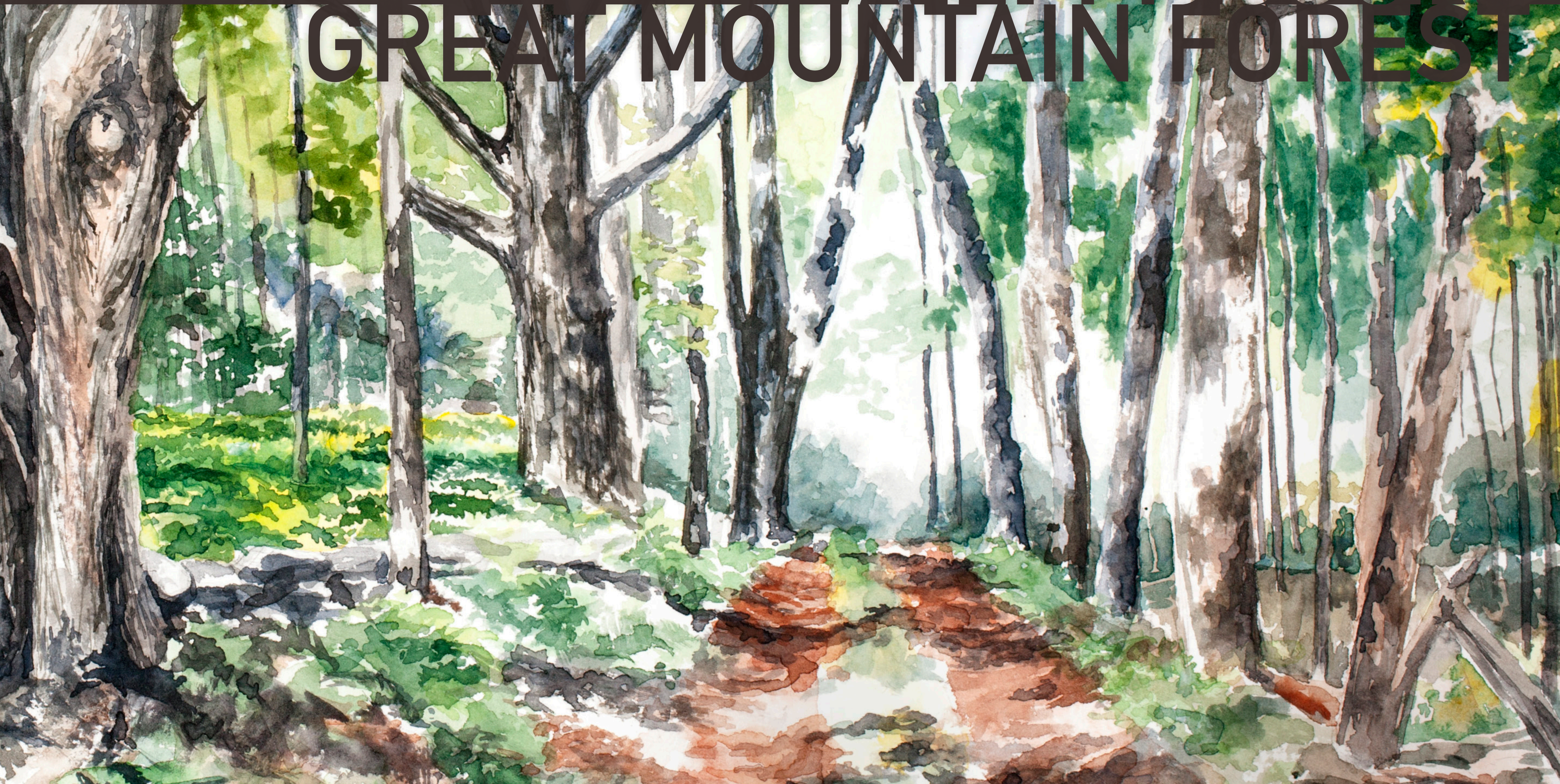
A FIELDBOOK
GREAT MOUNTAIN FOREST



Text by Michael Gaige and Yonatan Glogower

Photographs by Michael Gaige, Yonatan Glogower, and GMF

Watercolors and Design by Autumn Von Plinsky

RESEARCH SITES

PAST AND PRESENT

Ever since the early days of leadership by Ted Childs, Great Mountain Forest has been a major site of ecological research, with some 80+ published studies and articles coming from data collected by researchers throughout the forest. Studies cover a wide range of topics, including wildlife analyses, forest development and growth modeling, tree genetics, soil science, and meteorology. Promoting research in the forest is one of the major outreach goals of GMF, and staff members frequently help collaborate on projects.

Research in the forest also includes more informal, unpublished data collection efforts through the day to day management operations. GMF forester Russell Russ collects daily weather data from the Norfolk station established by Ted Childs by. Jody Bronson keeps detailed records from all timber harvesting, and collects wildlife reports from hunters on the property. The saphouse journal goes back more than sixty years, and records annual sap production and sugar content, as well as phenological data for plants and animals throughout the course of the sapping season.

What follows are six sites of past and current research projects where there are interesting features and lasting legacies to observe. For a more complete annotated bibliography of research conducted at Great Mountain Forest, please see Appendix II.

RESEARCH SITE 1: MOOSE EXCLOSURES

Summary

A recently established study to investigate the impact of moose browsing on the development of understory vegetation. Such work is pioneering in GMF, where moose have only recently arrived.

Access

The study plots are just off of the Number 4 Trail, about ½ mile south of the intersection with Old Meekertown rd. near the southernmost GMF boundary. Look for the clearcut site on the west side of the road.

Location

See included map.

Great Mountain Forest																									
Hunter Name:				Deer Sightings			Deer Harvested			Other Wildlife Sightings Please record numbers of each seen. For those not listed record animal in "Other"											Conditions (See legend below)				
Month / Year:							Buck		Doe															Mast	
		Hours Hunted	Zone	Buck	Doe	Fawn	Points	Weight	Weight	Bear	Bobcat	Coyote	Fisher	Fox	Grouse	Moose	Rabbit	Raccoon	Turkey	Other	Precip.	Wind	Moon Phase	Acorns	Beechnuts
1	am / pm																								
2	am / pm																								
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Legend: For Wind, Acorns, and Beechnuts use L for light, M for Moderate, and H for heavy.
For precipitation use CL for clear, LR for light rain, MR for moderate rain, HR for heavy rain, and LS, MS, HS for snow conditions.
For Moon Phase use NW for new, FQ for first quarter, FL for full, and TQ for third quarter.

