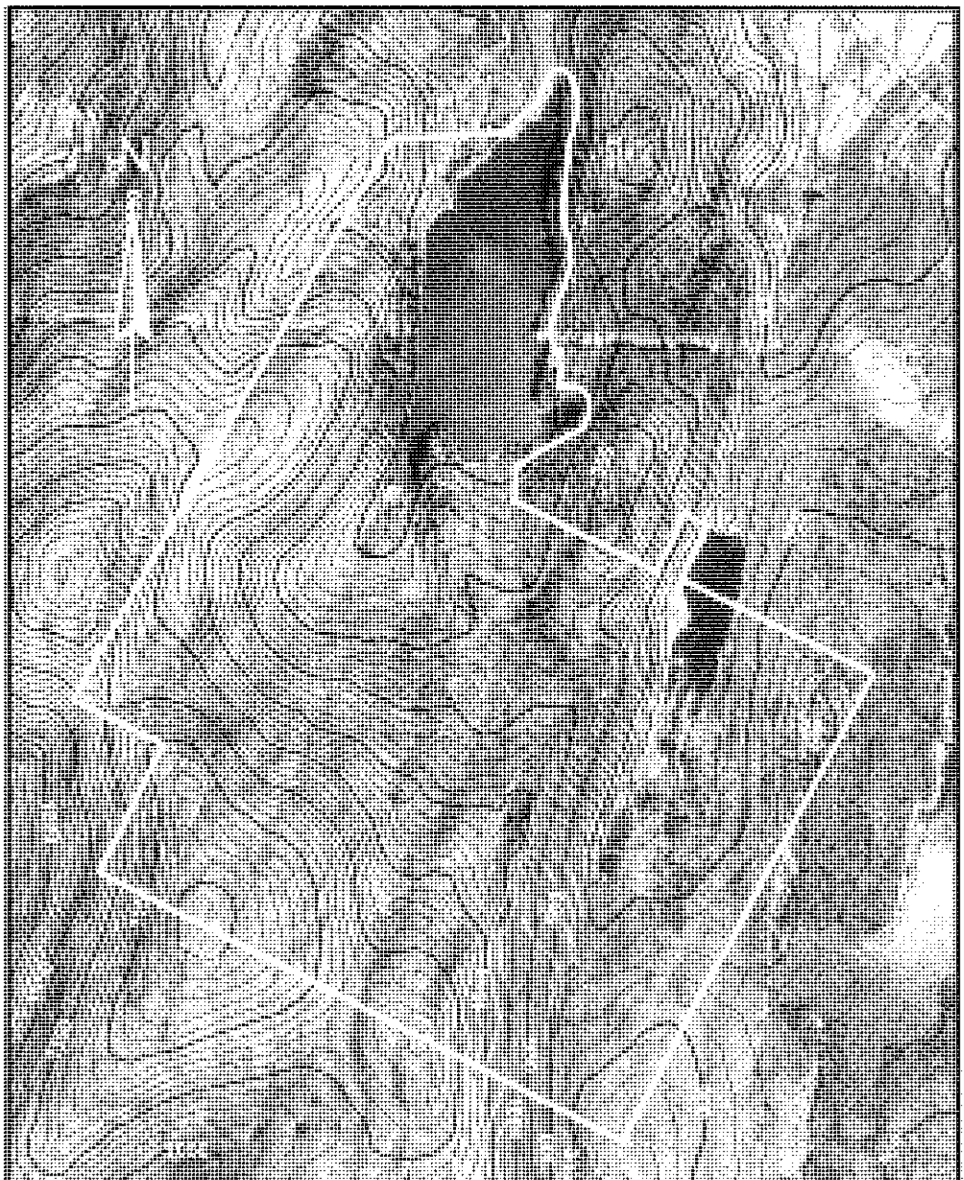


Figure 2: Topography of the Milton Municipal Forest. Contour interval five feet.

Landforms

Landforms are a way of classifying the different shapes that comprise the surface of a landscape. Many ecologists believe there is a link between the physical diversity of a landscape and its biological diversity (Burnett et al. 1998). The greater the number of different landform shapes present on a landscape, the greater the number of plant and animal species that can take advantage of these physical niches. Though this hypothesis has not been definitively tested, many landscape inventories include an analysis of landforms. (Thompson, personal communication).

The 18 landform classes that have been defined for the state of Vermont are listed here, with asterisks indicating the landforms represented in the MMF:

- Flat summit or ridgetop
- Steep slope*
- Cliff
- Low rounded summit/ridge*
- Flats*
- Lower sideslope or gentle draw*
- Bottom of draw, valley, bench*
- Stream*
- Lake, pond, reservoir*
- Slope crest or ridge: gentle grade*
- Slope crest or ridge: moderate grade*
- Flattish convexity*
- Upper sideslope or rounded ridge*
- Valley or toe slope: gentle grade*
- Flat in valley (usually water)
- Slope of cove or draw*
- River
- Wetland*

Fourteen out of 18 landform classes are represented in the Milton Municipal Forest, indicating that the forest is a highly physically diverse landscape.

Bedrock

Bedrock is a conspicuous feature of the Milton Municipal Forest, appearing as frequent outcrops throughout the landscape. The story of the forest's bedrock began approximately 550 million years ago when the area that is now Vermont lay under shallow ocean waters at the edge of an ancient continent. This ocean was called the Iapetus, and its ancient shoreline is represented by the current western shore of Lake Champlain. The Adirondacks, composed of rocks much older than those found in Vermont, are the eroded remains of the ancient continent. As the ancient Adirondacks eroded, rivers carried sand, silt and clay particles into the Iapetus and deposited them in layers many thousands of feet thick on the ancient continental shelf where they became sedimentary rocks such as sandstone, siltstone and shale. At the same time, marine organisms removed calcium from the ocean water to build their skeletons and shells and added a constant input of calcium carbonate to the ocean floor when they died and sank to the bottom. Layers of these calcium rich deposits formed minerals such as limestone and dolomite.

Approximately 450 million years ago, plate tectonic forces began to close the Iapetus ocean. As the ancient European continent approached and eventually collided with the ancient North American continent, the layers of rock that had formed on the continental shelf in the area that is now Vermont were caught in the middle and subjected to tremendous forces of pressure and heat. These forces warped, folded and broke the originally flat layers, and metamorphosed the original sedimentary rocks. Sandstone became quartzite, siltstone became schist, shale became slate, and limestone became marble. Where layers of rock broke, thrust faults were formed. Because the compressional forces of this event were oriented in an east-west direction, thrust faults generally run north to south, and older, deeper rocks east of the faults were thrust up and over younger, shallower rocks west of the faults (Figure 3).

By 435 million years ago, the Iapetus ocean had closed, and folding and faulting had raised a mountain range of possibly Himalayan proportions in the area of Vermont. This mountain range began to erode immediately, slowly uncovering and wearing away layer after layer of warped and metamorphosed rock. About 180 million years ago, the joined North American and European continents began to separate along the current eastern shoreline of North America, and the newly born Atlantic Ocean began to grow to its present width. Europe and North America are still drifting apart to this day.

Four hundred and thirty five million years of erosion have reduced the mountains of Vermont to their present stature. Figure 4 is a map of the MMF showing the types of rocks that are currently exposed at the ground surface. Surficial deposits (explained later) and soil cover much of this bedrock, but in

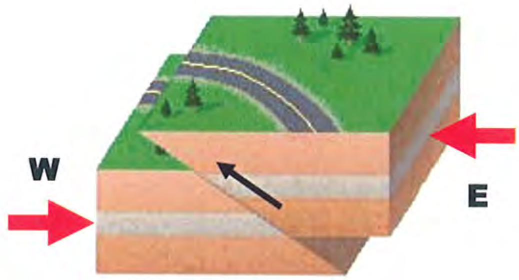


Figure 3: Thrust faulting. Red arrows indicate compressional forces. Black arrow indicates movement of rocks on the east side of the fault up and over rocks west of the fault (www.structural_geology_portal.com).

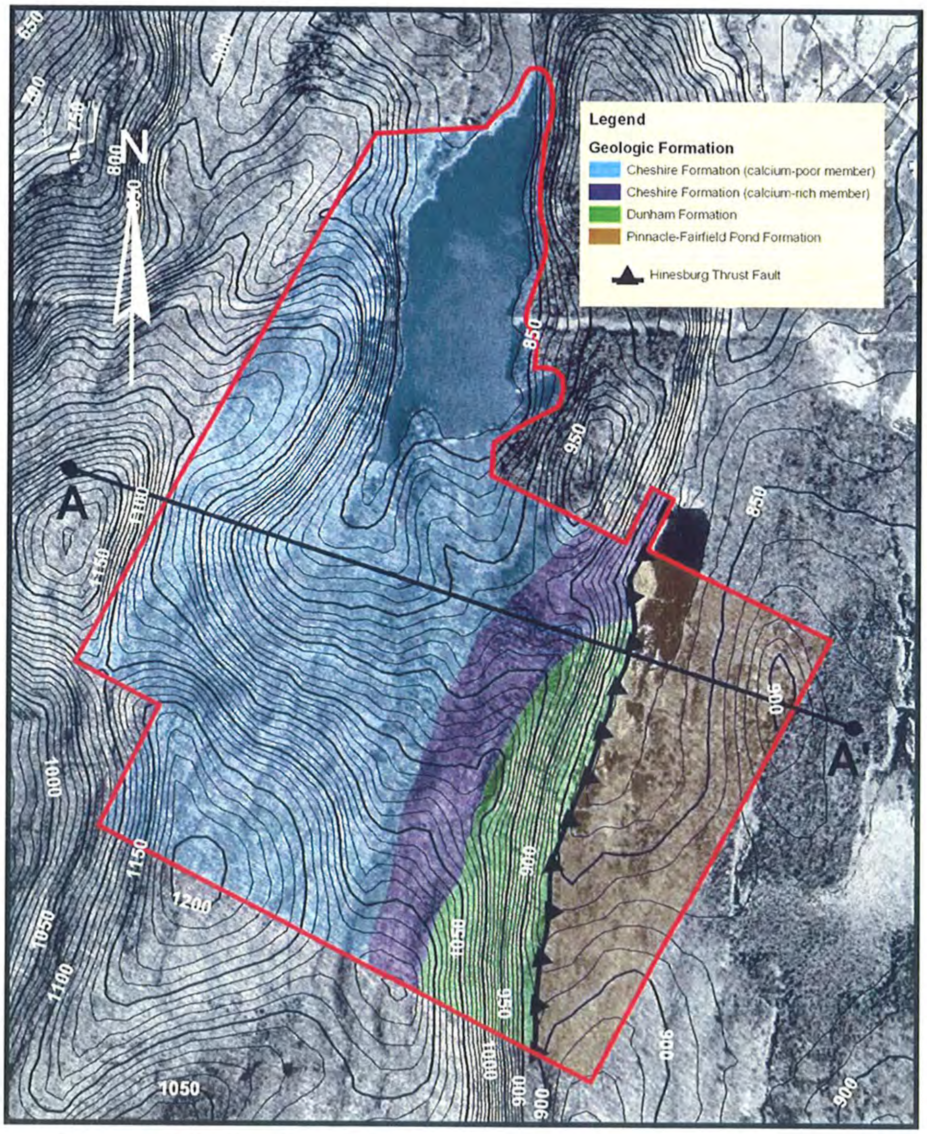


Figure 4: Bedrock geology of the Milton Municipal Forest (Dorsey et al. 1983).

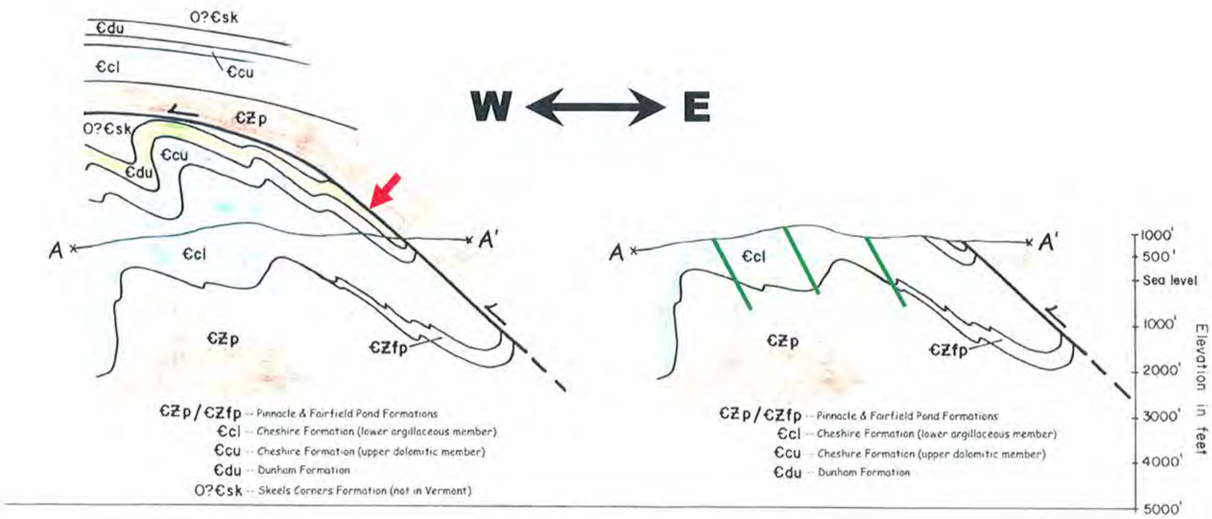


Figure 5a: Cross-section of Milton Municipal Forest bedrock before erosion. The line from **A** to **A'** represents the current land surface. Note that the layers of rock have been broken along the Hinesburg Thrust Fault (red arrow), and layers east of the fault have been carried up and over layers west of the fault (black arrows show direction of movement along the fault). Also note the dramatic folding of the originally flat layers west of the fault.

Figure 5b: Cross-section of Milton Municipal Forest bedrock after 435 million years of erosion. Many thousands of feet of rock have been eroded away to expose the formations and thrust fault as they are now seen in the MMF. Note the correspondance to the bedrock map in Figure 4. Green lines show the general orientation of striations and schistocity.

many places it is exposed and easily observed. This map shows four different "Geologic Formations." A formation is a group of rocks of similar type, though there can be large variation in the specific appearance and composition of rocks within a formation. Also, though our map shows distinct boundaries between formations, in reality these formations tend to grade from one to the next with no distinct separation between them. The geologic formations of the MMF are described next. The descriptions are based on the work of Dorsey et al. (1983).

The Cheshire Formation

The Cheshire Formation is composed mainly of quartzite, a metamorphosed sandstone. The western portion of this formation (blue) in the MMF originally contained a relatively large amount of clay, and is thus very fine-grained. In some outcrops, this quartzite breaks into thin, sharp-edged plates (Figure 6) that may have been used by Native Americans to make projectile points and tools (see Cultural Resources). The rocks of the western portion of the Cheshire Formation (purple) contain varying amounts of the mineral dolomite. As mentioned previously, dolomite is a calcium-rich mineral. Calcium is an important nutrient for plants, and unique plants and plant communities are often found growing on land underlain by rocks containing dolomite.

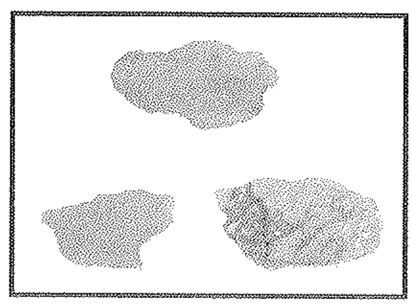


Figure 6: An outcrop of quartzite (left) and flakes of quartzite (above).

The Dunham Formation

The Dunham Formation (green) contains a rock called dolostone, which is also largely composed of calcium-rich dolomite. Again, this area may be a place to look for unique plant and/or plant communities. Many outcrops of dolostone in the Milton Municipal Forest have erosion-resistant veins of white quartz running through them, while the dolomite itself is quite soft and erodable. In these outcrops, one can easily see where the dolomite has worn away leaving the protruding veins of quartz exposed (Figure 7).

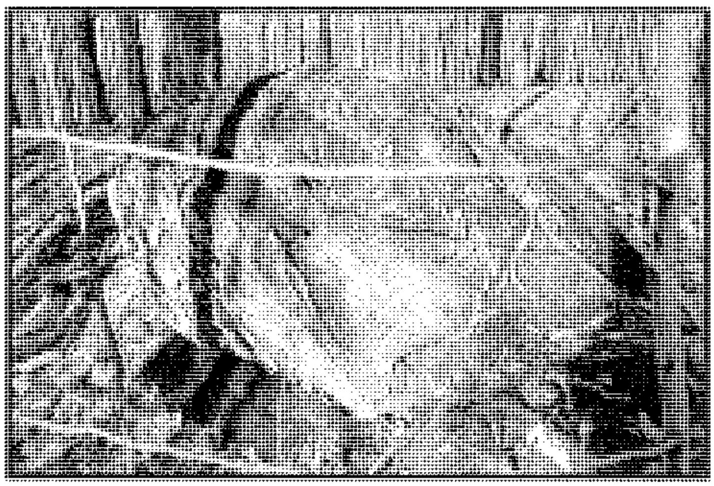


Figure 7: Dolostone boulder. Dolomite has eroded away leaving protruding veins of more erosion-resistant quartz.

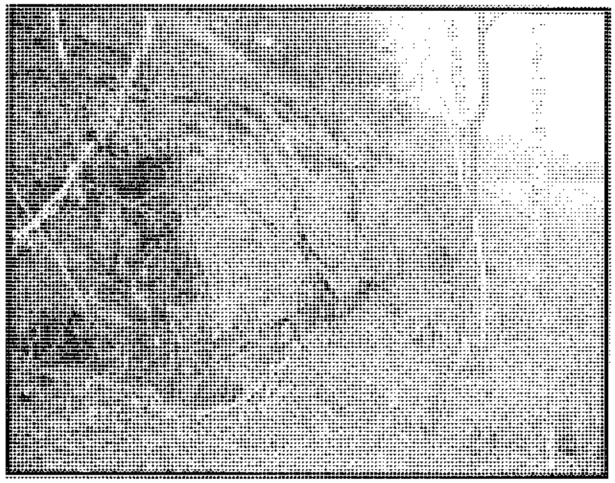
The Pinnacle-Fairfield Pond Formation

The Pinnacle-Fairfield Pond Formation is composed of more highly metamorphosed rocks called schist that are significantly older than the rocks of the Cheshire and Dunham Formations. These rocks are generally deficient in calcium and other plant nutrients (Figure 8).

The Hinesburg Thrust Fault

This thrust fault (see Figure 4) explains the difference in age between the rocks of the Cheshire and Dunham Formations and those of the Pinnacle-Fairfield Pond Formation. The schists of the east side were carried up and over the quartzites and dolostones of the west side by the compressional forces of continental collision.

In order to better visualize the structure of these formations and the thrust fault, Figures 5a and 5b present two cross sections of the Milton Municipal Forest's bedrock along the line **A-A'** shown in Figure 4.



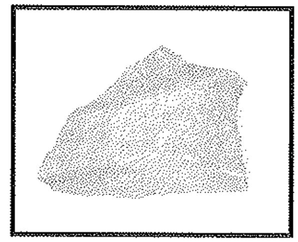


Figure 8: An outcrop of schist (left) and a chunk of schist (above).

In rocks subjected to intense compressional forces, minerals tend to line up and become flattened, and the rock tends to fracture, perpendicular to the direction of compression. The first process produces what geologists call "striations" and the second process produces "schistocity," the tendency of rock to fracture into thin plates. Both striations and schistocity can be seen in the bedrock of the Milton Municipal Forest, generally oriented north to south, and tilted to the west as shown in Figure 5b.

Surficial Materials

Surficial materials are loose sediments that have been deposited on top of bedrock by wind, water or glaciers. In the Milton Municipal Forest, the dominant surficial material is glacial till, also called basal till, which was deposited over much of the landscape of Vermont by the Laurentian ice sheet as it retreated into Canada at the end of the last ice age about 12,000 years ago. Glacial till is a very dense layer of sediments ranging in size from boulders down to very fine clay particles and jumbled together in an unsorted fashion. Because the glaciers traveled many hundreds of miles across the landscape—eroding, picking up and carrying rocks as they moved—glacial till may contain rocks of many types transported from far away. Thus, several rock types other than those described as bedrock above can be found in the MMF, but they occur as loose rocks rather than solid bedrock outcrops. The soils of the MMF formed in this layer of glacial till. Because it is very dense and contains a good deal of clay, water often drains very slowly through till and can remain "perched" in the soil layers that have formed in the upper portion of the till. Such perched water tables can have important consequences for runoff and soil erosion (see Impact Assessment).

Soils

Because they formed in glacial till, the soils of the Milton Municipal Forest are closely related and share many similar physical properties, though their appearance can vary widely. Most are identified as loams, having a relatively even mixture of sand, silt and clay particles. The main differences are in their depth to bedrock or glacial till and their position in the landscape on slopes ranging from flat to very steep. These two characteristics together determine how well water drains through a given soil, and thus how wet the soil will be in general. In the closely related till-based soils of the MMF, it is primarily the wetness of a given soil type that leads to its unique appearance. Having noted these general facts, it must also be said that soil formation is an extremely complicated process, and that soil properties can vary widely over very short distances.

Map 2 is a soil map of the MMF created from the original Chittenden County soil survey data collected between 1951–1966 (U.S. Natural Resources Conservation Service 1942). Each of the major soil types shown on this map will be described next. Descriptions are based on the U. S. Natural Resources Conservation Service Official Soil Series Descriptions. The relationship between these different soil types, and their relative positions on the landscape, are illustrated in Figure 9, a simplified cross-section of the soils of the Milton Municipal Forest.

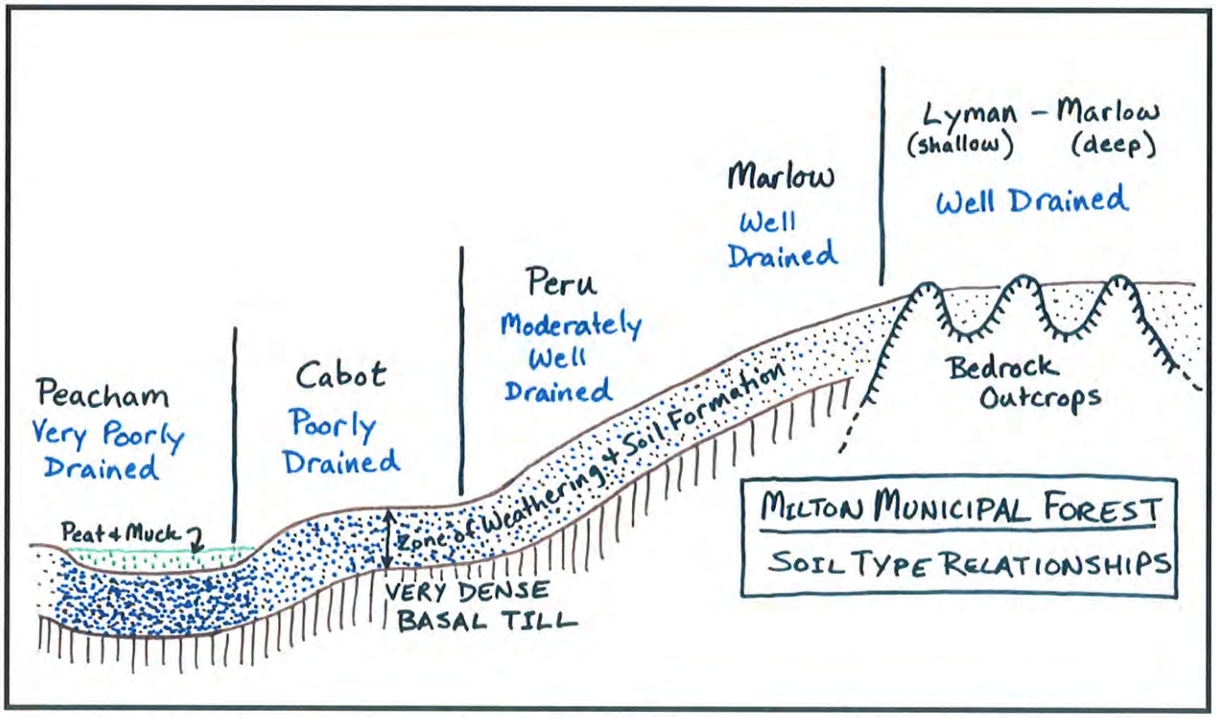


Figure 9: Simplified cross-section of the soils of the Milton Municipal Forest showing the relationships between different soil types. Note that soils have formed in dense glacial (basal) till in the "zone of weathering and soil formation." The density of blue dots indicates relative wetness.

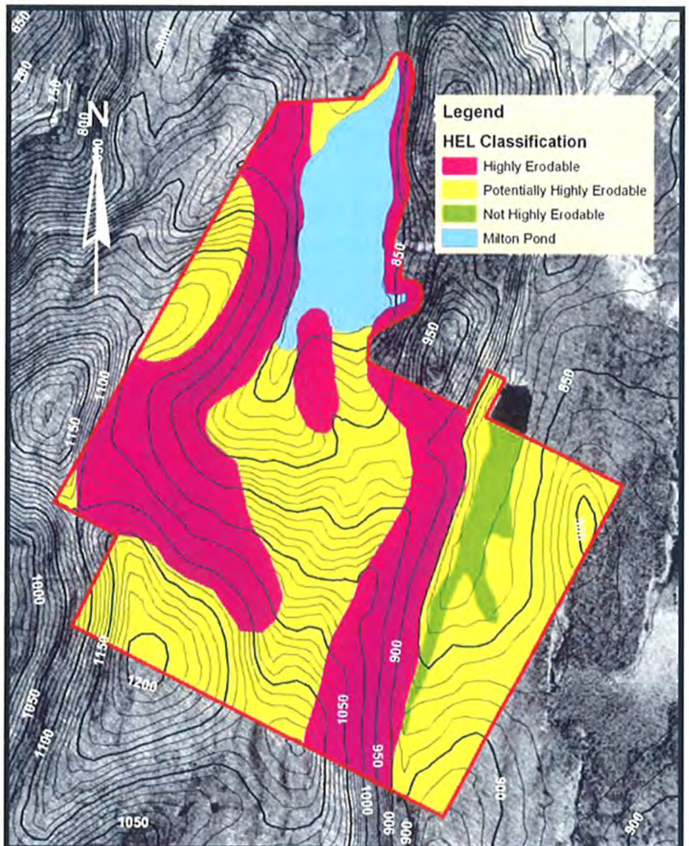


Figure 10: Erodable soils of the Milton Municipal Forest.

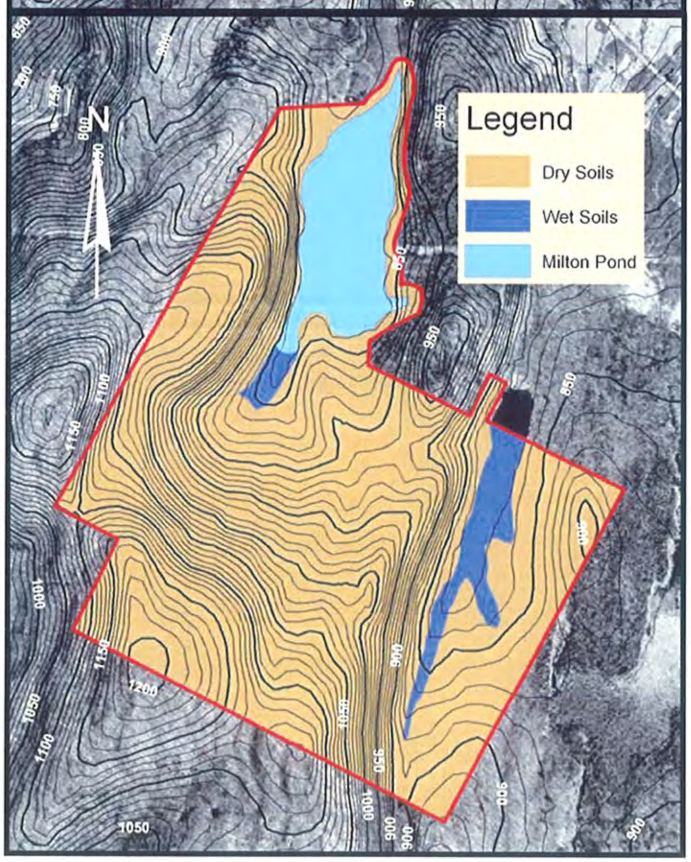


Figure 11: Wet soils of the Milton Municipal Forest.

Lyman-Marlow

Areas of brown and dark brown on the soil map (Map 2) contain two soil types, Lyman and Marlow, that are occur together in patches too small to map separately. Lyman and Marlow soils are essentially identical, except that Lyman is shallow while Marlow is deep. Lyman soils typically reach bedrock within 10 to 20 inches, while Marlow soils are typically 20-40 inches deep to a layer of dense glacial till and more than 60 inches deep to bedrock. Numerous bedrock outcrops explain the pattern of mixed soil types. Close to outcrops, where bedrock is near the surface, we find Lyman soils. Between outcrops, where bedrock is deeply buried, we find Marlow soils (see Figure 9). Bedrock outcrops also explain why these soil types are termed "rocky" and "very rocky." Both of these soil types are well drained, meaning that water drains out of them quickly, leaving them relatively dry compared to other soil types. They are considered highly erodable especially on steeper slopes, according to the U.S. Natural Resources Conservation Service Highly Erodable Lands (HEL) classification system.

Peru

Peru soils are till-based and closely related to Lyman and Marlow soils, but form on sideslopes where bedrock outcrops are few (see Figure 9). They are termed "stony" or "very stony," containing many loose stones of various sizes. Peru soils are typically 12-36 inches deep to dense glacial till and more than 60 inches deep to bedrock. They are "moderately well drained," thus wetter in general than Lyman and Marlow. They are considered highly erodable.

Cabot

Cabot soils are also till-based, but occupy a lower position on the landscape, typically at the base of slopes (see Figure 9). They are "silt loams," containing slightly more silt compared to soils previously described. They are typically less than 20 inches to dense glacial till and more than 60 inches to bedrock. Because of their position on the landscape and their relative shallowness, Cabot soils are poorly drained and can remain saturated for long periods of time. Especially when saturated, these soils are vulnerable to disturbance and compaction.

Peacham

Peacham soils form in the lowest depressions of the landscape (see Figure 9), with dense glacial till less than 20 inches from the surface. As a result, Peacham soils are very poorly drained and saturated with water much of the time. In fact, Peacham soils are so wet that plant materials falling on the surface of this soil decay very slowly. This organic material builds up into a thick layer of undecomposed plant parts called peat or muck that can be 6-16 inches thick. Similar to Cabot, these soils are vulnerable to disturbance and compaction when saturated.

Stetson

A small area of "Stetson Gravelly Fine Sandy Loam" at the north end of Milton Pond is unrelated to the till-based soils described previously. Stetson soils formed in sediments deposited by water flowing out from under a receding glacier. Particles in this soil range from clays and silts through sands and gravel, with the dominant component being fine sand. Stetson soils are generally 18-30 inches deep to layers of unweathered sands and gravel and greater than 60 inches to bedrock. They are very well drained. Stetson soils are often tapped as a source of sand and gravel for construction. It is no surprise, then, that we discovered an old sand and gravel quarry in this soil type on the north shore of the pond. Perhaps materials were taken from here to help with constructing the dam on Milton Pond (see Cultural Resources).

Peat and Muck

As mentioned above, peat and muck are terms for accumulations of undecomposed plant materials. Decomposition requires oxygen. Where soils are extremely wet, or where there is standing water, plant materials that fall here do not decay and turn into soil. Rather they pile up into sometimes deep layers of peat and muck. The large beaver meadow southeast of Milton Pond is an area that is almost constantly saturated, and which has also been periodically flooded by beaver dams built across the stream that drains the meadow. Under these conditions, a thick layer of peat and muck has accumulated over many decades.

Wet and Erodable Soils

As mentioned previously, the wet soils of the Milton Municipal Forest are vulnerable to disturbance and compaction, while many other soil types are vulnerable to erosion. In the Impact Assessment section of our report, we will explain why we believe soil disturbance, compaction and erosion are important to consider as threats to the soil and to other parts of the landscape. For now, we will simply provide a picture of where the wettest and most erodable soils are located in the MMF.

Figure 10 shows areas of "highly erodable" and "potentially highly erodable" soils according to the U.S. Natural Resources Conservation Service HEL classification system. Highly erodable soils are generally those occurring on the steepest slopes where water runoff is most intense. Potentially highly erodable soils may be the same soil types but occurring on gentler slopes. Under the right circumstances, such as extensive land clearing, these soils can also be easily eroded. Considering the location of erodable soils can inform management decisions such as the location of trails.

Figure 11 shows the location of the wettest soils of the MMF. Again, considering the location of these vulnerable soils can inform management decisions that might cause disturbance or compaction to these soils.

Cultural Resources

Introduction

In a landscape undisturbed by human beings, physical features described in the previous section would largely determine the kinds of trees and plants growing there, and the plant cover would in turn largely determine the kinds of wildlife living there. The Milton Municipal Forest, however, is not an undisturbed landscape. When we look at the forest today, we are seeing the combined result of natural processes that have shaped the landscape over millions of years and human uses that have dramatically influenced these processes over the past 200 years and more. Reading the combined natural and human history of a landscape is a daunting task. Especially in a landscape like the MMF that sees relatively little human use and is slowly reverting to a condition reminiscent of the pre-settlement forest, the human history has been obscured by ongoing natural processes. It is a story written in crumbling stone walls, overgrown cellar holes and vegetation patterns that are hard to pick out of the regrowing forest. To read this story, one must know what to look for. The purpose of this section is to provide information and tools for deciphering the complex human history of the MMF.

We define cultural resources as having three components. The first component includes specific, tangible cultural features that can be found on the landscape. These features can be very obvious, such as an old stone wall or cellar hole that is clearly human-made. Or they can be less obvious, such as a stand of white pines planted by a farmer in the 1930's to stabilize soil in an abandoned field that is now almost indistinguishable from the naturally regrowing forest. These features are the evidence of past human use.

The second component of cultural resources lies outside of the forest itself and consists of the documents, people and other sources of information that we used to interpret the cultural features and piece together the story of the forest's cultural landscape. Without these sources of information, the human history of the MMF could not be told.

Telling the human history of the MMF requires the interpretation and piecing together of information from all of the cultural features found in the forest and all of the documents and people we consulted. This history itself is the third component of cultural resources. The history of a landscape can be impaired if cultural features are destroyed, or if historical documents and knowledgeable individuals are lost. At the same time, the sense of a landscape's history—its historical integrity—can be impaired even when cultural features and historical resources are not lost. This can happen through natural processes, such as a regrowing forest, or through intensive human development, such as the construction of modern buildings, roads and other structures. Consider, for example, that the Gettysburg Battlefield would not provide the same sense of history if it were covered with a housing development, even though it is still the same physical place. Similarly, a Milton Municipal Forest that has been greatly altered by development might not have the same historical integrity it does now, even if old foundations and stonewalls can still be found. The value of the MMF's cultural features and the story they tell are considered in this context.

