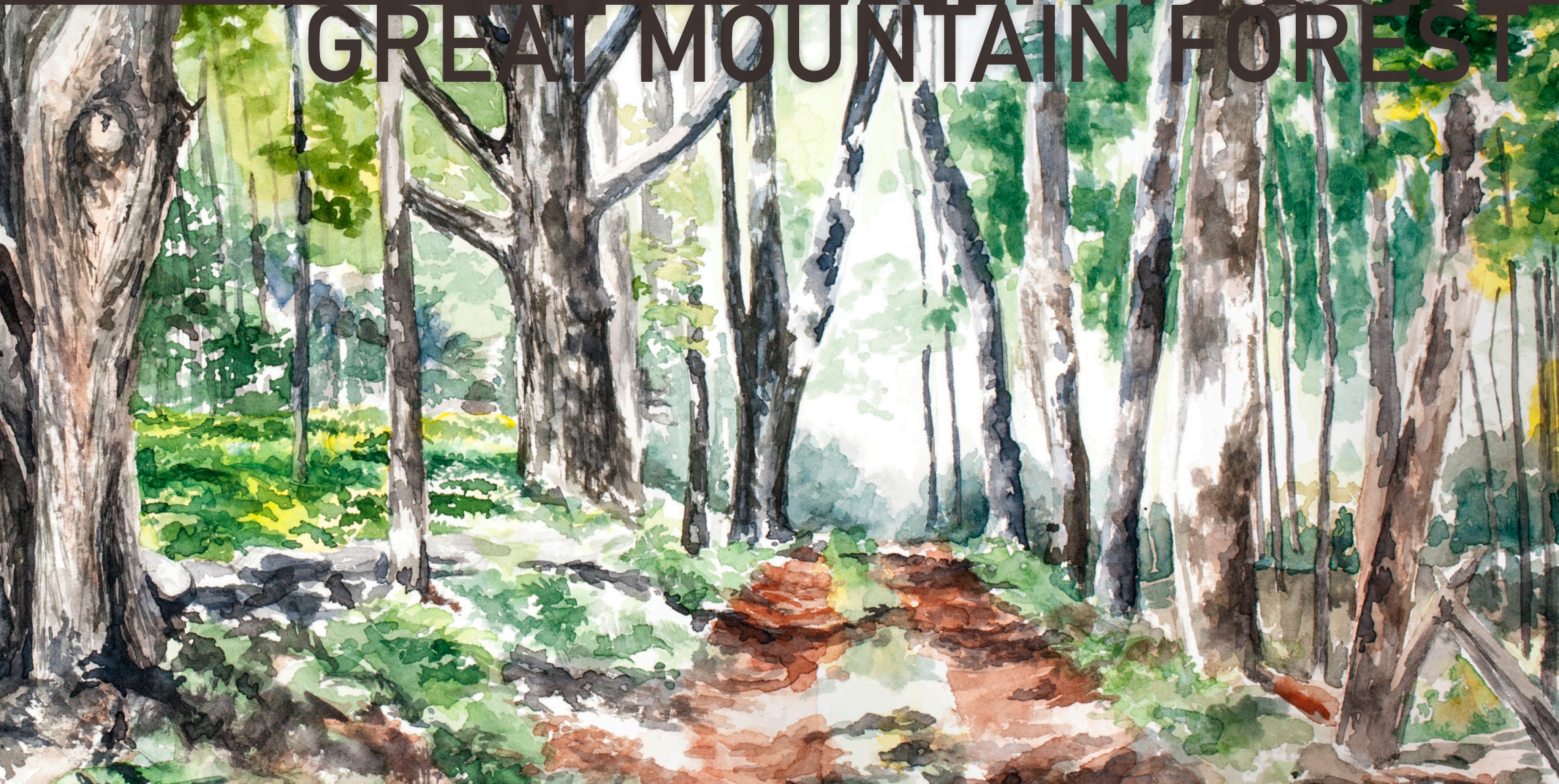


A FIELD BOOK GREAT MOUNTAIN FOREST



Text by Michael Gaige and Yonatan Glogower

Photographs by Michael Gaige, Yonatan Glogower, and GMF

Watercolors and Design by Autumn Von Plinsky

Copyright © Yale Global Institute of Sustainable Forestry, 2016

All Rights Reserved



FOREST MANAGEMENT

AT GREAT MOUNTAIN FOREST

The Great Mountain Forest is well known for its beautiful natural communities and the story of its human legacy, but it is also actively managed for a variety of economic, educational, and environmental objectives. Since the early days of Childs and Walcott, GMF has striven to serve as a model for forest management that sustains and strengthens the integrity of the ecosystem, serving human stakeholders as well as plants and other creatures.

Silviculture, in its broadest sense, means using principles of ecology to guide the management of trees and forests. Although practiced meticulously for many years in countries like Germany, the seemingly boundless expanses of old growth forest in the United States fueled centuries of waste and decimation with no plan for the future. The U.S. Forest Service was officially established in 1905 (first as the USDA Division of Forestry in 1881), to address concerns of an impending “timber famine” by employing scientific silviculture methods for sustainable yields and growth across federal forest lands. Gifford Pinchot, the first Chief Forester for the new agency, (and co-founder of the Yale Forest School) wrote in 1907: “Unless we practice conservation, those who come after us will have to pay the price of misery, degradation, and failure for the progress and prosperity of our day.” The initiative to acquire and sustainably manage federal lands was part of a larger growing environmental movement—an awakening consciousness of the limits to unbridled resource depletion.

The Great Mountain Forest is very much a product of such emergent land use ethics, though the manifestation of their mission has evolved over time in step with shifts in forestry science and environmental culture. The early days of Childs and Walcott were part of the generation

dominated by figures like Theodore Roosevelt, concerned with improving game habitat and hunting practices that sustained their populations. They planted trees, dug ponds, and imported animals to help achieve their social goals. Forestry in the traditional sense of the term (that is to say, concerned with timber production) didn't get underway at GMF until the 1940s, under the careful guidance of Ted Childs and his succession of hired foresters—most notably Darrell Russ and, later, Jody Bronson. Prescriptions for harvesting were always conducted with an eye to sustainable yields and preserving the integrity of the ecosystem, and over the years became more sophisticated as new technologies and methodologies of landscape management came into vogue.

The sites in this section are ordered such that they follow GMF's forest management practices, more or less, through this progression of ideas. We start with the various tree plantations (Plantations) that are scattered throughout the property; interesting, though representative of an old fashioned forestry practice that is now rarely employed in the New England region. There are then examples of five timber treatment sites (High Pocket, Skyline Drive, Wapato Lookout, Lowland White Pine, and Red Pine Salvage), selected to demonstrate a range of nuanced silviculture techniques. These sites are followed by descriptions of the harvesting of two non-timber products (Witch Hazel, and Maple Syrup), which have their own specialized niches in terms of markets and management practices. The final two sites (NRCS Bird Habitat, and New England Cottontail Habitat) are examples of silviculture operations specifically designed with the aim of creating habitat for target animal species, a practice becoming more common among conservation organizations.

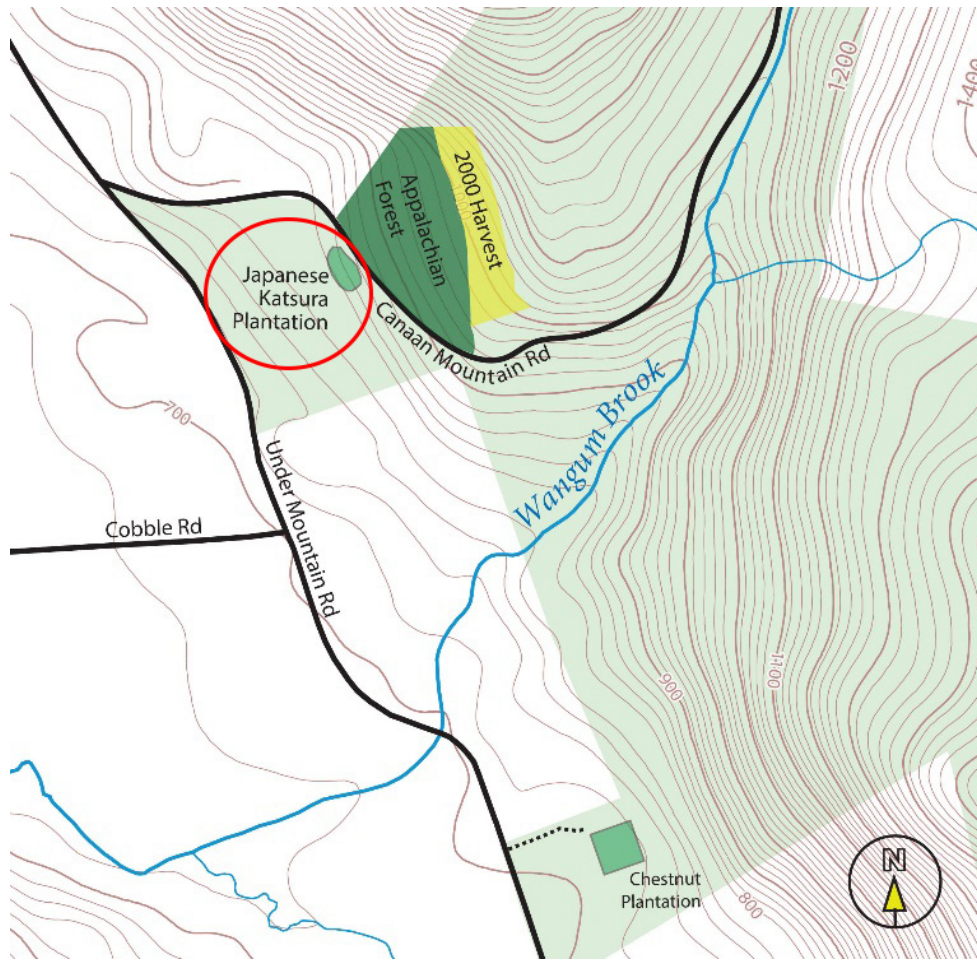
Resources

Pinchot, Gifford (1907) The conservation of natural resources. The Outlook 87: 291-294