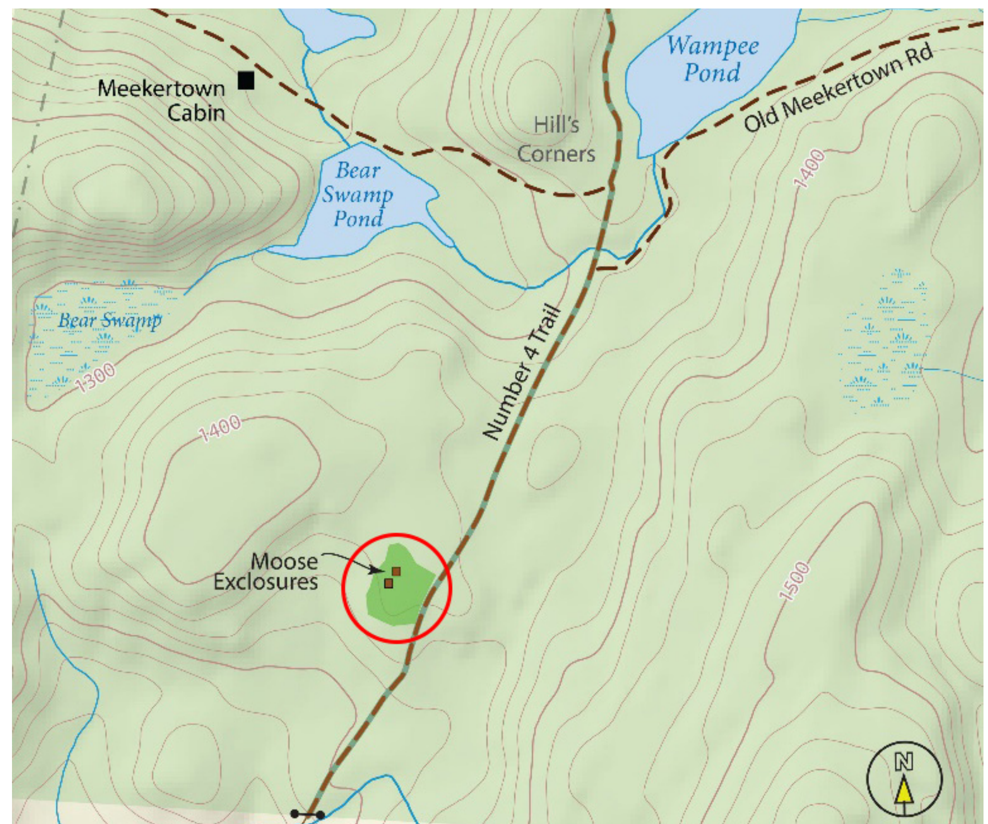
The wildlife sighting sheet given to hunters at GMF. By engaging with GMF's diverse visitor base, valuable information can be collected about the health and diversity of the forest.

Moose Exclosures
N 41° 55' 11.142"
W -71° 15' 7.7454

Description

This ongoing study was established in 2010 as a collaboration between researchers from Highstead and the University of Massachusetts at Amherst. The purpose is to study the impact of moose herbivory on the regeneration of tree seedlings following the opening of light gaps in the canopy. It has been long documented that interference from mammals can significantly delay or alter the dynamics of forest regeneration, though the impact of Moose in their new Connecticut environment has yet to be established.

The study sites are established within a 4 acre clearcut site that was conducted specifically for the purposes of this research. GMF harvested the trees, which primarily consisted of white pine and oak that were later used



Location of Moose Exclosure site.

to build the 2012 GMF saphouse (see Forest Management 8).

The site consists of three equal-sized experimental plots Plot 1 is surrounded by tall fencing that is suspended slightly above the ground, while Plot 2 is surrounded by fencing that goes all the way down. This is meant to control for differences in herbivory by non-moose animal species who are able to fit beneath the fencing gap, such as rabbits and small deer. Plot 3 is a designated control plot area, marked on all sides by metal posts but with no fencing to impede access by animals.

Even just a few years into the establishment of the study, there are already stark differences between the enclosed areas and the moose exposed clearcut. Among the common tree species present, (red maple, black cherry, red oak, and beech), there is markedly higher growth and abundance. Outside of the exclosures, trees are frequently shrub-like and multi-trunked, the result of vigorous re-sprouting following grazing. The deer exclusion areas also feature a much lower ground cover density of hay-scented fern and blackberry, species that can impede tree seedling regeneration for extended periods of time if given the opportunity to establish a foothold.

Besides being notable for its value as an important research location, the moose exclosure study site is also an excellent place for birdwatching. Keep an eye out for the eastern towhee, catbirds, yellow-rumped warblers, and other forest edge species.

View from the outside of the complete moose exclosure. Even several years into this long term study, there are already stark differences in vegetation where the moose are excluded from browsing.

Researcher Contact Information

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RESEARCH SITE 2: FOREST SUCCESSION DYNAMICS STUDY

Summary

Established in 1967, this is one of the longest running studies following forest succession in eastern North America.

Access

The Thick and Thin Till sites are both off of Chrissey Trail to the south. From Chattleton Rd, turn onto Camp Rd at Potter's Corners, turn right onto the Number 4 Trail, and then left onto Chrissey Trail. The Outwash Site is just off of Gamefield Rd, a private road off of Windrow Rd., east of the GMF Forestry office. Please get permission from the GMF staff beforehand if you are planning on using a motorized vehicle to access any of these sites.

Location

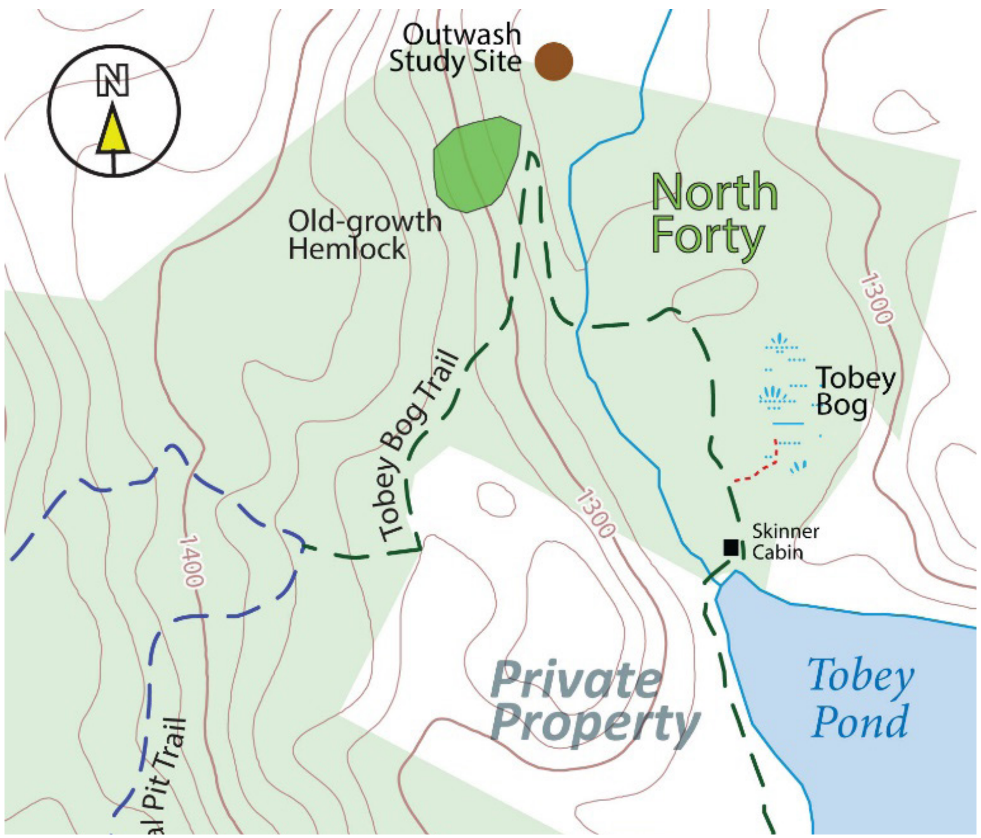
Outwash Site
41°58'55.40" N
73°13'41.69" W