Methods

In order to provide an inventory of the people and documents that are critical to the telling of the Milton Municipal Forest's human history, we enumerate our sources of information in this methods section and cite them throughout the text. Our search for historical documents began in the Special Collections Department at the University of Vermont. The *Atlas of Chittenden County*, by F. W. Beers, originally published in 1869, and the 1882-83 *Gazetteer and Business Directory of Chittenden County*, compiled by Hamilton Child, were primary sources found there. Land ownership history from the mid-1800's to the present was reconstructed by consulting deeds and maps held in the Milton Town Clerk's office. Further information about land ownership history was gained through personal interviews with landowners currently abutting the forest, and with other residents of Milton who possess knowledge of the forest and the people who lived and worked there. Specific cultural features were found during numerous visits to the forest. A global positioning system (GPS) unit was used to record the location of every feature found, and a geographic information system (GIS) software package was used to create a Cultural Features Map. Because cultural features can be difficult and time-consuming to locate in the forest, this map should not be considered complete. It is likely that the MMF contains more cultural features to be discovered!

Using the information derived from these sources of information, we provide a chronological timeline and a description of specific cultural features in order to paint the compelling story of the MMF's human history.

Pre-settlement History: 9500 B.C. – 1600 A.D.

We did not discover evidence of pre-settlement Native American use in the Milton Municipal Forest. However, this does not mean that such evidence is absent. The human history of the Vermont landscape is thought to have commenced around 11,500 years ago as the Laurentian ice sheet retreated north into Canada at the end of the last ice age (Haviland and Power 1994). As the ice retreated, vegetation began to recolonize the barren landscape that had been stripped of all life by the ice. During the early part of the period between 9500 – 7000 B.C., the area of the Milton Municipal Forest may have been covered by alpine tundra, the first vegetation that could handle the colder climate and exposed till left in the wake of the glaciers. A thin forest of spruce, fir, and birch may have crowned the highest points of land around the forest. The early paleoindians who inhabited this landscape were a semi-nomadic people who are known best as hunters of big game such as caribou and wooly mammoths. The high ground of the Milton Municipal Forest, surrounded by lower land of the Champlain Valley, may have been an excellent vantage point from which to monitor migrating herds of big game across the open landscape.

As the post-glacial climate warmed, dense forests invaded the open landscape and the types of animals living in these forests changed. Being entirely dependent on the land for their sustenance, Native American cultures evolved along with the changing forests and wildlife populations, passing through what archaeologists have identified as the Archaic Period (7000 – 1000 B.C.) and the Woodland Period (1000 B.C. – 1600 A.D.) (Consulting Archaeology Program 2003). The evolution of Native American culture through these lengthy periods has been deduced through the painstaking analysis of cultural remains such as projectile points, stone tools, pottery shards, human and animal bones, and even shreds of textile baskets and clothing, among many other items manufactured and used by Native Americans. If any of these cultural remains are present in the Milton Municipal Forest, they have likely been buried by many, many years of soil formed from the annual fall of leaves from the hardwood forest. However, Milton Pond is an area of great interest to the archaeologists we consulted. They assessed the likelihood of finding Native American cultural remains in the area around the pond to be very high (Crock, personal communication; Dillon, personal communication). The Vermont Division for Historic Preservation's *Guidelines for Conducting Archaeology in Vermont* (2002) include a model for predicting the probability of finding Native American cultural remains in any given location. Using this model, many areas of the Milton Municipal Forest score high for the following features:

- Proximity to a pond or lake (a source of water and food)
- Proximity to a wetland (a source of plant and animal foods)
- Elevated landforms such as knolls or ridge crests (vantage points to watch for enemies or game animals)
- Outcrops of stone used to make tools and weapons (quartzite was frequently used to make projectile points and tools)

Figure 12 shows a map of the possible location of Native American cultural remains based on areas in and near the Milton Municipal Forest that possess the above combination of features.

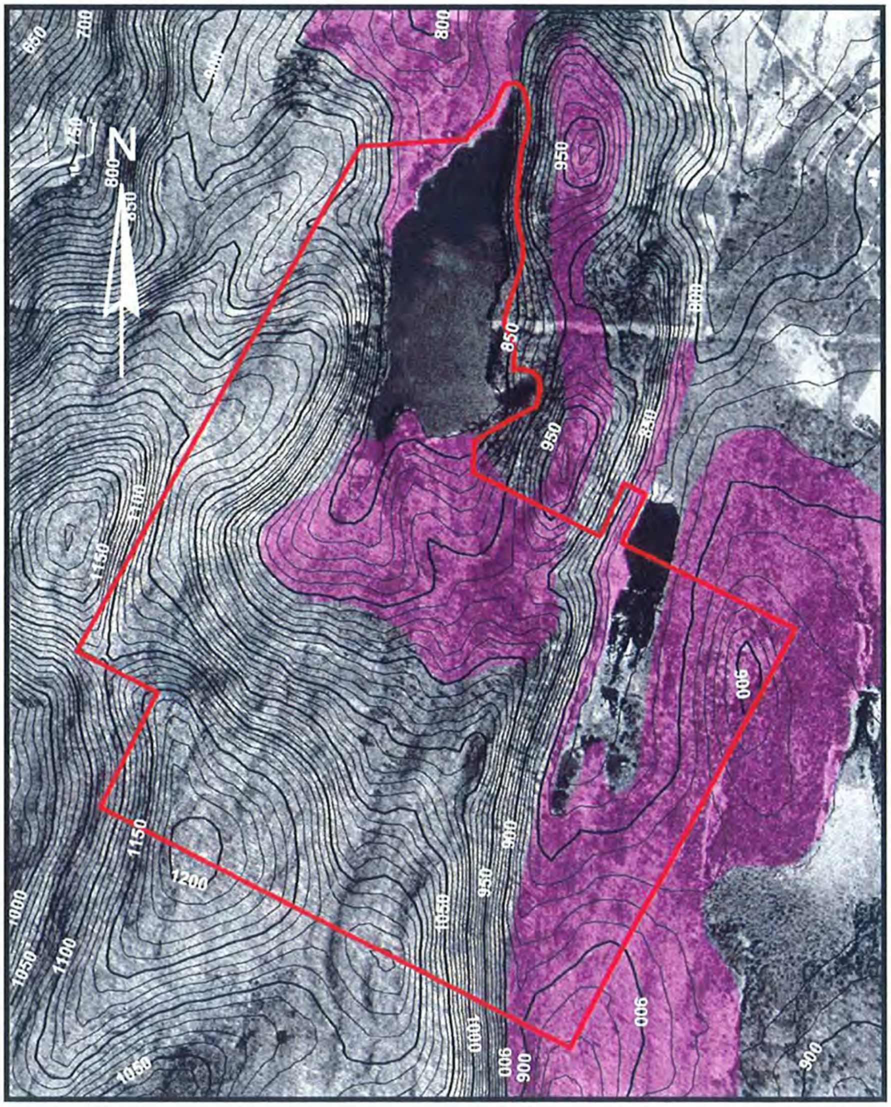


Figure 12: Hypothetical map showing the possible location of Native American cultural remains in and near the Milton Municipal Forest.

In 1609, Samuel de Champlain became the first European to set eyes upon the landscape of Vermont. He commented on "fertile fields of maize," growing in the Champlain Valley (Haviland and Power 1994). The Native Americans who lived in Vermont at the time of European contact were the Western Abenaki, a people who hunted, fished and cultivated the forests, waters, and fields of the Champlain Valley. By the time the story of the Town of Milton begins, 150 years after European contact, the populations of Western Abenaki had been so reduced by war, disease, cultural assimilation and the encroachment of settlers into traditional hunting and agricultural land, that the MMF had likely reverted to an uninhabited wilderness.

From Wilderness to Municipal Forest: 1600 – Present

The New Hampshire Grants

In 1741, New Hampshire became a separate English colony under the governorship of Benning Wentworth. At this time, Vermont did not exist, and the western boundary of New Hampshire was unclear. During the period of 1749–1764, Wentworth divided up more than half the land that is now Vermont and granted it to various "proprietors," most of whom were wealthy, out-of-state land speculators hoping to make a profit by selling their grants sight-unseen to homesteaders (Albers 2000).

The Town of Milton was chartered on June 8, 1763 (Child 1882). Governor Wentworth granted 27,616 acres in the town to 62 proprietors. However, there was no permanent settlement in the town until the dangers of the Revolutionary War had passed (Hollenbeck 1976). In 1791, the population of Milton was just 282 people (Beers 1971). The original boundaries of the New Hampshire Grants can be seen on an 1869 map of Milton found in the *Atlas of Chittenden County*, by F. W. Beers (Figure 13). What is now the Westford Road is shown on this map, along with Milton Pond and an old town road east of the pond that was discontinued in 1958 (Milton deeds). The Milton Municipal Forest, therefore, appears to lay in the vicinity of lots 51^4, 52^4, 53^4, and parts of lots 58^3 and 57^3. However, because these lot lines were drafted in New Hampshire by people who had never seen the area, they have little relationship to the actual features and

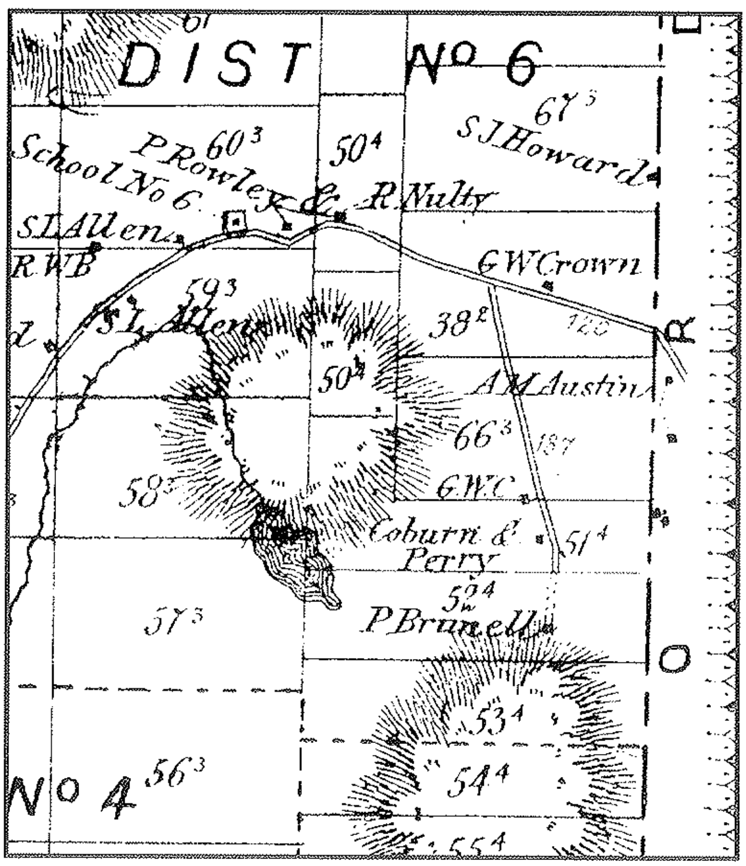


Figure 13: 1869 map of the area surrounding Milton Pond (Beers 1971). Location of pond and topography are inaccurate.

topography of the landscape, and they were often abandoned by settlers shortly after arrival in an area.

The Legacy of the Early Settlers: 1785 – 1850

The early settlement history of the Milton Municipal Forest must be pieced together from the collapsed stones of cellar holes and stone walls and the faded ink of 200-year-old deeds. There are still many fascinating questions remaining to be answered, and the chronology presented here should not be considered absolutely complete and accurate. Unless otherwise cited, the history presented below is a reconstruction from deeds and maps found in the Milton Town Clerk's office (Milton deeds).

To the best of our knowledge, the first Americans to settle in the vicinity of Milton Pond were the brothers David and Joseph Austin. Joseph Austin settled along what is now the Westford Road on land north of Milton Pond, and in addition to his farm, Joseph owned and operated a hotel in Milton. David Austin settled on land west of his brother, closer to the Westford town line. Joseph had 5 children and David had 12 children (Child 1882), and town records suggest that much of the land surrounding Milton Pond was settled by the numerous children of the Austin brothers. The precise location of each farmstead is very difficult to determine, however. For example, land near David's farm was settled by one of his sons, Ethan, and his wife, Clarissa. This land then passed to Ethan and Clarissa's daughter, Veronica, and her husband, George W. Crown, at some point in the early 19^{th} century. Two farmsteads owned by George W. and Veronica Crown in 1869 are shown on the Beers map (Figure 13). A second family to settle in the area was the Allen family, but their history and the location of their farms are even more unclear. The building labeled as "School No. 6" in the 1869 Beers map (Figure 13) was originally known as the "Allen School" (Fitzgerald, personal communication). Each of these families had their own cemetery, and both the Austin and Allen Cemeteries can still be found today along the Westford Road (Figure 14).

Figure 14: The grave of Joseph Austin in the Austin cemetery on Westford Road. The tombstone reads, "Joseph Austin…Died Feb. 27…1839…Aged 82 years." The brass medallion left of the grave reads, "Veteran of the Revolutionary War." The cemetery contains about 15 graves, some just makeshift stones with no inscriptions, a sign of hard times.

From the start, settlers struggled to make a living in the uplands of Vermont. Though the lowlands of the Champlain Valley and major rivers in Vermont possess extremely fertile soils, the till-based soils of the uplands are often infertile and stony (see Physical Features inventory). Referring back to our inventory of soils, phrases like "very rocky" and "extremely stony" give a hint as to the challenges settlers would face in attempting to farm these lands. In addition, since many settlers had purchased their land sight unseen from out-of-state proprietors, they were often shocked to find such unfriendly conditions. Nevertheless, these early "hill farmers" began clearing the wilderness with vigor (Figure 15). The original forest area of Vermont, estimated at 95% of the state, had been reduced to just 37% by 1880 (Klyza and Trombulak 1999). It is likely that by the middle of the 19th century, most of the land of the MMF, except for the steepest, rockiest slopes on the west and east sides of Milton Pond, had been cleared of its original forest cover. Any fertility that had accumulated through thousands of years of leaf litter input and soil formation was quickly depleted within a few growing seasons, and many hill farmers turned to grazing sheep. The early 19th century provided an economic boom in wool

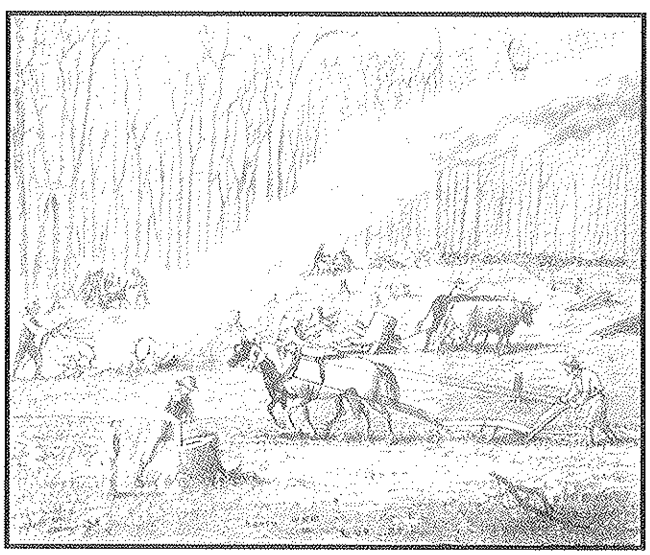


Figure 15: Clearing the forests of Vermont (Albers 2000).

exports, and Vermont became world famous for its Merino sheep. This economic boom crashed by 1840, however, and Vermonters began to leave the state in droves for the more fertile lands and more promising opportunities of the West (Albers 2000). This pattern of boom, bust and exodus is evident in the early population of Milton. From 1790 to 1810, Milton grew from 282 to 1548 residents, more than 100% per decade. Between 1810 and 1850, growth slowed to 20% per decade or less, the population peaking at 2451 residents. By 1860, the population had declined to 1963 residents, and this decline continued through the end of the century (Beers 1971). Many hill farms were abandoned during this exodus and began a 150 year process of slow decay.

Most of the specific cultural features discovered in the MMF date to the early and mid 19th century. Because it is difficult to trace the records of land ownership back this far, we were not able to definitively determine the ownership history of each cultural feature found. Our Cultural Features Map (Map 3) shows the location of each feature, and Appendix A provides a catalog and description of these features. This map and appendix provide the tools needed to locate and interpret the legacy of cultural features left behind by the MMF's earliest settlers.

Land Consolidation: 1850 – 1881

As settlers left Vermont, land was frequently consolidated into larger farms, owned by a generation of farmers who would commit themselves to an extended struggle to make the land produce. Many of these farmers were Irish or French Canadians seeking opportunity in America and often settling on marginal land abandoned by the earliest American settlers (Dorney, personal communication). Evidence of this consolidation can be found in the MMF's history. For example, in 1849 and 1857, four farms totaling 400 acres were sold by four members of the Austin clan to Albon M. and Matilda P. Austin. The homestead of Albon and Matilda can be seen on an 1857 map of Milton by H. F. Walling (Figure 16). This homestead became known as the "Austin Farm" and was located in the vicinity of the residence now occupied by Geof and Connie Plunkett. The 400-

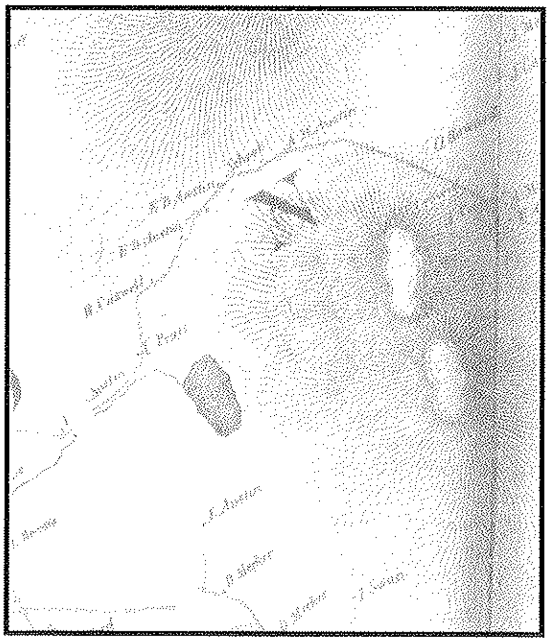


Figure 16: 1857 map of the area surrounding Milton Pond (Wallings 1857). Location of pond and topography are very inaccurate.

acre farm likely included the northern end of Milton Pond, Parcel A (see Cultural Features Map, Map 3). In order to avoid economic ruin, farmers began a transition to dairy farming, cultivating grains solely to feed cattle and producing dairy products on the farms themselves rather than selling milk to creameries. In addition, farmers found many other diversified uses for their land. The abandonment of sheep farming, the growth of dairy farming and the intensive multiple-use of the landscape are reflected in the livelihood of Albon and Matilda Austin during the period 1850–1860. The *Vermont Agricultural Census* for 1850 and 1860 shows that Albon and Matilda possessed horses, dairy and non-dairy cattle, oxen, sheep and swine. They produced wheat, Indian corn, oats, and hay for fodder, and they grew Irish potatoes and orchard products (probably apples) for sale. In addition they made and sold large quantities of butter, cheese and maple syrup.

Land consolidation continued in the 1860's when Albon and Matilda's 400-acre farm was joined with 50 adjacent acres from Edgar D. and Ruth A. Austin whose two residences are also visible on Walling's 1857 map (Figure 16). In 1868, these 450 acres passed to Patrick Rowley and Robert Nulty who paid $4,500 down and received a $12,000 mortgage from a wealthy Milton industrialist, Jed P. Clark. The residences of Rowley and Nulty are clearly marked on the 1869 Beers map (Figure 13). These 450 acres, including the north end of Milton Pond, would be owned by Rowley and Nulty for the next 13 years, and by Robert Nulty for an additional 21 years after Patrick Rowley sold Robert his share of the land in 1881. Eventually, this land became known as the "Nulty Farm."

The first clear picture of land ownership surrounding Milton Pond is seen on the 1869 Beers map (Figure 13). Several names from this map can be combined with information from deeds to paint a picture of land ownership around the pond at this time. Hypothesized property boundaries are shown on our Cultural Features Map (Map 3). As previously discussed, George W. Crown owned 348 acres east of Milton Pond, including the east shore, Parcel B. Patrick Rowley and Robert Nulty owned 450 acres north of the pond, including Parcel A. These are the only two parcels for which we traced pre-1869 ownership. Paul Brunell owned 108 acres southeast of Milton Pond, including most of the land in Parcel D (blue). Charles Coburn and Lorenzo Perry owned approximately 130 acres, mostly within Parcel C (brown) west and south of Milton Pond. In addition, and not shown on the Beers map, Heiram B. Smith, a wealthy man who lived in town, owned an approximately 40-acre woodlot comprising the west half of lot 53[4]. The orange dashed rectangle on the Cultural Features Map is our best guess as to the location of this "Smith Lot."

Entering a New Century: 1881 – 1923

Between 1881–1923, the history of the land surrounding Milton Pond can be told in terms of the parcels identified on our Cultural Features Map (Map 3).

<u>Parcel A (purple)</u>: By 1881, Parcel A was part of a 450-acre farm owned by Robert Nulty. In 1889, Nulty was co-owner of Milton Pond with two other landowners, Arthur Martell to the east, and Walter Perry to the south and southeast (see Parcels B and C below). In this year, these three owners decided to lease Milton Pond for 15 years to Azro B. Ashley for the purposes of stocking and harvesting fish. The only stipulation was that Nulty, Martell and Perry would be able to fish from the pond (Figure 17). This lease has interesting possible ramifications for the fish species currently found in Milton Pond.

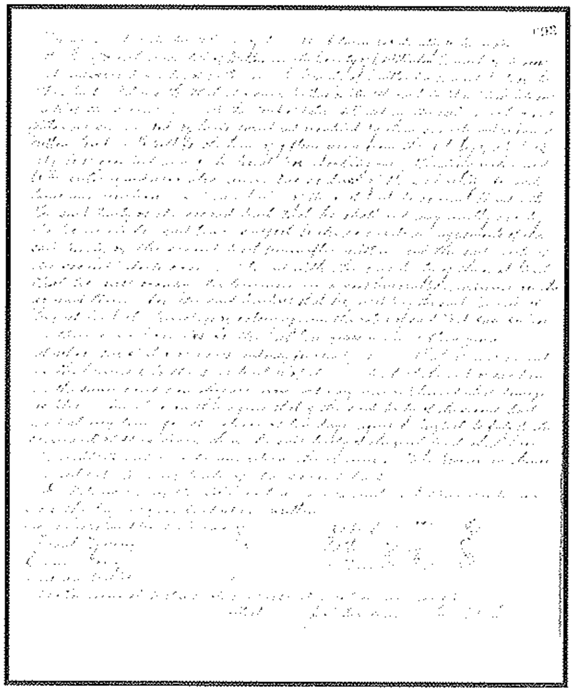


Figure 17: 1889 deed showing the lease of Milton Pond from Robert Nulty, Arthur Martell and Walter Perry to Azro B. Ashley for 15 years.

Robert Nulty finally sold his farm in 1902 to Homer E. Powell, a wealthy man who was involved in several land deals in the vicinity of Milton Pond. He held onto this farm for several years until his death. In 1922, Homer's widow, Lucia, sold the 450-acre Nulty Farm to George A. Thompson for $8,000.

Smith Lot (orange dashed): Heiram B. Smith owned this approximately 40-acre woodlot in 1869. At some point between 1869 and 1896, Heiram died and the lot passed to his widow, Almira. In 1896, Almira sold the lot to Homer Powell for $800, and this land too passed to Homer's wife, Lucia, after his death. Neither the Smiths nor the Powells are believed to have lived on this land.

<u>Parcel B (yellow)</u>: This parcel along the east shore of Milton Pond was part of George W. Crown's 348 acre farm in 1869. At some point between 1869 and 1882, George died and the farm passed to his widow, Veronica, and his daughter, Amanda. In 1883, Veronica and Amanda sold this land to Lucretia B. Witters who quickly resold the land to Arthur Martell for a profit of $1,100. Arthur Martell owned this farm for the next 47 years.

<u>Parcel C (brown)</u>: This 130-acre parcel (not including the Smith Lot) was owned by Charles Coburn and Lorenzo Perry in 1869. The history of this land after 1869 is unclear, but it seems to have remained in the Perry family until it passed to Walter Perry in 1886. In 1890, Walter sold this land for $1,400 to Homer Powell who immediately resold it to Ellen and D. D. Marquette. The Marquettes joined this land with land they had purchased four years previously (see Parcel D).

Parcel D (blue): By 1882 Paul Brunell had retired and leased this 108-acre parcel to his son, Peter. Between 1882 and 1886, Paul sold this land to Archibald and Olive Perry who in turn sold it to Ellen Marquette for $800. Parcels C and D (minus the Smith Lot), comprising a total of 238 acres, soon became known as the "Marquette Farm." The Marquettes owned this farm for the next 33 years, though they tried to sell out twice without success, in 1918 to Henri and Minnie Limoges, and in 1922 to Frank Adams. Town deeds suggest that the Limoges and Mr. Adams could not make their mortgage payments and reconveyed the land to Ellen Marquette. There is even reference to a legal dispute between the Limoges and Ellen Marquette. The only foundation in the Milton Municipal Forest that we were able to confidently identify is Foundation f, which was the home of D. D. and Ellen Marquette (Desranleau, personal communication). Today, this foundation looks more like a retaining wall along the trail that heads west from the beaver meadow southeast of Milton Pond (Figure 18). A large bed of lilies grows on a slope next to the trail near this foundation. Finally, in 1923, the Marquettes sold their 238 acres to the brothers George A. and Karl J. Phelps, co-founders of O. G. Phelps and Co., a store in Milton named after their father and run mainly by Karl. Evidence suggests that George and Karl did not live on the land around Milton Pond, though they did try to profit from the land in numerous ways, and probably camped there during sugaring season.

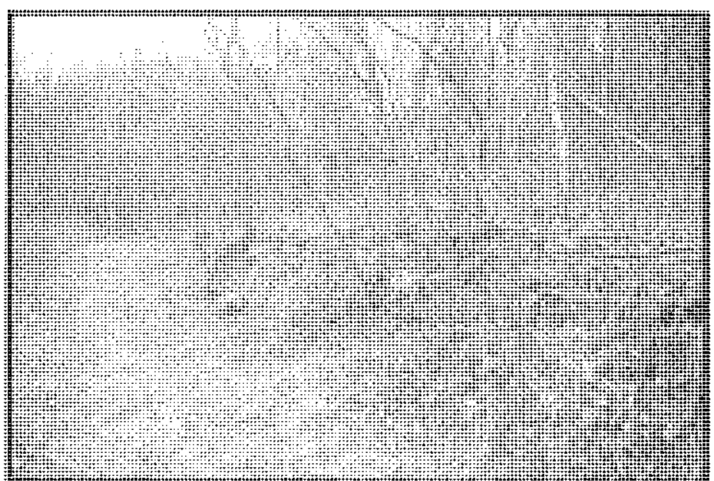
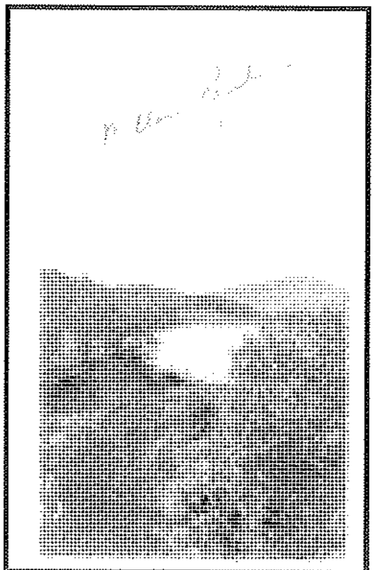


Figure 18: Foundation f, site of the Marquette home.

Equipment and livestock were sold along with the land in these exchanges. From examining the items and animals exchanged, it is clear that intensive multiple use of the Milton Municipal Forest landscape continued into the first quarter of the 20th century, with an ever-increasing emphasis on dairy farming which would require large areas of open land for pasturing cattle and for growing hay and feed grains.

Hill Farms to Drinking Water Supply: 1923 – 1969



Milton Pond from the south shore, early 1920's.

In 1919, John McGrath started the Milton Cooperative Dairy Corp. and served as its president for the next 34 years. One year later, McGrath, along with 19 other Milton residents, also formed the Milton Water Corp. and served as president of this company until his death. How are these facts connected and what do they have to do with the Milton Municipal Forest? A large creamery requires a large volume of water to operate. McGrath formed the Milton Water Corp. with the intention of purchasing and damming Milton Pond in order to provide a reliable water source for the Cooperative Dairy Corp.'s creamery in Milton (Hollenbeck 1976).

In 1923, four landowners held the land under and around Milton Pond: George and Ardelle Thompson, George and Karl Phelps, Lucia B. Powell, and Arthur Martell. On October 20 of this year, the Thompsons, Phelps and Mrs. Powell agreed to sell their land under Milton Pond, plus a buffer of 50 feet beyond the high water mark, to the Milton Water Corp. Permission was given to build a dam at the outlet and to flood the pond to the extent of the 50 foot buffer, in addition to building and maintaining ditches across the owners' lands. Assuming the pond was actually flooded to the maximum extent allowed by the deeds, the original shoreline may have looked something like the projected pre-1923 shoreline shown on our Cultural Features Map (Map 3). The Thompsons also reserved the right to cut 200 cakes of ice every winter (20 by 20 inches) from Milton Pond and pay the Water Corp. 4¢ per cake. Arthur Martell, who was notoriously difficult to get along with (Desranleau, personal communication), refused to sell his land, and thus the Water Corp. failed to acquire the east shore of the pond. The quarry shown on our Cultural Features Map (Map 3) at the north end of the pond may have served as a source of sand and gravel for dam construction (Figure 19). The fact that the Water Corp. purchased only the pond in 1923 shows that they may not have fully understood the connection between protecting water quality in Milton Pond and protecting the integrity of the pond's watershed. Uses such as cattle grazing and logging that could impact the water quality of Milton Pond would continue in the watershed for another 25 years. Much of the milk produced on the farms around Milton Pond would now be delivered to the Milton Cooperative Creamery (just like the water from Milton Pond!), rather than being processed on the farms themselves.

Figure 19: Quarry on the north end of Milton Pond.

In 1924, Lucia B. Powell sold the "Smith Lot" to the Phelps brothers for $2,000. George and Karl, under the name of O. G. Phelps and Co., now owned the entirety of Parcels C and D.

In 1930, Arthur Martell transferred his 348 acres east of Milton Pond to his daughter, Caroline, and her husband, Edward Desranleau, in exchange for a $9,000 mortgage. Arthur died shortly thereafter, and in 1932, Edward and Caroline sold a 100 foot strip (Parcel B) along the east shore of Milton Pond to the Milton Water Corp. Finally, the Water Corp. owned all of the land under and around the pond. Figures 20 and 21 show Edward and Caroline, and their son Emile, on the old Martell Farm.

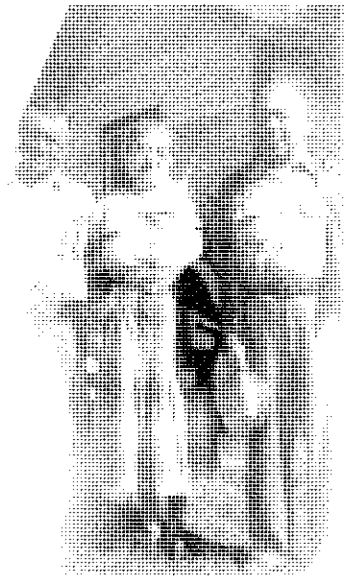


Figure 20: From right to left, Edward and Caroline Desranleau, and Elmer Murray (Caroline's brother) on the old Martell Farm.

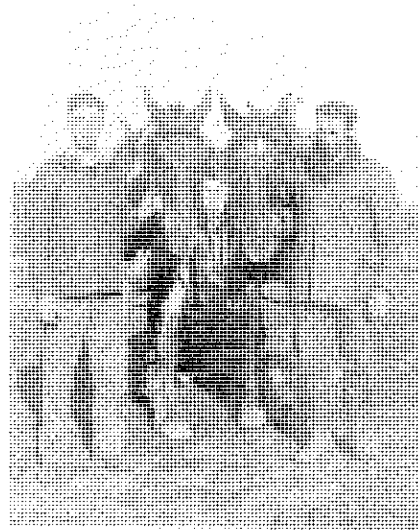


Figure 21: Emile Desranleau and a hired hand at work on the old Martell Farm, 1935.

The earliest image we found that provides a vivid picture of the entire landscape around Milton Pond is a 1942 aerial photograph used by the U.S. Soil Conservation Service (now the Natural Resources Conservation Service) to perform the original soil surveys of Chittenden County (Figure 22). This photo clearly shows the extent of open land in 1942. This open land is also shown as an area of green stippling on our Cultural Features Map (Map 3).

In 1946, the Phelps brothers leased a portion of their lands to the Atlas Plywood Corp. of Boston for the extraction of timber. Lands to be logged included the "Smith Lot" and the "Old Marquette Sugar Orchard." Based on the 1942 aerial photo and on our Cultural Features Map (Map 3), these lands must have included the forested land shown west and south of Milton Pond. Stipulations on this lease were quite specific. Timber was to be removed within three years of the lease. Trees less than 12 inches diameter at the stump were to be left, except ash for which any marketable size could be cut. Of course, this lease of land is no proof that the logging actually took place. If logging did take place, it must have been at a moderate level since the same areas were able to be intensively logged just 44 years later in 1986.

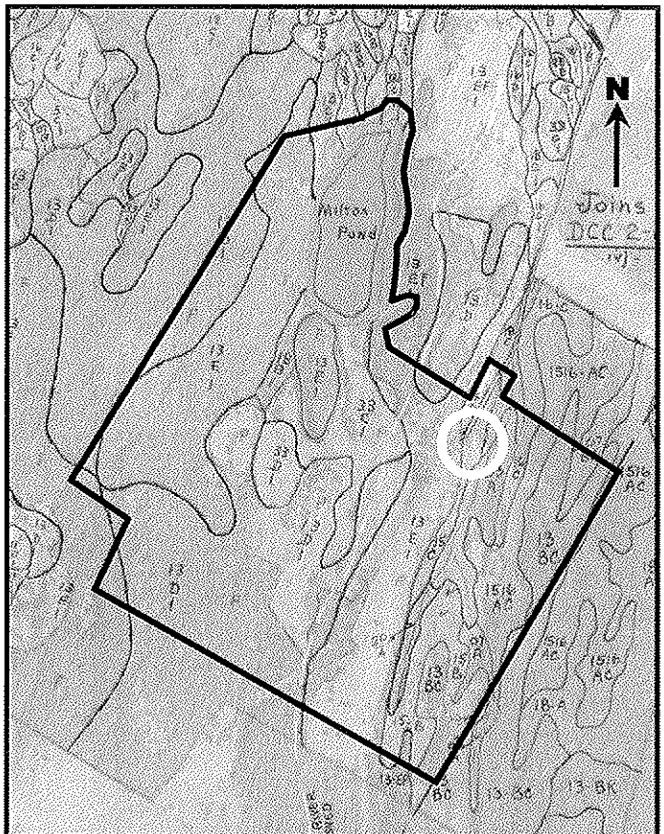


Figure 22: 1942 aerial photograph of Milton Pond and vicinity showing the extent of land clearing. Lines and labels are from the original soil surveys of Chittenden County. Open land is marked "P" for pasture, but may also have included hayfields. This open land is also shown as green stippling on our Cultural Features Map (Map 3). With close inspection, the Marquette home can be seen in the center of the white circle. This photo also shows a trace of the old town road east of Milton Pond. In this photo the road passes to the north of the Marquette home (Foundation f), high on the hillside as previously discussed. The current road passes east of the Marquette homesite before curving west away from the beaver meadow, as shown on our Cultural Features Map.