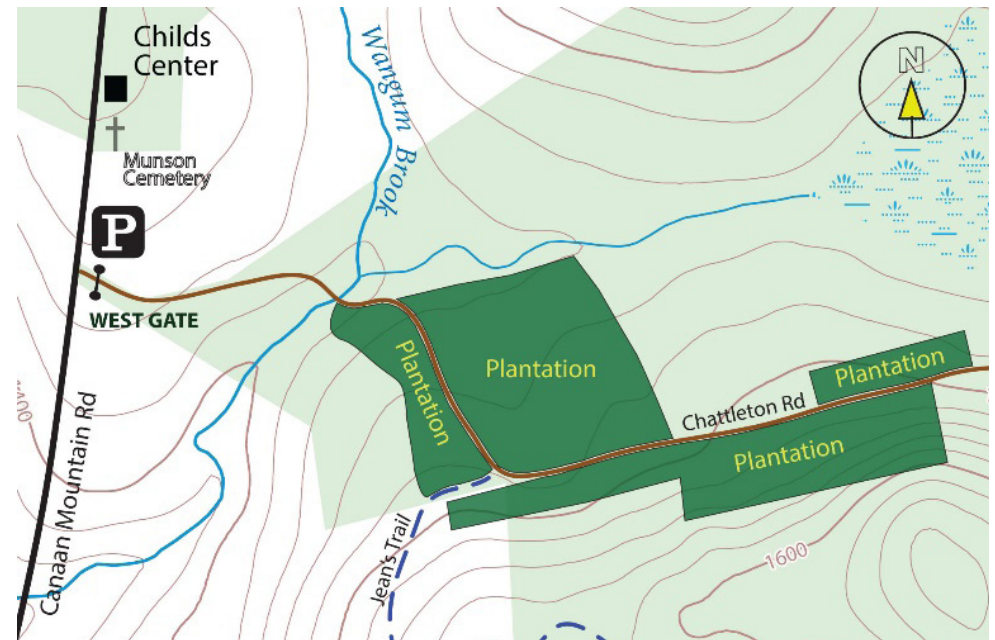
Smith, D.M., B.C. Larson, M.J. Kelty, and P.M.S. Ashton (1996) The Practice of Silviculture: Applied Forest Ecology, 9th ed. John Wiley and Sons, Hoboken.



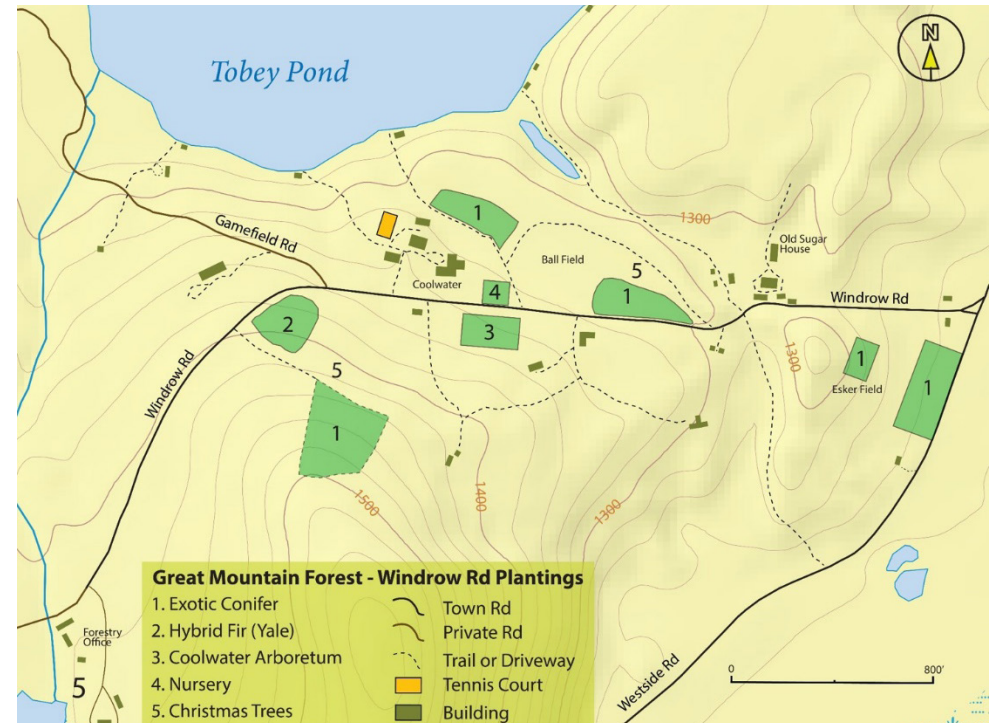
The Great Mountain Forest Office: where the magic happens.



Katsura/Dawn Redwood: N°41 56'54.54"; W°73 16'58.76"



Exotic Conifers: N 41°57'39.24"; W 73°15'16.23"



Coolwater Plantings: N 41°58'12.48"; W 73°13'26.52"

FOREST MANAGEMENT SITES 1: PLANTATIONS

Summary

A brief overview of the various tree plantations that exist at GMF, from the arboretum at the Coolwater estate to the exotics planted by Ted Childs and Darrell Russ from 1959-1976. Though no longer part of any active research or conservation effort, those plantations still standing offer an opportunity to see many species unusual to the region, and continue to be a distinctive feature of the forest.

Access

The major plantations are arranged in two main clusters. The so-called “Coolwater Area Plantings” lie along Windrow Road, to the south of Tobey Pond. Visitors may park at the Forestry Office and walk to them, or else obtain permission to park at the Coolwater residence.

The Exotic Conifer plantations lie along either side of old Munson and Chatleton Roads, soon after crossing the bridge while heading south to Yale Camp. Another set of plantations, which includes the katsura (*Cercidiphyllum japonicum*) stand, occurs along the south side Canaan Mountain Road, heading north to the Mountain House from the intersection with Under Mountain Road. Visitors may park in any of several clearings to the side of the road near there (see appalachian forest in Natural Communities for location and information).

Location

See included maps.

Nearby or Comparative Sites

Three of the research sites covered in this field book are plantations in their own right, often with similar goals: The Chestnut Plantation (Research Site 3), Mergen’s genetic studies (Research Site 4), and the Pitch Pine Study (Research Site 5). See also the red pine salvage site (Forest Management 6). Spread as they are across different regions of the forest, the various plantations today lie nearby too many sites of interest to name here (see maps).



The Norway spruce plantation on Camp Road near the Forestry Office, planted in 1919. These trees are much larger, and have been thinned to allow for more space between plantings, permitting a lively fern and shrub understory to develop.



Close up of the katsura tree bark.

Description

The various plantations that dot the GMF landscape are among the forest's most unique and distinctive human legacies. When Ted Childs began to take over operations beginning in the 1930s, he used his background in forestry to shape the landscape. The forest was young in those years, still recovering from a century of fires and repeated clear cutting under the auspices of the charcoal industry. As was in vogue at the time, one of his first activities was to establish tree plantations in denuded areas. In many cases, these were former agricultural sites that had just recently been abandoned.

The earliest plantations were planted near and around the family's Coolwater estate along Windrow Road. These were gradually added to over the years to make an expansive cluster that stretched north to Westside Road, west to Tobey Pond, and south to the Forestry Office (see map). Included among these plantings is the Coolwater Arboretum, which features various hardwood and coniferous species (both native and exotic) planted in artful arrangements. A section to the south next to the intersection with Gamefield Road was set aside in 1971 for Francois Mergen's hybrid fir study.



View of the katsura plantation canopy. The straight and tall growth form makes katsura a prized timber species in its native Japan.

Immediately north of the Coolwater house was the nursery, used to supply various spruce, fir, and pine growing stock for Christmas tree cultivation, which was once a significant non-timber forest product of GMF. Once big enough, saplings were transplanted to the Christmas tree plantations, mainly located along Under Mountain Road, where they would grow to a harvestable size within 8-12 years. Production of Christmas trees was in decline by the early 2000s, and stopped altogether by 2004. Much of the land where they were once grown is now owned privately by members of the Childs family, and are no longer within the official boundaries of GMF. The Chestnut plantation is actually planted on one of the former Christmas tree plantation sites. The nearby cultivated stands of Scots pine and quaking aspen are lingering relicts from that earlier era.

In 1959, Ted Childs and head forester Darrell Russ began a new set of plantations on the Canaan side of the forest, along Munson and old Chatleton Roads. As part of a long term adaptability study, they collected and planted pine, spruce, fir, larch, and cedar species from all around the world. This exotic conifer planting mania would consume Ted and Darrell's interest and efforts for the next seventeen years, ultimately resulting in 69 individual stands representing 31 species. Most of the trees were purchased



Close up of the leaves of the katsura tree. The heart shape resembles the leaves of the unrelated redbud tree (*Cercis* spp.), which is where the katsura genus name is derived (*Cercidiphyllum*, “Cercis-like leaves”).

from local nurseries such as Musser and Itasca. However, according to GMF folklore, on one occasion Ted smuggled pine seeds to the U.S. by hiding them in his shoe. Many of these stands are still in solid shape to this day, now with signage designating the species, country of origin, year planted, and treatment history of each.

Additional exotic conifers were planted by the Coolwater estate, as well as along Canaan Mountain Road, across the street from the Appalachian forest area (see Natural Communities 6: Mixed Appalachian Forest). This last stand, which contains grand fir (*Abies grandis*), western red cedar (*Thuja plicata*), and a small grove of dawn redwoods (*Metasequoia glyptostroboides*), was also planted with several broadleaf species: an experimental plantation of native American chestnut (*Castanea dentata*) in 1962, the highly invasive, though medicinal, Amur corktree (*Phellodendron amurense*), and a stand of Japanese katsura (*Cercidiphyllum japonicum*) in 1978. Katsura is Japan’s leading lumber species, prized for its soft, light wood. Ted thus sought to corner the katsura timber market in Connecticut, where it is only grown ornamentally in urban settings. Today the trees have grown huge (70+ ft.), owing perhaps to the rich limestone soils where they are planted, which the species prefers. The species is escaping and growing



The Norway spruce plantation on Chattleton Road, planted in the 1960s. The trees still grow so densely that no herb or seedling can establish in the understory.

from seed on the flat bottomland of this site leading to, yet another, exotic species outbreak.

Though interesting for their history and botanical specimens, these sites have far lower species and structural diversity when compared with the surrounding forest. Such plantations, with their tight rows of dense shady conifers, exclude the regeneration of trees and herbs in the understory. This effect is particularly stark in the Norway spruce plantations, along both Chattleton Road and Jean’s Trail. In some areas, as with the katsura stand, the planted exotic species have begun to naturalize by reproducing outside the planted area, with potentially harmful long term effects.

In the aim of maintaining a functioning, self-replenishing forest ecosystem, plantation forestry in the New England region has long been rejected in favor of naturalistic harvest methods, as is practiced at GMF and outlined in the succeeding management site selections. Though the various plantations are periodically thinned and maintained for their timber and sentimental value, they have not been added to for over thirty years, and there are no current plans to replace the trees when they die or are harvested. In time, they will revert to the composition of the surrounding forest matrix.



FOREST MANAGEMENT SITE 2: HIGH POCKET TIMBER HARVEST

Summary

A timber harvest parcel that was logged in 2002 and 2006. The goal was to create a shelterwood cut, promoting the regeneration of new red oak seedlings—a common approach at GMF.