Nearby or Comparative Sites

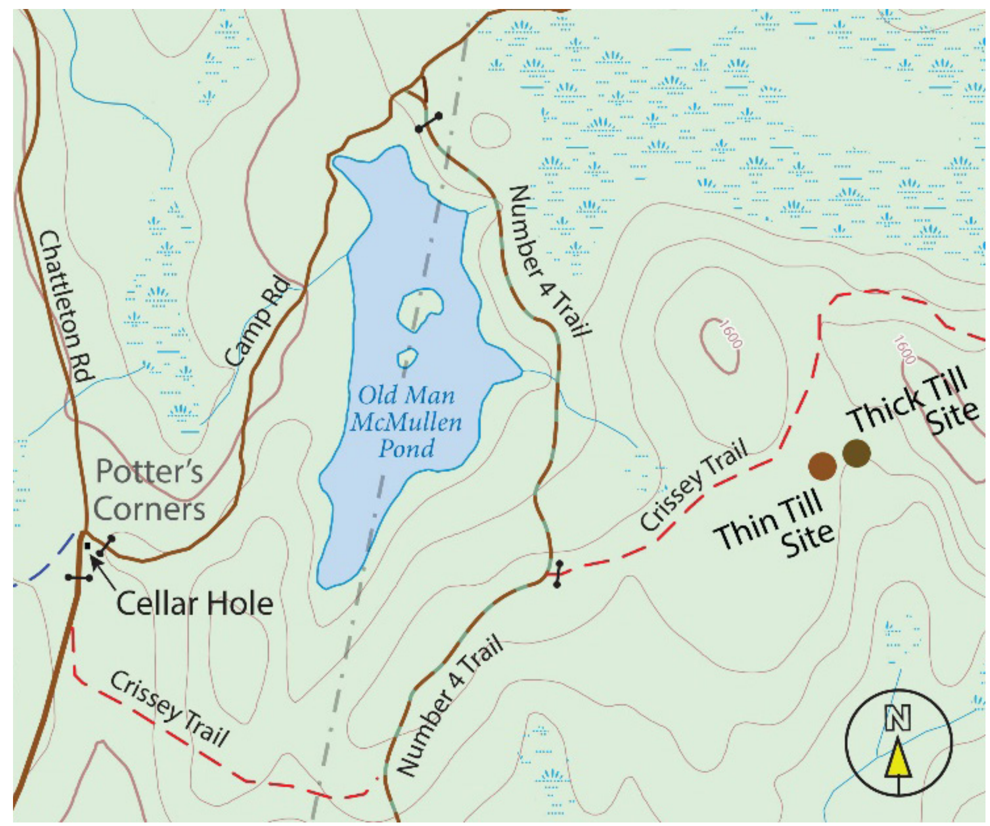
The research on forest succession nicely complements the PhD studies by Matt Kelty (see Research Bibliography, Appendix II), providing an earlier snapshot of the mature canopy dynamics that he details.

Description

This ongoing study was established by former Yale F&ES silviculture professor David M. Smith in 1967. He set up cleared strip plots (80 feet wide) in three different microenvironments to monitor how the tree species



Outwash Site 41°58'55.40" N; 73°13'41.69" W



Thick Till Site 41 57'25.08" N; 73 14'37.73" W

Thin Till Site 41°57'24.64" N; 73°14'39.04" W

The Thick Till Site, shortly after establishment in 1969. For several years at the beginning of the study, a dense ground story layer inhibited tree seedlings from establishing.

The Thin Till Site in 1969. David Smith put fencing around all the plots, to prevent deer herbivory as a confounding factor in the study.

composition and structure would develop in each over time. The sites all experience similar climactic conditions, but have different underlying substrates. The thin till and thick till sites have unsorted rocky soils of gneiss and schist origin—ground up and dumped in a heap by glacial activity. They differ only with regard to average depth of soil to bedrock (1.5 feet and 3.0 feet, respectively). The outwash site contains sand and gravel soils whose particles have been sifted and sorted by running water following the retreat of the glacier. Trees of all species were measured for height and diameter at periodic intervals, as well as mortality of individuals. In this way, the growth and composition of the forest in these plots have been charted continuously for almost 50 years.

These sites have been the source of two published papers so far, with a third currently in preparation. Smith and Ashton (1993) describes the development of the forest canopy over the first 18 years of the study at GMF, as well as counterpart plots located in the Yale-Toumey Forest in New Hampshire. All showed similar initial development, becoming dominated early on by dense tangles of blackberry (*Rubus* sp.) and thick stands of pin cherry (*Prunus pensylvanica*), an early pioneer tree species that quickly dominated the initial canopy. Gradually, all plots increased in abundance of paper birch (*Betula papyrifera*), and later black birch (*B. nigra*) in the midstory, with some red oaks (*Quercus rubra*) and hemlocks (T*suga canadensis*) beginning to establish in the understory. The initial results show a forest beginning to develop different strata based on dispersal mechanism and relative shade tolerance of the tree species present.

The second paper, Liptzin and Ashton (1999), charts forest development in the thick and thin till sites after 28 years of growth, comparing canopy structure between the years 1986 and 1995. The stratification of the stands continued during this period, with pin cherry and paper birch still the dominant canopy species, and a mid-story of ascendant black birch and black cherry. By this point in the forest development, the available growing space has been taken up, with increased mortality among out-competed trees. As a consequence, both plots showed a reduction in the number of trees over time, but an overall increase in average basal area, as remaining trees grew larger to take up the newly available light made available by their dying neighbor trees. Differences between the plots also began to emerge during this time period, with smaller diameter trees and a greater abundance of red oak in the thin till site, and more black and yellow birch on the thick till site.

The Thick Till Site, summer 2015. The stands have grown into more mature black birch dominated mixtures, with an ascending midstory of shade tolerant beech and hemlock.

Yale FES doctoral student Mark Ashton in one of the strip cuts, September 1987. In less than 25 years, the forest has already grown back into a densely crowded overstory.

The paper currently under preparation aims to compare the growth patterns of all three plots from their inception to the present day. Preliminary data collected in 2015 shows a dramatic shift in canopy composition, with all the pioneer pin cherry and paper birch completely absent, greater numbers of red oak entering the black birch canopy, and more shade tolerant hemlock and American beech moving into the midstory.

Though long term forest succession studies of this kind have become more common, very few have been running as long as this study. New data collected from these sites will continue to shed light on succession dynamics in the GMF region.