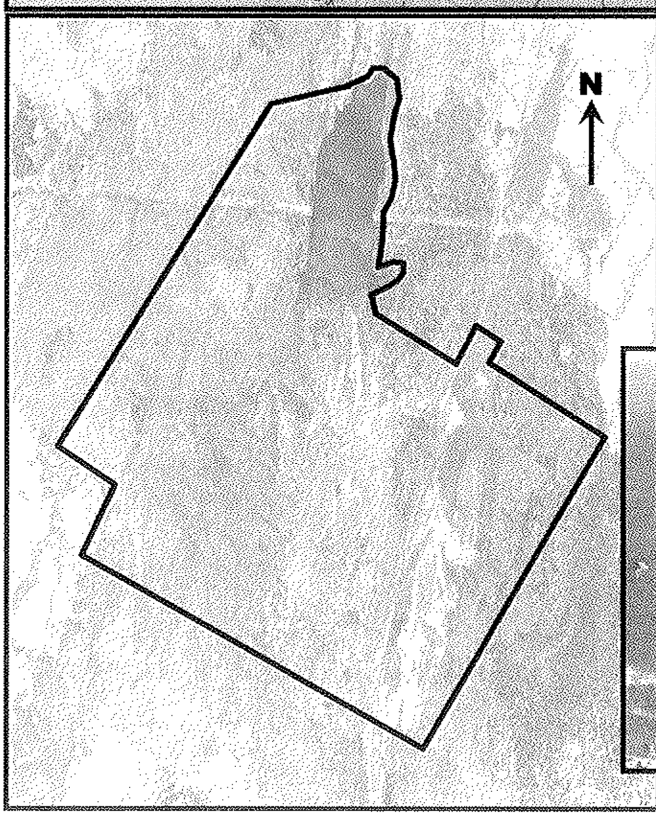
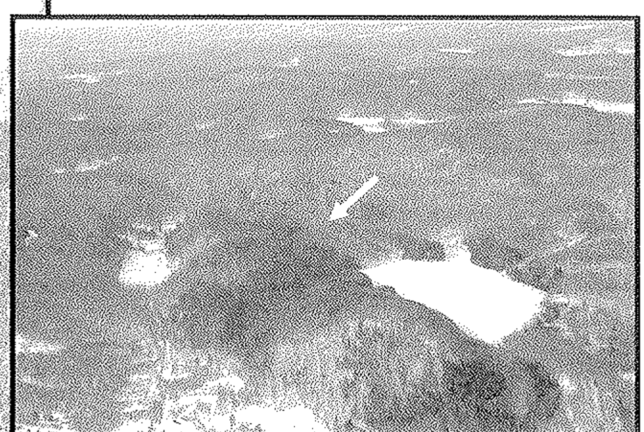


Figure 23: 1962 aerial photograph showing the same cleared area as the above 1942 photo, with individually regrowing white pines.

The photograph below, from April 2003, shows the area of denser white pine growth south of Milton Pond (white arrow).



At some point before 1948, George Phelps died and the interest in Parcels C (including the "Smith Lot") and D was divided between Karl Phelps and George's estate, administered by his widow, Ellen G. Phelps. At the same time, the Milton Water Corp. began to pursue the acquisition of the Milton Pond watershed, intending to end uses (i.e. cattle grazing and logging) that might impact water quality of the pond which was now also being used as a drinking water supply for the Town of Milton. The transactions through which the Water Corp. acquired the watershed are a bit complicated. Karl Phelps first sold his ½ interest in Parcels C and D to his daughter, Elizabeth, and her husband, John C. Fienemann. The Fienemanns quickly sold their ½ interest in Parcel C to the Water Corp. At the same time, Ellen Phelps sold George Phelps' ½ interest in Parcel C directly to the Water Corp. Parcel C, containing a large portion of Milton Pond's watershed (see Cultural Features Map, Map 3), was now fully owned by the Milton Water Corp.

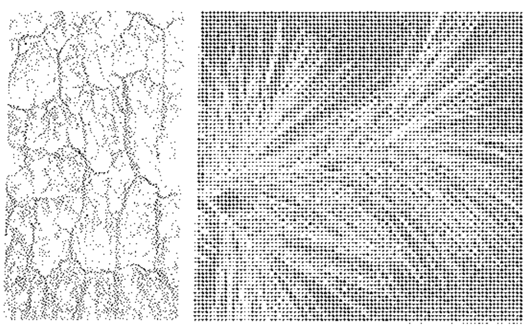


Figure 24: White Pine bark and needles (Sutton and Sutton 1997).

If all uses were truly removed from the Milton Pond watershed in 1948, then the forest must have begun to regrow at this time. Close inspection of a 1962 aerial photograph of the Milton Pond vicinity (Figure 23) shows that the open areas in the 1942 photo are still open, but they are filled with tiny black specks. These specks are individual white pines (Figure 24) which are typically the first trees to invade an abandoned field or pasture. They do well in open sunlight, grow quickly and develop many wide-spreading branches. Such open grown white pines are often called "wolf pines," and many such trees can be found within the previously cleared areas of the MMF (Figure 25). In the current forest, areas that fall within the stippled green shown on our Cultural Features Map (Map 3) generally have a greater density of white pines than areas outside the stippled green. In many places, this transition between uncleared (or recently logged) forest and previously farmed land is very dramatic. In addition, there is one area of dense pines (labeled "p" on our Cultural Features Map) which may have been planted in the 1930's or 40's during

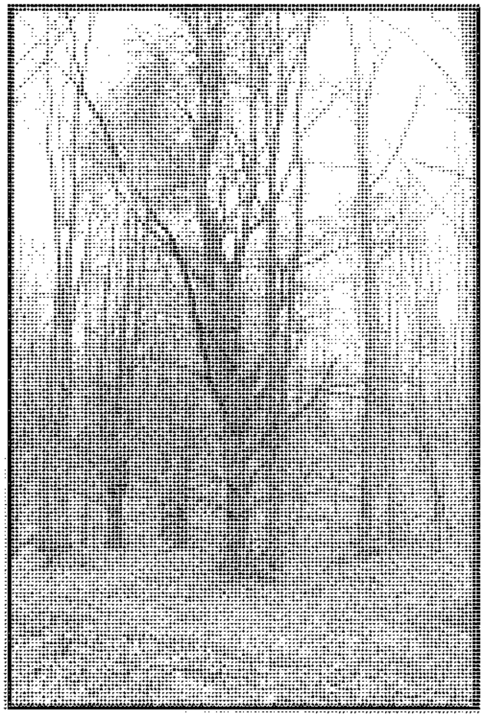


Figure 25: An open-grown white pine.

a time when the Soil Conservation Service encouraged farmers to plant softwoods in abandoned fields in order to prevent soil erosion (Dorney, personal communication).

Also by 1948, Arthur J. and Etta Pidgeon had purchased the Thompson Farm and the Arthur Martell Farm (Pidgeon, personal communication), and in 1950 they sold the 9.2 acres included in Parcel A to the Water Corp., adding to its ownership of the Milton Pond watershed.

Parcel D continued through a string of five different owners until 1963. Interestingly, a 1961 deed for the sale of this parcel notes that all buildings (including the Marquette home) had recently burned down. Finally, in 1963, the Milton Water Corp. also acquired this 108-acre tract, intending to build a second dam at the outlet of the beaver meadow east of Milton Pond in order to create a supplementary water supply (G. Plunkett, personal communication). Needless to say, this dam was never constructed.

By May 20, 1963, all of the land that now comprises the Milton Municipal Forest was in the hands of the Milton Water Corp. and served as the primary drinking water supply for the Town of Milton.

Public Ownership to the Present: 1963 – 2003

On August 27, 1968, the minutes of a meeting of the Milton Water Corp. record a decision to offer its land around Milton Pond for sale to the town. The price tag was $60,000. The town voted to complete this purchase, and created the Milton Water Department to oversee the drinking water supply (Hollenbeck 1976).

In the mid-1980's, the Town of Milton began a transition to the Champlain Valley Water District, a transition that required several years to complete. Since Milton Pond would soon no longer be needed as a drinking water supply, it is possible that the town administration began moving towards selling the land. Evidence of this trend comes from the nature of a logging operation that was performed on the western portion of the forest in 1986. In 1983, then County Forester Bill Hall performed a reconnaissance of the forest with the Milton Town Manager, Ernest A. Laird, and followed up with a letter containing recommendations. Hall noted that the best timber lay west of the pond, including mature sugar maple, ash, oak and beech. He described areas further east as, "composed of immature timber with a few scattered residuals" (Hall 1983). These areas correspond to the forested and cleared land shown in the 1942 aerial photo (Figure 22) and on our Cultural Features Map (Figure 6). Hall goes on to recommend that boundaries be clearly established and that, "only a good, reputable logger should be permitted to operate, due to the proximity of [Milton Pond] and its related erosion problems." Despite this advice, the logging that was performed in 1986 was poorly executed, though it did generate $50,000 in revenue for the town. Vermont Department of Forests and Parks memos from September, 1986, describe the logging operation as a "clobber job" and "an unmitigated disaster" (Vermont Department of Forests and Parks 1986). Perhaps the most obvious signs of this logging are the many scars adorning the trunks of remaining trees where they were struck by machinery or logs. This logging will likely affect vegetation patterns and the value of the timber resource in the MMF for decades to come (Hall 1993).

This logging drew the attention of a number of Milton residents, particularly those living near the forest, who did not previously recognize the extent and value of the land around Milton Pond (G. Plunkett, personal communication). In order to head off further damage and the possible sale of the land, 10 residents formed the Milton Pond Study Group in 1991 and persuaded the Select Board to designate the land around Milton Pond as a Municipal Forest. A revised 1993 Town Charter included the following clause in Chapter 1, Section 103C: "A Municipal Forest shall be established and it shall not be sold, leased or otherwise disposed of unless so voted by Australian ballot at a legally warned town meeting. This forest land shall be maintained by using proper forest and wildlife practices" (1993). A Town Forest Committee was created, and Bill Hall was engaged to perform a forest inventory and generate a forest management plan. The forest management plan and the Forest Committee's recommendations for management of the forest were submitted to the Select Board (Hall 1993, Town Forest Committee 1993). Because the Milton Select Board is familiar with these documents, we will not summarize their recommendations here.

In 1997, Milton was awarded a $5,000 Recreational Trails Grant and in 1998 the Vermont Youth Conservation Corps performed trail maintenance around the west and south shores of Milton Pond, including the construction of four footbridges across streams and wet areas (G. Plunkett, personal communication).

Over the next several years, the Town of Milton experienced controversy over the issue of providing public access to the Municipal Forest, which is currently surrounded by private land. Because we have not been asked to address the access question, we will not describe this history here.

As a final tidbit of the forest's fascinating human history, there is a small shack located on the southeast side of the lake. The shack is stocked with a small amount of equipment and food, and showed evidence of use during the winter of 2003. In addition, the builders of the shack have carried in a small boat and stored it here. This shack is shown on our Cultural Features Map (Map 3).

The Value of a Story

Clearly the landscape of the Milton Municipal Forest has a rich human story to tell, assuming one can read the clues written in often obscure cultural resources. These resources include all of the cultural features that can be found in the forest, all of the documents that pertain to the forest's history, and all of the people living in Milton and elsewhere who have some connection to the forest's past. All of these resources together tell the human story of the landscape, shedding light on the past of the MMF and the entire Town of Milton.

Vegetation

Introduction

Vegetation inventories can serve several purposes. One might want to know which plant species grow on the site, where they are found, and if they are healthy. If timber harvest is a potential use of the forest, information must be gathered about the size and health of the trees. Beyond this focus on individual species, inventories can also help us understand the associations that exist between different species of plants, as well as the associations between plants and the components of their environment, such as soil type, topography, or geology.

Methods

Four approaches were used to answer the questions above. First, to gain a general understanding of the current tree species composition of MMF, we mapped the predominant cover types of the forest. Second, because timber harvest was identified as a potential use for the MMF at the public meeting on January 28, 2003 (Gaherty 2003), we conducted a preliminary timber assessment. Third, we mapped the natural communities found on the MMF. A natural community is "an interacting assemblage of organisms, their physical environment, and the natural processes that affect them" (Thompson and Sorenson 2000). The information gained by mapping natural communities has several uses. Natural communities can provide a "coarse filter" for conserving biological diversity; by conserving an array of natural communities, scientists hypothesize that we will also protect the variety of individual species that make up the different communities. A map of natural communities also quickly communicates ecological information about a site to practitioners such as botanists, foresters, or planners (Thompson and Sorenson 2000). Fourth, we inventoried the plant species found in the MMF. Knowing the species of a site helps convey the character of the site and is useful for documenting occurrences of rare or invasive species. For each of the four approaches, the method and results of our inventory are detailed below.

Current Cover

We mapped the distribution of forest stands and open areas by combining information from aerial and infrared photo interpretation with field observation and the results of our timber assessment. The eight cover types we identified are described below and depicted on the current cover map (Map 4). The Beaver Wetland/Meadow was identified by the presence of active beaver activity, saturated or inundated soil, and a minimal canopy cover where a canopy was present. For the forested cover types, we named the type based on the most abundant overstory tree species.

Cover Types

Northern Hardwood Forest

This is the most common forest type in Vermont (Thompson and Sorenson, 2000). Sugar maple, yellow birch, and American beech are characteristically abundant in Northern Hardwood Forests; other species can include red maple, white pine, eastern hemlock, white ash, black cherry, basswood, and red spruce. All of these species were present in the area mapped as Northern Hardwood Forest. The most abundant species found in this area were sugar maple, red maple, yellow birch, and white ash. The remaining forested cover types below are variations on the Northern Hardwoods type.

Patchy Northern Hardwood Forest

To the west of the pond lies a Northern Hardwood Forest that was heavily logged in 1985-86. Although sugar maple, yellow birch, and American beech are a component of the uppermost canopy layer, or overstory, of the forest in this area, other species that seed into a forest following heavy logging, such as pin cherry and paper birch, predominate in large patches.

Hemlock-Northern Hardwood Forest

This type is found in bands around Milton Pond. Hemlock dominates the overstory here, although small inclusions of deciduous trees, especially northern red oak, are present.

White Pine-Northern Hardwood Forest

The area now occupied by this cover type roughly corresponds with an area that is known to have been relatively open in the 1940's. This is not surprising: White pine often colonizes abandoned fields (Wessels 1997). Although white pine is the dominant overstory species in this area, many of the characteristic species of Northern Hardwood Forests are present, particularly sugar maple and red maple.

Birch-Northern Hardwood Forest

The Birch-Northern Hardwood type is similar to the Northern Hardwood type but contains higher proportions of paper birch and aspen. Although this area was logged in the late 1980's, the trees are larger here than in the Patchy Northern Hardwood type.

Hemlock-Spruce-Northern Hardwood Forest

This type is found on a rise of land in the northeast corner of the MMF. The most abundant overstory species are eastern hemlock, red maple, and sugar maple. Many spruce saplings are present.

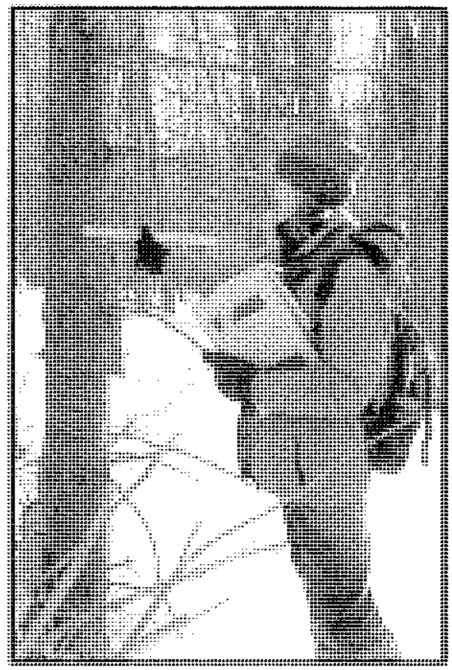
Red Oak-Northern Hardwood Forest

Northern red oaks in the MMF tend to be found on the tops of ridges or ledges or along side slopes (See section on Natural Communities). This patch was mapped because of the abundance of northern red oaks on this particular ridge top.

Beaver Wetland/Meadow

The Beaver Wetland/Meadow is described in detail in the section on Natural Communities.

Timber Resource



The timber assessment was designed to meet two goals. First, we wanted to be able to provide baseline information about the state of the timber resource on the MMF that the town of Milton could pass on to a certified forester, if it so chose. Second, carrying out the assessment would provide us with a way of moving across the land in a systematic way. The method of our assessment was in some ways similar to that of a traditional timber cruise. We overlaid a grid of 40 points on a map of the forest. At each point we recorded the species and diameter of each tree that was "in" the plot according to a ten-factor prism. We also recorded additional data at each point, such as topography, tree regeneration, and presence of disease. Because the area west of Milton Pond was so heavily cut in the 1980's, we chose to concentrate our grid points in the south-central and eastern portions of the forest.

Our method differed from a timber cruise in that we did not attempt to collect certain critical data (merchantable height being a good example) because we do not have the proper level of expertise. We would like to stress that we are not trained foresters; our timber assessment was just one small part of the work that a forester would do to evaluate the timber resource.

Table 1 summarizes information about each stand evaluated in the timber assessment. Additional data from the timber assessment can be found in Appendix C.

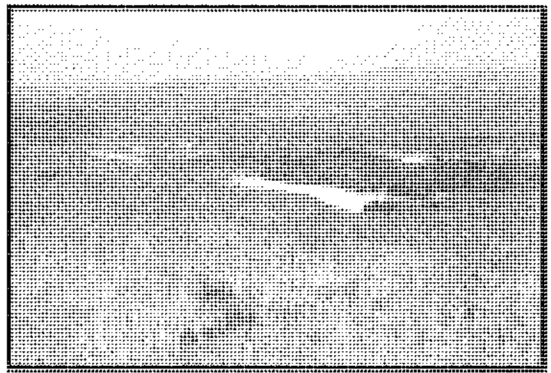
Cover Type	Acres	Plot Count	Basal Area (sq ft./acre	***Abundant Species***
Northern Hardwood Forest	137	7	69	sugar maple red maple yellow birch white ash
Hemlock-N. Hardwood Forest	24	1	110	eastern hemlock northern red oak
Birch-N. Hardwood Forest	69	9	112	paper birch sugar maple red maple aspen
White Pine-N.Hardwood Forest	59	16	92	white pine red maple sugar maple
Hemlock/Spruce-N. Hardwood Forest	15	2	100	red maple sugar maple eastern hemlock

Table 1: Summary of forest types, based on timber assessment data

In 1993, William Hall, the Chittenden County Forester at that time, wrote a forest management plan for the MMF. Hall noted, "Since this 350 acre watershed was cut heavily and indiscriminately in 1985-86, any commercial logging activities will have to be deferred for many years. However, it will be important to re-evaluate all stands in approximately ten to fifteen year intervals in order to clearly define future activities." Hall estimated that timber harvests designed to improve stand quality would be possible in thirty years (Hall 1993). Following a brief tour of the MMF with LIA Consultants, Mike Snyder, the current Chittenden County Forester, concurred with the findings of Bill Hall (Snyder, personal communication).

Natural Communities

Methods



Natural communities were mapped based on information from aerial photographs, satellite infrared images, bedrock geology and soil maps, topographical information, our own timber inventory data, current conditions observations, and spring ephemeral inventories. In April, we made an aerial reconnaissance of the site to observe larger vegetation and topographic patterns. Photos taken from the air were sharp enough for us to identify some trees by species, and, therefore, became another important reference. By compiling our field observations and published information, we were able to describe and delineate natural community boundaries within MMF. Most natural community types were named based on the designations described in *Wetland, Woodland, Wildland* (Thompson and Sorenson 2000). For a few natural community variations, we applied our own descriptive names.

Northern Hardwood Forest

Northern Hardwood Forest is by far the most common natural community in the state, covering gentle to moderate slopes below 2,700 feet (Thompson and Sorenson 2000). In MMF, Northern Hardwood Forest is located on moderately steep slopes composed of rocky to very rocky soils (Map 5). Aside from occasional seeps or stream channels, these soils are moderately well drained. This natural community has many variations, some of which we have identified at MMF and are described below.

The "pure" Northern Hardwood Forest of MMF is composed of yellow birch and sugar maple, as well as areas of red maple, hop hornbeam, white ash, beech, and aspen. In areas with a history of grazing, large "wolf pines" can be found. Portions of this natural community were heavily logged in 1985, which is reflected in the presence of tree species such as pin cherry, striped maple, and paper birch. It is expected that these patches of shade intolerant species will eventually be replaced by species such as beech, maple, and yellow birch. The northern hardwood forest understory is composed of young sugar maple, beech, and evergreen ferns. On less steep slopes, trout lily blankets the ground in the spring. Natural disturbances such as wind and snow/ice loading have led to tip ups, snags, and snapped branches.

Although Northern Hardwood Forest is very common in Vermont, there are few places where it has been left undisturbed by logging or clearing for agriculture. It is encouraging to note, however, that with time Northern Hardwood Forests have recovered well from these disturbances (Thompson and Sorenson 2000).

Red Oak-Northern Hardwood Forest

This variant of the Northern Hardwood Forest is mostly found on exposed ridgelines and moderate slopes in MMF (Map 5). The major difference between this natural community and the typical Northern Hardwood Forest is the heavy presence (past and present) of red oak. The soils here also appear rockier; outcrops, boulders and rocks litter the soil surface. Although portions of this community were logged in the 1980's, stumps of old oak can still be identified, living red oaks remain in the canopy, and some red oak regeneration was noted. It is possible that the Red Oak-Northern Hardwood Forest on higher elevation ridges and plateaus in MMF has acted as the seed source for the red oaks found on lower slopes.

Mixed in with oak in the overstory are white ash, yellow birch and some hemlock and aspen. The understory is composed of maple-leaved viburnum, striped maple, and regenerating hemlock and beech. A soil test in these areas revealed a pH of 6.5, suggesting circumneutral soils.

The successional trends and soil-vegetation relationships of the Red Oak-Northern Hardwood Forest are not well understood (Thompson and Sorenson 2000). Furthermore, much of this natural community type has been "highgraded" throughout the state in order to harvest valuable oak timber.

Typically a warmer climate species, distribution of red oak is somewhat limited by the cooler Vermont climate. For this reason it is generally restricted to warm, south-facing slopes and dry soils in Vermont.

Rich Northern Hardwood Forest

Another variant of the Northern Hardwood Forest, this natural community derives its name from the calcium-rich qualities of the soil and/or bedrock. Higher nutrient levels support species of trees and herbs that are generally not found on more acidic soils. An important process in the Rich Northern Hardwood Forest is the downslope movement of nutrients, termed "colluvial" processes. Minerals from enriched bedrock or soil move downslope and congregate in pockets or plateaus, thus providing the enrichment needed for certain plant species.

Figure 26: Wild leek carpeting the forest floor in Rich Northern Hardwood Forest.

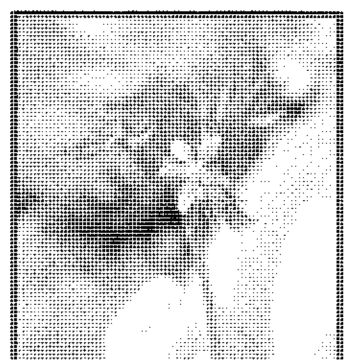


Figure 27: Blue cohosh, flowering in Rich Northern Hardwood Forest.

When found together, some species are considered "indicators" of richer soil. These include sugar maple, white ash, basswood, sharp lobed hepatica, dutchman's breeches, wild leek (Figure 26), blue cohosh (Figure 27), and plantain-leaved sedge, all of which occur in MMF's Rich Northern Hardwood Forest (Map 5). Other tree species in these areas include butternut and yellow birch. Plants typical of the Rich Northern Hardwood Forest show a distinct pattern in MMF. Drainages, the bottom of slopes, and pockets of lower elevation (some as small as 25 ft^2) frequently contained enrichment indicators, most likely a reflection of colluvial processes. These slopes and pockets contained moderately well drained to poorly drained soils, and were often adjacent to standing water or streams. The pH for these areas was 6.5 to 7.0 (neutral).

Though not a rare community in Vermont, the Rich Northern Hardwood Forest is of interest to many because of its distinct array of plant species. Typically found in small, isolated patches, its uniqueness stands out against the typical matrix of Northern Hardwood Forest. Fragmenting activities such as road building or massive topsoil removal would threaten the integrity of the Rich Northern Hardwood Forest by interfering with colluvial processes (Thompson and Sorenson 2000).

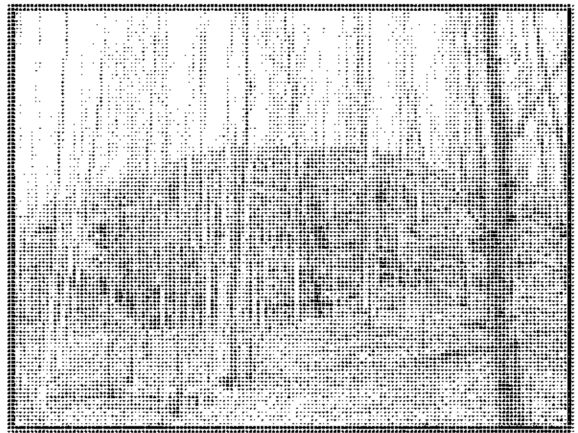
Hemlock-Northern Hardwood Forest

The general composition of this natural community is very similar to the Northern Hardwood Forest, except that it has a large amount of hemlock in its canopy. Technically speaking, hemlock may occupy up to 75% of this natural community type (Thompson and Sorenson 2000). Adjacent to the edge of Milton pond the hemlock does come close to such high proportions. It is possible that local beavers may be encouraging the hemlock to grow by removing its (tastier) hardwood competitors such as birch. Here, red oak and sugar maple are a part of the canopy, and young beech and hemlock are regenerating underneath. The soils are rocky, somewhat moist, and shaded by the heavy evergreen canopy above.

Red Spruce-Northern Hardwood Forest

Patches of red spruce and a few balsam fir are what makes this natural community stand out from the Northern Hardwood Forest matrix. Mixed into the canopy are paper birch, red maple, sugar maple, hemlock and white ash. Young red spruce are regenerating along with yellow birch, striped maple, and beech. This natural community is positioned on a rock outcrop with well drained soils.

Circum-neutral Ledges



Ledge outcrops are often nodes of biodiversity (Engstrom, personal communication). In areas where bedrock has enough calcium readily available for plant life, a unique assemblage of vegetation can be found clinging to what appears to be bare rock. Circum-neutral Ledges (referring to a pH of around 7.0) can be found in the southwestern region of MMF (Map 5). These Cheshire formation outcrops appear within the Rich Northern Hardwood Forest as well as within the Northern Hardwood Forest of MMF. Plant species on these ledges include waterleaf, dutchman's breeches, toothwort, ebony spleenwort, rock polypody, and fragile fern.

Hemlock Forest

There are two small areas around Milton Pond that are dominated by eastern hemlock trees (Map 5) (Figure 28). These cool, shady areas are composed of the steep slopes, bedrock outcrops and rocky soil that tend to support hemlock.

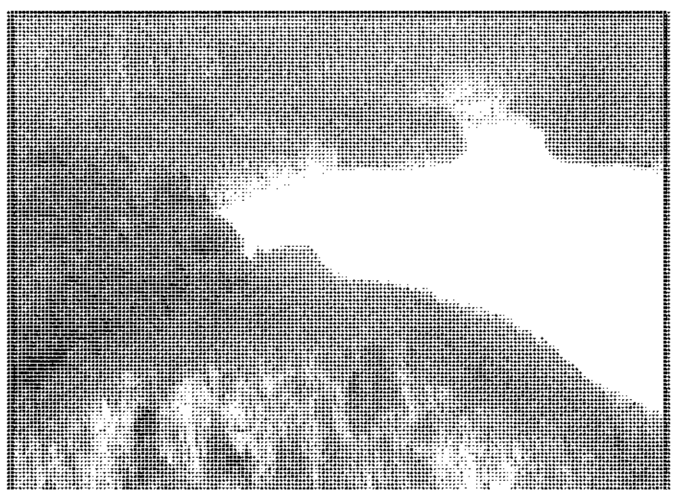


Figure 28: Hemlock Forest around Milton Pond. View is looking southeast. Hemlock forest is seen as a diagonal line through photo and a dark pocket towards the top of photo.

Mixed in with the hemlock are individual paper birch and spruce trees, although they are a minor component of the forest canopy. Due to the dense shade provided by the hemlock, groundcover vegetation is limited. Although beaver are active in these areas, their preferred food and building materials do not include hemlock. However, other natural disturbances such as windthrow and fire are a part of the history of these two areas. Approximately 40 years ago, a fire burned the steep slope on the east side of Milton Pond (C. Plunkett, personal communication).

Prior to European settlement, research suggests hemlock made up 10% of the Vermont's forests, while today it occupies less than five percent (Thompson and Sorenson 2000). Hemlock was once widely used for tanning leather during the 1700's and 1800's; a use that may have contributed to this decline (Thompson and Sorenson 2000). Because this tree is a late successional species, hemlock forests tend to remain relatively stable until disturbance allows for the regeneration of more shade intolerant species. A non-native insect called the Hemlock wooly adelgid is an introduced threat to the health of some New England hemlock forests, however there are no known records of it in Vermont (Forest Health Protection 2002).

Red Maple-Speckled Alder-Swamp

This natural community, located along the edge of the beaver wetland and the west side of Milton Pond, is characterized by disturbance (Map 5). Beaver activity is constantly altering both the water levels and the vegetation in these areas. The result is a community full of sprouting speckled alder, young red maples, some willow shrubs, nannyberry, and a few older red maple trees. Overall the swamp is very open, dominated by ground cover such as ostrich fern, sensitive fern, sedges. The soil is very poorly drained and is mapped as peat and muck to the south of the beaver wetland. West of Milton Pond the soil has a higher mineral component, and grades quickly to upland. Both sites have hummocky ground, dead rotting logs, and abundant beaver chew.

Red Maple-Ash-Speckled Alder-Swamp

This community is very similar to the Red Maple-Speckled Alder-Swamp, except that it [redacted] end in the early 1970's (G. Plunkett, personal communication). Today the stumps are all broken off at about the same height as that old beaver dam, making it difficult to determine species. Our assessment, however, suggests there may have been hemlock growing here prior to beaver activity.

Seep

Wet areas that seem to "leak" out of rock or form wet pools year round are termed Seeps. In the MMF, seeps occur at the base of slopes or on the slopes themselves, where water leaks out above an impenetrable layer in the soil or fractures in the rock (Map 5). While the Seeps all occur in forested regions, herbaceous growth such as touch-me-not and sensitive fern mark the change in soil moisture. Typically, these Seeps contain pools of shallow water, water stained leaves, and very muddy ground. On rocky slopes the Seeps are indicated by moss growth and water stained rocks.

Plant Inventory

A list of all plant species encountered in MMF was compiled throughout the winter and spring of 2003 (Appendix D). As spring ephemerals began to emerge during the last two weeks of April, time was focused on looking for new species to add to the list. Observations made by other field scientists were also solicited in order to provide a more comprehensive overview of plant species in MMF.

Red trillium (*Trillium erectum*)

It should be noted that the plant list is by no means complete. Most of the ferns, flowering plants, and shrub species on the site are not visible or recognizable until the summer months. For this reason, the plant species list is heavily weighted towards trees and spring ephemerals.

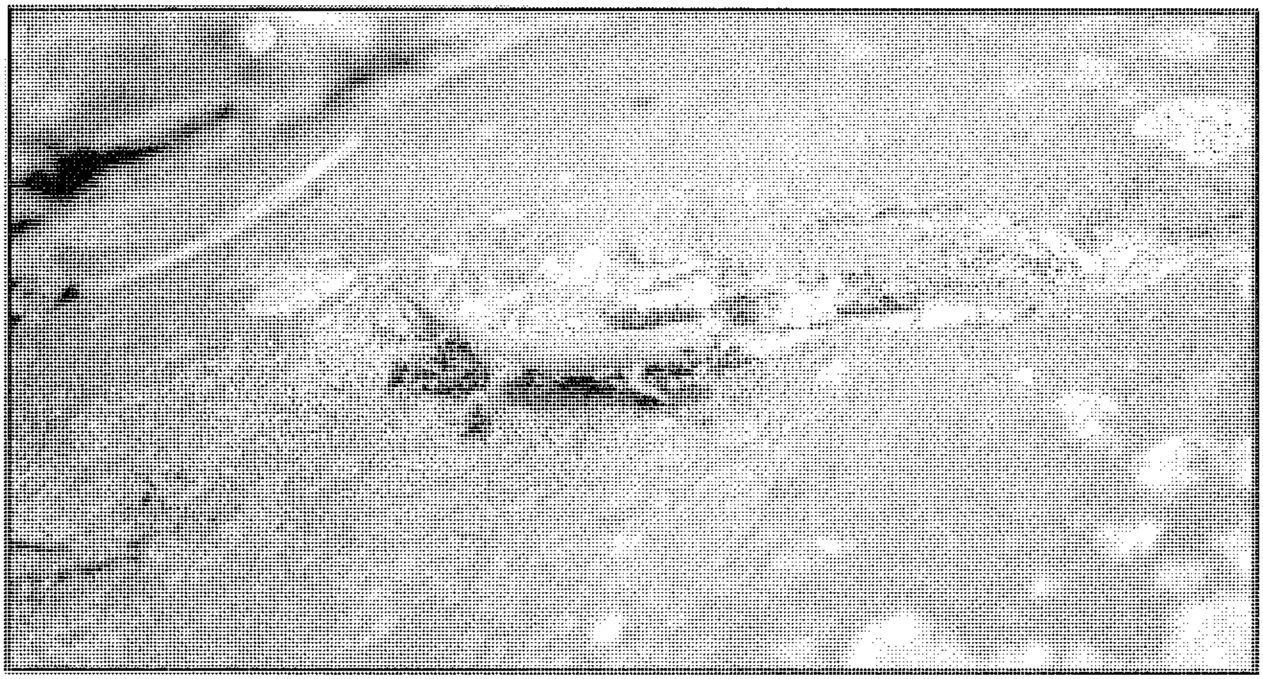
Rare and Threatened Plant Species

While we did not locate any endangered or threatened plant species in MMF, plants officially listed by the state as endangered have been identified in areas nearby (Shippe, personal communication). Three endangered plant species were found on the slopes of Georgia Mountain in Georgia, less than two kilometers away (Table 2). Because of the proximity and ecological similarity of Georgia Mountain to MMF, it is reasonable to think that some or all of these three species may exist within MMF.

