Friends of Mohawk Trail State Forest
Report on Forest Research at Mohawk Trail State Forest

Prepared for Department of Conservation and Recreation
By Robert T. Leverett and Gary A. Beluzo

Oct. 28, 2003

Mr. William Rivers
Chief Management Forester
Department of Conservation and Recreation

Dear Bill:

This report provides summary information on the research that Friends of Mohawk Trail State Forest has been doing for the past several years. The report is being provided in accordance with our agreement to pass all research results compiled by Friends to the Massachusetts Department of Conservation and Recreation. While heretofore we have done this primarily through old growth forest briefings and e-mail communications, we feel it is time to present the results of our work more formally in a series of summary documents. The first summary document is attached. It concerns Mohawk Trail State Forest where much of our research has taken place. Summary reports on other state properties will follow in time. Our plan is to cover Mount Washington SF next, followed by Monroe SF and then Mount Greylock and Mount Tom State Reservations.

As you know, we have been gathering research data for a variety of initiatives for a number of years. In the last couple of seasons we have been implementing a serious research protocol to support the species modeling we are doing. Our long-term objective is to statistically explain the maximum growth potential of several species including white pine, hemlock, white ash, northern red oak, sugar maple, and red maple. Climate, topography and aspect, soil, bedrock geology, moisture availability, and competition are assumed to be the drivers of growth. However, there are no empirical models that we know of that express the relationship between growth as the dependent variable and the other variables as the independents that can be directly applied to the trees at Mohawk. Therefore we will fill the gap. The research on maximum growth potential is being done in conjunction with the Eastern Native Tree Society (ENTS) headquartered at the University of Arkansas and the Center for Hardwood Ecology at the University of Minnesota.

The research that Friends has been doing over the past several years in Mohawk Trail State Forest falls generally in one of the following areas:

1. Identification, characterization, and GIS mapping of old growth forests with the delineation of boundaries for old growth and other forest features
2. Documentation of exemplary trees, forest sites, historic sites, and special features
3. Research into growth potential of the white pines in Mohawk Trail State Forest

These topics will be discussed in order below. We will conclude with a discussion of research remaining to be done.

Yours truly,	Yours truly,	Yours truly,
Jani A. Leverett President,	Robert T. Leverett Executive Director	Gary A. Beluzo Science Advisor

Encl, Study report

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President

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Section I. Introduction

A. Areas Covered by Report

This report summarizes the ongoing research and documentation that is being done by Friends of Mohawk Trail State Forest (FMTSF) within the boundaries of the State Forest. The report covers the following areas.

1. Identification and characterization of Mohawk's old growth forests with a phase 1 delineation of the boundaries in a GIS database pursuant to the special permit issued to Friends by the Department of Conservation and Recreation;

2. Documentation of exemplary trees, exemplary forest sites, historic and cultural sites, and features of special interest such as scenic resources within the boundaries of the State Forest;

3. Research into the current growth rates and maximum growth potential of the white pines, white ash, northern red oak, sugar maple, hemlock, and other species in selected areas of the State Forest and comparing the Mohawk growth rates and growth potential to that found in other eastern forests for the same species.

B. Contributors to Report

Research and documentation in the above areas has been conducted principally by Robert T. Leverett, Cofounder and Executive Director of Friends of Mohawk Trail State Forest and the Eastern Native Tree Society; Professor Gary A. Beluzo, Science Advisor to Friends of Mohawk Trail State Forest; research assistants Lisa Bozutto (masters degree in forestry, UMASS), John Knuerr, environmental ethics instructor at Greenfield Community College; Susan Benoit, and naturalist Kimberly Jensen. While the above form the core team, the research efforts of Friends have benefited immeasurably by inputs from visiting scientists, naturalists, and nature interpreters, some of whom have visited Mohawk Trail State Forest at the invitation of Friends specifically to provide input on one or more of the above areas of research. The principal visiting scientists and naturalists, including state employees, follows:

1. Lee Frelich, Director, Center of Hardwood Ecology, University of Minnesota
2. Charles Cogbill, Consultant to USFS for ecology and forest history
3. Larry Winship, Professor of Forest Ecology, Hampshire College
4. David Orwig, Forest Ecologist at Harvard Forest
5. Glen Matlack, Forest Ecologist, formerly at Harvard University
6. Robert Van Pelt, Forest Ecologist at University of Washington
7. John Okeefe, Forest Historian, Harvard Forest
8. Tom Wessels, Professor at Antioch Graduate School, Keene, NH
9. Marc Abrams, Professor of Forest Ecology, Pennsylvania State University
10. Rick Van de Poll, Consultant and formerly Professor at Antioch Graduate School
11. William Keeton, Associate Professor at the University of Vermont
12. Lynn Rogers, Nationally reknown Wild Life Biologist
13. Patricia Swain, Natural Heritage and Endangered Species Program
14. Jack Lash, DCR Planner
15. Peter Dunwiddie, Formerly Plant Ecologist with Massachusetts Audubon Society

16. Phil May, Independent Lichenologist
17. Sara Cooper-Ellis, Former Harvard Forest Researcher
18. Joseph Choiniere, Director of Wachusett Meadow Wildlife Sanctuary, Mass Audubon Society
19. Tom Tyning, Professor at Berkshire Community College
20. Paul Rezendes, Noted Animal Tracker and Wildlife Photographer
21. Leslie Luchonok, Areas of Critical Environmental Concern Program, DCR
22. Neil Pederson, Lamont Doherty Earth Observatory, Columbia University
23. Bruce Kershner, old growth forest ecologist
24. Pamela Weatherbee, botanist
25. Howard Stoner, Eastern Native Tree Society
26. Will Blozan, President, Eastern Native Tree Society

In addition to the scientists and naturalists, we have been honored by a number of visiting forestry professionals who have provided input to Friends. They include:

1. Ross Morgan, Co-founder, Forest Stewards Guild
2. Michael Mauri, Director, Massachusetts Chapter, Forest Stewards Guild
3. Steve Harrington, Forest Stewards Guild
4. Erhard Frost, Member, Forest Stewards Guild
5. Karl Davies, Member, Forest Stewards Guild
6. Michel Wilson, Member, Forest Stewards Guild
7. Don Bertolette, SAF, currently at the NPS, formerly the USFS
8. David Kittredge, PhD, Extension Forester for Massachusetts
9. Joseph Zorzin, Member, Forest Stewards Guild
10. Paul Harper, Member, Forest Stewards Guild

Students conducting research in Mohawk Trail State Forest who have done so with the support of Friends of Mohawk Trail State Forest include:

1. Daryl Detour, Antioch Graduate School – Salamander populations
2. Mo Ewing, Antioch Graduate School – Old growth delineation
3. Casey Rollah, Smith College – Lichen survey
4. David Eliah – Spatial patterns in white pine stands
5. Matt Whetbeck – Course woody debris

Other scientists, naturalists, and foresters have provided input on summer programs held in Mohawk Trail State Forest on behalf of the Nature Center and conducted specially by Friends. The inputs of the above are incorporated in the specific areas below. Comments will explain the contributions of each where appropriate.

C. Friends Perspective on Mohawk Trail State Forest

We begin our summary of research findings on Mohawk Trail State Forest with a broad overview of the state forest as a resource of the people of the Commonwealth of Massachusetts. This will be the format for future reports as well. Each property covered by Friends research is being surveyed for special resources and strengths and our report series will speak to those resources and strengths. A few words about resources are in order. One class of resources we include is scenic vistas. They should be recognized and preserved as such, as with the historical, cultural, and ecological. Some resources meet more than one definition. For instance, a significant

natural forest in a scenic setting, at the least, represents both a scenic and an ecological resource. However, forest aesthetics, as distinct from panoramic views, needs to be specifically addressed for places like Mohawk. Forest aesthetics has not been a well-defined resource in Massachusetts, at least not until recently.

Before we go further, we should explain the writing style that we've adopted for the report series. It is unusual for this kind of document. We combine science, straightforward documentation, promotion, and philosophical musings in our report. There is even a bit of evangelizing with the intent of opening eyes and minds.

It will help readers to view this report series as a window through which we can view the features of our forests, parks, and reservations. We highlight the special features and describe them as we have come to understand them. To this purpose, the authors have acquired considerable experience in searching out special features, some of which have slipped through the cracks. A few of the features have turned out to be veritable state, if not national, treasures. They have been there all along, but have escaped notice for any of several reasons. To be sure, most of the special features within our state forests are well known. Features of the obvious scientific curiosities, such as Natural Bridge, have been well studied and are understood in considerable depth, at least from the perspective of a particular discipline such as geology, but other places of less striking appearance and of particular classes such as woodlands have largely escaped notice except in a general way. Consequently, particulars that can put a resource in a new and different perspective have been largely missed as will be seen for Mohawk Trail State Forest.

We hope that the report series, sanctioned by DCR, will be viewed as Friends of Mohawk Trail State Forest's contribution to the people of the Commonwealth of Massachusetts, detailing what we have found of significance on our public properties that deserves recognition and in some cases added protection. Certainly protection presently exists for many of the resources, but in other cases, the resources could become at risk for no malice of forethought, but simply because they are not sufficiently understood and officially recognized. With this introduction, we will now turn our attention to the details of Mohawk Trail State Forest.

D. Mohawk's Obscure Role

Curiously, Mohawk is a state forest in search of official appreciation for its scenic, ecological, historical, forest aesthetic, and cultural treasures and its overall scientific value. Here is what the DCR description says about Mohawk Trail State Forest on the DCR website.

> "Mohawk Trail has over 18 miles of rivers and streams for excellent trout fishing, a swimming area, and a day use picnic area. Many of the original Indian trails, including the Mohawk Trail, are open for hiking. This is one of the most scenic woodland areas of Massachusetts. About 6,000 acres of mountain ridges, deep gorges and many pines over 100 feet tall are home to forest shrubs and flowers, deer and birds."

While this is a "nice-sounding" description, it is understated for the resources that exist at Mohawk. One absence is especially conspicuous. Mohawk is one of the current-day old growth forest icons of the Bay State and actually has been so for decades, courtesy of the Cold River Natural Historical Landmark and more recently because of two special studies, one sanctioned by the Natural Heritage Program and completed in 1993, and the other sanctioned by DCR and ongoing. As a consequence of the work done to date, Mohawk boasts the second largest reserve of old growth forest among the State's many properties. But equally important to the old growth, Mohawk Trail State Forest is the location of the historic Mohawk Indian trail, its colonial aftermath, and the Shunpike Pike route that was built to avoid a colonial toll road over Hoosac Mountain. Historical markers along State Route #2 discuss the Shunpike, but its exact whereabouts is unknown to all but a few.

With such rich natural and historical features, one has high expectations for State recognition and attendant funding and maintenance of appropriate facilities. However, for the quality of its natural features, Mohawk has minimal recreational facilities and interpretive services available to the public. Were it not for its recreational facilities, Mohawk might pass almost unnoticed in the descriptions of State properties. As a consequence, of the very limited descriptive material, the general public knows little about Mohawk Trail State Forest. For that matter, neither do most of the employees of state agencies. This was a problem in need of a solution. The formation of Friends of Mohawk Trail State Forest was in part motivated by the lack of State attention and in several summer seasons, Friends contributed by presenting from 12 to 22 interpretive programs per summer. Before passing, we should note, that the less than satisfactory condition of Mohawk's infrastructure is due to severe budgetary limitations that are beyond DCR's control.

Despite the dearth of the high quality, or at least well-developed, recreational opportunities that the public has a right to expect in a quality forest or park, over the years, Mohawk has attracted a small, dedicated group of supporters that includes state employees, scientists and naturalists, and ordinary citizens. Some of the ordinary citizens come annually to Mohawk from surprising distances when they could as easily travel to far better known scenic resources. These supporters all seem to recognize that Mohawk's importance does not lie in organized activities and definitely not in high impact recreation. Devotees are content to walk Mohawk's limited trail network and to sit quietly at the scenic overlooks atop Todd and Clark Mountains and at the end of the Totem Trail -most notably Indian Lookout at the summit of Todd, savoring a view that author Bill McKibben once described to Robert Leverett as "one of the most understated in New England". But if Mohawk's scenery has been understated, it is not overstating the case for Mohawk Trail State Forest to reiterate that Mohawk's value as a scenic, ecological, historical, forest aesthetic, and cultural resource has not been well understood by either the higher-level State officials or by local residents. There are different reasons for this obscured vision of both state officials and local residents.

Much of the State's governmental apparatus is focused on the populous eastern part of the state with its rich colonial history and dense population. The western part of the state has superior scenic and diverse ecological resources, but receives much less financial attention due to its sparse population. Western Massachusetts has not traditionally been particularly prominent in the thinking of the state officials who control the purse strings. Local residents around Mohawk are generally poor and all that that implies in terms of being able to fully appreciate and financially support Mohawk as a natural-cultural treasure. This is not to say that there aren't local residents who don't appreciate Mohawk. There are, but their numbers are very modest. In the countless visits that Friends personnel make to Mohawk, we seldom encounter visitors from the local area. As a consequence of official and local neglect, Mohawk almost seems like an orphan property. However, we don't want to imply that Mohawk is completely lacking in official support. Local headquarters personnel are strong supporters of Mohawk and the Bureau of Forestry of DCR has long recognized that Mohawk Trail State Forest possesses a reserve of commercially valuable trees. However, to its credit, the Bureau has also recognized that Mohawk possesses recreational, cultural, and ecological values that transcend its potential role as a timber reserve. The Bureau has recognized that Mohawk's value to the public goes considerably beyond the convenience of its campground. So despite Mohawk's designation as a State forest, the Bureau has accepted that Mohawk serves more of the purpose of a traditional state park, as most people think of that designation, and the Bureau has treated Mohawk accordingly. As a consequence of the careful Bureau's policy toward Mohawk, this modest-sized state forest has retained ecological and historical treasures and the people are indebted to the Bureau's forbearance. But before we turn to Mohawk's treasures, let's first examine Mohawk's park facilities.

Taking inventory of Mohawk's traditional recreational opportunities, there is a combination picnic area and swimming pool on State Route #2 less than a mile west of the entrance. In addition to picnicking, there is camping. Mohawk's campground has regular campsites and 6 cabins open year around. For campers and day

visitors, there are 7 scenic hiking trails in Mohawk and two tranquil meadows. There is the scenic Deerfield River and its equally scenic tributary, the Cold River.

Of the 7 hiking trails, one in particular has special significance, historically and culturally. We speak of the original Mohawk Indian Trail (actually two trails) and its later colonial aftermath that runs through Mohawk Trail State Forest. The Mohawk Indian trail is also the oldest of the 7 trails and will be described first.

Trail #1: The original Mohawk Indian Trail runs through Mohawk Trail State Forest following an east-west path, entering Mohawk near the confluence of the Cold and Deerfield Rivers. In the lower elevations, the original path is obscure, but generally follows the maintenance and campground roads. The route becomes an official trail on the south side of the Todd-Clark ridge as it climbs to the saddle between the summits of Todd to the east and Clark to the west. There the trail turns westward. Unfortunately, the route up the south side of Todd Mountain is badly eroded and multiple branches of the original Indian trail have developed. The original route long ago washed out. However, once the saddle between Todd and Clark Mountains is reached, there is no question as to where the trail is. Post cards from the 1920s show the saddle and a historic hemlock that marked the point at which the Trail reaches the saddle. Some accounts identify the tree as a white pine. The narrow ridge crest leaves no doubt about the trail's historic route. The old trail runs along the narrow ridge crest from the summit of Todd past the summit of Clark. From the saddle, a spur trail goes eastward to Indian Lookout, which offers spectacular views of Cold River Gorge to the west and the Deerfield Valley to the east. Native Americans supposedly used the spur trail to Indian Lookout for reconnoitering. The west fork of the trail is the mountain branch of the original Mohawk Indian Trail, which became a later and more developed colonial pathway. The western spur follows the Todd-Clark ridge crest. It just bypasses Clark Mountain's 1,923-foot summit staying to the north side and eventually connecting with South County Road. The area along the Todd-Clark ridge crest remains a trail and always has been. This 1.2-mile stretch is probably the oldest surviving foot trail in Massachusetts, if not in New England. The forest along the trail is largely old growth oak and hemlock. Tree ages are 170 to 300 years, with a small population of hemlocks around 400 years old. The ascent up Todd-Clark and the path along the ridge crest is 1.6 miles in length as a map distance.

Trail #2: On the south side of State Route #2 there is a modern hiking path named the Totem Trail. It starts at the swimming pool area on Route #2 and winds through maturing second-growth hardwood forests up to the top of an unnamed ridge that overlooks Trout Brook Cove and Hawks Mountain, which is the large ridge directly to the east. The Totem Trail cuts through an area that was logged in the 1930s, but has recovered into a handsome second-growth forest. The trial terminates within an area of old growth that is described in this report. Map distance is 0.9 miles.

Trail #3: From the group campsite, the third scenic trail is short and ascends little Thumper Mountain to provide limited views into Trout Brook Cove and of the Hawks Mountain ridgeline. A fire tower once stood on Thumper Mountain, built by the Civilian Conservation Corp. There is ample evidence of fire in the vicinity of the summit to suggest that the there was at one time a need for the tower. Map distance is 0.25 miles.

Trail #4: A nature trail starts from the old colonial Mohawk Trail going from the Group Campsite down to the lower meadow. Going down hill, the trail exits to the left and goes to the upper meadow, crosses most of it, then heads down to the lower meadow, passes a pond, doubles back, and joins the old colonial Mohawk Trail near the John Wheeler Grave site, and back uphill. Map distance is 1.6 miles.

Trail #5: At the north end of the lower meadow, what was an old county road bends around Todd Mountain, following the Deerfield River and goes to Zoar Gap. This road has been used in the past as a logging road. It

goes through a 1930s Pine Plantation. There are two short spur trails off this trail. One goes to a forest maze and the other goes through more of the pine plantation. Map distance of the trail is 1.7 miles.

Trail #6: A trail dedicated in 1997, named the Mahican-Mohawk Recreational Trail, enters Mohawk Trail State Forest at the confluence of the Deerfield and Cold Rivers, following what was probably the original Indian path. The recreational trail skirts Thumper Mountain on the east and then north, joins the nature trail to the upper of the two big meadows in Mohawk, crosses it completely going north and gradually ascends the Todd-Clark ridge on the north side. Park supervisor Denny Moore and Robert Leverett chose the path of the trail in 1995. More will be said about the trail in sections that follow. The part of the trail included here starts at the north end of Stafford meadow and goes to the saddle separating Todd and Clark ridges. Map distance is approximately 1.2 miles.

Trail #7: A hiking/cross country sky trail branches from the maintenance road to the dump over to the original Mohawk Trail that now connects the campground road to the lower meadow. Map distance between the access roads is approximately 0.7 miles.

Taking all the spurs including return paths on the campground roads (about 1.3 miles), Mohawk Trail State Forest has slightly over 9 miles of walking trails. An 8th trail, which has been marked by ski mobile enthusiasts in the Trout Brook area of Mohawk, is not included here, nor is the part of the old Shunpike route that ascends Clark Mountain.

Mohawk could support double this trail distance without reaching the point of over-development or compromising the semi-wilderness aesthetic of the area. The seldom-used southeast corner of the state forest is the logical area to create new trails. There are groups who would like to see an expanded trail network in Mohawk and it is unclear why the State has not developed a longer network, other than lack of funds. However, there are may be other reasons for prudence – good ones.

Friends of Mohawk Trail State Forest has been ambivalent on the subject of an expanded network of trails. To summarize our views, on balance and contrary to what others might think, we believe that the limited trail system provided the public in Mohawk Trail State Forest by the Department of Conservation and Recreation has been one of the reasons Mohawk's scenic and aesthetic treasures have not been compromised. The lack of easy access has prevented the kind of over development that our action-hungry society leans toward. Extensive trails bring trail bikers and four-wheel, all terrain vehicles, and trash.

We'd like to think that those who plan the uses of our forests and parks have had this kind of inappropriate use in mind, i.e. they have wanted to protect a gem in the rough. That well may be the case. However, if Mohawk has been spared the fate of the more fully developed parks, lack of attention to Mohawk Trail State Forest's infrastructure has provided the Commonwealth's citizens with a less than proud example of what the State sees as adequate maintenance for its forests and parks. On several occasions, Robert Leverett has alerted State planners to parks in other states that in no way exceed Mohawk's attractions, but are far better developed and maintained. Hartwick Pines and Porcupine Mountain State Parks in Michigan are two excellent examples. Cook Forest and Ricketts Glen State Parks in Pennsylvania are others. In fact there are many examples of state parks in other states with less natural resources that are far better funded and maintained.

Unless under-development has been intentional to protect the scenic, ecological, historical, and cultural resources of Mohawk, our central fear is that there is a void that could eventually be filled by outside interests that support logging and/or high impact recreation. Hunting and fishing have never been problems. In fact, the former is welcomed to maintain the deer population. But any void in planning that could be filled by

undesirable uses necessitates that ordinary citizens who value Mohawk Trail State Forest for what it really contributes to the forests and parks system stay vigilant.

In summary, with a modest increase in maintained trails, the recreational resources of Mohawk are presently near optimal. There just needs to be adequate funding for staff and facility maintenance. In the unequivocal view of Friends of Mohawk Trail State Forest, no high impact use of Mohawk should ever be allowed, but better maintenance of facilities and trails should be a priority. However, if an increase in traditional park-oriented development is not advisable, what should be Mohawk's place in the Commonwealth's system of forests and parks, at least in the sense of what is officially acknowledged and protected?

E. The Right Role for Mohawk Trail State Forest in the Massachusetts System of Forests and Parks

As of today, many people who visit Mohawk Trail State Forest do so to gain convenient access to the Deerfield River for river canoeing, rafting, kayaking, and fishing. River running has been a steadily growing sport and Mohawk is a convenient place to camp to pursue the sport. A lesser number of visitors come to enjoy Mohawk's modest network of hiking trails. Still fewer visitors come to see the exemplary stands of trees that are Mohawk's most distinguishing feature. Recognition of the latter feature has been motivated by a large number of articles written about the trees of Mohawk. However, despite the only modest number of visitors in the last category, Mohawk has also been visited in recent years by a surprising number of dignitaries who have vestigial connections to the trees. The dignitaries have been mostly Native Americans who come to honor and rekindle a faded cultural past. The Native dignitaries have come to see Mohawk as a symbol of wilderness pre-settlement eastern America and visit it to re-establish connections through ceremony and quiet meditation to a forest and cultural heritage that once nourished them. We should point out that visitation and use of Mohawk by Native Americans is completely unconnected to the commercial exploitation of Indian heritage as seen along State Route #2 between Greenfield and Charlemont, Mass. The Indian use of Mohawk is in the best of taste and entirely appropriate to a rebirth of recognition of the regions historical roles and roots.

The Natives may lead the way because relatively few of today's visitors to Mohawk Trail State Forest are aware of the region's role in the French and Indian War during the 1750s and early 1760s or the Revolutionary War in the 1770s and 1780s. However, the Mohawk Trail served the region as a pathway between the watersheds of the Hudson and Connecticut Rivers. It was a war trail during the above periods and probably a trade route before. However, for years, the route of the original Indian trail and its colonial upgrade was largely lost until a sizable effort was organized in the early and mid-1990s by Lauren Stevens of Williamstown, MA to map the original route that joined the Valleys of the Hudson and Connecticut Rivers. The primary objective of Lauren Stevens's project was to create a recreational trail that followed the original route of the Mohawk Indian Trail where possible and initially joined the watersheds of the Hoosic and Deerfield Rivers. A larger plan would extend the old Indian trail network, possibly even into Canada. Enough information was assembled from various historical sources to identify the Mohawk Trail route fairly reliably and as a consequence today we have the Mahican-Mohawk Recreational Trail. That it is an outgrowth of Lauren Steven's efforts stands as a testament to the importance of a single person's vision. The recreational trail concept and construction was fully supported by Friends of Mohawk Trail State Forest. The culmination of the trail project was the dedication of the Trail through Mohawk in a ceremony held on July 19, 1997 and attended by DCR Commissioner Peter Webber. Friends of Mohawk Trail State Forest was instrumental in securing funding for the project. In fact, it was primarily the connections of Jani Leverett, the Friends president, to U.S. Congressional Representative John Olver that led to the trail's funding.

There is no question that the historical and cultural past of the Mohawk Trail State Forest is inextricably interwoven with the original Mohawk Indian Trail and its colonial upgrades. The original Indian trail was upgraded, starting in 1753 by Elisa Hawley, and ran along the Todd-Clark Ridge and down its southern side. A second road, the Rice Road, was completed sometime after 1764. It climbed the north side of Clark Ridge and later became known as the Shunpike. As an example of the historical importance of these trails, Benedict Arnold used the Shunpike.

To a lesser extent, Mohawk is connected to the European settlers of the area who lived on homesteads adjacent to the Cold and Deerfield Rivers after the Revolutionary War. War veterans were often paid in land. However, little in the way of specific information is known about their lives other than that they were sheep farmers. The John Wheeler homestead at the east end of Mohawk is the only one that has any documentation associated with it and that is mainly because of the Wheeler gravesite and Wheelers role as the ancestral family to five American presidents. The two Bush presidencies are among the five.

If there is little known about the European settlers of Mohawk, there is even less known about the earlier Indian visitors other than a few forays across the Mohawk Trail by the Mohawk in 1663 and 1674. While an old Indian Encampment site at the confluence of the Cold and Deerfield Rivers has been known about throughout the history of the region, it has not figured into the cultural or natural history of the interpretive programming within Mohawk. Most of the site's artifacts were pilfered long ago and today the old encampment is a dumpsite for the Headquarters. This ignominious end to the seasonal encampment symbolizes the degree to which the role of Native peoples in the area is still little appreciated and less understood. It is the hope and intention of Friends of Mohawk Trail State Forest to one day have a major archeological excavation of the site conducted by reputable archeologists.

If Mohawk Trail State Forest is to serve its highest purpose, more people must discover Mohawk's historical and cultural roots and the State must ensure that those roots receive complete protection. Of course, any remaining archaeological or historical sites will receive protection, but identifying potential sites presents special challenges. Remaining artifacts are buried. The discoverer of the occasional artifact usually carries it off.

However, from a strictly cultural perspective as opposed to a historically correct one, connections of Mohawk's combination of Indian and colonial past have come alive. They have been revived through current-day associations between Mohawk Trail State Forest, Friends of Mohawk Trail State Forest, and the Indian nations that visit Mohawk and perform private ceremony there. What are the nations? The Mohawk, Canadian Algonquin, Lakota, Cherokee, Nipmuc, Wampanoag, and Narragansett have been most prominent. A Mohican dignitary has visited on one occasion and taken part in the dedication of the Mahican-Mohawk Recreational Trail.

Today, the association mentioned above between Indian Nations, Mohawk Trail State Forest, and Friends is maintained by symbolic dedications of forested areas and individual trees within several dominant and accessible white pine stands. The purpose of the dedications is to honor both Native nations and individual Native personalities. These dedications have been the principal means used by Friends with the permission of the Headquarters to cement connection to Native culture in a way that can enrich the entire region for years to come. Will the connections create an economic bonanza? We certainly hope not. The importance of extending this role of Mohawk Trail State Forest is not about promoting gaudy, mindless tourism, or attracting hoards of visitors, though modest economic benefits could accompany the right kind of expansion of the role of Mohawk.

Aside from the cultural connections that utilize some of Mohawk's pine stands as symbols, Mohawk Trail State Forest has another equally worthy purpose to serve and it is one that can easily be fulfilled. In fact, it is being fulfilled with no ecological penalties.

F: Mohawk Trail State Forest as a Haven for the Commonwealth's Tallest Trees

Though unintentional from the goals of past state administrations that have overseen Mohawk Trail State Forest and largely fortuitous given the area's past intense land use patterns, it turns out that Mohawk Trail State Forest is the reservoir of the Commonwealth's tallest trees. In fact, the stature of Mohawk's trees is the single most distinguishing feature of the woodlands of Mohawk Trail State Forest. This now remarkable and thoroughly documented feature was not obvious when Friends of Mohawk Trail State Forest was initially created. There was recognition of Mohawk's stately trees, especially its white pines, but the role Mohawk was destined to play was still in shadow. But before we explore the height characteristics of Mohawk's significant trees, we should discuss the three common dimensions taken of trees: girth (circumference), height, and crown spread and discuss the role of height.

With their forest-grown forms, Mohawk's trees do not stand out in the girth and spread dimensions, which in part explains why casual visitors do not generally recognize the Mohawk trees as the superlatives they actually are. Girth is the most common physical characteristic that captures the attention of big tree aficionados in the eastern United States. One is influenced by the girth of a tree, since the observation is made at eye level. A large diameter quickly catches the eye. Trees that are 6 feet in diameter gain followings and hardly anyone fails to notice trees that are 7 or more feet in diameter. While 7-footers are small compared to sequoia and redwood dimensions that on occasion exceed 25 feet, people in the East are still impressed by 6 to 7-foot diameter trees. However, Mohawk's big trees are typically 3 to 4 feet in diameter with only a very small percentage that are larger. Consequently, Mohawk's trees are not going to visually overpower visitors, but that does not mean that there isn't an important statistical significance to the heights reached by Mohawk's trees. Height can be used to measure the over all growing conditions of a site. The height to diameter ratio is even more important. A site that produces unusually tall trees relative to other sites with similar species and ages could be an indicator of genetic strength of the growing stock. Such a site could also provide us with benchmarks and/or baselines to use in evaluating other sites. This could further help us to identify losses in productivity due to poor forest practices. So apart from the aesthetics, there are practical forestry-based reasons for us to be concerned with Massachusetts sites harboring unusually tall trees.