Researcher Contact Information

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Resources

Liptzin, D., and P.M.S. Ashton (1999) Early-successional dynamics of single-aged mixed hardwood stands in a southern New England forest, USA. Forest Ecology and Management 116: 141-150.

Smith, D.M., and P.M.S. Ashton (1993). Early dominance of pioneer hardwood after clearcutting and removal of advanced regeneration. Northern Journal of Applied Forestry 10: 14-19

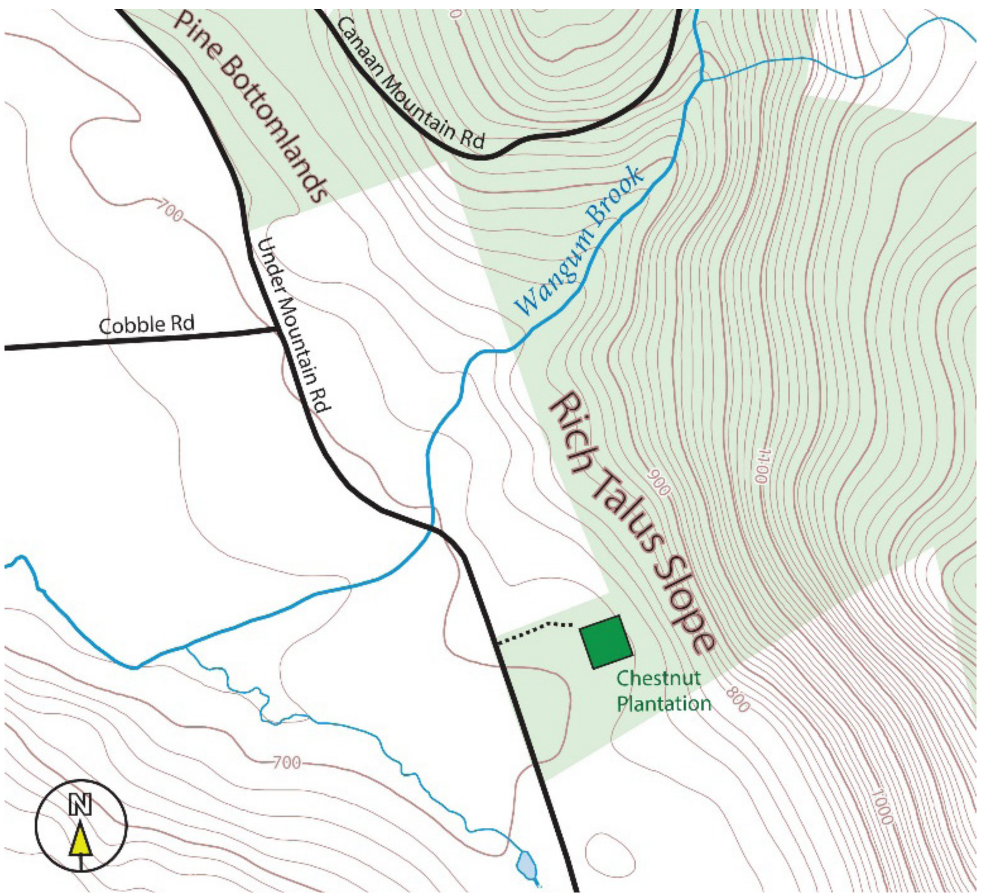
RESEARCH SITE 3: AMERICAN CHESTNUT PLANTATION

Summary

Once an abundant species in the eastern United States, the American chestnut has been decimated throughout its natural range by the chestnut blight, introduced in New York in 1904. The American Chestnut Foundation's plantation at GMF is part of a large, region-wide effort to create disease-resistant hybrids of the species

Access

The Chestnut Plantation rests at the east facing foot of Great Mountain (formerly Canaan Mountain), set back hidden from the road by a grassy meadow and a few relict Christmas tree plantations, (now grown to un-merchantable heights). A mowed pathway running east-west at the north end of the meadow provides the most direct car access to the site, though visitors may also park in the grass along Under Mountain Road.



Map of American Chestnut Plantation.

Location

See included map.

Chestnut Plantation
N 41°56'31.99"
W 73°16'58.26"

Nearby or Comparative Sites

As shown on the locator map, the Chestnut Plantation is near a number of unique sites, sitting as it does in the only small pocket of the forest whose elevation dips under 1000 feet above sea level. It is immediately adjacent to the Rich Tallus Slope site (Natural Communities 6), and close to the south of the lowland white pine thinning area (Forest Management 6), the Katsura Plantation (Forest Management 1), and the Appalachian Forest pocket (Natural Communities 8).

Description

When the chestnut blight swept through the northeast in the 1910's, it wiped out virtually all the adult trees in the region (see Species of Interest). At GMF, two separate salvage operations were conducted, in 1918 and in 1938, to retrieve what little merchantable timber could be found in the dead and dying trunks. Since that time, there have been several attempts at GMF to re-establish the species. In 1947, the Connecticut Ag. Station, led by pathologist Arthur Graves, received permission from Ted Childs to put in a plantation of hybrid American/Chinese chestnut crosses down by Robbin's Pitch, just north of Pothole Falls in the southwestern corner of the forest. The US Forest Service monitored and maintained the project until 1978, when they discontinued their efforts because all the trees had died. Concurrently, Ted himself established several chestnut plantations of his own in 1962; one group across the street from the Mountain House, another near the corner of Canaan Mountain Road and Mountain Road, and a third down by the lowland white pine on Under Mountain Road. These, too, succumbed to the blight after several years, and no trace of them remains today.

Following these failed attempts, it was not until 2007 that the current chestnut plantation was established at GMF. The American Chestnut Foundation (TACF) has been working since 1983 to breed trees that are resistant to the blight, but still retain most of the genetics and morphological characteristics of the original American chestnut. Since chestnuts as a genus are wind pollinated, any two individuals can be bred to one another by manually transporting selected pollen from one individual to selected flowers of others. By this process, the foundation bred hybrids of Chinese and American chestnut, and then backcrossed these with original American chestnuts. After three backcross generations, the resultant offspring are individuals that are 15/16 (~94%) American chestnut (the BC3 generation). Most of the BC3's are resistant to the blight, however, to ensure that they breed true to this trait, they are bred with one another for an additional two generations (the BC3F2 and BC3F3 generations, respectively). At each of these stages, only resistant individuals are selected to produce the progeny of the succeeding generation.

As a non-profit organization, the success of TACF depends upon private landowners and organizations who volunteer plots of their land for plantations. Facilitated by a strong pre-existing friendship with TACF collaborator Woods Sinclair, GMF became such a partner in 2007. The current 2 acre site was formerly and old Christmas tree plantation, which they cleared and mowed prior to planting. The site was chosen because it has all the required, favorable characteristics: suitable pH, good drainage, easy access from the road, ample sunlight from the south-western exposure, and ample water availability from the farm across the street.