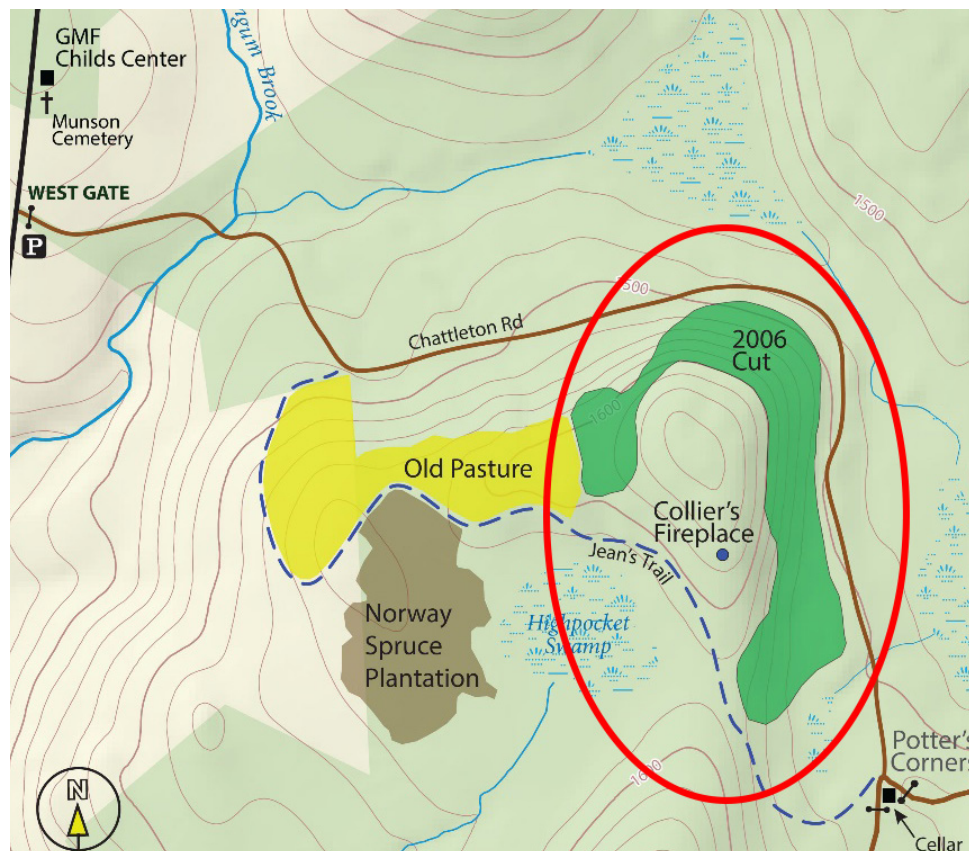
Access

The site lies just to the west of Chattleton rd., along Jean's Trail to the south.

Location

See included map.

Nearby or Comparative Sites



High Pocket Timber Harvest: N 41°57'18.91"; W 73°12'23.70"

This harvest gets its name from being next to the High Pocket Swamp described in the Dean Farm Site (Land Use History 9). Potter's Corners cellar hole site (Land Use History 10) lies just to the east.

Description

As with many harvests in Great Mountain Forest, the goal was to promote the regeneration of oak by clearing large gaps in the canopy, thereby leaving sturdy trees to provide the seed source. Trees like oaks, chestnuts, walnuts, and beeches are all masting species. Their main dispersal strategy is to produce, as groups, copious quantities of protein rich nuts during particular years, so as to overwhelm and satiate their seed predators. Foresters must time their harvests carefully to coincide with these mast years, to ensure that there is ample regeneration of the desired species. Timber harvests must also be conducted with an eye to appropriate weather conditions and the relative strength of timber markets—a dance that Jody and Russell must perform with mastery to keep operations afloat.

This 32-acre area was first harvested by GMF in 2002. Prior to the cut, the site had a canopy dominated by red oak, with a dense overstory of more shade tolerant beech and red maple. Like much of Great Mountain Forest on the Canaan side, the area had been cut hard for charcoal production during the 19th century. The canopy was undisturbed since that time, with a tree age class of approximately 130-150 years.

Most of the harvests at GMF today are contracted by South Norfolk Lumber Co. They used chainsaws to fell the trees, and a cable skidder to transport logs to the timber truck. Cable skidders are nimble vehicles which use a winch-loaded cable to drag logs from where they are cut to a desired loading location. It is often used for forest operations at GMF, partly because the reach of the chain can be used to gather trees from steep locations that would otherwise be inaccessible (as iterated throughout this field book, such topography is extremely common at GMF). From this site they removed 130,000 board feet (BF) of timber, of which 56% was high value red oak.

Jody returned to do an additional harvest in 2006, removing an additional 8,000 BF of oak. It is not uncommon for foresters to have repeat treatments on an area several years later, if the results of the first harvest are not to their satisfaction. In this case, recruitment of new seedlings was low following the initial cut. Removing the canopy opened up additional light for the regenerating understory, with a goal to stimulate germination.

Today the stand has an abundance of oak saplings dispersed



Regenerating red oak, in the midst of an ocean of hay scented fern. Herbaceous vegetation can quickly colonize growing space opened by timber harvesting, inhibiting the initial establishment of young tree seedlings.

throughout the harvest area. Some gaps have grown back thick with black birch, a pioneer species whose millions of wind dispersed seeds can quickly colonize newly opened growing space.



GMF head forester Jody Bronson (left) at an active harvest site with one of the forestry interns. Note the chain tires on the yellow cable skidder in the background, which provide extra traction when moving cut logs.

FOREST MANAGEMENT SITES 3: SKY LINE DRIVE TIMBER HARVEST

Summary

A relatively small harvest area, but with one of the most beautiful views in GMF. The site has been cut twice: in 1996 to remove low quality oak and hemlock, and again in 2014, opening up a small viewshed over a steep ledge on the western border of the parcel.

Access

The Skyline cut sits on the western side of the Number 4 Trail, just north of Wapato Pond.

Location

See included map.

Nearby or Comparative Sites

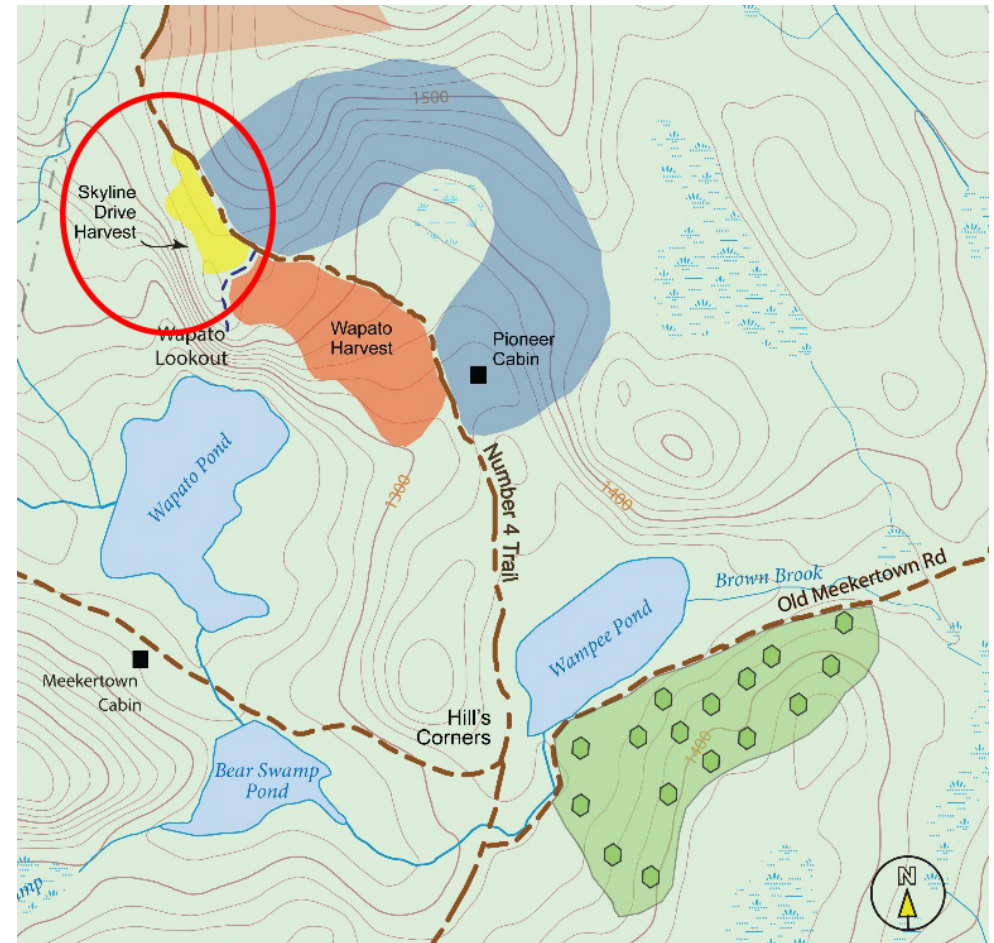
This site is part of the mosaic of harvest areas that run along both sides of the Number 4 trail. One other of these, the adjacent Wapato Lookout harvest, is covered in this fieldbook (Forest Management 3).

Description

The goal of this harvest was to promoting regeneration of white oak—common regionally, but rare in GMF, except on dry hill slopes inaccessible to harvest equipment. The 15.2 acre area was first treated in 1998, removing about 35-40% of the mature growing stock, mostly low grade oak and hemlock, and assorted hardwoods that were split for cordwood. Left behind was a motley mixture of white oak, hickories, hemlock, tulip tree, and some white pine.

The ideal scenario prescribed by silvicultural concepts often runs up against the realities of the actual harvest on the ground. As a result, additional measures must often be undertaken to ensure that the operations do not leave harmful environmental impacts. During this harvest, a skid road was constructed on the site to facilitate movement of timber to the landing. The last 50 yards were extremely muddy, and moving vehicles across it would have wrought long lasting damage to the soil community there. To fix this problem, they constructed a “corduroy road” —laying softwood slabs to stabilize the ground for vehicles and equipment.

The site was cut again in 2014, opening up the canopy more



Vista 41°56'2.78" N; 73°15'14.69" W

dramatically to create the west facing viewshed seen today. About 10% of the original trees were left for mast. A year later, the ground story is covered in all manner of blackberries, raspberries, ferns, wildflower forbs, and regenerating trees, many of which must have been established since the canopy was first opened in 1996. The goal of the vista itself was two-fold: removing more oak and white pine to add to the adjacent harvests of that year, while creating a striking view across the steep west facing slope.