There is one last point to consider in thinking about Mohawk's status and that is the sense of pride we can all share in knowing that Massachusetts has the premier tall forest in all of New England. Other forest sites may score well on two or three species and Ice Glen at Stockbridge scores high on a half dozen, but Mohawk is the clear overall leader. We can think of no compelling argument not to recognize Mohawk's status and take pride in that status.

Before we get into the specifics of Mohawk's tall trees, we will present a species list for Mohawk and that includes the relative abundance of each included tree species. For the most part, the forests of Mohawk reflect a mix of natural and human disturbances. The abundance of white pine and the scattered occurrences of bigtooth aspen attest to human influence.

Figure 1: List of Tree Species and Relative Abundance for Mohawk Trail State Forest

No	Species	Distribution	Overall Abundance
1	Eastern white pine	Throughout	Low except in areas of former fields
2	Eastern hemlock	Throughout	Relatively high
3	Red spruce	Upper gorge	Low except for upper Cold River gorge
4	Pitch pine	Former pasture, on ridge	Very low
5	Red pine	Plantation and isolated individuals	One concentration and isolated individuals, absent elsewhere
6	Sugar maple	Throughout	High
7	Red maple	Throughout	Moderately high
8	Striped maple	Throughout	High
9	Ash-leaf maple	Stream corridors	Very low
10	Mountain maple	Boulder fields on ridges	Low to moderate
11	Yellow birch	Throughout	Moderately high
12	Black birch	Throughout	Moderately high
13	White birch	Throughout	Moderate
14	Bigtooth aspen	Throughout	Low
15	Quaking aspen	Road and stream corridor	Very low
16	Cottonwood	Road and stream corridor	Extremely Low
17	American beech	Throughout	High
18	American basswood	Rich woods environments	Low
19	American elm	Rich woods environments	Extremely Low
20	Black cherry	Throughout	Low
21	American hornbeam	Low, moist areas	Low
22	Hop hornbeam	Throughout	Moderate
23	White ash	Throughout	Moderate
24	Shadbush	Ridge tops	Low
25	Northern red oak	Throughout	High
26	White oak	South-facing slopes	Low
27	Black oak	South-facing slopes	Very low-questional identification
28	Chestnut oak	South-facing slopes, ridge tops	Very low
29	American chestnut	Confluence of streams	Extremely Low
30	Bitternut hickory	Rich woods	Low
31	Shagbark hickory	Primarily Thumper Mountain	Low
32	Staghorn sumac	Road and stream corridor	Low
33	Butternut	Rich woods	Extremely Low, one is known

The above chart lists 33 species of trees. It does not include several species of shrub-sized willows growing along the Cold River or witch hazel, mountain laurel, spice bush, red elderberry, or hobble bush.

Despite what was said previously about the attraction of large girth trees to the public, the circumferential measurements of the trees in Mohawk are fairly large for a state forest in Massachusetts and as such at least noticeable to tree-conscious people. Many Mohawk trees are in the 8 to 11-foot circumference range (2.5 feet to 3.5 feet in diameter). Three trees have been recorded to between 14 and 15 feet in circumference in Mohawk and one is slightly over 18, the state champion sugar maple. Yet, except for the very largest, these girths do not stand out to the casual visitor.

The distinguishing feature of trees in Mohawk Trail State Forest that are in the 2.5 to 3.5-foot girth range is their significant height. Significant height can have a magnifying visual effect, especially when trunks are free of lower limbs. Accept in wooded parks, trunks of city trees commonly branch for 5 to 35 feet. Trunks of forest-grown trees in Massachusetts commonly branch from 35 to 50 feet. However, in Mohawk, trees of many species can be free of limbs for 50 to 65 feet and on occasion 65 to 80 feet. It is the combination of moderately large trunks and exceptional heights that catches the eye of the tree-conscious visitor and pulls the attention upward in a remarkable 100-foot plus canopy that is often the rule instead of the exception.

One species contributes more than any other to the perception of great height in Mohawk to even casual observers and that species is ***Pinus strobus***, the eastern white pine. The pines in a number of Mohawk stands are literally towering trees and impart a cathedral appearance to Mohawks forests. Their heights, as described throughout this report, will amply attest to Mohawk's dominance. In addition, the white pine is the Iroquois tree of peace and the most important timber tree in the colonies for a time period. It was under the roots of an old white pine that the warring Nations of Iroquois buried the hatchet. But the white pine has plenty of company.

What is most striking from a statistical analysis of the Mohawk forests is the number of tree species that exhibit exceptional height. In fact, it is in this attribute that Mohawk surpasses all other State forests in Massachusetts, a fact that will be reinforced in this report through a series of tables that not only present the individual champion trees, but more importantly, compare Mohawk to many other big tree locations in Massachusetts and elsewhere. It is through the site to site comparisons that Mohawk's the dominance emerges.

G. The Meaning of Mohawk's Tall Tree Statistics

What does it mean to be the Commonwealth's tallest forest? Is Mohawk's advantage considerable, modest, or slight? The facts that follow suggest the advantage to be considerable when Mohawk is compared to its New England competitors. While Mohawk's full advantage in the battle of the statistics is one that only persons who are both tree and numbers-conscious can fully appreciate, we emphasize that nothing is lost to the casual visitor to Mohawk who appreciates fine trees. But where and exactly how does Mohawk excel? We are now ready to examine what it means to be the Commonwealth's tallest forest.

A total of 22 species of trees in Mohawk Trail State Forest, 20 native and 2 non-natives exceed 100 feet in height. Ten species exceed 120 feet in height. Six exceed 130 feet. Two exceed 140, and one exceeds 160 feet. No other state, federal, or private property in New England can match this record and to our knowledge, Mohawk presently has only three serious rivals in the entire Northeast, Cook Forest State Park, PA, Zoar Valley, NY, and possibly Fairmount Park in Philadelphia. Cook Forest State Park and Zoar Valley both exceed Mohawk's tall tree statistics by small amounts. In time locations in New Jersey and others in southern Pennsylvania may be found that surpass Mohawk, but at present, Mohawk is a solid #3 in the Northeast. The following table lists the species that reach the height thresholds mentioned previously along with the relative frequencies with which those thresholds are reached.

Figure 2: Significantly Tall Trees in Mohawk Trail State Forest:

Species	Maximum Hgt in MTSF	Exceeds 100 Ft	Exceeds 120 Ft	Exceeds 130 Ft	Exceeds 140 Ft	Exceeds 150 Ft	Exceeds 160 Ft
White pine	163.5	Common	Common	Common	Common	35 found	5 found
White ash	147.4	Common	Common	Fairly common	11 found		
Sugar maple	138.0	Common	Fairly common	Rare			
Hemlock	131.0	Common	Rare	1 found			
Northern red oak	130.6	Common	Fairly common	1 found			
American beech	130.0	Fairly common	Rare	1 found			
Bitternut hickory	128.4	Common	Rare				
Big tooth aspen	127.7	Common	Rare				
American basswood	125.5	Common	Rare				
Red maple	122.4	Common	Rare				
Black cherry	119.2	Common					
Red pine	116.7	Fairly common					
Black birch	116.2	Fairly common					
Red spruce	114.7	Fairly common					
American elm	112.1	1 found					
White birch	110.5	Rare					
Black oak	110.5	Rare					
Shagbark hickory	109.8	Rare					
White oak	101.3	1 found					
Yellow birch	101.1	1 found					

It is important to emphasize that the above numbers and frequencies for Mohawk do not follow from unsubstantiated claims or hobby level interest in measuring trees. More work has gone into understanding the role of Mohawk's tall trees than probably can be said of any other public property in New England, if not the entire Northeast and possibly all the East. Moreover, we should point out that Mohawk's claim to tree height records is not connected with big tree sport-oriented contests and their derived champion tree lists, state or national. Champion tree lists popularize big tree hunting and have good intentions, but measurement methods used to crown champions are often inexact. Tree heights are often in error by 5 to 15 feet and on occasion much more as will be explained in the last section of this report. By contrast, the Eastern Native Tree Society (aptly called ENTS) regularly confirms the claims made about the heights of Mohawk's trees. ENTS is an elite organization of scientists and forestry professionals dedicated to the proper measurement and documentation of native trees in the eastern United States. ENTS has a predominately science and forest history-based mission. In documenting Mohawk's trees, sport enters into our efforts only peripherally. We do experience the enjoyment of sport, but it remains subordinate to scientific research and historical documentation by the experts. Some of the expert tree measurers have been named in the list of Mohawk's visitors, but those of special prominence are listed below. All have confirmed tall trees in Mohawk. Special mention made of two individuals. Dr. Robert Van Pelt of the University of Washington is quite possibly the foremost tree measurer in the United States if not the world. Dr. Van pelt has measured the tallest trees on the planet, including not only those on the west coast (redwoods, Douglas fir, sequoia, Sitka spruce, etc., but also the eucalyptus of Australia and Tasmania and rainforest giants in several of the Earth's greatest rainforests. Will Blozan is the eastern United States's foremost tree climber, holding height records for North Carolina, South Carolina, Tennessee, Georgia, Pennsylvania, Massachusetts, and New Hampshire.

Figure 3: Eastern Native Tree Society Tree Measurers of Prominence

Name	Professional Affiliation
Dr. Robert Van Pelt	University of Washington, forest ecologist
Will Blozan	Arborist, former scientist with Great Smoky Mountains NP
Robert Leverett	Holyoke Community College, adjunct professor of computer science
Prof. Gary Beluzo	Holyoke Community College, professor of environmental science
Dr. Thomas Diggins	Youngstown State University, forest biologist
Dale Luthringer	Naturalist and education specialist, Cook Forest State Park, PA
Colby Rucker	Retired forest specialist, State of Maryland
Dr. Lee Frelich	University of Minnesota, forest ecologist
Howard Stoner	College-level mathematics instructor
John Knuerr	Greenfield Community College, environmental ethics instructor
Jess Riddle	Furman University, ecology student
Bruce Kershner	Forest ecologist
Paul Jost	Electrical engineer
Michael Davie	Arborist, formerly with Great Smoky Mountains NP
Jack Sobon	Timber framer, architect, surveyor

If for no other reason than its undisputed place as the Commonwealth's premier reserve of tall, stately trees and a prime old growth resource, Mohawk Trail State Forest deserves special state recognition and attendant protection. There would be little point in awarding the former were it not accompanied by the latter. Hopefully, the reasons for this assertion will become increasingly clear from the information presented in the narrative, tables, charts, and maps that follow.

H: A Closer Look at Mohawk's Tall Trees:

A casual drive on Route #2 through Mohawk Trail State Forest does not fully reveal Mohawk's dominance in the tall tree department. Even an experienced eye won't confirm Mohawk's dominance, because the differences in average height are not so much greater than at other tall tree sites to make Mohawk stand out strikingly as it would were one comparing an eastern forest to the Pacific coast redwoods. Height advantage has to be considerable before most people notice it. Most people cannot tell the difference between a 90-foot tall and a 120-foot tall tree. The difference of 30 feet is not striking when viewed from ground-level. It takes statistical comparisons between Mohawk and other sites in Massachusetts and elsewhere in the East to put Mohawk into context and proper perspective. We will be doing this throughout the remainder of this report.

We will begin by comparing the tall trees of Mohawk Trail State Forest to those of the fertile Connecticut River Valley region of Massachusetts – the entire valley region, from the Vermont to the Connecticut border. We will make the comparison using the Eastern Native Tree Society's Rucker site index. The Rucker index is explained more fully below, but basically the height of the tallest member of each of the ten tallest species is measured for an area. The ten heights are then averaged. The average of the ten heights is the Rucker index. For example, the table below shows the Rucker index computed for the Mount Tom State Reservation, a treasure trove of large, tall trees within the Connecticut River Valley.

Figure 4: Example of a Rucker Site Index Using Mount Tom State Reservation

Species	Height	Circumference	Comments
White pine	139.4	14.1	Double- near Bray Lake
Red pine	121.3	5.4	Old field pine-near Bray Lake
Eastern hemlock	120.6	14.6	Largest in New England
White ash	116.3	5.1	Bray Brook
White oak	111.3	6.7	Rivulet above Bray Brook
Sycamore	110.4	5.8	On Bray Brook
N. red oak	108.7	8.7	Lower Bray Brook
Bitternut hickory	107.8	4.9	Lower Bray Brook
Red maple	106.7	8.8	Lower Bray Brook
Black birch	105.7	7.3	Lower Bray Brook
Rucker Index Averages	114.8	8.1	

The conclusion to be reached from the above data is that the tallest tree on Mount Tom State Reservation is a white pine and it is 139.4 feet tall. So white pine is the reservation's tallest species. The next tallest species is red pine at 121.3 feet. Eastern hemlock is the third tallest with the tallest single hemlock at Mount Tom is 120.6 feet in height. Incidentally, there are a number of Mount Tom white pines over 130 feet tall, but the Rucker index takes only one member of each represented species to calculate the index. So the Rucker Site Index is not an average of simply the 10 tallest trees at a site but rather an average of the 10 tallest species.

How does Mount Tom's index compare with a larger area to which Mount Tom belongs, for instance, the entire Connecticut River Valley? Can we predict how expanding the geographical region will affect the index? The Valley's index rises to 124.00 points for an increase over Mount Tom of 9.3 points. Going from a 2,000-acre property to an area encompassing over 450,000 acres produces a surprisingly modest rise. What this signals is that a very good tree-growing site can pack a surprising number of tall trees in a small area. Yet one is unsure if Mount Tom is that good or the Connecticut River Valley, for some reason, rather modest.

Now let's take a look at Mohawk. The Rucker index for Mohawk Trail State Forest currently stands at 134.45. That is a jump of 10.49 points over the entire Connecticut River Valley and 19.75 feet over the best single site in the Valley. So, at their tallest, the Valley trees don't match those at Mohawk for height, yet the area within Mohawk that produces the tall trees is not more than 3,000 acres. In addition, if we take the average of the ten tallest trees in Mohawk, we get 158.9 feet. The comparable figure for the Valley is 135.6 feet. The difference is 23.3 feet.

The following tables will make the Mohawk versus Valley comparison even clearer. The first table shows the Rucker index for Mohawk and the Connecticut River Valley of Massachusetts side by side. In examining the table and at the risk of being too repetitious, it should always be remembered that a relatively small sample area of Mohawk Trail State Forest, less than 3,000 acres, is being compared to an area of the Valley of over 450,000 acres.

Figure 5. Rucker Site Index for Connecticut River Valley and Mohawk Trail State Forest

Species	Height	Location	Species	Height	Location in Mohawk
White pine	140.2	Easthampton	White pine	163.5	Trees of Peace
Sycamore	136.2	Easthampton	White ash	147.4	Clark Ridge-north side
Tuliptree	131.2	Northampton	Sugar maple	138.0	Todd Mtn-east side
Cottonwood	127.0	Northampton	Eastern hemlock	131.0	Clark Ridge-north side
Hemlock	120.6	Mt Tom Reservation	Northern red oak	130.6	Clark Ridge-north side
Silver maple	118.9	Hatfield	American beech	130.0	Clark Ridge-south side
Red pine	121.3	Mt Tom Reservation	Bitternut hickory	128.4	Near headquarters entrance
White ash	117.2	Skinner State Park	Bigtooth aspen	127.7	Clark Ridge-Shunpike area
N. red oak	115.0	South Hadley	American basswood	125.5	Clark Ridge-Shunpike area
Sugar maple	114.7	Northampton	Red maple	122.4	Clark Ridge-Elders Grove
Rucker Index	124.15		Rucker Index	134.45	

Two points seem clear. Mohawk's dominance over the Connecticut River Valley is undeniable, however, its advantage in terms of feet is not overpowering in terms of how the trees of each look to an untrained eye. The table shows that Mohawk's tallest specimens outperform the Valley's best by an average of 10.30 feet. This is truly a subject for statisticians. The differences become increasingly meaningful when all the numbers are considered.

Let's try another comparison. Were Mohawk's 10 tallest trees compared to the Valley's 10 tallest, independent of species, then Mohawk's advantage would jump to 23.5 feet. All of Mohawks entries would be white pines. Interestingly, Mohawk's single tallest tree, the Jake Swamp white pine exceeds the Valley's tallest tree, a white pine in Mount Tom State Reservation, by 23.3 feet. That the advantage of the 10 species almost exactly equals the advantage of the top species is probably coincidental.

An additional observation is that in the Valley, 5 species have been measured to over 120 feet in height, while 10 species reach that threshold in Mohawk. More extensive Valley searches would likely eventually add white ash and sugar maple to the 120 Club, but it is highly doubtful that we would ever reach 10 species within the Valley.

In considering the implications of the species that make up the Rucker index for both Mohawk and the Valley, it is important to realize that the index for the Valley can't be improved by substituting other species. The species listed are the tallest for the region. There are no surprises. The big performers of the Valley are predictably the tall-growing species like white pine, tuliptree, sycamore, and eastern cottonwood. But white ash, hemlock, red pine, northern red oak, silver maple, and sugar maple also do well. The Valley has been searched extensively for outstanding members of all these species and other species, so the above table would likely not change much with additional searching, though it would change some. Sugar maple and northern red oak are both under-sampled. We suspect that a very wide tree hunt would eventually raise the tallest of each by 3 or 4 feet.

Let's try another comparison. The next table compares the tallest measured trees of 14 species that are common to both the Mohawk Trail State Forest and the Connecticut River Valley, a kind of apples to apples comparison. The species chosen for comparison must be well represented in both Mohawk and the Valley. For instance, a lone mature American elm has been measured in Mohawk and while it exceeds in height any Valley elm yet

measured, the American elm is not sufficiently well represented in Mohawk to be used in this comparison. The same is true for the black oak, which is common in the Valley, but uncommon in Mohawk. Consequently, both the elm and black oak have been omitted from the comparison. Another species that is very poorly represented in Mohawk, but grows prolifically in the valley, is the eastern cottonwood. In the case of the cottonwood, in contrast to the elm and black oak, the valley would be highly favored. Cottonwoods are towering trees in the Valley, but modest in Mohawk. Alternatively, red spruce is well represented in Mohawk, but grows naturally in the valley region in only a few places like Mount Tom and Mount Holyoke ranges, where it is extremely small. Species that appear in Mohawk only from human plantings have also been omitted regardless of how well they grow. Excluded from the list are the red pine, Norway spruce, white spruce (one tree), and black locust. One species that grows well in both the valley and Mohawk is the bigtooth aspen. However, it has been omitted because of a lack of data for the species in the Valley. Mohawk would be greatly favored, were it included.

Figure 6. Rucker Site Index for Connecticut River Valley and Mohawk Trail State Forest for 14 Species Well Represented in Both Regions.

Species	MTSF	Connecticut River Valley	Difference
White pine	163.5	140.2	23.3
White ash	147.4	117.2	30.2
Sugar maple	138.0	114.7	23.3
Northern red oak	130.6	115.0	15.6
American beech	130.0	102.2	27.8
Bitternut hickory	128.4	107.8	20.6
Hemlock	131.0	120.6	10.4
Red maple	122.4	106.7	15.7
Black cherry	119.2	106.9	12.3
Black birch	116.2	105.7	10.5
American elm	112.1	102.3	9.8
White birch	110.5	94.0	16.5
Shagbark hickory	109.0	103.8	5.2
White oak	101.8	111.3	-15.0
Average	125.7	110.6	15.1

The advantage in this comparison goes to Mohawk by an average of 15.1 feet. Given the fertile soils of the Connecticut River Valley, Mohawk's advantage over areas farther east in the State is likely to be even more dramatic because we would expect the Valley to surpass regions east of the Valley, although there might be parity with Quabbin Reservoir and the Pelham Hills region.

In summary, were species like the American elm, black oak, red spruce, and cottonwood included, Mohawk would fall short on only the eastern cottonwood. The clear dominance of Mohawk over the Connecticut River Valley in Massachusetts, given the fertility of Valley soils and the overwhelming area advantage of the Valley, highlights the exceptional nature of Mohawk's forests. This is where the statistics lead us.

Let's now compare Mohawk to the next best tall tree site in the State, which is Ice Glen, at Stockbridge, MA. The currency of the measurements of Ice Glen lag those of Mohawk, but changes to Ice Glen from a much more intensive search would likely not raise Ice Glen's Rucker Index over one to two feet and three at the absolute most. The white pine, white ash, and hemlock are all near or at their maximums. Greatest potential for improvement lies in the trees near the bottom of the list, but that potential is constrained by site limitations.

Figure 7. Comparison of Rucker Site Index for Ice Glen and Mohawk Trail State Forest

Ice Glen		Mohawk Trail State Forest	
Species	Height	Species	Height
White pine	153.2	White pine	163.5
White ash	137.6	White ash	147.4
Hemlock	136.6	Sugar maple	138.0
Shagbark hickory	131.2	Eastern hemlock	131.0
Black cherry	121.9	Northern red oak	130.6
Pignut hickory	120.8	American beech	130.0
Red maple	115.6	Bitternut hickory	128.4
American elm	115.2	Bigtooth aspen	127.7
Northern red oak	110.9	American basswood	125.5
American basswood	110.9	Red maple	122.4
Rucker Index	125.40	Rucker Index	134.45

The advantage goes to Mohawk by 9.05 feet. The smaller difference between Mohawk and Ice Glen as opposed to Mohawk and the Connecticut River Valley emphasizes the tree-growing advantages of the western Massachusetts mountain sites. If we compare the 10 tallest trees in Mohawk to the 10 tallest trees in Ice Glen, we get 158.9 versus 145.5 feet for a difference of 13.4 feet. These are all white pines. A similar comparison between Mohawk and the William Cullen Bryant Homestead yields 158.9 versus 149.8 feet for a difference of 9.1 feet. Again, these are all white pines. The Bryant Homestead has the tallest stand of white pines in Massachusetts outside of Mohawk.

We now perform the ultimate test for Mohawk. We will compare its tall trees to those of the rest of the state. The following table shows the results.

Figure 8. Comparison of Maximum Tree Height for Ten Species of Trees Mohawk Trail State Forest versus the Entire State

Species	MTSF		Species	State
White pine	163.5		White pine	156.2
White ash	147.4		White ash	137.3
Sugar maple	138.0		Hemlock	136.6
Hemlock	131.0		Sycamore	136.2
N. red oak	130.6		Shagbark hickory	131.7
American beech	130.0		Tuliptree	131.1
Bitternut hickory	128.4		Red spruce	129.6
Bigtooth aspen	127.7		Cottonwood	128.6
American basswood	125.5		Black cherry	121.9
Red maple	122.4		Pignut hickory	120.8
Average	134.45			133.00

Mohawk still has the higher index. Extensive searches across Massachusetts would likely increase the rest of the State's index, but not by much based on the searches that have been done. So if these numbers are reliable, then at least from a statistical standpoint, they are astonishing. But are there holes in the analysis? Has the entire Commonwealth of Massachusetts actually been searched well enough for tall trees to lend credibility to conclusions that one might draw from the numbers in the above height tables? Can these data be taken at face value? The answer is yes, even if somewhat qualified. The Eastern Native Tree Society has conducted extensive searches to identify areas with exceptional trees employing sophisticated search models that narrow down the places to look for tall trees. In addition, the search for champion pines has been ongoing for nearly 20 years. All species of trees that reach heights of 100 feet or more have been given priority at one time or another. The search effort in Massachusetts probably exceeds that of any other state in the eastern United States.

As a conclusion to these height comparisons, the final table of this session shows the Rucker site index for Massachusetts as a whole including Mohawk Trail State Forest.

Figure 9. Rucker Index for the Commonwealth of Massachusetts

Species	Location	Height	Circumference
White pine	Mohawk Trail State Forest	163.5	10.1
White ash	Mohawk Trail State Forest	147.4	9.5
Sugar maple	Mohawk Trail State Forest	138.0	11.4
Eastern hemlock	Ice Glen	136.6	10.2
American Sycamore	Easthampton	136.2	13.2
Shagbark hickory	Ice Glen	131.7	5.0
Tuliptree	Northampton-Mill River	131.2	13.4
Northern red oak	Mohawk Trail State Forest	130.6	7.0
American beech	Mohawk Trail State Forest	130.0	7.8
Red spruce	Mt Greylock-Hopper	129.2	6.5
Average		137.5	9.4

A comparison of Mohawk's 10 tallest trees to the rest of the State's 10 tallest yields 158.9 feet to 151.7 for a 7.2-foot advantage for Mohawk.

Where does Mohawk fall short? Despite Mohawk's high Rucker Index, Mohawk cannot pull Massachusetts up high enough to compete with Pennsylvania. At present, Pennsylvania's Rucker Index stands at 144.2 and that of Cook Forest stands at 135.27. New York's Rucker Index presently is 137.5, the same as Massachusetts, and Zoar Valley's index stands at 134.69. Extensive searches of New York will likely produce an index close to that of Pennsylvania. The size and/or latitude advantage of New York and Pennsylvania will enable them to continue to out perform Massachusetts, but the differences will at least be less dramatic thanks to the contribution of Mohawk Trail State Forest.

We will present one last table to list the trees we have measured in Mohawk with a focus on girth. The last table shows trees we've measured that exceed 10 feet in circumference. However, the list is far from complete. There are many more trees over 10 feet in circumference in Mohawk, but the table at least provides a flavor for the bulkier trees of Mohawk. Remembering that the large white pines are often little more than 120 years of age, many pines currently over 9 feet in circumference will eventually reach 10 feet.

Figure 10: A Sample of Trees in Mohawk Exceeding 10 Feet in Circumference

Species	Circumference	Location	Height
BLCT	13.0	MTSF-Clark Ridge	87.5
HM	14.8	MTSF-Cold River A	105.8
HM	13.3	MTSF-Cold River A	97.2
HM	11.6	MTSF-Cold River C	108.2
HM	11.1	MTSF-Cold River C	92.1
HM	10.8	MTSF-Cold River A	116.8
HM	10.7	MTSF-Cold River B	131.0
HM	10.3	MTSF-Trout Brook	119.7
NRO	13.5	MTSF-Todd Mtn	
NRO	11.6	MTSF-Clark Ridge	110.1
NRO	10.0	MTSF-Todd Mtn	130.1
RM	12.5	MTSF-Trout Brook	93.9
RM	10.3	MTSF-Todd Mtn	111.3
RM	10.2	MTSF-Trout Brook	94.3
RM	10.1	MTSF-Cold River C	89.8
SM	18.3	MTSF-Todd Mtn	103.8
SM	13.0	MTSF-Todd Mtn	
SM	12.9	MTSF-Todd Mtn	
SM	12.7	MTSF-Todd Mtn	
SM	11.4	MTSF-Todd Mtn	138.0
SM	10.0	MTSF-Trout Brook	127.7
WA	12.3	MTSF-Todd Mtn	0.0
WA	11.2	MTSF-Clark Ridge	123.4
WP	14.6	MTSF-Trout Brook	148.3
WP	13.5	MTSF-Pocumtuck Pines	144.8
WP	13.5	MTSF-Pocumtuck Pines	146.1
WP	12.7	MTSF-Trout Brook	130.6
WP	12.5	MTSF-Cherokee Grove	153.0
WP	11.7	MTSF-Trout Brook	138.7
WP	11.7	MTSF-Encampment Pines	131.5
WP	11.4	MTSF-Clark Ridge-Zoar Stand	162.5
WP	11.4	MTSF-Encampment	138.5
WP	11.3	MTSF-Trees of Peace	140.4
WP	11.2	MTSF-Clark Ridge-Zoar Stand	161.2
WP	10.9	MTSF-Stand-Indian Springs	125.8
WP	10.9	MTSF-Encampment Pines	140.4
WP	10.9	MTSF-Clark Ridge-Zoar Stand	146.9
WP	10.8	MTSF-Mast Pines	129.7
WP	10.7	MTSF-Clark Ridge-Zoar Stand	147.4
WP	10.7	MTSF-Cherokee Grove	146.4
WP	10.6	MTSF-Todd Mtn	137.1
WP	10.6	MTSF-Clark Ridge-Shunpike Area	160.5
WP	10.5	MTSF-Clark Ridge-Zoar Stand	143.2
WP	10.4	MTSF-Algonguin Pines	152.4

WP	10.4	MTSF-Trees of Peace	115.9
WP	10.4	MTSF-Trees of Peace	151.3
WP	10.3	MTSF-Trout Brook	127.5
WP	10.3	MTSF-Trees of Peace	128.9
WP	10.3	MTSF-Encampment Pines	135.5
WP	10.2	MTSF-Trout Brook	134.6
WP	10.2	MTSF-Encampment Pines	136.3
WP	10.2	MTSF-Clark Ridge-Zoar Stand	141.2
WP	10.1	MTSF-Encampment Pines	107.7
WP	10.1	MTSF-Encampment Pines	128.0
WP	10.1	MTSF-Trout Brook	130.1
WP	10.1	MTSF-Trees of Peace	144.5
WP	10.1	MTSF-Algonguin Pines	150.6
WP	10.1	MTSF-Trees of Peace	163.5
WP	10.0	MTSF-Encampment	151.8
WP	10.0	MTSF-Stand-Indian Springs	125.9
WP	10.0	MTSF-MM Recreational Tr	126.3
WP	10.0	MTSF-Clark Ridge-Zoar Stand	138.3
YB	12.2	MTSF-Trout Brook	
YB	10.0	MTSF-Trout Brook	75.0
Average	11.3		126.5

I. Measures of Forest Productivity

Explaining the superlative nature of Mohawk Trail State Forest's individually tall trees and high canopy stands requires the use of special measures and a context for presenting those measures. Accordingly, throughout this report, certain benchmarks or threshold measures will be employed to identify the exceptional trees and areas of forest in Mohawk Trail State Forest and to put them into context relative to other areas in Massachusetts, New England, the Northeast, and in some cases, the entire East. Definitions and explanations of measures will be provided as needed. There will be measures of species diversity and species performance with respect to growth parameters. Composition profiles, individual tree height and diameter measures, and overall stand measures will be used. All will play important roles. The primary measures used will now be defined.