The trees in this plantation are all members of the first BC3 generation—the first batch of hybrid trees that share 96% of the same genetic material as native American chestnut trees. Those that are deemed resistant to the blight will be crossed with other BC3's to produce a generation that will breed true for resistance. To prepare the site for planting, Woods brush-hogged the entire site and installed a solar-panel electric fence to exclude deer. They planted rows approximately 6 feet apart, with trees about every 3 feet within rows, using seeds and saplings provided by the Burlington, VT branch of TACF. Students from the local high school came to help with the planting efforts, as part of their vocational agriculture science and technology program. Proper tree establishment involved first sifting and mixing the soil substrate at each planting site, digging the holes, placing the nut or seedling, and finally staking the new initiates with Blue-X tree shelters to protect them from

Volunteers planting chestnut seedlings at the new plantation. Note the blue tree shelters, used to protect the young trees from herbivory.

Woods Sinclair (blue shirt, rear) with planting volunteers from the local high school.

marauding herbivorous woodland creatures.

TACF staff and their volunteers planted several new rows of trees each year from 2007 to 2012. Since establishment, Woods, with assistance from his student volunteers, has kept an annual fall inventory of growth and mortality. This information is used by TACF to determine protocols for their various breeding lines, in conjunction with similar studies of their many other plantations. A special account exists to pay for an intern to maintain the orchard throughout the rest of the growing season.

The future of the GMF chestnut plantation is currently uncertain. TACF is currently conducting test plantings of their first BC3F3 generation seedlings, but only time will tell if they prove to be as resistant to the blight as expected.

The chestnut plantation in 2015. Although several trees have succumbed to the blight, the vast majority are still growing vigorously.

Researcher Contacts

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Dr. Leila Pinchot, U.S. Forest Service
corneliapinchot@fs.fed.us

Resources

TACF official website: http://www.acf.org/

Listing for the GMF orchard in the Connecticut chapter of TACF: http://ctacf.org/ct-plantings/great-mountain-forest-orchard/

Freinkel, Susan (2007) American Chestnut: The Life, Death, and Rebirth of the Perfect Tree. University of California Press, Berkeley and Los Angeles.

RESEARCH SITE 4: GENETICS STUDIES AT THE YALE PINE AND FIR PLANTATIONS (FRANCOIS MERGEN)

Summary

These are two old research sites established on opposite sides of the GMF property: a pine tree plantation to the west, and a fir plantation to the east. Both contain wide varieties of native and exotic species, and many hybridized combinations. By studying their relative growth characteristics over time, Francois Mergen hoped to identify species with superior sawfly resistance genes among the pines, and superior timber quality among the firs.

Access

The Pinetum sits on the east side of Canaan Mountain Rd., at the northern curve where it becomes Wangum Rd. Visitors may park at the GMF West Office and walk up, or park (carefully) on the grassy strip along the road.

The Fir Plantation is on the other side of the property, near the corner of Windrow Road and Gamefield Road. Visitors may park in the designated lot by the kiosk near the Forestry office.

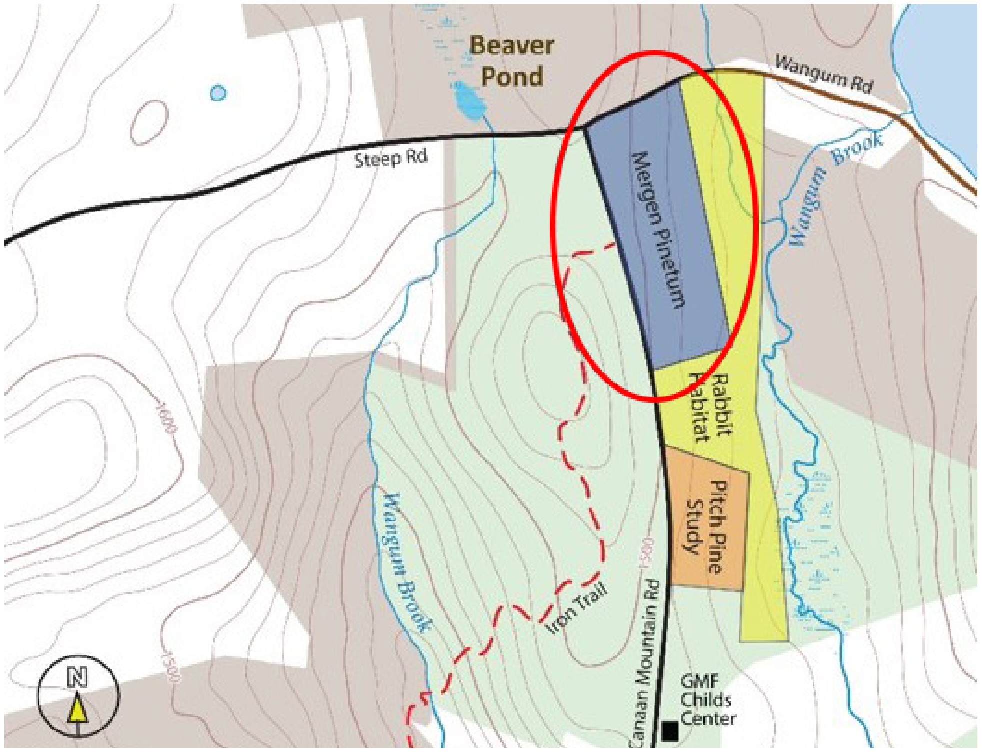
Location

See included maps.

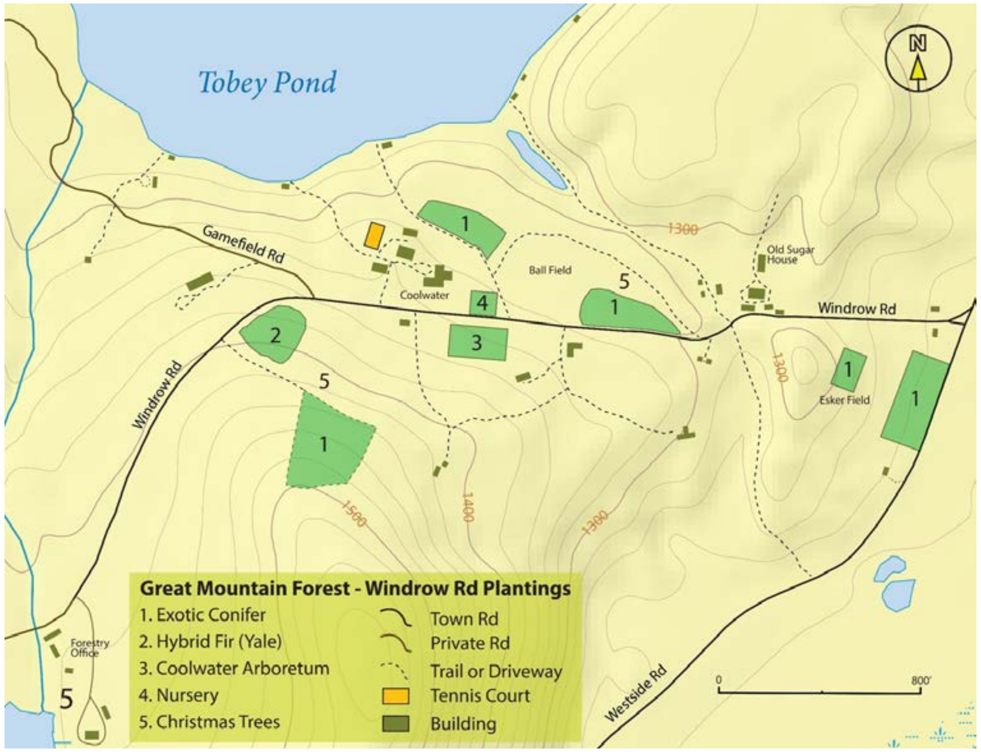
Mergen Pinetum
N 41°58’21.93”
W73°16’19.76”

Nearby or Comparable Sites

The Pinetum sits directly adjacent to the eastern cottontail rabbit habitat (Forest Management 10), the pitch pine plantation (Research Sites 5), and near the entrance to the Stone Man Trail (Geologic Features 7).