As with the nearby Wapato Lookout harvest (next entry), this forest area is noteworthy for its abundant of tulip tree seedlings, a more Appalachian species whose presence has increased in GMF in recent years. Many can be found in the dense ground story of the vista area, and will possibly constitute a significant proportion the future canopy.



FOREST MANAGEMENT SITE 4: WAPATO LOOKOUT TIMBER HARVEST

Summary

A more complex harvest involving specialized prescriptions for three distinct stands. Subtle differences in topography, underlying geology, soil type, and land use history, all contribute to the character of given patches within the larger forest matrix. The ability to read complex landscapes is essential for the proper administering of sustainable forest management.

Access

This site is accessible along the Number 4 Trail.

Location

See included map.

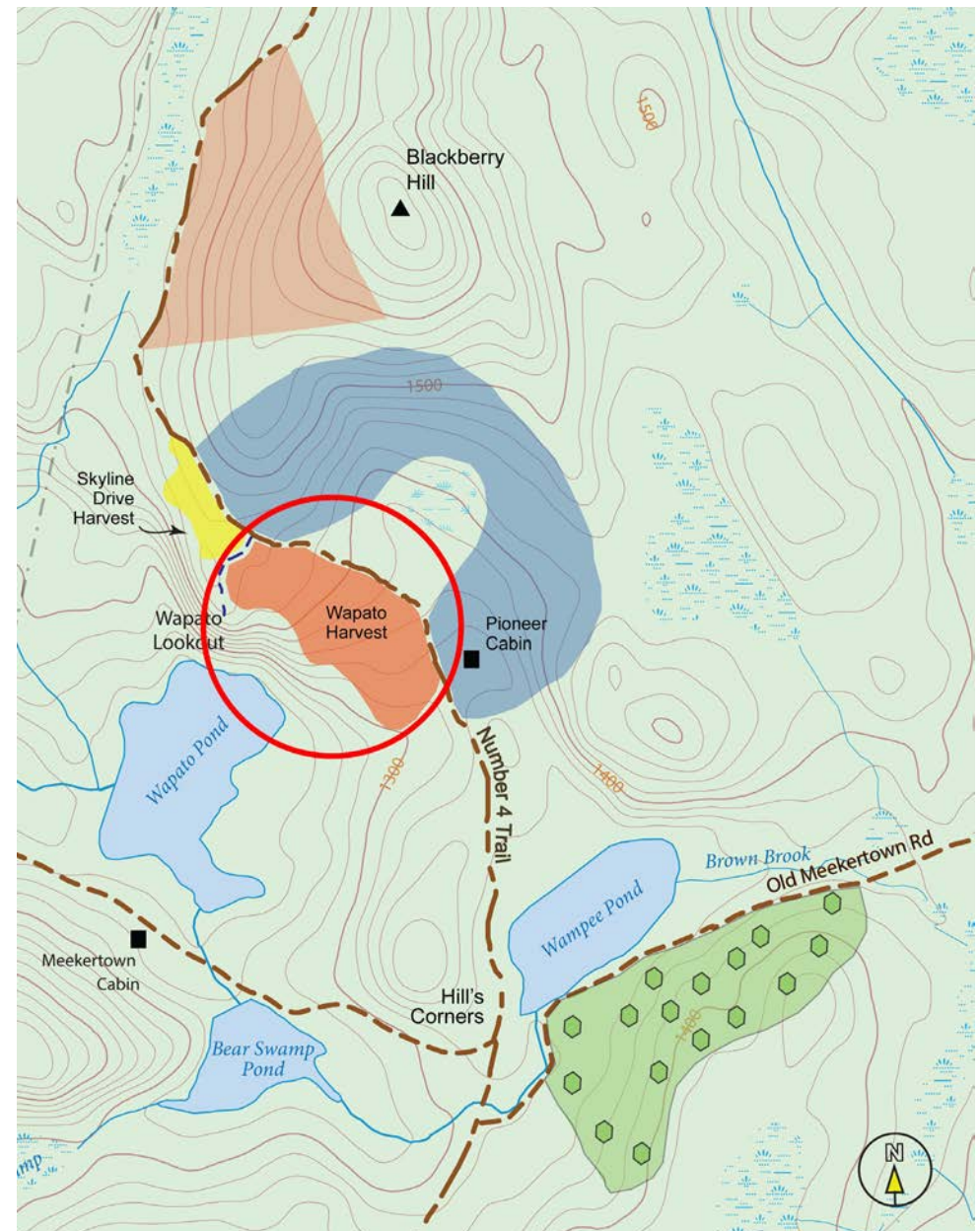
Nearby or Comparative Sites

Directly adjacent to the Skyline Drive Harvest (Forest Management Site 3) and the Pioneer Homestead (Land Use History 7). For more on moose herbivory research, see the Moose Exclosure entry (Research Site 1).

Description

This 2014 harvest was conducted on a much larger scale than the previous two, covering approximately 75 acres. The parcel contains three distinct stands of differing topography and tree composition, and accordingly each was given its own custom treatment. The first stand consists of about 20-acres to the north and northeast, characterized by slow growing oaks and hickories on rocky substrate with a poorly developed shrub layer. This stand was mostly left alone due to inaccessibility, the low timber value of the trees, and its value as an interesting natural community.

The second stand, comprising 37.4 acres across the middle of the parcel, has an oak dominated overstory with scattered large beech, averaging 7,900 BF per acre. In 2001, some of the large red oaks were thinned in order to open up parts of the canopy. This created the conditions for open areas of advance regeneration oak and red maple to establish in the midst of hay scented fern patches. Unlike the first stand, the canopy here was well stocked with merchantable oak trees, with an average diameter at breast height (DBH) of 15 inches.



Map of Wapato Lookout Timber Harvest.



The rocky substrate stand. The white oaks growing here are very old, yet are too poorly formed and gnarly to produce much merchantable timber.



Regenerating tulip tree seedlings from the harvest area, emerging from beneath dense mountain laurel.

The third stand comprises a wet lowland sector of 12.2 acres in the center of the parcel. The canopy composition is dramatically different from the previous two stands: dominated overwhelmingly by hemlock, but interspersed with tulip tree, yellow birch, white ash, black cherry, and several black gums. It is notable for being a site frequented by moose, and one of the few places where they have come into contact with tulip trees.

In all, the harvest brought in 120,000 board feet of timber, 66,000 of which was from the 37 acre site alone. In the third stand, a smaller amount was harvested, mostly in the area surrounding the mature tulip trees. The goal here was to provide space for their seedlings to germinate and grow, and to observe whether moose prefer it as a source for browsing. Though it has not been officially documented here, the foresters of GMF have noticed that they do indeed favor the young tulip tree shoots as a food source.

FOREST MANAGEMENT SITES 5: RED PINE SALVAGE OPERATIONS

Summary

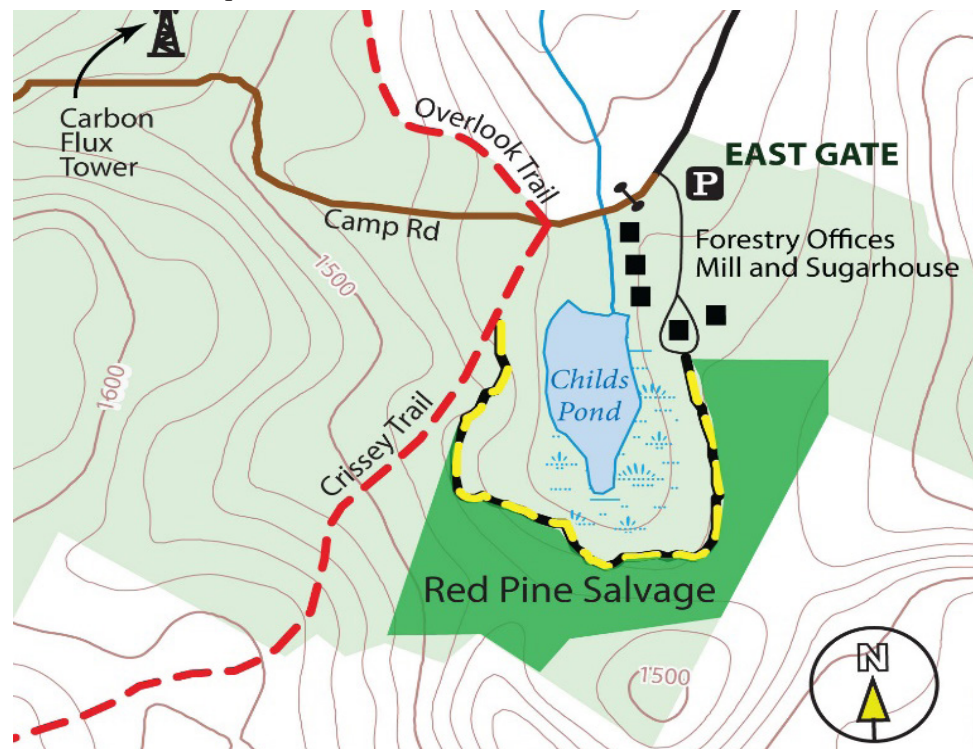
Red pine plantings at GMF began in 1919, with two small groves installed by Childs and Walcott. This was followed by more extensive plantations in 1938 under Ted's guidance. When these fell victim to the red pine scale in 1999, it prompted a desperate salvage operation to obtain what timber could be harvested before the trees became non-merchantable. This site is distinctive for containing several trees that never succumbed to the insect.

Access

The site lies at the trailhead for the Tamarack Trail, near the Forestry Office at 201 Windrow Road.

Location

See included map.



Red Pine Plantation Salvage: N 41°57'59.83"; W 73°13'28.21"

Nearby or Comparative Sites

The salvage site is just south of the GMF saphouse (Forest Management Site 8). See also the more detailed description of plantations at GMF in general (Forest Management Site 1).

Description

Red pine was once among the most abundant of the plantation tree species at GMF. Ted Childs and his crew planted most of them in 1938, intrigued by the impressive yield of board feet per acre that the straight trees were known to produce. There was a healthy market for red pine posts then which could be harvested cheaply from thinning the young stands. At this site, two plantations adjacent to one another stood north-south along what is now the start of the Tamarack Interpretive Trail.

The red pine scale (*Matsucoccus resinosa*) is an invasive insect from Asia, thought to have been introduced to the United States during the New York World's Trade Fair in 1939, clinging to exotic trees planted for the event. The larvae hatch from eggs laid on branch axils, and move beneath bark scales to feed on the phloem of the host tree, eventually killing it or making it vulnerable to attack from other pathogens, such as the annosum root rot (*Heterobasidion annosum*). Spread by the wind, the red pine scale reached northwestern Connecticut by the late 1970s, and soon converged on Great Mountain Forest.