Common name	***Latin name***	**Habitat/Ecology**	**State/Global rank** (*S and G ranks are defined in Appendix E)
Bronze sedge	*Carex foena*	Rock outcrops, dry sites	S1/S2 G5 endangered
Autumn coral root	*Corallorhiza odontorhiza*	Dry oak forests, cool aspect, blooms in late summer/fall	S2 G5 threatened
Stout goldenrod	*Solidago squarrosa*	Dry oak forests, rocky soil	S2/S3 G4?

Table 2: Species identified at Georgia Mountain that are listed as threatened or endangered in Vermont. Because of Georgia Mountain's ecological similarity and proximity to MMF, these species have the potential to exist in MMF as well.

Wildlife



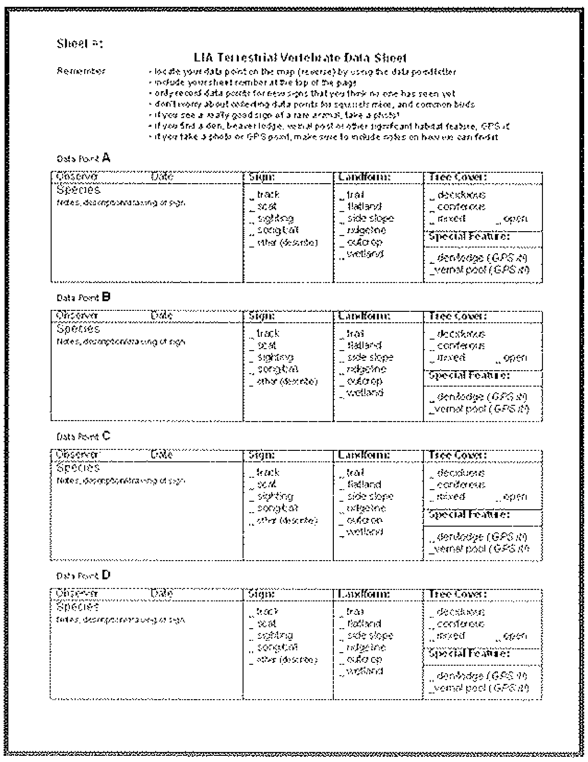
Red Eft, *Notophthalmus viridescens viridescens*

Introduction

Milton Municipal Forest's hemlock, pine, spruce, and hardwood stands, together with the unique features of a pond and beaver wetland area, provide a diverse complex of wildlife habitat likely to support some 150 wildlife species (see Appendix F). In this subsection, the term "wildlife" refers to that group of animals that have vertebra and live at least partly on land (fish will be covered in the Aquatic Features subsection). We group these wildlife species into three subcategories: Reptiles and Amphibians, Birds, and Mammals.

Methods

Throughout the winter and early spring, we focused on two wildlife inventory goals: 1) identification of wildlife species in the field, and 2) analysis of the variety of wildlife habitat features present on site. In order to best gather information on species observed in the field, we used a wildlife observation datasheet to record sightings, tracks, songs, calls, and any other sign that indicated the presence of a particular wildlife species (see Figure 29). Next, we gathered supplementary information through interviews with neighboring land owners, hunters, and other MMF recreationists. Then, on International Migratory Bird Day (May 10), a group of community members, graduate students from the University of Vermont, and other bird enthusiasts gathered in the early morning to identify the resident and migratory bird species present on MMF. Finally, we compiled all this information to create an inventory of wildlife species observed on site (Appendix G).


Sheet #:

LIA Terrestrial Vertebrate Data Sheet

Remember:
- locate your data point on the map (reverse) by using the data point letter
- include your sheet number at the top of the page
- only record data points for new signs that you think no one has seen yet
- don't worry about collecting data points for squirrels, mice, and common birds
- if you see a really good sign of a rare animal, take a photo!
- if you find a den, beaver lodge, vernal pool or other significant habitat feature, GPS it
- if you take a photo or GPS point, make sure to include notes on how we can find it

Data Point A

Observer Date	Sign:	Landform:	Tree Cover:
Species Notes, description/drawing of sign	_ track _ scat _ sighting _ song/call _ other (describe)	_ trail _ flatland _ side slope _ ridgeline _ outcrop _ wetland	_ deciduous _ coniferous _ mixed _ open **Special Feature:** _ den/lodge (GPS #) _ vernal pool (GPS #)

Data Point B

Observer Date	Sign:	Landform:	Tree Cover:
Species Notes, description/drawing of sign	_ track _ scat _ sighting _ song/call _ other (describe)	_ trail _ flatland _ side slope _ ridgeline _ outcrop _ wetland	_ deciduous _ coniferous _ mixed _ open **Special Feature:** _ den/lodge (GPS #) _ vernal pool (GPS #)

Data Point C

Observer Date	Sign:	Landform:	Tree Cover:
Species Notes, description/drawing of sign	_ track _ scat _ sighting _ song/call _ other (describe)	_ trail _ flatland _ side slope _ ridgeline _ outcrop _ wetland	_ deciduous _ coniferous _ mixed _ open **Special Feature:** _ den/lodge (GPS #) _ vernal pool (GPS #)

Data Point D

Observer Date	Sign:	Landform:	Tree Cover:
Species Notes, description/drawing of sign	_ track _ scat _ sighting _ song/call _ other (describe)	_ trail _ flatland _ side slope _ ridgeline _ outcrop _ wetland	_ deciduous _ coniferous _ mixed _ open **Special Feature:** _ den/lodge (GPS #) _ vernal pool (GPS #)

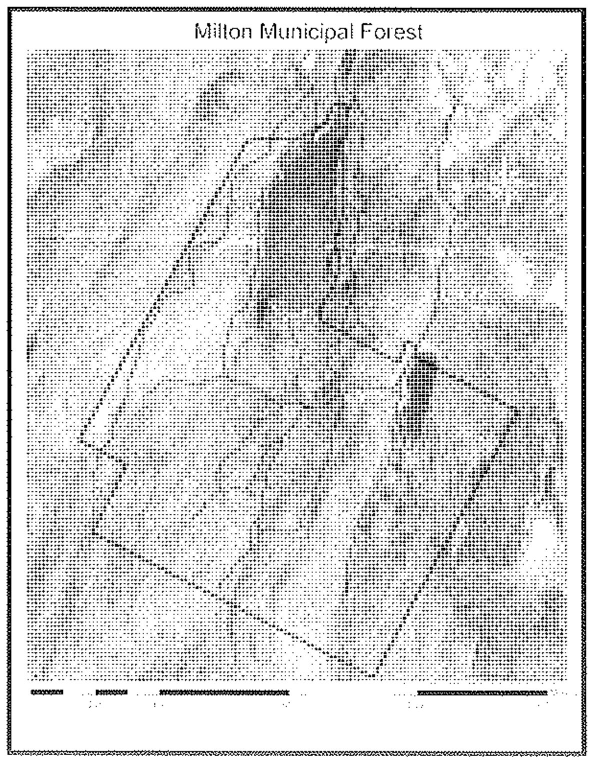


Figure A: Datasheet used in the collection of wildlife observation information.

Because of the restrictions of time and season, our observed inventory is not comprehensive. Part of the difficulty encountered when developing a wildlife inventory is that animals, unlike plants, have a tendency to move around and hide from us. Many wildlife species are difficult to detect in the field during a short period of study. For this reason, a great deal of our field research focused on an understanding of the wildlife habitat contained within MMF. Data we collected during our timber assessment (see Vegetation subsection) included information about structural features critical to the determination of wildlife habitat. Because these features, such as tree cavities, vernal pools, outcrops, perches, and downed woody debris, are cited as important requirements for the survival and reproduction of specific wildlife species, they can be used, along with information about the sizes and species of trees, to define a suite of wildlife species expected to be present on site (DeGraaf and Yamasaki 2001). By entering this information into the NED-1 software package developed by the U.S. Forest Service, we performed a stand-by-stand evaluation of wildlife habitat that generated lists of expected species (USDA Forest Service 2000). These lists were compiled to create an expected species list for the entire property (Appendix F).

Wildlife Habitat

MMF is home to a mosaic of upland and wetland habitat types unique to Chittenden County. Scattered throughout these habitat types, there are a number of special habitat features that have particular wildlife value. Below we describe these habitat types and features, explain why they are important to wildlife, and list some of the wildlife species that depend on them. It is important to keep in mind than any one species is not restricted to a single habitat type. Many species, such as moose and bear, require a number of different habitat types to fulfill their requirements for survival.

Northern Hardwood Forest

The most common forest cover and habitat type in Vermont, the Northern Hardwood Forest occupies the majority of land in MMF. It is preferred habitat for a number of interior forest specialists (animals that don't like open areas), including wood thrush, scarlet tanager, snowshoe hare, and gray fox. However, MMF's logging history (a recent cut in 1986) limits the availability of mature forest conditions (large trees, a complex canopy, large snags and downed logs, etc.) that support many old-forest species such as the northern flying squirrel, barred owl, and pileated woodpecker.

Pondside Hemlock Patches

The thin band of hemlock bordering Milton Pond provides winter thermal cover, food, and shallow snow conditions for a variety of wildlife species. The dense canopy and low branches trap warm air closer to the ground in winter and prevent deep snow accumulation. These factors create preferred winter habitat for such species as white-tailed deer, snowshoe hare, bobcat, and northern saw-whet owl. In the warmer months hemlock provides preferred nesting sites and food for the black-throated green warbler, blue-headed vireo, red squirrel, deer mouse, and great-horned owl.

Bobcat

White-tailed deer

Early Successional Thickets

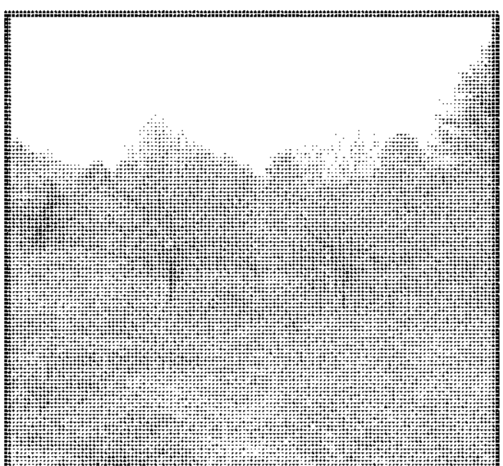
While older forests are generally able to support a more diverse array of wildlife species, early successional stands (or patches of the forest that have been cut in the last 10-15 years) are important to some wildlife species as well. Species such as ruffed grouse, cottontail, white-tailed deer, and moose rely on this habitat type for ample browse of young tender buds, twigs, and bark, while other species like American woodcock, veery, and American redstart rely on the dense cover to hide and protect them from predators. Many early successional tree and shrub species such as pin cherry, blackberry and raspberry produce soft mast (berries and fleshy fruits) that provide food for a wide variety of birds and mammals from cedar waxwing to black bear. MMF contains ample early successional habitat along the power-lines and on the mid-slopes to the west of the pond.

Ledges and Rocky Areas

The thin till-based soils and rugged topography of MMF bring numerous areas of exposed bedrock to the surface and supply the forest floor with countless stones and cobbles. The crevices, ledges and small caves in rock outcrops provide ideal shelter for a wide range of reptiles, birds, and mammals, from ravens to porcupines to bobcat.

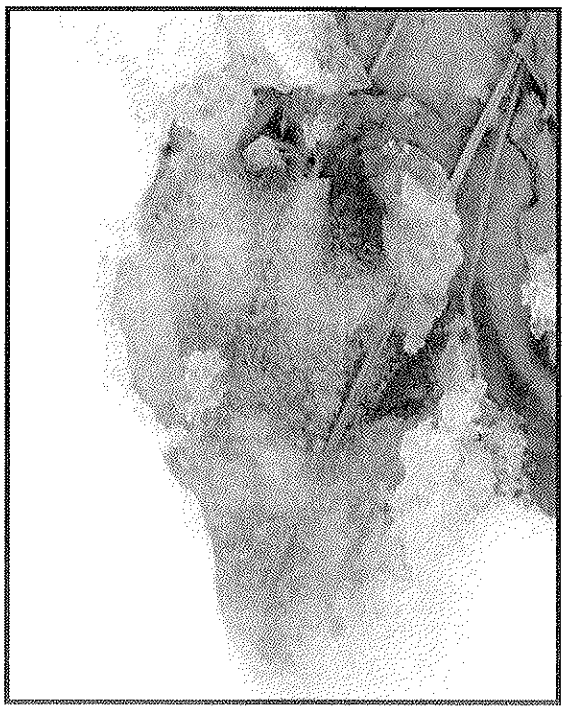
Old Orchards

The remnants of old orchards from early 19th century farms also provide a unique wildlife food source (see Cultural Features subsection and Map 6). Many species such as coyote, gray squirrel, black bear, and white-tailed deer consider the apples produced in these orchards a real treat. Apple trees are not native to Vermont, and, if left alone, will eventually die off as native tree species shade them out. For this reason, the areas around some of MMF's old orchards have been periodically cleared of competing trees to keep the apple trees alive and help support game populations for hunting.



Riparian Areas

At the interface of land and water, riparian areas (See Aquatic Features subsection for definition) house an especially high diversity of wildlife species. Many species rely heavily on this ecosystem for critical resources. Examples include belted kingfisher, painted turtle, river otter, raccoon, mink, and a wide range of bats, ducks, and salamanders. Other species like moose, coyote, and pileated woodpecker use streams and pond edges as transportation corridors. MMF is blessed with a wealth of riparian habitat surrounding the pond, beaver meadows, and major streams in the southern part of the property (Map 6).

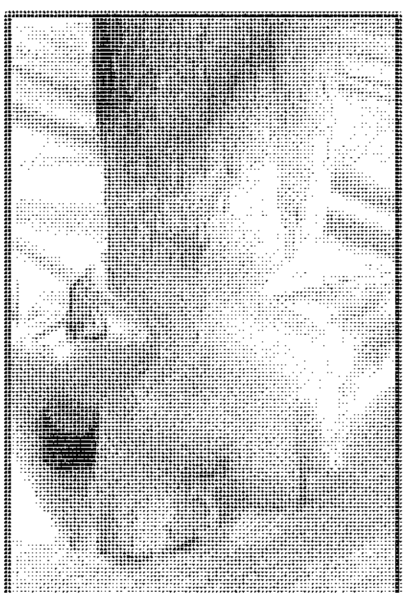


Otter

Raccoon

Beaver Wetlands

Because of the key role they play in the development of different wildlife habitats on the landscape, beavers require special treatment in any review of wildlife resources, especially in MMF. Over the last 60 years, aerial photos show how beavers have continuously altered the MMF landscape, damming and re-damming the beaver meadow in the eastern part of the property and radically altering the composition of tree species on the adjacent upland slopes with their foraging. Contrary to popular belief, these dramatic shifts often improve the general quality of wildlife habitat and increase biodiversity. As Tom Wessels states in his book *Reading the Forested Landscape*, "No other creature fashions such an array of habitats on which so many other species are dependent." By clearing trees, flooding forests, and digging channels, beavers create a complex mix of wetland, pond, stream, early-successional forest, mid-successional forest, and grassland ideal for providing the widest range of habitat possible.



In MMF, the beaver wetland areas at the north and south ends of the pond and the wide area in the eastern portion of the property support a vast array of wetland inhabitants such as great blue heron, spring peeper, red-spotted newt, swamp sparrow, raccoon, and moose.

Special Habitat Features

While recent timber harvests have eliminated many of the complex structures characteristic of mature forests, MMF retains some unique habitat features that contribute to the diversity of species it can support. With continued growth of the forest, these features will increase in wildlife value and improve the quality of habitat, thereby supporting larger, more diverse wildlife populations.

Hard Mast Trees

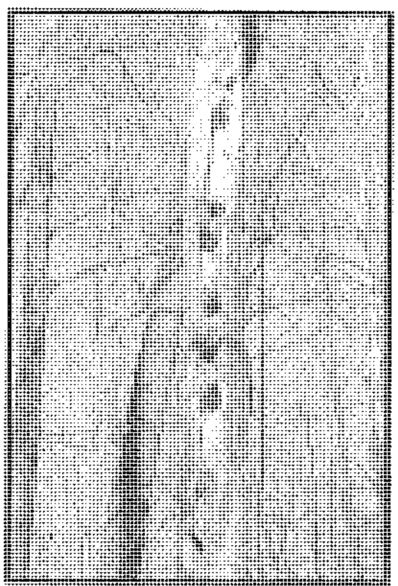
Hard mast trees such as oak and beech produce acorns and nuts favored by wild turkey, brown thrasher, squirrels, and black bear. This fall food source comes at a critical time of year for these species and allows many of them to accumulate the fats and carbohydrates necessary to survive the winter. However, only large trees produce appreciable amounts of mast. Map 6 shows the location of most of the beech and oak trees in MMF large enough to provide a significant food source (over 14 inches in diameter). Many of these are consolidated on the dry, rocky slopes along the West Side Trail.

Cavity Trees

Because of their low timber value, many large trees with basal scars and twisted trunks were left behind during the recent harvest. Some of these are "wolf trees," that were once part of agricultural fence lines or left to grow in the open. Together with some of the mid-sized hardwoods on the property, these old sugar maples provide an important forest resource in the form of tree cavities. Tree cavities, often referred to as dens in live trees, serve as shelter and nest sites for a host of wildlife species, including white-breasted nuthatch, screech owl, raccoon, and big brown bat. In general, the more big trees there are, the greater the size and number of cavities that can sustain larger, more diverse wildlife populations. Therefore, the isolated large-diameter cavity trees present in MMF provide a crucial, limited habitat feature.

Snags

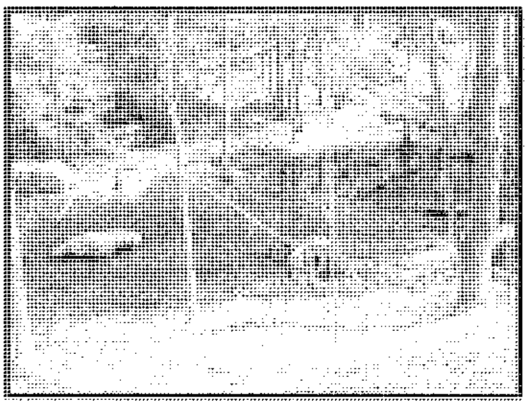
Many of the tree cavities used by wildlife occur in dead standing trees, or snags. Snags have expanded wildlife value in that they provide exposed perches and hunting platforms for hunting birds like red-tailed hawk and great-horned owl, as well as insect food sources for tree-foragers such as brown creeper and a variety of woodpeckers. Here again, the bigger the snag, the greater the wildlife value. While an older forest would generally contain a higher number of snags, there are still many snags throughout MMF, especially in wet areas where beavers have flooded and killed low-lying stands of trees. The southern tip of the pond is a good example (Map 6).



Downed Woody Debris

Downed woody debris is defined as any logs, branches, or stumps on the ground with a diameter greater than one inch. Like snags, they often provide insect foragers with a food supply, but they also provide shelter and breeding sites for those animals not able to fly or climb trees. In this case as well, the larger the log or branch, the greater the habitat value. High densities of these larger pieces of woody debris are associated with fisher, shrews, and the full suite of salamander species. While woody debris is present consistently throughout MMF, most of the downed logs are under 12 inches in diameter.

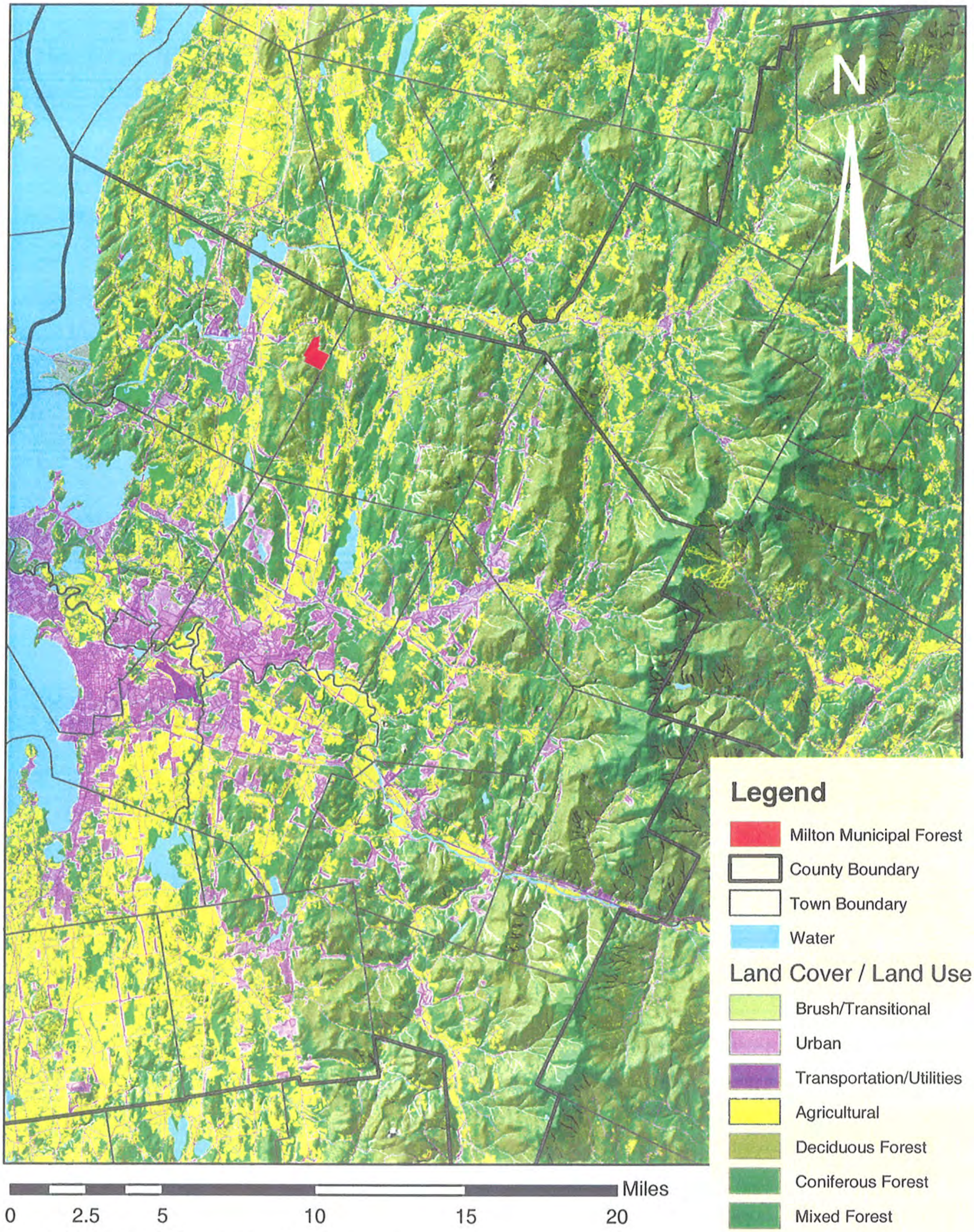
Vernal Pools and Seeps



A vernal pool is technically defined as an isolated, ephemeral wetland subject to wet-dry cycles that preclude permanent populations of fish (Kenney and Burne 2000). Because their eggs are not exposed to fish predation, amphibians like mole salamanders and wood frogs use vernal pools as key breeding areas where they migrate briefly in the spring to mate and lay their eggs. These species are called obligate vernal pool species because these habitats are a required part of their life cycle.

In and around MMF, there are a number of ephemeral pools that have formed in forest depressions (usually defined by a hard-clay or bedrock bottom). So far, obligate vernal pool inhabitants have been observed in only a few. Further study and field observation might uncover new species not yet observed in Milton (see Andrews 2002). One possible explanation for amphibians' failure to use vernal pools for mating might be explained by the numerous pools in the beaver-defined wetland complexes mentioned above. Because of the complex system of dams and wetlands separating these pools from the pond or streams, we believe that many of them are operating as vernal pools, providing the needed habitat for amphibian species in ample supply. Indeed, wood frog eggs and calls have been observed in many of these beaver wetland pools (Map 6).

Landscape Context of Milton Municipal Forest



Milton, Vermont
LIA Consulting Team

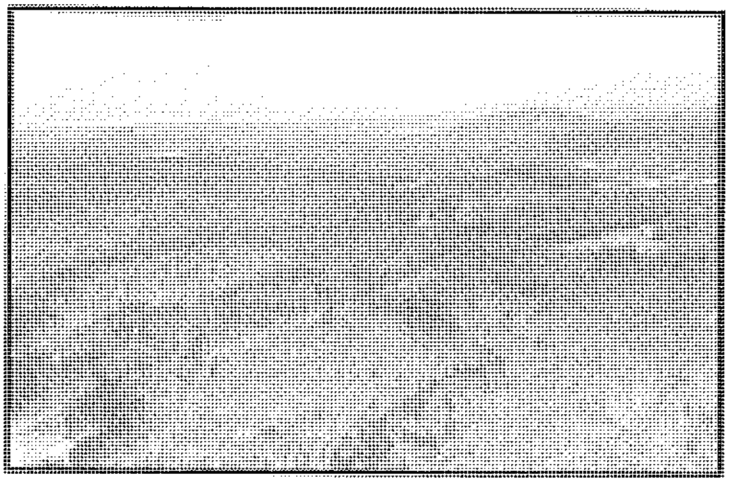
1:300,000 May 2003

Data Sources:
All layers produced by LIA team or provided by Vermont Center for Geographic Information

Map Created by LIA Consultants

Map 7

Landscape Context

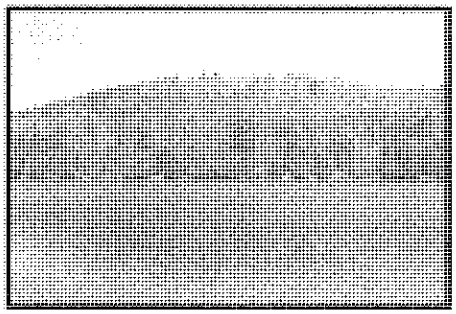


Many of the wildlife species mentioned above have home ranges that expand beyond the boundaries of MMF. Wide-ranging species with a diverse array of requirements utilize habitats at a much larger scale than MMF's 340 acres. Moose for example, can range as widely as 37,000 acres looking for swamps and lakes in the spring/summer, early successional patches in the fall, and mature conifer stands in the winter (Miller 1989, DeGraaf and Yamasaki 2001). For this reason, it is important to look to the surrounding landscape when attempting to inventory the wildlife that uses MMF.

MMF occupies a unique location within the larger landscape. The bowl defined by Milton Pond's watershed sits astride a ridge that supports a significant portion of Champlain Valley's contiguous forest (Map 7). Independent from the high Green Mountains to the East and surrounded by a sea of agriculture and development on all sides, this low ridge serves as in important refuge for wildlife in the Champlain Valley. Large areas of low elevation forests are rare in the region. Most wildlife species, like humans, prefer the milder climate of lower elevations, especially during Vermont's bitter winters. But as development pressures increase, many animals are pushed up into higher elevations of the Green Mountains where living is more difficult, and survival more risky. The area around MMF remains one of the last places wildlife can find a significant block of low elevation forest habitat in the lower Champlain Valley.

Aquatic Features

Introduction



Sitting quietly in the topographic "bowl" that forms much of MMF, the waters of Milton Pond both literally and figuratively reflect the quality of the surrounding forest. While the still waters mirror the hills and trees, their chemistry and biology are affected by the composition and land use of the landscape around them. The pond and other aquatic features such as tributary streams, vernal pools, and wetlands play an important role in enhancing the aesthetic quality of the landscape while also providing high quality freshwater habitat.

This section will explore the current condition of MMF aquatic features while providing the background for understanding subsequent impact assessments and management recommendations.

For the purposes of this document, "Aquatic Features" refers to all standing or moving water and the landscape over which that water flows. Aquatic features discussed in this section include the pond, tributary streams, and wetlands, as well as the watershed of Milton Pond and the riparian areas along streams.

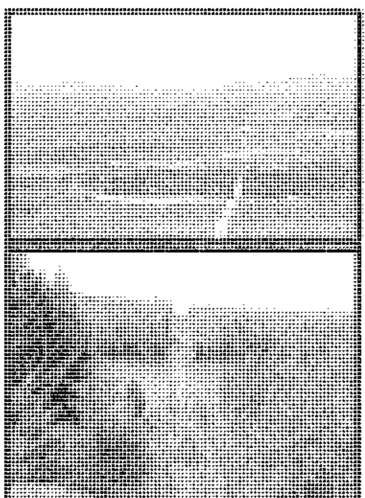
A "watershed" is an area in which all water flows to a common point. Land use practices within a watershed can have direct impact on the water quality within and downstream from that watershed. "Riparian areas" refers to stream or riverside areas.

Vernal pools will be discussed primarily in the Wildlife section. Additionally, the wildlife and plant components of the wetland areas will be discussed in the Wildlife and Natural Community sections respectively. The role of wetlands in maintaining water quality will be discussed in this section.

Methods

Because of its size and significance, Milton Pond was chosen as the primary focus of our aquatic inventory. While winter conditions (ice!) prevented field assessment of the pond and other aquatic features for much of our study's duration, we were able to draw upon a number of resources to collect information. Through conversations with both academic and non-academic experts, use of previously collected Vermont Department of Environmental Conservation (VTDEC) data, and a review of regulatory documents and relevant literature we were able to prepare for limited field work after the ice had melted. Such field work involved a shoreline freshwater mussel survey and VTDEC spring phosphorous testing protocol.

Milton Pond Watershed



Milton Pond covers an area of approximately 24 acres and is 13 feet deep at its deepest point. The 267 acre watershed the pond forms the easternmost headwaters of Mallet's Creek and falls almost entirely within the boundaries of MMF (Map 8). There is no agricultural or domestic land use within the watershed boundaries; the only development within the watershed consists of a powerline clearing. This clearing, housing transmission line #126, runs east-west and crosses the pond at its approximate center. Managed by Central Vermont Public Service, the line was constructed in approximately 1965 and carries 33,000 Kv (33 times the voltage that enters your home!) from the Milton Service Station to the Fairfax Falls Substation (Disorda and Dickensen, personal communication.).

Milton Pond Water Quality and Water Use History

Milton Pond was used as a drinking water supply from 1923 to the mid-1980's. From 1923 to 1969, the water supply was controlled by the Milton Water Corporation, and from 1969 to the mid-1980's it was under the jurisdiction of the town of Milton (see Cultural Resources for additional details). During this time, quality was monitored by the town and held at acceptable drinking water standards. Unfortunately, these records are no longer available (Hunt, personal communication). When the town switched to another water supply in the mid-1980's, monitoring ceased. A study of mercury levels (as measured by mercury concentration in fish) found mercury levels to be 0.09 ppm; the Vermont/New Hampshire average is .239 ppm (Kamman, personal communication).

Limited water quality testing of Milton Pond was most recently conducted on April 30th, 2003. Results of this testing are unavailable at the time of writing but will be sent to the Milton Select Board when available.

VTDEC surveys in 1991 and 1998 indicated no presence of Eurasian Water Milfoil (*Myriophyllum spicatum* L.), an aquatic nuisance species, and describe the lake as "wilderness like."

Results of shoreline freshwater mussel survey indicate the presence of at least one native freshwater mussel species: eastern floater (*Pyganodon cataracta*). Furthermore, the absence of zebra mussels (*Dreissena polymorph*) from the survey results suggests that the pond may be free of this aquatic nuisance species.

Although the pond was historically used for fish stocking purposes (see Cultural Features), it is not presently stocked. Based on current knowledge about the pond, Rich Langdon of Vermont DEC suggested a possible fish species list as follows:

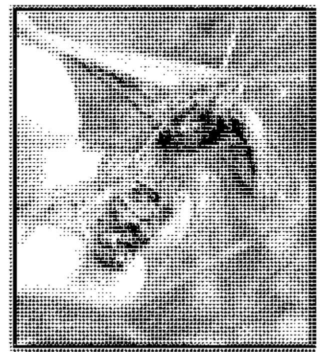
- Pickerel
- Bullhead Catfish
- Smallmouth Bass
- Northern Pike
- Yellow Perch
- Mud Minnow
- Brook Stickleback
- Creek Chub
- Banded Killifish
- Northern Redbelly Dace
- Common Shiner
- Golden Shiner

Colby Brock, a Milton High School student and avid angler, has found Northern Pike (not native at this elevation), Yellow Perch (native), Bullhead Catfish (native), and Golden Shiners (native) in the Pond. He also reported that few Pike have been found greater than 18 inches in length (the minimum catch length is 20 inches) (Brock, personal communication). It is possible that an overstocked Pike population is suppressing the yellow Perch population as well (Marsden and Parish, personal communication).

Because of high levels of beaver activity in the watershed, it is likely that Milton Pond contains a microscopic, fecal-borne parasite called *Giardia lamblia*. Ingestion of water containing *Giardia lamblia* can cause severe intestinal problems in infected persons.

Streams

No chemical or biological assessments of streams were conducted. However, cadissfly larvae (a mild indicator of good water quality) were casually observed. Several tributary streams currently flow in old roadbeds and have become channelized. Where they may have previously followed a more shallow and sinuous route, they are now straighter, deeper, and subsequently more likely to carry higher sediment loads.



Beaver Meadow Wetlands

There are several beaver meadow wetlands on MMF (Map 8). These wetlands perform the vital function of storing sediments and filtering the water that passes through them. Without these wetland areas, downstream waters would likely have higher nutrient and sediment loads (Mitsch and Gosselink 1993).

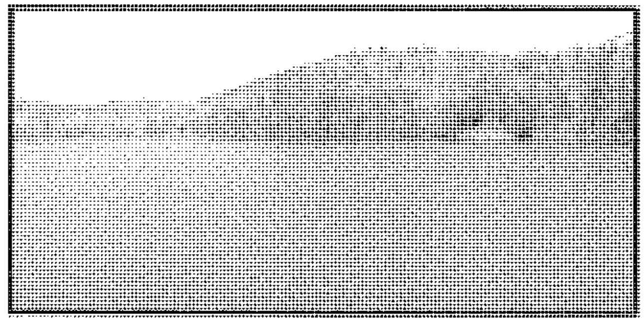
The Dam at Milton Pond

Originally constructed in 1923 by the Milton Water Corporation, the earthen dam at the northern end of Milton Pond raised the water level in what was previously a natural but smaller pond. Currently the dam is experiencing erosion in the western side of the sluice gates. Recent patching efforts by both beavers and hikers have re-diverted some of the overflow.

Recreation

Introduction

It is easy to see the lure of recreational activities in the MMF. The woods, rich in cultural history and scenic views, surround a pristine, undeveloped, 35-acre pond. A trail system consisting of walking trails and abandoned logging roads rings the pond and extends south into the surrounding hills as well as east down to the beaver meadow. Current recreational activities in the Milton Municipal Forest include hiking, dog walking, bird watching, skiing, snowshoeing, hunting, fishing, and driving off road vehicles (ORV's). In addition to the current uses of the MMF, we assess the recreation potential of mountain biking, swimming, boating, camping, snowmobiling, horseback riding, and using off road vehicles (ORV's).