Mergen Pinetum: N 41°58’21.93”; W73°16’19.76”



Fir Plantation.

The Fir Plantation is close to the Sugar Sap House (Forest Management 8) and the Red Pine Salvage Site (Forest Management 6) on the eastern side of the property.

Description

The pine genetics plantation was established in 1958 by Francois Mergen, the former dean and professor of forestry at the (then named) Yale School of Forestry. The goal was to study the relationship between the invasive European pine sawfly (*Neodiprion sertifer*), introduced to North America in 1925, and various species and hybrids of pines in the sylvestris sub-genus (the so-called yellow, or hard pines). The larvae of this species of sawfly grow nestled at the base of needle clusters of mature trees, and grow to be adults by eating the fresh leaf shoots each spring. By stocking the plantation with a variety of pine species and hybrids, Mergen hoped to discover the relative resistances of each to the sawfly infestation, with an eye towards breeding more resilient pines for timber production.

The Mergen Pinetum today. Many of the original pine individuals have died away. The others are nearly impossible to identify, as they are a complex series of hybrids arranged randomly in grids.

At the time of this study, large infestations of the European sawfly were ravaging plantations of red pine throughout the Great Mountain Forest. Some of these were adjacent to the genetic study plantings, which ensured there would be a steady source of the insect for the purposes of the long term experiment. Mergen planted a huge variety of pines, both domestic and exotic, including hybrids. Intriguing gems include crosses of the Chinese Yunnan pine (*Pinus yunnanensis*) with the Japanese black pine (*P. thunbergii*), and cultivars of the Mediterranean black pine. Individuals from the same species were often further sourced from various provenances, to see if regional genetic variation might be a factor in the ability of trees to resist the sawfly. For example, Scots pines (*P. sylvestris*) from Scotland, England, Australia, Spain, France, Finland, Sweden, Czechoslovakia, and Turkey are all present in the plantation.

To ensure that all the planted trees started off with the same blank slate of zero sawfly infestation, they were all treated with DDT for the first few years of the study—a compound now known to have extremely harmful environmental effects. Rachel Carson's book "Silent Spring", a book that details the myriad negative impacts of the pesticide (among others) on various spheres of environmental health, was published in 1962, four years after the establishment of the plantation. It is perhaps ironic that DDT would be outlawed in the U.S. in 1972, just two years following the publication of this study. It is a good example of how reading research from the past can provide a window into the world where it was conducted. Chemicals we would not use today were a less questioned presence fifty years ago and more. How will society regard our current day environmental practices fifty years from now?

In 1960 Francois Mergen set up a second genetics plantation, this time of fir tree species on the opposite side of the GMF property. The goal of this genetics study was to see what hybrid crosses, if any, would produce trees with superior growth form characteristics. Like the pine genetics study, these were representative species from all over the world, crossed in novel ways, and planted in huge randomized blocks. As noted in the discussion section, there are no native fir trees in the Great Mountain Forest region. Both of these studies were essentially conducted with the intent of producing vigorous trees for timber production in plantation settings. Again, as with the DDT usage, times have changed. Forestry research and practice today, as a whole, is more focused on maintaining the resilience of entire naturally occurring forest ecosystems rather than creating a few new super-trees for the sawmill.

Researcher Contact

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Resources

Henson, W.R., L. C. O'Neil, and F. Mergen. (1970) Natural variation in susceptibility of Pinus to Neodiprion sawflies as a basis for the development of a breeding scheme for resistant trees. Yale F&ES Bulletin no. 78, Yale University

Mergen, F. and T. R. Gregoire (1988) Growth of hybrid fir trees in Connecticut. Silvae Genetica 37: 118-124

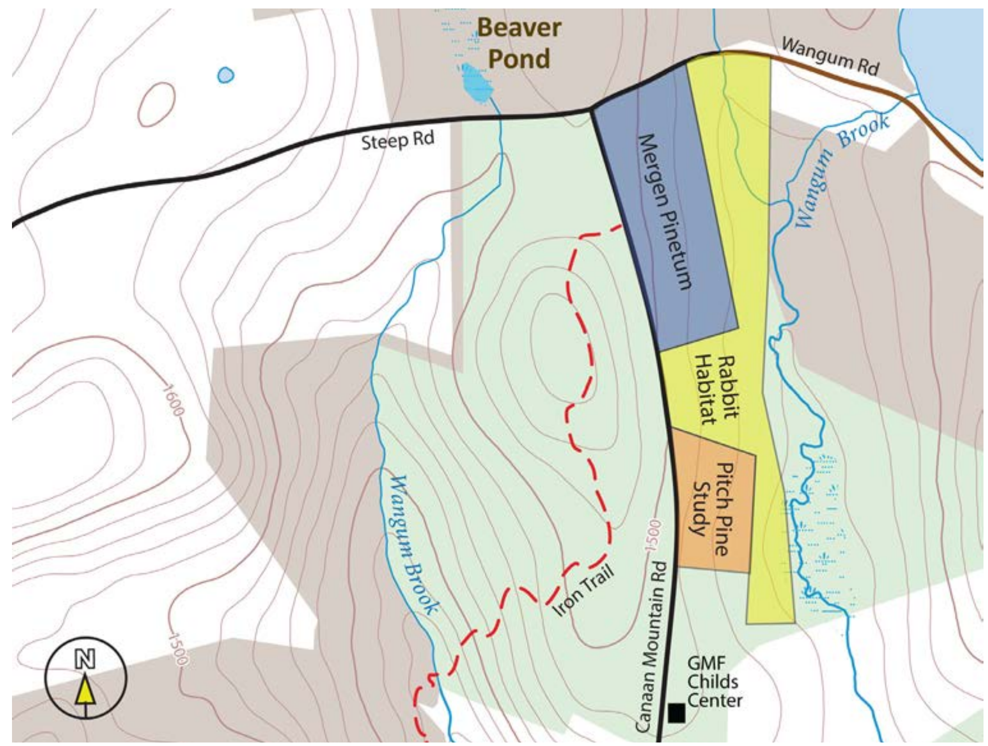
RESEARCH SITE 5: PITCH PINE PLANTATION STUDY