A string of several warm winters boosted their populations, and by the summer of 1999 red pine scale spread to nearly all the plantations in the forest. Jody and his forestry crew scrambled to mark as many of the red pine stands as they could while they were still merchantable, which were cut by an independent contractor. This site was no exception to the infestation and harvest, but miraculously, several of the adult red pines never got the scale, and can be seen standing today. A positive consequence of the salvage operation was the scrubland habitat left behind—a haven for passerine birds and small mammals.

Following the salvage operations, Jody and staff planted white pine and European larch in the area. The fast growing larch aided in deterring the white pine weevil from infesting the white pine. A small open patch of these is still growing, on the east side of the trail near the entrance. For the most part, however, the space was quickly overtaken by vigorous pioneer hardwoods, chiefly black birch, which dominate the growing space today.



The red pine salvage operation in progress, summer 1999. The vehicle here is called a harvester, whose long boom can reach a range of trees from a single stationary position, thereby minimizing soil compaction and damage to understory vegetation.

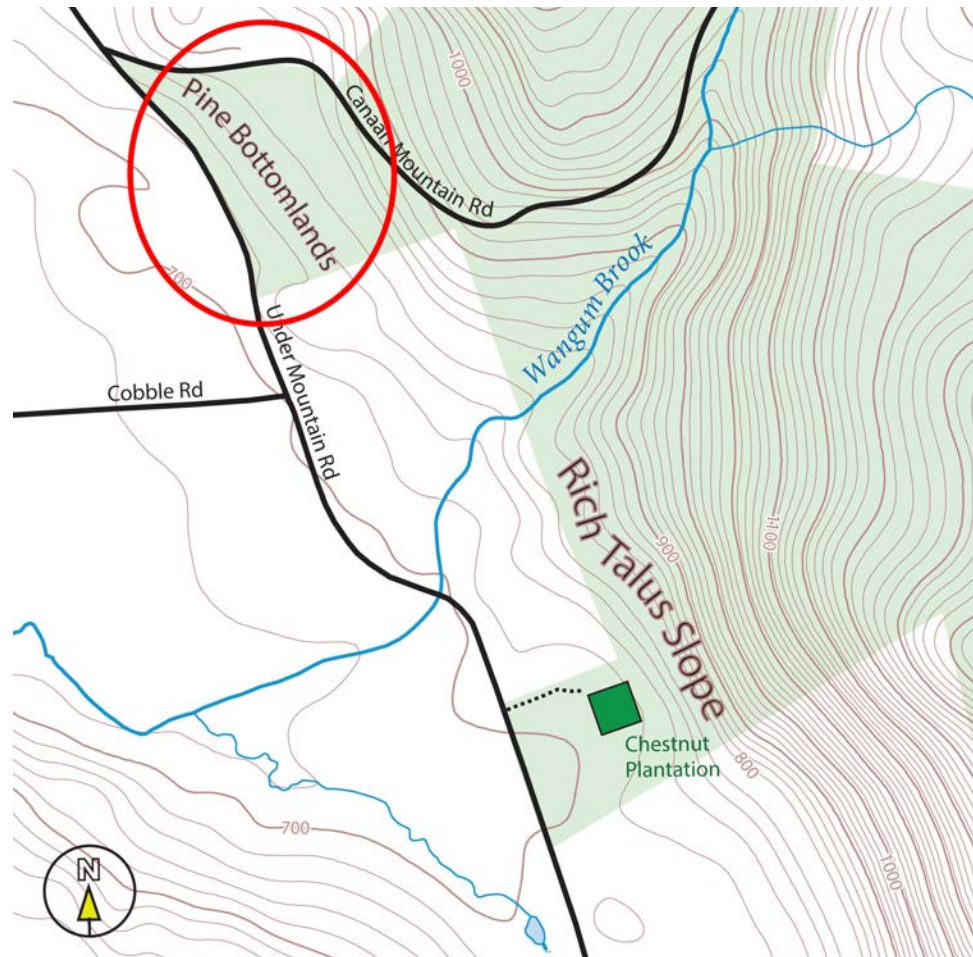


Some of the few remaining red pine at GMF, out of the many plantations which once existed. They stand out high above the surrounding canopy, which mostly established post-salvage efforts.

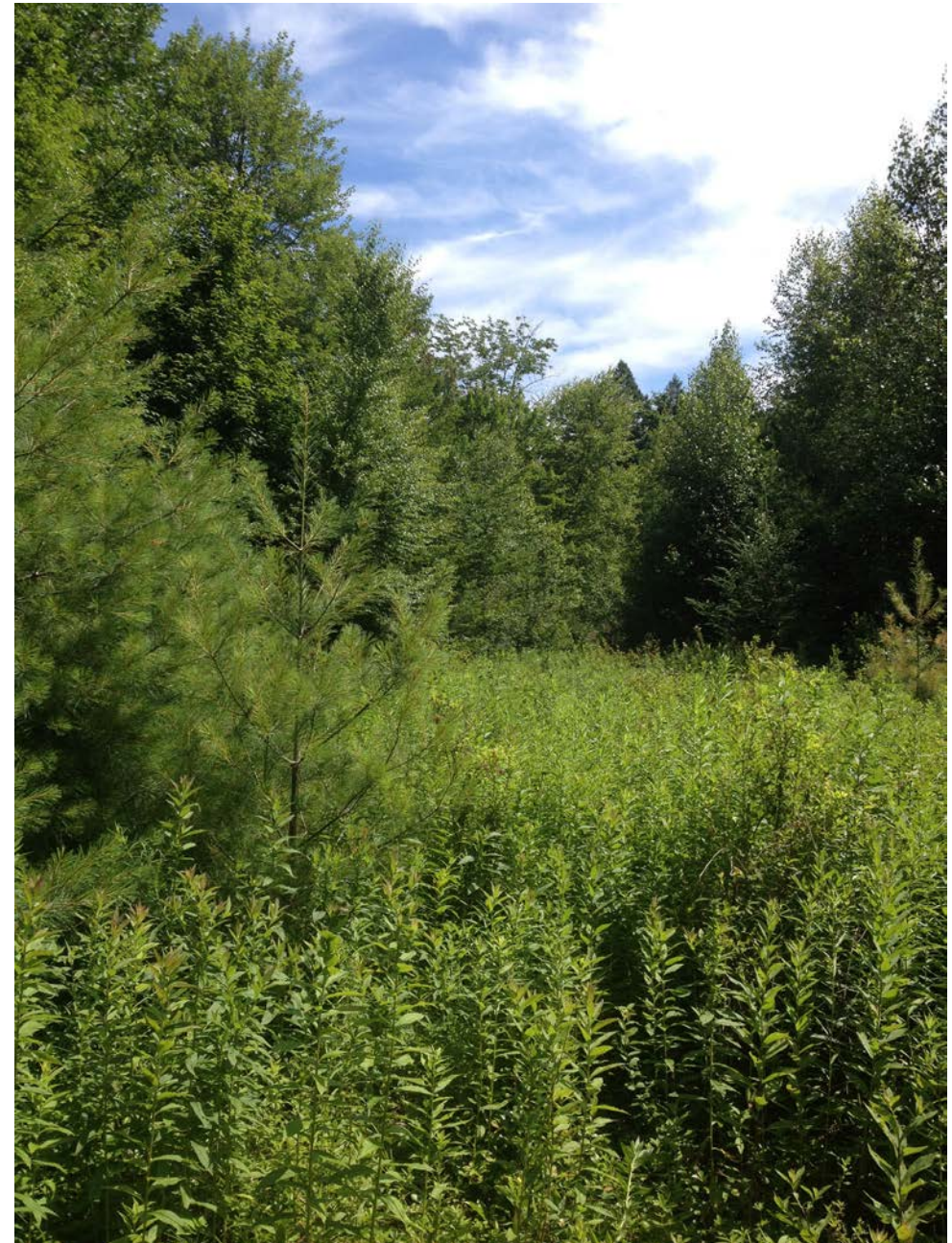
FOREST MANAGEMENT SITE 6: LOWLAND WHITE PINE THINNING

Summary

This site of old field white pine was thinned in the early 1980s to promote the growth of selected individuals. The site has become a haven for several invasive species, who have made the most of the rich soils to grow abundantly around the understory.



Map of Parking Area and Lowland White Pine.
Parking Area: N 41°57'00.14"; W 73°17'16.17"
Lowland White Pine: N 41°56'58.89"; W 73°17'16.03"



View of the attempted white pine planting area in the former red pine plantations along the Tamarack Interpretive Trail. Though a few of the young individuals persist, most did not make it. Darrell Russ, the former GMF head forester, was known to quip at times like these: "the site will grow what it wants to grow!"

Access

The site is accessible off of Undermountain Road, heading into the thicket near the intersection with Canaan Mountain Road. Visitors can also park along Canaan Mountain Road, and descend into the site via the katsura plantation.

Location

See included map.

Parking Area

N 41°57'00.14"

W 73°17'16.17"

Lowland White Pine

N 41°56'58.89"

W 73°17'16.03"

Nearby or Comparative Sites

The lowland white pine lies just to the north of the rich talus slope (Natural Communities 1) and TACF chestnut plantation (Research Sites 3), and across the street to the south of the Appalachian Forest (Natural Communities 6).

Description

This site contains former agricultural land, which regenerated naturally with white pine approximately 70 years ago. Ted Childs bought the parcel as part of the Kellogg purchase in 1941, and proceeded to have several small plantations of chestnut, katsura, dawn redwood, and white fir planted throughout the 1960s and 1970s (see Forest Management 1: Plantations). Abundance of spicebush (*Lindera benzoin*) and a healthy understory wildflower community indicate that the soils here are nutrient rich, underlain as they are with the same blessed limestone as the rich talus slope (Natural Communities 1: Rich Talus Slope).

Over the course of the years of 1980-1984, the GMF crew systematically thinned pines growing in the lowland were by hand. Thinning is a site treatment method that creates more growing space for selected individuals. Self-thinning occurs naturally given enough time, as trees that germinated densely in a site during the stand initiation phase begin to crowd one another, and those without a competitive advantage die

off. By thinning manually, humans are in effect speeding up the process, and are able to exert choice in the remaining trees based on desirable timber (or other) characteristics.

This thinning prescription also included pruning the branches of younger pine stems with hand saws. This ensures that subsequent radial growth will be knot free, and therefore produce a higher quality product.

After each thinning, foresters wait until the remaining trees have grown larger into the released growing space before conducting a harvest, or additional thinning treatments. In the meantime, the understory of this site has unfortunately grown in with hordes of invasive plant species, possibly released themselves by the extra light made available from the thinning treatments. Japanese barberry (*Berberis thunbergii*), a lover of wet environments, is abundant here in the lowland environment along Under Mountain Road. Asiatic bittersweet (*Celastrus orbiculatus*) is a common invasive vine that is now common in the site. Also a lover of mesic woods and edges, it climbs almost cartoonishly by winding around tree trunks of all sizes. Sometimes after removing them, a spiral shape is left embedded in the wood of their host trees if the bittersweet has been growing for a long time. Katsura, from a small adjacent plantation, is also escaping and regenerating in this forest.