Methods

To inventory recreation opportunities and impacts at the MMF, we first created a map of the boundaries and existing trails using GPS and GIS. We continuously added detail to this map as we revisited MMF, including features such as animal dens and wet areas. This map became an important tool in aiding our understanding of MMF's recreation potential.

We also researched all of the recreation possibilities mentioned by Milton citizens in the public forum on January 28. Looking to the scientific literature, we gained an overview of the impacts recreation activities can have on a landscape. In conjunction with Rick Paradis, UVM's natural areas manager, we honed our understanding of the impacts of recreation activities particular to Chittenden County.

Trail System

MMF's trail system has not been designed intentionally; rather, it has evolved with the various uses of the forest over time. Historical roads dating from the settlement of MMF lead past old foundations and other cultural features (see cultural features section). Logging roads that date back to the 1985 timber harvest tend to run north-south in the MMF. A walking path, established by visitors to the MMF, rings the pond (Figure 30). The logging roads tend to be most eroded, while the walking trails seem to be the most intact.

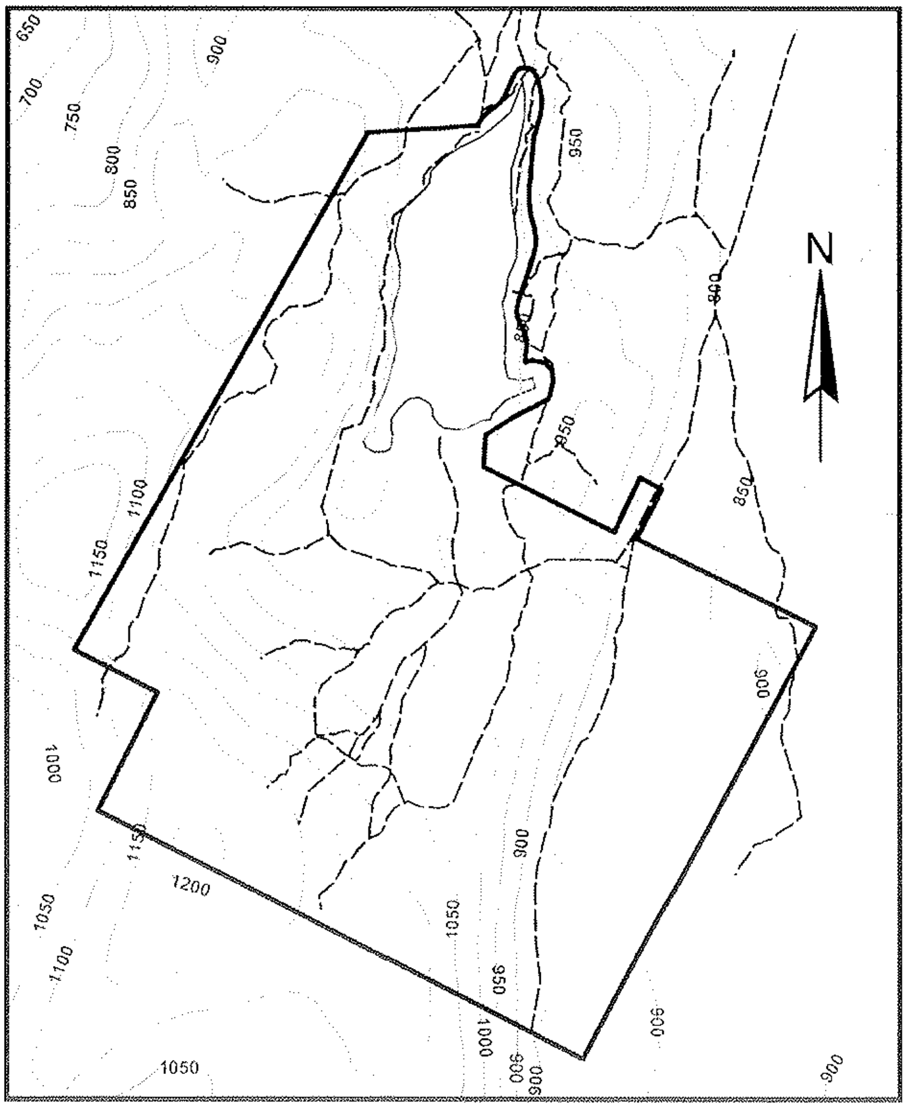


Figure 30: Current trails and old skid roads in Milton Municipal Forest.

SECTION 2: IMPACT ASSESSMENT

This section of our report explores the relationships between the landscape features inventoried in the previous section and the various uses of the Milton Municipal Forest that we have been asked to consider. These uses were identified in a Milton public town meeting of January 28, 2003, and include the following categories (Gaherty 2003):

- Hiking
- Skiing and Snowshoeing
- Mountain Biking
- Hunting and Fishing
- Swimming and Boating
- Camping
- Off-road Vehicles (ORV's)
- Snowmobiles
- Horseback Riding
- Timber Harvesting
- Education

Impact Assessment is the process of identifying the possible impacts that these uses can have on the landscape features of the Milton Municipal Forest. Impacts can be either positive or negative. For the most part, however, we focus on impacts that represent potentially damaging changes to the landscape features of the MMF. In addition, Impact Assessment involves identifying potential conflicts between the different uses and users of the forest.

Scale, Intensity, and Magnitude

Our Impact Assessment will frequently consider complicated issues of scale, intensity and magnitude. Scale refers to the fact that impacts from human use are often limited in space and time to certain locations and certain times of year. In terms of space, for example, the impacts from recreational uses such as hiking and mountain biking are generally concentrated along trail corridors. As an example of time scale, consider that uses such as skiing and snowmobiling are limited to winter months.

The issues of intensity and magnitude are closely related. With respect to a single specific use, the magnitude of impact generally increases with increasing intensity of use. As an obvious example, six hikers per day passing through the Milton Municipal Forest are likely to create a low magnitude of impact relative to 100 hikers per day. When comparing the magnitude of impacts from different uses, a common conception is that some uses have more impact on landscape features than others. For example, motorized vehicle use is often thought to have a high magnitude of impact relative to use by hikers. Dramatically increase the intensity of hiking use, however, and the question of magnitude can become unclear. Would the magnitude of impact from a few responsible motorized vehicle users be greater than that from 100 irresponsible hikers per day? Such comparisons of relative magnitude of impact from different uses and different intensities of use are very difficult to assess and often lead to controversy between different user groups.

The issues of intensity and magnitude also apply to cumulative impacts from increasing multiple uses of the landscape. As more and more people visit the forest, engaging in more and more different uses, the potential magnitude of cumulative impacts increases dramatically, along with the potential for increased conflicts between different uses and users. These are the issues of scale, intensity and magnitude that we must tackle in our Impact Assessment.

Impacts and Conflicts of General Concern

Through our Impact Assessment, we were able to identify several conflicts and impacts of concern that span several categories of uses and landscape features. For example, erosion is an impact that can be caused by several different uses and can negatively impact several different landscape features. We identified the following impacts and conflicts of general concern:

- Soil Compaction
- Soil Erosion
- Invasive Species
- Harassment of Wildlife
- Loss of Wilderness Experience (LWE)

These topics are frequently referenced in our Impact Assessment. In order to avoid repetitive explanation of these conflicts and impacts, their importance and possible consequences for the landscape features and multiple uses of the MMF will be described here.

Soil Compaction

Both plants and soil organisms require a relatively loose soil whose many pore spaces are filled with a certain balance of water and air needed for proper growth. When soil is mechanically compacted, it becomes more dense and the amount of pore space is reduced. Plant roots and soil organisms can have a tough time growing and moving through soil that is too dense. It is more difficult for rainwater to enter a dense soil, and this can lead to increased runoff and erosion of the soil (see below for consequences of erosion). Also, water drains more slowly out of a soil with reduced pore space, thus when compacted soil does become saturated it can remain so for longer periods of time. In soil that is saturated, there is not enough air for plant roots and soil organisms to breathe; they literally suffocate. Overall, soil compaction can generally lead to reduced plant growth and reduced activity of soil organisms (Brady and Weil 2002).

Soil Erosion

Soil erosion can occur on certain soils when they are exposed (usually by having their vegetation cover removed) to rainwater and snowmelt. Erosion can be exacerbated when a given soil becomes more dense from compaction, allowing more water to run off instead of entering the soil. Erosion strips nutrients from the soil that are required for proper plant growth and can dramatically alter the topography of the ground surface, creating deep gullies that concentrate runoff and further enhance erosion. Thus, erosion can be damaging to the soil itself and the vegetation that grows in it. Trails can serve as channels to concentrate runoff and enhance erosion, thus trails can also be damaged by gullying caused by erosion. Where small streams cross poorly-designed trails, sediment eroded from the trail enters the hydrologic system of the landscape. Sediment and nutrients removed from the soil by erosion enter water bodies, first small streams and eventually larger water bodies such as Milton Pond (Brady and Weil 2002). Excess sediment in streams and water bodies has several possible consequences that will be described in our impact assessment for Aquatic Features.

Non-native Invasive Species

For the purposes of this report, the term non-native invasive species refers to plant and animal species that are not native to North America but have been introduced to the area and have subsequently become well established. For the most part, non-native species are introduced by human activities. Non-native plants have been introduced throughout North America as ornamental species. The highly invasive common buckthorn, introduced in the 1800's for hedgerows, is one such example. Non-native animal species are often introduced accidentally. One such example is the zebra mussel, carried in ship ballast from Russia and introduced to the Great Lakes in the 1980's.

Invasive species are both an ecological and economic problem. Once introduced, non-native plants and animals may become quickly established. As non-native introductions to a natural system, they have no native predators and may be faster-growing, more competitive or longer lived than native species. In the case of animals, they may also prey upon native plant and animal species. Invasive species out-compete and replace native species, disrupting the entire ecosystem. One study found that approximately 42% of the federally listed Threatened or Endangered species are at risk because of non-native invasive species (Pimentel et al. 1999). The economic impacts can be severe as well. Invasive species clog waterways, reduce aesthetic values, disrupt recreational activities and damage infrastructure. It has been estimated that every year the United States loses up to $100 billion due to invasive species (Pimentel et al. 1999). In light of these potential economic and ecological impacts, this report will assess the current status of non-native invasive plant and animal species within the Milton Municipal Forest and, when applicable, make recommendations for their management or prevention.

Loss of Wilderness Experience

Many people go to forested landscapes to experience quiet solitude in a natural setting. When this experience is negatively impacted, we call the impact a loss of wilderness experience. Visual impacts include trash and built structures; aural impacts include vehicle or chainsaw noise. What is considered a loss of wilderness experience is subjective. Some visitors may object to seeing deer stands in the woods; to others, a deer stand is merely a sign of a traditional use.

Our Impact Assessment focuses separately on each inventory category described in our Landscape Inventory. In each subsection, the possible impacts and conflicts resulting from two different levels of visitor use are considered. First, the possible impacts and conflicts resulting from current levels of visitor use are assessed. Second, we speculate on the possible impacts and conflicts that could result with greatly increased visitor use. This format allows us to identify use conflicts and impacts of immediate concern under current conditions, as well as informing the Town of Milton about future concerns under a scenario of increased multiple use of the MMF.

Lastly, it is extremely difficult to predict and quantify the potential impacts and conflicts resulting from different levels of human use. Our Impact Assessment presents a mostly qualitative description of potential impacts and conflicts, though we will comment on relative intensity and magnitude of impacts and conflicts and provide quantitative information when possible.

Physical Features

The only physical feature for which we believe negative impacts from human use are a serious concern is the soil. This assessment will first discuss the problems of soil compaction and soil erosion, and their consequences for other elements of the landscape. The problems of compaction and erosion will be referred to throughout our Impact Assessment. Second, this assessment will discuss the possible roles that the several human uses of the Milton Municipal Forest can play in causing soil compaction and/or erosion.

Possible Impacts from Current Use Levels

The erosional impacts of recreational uses, including hiking, mountain biking, camping, off-road vehicles and horseback riding, are generally concentrated in certain areas of a forest. These include areas on and near trails and around major water bodies such as Milton Pond. Trails and the shorelines of aesthetically pleasing water bodies are the areas most utilized by people. In general, the magnitude of soil erosion along shorelines and trails increases with increasing intensity of any or all of these uses. In addition, off-road vehicle use and horseback riding are generally found to be more damaging in terms of soil erosion than hiking and mountain biking. Winter uses, such as snowmobiling, snowshoeing, and skiing are generally not a concern for soil erosion

A poorly-designed and poorly-maintained trail system can be subject to excessive soil erosion from any recreational use, even at a low intensity level. The fact that many of the trails in the Milton Municipal Forest originated as 19th century roads and have since been used by logging vehicles in an unplanned fashion has several consequences for soil erosion. The roads (now trails) were clearly not originally designed to resist soil erosion. Thus, past use of the trails has brought many sections to a state of disrepair where they are either vulnerable to soil erosion, or they have already formed active erosional gullys (see Impact Assessment). The VYCC repaired and maintained some sections of trail in 1998. However, many other sections of trail remain susceptible to soil erosion, and there are no current plans for ongoing trail maintenance and repair.

Soil erosion can occur around Milton Pond when hikers and other users travel off-trail around the shoreline and trample the often fragile shoreline vegetation, eventually exposing bare soil. Camping is a particular concern, since many people enjoy setting up camp immediately beside a pond. Over time, when people use the same campsites repeatedly, large bare areas of soil susceptible to erosion can result. At current use levels, these impacts do not seem to pose a major problem, though we did find one campsite near the pond's south shore.

At current use levels, off-trail use of the forest does not seem to occur at a high intensity. Thus, most erosional impacts from recreation are limited to the areas already described.

All recreational uses compact the soil, especially where they are concentrated to small areas that are repeatedly trafficked. Along trails, this is often not a concern since well-designed trails are meant to last many, many years. Compaction of a poorly-designed and poorly-maintained trail, however, can exacerbate soil erosion along its length. Compaction around Milton Pond and in repeatedly used campsites is more of a concern, as the bare spots created can require many years to become revegetated, and runoff and erosion is enhanced on these bare surfaces. Campfires built directly on the soil surface can also pose a problem. The heat of a fire kills soil organisms, and a ring of highly toxic ash is left behind. Campfire rings can persist for many years before vegetation can reclaim the area. Again, at current use levels, these impacts do not pose a major concern.

Large-scale timber harvesting can have far greater implications for soil compaction and erosion over a much larger area than the recreational uses just discussed. Indeed, the 1986 logging operation most likely generated a good deal of erosion, compacted the soils over a wide area, and contributed to the degradation of trails that were used as skid roads. We did not assess the extent of these past impacts, however. Since it was suggested in the 1993 Forest Management Plan (Hall 1993) that future logging be postponed for another 30 years, widespread soil compaction and erosion from current use levels (i.e. no logging) are not a present concern. If Milton did decide to engage in ongoing

Timber Stand Improvement, however, the impacts of these operations on the soil should be considered.

Finally, in addition to concerns about compaction and erosion, uses that involve motorized equipment can introduce toxic chemicals into the soil via gas and oil leaks and spills. Camping can also introduce toxic chemicals if stove fuel is spilled.

Overall, soil compaction and soil erosion from current use levels has a relatively low magnitude of impact that reflects overall low intensity of use, especially the very low intensity of uses with the highest potential impacts such as horseback riding, off-road vehicles, camping, and timber harvesting.

Possible Impacts from Elevated Use Levels

At elevated use levels without management, the impacts of soil compaction and soil erosion would certainly increase. However, they would likely remain concentrated in the same areas mentioned: along trails and around Milton Pond. Without maintenance and repair, trails would become wider, more compacted, more vulnerable to erosion and more gullied where they are already eroding. This is especially true if elevated use means the introduction of more damaging uses at higher intensities, such as horseback riding and off-road vehicles. With more uses and users, more people would be likely to leave the trails, so the development of multiple parallel and "braided" trails, along with off-trail compaction and erosion, could become concerns. Areas of bare soil, and possibly the number of campsites, around Milton Pond would increase. If timber harvesting is reintroduced, then soil compaction and erosion could occur over a large area, unless it is carried out with extreme caution. All of these increased impacts on the soil would translate to increased impacts on vegetation and on the aquatic features of the forest, including small streams and Milton Pond.

Cultural Resources

Possible Impacts from Current Use Levels

Overall, we feel that the possible impacts on cultural resources from current use levels are relatively small. Cultural features have persisted in the Milton Municipal Forest for over 200 years, and although their slow decay is inevitable simply due to ongoing natural processes, human use does not seem to be contributing significantly to this decay. Disturbance of cultural resources by recreational uses in the forest would consist of the removal or destruction of specific cultural features, and this does not seem to be happening. The cultural features tell a fascinating story, but they are not so valuable that users would want to remove them from the forest.

Possible Impacts from Elevated Use Levels

At elevated use levels without management, the favorable picture painted above may change. As explained in our landscape inventory, many of the corridors that are now used as trails were originally 19th century roads that provided access to the homes and barns that are now cellarholes and foundations. Stonewalls were often constructed along these roads, and orchards were often planted beside them. This history of the roads means that most of the cultural features of the Milton Municipal Forest are located very close to current trails. This makes these features vulnerable to disturbance under a scenario of elevated human use. As mentioned in our Physical Features Assessment, more and more users, engaged in a wider range of uses, would start to wander from the established trail system, and they would not need to wander far in order to disturb many of the cultural features of the forest. Hikers and off-road vehicle users are most likely to wander in the zone near trails where most cultural features lie. Horseback riders and mountain bikers will tend to stick more to the trails. Many hunters probably wander far enough away from trails that their impact on cultural features is dispersed. Winter uses—skiing, snowshoeing, and snowmobiling—could pose a threat when snow is deep enough to conceal the most delicate cultural features from view, but not so deep as to protect them from harm when a user accidentally stumbles upon them.

The most potentially damaging use with respect to cultural features is timber harvesting. If performed carelessly and on a large scale, many cultural features could be disturbed or destroyed. Timber harvesting, as opposed to recreation, is also a use that could cause major changes in the vegetation patterns that reveal historical land use. For example, cutting the large trees along stonewalls, logging the possible pine plantation, or cutting down apple trees would eliminate or obscure evidence of human history. If timber harvesting is conducted on a large enough scale, with little attention paid to cultural resources, then impacts could go beyond the disturbance and destruction of specific cultural features to impairment of the historical integrity of the entire landscape. The story of the landscape could be obscured to the point where it can no longer be interpreted from the few clues that remain.

Vegetation

Timber Resource

Recreational use of MMF will impact the timber resource only to the extent that the uses increase the frequency of fire. Campfires, especially if they are left unattended, pose the greatest risk for starting fires in the forest. Fires are most likely to spread when flammable ground cover is present and the weather is dry, hot and windy. This combination of factors does not often happen in this part of Vermont.

Beaver activity is a natural process in MMF that impacts the timber resource. Beavers selectively remove aspen, oak, ash, sugar maple, and paper birch from an area up to 200 meters from the water's edge (Wessels 1997). Because sugar maple, red oak, and white ash are commercially valuable species (Long 2001), the removal of these species by beavers negatively impacts the timber value of the forest.

Natural Communities

To determine the impact of different activities and forest uses on natural communities, it is important to consider the patch size of that community. Patch size refers to the amount of contiguous space that a natural community occupies on the land (Thompson and Sorenson 2000). Natural communities that generally occupy a small (<50 acre) patch of land are more likely to require a unique combination of ecological factors that do not exist very often across the landscape. One example of a small patch community is a Seep. Natural communities that generally occupy large patch sizes (such as the Northern Hardwood Forest) may exist across a broad range of bedrock, topographic, and soil types and, therefore, form much larger, more contiguous patches. In general, natural communities in MMF exist as small patches, except for the Northern Hardwood Forest and Rich Northern Hardwood Forest communities. The current and potential impact of recreation and timber extraction on these natural communities is closely tied with these patch sizes.

Recreational Activities

Recreational activities operate (or have the potential to operate) at different scales in MMF. For example, of all the recreational activities currently enjoyed in MMF, none is on a scale large enough to substantially impact the integrity of the Northern Hardwood Forest natural community, due to its large and continuous patch size. On the other hand, Seeps are particularly vulnerable to degradation by recreational activities. These areas are small (some less than $50ft^2$), discontinuous, and dependent upon a specific combination of bedrock, soil, and hydrologic factors that can be disrupted by constant foot or tire traffic (see Section 2, Recreation Assessment). Wetland communities in general are vulnerable for these same reasons. Although it does not appear that *current* recreational activities are having an impact on the Red Maple-Speckled Alder-Swamp, Sedge Meadow, or Red Maple-Ash-Speckled Alder-Swamp natural communities, if use increases or recreational "traffic" gets directed through these areas, substantial impacts to the community could result. Resulting compaction and soil erosion would change the hydrology and plant composition of these wetland sites, and fragment their already small patch sizes.

Timber Harvest

Timber harvesting within MMF would impact the forest on a much larger scale than recreation. Removing trees creates gaps in the canopy that permit early-successional species to grow in. The degree to which this would happen depends on the type of logging employed. For example, timber harvesting similar to the heavy logging done in 1985 would have a very large impact on natural communities. When large canopy openings are created, short-lived, fast-growing tree species such as pin cherry and paper birch will dominate. In addition, the indiscriminate removal of large, older trees could mean the loss of important seed sources for the rest of the natural community. For example, the Red Oak-Northern Hardwood Forest located on lower slopes in MMF may be dependent upon the acorns produced and distributed by oaks on upper slopes and ridgelines. Finally, construction of logging roads could impact the downslope movement of nutrients that characterizes the Rich Northern Hardwood Forest

(Thompson and Sorenson 2000). If Milton considers timber harvesting to be an option, a forester could recommend ways to maintain the general composition and integrity of a natural community while removing marketable timber.

Plant Species

Recreational Activities

Trails in MMF represent open corridors of light and disturbance that often provide the perfect conditions for non-native, invasive plants to become established and spread. Invasive plants such as common buckthorn and Japanese knotweed have been found in MMF, although in very low numbers (Appendix D). If changes in recreational use alter adjacent areas, making sunlight more available and opening up corridors for dispersal, these species may spread rapidly, displacing native plants. Once established, invasive plants are difficult to eradicate.

Other potential impacts of recreational activities on plant species are trampling and flower picking. Often, people enjoy a spring or summer walk on the trails to see wildflowers in bloom. If trails are not carefully maintained or delineated, erosion and accidental trampling may eliminate the plants people come to see. Unless it is discouraged, people may pick flowers growing along trails. If use of MMF's trails increases, the risk of erosion, trampling, and picking will increase as well.

At this point no rare plant species have been identified in MMF. However, as mentioned in the Resource Inventory section above, MMF is a potential host for three rare species found on nearby Georgia Mountain. If these plants are discovered in MMF, the impact of destroying these plants through accidental trampling would be more significant (the rarer the plant, the greater the significance of its loss).

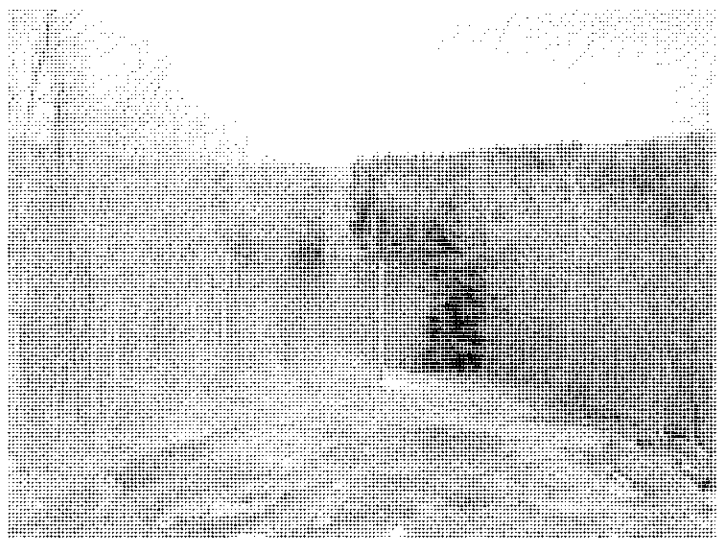
Timber Harvest

Timber harvesting of any kind will impact plant species, either by the removal of individuals or by alterations in the amount of light available to the forest floor.

Soil disturbance, compaction, and road building associated with logging will also favor some plant species, especially invasives, while deterring others. Most of these potential impacts are described above, under "Natural Communities."

Powerline Easement

The powerline corridor currently maintained by Central Vermont Public Service is another potential avenue for the introduction of invasive plant species. Just as with logging roads, the powerline serves as an area of disturbance that can favor invasive species.



Wildlife

Harassment

Harassment is the most common impact that recreational activities impose on wildlife populations. The Endangered Species Act of 1973 defines harassment as "An intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, feeding or sheltering." While "annoying" an animal may not sound like a serious concern, the stress caused by disrupting normal behavior patterns in animals can be serious enough to threaten an animal's survival. Wild animals are often in a state where they need to carefully balance their physiological needs with the availability of food. Frequent harassment costs animals precious calories as they expend energy in the stress of human contact.

Harassment and Warm-weather Recreational Activities

Any interaction with non-native predators (such as domestic pets) or perceived predators (such as humans) that startles or spooks an animal is considered harassment. All recreational uses of MMF harass wildlife in some way. However, some activities generate more serious levels of harassment than others. Surprisingly, some studies have shown that recreationists on foot disturb wildlife more than off-road vehicles (Freddy et al. 1986 cited Liddle 1997 p.452). Even though the noise generated by ORV's and snowmobiles does provide a certain level of environmental stress, this noise often warns an animal of the approaching danger with enough time for it to escape without panicking. Horses as well appear to spook wildlife less than simple hikers, although conclusive evidence has not yet been produced. The level of harassment impact created by mountain biking falls somewhere between hiking and off-road vehicle use.

Harassment and Winter Recreation

Recreational activities such as skiing, snowshoeing and snowmobiling are particularly dangerous to wildlife because they take place during the winter, when the balance of energy is all the more precarious for an animal. Here again though, snowmobiling appears to have less of an impact than skiing and snowshoeing (Freddy et al 1986). All winter recreational activities provide an impact on small mammals that live under the snow layer such as mice, voles, and shrews. The compaction of snow created by winter recreation traffic diminishes its critical role as insulator for these species, and often creates a barrier between the burrowing animal and a valuable resource, such as water.

Harassment and Camping

The harassment impacts generated from camping are probably more significant than other activities simply because of the prolonged effect of camping. Feeding of wildlife (both intentional and unintentional) also becomes more of a problem in camping situations, altering the natural behavior of the animal and often creating a nuisance when frequently fed animals come looking for more.

Harassment and Dogs

Dogs off-leash create perhaps the most damaging form of harassment. One study on mountain sheep showed that a human with a domestic dog inflicted twice as much physiological stress as a human alone. (MacArthur, Geist, and Johnston 1982 cited Liddle 1997 p.461). When allowed off-leash to track and pursue wild animals beyond the trail corridor, dogs can generate significant levels of wildlife harassment.

Harassment and Scale

Clearly, the issues of scale and intensity mentioned in the introduction to this section apply to wildlife harassment as well. Level of harassment not only changes with the type of use, but also with the amount and frequency of visitation. Under current use conditions, the level of harassment impacts in MMF is relatively low. However, if use levels begin to diversify and increase, harassment may become a real concern.

Hunting

Obviously, the impacts on wildlife generated by hunting are significant. The removal of an individual animal from an ecosystem can have serious and often unforeseen ramifications. Intense hunting pressures can destabilize wildlife populations and may even locally extirpate a species. On the other hand, humans have a role in the web of nature as predators too, and regulated hunting often performs a valuable function for the ecosystem. For example, too much browse from unchecked deer populations can inhibit natural plant regeneration and prevent the growth of trees and shrubs needed to stabilize soils and prevent erosion.

In faith that Vermont Fish and Wildlife is appropriately monitoring the populations of game species in the area, careful hunting on MMF should be able to proceed without drastic influence. However, it is important to recognize that hunting's impact on wildlife can extend beyond the game species hunted. The harassment associated with hunting of non-game species is at least as severe as it is for hiking, and may exceed hiking, especially if hunting dogs are used. Also, because hunters spend much of their time traveling off-trail, they may disturb fragile habitat that trails were designed explicitly to avoid. Another problem arises from misidentification of game species. One study reported that 30 percent of wild fowl hunters could not adequately distinguish rare species from game species (Speight 1973).

Habitat Modification

Because many wildlife species rely heavily on specific habitat conditions (see wildlife inventory above), the modification of wildlife habitat often creates a more dangerous and lasting impact than harassment or hunting. Hammit and Cole (1998) state that "Habitat change can affect the behavior, distribution, survivorship, and reproductive ability of individual wildlife."

Often habitat is affected simply by the placement of trails. All of the recreational uses described above localize their activity around an existing trail system. Therefore, trail design that does not take wildlife habitat into account can indirectly impact wildlife populations in MMF. For example, if high-use trails are routed near critical habitat features, the frequent, high-intensity harassment resulting from trail traffic may force wildlife to abandon a limited resource. On the other hand, well-designed trails keep traffic away from wildlife or habitat that is especially sensitive to harassment and provide transportation corridors to larger mammals.

Timber harvesting is another form of habitat modification that can either improve or reduce the value of wildlife habitat. Of all the factors associated with forested wildlife habitat in the Northeast, the number, size, and species of trees in a habitat is probably the most important. When trees are removed from an ecosystem, an animal's source of food and shelter is removed as well. Careful selective logging of a well-stocked forest can often minimize these impacts, and in some cases even improve wildlife habitat, but the rarity of big, healthy trees in MMF makes even this type of low-impact logging unfeasible. On the other hand, as mentioned in the Wildlife Inventory section above, some species rely on the presence of early successional patches of vegetation for young shoots, buds, and berries. Forestry practices that emulate the natural disturbances that create these kinds of localized patches are often the most successful at improving wildlife habitat at the landscape level.

Aquatic Features

Milton Pond Watershed

The absence of agricultural or domestic land use within the watershed boundaries means that the watershed is free of such pollution sources as agricultural runoff, lawn fertilizers, and septic system inputs. However, any activities that lead to erosion and compaction pose threats to the integrity of the watershed.

Currently, Central Vermont Public Service is managing the powerline corridor adjacent to the pond under the assumption that the pond still functions as public drinking water supply. Such management involves no pesticide use within 400 feet (west side) and 350 feet (east side) of the pond. Only mechanical and hand cutting is used within these buffer zones. Beyond the buffer zones, herbicide is application is done by hand, using backpack pumps. Application of herbicide and cutting occur on a 5 year cycle. The powerline corridor on MMF is scheduled for maintenance in July of 2003. At this time there will also be selective removal of "danger trees" – trees in danger of falling on the high voltage lines (Disorda, personal communication).

Milton Pond Water Quality and Water Use

In an undeveloped watershed such as that of Milton Pond, erosion is the most significant source of pollution. Erosion of the surrounding landscape allows more sediment to be carried in surface water; excessive erosion can lead to excessive sedimentation.

Sedimentation refers to the deposition of sediment on the bottom of the water column and the possible clouding of the water column itself. While sediment deposited on the bottom of a body of water can lead to death of bottom dwelling plants and animals, the clouding of the water column can result in reduced levels of sun transmission. This, in turn, leads to lowered productivity of photosynthetic plants and, thus, lowered oxygen concentration.

Death of plants and animals leads to further reductions in oxygen levels because death results in increased levels of bacterial decomposition. Many bacteria involved in decomposition utilize oxygen as they consume dead material. This leads to an increased level of "Biological Oxygen Demand" or BOD. As BOD increases and more oxygen is consumed, oxygen levels fall. This drop in oxygen levels can lead to additional die offs of fish and other oxygen needing species.

As mentioned in the Introduction to this section, an additional issue of concern is the addition of nutrients due to erosion and sedimentation. Cut banks and exposed slopes caused by recreation, resource extraction, and development can lead (with varying degrees of severity) to release of nutrients such as phosphorous form the soil. Addition of such nutrients to water bodies often results in alteration of the biological and chemical composition of that water body. All the factors described above together shape a process known as eutrophication. Under natural conditions, a pond like Milton Pond might experience a slow process of eutrophication over the course of centuries. Through human land-use practices within the watershed, however, it is possible to greatly (and artificially) accelerate this process (Figure 31) (Raven and Berg 2001).