Summary

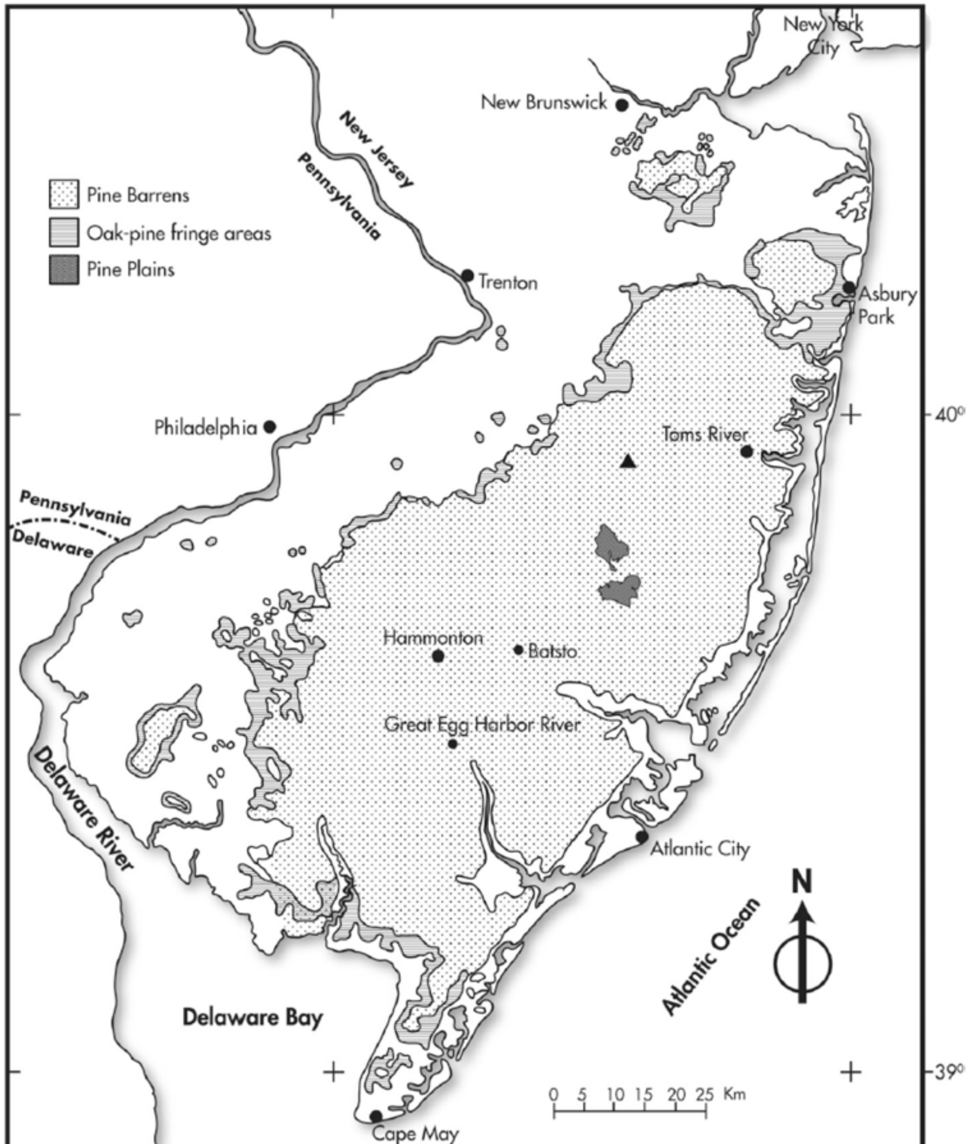
Pitch Pine (*Pinus rigida*) is a tree species mostly known in the fire-prone Pine Barrens ecosystem of southern New Jersey. Though too coarse grained to be a source of quality timber, pitch pine's numerous hard knots produce impressive quantities of resin, for which it was harvested to make tar, pitch, and turpentine to use in the iron working industry. Never an abundant species in Connecticut to begin with, extensive exploitation throughout the 1800s removed it almost completely from the forested landscape. This plantation, established in 1974 to study the heritable characteristics of a dwarf ecotype of the species, is one of the only places where pitch pine can be found in the Great Mountain Forest region today.

Access

The plantation sits behind a forested buffer on the east side of Canaan Mountain Rd, just north of the GMF administrative headquarters. Visitors may park there, or (carefully) on the grassy strip along the road.



Map of Pitch Pine Plantation: N 41 58'9.18; W 73 16'15.89



Map of the New Jersey Pine Barrens, where seed for this study was sourced (from Ledig et al. 2013)

Location

See included map.

Pitch Pine Plantation
N 41 58'9.18
W 73 16'15.89

Nearby or Comparative Sites

The plantation is adjacent to the eastern cottontail rabbit conservation area (Forest Management 10), Francois Mergen's pinetum (Research Sites 5), and is near the start of the Stone Man Trail (Geologic Sites 8) across the street to the west.

Description

The purpose of this study was to investigate possible mechanisms for the difference in tree morphology among pitch pines growing in the New Jersey Pine Barrens proper, and those growing in the slightly elevated Pine Plains embedded within the Barrens region. Due to differences in physiography, the Pine Plains experience more frequent fires than the surrounding Pine Barrens, and it has long been thought that this is why the trees that grow there are distinctively more stunted and crooked. However, it remained unclear whether this modified morphology is actively passed on to progeny, or merely the predictable response of genetically similar pitch pine individuals to habitats with more regular fire disturbance.

To test the heritability of the Pine Plains growth form, Ledig et al. collected pitch pine cones from different provenances of both Pine Barrens and Pine Plains, and planted individuals of both species side by side in controlled garden sites elsewhere. One of these sites is the plantation in the Great Mountain Forest, with others located in Massachusetts, New Jersey, and South Korea. They found that even when grown in identical conditions within each of these sites, the offspring from Pine Plains individuals still varied differed distinctively from those of the Pine Barrens. They were, on the whole, shorter and more crooked in form, and a much higher proportion of them produced serotinous cones (cones that only open in response to some environmental trigger—fire, in the case of pitch pines). From these results, Ledig et al conclude that the Pines Plain pitch pines constitute a genetically distinct ecotype of the species, growing in a "pocket of variability" within the greater Pine Barrens ecosystem. They speculate that these so-called dwarf trees may have originated during the last glacial period, when the then frigid New Jersey climate just south of the ice sheet might have selected for a more stunted growth form, like the krumholtz trees that grow along the timber line in boreal Canada and Alaska today.

The methods section describes the untimely demise and abandonment of the plantation sites in Massachusetts and Korea partway through the study, due to high mortality from herbivory, harsh winters, and lack of maintenance. At the GMF plantation, the pitch pine still standing today are but a fraction of those initially planted—about 20%. The trees from New Jersey provenances are not adapted to survive the much colder winters experienced in New England. This is one reason why the American chestnut plantation at GMF is planted with seed from local sources.