J. Stand-based Measures and Added Emphasis on Tree Heights

Most stand-based measures we use are traditional forestry or forest ecology-oriented ones such as height, basal area, stand density, and trunk volume. Data are collected for these measures for individual species and over all.

Another measure of site productivity is the height to diameter ratio, called the HD ratio. The heights of trees for a site are measured and trees with similar diameters are compared within and across species. Sites that produce taller trees at particular diameters ranges generally represent the more productive sites. There are patterns that emerge that need to be factored into the analysis. For example, hardwoods growing along with pines must grow rapidly or they become and remain understory trees. One approach to HD Ratios we plan to use is to examine how species influence each other and the role of dominant species on subordinates. However, to draw reliable conclusions, HD ratio analysis requires sophisticated statistical tools, which have not been applied at Mohawk. This will constitute future research efforts. Dr. Lee Frelich of the University of Minnesota is developing the statistics for applying this method. The following table shows maximum height to diameter ratios for 10 species in Mohawk Trail State Forest.

Figure 11: Height to Diameter Ratios for the top ten species in Mohawk Trail State Forest

Height to Diameter Ratio	Location	Species	Height	Circumference
115.2	MTSF-Todd Mtn	Bitternut hickory	124.6	3.4
101.0	MTSF-Clark Ridge-Zoar Stand	Red pine	106.1	3.3
96.5	MTSF-Algonguin Pines	Red maple	104.4	3.4
95.5	MTSF-Pocumtuck Pines	White pine	151.1	5.0
91.1	MTSF-Clark Ridge	White ash	119.6	4.1
88.4	MTSF-Clark Ridge-Shunpike Area	Bigtooth aspen	121.0	4.3
87.8	MTSF-Encampment Pines	Shagbark hickory	109.0	3.9
80.3	MTSF-Trout Brook	Sugar maple	122.7	4.8
80.1	MTSF-Todd Mtn	Black Cherry	107.1	4.2
76.3	MTSF-Clark Ridge	American basswood	111.3	4.6

Lastly, a new measure has been introduced to analyze the overall growth potential of a site that measure has no counterpart that we know of in forestry or forest ecology literature. The measure is employed courtesy of ENTS. As previously explained, and demonstrated, it is formally called the Rucker Site Index. For a site being studied, a concentrated search is made for the tallest member of each of the ten tallest species. This is obviously labor intensive and requires a lot of experience at spotting tall trees in a closed canopy forest. The height of the tallest member of each of the chosen species is carefully measured by ENTS-engineered techniques. The ten heights are then averaged. The result is formally called the Rucker Site Index.

The use of height thresholds to identify exemplary trees and forest sites may appear more sport-oriented than scientific, but there is a sound ecological basis to employ them. Individual tree height thresholds are used extensively to identify superlative forest sites and individual trees in Mohawk Trail State Forest. The superlatives that emerge can be important in either an ecological or historical context. In an ecological context an exceptionally tall tree should tell us something about the surrounding habitat and growing conditions. Poor soils and insufficient moisture does not grow tall trees.

In a historical context, we look for windows into the past to ascertain what a species did in say colonial times. Some thresholds have been carried over from colonial times. For instance, a 150-foot height for white pines has been the defining threshold for the species throughout its range. Henry David Thoreau and others often used 150 feet as a threshold to identify the great pines and pine stands of yesteryear. That threshold still applies. ENTS data from the southern Appalachians to southern Canada have turned up a surprising number of sites with 150-foot white pines. A long term ENTS project has been to document all stands of pines and isolated trees reaching 150 feet or more in the eastern United States. In this context, Mohawk Trail State Forest figures prominently. But does the 150-foot threshold apply to other species? It depends on the geographical region.

The white pine height threshold cited above applies to the entire eastern United States. However, the hardwood for New England is 130 feet. The threshold is less clear outside New England. It generally applies in other areas of the Northeast above 41 degrees north latitude or roughly central Pennsylvania. A conspicuous exception is Zoar Valley, NY where two species of hardwoods exceed 150 feet. In this aspect Zoar Valley has no competitors in the Northeast. The closest to 150 feet that ENTS scientists and technicians have documented in New England is a white ash in Mohawk Trail State Forest, which currently reaches 147.4 feet.

Going southward, in a few private sites, such as the Belt Woods of Maryland and more generally in the southern Appalachians (mainly the Great Smoky Mountains NP, Sumter NF, and Joyce Kilmer Memorial Forest in the Nantahala NF), and in Congaree Swamp NM in the South Carolina about a dozen species of hardwoods can reach 150 feet.

K. A Rigorous Use of the Rucker Site Index

Before leaving the section on site productivity, we will address the process of applying the Rucker Index through an iterative process. Repeated application of the index provides an increasingly sensitive measure of a site's capacity to produce outstanding trees of many species since the Rucker Index is highly sensitive to diversity as opposed to being a measure of how well a site grows a single species, such as white pine. In this way, the Rucker Index doubles as a site diversity index. But we need to assure ourselves that we are not over-rating a site as a consequence of a few very atypical trees. We do that by repeated applications of the Rucker Index.

By applying the index then removing all the trees that make up the first iteration and applying it again, we are able to eliminate the influence of atypical trees. If after three iterations for a site, the Rucker Index is still high, we can be reasonably sure that a high initial site index is not the result of a very few, atypical trees. In the case of Mohawk Trail State Forest, we have processed through 12 full iterations. Unfortunately, multiple iterations call for extensive searches for candidate trees and very few sites have been studied enough to apply the process more than 2 or 3 times. The legwork required is much greater than measuring all the trees in a plot. The iterations for Mohawk follow.

Figure 12: Ten Iterations of the Rucker Site Index for Mohawk Trail State Forest

First Level Calc	134.45	Second Level	131.5	Third Level	128.34
Species	Hgt	Species	Hgt	Species	Hgt
White pine	163.5	White pine	162.2	White pine	161.2
White ash	147.4	White ash	144.8	White ash	144.5
Sugar maple	138.0	Sugar maple	131.9	Sugar maple	130.6
Eastern hemlock	131.0	Northern red oak	130.1	Northern red oak	127.3
Northern red oak	130.6	American beech	128.7	Eastern hemlock	122.9
American beech	130.0	Eastern hemlock	127.9	American beech	122.0
Bitternut hickory	128.4	Bitternut hickory	124.6	Bigtooth aspen	121.4
Bigtooth aspen	127.7	American basswood	123.6	Bitternut hickory	118.6
American basswood	125.5	Bigtooth aspen	122.0	Red maple	118.2
Red maple	122.4	Black cherry	119.2	Red pine	116.7
Rucker Index	134.45		131.50		128.34

Fourth Level	127.68	Fifth Level	125.86	Sixth Level	124.68
Species	Hgt	Species	Hgt	Species	Hgt
White pine	160.5	White pine	160.1	White pine	158.2
White ash	143.2	White ash	141.5	White ash	141.3
Sugar maple	129.7	Sugar maple	127.7	Sugar maple	126.5
Northern red oak	126.7	Northern red oak	125.2	Northern red oak	123.7
Eastern hemlock	122.5	Eastern hemlock	121.1	Bigtooth aspen	120.7

American beech	121.8	Bigtooth aspen	120.9	Eastern hemlock	119.8
Bigtooth aspen	121.0	Bitternut hickory	118.2	Bitternut hickory	118.2
Bitternut hickory	118.4	Black Cherry	115.0	Red maple	113.5
A. basswood	116.5	Red spruce	114.7	American beech	112.7
Black birch	116.5	American basswood	114.2	American Elm	112.2
Rucker Index	127.68		125.86		124.68

Seventh Level	123.14	Eighth Level	122.19	Ninth Level	121.28
Species	Hgt	Species	Hgt	Species	Hgt
White pine	157.4	White pine	156.6	White pine	155.0
White ash	141.1	White ash	140.3	White ash	140.3
Sugar maple	125.7	Sugar maple	125.3	Sugar maple	123.6
Northern red oak	121.8	Northern red oak	121.3	Northern red oak	120.2
Bigtooth aspen	119.0	Bigtooth aspen	118.0	Bigtooth aspen	115.8
Eastern hemlock	119.7	Eastern hemlock	116.7	Eastern hemlock	115.7
Black birch	112.1	Red maple	111.3	Red maple	111.3
Red Maple	111.8	Black Birch	111.3	American Basswood	110.6
Red Maple	111.5	Red Pine	110.6	White birch	110.5
American Bass	111.3	Black Oak	110.5	Bitternut hickory	109.8
Rucker Index	123.14		122.19		121.28

Tenth Level	120.17	Eleventh Level	118.63	Twelfth Level	117.67
Species	Hgt	Species	Hgt	Species	Hgt
White pine	153.8	White pine	153.7	White pine	153.1
White ash	139.2	White ash	138.8	White ash	138.5
Sugar maple	123.5	Sugar maple	123.0	Sugar maple	122.7
Northern red oak	119.2	Northern red oak	117.7	Northern red oak	117.4
Bigtooth aspen	114.0	Eastern hemlock	112.2	Eastern hemlock	111.3
Eastern hemlock	113.3	Red maple	110.5	Red maple	110.2
Red maple	111.2	ABW	108.2	BB	106.8
American beech	109.5	Bigtooth aspen	107.4	Bigtooth aspen	106.6
Shagbark hickory	109.0	Black cherry	107.1	Black cherry	105.5
American basswood	109.0	Red Spruce	107.7	American beech	104.6
Rucker Index	120.17	Rucker Index	118.63	Rucker Index	117.67

The 12-iteration process does not tell the whole story. Continued searching would sustain the index at around 116 for a dozen more iterations and 114 to 115 for 25 to 30 more. We conclude this section with the following observations. In pre-settlement times, western Massachusetts may have had many places that equaled or even surpassed Mohawk Trail State Forest in tall trees. Historical information suggests that Granby, MA had some exceptionally tall trees and we doubt that Ice Glen stood alone in years past as the only exceptionally rich site in the lower Housatonic River Valley. Today Bartholomew Cobble holds promise for an index of between 110 and 113, but not more. With more work, Bullard Woods will likely reach 110 and could make 112. Other site will exceed 105, but not much more. So for today, Mohawk is the clear, unchallenged leader and our challenge is to understand why.

II. Definitions of Old Growth Forest

From the outset of Friends of Mohawk Trail State Forest research, our primary objective has been to identify and study old growth sites in Massachusetts. Initially, the definition used to qualify a site as old growth was highly restrictive and tended to identify isolated stands of trees with:

1. A high average age structure,
2. No visible signs of past direct human intervention such as the ubiquitous New England rock wall,
3. All native species,
4. Ample evidence of long-term management by natural forces producing so-called old growth characteristics.

We have also introduced the concept of the "autopoietic forest" and acknowledged the concept of primary forests, which are areas that have had no record of past direct human land use. Primary forest is a closely related concept to the once in-vogue concept of virgin.

In recent years our thinking has evolved to factor in natural disturbance on a broader spectrum of spatial and temporal scales. This adjustment has been motivated by the landscape-scale thinking of conservation biologists and has reduced the importance of the high average age criterion by shifting emphasis from the stand to larger spatial and temporal units. This seems reasonable when one considers that a large area of primary forest can have stands of old trees, stands of relatively young trees, and stands of all ages depending upon what spatial scale or temporal window one chooses. In other words, should a primary forest with old growth characteristics that experiences a direct hit from a major disturbance (e.g. hurricane, microburst, fire, etc) and loses old trees be removed from consideration as old growth because at that particular time, in that temporal snapshot, there are no old trees? What about the potential that that primary forest has to generate an "old growth forest" in the future? These considerations have entered our thinking because we would like to provide DCR with visions of what particular areas may or could look like in the future.

A. Old Growth Examined Historically

"Old Growth Forest" or just old growth is a common forest label these days. The term is used frequently and can evoke surprisingly strong passions, positive and negative. Yet paradoxically, while the concept of old growth is ecologically ambiguous, it serves us well as a designation for those older forests that we deem to have high ecological, historical, or aesthetic value and in need of protection for any of those values. Actually, many forests that are labeled old growth by one source or another share little in common ecologically, except perhaps for an abundance of old trees, and not always that. If we are going to delineate boundaries of forest in Mohawk Trail State Forest and designate them as old growth, we should clarify what it is that we are delineating and why. We begin with a general discussion of old growth.

Historically, the term old growth has been applied to several kinds of non-exclusive forest habitats. The important ones are listed below.

1. Primary forests, i.e. forests with no known major human intervention such as past clearing for pasture, agriculture, charcoal, burning for habitat, or significant logging, and no evidence of past human concentrations that would give rise to suspicions about aboriginal land use. In the past, this category of forest was often called virgin. Forests in the vast Adirondack Park and in the Great

Smoky Mountains NP best illustrate the concept of primary forests. Massachusetts has very few, if any, places that can legitimately be called primary forest. From our surveys, we would be hard pressed to identify any site.

2. Forests that have a high percentage of trees that are in forestry parlance "over-mature" and past the state of maximum economic return. This is the root of forestry's original concept of old growth. Tree age in excess of 150 years has commonly distinguished old growth from non-old growth in both west and east. In the East, 150 years also closely corresponds to middle age for a number of important species.

3. Forests that have been natured-managed for over a century (and preferably much longer), and as a consequence, have developed the identifying characteristics of long-term nature-managed forests, i.e. the result of the hand of nature instead of the hand of humans. Physical characteristics include advanced age in a significant percentage of trees and other characteristics that will be enumerated later.

4. Even-aged stands of trees with a stately appearance that have grown back after a common stand-leveling disturbance. Even-aged stands in our geographical region are often dominated by conifers - such as white pine, hemlock, or red spruce. On south-facing slopes of ridges, oak regeneration after fire can be fairly even-aged

5. A stand of exceptionally big trees relative to the forest in the general area. This fits more closely with the public perception of old growth, but has no ecological basis.

6. A landscape scale natural forest that represents a patchwork of disturbance impacts and age classes composed of a combination of any or all of the above. The idea here is long-term management by nature regardless of the age structure of the trees. Areas like northern Minnesota have done much with this concept.

7. An autopoietic forest, a self-regulating, self-sustaining forest. The concept of an autopoietic forest is closely related to that of the maintenance of a natural forest ecosystem, but specifically stresses the impact of the forces operating within the forest (i.e. emergent behavior of the system at large) that serve to shape the present and future composition and functions without the direct manipulation of humans. The result generally serves a variety of needs by providing many niches and animal and plant habitats. The concept of "autopoiesis" stresses the importance of endogenous factors that control the impacts of exogenous factors such as insect infestation. This type of forest may best illustrated in our area by the northern hardwood-hemlock forest. In the central Atlantic states and part of the Southeast, mixed mesophytic forests are autopoietic.

8. Lastly, a designation for administrative purposes that may include a core area of old forest surrounded by a buffer of mixed-age or younger forest.

The above definitions of old growth are admittedly broad-based and for scientists raise as many questions as they answer. The list does not exhaust the definitions one finds in the literature of the scientific, forestry, and governmental communities. To illustrate the point, the U.S.F.S. has catalogued 100 citations on old growth definitions including those put forth by Robert Leverett in a series of articles written in the early and mid-1990s for a publication named 'Wild Earth'.

However, many of the 100 so-called old growth definitions are derivatives or re-statements of others. There are not 100 independent definitions floating around. The more scientific approaches to defining old growth are seldom in serious conflict with one another relative to areas that have been nature-managed for centuries and have an abundance of old trees, especially if late successional, i.e. there is a core of agreement. Despite this, the high number of old growth definitions claimed by the F.S. has been used to the detriment of the basic concept of an old growth forest. Claims from the wood products industry are not uncommon that assert that so many separate (and presumably conflicting) definitions invalidates the whole concept of old growth. However, the claims of an industry that has a vested financial interest in eliminating old growth should not be taken too seriously. The industry's claims do not serve a legitimate educational or scientific purpose. Still we cannot ignore that the concept of old growth does lead to disagreements among the well intentioned and those disagreements can obscure what is truly important. So with industry propaganda being an exception, what might be some legitimate areas of disagreement?

The most basic division within the definitional hierarchy follows the two main professions that have an interest in old growth: forestry and forest ecology. Both professions are involved in crafting old growth definitions. Each field has its own approach to understanding forest structure and function and the divergent definitions reflect the differences in approaches. Basically, the ecologist's understanding of what may constitute an old growth ecosystem has undergone an evolution as ecology-based concepts of forest development have replaced old stand-based concepts that have a forestry origin. Old growth via the ecologist's understanding is not about economics, while that of the forester, understandably, is.

There is even a historical component to definitions. One line of thinking about old growth stems from romantic descriptions of authors as they attempted to convey their impressions of "ancient or primeval forests". What were Indian-managed woodlands with open park-like appearances and a scattering of very large trees were originally thought to be virgin. In fact, in the minds of some writers, these Indian-managed woodlands were the quintessential virgin forests. Virgin became synonymous with open forests with big trees.

Today, perhaps, the most common difference in definitions of old growth among ecologists stem from different forest types being used to model old growth. A fire-successional oak forest takes a different development path in species composition and appearance than does a northern hardwood-hemlock forest. The span of differences is even more dramatic when an even-aged confer stand is included. One cannot devise a set of physical thresholds for old growth that fits all forest types, such as the number of stems/acre falling into an age class. It has been tried repeatedly, but it simply does not work.

It is important to emphasize that there are forests in Massachusetts that may not presently contain many old trees in the sense of high age, or may have them now, but will lose them in the future. But these forests function in a self-sustaining way without the input of forestry practices. These forests are the "autopoietic" ones mentioned above. Their clearest expression is in late successional forests, but dynamic areas such as the east and south sides of Todd Mountain are autopoietic. We will point out the autopoietic forests in Mohawk Trail State Forest in future releases of this report.

While we have not abandoned traditional definitions of old growth, we lean toward process-based definitions being proposed by Dr. Lee Frelich in which natural processes have shaped and reshaped the forests without direct, or at least minimal human interference. This definition lifts the age requirements, but reinforces the role of natural processes.

B. Old Growth in Mohawk Trail State Forest

Irrespective of the 100 citations that put various spins on old growth, today we have a far better understanding of the natural disturbance regimes that shape forests at different spatial and temporal scales. We know what to expect following disturbances of varying magnitude and frequency for different forest types, based on work done at the Universities of Minnesota, Wisconsin, Maine, and in number of other colleges. This knowledge allows us to avoid the confusion of the past when models based on climax vegetation prevailed. Our deeper understanding has moved us toward a landscape perspective tolerant of large and small-scale disturbances, although a strictly stand perspective still has a place where an old growth site is small in physical area. Even then it is a mistake to rely on cohorts of one or two species to shape our thinking, which it once did. For example, old cohorts of hemlock, red spruce, or white pine are easy to recognize and traditionally influenced our notions of what was or was not old growth in the Northeast. Multi-aged hardwood stands that should have been designated old growth often went unrecognized. None of those of us who do old growth research in the Northeast would deny that even-aged stands of old hemlocks and/or white pines influenced us heavily in the past. Lastly, we have become tolerant of large scale disturbances. They seem less apocalyptic now – even when they knock down every mature tree in a favored old growth stand.

What has evolved for us is the notion of old growth for Massachusetts that is disturbance-driven. The result is a multi-aged forest shaped by natural processes with a significant but not necessarily overpowering component of old trees. This definition has gained acceptance and it is just the breakthrough that we needed to recognize most of our "old growth forest" in Massachusetts. This breakthrough is especially important when we consider that we seldom know the complete histories of candidate old growth sites. A decade ago, the ambiguity was very troubling, but precise knowledge of site history is less important today than in years past as we accept that human impact at some level is ubiquitous, but if autopoietic processes are in control, a detail of past human influences is relatively unimportant. Excluding sites as "old growth" because of recorded or minor visible human impact or the lack of dominance of "old trees" should be done with caution. With this background, we present our definition of old growth.

C. Friends of Mohawk Trail State Forest Definition of Old Growth:

For purposes of this report old growth is defined as a forest that:

1. Has been shaped principally by natural processes for the past 150 years or more to produce:
    a. An increasingly multi-aged forest,
    b. Pit and mound micro-topography consistent with the forest type,
    c. Abundant coarse woody debris for the particular forest type (less in some, more in others),
    d. Single and multiple tree-fall gaps,
    e. Conspicuously large diameter and/or tall trees on sites with high growth indexes,
    f. Dominance by native species.
2. Has a significant percentage of trees in the 100 to 200-year age range with preferably a few approaching longevity maximums for at least one of the species represented,
3. Has no visible signs of significant human land manipulation within the designated old growth area that would have dramatically changed forest composition,
4. Is large enough in area to be self-sustaining for the forest types represented

SECTION III. Areas of Old Growth Forest, Exemplary Second Growth Forest, and Cultural and Historical Features of MTSF

A. Mohawk's Present Composition

Mohawk Trail State Forest covers slightly less than 6,800 acres of land, with the latest acquisition of approximately 300 acres. Within Mohawk's boundaries, several areas of old growth and exemplary second-growth forest can be found. There are areas of very young forest also. The boundaries of all are imprecise and in future work we will attempt to refine them. We will be looking at Mohawk through different lenses, not just an old growth lens. The mature second growth and the youngest forests will receive equal attention. Questions we pose to ourselves are: (1) how do the three differ, (2) what is the direction of succession in each, (3) what kinds of disturbances might we expect in the future and can we predict their impacts.

To provide readers with the best possible picture of Mohawk's present forests, we have divided Mohawk up into regions that follow our old growth research and confirmations. This delineation by old growth concentration will become more apparent in the paragraphs that follow. .

B. Important Forest Sites

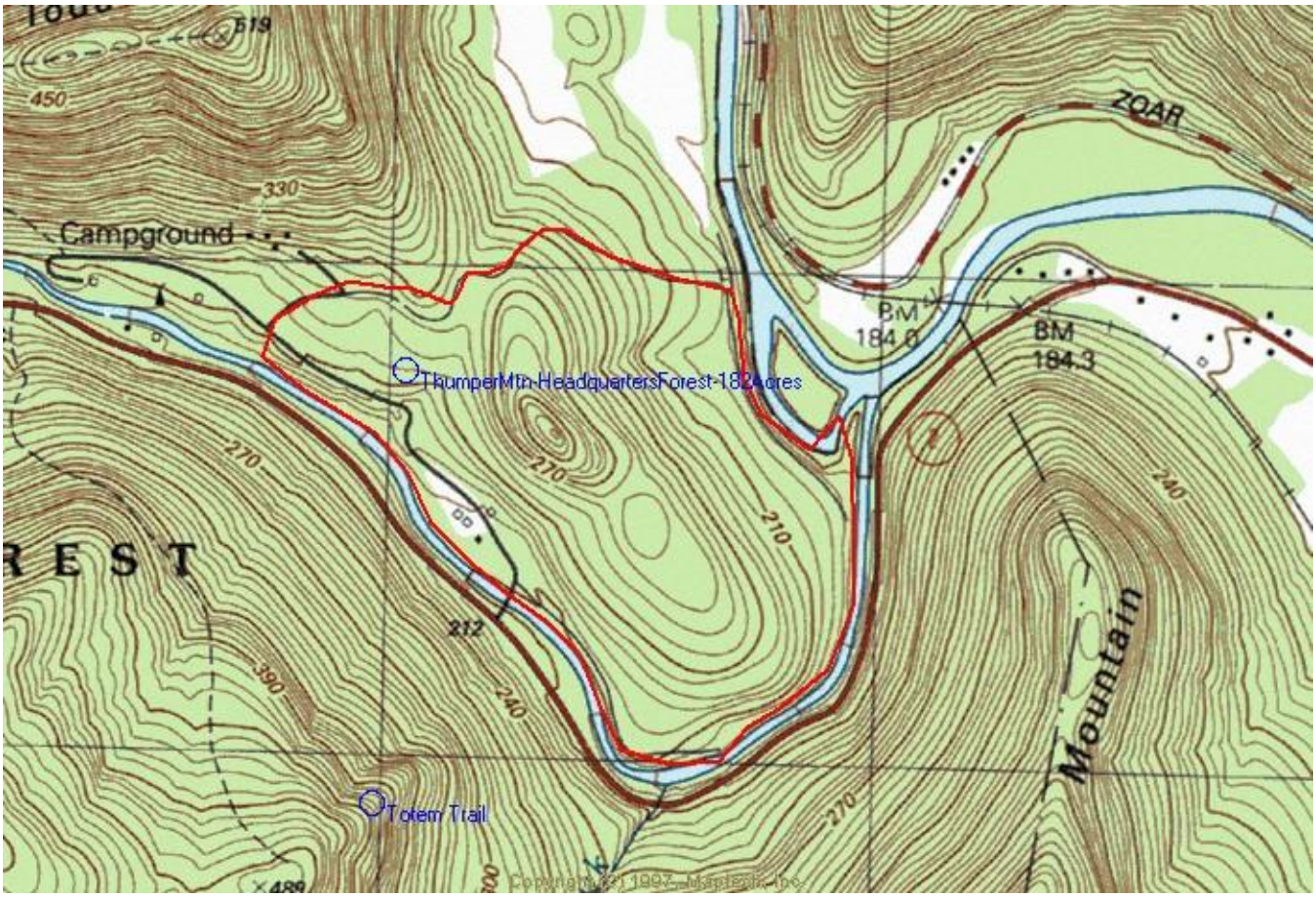
For the purpose of presenting areas of old growth, exemplary second growth, historical and cultural features, and forests of high aesthetic value, we have divided Mohawk Trail State Forest into nine regions. The total area of these regions is 3,178 acres, which is slightly less than half of Mohawk Trail State Forest. A topographical map has been provided for each of the areas. The regions we have defined are listed below:

Region	Map Name
1. Thumper Mountain-Headquarters Forest: 182 acres	MTSFThumperMtnHQForest.jpg
2. Todd-Clark Ridge East-side Forest: 211 acres	MTSFToddClarkESForest.jpg
3. Todd-Clark Ridge North-side Forest: 384 acres	MTSFToddClarkNSForest.jpg
4. Trout Brook Forest: 597 acres	MTSFTroutBrookForest.jpg
5. Cold River North-side Forest: 820 acres	MTSFColdRiverNSForest.jpg
6. Black Brook Forest: 128 acres	MTSFBlackBrookForest.jpg
7. Todd-Clark Ridge South-side Forest: 530 acres	MTSFToddClarkSSForest.jpg
8. Cold River Natural Landmark Forest: 280 acres	MTSFColdRiverNaturalLandmarkForest.jpg
9. Manning Brook Forest: 46 acres	MTSFManningBrookForest.jpg

Before turning to the specific descriptions for each of these regions, we should point out that the boundaries do not follow ecological divisions. The boundaries are largely for our convenience. However, there are advantages to seeing Mohawk Trail State Forest subdivided in to regions that approximate the boundaries of our nine regions. The Thumper Mountain-Headquarters Hill region is an area that has been heavily used by humans. Outside of a marginal area of old growth on Thumper Mountain, this region is characterized by 60 to 120-year old forests. By contrast the Todd-Clark South-side Forest is a region that has been impacted far less by direct human activity, but has been heavily affected by past fire. This has created an oak forest that varies in age from between 120 to 180 years with scatterings of older trees growing on slopes that often exceed a grade of 70%. The regions are then fairly differentiated by topography and forest type.