Boating and Fishing

While the absence of both Eurasian Water Milfoil (see photo, left) and Zebra Mussels is always an encouraging finding, it does not indicate that the pond is invulnerable to these aquatic nuisance species. The difficulty of boat access to the pond has likely restricted boaters use of the pond. Were

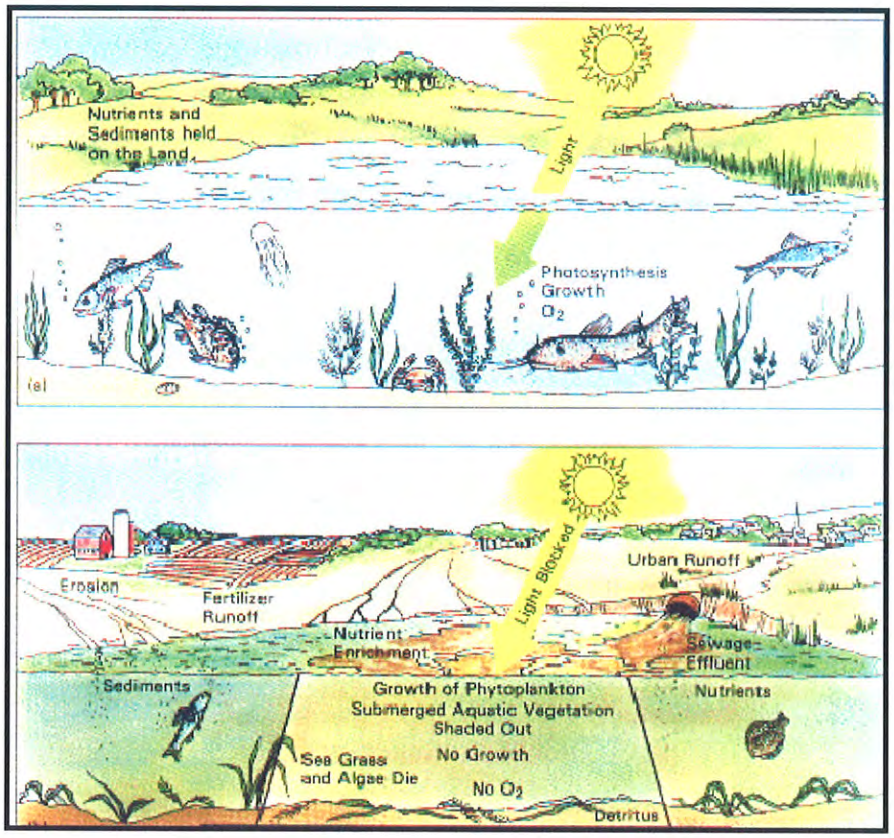


Figure 31: Illustration of the process of eutrophication. The upper image represents the a less impacted body of water . The lower image represents a similar body of water that has been subjected to far more nutrient inputs. (Source: www.sepro.com/pondpak/images/ pondpak_faq_1.gif)

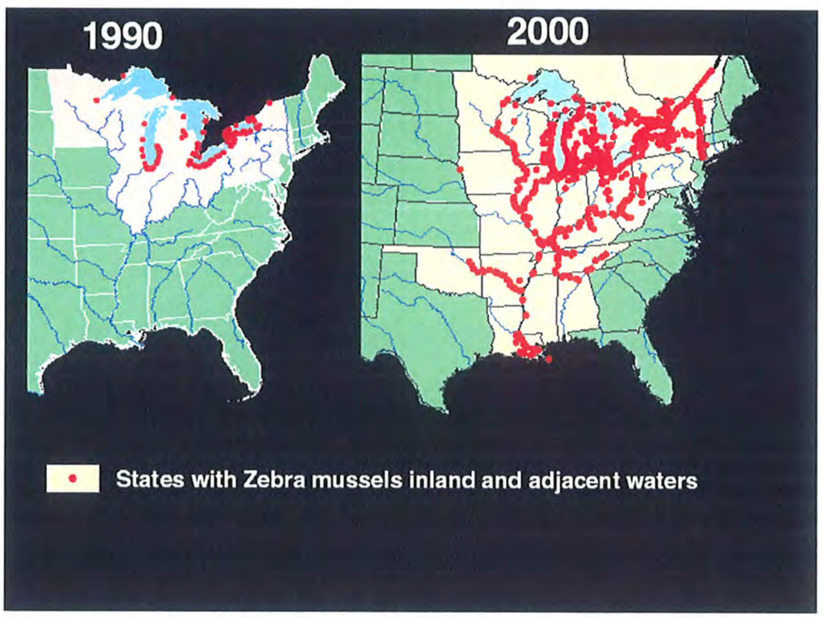
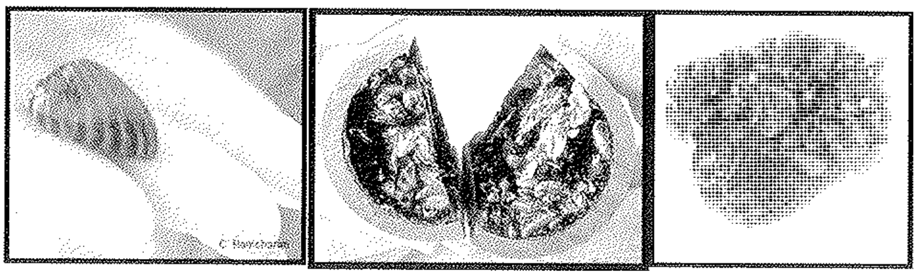


Figure 32: Confirmed Zebra Mussel distribution 1990 and 2000. Source: U.S. Geological Survey Noindigenous Aquatic Species Program. (Source: http://www.unl.edu/nac/conservation/atlas/Map_Html/Biodiversity/Regional/Zebra_Mussel/zebra.jpg)

Figure 33: Vermont Lakes monitored for adult and veliger (larval) zebra mussels. (Source: Vermont Department of Environmental Conservation. http://www.anr.state.vt.us/dec/waterq/ans/zmdist.htm)

access to be improved, the likelihood of Eurasian water milfoil and zebra mussel infestation would also increase.

Eurasian Water Milfoil is an aquatic plant, native to Asia, that is commonly used in aquariums. Introduced to North American waters (beyond the aquarium) around 1940, Eurasian Water Milfoil has spread rapidly throughout the continent. Because of its ability to outgrow many native plant species, Eurasian Water Milfoil out-competes native aquatic plants. It is considered an aquatic nuisance species by the Vermont Department of Environmental Conservation (VTDEC) and there is great concern about its ability to infest water bodies such as Milton Pond.



Zebra mussels, also a native of Asia, were mistakenly introduced to North American waters around 1982. Transported in the bilge water of a tanker from the Caspian Sea, zebra mussels were first released in the great lakes. Zebra Mussels are small (see photos, above) and, unlike other North American freshwater mussels, can affix themselves to hard surfaces. This ability results in their remarkable—and unfortunate—propensity to clog intake pipes and suffocate other mussel species. Since their 1982 introduction, zebra mussels have spread rapidly throughout the United States (Figure 32). This spread has led to an estimated national freshwater mussel extinction rate of 10% per decade (Riccardi and Rasmussen 1999).

While Eurasian Water Milfoil is most easily transported from water body to water body in the motors of boats, the larvae of Zebra Mussels (invisible to the human eye), can be much more easily transported. Bilge water, unwashed/undried boats, kayak flotation compartments and bait buckets are all likely transmission vehicles. Current state-wide public education efforts are designed to encourage anglers and boaters to clean boats and bait buckets carefully when traveling between bodies of water (Marsden and Merrell, personal communication).

Currently, only four water bodies in the state of Vermont are know to be infected with zebra mussels: Lake Champlain, Lake Dunmore, Lake Hortonia, and Lake Bomoseen (Figure 33). However, it must be remembered that absence of evidence is not evidence of absence.

An additional potential threat to the biological water quality of Milton Pond is the potential failure of the dam. Dam failure would not only result in potentially catastrophic release of water and sediments downstream but also in a dramatic decrease in water levels. Such a decrease would lead to a decrease in available aquatic habitat and subsequent reductions in populations of aquatic plants and animals.

Additionally, the decrease in water level would allow the water to warm up faster. Because warm water does not hold dissolved oxygen as well as cold water, this would also result in a decrease in dissolved oxygen levels, likely fish die-offs, and an increase in biological oxygen demand (because of increased decomposition by bacteria). In other words, it would further accelerate eutrophication (Figure 31). In addition to generally less favorable fishing conditions, the pond could become quite foul.

Swimming

While the previously mentioned possibility of *giardia* likely limits the probability of swimming activities in Milton Pond, it should be noted that such activities could contribute additional nutrients and pathogens (in the form of human waste) to the water. Beavers are not the only carrier for the *giardia* parasite; humans and dogs are equally capable carriers whose feces also carry *E. coli* bacteria.

Streams

Streams in MMF appear vulnerable to channelization in old roadbeds. As mentioned earlier, this can lead to higher rates of sediment transport and erosion which, in turn, contribute to an acceleration of eutrophication (see Recreation).

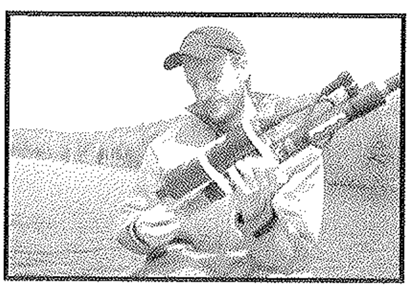
Riparian areas along tributary streams are particularly sensitive to disturbance. Such areas play an important role in maintaining water quality. Streamside vegetation provides stabilization of stream banks, provides a source of woody debris (important to insects that reproduce in streams), and regulates water temperatures.

Beaver Meadow Wetlands

Beaver meadow wetlands are dynamic systems that experience natural changes throughout time. The only currently noted threat to beaver meadow wetlands is the potential failure of the dam at Milton Pond.

Regulatory/ Institutional Context

MMF and the watershed of Milton Pond lie within the larger Lamoille River Watershed. Currently, this watershed is undergoing a large-scale planning process as part of a state-wide program know as the Basin Planning Program. Coordinated by the state Agency of Natural Resources, the program involves cooperation between landowners, municipalities, and state government in defining and setting management objectives for water bodies within major watersheds. Planners from the state are currently preparing to begin the process in and around Milton (Bates, personal communication).



Water quality testing on Milton Pond.

Additionally, the VTDEC is interested in maintaining its spring phosphorous monitoring program at Milton Pond as well as initiating more extensive surveys of biological indicators of water quality. Such surveys could provide additional insight into the aquatic ecosystem of Milton Pond. They would be conducted during the summer, require approximately one day of field work for one individual, and occur on an annual basis.

Recreation

Assessment

Our assessment of recreation activities on the MMF includes all recreation activities suggested by Milton citizens at the January town meeting. For each use, the way in which recreation activities impact the landscape will be discussed, as well as how each activity affects other activities and may affect itself. Ultimately, it is up to the town of Milton to define the recreational purpose of the MMF, what activities are appropriate for that purpose, and the trail design and management are needed to accommodate those activities.

Trail System

Figure 34: This former logging road has been eroded down to bedrock and turned into a stream.

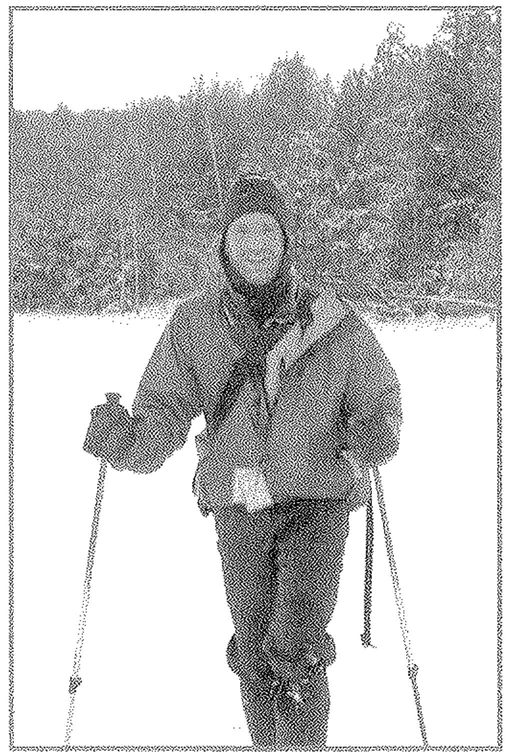
The trail system, used in varying degrees by all recreational activities, is in need of repair. While a scenic footpath in relatively good shape rings the pond, many of the current trails are actually abandoned logging roads that were not created with long term use in mind. Often the roads cross wet areas, and some have turned into streams that have eroded through MMF's thin soils to exposed bedrock (Figure 34). The logging roads frequently dead end on steep slopes and have little recreation value.

A well designed and maintained trail system is integral to all recreation activities. The following sections describe particular recreation activities and their impacts on the landscape as well as their impact on each other. One impact implicit throughout this recreation assessment is crowding. Trail crowding will impact the recreational enjoyment of all visitors to the MMF, whether hiking, camping, or horseback riding. Crowding may also stress the resources of the

MMF, causing erosion and reducing wildlife's ability to use the area, even on well constructed trails.

Hiking, Skiing, and Snowshoeing

Hiking is one of the lowest impact activity that takes place in the MMF, although the level of impact depends on the quality of the trails. In this category we include other walking-based activities such as bird watching. If trails are in poor condition (due to poor construction or previous misuse), they are more likely to be eroded by activity, even a low impact activity like hiking. Because skiing and snowshoeing occur only when there's a substantial layer of snow on the ground, soil erosion is not a factor. Other than increasing trail traffic, which may reduce the wilderness experience of visitors, hiking, skiing, and snowshoeing have little impact on other recreation activities.



Mountain Biking

As mountain biking is a relatively new sport, research on its impacts is somewhat limited. Specifically, the potential of mountain bikes to cause erosion has not been well studied in soil types similar to those found in MMF. In general, mountain bikes have not been shown to cause more erosion than hikers as long as the trails are well maintained. If trails are poorly maintained, mountain bikes may cause more erosion than hikers. Mountain bikers can be tempted to bike off trail in search of exciting terrain, which can disturb fragile areas of the forest. In other locations, conflicts have arisen between hikers and mountain bikers who share trails, typically over a perceived loss of wilderness experience on the part of the hikers. Lastly, conflicts can potentially arise between mountain bikers and horseback riders; mountain bikers can move quickly along trails and spook unsuspecting horses.

Hunting and Fishing

Hunting is most affected by the quality of the woods and the prevalence of other recreation activities. The activity impacts the landscape mainly through the construction of deer stands (of which there are approximately seven in the MMF). Hunting also impacts potential visitors who are nervous about visiting MMF during hunting seasons. Fishing is covered in Aquatics Features.

Swimming and Boating

Swimming and boating are covered in Aquatics Features.

Camping

There are limited dry, flat areas appropriate for camping within the MMF. Camping can impact other recreation activities if campers are noisy, leave trash around their campsite, or dispose of their waste improperly. Campers may also be tempted to cut down trees for campfires, and there is always a risk that fires could burn out of control.

Off Road Vehicles (ORV's)

Studies have shown that ORV's have the most erosive impacts on trails of all the potential recreation activities (Liddle 1997). ORV's mobilize sediment in wet areas and loosen soil on steep slopes as tires grip for traction. This erosion damages trails for hikers, skiers, snowshoers, mountain bikers, and horseback riders. In addition to trail erosion, ORV's generate enough noise to significantly impact the wilderness experience of other recreationists. ORV users can be impacted by trail traffic, when worries about collisions with other ORV's or hikers arise.

Snowmobiles

Snowmobiles have an especially complex impact on forested areas. Since they are used in the winter months, trail erosion is not an issue. For some animals, such as white-tailed deer or fox, the packed trails of snowmobiles create transportation corridors that ease travel through snow. For other animals, such as mice or voles, snowmobiles collapse wildlife transportation tunnels under the snow and reduce the insulating capacity of snow, which is crucial to these small animals' winter survival.

For winter recreationists, snowmobiles can create trails of packed snow that ease skiing and snowshoeing. Some visitors may object to the noise of snowmobiles, resulting in a loss of wilderness experience.

Horseback Riding

There are two concerns with horseback riding in natural areas: erosion and the introduction of exotic plant species via horse droppings. Horse hooves can sink deep into wet soil, but a conversation with a neighboring horse barn manager assured us that horses are not used in the MMF when trails are muddy. It is difficult to ascertain the likelihood of exotic plant species being introduced into the MMF via droppings. Studies in the western half of the U.S. have proven the introduction of exotics via droppings to be an issue, but no studies, to our knowledge, have been undertaken in the shady woods of Vermont.

SECTION 3: MANAGEMENT RECOMMENDATIONS

This section provides a menu of recommended management objectives and strategies from which the Town of Milton Select Board can pick and choose in the creation of a final management plan for the Milton Municipal Forest. Ideally, management strategies are based upon clearly defined management objectives. Knowing Milton's specific objectives with respect to the use of the forest would allow us to craft a specific set of management strategies to best meet those objectives. Rather than a specific set of management strategies, however, we have been asked to provide a range of management options. We feel that the format used in this section of our report serves this request for a range of management options.

Navigating our format for management recommendations requires some explanation. Based upon our thorough landscape inventory and impact assessment for the Milton Municipal Forest, we first generated a list of suggested management objectives that we believe are important to consider. We leave it to the Select Board, however, to decide how important each suggested management objective is for the Town of Milton. Each suggested management objective is followed by a list of recommended management strategies to achieve that objective. Therefore, if the Select Board decides that a particular management objective is important, it can then consider our list of recommended management strategies to achieve that particular objective. Some management strategies are listed more than once under different suggested management objectives. This simply means that some strategies can help to achieve multiple objectives. We maintain this redundancy in the format because we do not know which suggested management objectives the Select Board will decide are most important. Redundant recommendations are cross-referenced in italics.

To minimize **erosion**,

- Repair and relocate trails according to the Trail Repair Map (Map 9). (See also *Trail System, Cultural Features*)
- Prohibit the use of off road vehicles. (See also *Multiple Uses*)
- Prohibit the most damaging trail uses (mountain biking and horseback riding) until trails can be repaired.
- Restrict mountain biking and horseback riding during snowmelt when trails are saturated.
- Encourage users to camp more than 200 feet from Milton Pond and other wet areas. (See also *Water Quality, Camping*)
- Plan any timber harvest in consultation with the Chittenden County Forester to minimize soil compaction and erosion. Use only a certified logger who will carefully follow Vermont's Acceptable Management Practices (AMP's) for timber harvesting. (See also *Plant and Natural Community Diversity, Non-Native Invasive Species, Wildlife, Water Quality*)

To maintain or enhance **plant and natural community diversity**,

- Hire a qualified botanist to conduct a survey of rare plant species during the growing season.
- Plan any timber harvest in consultation with the Chittenden County Forester to minimize soil compaction and erosion. Use only a certified logger who will carefully follow Vermont's Acceptable Management Practices (AMP's) for timber harvesting. (See also *Erosion, Non-Native Invasive Species, Wildlife, Water Quality*)

To avoid the introduction of **non-native invasive species**,

- Maintain current limited boat access to Milton Pond.
- Prohibit motorboats.
- Discourage the use of untreated kayaks (see Appendix I).
- Provide information to users about the transmission of zebra mussels and Eurasian water milfoil on boats and in bait buckets.
- Avoid clearing timber near the West Side Trail to prevent the spread of non-native, invasive Japanese knotweed.
- Plan any timber harvest in consultation with the Chittenden County Forester. Use only a certified logger who will carefully follow Vermont's Acceptable Management Practices (AMP's) for timber harvesting. (See also *Erosion, Plant and Natural Community Diversity, Wildlife, Water Quality*)

To maintain **wildlife** habitat and diversity,

- Keep trails away from dens, vernal pools, riparian areas, and other fragile habitat features.
- Preserve cavity trees, mast trees, and snags.
- Do not trap, disturb, or displace beavers.
- Establish wildlife monitoring system. (See also *Education*)

- Keep pets on leash to prevent wildlife harassment and to protect pets from the abundant porcupine population at the MMF. (See also *Water Quality*)
- Restrict snowmobile use to the West Side Trail. Use of snowmobiles on trails next to wet areas may prevent small mammals from accessing needed resources in Milton Pond and the beaver meadow. (See also *Multiple Uses*)
- Plan any timber harvest in consultation with the Chittenden County Forester. Use only a certified logger who will carefully follow Vermont's Acceptable Management Practices (AMP's) for timber harvesting. (See also *Erosion, Plant and Natural Community Diversity, Non-Native Invasive Species, Water Quality*)
- Permit continued clearing around old apple orchards.

To **educate** visitors about the MMF while preventing over-use,

- Produce an educational brochure for circulation in the community and distribution at the trailhead.
- Post a sign at the trailhead with a sign-in book, brochures, maps, rules and regulations, etc. (See also *Health*)
- Develop connections with local environmental education centers, local schools, boy scout and girl scout troops, etc. Send them copies of the brochure.
- Require permits for educational groups of over 20 people.
- Require all large groups to stay on trails.
- Create education programs that aid in monitoring the MMF, for example, water quality monitoring and wildlife tracking. (See also *Water Quality, Wildlife*)

To ensure the **health**, safety, and enjoyment of visitors to the MMF,

- Post a sign at the trailhead with a sign-in book, brochures, maps, rules and regulations, etc. (See also *Education*)
- Prohibit trapping.
- Require all visitors to wear safety orange during hunting season and post signs at trailheads to alert visitors of hunting seasons.
- Prohibit swimming (elevated levels of *E. coli* and giardia are suspected). (See also *Camping*)
- Encourage users to pack out their trash and pick up other peoples' trash. (See also *Camping*)
- Organize periodic volunteer efforts to remove litter from the forest.
- Encourage users to bury human waste more than 200 feet from any water source in a 6-8 inch deep hole. (See also *Water Quality*)
- Encourage users to keep dogs on leash at all times. Pack out dog waste. (See also *Wildlife, Water Quality*)

To maintain the **water quality** in the MMF,

- Plan any timber harvest in consultation with the Chittenden County Forester. Use only a certified logger who will carefully follow Vermont's Acceptable Management Practices (AMP's) for timber harvesting. (See also *Erosion, Plant and Natural Community Diversity, Non-Native Invasive Species, Wildlife*)

- Encourage users to bury human waste more than 200 feet from any water source in a 6-8 inch deep hole. (See also *Health*).
- Encourage users to keep dogs on leash at all times. Pack out dog waste. (See also *Wildlife, Health*)
- Become informed about and involved in the Vermont Watershed Basin Planning Process:
    - Work with the Vermont Department of Environmental Conservation (VTDEC) to determine a Water Quality Classification for Milton Pond.
    - Develop watershed-based strategies to maintain the level of water quality required by the classification.
- Work with the VTDEC to perform the yearly Spring Phosphorous and Biocriteria Monitoring on Milton Pond. Volunteer efforts could be coordinated to perform this monitoring in partnership with DEC staff. (See also *Education*)
- Maintain integrity of the dam to prevent dam failure; consultation with an engineer is recommended.

To minimize physical disturbance of **cultural features**,

- Maintain a well-designed trail system to encourage users to stay on trails and avoid disturbing cultural features (See also *Erosion, Trail System*)
- Be certain that any logging operations avoid disturbing cultural features or greatly impacting the historical integrity of the MMF.

To allow **camping** on the MMF,

- Require permits from the town office for all campers.
- Allow groups of no more than six at each campsite.
- Prohibit fires and swimming. (See also *Health*)
- Require that all users pack out trash. (See also *Health*)
- Encourage users to camp more than 200 feet from the pond and other wet areas. (See also *Water Quality, Erosion*)

To establish the **boundaries** of the MMF,

- Re-blaze boundary lines.
- Replace missing iron posts at boundary corners.

To maintain **multiple uses** of the MMF while ensuring these uses don't conflict with each other,

- Restrict snowmobiles to the West Side Trail. (See also *Wildlife*)
- If mountain biking or horseback riding becomes a popular activity in the MMF, consider restricting these activities to certain trails in order to prevent conflicts with bikers and other trail users. (See also *Erosion*)
- Prohibit the use of off road vehicles. (See also *Erosion*)

To develop a low-impact, sustainable, and easily-navigated **trail system** (see Map 9),

- Close eroding skid roads on slopes south of Milton Pond to foot traffic by dragging available brush to trail entrances.
- Close North Shore Trail by dragging available brush to trail entrance.

- Install check steps and water bars at the northern end of the West Side Trail and towards the eastern end of the South End Trail.[1]
- Install bog bridges at the northern end of the East Side Trail, where the Overlook Trail crosses a seep, and where the West Side Trail crosses a stream.[2]
- Clear out the Sugar House Trail and install check steps and water bars where necessary.
- Re-route part of the Back Line trail around a wide seep.

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[1] Check steps are logs or rocks fitted and placed across the trail. They prevent erosion by slowing water down and trapping sediment. Water bars are logs or rocks fitted and placed at an angle across the trail. They prevent erosion by directing water off of the trail.

[2] Bog bridges are long logs laid across the tops of "sills," or short-cut logs placed in rock beds. The long logs are thereby elevated above wet areas and prevent trail degradation by keeping hikers out of the mud.

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Appendix A: Cultural Features Inventory

This appendix provides an inventory of the specific cultural features discovered in the Milton Municipal Forest. This inventory describes the clues a visitor can look for when trying to read the human history of the forest, and links these clues to the chronology presented in this report. All of these features are shown on our Cultural Features Map (Map 3). Though we were not able to draw any definitive conclusions, we speculate about past origins and ownership of the various cultural features discovered. Information in this section draws on the work of Sanford et al. (1995) and the knowledge of Jane Dorney, a cultural geographer.

Microtopography and Stony Ground

Figure A1: Rocky, rough microtopography west of Milton Pond.

A natural forest floor is extremely uneven. Trees periodically fall and their roots create large mounds while leaving large pits where they were previously anchored in the soil. Stones of all sizes cover the ground. In order to farm such land, the stones must first be removed, and decades of plowing eventually smoothes the uneven microtopography. This contrast can be seen in the MMF. Walking the trail on the west side of Milton Pond, one can look up into the forest and see rocks and stones of all sizes covering a very rough forest floor (Figure A1). Such microtopography suggests that the steep slopes of the westernmost portion of Milton Municipal Forest were never cleared for agriculture. These slopes were cleared during logging operations in 1986, and it is interesting to see the contrast in vegetation between parts of the forest that are recovering from recent logging and other parts of the forest that are still recovering from nearly 200 years of farming.

Stonewalls and Stonepiles

Both stonewalls and stonepiles are encountered frequently in the Milton Municipal forest. Many of the stonewalls are shown on our Cultural Features Map (Map 3). Stonewalls were most often constructed around cropfields and hayfields, rather than around pastures. They helped to keep livestock from destroying these crops. In order to plow, stones were first removed from the ground and transported to the edge of the field where they were used to build the walls. Every year, winter freezing and thawing of the soil would heave a new crop of stones to the surface, and "weeding" the fields of stones was a grueling annual task. Stonewalls were built through the end of the 19th century. By the beginning of the 20th century several factors led to the decline of stonewall construction. Inexpensive barbed-wire became available, the skill of wall-building deteriorated, and many farmers who were struggling economically just couldn't afford the effort. In fact, many stonewalls in the MMF are also draped with barbed-wire that was likely added in the early 20th century, the fenceposts having long since decayed (Figure A2). Still, the annual crop of stones needed to be disposed of somehow. More and more often, they were simply gathered into piles, and many stonepiles can be found throughout the Milton Municipal Forest (Figure A3). Also throughout the 19th century, tree saplings that would inevitably

Figure A2: Three varieties of wire fence found embedded in a tree on the southern boundary of the Milton Municipal Forest.

Figure A3: Large stonepile in a previously cultivated area.

grow alongside stonewalls were frequently grubbed out in order to keep their roots from destroying the walls. At the same time, trees (maples especially) were often deliberately planted along stonewalls leading to a home, for both shade and ornamentation. In the early 20th century, the practice of maintaining stonewalls was often abandoned. Many of the stonewalls in the MMF have very large, old trees of several species growing along their lengths (Figure A4). Where these stonewalls pass near an old building foundation (Foundation g, for example), these trees may have been deliberately planted. Elsewhere in the forest, these large, old trees were once saplings who simply avoided a farmer's attention by growing close to a stonewall, too close to merit being destroyed. This practice can be seen today on land north of Milton Pond, where narrow treelines grow along old stonewalls between hayfields that are currently in use. A study of tree ages along stonewalls in the Milton Municipal Forest might give us interesting information about when these walls were abandoned to natural processes.

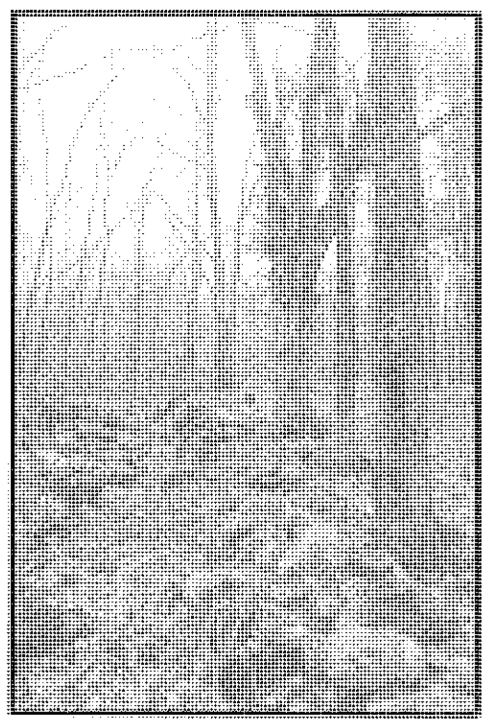


Figure A4: Stonewall running through the Milton Municipal Forest (left), and large, old trees growing along another stonewall (right).

19th Century Roads

What is the origin of the current trail system in the Milton Municipal Forest? We believe many of the corridors that have been used by hikers, motorized vehicles and logging equipment in the past two decades were originally constructed in the 19th century to access the numerous hill farms in the area (Figure A5). The hypothesized 19th century road system is shown on our Cultural Features Map (Map 3). Where roads are shown to dead end, they may have originally extended farther, but have now deteriorated to the point where they cannot be followed. Evidence of careful construction, ancient stonewalls and rusty sap buckets found along roads, and trees older than 20 or 30 years (older than the 1986 logging) growing in the middle of some roads, provide evidence that these roads have a long history. The road that enters the forest east of Milton Pond and travels along the west side of the beaver meadow is a case in point. This road is shown on the Beers map (see Cultural Resources inventory), but it appears to deteriorate before reaching the residence of Paul Brunell. However, evidence we discovered in the forest indicate that this road once extended at least to the southern boundary of the forest and possibly beyond. Looking at our Cultural

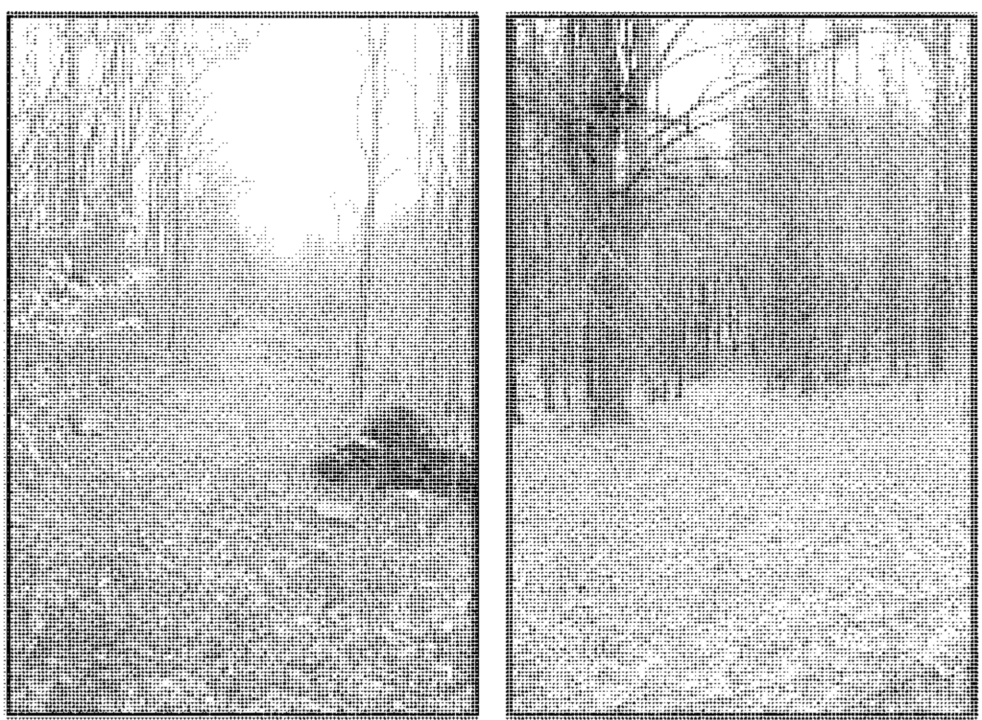


Figure A5: 18th century roads in the Milton Municipal Forest.

Features Map (Map 3), one can see this road lined with an obvious stonewall and passing by Foundation c in the southeast corner of the forest. In addition, there is evidence that the portion of this road beside the beaver meadow was originally constructed on the hillside to the east of its current location. It would have been unusual for a road to have been built so close to a wetland where flooding and water damage would have been a risk. The long line of barbed-wire shown on the map just west of the current trail follows a row of large trees along a flattened terrace that may have been the original roadbed. If this is the case, then the old car found near Foundation d may have rolled *downhill* from the road above until it coincidentally crashed into an old apple tree. Similarly, there is evidence that the road curving west from the beaver meadow near Foundation f was originally constructed higher on the hillside. The "oven" labeled on our Cultural Features Map (Map 3) was dumped on the side of this road whose old surface is clearly visible just above the oven. Knowing the model and year of this oven might allow us to put a date on this old road bed!

Sap Buckets

There has been a long history of maple sugaring in the Milton Municipal Forest dating back to the earliest settlers and extending to the middle of the 20th century. Rusty, flattened sap buckets can be found

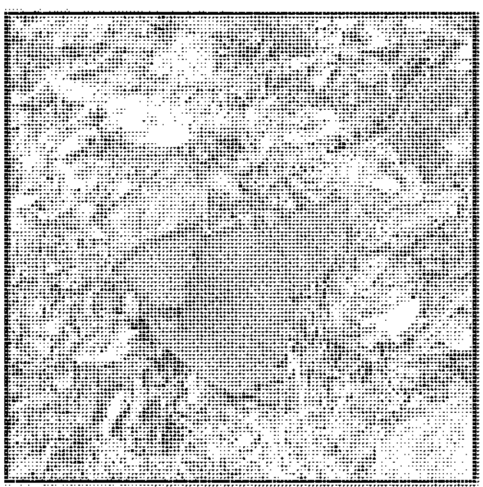
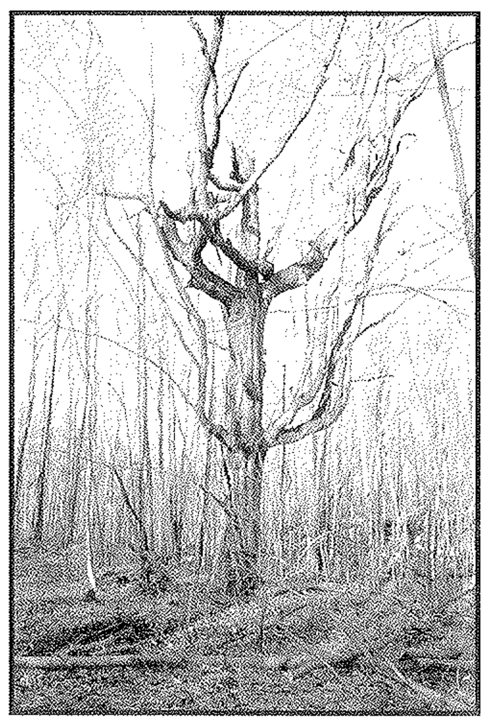


Figure A6: Rusty sap bucket in a grove of sugar maples (top) and a majestic old maple (right), still alive!



throughout the forest, and a few are shown on our Cultural Features Map (Map 3). In addition to buckets, huge, old maple trees and dead maple snags are abundant, and these no doubt produced sap for many different land owners over a period of decades. Today they provide important wildlife habitat and food sources, as well as a sense of wonder and history to visitors (Figure A6).