Jody plans to return to the site in the future to conduct a harvest of the pine trees, but is concerned about the possibility of the spread of invasives and susceptibility to windthrow. After a thinning, the stem density in the treatment area is, by definition, greatly reduced, which exposes a greater proportion of the stand to the wily whims of the wind. Further harvesting, particularly in this wet area, could heighten the risk of the remaining trees toppling after a particularly heavy storm. Jody and Russell must always dance their dance...



A preponderance of Japanese Barberry, growing below the opened white pine canopy.



Asiatic bittersweet, climbing a mature white pine. The thick, fast growing vines can twist and graft to one another as they ascend.

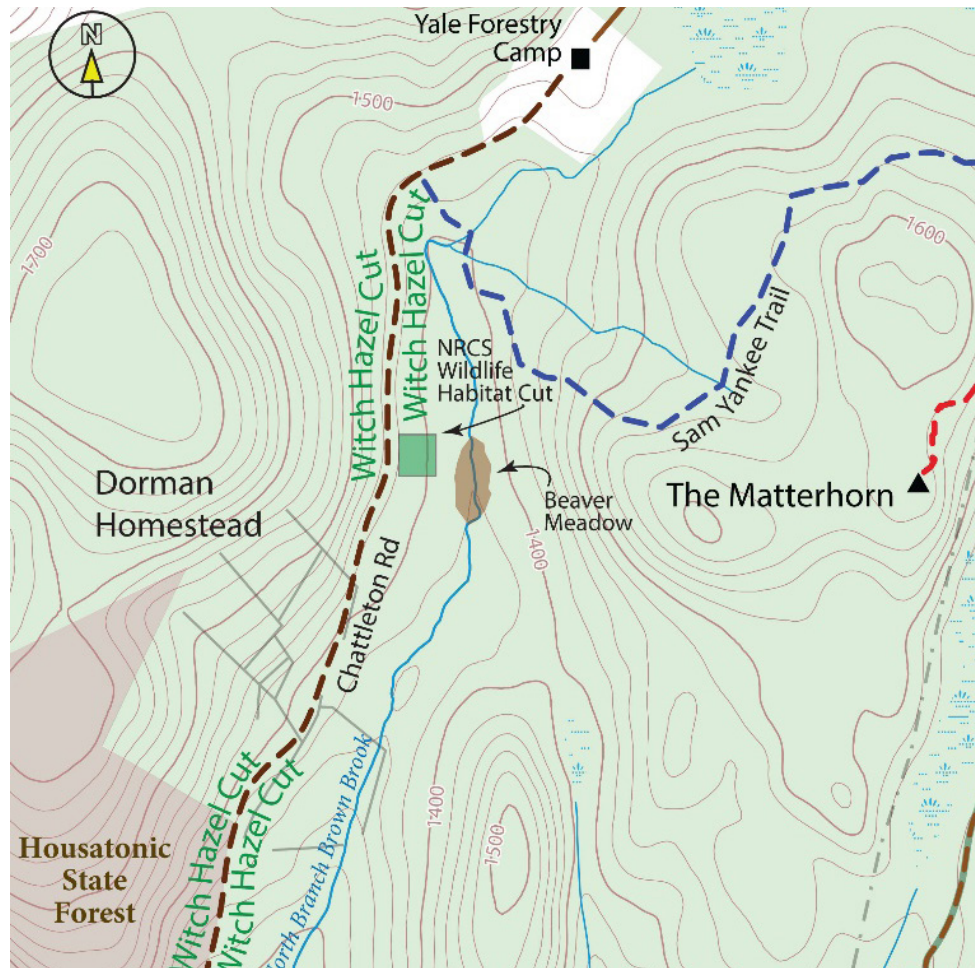
FOREST MANAGEMENT SITE 7: WITCH HAZEL HARVEST

Summary

Witch hazel oil is a non-timber forest product that is harvested at GMF. The process involved opportunistic hand felling along Chattleton Road, and hiring someone with a specialty vehicle to collect to stacked trunks and branches for processing elsewhere.

Access

This harvest was not conducted in one distinct location, but rather all along either side of Chattleton Road, south of Yale Camp. Look for cut stumps at the bases of witch hazel growing in this region.



Map of Witch Hazel Harvest location.



Early advertisement of Dickinson's Witch Hazel, circa. 1920.

Location

Witch Hazel Harvest, North Boundary
N 41°56'43.95"
W 73°15'53.27"

Nearby or Comparative Sites

The witch hazel harvest occurred beside the Dorman Homestead Site (Land Use History 6), and the later NRCS Bird Habitat Cut (Forest Management 9).

Description

Witch hazel is a common understory shrub in the forests of New England, sometimes growing to tree like proportions. The oil extracted from the bark and leaves has various medicinal properties, used mostly for topical wounds and skin care. As it turns out, Connecticut is the #1 global exporter of witch hazel oil and its associated products.

This witch hazel harvest represents GMF's first foray into the lucrative industry. The entire process took place in the fall of 2002, after the leaves were down. The first step involved cutting witch hazel all along

either side of Chattleton Road, south of Yale Camp, and stacking them in piles of about 1-ton each. GMF contracted Eugene Buyak, a proud witch hazel harvest specialist, to cut and gather the piles using his home-made doodlebug. This was an old deuce-n-a-half military truck with a chains added on the back to grapple the stacks of witch hazel. He used this contraption to drag stems to a specialty wood chipper, loaned by Dickinson's Witch Hazel. The chips were then delivered to their processing facility for oil extraction. From there GMF's hard-earned witch hazel made it to the skin and faces of people near and far.

In all, around 2000 tons of witch hazel were removed from along this corridor. In general practice, witch hazel can be harvested from an area on a 10-12 year rotation. The species re-sprouts so vigorously that it is often hard to tell that a plant had ever been cut in the first place. Upon careful inspection, you can see the flat cut stumps at the bases of the fully grown individuals alongside Chattleton Road.

As an unforeseen consequence of this harvest, the doodlebug unearthed many acorns that were buried beneath the duff layer. This facilitated great regeneration of oak trees around the stumps of the cut witch hazel. It is yet another example of a chance factor steering the fate of complexity in forest development.

Resources

Dickinson's Witch Hazel Website: <http://www.dickinsonbrands.com/>

Beers, David (2010). At work with Bob Haines. Northern Woodlands Magazine, Summer 2010 <http://northernwoodlands.org/articles/article/at-work-with-bob-haines>



Huge multi-trunked witch hazel along Chattleton Road. This individual resprouted vigorously after the initial cutting.



The coppiced stump of a resprouted witch hazel on Chattleton Road.

FOREST MANAGEMENT SITE 8: MAPLE SYRUP PRODUCTION

Summary

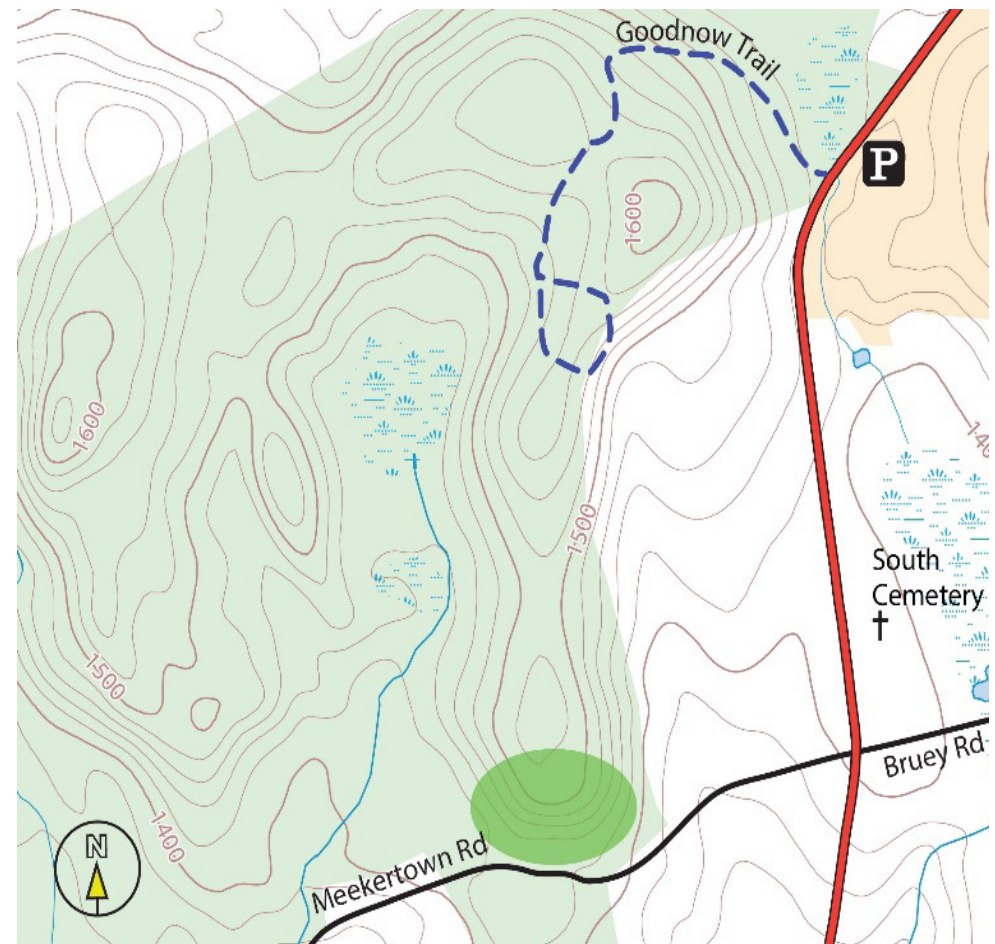
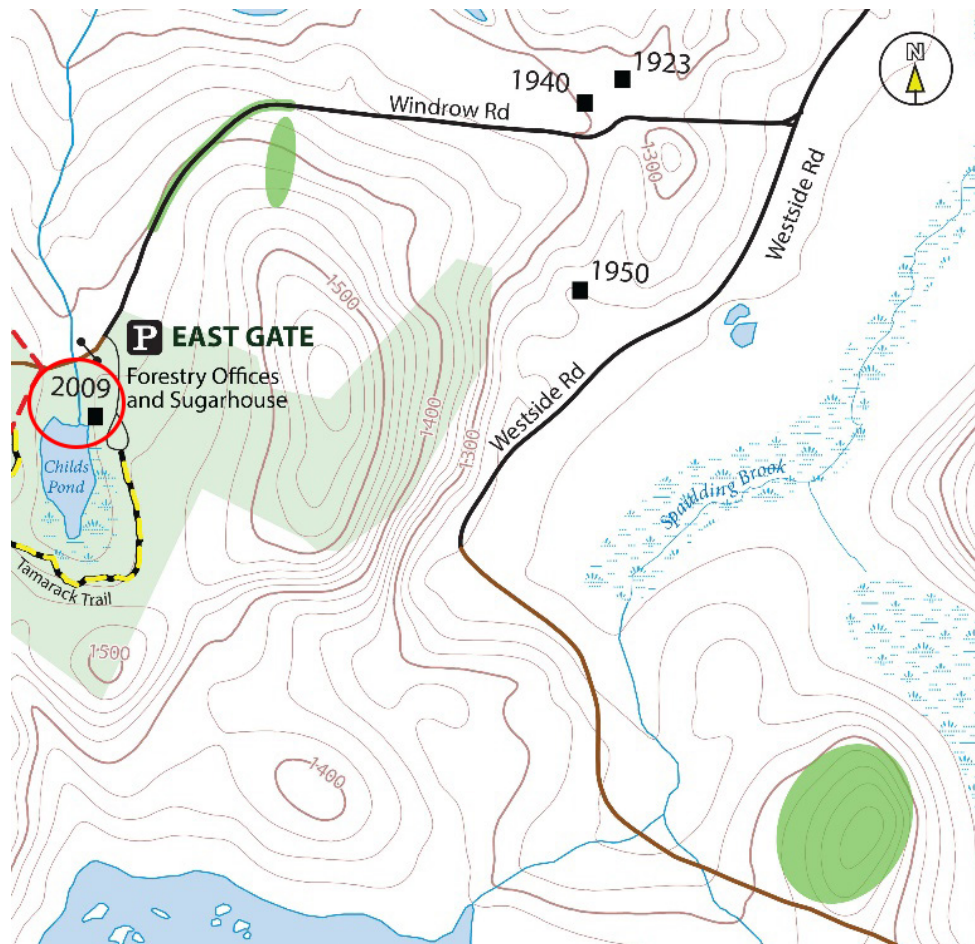
This section outlines the history of maple syrup production at GMF. Sugaring operations have been ongoing at Great Mountain Forest for 75 years. Over time various technologies and innovations have been implemented to streamline the process. There have been four incarnations of the GMF saphouse—where sap collected from trees is processed into syrup. In addition to the delicious syrup, sugaring activities provide educational opportunities for community engagement, with folks of all ages.