1. Thumper Mountain-Headquarters-Forest

Map: MTSFThumperMtnHQForest



The Thumper Mountain-Headquarters Forest covers approximately 182 acres.

a. Land Form

The headquarters area of Mohawk Trail State Forest sits at an elevation of 700 feet above sea level at the base of Thumper Mountain, which is an extension of the Todd-Clark mountain ridge. The crest of Todd-Clark runs in an east-west direction. Thumper is an extension of Todd and runs in a northwest-southeast direction, ending at the confluence of the Deerfield and Cold Rivers. Thumper's summit is 1043 feet above sea level. It rises 354 feet above the Cold River at Mohawk's headquarters, which is on the south side of Thumper's summit. Thumper rises 453 feet above the Deerfield River to the east. The steepest part of the grade up Thumper over a distance of 300 feet is between 55 and 60 percent. A short rise just beneath the summit has an 88% grade for a map distance of 120 feet. The east end of Thumper drops gradually to the confluence of the Cold and Deerfield Rivers. Large river terraces surround Thumper's high ground. These terraces were the areas that European settlers occupied in the late 1700s and used for sheep pasturing. A later use was as a dairy farm. The Headquarters itself sits on an old outwash terrace of the Cold River.

b. Old Growth

A marginal area of old growth forest covering 3 to 4 acres at most can be found on the southwest and northeast sides of Thumper. Hemlock, white pine, black birch, northern red oak, and red maple make up the majority of the species. Tree ages suggest past fire from colonial clearing in the early 1800s. A lone pitch pine on the south-side forest of Thumper attests to the high probability of past pasture-oriented kinds of disturbance. However, signs of more recent human land use are absent, so the forest has regained a significant degree of "naturalness". In this context, it is marginal old growth. It is aesthetic, but beyond appearance, no special significance has been found for this small marginal old growth remnant other than possibly as a clear marker for an age change from the woodlands on the slopes of Thumper that vary from 50 to 150 years to those in the 3 to 4 acres that are between 150 and perhaps over 220 years. Although large pines grow at the base of Thumper, not are old.

c. Forest Features

A large area of dense mountain laurel grows on the southeast ridgeline of Thumper Mountain suggesting that fire has been a visitor to all parts of Thumper in the past. For the most part and excepting the 3 to 4 acres of marginal old growth, the forest on the sides of Thumper Mountain down to the confluence of the Deerfield and Cold Rivers bears the mark of old pasturelands and woodlots. Characteristic terrain smoothing associated with pastures is everywhere evident. Most of the woodlands on the southeast side of Thumper have the heavily used look so typical of New England forests. The Thumper Mountain forests exhibit little of the vitality of other forest areas of Mohawk that are described in this report. Contrasts between the southeastern terminus of the Thumper ridge to other areas of Mohawk are striking, at least to a trained eye. However, one feature worth noting is that the extreme southeast corner forest has the only American chestnut sprouts found in all Mohawk Trail State Forest. If others grow in Mohawk, they will likely be found on the southeast-facing area of Thumper Mountain where there was a seasonal Native American presence.

d. Exemplary Trees

No sooner does one enter the headquarters area of Mohawk Trail State Forest than do Mohawk's trees start to reveal themselves as special. The area around the headquarters structures includes a few planted trees, but most are native. The planted trees include Norway spruce, a single white spruce, and a few small hardwood species including a hybrid chestnut. Interestingly, the Norway and lone white spruce near the Headquarters tollbooth all top 100 feet in height. But as visitors will increasingly see, 100-foot heights are commonplace for the trees in Mohawk.

One species that seems out of place in the headquarters area is the scattering of eastern cottonwoods on the southeast side. Several cottonwood trees grow near the entrance to Mohawk. Several others grow near the Nature Center. Cottonwood is not a competitive species in mountain gorges and drops out just a few miles up the Cold River. In the Connecticut River Valley, cottonwoods are huge, conspicuous trees. But they just do not compete well in the Cold River gorge where soils are shallow and there are no large areas that stay flooded in the spring to give cottonwoods a competitive advantage over other aggressive, fast-growing species. Nonetheless, the headquarters cottonwoods are doing okay. The most conspicuous tree is 7 feet in circumference and 95 feet in height. Two other cottonwoods near the entrance to Mohawk and a third near the pavilion just reach 90 feet. These are slender trees at around 6 feet in girth. However, at the rate that cottonwoods grow, the tallest of the group should reach the 100-foot threshold in 2 to 3 years and raise Mohawk's total to 20 native species that break the 100-foot threshold. Presently there are 22, including two non-natives. The principle tall non-native is the Norway spruce. The white spruce is the other.

A cluster of tall Norway spruces grows at the entrance to Mohawk Trail State Forest. Two reach to 112 feet in height. Virtually all break 100 feet. Girths of the Norway spruce are modest for the species at 6 to 7.5 feet. The probable planting date for these trees would be in the Civilian Conservation Corp period of construction and landscaping, perhaps the mid-1930s.

Although Mohawk Trail State Forest has many exemplary trees, most are not easily accessible to the general public. However, one species, the white pine, is immediately visible at the state forest headquarters. The Thumper Mountain-Headquarters region has a band of white pines that shadows the campground access roads and acts as an excellent advertisement for Mohawk. The Thumper Mountain-Headquarters pines blend with those on the southeastern slopes of Todd Mountain to form a contiguous area of spectacular pine forest that is the very hallmark of Mohawk Trail State Forest. These are the flagship trees of Mohawk and they can be fully enjoyed by simply strolling from the headquarters along the campground roads. A detraction to the ambience of the pine forest in this area is the garbage strewn by black bears that raid the Headquarters dumpsters and drag the plastic bags through the pines and on to Thumper Mountain. The staff of Mohawk Trail State Forest does its best to stay on top of the problem, but the bears are persistent. Regrettably, Mohawk has no funds available to manage the black bears or the messes they create.

The most accessible area of tall pine forest is reached by walking up the campground access road from its start at the headquarters area. Pines on both sides of the road form a corridor. We call these pines the Headquarters Hill Pines and they represent super canopy old-field pines. The understory species include red maple, northern red oak, white oak, black birch, yellow birch, American beech, and a few black cherries and white birches.

The Mohawk Headquarters and Headquarters Hill Pines are arrow-straight and have virtually no weevil damage or blister rust. They reach heights of 125 to 140 feet and girths of 20 to 34 inches. Two of the pines a short walk from the headquarters presently top 140 feet, but their locations within the grove do not allow for convenient viewing by visitors. Nonetheless, they and the lesser pines provide an ambience to the area that is noticeable by all who enjoy trees. The champion member is the Headquarters Staff Pine, which measures 144.7 feet in height and 9.0 feet in girth. It is named in honor of Mohawk's staff members who are the forest's direct caretakers.

Following the paved campground road around toward the cabins, one reaches the first of two leaching fields. The paved road passes the leech field and bears to the left. A dirt road branches to the right heading toward Mohawk's group campsite. The pines in this area on both sides of the paved and dirt roads have been named the Pocumtuck grove or the Pocumtuck Pines. The Pocumtuck Pines area continues along the dirt road to the group campsite. Beyond the group campsite, to the east, on the south side of the dirt road (the colonial Mohawk Trail), the pines are called the Cherokee grove. The Cherokee pines are older than those in the Pocumtuck grove by probably 30 to 40 years, if not 50 to 60.

Most of the Pocumtuck grove is populated with pines that are 75 to 110 years of age. Because the stand is still relatively young, it hasn't self-thinned and in places basal areas are over 300 square feet per acre. The two leaching fields provide convenient places to observe the Pocumtuck Pines. Visitors are afforded the opportunity to observe the impact of the opening up of a white pine stand. Trees along the boundary of the leaching fields receive extra light, which is good for growth, but the trees are also subject to extra wind damage. Courtesy of DCR, the Pocumtuck Pines area is one of Friends' main research areas into the growth patterns white of pines that are in the 75 – 110-year age bracket. We are especially interested in monitoring the health of the pines on the boundaries of the leech fields.

Even though the Pocumtuck Pines are fairly young, they have already reached remarkable heights. At least 15 pines are now over 140 feet in height and six are over 150. The 150-footers include the Metacomet, Massosoit,

and Frank James trees – all Wampanoags and 3 unnamed trees confirmed on October 26th, 2003 by Will Blozan. Of the six 150-footers, the Metacomet tree is both the overall largest at 151.3 feet in height and 9.0 feet in circumference. However, besides the six 150-footers, another two pines top 148 feet in height. In 2 to 3 years, they will join the other 150-footers and the stand will have at least eight 150-footers visible from the campground road. Visitors can walk the campground road and gaze upward into the crowns of 150-foot pines growing in the Pocumtuck, Trees of Peace, and Mast pine groves - without ever having to leave the convenience or safety of the road. More will be said about the 150 Club in subsequent paragraphs.

Another area of impressive pines is the Encampment Pines, which are located on the peninsula that separates the Cold and Deerfield Rivers. Four white pines along the cross-country ski trail exceed 140 feet and one reaches to 151.7 and 10.0 feet in circumference. Hardwoods in the area commonly exceed 100 feet. A Norway spruce reaches to 117.7 feet and is the tallest of its species measured in Mohawk.

Other species in the Thumper Mountain-Headquarters area are not particularly conspicuous although they do well by the tale of the tape. The hardwood canopy is typically 90 to 105 feet. The larger oaks measure 28 to 35 inches in diameter. A walk down the road from the entrance to a dumpsite is quite pleasant and there is a cluster of 10-foot circumference white pines near the first dumping area.

e. Historic and Cultural Features of Thumper Mountain and Headquarters Area

Fire Tower Site

A fire tower erected by the Civilian Conservation Corp once stood on the summit of Thumper Mountain. It has been removed. The summit may have once served as an observation area for Native Americans. So far no artifacts have been found.

Old Indian Encampment Site

A second historic feature of Thumper Mountain is an area at the confluence of the Deerfield and Cold Rivers that served as an old seasonal Indian encampment. The encampment shows up on old maps of Mohawk. Several citizens of Charlemont remember artifacts from the encampment site. We assume the site was used as a location for either trading or fishing. The latter purpose is the more likely early on, since the Cold River was an important spawning ground for the Atlantic salmon in both the pre and post-settlement eras. Salmon Falls at Shelburne Falls, MA was a prime fishing ground for both indigenous peoples and later white settlers when the populations of Atlantic salmon were still high. Items found at the encampment suggest trade was important, but later. The site was well known in years past, but has been pilfered and sadly treated with indifference by the State. In fact the area is a dumpsite for Mohawk Trail State Forest. Why this is the case is unclear, but it is not the fault of local management. The State Forest has no funds for cleaning up the area. This should be established as a future project and adequately funded by DCR.

Tree Planting Ceremony

In April 1996, Chief Jake Swamp planted a white pine as part of his ceremony and recounting of the formation of the Iroquois Confederation. The legendary Hiawatha figure stems from the Iroquois's mythology. However, the Hiawatha of the Iroquois mythology is not the same as in Longfellow's poem. Chief Swamp's ceremony took place in front of the Nature Center. We note that Chief Jake Swamp is the officially recognized "Peace Tree Chief" of the Mohawk Nation, Akwesasne Reserve. Chief Swamp has gone around the world planting

trees in his support of world peace. He has honored Mohawk Trail State Forest with two planting ceremonies., one in May 1994 and one in April 1996.

Mohawk-Narragansett Meeting

On July 19, 1997, John Brown, then a representative of the Narragansett Nation of Rhode Island and Grand Chief Joseph Takwiro Norton of the Kanawake Mohawks of Canada came together at the pavilion at Mohawk Trail State Forest Headquarters and revived the friendship pact that had once bound their two nations. This was a historic event deserving of documentation and official high-level State recognition. But despite the relatively little attention given to it, the fact remains that the event took place in Mohawk Trail State Forest and we all are the richer for it. We hope to have a future event at Mohawk that commemorates the occasion.

Nature Center

The Nature Center is worth mentioning as a cultural resource. It is a construction of the Civilian Conservation Corp era. It has recently been restored. It houses a collection of nature and cultural displays.

Dedication of Mahican-Mohawk Recreational Trail

On July 19,1997, the Mohawk Trail State Forest portion of the Mahican-Mohawk Recreational Trail was dedicated by then DEM commissioner Peter Webber. The event marked an important step in the recognition of the region's historical roots.

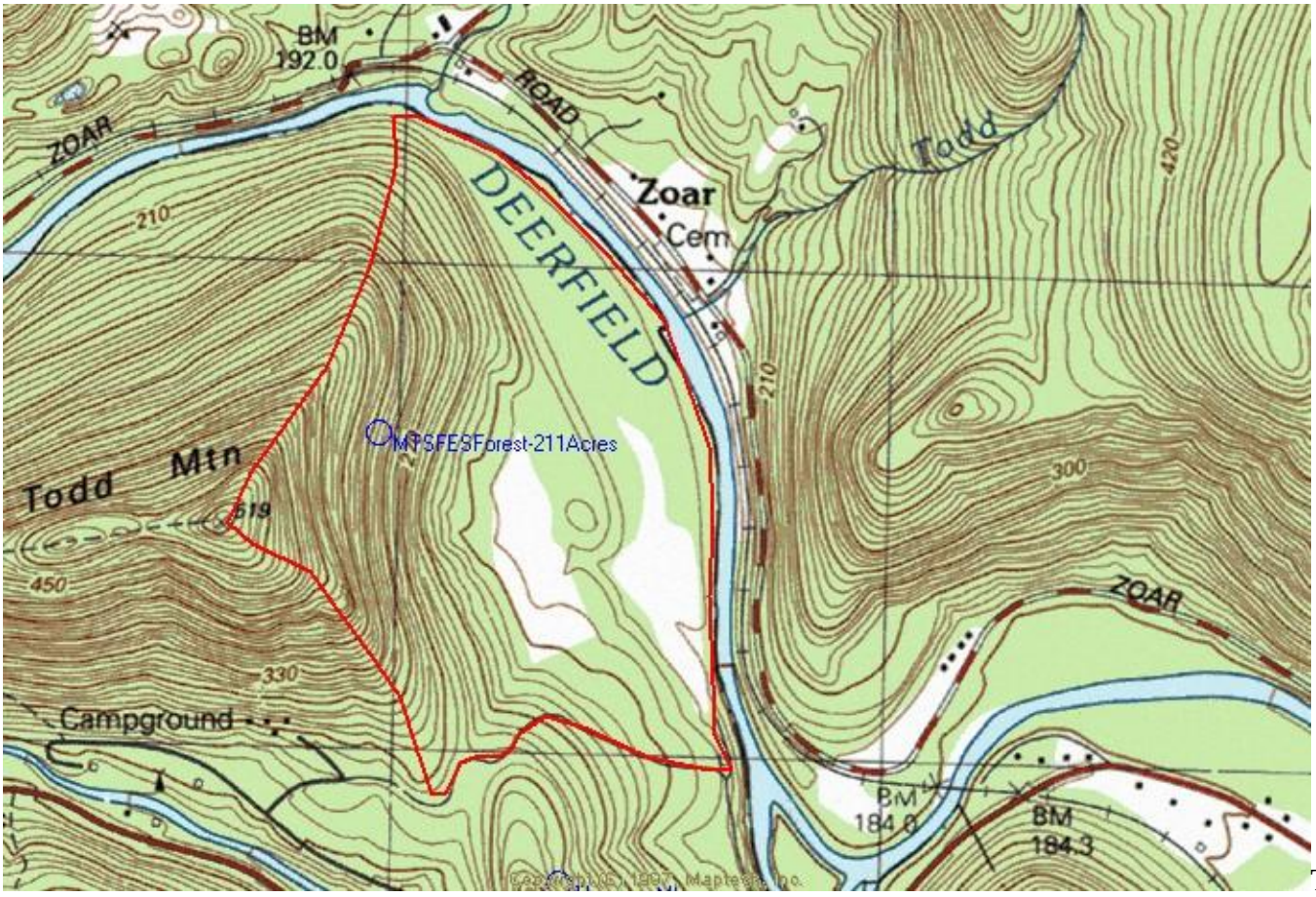
Shunpike Route

The construction of the Samuel Rice Road was begun in 1764 and completed in 1768. Its purpose was to provide a safer route up over Hoosac Mountain than Hawley's Road, which was an improvement of the old Indian Trail. In 1797 the Shunpike was used to avoid tolls on the Turnpike. It fulfilled this role until 1833.

The Shunpike crossed over the Deerfield River near the confluence of the Cold and Deerfield Rivers, close to the old Indian encampment. Within the Headquarters-Thumper Mountain Forest, it is the road that runs along the edge of the Deerfield and leaves the old Mohawk Trail near the south edge of the lower meadow. The old Mohawk Trail climbs to the saddle between Thumper Mountain and Todd Mountain. The Shunpike route continues across the lower meadow and crosses the Deerfield where the north rib of Todd Mountain descends to the river. The place of crossing was called Rice's ford. It was by the Shunpike route that Benedict Arnold traveled in 1775.

2. East-side Forest (East Side of Todd Mountain and Meadows):

Map: MTSFTODDCLARKESForest.jpg



The East-side forest covers 211 acres.

a. Landform

The East-side Forest is so named because of the prominent area of old growth that stands out in the bowl of Todd Mountain from considerable distances. The old growth can be seen very clearly from River Road across the Deerfield River. The East-side forest is bounded by the northeast and southeast backbones of Todd Mountain. The backbones form the western boundaries of the East-side Forest. On the north, the boundary goes from the summit of Todd down to the Deerfield River. On the south side, the boundary runs from the summit down to the old Mohawk Trail road and then follows the road down to the lower meadow and then down to the river. The upper and lower meadows are included in the area designated as the East-side Forest.

For Massachusetts, Todd Mountain is a fairly imposing landform. Seen from the Deerfield River at Route #2, it is conspicuous for its pleasing contours. Yet Todd Mountain is deceptively steep. The full drop from the summit of Todd to the Deerfield River is 1,083 vertical feet. The drop from the summit to the upper meadow, Todd's immediate base is 990 feet. The average grade of Todd's east side, a concave bowl, is 75 to 80% and this grade is maintained for 1,000 map feet. The drop from Todd's summit occurs rapidly across a series of ledges and boulder fields. Ledges near the summit of Todd's east side have afforded nesting sites for ravens. Turkey

vultures commonly soar in the currents above Todd. In addition, rock ledges and huge boulders make Todd's east side extremely rugged and dangerous. Bad accidents have occurred. The lower boulder field is one of the more rugged ones in Massachusetts. Cracks between some of the large boulders can be 10 to 25 feet deep.

The meadows at the base of Todd are quite aesthetic and among Mohawk's main attractions. The lower meadow covers approximately 49 acres. The upper meadow covers approximately 20 acres.

b. Old-growth Forests

Old growth forests on Todd Mountain's north and south sides ride fairly high on the ridge, generally around mid-ridge. However, the lower old growth boundary drops to near the bottom of Todd's east side where the boulder field presents a barrier. The total old growth acreage on the east side is approximately 50 acres. Near the summit of Todd, hemlocks and oaks reach advanced age and take on gnarled forms from exposure to wind and the shallow soils. The hemlocks near Todd's summit appear to be about as old as the species gets in Massachusetts. However, life for the trees on Todd Mountain's eastern side is precarious. Many topple when spring snowmelt and subsequent rains create very loose soil. As a consequence, in the center of the east-side bowl, tree ages are somewhat less than higher on the ridge, but still average well over 200 years. The species diversity in the bowl is virtually the same as the north-side forest, but higher than the south-side forests that heavily favor oak. Some of the tree shapes in the South-side forests are classic old growth and visitors can view these shapes from the bottom of Todd without endangering fragile vegetation.

c. Exemplary Hardwoods of the East-side Forest

At the lower boundary of the old growth on Todd's eastern side, a remarkable grapevine grows. Its girth is 24 inches and is the largest we've seen in Massachusetts. However, the grapevine is but one of the superlatives of the east-side forest. Other superlatives on Todd include a black birch, which a Harvard Forest scientist and Robert Leverett dated in the late 1980s. The core was 29 centimeters long of which 17 were not countable due to rot. The 12 centimeters that were aged produced a solid count of 183 years. This black birch was one of the first that allowed us to confirm the antiquity of the species in the old growth areas of Massachusetts. Data we had previously seen and discussions with foresters and forest ecologists suggested 150 years as a maximum age for black birch. However, black birch between 150 and 200 years of age are relatively common in old growth areas, and there is at least a scattering of birch between 250 and 300 years of age.

Taken as a whole, tree size in the east-side forest within the bowl area does not match the high canopy forest of the north-side forest, but there are still many individually outstanding trees, including some surprising champions. At the lower boundary of the old growth, there is evidence of an old woodlot. Below the woodlot is an old stonewall, built in the latter 1700s. Farther out on the outwash terrace, beyond the stonewall that marks the boundary of old sheep pasture, is an old barbed wire fence line. A line of large, old sugar maples at the base of the east-side bowl forest mark an eighteen hundreds sugar-bush. The trees are generally 9 to 11 feet in circumference and 90 to 110 feet tall. They are impressive, but not that unusual for Massachusetts. However, two sugar maples stand out from the rest. The first is the Massachusetts State champion sugar maple. The last set of measurements for the tree placed its height at 103.8 feet and its girth at 18.3 feet. Its average spread is 90 feet. This earns the tree 346 points on the State's champion tree formula. The tree once had a third major branch that fell off 10 years ago. Robert Leverett had measured the girth at 19.3 feet before the breakage. The tree is arguably a double. Its age is likely circa 250 years.

Other trees growing at the lower boundary of the bowl of the east-side forest include the record height sugar maple. At last measurement, it was 138.2 feet and 11.5 feet in girth. This maple has no serious competitors in

New England and so far not in the entire Northeast. Comparably tall maples may eventually be found in New York and/or Pennsylvania, but so far, the Todd tree is the champion. Like the north-side white ash trees, this tall east-side maple is pushing the limits for its species for the latitude. Unfortunately, the old maple has a large area of rot where a shelf fungus dropped off a year ago. It is unlikely that this maple will be standing for many more years. The tree's height measurement is a story unto itself. Robert Leverett originally measured the tree in the early 1990s with a Haga altimeter borrowed from Harvard Forest. The method used to measure the height was a standard forestry technique, which suffices for straight-trunked conifers, but can lead to errors, especially over-measurements for tall, broad-crowned hardwoods. Eventually the tree's height was accurately determined when Jack Sobon of Windsor, Mass and Robert Leverett re-measured the tree using a transit. The tree at that time was 134.6 feet. The tree continued to grow at the rate of 4 inches per year. The tree is now at the point of decline. The 138.2 feet is the high water mark for the sugar maple.

Close to the tall maple grows an extraordinary bitternut hickory. It is a young tree, not more than 60 years of age, but is has reached a remarkable height of 124.6 feet at the very slender girth of 3.4 feet (1.08 feet in diameter). This gives the bitternut hickory a height to diameter ratio of 115 to 1, the highest for any tree thus measured in New England that is 75 or more feet in height. Proportions for saplings produce high height to diameter ratios. Tall trees with greater height to diameter ratios are common in the southern Appalachians where growing conditions are more favorable. Ratios of as high as 176 to 1 have been obtained for trees in the 140-foot height class. However, 115 to 1 is remarkable for New England and the statistic is more than just a curiosity.

A short distance away from the sugar maple and to the east grows a white ash that just exceeds 130 feet in height. It is a relatively young tree and in time should reach 135 to 140 feet, if not more. To the west grows a northern red oak that just reaches 130 feet. The herb layer includes blue cohosh, maidenhair fern, dwarf ginseng, dutcheman's breeches, squirrel corn, wild ginger, baneberry, and other rich woods species.

Dr. Lee Frelich of the Center for Hardwood Ecology at the University of Minnesota utilizes height to diameter ratio to measure growing conditions. Trees of similar diameter are compared for the same species. Regression curves can be developed to analyze site growth characteristics as an alternative to the traditional site index, used in forestry. The traditional index, which uses height at 50 years of age, makes sense for even-aged tree plantations where age is well known, but site index is impractical for natural, multi-aged forests.

d. Tall Pines of the East-side Forest

The most striking woodlands of the east-side forest area are two mature stands of white pine. One is at the north end of the upper meadow (known locally as Stafford Meadow) and the other stand is at the south end. The north end stand has been named the Algonquin Pines in honor of the Algonquin-speaking Indians who lived in the surrounding regions. The Algonquins were New England's Indians. The Mohawk, which were part of the Iroquois Confederacy, were New York Indians.

The south end stand is called the Trees of peace to honor all Indian nations, but especially those that we assume used the Mohawk Trail. From our research, this at least includes the Mohawks, Mahicans, Pocumtucks, Nipmucks, Abenakes, Wampanoags, and Narragansetts. Other Iroquois nations likely used the trail on occasion and perhaps the Agawams and Sokokis. However, this is speculation on our part.

Both white pine stands are composed of trees that are in the 125 to 150-year age class. However, at the lower borders of the stands there are belts of younger trees. Basal areas of the Algonquin Pines are impressive. They vary from 220 to 320 square feet per acre. Basal areas for the Trees of Peace are typically 200 to 280 square feet

per acre. The acreage of the Algonquin pines is 4 acres. The acreage of the Trees of Peace within the east-side forest, including an area called the Mast Pines, is approximately 17 acres. The total area of the Algonquin Pines and the Trees of Peace then is approximately 21 acres. This does not include the areas of younger pines at the borders such as those closer to the Deerfield River. The area of younger pines covers around 40 additional acres.

Stem densities vary greatly within the mature pine stands, but average 75 per acre. Studies of pine densities in the younger and older areas are on-going. We hope to eventually develop predictive models that will statistically explain the growth rates and the densities that we are seeing.

The most noteworthy physical feature of the 21 acres of mature pines is unquestionably the remarkable heights that the trees have reached. There are 25 white pines in the Algonquin Pines, Trees of Peace, and Mast Pines that reach 150 feet in height, 11 are in the Trees of Peace, 10 are in the Algonquin Pines, and 4 are in the Mast Pines. These pines added to 1 in the Cherokee Pines, 7 on the north side of the Todd-Clark ridge, 6 in the Pocumtuck Pines, and 1 in the Encampment Pines equals 40 and gives Mohawk the third highest concentration of 150-foot white pines in the entire Northeast. There may be a few places in New York's vast Adirondack Park that have similar concentrations, but so far we have confirmed on a handful of 150-footers in the Adirondacks.

Before leaving the subject of 150-footers in Mohawk, let's examine the 40-statistic a little more closely. It carries considerable weight. At present, we have confirmed 47 pines in Massachusetts that have been laser-measured to a height of 150 feet or more. Thus, Mohawk Trail State Forest has 85 percent of the Commonwealth's 150-footers. Elsewhere in New England, 63 pines have been verified in New Hampshire, and so far, 1 in Maine (we think). So Mohawk Trail State Forest has 36% of all accurately measured 150-footers in New England. Future discoveries will unquestionably lower the percent, but Mohawk's 150-footers will likely stay dominant and barring some major discovery compose at least 1/3rd of the New England total. That is a remarkable statistic and attests to the rarity of trees in the 150-foot height class in present-day New England.

The greatest concentration of 150-footers in Mohawk includes the 11 pines in the Trees of Peace, the 4 pines in the adjacent Mast Pine area just down hill, and 1 pine in the adjacent Cherokee Grove uphill for a total of 16 pines over 150 feet tall in a concentrated area. At least 3 and probably 4 pines will join the 150 Club with the next 3 to 5 years, barring blow down. The tall tree significance of the area, at least from a statistical perspective, will likely be maintained for quite a number of years. Those are the general statistics. What about specific trees?

The two most notable pines in the combined Trees of Peace, Mast Pines, and Algonquin groves are the twin sentinels, the chiefs. The Chief Jake Swamp Tree and the Chief Joe Norton Tree, both named for current-day Mohawk chiefs, are two of Mohawk's five flagship pines. Both of these pines were initially measured by transit in November of 1992 by Jack Sobon and Robert Leverett. At that time the Jake Swamp tree was 155.2 feet in height and the Joe Norton tree was 155.6 feet. Today the trees are 163.5 and 162.2 feet in height, respectively, and remarkably both heights include recovery from small crown breakages. The Joe Norton tree suffered the more extensive breakage. Not counting recovery, the average annual height growth for the Jake tree has been 9.1 inches. Given that the age of the Jake Swamp white pine is approximately 145 years, this is a higher than expected annual growth rate for white pines in that age class – at least as indicated from the available silvicultural data. The expected rate of height growth for trees approaching 150 years of age is more on the order of 3 to 5 inches per year. At least, that is our understanding.

It is important to understand that the Jake Swamp tree has been climbed twice (1998, 2001) and the Joe Norton tree once (2001) to get precise height measurements with plumb lines. So the current measurements we cite are

accurate to within one to three inches. Incidentally, we know of no such comparable tree height data on tall eastern trees that are standing.