Foundations c and d

We were not able to confidently match many of the building foundations discovered in the Milton Municipal Forest with specific farms or owners. We can only speculate on ownership and leave the mystery open to future researchers. The area of Foundation c hosts the scant remains of two or three building foundations. They are clearly human-made, but barely discernable as foundations. At least two very old apple trees grow near these remains. Nearby,

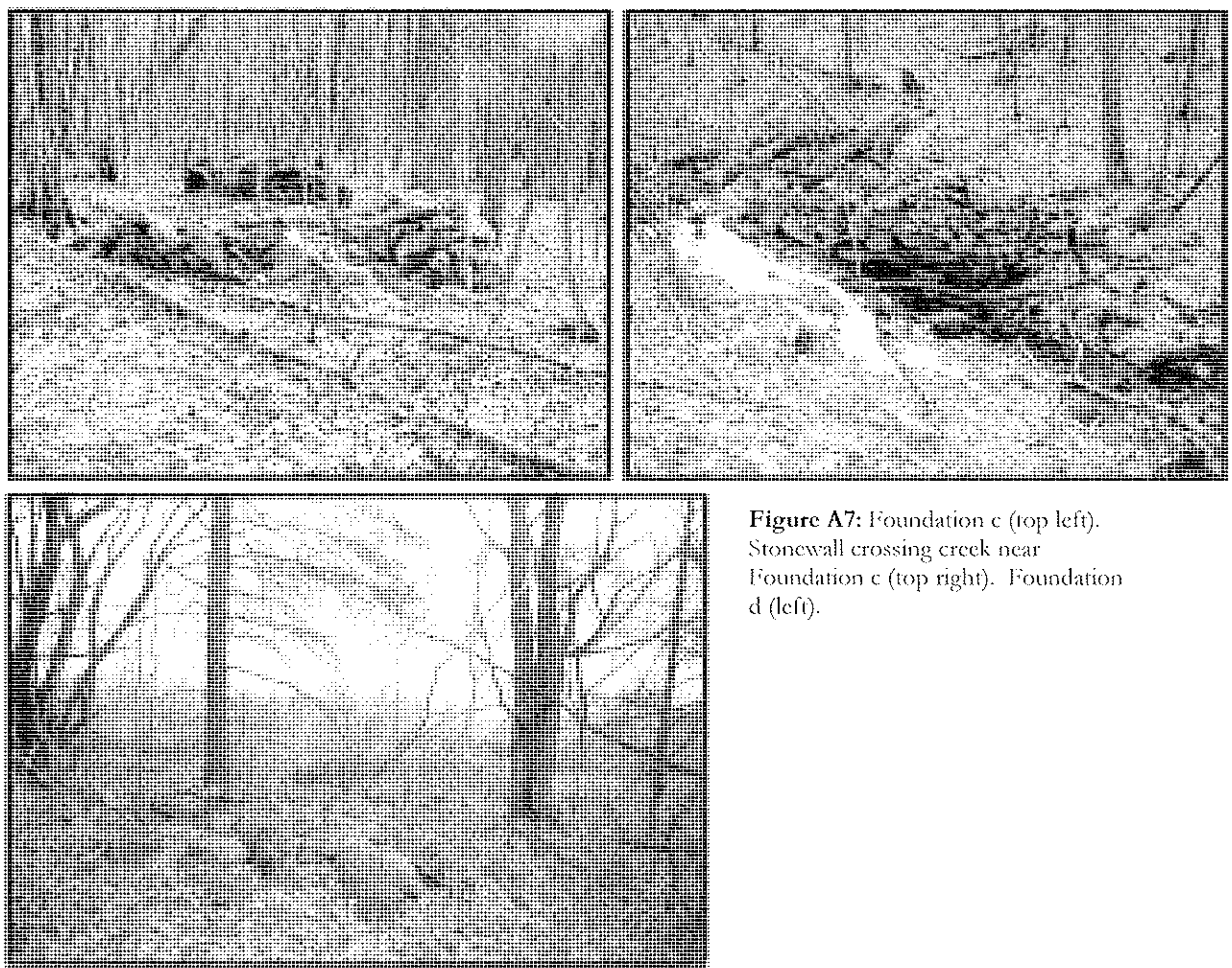


Figure A7: Foundation c (top left). Stonewall crossing creek near Foundation c (top right). Foundation d (left).

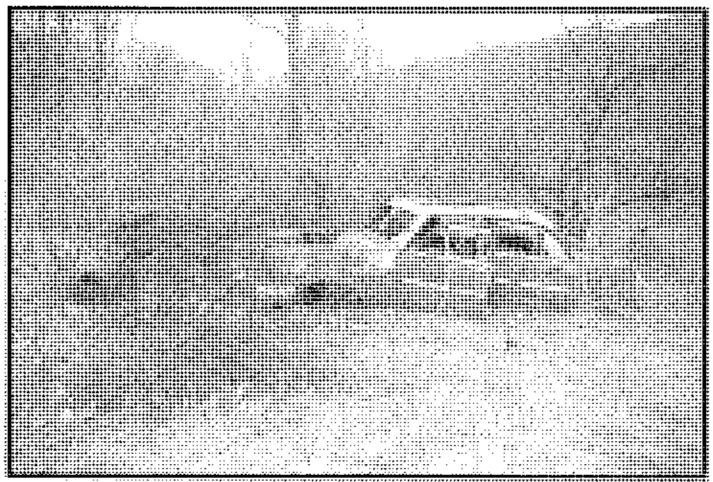
an extensive stonewall crosses a small creek. This crossing was carefully constructed by bridging the creek with a long flat rock and piling more rocks on top. Foundation d is another mystery. Again, it is not obvious as a building foundation. Rather, it looks like a large jumble of stones. There is a second jumble of stones about 40 feet away from the first, and some very old apple trees growing nearby. One of these trees was battered by an automobile, as described previously. Both of these foundations are likely remains from the early 19th century (Figure A7).

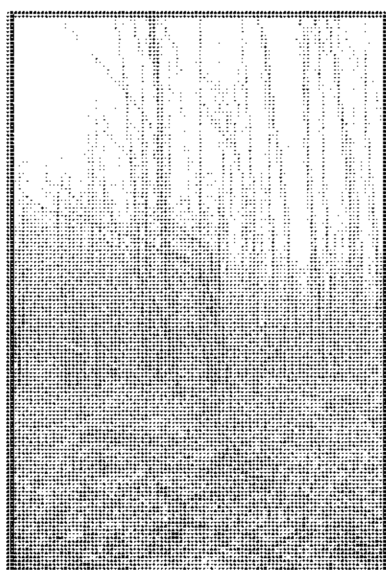
Foundations e and i

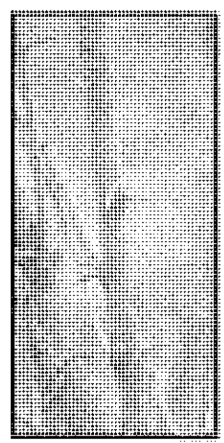
Foundation e is an impressive cellarhole, approximately 30 by 15 feet, built into the hillside immediately next to the trail. A cellarhole was dug for the purpose of storing perishable food through the winter, thus it indicates the site of someone's home, rather than a barn or outbuilding. This cellarhole is quite overgrown, and a rusty washing machine drum and the remains of an old car are scattered in front of it. Several apple trees grow nearby. Stonework extends to the north of the cellarhole, suggesting that an addition may have been added to the original house. Foundation i is also a valuable find. This large cellarhole (also 30 by 15 feet) has stonework extending south that suggests two additions to the original house. It contains an old washtub, and a junked car and a truck rest beside it. Just north of the cellarhole is a flat grassy area with evidence of stonework that may have been the foundation of a large barn. Perhaps most impressive is the large orchard of apple trees and a few hawthorns surrounding this foundation (Figure A8). There may be more than 50 apple trees in this area. From our research, the earliest known owner of this land was Paul Brunell. Though it is not known if Paul lived at either of these home sites, the 1870 *Agricultural Census* does tell us that his farm (Parcel A, see Cultural Features Map, Map 3) supported the following products: 2 horses, 14 milk cows, 2 oxen, 8 other cattle, 4 sheep (26 lbs. of wool), 2 swine, 27 bushels of wheat, 60 of oats, 75 of potatoes, $25 of orchard products, 50 tons of hay, and 1,600 lbs. of butter. At some point before 1880, Paul retired and leased his land to his son, Peter. In 1880, Peter provided the following numbers to the census: 1 horse, 13 milk cows, 2 other cattle, 2

Figure A8:

- Foundation e (left)
- Foundation i (middle left)
- Junked car and truck beside Foundation i (middle right)
- Large orchard of apple trees (Orchard d) surrounding Foundation i (bottom left)
- Hawthorn tree in Orchard d (bottom middle)
- Detail of thorns on Hawthorn (bottom right)







swine, 18 bushels of wheat, 100 of Indian corn, 40 of oats, 100 of potatoes, $10 of orchard products, 30 tons of hay, 1600 lbs. of butter, 200 lbs. of maple syrup, and $30 of forest products. The small value of orchard products suggests that the Brunells did not harvest the large orchard associated with Foundation i. The mystery remains.

Foundation b

This foundation is an obvious cellarhole located just off the road entering the forest east of Milton Pond. It is reached through a gap in the stonewall that lines the road here. The cellarhole measures about 15 by 15 feet and contains an old, rusty cauldron. Also growing near this foundation are several cedar trees (probably planted) and three beds of lilies, often planted as ornamentals by settlers (Figure A9). This may have been a home owned in 1869 by either George W. Crown or by Charles Coburn and Lorenzo Perry, according the the Beers map (1971). Also discovered near Foundation b is a row of very large, old trees (mostly maples) that may indicate the location of a previous road.

Figure A9: Foundation b. Beds of lilies surround this cellarhole.

Foundation a

This foundation has been largely obscured by leaf litter and soil formation. One stone wall is still visible flush with the ground surface, and a few stones on the opposite wall are also visible. The structure may have been as large as 30 by 15 feet. On the ground nearby are a rusty sugar bucket and the top of an old stove pipe. Apple trees (Orchard a), hawthorns and a very large butternut tree grow near the foundation (Figure A10). Butternut was very commonly planted as a food source by settlers, suggesting that this was a home site. Again, however, the owner of this home is not known.

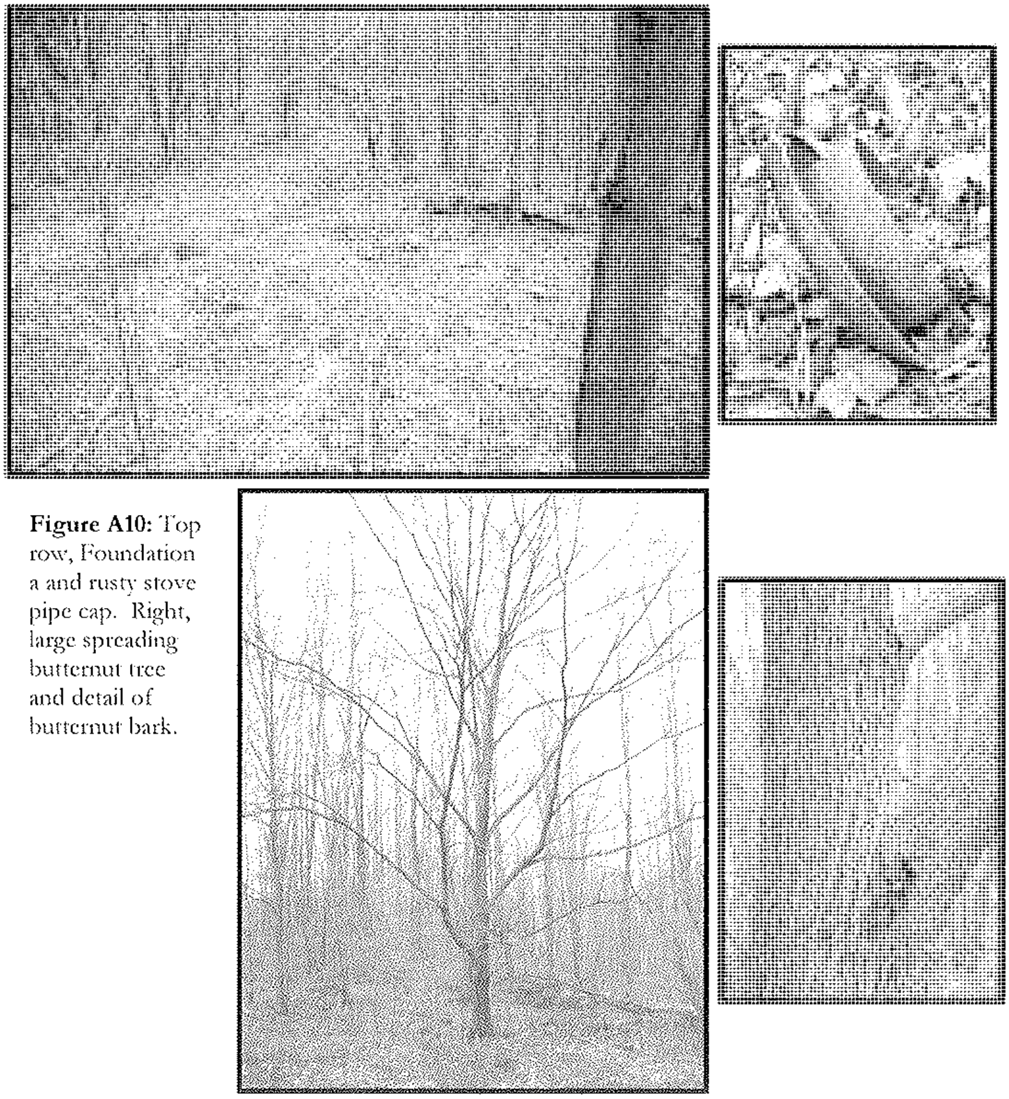


Figure A10: Top row, Foundation a and rusty stove pipe cap. Right, large spreading butternut tree and detail of butternut bark.

Foundation g

Foundation g includes two features, a cellarhole and a barn foundation. The cellarhole is about 15 by 15 feet, and the barn 30 by 20 feet (Figure A11). This pair of foundations is interesting in that they are surrounded by stonewalls and barbed-wire fence suggesting an enclosed rectangle (see Cultural Features Map, Map 3). These two structures together may have been a single functional farm unit dating back to the early 19th century, including a house and barn surrounded by cropfields protected from livestock by the surrounding stonewall. Once again, the owner of this tidy little farm is not known. Large, old trees along the road approaching these foundations may have been deliberately planted, and nearby apple trees (Orchard c) may also have been associated with this farm.

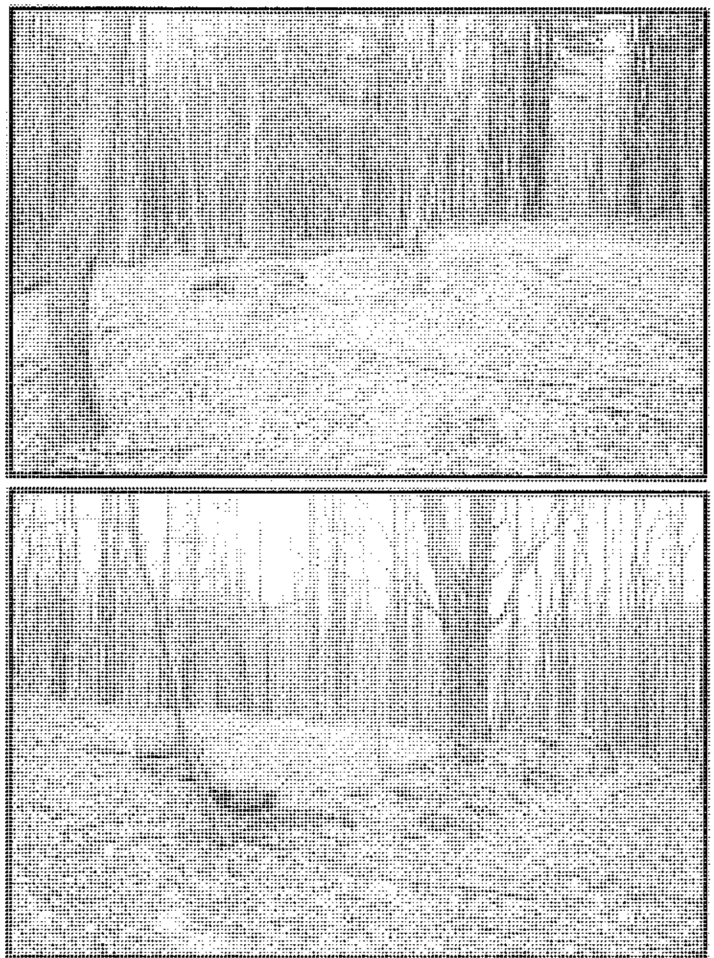


Figure A11: Foundation g, cellarhole (top) and barn foundation (bottom).

Sign

There is a very old piece of plywood nailed to a dead snag on the edge of the pond, and shown on our Cultural Features Map (Map 3). There are no words on the sign, but because it is located on the forest boundary, it may have had something to do with the marking of an old property line.

Cultural Features not described in this Appendix are described in our Cultural Resources inventory where they are appropriate to the telling of the MMF's human history.

Appendix B: Detailed Land Ownership History: 1785 – 1963

This appendix provides a detailed history for each parcel of land comprising the Milton Municipal Forest from 1785 when the area was first settled, to 1963 when Milton Pond was entirely owned by the Milton Water Corp. (see Cultural Features Map, Map 3). For land ownership history post-1963, please refer to our Cultural Resources inventory. Unless otherwise cited, the history presented below is a reconstruction from deeds and maps found in the Milton Town Clerk's office (Milton deeds).

1785 – 1923

Parcel A (purple)

To the best of our knowledge, the first Americans to settle in the vicinity of Milton Pond were the brothers David and Joseph Austin in 1785. Joseph Austin settled along what is now the Westford Road on land north of Milton Pond that may have included Parcel A. In addition to the farm, Joseph owned and operated a hotel in Milton. David Austin settled on land west of his brother, closer to the Westford town line (see Parcel B). Joseph had 5 children and died in 1839. David had 12 children and died in 1813 (Child 1882). Town records suggest that much of the land surrounding Milton Pond was settled by the numerous children of the Austin brothers.

In 1849 and 1857, land totaling 400 acres was sold by George W. Crown, Seymour P. Austin, Ethan Austin, and Moroni Austin to Albon M. and Matilda P. Austin. The farmstead of Albon and Matilda can be seen on the 1857 map of Milton by H. F. Walling (Figure 16). This homestead was known as the "Austin Farm" and was located in the vicinity of the residence now occupied by Geof and Connie Plunkett. The abandonment of sheep farming, the growth of dairy farming and the intensive multiple-use of the landscape are reflected in the livelihood of Albon and Matilda during the period 1850–1860. The *Vermont Agricultural Census* of 1850 shows for that year that Albon and Matilda Austin possessed 4 horses, 24 "milch" (i.e. milk) cows, 2 oxen, 28 non-milk cattle, 20 sheep (70 lbs. of wool) and 15 swine. They grew 40 bushels of wheat, 300 of Indian corn, 250 of oats, 200 of Irish potatoes, and 90 tons of hay. They sold $75 worth of "orchard products" (probably apples), and made 800 lbs. of butter and 6,000 lbs. of cheese. In addition, they produced 100 lbs. of maple syrup. By the 1860 census, Albon and Matilda's farm had grown and the following numbers were recorded: 7 horses, 60 milk cows, 2 oxen, 14 non-milk cattle, 8 swine, 45 bushels of wheat, 50 of Indian corn, 100 of oats, 350 of potatoes, 800 lbs. of butter, 6,000 lbs. of cheese, 150 tons of hay and 600 lbs. of maple syrup.

Land consolidation continued in 1860, when Albon and Matilda sold their 400 acres to Newton H. Ballon, who sold the same land 4 years later to Oscar Burton. In 1863, Oscar had also purchased 50 adjacent acres from Edgar D. and Ruth A. Austin whose two residences are also visible on Walling's 1857 map (Figure 16). In 1868, Oscar Burton sold these 450 acres to a wealthy Milton industrialist, Jed P. Clark, who intended to turn a profit on the land by immediately selling it to Patrick Rowley and Robert Nulty. Patrick and Robert paid $4,500 down and received a $12,000 mortgage from Jed. The residences of Rowley and Nulty are clearly marked on the Beers map (Figure 13). These 450 acres would be owned by Rowley and Nulty for the next 13 years, and by Robert Nulty for an additional 21 years after Patrick Rowley sold Robert his share of the land in 1881. This land eventually became known as the "Nulty Farm," and it certainly included the north end of Milton Pond, Parcel A. According to the *Agricultural Census*, in 1870 Rowley and Nulty reported the following numbers: 2 horses, 54 milk cows, 4 oxen, 8 other cattle, 5 sheep (20 lbs. of wool), 8 swine, 85 bushels of wheat, 100 of Indian corn, 50 of oats, 100 of barley, 30 of buckwheat, 500 of potatoes, $150 of fruit, 6000 lbs. of butter, 100 tons of hay, 800 lbs. of maple syrup, 80 lbs. of honey, and $80 of forest products. In 1880, the following numbers were recorded for the Nulty Farm: 7 horses, 37 milk cows, 8 other cattle, 25 sheep (150 lbs. of wool), 9 swine, 60 bushels of wheat, 150 of Indian corn, 450 of oats, 500 of potatoes, 400 of apples, 1,400 lbs. of maple syrup, and $125 of forest products.

In 1889, Robert Nulty was co-owner of Milton Pond with two other landowners, Arthur Martell to the east, and Walter Perry to the south and southeast (see Parcels B and C below). In this year, these three owners decided to lease Milton Pond for 15 years to Azro B. Ashley for the purposes of stocking and harvesting fish. The only stipulation was that Nulty, Martell and Perry would be able to fish from the pond (Figure 17). This lease has interesting possible ramifications for the fish species currently found in Milton Pond.

In addition to the original mortgage, Robert Nulty took out at least $10,800 in mortgages through the years, possibly an indication of the struggle required to make a living on this stony land. Nulty finally sold his farm in 1902 to Homer E. Powell for $5,500, a large drop in price from the original $16,500 that Rowley and Nulty had paid in 1868. Homer Powell was a wealthy man who was involved in several land deals in the vicinity of Milton Pond. He held onto this farm for several years until his death. We were unable to determine the date of his death, but it is clear that the land passed to his widow, Lucia B. Powell, and that Lucia sold the 450-acre Nulty Farm to George A. Thompson in 1922 for $8,000.

Smith Lot (orange dashed)

The "Smith Lot" comprises approximately 40 acres in the west half of lot 53[4] (see Beers map, Figure 13). We were not able to confidently trace the history of this parcel prior to 1869, nor were we able to determine exactly where this parcel is located in the MMF. The orange dashed rectangle on our Cultural Features Map (Map 3) is our best guess as to the location of the "Smith Lot." Heiram B. Smith, a wealthy man who lived in town, owned this land in 1869, and it is referred to in deeds as a woodlot.

At some point between 1869 and 1896, Heiram died and the lot passed to his widow, Almira P. Smith. In 1896, Almira sold the lot to Homer Powell for $800, and this land too passed to Homer's wife, Lucia, after his death. Neither the Smiths nor the Powells are believed to have lived on this land.

Parcel B (yellow)

David Austin settled along what is now the Westford Road in 1785 (see Parcel A). One of David's 12 children, Ethan Austin, married Clarissa Hill and settled on land near David's farm. A daughter of Ethan and Clarissa, Veronica, married George W. Crown and at some point in the early 19^{th} century settled on the farm previously owned by Ethan and Clarissa. Two farmsteads owned by George W. and Veronica Crown in 1869 are shown on the Beers map (Figure 13), and these may have included Parcel B, the east shore of Milton Pond. George and Veronica's land totaled 348 acres.

At some point between 1869 and 1882, George died and the farm passed to his widow, Veronica, and his daughter, Amanda. In 1883, Veronica and Amanda sold this land to Lucretia B. Witters for $5,000. Lucretia quickly resold the land to Arthur Martell for $6,100, turning a clean profit. Arthur Martell owned this farm for the next 47 years.

Parcel C (brown)

This 130-acre parcel (not including the Smith Lot) was owned by Charles Coburn and Lorenzo Perry in 1869 (see Beers map, Figure 13). The history after 1869 is unclear, but the land seems to have remained in the Perry family, until it was sold by Monroe and Laura Perry to Walter Perry in 1886 for $1,500. In 1890, Walter sold this land for $1,400 to Homer Powell who immediately resold it to Ellen and D. D. Marquette. The Marquettes joined this land with land they had purchased four years previously (see Parcel D).

Parcel D (blue)

The history of Parcel D prior to 1869 is unclear. In 1869, this 108-acre tract was owned by Paul Brunell (see Beers map, Figure 13). By 1882 Paul Brunell had retired and leased his 108 acres to his son, Peter. At some point between 1882 and 1886 (the date is unclear), Paul sold this land to Archibald and Olive Perry. The Perrys did not own the land long before they sold it to Ellen Marquette in 1886 for $800. These 108 acres, along with the 130 acres purchased from Walter

Perry (via Homer Powell) in 1890, became known as the "Marquette Farm" and comprise the bulk of Parcels C and D (minus the Smith Lot). The Marquettes owned this 238-acre farm for the next 33 years, though they tried to sell out twice without success, in 1918 to Henri and Minnie Limoges, and in 1922 to Frank Adams. Town deeds seem to suggest that the Limoges and Mr. Adams did not purchase the farm outright, but rather took out large mortgages with Ellen Marquette. It is suspected that the new owners could not make their mortgage payments and thus reconveyed the land to Ellen Marquette. There is even reference to a legal dispute between the Limoges and Ellen Marquette. The only foundation in the Milton Municipal Forest that we were able to confidently identify is Foundation f, which was the home of DD and Ellen Marquette (Desranleau, personal communication). Today, this foundation looks more like a retaining wall along the trail that heads west from the beaver meadow southeast of Milton Pond (Figure B1). A large bed of lilies grows on a slope next to the trail near this foundation. Finally, in 1923, the Marquettes sold their 238 acres to the brothers George A. and Karl J. Phelps, co-founders of O. G. Phelps and Co., named after their father. O. G. Phelps and Co. was the name given to a store in Milton run mainly by Karl. Evidence suggests that George and Karl did not live on their land around Milton Pond, though they did try to profit from the land in numerous ways, and probably camped there during sugaring season.

Figure B1: Foundation f, site of the Marquette home.

1923 – 1963

In 1923, four landowners held the land under and around Milton Pond: George and Ardelle Thompson, George and Karl Phelps, Lucia B. Powell and Arthur Martell. On October 20 of this year, the Thompsons, Phelps and Mrs. Powell agreed to sell their land under Milton Pond, plus a buffer of 50 feet beyond the high water mark, to the Milton Water Corp. Permission was given to build a dam at the outlet and to flood the pond to the extent of the 50 foot buffer, in addition to building and maintaining ditches across the owners' lands. The Thompsons also reserved the right to cut 200 cakes of ice every winter (20 by 20 inches) from Milton Pond and pay the Water Corp. 4c per cake. Arthur Martell, who was notoriously difficult to get along with (Desranleau, personal communication), refused to sell his land, and thus the Water Corp. failed to acquire the east shore of the pond.

In 1924, Lucia B. Powell sold the "Smith Lot" to the Phelps brothers for $2,000. George and Karl, under the name of O. G. Phelps and Co., now owned the entirety of Parcel C and D.

In 1930, Arthur Martell transferred his 348 acres east of Milton Pond to his daughter, Caroline, and her husband, Edward Desranleau, in exchange for a $9,000 mortgage. Arthur died shortly thereafter, and in 1932, Edward and Caroline sold a 100 foot strip (Parcel B) along the east shore of Milton Pond to the Milton Water Corp. Finally, the Water Corp. owned all of the land under and around the pond.

In 1946, the Phelps brothers leased a portion of their lands to the Atlas Plywood Corp. of Boston for the extraction of timber. Lands to be logged included the "Smith Lot" and the "Old Marquette Sugar Orchard." Based on the 1942 aerial photo and on our Cultural Features Map, these lands must have included the forested land shown west and south of Milton Pond. Stipulations on this lease were quite specific. Timber was to be removed within three years of the lease. Trees less than 12 inches diameter at the stump were to be left, except ash for which any marketable size could be cut. All buttings and tops were to be left for the use of the Phelps. Rights for access and roadbuilding were provided, and Atlas was allowed to pile its logs in the vicinity of Foundation g and in a meadow north of the Marquette home. Loggers were allowed to use the Marquette home or the camp used by the Phelps during sugar season.

At some point before 1948, George Phelps died and the interest in Parcels C (including the "Smith Lot") and D was divided between Karl Phelps and George's estate, administered by his widow, Ellen G. Phelps. At the same time, the Milton Water Corp. began to pursue the acquisition of the Milton Pond watershed, intending to end uses (i.e. cattle grazing and logging) that might impact water quality of the pond which was now also being used as a drinking water supply for the Town of Milton. The transactions through which the Water Corp. acquired the watershed are a bit complicated. On June 12, 1948, Karl Phelps sold his ½ interest in Parcels C and D to his daughter, Elizabeth, and her husband, John C. Fienemann. On September 25, Ellen Phelps sold George Phelps' ½ interest in Parcel C to the Water Corp., and on October 6, the Fienemanns sold their ½ interest in Parcel C to the Water Corp. Parcel C, containing a large portion of Milton Pond's watershed (see Cultural Features Map, Map 3), was now fully owned by the Milton Water Corp.

Also by 1948, Arthur J. and Etta Pidgeon had purchased the Thompson Farm and the Arthur Martell Farm (Pidgeon, personal communication), and in 1950 they sold the 9.2 acres included in Parcel A to the Water Corp., adding to its ownership of the Milton Pond watershed.

Parcel D continued through a string of ownership until 1963. In 1949, Ellen Phelps sold George Phelps' ½ interest in these 108 acres to the Fienemanns, the Fienemanns now owning full interest in this parcel. The farm passed from the Fienemanns to Chaoying and Lienche Tu Fang in 1951; from the Fangs to Harry W. and Maejorie E. Destromp in 1959; and from the Destromps to Alwyn J. and Geraldine D. Mayo in 1961. Interestingly, the deed transferred to the Mayos in

1961 notes that the buildings on this parcel (including the Marquette home) had recently burned down. Finally, in 1963, Elmer E. Turner purchased the parcel and immediately sold it to the Milton Water Corp. intending to turn a tidy profit. The Water Corp. at this time was interested in building a second dam at the outlet of the beaver meadow east of Milton Pond in order to create a supplementary water supply (Plunkett, personal communication). Needless to say, this dam was never constructed.

By May 20, 1963, all of the land that now comprises the Milton Municipal Forest was in the hands of the Milton Water Corp. and served as the primary drinking water supply for the Town of Milton.

Appendix C: Timber Assessment Data

Note: Table Produced by NED-1 software (with modifications)
Data exists as a NED-1 file

Stand 1: Northern Hardwood Forest

Obs.	Spp	dbh	Living	Cavity	Crown
1:1	AB	4.0	yes	absent	100%
1:2	SM	14.0	no	absent	100%
1:3	OST	6.0	yes	absent	100%
1:4	SM	14.0	no	present	100%
1:5	SM	14.0	yes	present	50%
1:6	SM	14.0	yes	present	100%
1:7	SM	18.0	yes	absent	100%
1:8	AB	8.0	yes	absent	100%
1:9	SVB	6.0	yes	absent	100%
1:10	YB	8.0	yes	absent	100%
1:11	WA	4.0	yes	absent	100%
2:1	SM	14.0	yes	absent	100%
2:2	PNC	4.0	yes	absent	100%
2:3	SM	14.0	yes	absent	100%
3:1	SM	6.0	yes	absent	100%
3:2	SM	18.0	yes	absent	100%
3:3	PB	4.0	yes	absent	100%
3:4	NRO	10.0	yes	absent	100%
3:5	BTA	16.0	yes	absent	100%
4:1	BTA	8.0	yes	absent	100%
4:2	AB	4.0	yes	absent	100%
4:3	BTA	16.0	yes	absent	100%
4:4	RM	6.0	yes	absent	100%
4:5	WA	12.0	yes	absent	100%
4:6	SM	16.0	yes	absent	100%
5:1	BUT	16.0	no	present	100%
5:2	YB	10.0	yes	absent	100%
5:3	YB	12.0	yes	absent	100%
5:4	YB	6.0	yes	absent	100%
5:5	YB	10.0	yes	absent	100%
5:6	YB	12.0	yes	present	50%
5:7	SM	20.0	yes	present	100%
5:8	BUT	14.0	yes	present	50%
6:1	SM	6.0	yes	absent	100%
6:2	SM	12.0	yes	absent	100%
6:3	WA	8.0	yes	absent	100%
6:4	SM	10.0	yes	absent	100%
6:5	SM	10.0	yes	absent	100%
6:6	WA	10.0	yes	absent	100%
6:7	SM	18.0	yes	present	100%

Stand 1: Northern Hardwood Forest, cont;

Obs.	Spp	dbh	Living	Cavity	Crown
7:1	RM	6.0	yes	absent	100%
7:2	RM	8.0	yes	absent	100%
7:3	RM	6.0	yes	absent	100%
7:4	RM	8.0	yes	absent	100%
7:5	RM	6.0	yes	absent	100%
7:6	NRO	14.0	yes	absent	100%
7:7	WA	6.0	yes	absent	100%
7:8	RM	4.0	yes	absent	100%
7:9	RM	8.0	yes	absent	100%
7:10	SM	6.0	yes	absent	100%
7:11	WA	4.0	yes	absent	100%

Stand 2: Hemlock-Northern Hardwood Forest

Obs.	Spp	dbh	Living	Cavity	Crown Cond.
1:1	NRO	18.0	yes	absent	100%
1:2	NRO	14.0	yes	absent	100%
1:3	EH	18.0	yes	present	100%
1:4	EH	22.0	yes	absent	100%
1:5	EH	22.0	yes	absent	100%
1:6	SM	6.0	yes	absent	100%
1:7	NRO	16.0	yes	absent	100%
1:8	NRO	20.0	yes	absent	100%
1:9	EH	26.0	yes	absent	100%
1:10	EH	14.0	yes	absent	100%
1:11	EH	24.0	yes	absent	100%

Stand 3: Birch-N. Hardwood Forest

Obs.	Spp	dbh	Living	Cavity	Crown Cond.
1:1	BTA	10.0	yes	absent	100%
1:2	PB	4.0	yes	absent	100%
1:3	PB	6.0	yes	absent	100%
1:4	PB	6.0	yes	absent	100%
1:5	PB	4.0	yes	absent	100%
1:6	PB	6.0	yes	absent	100%
1:7	PB	8.0	yes	absent	100%
1:8	PB	4.0	yes	absent	100%
1:9	RM	8.0	yes	absent	100%
1:10					
1:11	PB	4.0	yes	absent	100%
2:1	RM	8.0	yes	absent	50%
2:2	PB	10.0	yes	absent	100%
2:3	PB	8.0	yes	absent	100%
2:4	PB	10.0	yes	absent	100%
2:5	RM	8.0	yes	absent	100%
2:6	SM	6.0	yes	absent	100%
2:7	PB	8.0	yes	absent	100%
2:8	RM	6.0	yes	absent	100%
2:9	PB	10.0	yes	absent	100%
2:10	PB	6.0	yes	absent	100%
2:11	PB	6.0	yes	absent	100%
2:12	PB	4.0	yes	absent	100%
2:13	SM	4.0	yes	absent	100%
2:14	PB	6.0	yes	absent	100%
2:15	PB	6.0	yes	absent	100%
2:16	PB	8.0	yes	absent	100%
2:17	PB	6.0	yes	absent	100%
2:18	PB	4.0	yes	absent	100%
3:1	SM	6.0	yes	absent	100%
3:2	SM	6.0	yes	absent	100%
3:3	SM	4.0	yes	absent	100%
3:4	RM	6.0	yes	present	100%
3:5	SM	6.0	yes	absent	100%
3:6	PB	12.0	yes	absent	100%
3:7	SM	4.0	yes	absent	100%
3:8	SM	6.0	yes	absent	100%
3:9	SM	6.0	yes	absent	100%
3:10	YB	10.0	yes	absent	100%
3:11	OST	6.0	yes	absent	100%
3:12	WA	8.0	yes	absent	100%

Stand 3: Birch-N. Hardwood Forest, cont;