Access

The saphouse is adjacent to the Forestry office at 201 Windrow Road. Visitors may park in the parking area by the welcome kiosk. There are areas of currently tapped maple trees along Windrow Road and a sugarbush on Westside Road (green areas, map 1). The primary sugarbush currently in use for gravity tube harvest is just along the Old Meekertown Road, accessed from the southeast quadrant of GMF (green area, map 2).

Location

See included map.



Map of Current Saphouse: N 41°58'03.47"; W 73°13'03.26" and Tapped Maples (in green).

Map of Gravity Tube Harvest Site: N 41°56'30.20"; W 73°12'40.42"

Nearby or Comparative Sites

The saphouse is near the Forestry Office, the start of the Tamarack Trail, and the Red Pine Salvage Site (Forest Management 6).

Description

By far, maple syrup is the most beloved of the forest products of GMF. Maple syrup making is a relatively simple process that has been practiced in New England for millenia by Algonquian Indian tribes, many years before the arrival of Europeans. Sap is harvested by drilling short holes into the xylem (water conducting tissue) of sugar maple trees during the earliest part of the spring thaw—a brief period in late February and early March when starch stored in the roots over winter is converted to sugar, and moved upwards through the trunk to provide energy for leaf-out on the outer branches. The collected sap is then boiled to evaporate excess water, leaving behind the viscous sugary substance we know as maple syrup. American Indians accomplished this by filling carved out logs with sap and depositing heated rocks until it was boiled down to the desired consistency. Most private and commercial maple syrup enterprises today use heated evaporators specially designed for that purpose, often with vacuum pumps and reverse osmosis, designed to increase the yields and efficiency. Sugar content in the sap varies according to a number of known and unknown environmental factors, but as a general rule it takes about 40 gallons of sap to produce 1 gallon of syrup.

Retail sugaring operations at GMF have been ongoing continuously since 1940, when Ted Childs established “Coolwater Maple Syrup” (named after the Coolwater family estate) by building a saphouse on Windrow Road. The fledgling enterprise used a small 3’ x 8’ evaporator to heat the collected sap. Initially, GMF staff used a large wagon-mounted tank to transport the gathered sap from the 300 tapped trees to the saphouse. The most valuable workers in this effort were the two horses charged with pulling the wagon on the back and forth journeys, named Chubb #1 and Chubb #2 (respectively). These equine tree sugar couriers served dutifully until 1950, when a second, bigger saphouse was built near Westside Road, and a newly bought truck took over sap collection responsibilities.

The new saphouse, with its larger wood fired evaporator, could process sap into maple syrup at a much faster rate—heating almost 200 gallons of sap an hour (the old evaporator was employed as a pre-heater, to accelerate the proceedings). Productivity increased with the tapping of many new trees, reaching a maximum of 1,950 at one point. An ingenious



A 1973 ad for Buc Wheats cereal, featuring the second GMF saphouse. During shooting, the photographer insisted that he wanted more sap buckets to be visible, which is why additional ones were hung on the tree to the left, even though apple trees are never tapped for sap production.



The faithful Chubbs at work, circa. 1940s.

system to streamline sap collection was devised whereby strategic sap depo containers were established at the tops of steep hills. The sap could then gravity flow down through a labyrinth of aluminum piping to larger holding tanks at the bottom. This incarnation of the saphouse was featured in an advertisement for Buc Wheats cereal, of which maple syrup was apparently a key ingredient (see photo). The second saphouse was used until 1973, when a third house was built near Windrow Road. The fourth (and current) saphouse was built in 2012, constructed completely from white pine and douglas fir timber harvested at GMF. It sits proudly next to the Forestry office at 201 Windrow Road, at the eastern boundary of the forest.

Today, sugarers at GMF produce around 100 gallons of maple syrup annually for retail consumption. Many of the 450 currently tapped trees are the same ones that have been used for the past 60 years. While the traditional bucket method is still used on about 100 of the tapped trees, most of the collection is now collected via gravity-fed tubing. There are several sugarbush management areas in Great Mountain Forest—Groves



Tapped trees using the bucket method. Unlike the gravity tube, these must be individually emptied on a regular basis after they fill during the heat of the day.

of sugar maples are carefully thinned to produce stands of maximum sap production once they have reached the appropriate size of 15-inches DBH. These may be utilized one day in future sap harvests.

Aside from the syrup itself, sugaring operations at GMF have yielded substantial informational outputs. A detailed saphouse diary has been kept for the past 70 years, chronicling the sap output, sugar content, and syrup production levels throughout each sugaring season, as well as observations of phenological phenomena such as the return date of various migratory birds, or the first budding of particular tree species. Taken together, these records provide a wealth of information on the timing and fluctuations of many forest phenomena across a huge period of time. But perhaps the most important aspect of the sugaring operation is its value as an educational resource for the community. GMF hosts maple syrup workshops and outreach programs to demonstrate all stages of the process from tapping to tasting throughout the season.



Head forester Jody Bronson, posing by the current saphouse woodshed. The evaporator used to turn sap into syrup is heated exclusively by firewood harvested and seasoned at GMF.



The modern day saphouse in action.



The modern day Jody in action. The wood-fired evaporator heats up the sap in several stages to speed up the process.



GMF sugarbush along Old Meekertown Road, tapped with gravity tubes. The sap drains directly from the trees into a single shared basin, thereby saving much labor in the collection process.



A demonstration sugarbush management area along Chatleton Road. Once the trees have grown to sufficient size, they will be recruited for future sap harvests.

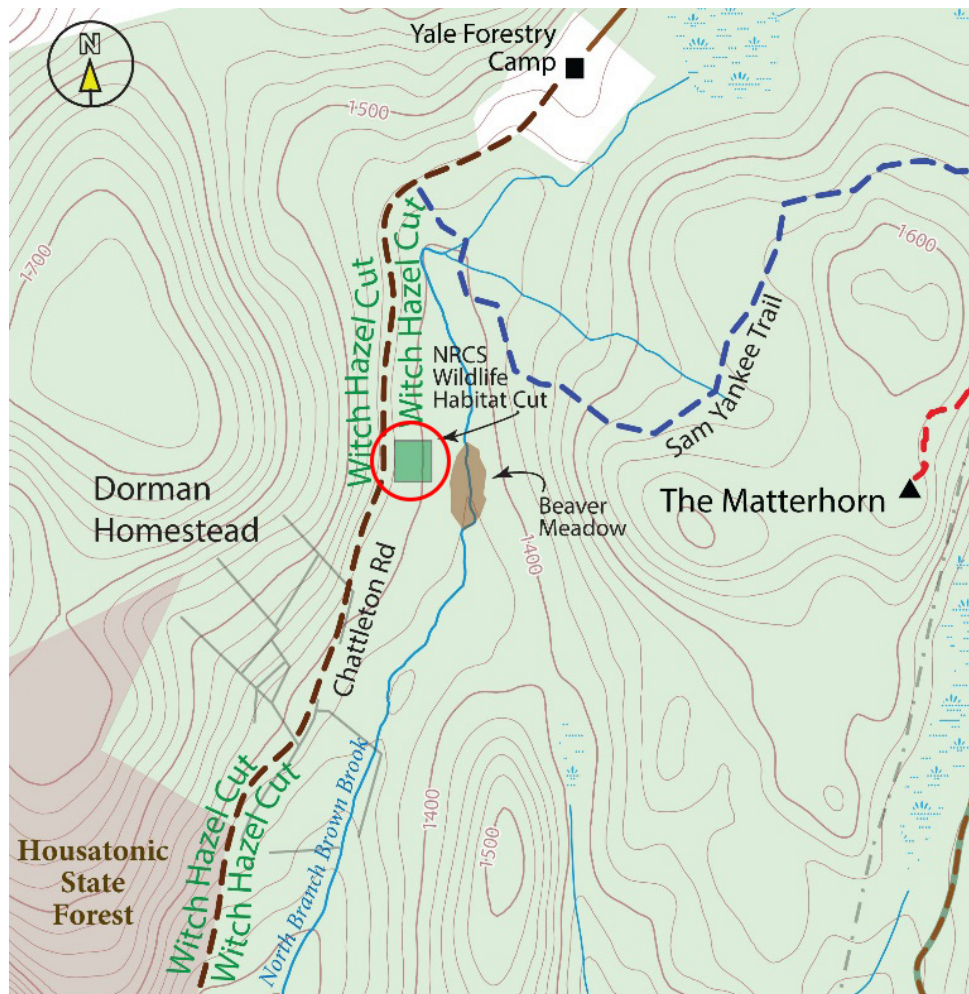
FOREST MANAGEMENT 9: NRCS BIRD HABITAT CUT

Summary

This 2013 cut was conducted to create habitat for a more diverse assemblage of bird species. Through considering canopy structure and the retention of certain features, the forested environment can be tailored to promote diversity and resilience in forest bird populations.