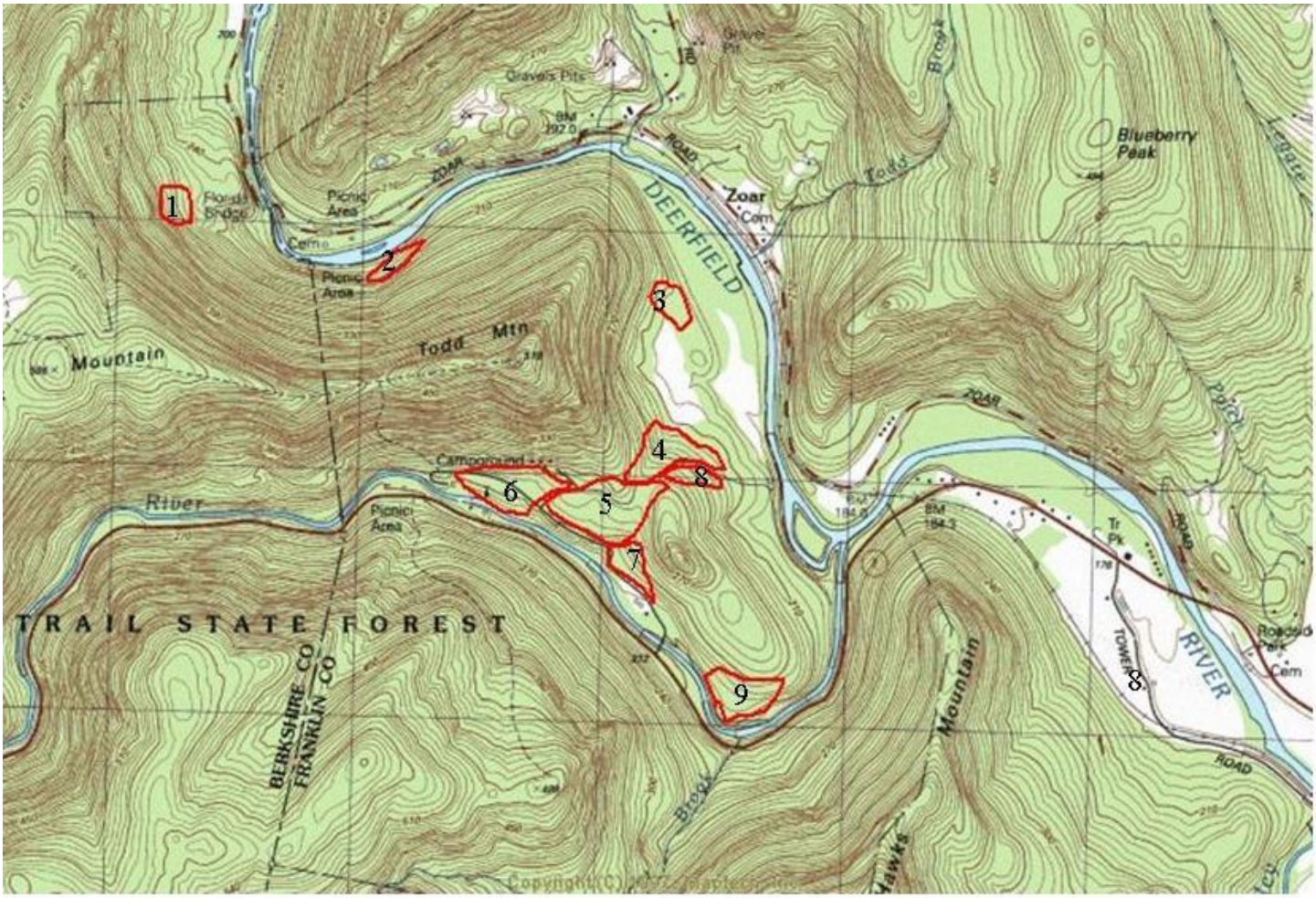
The above numbers are not meant to imply that the high growth rates apply only to the sentinel pines. The impressive height growth of the Jake Swamp and Joe Norton trees is repeated for the other pines in the tall pine stands of Mohawk Trail State Forest. Based on current silvicultural data, the rates of growth for Mohawk's tall pines is well worth monitoring, and to this end, Friends of Mohawk Trail State Forest has begun a study with DCR's approval to do that. Details are in Section IV. The following table summarizes the tall pines by height class.

Figure 13: Summary of Tall pines of the East-side forest.

Location	>= 140 ft	>=150 ft	>=160 ft
Trees of Peace	33	11	2
Algonquin Pines	19	10	
Mast Pines	13	4	
Encampment Pines	4	1	
Totals	69	26	2

A few words are in order about the data in above table. The effort required to accurately measure tall trees growing closely together requires a lot of experience and patience. The job cannot be done by novices nor can it be done with the use of a clinometer even by an experienced person. At the least, a laser rangefinder clinometer, and electronic calculator with trigonometric functions are required. The exact methods used are explained on the Eastern Native Tree Society's website: www.uark.edu/misc/ents. The methods have been perfected to yield results with an accuracy of +/- 1.5 feet with a 90% probability. Higher accuracies can and have been obtained and the methods used are applied to a sample of trees used for stand callibration. Instruments are constantly being checked for out of callibration conditions. The last section of this report provides a more complete explanation of the measurement method employed.

Figure 14: Location of Named Pine Stands.



Key to white pine locations:

1. Shunpike Pines
2. Elders Grove
3. Algonquin Pines
4 Trees of Peace
5. Pocumtuck Pines
6. Indian Springs Pines
7. Headquarters Hill Pines
8. Cherokee Pines
9. Encampment Pines

e. Historic and Cultural Features of the East-side Forest

John Wheeler's Grave

There are several historic features on the east side of Todd Mountain that are important to discuss. First there is the gravesite of John Wheeler who was a revolutionary soldier in what would have been the equivalent of the modern day Army Medical Corp. Wheeler owned the land in the vicinity of his grave. The site is maintained by the Daughters of the American Revolution. Grace Wheeler, a relative of John Wheeler by marriage did extensive research in the 1990s and established that Wheeler is the ancestor of 5 American presidents, the Bushes being among them. This extraordinary association should make the gravesite a state (or national)

monument. However, there has been a curious indifference to the Wheeler lineage by the State. We are at a loss to explain it. The location of the gravesite is at the east end of the lower meadow.

Old 1700s Cart Road - Shunpike

A third historic feature is a late 1700s cart road that parallels the Deerfield River from the lower meadow to Zoar Gap. The road is shown on old maps as the famous Shunpike, which starts at the confluence of the Cold and Deerfield Rivers and runs to where the northern shoulder of Todd Mountain reaches the Deerfield River. There was a crossing there. Little is known about the origin of the road beyond. It is a reasonably safe bet that it follows an old Indian trail. Later it became an old county road according to Charlemont residents. In the 1930s and thereafter, it served as a route to extract timber from the lower sides of Todd and Clark Mountains.

Old 1800s Vintage Apple Trees

The upper and lower meadows both served as orchards during the 1800s. Two apple trees remain from that period. Around 1990, a half dozen trees remained. One of the two survivors is quite old, perhaps 150 years in age. It still bears fruit and grows at the south end of the lower meadow.

Red Pine Plantation

A red pine plantation lies at the north end of the lower meadow, which represents one of the efforts of the Civilian Conservation Corp projects of the 1930s. The overall symmetry of the pines, individually and as a stand, makes them an attractive feature for visitors who like a pruned-managed look. In fact, weddings have been held in the red pine stand. The red pines, themselves, have grown rapidly since their planting and a few are now between 100 and 110 feet in height. The stand has not been thoroughly searched, but it is likely that there are a few pines circa 112 or 113 feet. A single tree reaches 116.7 feet in height and is the second tallest of its species known in Massachusetts. However, the stand is beginning to show signs of deterioration. Like white pine, red pine does not reproduce in its own shade, so deterioration of the stand can be expected to continue. The red pines serve a useful educational purpose to illustrate both what has worked and what hasn't in our efforts to improve on natural regeneration of trees. It will be interesting to follow the growth of these pines. There is little doubt that many will exceed 120 feet in 5 to 10 years and a few before that.

Tree of Peace in Lower Meadow

In May 1994, Chief Jake Swamp of the Akwesasne reserve at Hogansburg, NY, planted a white pine near the north end of the lower meadow at a ceremony entitled "In Remembrance of the Lost Ones". Chief Swamp recited, in abbreviated form, the legend of how the Iroquois people formed a single nation. Approximately 240 people attended the event. The tree is one of two planted by Chief Jake Swamp as symbols of support for Mohawk Trail State Forest's role in maintaining cultural awareness of the past role of the Mohawks in western Massachusetts.

Trees of Peace Dedication

A sign stands within a path down through the Trees of Peace dedicating the grove to Native Americans who would have traveled the area. Commissioner Peter Webber of the Department of Conservation and Recreation (DCR) dedicated the Trees of Peace grove in July 1997. DCR was then named Department of Environmental Management (DEM). The dedication was part of an on-going effort to strengthen cultural ties between Native

Americans and European Americans by recognizing the frequently misunderstood role of the former in the pre and post-settlement eras of this nation.

Lakota Ceremony and Tree Dedication at the Trees of Peace

In November 2001, Chief (Dr.) Arvol Lookinghorse led a ceremony within the Trees of Peace stand, which was attended by 45 people. Chief Lookinghorse is perhaps one of the 4 or 5 best-known members of the Lakota Nation in the world. He has a United Nations role as a representative of indigenous groups, which seek a formal seat at the United Nations. Chief Lookinghorse is internationally known for his work for world peace. Accordingly a tree in the grove, formerly named the Flag Tree, was renamed for Chief Arvol Lookinghorse. A second pine was named for elder Dave Chief, who regularly accompanies Dr. Lookinghorse on his trips. The dedications mark an area now referred to as the Lakota Grove.

Algonquin ceremony

In the fall of 1993, Canadian Algonquin elders William Commanda and Frank Decontie performed a ceremony at the west end of the Algonquin Pines. William Commanda is an international figure and spiritual leader of the Algonquin nation in Canada. The ceremony marked the beginning of a 7-year association between the Algonquins and Mohawk Trail State Forest. Frank Decontie became a Native American advisor to Friends of Mohawk Trail State Forest. Trees have been named in honor of William Commanda and Frank Decontie who passed away in August 2001. A tree has also been dedicated to Sandra Decontie who carries on her husbands work. Frank Decontie's tree was the first in the Algonquin Pines to be confirmed to over 150 feet.

Mike Perlman Tree

Dr. Michael Perlman was a well-known ecologist and psychologist who died in April 1998. He was a peace activist and a tireless supporter of environmental causes. A tree, the Mike Perlman Pine has been named in his honor. The tree grows in the Algonquin grove. Dr. Perlman wrote several books. One is entitled "The Power of Trees – A Reforesting of the Soul". He was a great friend of Mohawk Trail State Forest.

Karl Davies Tree

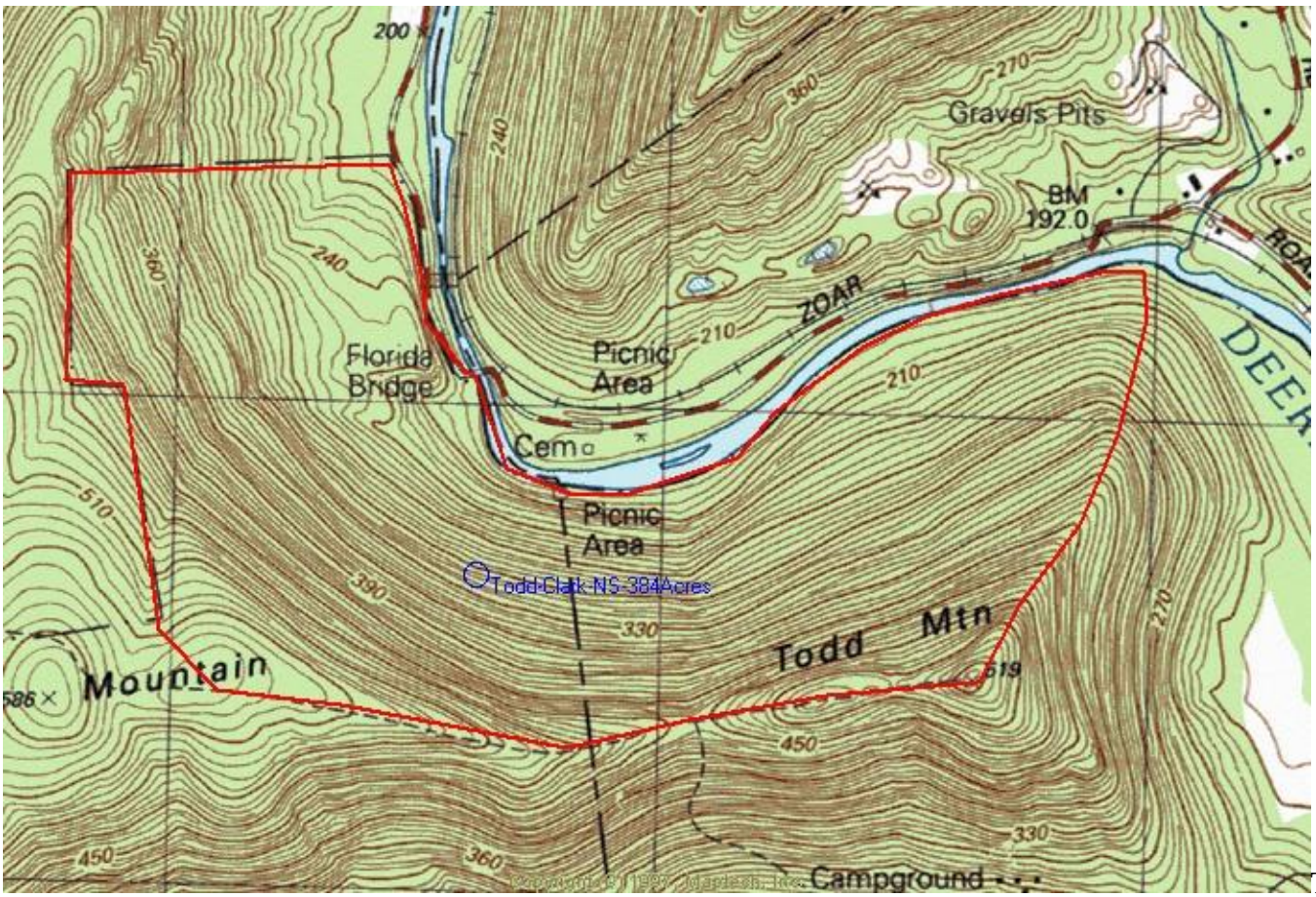
On October 25, 2003, a ceremony was held for Karl Davies of Northampton, MA to honor Davies for his exemplary record as a forester and caring custodian of the forests. Sixty people attended the symbolic dedication of the tree. Karl Davies was known for his attention to the needs of wild life and the importance of maintaining the genetic heritage of native tree species. He was a fierce critic of poor forestry practices and was working on a process to evaluate a cutting operation in terms of the best silvicultural practices for the long term ecological and economic health of the forest.

Music and Poetry About Mohawk Trail State Forest

There have been at least 3 songs and 3 poems written about Mohawk Trail State Forest in the 1990s, inspired by the tall trees and the meadows of the East-side forest. Collecting the music and poetry will be an area of future research for Friends.

3. North-side Forest (Todd-Clark Ridge):

Map: MTSFToddClarkNSForest.jpg



This North-side forest covers approximately 385 acres.

a. Landform

The North-side Forest of the Todd-Clark ridge is no ordinary place. It has a story to tell. The entire region is a bowl-shaped mountainside that creates a fairly large area of slow drainage. Elevations on the north side of Todd-Clark range from 590 feet at the Deerfield River to 1923 feet atop Clark Ridge. The summit of Todd is 1,711 feet. The drop from Clark to the Deerfield represents a 1,333-foot elevation change and the change occurs in a relatively short distance. The average grade along a transect from the point of rapid drop from Clark's summit down to the river is 66%. Overall, the slope of Todd-Clark's north side ranges from 50 to 75%, with the mean around 60%. An important feature of the bowl is its boulder fields, which along with the relatively steep slopes and a very narrow ridge top limited logging operations over the 385 acres of the north side to the bottom half of the ridge. However, fingers of old logging operations extend farther up into areas with few boulders. The lower slopes of Todd-Clark received a good deal of attention from loggers in the 1930s as part of a Civilian Conservation Corp effort. The paths of several skid roads reaching halfway up Todd-Clark are especially apparent in the winter from nearby Negus Mountain.

b. Historic Features

Shunpike Route

The description of the north side of Todd-Clark thus far is not remarkable. However, there are features, both human-made and natural, that make the north side an exceptional place. Two human creations are especially noteworthy. Traversing the north part of the Clark side of the ridge is the old Shunpike route that was established in the late 1700s to avoid the tolls charged to cross Hoosac Mountain on what is now the Whitcomb Hill road. Few people know about the old Shunpike route, but it is an important historic feature of the mountain complex and should be both acknowledged and preserved.

Mohawk Indian Mountain Trail

An even more historic feature of Mohawk Trail State Forest runs along the summit of the Todd-Clark ridge. This second feature is one of our most historic in all of Massachusetts, yet perplexingly one of our least understood and least appreciated. We speak of the mountain branch of the historic Mohawk Indian Trail that runs along the crest of the Todd-Clark ridge. Another branch follows the Cold River, but its exact path has not been preserved. In fact, all but segments of the river path that exist as county roads have long been obliterated due to erosion and timbering. However, the mountain branch continues to exist as a trail for about 1.5 miles. Its use was first by Indians, then by British soldiers and colonials, and finally, only by colonials. The extent of all the uses is more speculation than fact, but it did serve as a supply route for Fort Massachusetts at North Adams. The origin of the trail probably dates back to the late 1500s when contact between the Mohawk in eastern New York and Algonquin tribes in western Massachusetts and the Connecticut River valley was being established most likely for trade. As the Mohawks gained dominance due to their receipt of weapons from the British, the route developed into a warpath. It is its warpath fame for which the trail is primarily known. Indian nations that made use of the trail include Mohawk, Pocumtuck, Nipmuc, Abenaki, and Wampanoag. King Phillip took from 400 to 600 warriors across the path in 1674 to try to gain the support of the Mohawk for what has become known as King Phillip's War. The Mohawk used the trail to attack the Sokoki in New Hampshire and the Pocumtucks in what is today Old Deerfield.

Famous personages that traveled or probably viewed the trail included Ethan Allen, Benedict Arnold, and the Mohawk ambassador Saheda. It is not clear if Henry David Thoreau ever walked the trail when he was in the Charlemont area. The odds are that he didn't. Nor we doubt that Mark Twain did when he visited a friend in Charlemont, Mass. We'll never know for sure.

At least a couple of authors have written about the historic Mohawk Trail route atop the Todd-Clark ridge. Research has centered on the rediscovery of the mountain trail by an elderly gentlemen named Deacon Field who along with Judge Williams reconnected to the trail as remembered by Field as a boy. The rediscovery came late in the 1800s. The trail lay dormant for close to a century and apparently only a few people were alive in the latter 1800s who could remember that the trail had ever existed. The last author to write about the trail apparently did so from an armchair perspective. He doubted that Indians had ever made use of the mountain route. He was evidently not aware of a substantial cache of artifacts that had been found along the trail over the years by residents of Charlemont, Mass. Robert Leverett is acquainted with a family whose son had quite a collection.

As previously mentioned, the role of the mountain branch of the Mohawk Trail became important around 1760 as a re-supply route for Fort Massachusetts in North Adams. After the end of the French and Indian Wars

around 1763 the trail may have been known as Hawk's Road. However, it was notoriously treacherous descending Todd Mountain from the saddle between Todd and Clark on the south-facing side. What is named the River Road was the Turnpike as it went up river to what became later known as the village of Hoosac Tunnel.

Today, the 1.5-mile surviving mountain branch of the Mohawk Trail exists as a recreational path, known for its spectacular views. The scenic vistas across and into the thousand-foot deep Cold River gorge prompted author Bill McKibben to describe the scenes to Robert Leverett in the early 1990s as one of the most under-appreciated areas he had seen. In 1997, Tom Dosteau, a pipe carrier for the Algonquins performed a ceremony at Indian Lookout.

c. Forest Zones of the North-side:

Outside the spectacular terrain, the exemplary forest on the north side of the Todd-Clark ridge is the single most distinguishing natural feature. We have divided the forest into five separate zones.

Zone #1: The upper one fourth of the north-side is dominated by a mix of hemlock, black birch, and northern red oak. Striped maple is a frequent understory component. There is a sprinkling of other canopy species, including red maple, sugar maple, white ash, beech, white birch, and yellow birch, but they add only marginally to the overall stem density and canopy cover. The upper one fourth is the region of greatest average tree age. Many trees are between 150 and 300 years of age. A few hemlocks approach 400 years of age.

Zone #2: An area that follows the eastern backbone of Todd Mountain is dominated by what appears to be fire successional hemlock. The trees are uniform in age at around 100 to 130 years and are slender and crowded. This area has no doubt seen a lot of human disturbance.

Zone #3: A narrow strip of forest at the eastern end of the ridge complex starting about 100 vertical feet above the Deerfield River and going upward another 75 to 100 vertical feet consists of a mix of white pines and hardwoods. Ages range from around 100 years to near 200. An area of pines called the Elder's Grove contains the largest and tallest trees in the north-side forest.

Zone #4: The area below the pine-hardwood zone is dominated by northern red oak and appears fire successional. Other species include not surprisingly red maple and black birch. Ages range from 95 to around 130 years for the oaks as dated by Neil Pederson of Lamont Dogherty Earth Observatory.

Zone #5: The remainder of the acreage on the Todd-Clark ridge's north side is a rich mix of hardwoods with an occasional conifer or clump of conifers, either hemlock or white pine. Zones #4 and #5 form one of the most remarkable forests in New England. The woodland might be called the forest roof of Massachusetts and comes closer to any in the State as being a true "Commonwealth Forest".

d. Old-Growth Forests:

The forest on the north side of the Todd-Clark ridge is a reservoir of old growth and mature second growth. An area of old growth follows the contours of the ridge at about two-thirds the distance upon the ridge and runs for approximately 1.1 miles. The irregular boundaries of the old growth make accurate delineations difficult. However, the old growth covers not less than 100 acres. For untrained eyes, most of the old growth is nondescript. Tree size is modest. However, about half of the old growth and a larger area of second growth on the lower slopes form an extraordinary, mature forest of about 135 acres. This is largely second-growth forest,

but it is rapidly approaching old growth status. One area is a stately stand of pines that are 140 to 170 years of age called the Elders Grove. The hardwoods are generally 100 to 150 years of age.

The remainder of the north-side forest is younger, around 70 to 80 years of age, but this latter area still has embedded clusters and individual trees that are 150 years old or older. We presume the largest were though to be hollow inside when the last logging operations were conducted on the ridge, so they were left as isolated old trees. These trees have served well as seed sources for the young vigorous forest that has grown back.

e. High Canopy Forest

The most remarkable area of forest on the north side of Todd-Clark is the 135 acres just described, which despite its boulder fields, possesses some of the best growth conditions yet documented for Massachusetts. Tree height is the most important measure that distinguishes the productivity of the north-side forest and the statistics speak for themselves. Nine species of trees in the 135-acre area reach record height for Massachusetts, New England, or the entire Northeast. To compare the growing potential of sites, we use the Eastern Native Tree Society's Rucker Site Index, which the reader will recall averages the heights of the tallest member of the 10 tallest species of trees for an area. A high Rucker index is a good measure of a site's overall growing capacity. By using the index to make comparisons among similar-sized areas, we can gain a better understanding of the growing potential of each. An added advantage of the Rucker index for a natural, mature, multi-aged forest is that the index does not require that we know the ages of the trees. A very good growing site will produce tall trees quickly so that a site with 80 to 120-year old trees can exhibit a spectacular canopy.

To assess the North-side Forest, we revisit some Rucker indices. At 135.27, Cook Forest State Park, PA is number one in the Northeast. Cook Forest covers slightly less than 8,000 acres. Zoar Valley, NY, is second at 134.69. Mohawk Trail State Forest, taken as a whole, is third at 134.45 and covers slightly less than 7,000 acres. The area covered by the index covers about 2,000 acres. The fourth highest index is Fairmount Park, Philadelphia at 128.5. The fifth highest index is the Massachusetts site Ice Glen in Stockbridge, MA, which computes to 125.4 and reaches this index within an area of about 75 acres. Wintergreen Gorge, PA is sixth at 125.3 and covers about 75 acres. In general, an index of 100–105 would be very good for most high quality New England forests.

With these preliminary comparisons to guide us, the Rucker index computed for the 135-acre swath is presently a surprising 131.3. With the possible exception of Zoar Valley, NY, we know of no comparably-sized area in the Northeast that exceeds this average. Larger areas elsewhere in the Northeast, including all of the high-growth areas of Mohawk Trail State Forest (134.45), exceed the north-side forest, but that is it. What explains the extraordinary growth statistics of the north-side forest? We are still trying to understand the reasons, but think we are making progress.

The north side of the Todd-Clark ridge has a rock base of amphibolite, which accounts for the calcium, magnesium, and iron available to tree roots. So far 13 species of ferns have been catalogued including maidenhair fern. Other rich woods indicator species growth on the north side including blue cohosh, foam flower, wild ginger, dwarf ginseng, bane berry, and American ginseng. So a rich mineral base is definitely present. The concave bowl of the cool north side of Todd-Clark encompasses an elevation change of 1,333 feet. The boulders within the bowl are in a very stable configuration and the boulder fields are continually fed moisture from the large concave area above that serves as a reservoir to slowly meter out moisture. Although annual rainfall on the ridge is unknown, it is likely around 55 inches per year. All these factors combine to provide extraordinary growing conditions.

Figure 15. A comparison for individual species for the north-side forests for maximum height within encompassing geographical areas follows. (The data are courtesy of the Eastern Native Tree Society (ENTS)

Species	Max Hgt on north ridge	Max hgt in MTSF	Max hgt in Mass	Max hgt in New England	Max hgt in Northeast	Max hgt in East
White pine	161.2	163.5	163.5	166.1	181.3	186.0
White ash	147.4	147.4	147.4	147.4	147.4	163.4
Sugar maple	131.9	138.0	138.2	138.2	138.2	152.5
N. red oak	130.6	130.6	130.6	130.6	132.1	146.5
A. beech	130.0	130.0	130.0	130.0	130.0	138.5
Bigtooth aspen	127.7	127.7	127.7	127.7	127.7	127.7
A. basswood	125.5	125.5	125.5	125.5	125.5	125.5
Red maple	122.4	122.4	122.4	122.4	136.6	145.5
Black cherry	119.2	119.2	121.5	121.5	137.3	146.7
Bitternut hickory	118.6	128.4	128.4	128.4	134.0	155.0
E. Hemlock	117.8	131.0	136.6	136.6	145.8	169.8
Black birch	116.2	116.2	116.2	116.2	116.2	117.3
American elm	112.2	112.2	118.5	118.5		133.5
White birch	110.5	110.5	110.5	110.5	110.5	110.5
Yellow birch	101.1	101.1	101.1	101.1	101.3	106.0
Hop hornbeam	71.1	73.1	73.1	73.1	73.1	76.3

The above table lists fifteen species of trees that reach 100 feet or more in height in the North-side forest of the Todd-Clark ridge. Eight species reach 120, 5 reach 130, 2 reach 140, 1 reaches 150, and 1 reaches 160. How far removed are these maximums from what might be generally seen across the range of the North-side forest? Let's examine the frequencies with which different species that make up the canopy achieve different height thresholds. The following table shows the frequencies for seven height thresholds. The first column lists the species. The second column lists the relative abundance as a canopy species. The remaining columns list the relative abundance within the height thresholds for each species based on its representation in the canopy. For instance, a high abundance for a species in a height threshold column simply means that when that species is seen in the canopy its probability of reaching the height threshold is high. Its absolute numbers meeting the threshold can still be low if its overall abundance is low within the canopy.

Figure 16. Distribution of Tall Trees in the North-side Forest

Species	Overall abundance	Hgt >=150 ft	Hgt >=140 ft	Hgt >=130 ft	Hgt >=120 ft	Hgt >= 110 ft	Hgt >= 100 ft	Hgt >= 90 ft
White pine	Low	7 trees	High	Most	All	All	All	All
White ash	High	None	Low	Scattered	Common	Very common	Very common	Very common
Sugar maple	High	None	None	Scattered	Fairly common	Very common	Very common	Very common
N. red oak	High	None	None	Rare	Scattered	Common	Common	Very common
A. beech	Low	None	None	Rare	Rare	Scattered	Common	Very common
Bigtooth aspen	Low	None	None	None	Uncommon	Fairly Common	Common	Very common
A. basswood	Scattered	None	None	None	Rare	Scattered	Common	Very common
Red maple	Fairly High	None	None	None	Rare	Scattered	Common	Very common
Black cherry	Low	None	None	None	None	Scattered	Common	Very common
Bitternut Hickory	Low	None	None	None	None	Scattered	Common	Very common
E. hemlock	Fairly High	None	None	None	None	Scattered	Scattered	Common
A. elm	Very low	None	None	None	None	One	One	One
Black birch	High	None	None	None	None	Scattered	Fairly common	Very common
White birch	Scattered	None	None	None	None	One	Rare	Common
Yellow birch	High	None	None	None	None	None	One	Common

The frequencies in the above columns communicate to us that over a large area the canopy is uniformly above 100 feet. In places, concentration of ash and maple create a super canopy that averages close to 120 feet. In other areas, the mix of species creates a canopy around 110 feet high. Lower on the ridge, the super canopy of the Elders grove of white pine exceeds 140 feet.

The lower reaches of the old growth on the North-side Forest make up part of the tall canopy forest. The 147.4-foot white ash is in the old growth belt as are a number of 130-footers. This uniformly high canopy contrasts slightly with the forest on the north-facing side of Dunbar Brook in Monroe State Forest, a few miles to the north. In Dunbar, the crowns of the older ash trees have been pared back more. We have not broken 140 feet on an ash in the Dunbar watershed and have broken 130 feet only twice, although the canopy average reaches 100 feet to high up on the Dunbar ridge.

As indicated, the most prominent area of high canopy forest in the north-side forest is the Elder's Grove white pine stand, which occupies 4 acres and lies 100 vertical feet above the Deerfield River. The grove has been dated by Harvard Forest and the white pines are 140 to 170 years of age. Five trees of the 19 pines that make up the Elders Grove exceed 150 feet in height. They are listed below.