Obs.	Spp	dbh	Living	Cavity	Crown
4:1	EH	6.0	yes	absent	100%
4:2	EH	6.0	yes	absent	100%
4:3	PB	6.0	yes	absent	100%
4:4	PB	6.0	yes	absent	100%
4:5	PB	8.0	yes	absent	100%
4:6	EH	6.0	yes	absent	100%
4:7	EH	10.0	yes	absent	100%
4:8	EH	6.0	yes	absent	100%
4:9	EWP	18.0	yes	absent	100%
4:10	RM	12.0	yes	absent	100%
4:11	RM	14.0	yes	absent	100%
4:12	RM	6.0	yes	absent	100%
5:1	BTA	12.0	yes	absent	100%
5:2	WA	8.0	yes	absent	100%
5:3	SM	6.0	yes	absent	100%
5:4	EWP	8.0	yes	absent	100%
6:1	YB	10.0	yes	absent	100%
6:2	SM	16.0	yes	absent	100%
6:3	WA	14.0	yes	absent	100%
6:4	WA	10.0	yes	absent	100%
6:5	SM	20.0	yes	absent	50%
6:6	SM	12.0	yes	absent	100%
6:7	PB	10.0	yes	absent	100%
7:1	WA	6.0	yes	absent	100%
7:2	WA	8.0	yes	absent	100%
7:3	EWP	4.0	yes	absent	100%
7:4	SM	4.0	yes	absent	100%
7:5	SM	6.0	yes	absent	100%
7:6	EWP	14.0	no	absent	100%
7:7	SM	8.0	yes	absent	100%
7:8	SM	6.0	yes	absent	100%
7:9	WA	4.0	yes	absent	100%
7:10	SM	8.0	yes	absent	100%
8:1	SM	4.0	yes	absent	100%
8:2	PB	8.0	yes	absent	100%
8:3	WA	16.0	yes	absent	100%
8:4	WA	8.0	yes	absent	100%
8:5	SM	8.0	yes	absent	100%
8:6	WA	8.0	yes	absent	100%
8:7	SM	10.0	yes	absent	100%
8:8	SM	8.0	yes	absent	100%
8:9	SM	6.0	yes	absent	100%
8:10	SM	8.0	yes	absent	100%
8:11	WA	10.0	yes	absent	100%
8:12	SM	8.0	yes	absent	100%

Stand 3: Birch-N. Hardwood Forest, cont;

Obs.	Spp	dbh	Living	Cavity	Crown
9:1	RM	10.0	yes	absent	100%
9:2	RM	14.0	yes	absent	100%
9:3	BTA	12.0	yes	absent	100%
9:4	PB	10.0	yes	absent	100%
9:5	PB	10.0	yes	absent	100%
9:6	QA	10.0	yes	absent	100%
9:7	QA	10.0	no	absent	100%
9:8	RM	10.0	yes	absent	100%
9:9	PB	12.0	yes	absent	100%
9:10	PB	12.0	yes	absent	100%
9:11	SM	20.0	yes	absent	100%
9:12	BTA	14.0	yes	absent	100%
9:13	SM	4.0	yes	absent	100%
9:14	SM	4.0	yes	absent	100%
9:15	SM	8.0	yes	absent	100%
9:16	QA	10.0	yes	absent	100%
9:17	BTA	16.0	yes	present	100%

Stand 4: White Pine-Northern Hardwood Forest

Obs.	Spp	dbh	Count	Living	Crown cond.
1:1	AEL	10.0	no	absent	100%
1:2	WA	12.0	yes	absent	100%
1:3	AEL	10.0	no	absent	100%
1:4	EWP	6.0	yes	absent	100%
1:5	SM	4.0	yes	absent	100%
1:6	SVB	6.0	yes	absent	100%
2:1	EWP	12.0	yes	absent	100%
2:2	EWP	8.0	yes	absent	100%
2:3	EWP	8.0	yes	absent	100%
2:4	EWP	6.0	yes	absent	100%
2:5	EWP	4.0	no	absent	100%
2:6	EWP	6.0	yes	absent	100%
2:7	NRO	10.0	yes	absent	100%
2:8	NRO	8.0	yes	absent	100%
2:9	RM	4.0	yes	absent	100%
2:10	NRO	8.0	yes	absent	100%
3:1	WA	8.0	yes	absent	100%
3:2	BUT	14.0	yes	absent	50%
3:3	WA	6.0	yes	absent	100%
3:4	BUT	14.0	yes	absent	100%
3:5	SM	40.0	yes	present	50%
3:6	SM	20.0	no	present	100%
3:7	AEL	4.0	yes	absent	100%
3:8	WA	10.0	yes	absent	100%
4:1	EWP	12.0	yes	absent	100%
4:2	EWP	14.0	yes	absent	100%
4:3	EWP	12.0	yes	absent	100%
5:1	RM	4.0	no	absent	100%
5:2	RM	6.0	yes	absent	100%
5:3	EWP	6.0	yes	absent	100%
5:4	EWP	10.0	yes	absent	100%
5:5	RM	6.0	yes	absent	100%
5:6	EWP	12.0	yes	absent	100%
5:7	EWP	8.0	yes	absent	100%
6:1	WA	10.0	yes	absent	100%
6:2	SM	4.0	yes	absent	100%
6:3	RM	10.0	yes	absent	100%
6:4	RM	6.0	yes	absent	100%
6:5	WA	12.0	yes	absent	100%
6:6	EWP	14.0	yes	absent	100%
6:7	RM	8.0	yes	absent	100%
6:8	RM	10.0	yes	absent	100%
6:9	SM	8.0	yes	absent	100%
6:10	WA	12.0	yes	absent	100%
6:11	WA	12.0	yes	absent	100%

Stand 4: White Pine-Northern Hardwood Forest, cont;

Obs.	Spp	dbh	Count	Living	Crown cond.
7:1	WA	12.0	yes	absent	100%
7:2	EWP	8.0	yes	absent	100%
7:3	EWP	6.0	yes	absent	100%
7:4	RM	6.0	yes	absent	100%
7:5	EWP	10.0	yes	absent	100%
7:6	QA	4.0	no	absent	100%
7:7	EWP	10.0	yes	absent	100%
7:8	WA	12.0	yes	absent	100%
7:9	SM	6.0	yes	absent	100%
7:10	EWP	8.0	yes	absent	100%
7:11	QA	6.0	yes	absent	50%
7:12	PNC	4.0	no	absent	100%
8:1	RM	8.0	yes	absent	100%
8:2	RM	8.0	yes	absent	100%
8:3	SM	4.0	yes	absent	100%
8:4	PB	10.0	yes	absent	100%
8:5	PB	6.0	yes	absent	100%
8:6	PB	6.0	yes	absent	100%
8:7	RM	8.0	yes	absent	100%
8:8	PB	10.0	no	absent	100%
8:9	BC	14.0	yes	absent	100%
8:10	PB	14.0	yes	absent	100%
8:11	RM	16.0	yes	absent	100%
9:1	RM	8.0	yes	absent	100%
9:2	EWP	8.0	yes	absent	100%
9:3	EWP	12.0	yes	absent	100%
9:4	EWP	12.0	yes	absent	100%
9:5	EWP	8.0	yes	absent	100%
9:6	EWP	12.0	yes	absent	100%
9:7	EWP	10.0	yes	absent	100%
9:8	EWP	12.0	yes	absent	100%
9:9	EWP	10.0	yes	absent	100%
9:10	EWP	6.0	yes	absent	100%
9:11	EWP	8.0	yes	absent	100%
9:12	EWP	12.0	yes	absent	100%
9:13	PB	8.0	yes	absent	100%
9:14	EWP	6.0	no	absent	100%
9:15	EWP	6.0	no	absent	100%
9:16	EWP	10.0	yes	absent	100%
9:17	PB	8.0	yes	absent	100%

Stand 4: White Pine-Northern Hardwood Forest, cont;

Obs.	Spp	dbh	Count	Living	Crown cond.
10:1	EWP	8.0	no	absent	100%
10:2	EWP	6.0	yes	absent	100%
10:3	EWP	8.0	yes	absent	100%
10:4	EWP	8.0	yes	absent	100%
10:5	EWP	6.0	yes	absent	100%
10:6	EWP	8.0	yes	absent	100%
10:7	EWP	10.0	yes	absent	100%
10:8	EWP	6.0	yes	absent	100%
10:9	EWP	6.0	no	absent	100%
10:10	SM	6.0	yes	absent	100%
10:11	EWP	6.0	yes	absent	100%
10:12	EWP	8.0	yes	absent	100%
10:13	SVB	4.0	yes	absent	100%
10:14	SM	6.0	yes	absent	100%
11:1	WA	14.0	yes	absent	100%
11:2	SM	8.0	yes	absent	100%
11:3	EWP	10.0	yes	absent	100%
11:4	SM	6.0	no	absent	100%
11:5	WA	10.0	yes	absent	100%
11:6	SM	4.0	yes	absent	100%
11:7	SM	6.0	yes	absent	100%
11:8	SM	10.0	yes	absent	100%
11:9	EWP	20.0	yes	absent	100%
12:1	EWP	14.0	yes	absent	100%
12:2	EWP	14.0	yes	absent	100%
12:3	SM	16.0	yes	absent	100%
12:4	SM	12.0	yes	absent	100%
12:5	SM	12.0	yes	absent	100%
12:6	SM	16.0	yes	absent	100%
12:7	SM	10.0	no	present	100%
12:8	SM	10.0	yes	absent	100%
12:9	SM	12.0	yes	absent	100%
12:10	SM	6.0	yes	absent	100%
13:1	EWP	14.0	yes	absent	100%
13:2	EWP	14.0	yes	absent	100%
13:3	QA	10.0	no	absent	100%
13:4	EWP	18.0	yes	absent	100%
13:5	EWP	18.0	yes	absent	100%
13:6	QA	12.0	yes	absent	100%
13:7	EWP	22.0	yes	absent	100%
13:8	EWP	22.0	yes	absent	100%
13:9	EWP	16.0	yes	absent	100%
13:10	EWP	16.0	yes	absent	100%

Stand 4: White Pine-Northern Hardwood Forest, cont;

Obs.	Spp	dbh	Count	Living	Crown cond.
14:1	RM	6.0	yes	absent	100%
14:2	PB	12.0	yes	absent	100%
14:3	RM	10.0	yes	absent	100%
14:4	RM	10.0	yes	absent	100%
14:5	RM	10.0	yes	absent	100%
14:6	SM	6.0	yes	absent	100%
14:7	RM	8.0	yes	absent	100%
14:8	RM	28.0	yes	absent	100%
14:9	EWP	6.0	no	absent	100%
14:10	SM	8.0	yes	absent	100%
14:11	EWP	4.0	no	absent	100%
15:1	SM	4.0	yes	absent	100%
15:2	SM	4.0	yes	absent	100%
15:3	PB	10.0	yes	absent	100%
15:4	RM	40.0	yes	absent	50%
15:5	PB	4.0	yes	absent	100%
15:6	BTA	16.0	yes	absent	100%
15:7	RM	16.0	yes	absent	100%
15:8	RM	10.0	yes	absent	100%
15:9	RM	10.0	yes	absent	100%
15:10	RM	14.0	yes	absent	50%
15:11	QA	14.0	yes	absent	100%
16:1	PB	6.0	yes	absent	100%
16:2	EWP	12.0	yes	absent	100%
16:3	SM	8.0	yes	absent	100%
16:4	RM	8.0	yes	absent	100%
16:5	WA	4.0	yes	absent	100%
16:6	BTA	24.0	yes	absent	100%
16:7	SM	36.0	yes	absent	50%
16:8	SM	28.0	yes	present	50%
16:9	BTA	14.0	yes	absent	100%
16:10	PB	6.0	yes	absent	100%
16:11	PB	4.0	yes	absent	100%
16:12	PB	10.0	yes	absent	100%
16:13	PB	6.0	yes	absent	100%
16:14	RM	8.0	yes	absent	100%

Stand 5: Beaver Wetland/Meadow

Obs.	Spp	dbh	Living	Cavity	Crown Cond.
1:1	AEL	12.0	no	present	100%
1:2	BUT	10.0	yes	absent	50%
1:3	WA	12.0	yes	absent	100%
1:4	WA	10.0	yes	absent	100%
1:5	BUT	10.0	no	present	100%
1:6	SM	8.0	yes	absent	100%
2:1	EWP	12.0	yes	absent	100%
2:2	EWP	12.0	yes	absent	100%
2:3	SM	6.0	yes	absent	100%
2:4	RM	10.0	yes	absent	100%
2:5	RM	10.0	yes	absent	100%
2:6	EWP	18.0	yes	absent	100%
2:7	RM	10.0	no	absent	100%
2:8	RM	8.0	yes	absent	100%
2:9	EWP	14.0	yes	absent	100%
2:10	EWP	10.0	yes	absent	100%
2:11	EWP	16.0	yes	absent	100%
2:12	EWP	14.0	yes	absent	100%
2:13	EWP	18.0	yes	absent	100%
3:1	AEL	4.0	no	absent	100%
3:2	RM	6.0	yes	absent	100%
3:3	AEL	4.0	no	absent	100%

Stand 6: Hemlock-Spruce-N. Hardwood Forest

Obs.	Spp	dbh	Living	Cavity	Crown Cond.
1:1	BTA	14.0	yes	absent	100%
1:2	RM	14.0	yes	present	50%
1:3	RM	12.0	no	present	100%
1:4	EH	10.0	yes	absent	100%
1:5	EH	8.0	yes	absent	100%
1:6	PB	10.0	no	present	100%
1:7	RM	10.0	yes	absent	100%
1:8	RM	14.0	yes	absent	100%
1:9	RM	12.0	yes	absent	100%
1:10	RM	10.0	yes	absent	100%
1:11	RM	12.0	yes	absent	100%
1:12	EH	10.0	yes	absent	100%
1:13	RM	12.0	yes	absent	100%
1:14	BF	6.0	yes	absent	100%
2:1	RM	10.0	yes	absent	100%
2:2	SM	10.0	yes	absent	100%
2:3	SM	10.0	yes	absent	100%
2:4	SM	10.0	yes	absent	100%
2:5	RM	12.0	yes	absent	100%
2:6	PB	12.0	yes	absent	100%
2:7	WA	10.0	yes	absent	100%
2:8	RM	14.0	yes	absent	100%

Species Codes for Timber Assessment Data

AB	*Fagus grandifolia*	American beech
AEL	*Ulmus americana*	American elm
BC	*Prunus serontina*	black cherry
BF	*Abies balsamea*	balsam fir
BTA	*Populus grandidentata*	bigtooth aspen
BUT	*Juglans cinerea*	butternut
EH	*Tsuga canadensis*	eastern hemlock
EWP	*Pinus strobus*	eastern white pine
NRO	*Quercus rubra*	northern red oak
OST	*Ostrya virginiana*	eastern hophornbeam
PB	*Betula papyrifera*	paper birch
PNC	*Prunus pensylvanica*	pin cherry
QA	*Populus tremuloides*	trembling aspen
RM	*Acer rubrum*	red maple
S	*Picea sp.*	spruce
SM	*Acer saccharum*	sugar maple
STM	*Acer pensylvanicum*	striped maple
SVB	*Amelanchier sp.*	serviceberry
YB	*Betula alleghaniensis*	yellow birch
WA	*Fraxinus Americana*	white ash

Appendix D: Plant List for Milton Municipal Forest, 2003

Latin Name	Common Name	Latin Name	Common Name
Abies balsamea	Balsam fir	*Epilobium glandulosum*	Northern willow herb
Acer pennsylvanicum	Striped maple	*Equisetum sp.*	Horsetail sp.
Acer rubrum	Red maple	*Erythronium americanum*	Trout lily
Acer saccharum	Sugar maple	*Eupatorium perfoliatum*	Boneset[1]
Achillea millefolium	Yarrow	*Fagus americana*	American beech
Alium tricoccum	Wild leek	*Fragaria sp.*	Strawberry
Alnus incana (Alnus rugosa)	Speckled alder	*Fraxinus americana*	White ash
Amelanchier sp.	Serviceberry	*Fraxinus nigra*	Black ash*
Anemonella thalictroides	Rue anemone	*Galium sp.*	Galium
Aquilegia canadensis	Canadian columbine*	*Gaultheria procumbens*	Wintergreen
Asplenium platyneuron	Ebony spleenwort	*Gentian clausa*	Closed gentian
Aster divaricatus	White wood aster[1]	*Geranium robertianum*	Herb robert
Aster novae-angliae	New England aster[1]	*Glyceria striata*	Fowl meadow grass*
Aster puniceus	Purple stemmed aster[1]	*Hamamelis virginiana*	Witch hazel
Betula alleghenensis	Yellow birch	*Hepatica acutiloba*	Sharp-lobed hepatica
Betula papyrifera	Paper birch	*Huperzia lucidula*	Shining clubmoss
Caltha palustris	Marsh marigold[1]	*Hydrophyllum virginianum*	Virginian waterleaf*
Cardamine diphylla	Two-leaved toothwort*	*Hypericum sp.*	Saint johnswort[1]
Carex comosa (?)	Sedge	*Impatiens sp.*	Jewelweed
Carex laxiflora	Loosely flowered sedge	*Juglans cinerea*	Butternut
Carex pedunculata	Peduncled sedge	*Juncus effusus*	Soft rush
Carex stricta	Tussock sedge	*Juniperus sp.*	Juniper
Carya cordiformus	Bitternut hickory	*Lonicera sp.*	Honeysuckle sp.
Caulophyllum thalictroides	Blue cohosh	*Lycopodium annotinum*	Bristly clubmoss
Claytonia caroliniana	Carolina spring beauty (?)	*Lycopodium digitatum*	Ground cedar
Claytonia caroliniana	Spring beauty	*Lycopodium obscurum*	Princess pine
Cornus alternifolia	Alternate leaved dogwood	*Lysimachia terrestris*	Swamp candles[1]
Crataegus sp.	Hawthorn	*Malthus sp.*	Apple
Cypripedium sp.	Ladyslipper[2]	*Metteucia struthiopteris*	Ostrich fern
Cystopteris fragilis	Fragile fern*	*Mitchella repens*	Partridgeberry
Danthonia compressa	Wild oat grass	*Monotropa uniflora*	Indian pipe
Daucus carota	Queen Anne's Lace	*Oenothera biennis*	Evening primrose
Dicentra cucullaria	Dutchman's breeches	*Onoclea sensibilis*	Sensitive fern
Diervilla lonicera	Bush honeysuckle*	*Ostrya virginiana*	Hophornbeam
Dryopteris intermedia	Intermediate wood fern	*Phalaris arundinacea*	Reed canary grass*
Dryopteris marginalis	Marginal wood fern	*Phyrma leptostachya*	Lopseed[1]
Epifagus virginiana	Beech drops	*Picea rubens*	Red spruce
Pinus strobus	White pine	*Viburnum lentago*	Nannyberry

Latin Name	**Common Name**
Polygonum cuspidatum	Japanese knotweed
Polypodium virginianum	Rock polypody
Polystichum acrosticoides	Christmas fern
Populus grandidentata	Big tooth aspen
Populus tremuloides	Quaking aspen
Prunus pensylvanica	Pin cherry
Pteridium aquilinum	Bracken fern
Pyrola elliptica	Shinleaf[1]
Quercus rubra	Red oak
Ranunculus abortivus	Kidneyleaf crowfoot*
Rhamnus or *Frangula sp.*	Buckthorn
Rhus hirta	Staghorn sumac
Ribes cynosbati	Dogberry*
Rubus sp.	Raspberry
Rumex acetosella	Field sorrel[1]
Rumex obtusifolius	Broad-leaved dock[1]
Salix sp.	Willow sp.
Sambucus canadensis	Elderberry
Saxifraga virginiensis	Early saxifrage*
Sedum sp.	Sedum
Solidago sp.	Goldenrod sp.
Sparganium sp.	Burr-reed
Spiraea latifolia	Meadowsweet
Spiraea tomentosa	Steeplebush
Taraxacum officinale	Common Dandelion
Thalictrum dioicum	Early meadow rue
Thuja occidentalis	Northern white cedar
Tiarella cordifolia	Foamflower
Tilia americana	Linden
Trillium erectum	Red trillium
Tussilego farfara	Coltsfoot
Typha sp.	Cattail
Ulmus americana	American elm
Ulmus rubra	Slippery elm
Vaccinium sp.	Blueberry
Verbascum thapsus	Common mullein
Veronica officinalis	Common speedwell[1]
Viburnum acerifolum	Maple-leaved viburnum
Viburnum lantanoides	Hobblebush
Viburnum opulus var. americanum	Highbush cranberry

Non-native invasive plant species:

Buckthorn - located on the east side of the trail, just inside northern border of MMF, next to beaver wetland

Japanese knotweed - located in middle of trail on west side of Milton Pond, where "Bernier access" intersects trail

Reed canary grass - located in beaver wetland on South side of Milton Pond. Identified by Brett Engstrom.

All plants were identified by Kristen Puryear and Kendra Schmiedeskamp, except for:

***Identified by Brett Engstrom**
[1]Identified by Laurie DiCesare
[2]Identified by Geoff & Connie Plunkett

Appendix E: Definition of Threatened/Endangered Species

State and Global Rankings, According to Vermont's Endangered Species Law.

S1 rank: The species is very rare and vulnerable to extirpation, with only 1-5 occurrences located in Vermont.

S2 rank: The species is rare, with 6-20 occurrences in Vermont.

S3 rank: The species is uncommon in Vermont (more than 20 occurrences) and there is some threat to its existence in the state.

G4 or G5: The species is secure or abundant globally.

Endangered: The species is in immediate danger of becoming extirpated in Vermont.

Threatened: The species has a high possibility of being extirpated in Vermont.

APPENDIX F: Expected Wildlife Species List

Amphibians (15)

Jefferson Salamander (*Ambystoma jeffersonianum*)
Blue-spotted Salamander (*Ambystoma laterale*)
Spotted Salamander (*Ambystoma maculatum*)
Red-spotted Newt (*Notophthalmus v. viridescens*)
Northern Dusky Salamander (*Desmognathus f. fuscus*)
Redback Salamander (*Plethodon cinereus*)
Four-toed Salamander (*Hemidactylium scutatum*)
Northern Spring Salamander (*Gyrinophilus p. porphyriticus*)
Northern Two-lined Salamander (*Eurycea b. bislineata*)
Eastern American Toad (*Bufo a. americanus*)
Northern Spring Peeper (*Hyla c. crucifer*)
Bullfrog (*Rana catesbeiana*)
Gray Treefrog (*Hyla versicolor*)
Wood Frog (*Rana sylvatica*)
Pickerel Frog (*Rana palustris*)

Reptiles (10)

Common Snapping Turtle (*Chelydra s. serpentina*)
Wood Turtle (*Clemmys insculpta*)
Painted Turtle (*Chrysemys picta*)
Northern Water Snake (*Nerodia s. sipedon*)
Northern Brown Snake (*Storeria d. dekayi*)
Northern Redbelly Snake (*Storeria o. occipitomaculata*)
Common Garter Snake (*Thamnophis sirtalis*)
Common Ribbon Snake (*Thamnophis sauritus*)
Northern Ringneck Snake (*Diadophis punctatus edwardsi*)
Eastern Milk Snake (*Lampropeltis t. triangulum*)

Birds (87)

Great Blue Heron (*Ardea herodias*)
Green Heron (*Butorides virescens*)
Turkey Vulture (*Cathartes aura*)
Wood duck (*Aix sponsa*)
Mallard (*Anas platyrhynchos*)
Northern Harrier (*Circus cyaneus*)
Sharp-shinned Hawk (*Accipiter striatus*)
Cooper's Hawk (*Accipiter cooperii*)
Red-shouldered Hawk (*Buteo lineatus*)
Broad-winged Hawk (*Buteo platypterus*)
Red-tailed Hawk (*Buteo jamaicensis*)
Ruffed Grouse (*Bonasa umbellus*)
Wild Turkey (*Meleagris gallopavo*)
Mourning Dove (*Zenaida macroura*)
Eastern Screech-Owl (*Otus asio*)
Great Horned Owl (*Bubo virginianus*)
Barred Owl (*Strix varia*)
Long-eared Owl (*Asio otus*)
Northern Saw-whet Owl (*Aegolius acadicus*)
Common Nighthawk (*Chordeiles minor*)
Ruby-throated Hummingbird (*Archilochus colubris*)
Yellow-bellied Sapsucker (*Sphyrapicus varius*)
Downy Woodpecker (*Picoides pubescens*)
Hairy Woodpecker (*Picoides villosus*)
Northern Flicker (*Colaptes auratus*)
Pileated Woodpecker (*Dryocopus pileatus*)
Eastern Wood-Pewee (*Contopus virens*)
Alder Flycatcher (*Empidonax alnorum*)
Least Flycatcher (*Empidonax minimus*)
Eastern Phoebe (*Sayornis phoebe*)
Great Crested Flycatcher (*Myiarchus crinitus*)
Yellow-throated Vireo (*Vireo flavifrons*)
Blue-headed Vireo (*Vireo solitarius*)
Philadelphia Vireo (*Vireo philadelphicus*)
Red-eyed Vireo (*Vireo olivaceus*)
Blue Jay (*Cyanocitta cristata*)
American Crow (*Corvus brachyrhynchos*)
Common Raven (*Corvus corax*)
Tree Swallow (*Tachycineta bicolor*)
Black-capped Chickadee (*Parus atricapillus*)
Tufted Titmouse (*Parus bicolor*)
Red-breasted Nuthatch (*Sitta canadensis*)

White-breasted Nuthatch (*Sitta carolinensis*)
Brown Creeper (*Certhia americana*)
House Wren (*Troglodytes aedon*)
Winter Wren (*Troglodytes troglodytes*)
Golden-crowned Kinglet (*Regulus satrapa*)
Ruby-crowned Kinglet (*Regulus calendula*)
Blue-gray Gnatcatcher (*Polioptila caerulea*)
Veery (*Catharus fuscescens*)
Hermit Thrush (*Catharus guttatus*)
Wood Thrush (*Hylocichla mustelina*)
American Robin (*Turdus migratorius*)
Gray Catbird (*Dumetella carolinensis*)
Brown Thrasher (*Toxostoma rufum*)
European Starling (*Sturnus vulgaris*)
Bohemian Waxwing (*Bombycilla garrulus*)
Cedar Waxwing (*Bombycilla cedrorum*)
Tennessee Warbler (*Vermivora peregrina*)
Nashville Warbler (*Vermivora ruficapilla*)
Northern Parula (*Parula americana*)
Black-throated Blue Warbler (*Dendroica caerulescens*)
Yellow-rumped Warbler (*Dendroica coronata*)
Black-throated Green Warbler (*Dendroica virens*)
Blackburnian Warbler (*Dendroica fusca*)
Pine Warbler (*Dendroica pinus*)
Bay-breasted Warbler (*Dendroica castanea*)
Black-and-white Warbler (*Mniotilta varia*)
American Redstart (*Setophaga ruticilla*)
Ovenbird (*Seiurus aurocapillus*)
Northern Waterthrush (*Seiurus noveboracensis*)
Mourning Warbler (*Oporornis philadelphia*)
Common Yellowthroat (*Geothlypis trichas*)
Canada Warbler (*Wilsonia canadensis*)
Scarlet Tanager (*Piranga olivacea*)
Song Sparrow (*Melospiza melodia*)
Swamp Sparrow (*Melospiza georgiana*)
White-throated Sparrow (*Zonotrichia albicollis*)
Dark-eyed Junco (*Junco hyemalis*)
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)
Red-winged Blackbird (*Agelaius phoeniceus*)
Brown-headed Cowbird (*Molothrus ater*)
Baltimore Oriole (*Icterus galbula*)
Purple Finch (*Carpodacus purpureus*)
House Finch (*Carpodacus mexicanus*)
American Goldfinch (*Carduelis tristis*)
Evening Grosbeak (*Coccothraustes vespertinus*)

Mammals (39)

Virginia Opossum (*Didelphis virginiana*)
Masked Shrew (*Sorex cinereus*)
Water Shrew (*Sorex palustris*)
Smoky Shrew (*Sorex fumeus*)
Pygmy Shrew (*Sorex hoyi*)
Northern Short-tailed Shrew (*Blarina brevicauda*)
Hairy-tailed Mole (*Parascalops breweri*)
Little Brown Myotis (*Myotis lucifugus*)
Silver-haired Bat (*Lasionycteris noctivagans*)
Eastern Pipistrelle (*Pipistrellus subflavus*)
Big Brown Bat (*Eptesicus fuscus*)
Red Bat (*Lasiurus borealis*)
Hoary Bat (*Lasiurus cinereus*)
Snowshoe Hare (*Lepus americanus*)
Eastern Chipmunk (*Tamias striatus*)
Gray Squirrel (*Sciurus carolinensis*)
Red Squirrel (*Tamiasciurus hudsonicus*)
Southern Flying Squirrel (*Glaucomys volans*)
Northern Flying Squirrel (*Glaucomys sabrinus*)
Beaver (*Castor canadensis*)
Southern Red-backed Vole (*Clethrionomys gapperi*)
Rock Vole (*Microtus chrotorrhinus*)
Woodland Vole (*Microtus pinetorum*)
Muskrat (*Ondatra zibethicus*)
Woodland Jumping Mouse (*Napaeozapus insignis*)
Porcupine (*Erethizon dorsatum*)
Coyote (*Canis latrans*)
Gray Fox (*Urocyon cinereoargenteus*)
Black Bear (*Ursus americanus*)
Raccoon (*Procyon lotor*)
Ermine (*Mustela erminea*)
Fisher (*Martes pennanti*)
Long-tailed Weasel (*Mustela frenata*)
Mink (*Mustela vison*)
Striped Skunk (*Mephitis mephitis*)
River Otter (*Lutra canadensis*)
Bobcat (*Felis rufus*)
White-tailed Deer (*Odocoileus virginianus*)
Moose (*Alces alces*)

APPENDIX G: Observed Wildlife Species List

Amphibians (4)

Spotted Salamander (*Ambystoma maculatum*)
Red-spotted Newt (*Notophthalmus v. viridescens*)
Northern Spring Peeper (*Hyla c. crucifer*)
Wood Frog (*Rana sylvatica*)

Reptiles (3)

Common Snapping Turtle (*Chelydra s. serpentina*)
Painted Turtle (*Chrysemys picta*)
Common Garter Snake (*Thamnophis sirtalis*)

Birds (53)

Great Blue Heron (*Ardea herodias*)
Canada Goose (*Branta canadensis*)
Wood Duck (*Aix sponsa*)
Broad-winged Hawk (*Buteo platypterus*)
Red-tailed Hawk (*Buteo jamaicensis*)
Ruffed Grouse (*Bonasa umbellus*)
Wild Turkey (*Meleagris gallopavo*)
Virginia Rail (*Rallus limicola*)
Mourning Dove (*Zenaida macroura*)
Great Horned Owl (*Bubo virginianus*)
Barred Owl (*Strix varia*)
Common Nighthawk (*Chordeiles minor*)
Ruby-throated Hummingbird (*Archilochus colubris*)
Belted Kingfisher (*Ceryle alcyon*)
Yellow-bellied Sapsucker (*Sphyrapicus varius*)
Downy Woodpecker (*Picoides pubescens*)
Hairy Woodpecker (*Picoides villosus*)
Northern Flicker (*Colaptes auratus*)
Pileated Woodpecker (*Dryocopus pileatus*)
Least Flycatcher (*Empidonax minimus*)
Blue-headed Vireo (*Vireo solitarius*)
Red-eyed Vireo (*Vireo olivaceus*)
Blue Jay (*Cyanocitta cristata*)
American Crow (*Corvus brachyrhynchos*)
Common Raven (*Corvus corax*)
Black-capped Chickadee (*Parus atricapillus*)
White-breasted Nuthatch (*Sitta carolinensis*)
Brown Creeper (*Certhia americana*)
Winter Wren (*Troglodytes troglodytes*)
Veery (*Catharus fuscescens*)
Hermit Thrush (*Catharus guttatus*)
Wood Thrush (*Hylocichla mustelina*)
American Robin (*Turdus migratorius*)
European Starling (*Sturnus vulgaris*)
Tennessee Warbler (*Vermivora peregrina*)
Nashville Warbler (*Vermivora ruficapilla*)
Black-throated Blue Warbler (*Dendroica caerulescens*)
Yellow-rumped Warbler (*Dendroica coronata*)
Black-throated Green Warbler (*Dendroica virens*)
Blackburnian Warbler (*Dendroica fusca*)
Black-and-white Warbler (*Mniotilta varia*)
Ovenbird (*Seiurus aurocapillus*)
Northern Waterthrush (*Seiurus noveboracensis*)
Common Yellowthroat (*Geothlypis trichas*)
Song Sparrow (*Melospiza melodia*)
Swamp Sparrow (*Melospiza georgiana*)
White-throated Sparrow (*Zonotrichia albicollis*)
Dark-eyed Junco (*Junco hyemalis*)
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)
Red-winged Blackbird (*Agelaius phoeniceus*)
Brown-headed Cowbird (*Molothrus ater*)
Baltimore Oriole (*Icterus galbula*)
American Goldfinch (*Carduelis tristis*)

Mammals (18)

Snowshoe Hare (*Lepus americanus*)
Eastern Chipmunk (*Tamias striatus*)
Gray Squirrel (*Sciurus carolinensis*)
Red Squirrel (*Tamiasciurus hudsonicus*)
Beaver (*Castor canadensis*)
Muskrat (*Ondatra zibethicus*)
Woodland Jumping Mouse (*Napaeozapus insignis*)
Porcupine (*Erethizon dorsatum*)
Coyote (*Canis latrans*)
Red Fox (*Vulpes vulpes*)
Gray Fox (*Urocyon cinereoargenteus*)
Raccoon (*Procyon lotor*)
Fisher (*Martes pennanti*)
Mink (*Mustela vison*)
River Otter (*Lutra canadensis*)
Bobcat (*Felis rufus*)
White-tailed Deer (*Odocoileus virginianus*)
Moose (*Alces alces*)

Appendix H: Aquatic Nuisance Species Prevention

Zebra Mussels:

To prevent the spread of Zebra Mussels:

- Drain all bilge water, live wells, bait buckets and any other water from boat, engine and equipment before leaving water-body site.
- Inspect boat hull, drive unit, trim and trolling plates, prop, transducers, anchor, anchor rope and trailer thoroughly. Scrape off and dispose of any mussel regardless of size.
- Wash boat hull, drive unit, live wells, bilge area, trailer, bait buckets, engine cooling systems and other boat parts before moving your boat to different waters. A high pressure/hot water wash is more effective in killing all life stages of zebra mussels and is essential for killing off adults.
- Dry your boat and trailer thoroughly in the sun when moving between bodies of water. Be sure to allow flotation compartment of kayaks to dry thoroughly.

Eurasian Watermilfoil:

To prevent the spread of Eurasian Watermilfoil:

- Remove all plant material from boat. (Remember: Plant does not need roots to grow.)
- Discard removed material in a trash receptacle or on high, dry ground where there is no danger of material washing into any water body
- Drain all water in boat, engine and other equipment.
- Rinse all boat parts with tap water (preferably hot) or leave boat out of water and in sun for at least five days.

Sources: Lake Champlain Sea Grant Aquatic Resources Program
Vermont Agency of Natural Resources, Department of Environmental Conservation