Researcher Contact

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Resources

Ledig, F. T., J. L. Hom, and P. E. Smouse. 2013. The evolution of the New Jersey Pine Plains. American Journal of Botany 100: 778-791

The pitch pine plantations today. Despite high levels of mortality during the early stages of the project, the remaining trees are growing healthily.

Pitch Pine cones, decidedly not serotinous.

RESEARCH SITE 6: CARBON FLUX TOWER

Summary

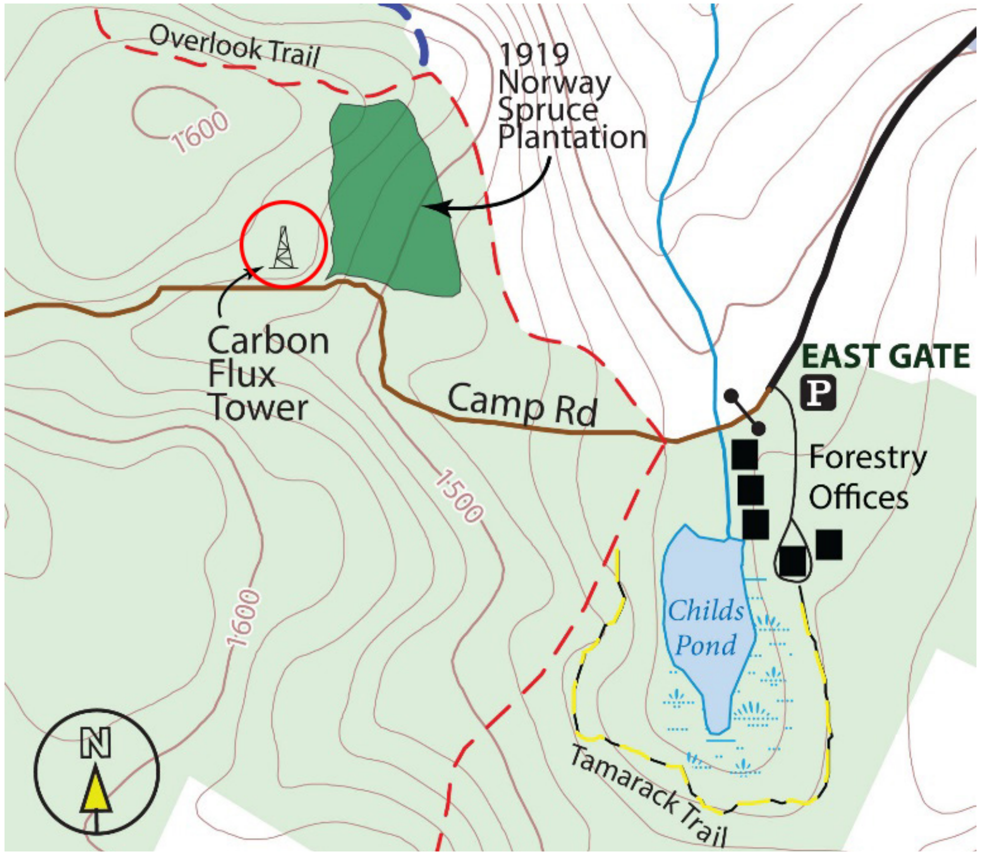
The carbon flux tower was active from 1999-2005, used to study feedback cycles of gases in the atmosphere. Though not currently in use, the tower still stands and can be visited by curious meteorology lovers of all strata.

Access

Visitors may park in the guest lot near the Forestry Office, then walk a short way west on Camp Road to reach the carbon flux tower.

Location

Carbon Flux Tower: N 41°58'10.78"; W 73°13'50.90"



Map of Carbon Flux Tower location: N 41°58'10.78"; W 73°13'50.90"

Description

The carbon flux tower is a structure used for measuring the exchange cycles of carbon dioxide and water between the earth and the atmosphere. The instruments at the top operate by measuring trace gases in the vertical component of wind flow over time (known as eddy covariance methods). By gathering together data on air speed, humidity, temperature, and gas concentration, researchers can generate detailed information about atmospheric feedbacks related to phenomena like forest fires, soil, plant, and animal respiration, and the burning of fossil fuels.

The tower at GMF was erected by Dr. Xuhui Lee's lab in 1999 as part of FluxNet—a worldwide network of over 683 tower sites with the mission of collecting global data on element fluxes within the atmosphere. To date, data collected from the GMF tower has yielded nine published scientific papers, with studies on soil and forest respiration, ratios of water vapor isotopes, and the prevalence of atmospheric mercury resulting from anthropogenic processes. The most recently published study, which investigates the impact of deforestation on cooling surface feedbacks (Lee et al. 2011), utilized data collected from 33 FluxNet towers, illustrating the potential for meaningful (and powerful) scientific collaboration through the network.

Though only operational through the end of 2005, the carbon flux tower yielded a wealth of impressive data and discoveries through the hard work of Dr. Lee and his colleagues. Pending an application for additional funding, it is hoped that the site will become active once more in the future.

Researcher Contact

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Resources

The Great Mountain Forest Tower on the Fluxnet Database: http://fluxnet.ornl.gov/site/883

Lee X, ML Goulden, DY Hollinger, A Barr, TA Black, G Bohrer, R Bracho, B Drake, A Goldstein, L Gu, G Katul, T Kolb, B Law, H Margolis, T Meyers, R Monson, W Munger, R Oren, K T Paw U, AD Richardson, HP Schmid, R Staebler, S Wofsy, L Zhao (2011) Observed increase in local cooling effect of deforestation at higher latitudes. Nature 479: 384-387.

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Lee X, TJ Griffis, JM Baker, KA Billmark, K Kim, LR Welp (2009) Canopy-scale kinetic fractionation of atmospheric carbon dioxide and water vapor isotopes. Global Biogeochemical Cycles 23: GB1002, doi:10.1029/2008GB003331

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Lee X, R Smith, J Williams (2006) Water vapor 18O/16O isotope ratio in surface air in New England, USA. Tellus B 58: 293-304.

Lee X, HJ Wu, J Sigler, JC Oishi, T Siccama (2004) Rapid and transient response of soil respiration to rain. Global Change Biology 10:1017-1026.

Lee X, X Hu (2002) Forest-air fluxes of carbon and energy over non-flat terrain. Boundary-Layer Meteorology 103: 277-301.

Lee X., OR Bullock Jr, RJ Andres (2001)Anthropogenic emission of mercury to the atmosphere in the northeast United States. Geophysical Research Letters 28: 1231-1234.

Researcher climbing the tower to adjust equipment. In order to operate properly, all instruments must be positioned well above the surrounding tree canopy line, yet within range of the average wind speed for the area, so as to collect data consistent with other flux towers.

View of the sonic anemometers high above Great Mountain Forest. These devices detect pulses of ultrasonic sound waves as a means of measuring wind velocity. Other essential equipment includes the infrared gas analyzer for measuring the elements or molecules of interest, and a hygrometer for determining the relative humidity of wind samples.

View of the base of the tower, with a deep concrete foundation to keep it in place.