Figure 17. The Elder Grove White Pines

Height-ft	Girth-ft	Name
161.2	11.2	Saheda
160.1	11.4	Tecumseh
152.6	9.8	Washakie
151.7	8.9	Crazy Horse
150.6	7.7	Ouray

f. Rates of Pine Growth

The Saheda pine was measured with a transit in 1994 by Jack Sobon and Bob Leverett and was, at the time, 160.1 feet tall. It suffered subsequent crown damage, but has sense regained it. The Saheda pine was climbed in November of 1998 by Will Blozan, an arborist from Black Mountain, NC and president of the ENTS, and measured with a plumb line. At the time the tree was 158.3 feet tall. Its current height of 161.2 feet indicates an average growth rate of 7.0 inches per year. Its present height of the Saheda pines is probably around 162 feet. It hasn't been re-measured since the end of the 2002 growing season. The tree is approximately 170 years of age. A tree in the vicinity was dated by Dr. David Orwig of Harvard Forest and found to be around 170 years of age. The Tecumseh tree was also measured in 1994 and was 154.6 feet tall at the time. Its height at last measurement was 160.1 feet, which was taken on October 24, 2003- the end of the growing season. Its growth rate has been around 8 inches per year. The Tecumseh's last measurement included the team of Robert Leverett, Howard Stoner, and Gary Beluzo. All three made the same distance measurements to crown and base using three separate sets of instruments. Conservative angle measurements were used. The close agreement of the measurements all based on lasers for distance and clinometers for angles lends credibility to the measurement technique, which will be explained fully in a future attachment to this report. The Tecumseh tree was climbed by Will Blozan on Oct 24, 2003 and taped to a height of 160.1 feet.

Other notable trees growing in the Elder's Grove include the New England champion red maple at 122.4 feet in height and 6.5 feet in circumference. Other red maples in the area are between 100 and 113 feet in height. White ash on the periphery of the Elders Grove reach to impressive heights of 120 to 125 feet. One tree reaches 138 feet in height. The area of the Elders Grove appears to have been an old sheep pasture in the mid-1800s. Rock piles and part of a rock wall are still in evidence. The land was probably owned by the Nelson family whose cemetery is on the other side of the Deerfield River.

Another area that has a small cluster of very tall pines is at the north end of the north-side forest in the Shunpike region. A large pine there called the Joseph Brant Pine reaches 160.5 feet in height and is 10.6 feet in circumference. A second tree called the Oneida Pine reaches 155.0 feet in height and 9.8 feet in circumference. The five pines in the Elder's Grove and the two pines in the Shunpike area make up all the 150-footers in the north-side forest. Figure 11 summarizes the tall pines in the North-side forest.

Figure 18. Distribution of Extremely Tall Trees in North-side Forest:

Location	>= 140	>=150	>=160
Elders Grove	19	5	2
Shunpike Pines	5	2	1
Totals	24	7	3

g. Other Productivity Measurers for the North-side Forest

Other measures of the productivity have been taken for the North-side Forest. Erhard Frost, a forester from Vermont, and Robert Leverett took basal area measurements in the center of the bowl with an area dominated by white ash and sugar maple. Measurements indicate that basal areas commonly average between 180 and 200 square feet per acre and the densest areas average 220. This is very high for a hardwood forest although an even-aged stand of aspen is equally high for a small area within the north-side forest.

The age structure of the old growth forest on the north side of Todd-Clark is highly varied due to the change of disturbance regime from the exposed ridge crest to the center of the bowl. The upper elevations of the ridge receive more wind and the mix of white and red oak and hemlock reflect the harsh growing environment. Ages are typically 170 to 250 years along the crest. However, little changes in the age structure within the bowl where half a dozen species commonly reach 150 to 250 years in age. However, small pockets of hemlock, especially at the Todd Mountain end of the ridge complex, reach 300 to 400 years.

Other datings by Robert Leverett have revealed a swath of black birch between 150 and 200 years of age, which suggests a disturbance between 1800 and 1850. More work needs to be done to better understand the age structure of the north-side forests, but a minimum of 100 acres can be safely declared as old growth.

Gary Beluzo and Robert Leverett performed brief studies of species distributions in the Elders Grove and parts of the Shunpike area on Sept 14 and Sept 20, 2003. The purpose of these two studies was to better understand the direction of succession within the mature white pine stand and other areas. The tables below show the results of seven plots. Five variable plot samples were taken across the Elders Grove and two in the Shunpike area. Looking into the ridge, the Elders grove was sampled along a diagonal from the upper right corner (southeast) of the stand to the lower left (northwest). The species distribution derived from the 5 plots in the Elders Grove shows that in this area, which was once a sheep pasture, the direction of succession is toward the forest type, which occupies the center of the bowl of the Todd-Clark Ridge, i.e. a northern hardwood forest. Plot # 5 is in the lower left-hand corner of the Elders Grove and in an area that appears to have suffered the greatest impacts from effects of once having been an old field including some burning. The lower left-hand corner is the area with a moderate amount of young hemlock. The upper right-hand corner is closest to the bolder field region and may not have been part of the pasture. However, it may have served as a woodlot and was definitely logged.

The species distribution shown below suggests that barring further disturbance of a stand-altering scale, sugar maple will eventually dominate. American beech is virtually absent due to the blight.

Figure 19. Distribution of Understory and Overstory Species in the Elders Grove

Plot	Species	Overstory	Understory	Total	Percentage	Basal Area	
1	Sugar maple	3	3	6	33%	60	
1	Red maple	5	0	5	28%	50	
1	White pine	4	0	4	22%	40	
1	Hemlock	0	1	1	6%	10	
1	N. red oak	1	0	1	6%	10	
1	Yellow birch	1	0	1	6%	10	180
2	Sugar maple	6	0	6	46%	60	
2	Yellow birch	2	2	4	31%	40	
2	Red maple	1	0	1	8%	10	
2	White pine	1	0	1	8%	10	
2	N. red oak	1	0	1	8%	10	130
3	Sugar maple	3	2	5	33%	50	
3	Red maple	4	1	5	33%	50	
3	White ash	2	1	3	20%	30	
3	Yellow birch	1	0	1	7%	10	
3	N. red oak	1	0	1	7%	10	150
4	Sugar maple	4	1	5	31%	50	
4	Red maple	6	1	7	44%	70	
4	White pine	1	0	1	6%	10	
4	Black birch	1	0	1	6%	10	
4	Hemlock	0	1	1	6%	10	
4	Yellow birch	0	1	1	6%	10	160
5	Hemlock	0	6	6	30%	60	
5	White pine	3	1	4	20%	40	
5	Black birch	3	1	4	20%	40	
5	White birch	2	0	2	10%	20	
5	N. red oak	0	2	2	10%	20	
5	Yellow birch	1	0	1	5%	10	
5	Sugar maple	1	0	1	5%	10	200
Totals				82		164	
Summary	Species	Overstory	Understory	Total	Percent		
	Sugar maple	17	6	23	28%	46	
	Red maple	16	2	18	22%	36	
	White pine	9	1	10	12%	20	
	Hemlock	0	8	8	10%	16	
	Yellow birch	5	3	8	10%	16	
	N. red oak	3	2	5	6%	10	
	Black birch	4	1	5	6%	10	
	White ash	2	1	3	4%	6	
	White birch	2	0	2	2%	4	
Totals		58	24	82	100%	164	

The two plots established in the Shunpike area yielded the following results.

Figure 20: Shunpike Data:

Plot #1	Start of Shunpike near Zoar Bridge				
Species	Overstory	Understory	Total	Percent	Basal Area
N. red oak	6	0	6	40%	
Red maple	2	3	5	33%	
White ash	3	0	3	20%	
White birch	1	0	1	7%	
Totals	12	3	15	100%	150
Plot #2	Oneida Pines - Northeastern corner, Mohawk Trail State Forest				
Species	Overstory	Understory	Total	Percent	Basal Area
White pine	4	0	4	27%	
Yellow birch	0	3	3	20%	
Black birch	3	0	3	20%	
Sugar maple	2	0	2	13%	
Red maple	2		2	13%	
White ash	0	1	1	7%	
Totals	11	4	15	100%	150
Summary					
Red maple	4	3	7	23%	
N. red oak	6	0	6	20%	
White pine	4	0	4	13%	
White ash	3	1	4	13%	
Yellow birch	0	3	3	10%	
Black birch	3	0	3	10%	
Sugar maple	2	0	2	7%	
White birch	1	0	1	3%	
Totals	23	7	30	100%	150

Interestingly, red maple emerges as the single most abundant species. The Shunpike area is the most recently used area of the areas sampled. Over time the abundance of red maple will most likely decline, however, readers should not assume the red maple in these sample plots resembles that about which foresters and other wood products industry people often complain. In Massachusetts, wood products people often regard red maple as an undesirable species, even referring to it as a "trash species". Red maple on private lands is often of poor quality for timber purposes because of highgrading and multiple cuts and serves landowners mostly as a source of cordwood. The red maple regeneration of Mohawk's north-side forest provides us with another example of the productivity of that forest. Below, we present a small list of sample measurements of red maple that we have measured to over 100 feet or more in height. We present the list as an example of what the species is capable of doing when not growing in frequently cutover woodlands.

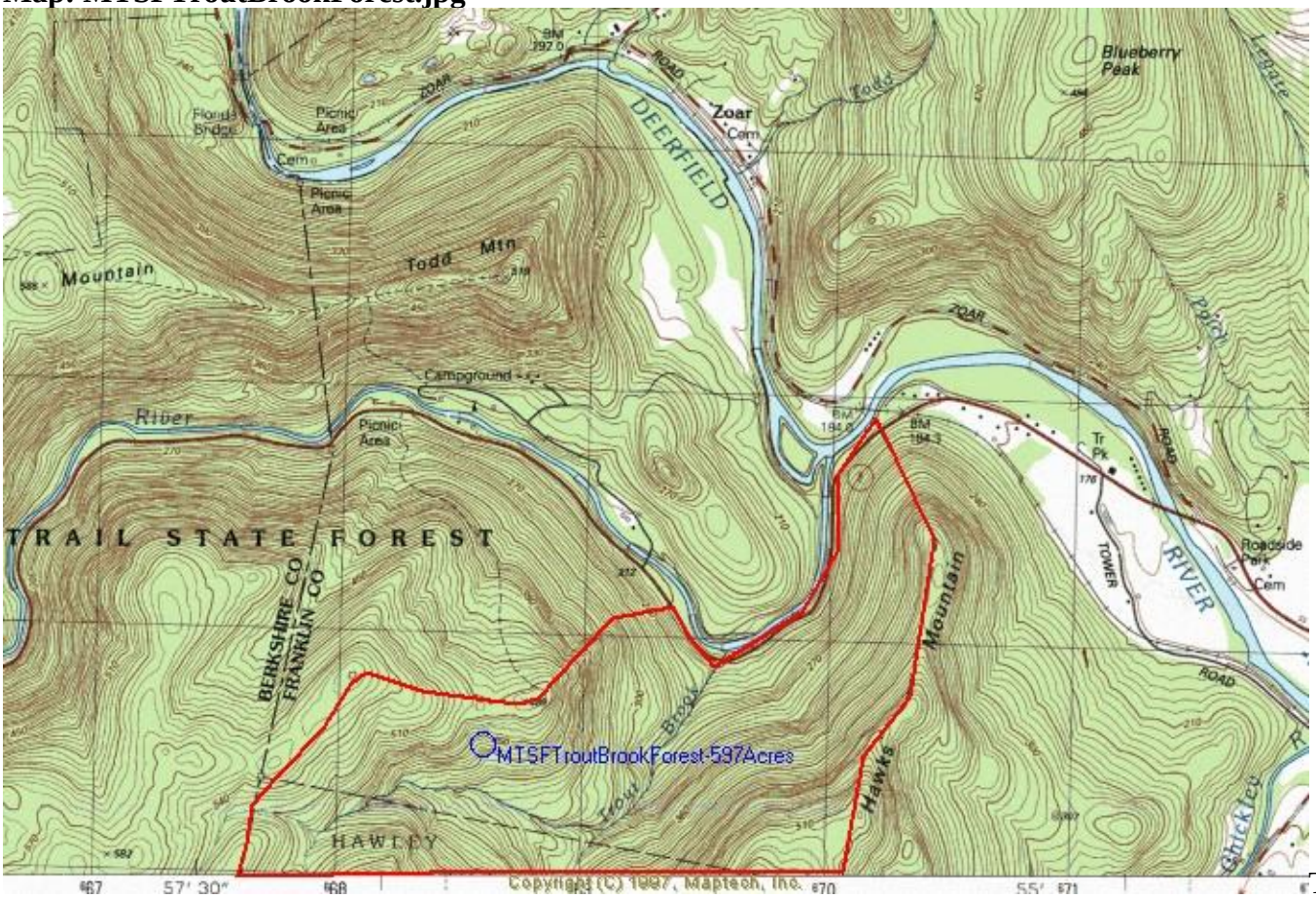
Figure 21: Sample of Measurements of Red Maples in the North-side Forest that Exceed 100 Feet.

Location	Height	Circumference	DOM
MTSF-Clark Ridge-Elders Grove	122.4	6.5	25-May-03
MTSF-Clark Ridge-Elders Grove	113.6	7.7	01-Oct-98
MTSF-Clark Ridge-Elders Grove	111.8		
MTSF-Clark Ridge	111.3	8.1	22-Sep-02
MTSF-Clark Ridge	108.4	6.4	27-Jun-98
MTSF-Clark Ridge	107.9		27-Jun-98
MTSF-Clark Ridge	106.7	6.6	28-Nov-99
MTSF-Clark Ridge	106.3		27-Jun-98
MTSF-Clark Ridge	104.5	6.9	28-Nov-99
MTSF-Clark Ridge	100.5		27-Jun-98
MTSF-Clark Ridge-Elders Grove	108.5	6.9	26-Jul-03
MTSF-Clark Ridge-Shunpike Area	111.2	6.9	28-Jul-01
MTSF-Clark Ridge-Shunpike Area	109.7	7.8	20-Sep-03
MTSF-Clark Ridge-Shunpike Area	108.1	5.9	20-Sep-03
MTSF-Clark Ridge-Shunpike Area	105.4	7.1	20-Sep-03
MTSF-Clark Ridge-Shunpike Area	103.0	6.1	20-Sep-03
Averages	108.7	6.4	

It turns out that red maple fairly commonly surpasses a height of 100 feet in Mohawk Trail State Forest. However, there are “hot spots” where the species reaches its best development and the North-side forest is one of the places. The species has been widely sampled over Mohawk and the current maximum of 122.4 feet will likely not be surpassed.

4. Trout Brook Cove Forest:

Map: MTSFTroutBrookForest.jpg



The Trout Brook Cove Forest covers approximately 597 acres.

a. Landform

The Hawks Mountain-Trout Brook-Totem Trail watershed encompasses nearly 700 acres. Elevations range from 1,854 feet atop Hawks Mountain down to 575 feet at the Cold River for a change of 1,279 feet. This drop almost matches the one from Clark Ridge to the Deerfield River. Two small streams converge in upper Trout Brook Cove to create a scenic brook with two small cataracts. The climate of the cove is cool and moist.

b. Old Growth Forests

The Trout Brook Cove includes five pockets of old growth forest. The largest one is near the terminus of the Totem Trail. A second one is on the crest of Hawks Mountain. The third and fourth ones are on the steepest parts of the slopes separating Trout Brook to the east and its sister, unnamed brook to the west. These latter two areas are between 4 and 8 acres each and are dominated by hemlock and yellow birch. Beyond brief visits, these latter areas have not been studied, nor has the old growth atop Hawks Mountain, which may prove to be the largest area. It may cover as much as 40 acres, but not less than 20. The Totem Trail old growth covers an area of not less than 30 acres or more than 40. Most of the old growth consists of hemlock, black birch, yellow birch,

northern red oak, and beech. Small pockets of sugar maple, red maple, and white ash penetrate the old growth. Near the top of the ridge, the forest becomes beech-dominated and quickly gives way to past logging operations that typify the southeastern corner of Mohawk Trail State Forest. Ages in the old growth run generally from 130 to 200 years with a scattering of trees over 250 years of age. As few individual trees are noteworthy including a hop hornbeam 15.2 inches in diameter. This is as large as we see forest-grown hop hornbeams. Those grown in the open can be up to 24 inches in diameter.

c. High Canopy Forest

Similar in geology to the North-side Forest site of Clark Ridge, the Trout Brook Cove has an area of high canopy hardwoods, which cover between 15 and 20 acres. The high canopy area is a mix of old growth and second growth, with the area of second growth being the larger area. Basically, it is a toe-slope forest. The elevation drop from the lookout of Totem Trail to the Cold River is 935 feet or 400 vertical feet less than Clark Ridge. Nonetheless, the area creates sufficient drainage and protection to support a tall canopy northeast to east-facing forest. By contrast to the species rich north-side forest, white ash and sugar maple make up most of the trees of exceptional stature. Since the high canopy area of Trout Brook area is much smaller than the North-side Forest, it would seem to be a more manageable job to map this forest. However, so far the exceptionally tightly packed stems have prevented us from identifying all the tallest members on this site. So far one 140-foot ash has been confirmed and 4 others over 130 feet. There are many that exceed 120 feet. Sugar maples in the high canopy forest average about 10 feet less than do the ash. So far 5 sugar maples have been measured to over 120 feet. None have been confirmed to 130. A scattering of tall red maples has been measured including one slightly over 118 feet, which presently ranks as number 2 in Massachusetts.

d. Old Field Succession and Norway Spruce Plantations

Below the high canopy forest is an area of white pines and an old Norway spruce stand. The white pines are field successional, but the Norway spruce, of course, were planted. The spruce stand is rapidly falling apart, but the white pines are doing okay. Our general observation is that the areas within the Trout Brook Cove that received a lot of past use, and there is plenty of evidence for that, aren't doing as well as the areas that received less intense use. The upper reaches of the cove harbors a slightly younger forest and is less vigorous than that the forest at the lower end of the cove. It appears that the most recent logging was from the top of the ridge down rather than from the bottom up.

It is worth noting that the field-successional white pines in Trout Brook do not match their equivalents in either the north or east-side forests. The difference in heights run 10 to 20 feet less for the Trout Brook Trees compared to the north and east-side forests. Reasons have not yet been assigned to the difference, but more intense use of the land is a probable cause.

e. Exemplary Trees of Trout Brook Cove

The single most impressive tree in the Trout Brook Cove is a huge white pine that we affectionately call Big Bertha. At 14.6 feet in circumference and a maximum height reached of 148.3 feet, Big Bertha is one of the largest volume pines in western Massachusetts. However, Big Bertha has three trunks and one broke off a year ago, the wound has caused the top of the tree to die. Soon the tree may be little more than a memory. However, its dimensions have been recorded for posterity.

Several white ash and sugar maples in the high canopy forest are worth mentioning. The two most impressive include a white ash at 140.2 feet and 9.9 feet in circumference and a handsome sugar maple measures 127.7 feet

in height and 10.0 feet in circumference. A red maple measures 118.2 feet tall and 8.8 feet around. The red maple is the second tallest we have found in Massachusetts. A Norway spruce in a small declining spruce plantation reaches 117.1 feet in height and a girth of 6.2 feet near the base of the ridge below the Totem lookout. This is the second tallest Norway spruce we've measured in Mohawk.

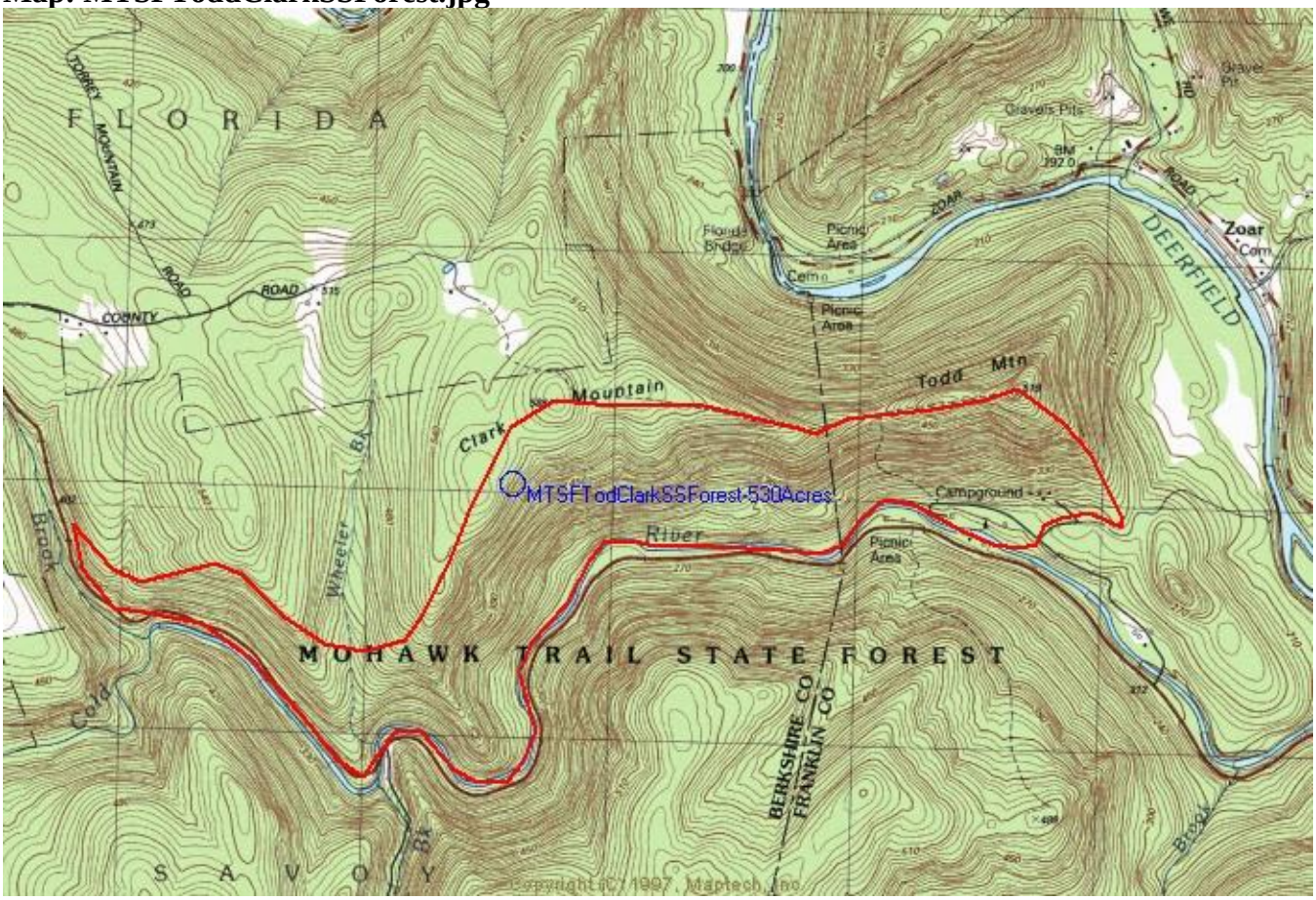
A remarkable, but small cluster of yellow birch trees grow high on the ridge above Big Bertha. These trees are extremely old, perhaps 350 years or more. Circumferences are 8.5 to 10.5 feet. The old yellow birch and an occasional sugar maple often appear as the only exceptionally old trees on this part of Hawk's Mountain. Overall the mountain received intense logging pressure in the early 1900s. However, due to the richness of the soil, and the mineral content of the bedrock, and the abundant moisture, this forest is rapidly returning.

f. Historic and Cultural Features of the Trout Brook Cove

The Cove has an old road that follows, gently sloping terrain up to the Berkshire uplands. Historical references suggest that the road called Hawk's Road was one of the original paths into the uplands and eventually across the Berkshire plateau and down into the watersheds of the Hoosic and Housatonic rivers. Research needs to be done to confirm this. However, the grade is gentler and the course probable.

5. Todd-Clark Ridge, South-facing Forest:

Map: MTSFToddClarkSSForest.jpg



The Todd-Clark, South-Facing Forest covers approximately 530 acres.

a. Landform

The south side of the Todd-Clark ridge from the ridge crest down to the Cold River encompasses approximately 530 acres within an area of about 780 acres. The North-side and South-facing forests do not encompass all of the land within the boundaries of Mohawk Trail State Forest within its northwest corner. There is an area of 250 acres that holds little interest and is not included in this description. The grade of the south side of Todd-Clark is uniformly steep with an average grade that ranges from 59 to 70%. Elevation changes from the ridge crest to the Cold River are on the order of 800 to 975 feet or 250 to 375 feet less that the north side. However, the south-facing side of Todd-Clark is very difficult to climb because the soils are very shallow and there are numerous areas of exposed rock or ledges, both steep pitches. Climbing down from the crest of the Todd-Clark ridge can be a challenge. For linear distances of 650 to 750 feet the grade often averages from 75 to 85%, including several layers of rock ledges. Logging such steep slopes was out of the question. Seeps do exist, but result in high canopy forests only near the bottom of the ridge. Past fire has played a major role in shaping the south-side forests.

b. Old Growth

The forests on the north and east sides of the Todd-Clark ridge were first described because these forests are generally of greater interest. As described, the north side supports one of the most remarkable, if not the most remarkable, forests in all of Massachusetts. But by contrast, with notable exceptions, the south-side forests are often average to scrubby. Yet it is the south side that harbors the largest acreage of old growth forest in Mohawk. Approximately 200 acres of the south side are in an old growth state, albeit a very close call for half the acreage because of the past fire history of the ridge that has left large areas of forest fairly even-aged. It is the south side that will receive a lot of attention in 2004.

The 200 acres of south-side old growth, combined with the 100 acres on the north side and the 50 acres on the east side total 350 acres for the Todd-Clark ridge as a whole. Depending on the definition of old growth in terms of the age criterion adopted, the Todd-Clark ridge has a minimum of 250 acres of old growth to a maximum of 350 to 400. It is unlikely that very precise boundaries can be drawn for the old growth without an extensive multi-year study effort that factors in the fire history of the ridge. However, the steepness of the ridge renders the determination somewhat academic.

One area of old growth in the south-side forest that does contain a high density of old stems is located on the east side of Wheeler Brook. A stand of hemlocks that are uniformly 200 to 300 years old covers about 7 acres. The adjacent area is old growth, but is mixed hemlock and hardwood and not as uniformly old. A water fall at the lower end of Wheeler Brook created an effective logging barrier. Well above the waterfall, logging becomes evident.

Composition of the old growth includes a minor but visible component of hemlock and white pine among an ocean of northern red oak with a sprinkling of white oak. The understory is often chocked with mountain laurel of all ages.

c. High Canopy Forest

Despite the abundance of medium stature northern oaks, hemlock, and white pine, the South-side Forest has three prominent terraces two of which harbor exception stands of white ash and northern red oak with a sprinkling of other species. The eastern most terrace covers approximately 6 acres and has little that is exceptional. This is an area that appears to have had logging in the 1920s or 30s. Tree sizes are typically 20 to

30 inches DBH and 90 to 110 feet in height. While these statistics may sound high and would be high for most of today's managed forests, for the mature forests of MTSF, they are not exceptional.

In the south-side forest there are, however, two terraces, which have exceptional forests. We call one Indian Flats and the other Ash Flats. Indian Flats covers approximately 4.5 acres and is the eastern most of the two. Ash Flats covers approximately 7 acres. A 0.41-acre study plot, established in Ash Flats, produced some interesting statistics. The basal area for the 8 species measured in the plot projects to a remarkable 257 square feet per acre. Taken over the entire 7 acres, the basal area averages circa 200 square feet per acre. It must be remembered that these are hardwoods. The average stand age for all of Ash Flats is circa 120 years with the range being from 100 and 140 years for species making up the canopy. Three white ash trees in Ash Flats have been measured to over 140 feet in height (144.8, 144.5, and 141.1). One white ash in Indian Flats surpasses 140 feet (141.5). These 4 mature ash trees started from a human disturbance between 100 and 120 years ago and have grown exceedingly tall although their diameters don't suggest such height. Diameters vary from only 22 inches to 31. The ash zone on both flats is against the ridge where moisture availability is highest.

It is possible that some of the ash trees in Ash Flats will reach close to 150 feet in time, barring disturbance. This may also occur for ash trees in the North-side Forest, but the northern trees must contend with more disturbance. The Ash Flats site is well worth a long-term monitoring effort to monitor growth and should include soil moisture, soil mineral content, and temperature measurements. The site's southern exposure provides ample sunshine. Its position low on the ridge provides extra protection.