Access

The site sits along the east side of the old Chattleton Road, a short walk south from the Yale Camp.



Map of Bird Habitat: 41°56'28.65" N; 73°15'56.00" W

Location

See included map.

Bird Habitat

41°56'28.65" N

73°15'56.00" W

Nearby or Comparative Sites

This site occurs in a hub of forest activity directly west of the beaver meadow (Natural Communities 9), northeast and southeast of the 2004 witch hazel harvest (Forest Management 7), and northeast of the Dorman homestead (Land Use History 6).

Description

Silvicultural goals can run the gamut from economic gain, to aesthetic virtue, to habitat creation. Through thoughtful planning and careful execution, diverse objectives may be achieved. Oftentimes, the primary intention is to conduct a profitable harvest that maintains the health and productivity of the forest. Creating wildlife habitat is often a matter of secondary importance (however diligently considered). The chief priority of the next two sites, however, was opening the canopy to promote populations of specific animals. Such cutting edge silviculture is becoming more common in conservation organizations throughout the globe.

In 2013, GMF received a grant from the Natural Resources Conservation Service (NRCS: an agency in the USDA) to clear a section of open forest habitat for passerine (perching) songbirds. Birds as a taxonomic group are a good example of adaptive radiation, wherein diversity increases greatly following the creation of a new set of resources in an environment, or the evolution of some novel feature. In this case, the advent of flight allowed birds to evolve into a diverse suite of hitherto unoccupied niches. Among forest birds, individual species are each specialized (by varying degrees) to different canopy structures. By creating a mosaic of different stands, forests can be managed to provide habitat for a much greater diversity of bird species than would be present otherwise.

Complex canopy structure is the chief consideration to meet the habitat requirements of as many bird species as possible. This means maintaining patches of different age classes within the wider, more mature forest. This small several-acre cut at GMF is open enough to promote the regeneration of a new cohort of trees. Adjacent to the east is the beaver



A cut red maple stump on site, which is re-sprouting. Tree coppicing is a way for certain species to regenerate quickly from an already mature root system.



View of the site, just two years after harvesting. In that time, the understory has grown back in great swaths of hay scented fern, which is notorious for its ability to impede tree seedling regeneration for many years.

meadow, with its own distinct wetland structure. Both of these sites are relatively small patches, nestled strategically within the broader matrix forest of GMF. Structure is also defined vertically, referring to the niches in canopy position that are available. Though mostly open now, the site will receive additional treatments in years to come to ensure that the developing canopy, mid-story, understory, and ground layers are each represented with the appropriate vegetation.

The site retains a few tall trees that will grow to have large diameters. Tall trees provide nesting sites for woodland raptors, such as the Cooper's hawk (*Accipiter cooperii*). Many of the cut branches of removed trees were left on the ground as coarse woody debris, where they are used as habitat for ground nesting birds such as the ruffed grouse (*Bonasa umbellus*) and wild turkey (*Meleagris gallopavo*). Though none are located on the current site, it is common practice for harvests at GMF to leave snags (standing dead trees) as crucial habitat for woodpecker species and other birds that nest in them.

This cut was performed with hand felling techniques and a skidder to transport logs to the road. Much of the cut red maple was processed as firewood for use at GMF. As the final stage of the harvest, all invasive Japanese barberry in the site was treated with a chemical herbicide. Though many bird species will sometimes eat the berries of invasive barberry and bush honeysuckle, they provide only minimal nutrition, and compete vigorously for growing space with more beneficial shrubs.

Though still in the early stages of development, this site is a key demonstration of GMF's commitment to practicing conservation forestry. Repeat treatments will be performed at regular intervals over the next century to help maximize bird diversity in the area.

Resources

Audubon Society, 2011. Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont. http://ct.audubon.org/sites/default/files/documents/silviculture-options_0.pdf.

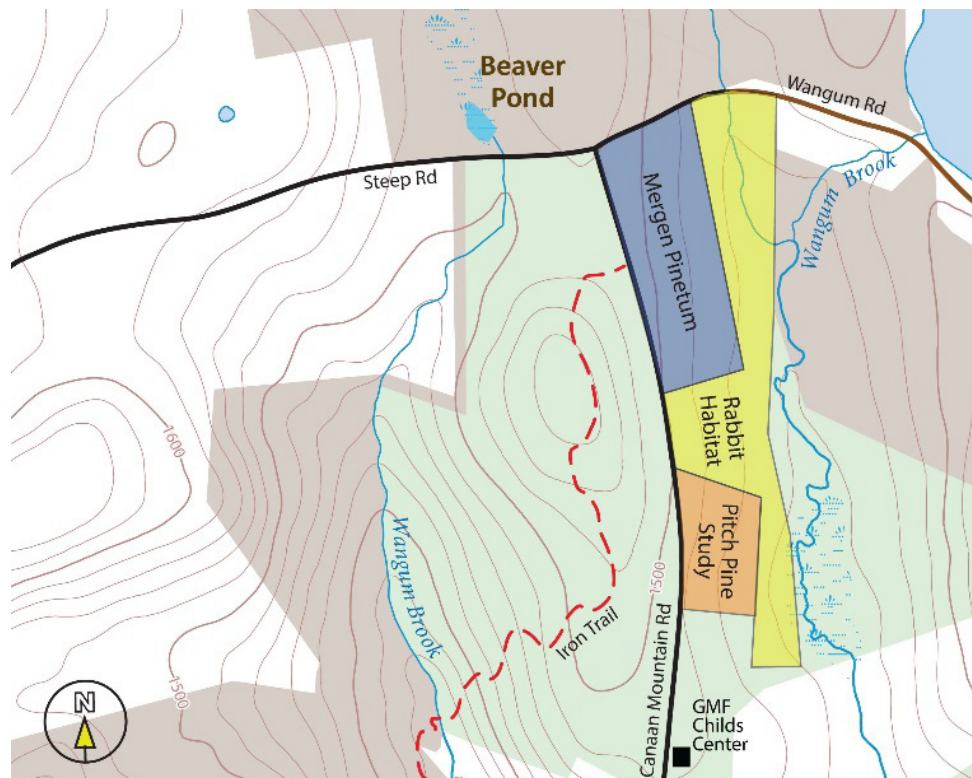
FOREST MANAGEMENT SITES 10: NEW ENGLAND COTTONTAIL RABBIT HABITAT

Summary

This clear cut was performed during the winter of 2015 to create habitat for the New England cottontail, which has become rare throughout the majority of its historical range. The 18 acre area will regenerate into dense, early successional forest which the rabbits require for foraging and protection from predators. Populations will be monitored to determine the success of these efforts.

Access

The New England cottontail habitat is easily accessible just off of the south side of Wangum Road. The information kiosk at its northern edge is an easy walk from the Mountain House.



Map of Rabbitat: 41°58'28.10" N; 73°16'12.04" W

Location

See included map.

Rabbitat

41°58'28.10" N

73°16'12.04" W

Nearby or Comparative Sites

The eastern cottontail habitat restoration area sits adjacent to the Mergen Pinetum (Research Sites 4), the Pitch Pine Study Site (Research Site 5), and across the street from the Stone Man Trail (Geologic Site 7).

Description

The goal of this cut was to create habitat for New England cottontail rabbits (*Sylvilagus transitionalis*). The species once ranged from New York state, east across the Hudson River to southern Maine and New Hampshire. From the late 1800s through the 1960s, the closely related eastern cottontail (*S. floridanus*) was systematically introduced across much of this region as a source of game for hunters. They eventually replaced the native New England cottontails, who today exist in just a few scattered populations in Maine, New Hampshire, Massachusetts, eastern New York state, and Connecticut. The species was listed as vulnerable in 1996 by the International Union for the Conservation of Nature (IUCN), and is currently a candidate for endangered status.

Unlike the eastern cottontail which is more of a habitat generalist, New England cottontails are restricted to early successional forests, where the dense thickets of young, regenerating trees enable them to evade predators, while providing ample browsing opportunity. However, for the last hundred years most forests in the region have grown to a mature state from abandoned agricultural land, or else been converted wholly to development projects, leaving very little of the scrubland that the species needs in order to thrive.

One of the last major population pockets of the New England cottontail rabbit is in Litchfield county, Connecticut, prompting special efforts to focus habitat creation in the region. In 2013, the Connecticut State Department of Energy and Environmental Protection (DEEP) conducted a 59 acre clearcut on part of its state land holdings near Goshen. After identifying the presence of a small population of New England cottontails near Wangum Road in Norfolk, DEEP collaborated with the



Southward facing view into the cottontail habitat from Wangum Road. The kiosk provides information about the New England cottontail, and the motivations behind clearcutting the area (lest passerby think it was for selfish reasons).

Great Mountain Forest to create an 18 acre early successional habitat parcel in the winter of 2014. The area was completely clear cut of all trees greater than 3 inches in diameter, except for some stray apple and hawthorne trees which offer excellent wildlife value. Brush was stacked into piles throughout the area to provide habitat cover for the next few years, while waiting for young trees sprout into a dense thicket. Wildlife biologists from the New England Cottontail Initiative will monitor the area for signs of new rabbits. In the meantime, the opened area makes great habitat for ground nesting birds like turkeys and ruffed grouse. It is well to remember that conservation efforts aimed at a particular species can have positive consequences for other organisms.



Heaps of brush like this one were piled strategically all around the cut over area. They will hopefully provide shelter for the rabbits until the surrounding forest has developed.

Resources

New England Cottontail Initiative Website: <http://newenglandcottontail.org/>.

Wood, Wiley. "Connecticut Biologists Create Habitat for the Endangered New England Cottontail." *Norfolk Now*. 02 June 2013. Web. 21 Aug. 2015. <http://www.nornow.org/2013/06/02/its-only-natural/>.

Wood, Wiley. "Landowners Make Clear-Cuts To Benefit Rare Cottontail Rabbit." *Norfolk Now*. 27 Feb. 2015. Web. 21 Aug. 2015. <http://www.nornow.org/2015/02/27/landowners-make-clear-cuts-benefit-rare-cottontail-rabbit/>.