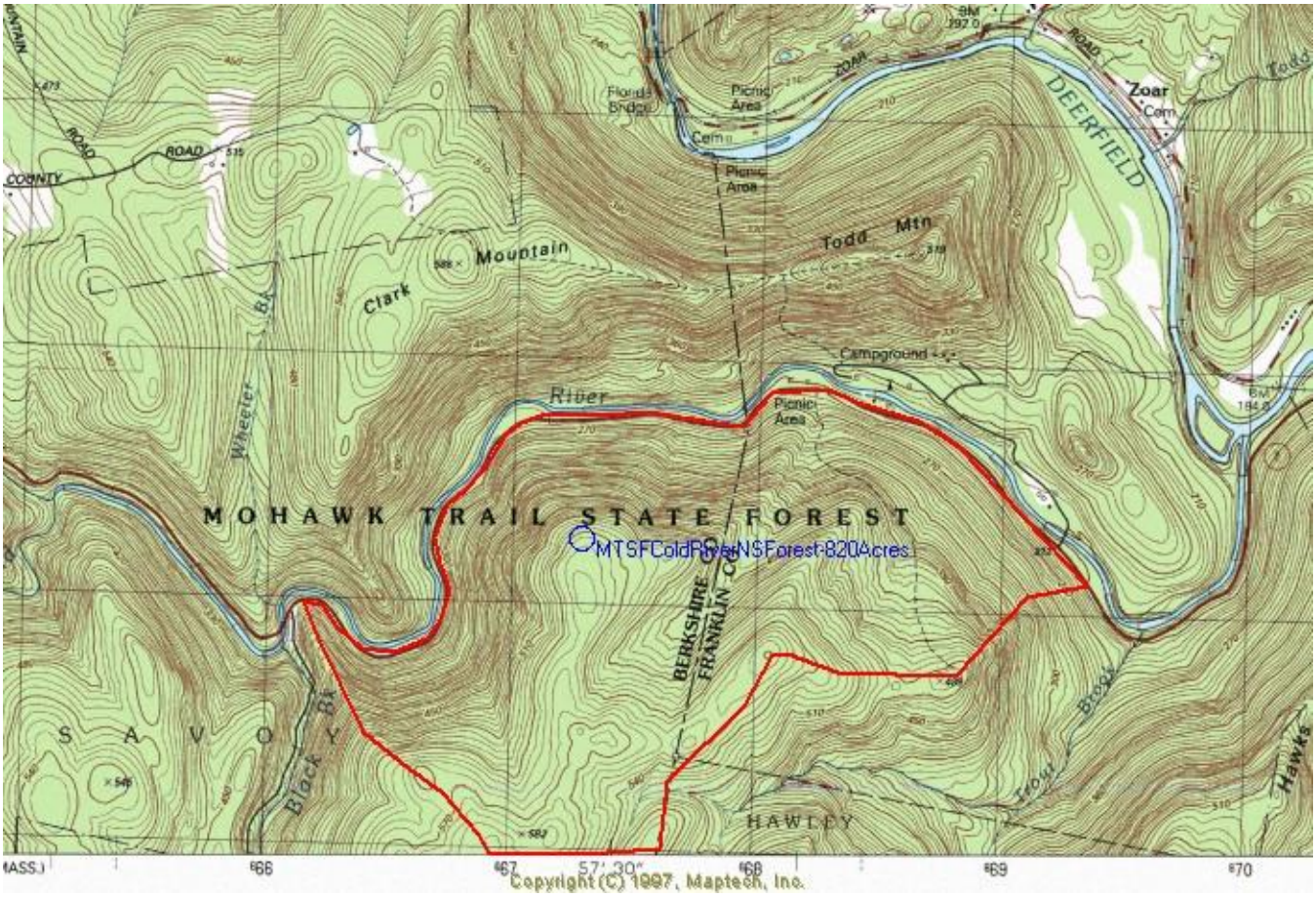
d. Historic and Cultural Features of the South-side Forest

The mountain branch of the Mohawk Indian Trail climbs from near Indian Spring on the mountainside to the notch between Todd and Clark. British colonials constructed this part of the Mohawk Trail probably around 1760. Timber from the immediate area was used to shore up the sides of the route. The trail was notoriously dangerous. An ox fell from a rock ledge part way up the side and erosion has obscured the original path so that the exact route and probable ledge has been lost. Nonetheless, it was the climb up the south-side that led to the eventual abandonment of the Mohawk Trail for two easier routes, one of which later became the toll road and the other the Shunpike. River Road across the Deerfield River was the toll road's path. There was once a large conspicuous pine or hemlock that marked the spot where the trail reached the ridge crest. It shows in old post card photographs of the 1920s, although the tree profile has been enhanced. What is especially telling about the post card pictures is that the south-side forests look remarkable similar today to the way they appeared in the 1920s. The pictures clearly show forest continuity and bolster our feeling that our projection of old growth is entirely reasonable.

At a location upstream in what we call Indian Flats, the foundation of an old structure can be seen. It appears to date to the middle 1850s, but could be older. Also, there is an old holding pond well up on Wheeler Brook. A waterfall on the lower part of Wheeler Brook represents a substantial natural barrier to use of this stream below the pond. We do not know what the purpose of the pond is. One of our future focuses will be catalog all the cultural features and gain an understanding of their uses.

6. Cold River Gorge-North-Facing Forest -Route #2:

Map: MTSFColdRiverNSForest.jpg



The Cold River Gorge-North-facing Forest covers approximately 820 acres.

a. Land Form

The north–facing side of the Cold River Gorge from the western boundary of the Trout Brook Cove to the eastern boundary of Black Brook watershed includes 420 acres of steep terrain and 400 acres of less steep terrain. Beyond the less steep area, the forest becomes much less interesting and is not included here. The pitch varies considerably on the north-facing side of the Gorge, from as low as 32% to as high as 70%. The average is probably 50%. While this grade is less that either side of the Todd-Clark Ridge, it is definitely steep with ledges and areas of boulders that absolutely rule out management options.

b. Old Growth

There is a thin strip of old growth just west of the start of Trout Brook Cove. Total acreage has not been determined, but it is likely less than 10 acres. Hemlock, northern red oak, American beech, yellow birch, and black birch make up most of the species in the strip, which is high on the ridge. A second area of old growth is

in the stream drainage at the foot of the Brook that drains the start of the Totem Trail. The area is small, probably less than 5 acres.

While we have no history of the north-facing side of Cold River Gorge, a network of old logging roads appear to date from around the 1930s to slightly later. Damage from logging was done to the north-facing side forest and although it is gradually returning, it possesses little of the charisma of the North-side Forest to the Todd-Clark Ridge. There is a clear lesson to be learned here about mountain-side logging and that lesson is do it very cautiously. Adverse effects last a long time.

The west end of the north-facing side of the Cold River Gorge contains an area of prime old growth, literally one of our best. This area was labeled Cold River-A in the 1993 Old Growth Survey headed by Dr. Peter Dunwiddie. Robert Leverett was a primary participant in that study, initially identifying most of the candidate old growth sites, providing preliminary maps, and supplying tree dimension data. A revision of the initial study was published in 1996 by the journal *Rhodora* and extended the old growth acreage surveyed on DEM lands from slightly over 300 acres to slightly over 600.

A combination of hemlock, northern hardwoods, a small component of red spruce, and an extensive shrub layer make this old growth area vegetatively diverse. The aspect of the old growth area is northeast to northwest. It includes approximately 100 acres of old to very old trees. Ages of the hemlocks reach 350 and even 400 years. Clusters of yellow birch are comparably old. A distinguishing feature of this area of old growth is its extremely dense understory. Hobble bush and striped maple are especially conspicuous. One area includes striped maple with stems 24 to 39 inches in circumference.

It would be appropriate to describe this concave area as one that exhibits the maximum number of old growth characteristics for overall tree age, gap dynamics, coarse woody debris, and multi-age aspect. However, the character of the old growth changes dramatically at the extreme edge of the bowl. The exposure factor increases greatly as does the reduction of available moisture. The old growth becomes more commonly what we see following the backbones of ridges. Tree size diminishes and hemlock dominates. In the center of the bowl, hemlock size is very impressive and the trees have taken on the form that is characteristic of large trees on steep slopes. Root buttressing becomes highly visible and leads to large girths even at mid-slope.

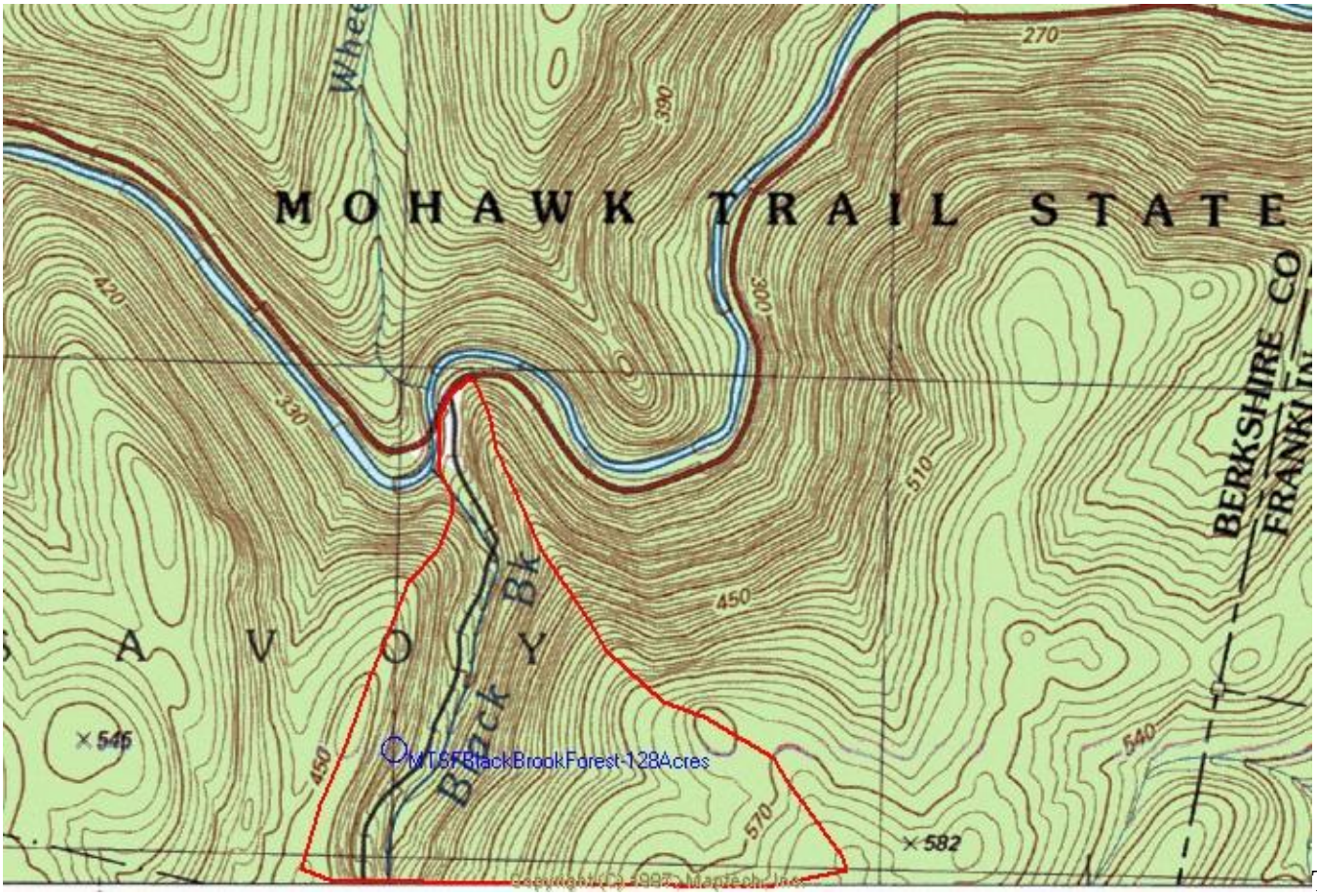
c. Exemplary Trees of the North-facing Side of the Cold River Gorge

The single most exceptional tree in the North-facing forest of Cold River is a huge hemlock in Cold River-A. It measures 14.8 feet in circumference and is 105.8 feet tall. Several other hemlocks in the vicinity reach between 9 and 10.5 feet in circumference and are 95 to 110 feet tall. One other hemlock stands out as exceptionally tall for the area. It measures 10.8 feet in circumference and 116.8 feet in height. A number of striped maples measure 24 to 39 inches around and are 25 to 50 feet in height. As such the represent maximum development for the species.

Farther down on the ridge near Route #2 and farther down stream, two trees stand out conspicuously. A white ash measures 8 feet in circumference and 131.2 feet tall. A white pine near the Cold River measures 9.1 feet around and 140.6 feet in height. It is safe to assume that prior to the 1920s-1940s logging there were many sugar maples and white ashes in the 120-foot height, 8-foot circumference size range. Tree height and girth has climbed back to where the canopy is between 90 and 110 feet and girths for trees in the canopy are typically 5 to a little under 8 feet. The forest holds promise of eventually returning to what was probably its former glory in another 50 years.

7. Black Brook Forest:

Map: MTSFBlackBrookForest.jpg



The Black Brook Forest covers approximately 128 acres.

a. Land Form

For the purposes of this report, the Black Brook watershed encompasses an area of approximately 128 acres. As with other regions, not all of the watershed land is included. On the east side, the ridge drops almost 800 feet to the brook at an average grade of about 55%. However, for nearly 600 linear feet, the grade averages 80% near the mouth of the brook. It is steep terrain and won't support large trees except near farther up the brook, where the grade lightens considerably to around 40%. The west side has a lower ridgeline with a 60% grade down to the brook.

b. Old Growth

A road parallels Black Brook through a part of MTSF and allows easy access to a swath of charismatic old growth on the east side of the brook, featuring 250-300-year old hemlocks and yellow birches. A few trees appear to be in the 400-year age range. This site is referred to as both Black Brook and Cold River-B in the Peter Dunwiddie old growth 1993 study. Although the site exhibits hemlocks with advanced age and impressive physical appearance, the species diversity is fairly low. Canadian yew does make a noticeable presence.

c. Exemplary Trees in the Black Brook Forest

The most charismatic group of large trees is near the water and on the east side of the brook about 3,500 feet up Black Brook road. A large hemlock near the water was once thought to be the tallest of its species in Massachusetts. It is currently 10.7 feet in circumference and 131.0 feet tall. The hemlock is between 250 and 300 years and grows in a protected area so its crown has not suffered the misfortunes of its relatives up toward the tops of the ridges. The old Black Brook hemlock is one of only four in Massachusetts measured to over 130 feet in height. Other hemlocks in the Black Brook range from 105 to 120 feet in height. The protected nature of the ravine cut by Black Brook affords the hemlocks extra protection. Perhaps the most interesting fact about the hemlock is its combination of great age and great height. The protected ravine has allowed it to keep its crown. It has not become stag-headed.

Several of the yellow birch and sugar maples growing along Black Brook are probably between 350 and 400 years of age. Hemlocks on the east side of Black Brook are of great age.

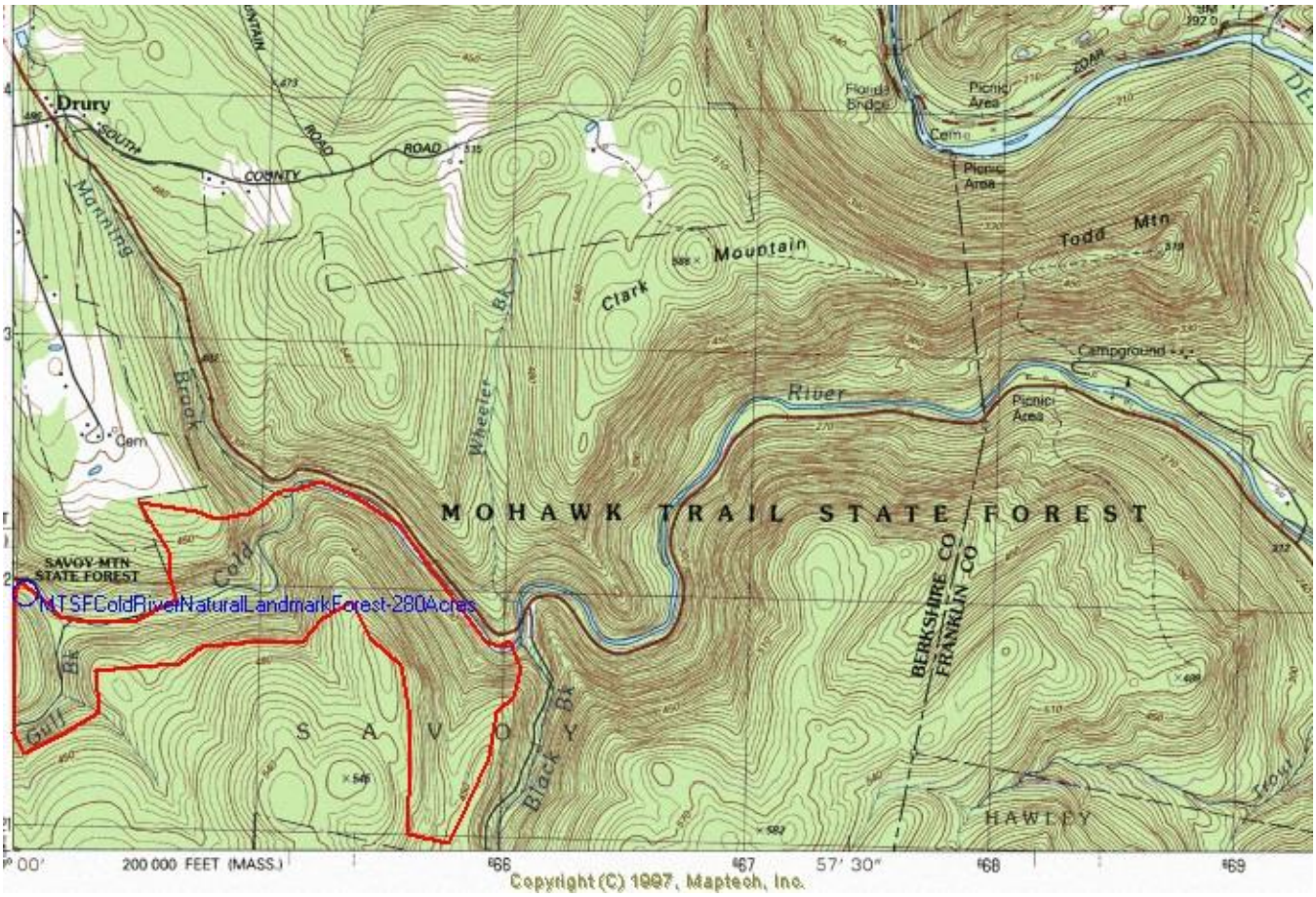
d. Historic and Cultural Features of the Black Brook Forest

In May 1994 a team from WQED Pittsburgh visited Black Brook with Robert Leverett and filmed the old growth area there. The program produced was entitled the ‘Web of Life’ and was seen across the United States on public education stations. Periodically it is re-shown.

Black Brook and the Cold River North-side old growth have been featured on other programs and in newpaper articles including the NPR program ‘Living on Earth’ and a feature article in a large Japanese newspaper. The Black Brook hemlock was featured in an article written by Tom Conuel for the Massachusetts Audubon Society.

8. Cold River Natural Landmark Forest:

Map: MTSFColdRiverNaturalLandmarkForest.jpg



The Cold River Natural Landmark Forest covers approximately 280 acres within Mohawk Trail State Forest.

a. Land Form

The area encompassing Mohawk Trail State Forest's part of the natural landmark old growth area covers approximately 280 acres out of 550. The hilltop area of 270 acres has had logging pressure in the last 60 or 70 years and is of little interest.

Within the gorge terrain, the forests become much more interesting. Grades vary on the steep slopes as they drop down to the Cold River. Grades vary from as low as 45 percent to as high as 60 percent over a map distance of 500 to 700 feet. The vertical drop of the steep areas upstream is considerably less than that farther down Cold River. A drop of only 200 feet for the steep part is typical near Gulf Brook. However, west of Black Brook on the terrain that faces Route #2, the drop increases to 700 feet.

b. Old Growth

Despite the shallowness of the upstream portion of the gorge, it is very narrow and in combination with the steepness of the down stream areas inhibited logging and allowed an area of between 120 and 140 acres of old growth to survive within the Mohawk Trail State Forest. A swath of prime old growth runs for 0.75 miles from

Black Brook to where Route #2 crosses the river. The old growth follows the ridge around as it heads southwest for 0.3 miles, before heading more westerly and finally northwest. At the bend in the river, looking upstream, large hemlocks and the spires of red spruces catch the eye. This view is especially conspicuous when going up Route #2 at the point Cold River swings away from the road. The forest has a coarsely textured canopy. It appears noticeably shaggy and wild. The spines of the ridges support a few white pines. The area in the gorge terrain consists of hemlock, red spruce, and northern hardwoods. Tree age for hemlock and yellow birch is commonly between 150 and 400 years. The craggy appearance of these hemlocks gives this area a classic old growth look. Only the proximity of Route #2 detracts from the wilderness feeling.

c. Exemplary Trees

Large old trees are abundant and conspicuous on the ridge-side facing Route #2 between Black Brook road and the bend in Cold River where it comes in from the west to join Route #2. The hemlocks are typically 95 to 115 feet in height and 7 to 8.5 feet in girth. A few exceed 9 feet in circumference. A number of large yellow birches reach advanced age on the ridge face. Ages between 250 and 350 years are not uncommon for both yellow birch and hemlock. However, as impressive as individual trees are in this area, they are not unusually large considering what can be found elsewhere in Mohawk Trail State Forest and on other DCR lands.

Looking into the narrow gorge created by the Cold River, the best surprise is the red spruces, which in this region grow down to elevations of 1,400 feet above sea level. The spruces are often the tallest trees on the ridgeline. Most surpass 90 feet and a few exceed 100 feet. The pointed crowns of these slender trees rise above the other species to make them stand out. Their circumferences varying, but seldom exceed 6.5 feet. Today, only very rarely do we encounter a red spruce in the gorge that exceeds 7 feet in circumference. The largest we have found is in adjacent Savoy Mountain State Forest. Its girth is 7.7 feet. So it isn't the size of the spruce that draws the attention. It is their graceful form, a form that is not shared by the other species. The pleasing form of the red spruce is an aesthetic resource.

The oldest tree dated by full ring count in Mohawk Trail State Forest was a hemlock that had fallen into Cold River. Robert Leverett dated the tree to 425 years of age. Other hemlocks may be older, but that remains to be proven.

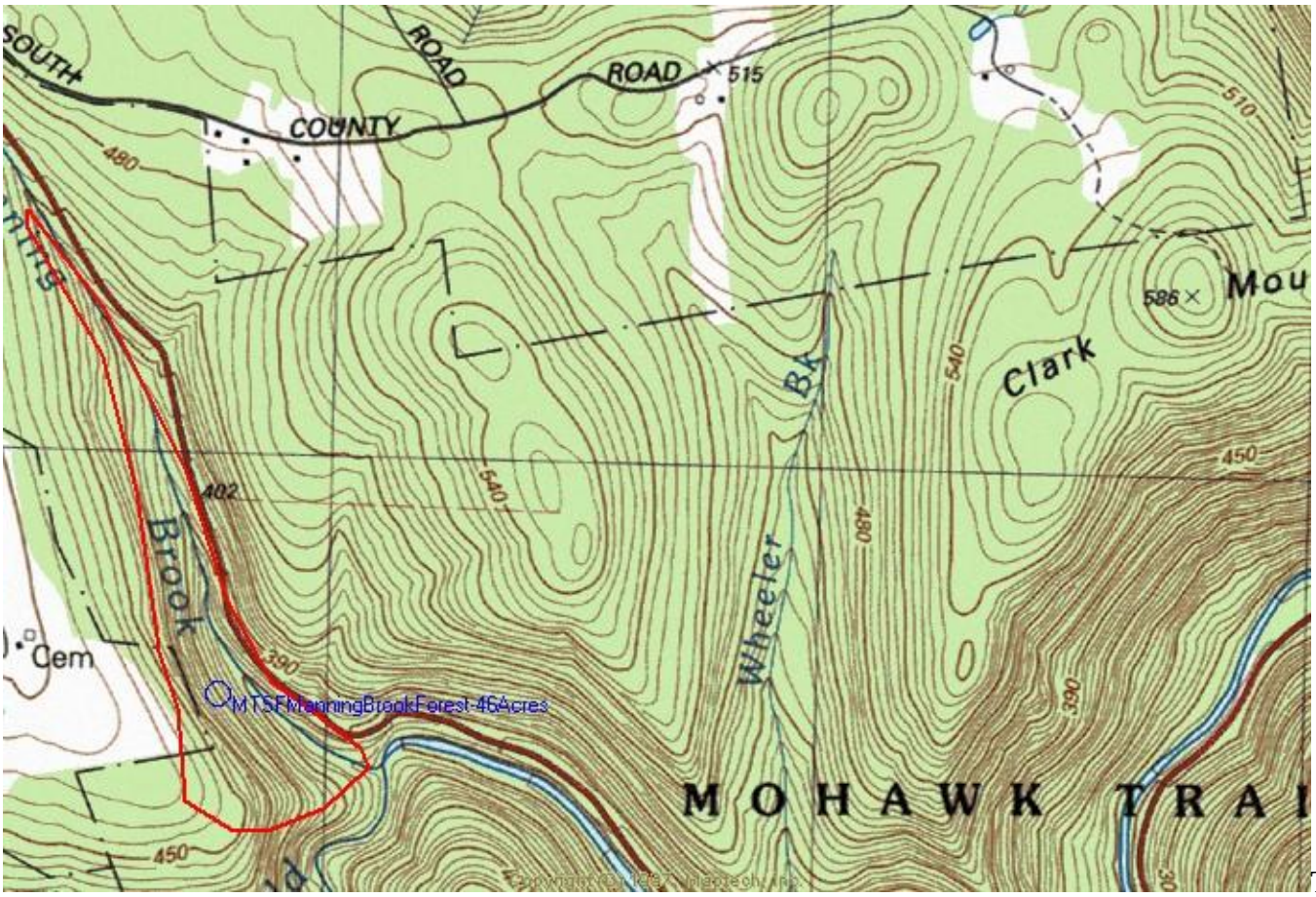
d. Historic and Cultural Features of the Cold River Natural Landmark:

The river branch of the Mohawk Indian Trail followed the Cold River. However, the narrow sides of the gorge conspired against its long-term survival and the mountain branch became the route by the middle 1700s. In 1745, the Cold River Branch of the Mohawk Indian Trail was improved for use by pack horses by a John Catlin. We do not have any records of how often horses were used on the improved trail.

Some of the trail can be traced in the Cold River North-side forest and a little of it in the Cold River Natural Landmark, but the authors have not found a continuous path nor any artifacts, such as those found on the mountain branch of the Mohawk Indian Trail.

9. Manning Brook Forest:

Map: MTSFManningBrookForest.jpg



The Manning Brook Forest covers approximately 46 acres.

a. Land Form

The area identified as the Manning Brook covers approximately 46 acres out of about 70. This is the last stand of old growth along Route #2 going into the community of Florida. The maximum grade from the brook to the top of ridge is between 55 and 65% and is located near the confluence of Manning and the Cold River. The maximum elevation change near the Cold River is approximately 400 feet. The aspect is northeast. The elevation change on the upper part of Manning Brook is between 200 and 250 feet.

b. Old Growth

Despite the impacts from the fields at the top of the ridge and the construction of Route #2 at the bottom, the ridge face of the west side of Manning Brook has a nice swath of old growth that covers about 17 acres. Its composition is a mix of hardwoods and hemlocks, the crowns of yellow birch and the spires of the hemlocks

being quite conspicuous. Ages of the hemlocks vary between 250 and 350 years. Harvard Forest as dated several of the hemlocks to ages in that range.

c. Exemplary Trees

We have not found any truly exceptional trees on the lower part of the ridge, although a height of 100 feet is not uncommon for the hemlocks. Girths are typically 6.5 to 8 feet. Near the top, we measured a shadbush to a height of 60 feet and near the crest of the ridge there are some conspicuous field pines, though none of exceptional stature or girth.

Near the confluence of Manning brook and Cold River, a number of years ago a large red spruce grew. It fell across the brook around 1980. The spruce was once thought by Professor Robert Livingston of UMASS to be the tallest of its species in the world. Professor Livingston or one of his students had measured the spruce while standing. It was 140 feet tall as determined by them. Evidently they failed to take into account the tree's lean. The tree's actual height was between 114 and 117 feet as measured on the ground. Though not a champion, it was still very respectable. Incidentally, a few red spruce in the Great Smoky Mountains reach to 150 feet and a little more. The downed spruce was aged by Jack Sobon of Windsor, Mass to 353 years old when it fell from 4 feet of its base. The height champion red spruce for all New England is a tree that grows in Mount Greylock's Hopper. At last measurement, the tree was 129 feet tall. There may have been a few red spruce in this height range in the 1920s when Mohawk Trail State Forest. A past Region 5 Supervisor of Forests and Parks told Robert Leverett about once cutting a tree of that class in Mohawk Trail State Forest.

Section III. Research into the Growth of Mohawk Trail State Forest's White Pines

As a consequence of early height measurements made of the white pines in what is now called the Trees of Peace, the Elders Grove, and the Algonquin Pines, Friends of Mohawk Trail State Forest proposed a growth study to the Department of Conservation and Recreation's Chief Management and Planning forester William Rivers and received permission to tag white pines in Mohawk and monitor their growth.

As of this report, 127 pines have been tagged and identified spatially on a map covering the Trees of Peace Area. Another 18 pines have been tagged in the Elders Grove at Zoar Gap. The Cherokee Grove, adjacent to the Trees of Peace is presently being tagged. A small number of trees have been tagged in the Pocumtuck Grove. Altogether 170 trees have been tagged. Eventually we'll have the Algonquin Grove, Pocumtuck, and Cherokee pines all completely tagged. At that time a very limited number of cores will be taken to confirm stand ages.

The white pine study has several important objectives. The most basic objective is to develop a sophisticated comparison of the Mohawk pines in terms of their age, size, and overall growth characteristics relative to other conspicuous white pine stands in Massachusetts, elsewhere in New England, and eventually in New York and Pennsylvania. Friends wants to determine exactly where the Mohawk pines fit in terms of size and growth rates for similarly aged pines elsewhere. We want to answer the question, are the Mohawk pines average, above average, or exceptional for their age in terms of their growth characteristics?

A more sophisticated objective of the white pine study is to reach a point where we can reach data-driven conclusions about the maximum growth potential of the Mohawk pines as a function of a host of environmental variables, age, and natural disturbance. This latter objective necessarily involves a longer term of data collection and analysis and a more sophisticated experimental design.

Questions we eventually hope to be able to answer about the Mohawk pines are summarized below.

1. How fast are the Mohawk pines growing in relative and absolute terms in radial growth, height growth, and in total volume growth as a function of:
    a. Age,
    b. Moisture availability,
    c. Topographic features,
    d. Soil type and depth,
    e. Position in stand?

2. How long will the Mohawk pines grow at their current rates?

3. What is the maximum size potential of the Mohawk pines?

4. How do the Mohawk pine stands compare to other notable white pine stands? Data for particular pine stands to be used for comparison will be supplied by the Eastern Native Tree Society. At present, ENTS has data on pines at:

    a. Claremont, NH
    b. Hemmenway State Park, Tamworth, NH
    c. Pine Park, Hanover, NH
    d. Bradford, NH

e. College Pines, Durham, NH
f. Fisher-Scott Memorial Pines, Arlington, VT
g. Ordway Pines, ME
h. Bowdoin College Pines, ME
i. Ice Glen Pines, Stockbridge, MA
j. Bryant Pines, Cummington, MA
k. Carlisle Pines, Carlisle, MA
l. Bullard Woods, Stockbridge, MA
m. Pack Pines, Warrensburg, NY
n. Cathedral Pines, Adirondack Park, NY
o. Cook Forest State Park, Cooksburg, PA
p. Hearts Content Scenic Area, Tionesta, PA
q. Anders Run, Cornplanter State Park, Warren, PA
r. Gold Pines, West Cornwall, CT
s. Hartwick Pines State Park, Grayling, MI
t. Cataloochee District, Great Smoky Mountains National Park
u. Linville Gorge, Linville, NC
v. Cullasaja Gorge, Highlands, NC
w. Porcupine Mountain State Park, MI

As a teaser, we provide the following data for a sample of pines that are 130 to 150 years in age. The sample includes tagged trees in the Trees of Peace Grove.

Figure 22: Sample of Tagged Trees in Trees of Peace Grove:

Tag No	Circumference	Height	DLM	Name
52	10.1	163.5	8/31/2003	Jake Swamp
58	9.5	162.2	7/28/2003	Joe Norton
48	7.8	157.4	9/7/2003	John Brown Tree
31	8.1	156.6	8/11/2003	Tom Porter Tree
34	8.4	151.9	7/27/2003	Lynn Rogers Tree
26	8.4	151.7	6/16/2002	Arvol Lookinghorse
27	10.4	151.3	8/31/2003	Clutter Tree
32	8.0	151.1	8/31/2003	Unnamed
70	7.4	151.0	8/31/2003	Guardian
5	9.4	150.3	10/13/2003	Unnamed
63	9.0	150.2	10/7/2002	Dave Chief

Reviewing the table, circumference (or diameter) and height are poorly correlated in this sample of 150-footers, all of which grow in the same stand. The correlation coefficient between height and circumference (or its derivative, diameter) is only 0.37. One might expect the larger diameter trees to also be the taller, but that is not always the case. Competition plays a big part in heights, but position in the stand has the greatest impact where availability of water and protection from wind play an important role. The tallest 4 trees in the sample are all located lower on the slope. The benefits of their lower positions include slightly more protection from wind and a somewhat steadier supply of water. Were other trees included that grow higher on the hill in the adjacent Cherokee Grove, the differences would be even more dramatic. The Cherokee pines have maximum heights of

140 to 148 feet with girths comparable to those in the Trees of Peace. An advantage of 15.5 feet in height occurs for the pines on the low ground compared to the high ground.

Modeling of individual pines in Mohawk has been going on for several years. This has allowed us to estimate annual volume increase for big trees such as the Jake Swamp pine. Our calculations suggest that the Jake Swamp tree is adding trunk volume at the rate of 3 to 3.5 cubic feet per year. Younger pines in the 50-year age bracket appear to be adding volume at the rate of 3.5 to 4.5 cubic feet per year. The faster growth for the younger pines is to be expected, but the continued fast growth of the larger, older pines comes somewhat as a surprise.

Subject to the approval of DCR, Friends is developing a schedule of periodic climbs of a sample of white pines for the purpose of getting exact circumferential measurements at increments of a yard or a meter and keeping exact height growth data. Our objective is to model the volume of each tree in the sample over a ten-year period to determine annual volume growth to a high degree of accuracy. Regression equations will then be developed for application to other pines. Since climatology data will also be gathered, we will be in a position to predict growth rates over a variety of environmental conditions.

The Mohawk pine growth database is not being developed in isolation. Data is being gathered by ENTS under the guidance of Dr. Lee Frelich, Vice President of the Eastern native Tree Society and the Director of the Center For Hardwood Ecology, University of Minnesota, from a number of prominent white pine sites, not the least of which is the Menominee Indian Reservation in Wisconsin. Data from the Great Smoky Mountains National Park will also be included under a special long-term research permit granted to ENTS by the NPS. In time data from many white pine stands of varying ages and conditions will be included to better explain annual growth and determine maximum growth potential, something that cannot be done at present. Data from the following white pine sites will comprise most of the input used in the modeling.

1. Mohawk Trail State Forest, MA
2. William Cullen Bryant Homestead-Poets Pines, MA
3. Ice Glen, MA
4. Claremont, NH , (private site)
5. Tamworth Pines – Hemminway State Park, NH
6. College Pines – UNH, NH
7. Pine Park, Dartmouth College, NH
8. Cook Forest State Park, PA
9. Hearts Content, PA
10. Anders Run, Cornplanter State Park, PA
11. Paul Smith College – Elders Grove, NY
12. Cathedral Pines, Adirondack Park, NY
13. Pack Pines, Adirondack Park, NY
14. Menominee Indian Reservation, WI
15. Cathedral Pines Natural Area, WI
16. Great Smoky Mountains National Park, several sites, NC-TN
17. Fisher Scott Memorial Pines, VT
18. Ordway Pines, ME
19. Hartwick Pines State Park, MI
20. Porcupine Mountains State Park, MI

Section IV. Summary

This report summarizes the research that is either going on or in the planning stages for Mohawk Trail State Forest by its Friends organization. Even considering what we have done so far, we still have a long way to go. The future direction of Friends research and projects in Mohawk will concentrate in the following areas.

1. Determining the successional patterns at work in the Mohawk Forests with the end objective of predicting the future composition and age structure of Mohawk's forests under several disturbance scenarios. This objective will involve establishing many variable radius plots such as those done for the north-side forest.
2. Gain a better understanding of Mohawk's climate, its soils, and its bedrock geology. This will include placing precipitation and temperature monitoring devices in a number of locations and securing the help of soil scientists.
3. Intensify the study of the growth patterns of the white pines in the stands identified above. This will include more tagging and the utilization of an extensive sampling system.
4. Continue documenting the overall superlative nature of Mohawk's forests by completing additional iterations of the Rucker Index. Our goal is an index completed through at least 25 iterations.
5. Extending our already impressive GIS database to include both 2-dimentional and 3-dimensional analysis.
6. Develop computer profiles of the high and low growth areas.
7. Continue to research the cultural roots of Mohawk Trail State Forest. This will include using GPS receivers to plot the exact route of the old Shunpike and search for more cultural remnants such as old foundations, rock walls, old trails, location of artifacts.
8. Evaluate the scenic attributes of Mohawk Trail State Forest, rank them, and identify any at risk from development, road expansions, etc.
9. Develop nature trail guides to the 7 trails listed in the Introduction that will be available to the public. These guides will be augmented with cultural material
10. Develop a tree and shrub identification guide for Mohawk Trail State Forest
11. Develop PowerPoint presentations that can be shown at schools. DCR will be given copies of all materials produced by Friiends.

Mohawk's convenience as an access point for the Deerfield River will keep its campground occupied so long as river rafting stays popular. But beyond that recreational pursuit which makes minimal use of Mohawk's resources, what can we say about Mohawks future popularity? If Mohawk Trail State Forest had a scenic waterfall, large body of water, an imposing rock face, or just the highest ground in the Commonwealth, it would undoubtedly draw many more visitors. Even a limited resource like Purgatory Chasm draws large crowds who love to scramble among the boulders. A modest increase in visitation to Mohawk could be a blessing, but a substantial increase would be a curse. So overuse of Mohawk is not likely to occur from its scenic resources. But what kind of future does a review of Mohawk's scenic, ecological, historical, and cultural resources suggest? Some will have little impact.

Mohawk's pre-settlement history is a blank page. Its European history is a little better know, yet invisible to the casual visitor. The hidden attributes of Mohawk's dimly lit past do not diminish its cultural value to the people of the Commonwealth of Massachusetts, but the historical-cultural assets will not be big drawing cards, since

there are no monuments or museums to draw attention to the region's history. What will draw more visitors to Mohawk is a widespread knowledge of Mohawk's exemplary forests. We will see expanded visitation as more people understand where the forests of Mohawk rank, and with perhaps the designation of a "Commonwealth Forest". Could this lead to overuse? Forest lovers, on balance, are gentle souls. Based on what we see in the forests of other states, there is little danger of Mohawk being overrun with visitors seeking aesthetic woodlands. Still, it doesn't take much to have an adverse impact. The old growth ecosystems of Mohawk are fragile places and it is best not to over-advertise them. However, the splendid white pine stands of Mohawk are not old growth and are accessible by road and trail. It is this resource that is safest to advertise to the public and it is this resource that holds the most promise as a cultural asset.

Peace Park Concept

Over the last several years, a number of small indigenous groups have held quiet events at Mohawk Trail State Forest. While these indigenous groups arguably have made the greatest use of Mohawk Trail State Forest for ceremonial purposes, other groups have found the ambience of Mohawk conducive to prayer and meditation. Over the years Robert Leverett has guided scores of religious groups around the upper and lower meadows of Mohawk.

On his visit in November 2001, Chief Arvol Lookinghorse voiced the opinion that Mohawk would be an ideal setting for simple ceremonies that honor world leaders of peace. This has led to the concept of designating a small area of Mohawk as a peace park, an international peace park. While there is no doubt that pros and cons exist for this idea, pursued on a modest level, initially the pros appeared to outweigh the cons. Many people with whom we have spoken like the idea of small accessible areas of Mohawk Trail State Forest being used to honor international leaders of peace in a non-denominational way. The dedication of individual or small areas of white pines in the named areas for the purpose recognizing international figures of peace could be a bold statement of Mohawk. It could also lead to unintended consequences.

Recently, Friends intensified its efforts to explore the idea of recognizing international leaders of peace through symbolic dedications of white pines in the accessible area of Mohawk. Viewed from one perspective, the white pines offer us living symbols to use and are especially appealing to earth-conscious movements. Please bear in mind, that use of a small part of Mohawk is just a concept, but a superficially appealing one if pursued on a modest scale for several reasons. One reason stands out in particular. The greatest appeal of the peace park concept is that it represents a non-destructive use of a spectacular resource and could be combined with the non-destructive science objectives to the benefit of many. This is the appeal that propelled us to further investigate the concept. The concept's principal negative is that it might eventually attract too many people who have little or no interest in the forest, the wildlife, and the history of the area. People without a real connection to the forests of Mohawk who come to honor other people and their accomplishments, while noble in its own right, could eventually change the focus and priorities that we have defined in the paragraphs above. This is certainly not what we have in mind.

Our present leaning is away from the concept. We will seek more public input, but after an initial enthusiasm and making a few discreet tests, we have cooled off. The risks appear unacceptable. The risk to the white pines from excessive foot trampling around the base of the trees and the trampling of the herb layer appears too great. The more prudent course is to honor Native American nations and individual Indians of prominence.

Section V. SPECIAL TALL TREE AND SPECIAL SITES LISTS

This section includes a number of comparative tables that provides the reader with tall tree information that will help to define and distinguish Mohawk's undisputed claim to the title of the Commonwealth of Massachusetts Tall Tree Heritage Forest. These tables will be periodically updated.

Figure 23: Listing of All White Pines in Massachusetts with Heights of 150 Feet or More

Massachusetts - 150 Club (White pines 150 or more feet in height)				
Created by: Friends of Mohawk Trail State Forest: Jani Leverett, President				
and the Eastern Native Tree Society Bob Leverett,Co-founder				
Location	**Hgt-ft**	**Circ-ft**	**DOM**	**TreeName**
Mohawk Trail State Forest ,Charlemont,MA				
Algonguin Pines	158.2	8.7	3-Aug-03	Algonquin
Algonguin Pines	153.7	9.7	31-Aug-03	Frank Decontie (Algonquin)
Algonguin Pines	153.1	6.5	22-Jun-02	Little Frank Decontie
Algonguin Pines	152.7	7.9	22-Jun-02	Little Frank Decontie #2
Algonguin Pines	152.4	10.4	1-Jul-02	Bear Tree
Algonguin Pines	151.2	9.5	1-Jul-02	Sandra Decontie (Algonquin)
Algonguin Pines	151.2	8.4	22-Jun-02	Brightside Tree
Algonguin Pines	150.8	6.7	22-Jun-02	Middle Tree
Algonguin Pines	150.6	10.1	22-Jun-02	William Commanda (Algonquin)
Algonguin Pines	150.3	8.4	1-Jul-02	Circle Pine
Cherokee Grove	153.0	12.5	28-Jul-03	Calibration Tree (Junaluska Pine - Cherokee)
Shunpike Pines	160.5	10.6	20-Sep-03	Brant (Mohawk)
Shunpike Pines	155.0	9.8	20-Sep-03	Oneida
Elders Grove	161.2	11.2	25-May-03	Saheda (Mohawk)
Elders Grove	160.5	11.4	2-Dec-01	Tecumseh (Shawnee)
Elders Grove	152.6	9.8	24-Jun-00	Washaki (Shoshoni)
Elders Grove	151.7	8.9	7-May-01	Crazy Horse Tree (Lakota)
Elders Grove	150.6	7.7	7-May-01	Ouray (Ute)
Mast Pines	153.8	8.1	25-May-03	Mast Tree #2
Mast Pines	151.3	8.8	25-May-03	Mast Tree #1
Mast Pines	150.6	7.8	22-Dec-02	Mast Tree #3
Mast Pines	150.3	7.8	25-May-03	Mast Tree #4
Pocumtuck Pines	153.3		10/25/2003	
Pocumtuck Pines	151.9	9.0	5-Sep-03	Metacomet (Wampanoag)
Pocumtuck Pines	151.1	8.4	6-Sep-03	Frank James (Wampanoag)
Pocumtuck Pines	151.3	6.5	5-Sep-03	Massasoit (Wampanoag)
Pocumtuck Pines	151.2		10/25/2003	
Pocumtuck Pines	150.8		10/25/2003	
Trees of Peace	163.5	10.1	31-Aug-03	Jake Swamp (Mohawk)
Trees of Peace	162.2	9.3	28-Jul-03	Joe Norton (Mohawk)

Trees of Peace	157.4	7.8	16-Jun-02	John Brown (Narragansett)
Trees of Peace	156.6	7.4	11-Aug-03	Tom Porter (Mohawk)
Trees of Peace	151.9	8.4	27-Jul-03	Dr. Lynn Rogers Tree
Trees of Peace	151.7	8.4	16-Jun-02	Arvol Looking Horse (Lakota)
Trees of Peace	151.3	10.4	31-Aug-03	Clutter Tree
Trees of Peace	151.1	8.0	31-Aug-03	Unnamed
Trees of Peace	151.0	7.4	31-Aug-03	Guardian
Trees of Peace	150.3	9.4	13-Oct-03	Unnamed
Trees of Peace	150.3	9.0	7-Oct-02	Dave Chief (Lakota)
Encampment Grove	151.8	10.0	25-Oct-03	
Bryant Homestead,Cummington,MA				
Poets Walk	156.3	10.2	27-Sep-03	William Cullen Bryant
Poets Walk	151.8	11	14-Jul-02	Robert Frost
Poets Walk	151.2	8.6	14-Sep-02	Emily Dickenson
Poets Walk	150.7	10.6	16-Sep-02	Carl Sandberg
Ice Glen-Stockbridge,MA				
Ice Glen	153.2	12.8	30-Mar-02	Ice Glen
Ice Glen	151.1	6.8	30-Mar-02	Little Ice Glen Pine
Monroe State Forest,Monroe,MA				
Dunbar Brook	156.2	12.2	20-Jun-02	Thoreau
Averages	153.3	9.1	47	
Total Number	47.0			

Figure 24: Distribution of All Known White Pines in Northeast 150 Feet or More in Height:

Number of White Pines Over Following Height Thresholds in the Northeast					Tallest single tree
Location	>=150	>=160	>=170	>=180	Hgt
Cook Forest State Park, PA	97	28	5	1	181.1
Claremont, NH	60	7			166.1
Mohawk Trail State Forest,MA	40	5			163.5
Hearts Content,PA	16	2			162.0
Elders Grove, Paul Smith Co, NY	6				158.3
Anders Run, PA	5	1			163.8
Bryant Homestead, MA	4				156.3
Pine Park, NH	2				152.2
Ice Glen, MA	2				153.2
Dartmouth College, NH	1				150.3
Cathedral Pines, NY	1				152.0
Monroe State Forest, MA	1				156.2
Tamworth Pines, NH	1				150.0
Totals	236	43	5	1	

The Claremont stand referenced above may have considerably more than 60 white pines over 150 feet. It may be the top tall white pine site in the Northeast meeting that category. The Eastern Native Tree Society has special access to the site, which is on private land, and will collect data on the site over the next several years. Although the Claremont site surpasses Mohawk for the total number of tall pines, its trees are growing at a considerably slower rate. In 10 to 15 years, Mohawk and Claremont could be very close in total numbers of tall pines.

Figure 25: Rucker Index For Selected Sites in the Northeast

Site	Rucker Index
Cook Forest State Park, PA	135.27
Zoar Valley, NY	134.69
Mohawk Trail State Forest, MA	134.45
Fairmount Park, PA	128.50
Wintergreen Gorge,PA	126.33
Ice Glen,MA	125.44
Monroe State Forest, MA	120.74
Anders Run,PA	118.65
Green Lakes State Park,NY	118.00
Mill Creek Park, OH	115.88
Mount Tom State Reservation,MA	114.50
Hearts Content,PA	113.79
Alan Seeger Natural Area, PA	111.13
Arcadia Wildlife Sanctuary, MA	110.70
Tionesta, PA	109.36
Bryant Homestead, MA	109.00
Mill River Terrace, MA	106.66
Black Stevens Natural Area,MA	105.00

The above list will constantly change as new sites are studied and added by the Eastern Native Tree Society. A listing of these sites is maintained at the University of Arkansas. Our ENTS Website address is:

www.uark.edu/misc/ents

Predictions can be made about where Mohawk Trail State Forest will fit in future revisions of the list. Pennsylvania, New York, and New Jersey likely have several undocumented sites per state that have Rucker indexes in the low to mid-120s. It is possible that one or two undocumented sites reach 130, but beyond that it is highly unlikely. High indexes, wherever found, require mature to old growth woodlands that possess extremely good growing conditions and include species that are capable of reaching great heights. Usually there is at least one flagship species on a high index site such as white pine or tuliptree that is above 140 feet.

In strictly New England, the number of candidate sites has remained small. The trees near the ocean are height-challenged and inland areas often have been logged repeatedly. Connecticut has good potential, but so far nothing extraordinary since the Cathedral Pines blew down in July 1989. That stand was the flagship of New England. Many trees were over 150 feet and at least a few over 160. But alas, the stand is no more.

North of Massachusetts, Rucker Site Indices are predictability lower. In New Hampshire, sites with high indexes are likely to be in the southern part of the state. We may have found the best. A site in Claremont, New Hampshire on private land has an index of at least 115, with 117 to 118 probable. Other tall tree stands have indices closer to 100. Vermont probably has some stands in the 110 to 117 range in the southeastern corner, but it is improbable that we will break 120 in either New Hampshire, Vermont, or Maine.

Figure 26: List of Tallest Trees in Massachusetts

Species	Location	Species	Height	Circ
American Basswood	MTSF-Clark Ridge-Shunpike Area	American Basswood	124.5	5.9
American Beech	MTSF-Clark Ridge	American Beech	130.0	7.8
American Chestnut	Mount Everett	American Chestnut	66.3	0.9
American Elm	Ice Glen	American Elm	115.2	6.1
Big Tooth Aspen	MTSF-Clark Ridge-Shunpike Area	Big Tooth Aspen	127.7	3.5
Bitternut Hickory	MTSF-Clark Ridge_Indian Flats	Bitternut Hickory	128.4	4.1
Black Birch	MTSF-Clark Ridge	Black Birch	116.2	3.6
Black Cherry	Ice Glen	Black Cherry	121.9	7.1
Black Gum	MT Tom	Black Gum	81.0	7.2
Black Locust	South Hadley-Black Stevens	Black Locust	114.2	5.8
Black Oak	MTSF-Clark Ridge-Ash Flats	Black Oak	110.5	4.8
Black Willow	Deerfield	Black Willow	83.7	21.6
Bur Oak	Northampton-Smith College	Bur Oak	87.2	11.2
Butternut	Northampton-Manhan	Butternut	111.7	6
Catalpa	Holyoke	Catalpa	85.0	7.7
Chestnut Oak	Bardwell Ferry	Chestnut Oak	98.7	6.2
Cottonwood	Bartholomew's Cobble	Cottonwood	128.6	18.8
European Beech	Northampton-Manhan	European Beech	101.2	10.6
Green Ash	Arcadia	Green Ash	104.7	5.5
Hackberry	Hatfield	Hackberry	83.7	10.2
Hemlock	Ice Glen	Hemlock	136.6	10.2
Hop Hornbeam	MSF-Bear Swamp	Hop Hornbeam	78.1	3.7
Northern Red Oak	MTSF-Clark Ridge-Shunpike Area	Northern Red Oak	130.6	7.7
Norway Spruce	Egremont	Norway Spruce	123.8	7.5
Pignut Hickory	Ice Glen	Pignut Hickory	120.8	6.4
Pin Oak	Westfield	Pin Oak	105.7	11.5
Pitch Pine	Mt Tom	Pitch Pine	92.0	5.5
Quaking Aspen	Mt Greylock-Hopper	Quaking Aspen	85.4	8.7
Red Maple	MTSF-Clark Ridge	Red Maple	122.4	6.5
Red Pine	MT Tom	Red Pine	118.8	5.4
Red Spruce	Mt Greylock-Hopper	Red Spruce	129.2	6.5
Scarlet Oak	Mt Tom	Scarlet Oak	83.6	6.7
Shagbark Hickory	Ice Glen	Shagbark Hickory	131.7	5.0
Silver Maple	Hatfield	Silver Maple	118.9	11.1
Slippery Elm	Greenfield	Slippery Elm	118.0	6.8
Sugar Maple	MTSF-Todd Mtn	Sugar Maple	138.0	11.4
Swamp White Oak	Northampton-Manhan	Swamp White Oak	103.6	9.8
Sycamore	Easthampton	Sycamore	136.2	13.2
Tuliptree	Northampton-Manhan	Tuliptree	131.2	13.4

White Ash	MTSF-Clark Ridge	White Ash	147.4	9.5
White Birch	MTSF-Clark Ridge	White Birch	110.5	5.2
White Oak	MT Tom	White Oak	111.3	6.7
White Pine	MTSF-Trees of Peace	White Pine	163.8	10.1
White Spruce	MTSF-Headquarters	White Spruce	102.9	6.9
Yellow Birch	MTSF-Clark Ridge-Shunpike Area	Yellow Birch	101.1	4.7

Figure 27: Tallest Trees by Species in Mohawk Trail State Forest

No.	Species	HGT	CIR	Natural to Area	Champion status
1	A. beech	130.0	7.8	Y	NENG
2	A. basswood	124.5	5.9	Y	MASS
3	A. elm	112.1	6.1	Y	
4	Black birch	116.2	3.6	Y	NE
5	Black cherry	119.2	4.9	Y	
6	Black locust	87.8	13.0	N	
7	Bitternut hickory	128.4	4.1	Y	NENG
8	Black oak	110.5	4.8	Y	
9	Bigtooth aspen	127.7	3.5	Y	NE
10	Cottonwood	95.0	7.0	Y	
11	Hop hornbeam	73.0	4.0	Y	MASS
12	Eastern hemlock	131.0	8.0	Y	
13	Northern red oak	130.6	7.0	Y	MASS
14	Norway spruce	117.7	6.2	N	
15	Red maple	122.4	6.5	Y	NENG
16	Red pine	116.7	4.2	Y	
17	Red spruce	114.7	7.3	Y	
18	Shagbark hickory	109.0	3.9	Y	
19	Sugar maple	138.0	11.4	Y	NE
20	Striped maple	58.3	1.3	Y	MASS
21	White ash	147.4	9.5	Y	NE
22	White birch	110.5	5.2	Y	NENG
23	White oak	101.7	8.3	Y	
24	White pine	163.5	10.1	Y	MASS
25	White spruce	102.9	6.9	N	MASS
26	Yellow birch	101.1	4.7	Y	MASS

Figure 28: Selection of Eastern States and their tallest accurately measured trees

Rank	State	Species	Height
1	North Carolina	WP	186.0
2	Pennsylvania	WP	181.3
3	Georgia	WP	178.6
4	Tennessee	WP	175.0
5	South Carolina	WP	171.2
6	Wisconsin	WP	167.0
7	New Hampshire	WP	166.1
8	Massachusetts	WP	163.5
9	Maryland	Tuliptree	159.9
10	Virginia	Tuliptree	158.9
11	New York	WP	158.2
12	Michigan	WP	157.0
13	Maine	WP	155.0
14	Connecticut	WP	144.6
15	Vermont	WP	143.4
16	Minnesota	WP	136.5

Figure 29: Trees Climbed and Taped in Mohawk Trail State Forest

Tree	Grove	Height by Transit Jack Sobon and Robert Leverett	Date	Height by Climb and Tape	Date	Climber	Comments
Jake Swamp	Trees of Peace	155.3	Nov-92	158.6	Nov-98	Will Blozan	Tree suffered broken top between dates
				160.9	Oct-01	Michael Davie	
Joe Norton	Trees of Peace	155.6	Nov-92	159.6	Oct-01	Will Blozan Bob Van Pelt	Tree suffered broken top between dates
Saheda	Elders Grove	160.1	Aug-95	158.6	Nov-98	Will Blozan	Tree suffered broken top between dates
Tecumseh	Elders Grove	154.6	Apr-95	160.1	03-Oct	Will Blozan	Tree suffered broken top between dates

Professional arborists have made the above climb. These arborists do not employ spikes or any equipment that could damage the cambium layer of the pines. We emphasize that these climbs are strictly for gathering data. They are not sporting events. Members of the Eastern Native Tree Society, DCR, and special guests will be the only people present on future climbing event. Over the next several seasons, new climbs are planned for the Joseph Brant Pine and the Algonquin Pine, and re-climbs of the above trees.

Figure 30: Relative Abundance of Trees 130 Feet in Height or More in Mohawk Trail State Forest

Species	Location	Abundance
White pine	Clark Ridge: North-side Forest	Common where white pine occurs
	Todd Mtn: East-side Forest	Common
	HQ-Thumper Mtn Forest	Common
	Clark Ridge: South-side Forest	Common where white pine occurs
	Trout Brook	Fairly Common
	Cold River: North-side Forest	A small number
White ash	Clark Ridge: North-side Forest	Common
	Trout Brook Forest	A small concentration
	Todd Mtn: East-side Forest	One measured
	Cold River: North-side Forest	One measured
Sugar maple	Clark Ridge: North-side Forest	Scattered
	Trout Brook Forest	Very small concentration
	Todd Mtn: East-side Forest	One measured
N. red oak	Clark Ridge: North-side Forest	One measured
Hemlock	Black Brook Forest	One measured
A. Beech	Clark Ridge: North-side Forest	One measured

A: Methodology Used for Measuring Tree Height

The technique used by ENTS to measure tree height employs trigonometry. Basically an imaginary, horizontal plane is passed through the highest twig, a second through the measurer's eye, and a third through the base of the tree. With the eye remaining fixed, the linear distance from the eye to the tip of the twig is measured with a laser. The angle from the eye to the twig is then measured. Using the trigonometric sine function, the height of the twig above eye-level is calculated. Those familiar with right angle trigonometry will recognize that the hypotenuse distance is being measured from the eye to the tip of the twig. This process is repeated fro the base of the tree, i.e. height of the eye above/below the base. The two vertical distances are then added algebraically. The sum is the height of the tree according to the rules of American Forests. It should be noted that the result is not the length of the trunk. It should also be noted that since the sine function is used, no assumption is made about where the top of the tree is relative to the base; i.e. the top does not have to be over the base as is the case when just a clinometer is used to measure tree height along with a known baseline to the tree. This latter method can lead to large errors in broad-crowned trees and leaning trees. ENTS has a list of clinometer-based measurements that are in error by 20 to a whopping 67 feet. Scientists, forestry professionals, and experienced big tree hunters all made these errors. ENTS provides annual classes on tree measuring.

B. Location of Champion Trees in Mohawk Trail State Forest:

The map on the following page has been prepared for DCR and shows the approximate locations of Mohawk's 13 champion tall trees. Since these are all tall tree champions, distinguishing the champion from almost equally tall neighbors is often difficult. There are only three of the champions that are appropriate for public visitation. They are:

1. White pine: Jake Swamp tree in the Trees of Peace, Todd Mountain East-side forest
2. Sugar maple: base of Todd Mountain, Todd Mountain East-side forest
3. Red maple: Clark Ride North-side Forest

The task of keeping track of the champions and verifying heights falls to ENTS. We try to visit each champion at least once per year and do a re-measurement.

Map: Location of Height Champions in Mohawk: